ANNUAL REPORT

1980

Nuclear Energy Laboratory

SCHOOL OF ENGINEERING AND APPLIED SCIENCE
UNIVERSITY OF CALIFORNIA, LOS ANGELES

CONTENTS

TABLES

NOMENCLATURE

BH = Boelter Hall

E = East

FB# = Film badge number

HP = Health Physics

mo. = month

MSA = Math Science Addition

N = North

NEL = Nuclear Energy Laboratory

NELF = Nuclear Energy Laboratory and Fusion Engineering

0N = Zero neutrons

Qt = Quarter year (3 months)

RHB = Reactor High Bay

Rm = Room

S = South

W = West

1000 = ground floor

2000 = second floor

3000 = third floor, etc.

β = Beta Radiation

γ = Gamma Radiation

Section 1

REACTOR OPERATING EXPERIENCE

Operations during the calendar year 1980 totaled 594 port hours of service accomplished in 381 actual operating hours, or 289 equivalent full power hours.* The total energy expended was 28.9 megawatt hours, down by 2% from the previous year. Prudent scheduling allowed this decrease with an actual increase of 33% in port operating hours over the previous year.

Table I shows the overall comparison with the four previous years. It should be noted that all class, maintenance and demonstration hours are considered as one port hour per operating hour, whereas the remaining user hours may represent up to 3 port hours per operating hour. The fact that the reactor does not operate at its full licensed power 100% of its operating time explains the distinction between the actual run time and the equivalent full power hours.

*Port hours are the product of the number of irradiation ports in use and the number of hours those ports are in use. Port hours are a measure of service. Equivalent full power hours at 100 kw or megawatt hours are useful for fuel burnup and effluent release calculations.

Table 1. Reactor Usage

CATEGORY	1976	1977	1978	1979	1980
CLASSROOM INSTRUCTION	17	83	52	31	46
MAINTENANCE	23	14	34	1	38
RESEARCH					
NEL STAFF USERS	4	31	9	1	27
OTHER UCLA USERS	109	106	105	91	101
COLLEGE & UNIVERSITY USERS	45	47	37	53	20
OTHER EXTRAMURAL USERS	1	5	95	264	360
DEMONSTRATIONS	10	6	7	5	2
TOTAL PORT HOURS	208	290	340	446	594
ACTUAL RUN TIME	184	238	271	372	381
EQUIVALENT FULL POWER HOURS	131	159	203	294	289

PORT HOURS ARE A MEASURE OF USER DEMAND, TWO CONCURRENT USERS FOR ONE HOUR CONTRIBUTE TWO PORT HOURS. INSTRUCTIONAL AND MAINTENANCE HOURS ARE COUNTED AS ONE PORT-HOUR PER HOUR.

CLASSROOM INSTRUCTION INCLUDES GRADUATE AND UNDERGRADUATE LABORATORY WORK INVOLVING BASIC COUNTING, ACTIVATION ANALYSIS, REACTOR PARAMETER DETERMINATIONS AND OPERATOR TRAINING AND REQUALIFICATION.

NEL STAFF USERS INCLUDES EXPERIMENTS CONDUCTED BY THE REACTOR STAFF, SUCH AS SEED IRRADIATION, GEM COLORING EXPERIMENTS, ACTIVATION ANALYSIS, TRACER STUDIES & ISOTOPE PRODUCTION USING THE N-P REACTION.

OTHER UCLA USERS INCLUDED, IN THE PAST, THE DEPARTMENTS OF CHEMISTRY, GEOLOGY, GEOPHYSICS, METEROLOGY, AND NUCLEAR MEDICINE. THE TYPES OF EXPERIMENTS HAVE INVOLVED ACTIVATION ANALYSIS, TRACER STUDIES, AND DELAYED NEUTRON COUNTING.

