NUCLEAR ENGINEERING REACTOR LABORATORY

TRIGA MARK III FACILITY

UNIVERSITY OF CALIFORNIA

BERKELEY, CALIFORNIA

BERKELEY RESEARCH REACTOR

ANNUAL REPORT OF OPERATIONS

January 1, 1983 through December 31, 1983

(BRR Technical Specifications 6.7.2)

Tek H. Lim
Reactor Supervisor

BERKELEY RESEARCH REACTOR OPERATIONS, 1983

Reactor Use

The Berkeley REsearch Reactor (BRR) is a TRIGA Mark III facility capable of producing 1 MW steady state and of pulsing to 1300 MW peak power. The Berkeley Research Reactor is a research and educational tool of the University of California, is located on the Berkeley Campus and is operated by the Department of Nuclear Engineering.

Besides being used by the Department of Nuclear Engineering, it is used by other departments and campuses of the University, by the Lawrence Berkeley Laboratory and is available to Universities and Colleges in the area. The Lawrence Berkeley Laboratory is operated by the University of California under contract from the Department of Energy.

In addition, the Berkeley Research Reactor is used as an irradiation source for service to industry contracts and provides a stimulant to touring and interested high school and college students.

Experiments Performed

Table I lists the experiments which were performed in the Berkeley Research Reactor during the year 1983. A total of 25 different experiments were performed. Three new experiments were approved between January 1 and December 31, 1983. The last column in Table I illustrates the number of times each experiment was performed.

Table I. Experiments Performed at the Berkeley Research Reactor in 1983

Experiment #	Class	Title Objective	Facility	Principal Investigator, Experimenter	Dept / Company[1]	No. of Runs
13	A	Staff operation of reactor, calibrations, demonstrations, etc.	any, all	Lim	NE	150
188	B	Determination of fission yield	Lazy Susan	Prussin	NE	2
196	A	A short term activation analysis study on archaeological artifacts	Central Thimble	Asaro, Michel	DOE	51
199	A	Study of the characteristics of compensated Ion-chamber	Pool	Lim	NE	1
221	A	Determination of nickel impurity in Fe_2O_3 by activation analysis	Central Thimble	Prussin, Carn	NE	4
273	A	Origin of pottery	Central Thimble	Asaro, Michel	DOE	15
274	A	Irradiation of ethylene dibromide	Lazy Susan	Somorjai, Angeles	Chemistry	4
275	B	Electronic components test	Exposure Room	Young, et al	LMSC	89
280	A	Production of Co-60m	Lazy Susan	Prussin, Markowitz	NE	2
281	A	Production of Au-198	Lazy Susan	Prussin, Markowitz	NE	1
282	A	Production of P-32	Lazy Susan	Prussin, Markowitz	NE	1
283	A	Irradiation of household aluminum foil	Lazy Susan	Prussin, Cann	NE	6
284	A	Reactor power calibration and Xenon buildup	Pool	Lim	NE	3

Table I. Experiments Performed at the Berkeley Research Reactor in 1983 cont'.

Experiment #	Class	Title Objective	Facility	Principal Investigator, Experimenter	Dept/ Company[1]	No. of Runs
303	A	Magnitude and shape of Central Thimble flux	Central Thimble	Lim	NE	2
304	A	Reactor chekcout, approach to critical and pulsing	Pool	Ruby, Lim	NE	13
305	A	Reactivity worth of control rods	All	Lim	NE	16
306	B	Graphite prism and thermal column experiment	Thermal Column	Ruby, Lim	NE	3
313	A	Activation analysis of biological materials in the Central Themble	Central Thimble	Lim, Cann	NE	4
315	A	Activation Analysis of Biological materials in the Lazy Susan	Lazy Susan	Lim, Cann	NE	2
351	B	Neutron tracks studies in Lexan	Hohlraum	Wollenberg, Lim	DOE	1
352	A	Deuterium-tritium micro ballons irradiation	Central Thimble	Lane, Lim	DOE	20
354	A	Irradiation of environmental samples	Central Thimble	Heft, Lim	DOE	8
361	B	Irradiation of Natural or depleted uranium in ceramic form	Lazy Susan	Prussin	NE	22
363	A	Production of Pt-197	Central Thimble	Lougheed, Lim	DOE	1
365	B	Irradiation of Cu containing phantom	All	Lim, Derenzo	NE/DOE	8

[1] Chemistry: Department of Chemistry, University of California, Berkeley

DOE: Department of Energy, U.S.A.

