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PROGRAMME ON RADIOACTIVE WASTE MANAGEMENT AND STORAGE

(submitted to the Council by the Commission)

COM(74) 2285 final.

TABLE OF CONTENTS

Programme on radioactive waste management and storage

1. Motivation

On 22 November 1973 the Council approved, as part of the Community's programme of action for the environment, the principle of a five-point work plan concerning the management of radioactive waste (OJ C112, 20 December 1973). It asked the Commission to put forward a proposal on the subject before 31 December 1974.

The Council reaffirmed the need for such action in its resolution of 7 November 1974 (R/2996/74 ENV. 137/ENER. 48) and felt that it was the responsibility of the Communities and the Member States to study the problems involved mainly in nuclear power expansion and in particular, in radioactive waste.

The reasons and aims of Community action in this sphere may be summarized as follows:

- On the technical side, there is the fact that the growth in the use of nuclear energy to meet an increasing proportion of the Community's electricity requirements has a concomitant disadvantage in that industrial radioactive waste is produced in quantities proportional to the scale of the nuclear electricity programme; Annex A contains some forecasts regarding the activity and volume of the waste which will have to be dealt with by the end of this century.

  The management of this waste - especially that with a high specific activity and long half-life such as is produced in fuel-reprocessing plants - presents and will continue to present difficult problems for those Community countries which have a high population density. It is therefore essential to find effective solutions for the isolation (and/or destruction) of such waste (after appropriate processing and, where necessary, transport) for periods which may in some cases run into geological era.

It is also necessary to evolve a legal, administrative and financial framework to ensure that the waste is managed without danger to the public or the environment.

- Action at Community level offers a number of advantages. Some partial solutions are already being studied in certain Member States, but the efforts vary in intensity. In the search for solutions, time and money could be saved by exchanging information and sharing work. The public service nature of this work and the secondary importance of the commercial interests at stake call for Community-level direction.

Furthermore, many problems in this sphere have industrial, economic and social repercussions which affect whole regions such as the Community. For instance, the industry which produces the most waste - irradiated-fuel reprocessing - works for a market which transcends national frontiers; solutions must therefore be sought on a wider plane.

The solutions adopted may also influence the development of nuclear power through their economic impact and through the reception they meet with among the public; a community approach should convince the general public that both man and his environment will be protected, whatever the technologies adopted to suit particular features of national territories or the urgency of the nuclear programmes; it should thus facilitate the harmonious development of nuclear power production in all the Community countries.

- As regards the timescale, the experts consider that it will take at least another few decades of hard work in order to develop and try out in practice the best solutions to the problems posed by radioactive waste management - and especially disposal(*) - in a highly developed nuclear economy. It is therefore not too early to take an immediate

(*) Cf notes on page 4

decision to join forces in order to cope with the situation which will obtain in the years 1990 to 2000.

Consequently, this programme, which is proposed for a period of five years (1975-1980), must be regarded as the first stage of a longer-term programme.

It has been drawn up by the Commission with the aid of a working party composed of national experts. It consists of a series of technological projects and general studies aimed at working out the technical solutions and legal, administrative and financial framework needed to enable the management of radioactive waste to become an integral part of the nuclear-fuel cycle industries, without endangering the environment and mankind.

All these studies and projects will be financed largely by the Commission and coordinated by it with the help of a Programme management committee comprising representatives of the Member States and Commission officials. This committee will have to meet as soon as this programme is approved. The work will be carried out by qualified public or private agencies in the Member States.

The proposed programme takes into account the research work currently in hand at the Community Joint Research Centre, the results of which will serve as back-up material for this programme.

It also takes into account the activities of the international organizations in order to avoid duplication. In particular, it proposes a Community financial contribution towards the continuation of certain technological studies begun by the OECD Joint Enterprise (Eurochemic).

It will be submitted for review at the end of two years, to reorientate or amplify individual projects where necessary in the light of the results obtained.

2. Programme proposals

Programme proposals concern: (*)

- work on the processing of radioactive waste with a view to storage(**) and disposal(***);
- work on waste storage, and Community measures to promote disposal in geological formations;
- strategic studies to assess the advantage of an advanced management model (separation and transmutation of actinides);
- studies designed to identify the problems of radioactive waste management which cannot be solved under current international legal, administrative and financial provisions, and to propose appropriate solutions;
- studies of the principles which must guide radioactive waste management from the technical aspects.

