De Stafford

NI(60) 1

NATIONAL INSTITUTE FOR RESEARCH IN NUCLEAR SCIENCE

GOVERNING BOARD

REACTORS FOR UNIVERSITIES: INTERIM REPORT
By the RESEARCH REACTOR COMMITTEE

The attached interim report has been transmitted to the Treasury with the following covering note. Copies have also been sent to the office of the Minister for Science, the D.S.I.R., and the U.G.C.

.....

"

National Institute for Research in Nuclear Science

Mr. J. A. Annand,
Treasury Chambers,
Great George Street,
LONDON S. W. 1.

Rutherford High Energy Laboratory,
Harwell,
Didcot, Berks.

18th February, 1960.

Dear Mr. Annand,

On the instruction of Lord Bridges, I submit the interim report of the Research Reactor Committee of the Institute, recommending a programme of reactor installation in universities for teaching and research. The report is not of course final, since it will be necessary for the Committee to meet from time to time to develop it further. But it is submitted now to avoid delay in seeking approval for the most urgently needed reactor at Imperial College, on which the Committee agree that early action is required.

There are some matters of procedure concerning the respective rules of the Institute and the DSIR which appear to be still un-resolved, but these should not be allowed to delay action on the Imperial College proposals.

I am sending copies of this letter and of the report to ths Office of the Minister for Science, D.S.I.R., and the U.G.C.,

Yours sincerely,

(signed) J. A. V. Willis
Secretary - NIRNS

"

February 15th 1960.

NATIONAL INSTITUTE FOR RESEARCH IN NUCLEAR SCIENCE

REACTORS FOR UNIVERSITIES

Recommendations by the N.I.R.N.S.

INTRODUCTION

1. We have sought information from all the universities in the United Kingdom about their requirements for the use of existing AEA reactors for training and research. In the course of this enquiry, and also independently, we have received or have been informed about applications for the provision of new reactors for universities. We have not thought it desirable to write to all the universities inviting applications but we believe that we know about all the proposals which are firm enough for detailed consideration at present.

HIGH POWER REACTORS

2. Our first conclusion is that the requirement for very expensive high-power reactors is limited, and should for the present be met by the provision of limited facilities at reactors of the Atomic Energy Authority. In this connection it may be mentioned that we intend shortly to propose the construction of a small radiochemical laboratory at the Rutherford Laboratory, partly for use by university scientists working with reactors at the Atomic Energy Research Establishment.

LOW POWER REACTORS

3. Extensive requirements have been stated for the use of low-power reactors, operating at 100 kilowatts, 10 kilowatts or less, giving maximum neutron fluxes respectively of approximately 10^{12}, 10^{11}, or less, neutrons per square centimetre per second. In two main types of case there is a particular need for such a reactor at or near the university rather than at distant centre:-

   (a) For use in training engineers, chemists and physicists in reactor technology

   (b) For research on short-lived isotopes and irradiation products.

   Hitherto proposals based on (a) have been developed rather more vigorously and completely than those based on (b). This is perhaps because the heads of University Departments concerned with the former are interested in a reactor as such, whereas those concerned with the latter essentially want a source of neutrons, and are not necessarily interested in the reactor which produces them. Also, in many cases of type(b) there is scope for similar work with longer-lived isotopes produced at a distant reactor, which can be carried on while the proposal for a local reactor is developed.

REACTORS PRIMARILY FOR TRAINING IN REACTOR TECHNOLOGY

4. Two proposals for reactors primarily for training are already fully developed. These are the proposals of the Manchester-Liverpool group and of the Imperial College group. They would together provide for training some 50-60 postgraduate students per year. We are satisfied that there is a need for this training provision and we recommend that these two groups, which have already developed the training schools with great energy, should be the first ones to be provided with reactors for this purpose.

A proposal which is only a little less fully developed has been made by Queen Mary College, London. This proposal, which we consider to be a very good one, is also mainly concerned with post-graduate training in reactor technology, although the emphasis is laid upon training through nucleonics research rather than through course work. We have very carefully considered the possibility of accommodating this proposed work at the Imperial College reactor, either at the Imperial College, Silwood Park site or at an alternative site (such as the NPL). We have concluded that it would be technically possible to combine the work, for the first two years of operation at least, and that the additional Laboratory accommodation and equipment to make this possible would cost substantially less than a separate reactor for Queen Mary College. Nevertheless, we do not recommend that the work should be combined. In the first place, no site has been found which would be convenient for daily travel from both colleges and from the areas where their respective staff and students mostly live.

More important, however, is the point that a reactor is the logical central feature of the nuclear engineering department which has been built up with great energy and determanation at Queen Mary College and on which a large amount of money has already been spent. While Imperial College have shown the greatest readiness ~~to accommodate the requirements~~ to accommodate the requirements of Queen Mary College, we have concluded that the part-time use of a reactor operated by another body would not provide the intimate experience of work with a reactor which the Queen Mary College programme requires. The same difficulty would apply to the possible use by Imperial College of a Queen Mary College reactor.

