

May 20, 1958

**Letter, S.M. Naude, 'South African Atomic Energy
Research Programme'**

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Summary:

Naude, the President of the Council of Scientific and Industrial Research in South Africa, writes to Dr. Schonland, the Director of the Atomic Energy Research Establishment to voice concerns about Dr. Roux's nuclear program proposal. The two knew each other personally.

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SOUTH AFRICAN COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCHP.O. Box 395,
Pretoria.
20th May, 1958PERSONAL

Dr. B.F.J. Schonland,
Director,
Atomic Energy Research Establishment,
Harwell,
Didcot, Berks.,
England.

Dear Dr. Schonland,

SOUTH AFRICAN ATOMIC ENERGY RESEARCH PROGRAMME

I am again coming to you with the request to give me advice about our atomic energy programme. I know that you more than anyone else will be able to help us, for you know not only the intricacies and consequences of an atomic energy programme, but you also know the situation in South Africa better than anybody else overseas.

At long last Dr. Roux has completed his report on his overseas trip and has produced his proposed programme for atomic energy research. I am enclosing a copy of his summary which lists twelve themes and twenty recommendations. The proposed programme has come as a shock to many of us including Professor Hales, Dr. Sellschop and myself, for it is much bigger than anything which I ever contemplated. What is more, our scientific staff position has deteriorated very much in recent years and at the moment we have 20% of the scientific staff positions in the National Chemical and National Physical Research Laboratories vacant. If this programme were accepted, it would certainly draw more of our scientific staff into the atomic energy programme, but fortunately it would probably also retrieve some of the scientists whom we have lost to other countries where they are able to co-operate in an atomic energy programme.

During my discussions with you in 1955 or 1956 you said that you felt that the Australians had tackled a very big project and that many scientists would be tied down in their programme. You also indicated that you felt that South Africa should think twice before attacking an atomic energy programme on a similar scale. It now worries me that Dr. Roux proposes a programme which to my mind will be bigger than that of the Australians, for according to his programme we shall have two reactors instead of one eventually. Could you perhaps give me an estimate of what Dr. Roux's programme will cost eventually when both

reactors/.....

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reactors are operating? This is very essential for us to know, for South Africa is at the moment suffering from financial stringencies. The C.S.I.R. has been told by Treasury that the most we can expect during the financial year 1959/60 is an increase of 7½% on our budget for 1958/59. At the same time our universities are very short of funds to develop properly. I, therefore, feel very upset about the extent of the proposed programme and have voiced my feeling very strongly, but I would very much like to know what your feelings are in this connection.

Coming to the various themes,

Theme I)
Theme II) These are acceptable.

Theme III - I feel that in the initial stages of the research programme this is far too ambitious for South Africa. At the first meeting of the Research Advisory Committee of the Atomic Energy Board I suggested that a limited research and development programme should be considered. If it were to become possible at any stage to formulate a specific aspect of this theme which appeared suitable for study here, then I think that the matter could be reconsidered, since there may be developments in this field which could affect policy in regard to the form in which uranium is marketed.

Theme IV)
Theme V)
Theme VI) These all appear justified to me.
Theme VII)
Theme VIII)

Theme IX - This also appears far too big a project to me at the present stage. I believe that the programme of work here should be aimed at:

- (a) Keeping scientists and engineers in touch with developments in nuclear science.
- (b) Training of South African students in nuclear science.

I do not think that a reactor programme which would aim at the development of designs particularly suited to South Africa would be justified in the light of our financial and manpower resources.

Theme X)
Theme XI) I believe that the use of radioactive isotopes could best be fostered through the C.S.I.R., except in so far as reactors will provide high neutron flux sources. The Atomic Energy Board activities in this field should be restricted to the study of problems of importance for reactor design and operation and all other problems and developments in this field left to the C.S.I.R. If this policy is not strictly adhered to, I anticipate great overlapping and confusion as between the N.C.R.L. and N.P.R.L. of the C.S.I.R. on the one hand and the reactor research

groups on the other.

Theme XII - This seems most desirable.

Recommendation 1 - I agree with this recommendation. As a matter of fact I came back in 1957 with the firm conviction that we should start by building a 5 Mw. Merlin type reactor ourselves. Sir Edwin Plowden promised to give us as much help as possible.

