

February 7, 2012

Dr. Barry Klein, Reactor Director
University of California, Davis
One Shields Avenue
Davis, CA 95616-8558

SUBJECT: UNIVERSITY OF CALIFORNIA, DAVIS/MCCLELLAN NUCLEAR RADIATION
CENTER - NRC INSPECTION REPORT NO. 50-607/2012-201

Dear Dr. Klein:

On January 23 – 26, 2012, the U.S. Nuclear Regulatory Commission (NRC, the Commission) completed an inspection at the University of California, Davis/McClellan Nuclear Radiation Center (Inspection Report No. 50-607/2012-201). The enclosed report documents the inspection results, which were discussed on January 26, 2012, with Mr. Walter Steingass, Reactor Supervisor, and Mr. 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, no findings of significance were identified. No response to this letter is required.

In accordance with Title 10 of the *Code of Federal Regulations*, Section 2.390, "Public inspections, exemptions, 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).

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.

Sincerely,
/RA/

Johnny H. Eads, Jr., Chief
Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

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

Enclosure: NRC Inspection Report No. 50-607/2012-201
cc: Please see next page

University of California, Davis/McClellan Nuclear Radiation Center

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

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

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

Docket No: 50-607

Report No: 50-607/2012-201

Licensee: University of California, Davis

Facility: McClellan Nuclear Radiation Center

Location: McClellan Park
Sacramento, California

Dates: January 23 - 26, 2012

Inspector: Craig Bassett

Accompanied by: Taylor Lichatz, Inspector Trainee
Jonathan Fiske, NSPDP Program Assignee

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, Davis
McClellan Nuclear Radiation Center
Report No: 50-607/2012-201

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the University of California, Davis (the licensee's) 2 Megawatt (MW) Class I research and test reactor safety program including: 1) organization and staffing, 2) review and audit and design change functions, 3) reactor operations, 4) operator requalification, 5) maintenance and surveillance, 6) fuel handling, 7) experiments, 8) procedures and procedural control, and 9) emergency preparedness 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. No violations or deviations were identified.

Organization and staffing

- The organizational structure and staffing had not changed since the last inspection and were generally consistent with Technical Specification requirements.

Review and Audit and Design Change Functions

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

Reactor Operations

- Reactor operations were conducted in accordance with procedure and the appropriate logs were being maintained.

Operator Requalification

- Operator requalification was conducted as required by the Requalification Program and the program was being maintained up-to-date.
- Medical examinations were being completed for each operator biennially as required.

Maintenance and Surveillance

- The Preventive Maintenance Program was being used to effectively accomplish the various maintenance and required surveillance activities at the facility.

Fuel Handling

- Fuel movements and inspections were conducted in accordance with Technical Specification and procedural requirements.

Experiments

- The program for reviewing and conducting experiments satisfied procedural and Technical Specification requirements.

Procedures

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

Emergency Preparedness

- The emergency preparedness program was conducted in accordance with the Emergency Plan.
- Emergency response equipment was being maintained and alarms were being tested as required.
- The Memorandum of Understanding between the County of Sacramento and McClellan Park and the one between the facility and the University of California, Davis Medical Center were being maintained.
- Emergency drills were being conducted annually as required by the Emergency Plan.
- Emergency preparedness training for Senior Reactor Operator personnel was being completed through the Requalification Program.

REPORT DETAILS

Summary of Plant Status

The University of California, Davis (the licensee's) two megawatt (2 MW) Class I TRIGA Mark-II research and test reactor continued to be operated in support of neutron radiography, medical isotope production, neutron tomography, and sample/product irradiation. During the inspection, the reactor was operated several hours per day at approximately 1 MW to support neutron radiography and various other experiments.

1. Organization and Staffing

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

The inspector reviewed the following regarding the University of California, Davis/McClellan Nuclear Radiation Center (UCD/MNRC) organization, staffing, and staff responsibilities to ensure that the requirements of License Amendment No. 6 (which included Technical Specification (TS) Section 6.1, Revision (Rev.) Number (No.) 13) dated November 25, 2003, were being met:

- Management responsibilities
- Qualifications of facility personnel
- Current UCD/MNRC organizational structure
- Staffing requirements for safe operation of the research reactor facility
- Nuclear Safety Committee (NSC) meeting minutes for December 2010 through the present
- Facility Procedure UCD/MNRC-0004-DOC-13, "Technical Specifications for the University of California, Davis/McClellan Nuclear Radiation Center (UCD/MNRC)," Rev. 13, approval dated March 28, 2003
- Facility Procedure UCD/MNRC-0045-DOC, "Quality Assurance Program for McClellan Nuclear Radiation Center (MNRC)," Rev. 1, approval dated November 22, 1999
- University of California, Davis/McClellan Nuclear Radiation Center 2009 Annual Report, submitted to the U. S. Nuclear Regulatory Commission (NRC) on June 17, 2010
- University of California, Davis/McClellan Nuclear Radiation Center 2010 Annual Report, submitted to the NRC on June 28, 2011
- American Nuclear Society Standard (ANS/ANSI) 15.4 - 1988, "Selection and Training of Personnel for Research Reactor," approved June 9, 1988

b. Observations and Findings

During a previous NRC inspection in February 2011, the subject of facility staffing was reviewed. It was noted that the reactor operations staff consisted of five licensed Senior Reactor Operators (SROs). The inspector noted that this had not changed and that all of the SROs continued to serve in other capacities at the facility as well. One SRO was the Reactor Supervisor and Associate Director for Operations, another was the Training Coordinator and a qualified radiographer, one SRO was the Radiography Supervisor as well as a qualified radiographer, one was an SRO and a qualified radiographer, and the other SRO had been designated as the facility Radiation Safety Officer. From a review of records and

interviews with the staff, the inspector determined that the reactor operations staff members satisfied the training and experience requirements associated with their respective positions.

