

April 20, 2006

Dr. Robert G. Flocchini, Director  
UC Davis McClellan Nuclear Radiation Center  
5335 Price Avenue, Building 258  
McClellan, CA 95652

SUBJECT: NRC INSPECTION REPORT NO. 50-607/2005-201

Dear Dr. Flocchini:

This refers to the inspection conducted on December 5 - 9, 2005, at the University of California, Davis Nuclear Radiation Center. The enclosed report presents the results of that inspection. Areas examined during the inspection are identified in the report. Within these areas, the inspection consisted of selective examinations of procedures and representative records, interviews with personnel, and observations of activities in progress.

Based on the results of this inspection, no safety concern or noncompliance to NRC requirements was identified. No response to this letter is required.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) <http://www.nrc.gov/reading-rm/adams.html>. If you have any questions concerning this inspection, please contact Mr. Thomas Dragoun at 610-337-5373.

Sincerely,

**/RA/**

Brian Thomas, Branch Chief  
Research and Test Reactors Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

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

Enclosure: NRC Inspection Report No. 50-607/2005-201

cc w/enclosures: Please see next page

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

Docket No: 50-607

Report No: 50-607/2005-201

Licensee: University of California, Davis

Facility: McClellan Nuclear Radiation Center

Location: McClellan Park  
Sacramento, California

Dates: December 5 - 9, 2005

Inspector: Thomas F. Dragoun

Approved by: Brian Thomas, Branch Chief  
Research and Test Reactors Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

## EXECUTIVE SUMMARY

University of California, Davis  
Report No: 50-607/2005-201

The primary focus of this routine, announced inspection was the on-site review of selected aspects of the licensee's Class 1 research reactor program including: reactor organization, radiation protection program, effluent control and environmental monitoring.

### Reactor Organization

The licensee's organization experienced a period of large, rapid reduction in staff and personnel changes in the office of the Director. The inspector found the remaining staff to be qualified in accordance with the TS requirements and capable of safe operation of the reactor on the reduced work schedule. The facility staffing level was under review by the licensee.

### Radiation Protection

Within the scope of this review, the radiation safety program met regulatory requirements. However, major changes to the program were implemented but with unacceptable consequences that reduced the safety margin in certain activities. For example, no radiation safety personnel were available for monitoring jobs with high radiation levels or to provide recommendations to the workers. Revisions of the policies and procedures that define the program have not been completed. NRC inspector follow-up item 50-607/2004-202-01 remains open.

### Effluent Control and Environmental Monitoring

The licensee's effluent control and environmental monitoring program was conducted in accordance with the requirements in Technical Specification 6.4.2(d) and 10 CFR Part 20. Monitoring results demonstrate that doses to the public from effluent releases were below the NRC regulatory limits.

## REPORT DETAILS

### **Summary of Plant Status**

The licensee's two megawatt TRIGA research reactor was operated in support of neutron radiography, medical isotope production, neutron tomography, experimental sample irradiation, and reactor operator training.

#### **1. Organization**

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

The inspector reviewed the following to verify compliance with the staffing requirements in TS 6.1 "Organization" revision 12:

- C organizational structure of the radiation protection staff
- qualifications of radiation protection personnel
- C management responsibilities
- Safety Analysis Report, Revision 4, dated December 1999, Chapter 11, "Radiation Protection and Waste Management Program"
- Safety Analysis Report Revision 4, dated December 1999, Chapter 12, "Conduct of Operations"
- American Nuclear Society Standard 15.11 - 1993, "Radiation Protection at Research Reactor Facilities"
- American Nuclear Society Standard 15.4 - 1988, "Selection and Training of Personnel for Research Reactor"