Recommendation 2 - I feel that I could still compromise and agree to recommendation 2 being carried out provided recommendation 1 is dropped, provided of course we can finance recommendation 2 and have sufficient staff for the project. I definitely feel that we cannot embark on both 1 and 2 as proposed by Dr. Roux.

Recommendation 3 - I agree but the Board's responsibilities should be financial only, the work being contracted to the appropriate institutions.

Recommendation 4 - I agree with this, except in so far as my views are influenced by my conviction that the Government Metallurgical Laboratory should in some way or other be linked more closely with the C.S.I.R. Our Advisory Council on Scientific Policy is now investigating this matter. I feel that the suggestion that the Board maintains complete control of the work is quite impracticable. The work should in my view be done in terms of a contract with the G.M.L. and should be controlled by a Steering Committee on which the Board could be strongly represented.

Recommendation 5)
Recommendation 6) Agreed
Recommendation 7)

Recommendation 8 - I regard this as outside the orbit of the Board and as something which would be more properly operated by the C.S.I.R.

Recommendation 9 - Agreed.

Recommendation 10 - Agreed. The radiation group should be part of the reactor team and should be reinforced by staff seconded to them by the N.C.R.L. and N.P.R.L.

Recommendation 11 - I doubt whether this is practicable.

Recommendation 12)
Recommendation 13) Agreed
Recommendation 14)
Recommendation 15)

Recommendation 16 - The need for this does not arise, unless the Merlin reactor (if we have only it) cannot safely be housed on the C.S.I.R. site or the policy towards reactor work which is decided upon is an active one.

Here I should like to ask your advice more specifically in view of your experience in connection with the Windscale accident. Would you definitely advise not to have a small reactor of the Merlin type on our site? The

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advantage of having it here would be that the neutron flux produced in it would be a very valuable complement to the facilities of our Nuclear Physics Institute. The various groups working around the reactor could make use of our library facilities and could also be attached to the various research laboratories on the site. In addition the agreement we have with the universities for the training of students in nuclear physics could be extended to include training on the research reactor.

Recommendation 17 - This is really tied up with the preceding recommendations and will depend largely on whether recommendation 1 or 2 or both are accepted.

Recommendation 18 - Unfortunately I do not see any possibility that the financial burden will be spread at the moment. Our uranium industry takes the standpoint that they already pay income tax to the tune of about £15,000,000 p.a. and that the Government should support the whole programme. Escom has intimated that their Act does not allow them to make a contribution. Iscor may perhaps make a small contribution.

Recommendation 19 - This recommendation touches on the organization under which our atomic energy programme should develop. I feel that this should occur only when an industrial reactor is envisaged. In the intervening research stage of development, growth should occur within the framework of the C.S.I.R. and have the restricted aims mentioned by me.

Recommendation 20 - No comment, if my proposals outlined below are accepted.

To sum up my standpoint, I feel that our programme must be assessed

- (1) Against South Africa's need for it;
- (2) In the light of financial considerations;
- (3) In relation to our resources of manpower.

South Africa's need for a power research reactor as opposed to a scientific research reactor programme.

It is unlikely that the installation of a power reactor will be justified in the Union before 1970 and even then any economic advantage will probably be marginal and restricted to certain areas.

The basic decision which must be taken now is therefore as to how we should prepare ourselves for possible purchase of a power reactor. There are two possibilities:

- (a) We can decide now that we shall purchase a reactor when we need it, making preparations for the purchase say five years in advance. In that case we will probably purchase a reactor of proved efficiency and established design.
- (b) We can decide now to enter the field of reactor design, etc., so that when we come to install a reactor here, we shall have a group sufficiently knowledgeable to discriminate between the merits of

more/.....

more recent but improved designs; i.e., as a return on our investment in our reactor programme we could hope to get a possible (but uncertain) advantage through being able to select a modern design with some measure of confidence.

What are the financial implications of these two alternatives?

