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REPORT

drawn up on behalf of the Committee on Energy, Research and Technology

on the need for Community measures for the final storage of radioactive waste and the reprocessing of irradiated nuclear fuel

Rapporteur: Mrs H. WALZ

PE 84.332/fin.

nglish Edition

By letter of 6 July 1982 the Committee on Energy, Research and Technology requested authorization to draw up a report on the need for Community measures for the final storage of radioactive waste and the reprocessing of irradiated nuclear fuel.

By letter of 8 October 1982 the committee was authorized to draw up a report on this subject.

On 3 November 1982 the committee appointed Mrs WALZ rapporteur.

The committee considered the draft report at its meetings of 2 December 1982, 21 June 1983, 3 November 1983 and 23 November 1983. The motion for a resolution as a whole was adopted on 23 November 1983 by 19 votes to 1.

The following took part in the vote: Mr SELIGMAN, acting chairman; Mr IPPOLITO, vice-chairman; Mrs WALZ, rapporteur; Mr BERNARD, Mr FLANAGAN, Mr GAUTHIER, Mr HERMAN (deputizing for Mr FUCHS), Mr MARKOPOULOS, Mr MORELAND, Mr PEDINI, Mr PETERS (deputizing for Mr SCHMID), Mr PFLIMLIN, Mrs PHLIX, Mr PURVIS, Mr RINSCHE, Mr SÄLZER, Mr SASSANO, Mr TURNER (deputizing for Mr NORMANTON), Mr VANDEMEULEBROUCKE (deputizing for Mr CAPANNA) and Mr VERONESI.

The report was tabled on 29 November 1983.

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

MOTION FOR A RESOLUTION

on the need for Community measures for the final storage of radioactive waste and the reprocessing of irradiated nuclear fuel

The European Parliament,

- having regard to its earlier resolutions on
  - the need for a Community policy on the reprocessing of irradiated fuels and materials[1],
  - measures to be taken in connection with the removal of radioactive waste as part of Community energy policy[2],

- having regard to the communication from the Commission to the Council on the report of the ad hoc Advisory Committee on the Reprocessing of Irradiated Nuclear Fuels (CORECOM) (COM(82) 37 final),

- having regard to the communication from the Commission to the Council containing the first report on the present situation and prospects in the field of radioactive waste management in the Community COM(83) 262 final,

- having regard to the report of the Committee on Energy, Research and Technology (Doc. 1-1129/83),

A. whereas the use of nuclear energy inevitably involves the creation of radioactive waste, the elimination of which in a manner harmless to man and his natural environment represents an absolutely essential prerequisite for the responsible use of this source of energy,

B. giving serious consideration to the misgivings still prevalent in sections of the European public concerning the use of nuclear energy, above all the misgivings about disposal[3] and about the construction and operation of nuclear reactors, since doubts exist as to whether this problem can be solved, particularly in the light of its long-term nature,

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1 OJ No. C 125, 8.6.1976, p. 14 (NOE' report)

2 OJ No. C 85, 10.4.1978, p. 46 (FLÄMIG report)

3 The term 'disposal' covers interim storage, final storage and reprocessing.

C. aware that the greater contribution of nuclear energy, the need for which has been stressed time and again by all the Community bodies, cannot be achieved on a permanent basis without progress being made in disposal and being recognized as such by the general public,

D. taking account of the complexity of the disposal process, which consists of a number of stages, at each of which different technical solutions exist,

E. whereas there is a problem with the disposal not only of the highly radioactive waste contained in spent fuel elements from nuclear power stations but also the large volume of low-level radioactive waste from nuclear technology, industry, research and medicine, and decommissioning waste, although this will only be present in large quantities from the turn of the century;

1. Calls for the development, further development and application of disposal procedures appropriate to all categories of radioactive waste;

2. Notes that waste disposal is only feasible if appropriate conditioning and if a secure form of final storage can be ensured;

3. Calls in this connection for regulations or directives to be developed at Community level in cooperation with international organizations such as the IAEA;

4. Sees an urgent need in this context to formulate a Community-level approach, compatible with ecological considerations, to the question of dumping low-level waste containing no alpha-emitters at sea and the fixing of tolerance levels for decommissioning waste;

