U.C.IRVINE TRIGA REACTOR

Annual Report for Period

July 1st, 1979 to June 30, 1980

Facility License R-116
Docket 50-326

Prepared in accordance with Part 6.7f of
the facility specifications.

by

Dr G.E.Miller
Reactor Supervisor

CHAPTER 1

OPERATIONS

Operation of this facility is in support of the Department of Chemistry program in research and education in the use and application of radiochemical techniques and radioisotope utilization in chemical studies.

Reactor utilization, apart from operator training and maintenance, is thus entirely for sample irradiation. Samples come from diverse origins related to forensic science, fossil fuels, geochemistry, art and archeology studies, chemical synthesis, industrial quality control, enzyme studies, trace element pollution,etc.

The reactor was also utilized in class work by undergraduates learning tracer and activation analysis techniques using small quantities of short-lived activated materials.

12 graduate students and 6 post-doctoral associates have used the facility under the guidance of three faculty in Chemistry. These include visitors from Israel and Norway.

One senior operator license has lapsed in this period and no new operators have been trained. Currently the facility thus has 4 licensed senior operators and 1 licensed operator (including the reactor supervisor).

No major changes or maintenance have been needed in this period. Minor replacement work has been performed in rebuilding of the two "fast" transfer system in-core termini and the SHIM rod drive magnet was replaced. The annual inspection of core components indicated that all core items are in good condition.

Operations this year have been maintained at about the level of last year. A list of recent publications is given in Appendix I.

CHAPTER 2

DATA TABULATIONS FOR THE PERIOD (JULY 1,1979 -JUNE 30,1979).

TABLE I.

Experiment approvals on file	7	
Experiments performed (including repeats)	369	
Samples irradiated	3835	
Energy generated, Mw hours	58.52	
Total, 59 element core: 127.0		
>74 element core: 641.5		
Total since initial criticality:	768.5 Mwh	
Pulse operation (annual)	11	
of which greater than $2.00 insertion:	9	
Total pulses to 6-30-80	636	
Hours critical (annual)	344	
Total to 6-30-80	3953 hr	
Operator training and requalification	4	hours
Inadvertent scrams	26	
Visitors to reactor (admitted)	413	
Max dose recorded (all within instrument errors)	1	mr
Visiting researchers(dosimeter issues)	250	
Maximum dose recorded	14	mr
Visiting researchers (badged)	6	

Table II.

Reactor Status 6-30-80

Fuel elements in core (incl 2 fuel followers):	8
Fuel elements in storage (reactor tank) - used	29
Fuel elements unused (instrumented)	1
Graphite reflector elements in core	34
Experimental facilities in fuel element positions	4
Water filled positions	9
Core excess (cold, no Xenon)	$2.68

Control Rod worths (5-6-80)

REG	$3.66
SHIM	$3.24
ATR	$1.68
FTR	$0.81
TOTAL	$9.39

Maximum possible pulse insertion (ATR + FTR)	$2.49
Maximum peak power attained(5-18-80)	964 Mw
Maximum peak temperature observed (B-ring)	328 C

CHAPTER 3

INADVERTANT SCRAMS AND UNPLANNED SHUTDOWNS

TABLE III

DATE	TIME	POWER	TYPE AND CAUSE
1979			
7/5	11:48	<5kw	Linear power scram.Operator switched range switch incorrectly during raise to power.
7/25	11:29	<5w	Period scram.Operator error during criticality approach.
8/15	11:42	<1w	Period scram.Operator error during criticality approach.
8/21	11:38	<3w	Period scram.Operator error during criticality aaproach.
9/28	10:40	1.5w	Period scram on switching to auto mode.
	13:12	10kw	Linear scram on switching to auto mode.
10/2	15:47	150kw	Period scram on switching to auto mode.
10/10	14:12	10kw	Period scram on switching to auto mode.
10/24	13:29	250kw	Linear scram on switching to auto mode.
11/9	9:18	250kw	Fuel Temp scram on switching to check water temps (dirty contacts!)
11/20	16:35	200kw	Shim rod drop due to bad magnet contact.
	16:54,17:18		same
11/30	10:18	10kw	Linear power scram.Operator range sw.error.
	14:29	250kw	Seismic trip. No seismic activity.
12/5	15:49	20kw	Period scram on switching to auto mode.
12/10	15:05	250kw	%Power scram.Operator error on unbalanced lazy susan sample load.
1980			
1/15	15:21	250kw	%Power scram. Same error as 12/10/79
2/13	09:05	10kw	Linear power scram. Shim rod DOWN push button failure.
2/25	11:13	250kw	%Power scram. Same error as 12/10/79.
3/4	14:48	1kw	Linear scram.Range switch error during rod calibrations.
3/10	08:25	250kw	Seismic scram.No seismic activity.
3/17	12:44	300w	Period scram during raise of power.
	15:26	250kw	FTR rod released. No explanation found.

