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REPORT
drawn up on behalf of the Committee on Energy and Research

on measures to be taken in connection with the removal of radioactive waste as part of Community energy policy

and on the proposals from the Commission of the European Communities to the Council for

- a draft Council resolution on the implementation of a Community plan of action in the field of radioactive waste
- a draft Council decision on the setting up of a high-level committee of experts responsible for assisting the Commission in the implementation of the plan of action in the field of radioactive waste
(Doc. 255/77)
- a draft Council decision on the setting up of an ad hoc committee for the reprocessing of irradiated nuclear fuels
(Doc. 242/77)

Rapporteur: Mr G. FLÄMIG

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English Edition

By letter of 21 July 1976 the Committee on Energy and Research requested authorization to draw up a report on measures to be taken in connection with the removal of radioactive waste and the decommissioning of nuclear power stations as part of Community energy policy.

By letter of 15 September 1976 the President of the European Parliament granted authorization. On 10 February 1977 the Committee on the Environment, Public Health and Consumer Protection was asked to deliver its opinion on the matter.

Since the Bureau had decided on 2 September 1976 to authorize the report, on 10 September the Committee on Energy and Research appointed Mr Flämig rapporteur.

The Council of the European Communities requested the European Parliament, by letter of 11 August 1977, to deliver an opinion on a communication on points for a Community strategy on the reprocessing of irradiated nuclear fuels together with a draft Council decision on the setting up of an ad hoc committee for the reprocessing of irradiated nuclear fuels and, by letter of 29 August 1977, to deliver an opinion on a communication on a Community plan of action in the field of radioactive wastes. The President of the European Parliament forwarded both requests to the Committee on Energy and Research as the committee responsible and the latter request to the Committee on the Environment, Public Health and Consumer Protection for its opinion.

On 28 September 1977 the Committee on Energy and Research appointed Mr Flämig rapporteur on these two communications and at the same time decided that, given the similar subject matter, he should incorporate the opinions into the abovementioned draft report.

The committee considered the draft report and the proposals at its meetings of 13 October and 21 December 1977, 2 February, 21 February and 1 March 1978 and at the latter meeting adopted the motion for a resolution and explanatory statement unanimously with one abstention.

Present: Mrs Walz, chairman; Mr Flämig, vice-chairman and rapporteur; Mr Normanton and Mr Veronesi, vice-chairmen; Mr Brown, Mr Edwards, Mr Fuchs, Mr Houdet, Mr Jensen, Mr Lamberts, Mr Noè, Mr Osborn, Mr Verhaegen and Mr Zywietz.

The opinion of the Committee on the Environment, Public Health and Consumer Protection is being published separately.

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A

The Committee on Energy and Research hereby submits to the European Parliament the following motion for a resolution together with explanatory statement:

MOTION FOR A RESOLUTION

on measures to be taken in connection with the removal of radioactive waste as part of Community energy policy with the opinion of the European Parliament on the proposals of the Commission of the European Communities to the Council on

- a draft Council resolution on the implementation of a Community plan of action in the field of radioactive waste
- a draft Council decision on the setting up of a high-level committee of experts responsible for assisting the Commission in the implementation of the plan of action in the field of radioactive waste
- a draft Council decision on the setting up of an ad hoc committee for the reprocessing of irradiated nuclear fuels

The European Parliament,

- having regard to the proposals from the Commission of the European Communities to the Council[1],
- having been consulted by the Council (Docs.255/77 and 242/77),
- having regard to the report of the Committee on Energy and Research and the opinion of the Committee on the Environment, Public Health and Consumer Protection (Doc. 576/77 and Doc. 576/77 Annex),
- recalling its resolutions
  - of 17 January 1973 on the establishment of the Community structures for the permanent storage of radioactive waste[2],
  - of 11 May 1976 on the need for a Community policy on the reprocessing of irradiated fuels and materials[3],

1. Recalls its previous opinions pointing out the vital need for the Community to use nuclear fission as a means of energy production in the transition from convencional sources to future forms of energy;

