NATIONAL INSTITUTE FOR RESEARCH IN NUCLEAR SCIENCE

THE NUCLEAR AND RADIOCHEMISTRY LABORATORY AT THE RUTHERFORD HIGH ENERGY LABORATORY, HARWELL

First edition - 1st September, 1962

1. INTRODUCTION

So that nuclear chemical research, involving the use of the accelerating machines and reactors both at the Rutherford Laboratory and at A.E.R.E., may be conveniently carried out by scientists not employed permanently by N.I.R.N.S. or A.E.R.E., a new laboratory has been built and equipped especially for such work. It is situated in the Rutherford Laboratory, adjacent to A.E.R.E., Harwell and consists of four suites and ancillaries. Each suite comprises an active laboratory, office, vestibule and counting room, and is designed for up to four occupants.

Paragraph 2 describes the facilities provided, while paragraph 3 explains how University and other potential users may arrange to use the laboratory. Appendix A gives the major laboratory equipment available for users either now or in the near future, while Appendix B lists the more important accelerating machines and reactors, together with their main characteristics.

2. DESCRIPTION OF THE BUILDING

(a) Active laboratories

Each laboratory has five fume hoods designed for active work. Fast air flows, armour glass windows and all normal services are installed in each hood.

A long L-shaped analytical bench with sink stretches along two walls, and the fourth wall is occupied by a large cupboard for glassware with a 4" thick lead safe underneath.

Two complete sets of services depend from the ceiling and the laboratories can be equipped with further analytical benches or glove boxes running from these as required.

(b) Offices

Each office is adequate for four people and is fitted with sockets for the connection of calculating machines and other electrical equipment.

(c) Vestibules

The laboratory and office of each suite are entered through a vestibule which acts as a buffer area to assist in contamination control. Laboratory clothing, emergency air-hoods and an emergency shower are provided in each.

(d) Counting rooms

Each suite has its own counting room. These have two massive benches for racks and castles, and all electrical services. 250 volts A.C. smoothed and stabilised, 250 volts A.C. smoothed only, 50 volts D.C. smoothed and stabilised, and timing pulses at 1/60, 1/10, and 1 minute intervals are provided through a profusion of sockets.

(e) Balance room

A small balance room is provided.

(f) Cave room

An αβγ cave, equipped with manipulators and a large window will probably be installed. It will be designed for levels in the 1-10 curie range. It may also be possible to arrange for the use of one of the A.E.R.E. high activity caves if sufficient notice is given. Levels up to 10^5 curies can be handled in these.

(g) Changing rooms

Male and female changing rooms are provided. They are equipped with lockers, toilet facilities and showers.

3. ADMINISTRATIVE ARRANGEMENTS

(a) Responsibility for the laboratory

The laboratory is the direct responsibility of the Director of the Rutherford High Energy Laboratory, but assistance in its day-to-day running is given by the Proton Linear Accelerator group under the general supervision of Dr. G. H. Stafford.

The Local Administrative Officer in Building R.12 will provide all the necessary administrative support.

The Chemistry Division of A.E.R.E. has agreed to allow a section of its Fission Chemistry Group to work in the laboratory in order to provide a Laboratory Supervisor experienced in the handling of radioactive materials. This Laboratory Supervisor will be responsible to the Director of the Rutherford High Energy Laboratory for the safe operation of the laboratory, and for arranging for the supply of equipment for it. He will also try to give scientific advice on problems if he is asked to, but will be unable to provide any practical assistance to experimenters.

The Laboratory Supervisor is Mr. J. G. Cuninghame.

(b) Types of experimenters in the laboratory

There are three types of experimenters who are not N.I.R.N.S. permanent staff - those who are paid by their parent organisation (i.e. university, etc.), but whose out-of-pocket expenses are paid by N.I.R.N.S.; unpaid visitors on external fellowships, and experimenters holding N.I.R.N.S. fixed-term appointments

(i) Visiting experimentalists

Reasonable out-of-pocket expenses incurred by visitors through working at the laboratory are refunded. Such expenses include travelling expenses, any excess cost of accommodation, etc. Full details can be obtained from the Local Administrative Officer, Building R.12, Rutherford High Energy Laboratory, Harwell, Didcot, Berks.

(ii) Unpaid visitors

It may be possible to arrange for visitors who are in receipt of external fellowships and for whom N.I.R.N.S. would have no financial responsibility, to work in the laboratory during their fellowship. Application for such permission should be made to the Director, Rutherford High Energy Laboratory.

(iii) N.I.R.N.S. Fixed-term Appointments

In a small number of cases it may be possible to arrange a N.I.R.N.S. fixed-term appointment. Conditions of pay and service are similar to those of the permanent staff except that superannuation benefits are provided through F.S.S.U. rather than the A.E.A. Superannuation Scheme. Full details can be obtained from the Personnel Branch of the Rutherford Laboratory.

(c) Method of arranging to carry out experiments

Anyone who wants to use the laboratory for experiments as a visiting experimentalist (para. 3b(i) above) should first contact the Laboratory Supervisor (Mr. J. G. Cuninghame) and discuss the proposed experiments (which may be short term ones, or may be a series stretching over many months) with him. The proposal must be endorsed by the Head of the university department to which the experimentalist belongs. When the details have been worked out, the proposal should be submitted to the Director of the Rutherford Laboratory for approval.