##### b. Observations and Findings

The last NRC inspection of this program occurred on November 15 - 19, 2004. At that time, the recently appointed Facility Director terminated 14 licensed reactor operators and all 4 staff engineers which left 18 personnel remaining on the operations staff. Since that time, additional losses include 2 radiation protection personnel, 2 Senior Reactor Operators, 4 radiographers, 1 finance manager, and the Radiation Safety Officer, all were either terminated or left. These personnel actions resulted in a total loss of the entire radiation protection staff. The Director at that time stated that the licensed operators will be directed to perform all of the radiation protection program requirements usually done by the radiation protection staff. A Reactor Operator with experience as a radiation protection technician was designated as the replacement RSO on December 1, 2005. The Director, who implemented the staff reductions, arrived on site in June 2004, and left the site in June 2005. In November 2005, a University faculty member was designated as the permanent, replacement Director. The rapidity of the personnel changes precluded any knowledge transfer. At the time of this inspection, the staff consisted of 5 licensed Senior Reactor Operators (SRO) (down from a total of 32 SRO the previous year) and the recently appointed Radiation Safety Officer (RSO). Three of the 5 SRO may retire early for health reasons. From a review of records and interviews with the staff, the

inspector determined that the current staff personnel satisfied the training and experience requirements associated with their position. In addition, the workload has decreased and the schedule reduce to one shift of operations.

In November 2005, a faculty member who had been the acting Reactor Facility Director was appointed to the position on a full time basis. He indicated that he will continue his 30 year association and directing the operation of the on-campus cyclotron (25% time commitment) while focusing the majority of his attention to the reactor facility (75% time commitment). The inspector was advised that the staffing situation was being reviewed on a high priority by the Director with input from the staff to ensure that safety was not compromised by the staff reductions.

c. Conclusion

The licensee's organization experienced a period of large, rapid reduction in staff and personnel changes in the office of the Director. The inspector found the remaining staff to be qualified in accordance with the TS requirements and capable of safe operation of the reactor on the reduced work schedule. The facility staffing level was under review by the licensee.

**2. Radiation Protection**

a. Inspection Scope (Inspection Procedure 69012 )

The inspector reviewed the following to determine if the facility radiation protection program has been maintained in accordance with regulatory requirements and licensee commitments since the last inspection.

- 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-15.1-1990, "The Development of Technical Specifications for Research Reactors"
- American National Standard ANSI/ANS-15.11-1993, "Radiation Protection at Research Reactor Facilities"
- American National Standard ANSI/ANS N323-1997, "Radiation Protection Instrumentation Test and Calibration"
- "Comprehensive List of Duties", undated, unsigned. Used by the new RSO to inform site personnel (Security Manager, Emergency Coordinator, EH&S Official, Senior Reactor Operator) with their role in the radiation safety program

- Internal document “What HPs Do,” a summary list of routine tasks and periodicity required by the radiation protection program compiled by the RSO
- Document Number MNRC- 0029-DOC-06 revision 6, dated March 16, 1998, “MNRC Health Physics Procedures”
- The “Self Inspection Checklist” (annual audit) was completed by the RSO on June 29, 2005
- Data records for the weekly and monthly status checks on radiation area monitors (RAM) and continuous air monitors (CAM) for 2005.
- Routine radiation survey data records for the period December 2004 to October 2005
- Health Physics Procedure “Radiation Survey Procedures” Revision 10 undated. Records of weekly surveys of radiation and contamination levels in building 258 for the period July 1 to November 30, 2005
- Personnel exposure records for current year as of December 6, 2005
- Special Operating Procedure (SOP) 03-09, “Transfer of Residual Xenon Gas From the Cold Finger to DS-2” dated November 13, 2003
- SOP 04-01, “Iodine - 125 Production Facility Safety Interlock Relay Upgrade” dated February 10, 2004
- Procedure “Radiation Survey Procedures”, Revision 10, undated. Appendix A, “Required Radiation Surveys for the MNRC Facility” Appendix B, “Required Contamination Surveys for the MNRC Facility”
- Daily smear records for September 2003 to June 2004. Weekly smear records for September, October, and November 2005. Quarterly smear results for 4<sup>th</sup> quarter 2005. Random radiation level results for the past two years
- SOP 04-03, “Anti-Contamination Clothing Requirements for Iodine Loop Irradiation Chamber Replacement” dated March 29, 2004
- SOP 04-10, “Package Radioactive Waste in 55 Gallon Drums” dated September 2, 2004
- Radiation Work Permit (RWP) 05-001, “Insert/Remove Tools and Fixtures In/Out of Reactor Tank” issued January 5, 2005
- RWP 05-002, “Change and Pump Down Demineralizer Bottles” issued January 5, 2005