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[1] OJ No. C 24 , 18.10.1977, p. 8. and OJ No. C 199, 20.8.1977, p. 2

[2] OJ No. C 4, 14 2.1973 , p. 10

[3] OJ No. C 125, 8.6.1976 , p. 14

2. Emphasizes that recourse to this source of energy is permissible only if it is accompanied by complete respect for standards of public safety and environmental protection;

3. Notes that a high level of safety has hitherto been achieved in the peaceful uses of nuclear energy;

4. Stresses the Community's responsibilities in overcoming the technological, financial and, above all, psychological obstacles to the development of nuclear energy;

5. Considers, in this connection that, in the public debate on nuclear energy, the Community and the political forces should fulfil their responsibilities by providing public opinion in the Member States with as much clear and objective information as possible, especially as regards problems associated with the completion of the fuel cycle;

6. Feels that a Community energy policy should at last be drawn up and must take account of the various aspects of a nuclear energy development policy, and recalls in this connection its opinions on the creation of a Community uranium enrichment capacity, the recycling of plutonium, the Community siting policy for nuclear power stations, the reprocessing of irradiated fuels and the fast breeder option;

7. Notes that the two communications from the Commission on a Community plan of action in the field of radioactive wastes and points for a Community strategy on the reprocessing of irradiated nuclear fuels reflect this concern to incorporate the whole nuclear fuel cycle in Community energy policy;

8. Requests the Commission to extend its field of action to the problems associated with the decommissioning of nuclear power stations with a view to defining an appropriate Community strategy;

9. Emphasizes the need to establish standards for the construction of nuclear power stations so that, during their lifespan, they can be maintained and ultimately dismantled more easily; instructs the committee responsible to study these aspects more closely;

As regards points for a Community strategy on the reprocessing of irradiated nuclear fuels

10. Points out that reprocessing enables uranium and plutonium to be recovered and used to make new fuel elements;

11. Emphasizes, moreover, that the Member States' choice in favour of fast breeder reactors presupposes the availability of the plutonium needed to operate them;

12. Stresses that the problems connected with the final disposal of unprocessed irradiated nuclear fuels have not as yet been solved and that processing has the advantage of reducing considerably the volume of radioactive wastes and probably also of shortening the period for which they must be stored;

13. Considers therefore that, both to save energy resources and to protect the environment, the Community and its Member States should pursue and improve the recovery and recycling of spent fuels discharged from nuclear reactors, that is, reprocessing;

14. Considers that the drawing up of a Community reprocessing strategy offers definite advantages from the point of view both of guarantees against the diversion of nuclear materials and of the economic viability of this technology (small number of plants of optimum size);

15. Approves the setting up of an ad hoc committee to assist the Community institutions in the definition of objectives and the means to achieve them in order to put into practice the programme proposed by the Commission;

16. Notes the Commission's proposal to use the Joint Undertaking provided for in the Euratom Treaty to promote the development of reprocessing;

17. Feels that one of the long-term objectives should be the setting-up of a limited number of reprocessing centres as a preliminary to effective Community 'nuclear fuel centres';

18. Requests the Commission to take all the necessary steps, above all as regards research and development programmes and the perfecting of new processes, to ensure that:

    (a) the development of reprocessing is at all times compatible with the objectives of safety for the population of the Community and the protection of its environment,

    (b) in conjunction with the IAEA the strictest possible measures are taken to prevent the diversion and misuse of nuclear materials;

<u>As regards a Community plan of action in the field of radioactive wastes</u>

19. Recalls that the principal aim of radioactive waste management and storage must be to ensure that the population and the environment are protected against the radiological hazards associated with such waste;

20. Notes the major progress achieved in radioactive waste management as a result of the research and development programmes of the Member States and the Community;

21. Considers, however, that research and development into waste management should be intensified still further and involve increasingly close cooperation at Community level;

22. Emphasizes, as it did in 1973, that the numerous problems connected with radioactive waste (industrial, financial, ecological, social) extend beyond national borders and can be solved only within a wider context, thus avoiding the need for individual Member States to take costly measures for final disposal and preventing the multiplication of radioactive waste depositories and an increase in the associated expenditure;