5. Observes in relation to highly radioactive waste that studies in various Member States and other countries have shown that two basic strategies exist:
   - reprocessing and the encapsulation of waste in glass blocks, or
   - direct final storage of fuel elements in appropriate containers;

6. Notes, moreover, that given the current state of investigations into the advantages and disadvantages of the two strategies, it is too soon to come down definitively in favour of only one of them;

7. Considers, therefore, that there is no justification for postulating a conflict between the two strategies, since they complement each other;

8. Sees a complementary relationship in that reprocessing should be applied above all for the large quantities of similar fuel elements from large reactors because of the recyclable fuels to be gained and direct final storage for all other types;

9. Urges in this respect the further development of the technology of direct final storage to a point where it is industrially applicable;

10. Calls on the Commission to draw up a proposal for a European Community project to secure control of the entire nuclear fuel cycle, having special regard to the technology of direct final storage and with the Joint Research Centre suitably involved;

11. Welcomes the flexibility which has now been achieved by means of storage measures between the individual stages of disposal, which the public should not misunderstand as a postponement of problems to the future but in many ways as a simplification of the subsequent stages;

12. Considers the construction of disposal plants, which are generally sited in thinly-populated and therefore usually economically weak regions, inter alia as an instrument of employment and regional policies;

13. Calls for specific importance to be attached in European research policy to research into and development of disposal and, in particular, final storage;

14. Stresses the need to inform the public more effectively than in the past of research into disposal, which began at an early date and received considerable support from the Community, and the results achieved, which already demonstrate that the problem can be solved within the requisite period;

15. Calls for the general public to have a say in the planning and construction of disposal plants;

16. Calls for the establishment, after suitable rules have been laid down for the construction and operation of nuclear power plants, of Community disposal or final storage facilities for the waste from those Member States which, for geological or other reasons, lack their own facilities;

17. Calls for a directive on Community safety standards;

18. Takes the view that, in determining the most suitable sites from a geological viewpoint, account should also be taken of the need to preserve places of tourist and ecological interest;

19. Instructs its President to forward this resolution to the Commission and to the Council of Ministers and to the national parliaments.

EXPLANATORY STATEMENT

I. INTRODUCTION

1. The use of nuclear energy inevitably involves the production of radioactive waste. All the stages in the elimination of this waste in a manner which is permanently harmless for man and his natural environment can be summed up in the term 'disposal'; disposal is thus a prerequisite for the responsible use of this source of energy.

2. In the nuclear energy debate in the media and among the interested European public, the question of disposal has now developed into the predominant topic and thus taken the place of the concern about reactor safety, which has been virtually eliminated by the results of intensive safety research on the one hand and practical experience of safe power station operation on the other. The main reason for this development is probably the long-term nature of the problem of disposal, which extends far beyond the period of one's own experience.

3. Public discussion about disposal has usually been limited to that of highly radioactive waste, i.e. spent fuel elements. This is justified in as much as fuel elements contain more than 95% of the radioactivity of all waste for disposal. The intermediate and low-level waste arising, however, also presents a not inconsiderable problem, as very large quantities are involved (according to Communication COM(83) 262 final some 670,000 m^3 will have been amassed in the Community by 1990 and 1.56 million m^3 by the year 2000), which could cause problems even sooner than the very small quantities of highly active waste (approx. 0.44 m^3 of treated waste (glass) per thousand million kWh of electricity produced).

4. In Community electricity production, nuclear energy accounts for 19% (Finland already 40%, Sweden 35%) and has become one of the major sources. For this reason alone the question of disposal is an important one for the European Parliament in relation to energy policy. There are also implications for labour market policy, because of the construction and operation of disposal plants which, for safety reasons, are usually located in thinly-populated and therefore, as a rule, economically weak regions. According to a study by the German Institute for Economic Research in Berlin, the proposed German 350 tonne/year reprocessing plant will create or secure 11,000 jobs during the construction period and 8,000 jobs during subsequent operation. The question of disposal acquires an additional dimension because of the long-term nature of the problem, extending over generations, and the resultant concern among the population. Facing up to this dimension in particular should be Parliament's prime duty.