It was noted that, in addition to the three SRO/radiographers noted above, there was one other individual employed at the facility who was a qualified radiographer, and two other individuals who had been hired as radiographer trainees. The inspector also noted that the licensee had hired an electronics engineer to help out at the facility. That individual was also participating in the licensee's training program to become a qualified Reactor Operator. The inspector determined that all licensee staff members had received additional training in radiation protection practices, survey techniques, and instrumentation as well.

Staffing appeared to be adequate for the current level of operation but an increased workload would necessitate an increase in the number of staff needed to provide for efficient and safe operation of the facility.

c. Conclusion

The licensee's organization and staffing remain in general compliance with the requirements specified in 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 by the licensee and to ensure that facility changes were reviewed and approved as required by TS Section 6.2, the inspector reviewed selected aspects of:

- Annual Audits conducted in 2010 and 2011
- Nuclear Safety Committee (NSC) meeting minutes for December 2010 through the present
- UCD/MNRC Facility Modification Notebook containing Facility Modification Log Forms
- Selected Facility Modification Installation Authorization Forms and the associated Facility Modification Checklist Forms processed during 2010 and 2011
- Facility Procedure UCD/MNRC-0043-DOC, "Facility Modification Procedure," Rev. 4, approval dated January 8, 2008
- Facility Procedure UCD/MNRC-0045-DOC, "Quality Assurance Program for McClellan Nuclear Radiation Center (MNRC)," Rev. 1, approval dated November 22, 1999
- University of California, Davis/McClellan Nuclear Radiation Center 2009 Annual Report, submitted to the NRC on June 17, 2010
- University of California, Davis/McClellan Nuclear Radiation Center 2010 Annual Report, submitted to the NRC on June 28, 2011

- Charter of the Nuclear Safety Committee (NSC) for the University of California, Davis/McClellan Nuclear Radiation Center (UCD/MNRC), Rev. 3, approval by the UCD Vice Chancellor for Research dated July 2, 2010

b. Observations and Findings

(1) Review and Audit Functions

Composition of the NSC and qualifications of NSC members were as specified in TS 6.2.1. Minutes of NSC meetings demonstrated that the committee met semiannually as required by TS 6.2.2 and provided the reviews and oversight specified in TS 6.2.3. Through records review the inspector determined that safety reviews were conducted by the NSC or a designated representative. 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 noted that the annual audit for 2010 was adequate and reviewed the activities specified in TS 6.2.4 including various aspects of the reactor facility operations and programs. It was noted that the audit had been completed by the Chair of the NSC on November 4, 2010. The audit appeared to be adequate and the auditor noted that procedures had been developed as had been suggested in the 2009 audit. The 2011 facility audit had also been conducted by the Chair of the NSC and was completed on December 9, 2011. The audit appeared to be adequate. No recommendations had been made in the 2011 audit.

(2) Design Change Functions

To satisfy the regulatory requirements stipulated in Title 10 of the *Code of Federal Regulations*, Section 50.59 "Changes, tests, and experiments," the licensee had implemented Facility Procedure UCD/MNRC-0043-DOC, "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, 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 verified that, as required by procedure, all proposed facility modifications were presented to a Modification Review Committee (MRC) for screening and classification. The MRC classified the modifications (mods) as Class I, Class II, or Class III. Class I mods were those requiring extensive changes that would involve a change to the TS or the SAR and would require NRC approval. Class II mods were those that resulted in a basic configuration change of a facility system or equipment but would not require a change to the TS or SAR. Class III mods were

those that did not result in a basic configuration change and would not change form, fit, or function of the system under consideration.

When a modification was proposed at the facility, the supporting documentation was compiled into a modification package. The mod package was then processed through and controlled by the Reactor Supervisor. In addition to the MRC screening, the packages were required to be reviewed by the Reactor Supervisor and a Health Physics representative and then approved by the Facility Director. All Class I and II changes and modifications were required to be reviewed and approved by the NSC.

The inspector reviewed a listing of the most recent facility mods. It was noted that two packages had not been closed out. One mod package from 2007 had not been closed because, although the X-ray system had been modified as outlined, the procedures detailing how to operate/use the system had not yet been updated. (The system was not currently needed or in use.) A mod package from 2009 dealing with the security system remained open. The modifications that had implemented through that package had been completed and paid for by the federal government but the licensee was under the impression that further upgrades or modifications were to be made. Therefore, the package remained open.

The only modification that had been considered during 2011 was still in the conceptual and developmental stage and the complete modification package had not been submitted to the Reactor Supervisor to date. It dealt with the possible future production of Iodine-125. This mod would be a Class I type and would require a 10 CFR 50.59 review and NRC approval.