LMSC: Lockheed Missiles & Space Company

NE: Department of Nuclear Engineering, University of California, Berkeley

Reactor Maintenance

Routine Maintenance, minor repair and modification, testing and inspection as required by the Tech Specs were performed during 1983.

10 CFR 50.59 Changes

There were no changes in 1983 that required review under 10 CFR 50.59.

Administrative Changes

In April 1983, Michael Denton replaced Harry Braun, who retired early in the year, as Chief Reactor Operator.

Starting as of August 1, 1983, Thomas H. Pigford was appointed Reactor Administrator to replace Selig N. Kaplan.

Routine Tests and Calibrations

Thermal power calibrations were performed in May 1983. The constant Air Monitor was calibrated during the month of November 1983.

The Reactor Pool Water Radiation Monitor was calibrated in June 1983, and the Stack Gas Argon-41 Monitor was calibrated in September 1983.

Operating Schedule

The Berkeley Research Reactor normally operates on a single 8 hour shift between 8 AM and 5 PM, Monday through Friday. One day every two weeks is set aside for routine monthly checks and maintenance. Extended reactor runs and overtime operation are allowed if required by the experimental program.

Fuel Addition and Fuel Inventory

There were no fuel additions in 1983. The annual fuel element inventory was performed in June 1983.

Energy Production and Fuel Burn-up

The Berkeley Research Reactor produced 126,014 kW-hours or 5.25 MW-days of energy during 1983. As there were 192 operating days in 1983, this corresponds to an average daily energy production of 656 kW-hours per operating day. In 1983, the Berkeley Research Reactor was critical approximately 270 hours and was operated at full power (1 MW) for approximately 119 hours.

The total burn-up in 1983 was 5.6 grams elemental and 6.5 grams of isotope U-235.

The total cumulative energy production since initial criticality is approximately 266.3 MW-days.

Nuclear Regulatory Commission Inspection

Inspections of the Berkeley Research Reactor safety were performed by the Nuclear Regulatory Commission Region V office in May of 1983. No items of noncompliance to the Technical Specifications and Nuclear Regulatory Commission regulations were found during the inspections.

Operating Procedures

The following new and revised operating and safety procedures were introduced in 1983:

Appendix #10 NERL #27	April 1983	Reactor Monthly Inspection's Entry

Emergency Shutdowns and Inadvertent Scrams

Date	Scram Circuit	Reason
4-11-8	Linear Power Scram	Operator Error
4-12-83	Linear Power Scram	Mode Switch Contact Noise
7-1-83	Accidental Scram	Leak in transient rod hose
9-8-83	Linear Power Scram	Operator Error

Operator's Training

In July 1983, one reactor operator and one senior operator passed the Nuclear Regulatory Commission Reactor Operator's examination.

Requalification Training Program

In accordance with regulations, a successful requalification written examination was given to licensed operators and senior operators in September and November 1983.

Exercise

Routine security and emergency evacuation exercises were performed during the months of June and December 1983. Both the reactor staff and campus police participated in the drills.

Radioactive Effluent Released or Shipped

Liquid Waste

All liquid waste from the facility was picked up by Campus Environmental Health & Safety personnel for disposal in accordance with their regulations. All waste was in one gallon glass jugs.

Material shipped included:

6-17-83 2 gallons 0.05 mCi miscellaneous activation product plus 1 gm U-nat.

No liquid waste was discharged to the sewer, storm drain or other location in the environment from this facility in 1983.

Gaseous Waste

All gaseous waste discharged was calculated as Ar-41, since studies in the past have shown no other significant radionuclides.

Total curies released was 2.37 Ci as Ar-41 of a maximum permitted release of 2,785 Ci. Average concentration at stack discharge was 2.7×10^{-9} µCi/ml. This concentration is 0.0009 of allowable maximum concentration for this facility of 3.12×10^{-6} µCi/ml.