II. Nuclear energy in the electricity industries of the Member States

5. The figure of 19% of electricity production in the Community mentioned above is divided very unequally between the individual Member States (all figures for 1982) :

- the highest levels are found in France with 39% and Belgium with 30%. As further power stations are under construction or projected in both countries, especially France, it can be expected that this proportion will further increase. Belgium will therefore be able to cover its base-load requirement largely by nuclear energy and thus at favourable cost within the present decade; in France, moreover, there is likely to be a surplus exceeding French base and intermediate load demand as a result of the lower than forecast rates of growth and high operational effectiveness of the power stations. This surplus could be exported.

- The figures of 17%[1] for the Federal Republic of Germany and 15% for the United Kingdom are fairly close to the Community average. Because of the plants under construction, it is also likely that the proportion will rise considerably in the Federal Republic of Germany; in conjunction with the very economical lignite, it can be expected that base-load will be largely covered by the end of the 1980's. In the United Kingdom, on the other hand, development will be less dynamic compared with the Member States mentioned so far. The reason for this is the transition from the British-developed gas-cooled reactor system, of which some 5,500 MW are still under construction, to the light water reactor which now predominates throughout the world. The first plants of this type, which is new for the United Kingdom, will not go into service until the next decade and will first have to serve as a replacement for the first-generation reactors from the 50's and early 60's.

- Nuclear power stations make an admittedly small contribution to electricity production in the Netherlands with 6% and Italy with 4%. In the Netherlands there are no plants under construction or at a concrete planning stage, so that the contribution of nuclear energy, at least until the 90's will remain fixed at this low level. In Italy, because of the three plants under construction and further projects, the figure can be expected to increase but still remain well below the average.

- Four Member States, Denmark, Greece, Ireland and Luxembourg still have no nuclear power plants. Furthermore, there are no advanced concrete plans, so that nuclear energy cannot be expected to make any contribution in

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[1] In the public supply system (not including industries and the Federal Railway's own supply) the figure is already 21%.

these countries within the present decade. In the case of Luxembourg, however, it has to be taken into account that some 75% of its electricity requirements are covered by imports from Belgium and the Federal Republic of Germany, and thus it participates indirectly in the use of nuclear power by these countries.

III. Technical and physical principles of the disposal of highly radioactive waste and fuel elements and the process stages

Preliminary note :

6. The following remarks apply only to reactor types with the following characteristics

- enriched uranium dioxide UO_2 as fuel (2 - 4% U 235),
- metal fuel rod cladding,
- burn-up (specific thermal energy production) from 20,000 to 40,000 MWd/t (corresponding to 480 to 960 million kWh/t),

i.e. the light water reactor (boiling water and pressurized water) and the British AGR (advanced gas-cooled reactor). These three types accounted for 82.5% of electricity production by 1982 and the trend is rising, as the Member States' programmes provide almost exclusively for the construction of these types.

Basically, the following remarks are also valid, however, for all other reactor types in operation in the Community.

Their disposal requirements are already covered or are insignificant in terms of quantities, except in the case of the waste from the British MAGNOX reactors.

A. Composition of the fuel elements after energy production (burn-up in the reactor)

7. After a life of up to 4 years in energy production in the reactor, the fuel elements are discharged. In contrast to fossil fuels, the fuel elements have retained their external structure during this period but their composition and physical properties have considerably changed as a result of the fission processes and the effect of the neutron field in the reactor.

8. Before use, the new fuel elements contain only uranium

- some 2 - 4% of the fissile isotope U 235,
- some 96 - 98% of the non-fissile isotope U 238.

There is virtually no radiation from the new fuel elements and the heat output is zero.

9. After use, the spent fuel elements contain a very complex mixture of substances, the precise composition of which depends on the degree of burn-up. For the pressurized water reactor, which is the most widespread type in the Member States, the composition is as follows (for a burn-up of 33,000 MW/t) :

- Uranium, just under 96% (95% non-fissile uranium isotopes (U 236 and U 238) and barely 1% fissile U 235),

- Plutonium and higher actinides 1% (including some 70% fissile plutonium isotope),

- Fission products, somewhat more than 3%.