Except as noted above, the Facility Modification Installation Authorization Forms and the associated Facility Modification Checklist forms reviewed by the inspector were completed and closed out properly. The completed packages showed that the proposed modifications were acceptably reviewed in accordance with the procedure. It was noted that, except for the Class I proposal mentioned above, all the modifications proposed recently were designated as Class III and therefore no 10 CFR 50.59 evaluations were required to be completed. As a result, none of the changes or modifications was determined to constitute a safety question or concern and none required a license or TS amendment. The only items required for each of the latest Class III changes were design drawing changes and/or the development of a new procedure.

c. Conclusion

The NSC was meeting semiannually, reviewing the topics outlined in the TS, and conducting annual audits of facility programs as required. The facility design change program satisfied NRC requirements.

3. Reactor Operations

a. Inspection Scope (IP 69006)

To verify that the licensee was operating the reactor and conducting operations in accordance with TS Section 3 and procedural requirements, the inspector reviewed selected portions of the following:

- Various UCD/MNRC Startup Checklist Forms for 2011 and to-date in 2012
- Selected UCD/MNRC Shutdown Checklist Forms for 2011 and to-date in 2012
- Various UCD/MNRC Facility Rounds Log Forms for 2011 and to-date in 2012
- Selected UCD/MNRC Operations Log Pages from Log Book No. 133 through Log Book No. 138
- Facility Procedure UCD/MNRC-0016-DOC, "UCD/MNRC Operating Instructions" Rev. 11, approval dated January 16, 2002
- Facility Procedure UCD/MNRC-0073-DOC, "UCD/MNRC Reactor Control Room Computer Operating Instructions" Rev. 3, approval dated June 27, 2006
- University of California, Davis/McClellan Nuclear Radiation Center 2009 Annual Report, submitted to the NRC on June 17, 2010
- University of California, Davis/McClellan Nuclear Radiation Center 2010 Annual Report, submitted to the NRC on June 28, 2011

b. Observations and Findings

The inspector reviewed selected UCD/MNRC Startup and Shutdown forms, Rounds Log sheets, and Operations Log entries dating from 2011 through the date of this inspection. The operating logs and checklists were complete and provided an acceptable indication of operational activities. The logs and checklists showed that operational conditions and parameters were consistent with license and TS requirements and indicated that operational limits had not been exceeded.

The logs were also used to record problems with equipment and abnormal events or anomalies. Emergency shutdowns and inadvertent scrams were also noted in the logs. These were also documented in the licensee's Monthly Reports and reported in Annual Reports submitted to the NRC.

The inspector observed facility activities on various occasions during the week including routine reactor operations and the handling of items that were being radiographed. The operations and item handling were conducted in accordance with the applicable procedures and the actions were documented in the required logs. The inspector was also able to observe a reactor startup and/or a reactor shutdown during the inspection. These activities were completed according to procedure and the appropriate checklists and logs were filled out as well.

c. Conclusion

UCD/MNRC reactor operations were conducted in accordance with procedure and the appropriate logs were being maintained.

4. Operator Requalification

a. Inspection Scope (IP 69003)

To verify that the licensee was complying with TS Section 6.1.4 and the facility Operator Training and Requalification Program, the inspector reviewed selected aspects of:

- Status of active operator licenses
- Selected operator physical examination records for the past three years
- Training Schedule for Maintenance of Qualifications for SROs for the 2009-2010 and 2011-2012 requalification cycles
- Operator active duty status documented on MNRC Personnel Reactivity Manipulations and Active Duty Performance Record forms for 2010, 2011, and to date in 2012
- Operator training and lecture attendance records for 2010 through 2012 documented on MNRC Training Attendance Record forms
- Selected records for 2010 and 2011 documented on UCD/MNRC Reactor Facility annual Operating Test for Senior Reactor Operators and Reactor Operators Forms and MNRC Senior Reactor Operator Requalification Written Examination Forms
- Memorandum for the Training Coordinator from B. Klein, UCD/MNRC Director dated March 17, 2011, specifying those individuals who had completed the Requalification Program and were certified to continue operating the reactor
- Facility Procedure UCD/MNRC-0009-DOC, "Selection and Training Plan for Reactor Personnel," Rev. 4, approval dated January 18, 2000
- University of California, Davis/McClellan Nuclear Radiation Center 2009 Annual Report, submitted to the NRC on June 17, 2010
- University of California, Davis/McClellan Nuclear Radiation Center 2010 Annual Report, submitted to the NRC on June 28, 2011
- ANS/ANSI Standard 15.4-1988, "Selection and Training of Personnel for Research Reactors," approved June 9, 1988

b. Observations and Findings

As noted above, there were five qualified SROs on staff at the facility. The inspector verified that all operators' licenses were current. There were two individuals whose licenses were due to expire in May 2012. The licensee was aware of this and indicated that the required documentation/forms would be submitted to the NRC prior to that date to ensure license renewal. As of the date of the inspection, there was one person who was officially designated as "in training" to become a Reactor Operator.

The inspector noted that the Requalification Program was being implemented and maintained as required. MNRC Personnel Reactivity Manipulations and Active Duty Performance Records and logs showed that operators were maintaining active duty status as required. A review of the logs and records also showed that training was being conducted in accordance with the approved requalification and training program. Procedure reviews and examinations had been documented as required. Records of quarterly reactor operations, reactivity manipulations, other operations activities, and Reactor Supervisor activities were being maintained. Records indicating the completion of annual operations tests and supervisory observations were also being maintained as required. Biennial written examinations were being completed by the operators as required as well. In addition, the inspector noted that all operators were receiving the biennial medical examinations required by the program in accordance with ANS/ANSI 15.4-1988.

c. Conclusion

Operator requalification was being completed and being maintained up-to-date as required by the Requalification Program. Medical examinations were being completed for each operator biennially as required.