3/19	15:43	250kw	Seismic scram. No seismic activity.
4/22	09:48	10kw	Linear scram on switch to auto mode.
5/2	10:30	<3w	Period scram during criticality approach.
5/5	15:19	<3w	Period scram druing rod calibrations.
5/22	14:01	3kw	Unintentional manual scram - bar hit.
5/23	14:22	10kw	Linear scram on switch to auto mode.
5/27	14:14	250kw	Linear scram.range switch incorrectly positioned.
6/5	13:09	250kw	Shim rod dropped. No reason found.
6/9	15:21	250kw	Shim rod dropped. Still no reason found.
6/10	09:02	250kw	Shim rod dropped. Maladjusted switch?

CHAPTER 4

MAINTENANCE OPERATIONS

All major items (fuel elements, control rods, console systems) continue to be found in good condition during routine maintenance inspections. There are a few recurring and new items given special attention this year.

(a) SHIM rod drive magnet. A new magnet was installed on 11/23/79. The previous magnet appeared to have swollen in its casing interfering with good armature contact and thus allowing frequent rod "drops". Later (June, 1980) problems with rod drops were again experienced, but these were traced to a loose lock-nut on the rod down push rod actuator, permitting microswitch tripping.

(b) The fixed area monitor designed to monitor samples removed from the rotating specimen rack was finally repaired on 11/13/79. Delivery time on a replacement geiger tube had been over 6 months!

(c) The compensation voltage to the LOG chamber was found to be at zero in November. This was found to be due to a broken wire at its attachement to the feeding BNC connector. The loose BNC connector rotating during previous testing had caused the wire to sever.

(d) Unusually high water conductivity was observed on 1/4/80 following addition of water to "top-up" the pool level. The level was about 3 micromhos/cm (normal about 1.4). Water valves on the building purification system had been incorrectly set by Physical Plant personnel. The pool was left over the week-end, and by Monday morning the level was back to 1.4 micromhos/cm.

(e) During fuel removal, checks, measurement and replacement for annual inspection purposes, one element was incorrectly latched and released prematurely, falling to the bottom of the pool. It was readily retrieved and showed no sign of physical damage. The element was returned to service.

(f) The pneumatic transfer capsules (rabbits) continue to fracture more frequently and easily than expected. Methods have been developed for easy sample retrieval when this occurs and no special problems have resulted.

CHAPTER 5

FACILITY CHANGES AND SPECIAL EXPERIMENTS APPROVED

The only facility change made this year has been to install replacement in-core termini for the "fast" pneumatic transfer systems. The construction is essentially identical to that employed before, except that slightly larger diameter tubing was used with a slightly heavier wall thickness to provide better stability. Slight problems were incurred during installation due to close tolerances on the tubing fitting into the fuel element positions. The tubes were eventually sanded off to increase clearance so that insertion and removal could be more readily accomplished. Core locations were changed so that the reactivity shadowing of the REG rod was reduced.

No other significant changes were made during this period and no special experiments were approved.

CHAPTER 6

RADIOACTIVE EFFLUENT RELEASES

(a) Gases. The major direct release to the environs is Argon-41 produced during normal operations. Very small amounts of other short-lived gases may be released from irradiated materials in experiments.

Releases are estimated based on original estimates at point of origin within the facility and taking only dilution into account. An integrated dose estimate is provided by an environmental dosimeter (calcium sulfate-dysprosium) hanging directly in the exhaust at the point of stack discharge. This is changed quarterly. The results substantiate the projection that the submersion dose to an individual standing in the stack discharge continuously would be less than the reliability limit of the dosimeter estimated at about 20 mrem per year.

The exact quarterly dose readings obtained are given below at Location 5 in Section 7.

(1) Operation of the pneumatic transfer system (7/16/79-6/30/80):

Total (250 kw assumed)	3,615 minutes
Release rate	6 x 10(-8) microcuries/ml
Flow rate	2 x 10(6) ml/sec
Total release	2.6 x 10(4) microcuries

(2) Release from pool surface:

Total operation (Mwh x 4)	274 hours
Release rate (assumed)	<1 x 10(-8) microcuries/ml
Flow rate (exhaust)	2 x 10(+4) ml/sec
Total release	<2 x 10(+4) microcuries

Total of (1) and (2) <4.4 x 10(+4) microcuries
Concentration averaged over 12 months = <7 x 10(-10) microcuries/ml

This is almost the same as the level reported last year.

(b) Liquids and Solids. Liquid and solid wastes from utilization of by-product materials are normally disposed through a University contract. Due to contract and shipping difficulties this year, most of the waste is being stored on Campus outside the reactor facility. Special facilities have been constructed for this and storage is under the close supervision of the UCI Radiation Safety Office. Shipments are expected to be resumed shortly. No wastes have been generated this year other than irradiated sample materials.

Much of the materials generated are transferred to other users operative under State of California license and transferred by those users beyond control of the reactor facility.

