

EUROPEAN PARLIAMENT

# Working Documents

1982-1983

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28 May 1982

DOCUMENT 1-200/82

REPORT

drawn up on behalf of the Committee on Energy and Research

on the ~~results~~ of the INFCE Conference (International  
Nuclear Fuel Cycle Evaluation)

Rapporteur: Mr P. VERONESI



By letter of 24 April 1980 the Committee on Energy and Research requested authorization to draw up a report on the results of the INFCE Conference (International Nuclear Fuel Cycle Evaluation).

By letter of 22 May 1980 the President of the European Parliament authorized the Committee on Energy and Research to draw up a report on this subject. The Political Affairs Committee was asked for its opinion.

On 2 June 1980 the Committee on Energy and Research appointed Mr Veronesi rapporteur.

It considered the draft report at its meetings of 20 March 1981, 23 April 1981, 26 February 1982 and 29 April 1982. It adopted the motion for a resolution and the explanatory statement by 12 votes to 10 on 29 April 1982.

The following took part in the vote: Mrs Walz, chairman; Mr Normanton, vice-chairman; Mr Veronesi, rapporteur: Mr Beazley, Mr Bombard (deputizing for Mr Adam), Mr Dido (deputizing for Mr Schmid), Mr Flanagan, Miss Forster (deputizing for Mr Moreland), Mr K. Fuchs, Mr Herman (deputizing for Mr Müller-Hermann), Mr Lalor (deputizing for Mr Meo), Mr Linkohr, Mrs Lizin, Mr Percheron, Mr Petersen, Mrs Phlix, Mr Rogalla, Mr Sassano, Mr Seligman, Mr Purvis (deputizing for Sir Peter Vanneck), Mr Radoux (deputizing for Mrs Théobald-Paoli) and Mrs Viehoff (deputizing for Mr Pattison).

The opinion of the political Affairs Committee is attached.

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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 the results of the INFCE Conference (International Nuclear Fuel Cycle Evaluation)

The European Parliament,

- having regard to the report of the Committee on Energy and Research and the opinion of the Political Affairs Committee (Doc. 1-200/82),
- having regard to its previous resolutions,
- having regard to the concluding report of the final plenary conference of the International Nuclear Fuel Cycle Evaluation (INFCE) and the report of the Commission to the Council on this subject (COM(80) 316 final),

1. Considers the convening of the INFCE Conference a significant example of international collaboration on energy problems;
2. Values highly the scientific and technical contribution made by the delegations of the participating countries and organizations to the various specialist working parties;
3. Considers the results obtained to be extremely important for the guidelines and energy options which all countries will have to adopt independently in future;
4. Calls for due attention to be paid to the joint effort and commitment shown in the search for a united response to the problems considered;
5. Agrees with the approach adopted by the conference in extending the scope of the problems considered beyond that of the proliferation of nuclear weapons;
6. Draws attention to the considerable progress made in the safety of proven reactors;
7. Endorses the encouragement which the conference gives to the countries, the research organizations and plant operators towards ever greater commitment in the development of technological research to improve the safety of the whole fuel cycle;
8. Notes the enormous energy potential offered by fissionable and fertile nuclear fuel reserves;
9. Notes that 'breeding' makes the nuclear materials market less dependent on small areas of supply and less sensitive to production costs which are a function of the richness of deposits;

10. Supports, with complete conviction, the proposal for international agreements and collaboration on the enrichment and reprocessing of nuclear fuel;
11. Notes the conclusions of the conference that:
  - (a) Supports the INFCE proposals to establish contractual agreements by means of an initiative from the Commission, to simplify the nuclear fuel cycle by increasing the involvement and the responsibility of the IAEA and to improve safety levels;
  - (b) no fuel cycle - in the present state of the art - is safer than any other in preventing the military use of nuclear energy;
12. Notes the conclusions of INFCE on the levels of risk of proliferation connected with various cycles, and the fact that the open cycle offers no advantage over other cycles particularly as it excludes the reprocessing of plutonium, and underlines the future role of the breeder reactor in the disposal of plutonium.
13. Believes that considerable emphasis must be given to two fundamental conclusions of the conference:
  - (a) The ever-increasing and vital importance of nuclear energy in covering world energy needs, bearing in mind known world reserves and the current state of research into new technologies.
  - (b) the need for specific measures to cope with the requirements of the developing countries in the peaceful uses of nuclear energy;
14. At the political level, in full awareness, urges the Community decision-making institutions to work with speed and determination, in the various national bodies, to strengthen and extend the IAEA's responsibilities and powers of control, to which all Member Countries should be subject, particularly over the use of fissile material. Furthermore, to lend support and impetus to the process of progressive and controlled nuclear disarmament, it seems essential to:
  - (a) enforce fully the NPT in such a way as to secure the accession of countries not yet party to the Treaty with special reference to:
    - Article 4, which deals with the development of collaboration and exchange in nuclear matters for peaceful purposes;
    - Article 6 and the spirit of paragraph 12 of the preamble, which call for a sincere commitment to the ending of the nuclear arms race and to progressive and controlled nuclear disarmament without which there would be no hope of avoiding the proliferation of nuclear weapons;
  - (b) strictly limit any and every type of experimentation with nuclear weapons, as persistently urged by the majority of the countries signatory to the NPT and in the spirit of paragraph 11 of the preamble to that Treaty;

15. At the technical and organizational level, calls upon the Community, in collaboration with all the more advanced countries in nuclear technology, to promote and encourage any action designed to:
- (a) extend studies and research aimed at achieving increasingly higher levels of safety for all types of plants in the cycle and improved techniques and procedural safeguards against national and sub-national proliferation, for instance by collocation, coconversion and lower enrichment;
  - (b) improve and make suitably reliable (with an acceptable risk/benefits ratio) the processes for storage of waste;
  - (c) standardize and unify environmental and civil protection measures and the design standards of plants with particular regard to safety;
  - (d) establish procedures for improved Community supervision of nuclear plant safety;
  - (e) overcome the existing difficulties for the agreed selection of sites for nuclear plants or any other dangerous plant or industry by drawing up a map of such sites in cooperation with the Member States and also with those non-Community countries which ask to participate;
  - (f) prepare plans and operational structures to cope with any emergencies, providing for international collaboration;
  - (g) take steps to make all sources of information on energy questions in general and on nuclear energy in particular more accessible to the public;
  - (h) strengthen and develop collaboration with the IAEA to perfect the instruments, techniques and methodologies used for the application of nuclear safeguards;
  - (i) devise an international system for the storage of unused plutonium;
  - (j) promote the development, on a multilateral basis if possible, of enriching and reprocessing plants;
16. Hopes that the conclusions of the INFCE Conference will firmly establish a positive climate between the USA and Europe in relation to their common goal of nuclear non-proliferation and between Europe and the Third World in the desire to provide mutual help in gaining access to this 20th century technology;
17. Stresses its commitment to Community procedures and, in particular, its hopes for a positive outcome of political cooperation activities in the field of non-proliferation and calls for the preparation of Community proposals in the context of the United Nations Conference on nuclear energy to be held in 1983;

18. Finally points to the need, vigorously expressed many times in previous resolutions:

- (a) not to rely solely on nuclear energy to solve energy problems;
- (b) to increase studies and investment on the use of all other appropriate energy sources;
- (c) to reconsider the siting of productive plants (industrial and energy) and residential areas in line with new criteria prompted by today's energy problems, with the aim of improving the use of land and protecting the environment;

19. Instructs its President to forward this resolution and the attached report to the governments of the Member States, the Council and Commission and the Presidents or Speakers of national parliaments for transmission to the committees responsible.



B

EXPLANATORY STATEMENT

I - METHODOLOGICAL APPROACH

1. With the completion of the INFCE programme at its final conference in Vienna on 25-27 February 1980 a wealth of material was made available for consultation and study to governments, institutions and other organizations interested in the question of nuclear energy as well as to the public at large.

Eight reports were produced in as many volumes together with a 'Summary and Overview' of some 350 pages which contains a full account of the conference's work. These make up thousands of pages of highly technical text.

2. The nine volumes edited and published by the INFCE have been followed up by commentaries, studies and theses of an unequal quality.

Newspapers throughout the world have carried reports which vary between pure news stories and attempts to make a political assessment of the conclusions of the conference.

Journals specializing in industrial economics, energy policy or politics alone (particularly international politics) and scientific periodicals covering various disciplines have made a more thorough appraisal of the problems raised by the INFCE. Viewing the subject from various angles - economic, industrial, technical, military,

ecological etc. - critical analyses have been made attempting to assess the impact of the INFCE on the world scene. Here too some thousands of pages have been produced.

3. The INFCE, of course, did not come into being spontaneously like Minerva springing forth from Jupiter's head. It has a history which will be reviewed briefly below.

The decision to hold the conference came after a long technical, but more particularly political debate: it was the compromise which made it possible to ease international tension on the political and economic problems connected with nuclear energy. It has provided a pause for thought during which all the interested parties have tried to gain a better and deeper understanding of their own problems and those of others and to question and perhaps revise their previous assumptions. Throughout this stage and in the troubled months which preceded it, an enormous amount of current affairs writing and specialized literature was produced.