2.1. Processing of solid radioactive waste

The processing of the various categories of radioactive waste is a problem which is being tackled by most of the Member States, although with varying resources. Very satisfactory solutions exist for certain types of waste and for intermediate storage, but the processing methods for waste disposal (ultimate storage) need to be further improved.

The Commission and the national experts therefore felt that the following points should be included in the Community programme to supplement the work of the Member States.

The purpose of these projects is to develop processing methods to ensure greater safety in handling of certain critical categories

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(*) See also Annex B.

(**) Storage: waste is stored with the intention and possibility of recovering the materials in question at a later date.

(***) Disposal (or ultimate storage): the waste is deposited in a place from which it is virtually irretrievable - Ref. OECD "Radioactive waste management practice in Western Europe" Sept. '71.

of waste and its transport to storage sites, and to permit or facilitate the use of reliable long-term or permanent storage (disposal) techniques to replace the present methods of interim storage.

Storage safety and the nature of the materials conditioned are largely complementary and, to some extent, interdependent, by reason of the interactions of the confining medium and material conditioned.

a. Medium-activity solid wastes

Study of immobilization with plastic resins (Sheet No. 1) in place of bitumen, affording a substantial reduction in volume compared with other methods.

b. High-activity solid wastes

Study of the decontamination and conditioning of irradiated fuel element claddings (Sheet No. 2) enabling the present provisional under water to be replaced by a storage process which is reliable in the long term;

Study of the incorporation of calers from high-activity wastes produced in reprocessing plants in a metal matrix (Sheet No. 3) in place of glass materials whose radiation level is difficult to assess in the long term and which do not efficiently dissipate the heat generated by radioactive decay, thus adding to the problems of storage.

c. Alpha contaminated solid wastes

Study of an incineration process (Sheet No. 4) affording appropriate conditioning of ash for the purposes of long-term storage.

d. Measurement and comparison of the properties of the various immobilization media for solidified products (Sheet No. 5).

This programme to be launched in Community laboratories should enable a comparison to be made on a joint basis of the characteristics of the different immobilization media being developed, to assist later selection of the most promising processes.

Community contribution:

a.	.....	0.5 Mua
b.	.....	3.5 Mua
c.	.....	1.5 Mua
d.	.....	0.3 Mua
	Total	5.8 Mua over five years

2.2. Storage and disposal of high-activity and/or long-lived radioactive wastes

After conditioning in a suitable solid form, high-activity wastes will, according to the experts, be stored for several decades in artificial structures in order to enable them to be partially cooled by radioactive decay. This cooling will help the subsequent handling, transport and disposal operations.

The processes for the disposal (final storage) of radioactive wastes containing long-lived emitters(*) (high-activity wastes from reprocessing plants, wastes from reprocessing of plutonium fuel elements) must in the meantime be developed with the necessary care. They pose a rather unusual problem (**), because they have to isolate these products from the environment for extremely long periods.

Practically all the experts agree that disposal into suitable geological formations represents a definitive solution to the problem outlined above and on which ought to be applied wherever possible as soon as this can be done with a full knowledge of the facts.

The significance of a final and irreversible decision to bury such waste far below the earth must not be underestimated. A pooling of information and results of studies, a permanent comparison of the experience gained by the various states at the level of a large geographical and industrial entity such as the Community -- only by these means can such a decision be made at the right moment.

Accordingly, the Commission and the national experts having regard to the unequal and often limited status of the work carried out so far in the Member States, considered that the present part of the programme constituted the bedrock of Community action as regards environment protection in the field of radioactive wastes -- and in the same way was a fundamental factor in the harmonious development of nuclear energy.

(*) i.e., emitters whose activity declines very slowly with time (thousands of years), cases in point being actinides such as isotopes of plutonium, americium and curium.

(**) Certain chemical wastes raise similar problems (e.g. mercury).

