ANNUAL REPORT

1983

Nuclear Energy Laboratory

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

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Section 1

REACTOR OPERATING EXPERIENCE

Reactor operations in 1983 provided 298 hours of services in 62 reactor runs. The operational intensity can also be summarized as 111 equivalent full (100 kWh) power hours or 11.1 megawatt hours, a decline of about 40% from 1982. Table I illustrates the reactor usage over the last five years in four broad categories.

The bulk of the research work category derives from the U.C.L.A. academic users. Since several irradiation ports can be occupied in a single reactor run, the intensity of user demand is appropriately summarized by port-hours of activity. One port, used for one hour, provides one port-hour. Table II displays a five year history of reactor usage in four broad categories. Staff usage appears highest for 1982 since an experimental nitrogen sweep of the core is done under the NEL user category in the "PAR VAR" experiment whenever the reactor is run at full power for an extended length of time.

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Table I
Reactor Usage (Operating Hours)

CATEGORY	1979	1980	1981	1982	1983
CLASSROOM INSTRUCTION	31	46	61	67	50
DEMONSTRATIONS	5	2	3	8	0
RESEARCH	335	295	284	203	226
MAINTENANCE	1	38	16	19	22
TOTAL OPERATING HOURS	372	381	364	297	298
EQUIVALENT FULL POWER HOURS	294	289	239	185	111
MEGAWATT HOURS	29.4	28.9	23.9	18.5	11.1

Classroom Instruction Comprises use of the reactor in support of UCLA undergraduate and graduate laboratory work involving basic counting, activation analysis, reactor parameter determinations, and operator training. Operator requalification is included in this category. Hours are reactor operating hours in support of class instruction.

Demonstrations are of various kinds; they are performed for educational groups and other tour groups.

Research is a broad category dominated by service irradiations in which the reactor is used as a tool without reference to reactor theory or operational properties (see Table II).

Maintenance represents the hours for which the reactor is operated for calibration purposes, and does not imply total maintenance hours.

TABLE II

Research Usage* (Port Hours)

USER CATEGORY	1979	1980	1981	1982	1983
UCLA ACADEMIC USERS	91	101	67	146	127
OTHER UNIVERSITIES & COLLEGES	53	20	38	6	16
OTHER EXTRAMURAL USERS	264	360	211	100	16
NEL STAFF	1	27	113	130.5	140
TOTAL PORT HOURS	409	508	429	382.5	298

*Research usage of the reactor is dominated by sample irradiations. Certain NEL staff research does not involve sample irradiations.

Section 2

UNSCHEDULED SHUTDOWNS & REPORTABLE (ABNORMAL) OCCURRENCES

Unscheduled Shutdowns

Of the four unscheduled shutdowns experienced in 1983, two were attributed to noise in the CIC power supply which caused the period circuit of the Log-n and Period Amplifier to effect a short period scram at low power (less than 100 watts). A third short period scram which occured at 0.6 watts appears to have been caused by an unknown transient when the low level trip alarm of the rabbit room monitor was being reset. This transient could not be duplicated. The last unscheduled shutdown, a high flux scram, is attributed to the inattention of the senior operator during a training session of a group of potential licensees, in which the student operator pushed the rod up button instead of the rod down button as he passed 100 KW.

Reportable Incidents/Abnormal Occurrences

There were no reportable incidents or abnormal occurrences during the year of 1983.

Section 3

PREVENTIVE AND CORRECTIVE MAINTENANCE

The annual maintenance calibration and tests on the reactor were delayed in their completion due to the failure of the rod 2 position potentiometer which had to be back-ordered and took over a month to arrive. The completion date of the annual calibration and tests was March 4th at which time the reactor was declared operational.

The unscheduled maintenance performed on various reactor subsystems or components is summarized in the following paragraphs.

CIC Power Supply

There were three instances of noise prevalent in the CIC power supply that could be corrected by cleaning the voltage divider network that controls the voltage regulator. Since a back-up power supply was available in the latter part of the year, a simple swap was effected when the problem arose for the third time, allowing a systematic repair.

Console Logic

Two instances of console logic failure occured during 1983. The transistor that controlled an area radiation monitor indicator deteriorated to a point where the indicator lamp was very dim. The problem was corrected by replacing the transistor.

The second instance of logic failure occurred in the start-up channel BF-3 protection circuit, when a diode in the protection logic failed thereby causing the BF-3 high voltage to remain on when the reactor exceeded 0.02 watts. Replacing the diode corrected the problem.