These again ran into thousands of pages.

4. Finally, it should not be forgotten that the 'nuclear issue' was brought to the attention of political parties and public opinion in a traumatic way on 6 August 1945 (Hiroshima). It had already been known to the most advanced scientific circles since 1939 (date of the discovery of uranium fission) and the highest levels of government in some countries as from 2 December 1942, the day the first nuclear reactor went critical in Chicago.

In the immediate post-war period it was one of the main topics of debate between nations both in international forums (UN, Geneva etc.) and as part of their bilateral relations, and it certainly influenced the course of political events. Moreover, the particular problem of nuclear weapons and their banning was taken up as a cause by mass movements across the world, spurred on and supported by a large number of highly-qualified scientists and cultural figures.

The military and political consequences of atomic energy (the title used by the Nobel Prize winner, P.M.S. Blackett, for his famous work in 1947) were the subject of numerous and extended critical analyses on military and economic strategy and the strategy of international relations.

An imposing number of books and papers were produced, forming, as it were, the background documents needed for a proper appraisal of the results of the INFCE.

5. Your rapporteur felt it necessary to lay down a methodological approach for his work.

This approach, which will now be defined, must be understood before reading and evaluating the present report. It stems solely from a personal vision of the problems we are to consider; it does not claim to be the only possible, one, nor the best, nor even to be completely satisfactory. The rapporteur's zeal can therefore be judged not only by the results, but also by the consistency between his methodology and the content of his exposition.

6. The essentials are as follows:

(a) The report, or rather the explanatory statement accompanying the resolution, was kept short in spite of the breadth of the subject under review. This is always to be recommended, and is usually possible, when documents and their authors already exist to which one may, as in the present case, refer.

(b) The content of the report is substantially political, since the institution (the European Parliament) in which it is being discussed is a political one. There are not as a consequence any technological explanations (these can be supplied by the competent directorate-general of the Community) unless they are needed to clarify the general discussion. Some notes are provided in the Appendix.

(c) The report does not, at the rapporteur's personal suggestion, attempt to sum up the results of the INFCE. As mentioned above, the conference produced a report in eight volumes plus an excellent summary in a ninth. This contains a highly condensed resumé of facts and figures which affords a complete view of the subject and, in the first 70 pages or so, a general outline of the conclusions of the Conference.

The staff of the competent directorates-general have drawn up two concise summaries of the ninth volume: Documents PE 64.962 of 7 May 1980 and COM(80) 316 final of 11 June 1980. In view of the immensity of the

subject, its complexity and the multiplicity of the topics dealt with, it seems improbably that one could make a better effort at a summary of a summary within a reasonable number of pages. These two documents, to which the rapporteur attaches great importance, will therefore be considered an integral part of this report. Particular attention should be paid to the section dealing with the aims, work done and undertakings given by the States and organizations participating in the INFCE Conference. Fortunately, Document COM(80) 316 final quotes these in full from the report by the Technical Coordinating Committee to the INFCE final conference which is reproduced as the introduction to the summary volume. The rapporteur will deal with them point by point in part III of this report. The same criterion will be applied to the eight working groups on specific subjects into which the conference was divided.

(d) Many questions in some way connected with the INFCE have already been discussed separately (or are now under consideration) by our committee and by Parliament since the direct elections. One need only refer to the Fuchs, Linde, Weber, Seligman and Ippolito reports.

These documents and the debates following them provide precedents which make it possible to advance more rapidly in dealing with the problems now under review.

## II - POLITICAL ORIGINS OF THE INFCE

7. To understand the origins and purpose of the INFCE conference, one must reconstruct the various stages in the evolution of the role of nuclear energy in the world energy strategy of the most highly developed industrial countries.

In making this historical reconstruction one should never lose sight - because of its obvious influence on past and present international relations - of the military origin of nuclear energy and the concept of 'power' which attaches to it.

This inescapable fact means that, whenever one considers and analyses these matters, one has to bear in mind the complex shifts in the relative military strengths of the world powers since World War II. Furthermore, the most important part of the INFCE report - in the rapporteur's opinion - and that on which public opinion is expressing the greatest concern - is certainly the problem of the proliferation of nuclear weapons.

This very brief historical digression lists facts which are quite recent and universally known. Its sole aim is to show clearly the political origins of the INFCE conference since this will make it easier to understand the conclusions.

8. On the 'nuclear issue' the United States has played a preponderant role (much more important than those of all other countries put together) which for a long time was the decisive one.

In the early 1950's, confident of its superiority in nuclear armaments (Hiroshima and Nagasaki had approved the power of the new weapons and the USSR had only just become familiar with military nuclear technology), the United States was intensively promoting the peaceful uses of nuclear energy in both the cultural and economic spheres.

(a) In December 1953 at the end of a wide-scale campaign in favour of nuclear energy, President Eisenhower launched the famous 'Atoms for peace' programme while speaking before the UN Assembly.

(b) At the end of 1954 Congress proceeded to amend the McMahon act (Atomic Energy Act) passed in 1946 which laid down that all nuclear activities and research had to be conducted in secret. The amendments resulted in permission being given for the transfer to allied countries of fissile materials, plant and information for the peaceful use of nuclear energy.

The proposal originated with the collapse of the Baruch plan (for a long time set against the Gromyko plan) for UN supervision of nuclear energy. The American President's proposal was for a limit to fissile material production and the creation of an international body which would have facilities and powers to promote and supervise the use of nuclear energy for peaceful purposes. Later, after difficult negotiations, the second proposal led to the creation in 1957 of the International Atomic Energy Agency (IAEA).

(c) In the summer of 1955, as a result of this new policy and a thaw in East-West relations, an international conference was held in Geneva on the peaceful uses of nuclear energy. Euphoria and optimism spread throughout the world since it held out the prospect of an unlimited and happy development of the human condition.

9. In June 1955 the six ECSC foreign ministers meeting in Messina took the decision to create a Community institution for 'the development of atomic energy for peaceful ends' which in the short term would open up 'the prospect of a new industrial revolution without comparison in recent years'.

Three specialists - the 'Committee of Three Wise Men' - drew up a suggested programme for the six (but having also heard the opinions of interested circles in the USA, the United Kingdom and Canada). From this sprang the EAEC (EURATOM) which was given institutional force by the Treaties of Rome in 1957 and which was intended to give rise to a 'strong European nuclear industry'.

This initiative appeared to be a long-term reply to the 1956 Suez crisis, which was the first sign of the instability and uncertainty of Middle Eastern oil supplies.

10. The new American policy was clearly intended to permit the industrial, commercial and economic exploitation of the precious know-how accumulated during the building of nuclear weapons, although Congress imposed stringent conditions on the transfer of technology and fissile material.

11. What was lacking was any sizeable demand for it. Oil supplied most energy needs (until 1973 the market price was about \$2 per barrel). Nuclear power was much more expensive and, in fact, not even the industrialized countries at that time had sufficient technical personnel to handle this new and complex technology to any great extent.

In addition, those countries which might have provided the first markets for the United States (France, United Kingdom, West Germany, Japan, Canada, Italy, etc.) began work on their own national nuclear programmes, some of which were based on reactor systems very different from the water reactors developed in the USA. This applies in particular to the British, Canadian and French programmes, although later, at the end of the 1960s, France opted for development of the American technology.

This situation, made possible by the low price of oil at that time, enabled these countries to escape an oppressive 'technological hegemony'. Over a period of 15 years they acquired sufficient know-how, technology and personnel in the nuclear and related sectors to enter the world market - which had by then considerably expanded - as credible competitors with the US. The US still had one decisive factor in its favour - readily available Uranium supplies and adequate enrichment facilities.

In spite of this the American share of international orders for nuclear power stations fell from 85% to 40% between 1972 and 1976.

Although they planned to sell between 800 and 1,000 'proven' reactors on the world market by the year 2000 under virtually monopoly conditions, more up to date estimates suggest that this number will not be much greater than 100 (partly because of the slowing-down in nuclear expansion) and that there will be very strong competition.

12. Under these changed circumstances it has become more difficult since the beginning of the 1970's to strike a fair balance between the need to develop nuclear energy for peaceful purposes and the greater good and the acutely felt need to prevent its military use.

The limitations of the IAEA's supervisory activity, the inadequacies of the Non-Proliferation Treaty (NPT, signed by the USA, the USSR and the United Kingdom in 1968)<sup>1</sup> and the more recent emergence of new countries having nuclear armaments (or able to acquire them rapidly) and not subscribing to the NPT have complicated the question even further.

The testing of the Indian nuclear bomb in 1974 gave rise to much controversy throughout the world, being set as it was against the serious and inexorable oil crisis which broke out with the Yom Kippur war.

13. A conference was convened in Washington on 11 February 1974 to discuss the oil situation and this led to the initialling of an agreement in Paris on 18 November 1974 leading to the creation of the International Energy Agency (IEA) (France was not a party to the agreement).