5. Maintenance and Surveillance

a. Inspection Scope (IP 69006, 69010)

To verify that the licensee was meeting the requirements of their Preventive Maintenance Program and complying with TS Section 4, the inspector reviewed selected aspects of:

- UCD/MNRC Reactivity Tables
- Danger/Caution Tag Issue Forms and log
- Selected UCD/MNRC Control Rod Calibration Forms for 2011
- Various UCD/MNRC Calorimetric Power Calibration Forms for 2011
- Selected UCD/MNRC Reactor Shutdown Margin Data Sheets for 2011
- Selected UCD/MNRC Work Order Tracking Sheets for 2011 and 2012
- Various UCD/MNRC Operations Log pages from Log Book No. 133 through Log Book No. 138
- UCD/MNRC Preventive Maintenance Schedule for the Month of January 2012
- Preventive Maintenance Program database maintained on the Control Room computer which included entries denoting equipment history
- McClellan Nuclear Radiation Center Preventive Maintenance System - Twelve Month Schedule for the period from February 2011 through January 2012
- Selected MNRC Work Order forms documenting various completed and pending maintenance tasks
- Facility Procedure UCD/MNRC-0007-DOC, "Maintenance Procedures," Rev. 5, approval dated November 23, 2005
- Facility Procedure UCD/MNRC-0030-DOC, "MNRC Tag-Out Procedure," Rev. 5, approval dated January 24, 2007

- Operation and Maintenance Manual (OMM) procedures including:
 - Facility Procedure UCD/MNRC-0012-OMM 5110, "Primary Cooling System," Rev. 5, approval dated November 12, 1999
 - Facility Procedure UCD/MNRC-0013-OMM 5140, "Control Rod Drives," Rev. 4, approval dated November 3, 2000
 - Facility Procedure UCD/MNRC-0019-OMM 5220, "Fuel Handling Tools," Rev. 4, approval dated January 12, 2009
 - Facility Procedure UCD/MNRC-0036-OMM 5510, "MNRC Pneumatic Transfer System," Rev. 4, approval dated May 3, 2000
 - Facility Procedure UCD/MNRC-0038-OMM 5330, "Nuclear Instrumentation," Rev. 1, approval dated November 18, 2008
 - Facility Procedure UCD/MNRC-0039-OMM 5420, "Personnel Shield and Radiography Shutter," Rev. 3, approval dated January 11, 2008
 - Facility Procedure UCD/MNRC-0061-OMM 5310, "Control System Console," Rev. 1, approval dated September 17, 2008
 - Facility Procedure UCD/MNRC-0063-OMM 5340, "Reactor Protection System," Rev. 1, approval dated November 14, 2008
 - Facility Procedure UCD/MNRC-0071-OMM 5160, "Emergency Core Cooling System," Rev. 0, approval dated June 29, 1998
 - Facility Procedure UCD/MNRC-0015-OMM-06, "Demineralizer System," Rev. 6, approval dated January 5, 2009
 - Facility Procedure UCD/MNRC-0053-OMM 01, "MNRC Electrical Distribution System," Rev. 1, approval dated September 30, 1997
 - Facility Procedure UCD/MNRC-0030-DOC 05, "MNRC Lockout/Tag-out Procedure," Rev. 5, approval dated January 24, 2007
- University of California, Davis/McClellan Nuclear Radiation Center 2009 Annual Report, submitted to the NRC on June 17, 2010
- University of California, Davis/McClellan Nuclear Radiation Center 2010 Annual Report, submitted to the NRC on June 28, 2011

b. Observations and Findings

The inspector reviewed the Preventive Maintenance Program that the licensee had developed to schedule and track maintenance activities. The program was maintained on an EXCEL database system and was designed to ensure that all maintenance activities were completed as required. It was also used to ensure that post maintenance testing was conducted and that the entire process was documented appropriately. In addition, the database was also set up to enable the licensee to maintain equipment histories for the various systems, components, and instruments in the program.

The inspector noted that periodic TS-required surveillance activities such as tests, checks, verifications, and calibrations were scheduled through the Preventive Maintenance Program as well. The program was designed to generate a work schedule for facility personnel. Weekly, monthly, and annual schedules were available as needed. The work schedules listed all the maintenance and surveillance activities that needed to be completed during the specified time interval.

The Preventive Maintenance Program not only produced weekly/monthly work schedules, but was set up to generate MNRC Work Orders (MWOs). The MWOs were used to complete and document the maintenance and/or surveillance activities. Most work was completed on Mondays during the routine scheduled reactor shutdown. It was noted that the MWOs were assigned to a lead SRO who was responsible to ensure that the work was performed and the results were recorded on the MWO. The data from each MWO was typically entered into the computerized tracking system by the Radiography Supervisor/Building Manager. The inspector reviewed selected data recorded in the database and on the MWOs for various TS required surveillances. The records indicated that the required tests, checks, verifications, and calibrations had been completed on schedule and in accordance with licensee procedures. The results reviewed by the inspector were found to be within the TS and procedurally prescribed parameters.