(d) Assistance available

Arrangements can be made to assist visitors in the obtaining of apparatus, or in its construction. Computing, administrative and information services are also available.

(e) Accommodation

The Cosener's House is a pleasantly situated house in Abingdon maintained by the N.I.R.N.S. for the use of its visitors. Wives and families of visitors can sometimes be accommodated in The Cosener's House when rooms are available. Normal canteen services are available during the day to workers in the Rutherford Laboratory.

4. CONCLUSION

This note gives only a very general outline of the operation of the new Nuclear and Radiochemistry laboratory. Some further useful detail is included in the Proton Linear Accelerator Handbook, copies of which, together with any special information required, may be had from the Local Administrative Officer, Building R.12, Rutherford High Energy Laboratory, Harwell, Didcot, Berks. Enquiries of a scientific nature should preferably be addressed direct to Mr. J. G. Cuninghame, Building R.12, Rutherford High Energy Laboratory, Harwell, Didcot, Berks.

T. G. Pickavance
Director
Rutherford High Energy Laboratory

Appendix A

Nuclear and Radio Chemistry Laboratory -

major equipment available

(Note:- Any reasonable request for additional equipment can probably be met, either by buying the item, or by arranging for the use of existing equipment elsewhere.)

(a) Laboratory equipment

Item	No. available
Spectrophotometer: Unicam SP500	1
Vacuum coating unit: Edwards 6E	1
Electric Spot Welder: Watkins	1
pH Meters: E.I.L. direct reading	4
Centrifuges: M.S.E. Minor	12
R.F. Heat Sealers	1
Muffles	4
Ovens	4
Balances analytical	2
Balances semi-micro	1
Small electrical items, e.g. stirrers, hot plates, etc.	As required
Glassware and other small laboratory items	As required
Chemicals	As required
Remote handling equipment and lead	As required
Platinum ware	As required
Hand tools	As required

(b) Office equipment

Electric calculating machines	2
Typewriter	1
Microcard reader	1
Books and journals	A small library of essential nuclear chemical and chemical books and journals are available in the laboratory. Users may also use the main R.H.E.L. and A.E.R.E. libraries

(c) Electronic equipment

100 channel pulse height analyser, with decimal read out and punched card output; type 1524	1
100 channel pulse height analyser with octal read out; type 1363	1
Scaler/timer units with full automatic control and display either:- (a) Manually, or (b) On individual paper tape printers, or (c) On the laboratory fully automatic punched card read out. Any or all of the available units may be coupled to the system, which controls and identifies each unit by preset switches, and records time/counts on punched cards via an I.B.M. Type 026 punch	18
E.H.T. Units, 5 kV	15
E.H.T. Units, 2 kV	10
Amplifiers, non-overload, Fairstein type	8

Item	No. available
Amplifiers, linear, type 3000	15
Single channel analysers, Fairstein type	6
Coincidence units, type 2013	8
Head amplifiers, discriminators, racks, castles, cables, etc.	As required
3" x 3" NaI/Tl crystals	2
1" x 1½" NaI/Tl crystals	4
Counters: proportional, G.M. end window, and G.M. Cosmic ray counters as required. Other types can be obtained or built if sufficient notice is given	
Oscilloscopes fast, Solartron Type 1015	1
Avometers, type 8	2
Signal generators, Type 1405 B	1

Appendix B

Major accelerating machines and reactors

at N.I.R.N.S. and A.E.R.E.

(Note:- Most machines and reactors work a schedule of experiments, and time has to be booked on them. This may be easy (as in the use of rabbits), or it may be difficult (as in the use of non-rabbit irradiations in DIDO or PLUTO) - see paragraph 3c in accompanying letter for method of arranging for time.)

1. Accelerators at N.I.R.N.S.

Machine	Particles	Energy Range (MeV)	Mean Current (max.)	When available
Proton linear accelerator	P	Up to 50	5 μA	Now
NIMROD	P	Up to 7000	0.5 μA (in circulating beam)	1964

2. Accelerators at A.E.R.E.

Variable energy spiral ridge cyclotron	P,d.α Heavy ions	P up to 50 8–12 MeV/ nucleon	P 100 μA outside machine: ~ 1 mA internal probe	1964
Synchro cyclotron	P	10-170	1 μA	Now
Van de Graaff	P,d,T,Li,He^3	Up to 6	20 μA	Now
Cockcroft-Walton	n	3	10^8 n/sec/4π	Now
	n	14	10^{10} n/sec/4π	Now
Tandem van de Graaf	P, d, T, heavy ions	P up to 12	2 μA	Now
Electron linear accelerator:-				
Pulsed electron beam gives	neutrons	Fission spectrum	5×10^{13} n/sec/4π	Now
	bremsstrahlung	Up to 28 MeV	> 10^5 R/min/ at 1 metre	Now

3. Reactors at A.E.R.E. (available now)

Name	Irradiation method	Thermal flux n/cm²/sec
BEPO	Rabbit	10^{12}
	Isotope holes	5×10^{11}
DIDO	Rabbit	5×10^{13}
	Flux scanning hole	10^{14}
	Experimental holes	Up to 5×10^{13}
PLUTO	Flux scanning hole	10^{14}
	Experimental holes	Up to 5×10^{13}