COLLEGE & UNIVERSITY USERS HAVE, IN THE PAST, INCLUDED CALIFORNIA POLYTECHNIC INSTITUTE, CALIFORNIA INSTITUTE OF TECHNOLOGY, CALIFORNIA STATE UNIVERSITY - LOS ANGELES, CALIFORNIA STATE UNIVERSITY - NORTHRIDGE, HARVEY MUDD COLLEGE, MT. SAN ANTONIO COLLEGE, PIERCE COLLEGE, UNIVERSITY OF CALIFORNIA - SAN DIEGO, & UNIVERSITY OF CALIFORNIA - SANTA BARBARA. THE TYPES OF EXPERIMENTS PERFORMED WERE ACTIVATION ANALYSIS, FISSION TRACK COUNTING, TRACER STUDIES, REACTOR PARAMETER DETERMINATIONS, REACTOR OPERATING CHARACTERISTICS, REACTOR OPERATIONS, SHIELDING STUDIES, AND HEALTH PHYSICS TRAINING.

OTHER EXTRAMURAL USERS INCLUDE GEOCHEMISTS, GEMOLOGISTS, AND ENGINEERING FIRMS. MINERAL ASSAY THROUGH ACTIVATION ANALYSIS AND DELAYED NEUTRON COUNTING, GEM COLOR ALTERATIONS, AND RADIATION SHIELDING STUDIES TYPIFY THE TYPES OF EXPERIMENTS PERFORMED.

DEMONSTRATIONS WERE ACTUAL REACTOR RUNS IN WHICH THE REACTOR WAS TAKEN CRITICAL TO DEMONSTRATE REACTOR PARAMETERS, CHARACTERISTICS OR OPERATION. TOURS IN WHICH THE REACTOR WAS SHUT DOWN ARE NOT INCLUDED. HIGH SCHOOLS, PIERCE COLLEGE, THE PRESS, SOUTHERN CALIFORNIA EDISON COMPANY WERE RECIPIENTS OF REACTOR DEMONSTRATIONS.

TOTAL PORT HOURS, ACTUAL RUN TIME, EQUIVALENT FULL POWER HOURS ARE INCLUDED IN THIS TABLE. DEVIATIONS BETWEEN THE REPORTED PORT HOURS AND THE TOTAL PORT HOURS ARE DUE TO ROUND-OFF ERRORS.

*THIS TABLE IS AN ADAPTATION OF A TABLE PREPARED FOR THE USNRC IN THE COURSE OF RENEWING THE REACTOR OPERATING LICENSE.

Section 2

UNSCHEDULED SHUTDOWNS AND ABNORMAL OCCURRENCES

The seven unscheduled shutdowns in 1980 are described below in the order of their occurrence. There were no abnormal occurrences in 1980.

6 February 1980. Shortly after the reactor leveled at 100 KW during a rabbit run, the reactor experienced a high flux scram. Examination of the linear chart showed that the reactor went from 100 KW to 120 KW in one minute which indicates a positive period of ≃330 seconds. The rabbit was discounted as the cause since the scram occurred ≃2 seconds after the rabbit was inserted, while the power had been climbing for at least a minute prior to scram. The scram was attributed to a line transient which set the reactor to manual when the reg rod was on the positive side of its cycle. (See Section 4, c.)

15 February 1980. While holding at 1W in preparation for a class experiment, the reactor experienced a full scram. Neither the Log N and period amplifier nor the safety amplifier were in alarm, indicating that they could not have caused the scram. The manual scram indicator on the full scram bus (which is a latching indicator reset by the acknowledge button) was normal, indicating that the remote manual scram has not been initiated. A momentary breach of the closures could have caused the scram but no earthquakes were reported or felt in the area. A power transient could have caused the dumpvalve to open, and there was an electrical storm going on at the time, but it does seem unusual that none of the other instruments were affected. The source of the

scram was therefore listed as unknown.

