U. S. NUCLEAR REGULATORY COMMISSION

REGION V

Report No. 50-224/83-01

Docket No. 50-224 License No. R-101

Licensee: University of California
Berkeley, California 94720

Facility Name: TRIGA, MARK III

Inspection at: Berkeley, California

Inspection conducted: May 24-25, and June 2, 1983

Inspector: Conrad I Sherman 6/16/83
C. I. Sherman, Radiation Specialist Date Signed

Approved By: F. Wenslawski 6/16/83
F. Wenslawski, Chief, Date Signed
Reactor Radiation Protection Section

Approved By: H. E. Book 6/17/83
H. E. Book, Chief, Radiological Safety Branch Date Signed

Summary:

Areas Inspected: Routine unannounced inspection of the radiation protection program including organization, personnel monitoring, surveys, effluent releases, instrument calibration; radioactive material transportation activities and environmental monitoring program. Independent radiation/contamination surveys were conducted. The inspection involved 17 hours of on site inspection effort by one NRC inspector.

Results: Of ten areas inspected, no items of noncompliance or deviations were identified.

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DETAILS

1. Persons Contacted

*Professor S. Kaplan, Reactor Administrator
*Dr. T. Lim, Reactor Supervisor
*G. Little, Reactor Health Physicist
*M. Denton, Chief Reactor Operator
J. Harrell, Reactor Operator

*Denotes those attending the exit interview.

2. Organization, Logs, and Records

The organizational structure for operation, radiation protection and administration of the Berkeley Research Reactor remains unchanged from that previously reported (50-224/80-03/82-03). The Chief Reactor Operator retired February 7, 1983 and a replacement was hired in April. The reactor health physicist has been assigned additional duties and no longer provides full time support to reactor operations. A part-time assistant performs routine tasks to assist the health physicist.

Facility operation records, reports, and logs were examined and found to document the performance of the radiation protection program, environmental monitoring and transportation activities consistent with the regulatory and Technical Specification requirements. Specific records examined are as follows:

a. Operation Logs

b. Survey Records (radiation, contamination, and airborne)

c. Personnel exposure records

d. Portable instrument calibration records

e. Audit reports

f. Waste shipping records

g. Weekly Reactor Operations Checklists

h. Fixed instrument calibration records

No items of noncompliance were identified.

3. Environmental Protection

a. Gaseous Effluent

The records of gaseous effluent releases were reviewed for the period January 1982 to date. Release records indicate 2.9 curies of Argon-41 were released in 1982 and 0.67 curies Argon-41 in 1983 to date. The average stack concentration was 3×10^{-9} uCi/cc. This

value is less than one percent of the maximum permitted by Technical Specification 3.6 (3.12×10^{-6} uCi/cc).

The maximum release for a ten minute period during 1982 was 0.44×10^{-6} uCi/cc. Argon-41 releases were within Technical Specification and Part 20 limits. The licensee stated that the reactor is not operated when the gaseous effluent monitor is inoperable.

No items of noncompliance were identified.

b. Particulates

Particulate air samples are taken in the facility exhaust systems, the reactor bridge and other locations within the facility. These samples are analyzed weekly. Results of particulate air samples range from 10^{-13} to 10^{-15} uCi/cc of beta gamma activity. All sample results are well within the Part 20 limits.

No items of noncompliance were identified.

c. Liquid Waste Releases

Liquid waste is collected in glass containers and transferred to the Berkeley campus Environmental Health and Safety (EH&S) office (State of California License) for disposal. A review of the waste log indicated one shipment of waste containing natural uranium. No liquid waste is discharged to the environment from the reactor facility.

No items of noncompliance were identified.

d. Solid Waste

One transfer of solid waste to EH&S was made during 1982 consisting of natural uranium and 0.2 mCi of mixed activation products.

No items of noncompliance were identified.

e. Environmental Radiation Study

The licensee conducts an environmental radition study using $CaSO_4$:Dy thermoluminescent dosimeters. These dosimeters are exchanged quarterly. Exposure record were examined for the period January 1982 to date. Exposure ranged from 0-5 millirem per quarter. Dosimeters located directly above the reactor on the patio ranged to 50 millirem per quarter. Only transient occupancy occurs on this patio.

A radiation survey of the patio area performed by the NRC inspector while the reactor was operating at maximum power indicated maximum exposure rate of 1 mr per hour at the patio deck in the area over the reactor core. The survey was performed with Eberline Model RO-2 ion chamber, NRC No. 009154 due for calibration June 11,

1983. Environmental dosimeter and radiation surveys indicate that radiation levels in unrestricted areas are within Part 20 limits.

No items of noncompliance were identified.