Of these, only the fission products and the higher actinides can be considered as waste; the uranium and plutonium components are recoverable fuels with approximately 1.7% fissile isotopes.

10. Spent fuel elements are also highly radioactive, because of the fission products in particular, and therefore they produce heat; the heat output, measured after reactor shut-down, is some 120 kW per fuel element after one day and still about 4 kW per fuel element after one year. Spent fuel elements can therefore only be handled where there is shielding and cooling.

B. Basic disposal stages

11. Disposal of fuel elements after removal from the reactor involves the following basic stages :

- interim storage of the fuel elements,
- processing of the fuel elements to make them suitable for final storage,
- interim storage of the products suitable for final storage,
- final storage.

C. Techniques available and under development for these disposal stages in the countries of the Community

(a) Interim storage of fuel elements

12. Technologies for the interim storage of fuel elements - including long-term storage - are available or can be used where necessary in all Member States which have nuclear energy production. The storage of the fuel elements begins in the cooling pond of the reactor (periods of 90 days to 3 years). After that come the following storage techniques, which are assigned different importance in the individual countries :

- storage in compact storage locations in the reactor cooling pond (periods to 9 years), e.g. generally throughout the Federal Republic of Germany.

- Wet storage in separate storage ponds at the power station site, a processing plant or at a separate site, e.g. at La Hague in France and at Sellafield (Windscale) in the United Kingdom.

- Dry storage in separate storage bunkers at sites as above, e.g. at Wylfa in the United Kingdom.

- Dry storage in special containers, a further development of transport flasks, at sites as above, e.g. at Gorleben and Ahaus in the Federal Republic of Germany.

For dry storage, a pre-cooling time of one to three years is necessary.

(b) Processing of fuel elements to make them suitable for final storage

13. There are two basically different ways of processing fuel elements to make them suitable for final storage :

- reprocessing and waste-conditioning
- conditioning of the fuel elements for direct final storage.

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14. Reprocessing and waste-conditioning was formerly the only method adopted[1]. Experience of reprocessing of the fuels considered here varies in the different countries of the Community. So far, only France has gained industrial experience; through the operation of military or industrial plants for fuels of the first generation gas-graphite reactors, or through the operation of prototype plants, the United Kingdom, Belgium and the Federal Republic of Germany have also achieved a level of experience enabling industrial capacity to be developed. Italy also has basic experience of reprocessing technology. Products of reprocessing suitable for final storage are glass blocks containing the highly radioactive waste, and low and intermediate level waste in appropriate conditioning and appropriate packaging.

15. Conditioning of fuel elements for direct final storage has not yet been technically tested in any Member State. Extensive studies of the technology are at present in progress in the Federal Republic of Germany ('Other Disposal Techniques' project, PAE); in France studies on this question have been suggested by the Castaing report (report of the Nuclear Safety Board's Working Party on the Management of Nuclear Fuels, December 1981 - November 1982). The highest level of development in this technology has probably now been reached in Sweden. It should be pointed out, however, that there are no fundamental difficulties in this technology and thus, if necessary, it could be introduced at industrial level within reasonable periods in all Member States having nuclear power production.

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[1] This was based on the expectation that reprocessing costs would at least be covered by the value of the recovered fuels. This appeared to be justified on the basis of extensive military experience; however, the difficulties arising from the transition to light water reactor fuels with a higher burn-up were underestimated. The result of this expectation was the Nuclear Fuel Service Plant in West Valley USA, and quoted prices for the Windscale plant of only $16/kg uranium. In the Federal Republic of Germany also the heavy chemical industry saw reprocessing at first as a remunerative operation. None of these ventures into 'commercial' reprocessing paid off, and they represented a serious handicap for the subsequent debate as to the feasibility of this technology.

More sensible, and in the final outcome also more successful, was the approach involving small pilot plants not committed to economic viability (EUROCHEMIC in Belgium, WAK in the Federal Republic of Germany) or the approach adopted in France of a gradual expansion of the UP2 plant in La Hague. Because of the experience acquired here, and the better organization and technical facilities which resulted from it, there has been a realistic approach since the middle of the '70s.

