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South Africa Department of Foreign Affairs, 'Purchase by the Union of a Research Reactors to be Discussed at Special Meeting of Atomic Energy Board: 16th March, 1960'

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Summary:

Summary of a memorandum prepared by Dr. A.J.A. Roux comparing the costs and benefits of different types of reactors.

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Purchase by the Union of a Research Reactor: To be discussed at Special Meeting of Atomic Energy Board : 14th March, 1960.

The question at issue is whether to proceed with the original plan, as approved by Cabinet, to purchase a small 5MW Merlin Reactor now and possibly acquire a larger one later, or whether, in the altered circumstances prevailing, it would not be preferable to go for a larger 20MW ORR Reactor right away. The point was debated at the second meeting of the Research Advisory Committee which favoured the second alternative. Dr. Roux has prepared a 22-page memorandum on the subject, which is summarised briefly in the following paragraphs.

2. The Board's research programme requires a thermal neutron flux range of from 10^{3} to 10^{14} n/cm^2 sec. The British-made Merlin 5MW open tank reactor offered thermal neutron fluxes up to 10^{13}, and would thus be suitable for some of (but not all) the work to be done. In view, however, of its very low price (£280,000) it was decided to purchase this type and to build a second larger reactor later for the balance of the work which required a flux of 10^{14}. That was in 1958.

3. Since then the Merlin type reactor has risen in price to £531,000 (without fuel). At the same time a quotation was received from the United States firm of Allis-Chalmers for £902,000 (without fuel) for a much larger 20MW closed-tank Oak Ridge Reactor (ORR), which could be started at 5MW and later adapted to reach 20MW at a cost of only £118,000, that is to say a total cost of £1,022,000. We know that this type is capable of reaching

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MW because it is already doing so at Oak Ridge. It is claimed that the Merlin type could also be stepped up (at a cost of £50,000) but only to 10MW and there is some doubt as to whether the plant can in fact operate at that level; it has not been tried before. The purchase of an ORR reactor would of course obviate the necessity for a second reactor later.

4. As regards the building required to house the reactor, a "controlled leakage" building would be perfectly adequate at 5MW, but there is a risk - albeit a slight one - that at 20MW a pressure resistant steel housing might be required at an increased cost of as much as £150,000. Present indications seem to show that this will not be necessary.

5. Fuel costs are a major item. If obtained (leased) from the United States, as they would be if an ORR Reactor were purchased, the initial charge would be only £10,000 for 5MW operation. If obtained (bought outright) from the United Kingdom, "the capital tied up at 5MW operation will be about £240,000". Whether one could approach the United States for fuel for a British reactor is problematical.

6. Thus we have the following costs:

	ORR.	MERLIN.
Reactor	£964,000	£544,000
Initial fuel	10,000	240,000
Miscellaneous	70,000	70,000
Conversion to higher power	118,000	50,000
	£1,162,000	£904,000

The difference in cost here is £258,000, but in return the ORR would provide a proven maximum rating of 20MW, while

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Merlin would provide an unproven maximum rating of only 10MW. I should perhaps add that a third type, the AMF 5MW Reactor, is also considered but not very seriously, and it is consequently ignored in this summary.

7. There are disadvantages also in the acquisition of an ORR type reactor. Its cost will be twice as much as was originally approved (£550,000) although funds are in fact available to meet this difference. A first reactor must be a proven overseas type, but it was the intention to build the second reactor ourselves, which would have provided valuable experience in technology which will not now be gained. Two reactors are better than one; there are difficulties in undertaking materials testing, isotope production and more fundamental research all in one reactor.

8. There are also questions still to be resolved such as the general technical standard and facilities of the manufacturers, operational difficulties and costs, what contract terms and conditions are available, whether a controlled leakage building is adequate etc.

9. Nevertheless the recommendation is that the ORR Reactor be acquired subject to satisfactory answers being provided to the unresolved questions mentioned in paragraph 8 above; that Dr. Roux and Mr. Colley (Reactor Manager) proceed overseas for further enquiry; that Dr. Roux appoint a consultant abroad; and that a Letter of Intent be sent to the chosen manufacturing group.