The proposed actions are as follows:

a. Exchange of information and comparison of designs for interim storage facilities (artificial structures); study of the position of such storage in an overall waste management strategy (Sheet No. 6).

b. Community project on the disposal of radioactive waste in geological formations (Sheet No. 7) comprising:

- listing or mapping by specialized institutes in the Community of the geological formations situated within the territories of the Community countries that are of a suitable type for final disposal;

- selection and study of certain sites, if possible of different geological characteristics, which national authorities would be prepared to accept as experimental final storage sites (**);

- the setting-up of these experimental sites on the basis of the results of the foregoing studies, and their technical management, under the auspices of the Commission, by a Committee responsible to the Programme Management Committee referred to on page 3; existing site(s) could be included in the project if the government(s) responsibl so wished(**).

c. In addition, specific project on the storage of gaseous waste (Sheet No. 8) is also submitted in view of the potential interest of the information obtained in the course of projects (a) and (b) in this connection and the multinational nature of the problem.

Community contribution:

a.	0.2 Mua
b.	12.0 Mua
c.	0.2 Mua
Total	12.4 Mua over five years

(*) This means experimental sites where final storage methods will be tried out, although it will still be possible to recover the waste pending the decision on the use of final methods.

(**) At this stage, responsibility for each site will lie with the State concerned.

2.3. Study of an advanced management model (separation and transmutation of actinides)

Actions 2.1 and 2.2 in this programme form part of a radioactive management model extrapolated from current storage and processing practices; it represents an overall approach in that the waste will be managed (processed, stored and disposed of) in the form in which it is produced by the nuclear plants, i.e. as mixtures of radioactive products having widely differing properties, and in particular with degrees of toxicity and half-lives which may differ by factors of about a million.

Only the actinides have very long half-lives and exhibit alpha radiotoxicity; this raises the problem of isolating them from the environment for perhaps a million years.

The problem of waste disposal would therefore in theory be simplified if the actinides could be separated from the other wastes and destroyed as complementary fuel in nuclear reactors.

Although "selective" management of this kind appears attractive at first sight, the experts are unable to say at present whether it is of any real advantage and could come up to expectations. First, the hazards to the environment of the final storage of actinides are perhaps greatly overestimated and must be analysed in depth. Secondly, the new technical operations involved - separation and destruction of actinides - would add to the list of problems to be solved and, since they could not be perfect, might themselves produce further waste.

For all these reasons, the Commission and the national experts strongly advocate, in view of what is at stake, the coordination of efforts in the Community, and especially in the JRC's laboratories (multi-annual research programme - direct action) with the support of Community financing for ad hoc evaluation studies (Sheet No 9).

Community contribution: ..... 0.76 Mua over five years.

2.4. Survey of the problems involved in the management of radioactive waste that could not be solved in the existing international legal, administrative and financial framework

Management of radioactive waste, especially high-activity and long-lived waste, will call for nuclear facilities with unusual technical characteristics, i.e. waste storage and disposal sites. These facilities will have to contain the waste in isolation from the environment for various periods which will sometimes be extremely long.

It is necessary to study the types of problem (financial, administrative, legal) to be faced by managers of these facilities in order to ensure that they function correctly at all times and to monitor their operation. It would then be possible to evaluate the scope of their responsibilities, to decide on the level (private, governmental, Community) at which the managers should be recruited and to assess the possible limits of the international conventions in force(*).

The Commission intends to set up a select working party of experts (technicians, health protection specialists and, at a later stage, specialized lawyers) to make proposals in this connection. The Commission should also have a limited budget so that it could have the necessary analyses performed under study contracts.

The Commission considers that this work is an essential counterpart to the activities outlined in section 2.2 in the search for a general scheme for the storage and disposal of radioactive waste in such a way as to safeguard the environment and the general public. It appears logical to the Commission to undertake this work as and when technical problems develop and in coordination with the work on them, so as to provide a realistic basis for their solution and prevent the development of nuclear energy in the Community from being inhibited, after the technical problems are solved, by the absence of the necessary legal, administrative, and financial framework.

Community financing (100%) ..... 0.2 Mua over five years.

(*) Brussels and Paris Conventions; these govern liability to third parties after accidents and for very limited periods.

2.5. Study of the guiding principles for the management of radioactive waste

The work and studies outlined above should make it possible to prepare a preliminary set of guiding principles for the management of high-activity and/or long-lived radioactive waste.