4. Radiation Monitoring System

a. Area Radition Monitors

Area radiation monitors (ARM) are located on the reactor bridge, and various locations in the facility. Technical Specification 3.5 and 5.4 require operability of at least two of these monitors. Technical Specification 4.2.3 requires an annual calibration and a weekly verification of operability. Technical Specification 6.5 specifies that procedures be available for calibration, tests and response to alarms.

A review of records indicated that the ARM system was calibrated July 15, 1981 and July 22, 1982, in accordance with written procedure NERL-23, 'Area Radiation Monitor-Annual Calibration'. A written procedure is available for response to alarms. The operator weekly checklist provides for checking the low and high alarm setpoints and the alarm function. A small source internal to each monitor and alarm function upon loss of detector radiation signal provide for a continuous source check. Operation of the reactor provides an additional check on detector response for the reactor bridge ARM.

The inspector considers the weekly check combined with the continuous source check to meet the verification of operability as required by Technical Specification 4.2.3.

No items of noncompliance were identified.

b. Air Monitoring Systems

Continous monitoring systems in use are the particulate continuous air monitor (CAM) at the reactor bridge and the noble gas monitor sampling the exhaust stack. Technical Specification requirements for the particulate CAM are the same as those described in paragraph 4(a). The continuous air monitor (CAM) is required for operation of the reactor.

The licensee provides a backup monitor when the CAM is inoperable. Review of records indicated that both monitors are calibrated annually, in accordance with Procedure NERL-24, 'Air Particulate Monitor-Annual Calibration.' Operability checks are performed weekly by the reactor health physics assistant and monthly by the reactor operator.

No items of noncompliance were identified.

c. Noble Gas Monitor(s)

This monitor is used to measure environmental releases of Argon-41 to assure compliance with Technical Specification.

The inspector reviewed Procedure NERL-8, "Stack Gas Monitor Calibration" and NERL-10, "Report on Ar-41, Production and release from BRR facility." Calibration of the monitor is accomplished by injecting a quantity of Ar-41 into the sample chamber and observing the detector response. The Ar-41 is produced in the BRR, the quantity produced is calculated based on a prior neutron flux measurement. Calculations are made to relate the detector response to a concentration of Ar-41 in the effluent.

The stack gas monitor is calibrated annually, the most recent calibration on September 17, 1982. Alarm and setpoints are verified weekly and a source check for proper response is performed on a monthly basis.

An area radiation monitor installed in the exhaust plenum area is used to meet Technical Specification requirements 3.5, 4.2.3 and 5.4. for an exhaust gas radiation monitor. This monitor is used to activate the emergency ventilation system. Discussions with reactor operations and review of weekly and monthly check sheets indicate that operation of this monitor and ability to actuate the emergency ventilation system is tested weekly. A continuous test of detector operability is provided by a small internal source and an alarm on low radiation signal. An external response test is performed monthly.

No items of noncompliance were identified.

5. Radiation Protection Program

a. Posting and Labeling

A review of licensee posting in accordance with 10 CFR 19.11 was performed during a tour of the reactor facility. The inspector noted that the current revision (6-82) of NRC Form-3 was not posted. The inspector provided copies of the current version to the reactor supervisor.

Radiation areas, high radiation areas were properly posted and controlled pursuant to 10 CFR 20.203. Independent radiation surveys are described in paragraphs 3.e and 12. Radioactive Materials were observed to be properly labeled.

No items of noncompliance were identified.

b. Personnel Monitoring

Regularly assigned personnel and students are assigned film badges (beta-gamma or beta-gamma-neutron (BGN), as appropriate), visitors are assigned pocket dosimeters. BGN badges use NTA film for neutron

monitoring. The limited value of NTA film for neutron dosimetry was discussed with the reactor health physicist. Badges are supplied and processed monthly or quarterly by a contractor. Observation during facility tours indicated that the devices are used. Extremity dosimetry is provided by the reactor health physicist at his discretion.

An examination of personnel monitoring records for 1982 and 1983 to date was performed. No neutron exposure was identified by the monitoring program. Only one individual received measureable gamma exposure, 255 mrem for 1982. Records for visitor exposure indicated a maximum exposure of 45 mrem to any individual in 1982.

It was noted that the licensee does not test or calibrate pocket dosimeters used by visitors. The licensee plans to implement a calibration program in the next few months.

No items of noncompliance were identified.

c. Surveys

The licensee performs monthly radiation surveys of the facility. Contamination surveys are performed weekly. Special radiation surveys are performed for experiments, classes and reconfiguration of facilities.

A hand and foot monitor is used to provide exit monitoring.

Surveys are performed by the reactor health physicist and his assistant. Surveys are performed for neutron and gamma radiation.

Surveys for airborne radioactivity include continuous fixed samplers in the sample handling area, the counting room and the reactor bridge. These samples are analyzed weekly. Review of records for 1982 and 1983 indicate that samples remain below 2×10^{-13} uCi/cc gross beta-gamma activity.