- (a) If we do not embark on a power reactor programme, then we need prepare ourselves in the intervening period only by ensuring that we keep up to date scientifically. In this case the purchase of a Merlin reactor as a scientific tool for training and research purposes would be desirable. This would have the advantage that it would specifically limit expenditure to a sum of much less than £500,000 p.a. Within this defined budget, provision could also be made for the training of engineers overseas prior to the purchase of our first industrial reactor, i.e. up to 1970 we could anticipate an expenditure of considerably less than £5,000,000 on our atomic energy programme.
- (b) If we do embark on a reactor programme as is proposed then we can expect on the basis of all experience overseas that expenditure will rise exceedingly rapidly and will be approximately as follows:

1958 - 1963	£ 4,000,000
1963 - 1968, say,	8,000,000
1968 - 1970, say,	<u>4,000,000</u>
Total	£16,000,000

These may be very approximate figures, but the facts are clear that if we are to engage in a power reactor as opposed to a research reactor programme, that we must be prepared to invest very heavily in both money and manpower. I feel convinced that this investment is not justified, particularly when our manpower and financial resources are reviewed against the actual need.

Raw materials research in the atomic energy research programme.

In regard to raw materials for atomic energy development, my view is that their exploitation and marketing should be controlled in order that the best return from our natural resources may be obtained. I also hold the view that any concentration on enrichment of fissionable materials should be controlled by the Board. I feel, however, that there is no justification for the building up of research on raw materials under the auspices of the Board and that the only functions that the Board should exercise in this regard should be those of guidance and financial support. Research on raw materials by the Board should in my view be confined to those aspects which flow directly from problems of reactor development and operation.

I have given you my point of view very candidly and shall appreciate it very much if you could point out to me where I am wrong. You will realize that this is a crucial point in the history of research in South Africa. You and I had the sad experience with the Bureau of Standards as a separate organization under a separate Council. After many years of struggling we succeeded in getting the Bureau

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of Standards placed under the C.S.I.R. The proposals as put forward by Dr. Roux visualize a completely separate research organization under the Atomic Energy Board. If atomic energy was of so much importance to South Africa as it is to Britain, I would still accept the position, but to my mind this programme should be started in a small way under the C.S.I.R. until we see that it is advisable to split it off as a separate organization. I visualize that it could very easily be organized under the C.S.I.R. with Dr. Roux as Vice-President responsible for atomic energy and a Nuclear Energy Research Advisory Committee on which the various interests like Escom, Iscor, I.D.C., C.S.I.R., Chamber of Mines, and Department of Mines, could be represented. This committee could decide on the annual budget. This could then be passed through the C.S.I.R. to the Atomic Energy Board which could provide the funds for the work to be carried out. The function of the Atomic Energy Board will then be restricted to the financial and business aspects of uranium.

I shall appreciate it very much to have your candid views on this whole matter. If you prefer it, I shall not make use of your name in this connection in our further deliberations, but will only use your advice to change my point of view, where necessary. The next meeting of the Research Advisory Committee of the Atomic Energy Board will take place on the 2nd June. I shall, therefore, appreciate it very much if you could find it possible to send me a reply before that date.

I hope you are keeping well. Unfortunately I had a small operation in February and had to resume my work immediately, because Dr. Roux had to give his whole attention to his report and proposed programme with the result that I am still not feeling completely recuperated. I hope, however, that now that Dr. Roux has finished his programme, he will be able to shoulder a few of my responsibilities. The Minister has also agreed that if Dr. Roux should be fully occupied with the atomic energy work, I could get an additional Vice-President to help me. You will be interested to know that since 1950 our staff has increased to 1799 (including the \pm 500 of the S.A.B.S.) and our annual expenditure to £2,500,000, including about £450,000 from contracts. You will, therefore, realize that my duties have become very onerous.

With kind regards, also to your wife,

Yours very sincerely,

S.M. NAUDÉ

PRESIDENT: COUNCIL FOR SCIENTIFIC
AND INDUSTRIAL RESEARCH

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PROPOSED ATOMIC ENERGY RESEARCH AND DEVELOPMENT
PROGRAMME FOR SOUTH AFRICA

by

A.J.A. ROUX

Director of Atomic Energy Research Programme.

