Home Affairs 2

United Kingdom Atomic Energy Authority

11 Charles II Street
London SW1Y 4QP

From the Chairman

Telephone: 01-930 5454

28th September 1979

Prime Minister

You asked me to get Sir John Hill's views on the DoE letter at Flag A. The AEA and DoE seem to be agreed that the current research effort is right.

PL
2/10

Dear Mr Lankester,

In your letter of 12th September you asked for my views on the letter the Prime Minister had received from the Department of the Environment about actinide incineration in fast reactors. The advice from the DoE is closely in accord with the views we have formed in the Authority.

The conversion of long-lived radioactive isotopes in nuclear wastes to shorter-lived isotopes has obvious attractions from the point of view of waste disposal. The difficulty is principally in the separation processes where the most important long-lived activity americium, follows the fission product stream in existing separation processes.

We are participating in an International Atomic Energy Agency programme on the assessment of actinide separation (which, of course, includes americium) and are studying the work being done at the Ispra and Gothenberg laboratories under the EEC radioactive waste management programme on the same problem.

To investigate the practicability of the second part of the programme, namely the transmutation of the long-lived activity to shorter-lived isotopes, we are undertaking at Dounreay our part of an experiment being carried out jointly with the Oak Ridge National Laboratory of the U. S. Specimens of the actinides, neptunium, americium and curium have been prepared in the U. S. and are now to be irradiated in our fast reactor at Dounreay to determine the rates at which they are converted to normal fission products.

I believe the level of effort we are deploying is about right for the present time since the hazard of americium in glassified waste is more perceived than real and the full scale separation of americium and some other less abundant but similarly long-lived isotopes may require completely new separation processes not yet known to us.

We are, however, in the forefront of this work and will pursue any promising lines that emerge, particularly any developments in

T. P. Lankester Esq.,
10 Downing Street,
London, S. W. 1.

separation technology that would facilitate further separation of long-lived species.

Yours sincerely

J. M. Hill

-2 OCT 1979

10 DOWNING STREET

From the Private Secretary

B/F 26-9-79.
to see if anything received - not to clear.

12 September 1979

The Prime Minister has recently received some advice from the Department of the Environment on research into converting long-lived radioactive wastes into fission products with much shorter half-lives. I enclose a letter which we have received from the Department, which I hope is self-explanatory.

? original

The Prime Minister's initial reaction to this letter is that it in fact makes out an excellent case for further research, rather than the contrary. The Prime Minister however would be grateful for your views on this question.

J. P. LANKESTER

Sir John Hill
AEA
Shattesbury Ave.

A

DEPARTMENT OF THE ENVIRONMENT
2 MARSHAM STREET
LONDON SW1P 3EB
01-212 3434

Mr Pattison.

MINISTER FOR LOCAL GOVERNMENT AND ENVIRONMENTAL SERVICES

PRIME MINISTER
You asked what would be done on waste conversion into products with a much shorter half-life - your note below.
MAP 30/viii

29 August 1979

This letter makes out an excellent case for further research! Why isn't S.R.C. doing any? Or Harwell? Could Walter Marshall come with me to Downing next week

Dear Mike,

Thank you for your letter of 15 August notifying me of the Prime Minister's agreement to the publication of the report by the Expert Group on the Revision of Cmnd 884.

The Prime Minister has enquired about research into converting long-lived radioactive wastes into fission products with much shorter half-lives. This process, which is known as "Actinide Incineration" is discussed in paragraph 6.15 of the Expert Group's report, from which I quote:

> "Various suggestions have been made for separating certain extremely long-lived constituents from the highly active reprocessing waste with a view to making its disposal easier .... Alternatively the separated transuranic elements could be converted by irradiation in a fast reactor to fission products. This would offer the prospect of 99.9% conversion in 30 years. However, separation of the transuranic elements of the required degree and their processing for reactor irradiation, etc, would demand a formidable and expensive new technology which would produce its own set of wastes. Some research is being carried out at Ispra and we recommend that the UK should continue to regard the European Communities as the main forum for such work. We recommend that no great research effort should be devoted in the UK to these separation options; at most, all that could be justified would be laboratory research into achieving greater efficiency in the separation of the transuranic elements."

Spent fuel consists of unused uranium, plutonium and the various isotopes of heavy elements produced by the nuclear reaction (actinides) (mainly neptunium, americium and curium). Most of the uranium and plutonium can be recovered for re-use of reprocessing, leaving the remainder to be disposed of.

Detailed theoretical studies of the nuclear physics of the fission of actinides in reactors have been made in a number of laboratories world wide, including those of the UK Atomic Energy Authority at Harwell. These have shown that the transplutonium nuclides have properties that make a potentially excellent nuclear fuel, especially if burned in fast reactors.

Reactor physics calculations show that the americium, neptunium and curium separated from a typical reactor fuel would have an "effective half-life" of about 3 years when irradiated in a fast reactor of conventional design, ie half the total mass of recycled actinides would be converted to fission products after 3 years in the reactor and 99.9% after 30 years in the reactor. The fission products resulting from the fissioning of higher actinides would be about 2% of those formed in the nuclear power programme giving rise to the actinides.

For practical reasons the recycled actinides would not be left in the reactor for a single period of 30 years but would be removed, say every 10 years (after 90% are destroyed), so that the fission products can be removed and the residual 10% of actinides can be concentrated and put into fresh cans.

While there is little doubt that physics of the process is perfectly feasible, it is not certain that, after actinide separation, fuel fabrication and subsequent reprocessing, the concentration of actinides in the waste to be disposed of is so reduced as to remove the difficulties associated with the disposal of long-lived species. Indeed, the operation of these processes would itself involve penalties in terms of additional radiation dose to operators and the production of additional low level wastes (which invariably have greater bulk than the original high level waste).

Until a rigorous assessment has been made of the potential hazard to man of disposal of actinides with the fission products compared with the hazard of separation and recycling, it would not be justifiable to assume that there is a real advantage in nuclear incineration.

At present, the major research efforts into the technique of actinide incineration are being undertaken at Ispra in Italy under the European Commission's 'Direct Action' Programme on Radioactive Waste Management, and at Gothenburg in Sweden. The UK Atomic Energy Authority have prepared reports on the state of the art in this field, and are maintaining a watching brief on the continuing research. It also participates in an international research programme on the hazard assessment of actinide separation. In addition, agreement has recently been reached between the UK Atomic Energy Authority and the US Department of Energy on a joint

experiment to explore actinide incineration in fast reactors. This will involve the incineration of small quantities of material supplied by the US in the Prototype Fast Reactor at Dounreay, and will take place between 1980 and 1982.

Yours,
Richard Thompson

pp P J CASH
Private Secretary