10 March 1980. The reactor was shutdown on a secondary radiation alarm during an open thermal column experiment being conducted by the reactor health physicist. The area was being monitored for neutrons, β and γ, by the health physicist while the power was being increased in discrete steps. When the reactor reached 700 Watts, the scram occurred. It appears that (n,γ) reactions in the vicinity of the detector caused the scram as the North and South area monitors were reading ≈ 0.3 mR/hr at the time.

28 March 1980. A period scram resulted with the reactor on auto 1W due to a faulty fluorescent light socket in the log N Recorder inducing transients into the Log N and period amplifier. The fluorescent light has been removed pending the replacement of the defective socket.

12 May 1980. The reactor shutdown on a period scram while holding at 1W awaiting the completion of the weekly health physics survey of the top of the reactor by the part-time student health physics aide. The period scram was attributed to the vibrations in the Log N and period amplifier signal cable caused by the student health physicist slamming the barrier gate as he left the top of the reactor. The student was admonished to exercise caution while working near the signal cable tray.

30 September 1980. Power line transients induced into the CIC compensation power supply by the dirty contacts of the flashing light circuit caused the reactor to shutdown on a short period scram. Cleaning the flashing light circuit contacts corrected the problem.

21 November 1980. The reactor shutdown on a short period scram

during a "control rod calibration experiment" being conducted by an Engineering class. The scram is attributed to the prompt jump caused by the 20¢ step of reactivity added to the reactor as the rabbit was fired out of the core. The prompt jump is usually precompensated by establishing the reactor on a negative period prior to firing the rabbit out.

2 June 1980. The reactor shutdown on a period scram on the approach to 1 Watt for the initial readings of the run. The cause of the period scram was determined to be the -30V CIC power supply. Bypassing the -30V power supply and the outputs at the connector to each chamber corrected the problem. The original run was cancelled but a test run showed the reactor performed in a normal manner.

Section 3

PREVENTIVE AND CORRECTIVE MAINTENANCE

The annual tests and calibrations as required by the technical specifications were completed in the month of January. The semi-annual calibrations of the various reactor radiation monitoring instrumentation were performed in January and July. Non-scheduled corrective maintenance having safety significance is summarized as follows.

28 January 1980. Failure of a diode in the bridge rectifier circuit of the magnet power supply prevented the energizing of the rod drive magnetic clutches during a pre-start check-out of the reactor. The unit was repaired, tested, and returned to service.

2,4 June 1980. Noise in the CIC compensating voltage power supply caused unsatisfactory operation of the Log N and period amplifier channel. Both CIC power supplies were bypassed with capacitors and the compensating power supply was placed on the sola regulated bus.

30 September 1980. Noise in the CIC neutron channels was traced to the CIC power supplies. The noise appeared in time with the reactor flashing light circuit. Cleaning the flashing light contact points cleared the problem.

Section 4

CHANGES TO FACILITY, PROCEDURES, TESTS AND EXPERIMENTS

Pursuant to 10 CFR 50.59, the following modifications have been performed.

8 January 1980. A water trap was placed in the dump tank vent line to prevent any air and Ar^{41} contained in the dump tank from venting into the reactor exhaust under normal operating conditions, yet allow the dump tank to vent to the stack should pressure build up in the tank.

17 March 1980. A protective key switch in series with the reactor console key switch was installed on the console. This key switch prevents the operation of the reactor when the key is checked out to maintenance men working in the third floor service area located above the reactor. There are only two keys. One is held by the reactor health physicist and the other is used by either maintenance men or the reactor operator.

19 March 1980. The pre-start check-off sheet and the procedures to delineate operator action were updated.

28 March 1980. At the recommendation of the Radiation Use Committee, the following circuit modifications were made in the reactor console.

A. The linear recorder, log recorder and Ar^{41} system power switches were tied into the circuit failure scram bus. This prevents disabling any of the critical instrumentation during an operation.

B. The AC power switches to the linear amplifier, the Log N and period amplifier, and the CIC power supplies were removed as those instruments are permanently powered. The switches were removed to reduce potential operator confusion.