These criteria will be formulated by the Commission, with the assistance of a working party, in close cooperation with the International Atomic Energy Agency and the OECD's Nuclear Energy Agency.

3. Summary and breakdown of the proposed funding

	Total (Mua)	1975 (Mua)	1976 (Mua)	1977 (Mua)	1978 (Mua)	1979 (Mua)
A. Contract costs	18.40	2.40	5.00	4.60	3.90	2.50
B. Staff and administrative costs	0.76	0.12	0.13	0.15	0.17	0.19
Total	19.16	2.52	5.13	4.75	4.07	2.69

This action will require a staff of 4.

ANNEX A

Estimated production of radioactive waste in the European Community
(based on the new energy policy strategy)

			1980	1990	2000
High-activity waste (1) (2) (3)	volume[4] (m^3)	annual	~ 350	~ 2500	~ 6000
		cumulative	~ 1300	~ 17000	~ 70000
	activity (ci)	annual	$\sim 8.7.10^9$	$\sim 5.5.10^{10}$	$\sim 1.10^{11}$
		cumulative	$\sim 1.4.10^{10}$	$\sim 1.1.10^{11}$	$\sim 3.10^{11}$
Medium and low-activity waste (5)	volume (m^3)	annual	several tens of thousands	> 100,000	several hundreds of thousands
		cumulative	> 100,000	> 1,000,000	several millions

(1) Cladding, fission products and actinides.
(2) Reprocessing industry only.
(3) The percentage of actinides is about 1% of the total volume and 0.1% of the total activity of high-activity waste.
(4) Processed waste (compacted or vitrified).
(5) Nuclear reactors and reprocessing facilities.

ANNEX B

Descriptive technical notes on the various operations to be carried out under this programme (programme sheets)

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Sheet No. 1

Medium-activity solid waste: study on immobilization with plastic resins

Medium-activity waste originating from the treatment of effluents from light-water power reactors is going to constitute, at least so far as volume is concerned, one of the most important features of radioactive waste in the years ahead.

These effluents are processed by evaporation and the resultant concentrate is nowadays almost exclusively incorporated in concrete. Although it is satisfactory and can offer a high degree of reliability, this method has several inherent disadvantages:

- to produce homogeneous blocks is a technologically delicate operation;
- to transport the blocks obtained, special devices (shielded transport containers, etc.) are necessary to bring the packaging into line with the transport regulations;
- to store these blocks special precautions must be taken to avoid the effects of rapid changes of temperature.

The method of packaging by coating with bitumen can offset these disadvantages, but calls for other precautions owing to the flammable nature of bitumen.

A third method now being developed in the United States and in Europe consists in immobilization in plastic resins. Developments in Europe, at any rate, have not yet gone beyond the pilot stage on very low-activity products. An important advantage of this method is that it has a large volume-reduction factor compared with the concreting technique in particular, and this is a tangible gain in respect of transport and the areas required for either temporary or permanent storage.

The proposal is to develop a pilot facility capable of processing medium-activity effluents. To install a pilot facility of this kind at a power reactor site would probably be difficult and scarcely compatible with the management of the reactor effluents unless large storage capacities were built. For this reason it is proposed to build such a pilot facility as an annex to the effluent treatment plant attached to an irradiated fuel works, seeing that the respective properties of the effluents make this a viable proposition.

Programme

- Erection of a pilot facility adjacent to an irradiated fuel reprocessing works to immobilize medium-active effluents in plastic resins.
- Operation of this experimental facility.
- Comparison of this process with the other present-day processes.

Community contribution: 0.5 million u.a. over five years.

Sheet No. 2

High-activity solid waste: decontamination and conditioning of irradiated fuel element claddings

The claddings of fuel unloaded from light-water nuclear reactors after irradiation are second on the list as regards total radioactivity of radioactive waste. This waste has a high specific activity, which identifies it as high-activity waste, and also a high content of transuranic elements.

The present expedient of under-water storage in concrete silos on the premises of the reprocessing works is not a satisfactory long-term solution. What is needed, therefore, is to develop a method for decontaminating and conditioning the claddings in a form suitable for long-term storage.

Programme

- Assessment of the various types of cladding.
- Physical and chemical properties of the claddings.
- Comparative study on decontamination processes.
- Development of a process for conditioning these claddings for long-term storage while not ruling out the possibility of recycling their zirconium.
- Comparative study of the conversion costs and risks inherent in the various processes.