Reactor Exhaust Ventilation System

There were two occurrences of failure to the ventilation system, both occurring during non-operations. The first resulted from a blown main circuit breaker which probably occurred during the repair of the reactor air conditioning system which is also powered by that same breaker. The second occurrence resulted in a less than normal flow of exhaust air due to worn fan belts driving the blower.

Flashing Light Circuit

The flashing light solid state relay failed during a reactor operation and was replaced between runs with a higher rated solid state relay.

Log-N Recorder

Inactivity of the system while awaiting the arrival of the rod position potentiometer probably caused an oxide coating on the slide wire of the Log-N recorder. Cleaning the slide wire restored it to its proper operating condition.

Primary Control Valve

The primary flow control valve was found to be leaking when the annual maintenance was being performed. New packing was installed which corrected the problem.

Rod Drive Position Potentiometer

During the pre-start check of the scheduled final heat balance calibration run, rod 2 exhibited a malfunction. The trouble was traced to a defective rod position potentiometer. The unit was replaced after a month's delay since it was not a standard stock item.

Secondary Effluent Channel

There were three instances of failure to the secondary effluent channel, all directly attributed to vacuum tube failure.

Shield Tank Level Indicator

There was one instance of electrical integrity failure due to the use of a wire nut splice in an area of high moisture which caused the shield tank indicator to be intermittant. Soldering the splice corrected the problem.

Temperature Recorder

Because of the sluggish action of the temperature recorder during a reactor run, the temperature recorder's servo mechanism was inspected, adjusted, and cleaned which corrected the problem.

During a pre-start check, the temperature recorder was found to be malfunctioning. The trouble was traced to a broken drive cord which was replaced.

Primary/Secondary Flow Meter Indicator

While conducting the pre-start check for the scheduled final calibration of the reactor, the flow meter indicator was found to be irratic. Oxide build-up on the function switch caused the problem as cleaning the switch corrected it.

Reactor Automatic 3-Mode Controller

The 3-mode controller was found to be malfunctioning when it failed to take control at the operators request. Upon shutting down, the 3 mode controller was found to have a control vacuum tube with a bent pin seated improperly in its socket. The cause was attributed to a faulty maintenance procedure.

Section 4

FACILITY AND PROCEDURE CHANGES

There was only one facility change made in 1983. The change consisted of removing all of the emergency horns from the NEL facility except the horn in the reactor high bay. This was done to comply with the newly accepted Emergency Response Plan.

A number of procedures were reviewed by the Radiation Use Committee (RUC) and implemented in 1983. The categories of procedures reviewed and implemented include operating procedures, calibration of radiation detection instruments, fuel handling procedures, the audit procedure, safety evaluation of experiments, and the emergency procedures.

Section 5

RADIOACTIVE MATERIAL RELEASES TO THE ENVIRONMENT

Total Releases

The total releases of radioactive material to the environment for 1983 were as follows:

A. Gaseous: Ar-41, 9.75 Ci

B. Liquid: None

C. Solid: None

Gaseous Effluents

The principal radioactive gaseous effluent as monitored in the building exhaust stack is Argon-41. The actual concentration is determined by a 4.3 liter ion chamber which is 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 release. The permissible release, based upon an effluent rate of 14,000 cfm, a permissible concentration of $460 \times 4 \times 10^{-8}$ micro Ci/ml, and 438 full power (equivalent) hours of reactor operation is about 192 Ci. The actual release for calendar 1983 was 9.75 Ci or about 5% of the maximum permissible amount. Since the actual energy expended for 1983 was approximately 25% of the maximum permissible, the extra reduction of radioactive gaseous effluents is attributed to the nitrogen sweep over the core during full power operations, and controlled venting of the core to the exhaust stack.

Airborne radioactive particulate monitoring at the Nuclear Energy Laboratory is done by the filtration method for air sampling analysis.

The system uses whatman 41 filter paper that samples both the supply and exhaust air from the reactor room at the reactor roof (3000 level) of Boelter Hall.

Particulate air samples were analyzed in a 2 pi windowless gas flow proportional counter for long-lived Beta activity at the Radiation Safety Office laboratory. Results of 45 simultaneous intake and exhaust samples in 1983 did not exceed the minimum detectable activity of approximately 7.2 disintegrations per minute for a calculated minimum sensitivity of 1.7×10^{-13} microcuries per milliliter.

Section 6

ENVIRONMENTAL SURVEYS

Periodic radiation surveys of controlled and uncontrolled areas are made by the reactor health physicist or a technologist or technician from the Radiation Safety Office. Such surveys are performed routinely to indicate levels of contamination and general radiation exposure levels. Complete results of current surveys are posted on the bulletin board in the reactor control room.