C. An inhibit safety circuit was added to cause rod 4 to drive down should and inhibit signal occur. The audio alarm also sounds and a red LED will indicate that rod 4 is driving down. This curcuit is intended to slowly shut the reactor down while alerting the reactor operator to take action should an inhibit signal switch the reactor to the manual mode of operation.

D. The pre-start check-Off and the operating procedures were updated to reflect the above modifications.

E. The rabbit procedures and emergency procedures call list were also updated.

17 June 1980. A "Reactor Use Authorization" was initiated in order to more fully inform the reactor operator as to the nature of the proposed run, and to inform the reactor supervisor of the current reactor condition and sample disposition at the conclusion of the run.

22 July 1980. The start up procedure was modified to allow rods 1, 2 and 3 to be pulled from 44% to 48% as recommended by the Radiation Use Committee, and approved by the Director.

31 July 1980. The carbon vane stack effluent sampling pump was replaced by a diaphragm pump.

2 September 1980. Provisions to introduce N_2 gas into the reactor core through the thermocouple conduit were installed. The system consists of the appropriate plumbing, a flow meter, a pressure regulator, and a high pressure liquid nitrogen source. This modification was instituted as an experiment to reduce Ar^{41} production by displacing the air in the reactor core with nitrogen gas.

3 November 1980. The fuel inventory procedures were updated.

6 November 1980. The reactor high bay ventilation shutdown circuit was extended to include a shut down switch in the rabbit room and a shutdown circuit connected to the reactor high bay high radiation detector.

17 November 1980. An Ar^{41} correction factor form was instituted to reconcile the actual stack gas concentration and the gas concentration as seen by the Ar^{41} monitor ion chamber.

Section 5

RADIOACTIVE MATERIAL RELEASES TO THE ENVIRONMENT

The total releases for 1980 were as follows.

A. Gaseous: argon-41, 83.0 Ci

B. Liquid: zinc-65, 4.1 μCi

C. Solid: none (see paragraph on Solid Waste below).

Identification of the principal radionuclides of each were conducted in the following manner.

Gaseous Effluents. The principal radioactive gaseous effluent as monitored in the building exhaust stack is identified as argon-41. The actual concentration of this gas is determined by a 4.3 liter ion chamber (and verified by quantitative/qualitative gamma spectroscopy on batch samples) which has been calibrated in microcuries per milliliter versus ion current. This data is recorded on a strip chart recorder whenever the reactor is running. The data are periodically integrated using a compensating polar planimeter to obtain the total curie discharge. The total discharge of 83 Ci divided by the 289 equivalent full power hours of 1980 yields a release rate of 0.287 Ci/full power hours, and an effective concentration of 1.2×10^{-5} μCi/ml. Because the argon-41 release rate lags the reactor power (both in build-up and decay), and operations at less than 100 kw are common, the effective concentration of 1.2×10^{-5} μCi/ml is never achieved in practice. Peak values in excess of 10^{-5} μCi/ml are not observed under normal conditions.

Liquid Effluents. A release of 400 gallons of water on March 11, 1980 contained 4 1 µCi (2.7×10^{-6} µCi/ml) identified by gamma spectroscopy as zinc-65. That concentration is approximately 2.7% of the permissible concentration of 10^{-4} µCi/ml (10 CFR 20, Appendix B, Table II, Column 2) for release to uncontrolled areas. The isotope is believed to have arisen as either a corrosion-activation product, a decontamination product, or some combination thereof. A release of 500 gallons of water on June 13, 1980 contained no observable radioactivity.

Solid Waste. No low level solid waste disposals or shipments for disposal were made by the NEL in 1980. [A small shipment (< 1 kg U^{235}) of irradiated fuel was made to Exxon Nuclear, Scoville, Idaho, on June 21, 1980. Upon return of the rental cask to General Electric, Pleasanton, California, the cask and trailer were found to be contaminated with cobalt-60. An investigation by the Department of Transportation failed to identify the source of the contamination.]