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At the request of the US a further conference was held in London in 1975 to make a close examination of the new nuclear situation. Fourteen countries from the West and from the socialist bloc having the technological and industrial capacity to export plant and sensitive material capable of being used also for non-peaceful purposes took part (the 'Club of London').

An attempt was made to reach agreement on precise limits and conditions to be attached to nuclear supplies which would provide some guarantee against proliferation.

14. An agreement was reached, but a bitter argument between the US on the one hand and France and West Germany on the other limited its scope and its intrinsic value. Essentially the American position was judged to be an attempt - notwithstanding their declarations of principle regarding security - to preserve their own nuclear superiority in both the military sphere (not indeed easy to undermine) and the industrial and commercial spheres.

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<sup>1</sup> More than 100 countries subsequently signed the treaty.

The developing countries - or those in which industrialization was advancing most rapidly - shared this view of the American position.

15. Another cause of difference between the US and the other countries was its decision not only to reject but to work to prevent the 'Plutonium economy'. Announced officially by President Ford in October 1976 and later adopted and developed by President Carter, the new American nuclear policy called for a ban on plant for re-processing spent nuclear fuels and an indefinite moratorium on sales of fast breeder reactors.

This decision too clashed with the interests of Japan, the USSR and Western industrialized nations as well as the developing countries. All of these felt it was the product of the position of privilege which rested on the ready availability to the US of Uranium and other energy sources and was confirmation of the Americans' intention to control the industrial development of other countries.

16. From an objective and honest assessment of the facts one may perhaps, in the rapporteur's opinion, conclude that :

(a) There was and is a real possibility of the international political order being destabilized by the proliferation of nuclear armaments;

(b) The United States was concerned to defend the technological hegemony and industrial supremacy it had established in the post-war period over other countries.

17. This confused situation had a number of results. The first was the suspension of Uranium supplies by Canada as from 1 January 1977 and the increasing difficulties with American exports of enriched Uranium.

The second was a vigorous and unified protest by the nuclear countries of the Community. On the one hand they approached the USSR for Uranium supplies (between 1975 and 1976 there had been an increase in imports from that country of 38%, but between 1976 and 1977 they increased by 171.6%) and, on the other, they began to press the United States to change its position.



18. President Carter launched the idea of the INFCE on 1 April 1977 and included it in the Nuclear Non-Proliferation Bill he sent to Congress on 27 April 1977.

In taking this action, Carter had no intention of giving up his nuclear policy but he was able to defer a possible embargo and maintain enriched Uranium supplies to EEC countries (EURATOM) until the work of the Conference was concluded.

The United States undertook:

- (a) to consider the Conference as a meeting open to all nations and institutions which wished to be present, thus going far beyond the restricted framework of the Club of London;
- (b) not to ask the participating countries to make any change in their nuclear policy during the two-year period of the work;
- (c) not to consider the conclusions of the Conference to be binding on any country;
- (d) to refrain from renegotiating existing agreements on nuclear cooperation, as required by the Act, until the work was finished.

It was in a similar spirit that Canada resumed its Uranium supplies to EURATOM under a cooperation agreement containing a clause valid until 31 December 1980<sup>1</sup> which made implementation of the chapter on safeguards (Chapter C) dependent on the results of the INFCE.

It should be remembered that the countries with which the US was negotiating within the INFCE were necessarily influenced by the measure which Carter had proposed to Congress and which was ratified as part of the 'new American nuclear strategy' in March 1978.

This provided for a series of particularly drastic measures, including:

- (a) the rule of prior authorization for reprocessing fuel of American origin or enriching fuel of the same origin beyond 20%; this is in marked contrast with the conditions negotiated with the US at the beginning of the 1960s and incorporated in the current US-Euratom agreements scheduled to expire in 1995;
- (b) a total embargo on nuclear supplies if the parties to the nuclear cooperation agreements in force have not demonstrated their readiness to renegotiate them within two years of this law coming into force (although this time limit may be extended by the US President).

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<sup>1</sup> Extended in November 1980 to the end of 1981 pending new agreements on which work is continuing.

19. The American President's proposal for an international conference on the fuel cycle was accepted in principle by the Western Summit held in London on 7/8 May 1977. The inaugural conference of the INFCE was held in Washington on 19-21 October 1977.

20. It would not be right politically, intellectually or morally to ignore or undervalue the pressure from the anti-nuclear movement which indirectly helped to bring the INFCE Conference about.

It is certainly true that in recent years there have been signs that the industrialized countries (East and West) have been having second thoughts about nuclear energy in general. The need for this reappraisal was felt first of all within the decision-making nuclear organizations (technical, economic and political) which recognized the need to make a thorough check of all the implications of the 'nuclear economy'.

The quantitative expansion - though less than forecast - and the improvement in quality of nuclear plant have widened the existing problems and created new ones of equal and perhaps greater complexity. We can now speak of a 'second era' in the nuclear question.

A much stronger and more widespread spur to reflection, however, came - as we have said - from the protest movements. Leaving aside the doubts cast by some on the origins and inspiration of these movements (but not on the good faith of the mass of their membership) based on when and where they first appeared, your rapporteur has always felt and often stated his conviction that anti-nuclear protest - and ecological protest in general - should be recognized as complementary and useful at the present stage of development.

This has indeed been remarked upon and emphasized by attentive and qualified students of the subject. It is complementary in that the objectives of the anti-nuclear lobby and of the people who design, build and operate the plants are the same: they are both concerned to make a careful and increasingly rigorous appraisal of nuclear development and its place within a proper energy strategy, respecting both economic and social imperatives.

It is useful since it stimulates the interchange of ideas and a continual examination of the options taken by the authorities in implementing nuclear programmes, particularly with regard to the problems of safety and the protection of man and the environment.

Finally, the anti-nuclear movement has certainly brought attention to bear on all the other possible sources of energy. This has helped to bring back into perspective certain ideas based on the use of nuclear energy alone.

It is your rapporteur's belief that this useful confrontation of ideas - when it is conducted as a serious, constructive and informed debate - does bring one to the objective conclusion that it is not possible to abandon nuclear energy without causing:

- (a) a serious and traumatic regression in the economic growth of the advanced countries;
- (b) a halt to progress in the developing countries of the third and fourth worlds which would be dangerous ; and have many serious consequences.

There are also the conclusions reached by the important study published by the US National Academy of Sciences in January 1980. The 783 pages of this report list the reasons why industrialized societies will not be able to forego nuclear energy over the next half century.

The real issue is how to enable the people to make informed and responsible decisions on the expansion and improvement of nuclear plant.

### III - POLITICAL ANALYSIS OF THE RESULTS OF THE INFCE

#### A. General comments

21. The general summary report and the eight reports from the working groups were approved (or not contested) by all the delegations from the States and organizations participating in the work. No minority reports were submitted on any topic.

This result is extremely important politically. Without doubt it owes something to the open and general (but not superficial) nature of the objectives fixed in advance as conditions for holding the Conference, but it also betokens a political will for dialogue, understanding and agreement amongst the delegations present. Every effort was made to minimize the area of disagreement and to widen the area of consensus as much as possible.

In view of the initial positions taken up on the nuclear issue, the outcome was perhaps beyond expectation and testifies to the concern and the sense of responsibility with which the issues were tackled.

It may constitute a valid basis for further steps to halt the proliferation of nuclear weapons, to outlaw and abolish them, and to achieve the balanced, rational and safe development of nuclear energy for peaceful purposes.

22. The problems facing all societies today (rising population, hunger, the social, cultural and political development of backward countries) cannot be solved simply with abundant energy alone, particularly if it is produced without adequate measures to protect health and the environment and, at the same time and with the same commitment, a strong effort to preserve peace.

As has already been ably demonstrated in all the studies contained in the reports of the Club of Rome, there is a need to rethink the plan of development for industrial societies, to reformulate the scale of values of civilian consumption and to bridge the North-South gap (EEC Ferrero report, UN Brandt report).

Nevertheless the fact remains that the energy problem exists, that it is a worrying one and that it will not be exorcised by evading reality (even if this is done with the best intentions and in the purest of good faith). A solution will not be possible, at least over the next 50 years, without there being a nuclear component.

23. Some experts claim to have discovered a certain 'ambiguity' in the INFCE summary report. They feel that it offers two possible readings which are almost at complete variance with one another: the first is that technological development is advancing in such a way as to allow the use of Plutonium and highly enriched Uranium as a nuclear fuel without any danger and the second is that such a prospect involves an unacceptable risk of the proliferation of nuclear weapons.

Your rapporteur did not perceive this ambiguity. In his opinion the report adopts a correct and objective methodological approach, pointing out the basic facts and conditions and hypotheses on which the conclusions are based.

Since the Conference did not set itself the task of defining rules or regulations but only of making a thorough examination of the question of non-proliferation, its business was able to proceed without being made subject to any conditions and in a climate of maximum objectivity.