- RWP 05-003, "Change Reactor Room Pre-filter/HEPA Filter" issued January 5, 2005
- Procedure MNRC-0042-doc, "Ludlum Model 19 Calibration Procedure" dated March 17, 1999
- Procedure MNRC-0042-doc addendum 36, "High Voltage Plateau Procedure" Revision 2, dated May 17, 1999
- Procedure MNRC-0042-doc addendum 26, "High Purity Germanium (HPGe) Counting Procedure (Genie-ESP)" Revision 2, dated May 10, 1999
- Procedure MNRC-0042-doc addendum 41, "HPGe Calibration Procedure" Revision 1, dated March 4, 1999
- Procedure MNRC-0042-doc addendum 47, "HPGe Shutdown and Start-up Procedure" Revision 0, dated March 4, 1999
- Procedure MNRC-0042-doc addendum 16, "Canberra 2404 Calibration Procedure" revision 6, dated April 20, 2005
- Records of annual calibration of HPGe detectors number 08, 25, 50, 99
- Records of training and training content for the following sessions:
  - Annual ALARA training held March 23, 2004, and March 30, 2005
  - Lesson Plan E held on February, June, and August 2005
  - Lesson Plan B held on June, July, August, and September 2004, and January and July 2005. Written exams were on file.
  - Lesson Plan C held in August 2003.
- Radioactive waste stored for decay in Bay 1
- Radioactive waste records and manifests for shipments for disposal on March 29 and June 15, 2005

b. Observations and Findings

Inspector Follow-Up Item 50-607/2004-202-01 was opened during the last NRC inspection in response to the Facility Director at that time who stated that major changes were underway in the radiation protection program but were only 50% complete. The new incumbent Director indicated that the program changes were complete. However, several of the changes appear to have had a negative impact on safety and are under review. The inspector confirmed that no violation of Technical Specifications or regulatory requirements was noted and the Follow-Up Item will remain active.

One of the program changes was the large number of personnel that were terminated, and elimination of the radiation protection department. To begin the

recovery, a radiation protection technician was hired and successfully completed the qualification program in August 2005. The technician was given direct responsibility for routine surveys and monthly checks of reactor equipment as required by TS Sections 3.7 and 4.7. A Radiation Safety Officer (RSO) was named on December 1, 2005, which was one week prior to this inspection. Since there was no knowledge transfer during the rapid staff reductions, the technician and RSO were on a steep learning curve with help from the experienced reactor operators.

A review of records shows that routine radiation protection monitoring activities were completed on time. The personnel dosimetry was supplied by a NVLAP certified company (Global Dosimetry Solutions). The dosimetry was processed monthly and all results were below the NRC limits. New electronic self reading dosimeters were issued to permanent staff to increase attention to the ALARA goals by providing real time data and various alarms.

Training of personnel who require access to the various areas of the reactor facility was offered in five levels coded "A" to "E". The inspector reviewed the content of the training and verified that the information provided to the workers satisfied requirements in 10 CFR Part 19. Written exams were challenging. Some training was on hold since the trainer was terminated during the cutback and a replacement has not been identified.

Portable survey instruments are calibrated in-house or by a vender (Qual-Tek Associates) using ANSI-N323 as guidance. In-house calibrations were performed in accordance with facility procedures. Random checks by the inspector found instruments in use in the facility were calibrated. An adequate supply of survey equipment was on hand. Calibration procedures were reviewed and found to follow the manufacturers recommendations and generally accepted practices. The maintenance and calibration of the analytical laboratory equipment was also properly conducted.

There were two shipments of radioactive waste during 2005 to a waste broker (Thomas Gray & Associates). Both shipments used NRC Form 540 as the manifest. The description, classification, and packaging of the waste appeared to be satisfactory.

The radiation protection program was documented in "MNRC Health Physics Procedures" as required by 10 CFR 20.1101(a). The annual review required by 10 CFR 20.1101(c) was completed on June 29, 2005, by the RSO on staff at the time. The review consisted of a checklist with 27 line items with each item referencing 1 or more regulatory requirements. No major weakness was identified during this review.