During the inspection, the inspector noted that on October 27, 2011, the Law Enforcement Desk dispatcher received a Reactor Console Alert and notified an SRO on the licensee's recall list. The SRO noted that the reactor console CSC High Resolution monitor was blank and the status monitor was locked up, indicating the time as 0325 hours. After troubleshooting and rebooting the computer several times, it was discovered that the computer was inoperable due to a failed CPU alarm. Following several phone calls and substantial research, the licensee was able to locate and order a replacement CPU card and an Ethernet card. The replacement cards were subsequently installed and a General Atomics Programmer performed some required editing of the CSC program. The reactor was returned to full operation on November 2, 2011 with Reactor Supervisor permission.

c. Conclusion

The MNRC Preventive Maintenance Program was being used to effectively accomplish maintenance and surveillance activities at the facility.

6. Fuel Handling

a. Inspection Scope (IP 69009)

To ensure that the licensee was following the requirements of TS Sections 3.2.4, 4.2.4, and 5.3, the inspector reviewed selected aspects of the following:

- Selected Fuel Inspection Sheets for 2011
- Various UCD/MNRC Fuel Transfer Forms
- Selected UCD/MNRC Present Element Location Forms
- Fuel Handling Checklists for fuel handling in December 2011
- Selected entries in the UCD/MNRC Fuel Measurement Notebook
- Various Fuel Movement Sheets - developed prior to fuel movements
- Selected UCD/MNRC Fuel Element Tracking Information Log Sheets

- Various entries in the UCD/MNRC Fuel Measurement Data Notebook detailing fuel element measurements
- Selected UCD/MNRC Operations Log pages from Log Book No. 133 through Log Book No. 138
- Selected Visual Inspection Forms completed for fuel elements inspected in 2011
- Core Fuel Status and Storage Boards located in the Control Room and in the Reactor Room indicating fuel element locations
- Facility Procedure UCD/MNRC-0019-OMM 5220, "Fuel Handling Tools," Rev. 4, approval dated January 12, 2009
- Facility Procedure UCD/MNRC-0011-OMM 5240, "Fuel," Rev. 5, approval dated April 19, 2001
- Standard Operating Procedure 10-01, "Control Rod Replacement," Rev. 0, approval dated December 3, 2010
- Safety Analysis Report for the First 30B Core Loading at the UCD/MNRC," Memorandum from H. Ben Liu to W. Steingass, dated December 17, 2009

b. Observations and Findings

The inspector reviewed the fuel movement process used by the licensee and verified that fuel was moved according to established procedure and in conjunction with the specific fuel movement sheets developed by an SRO for each evolution. The plan and sheets were used not only for fuel movement, which included transferring fuel from the core to storage and from storage to the core, but for fuel inspection as well. The inspector compared the current location of fuel elements in the reactor core with the information maintained on the Fuel Status Board in the Control Room and on the fuel movement sheets. No problems were noted. The licensee's current core was designated as the 30B core.

It was noted that, during the annual shutdown for facility maintenance completed in December 2011, the licensee also completed fuel movement and handling using an approved plan. The inspector reviewed selected fuel inspection sheets that had been completed. The inspections were being completed annually in compliance with TS Section 3.2.4. It was also noted that fuel handling tools were being properly maintained and controlled/secured.

c. Conclusion

Fuel movements and inspections were conducted in accordance with TS and procedural requirements.

7. Experiments

a. Inspection Scope (IP 69005)

The inspector reviewed selected aspects of the following to verify compliance with TS Sections 3.8, 4.8, and 6.5:

- Listing of current experiments and authorized users
- Most recent UCD/MNRC Irradiation Summary Forms
- Selected UCD/MNRC Experimenter Certification Forms
- Various UCD/MNRC Experimenter Approval Request Forms
- Most recent reviews conducted by the Experiment Review Board
- Various UCD/MNRC Irradiation Request Forms for 2011 and 2012
- Selected UCD/MNRC Irradiation Tracking Sheets for 2011 and 2012
- Various UCD/MNRC Operations Log pages from Log Book No. 133 through Log Book No. 138
- Selected UCD/MNRC Experiment Request Forms documenting:
 - Experiment Approval No.: K-4-48, "Fuel Cell Testing Station Operation at MNRC," UCD/MNRC Director's approval dated April 1, 2010
 - Experiment Approval No.: K-4-49, "Irradiation of Natural Xe gas to Produce Low Activity Xe-133," UCD/MNRC Director's approval dated June 28, 2011
 - Experiment Approval No.: K-4-50, "Irradiation of Lubricant Coated Aluminum Coupons," UCD/MNRC Director's current approval dated June 28, 2011
- Completed Facility Use Authorization Forms including:
 - Facility Use Authorization No. UCD/MNRC-001, "Radiography of Aircraft Parts," NSC approval dated February 7, 2000
 - Facility Use Authorization No. UCD/MNRC-002, "Irradiation of Materials in the UCD/MNRC Reactor In-core Irradiation Facilities," NSC approval dated February 7, 2000
 - Facility Use Authorization No. UCD/MNRC-003, "Irradiation of Materials Using the Pneumatic Transfer System," NSC approval dated February 7, 2000
 - Facility Use Authorization No. UCD/MNRC-004, "Radiography Bay Irradiations," NSC approval dated February 7, 2000
 - Facility Use Authorization No. UCD/MNRC-006, "In-Tank/Out-of Core Irradiation and Irradiation Fixtures," NSC approval dated February 7, 2000
- Facility Procedure UCD/MNRC-0027-DOC, "Utilization of the University of California, Davis/McClellan Nuclear Radiation Center Research Reactor Facility," Rev. 7, approval dated January 18, 2000
- Facility Procedure UCD/MNRC-0033-DOC, "University of California, Davis/McClellan Nuclear Radiation Center Research Reactor Facility Experiment Review and Authorization Process," Rev. 5, approval dated July 2, 2003
- Facility Procedure UCD/MNRC-0081-DOC, "UCD/MNRC Experiment Coordination Checklist," Rev. 0, approval dated October 24, 2000
- University of California, Davis/McClellan Nuclear Radiation Center 2009 Annual Report, submitted to the NRC on June 17, 2010
- University of California, Davis/McClellan Nuclear Radiation Center 2010 Annual Report, submitted to the NRC on June 28, 2011