23. Feels that the Community plan of action reflects this aim of organizing the preparation of long-term Community solutions to the problem of radioactive waste;

Requests the Commission in particular to support all measures being taken in the Community to industrialize solidification processes for long-lived radioactive wastes;

24. Emphasizes the importance of completing - during the period covered by the Community actionplan - research into geological formations suitable for storing radioactive wastes and studies to determine the properties of the containers that will have to hold them and the procedures for depositing them;

25. Considers the course of action outlined in the preceding paragraph to be the only one at present feasible; invites the Commission, however, to follow with the greatest attention studies and experiments aimed at finding other means of storage for long-lived radioactive wastes or at shortening drastically the period of their radioactive lives;

26. Calls on the Commission to harmonize the safety standards and security measures relating to radioactive waste as soon as possible and to monitor their application;

27. Welcomes the Commission's intention to go beyond its role as coordinator of a number of research programmes and to ensure total cooperation at Community level on all the problems relating to radioactive waste management and storage;

28. Is concerned, however, at a certain lack of proportion between these objectives and the means proposed to achieve them;

29. Regrets that in its proposal, the Commission limits Community action to studies and analyses in connection with a possible Community storage network for radioactive waste and emphasizes that the size of the problem would justify more ambitious proposals;

30. Feels that the setting up of this network, under the joint responsibility of the Member States and the Community, represents the vitally important first stage in the internationalization of waste management, whose public service role would be incontestable;

31. Considers, moreover, that the Commission's proposals on periodically informing the public, the need for which has been repeatedly emphasized by Parliament, are inadequate, and expresses reservations about using the Official Journal of the Communities for this purpose;

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32. **Approves, subject to the above reservations,** the proposals submitted to the Council;

33. Instructs its President to forward this resolution and the report of its committee to the Council and Commission.

B

EXPLANATORY STATEMENT

I. INTRODUCTION

1. Over many years the European Parliament has had occasion in various resolutions to state its position clearly in the debate concerning the peaceful uses of nuclear energy. It has repeatedly asked the Community authorities to apply the policies and instruments necessary for the development of nuclear energy. In the view of the European Parliament, such development must take place under conditions of optimum safety and security and should be of a scope sufficient to reduce appreciably the Community's energy dependence and ensure long-term energy supplies.

2. The conclusion reached in the continuing analysis undertaken by the European Parliament is that it is absolutely essential for the Community to have recourse to nuclear fission to effect the transition in energy generation from the traditional sources to the energy sources of the future (including fusion). This is even more necessary in connection with the present situation, in which the Community is too dependent for its energy supplies on hydrocarbons, with the risks that this involves both at economic and political levels. While emphasizing the importance for the Community of developing the use of new forms of energy and combating waste, the European Parliament has always been aware that such measures alone are and will not be enough and that the use of nuclear energy is inevitable to cover energy needs.

3. The European Parliament has also made its position clear on the question of whether one should rely totally or partially on nuclear energy. In its resolution adopted on 13 January 1976[1], it pointed out that 'the various constraints governing site selection should lead above all to a review of the scope of certain current energy programmes'

4. The European Parliament has not limited itself to reaffirming its favourable attitude to the use and development of nuclear energy for peaceful purposes. It has dealt with the problems arising at the various stages of the nuclear fuel cycle, always with a view to Community action as part of an energy policy.

It has considered in succession the following:

- uranium enrichment capacity: resolution of 16.3.1973 (Doc 296/72 - Noè report) and resolution of 23.3.1974 (Doc. 38/74 - Noè report)

- plutonium recycling: resolution of 11.7.1974 (Doc. 163/74 - Noè report)

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[1] OJ No. C 28, 9.2.1976

- nuclear power station siting: resolution of 13.1.1976 (Doc. 392/75 - Walz report) and resolution of 7.7.1977 (Doc. 145/77 - Walz report)

- irradiated fuel reprocessing: resolution of 11.5.1976 (Doc. 69/76 - Noè report).