(c) Interim storage of products suitable for final storage

16. Experience with the interim storage of products suitable for final storage so far only involves conditioned highly active waste resulting from reprocessing and also only in France (Marcoule). As the three techniques mentioned at (a) could be used for this with only slight modifications, there is no reason to expect fundamental technological difficulties hindering the prompt provision of the necessary capacity.

If a final store (4th stage) were introduced in good time, it would even be possible to dispense with this stage altogether.

(d) Final storage

17. The final storage of highly radioactive waste is planned to take place in all Member States except the UK in deep geological strata. Depending on the geology, the following final storage formations are being examined with the support of the Community :

- Rock salt by the Federal Republic of Germany (Society for Radiation and Environmental Research, Karlsruhe Nuclear Research Centre) and the Netherlands (Netherlands Energy Centre, ECN, Petten), as well as by Denmark as a prerequisite for the introduction of nuclear energy in that country,

- Granite by France and the United Kingdom,

- Clay by Belgium (Mol Nuclear Research Centre) and Italy (ENEA).

These formations represent in each case the first priorities of these countries. Information on other possible final storage formations is available from findings by other Member States, supplementary national programmes and participation in other international work.

18. Actual site studies for a final store for highly radioactive waste have gone furthest in the Federal Republic of Germany (decision of Federal Cabinet to make DM 1,200 m. available for geological survey of Gorleben), but are also being carried out in France. The United Kingdom decided in 1981 not to continue the general exploration of specific formations but to restrict itself for the next 50 to 100 years to interim storage, both of fuel elements and of products suitable for final storage. Research has also been initiated into disposal on and under the floor of the ocean.

D. Advantages and disadvantages of the various disposal stages and their consolidation into disposal strategies

(a) Interim storage of fuel elements

19. The advantages of (long, i.e. several years) storage of fuel elements are as follows :

- the radioactivity and the heat output can diminish considerably and thus greatly simplify all the successive stages;

- the subsequent stages can be handled more flexibly and more economically as regards the capacity required and its commissioning.

Interim storage itself accounts for only a very small proportion of total disposal costs.

20. The disadvantages are as follows :

- in the event of a decision in favour of reprocessing in the second stage, the recovered fuels will not be available until correspondingly later; and the decay of plutonium 241 to produce americium 241 produces more long-lived actinides for disposal;
- in the public debate, interim storage is subject to the charge of procrastination, despite the above-mentioned advantages.

(b) Processing of fuel elements

21. At this stage the decision has to be taken between the two strategies of reprocessing and final storage of conditioned waste on the one hand, and direct final storage of fuel elements on the other.

22. The advantage of reprocessing is that :

- recycling of the nuclear fuels contained in the fuel elements becomes possible. The recycling of uranium and plutonium under the procedures followed at present (see, for example, BMFT status seminar of 14 October 1981) produces a saving in natural uranium of some 40% and in enrichment capacity of some 30%. The risks arising from the associated production plants, in particular uranium mines, are also correspondingly reduced. The fuels recycled in light water reactors from a 350 tonne/year reprocessing plant thus represent an energy content of 11 million tonnes coal-equivalent/year.

- the hazards of the subsequent disposal stages are reduced because:
  - fewer long-lived uranium and plutonium isotopes enter the final store;
  - the various wastes arising can be more readily conditioned because of their properties;
  - reprocessing leaves open the possibility of re-irradiation of the higher actinides which determine the long-term hazards of the final store. These actinides can be fissioned by re-irradiation and thus converted into fission products with a much shorter half-life. Reactors with a fast neutron flux are particularly suitable for this. This technology, however, is still the subject of fundamental research, in the Ispra Joint Research Centre and elsewhere; hastening of these possibilities is called for in the Castaing report. Irradiation experiments are being conducted in the fast reactor at Dounreay, United Kingdom, as part of a joint US-UK research project.
- the possibility of introducing advanced (breeder) reactor strategies and thus the possibility of very long-term nuclear energy utilization through complete utilization of uranium is maintained. Without reprocessing, the use of nuclear energy would have to be restricted to a few decades. Reprocessing is a prerequisite for the breeder. It also offers advantages, however, for the present reactor systems, so that the reverse proposition, i.e. that the introduction of reprocessing necessarily implies the breeder, is not true.