24. In order to explain the 'ambiguity' that some have seen, it is perhaps necessary to give consideration to a factor which may almost seem an anticipated 'conclusion'.

Let us suppose for one moment that a total ban has been imposed on the peaceful development of nuclear energy. Could we then say we had removed the dangers of proliferation? The answer is definitely no. Nuclear bombs were built well before kWh were produced from Uranium and Plutonium fission!

On the other hand, one might ask: might the peaceful development of nuclear energy create additional dangers of proliferation? The answer in this case is yes, at least as a general rule.

Action must therefore be taken to minimize this additional danger by adopting those measures of a technical and (particularly) a political nature which the INFCE study has examined and discussed.

However, all of this changes the essence of the problem not one jot or tittle. Anyone who imagines it can be solved by ignoring the important role which nuclear energy can play in resolving the energy problem had better think again. The proliferation problem would remain substantially the same and it would then become clear to everyone that the real and final answer had to be a political one.

#### B. Comparison of the initial positions

25. As already mentioned in the second part, the substantial change in

American policy on the nuclear issue became evident during the 1976 presidential election campaign and took on precise form in March 1978 with the adoption of the Nuclear Non-Proliferation Act. In fact the review process had begun in 1974 with at first discreet and then more outspoken support from Canada and Australia.

26. The oil crisis in the winter of 1973/74 had spurred all countries to look for new energy policies to cope with something which was not simply a cyclical shortage but which indicated that a state of emergency would exist for a long time to come.

President Ford, in his state of the Union message to Congress on 1 January 1974, dedicated half of his remarks to the new energy situation and the measures needed to deal with it, and all nations, industrialized or semi-industrialized, tried to obtain reliable forecasts of what would happen if certain programmes were put into effect. (Particularly well known in the United States was the Freeman report sponsored by the Ford Foundation which appeared at the end of 1974. It considered three scenarios based on possible growth levels of the gross domestic product and corresponding energy consumption which it labelled historical growth, rationalized growth and zero growth.)

While recognizing the need for severe economies (which in fact proved extremely difficult to introduce and implement and whose results were largely unsatisfactory), most nations considered the development of nuclear energy to be an essential component of any future energy policy.

27. In this complex situation it seemed that there would be an expansion of the nuclear market (fissile materials, plant, technologies) only one part of which (fuel) was controlled by the United States and even this position was being eroded by the Europeans having opted in favour of fast breeder reactors.

The Indian test raised American alarm still further and convinced them of the need for a new policy.

28. The case put forward by the Americans was essentially that events had raised a legitimate doubt that preventive and supervisory measures were not effective against the diversion of nuclear materials by governments or terrorist organizations for manufacturing arms. Thus, rather than creating a more efficient legal, technological and operational network, a more drastic solution was needed and this was to stop the use of highly enriched Uranium in research reactors, to cease Plutonium production and not to put any breeder reactors on the market. Furthermore, they said, existing

fuel enrichment and reprocessing plant serving nuclear power stations built to produce electricity should be put under international supervision and all spent fuel should be collected there.

29. There were a number of general political and economic (but mainly political) considerations underlying these proposals. Nuclear energy was held to be :

- (a) a resource of limited importance to world economic development;
- (b) a resource to be used only as a last and extreme solution;
- (c) at the very most, a means of bridging the gap between traditional sources of energy and those of the future (of which there is only a vague notion at present). In fact, provided that a sensible and reasonable nuclear policy (proven open-cycle reactors), supplies of natural Uranium (and hence  $U^{235}$ ) will be adequate for many years to come and it will not be necessary to resort to known breeder reactors unless they are needed at some time in the future which we cannot predict at the moment.

Under these circumstances the United States undertook to assure supplies of fuel and technological assistance and to study alternative cycles for breeder reactors which would not necessitate the production and use of pure Plutonium which is the ideal material for military devices. Furthermore it promised to join in plans to assist the developing countries to exploit nuclear energy for peaceful ends.

30. The points of divergence between the United States and the industrialized countries interested in nuclear energy (not all of them members of the Community) arose for four quite different reasons which may be summed up as follows :

- (a) the precariousness and uncertainty of the oil market for countries obliged to import massive quantities of crude;
- (b) the absence of their own reliable alternative energy sources (except for coal which is very expensive to use);
- (c) their assessment of the role of nuclear energy in the development of their economies;
- (d) the need to escape from total dependence on Uranium suppliers by introducing fast breeder reactors and reprocessing.

At the same time they felt that international talks had to take place before any solution could be found to the problems of the diversion of materials and the proliferation of nuclear weapons. It was these differences that the INFCE Conference was asked to resolve.

31. Your rapporteur must point out here that there was no conflict between the United States (and Canada) and the other nuclear or pro-nuclear countries over the questions of physical security or the protection of man and the environment, which rightly took and still take such an important place in the public debate.

All polemic aside, this does mean that the vast majority of INFCE participants implicitly acknowledged that the present level of nuclear technology in all its forms offers sufficient safeguards for this sort of energy to be accepted. The INFCE itself went beyond this argument. The Conference and its study groups looked at a far broader range of questions partly in order to live up to the legitimate expectations of the public who were worried and uncertain. This wider outlook makes the final report that much valuable.

C. The most important results of the INFCE

32. As stated above, a summary of the most important results of the INFCE is contained in the two documents PE 64.962 and COM(80) 316 final.

The rapporteur believes that these documents have been well produced and give an understandable and fairly complete outline of the work of the Conference. It would therefore be superfluous (and wasteful) to make another summary here which would certainly not be any better. The rapporteur therefore suggests that readers refer to the documents themselves to gain an overall impression of the content of the INFCE. He for his part will simply quote and make general comments on the conclusions which he feels are the most important. First amongst these is certainly the question of the proliferation of nuclear weapons and this will be the subject of the fourth part of the present report.

33. It will not escape anyone's attention, even after the most cursory examination, that the central point of controversy and politically the most important part of the argument surrounding nuclear energy is the problem of controlling the use of fissile material and the proliferation of nuclear weapons. All other questions, however much they may be of concern to public opinion and in spite of their indisputable importance, are subsidiary to the fundamental question of the military use of nuclear energy.

Atomic weapons have, in current jargon, modified the scale of the problems of disarmament, security and peace by several orders of magnitude by making them enormously more complicated. As your rapporteur has already pointed out, this was the controversy which led



to the planning and holding of the INFCE Conference.

(A) 34. The INFCE report comes to the conclusion that in the present economic and social situation (resources, consumption, demand and development) the world economy as a whole cannot do without nuclear energy. The decision which has to be made is not whether nuclear energy has to be used but to what extent, in what way, over what time scale and with what safeguards it will have to be used.

35. For the industrialized countries the prospect is certainly fading - for a night which may be without dawn - that historical growth will continue with a constant increase in GDP of about 3-4% and unrestricted energy supplies (dynamic hypothesis of energy consumption).

36. A more reasonable plan might be for rational growth involving an annual GDP increase of about 1.5-2% supported by vigorous action to improve its elasticity and leaving the quality of consumption unchanged. It presupposes research into new technologies and the introduction of more advanced production methods to obtain acceptable growth without demanding a corresponding increase in energy availability (static hypothesis of energy consumption). No real precedent exists for such a change and there will have to be adequate research into the optimization of systems together with investment for the conversion of productive plant.

37. Finally one might envisage a situation of zero growth based on a very slight increase in GDP and a reduction in energy consumption (negative elasticity). It implies far-reaching rationalization of production processes and a profound change to the quality of consumption. Given the present conditions, if this economic but, above all, cultural and civil transformation were to take place, forceful action would have to be taken to alter collective and individual behaviour within industrialized societies. The traumas involved in having these measures accepted and put into practice can easily be imagined.

38. Last of all, one should point out that none of these schemes can be applied to the developing countries. They need rapid progress but they cannot and must not uncritically follow the example of the more advanced countries. They should profit by the latter's experience and reject the contradictions and distortions which have caused their development to degenerate.

39. Whichever development model is chosen, one must be able in the medium and long terms to count on an adequate supply of energy and a sizeable proportion of this will have to be nuclear.

The nature of nuclear energy, which at present can only be used for the production of electricity,<sup>1</sup> reinforces its role and importance.

There are two closely connected reasons for this. Firstly, the inevitable shift of energy consumption towards electricity means that plans must be made to meet an increase in the demand for electricity which will be much greater than that for other forms of energy. Secondly, nuclear energy can replace the oil and gas now used in electricity production and allow the countries who have few energy resources of their own to diversify their supplies of raw materials.

This of course does not mean one has to accept nuclear energy as the one and only solution.

(B) 40. While the INFCE Conference was not explicitly instructed to study the questions of safety and protection, its report does come up with objective findings. In your rapporteur's opinion, it has demonstrated that sufficient technological progress has been made in the operation and control of plant as to ensure their reliability in service. Probability assessments, statistics and historical analyses would seem to show that the balance of risks and benefits is an acceptable one.

41. Although this conclusion formulated in this way may shock public opinion (which has never before been called upon to judge the meaning or national basis of such a balance), it is the only logical one and it is extremely useful.