Section 6

ENVIRONMENTAL SURVEYS

The reactor room (1000 Boelter Hall, called the Reactor High Bay (RHB) at the Nuclear Energy Laboratory (NEL)), is completely surrounded by a radiation controlled buffer zone area of limited access. The unrestricted area (uncontroll beyond the buffer zone and available to the University population and general public, begins at the laboratory concrete wall outside of this second perimeter. Measured levels (records in area survey file) of direct radiation (beta, gamma and neutron) in this uncontrolled area are not detectable above background ($\leq$ 0.04 $\pm$ 0.03 mR/hour) with a calibrated GM survey instrument during steady state full power reactor operation (100 kilowatts thermal). Neutron surveys are done with an Eberline PRN-4 Neutron REM Counter; no flux can be found.

A complete area radiation survey (beta, gamma, and neutron) was taken while the reactor was at steady-state, full power on June 12 1980. This survey was taken with the normal biological radiation shielding in place. The shield had not been changed or disturbed since the previous annual area survey. The data reveal that no loss or change in shield integrity has taken place since the previous survey. Monitored values, locations, and isodose maps are on file at the NEL to validate NEL compliance with occupational and non-occupational area radiation limits as set forth in 10 CFR 20.

Direct radiation from facility effluents is not detectable above background with low level GM survey instruments (i.e., $\leq 0.04 \pm 0.03$ mR/hr) outside of any NEL controlled areas. This is due to the very low concentration of isotopes, dilution and dispersion of stack effluents and to the isolated waste and cooling systems of the liquid effluents. This is verified for effluent air by both the area survey and an environmental film badge monitoring program. Results are listed in the latter part of this section. The liquid waste is batch sampled for activity concentrations prior to discharge and this release is permitted only when the batch measures less than the 10 CFR 20 concentration release limits.

Nineteen environmental routine wipe tests were made weekly (as well as many recorded non-routine tests) at the most probable radioactively contaminated areas both inside and outside the controlled areas for the calendar year 1980. No activity above background statistics (i.e., none greater than three times background) was detected outside of the controlled areas. The detection limit for 95% confidence (10 minute count times, 60 minute background times) is between 9×10^{-8} to 9×10^{-7} μCi/cm^2 with 10% $\pm$ 3% efficiency for beta counting.

The continuous particulate air monitoring system samples the facility exhaust stack and intake duct at the third floor (3000 level). The limit of sensitivity for the system is in the range of 2×10^{-12} μCi/ml to 2×10^{-13} μCi/ml. The system for collection of particulates is more conservative than specified in ANSI 13.1-1969 and the particulate filters are counted routinely on a batch basis.

The system includes an upwind (intake duct) sample of volume identical to the exhaust sample, it is used for background subtraction from the exhaust sample to eliminate natural radon and thoron daughters collected as a result of this type of sampling system.

There were no exhaust filter counts greater than 3 times the intake filter counts. Following the routine technique of instrument background subtraction, before subtracting the intake from the exhaust filter count the worst case concentration for 1980 would be from 1.8×10^{-12} µCi/ml without intake subtraction to 0.8×10^{-12} µCi/ml with intake subtraction. Since the only isotopes that NEL handles regularly with restrictions in this category are natural uranium and natural thorium which have uncontrolled release limits of 5×10^{-12} µCi/ml and 2×10^{-12} µCi/ml annual average concentrations, it is concluded that there were no radioactive particulate releases from the facility which exceed 10 CFR 20 Appendix B Table II, Column 1 for air releases.

There is currently an environmental area film badge program conducted in and around the NEL. This program consists of 29 film badges which are designed to measure both the beta and gamma radiation. The badges are divided into 1 month and 3 month integrating periods and are located (see Tables II and III) at strategic locations inside and outside of Boelter Hall, Math Science Addition, and the NEL. There are two badges (which may be described as source badges) located inside the exhaust stack, one at the exhaust fan and the other at the center of the exhaust exit.