5. Finally, in 1973, the European Parliament examined the problems associated with the storage of radioactive waste. In adopting the resolution presented on behalf of our committee by Mr Ballardini on 17.1.1973, the European Parliament emphasized the need to establish Community structures for the final disposal of radioactive waste.

It can therefore be seen that in the field of nuclear energy the European Parliament has adopted a logical and coherent framework within which it has progressively studied the various stages of the nuclear fuel cycle.

6. The purpose of the present report is, taking account of developments since 1973, to resume consideration of the problems associated with the storage of radioactive waste and, in parallel, those raised by the dismantling of power stations, while drawing the lines of a Community policy in this matter.

7. In view of the complexity of these questions it was essential for your rapporteur to have the official views of experts and to visit the installations or research centres concerned with the treatment and/or storage of radioactive waste. Thus, following an exchange of views with the relevant officials of the Ministry of Research of the German Federal Government, your rapporteur visited the following installations:

- BNFL's reprocessing plant at Windscale

- the COGEMA reprocessing plant at La Hague

- the Eurochemic pilot reprocessing plant at Mol

- the GWK pilot reprocessing plant at Karlsruhe

- the GSF pilot plant for the disposal of radioactive waste at Asse.

These visits were in each case preceded by descriptions and explanations given by the officials of these centres at the request of your rapporteur.

Finally, the work of your rapporteur was made easier by the fact that the relevant departments of the Commission of the Community were always ready to help.

8. Your rapporteur would like to thank all these people who, by being always available to help, enabled him to draw up this report under excellent conditions. He would also like to emphasize the welcome which he was given everywhere and which helped to make the exchanges of views particularly fruitful.

The present report will deal in succession with the following aspects:

- General information on radioactive waste
- Waste management
- Dismantling
- The Community's role

9. Consideration of these various points will also include reference to the communications which the Commission of the Communities has submitted to the Council (15 and 26 July 1977). The communications relate to

- a Community plan of action in the field of radioactive wastes (COM(77) 397 final)
- points for a Community strategy on the reprocessing of irradiated nuclear fuels (COM(77) 331 final)

II. GENERAL INFORMATION ON RADIOACTIVE WASTE

A. Origin of waste : reprocessing

(a) Purposes of reprocessing

10. The operation of nuclear fuel reprocessing constitutes the principal source of waste. The purpose of this operation is to separate in the irradiated fuel the fissile materials which can be reused (uranium and plutonium) from the 'waste', which consists essentially of fission products and transuranic actinides. The effect of the chain reaction on the fuel elements in the reactor is to produce a gradual depletion of their fissile material content and an accumulation of fission products. Together, the two processes cause a loss of reactivity in the fuel, which must then be discharged and replaced by new fuel elements.

After storage in water at the reactor site, the spent fuel elements are placed in containers called 'flasks' and sent to a reprocessing plant. There the elements are placed in a 'pond' to await reprocessing. The time spent in the pond depends on a number of factors:

- technical factors (risk of corrosion of the cladding)
- industrial factors (the reprocessing capacity of the plant)
- economic factors (the desire of the electricity producers to recover the uranium and plutonium as soon as possible).

The radioactivity of the elements in the pond decreases to a considerable extent over a number of years, after which it falls only slowly.

11. The first operation after interim storage is the decladding of the nuclear material. This operation differs according to whether the fuel element is from a graphite-gas reactor (Magnox elements) or a light-water reactor (oxide elements).

The real reprocessing begins after this operation. This consists of various physico-chemical operations involving:

- dissolution of the fuel,
- clarification of the solution obtained,
- separation of the uranium, plutonium and fission products,
- purification of the uranium and plutonium until they are sufficiently pure for re-use,
- collection and conditioning of the wastes resulting from these operations.

The purpose of the treatment is therefore to separate the various products which make up the spent fuel, i.e. uranium, plutonium and the fission products which, in fact, constitute the radioactive waste.