This is because firstly it clearly identifies the points where greater efforts are needed to improve the ratio of benefits to risks and, secondly, because any other option has to be judged by the same yardstick so as to strike the same balance while taking into account all the technical, economic and social variables.

The Conference on Nuclear Plant Safety, organized by the IAEA in Stockholm on 20-24 October 1980 at the request of the INFCE Conference, substantially confirmed this view. Mature and reliable technologies are already available to deal with those subjects which are most often under discussion today, such as the storage of waste.

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<sup>1</sup> Its use in the production and distribution of heat is still very limited, although the prospects for this are far from negligible.

42. Have all the problems associated with nuclear energy therefore been overcome? No, they still exist and the INFCE has pinpointed them rather than covered them up. The report shows that a lot of research work is being done on them.

In any case the problem of safety cannot be resolved once and for all, since there is no such thing as absolute safety. As with all machinery (cars, aeroplanes, trains, ships, therapeutic and diagnostic health devices; the last of which was the subject of the recent Krouwel-Vlam report to the EP), there is a need for continual improvement.

43. Where there is still room for vigorous democratic action is in providing the public with correct information, guaranteeing it access to the supervision of plant management and checking the coverage and efficiency of measures to be taken in a large-scale emergency. These are clearly extremely political matters which require political solutions based on the spirit and the practice of democracy (but leaving demagoguery aside).

(C) 44. The INFCE report states that at the present time it is not possible to single out any one cycle that is more economic than the others. There are too many 'local' factors specific to individual countries to make it possible to give a general answer.

Another point established is that the recycling of spent fuel in LWR reactors to be used again in the same reactor is of limited economic advantage, even if it does mean less dependence on the market for fuel supplies.

Once the enormous investment costs during the present experimental phase have been paid, breeder reactors hold out good prospects for ending the dependence on supplies of fissile material. Here the reprocessing of spent fuel is not an option but an inherent characteristic of the system.

It should also be pointed out that the use of breeding makes the cost of electricity produced by a nuclear power station much less sensitive to the costs of extraction of the uranium, at the same time increasing the volume of the available resources. 'Poor' deposits (like sea-water, in which there are 3.5 tonnes U/km<sup>3</sup>) can be utilized; this also extends the areas of ore production and reduces the importance of the 'producer countries'.

It may be worthwhile here to emphasize a point which is all too often overlooked. Plutonium production is not something which is peculiar to fast reactors. As stated in the description of the fuel cycles above, Plutonium is produced by any reactor, thermal or fast, when  $U^{238}$  is irradiated.

What is peculiar to fast reactors is the need to recycle the Plutonium produced and consequently the presence of Plutonium in these segments of the cycle which precede irradiation.

The 'Plutonium economy' is not something exclusive to fast reactors. It is always present, but is more evident when this system is used.

45. While discussing the possible effects in its conclusions, the INFCE does not support the American request that the 'Plutonium economy' and the development of these reactors should be stopped.

It is your rapporteur's opinion that this technology has perhaps not yet reached commercial maturity, although experiments have been going on for some years with excellent results. The Community must maintain its research effort and prudently but resolutely encourage Community cooperation in this sector. The factors arguing for this are the meagreness of the Community's own resources and the need to reduce its dependence on third countries as far as possible.

(D) 46. The INFCE report gives some consideration to the problems of nuclear energy in the developing countries. These countries themselves are not all alike and in fact show great differences in their growth rates, culture, industry, infrastructures and natural resources.

The proposal to create an International Technology Centre under IAEA supervision would seem to provide a good opportunity for a proper transfer of know-how, aid and assistance in the nuclear field to these countries. It therefore deserves Community support and in fact a thorough discussion of the matter was held in the spring of 1979 (Flämig report).

#### IV - THE PROBLEM OF THE PROLIFERATION OF NUCLEAR ARMAMENTS

##### A- Two types of proliferation

47. One must first of all distinguish between vertical proliferation and horizontal proliferation.

Vertical proliferation is mainly the preserve of the United States and the USSR, but may also involve other powers having nuclear weapons. It is the frantic competition to find weapons which are more sophisticated and more efficient than those currently in service.

The fission bomb has given way to a fusion device (thermonuclear or H bomb) of much greater power, rockets (ballistic missiles) with multiple warheads have been developed for strategic and 'theatre' use, fleets of nuclear-powered submarines (for wider range) have been armed with missiles with nuclear warheads, special aircraft have been constructed to carry nuclear bombs and a neutron bomb is being designed and may already be at the testing stage.

It is a well-known fact that the stocks of nuclear explosive devices available to the United States and the USSR have reached such numbers and are of such quality as to make it difficult to judge their relative supremacy. What is absolutely certain is that the destructive power lying in those arsenals is more than enough to destroy the world and no area of the globe can be considered to be outside the target zone.

The two superpowers watch over and direct their military apparatuses with an extraordinary number of reconnaissance satellites backed up with a close network of radar stations and computers.

48. The World Armaments and Disarmament SIPRI Year Book of June 1980 notes the following facts :

- (a) the world's nuclear military arsenals now contain more than 60,000 nuclear weapons;
- (b) three quarters of the satellites put into orbit by the end of 1979 were for military purposes;
- (c) in 1979, 53 nuclear test explosions were carried out (all underground): 28 by the USSR, 15 by the US, 9 by France and 1 by the UK;
- (d) The total number of nuclear explosions up to the end of 1979 was 1,221, of which 733 took place after the signing of the Test Ban Treaty which prohibited nuclear explosions in the atmosphere, in water and in space, but not underground (August 1963) which was initialled by the US, the USSR and the UK.

(e) The United States is at present developing and installing the MX mobile missile, the Trident submarine and the Cruise missile, whilst the USSR is preparing the SS17, SS18, SS19 and SS20.

49. Vertical proliferation would therefore seem to involve only the two superpowers who are working to preserve their supremacy over other countries and not let themselves be overtaken by the other.

Other countries are to varying degrees below the level where they can compete and, in their case, the notion of proliferation does not have quite the same meaning.

The US and the USSR have certainly for some years been aware of their role and their responsibilities. The Test Ban Treaty was followed by the Non-Proliferation Treaty (NPT) initialled in 1 July 1968 and open for signature to all countries.

The non-ratification of SALT 2 by the US Senate and the tensions created by the Afghanistan crisis between the two countries have seriously slowed down the East/West dialogue on nuclear (and general) disarmament.

50. Horizontal proliferation means an increase in the number of countries having nuclear weapons. Some time ago the United Kingdom, followed by France and more recently China and India acquired such weapons and the technology necessary to manufacture them. Other countries such as Canada, South African, Brazil, Israel, Pakistan, Iraq and many industrialized countries in East and West Europe would be able, should they so wish, to do so quite rapidly. Of course, the quantity and quality involved would not compare with the arsenals of the two superpowers, but the possibility is no less worrying for that.

The INFCE has analysed this problem in connection with fuel cycles and political non-proliferation measures.

#### B. The fission bomb

51. In simple terms a nuclear fission bomb is made up of a quantity of fissile material which is sufficient to produce a 'supercritical' configuration but which is initially maintained in a 'subcritical' geometrical arrangement. If an impulse (of the order of microseconds) compacts the mass of material and into this mass are injected neutrons, the conditions are created for reactivity much higher than the 'critical' level and a chain reaction begins which leads to an explosion.

There are quite a few difficulties which have to be overcome before these conditions can be created and it seems scarcely credible that such a device - if one had the fissile material - could be built without the technology, without adequate equipment and without familiarity with the subject or with nuclear science in general.

Your rapporteur is not convinced that an atomic bomb could be put together on the kitchen table by a terrorist or a group of terrorists.

52. To understand the aspects of this problem considered by the INFCE it may be useful to recall the minimum quantities of fissile material required for an atom bomb. These are shown in Table 1 in the Appendix.

It will be seen that, in the case of military or even commercial Plutonium, the quantities are extremely small. In view of the high density of Plutonium such quantities will take up no more space than a tennis ball.

In the case of Uranium, the less it is enriched, the greater the required mass, making it difficult to acquire and use.

Although it is impossible to go into the technicalities here, it is a fact that the specific physical characteristics of Plutonium pose complex and delicate problems to anyone building a nuclear device.

Moreover, if Plutonium produced in nuclear power stations were to be used, this would require a higher level of sophistication in design and in the construction of the nuclear device.

It would be physically simpler to use highly enriched Uranium, but to obtain this one must possess or have access to an enrichment plant.

Clearly then nuclear weapons cannot be built unless the advanced technological structures required are available.