Disposals by the facility were as follows: (activities are determined as of time of transfer to Radiation Safety Office control).

Dry Wastes: 6 cubic feet- 26 microcuries mixed activation products.

Liquid Wastes: Nil

CHAPTER 7

ENVIRONMENTAL SURVEILLANCE

Calcium-sulphate:Dysprosium thermoluminescent dosimeters in packs supplied by Radiation Detection Company,Sunnyvale, California are placed at nine locations around Campus. One pack is kept off-campus in a wood frame house (second story) as a control. The average of the remotely located packs on campus is in fact used as a "concrete environment" background for comparison purposes for evaluation of packs placed closer to the facility.

Locations:

1. Window of reactor room (inside facility).
2. Between reactor laboratories and radiochemical lab,in hall.
3. Loading dock, adjacent to west wall of reactor facility.
4. Classroom 152, over reactor facility.
5. In roof exhaust air flow from reactor room.
6. Steinhaus Hall (Bio.Sci) building: 4th floor.
7. Library building, 5th floor.
8. Computer Science Building, 4th floor.
9. Fume Hood Exhaust, Roof Level, from reactor lab.
10. 17941 Spicewood Way, Irvine (control).

Table IV shows tha data as received from RDC reports for the period. All levels are as expected. Those above background reflect the neutron generator operating schedule (nitrogen-16 in the cooling water) and are essentially similar to those reported in prior years. As noted before, areas 1 and 2 are partly controlled so that the maximum possible annual dose to a true "off-site" individual would be estimated at less than 40 mrem from this data (above background).

The main and fume hood exhaust ducts continue to show no dose above background within error limits delivered to continuous occupancy of the exit stack locations.

TABLE IV
ENVIRONMENTAL DOSIMETRY REPORT DATA
1979-80
Average Exposures in mr

Location	Quarter 3 79	Quarter 4 79	Quarter 1 80	Quarter 2 80	Total	Total less BACKGROUND (121 mr) +21
1	38	39	45	39	161	40
2	54	47	67	53	221	100
3	lost	37	39	38	152	31
4	25	27	24	23	99	0
5	28	27	27	24	106	0
6	33	34	35	30	132	(0)
7	32	36	37	29	134	(0)
8	25	25	26	20	96	(0)
9	51	26	30	25	132	11
10	26	27	25	21	99	0

Average of locations 6,7,8 used for BACKGROUND.

CHAPTER 8

RADIATION EXPOSURE TO PERSONNEL

The annual exposures recorded are presented in Table V. Essentially all of these exposures are acquired in the course of isotope handling experiments and in some instances will have been received in State licensed areas. Most personnel working within the facility also carried neutron film. No non-zero exposures have ever been reported for these films.

29 of the personnel reported were undergraduate students in a class in Radioisotope Techniques meeting for one academic quarter (9 weeks of laboratory work) only. No non-zero readings were reported for this group.

Contamination surveys consisting of wipe tests and G-M surveys have shown significant, removable short-lived contamination in isotope handling areas. No other contamination areas have been found.

TABLE V.

Personnel Exposure Summary - 1/1/79 - 12/31/79 (in mrem)

Individuals	Whole Body Pen	Whole Body Non-Pen	Finger Ring
1	50	0	0
1	55	0	560
1	20	0	100
1	0	0	1000
1	0	0	220
1	0	0	140
1	0	0	100
1	0	0	90
1	0	0	40
1	0	0	30
65	0	0	*

* Not monitored.

APPENDIX I

Recent Reactor Facility Publications (79-80)

1. B.H.Olson and V.P.Guinn, "Accumulation of Trace Elements in Soil and Plants from Land Disoposal of Secondary Domestic Wastewater", in State of Knowledge in Land Treatment of Wastewater. Vol 2 (U.S.Army Corps of Engineers, Hanover, N.H., 1978), pages 289-299.

2. B.H.Olson, V.P.Guinn, D.C.Hill, and M.Nassiri, "Effects of Land Disposal of Secondary Effluent on the Accumulation of Trace Elements in Terrestrial Ecosystems", in Trace Substances in Environmental Health. XII, ed. by D.D. Hemphill (University of Missouri, Columbia, 1978), pages 362-375.

3. V.P.Guinn, "Historical Foreward", in Computers in Activation Analysis and Gamma-Ray Spectroscopy ed. by B.S.Carpenter, M.D.D'Agostino, and H.P.Yule (CONF-780421, Dept of Energy, 1979, 879 pages), pages iii-ix.

4. T. Izak-Biran and V.P.Guinn, "Determination of Cesium and Potassium in Marine Species by Neutron Activation Analysis", J. Radioanalytical Chem, 55(1980) 61-67.

5. V.P.Guinn and J.Hoste, "Neutron Activation Analysis", Chapter 7 in IAEA Technical report on Elemental Analysis of Biological Materials, ed. by R.M.Parr (IAEA, Vienna, 1980), pages 105-140.