Table II is divided into 3 categories.

A. The area films in the Math Science Addition (MSA) are on 3 month issue.

B. The area films inside the Nuclear Energy Laboratory (NEL)

Table 2. Film Badge Location and Type

FILM BADGE NUMBER	FILM BADGE LOCATION	AREA FILM BADGE DATA	TYPE OF FILM	ISSUE PERIOD
A. MATH SCIENCE ADDITION				
2372	MSA RM 8331	INSIDE AIRSHAFT S-11	β,γ	3 MO.
2357	MSA RM 7331	INSIDE AIRSHAFT S-10	β,γ	3 MO.
2367	MSA RM 6331	INSIDE AIRSHAFT S-9	β,γ	3 MO.
2349	MSA RM 5329	INSIDE AIRSHAFT S-8	β,γ	3 MO.
3202	MSA RM 5907	MR.W.KEHL'S OFFICE (INNER)	β,γ	3 MO.
2312	MSA RM 5308	MR.W.DRAIN'S OFFICE (OUTER)	β,γ	3 MO.
2298	MSA RM 4302B	MR.M.STEPHEN'S OFFICE (INNER)	β,γ	3 MO.
2287	MSA RM 4328C	COMPUTER AIR SUPPLY SHAFT	β,γ	3 MO.
2374	MSA RM 4328D	INSIDE AIRSHAFT S-6	β,γ	3 MO.
2395	MSA RM 3940	INSIDE AIRSHAFT S-4	β,γ	3 MO.
2268	MSA RM 3901	MR.D.ARCHER'S OFFICE	β,γ	3 MO.
2378	MSA RM 2334	KEYPUNCH ROOM WINDOW	β,γ	3 MO.
0834	MSA RM 2334	KEYPUNCH ROOM VENT INTAKE	β,γ	3 MO.
0426	MSA RM 3316	PROF.P.KOOSIS'S OFFICE	β,γ	3 MO.*
B. NUCLEAR ENERGY LABORATORY INCLUDING TOKAMAK RESEARCH AREA				
0218	BH RM 2001	REACTOR CONTROL ROOM EAST WINDOW	β,γ	3 MO.
0219	BH RM 1005	SAMPLE REFINING AND CONC. LAB	β,γ	3 MO.
0220	BH RM 2567	NEL BUSINESS OFFICE BADGE RACK	β,γ	3 MO.
0230	BH RM 1561	SHOP SOUTH OF R.H.B.	β,γ	3 MO.
1581	MSA RM 2000A	HEALTH PHYSICIST'S OFFICE	β,γ	1 MO.
1914	MSA RM 2000	NEL CLASSROOM	β,γ	3 MO.
1944	BH RM 1000A	EAST WALL TOKAMAK LAB**	β,γ	3 MO.
1951	BH RM 1000A	WEST WALL TOKAMAK LAB**	β,γ	3 MO.
1965	MSA RM 1000B	EAST END HEAT TRANSFER LAB**	β,γ	3 MO.
2048	MSA RM 1000B	CENTER OF HEAT TRANSFER LAB	β,γ	3 MO.
C. ROOF REGIONS - BOELTER HALL AND MATH SCIENCE ADDITION				
0203	BH RM 8000	INSIDE EXHAUST DOGHOUSE	β,γ	1 MO.
0265	BH RM 8000	EXHAUST STACK EXIT GRILLE	β,γ	1 MO.
030[illegible]	MSA RM 9000	MATH SCIENCE INTAKE DUCT	β,γ	1 MO.
0820	BH RM 8000	SOUTH OF REGION I TOWARD 8500 BH	β,γ	1 MO.