Community contribution: 0.8 million u.a. over five years.

Sheet No. 3

High-activity solid waste: immobilization of fission product calces in a metallic matrix

The reprocessing of irradiated fuel is a means whereby "unburnt" uranium and newly-created plutonium can be salvaged for later use. The fission products are separated during these operations in the form of very highly active liquid waste which is stored in tanks on the works premises after having been concentrated by evaporation.

This expedient, entirely satisfactory as it may be in the short term, gives rise to some long-term problems since it would be essential to change the tanks periodically for fear of corrosion. Furthermore, it will not always be feasible to store on site for very long periods and a transport operation will be needed which can best be carried out when the fission products have been brought into a solid form. A number of techniques for solidification and immobilization in matrices favouring the operations of transport and storage therefore ought to be available for large-scale use in Europe during the next decade, when the reprocessing industry will enter a period of rapid expansion.

The only technique developed so far in Europe from the laboratory stage to the pilot industrial stage is vitrification. While this method ensures a high level of safety it has two disadvantages:

- The fact that glass is a poor heat conductor complicates storage operations.
- Glass is a substance that would be difficult to hanle if in a few years time it proved necessary to reprocess the vitrified products in order, for example, to separate out the transuranic elements.

In addition to these disadvantages there is still some uncertainty over the long-term behaviour of the vitrified products.

It is proposed to develop another method within the European Community, whereby fission-product calces or small-sized glass beads obtained by vitrification are immobilized in a metallic substance. This method appears to offer the possibility of overcoming the above-mentioned disadvantages. The method has been investigated on a laboratory scale by Eurochemic which has filed patents concerning it. Trials have not gone beyond the inactive stage, however, and the cessation by this company of its reprocessing activities means the termination of the complementary research work financed by it.

The work which the Community would carry out in this field should be done at a reprocessing works having concentrated fission products on hand. The work already carried out by Eurochemic would appear to make it desirable to continue the study at this company's site.

Programme

It is proposed that the Community should give Eurochemic a contract to research this process under active conditions. The programme would cover:

- preliminary investigations in a hot cell under active conditions;
- the construction of a small active pilot facility;
- operation of this pilot facility for about two years.

Community contribution: 2.7 million u.a. over five years.

Sheet No. 4

Plutonium contaminated solid waste: incineration process

Solid waste containing plutonium is produced in fairly large quantities in cerain nuclear fuel fabrication plants and in the "tail-end" operations of fuel reprocessing plants. This waste mainly consists of paper, filters, gloves, oils and a wide variety of materials used in alpha glove-boxes.

For the time being, this waste is processed either by being compressed and suitably encased or by being compressed and immobilized in bitumen or concrete. The substances, after being thus conditioned, are disposed of at storage sites or in underground workings or else they are dumped at sea as a part of the sea-dumping operations organized by the NEA.

In the long term, this approach is unsatisfactory for the following reasons:

- the volume is unnecessarily high;
- the fact of the conditioning being somewhat rudimentary limits the storage and sea-dumping possibilities;
- the possibilities of recovery are too few.

It is for the foregoing reasons that a twofold effort is needed:

(1) to condition slightly contaminated waste more suitably; this would afford a large reduction in volume and better possibilities of permanent storage or sea-dumping;

(2) to recover the maximum amount of plutonium.

The programme covers the development of a high-temperature incinerator (minimum 1400°C) designed to handle various types of waste contaminated by plutonium, and fitted with a reliable gas scrubber.

The use of such high-temperature furnaces in industry has shown two major advantages:

(a) when suitably cooled, the combustion gases are easy to filter in view of the virtual absence of unburnt substances therein;

(b) the ash collected in molten form is then already conditioned for permanent storage or sea-dumping.

This programme in essence would achieve the objective mentioned above at (1) and could also mark the starting point for achieving objective (2).

Programme

It covers:

- a phase for the design and construction of a pilot facility;
- a phase for the research and experimental operation of the facility;
- a phase for techno-economic comparisons with other incinerators, as well as comparisons with wet techniques for processing plutonium-containing waste;
- exploratory tests concerning recovery of the plutonium held by the ash.