Contamination Surveys

Monitoring of the reactor room and environs for contamination are performed routinely. No discernible fixed or removable radioactive material was identified.

Radiation Surveys

The annual area radiation survey was performed on June 30, 1983 by the reactor health physicist and the radiation safety officer, assisted by the reactor supervisor. The reactor was operated at its maximum licensed power level of 100 kw thermal with all biological radiation shielding in place during the survey. Radiation exposure rates were measured with a GM survey instrument, an ionization chamber instrument and a portable neutron REM counter. Significant findings are summarized in the following paragraphs.

The potential for a high radiation area exists inside the process pit and inside the pipe rail barriers installed around the reactor top and around the thermal column area.

Radiation exposure levels at all accessible exterior surfaces of

the reactor room and control room, including the ceiling of the third floor outside the equipment room, did not exceed prescribed protection limits of 10 CFR part 20.

Additionally, routine area surveys are performed to assess the general radiation levels from various reactor components and in various reactor areas during inactive reactor periods in order to inform the operating and maintenance personnel of the ambient radiation levels present.

Area Monitoring Program

Radiation monitoring badges have been posted in specific areas of Boelter Hall and the Math Sciences Addition. These devices contain a photographic emulsion with varying degrees of sensitivity to beta particles, gamma rays, and x-rays.

Calibration, processing and evaluation is performed by the Radiation Safety Office at UCLA. The current locations of these badges and their frequency of change are shown in Table 3. No measurable exposure above base fog density was detected on any of these film badges.

TABLE 3

FILM BADGE NUMBER	LOCATION	AREA POSTED	ISSUE PERIOD
2372	MSA Rm. 833	Inside Airshaft S-11	3 mo.
2357	MSA Rm. 7331	Inside Airshaft S-10	3 mo.
2367	MSA Rm. 6331	Inside Airshaft S-9	3 mo.
2349	MSA Rm. 5329	Inside Airshaft S-8	3 mo.
3202	MSA Rm. 5907	W. Kehl's Office	3 mo.
2312	MSA Rm. 5308	W. Drain's Office	3 mo.
2298	MSA Rm. 4302B	B. Aten's Office	3 mo.
2287	MSA Rm. 4328C	Operations Air Supply Shaft	3 mo.
2374	MSA Rm. 4328D	Inside Airshaft S-6	3 mo.
2395	MSA Rm. 3940	Inside Airshaft S-4	3 mo.
2268	MSA Rm. 3901	D. Archer's Office	3 mo.
2378	MSA Rm. 2334	Terminal Room Window	3 mo.
0834	MSA Rm. 2334	Terminal Room Air Intake Vent	3 mo.
0203	BH 8000 Level	Inside Reactor Exhaust Chamber	1 mo.
0265	BH 6000 Level	Reactor Exhaust Stack Exit Grill	1 mo.
0302	BH 9000 Level	Math Science Air Intake Grill	1 mo.
0820	BH 8000 Level	South End of Cooling Towers	1 mo.
0218	BH Rm. 2001	Reactor Control Room	3 mo.
0219	BH Rm. 1005	Electronics Shop	3 mo.
0220	BH Rm. 2567	NEL Business Office	3 mo.
0230	BH Rm. 1561	Outside Wall, South of Reactor High Bay	3 mo.
2048	BH Rm. 1000B	Outside Wall, North of Reactor High Bay	3 mo.
1914	BH Rm. 2000	NEL Classroom	3 mo.
1581	BH Rm. 2000A	HP Office	1 mo.

Section 7

PERSONNEL DOSIMETRY

The personnel dosimetry program is administered by the UCLA Radiation Safety Office. Film badges for beta-gamma exposure and thermoluminescent dosimeters for fast neutrons were issued to personnel who were potentially occupationally exposed to ionizing radiation. Ten faculty and staff members in the Nuclear Energy Laboratory and two individuals having a part-time association with reactor operations were included in the personnel dosimetry program. A review of the supporting record for the dosimetry program indicated that whole body occupational exposures were in conformance with the applicable limits of 10 CFR 20.

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SCHOOL OF ENGINEERING AND APPLIED SCIENCE
LOS ANGELES, CALIFORNIA 90024

21 August 1984

Director
Division of Operating Reactors
USNRC
Washington, D.C. 20555

Docket 50-142

License R-71

Dear Sir:

Enclosed are two copies of the UCLA Nuclear Energy Laboratory Annual Report for 1983, covering the period from January 1, 1983 through December 31, 1983.

Sincerely,

Neill C. Ostrander

Neill C. Ostrander, Manager
Nuclear Energy Laboratory

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