(b) Need for reprocessing

12. The fact that this radioactive waste results from the reprocessing operation does not mean that this process must be banned, which some people have clamoured for, at the same time ignoring a number of associated questions. On the one hand, as Mr Noè has shown in a report already referred to, reprocessing techniques have already been thoroughly tested. Secondly, no one has yet answered the question of how to store non-reprocessed spent fuel. Finally, reprocessing has the not inconsiderable advantage for the energy policy of the Community of allowing the uranium and plutonium to be recovered for the manufacture of new fuel elements, thus reducing to that extent the need for imported uranium.

13. Another criticism often made of reprocessing concerns the production of plutonium and the associated dangers. In this connection it should first of all be remembered that the plutonium produced in light-water reactors and separated from the uranium following reprocessing would be of poor quality for the manufacture of nuclear weapons. After two recycling operations it would even be unsuitable for such use.

Secondly, there are at least two outlets for this plutonium in the field of energy production. Tests are now in progress on the behaviour of fuels containing plutonium in light-water reactors. Also, since the Member States of the Community have opted for the breeder system, provision must now be made for the plutonium needed to start them. In order to reduce the risks of plutonium diversion, the possibility is at present being examined of forming, during the reprocessing operation itself, a uranium-plutonium mixture which could be used as fuel for the breeders.

14. Even though the breeder system at the moment seems to have been abandoned by the United States, it should not be forgotten that they are at present devoting to research in this field a budget equivalent to those of France, the Federal Republic of Germany and Great Britain put together.

(c) M.U.F. (Material Unaccounted For)

15. Your rapporteur would like to give some information on the so-called losses of fissile material which have been mentioned in regard to the plutonium obtained after reprocessing.

Following a discussion with several experts, it would seem that these reports are based on a deplorable misconception. In fact, the quantity of fissile materials present in the irradiated fuels cannot be determined very precisely on the basis of existing physical methods. Precise measurements, using chemical methods, are possible only after the fuels have been dissolved. Hence, neither the quantities actually entering the reprocessing plant nor the quantities of fissile materials contained in the wastes can be known with absolute certainty. This is why there is a discrepancy between the quantities as calculated when entering the plant and the quantities which actually leave the plant after reprocessing as final products or as contaminants of the wastes.

'Material Unaccounted For' (MUF) is the term used to denote this discrepancy. To consider that the MUF constitutes a 'disappearance' of plutonium is either a case of ignorance or of deceit.

B. Problem of liquid and gaseous waste and the integral dose received by the staff and the surrounding populations

a) Gaseous effluent

16. Reprocessing plants in operation are fitted with ventilation and filtration systems which efficiently retain dusts and aerosols but generally do not yet have very elaborate systems to fix all the radioactive fission gases. Nor has it been necessary on health grounds to trap these gases completely in the reprocessing plants which hitherto have been processing gas-graphite reactor fuel elements, which have not been irradiated very highly and which have been cooled, or fairly limited quantities of oxide fuels from power reactors.

The levels allowed by the ICRP have never been exceeded. Spent fuel contains two important iodine isotopes. Iodine 131 has a short half-life and is allowed to decay before reprocessing. Iodine 129 has a very long half-life and will be important in future when high burn-up oxide fuels which contain a great deal of iodine are being reprocessed.

17. Extensive research programmes are at present in progress at the various national institutes concerned and are being conducted with close cooperation between them. The research is concerned in particular with two separate problems:

- the need to trap iodine with yields likely to improve observance of the discharge standards in force in plants processing water-reactor fuels
- a technical solution to the problem of complete trapping and conditioning of all the fission gases (primarily inert gases and tritium) with a view to possible tightening up of standards, or the widespread adoption of the principle of 'as little discharge as possible'.

18. Looking at the present situation, we find that, in all the reprocessing centres in operation, the air discharged is first purified by means of filters with a high retention capacity. Traps based on silver salts are currently under study, and a number of installations are already equipped with experimental systems. These are capable of eliminating 99.9% of the iodine contained in the treated air.