Community contribution: 1.5 million u.a. over five years.

Sheet No. 5

Testing and evaluation of the properties of various potential materials for immobilizing high-activity waste in a solid form

Several Community countries are engaged in programmes on the long-term immobilization of highly radioactive waste (fission products) in glasses and similar materials. Such work requires an assessment of the likely long-term physicochemical stability of these materials, which can only be forthcoming by employing methods using "accelerated" tests. Such methods are tricky and expensive to use, so that some concentration of the experiments in a few laboratories would enable duplication to be avoided and truly comparative results to be obtained.

Programme

It covers:

1. The development of a common set of equipment for measuring:
   - the leaching rate of fission products and actinides;
   - the rate of volatilization of fission products and actinides from the solid-phase storage places.
2. A Community study of the effect on the integrity of the immobilization substances (matrices) of:
   - temperature;
   - temperature gradients;
   - temperature variations;
   - ionizing radiations (neutron, alpha, beta, gamma);
   - radiation and temperature combined.

Community contribution: 0.3 million u.a. over five years.

Sheet No. 6

Storage of solidified radioactive solid-waste in engineered structures

As soon assit has been conditioned into a suitable solid form, high-activity waste will, according to the experts, be stored for several decades in special structures ("engineered structures"), located at the site of the reprocessing plant producing the waste.* This will enable it to be partially cooled off through radioactive decay and make the subsequent operations of handling, conveyence to the permanent storage sites or disposal much easier.

Such structures must isolate the waste stored over the required period, remove the radioactive decay heat of these products and enable them to be recovered for disposal. They must combine maximum reliability with minimum surveillance requirements.

In some Member States and at the Commission conceptual or pre-project studies are being conducted in order to assess various possible solutions (individual, modular or collective structures for holding the containers; cooling with air or water, etc.).

The programme proposed below should facilitate exchanges of information on the work in hand in the various countries and should ensure optimum integration of the stage of storage in engineered structures into the sequence of different operations that constitute radioactive waste management; it should also provide the necessary background for defining the Community's criteria for such facilities.

*The annual volume of solidified waste produced remains quite low, at about 30 m^3 for a 500 metric tons per annum plant.

Programme

- Comparison of conceptual studies or under way in the Member countries, in the Commission and outside the Community. Main conclusions.
- Study of various strategies for keying the stage of "storage in engineered structures" into the sequence of operations which start with the production of high-activity liquid waste by the reprocessing plants and finish with permanent storage in geological formations.
- Recommendations.

Community contribution: 0.2 million u.a. over five years.

Sheet No. 7

Disposal of radioactive waste in geological formations

1. Experts are practically unanimous that high-activity and alpha-active waste must be permanently stored in suitable geological structures.

Certain types of geological structure are by nature capable of offering all the necessary conditions for storage of this kind, including:

- saline formations;
- granites;
- basalts;
- clays.

It is, of course, true that not every geological structure corresponding to these types is likely to be suitable. Such structures must also satisfy a number of criteria, such as an adequate stability of the impermeable strata isolating the formation and strength of the structure for the making of cavities.

As so often happens, the available data are inadequate and, what is more, are not at the same status for the various geological structures. A further point to consider is that there already is a storage site in one of the Community Member countries and it would be an advantage to benefit from its experience.

2. It would therefore be desirable:

- to catalogue first those geological formations in Community countries which might be suitable for storage purposes;
- to assess, bearing in mind other factors and the economic and social background in particular, the number and nature of the most suitable sites from amongst the sites in the catalogue;
- to ascertain whether such sites can be used normally for one or two decades or whether temporary storage must be accepted for a fairly lengthy period (50-100 years);
- to study the storage conditions and the possibilities of recovering waste which will be assigned into such sites.

A specific study of a few geological structures and the experimental operating of them over several years are the only likely means of achieving these objectives. A joint study would also obviate the need for each Member country to develop straightaway its own designs and techniques for such storage facilities. It could even possibly constitute the first step towards the setting-up of Community sites, in particular through mutual exchanges of waste on an experimental basis between the countries where the demonstration sites would be installed.

3. It is proposed that there should be a Community "disposal of waste in geological formations" project, financed partly by the Community and managed by an ad hoc committee answerable to the Committee on Programme Management mentioned in the Introduction, acting under the authority of the Commission.