#### C - INFCE conclusions on the technical limits of proliferation

53. Briefly (cf. COM(80) 316 final) the report concludes that:

- the decision to construct nuclear weapons is essentially a political one taken by States: there may be different reasons for it and the investment costs are high;

- the use of plant designed for the peaceful use of nuclear energy and the diversion from it of fissile material is not the simplest nor the most convenient way to manufacture nuclear arms: available technology may, however, facilitate the acquisition of the necessary know-how for military ends;
  - at the present time (and for the foreseeable future) there are no alternative nuclear cycles to those already constructed or designed which will ensure the non-production and thus the non-proliferation of 'explosive' nuclear materials. (This rules out US hopes on this point);
  - the levels of the risk of proliferation connected with the various cycles are not comparable in abstract because they depend not only on the intrinsic physical characteristics of the cycle but also on changing external factors which are difficult to evaluate. For example, the open cycle, advanced so vigorously by Carter to the point where he stopped construction of the breeder plant at Clinch River, has not been recognized as offering any particular advantages over the others;
- 
- the dangers of proliferation may be reduced by lowering the amounts of separated Plutonium and highly enriched Uranium in the fuel cycle;
  - it is feasible to raise physical protection barriers around fissile materials, although it may be difficult to have such a course of action accepted;
  - the danger of the diversion of explosive fissile material may be reduced by using fuel of a lower enrichment in research reactors;
  - the dangers of proliferation may be lowered by installing different nuclear fuel cycle facilities on the same site (colocation);
  - fissile material would be less open to use for non-peaceful purposes if it took the form of mixed oxides produced from mixed Uranium and Plutonium solutions (co-conversion).

D - Measures to prevent proliferation

54. The conclusions above show that at the present state of the art there is no guideline in nuclear technology or development which can clearly identify peaceful and military uses and make them incompatible. They are both influenced by the other and hence there is no magic technical means to prevent proliferation.



What is needed is political action to forge agreements between nations and organizations and to improve supervision systems.

Your rapporteur is convinced that a policy of non-proliferation must be accompanied by a policy of nuclear and general disarmament for it to achieve the widest consensus and create new prospects. The SIPRI document forecasts that in 1980 world armaments expenditure will reach a figure of \$ 500,000 m (more than 1,000 EUA at current rates). It is utterly grotesque as well as tragic that thousands of millions of dollars are spent every year to protect us (so they say) from conflicts, the foundation of which are laid by withholding such gigantic resources from development.

55. Although a large dose of optimism is needed to deal with these disheartening facts, the course of international agreement seems to be the only feasible one. Some of the Conference's suggestions incorporate this approach, even though the road ahead will be a long and difficult one, as the history of the existing treaties shows.

The treaty which imposed a partial ban on test detonations of nuclear devices has been of questionable effectiveness and provoked much discussion. It has not prevented vertical proliferation and has never satisfied those countries which do not have nuclear weapons. Those that have signed the treaty in exchange for aid and assistance with their own peaceful nuclear development have incessantly asked for changes to be made, since they consider that all tests should be banned.

The Non-Proliferation Treaty (NPT) has, in spite of its shortcomings, marked an important step towards controlling horizontal proliferation. It was the first well-organized attempt to bring the matter under international control and may be compared to a piece of outline legislation which requires implementing provisions to be adopted later on.

During the 10 years it has been in force the NPT has not, however, been as effective as was hoped, partly because of the intrinsic weakness of its provisions, partly because of a lack of political consistency (it has not become 'universal', Article VI on nuclear disarmament was never implemented, Article IV on facilities to allow access to the benefits of nuclear energy has been shown to have some limitations and there has been some resistance to its application).

The Treaty was first re-examined at the 1st Review Conference in 1975, but no fundamental changes were made.

A second attempt at improvement it took place at the IIInd Review

Conference, but no fundamental changes were made.

A second attempt at improvement took place at the IInd Review Conference in August 1980 in Geneva. Although it opened with a message from the UN Secretary-General, Mr Kurt Waldheim who said that the countries other than the six who already possess it must be prevented from building nuclear weapons and that the atomic arsenal must be progressively reduced to the point where it is completely eliminated, the Conference ended in failure. During the proceedings the representatives of the developing countries which had signed the NPT adopted a strongly critical attitude towards the large nuclear powers (US, USSR, UK). These were accused by the representatives of the Third World of not having properly implemented the Treaty and not having met undertakings to ban all test explosion of nuclear bombs. The Conference chairman Mr Ismat Kittani of Iraq, had to announce that the participants were abandoning their efforts to find an agreement on new measures to prevent nuclear proliferation and on guaranteed supplies of nuclear energy for peaceful purposes to the developing countries.

56. This conclusion is even more serious since the INFCE Conference had emphasized that the present non-proliferation arrangements were open to improvement and that action was needed to minimize the dangers inherent in the sensitive areas which had been identified and hence guarantee more stable and uniform supplies. Having examined the various problems the INFCE singled out some measures of an institutional nature which might be introduced by means of general agreements. These include:

- (a) International Plutonium Storage (IPS);
- (b) International Spent Fuel Management (ISFM);
- (c) a limit on the number and the internationalization of 'sensitive plants such as those used for the enrichment, reprocessing and manufacture of Uranium-thorium fuel;
- (d) agreements to safeguard the continuity of supplies even while non-proliferation undertakings and conditions were being up-dated;
- (e) multi-national or international decisions on the location of waste storage sites.

57. It is your rapporteur's opinion that the IAEA should take a more active role on the world scene to tackle on these problems and that the Community should apply pressure to have it do so.

The new Commission of the European Communities must apply itself to these problems without delay.

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V - APPENDIX - NOTES ON SOME PHASES OF THE FUEL CYCLE

A - The fuel cycle

58. The nuclear fuel cycle is made up of all the handling and conversion processes to which the fuel is subjected between the extraction of the Uranium or Thorium from the ores containing them and the final storage of the waste.

Between these two events, the beginning and end of the cycle, there are a large number of operations - including, of course, irradiation in the reactor to obtain energy - the number and nature of which depend on the type of reactor to be fuelled.

To take an example, Figure 1 shows the fuel cycle of a 1,000 MWe LWR reactor. The quantities indicated in the diagram refer to one year of operation with a load factor of 80% (see Figure 1).

59. In principle, one could conceive of a large number of types of reactor, single or in combination, to meet the needs of a specific energy system. The various INFCE working groups considered 22 types of reactor and corresponding fuel cycles. Many of the designs considered were extremely interesting in as much as they allow a better utilization of resources, but in the present state of the art these undeveloped options still on the drawing board will most probably not be feasible until after the year 2000.

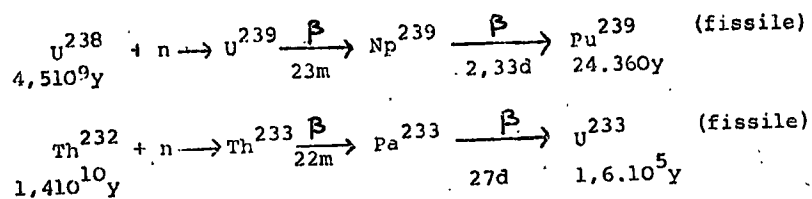
B - Breeding

60. The term breeding covers the entire series of nuclear reactions by which some natural non-fissile ('fertile') nuclides are transformed into fissile nuclides which may be used for the chain reaction within a nuclear reactor.

61. The only fissile nuclide found in nature is Uranium 235 ( $U^{235}$ ) which is an isotope constituting approximately 0.7% of natural Uranium.

The only known fertile nuclides are Uranium 238 ( $U^{238}$ ) which makes up 99.3% of natural Uranium and Thorium 232 ( $Th^{232}$ ) which is the only natural isotope of this element.

There are two nuclear breeder reactions:



These reactions, which may take place in any type of reactor, have a high yield in 'breeder reactors' which can simultaneously produce both energy and a greater amount of fissile material than is consumed.

62. The reaction described in the first cycle above has already been carried out and passed from the design stage to the experimental stage some years ago with some positive results in fast breeder reactors (FBR).

In terms of quantity it enables the reserves of fissile material to be multiplied by a factor of between 50 and 70. This is a guarantee that there will be sufficient nuclear fuel available for the production of electricity in nuclear power stations for thousands of years to come. The technology now in existence can ensure that the doubling time in fuel production will keep in step with the doubling time of electricity consumption.

In terms of quality, however, this process requires the irradiated fuel to be recycled several times within the plant and creating the 'Plutonium economy' which has a number of important ecological, social and political implications which it would be unpardonable to underestimate.

63. The second cycle is either still on the drawing board or in the early experimentation phase. The US Department of Energy, which is responsible for R & D in the energy field, in 1978 (after Carter's statements) called for greater efforts to be put into research into this cycle. Although it holds out good prospects, the end results will not be seen for some decades.

#### C - Fuel processing

64. Nuclear fuel is processed before and after the irradiation phase in the reactor. The main processes preparing the fuel for use in the reactor are concerned with isotope enrichment (indispensable for stations using enriched Uranium) and the fabrication of the fuel itself into fuel 'elements'. When discharged from the reactor the fuel may be 'reprocessed' in order to separate the remaining Uranium and Plutonium from the waste known as 'fission products'.

Enrichment and reprocessing are two particularly critical segments of the fuel cycle since it is here that the fissile materials ( $U^{235}$  and Plutonium) are obtained.