- the risk of proliferation is smaller, since it only exists for a short time. Admittedly, plutonium arises in a pure form in reprocessing. It can, however, be reliably supervised in the plant and is subsequently destroyed again by recycling in reactors for energy production. With direct final storage of fuel elements, however, large quantities of plutonium enter the final store as the years go by; the proliferation risk then remains present for a long time. It has to be emphasized, however, that the plutonium mixture from the high burn-up fuels of the reactors considered here is extremely unsuitable for military purposes because of the high proportion of non-fissile isotopes. From the point of view of technology and cost, military use can be achieved so much more simply in ways other than by electricity production in light water reactors that the proliferation risk in reprocessing of these fuels becomes totally negligible.

23. Advantages of processing fuel elements for direct final storage are as follows :

- possible economic advantages, for instance where the cost advantage, compared with reprocessing, taking into account any cost differences in the subsequent disposal stages (final storage), is greater than the value of the recovered fuels. However, there are no reliable figures available for this yet. Furthermore, this advantage is directly dependent on the trend in uranium and enrichment prices.

- the hazards arising from the treatment plant, and the radiation burden, would probably be less than with reprocessing.

24. The disadvantages of the two technologies are evident from the respective advantages.

(c) Interim storage of products suitable for final storage

25. This stage of interim storage offers the same advantages as interim storage of fuel elements. For the subsequent final storage the sum of all the storage and processing times is crucial. Long storage times offer the advantage that :

- the radioactivity and thus the heat output continuously decrease. Therefore the final store can be smaller in volume and area for a given permissible maximum temperature, or the temperatures are lower for a given volume or area. Lower temperatures mean in principle lower thermomechanical stresses on the final storage formation and thus greater safety in the final store.

26. The disadvantes of this stage are :

- additional costs, which would not arise in immediate final storage, although they may be offset to some extent by lower expenditure in the final storage itself. It would be worthwhile studying in this context the optimum schedule for final storage given on the one hand the costs of interim storage and on the other the savings in terms of final storage excavation.

- the hazards resulting from above-ground storage must be rated as greater than for immediate final storage, but there are no reliable figures available on this.

(d) Final storage

27. The purpose of final storage is to remove waste from the biocycle for a period in which it represents a hazard because of its radioactivity and toxicity. By appropriate conditioning and packaging an effort is also made to extend the multiple-barrier principle generally applied in nuclear technology to this stage of the process, to guard against the failure of individual barriers (destruction of packaging, penetration of water into the final store, etc.).

28. For the strategy involving reprocessing and final storage of conditioned waste, safe and industrially proven conditioning methods exist (incorporation in glass, cement, bitumen) for all types of waste. The strategy involving direct final storage of fuel elements has to be assessed in relation to these. Although there is still no technical experience of this, investigations so far (Swedish studies, 'Other Disposal Techniques' project in the Federal Republic of Germany) have not provided any evidence that a comparable level could not be achieved.

29. Advantages of final storage after reprocessing and conditioning are that

- the radioactivity and toxicity of the contents of the final store after 100 years will be significantly below the corresponding figures for final storage of fuel elements.

- on the basis of present knowledge, better use can be made of the available volume of the final storage formation.

- there is less highly radioactive waste altogether.

30. The disadvantages are that

- in reprocessing more intermediate and low-level (secondary) waste arises than in the case of simple treatment i.e. packaging of the fuel elements.

IV. Capacity required for the individual stages in the disposal of highly radioactive waste or fuel elements

31. The factor which determines the total disposal capacity required is the number of fuel elements discharged from the reactors. These quantities are therefore subject to the general uncertainty regarding the forecast expansion

of power station capacity and the power station load factor.