Programme

- Preparation by the specialized bodies in the Community of a list (or map) of the geological formations located in the territories of the Community Member countries which would be of a suitable type for a permanent storage. This work could be based on the comprehensive cartographic study carried out by Euratom from 1963 to 1968.

- Execution of preliminary studies on the selected sites, where possible in different geological formations, while making allowances for the different levels of information, based on the foregoing study and for which the competent national authorities would be ready to agree to the building of an experimental storage site; such studies have to form part of the safety file required for obtaining the necessary permits.

- Building of demonstration sites in the light of the completed studies. These sites would be designed from the start as though the storage had to be permanent but with the possibility of recovering the waste over a certain period. They will be managed, from the technical standpoint, by an ad hoc committee answerable to the Committee on Programme Management mentioned in the introduction, acting under the authority of the Commission. Such sites would at this stage remain the responsibility of each State concerned.

- Sites already set up by the Member States could, where the Government is willing, be associated with this project.
- The main aim of these activities is to make possible the development of practical experience associated with a permanent exchange of information from which all the Member States would benefit, to determine the technical and economic conditions of such storage facilities and to improve the necessary geological knowledge. They would further make the disposal of waste in geological formations more readily acceptable by public opinion.

Community contribution: 12 m u.a. over five years.

Sheet No. 8

Storage of gaseous wastes

So far effluent gases produced by nuclear plants have largely been discharged into the atmosphere where they become diluted and rapidly disappear through radioactive decay. The quantities of krypton-85 and tritium produced and their slow decay show that an action ought to be undertaken in the near future to reduce the effect of these elements upon the environment.

Methods must thus be developed which will first allow the krypton and tritium to be contained and isolated and then permit appropriate steps to be taken towards environmental safety in connection with their long-term storage. To this end, a method of immobilizing gas bubbles in the pores of water- and air-tight solid supports is to be studied for the purpose of finally enabling products to be stored in the solid form. The safety of such a technology must be compared with that of storage in pressurized containers on land or at sea.

In the case of tritium, these studies are to be supplemented by work on recovery of tritium from tritiated water. This gas is at present emitted by nuclear plants, with other effluent gases, or to a large extent, in solution in liquid wastes.

Programme

- Study of a separation method for krypton-85 and tritium from other effluent gases.
- Study of tritium recovery from solution in liquid wastes.
- Development and evaluation of a method of immobilizing krypton-85 and tritium in a solid support.
- Comparative study and evaluation on matters relating to environmental risks from:
  - storage in solid supports;
  - storage on land in pressurized containers;
  - discharging at sea in pressurized containers.

Community contribution: 0.2 m u.a. over five years.

Sheet No. 9

Separation and recycling of long-lived wastes (actinides)

The radioactive wastes produced by the nuclear industry consist of fission products, actinides*, and activation products. Only the second of these, as a result of their very long half-lives, create problems of isolation for millions of years in the human environment.

Consequently, the problem of waste disposal would be greatly simplified if actinides could be separated from the other wastes and destroyed, e.g. by being burnt as a complementary fuel in nuclear power plants which would convert them into short-lived products or inactive products.

Such a plan of action implies:

(a) research in the field of nuclear chemistry aimed at developing a practically one-hundred-per-cent efficient procedure for separating actinides from uranium and fission products, while ensuring that no significant increase in the total volume of wastes is thereby caused;

(b) research into production methods for actinide-based fuel elements;

(c) research in the field of reactor physics to help improve knowledge of in-pile destruction of these products* and to allow the increase in potential of these isotopes in various reactors to be assessed.

For these reasons, the Commission and the national experts recommend that:

- the endeavour of the various Community bodies, including Commission laboratories which are working on the chemical separation and transmutation in connection with the JRC's multiannual research programme, be unified;

- the technical demands of such a plan of action and its chances of success be evaluated in detail, and if these chances prove good, the extent to which it will contribute in the long term to protecting the environment be thoroughly assessed.

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* Various isotopes of thorium, protactinium, uranium, neptunium, plutonium, americium and curium.