65. The isotope enrichment of Uranium raises the proportion of  $U^{235}$  contained in natural Uranium (approx. 0.7%) to approx. 3% in the case of Uranium used in LWR reactors or more than 90% for the Uranium used for military purposes.

The processes used are based on the principles of gaseous diffusion and centrifuging of natural Uranium which, in the form of hexafluoride, is a gas. Both of these processes have been developed industrially.

Reprocessing, as we have said, consists of all the operations to be carried out on spent nuclear fuel to separate the unburnt material (and the fissile nuclides generated by breeding) from the fission products.

This process was used during the Second World War for the extraction of 'nuclear explosive' (Pu) but not for the recovery of Uranium.

At the end of the war, partly in view of its potential peaceful uses, the technology was developed and improved so as to be able to recover both the fissile components, the Plutonium and the non-fissioned Uranium, from the fuel discharged from the reactor.

There are essentially two types of reprocessing: wet (aqueous) and dry (non-aqueous), but about 30 or so possible methods have been found in all.

The first type is carried out at low temperature (approx. 30-70°C) and involves the dissolving in an aqueous solution of mineral acids of the irradiated fuel before separation of the various elements. This has the advantage of a high degree of decontamination of the fission products and has reached a high level of development in industrial use.

The second type covers high-temperature processes and those which involve halide distillation. They are carried out at temperatures of several hundred °C, allow less decontamination of the fission products and have not yet reached a satisfactory level of industrial development. Their advantage lies in the fact that they can be initiated after a very short cooling period since the greater after-heat which would be intolerable in the wet processes, because of the harmful effects of radiolysis on the solvents, does not create any serious problems here.

Fuel enrichment is not necessary for reactors using natural Uranium or Plutonium as the initial fissile material. With the possibility of an open (once-through) cycle, both enrichment and reprocessing would be eliminated in the case of natural uranium reactors, while for reactors using slightly enriched uranium it would be possible to dispense with reprocessing.

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#### D - Disposal of radioactive waste

66. This is the final part of the fuel cycle. Our committee and the European Parliament have recently debated this subject (Weber report). We are therefore well familiar with the technical aspects of this question and its possible effects on health and the environment.

#### E - Decommissioning

67. This covers all the operations involved in dismantling obsolete nuclear plant (particularly reactors) and restoring the site of the plant to its original condition. This is a problem which was not covered by the INFCE. It has only very recently begun to receive adequate attention; the European Parliament dealt with it at some length in the spring of 1979 (Flämig report). Reference is made to it here solely in order to complete the list of the more complex technical aspects connected with the use of nuclear energy for peaceful purposes.

FIG. 1

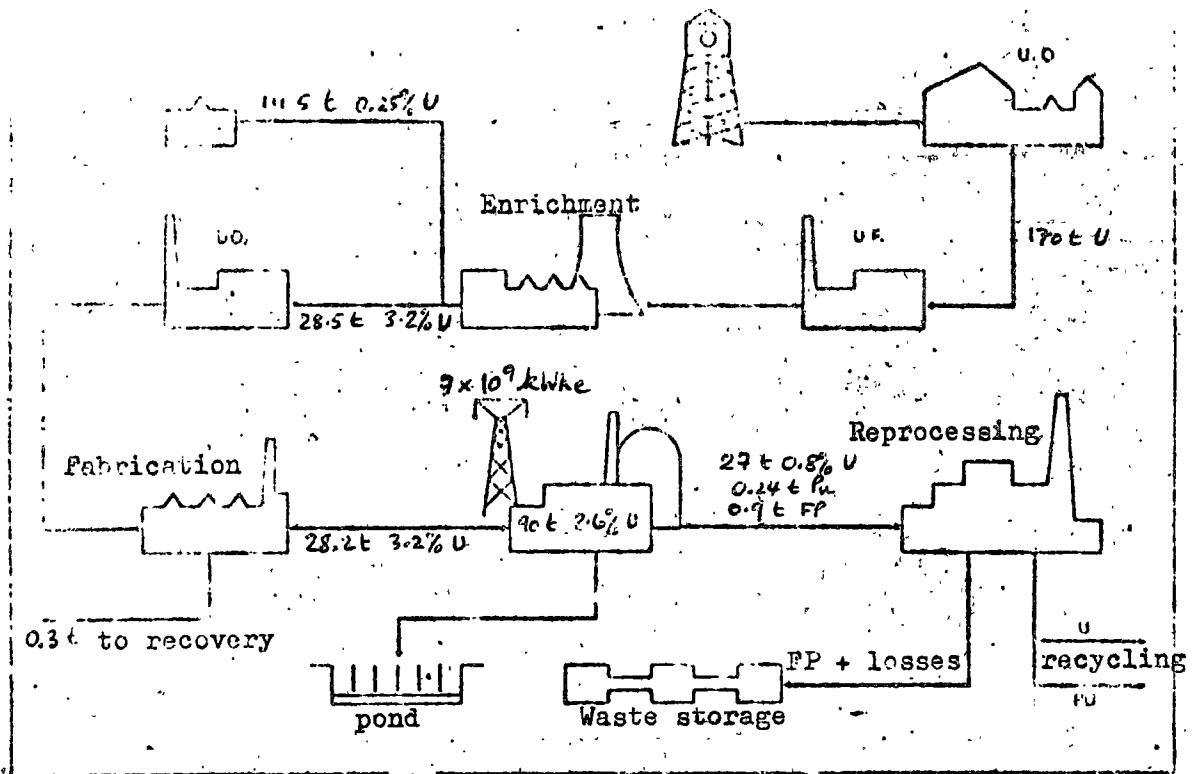


TABLE I

Fissile material	As metal (kg)	As oxide (kg)
Plutonium for military use	4	Approx. 6
Commercial Plutonium	8	" 10
Highly enriched Uranium (93% U <sup>235</sup> )	17	" 20
Enriched Uranium 20% U <sup>235</sup>	250	" 375
10% U <sup>235</sup>	1000	" 1500
5% U <sup>235</sup>	not feasible	not feasible

OPINION OF THE POLITICAL AFFAIRS COMMITTEE - Draftsman: Mrs A.-M. LIZIN

At its sitting of 6 July 1981 the European Parliament referred the results of the INFCE Conference (International Nuclear Fuel Cycle Evaluation) to the Committee on Energy and Research as the committee responsible and to the Political Affairs Committee for its opinion.

At its meeting of 27 to 29 January 1982, the Political Affairs Committee appointed Mrs LIZIN draftsman.

At its meeting of 24 to 26 February 1982, the Political Affairs Committee adopted this opinion by 15 votes to 1 with no abstentions.

The following took part in the vote: Mr Rumor, chairman; Lord Bethell, vice-chairman; Mrs Lizin, rapporteur; Mr Bournias, Lord Douro, Mr Gawronski (deputizing for Mr Bettiza), Mr Habsburg, Mr Hänsch, Mr von Hassel, Mr Israel (deputizing for Mr de la Malène), Mrs Lenz, Mr Majonica (deputizing for Mr Klepsch), Mr Moorhouse (deputizing for Sir James Scott-Hopkins), Mr Pelikan (deputizing for Mr Cariglia), Mr Plaskovitis, Mr Segre and Mr J.M. Taylor.



1. The Political Affairs Committee must assess the report by Mr VERONESI in the context of international relations and the implications of the INFCE for those relations. The committee must therefore pay particular attention to two aspects:

- relations between the USA and Europe as regards non-proliferation, exports of fissile materials and the marketing of the plutonium cycle,
- the implications of the results of the INFCE Conference for North-South relations, particularly in respect of those Third World countries which have turned to nuclear power and which feel that the American standpoint has so far deprived them of their freedom and their capacity for technological development, not to mention the military aspect.

2. There is little point in considering the results of the INFCE Conference from the viewpoint of international political relations as such. It is obvious that the INFCE programme was simply a phase in the development of nuclear relations between states, these relations having been strained as a result of a number of earlier developments. The historical background given in the VERONESI report is very comprehensive and so need not be repeated here. Attention should, however, be drawn to the highly restrictive tendency of American policy on the plutonium economy (Ford 1976), the export of fissile materials and of nuclear technology (Non-proliferation Act), European dissatisfaction with these policies which compromised technological development in Europe, the hostility of Third World countries which criticized the extremely restrictive interpretation of the NPT and the desire to keep them in a position of technological underdevelopment (failure of the Geneva Conference) and finally the appearance of international organizations (Club of London in 1975) which were formed by certain European countries without regard for the procedures laid down in the Euratom Treaty.

As regards the historical background therefore, we must remember that INFCE merely provided a 'brief respite' before a crucial stage in which the interests of the seven partners clashed. This stage is now complete. Its 'demise' should introduce the next stage in the dialogue and, if possible, lead to an agreement.