We consider that this particular difficulty only arises in the case of joint use by two leading departments of nuclear engineering, and would not hinder the use of either reactor by other Colleges as an irradiation source for chemical, medical etc research. Finally, we are satisfied that the needs of London University require two reactors, and that it is convenient to site one of them in East London.

We therefore recommend the provision of a separate reactor for Queen Mary College, but we would like certain minor details of the design to be discussed between Queen Mary College and AEA Research Group scientists to be nominated by Dr. Dunworth. This might result in recommendations involving a small increase in cost.

We recommend that the facilities of both the Imperial College reactor and the Queen Mary College reactor should be made available to other Colleges of London University to the greatest reasonable extent.

Proposals have also been made by the Universities of Edinburgh and Glasgow, and the Royal Technical College, Glasgow; by Birmingham University and Southampton University. We have already investigated the requirements in Edinburgh and Glasgow in some detail, they include a considerable potential requirement for training, but are not yet very far developed. We expect to recommend the provision of a reactor to be started in the year 1961/62. Apart from this, we would like to consider the various proposals further before recommending the provision of any further reactors for training.

LOW FLUX REACTORS PRIMARILY FOR RESEARCH

5. As mentioned above, it is not to be expected that proposals for reactors for research would be developed as quickly and as vigorously as proposals for training reactors. For a similar reason, it is necessary to examine carefully the probability of full and continued utilisation of research reactors. It is essential that the principal users should be people who already know how to use reactors in research. Such experience does however already exist in a number of cases, for example at Cambridge (radiochemistry and radiocherapeutics) Durham (radiochemistry) Liverpool (radiochemistry) and Leeds (chemistry).

There are also metallurgists with extensive experience of the use of reactors, but generally they need reactors of higher power than those now under consideration. Geographical considerations are also very important in the case of work with fairly short-lived isotopes, and this fact supports the claims of the Glasgow-Edinburgh group, whose requirements include research as well as training.

We believe that there is a need for two or three reactors for research during the next few years, but we are not yet ready to recommend the exact number nor where they should be. We propose to review the question during the next twelve months, taking into account the facilities already available to Universities in existing reactors, and also the experience of Universities in the U.S.A. of the utilisation of their reactors. In the mean time we recommend that no reactor project primarily of this kind should be started during the financial year 1960/61. It should be recognised, however, that the Liverpool/Manchester project provides for radiochemical work on a substantial scale and that this is why its cost is greater than that of the two London proposals.

FINANCIAL IMPLICATION

6. In summary, we recommend the starting of three projects in 1960/61 as detailed below and we expect to recommend the starting of a further project in 1961/62. We expect to make further recommendations in six to twelve months time.

Details of the recommended projects are as follows:-

(a) Manchester-Liverpool

Reference "Liverpool and Manchester Universities: Proposed nuclear reactor for research and training 17th July 1959" (NIR/N 14)

Estimated total capital cost	£180,000	(Buildings 80,000) (Plant 100,000)
Estimated capital expenditure	1960/61	£100,000
Estimated annual operating cost		£ 25,000

NOTE The above estimates include a certain margin above the figures quoted in paper NIR/N14. On the other hand, the Universities are at present reviewing their plans on account of the demand from their radiochemists for a higher flux. This would involve some increase in cost.

(b) Imperial College

Reference "Imperial College of Science and Technology: Proposal for the construction of a 10 KW training reactor at Silwood Park, Berkshire" July 1959.

Estimated total capital cost	£105,000	(Buildings £30,000) (Plant £75,000)
Estimated capital expenditure in 1960/61		£60,000
Estimated annual operating cost		£10,000

NOTES

(i) The above estimate includes a small margin recommended by the Development and Engineering Group, AEA on capital cost above the figure quoted in the Imperial College paper.

(ii) The modifications to accommodate Queen Mary College requirements, described in paper NIR/N23 are of course not required.

(c) Queen Mary College

Reference "Proposal for a Jason reactor at Queen Mary College" January 1960.

Estimated total capital cost £125,000 (Buildings £50,000) (Plant £75,000)

Estimated capital expenditure in 1960/61 £60,000

Estimated annual operating cost £10,000

NOTES

The estimated capital cost includes a small margin to allow for a more expensive gamma shield if advised by AERE.

(d) Glasgow-Edinburgh

Subject to the submission of a satisfactory detailed scheme, we recommend a reactor to be started in 1961/62

Rough estimated of total capital cost £150,000.

(e) Other projects

We expect to make recommendations in six to twelve months time about possible additional reactors primarily required as neutron sources for research. We may recommend about two such reactors costing about £150,000 each including buildings to be built in the next few years.

.....