Maximum concentration at the stack discharge was 6.6×10^{-7} μCi/ml which is 0.21 of the permitted average concentration at the release point.

Filter paper air samples showed no particulate radioactivity was released via exhaust stream. No particulate radioactivity concentrations above naturally occurring values were detected.

Solid (Dry) Waste

All solid (dry) waste was picked up by Campus Environmental Health and Safety personnel for disposal in accordance with their regulations. Material shipped included:

6-17-83 12 ft^3 0.05 mCi miscellaneous activation products

No solid waste was released to the environment.

Personnel Radiation Exposure

Recorded radiation exposures to personnel included:

a. Facility personnel (routine users of dosimeters) -

Maximum total exposure to an individual - 135 mrem

Minimum total exposure to an individual - 0 mrem

Note: Forty-two individuals were assigned dosimeters; two individuals incurred exposures (of 135 mrem and 20 mrem respectively). One badge result of 18,000 mrem was investigated and determined not to represent a personnel exposure.

b. Visitors (non-routine dosimeter users) -

Maximum total exposure to any individual - 17 mrem (74 entries)

minimum total exposure to any individual - 0 mrem

Average total exposure to any individual - 0.13 mrem

Note: Approximately 740 entries were made by 490 individuals. Forty-six positive readings were recorded for 19 individuals. No individual incurred total recorded exposures exceeding 25 mrem/year; two persons exceeded 10 mrem/year. Maximum exposure for any entry was 10 mrem incurred during portable instrument calibration.

c. There were no exposures in excess of 10 CRF 20 limits.

There were three persons for whom dosimeters were required by provisions of 10 CFR 20 (entry into high radiation area).

Radiation and Contamination Levels

a. Routine monthly meter surveys generated 396 individual radiation readings.

Maximum reading observed was 142 mrem/hr (70 Y + 72 netron).

Minimum reading observed was 0 mrem/hr.

Average of readings is meaningless due to abnormal influence of one high dose rate area out of 27 locations routinely surveyed.

b. Routine area quarterly film dosimeters at 27 locations generated 108 readings, routine area monthly dosimeters at 3 locations generated 36 readings.

Maximum readings observed - 290 mrem (monthly location), (50 Y + 240 neutron)
610 mrem (quarterly location)

Minimum readings observed - 0 mrem (monthly location)
0 mrem (quarterly location)

Maximum annual accumulated - 1135 mrem (monthly location),
(285 Y + 850 neutron)
1860 mrem (quarterly location)

Average dose is meaningless due to excessive influence of a few positions.

c. Routine quarterly area TLD dosimeter readings totalled 16.

Maximum total dose at any location for the year was 13 mrem.

Minimum total dose at any location for the year was 0 mrem.

Average total dose at any location for the year was 0.8 mrem.

Note that the period reported for film and TLD is 2-1-83 through 1-31-84.

d. Routine weekly swipe program generated 2040 swipes, of which 30 showed contamination above normally expected level.

Maximum swipe activities recorded was 2.1×10^{-2} μCi/100 cm^2 from normally contaminated surfaces, 3.1×10^{-3} μCi/100 cm^2 from not-normally-contaminated surfaces.

Minimum activities for both categories was zero.

Averages were not determined due to excessive influence of a few swipes.

Environmental Surveys

Environmental TLD measurements at eleven locations outside the facility generated 44 radiation readings.

Maximum total recorded exposure at any location for the year was 374 mrem.

Minimum total recorded exposure at any location for the year was 9 mrem.

Average recorded exposure for the eleven locations for the year was 44 mrem.

Note that the period reported was 2-1-83 through 1-31-84.

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COLLEGE OF ENGINEERING
DEPARTMENT OF NUCLEAR ENGINEERING

BERKELEY, CALIFORNIA 94720

March 9, 1984

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

Mr. James A. Miller, Chief
Standardization and Special Project Branch
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, District of Columbia 20555

Dear Mr. Miller:

For your information, enclosed is a copy of the Berkeley Research Reactor's Annual Report for the year 1983.

The Report is prepared for the Nuclear Regulatory Commission as required by our Technical Specifications.

Sincerely,

T. Lim

Tek H. Lim
Reactor Supervisor

THL:sf

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