These assessments nevertheless require a knowledge of certain data which are still missing. Consequently, the study of the plan of action proposed here should rely upon an experimental programme which is restricted at this stage to the essential topics. The programme outlined here answers all these concerns:

Programme

- Assessment of the various technical possibilities for separating actinides.
- Determination of the quantity of actinide products in the various types of reactors according to the different treatment processes.
- Choice of the conditions needed for in-pile destruction of recycled actinides.
- Analysis by the critical path technique of the potential hazards presented by actinides in wastes.
- Development of criteria regarding the level of which plutonium contamination ought to be reduced before storage.
- Comparison between the hazards brought about by actinide separation and its potential benefit.

Community contribution: 0.76 m u.a. over five years.

PROPOSAL FOR A COUNCIL DECISION ADOPTING A PROGRAMME CONCERNING THE MANAGEMENT AND STORAGE OF RADIOACTIVE WASTE UNDER THE PROGRAMME OF ACTION OF THE EUROPEAN COMMUNITIES ON THE ENVIRONMENT

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 presented by the Commission after consulting the Scientific and Technical Committee;

HAVING regard to the Opinion of the European Parliament;

HAVING regard to the Opinion of the Economic and Social Committee;

WHEREAS the programme of action of the European Communities on the environment, approved by the Council of the European Communities and the representatives of the Governments of the Member States meeting in the Council in the Declaration of 22 November 1973*, underlines the need for Community measures on the management and storage of radioactive waste and whereas it lays down the content of and procedures for implementing such measures;

WHEREAS in the near future nuclear energy is destined to become one of the main sources of energy alongside traditional sources, and whereas its specific nature requires permanent monitoring of its potential effects and intensified measures and research to protect the environment**;

WHEREAS the development of nuclear energy inevitably involves the production of radioactive waste, and whereas it is therefore essential to find effective solutions which are capable of ensuring the safety and protection of both man and his environment against the potential hazards involved in the management of such waste;

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*OJ No C 112, 20 December 1973, Chapter 7, Section 2.

**OJ No , , R/2996/74 (ENV 137/ENER 48), Council Meeting held on 7 November 1974.

HAS ADOPTED THIS DECISION

Article 1

A programme on the environment relating to the management of radioactive waste shall be adopted in the form set out in Annexes I and II for a five-year period from 1 January 1975. The Annexes form an integral part of this Decision.

Article 2

The upper limit for expenditure commitments and for staff necessary for the implementation of this programme shall be 19.16 million units of account and four Community servants, the unit of account being 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 set out in Annexes I and II shall be subject to amendment at the end of the second year, in accordance with the appropriate procedures.

Done at Brussels.

For the Council

The President

ANNEX I

ACTION IN THE FIELD OF THE ENVIRONMENT:
MANAGEMENT OF RADIOACTIVE WASTE

A maximum amount of 19.16 million units of account shall be allocated to this programme (the number of staff being fixed at four).

The aim of the programme is the joint development and finalization of a system of management of radioactive waste produced by the nuclear industry which, at its various stages, will provide man and his environment with the best protection possible.

In order to allow the Commission to present suitable proposals at the earliest opportunity, the programme seeks to promote:

A. Work to solve certain technological problems posed by the processing, storage and disposal of radioactive waste

Processing:

- Medium-activity solid waste: coating with plastic resins;
- High-activity solid waste: decontamination and conditioning of irradiated fuel element cladding;
- High-activity solid waste: immobilization of calcined waste from fission products in a metal matrix;
- Solid waste contaminated with plutonium: incineration method;
- Comparative study of the properties of various materials suitable for immobilization of high-activity waste.

Storage and disposal

- Storage of solidified radioactive waste in engineered structures;
- Disposal of radioactive waste in geological formations;
- Storage of gaseous waste.

Study of an advanced management model

- Separation and recycling of long-lived waste (actinides).

B. Work to contribute towards the definition of a general framework (legal, administrative, financial) for the implementation of measures concerning radioactive waste storage and disposal:

- Review of problems posed by radioactive waste management which are not solved under existing international legal, administrative and financial provisions and proposals for solutions;
- Study of principles which should govern radioactive waste management.

ANNEX II

TABLE SHOWING UPPER LIMIT FOR EXPENDITURE (AND STAFF)

Programme	Commitments (in millions of u.a.)	Staff
Management of radio-active waste	19.16	4