S U M M A R Y

The following is a brief summary of the proposed programme and the principal recommendations relating to the implementation and execution thereof:

COMPOSITION OF PROGRAMME

MATERIALS

- Theme I: Research and development work with a view to improving the methods of mining and extraction of uranium so as constantly to improve and strengthen South Africa's position in a competitive market for uranium.
- Theme II: A study of existing methods of uranium processing and the application of such methods or improvements thereof to South African ores under South African conditions.
- Theme III: A comprehensive study of the properties of uranium in relation to its use as a nuclear fuel and research and development work with the object of establishing the various forms in which it could be used most effectively in different types of reactors.
- Theme IV: To undertake a systematic and extensive prospecting programme for thorium deposits in the country.
- Theme V: A study and development of methods for the extraction and processing of thorium from South African ores.
- Theme VI: To extend the country's activities in the field of exploration with a view to establishing not only its further resources of those reactor materials which are known to exist in workable quantities, but also of minerals which are known to occur in minor quantities or of which no deposits have as yet been located.
- Theme VII: A study and development of extraction and processing methods of ores which are at present being exported and from which materials are being derived that are bound to become of much greater importance by virtue of their possible extended application in the nuclear power

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Summary : Proposed Atomic
Energy Research Programme

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programmes of the future and an industrial-economic study of the feasibility of applying such methods on a commercial scale in the country.

Theme VIII: A study of the various methods of producing heavy water with a view to establishing the feasibility of economic production in the country.

NUCLEAR POWER

Theme IX: Research and development work on a power reactor concept which has to take full account of the country's position in regard to the availability of raw materials and other local conditions.

RADIO-ACTIVE ISOTOPES AND RADIATION

Theme X Action to extend the already established uses of radio-isotopes and radiation in South Africa.

Theme XI: To conduct research with the object of establishing new uses of radio-isotopes and radiation, particularly in regard to important problems which are peculiar to the country.

FUNDAMENTAL RESEARCH

Theme XII: That apart from the fundamental research which will form an essential part of the various investigations undertaken, action be taken to support fundamental research in those subjects which are basic to developments in the field of atomic energy.

FACILITIES REQUIRED FOR THE EXECUTION
OF THE PROGRAMME

Of the equipment required for the execution of the proposed programme, a research reactor forms the major and most expensive single item. The following recommendations are made in regard to the research reactor facilities required:

Recommendation 1: That a 5 Mw. Merlin type of reactor be purchased to start the South African programme.

Recommendation 2: That an advanced type of research reactor with an average thermal neutron flux of at least 10^{14} n/cm²-sec. be designed and built, as far as possible in the country and that this reactor be completed not later than 1964/65.

IMPLEMENTATION/.....

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IMPLEMENTATION AND EXECUTION OF
THE PROGRAMME

It is recommended that the maximum possible use be made of existing facilities for the implementation and execution of the proposed programme. With this object in view the following specific recommendations are made:

Recommendation 3: That the following general policy be adopted in regard to the part of the programme which relates to the extraction of uranium:

- (a) The Transvaal and O.F.S. Chamber of Mines be asked to consider submitting to the Board at least every six months a statement of all research work being undertaken by its members on the extraction and mining of uranium, together with any suggestions which the Chamber may wish to make in respect of problems or projects which it feels should be investigated. (It is suggested that the preparation of such statements and suggestions might well be a responsibility of the Chambers' Uranium Technical Committee, and that progress reports on the different projects listed might be appended whenever this was acceptable to the company concerned.)
- (b) The Atomic Energy Board plans and organises its research effort in the light of the full knowledge, which would be available from these statements, of the research being conducted by industry.
- (c) The Atomic Energy Board does not undertake applied or developmental work, which by its nature is best undertaken by industry, if the latter is already working effectively on it, or is prepared to make effective arrangements for doing it.
- (d) The Atomic Energy Board considers from time to time the advisability of contributing to the costs of projects which are being undertaken by industry, subject to the condition that it has a say in the direction of these projects, and receives full progress and final reports upon them.
- (e) The Atomic Energy Board accepts responsibility for a programme of fundamental and laboratory scale research in connection with the mining and extraction of uranium.

Recommendation 4: That the Atomic Energy Board considers the possibility of arranging for the work in connection with the extraction and processing of reactor materials, which is not undertaken by industry in terms of Recommendation 3, to be executed in the Government Metallurgical Laboratory, provided the necessary security arrangements can be made, and that the Board accepts full financial responsibility for this work but maintains complete control over it.

Recommendation 5/.....