Krypton 85, a chemically inert gas, is allowed to be discharged from the reprocessing centres at La Hague and Windscale. It is considered by the authorities concerned that at present the discharge of very small quantities into the atmosphere does not present any difficulties but according to an OECD report a problem may arise after the year 2000. In addition, in assessing this problem, the favourable geographical situation of Windscale and La Hague have to be taken into account (at the edge of the sea, strong favourable winds) so that this gas can be discharged without difficulty into the atmosphere.Conditions are probably less favourable at the continental sites, e.g. at the Eurochemic Centre at Mol, Karlsruhe and the site at Gorleben, the proposed location of a commercial reprocessing plant in Germany. In the Federal Republic of Germany, the Committee on Radiation Protection has asked for krypton to be removed. It is estimated that an experimental krypton separation plant would cost about DM 20 million and an industrial plant DM 100 million. Tritium is usually found in the form of tritiated water. No industrial extraction technique has yet been developed. It is, however,

possible to separate the effluents containing tritated water from the plant's other effluents. These tritiated solutions are concentrated in relatively small quantities which, after separation from the other contaminants, can be discharged or, better still, incorporated in concrete.

b) Liquids discharged

19. In the treatment of liquid wastes low-active effluent is produced. In the various reprocessing plants at present in operation this can only be discharged after permission has been given and subject to the control of the responsible authorities. In addition, such liquids can only be discharged within the limits of standards established at international level. In the two commercial reprocessing plants in operation (Windscale and La Hague) liquid discharges have always remained below these limits. To allow dilution effluents are discharged at high tide via pipelines which extend several kilometers out to sea.

c) Environmental monitoring

20. Around the reprocessing plants, permanent monitoring is undertaken by authorities independent of the nuclear industry. All results are regularly made available to the public.

This monitoring is carried out in the following areas:

- atmospheric monitoring (with the help of meteorological stations)
  - . dust in suspension in the air
  - . air
  - . rain water
- hydrological monitoring (by sampling and analysis)
  - . underground water
  - . watercourses
- ground monitoring (by sampling and analysis)
  - . pasture land
  - . milk
  - . field crops and other food products
- marine monitoring (by sampling and anlysis)
  - . sea water
  - . beach sand
  - . marine sediment
  - . algae, crustaceans, molluscs
  - . fish
- protection of persons (staff of the reprocessing plant and surrounding population)

21. The staff of reprocessing plants are subject to strict monitoring carried out by the radiological protection services. The results of these tests show that the integral doses received by the staff are well below the

international limits. On average, staff are subject to a dose of 300 millirems per annum (2,500 millirems for staff most exposed) whereas the permitted dose is 5,000 millirems.

22. In connection with the 'risks' to which the population living near nuclear industries would be subject, a study carried out by the French C.E.A. arrives at the following figures:

Mean annual exposure of the population to ionizing radiation
for a man whose natural internal radioactivity is 25 millirems

1) Natural exposure

- from the earth: 50 millirems
- from cosmic radiation: 50 millirems

2) Artificial exposure

a) Miscellaneous sources
- x-ray examinations: 70 millirems
- television sets: 3 millirems
- luminous dials of watches etc.: 1 millirem (approx.)

b) Effects of the nuclear industry for very limited groups
- from a nuclear power station: 2 millirems
- near the La Hague plant
  - through the atmosphere 5 millirems
  - via the sea 1 millirem
  - the ground negligible

C. The various categories of waste

23. As we have already indicated, this report will only deal with problems raised by radioactive waste resulting from reprocessing. Neither the quantities nor the characteristics of the radioactive waste from other sources (uranium extraction, hospitals, laboratories, nuclear power stations) present any major problems when it is being disposed of.

24. As in the case of other industries, waste in the nuclear industry comes either in liquid, solid or gaseous form. Its radioactivity, its potential hazard and time required for it to become harmless[1], depend on the radionuclides which it contains. In practice the maximum radioactivity is of of the order of some 10^6 Ci/m^3 (in which case the waste gives off considerable heat). The minimum radioactivity considered is of the order of 10^{-6} Ci/m^3 (therefore lower than that of water from thermal springs).

[1] That is, it has no radiological effect on the environment within the meaning of the Member States' regulations on health protection drawn up in accordance with the Euratom radiological protection standards.