32. When reprocessing was still considered as the sole disposal policy, the quantities of fuel elements arising were converted directly into required capacity after a relatively short interim storage period (90 days to 3 years). The result was that the figures for reprocessing capacity requirements were very high and the commissioning dates very early. These forecasts of capacity requirements did not come true for various reasons, mainly because the economics of reprocessing were no longer self-evident, and they played an important part in the development of the 'unresolved disposal problem' in the mind of the public.

33. In practice, however, all those concerned (operators, industry and licensing authorities) have reacted flexibly and adopted a market economy approach to the disposal problem by means of the various storage possibilities (see above). This can also be expected in future. The licensing authorities are convinced that acceptable solutions can be found to the safety and disposal problems associated with various storage facilities.

34. Because of this flexibility, forecasts of capacity for individual disposal stages can therefore only be properly made on the basis of assumptions and boundary conditions relating to the other stages (conditional forecasts). However, because media reports regularly omit these assumptions and boundary conditions, there is always the danger that constant changes in statements over the years will intensify the credibility problem even further.

For an up-to-date survey of requirements and the existing and projected capacity of the individual disposal stages in the Community, excluding the special requirements of the waste from the British MAGNOX reactors, reference is made to the report of the ad hoc Advisory Committee (CORECOM) - COM(82) 37 final. The report basically accepts the requirements listed above and thus in its statements takes account of the flexibility which has now been achieved in the practice of disposal.

V. Disposal of intermediate and low-level waste and waste from decommissioned nuclear installations

35. Apart from in nuclear power stations and the fuel cycle plants, intermediate and low-level waste also occurs in industry and medicine, sometimes in considerable quantities. The proportion of total waste accounted for by medicine and industry in the Community is 20-30% at present and is likely to fall to 10-15% by the end of the century. The specific radioactivity, however, as the description already indicates, is very small. For the disposal of this waste (after interim storage and conditioning) there are three available strategies which are used on a large scale:

- dumping in precisely defined areas of the ocean;
- burial close to the surface;
- storage in deep geological formations.

36. While the first strategy has been used mainly by Belgium, the United Kingdom and the Netherlands, as well as other European countries, e.g. Switzerland, and the second mainly by France (La Manche Centre) and the United Kingdom (NIREX Drigg plant in Cumbria), the Federal Republic of Germany decided at an early stage on storage in deep geological formations. Industrial experience of this method is also now available from the several years' operation of the Asse II experimental final storage site. Under the pressure of the general environmental debate, a process of reexamination has begun regarding the first two strategies. Evidence of this is shown by the recommendation for a two-year suspension adopted by the London Dumping Convention in February 1983, the decision by the Netherlands Government to build an interim store on land and the recommendations of the Castaing report on final storage in France (stricter limits for alpha activity in low-level and intermediate-level waste cleared for burial at the surface, improved conditioning processes for such waste, establishment of experimental laboratories for disposal in geological formations, possibility left open for later improvements in waste treatmemt and storage).

37. In 1982 the Group of Three, comprising Belgium, Holland and Switzerland, and the United Kingdom dumped nearly 11,700 t at sea with a total radioactivity of almost 130,000 Ci (of which 1% were alpha emitters). Belgium and the United Kingdom are considering dumping again in 1983. There is therefore no common stance on this matter within the Community. Research in progress in the IAEA and other international organizations which should be completed by the end of 1984 may provide scientific findings which can serve as the basis of a joint Community position.

38. At present, in all Community countries, it is only highly radioactive waste and waste with a high alpha activity which is considered for disposal in different deep geological formations and in or under the sea bed. If further quantities of waste were to be placed in deep geological formations because of stricter limits for the other disposal strategies, in particular waste with a low alpha activity or all radioactive waste, it would be necessary, with a degree of urgency depending on the quantities arising, to:

- develop, further develop and make intensive use of processes to reduce considerably the volume of conditioned waste compared with untreated waste. There are several processes available for this (incineration, acid digestion, compaction, etc.) at various stages of development and application.
- provide interim stores, the capacity of which will depend on the success achieved by the measures mentioned above.
- provide final disposal areas either separately from or combined with the final disposal site for highly-active waste.