The licensee program for determination of exposure to non-penetrating radiation was reviewed. The licensee stated that experience and previous evaluation have shown that non-penetrating dose rate surveys are not necessary. The licensee does not perform calibrations in order to correct non-penetrating dose rate measurements to actual contact measurements. The inspector discussed this matter with the licensee and indicated that underestimation of non-penetrating radiation dose rates could occur.

The licensee has agreed to calibrate instruments for non-penetrating radiation using a uranium source and to develop a program for evaluating non-penetrating radiation exposure, either by special surveys or by routinely performing the surveys. This item will be reviewed in a subsequent inspection (83-01-01).

Other areas of the survey program appear consistent with the requirements of 10 CFR 20.201.

No items of noncompliance or deviations were identified.

6. Transportation Activities

An examination of licensee radioactive material shipment records for 1982 and 1983 to date was conducted. Radioactive materials produced in the reactor are transferred to the University's state license, DOE facilities, and one state licensed facility.

A review of transfers to the state licensed facility indicated that some shipping papers contained minor technical errors. During the inspection the licensee acknowledged the errors and took actions to correct them.

In connection with these shipments, the inspector verified certification of DOT specification 7A containers pursuant to 49 CFR 173.395(a)(1).

No items of noncompliance were noted.

7. Training

The licensee's training program for meeting 10 CFR 19.12 requirements was examined. The reactor training program is described in IE Inspection Report 50-224/80-03.

The inspection revealed that a formal training program has not been established. Instruction to student groups is provided in a 30 minute lecture by the reactor health physicist. Individual instruction is provided to other workers. The content of training appears to meet the requirement of paragraph 19.12 but material presented is not documented. Training is verified by personnel file cards. The reactor health physicist signs the reverse of these cards, noting that training was given. A "Certification to Enter Unescorted" form is maintained on file for persons granted unescorted access.

The licensee provides training, per the recommendation of Regulatory Guide 8.13 to all females entering the facility.

No items of noncompliance or deviations were identified.

8. Experiments and Irradiation Limits

The inspector examined the reactor health physicist's reviews of new experiments to verify compliance with the Technical Specifications. Review of Experiment 362A, "Production of Lutecium", and Experiment 361, "Irradiation of UO_2 and I-131", were examined by the inspector. The reactor health physicist routinely evaluates experiments for activity produced, expected radiation levels and other factors such as contamination potential. Reviews are documented in a memo to the reactor supervisor.

The experiment evaluations appear to be adequate.

No items of noncompliance were identified.

9. Audits

The inspector verified that audits are performed quarterly by members of the reactor hazards committee, in accordance with Technical Specification 6.2.C. A audit of the radiation monitoring system by E. Hill, dated December 16, 1982, was reviewed by the inspector.

No items of noncompliance were identified.

10. Instrument Calibration

The licensee conducts portable radiation survey instrument calibration activities at the reactor facility. Calibration procedures are available for each instrument. These procedures are approved by the Berkeley Campus RSO.

A review of records indicated that these instruments are calibrated quarterly. Inspection of licensee instruments verified that instruments in use are within the calibration frequency requirement.

The licensee does not calibrate instruments for non-penetrating radiation. This is discussed further in paragraph 5.C (surveys).

No items of noncompliance were identified.

11. Follow-up on Information Notice

The licensee had not received IE Information Notice 82-49, "Correction for sample conditions for air and gas monitoring."

The inspector provided a copy of the notice to the licensee.

12. Independent Measurements

Independent radiation surveys were performed by the inspector in order to confirm licensee compliance with the posting requirements of 10 CFR 20.203 and 20.105.

An independent contamination wipe survey check of the licensee's unrestricted areas was conducted by the inspector. The swipes were analyzed at NRC Region V office on a Nuclear Measurement Corporation scaler, Model PC-55. The analysis did not identify any contamination levels.

The examination of radition levels in unrestricted areas, posting in restricted areas and contamination levels did not reveal any items of noncompliance.

13. Exit Interview

The inspector met with licensee representatives at the conclusion of the inspection on June 2, 1983. Licensee representatives in attendance are denoted in paragraph 1. The inspector summarized the scope and findings.

The licensee concurred with the inspectors comments in the need for improving the following areas of concern:

a. The need to evaluate techniques for measuring non-penetrating radiation and to evaluate non-penetrating radiation exposure experienced at the facility.

b. The need to calibrate pocket ionization chambers in accordance with Regulatory Guide 8.4.

c. The need to document the content of the training program to assure a uniform presentation consistent with regulatory requirements.

d. The need to ensure that shipping papers are correct in order to fully conform to 49 CFR requirements.