In addition to the Health Physics Procedures, the licensee uses Special Operating Procedures (SOP) for repetitive tasks involving operation of equipment. The industrial and radiological safety requirements are documented in the SOP. Non-repetative jobs had Radiation Work Permits to specify the hazards and safety precautions. The Reactor Operations Manager indicated that

many procedures, including the SOP, needed to be revised and updated but no staff was available to accomplish the task.

c. Conclusions

Within the scope of this review, the radiation safety program met the regulatory requirements. However, major changes to the program were implemented but with unacceptable consequences that reduced the safety margin in certain activities. For example, no radiation safety personnel were available for monitoring jobs with high radiation levels or to provide recommendations to the workers. Revisions of the policies and procedures that define the program have not been completed. NRC inspector Follow-Up Item 50-607/2004-202-01 remains open.

**3. Reactor Effluent and Environmental Monitoring**

a. Inspection Scope (IP 69004)

The inspector reviewed the following to determine if the licensee's effluent controls and environmental monitoring program have been effectively maintained to meet regulatory requirements including the 10 CFR Part 20 constraint limit, TS Limiting Condition for Operation (LCO) 3.7 "Reactor Radiation Monitoring System," LCO 3.7.2 "Effluents - Argon 41 Discharge Limit", and TS 4.7 "Reactor Radiation Monitoring Systems":

- Procedure "Environmental Radiation Monitoring Procedures", Revision 13 data for March 9 to September 27, 2005
- Procedure "Radioactive Effluent Monitoring Procedures" Revision 11, undated. Data of the daily operability check of the 4 Continuous Air Monitors (CAM) recorded in the Health Physics Daily Log. Hourly readout data used to calculate dose to the public
- Quarterly environmental TLD results for January-April, April-July, and July-October 2005

b. Observations and Findings

The environmental monitoring program was changed significantly as reported in the previous NRC inspection. Monitoring was reduced to 94 dosimeters at the site perimeter which are processed quarterly. A surface water sample was also taken quarterly and analyzed using gamma spectroscopy, gas flow proportional counting for alpha and beta emission, and liquid scintillation for beta emissions. There was no radiation detected above background. The facility does not discharge potentially contaminated water. The public dose from argon 41 releases up the exhaust stack was calculated daily based on readout on the CAM. The data was entered into a computer spreadsheet which uses the

CAP88 software program to do the calculation. The doses to the public were below the NRC constraint limit.

c. Conclusions

The licensee's effluent control and environmental monitoring program was conducted in accordance with the requirements in the TS 6.4.2(d) and 10 CFR Part 20. Monitoring results demonstrate that doses to the public from effluent releases were below the NRC limits.

**4. Exit Interview**

The inspection scope and results were summarized on December 8, 2005, with members of licensee management. The inspector described the areas inspected and discussed in detail the inspection findings. No dissenting comments were received from the licensee.

## PARTIAL LIST OF PERSONS CONTACTED

### Licensee

R. Flocchini	Director
D. Reap	Radiation Safety Officer
W. Steingass	Reactor Supervisor

### INSPECTION PROCEDURE USED

IP 69004	CLASS I	RESEARCH AND TEST REACTOR EFFLUENT AND ENVIRONMENTAL MONITORING
IP 69006	CLASS I	RESEARCH AND TEST REACTORS ORGANIZATION AND OPERATIONS AND MAINTENANCE ACTIVITIES
IP 69012	CLASS I	RESEARCH AND TEST REACTOR RADIATION PROTECTION

## ITEMS OPENED, CLOSED, AND DISCUSSED

### Opened

none

### Discussed

50-607/2004-202-01	IFI	Review changes to licensee's radiation protection program. This item remains open.
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### Closed

none

## PARTIAL LIST OF ACRONYMS USED

CFR	Code of Federal Regulations
HP	Health Physics
IP	inspection procedure
MNRC	McClellan Nuclear Radiation Center
NRC	Nuclear Regulatory Commission
RSO	Radiation Safety Officer
SRO	Senior Reactor Operator
TS	Technical Specifications
UCD	University of California, Davis