3. There has been a noticeable shift in the American position. Some important work is currently being carried out within the American administration in order to implement the new guidelines laid down in the presidential declaration of July 1981, according to which the USA wishes to become a reliable partner once again without undermining its non-proliferation objectives. And it is true that the strict system of control, the full-scale 'nuclear police' to which the Carter administration seemed inclined, is an illusion since several countries, in Europe in particular, already possess the relevant technology. The aim, therefore, is to win acceptance not for a 'police force' but for a form of self-discipline to be exercised and supervised jointly. One element of uncertainty remains, however and that is the attitude of Congress. There is little chance of

the NNPA being amended. Ideally, the Administration would be inclined to revise certain provisions, such as those on retroactivity, and to transfer responsibility for export licences from the NRC to the State Department. However, the idea is to modify the application of the regulations rather than to change the regulations themselves.

4. We must also take account, without going into details, of the development of technology and the nuclear industry in the USA, which has been a major factor in this 'softening' of policy. All that America's policing role has achieved is to cause it to fall further behind and to lose a large number of contracts to certain European companies. Over the next few years, competition on the foreign market will be fierce in this sector. Although it began with a monopoly, the USA has been unable to keep the upper hand as regards technology and has, on the contrary, fallen well behind.

5. Owing to the different stages of development of Latin America, Africa and Asia in the field of nuclear technology, the Third World countries have not responded to this policy with a united front. They are, however, united in refusing to accept a discriminatory situation which deprives a country of the capacity for further development, even if such development still seems a doubtful prospect. What are the developing countries' criticisms of current policy and particularly of the NPT? Article IV (on the inalienable right of every state to the development of a civil nuclear programme and the transfer of technology) has not been applied. No progress has been made on Article VI (disarmament measures). All attempts to call even a temporary halt to underground nuclear tests have failed - it is surely safe to assume that there has been more than just one test per week since the NPT was signed. It is vital the Europe take up this claim by the least-developed countries and follow it up by specification, for example by acting as the spokesman for some of these countries in dealings with the USA to draw up a joint policy position putting them on an equal footing instead of confronting them with policy as a fait accompli, an attitude which has always exacerbated their hostility in the past. Such support would be highly appreciated by many countries and would reinforce Europe's role in this aspect of the North-South dialogue.

6. Europe does not have a common approach to these problems, either in discussions or in practice, and this is sometimes to its detriment. One Member State and one applicant country have not ratified the NPT; another Member State does not accept the IAEA's full scope safeguards. There was even a brief period of serious conflict between the Member States over non-proliferation and export controls following the creation of the Club of London when some countries took part in the drafting of restrictive standards at the expense of free movement and in contravention of the general principles of the Euratom Treaty. However, the toughening of American attitudes and in particular the adoption of the NNPA, which effectively made it necessary for all bilateral agreements to be renegotiated, was

seen throughout Europe and in Japan as an imposition which would be hard to accept. It is crucial that Europe's assessment of the 'post-INFCE period' should be organized through Community channels. Bilateral relations do exist and it would be unrealistic to think that they will disappear. Nonetheless, the Ten member States must harmonize their response to American policy and the softer line now emerging in order to arrive at the best possible policy. The Political Affairs Committee feels that any move towards preferential agreements between a few Member States, keeping the remaining Member States in a position of inferiority, would constitute a threat to the future of Europe. Some observers feel that the role of Euratom's safeguards is fading, which would be regrettable, and that internationally the safeguards which are used as a reference are those of the IAEA. The new guidelines may be considered under three headings: the plutonium cycle, policy on the export of fissile materials and nuclear technology and the international system of safeguards.

7. As regards plutonium, work has reached an advanced stage, having been given priority by the American administration. The EEC had special status ('waiver', which is currently being renewed) but would like to see the matter clarified. In our opinion, Europe must support the USA in this matter and share its concern for controls but it must also make it understood that this policy cannot be uniformly applied, particularly in relation to the electricity generating needs of individual countries and their reliability in respect of non-proliferation. This presupposes an effort on the part of European countries to make their concern for technological development and commercialization compatible with their support for an essential policy of non-proliferation.

8. As regards the export of sensitive materials, the American administration has re-established contacts with the various exporting countries and with Euratom as an official organization. These contacts were, for the most part, bilateral. These American tactics are clearly governed by self-interest, the aim being to divide and rule. This makes the need to determine a concerted policy within the Ten in response to this policy towards exports of materials and technology more obvious than ever. The new Belgian Presidency should ensure that work in this field is completed and call on the Commission to be more vigilant in respect of the Euratom Treaty. The need for stricter controls is obvious and acceptable to Europe since it is the sole means of limiting and slowing down the process of proliferation. The policies of peace and disarmament are also fundamental in reducing the appeal of acquiring nuclear weapons (Middle East). On no account, however, should Europe lay itself open to the obvious criticism from the 'grey zone' countries that they are setting up yet another rich men's club. We must not go back to the situation of the Club of London but should set up a temporary ad hoc committee to consider exports on a case-by-case basis in a global context. Europe could promote consideration of a special status for some or all importing countries offering considerable flexibility. This would make it possible to determine the outlines of a definitive solution in a worldwide context.

9. On the question of international systems of safeguards, attention should be drawn to the crucial role of the IAEA and the importance of improving it. Such an improvement could be brought about by additional funds from the European countries and particularly from the USA but also by greater political involvement in the success of two initiatives:

1. International Plutonium Storage (IPS) whose work is progressing satisfactorily;
2. The Committee on Assurance of Supply (CAS) which is trying to establish rules for a new worldwide system to guarantee supplies. So far its work has been unsatisfactory and it must act quickly to find some means of avoiding the dilemma of 'irrevocable supply versus irrevocable safeguards'.

Finally, the UN intends to hold an International Conference on Nuclear Energy in 1983 which could provide an opportunity to submit new proposals. Europe should combine its efforts in preparation for this conference.

## PROPOSALS

1. Our committee can regard the conclusions of the VERONESI report as excellent.
2. Mr VERONESI is correct in his positive assessment of the results of the INFCE Conference. As far as our committee is concerned, the important thing is to have convinced the American administration of the need to adopt a more flexible approach.
3. Europe has an important role to play in the developments which must necessarily follow the INFCE Conference, as it had on many issues throughout the conference, both in relation to the developing countries and to the USA.
4. Europe must not forget its commitment to disarmament policy which is the cornerstone of the NPT (Article VI) (paragraph 13(a) of the VERONESI report). It also hopes for a ban on underground tests (paragraph 13(b) of the VERONESI report).
5. Europe must reaffirm its concern for unrestricted application of Article VI of the NPT which allows technological development in countries not equipped with nuclear weapons in all matters relating to the use of nuclear energy for peaceful purposes (paragraph 13(a) of the VERONESI report). Some financial incentive should be added to improve this section so vital for the Third World countries which might otherwise withdraw from the system (paragraph 12(b) of the VERONESI report).
6. Europe must assert its wish to give practical support to America's policy of non-proliferation and export controls, a political aim which Europe shares. It is appropriate that this policy should now be pursued jointly by the USA and the EEC to put an end to the earlier climate of confrontation. This new American policy is a challenge to which Europe must respond by accepting a 'modus vivendi'.
7. This desire for understanding and acceptance presupposes a movement towards a stricter system (the total ban referred to in paragraph 13(c) of the VERONESI report) to which we subscribe.
8. It is in Europe's interest to give concrete support to the role of the Third World in this field and we should stress the need for specific case-by-case consideration of exports to each country on the basis of a flexible arrangement which would not discriminate against importing countries or impose conditions on them which they did not help to draw up. The acceptance of safeguards must include a provision for guaranteed supplies.

9. Europe must play an active part in extending and improving the Euratom and IAEA systems of safeguard (paragraphs 14(i) and 14(j) of the VERONESI report). It should also consider positive measures leading to the completion of the work of the IPS and CAS. Member States cannot, however, be associated with measures which are incompatible with the rules laid down in the Treaty, particularly in relation to the internal market or the free movement of goods, or which exclude the European institutions.

10. The Political Affairs Committee welcomes the fact that a study group has been set up within the Council within the framework of political cooperation to prepare a joint policy position by the Ten on non-proliferation and the harmonization of nuclear export policy. The Ten's procedures must be respected in respect of all advances in this field and joint initiatives must be taken in relation to the group of 77 in preparation for the United Nations Conference on nuclear energy to be held in 1983.

The Political Affairs Committee hopes that the Belgian Presidency will act as a motivating force in this field.

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In conclusion, the Political Affairs Committee feels that it would be appropriate to amplify the report by Mr VERONESI by including two amendments which relate to the political aspect.

(a) Insert the following paragraph 12a:

- Hopes that the conclusions of the INFCE Conference will firmly establish a positive climate between the USA and Europe in relation to their common goal of nuclear non-proliferation and between Europe and the Third World in the desire to provide mutual help in gaining access to this 20th century technology.

(b) Insert the following paragraph 14a:

- Stresses its commitment to Community procedures and, in particular, its hopes for a positive outcome of political cooperation activities in the field of non-proliferation and calls for the preparation of Community proposals in the context of the United Nations Conference on nuclear energy to be held in 1983.