

COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, 17 April 1974

Proposal for a
COUNCIL DECISION

adopting a programme of research and education for the
European Atomic Energy Community on plutonium recycling
in light-water reactors

(Indirect nuclear project)

(Presented by the Commission to the Council)

COMMISSION
OF THE
EUROPEAN COMMUNITIES

PROPOSAL FOR A PROGRAMME
OF PLUTONIUM RECYCLING IN LIGHT WATER REACTORS

1975-78

INTRODUCTION

As a result of the increasing generation of nuclear power over the coming years, ever larger quantities of plutonium will be finding their way on to the fissile materials market.

The most profitable way of using this fissile substance will be as a fast reactor fuel. On a world scale, however, the lack of sufficient installed fast reactor capacity during the next 10-20 years will lead electricity producers to recycle this material in light-water reactors.

The advent of such a use of plutonium on an industrial scale offers several advantages:

1. It supplies an element of flexibility in the fuelling of light-water reactors, while at the same time enabling fissile resources to be used to greater advantage over the short term.
2. It is a mode of stockpiling.
3. It facilitates the introduction of an all-plutonium fast reactor fuel cycle into the industrial world.

Several R&D programmes are currently under way in various Member States, although the scale of these programmes and their progress to date vary enormously from one country to another.

Primarily, the proposed Community programme is intended to be complementary in character.

It is divided into two parts:

- (a) general programme designed to solve general problems associated with the use of plutonium;
- (b) basic programme designed primarily to fill in the gaps in existing scientific and technical knowledge.

Although the proposed funds are modest, the Commission hopes that they will facilitate pooling of the experience acquired in this field.

The proposed duration of the programme is four years.

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1. General programme

The aim of this programme is to study general problems associated with the use of plutonium.

1.1 Plutonium market research

- medium and long-term plutonium production estimates, taking into account irradiated fuel production and reprocessing;
- estimate of priority plutonium requirements for fast reactors;
- forward study of the expected utilization of surplus plutonium, taking into account the various factors influencing its use, e.g., extra cost of plutonium fuel, supply of uranium-235, etc.

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1.2 Environmental problems

The environmental problems posed by the plutonium fuel-cycle industries are of a far more serious nature than those raised by the uranium fuel-cycle industry; nevertheless there will have to be general acceptance by society of the plutonium fuel industry in the economic and industrial context before fast breeders are put on the market. As plutonium recycling in light-water reactors represents a transitional solution between the nuclear industry based on uranium and one based on plutonium, it is important to start work now on the environmental problems which may be presented by the industrial scale use of this technology. Moreover, in this way the introduction of fast breeders on an industrial scale will be facilitated.

It would be useful to arrange, in a Community context, a comparison of the difficulties encountered in:

- obtaining operating licences for fuel fabrication plants and plutonium-fuelled power plants, or in the course of their operation;
- transporting plutonium, in the raw state (nitrate or oxide?) or in the form of finished fuel elements;
- storing plutonium (including "requalification");
- attempting to ensure protection against any act of sabotage or piracy;

and to seek a solution to these problems either through research or by means of tests agreed on jointly.

A programme to harmonize regulations and to inform the public may also prove necessary.

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The general programme is to be financed entirely by the Community to the amount of 800 000 u.a., i.e., 200 000 u.a. per year, of which about 25% will be spent on studies and 75% on experiments.

2. Basic programme

The aim of this programme is to supply industry and the electricity producers with the scientific and technical knowledge still needed for the rational use of plutonium fuels in light-water reactors.

2.1 Hitherto unsolved scientific and technical problems likely to arise during plutonium recycling

2.1.1 Higher plutonium isotopes and decay products

At present certain data (e.g., cross-sections) relating to higher plutonium isotopes (Pu^{236} , Pu^{238} , Pu^{241} and Pu^{242}) and their decay products (Am^{241} , Am^{242} , Am^{243} , Cm^{242} and Cm^{244}) are insufficient both for calculating core performance (including burn-up determination) and for dimensioning production lines (shielding) or containers.

Information on these isotopes can also be obtained by simulating repeated recycling by using either synthetic rods or, preferably, a second generation fuel-element.

Programme for obtaining improved data by means of research contracts with industry, research centres, etc., on a cost-sharing basis.

Community financing:

250 000 u.a.

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2.1.2 Comparison of computer codes available to electricity
producers and fuel manufacturers

Electricity producers will be called upon to play a very active role in determining plutonium reloads. Several electricity producers have their own computer codes and a comparative assessment of the latter may be advisable. Some fuel manufacturers are also interested in collaborating in this programme. A certain amount of readjustment may be necessary on the basis of in-pile experiments.

Comparative assessment and measurement programme to be conducted on a cost-sharing basis with the electricity producers.

Community contribution: 50 000 u.a.

2.2 Safety and control

Certain problems (e.g., the loss of coolant accident) associated with safety and control in light-water reactors differ depending on whether they are fuelled on plutonium or uranium. There is need for a comparative technical study to be carried out on the problems raised by the presence of a substantial quantity of plutonium in the core, with reference to the control and safety system and the health protection equipment, in order to see what modifications are necessary. This study should also show to what extent it would be possible, at a later date, to return to the use of uranium fuel.