b. Observations and Findings

The inspector reviewed the experiment review and approval process at the facility. It required that an approved experimenter, who decided to propose a new experiment, complete an Experiment Request Form for review. The Experiment Request Form required an evaluation of the target material. This was to verify that, if performed within the guidelines stated in the safety analysis, the irradiation experiment would remain within the TS limits for experiments. The evaluation was also required to include a safety analysis which consisted of a review of various operational, radiological, and safety considerations and limitations. The experimenter was required to ensure that the proposed experiment would meet the conditions established for one of five approved Facility Use Authorizations. The request was then required to be reviewed by the Experiment Coordinator, and by the Experiment Review Board (ERB), and be approved by the MNRC Facility Director. The Experiment Coordinator also completed an Irradiation Summary Form to further document approval by the Facility Director, the Reactor Supervisor, and the Radiation Safety Officer. Any new or revised Facility Use Authorizations were also required to be reviewed and approved by the NSC. (It was noted that no new Facility Use Authorizations had been approved since 2000.)

The experiments conducted at the facility had been reviewed and approved as required. The inspector noted that two new experiments, one involving irradiation of natural Xe gas and the other involving irradiation of lubricant-coated aluminum coupons, had been reviewed and approved since the last inspection. The inspector verified that an approved experimenter had proposed each of the new experiments, had completed an Experiment Request Form for each, and had submitted them to the Experiment Coordinator at the facility. Each was then reviewed and evaluated by the ERB using the process stipulated in Facility Procedure UCD/MNRC-0027-DOC, "Utilization of the University of California, Davis/McClellan Nuclear Radiation Center Research Reactor Facility." The new experiments were then approved by the UCD/MNRC Director as required. The Experiment Coordinator had then completed an Irradiation Summary Form for each experiment and these had been approved/signed as required.

In addition to the new experiment, the inspector reviewed several previous experiments or revisions that had been submitted. The evaluation/safety analysis for each had been performed and the reviews and approvals completed by the ERB, the MNRC Facility Director, and the NSC. The inspector noted that the experiments conducted at the facility were completed using an approved Facility Use Authorization Number and an Experiment Approval Number and under the cognizance of the Reactor Supervisor and the SRO, and in accordance with TS requirements (e.g., reactivity limitations). The results of the experiments were documented on the appropriate Irradiation Request Forms (IRFs) which listed the conditions of the irradiation and the radiological survey results of the material when removed from the reactor. If the irradiated material was found to be radioactive following removal from the reactor, the IRFs also typically included information on the final disposition of the irradiated material (i.e., to whom the material was transferred and documentation of their license to receive the material).

c. Conclusions

The program for reviewing and conducting experiments satisfied TS and procedural requirements.

8. Procedures

a. Inspection Scope (IP 69008)

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

- “Document Review” forms completed by staff members
- “UCD/MNRC Controlled Document Review and Approval Reference List”
- MNRC Document List including the procedure number, title, individual responsible for reviewing the procedure, and date of the last review
- Various memoranda from the Reactor Supervisor to the staff indicating document review assignments and due dates
- Facility Procedure UCD/MNRC-0005-DOC, “Document Control Plan,” Rev. 9, approval dated February 16, 2007

b. Observations and Findings

TS Section 6.4 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. Changes to the procedures also required the approval of the UCD/MNRC Director and all changes were required to be documented. The inspector noted that the appropriate facility procedures had been developed for the activities as required by the TS and had been approved by the Director. Also, recent changes had been approved by the Director as well.

As noted during previous inspections, various members of the facility staff were required to perform periodic reviews of the procedures to assure that they were current. The completion of these reviews continued to be tracked by the Reactor Supervisor. The inspector determined that biennial reviews of the maintenance procedures and annual reviews of the other types of procedures were generally being completed as required.

c. Conclusion

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

9. Emergency Preparedness

a. Inspection Scope (IP 69011)

The inspector reviewed selected aspects of the following to verify compliance with the UCD/MNRC-0001-DOC, “Emergency Plan for the University of California,

Davis - McClellan Nuclear Radiation Center (UCD/MNRC)," Rev. 8, approval by the NSC Chairman dated June 12, 2006:

- Assistance to be provided by offsite support groups
- 2010 and 2011 emergency drill documentation and critiques
- Memorandum of Understanding with the UCD Medical Center dated May 1, 2006
- Memorandum of Understanding dated November 23, 2004, between the County of Sacramento and McClellan Park
- Training Schedule for Maintenance of Qualifications for SROs for the 2010-2012 requalification cycle
- Facility Procedure UCD/MNRC-0018-DOC, "University of California, Davis/McClellan Nuclear Radiation Center Emergency Procedures," Rev. 7, approval dated November 11, 2007
- Facility Procedure UCD/MNRC-0078-DOC, "UCD/MNRC Emergency Procedures for Emergency Response Personnel – Class 0 Emergency - Personnel and Operation Events," Rev. 2, approval dated October 27, 2005
- Facility Procedure UCD/MNRC-0079-DOC, "UCD/MNRC Emergency Procedures for Emergency Response Personnel - Class I Emergency - Notification of Unusual Events," Rev. 2, approval dated October 27, 2005
- Facility Procedure UCD/MNRC-0080-DOC, "UCD/MNRC Emergency Procedures for Emergency Response Personnel – Class II Emergency - Alert," Rev. 2, approval dated October 27, 2005

b. Observations and Findings

The inspector reviewed the Emergency Plan (E-Plan) in use at the reactor and verified that it was reviewed annually. The inspector reviewed the UCD/MNRC Emergency Procedures as well. It was noted that the procedures were also reviewed annually and revised as needed to ensure effective implementation of the E-Plan.

Through records review and interviews with SRO personnel (e.g., emergency responders), the inspector determined that they were knowledgeable of the proper actions to take in case of an emergency. Training for these individuals had been conducted annually through the Requalification Program and documented acceptably. Training for support organization personnel was provided whenever those organizations' schedules would permit.

The inspector verified that the Memorandum of Understanding (MOU), dated November 23, 2004, between the County of Sacramento and McClellan Park remained in effect. The MOU stipulated that the Sacramento Metropolitan Fire District (SMFD) would be available during an emergency and would provide support for the facility. The inspector also verified that the MOU between the UCD/MNRC facility and UC Davis Medical Center (UCDMC) remained in effect. That MOU indicated that the UCDMC would provide the MNRC with needed support in case of any event involving a medical emergency.

Communications capabilities with support groups were acceptable and the various items of equipment (e.g., telephones and the building public address [PA] system) were in use daily. Portable radios and a portable PA device were also available for use as needed and were checked semiannually. Emergency Call Lists had been revised and updated as needed and were available in the Control Room and in the various Emergency Cache Kits as required. The inspector also verified that emergency equipment, including decontamination material, was available and was being inventoried semiannually as required by the E-Plan.

The documentation of the training and drills conducted during the past two years was reviewed. Emergency preparedness and response training was being completed typically just prior to the drills during the meetings held to prepare for the drills. Through drill scenario and record reviews, and personnel interviews, off-site emergency responders were determined to be knowledgeable of the proper actions to take in case of an emergency. Emergency drills had been conducted annually and had included participation of off-site support groups every other year as required by the E-Plan. Drill scenarios and critiques had been written as well. However, it was noted that little detail was included and attendance was not always well documented. Also, the critique write-ups did not typically include any strengths and weaknesses identified during the exercise. The licensee was informed that the issue of adequate documentation of drills and critiques would be considered by the NRC as an Inspector Follow-up Item (IFI) and would be reviewed during a future inspection (IFI 50-607/2012-201-01).

The inspector met with Captain Condit of Station 109 of the Sacramento Metropolitan Fire Department (SMFD). The inspector observed the Hazardous Materials (HAZMAT) capabilities and equipment. The inspector determined that SMFD representatives were familiar with the radiological equipment which is regularly calibrated. Captain Condit and the UCD/MNRC Radiation Safety Officer discussed potential training opportunities at the facility for the individuals at the department that may not be familiar with the facility. There appeared to be a good working relationship between the licensee and this support group.

c. Conclusion

The emergency preparedness program was being conducted in accordance with the Emergency Plan.

10. Follow-up on Previous Identified Item

a. Inspection Scope (IP 92701)

The inspector reviewed the licensee's actions taken in response to previously identified Inspector Follow-up Items (IFIs) and an Unresolved Item (URI).

b. Observation and Findings

- (1) IFI 50-607/2006-201-01 (Open) - Follow-up on the licensee's actions to update and correct the organizational chart specified in the TS by submitting the appropriate TS change request.

During an inspection in August 2006, the inspector determined that the licensee's organizational chart for the UCD/MNRC stipulated that the chain of command included an "Operations Manager" who would be in charge of reactor operations and to whom the Reactor Supervisor would report. The chart also included a staff position designated as "HP (Health Physics) Supervisor." Since these two positions were not part of the current organization, the inspector questioned the licensee about this. The licensee indicated that a TS change was being prepared but it was not complete and had not been submitted as of the date of the 2006 inspection.

The inspector reviewed this issue with the licensee. It was noted that, in 2010, the licensee had completed a change to the TS concerning the organization which would bring the organizational structure specified in the TS into agreement with actual conditions at the facility. This change had been reviewed and approved by the Chairman of the Nuclear Safety Committee and the licensee had subsequently submitted it to the NRC. The change was still under review by the NRC. This issue will remain open until the NRC reviews and approves the TS change.

- (2) IFI 50-607/2011-201-01 (Closed) - Follow-up on the licensee's actions to log changes in status of TS related equipment and performance of TS surveillances.

During an inspection in February 2011, it was noted that the reactor logs were used to record problems with equipment resulting in "call backs" (when licensee personnel had to return to the facility after hours to respond to an alarm) and to record abnormal events or anomalies. Emergency shutdowns and inadvertent scrams were also noted in the logs. However, the logs did not contain changes in status of TS related equipment such as failure to pass surveillances and performance of surveillances.