39. This category includes the waste from decommissioned nuclear installations. The major nuclear power stations and industrial plant will not be decommissioned on any scale until after the turn of the century and no large quantities of waste will be generated until some time later because of the intervening decay periods. Nevertheless a large number of smaller prototypes have already been decommissioned or will be in the near future so that small quantities of shutdown waste will be produced this century. The Community's research programmes (see COM(83) 298) and those in some Member States have taken account of this and are developing decommissioning and dismantling techniques and treatment processes for the waste produced.

40. A major problem with shutdown waste, and with all low-radiation waste, is the distinction between radioactive and non-radioactive material. Maximum permitted levels corresponding to radiation protection legislation should be defined - as far as possible at Community level - and the appropriate measurement procedures developed. The question of maximum permitted levels will determine the volume of waste for final disposal. Due account of this is taken in the Community's research programme.

41. Concrete plans for final geological disposal sites for these categories of waste are at present in hand only in the Federal Republic of Germany for the former Konrad iron ore mines at Salzgitter, the final disposal site at Gorleben and for the recommissioning of the Asse II plant.

VI. Consequences for the European Parliament's position on disposal policy

42. - Having regard to the technical and physical principles described above, actual developments in the last few years and the extreme political importance of disposal for the contribution to be made by nuclear energy, which is urgently called for by all authorities of the Community as part of energy policy, we can no longer justify limiting consideration of future energy policy solely to the reprocessing strategy and to statements on the required capacity for it. By doing that, we would be adopting positions which would be valid only for a relatively short time and would damage the credibility of Parliament. The same would apply in the case of a similar exclusive commitment to the strategy of direct final storage of fuel elements.

43. - European disposal policy should emphasize the existence of two possible strategies, and in particular the exceptional flexibility which has now been achieved in both strategies by storage measures. Comparative studies, particularly those of the 'Other Disposal Techniques' project in the Federal Republic of Germany as well as Swedish work, have so far provided no indication that would justify a commitment to only one strategy and rejection of the others, although it has to be admitted that our knowledge of direct final storage is not so extensive. However, if direct final storage were not to present any significant advantages in terms of hazards - including the increased hazards caused by the greater uranium requirements - and in terms of economics - taking due account of the uncertainty surrounding uranium price developments- reprocessing ought to remain the preferred strategy, for reasons of primary energy savings, for the fuel elements from the large power reactors, i.e. by far the most important in terms of quantity.

44. - There are adequate reasons to call for both strategies to be pursued up to industrial use. Apart from the primary energy saving already mentioned, reprocessing is also needed for breeder reactor systems. Direct final storage is appropriate for various experimental fuel elements which cannot be reprocessed or only with great difficulty. Direct final storage can also make a contribution to the economics of reprocessing :

Like nuclear power plants, reprocessing plants involve high capital costs and therefore only achieve low specific (per kWh) costs with a high load factor. In reprocessing, however, this means uninterrupted operating cycles of several months, as far as possible with similar fuel elements.

It may then be more economical to place all fuel elements of a different specification from experimental plants or older nuclear power plants in final storage rather than to process them in separate time-consuming operating cycles, unless reprocessing in existing experimental or prototype reprocessing plants is possible.

45. - The emphasis on flexibility, and the saving of time and effort at the final stage as a result of interim storage measures, must be backed up by major efforts at European level to develop all stages in both disposal strategies up to industrial level. This includes the construction and operation as soon as possible of at least one industrial plant in each Member State which makes substantial use of nuclear energy, or as a joint European project. Only the consistent adoption of this approach will maintain or restore the credibility of a European disposal policy. The idea that nuclear energy is like an aircraft flying around with nowhere to land could then be refuted. Disposal is one of the few problems which can be more easily and permanently solved by a deliberate policy of wait-and-see.

46. - European disposal policy cannot be separated from European research policy. Various disposal problems, for example final storage in diverse deep geological formations or the re-irradiation of long-lived actinides, have had a place in European research programmes for years. This requirement must be maintained and supplemented by appropriate measures with a view to the construction of pilot plants.

47. - Since a number of countries in the European Community have few possibilities for the final storage of their radioactive waste or none at all, a European policy must be directed towards establishing a Community duty to support such countries, in order to open the way for them also to the opportunity of using nuclear energy.