The studies will be based on specific cases and will not be conducted in a general context. They will be carried out in close collaboration with the electricity producers. Should the need arise, these studies could profitably be followed up by one or more series of measurements on the dynamic behaviour of plutonium-fuelled power plants (using either a power plant or a mock-up).

Community contribution: 1 000 000 u.a.

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2.3 Post-irradiation examination of plutonium fuels

In view of the anxiety expressed by the electricity producers and the fuel-element fabrication industry, and Commission considers it advisable to assume responsibility for some of the cost of the post-irradiation examinations of plutonium fuels and possibly special rods intended to supply information on specific problems of general interest.

This contribution should assist in speeding up the rate at which the entire Community industry acquires general industrial information on high-plutonium fuel elements, thus ensuring that the information is available in time to deal with potential problems arising out of the use of plutonium-core reactors.

Naturally, the defrayment of these costs by the Community will be conditional on a joint agreement by the fuel supplier and the electricity producer to ensure that sufficient data are made available to render the examinations meaningful, subject to the provision that the industrial and commercial interests of the parties concerned are properly safeguarded. The results of the tests will be placed at the disposal of Community firms who are covered by the regulations governing the dissemination of information laid down in Article 13 of the Euratom Treaty (communication).

The laboratories responsible for carrying out these examinations will be appointed on the basis of the results of an invitation to tender sent out to all the Community laboratories.

The work is to be done under research contracts on a basis of cost-sharing with electricity producers and/or fuel producers.

Allowing for the probable increase in the number of elements to be examined during the years covered by the programme, the breakdown of Community financing could be as follows:

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First and second years	400 000 u.a. per year
Third and fourth years	800 000 u.a. per year
i.e., for a four-year programme	<u>2 400 000 u.a.</u>

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Total Community contribution to the basic programme:

3 700 000 u.a.

3. Promotion of a concerted plutonium recycling policy in a
Community framework

Several electricity producers have embarked on various recycling programmes in a small number of light-water reactors.

Significant savings could be achieved by a comparison, in the respective national contexts, of the results obtained under these programmes.

The Commission will examine the prerequisites for a comparison of this type; it will make every effort to smooth out the difficulties arising out of the very unequal state of knowledge from one country to another and will endeavour to create the conditions necessary for a fruitful exchange of information.

Once the results are available, the Commission undertakes to forward to the Council a supplementary proposal to the present programme with the aim of promoting a concerted policy on the use of plutonium within the Community.

This proposal will probably be matched by substantial financial backing in order to encourage electricity producers to collaborate in such a programme.

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4. Financial aid required

The funds and staff required for this programme are as follows:

Operating budget	:	4 500 000 u.a.
Staff	:	(2 A + 1 B)
Staff expenditure	:	287 000 u.a.
Administrative expenses	:	12 000 u.a.
Reserve	:	678 000 u.a.
TOTAL funds required		5 585 000 u.a.

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PROPOSAL FOR A COUNCIL DECISION ADOPTING A PROGRAMME OF
RESEARCH AND EDUCATION FOR THE EUROPEAN ATOMIC ENERGY
COMMUNITY ON PLUTONIUM RECYCLING IN LIGHT-WATER REACTORS

(INDIRECT NUCLEAR PROJECT)

The Council of the European Communities,

Having regard to the Treaty establishing the European Atomic Energy
Community, and in particular Article 7 thereof;

Having regard to the proposal of the Commission presented after
consultation with the Scientific and Technical Committee;

Having regard to the Opinion of the European Parliament (optional);

Whereas, under the common scientific and technological policy, the
multi-annual programme of research and education is one of the
Community's essential ways of contributing towards the rapid
development and growth of nuclear industries and towards the
acquisition and dissemination of knowledge in the nuclear sector;

HAS ADOPTED THIS DECISION:

Article 1

A programme of research and education on plutonium recycling in
light-water reactors, as set out in Annexes I and II, shall be adopted
for a period of four years starting on 1 January 1975. The Annexes
form an integral part of this Decision.

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Article 2

For the implementation of this programme, the maximum amount of the expenditure commitments shall be 5 585 000 units of account and the maximum staff shall be three persons. The unit of account shall be as defined in Article 10 of the Financial Regulation of 25 April 1973 applicable to the General Budget of the European Communities.

Article 3

The programme defined in Annex I shall be reviewed at the end of the second year, according to the appropriate procedures, particularly in the light of the decisions reached at the Summit Conference in Paris.

Done at Brussels

For the Council

The President

ANNEX I

INDIRECT NUCLEAR PROJECT

PLUTONIUM RECYCLING IN LIGHT-WATER REACTORS

A maximum amount of 4 907 000 units of account, plus a reserve of 678 000 units of account, shall be assigned to this programme, for which the staff shall comprise three persons.

The purpose of the programme shall be the joint acquisition of the data still needed to ensure the judicious use of plutonium prior to the operation of fast reactor power stations on an industrial scale.

The programme shall comprise two parts:

- (a) the object of the first part will be to solve the general problems surrounding the use of plutonium;
- (b) the object of the second part will be to acquire the scientific and technical data still needed on plutonium recycling in light-water reactors.

The programme will be implemented under contract.

ANNEX II

TABLE OF MAXIMUM EXPENDITURE AND STAFF

Programme	Commitments	Staff
Plutonium recycling in light-water reactors	5 585 000 u.a.	3