The inspector reviewed the licensee's actions concerning the issue of documenting changes in status of TS related equipment and performance of TS surveillances in the operations logs. Efforts had been made to improve the amount of information that was entered into the logs. Although continual emphasis would be required to ensure that adequate log entries are made, the licensee was making progress. This issue is considered closed.

- (3) IFI 50-607/2011-201-02 (Open) - Follow-up on the licensee's actions to improve the biennial operator requalification written examinations through the reduction of overlapping question between examinations.

During the February 2011 inspection, the inspector reviewed the 2008 and 2010 biennial written examinations taken by the reactor operators at the facility. The inspector noted that there was an unacceptable quantity of overlapping of questions from the 2008 exam to the 2010 examination. The licensee was informed that the issue of improving the biennial operator requalification written examinations through the reduction of overlapping question between examinations would be considered an IFI.

The inspector reviewed the licensee's actions taken to improve the written examinations and reduce the number of overlapping questions from one exam to the next. The licensee was in the process of establishing a computer data base containing over two hundred questions that could be used to randomly select questions to generate an exam. This would ensure that the questions on each written examination were different and alleviate the problem of repeating questions from one exam to the next. Because this was still ongoing at the time of the inspection, this item will remain open and will be reviewed during the next operations inspection at the facility.

- (4) URI 50-607/2011-201-03 (Closed) - Follow-up to ensure that identified individuals change in medical condition and the condition of his license is resolved.

During the February 2011 inspection, the inspector also noted that all operators were receiving the biennial medical examinations required by the program in accordance with ANS/ANSI 15.4-1988. However, during the review, the inspector noted that one individual's November 9, 2009 NRC Form 396 CERTIFICATION OF MEDICAL EXAMINATION BY FACILITY LICENSEE identified a change in condition that had not been reported to the NRC. The licensee was informed that, pending the NRC doctor's review of the individuals' condition, this issue would be identified as an Unresolved Item (URI) by the NRC.

The inspector reviewed this issue. It was noted that the licensee had obtained a letter from the individual's doctor stating that the conditions noted during the examination were being treated with the proper medication and the proper equipment. This letter and an updated NRC Form 396 were sent to the NRC as requested. The licensee had not been required to submit any other documentation and the NRC doctor had not indicated that any other follow-up would be needed. This issue is considered closed.

c. Conclusion

Four Items identified during previous inspections were reviewed during this inspection. One IFI was closed but two remain open. The URI was reviewed and closed.

11. Exit Interview

The inspection scope and results were summarized on January 26, 2012, with members of licensee management and staff. The inspector described the areas inspected and discussed in detail 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. Effert	Electronics Engineer and RO Trainee
B. Klein	Reactor Director
M. Lerche	Associate Director for Research/Education Coordination and Experiment Coordinator
B. Liu	Research Support Engineer
R. Miller	Level II Radiographer and SRO
D. Reap	Radiation Safety Officer, Security Officer, and SRO
M. Lagunas-Solar	Associate Director for Radioisotopes Sciences and Development and Member of the Nuclear Safety Committee
W. Steingass	Associate Director for Reactor Operations and Reactor Supervisor
R. Walker	Radiographer/Mechanic

Other Personnel

J. Condit	Captain, Station 109, Sacramento Metropolitan Fire Department Hazardous Materials Unit
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INSPECTION PROCEDURE USED

IP 69003	Class I Research and Test Reactor Operator Licenses, Requalification, and Medical Activities
IP 69005	Class I Research and Test Reactor Experiments
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 69009	Class I Research and Test Reactor Fuel Movement
IP 69010	Class I Research and Test Reactor Surveillance
IP 69011	Class I Research and Test Reactor Emergency Preparedness
IP 92701	Follow-up on Previously Identified Items

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-607/2012-201-01	IFI	Follow-up on the licensee's actions to adequately document emergency drills and critiques at the facility.
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Closed

50-607/2011-201-01	IFI	Follow-up on the licensee's actions to log changes in status of TS related equipment and performance of TS surveillances.
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50-607/2011-201-03 URI Follow-up to ensure that identified individuals change in medical condition and the condition of his license is resolved.

Discussed

50-607/2006-201-01 IFI Follow-up on the licensee's actions to update and correct the organizational chart specified in the TS by submitting the appropriate TS change request.

50-607/2011-201-02 IFI Follow-up on the licensee's actions to improve the biennial operator requalification written examinations through the reduction of overlapping question between examinations.

PARTIAL LIST OF ACRONYMS USED

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
EH&S	Environmental Health and Safety
E-Plan	Emergency Plan
ERB	Experiment Review Board
HP	Health Physics
IFI	Inspector Follow-up Item
IP	Inspection procedure
IRF	Irradiation Request Form
LOA	Letter of Agreement
MNRC	McClellan Nuclear Radiation Center
Mod.	Modification
MOU	Memorandum of Understanding
MRC	Modification Review Committee
MW	Megawatt
MWO	MNRC Work Order
NRC	Nuclear Regulatory Commission
NSC	Nuclear Safety Committee
OMM	Operation and Maintenance Manual
PA	Public Address (system)
Rev.	Revision
SRO	Senior Reactor Operator
TS	Technical Specifications
UCD	University of California, Davis
UCDMC	University of California, Davis Medical Center
UCD/MNRC	University of California, Davis/McClellan Nuclear Radiation Center
URI	Unresolved Item