*1 MONTH NEUTRON FILM IN SAME HOLDER

**READINGS PRIMARILY FROM FUSION RESEARCH DUE TO BREMSSTRAHLUNG CREATED X-RAYS.

Table 3. Film Badge Readings - 1980

FILM BADGE NUMBER	1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER	TOTAL
2372	0	0	0	0	0
2357	0	0	0	0	0
2367	0	0	0	0	0
2349	0	0	0	0	0
3202	0	0	0	0	0
2312	0	0	0	0	0
2298	0	0	0	0	0
2287	0	0	0	0	0
2374	0	0	0	0	0
2395	0	0	0	0	0
2268	0	0	0	0	0
2283	0	0	0	0	0
2378	0	0	0	0	0
0834	0	0	0	0	0
0426	0,0N	0,0N	0,0N	0,0N	0,0N
0218	0	0	60	0	60
0219	0	0	0	0	0
0220	0	0	0	0	0
0230	0	0	0	0	0
1581	0	0	0	0	0
1914	0	0	0	0	0
1944	195*	320*	360*	850*	1725*
1951	560*	3243*	470*	320*	4593*
1965	0	190*	0	0	190*
2048	0	0	0	0	0
0203**	125B	100B	95B	<60B	<380B
0265**	70B	70B	65B	<60B	<265B
0302	0	0	0	0	0
0820	0	0	0	0	0

*THESE FILMS REFLECT TOKAMAK OPERATION, SEE SECTION 6.

**THESE FILMS SHOWED NO GAMMA RADIATION AND ARE LOCATED IN THE REACTOR EXHAUST STACK MAIN AIRSTREAM BEFORE DISPERSION.

including the Tokamak research area are of mixed 1 month and 3 month issue.

C. The area films on the roof regions I and II of Boelter Hall and the Math Science Addition are of 1 month issue.

These films are Kodak double emulsion, personnel monitor film type 2 and neutron NTA film in filtered standard type metal holders, the same as used in personnel monitoring.

The threshold detection levels for these films are:

x-ray (< 150 kev)	10 mR	Kodak Type 2
hard gamma (> 150 kev)	20 mR	Kodak Type 2
beta	20 mrad	Kodak Type 2
neutron (thermal & fast)	40 mRem	Kodak NTA .

Neutron badges are changed monthly to minimize track fading, others are on either one month or three month issue. As a badge exposure is cumulative, those on three month issue will detect lower exposure rates (by a factor of three) than those changed monthly. The films are processed and read by UCLA's Office of Research and Occupational Safety.

Area film badge measurements for 1980 are shown in Table III. Film badges #1944, #1951, and #1965 in the NEL area are reflecting Tokamak operations, and prior to the initiation of that program, badges at those locations were either zero or had exposures related to reactor core maintenance.

Film badges #203 and #265 located in and on the exhaust stack are observing the electrons emitted by the radioactive decay of argon-41. The film badge readings are reasonably compatible with direct beta observations of 2 to 4 mR/hour (2π or 4π geometry respectively) at those locations after several hours of steady operation at 100 kw.

Section 7

PERSONNEL RADIATION EXPOSURES

Film Badge Records. During 1980, seventeen individuals categorized as reactor-related personnel were carried on the UCLA film badge program. These individuals are considered to be covered by the USNRC license R-71. The highest exposure to any of these individuals was 80 mR (beta) and 25 mR (gamma). A second individual received 35 mR (beta), no gamma. The remaining 15 individuals had no measurable film badge exposures. There were no visitor badge exposures above minimum detectable limits

All permanent exposure records are kept at the UCLA Radiation Safety Office, A6-060J, Center for Health Sciences, Los Angeles, California, 90024. Duplicate copies in NRC format are also on file at the NEL facility to provide current exposure histories of key individuals should this be necessary in emergencies, during in-core maintenance operations, or inspections by regulatory agencies.

Pocket Dosimeter Records. Pocket dosimeters were issued on 37 occassions. The highest quarterly exposure (gamma only) to an individual was 17 mR and the highest single exposure to an individual was 14 mR. It was the same individual in both cases and the exposures were received in the course of calibrating the portable monitoring equipment.