Community action in nuclear safety

European File

The emergence of a persistent imbalance between oil demand and supply, combined with the precarious nature of Europe's energy supplies, has increased the need to save energy and develop other energy sources — particularly coal and nuclear power. Failing this, economic growth cannot be stepped up, nor — as a consequence — can the standard of living or the quality of life be increased. The use of nuclear energy should only be expanded as long as public safety is assured. These conclusions, from the meeting of the Nine's leaders in Strasbourg in June 1979, raise various questions, particularly: Why is nuclear energy indispensable? What means can be used to reduce the risks associated with nuclear power?

1. Why use nuclear energy?

Progress in our industrial society depends on extensive consumption of energy which could still increase by 30% by 1990. To help meet its requirements, the European Community has, of course, traditional energy resources: coal, natural gas, indigenous oil, etc. But despite an anticipated expansion in the energy output from these sources, their contribution to total energy consumption — which is rising — could drop from the 1978 level of 38% to 34% by 1990.

The Community still depends on outside suppliers for 54% of its current needs. Imported oil by itself accounted for 48% of total consumption in 1978.[1] In fact these oil imports are:

[1] See issue No 8/79: *Towards a European energy policy.*

Commission of the European Communities
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Rue de la Loi 200 - B - 1049 Brussels

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- becoming more and more expensive. The fourfold increase in oil prices in 1973-74 has contributed to the economic crisis, inflation and unemployment. The new price rises in 1979 also pose major problems;

- subject to uncertainty, given the current political background and, in the longer term, the gradual exhaustion of reserves.

Europe must have energy supplies at its disposal which are sufficient, reliable and stable. By 1985 it needs to reduce its dependence on outside suppliers to around 50% of total energy consumption. This objective implies putting a ceiling on oil imports and limiting them to 1978 levels (470 million tonnes). But what can be done to meet the rest of our needs?

- energy savings efforts must be stepped up to ensure that for every 1% increase in economic growth there will only be a maximum 0.7% increase in energy consumption. By 1983, Community funds allocated to energy savings will stand at an average of 20 million European units of account[1] per year as compared to 8 million in recent times;

- we must make greater use of coal. The European Commission is conducting a number of programmes at a total cost of 27 million EUA to improve production techniques. It has also sent proposals to the Nine recommending the adoption of Community measures to increase the production and use of coal.

- new sources, such as solar and geothermal energy, must be developed. The Community is already involved in major research and industrial demonstration projects in this field. In the long term, it is investigating thermo-nuclear fusion which uses the commonly-found raw materials deuterium and lithium. The Joint European Torus (JET) being built at Culham (UK) should bring about significant progress in this area but commercially usable results cannot be expected until well after the year 2000. By the end of the century these new energy sources as a whole will scarcely cover 5% of our requirements, which implies that we cannot count on them in the short term. Community funds put into developing new energy sources are considerable and are expected to double and reach a level of about 120 million EUA per year between 1980 and 1983. Around half will be allocated to fusion — a sector where all research conducted within the Community has been integrated — and a fifth to solar energy, which is also supported by purely national programmes;

- work in the field of nuclear energy must be maintained and developed *under safety conditions which are as strict as possible.* Nuclear energy, which will account for 15% of European energy consumption in 1990 compared to 3% in 1978, is, together with coal, the only way we can satisfy our energy requirements in the years to come.

The risks associated with the use of nuclear energy have been limited by the multiple precautions already taken. None of the incidents officially reported to the

[1] 1 EUA = about UKL 0.62 or IRL 0.67 (at exchange rates current on 3 September 1979).

competent authorities in Member States have resulted in the exposure of personnel or the general public to radiation doses above the permitted limits. It is nevertheless imperative to reduce to the minimum the possibilities of serious accidents such as, for example, the case of the Harrisburg incident which, though it did not affect the health of workers and the local population, did cause legitimate concern. Community countries and the industries concerned undertake a number of activities to ensure even higher levels of safety and, by means of the Euratom Treaty signed in 1957, the Community as such is also involved. To provide greater protection for man and his environment, it has laid down compulsory radiation protection norms and is conducting major research projects which are being carried out in the laboratories of the Community's Joint Research Centre and in the laboratories of Member States. These activities are being coordinated and integrated to ensure optimal use of available resources.

2. Health protection

The industrial development of nuclear energy as well as the medical applications of ionizing radiation and radio-isotopes raise the need for suitable protection and control measures.

☐ *Radiation protection research:* the European Commission's programme has two principal objectives:

- improving scientific knowledge and techniques in order to update the basic norms for the protection of the health of workers and the general public against the dangers of ionizing radiation. The right to lay down these basic norms was conferred on the European Commission by the Euratom Treaty;

- evaluating the biological and ecological consequences of nuclear activity and ionizing radiation in order to ensure appropriate protection for man and the environment in all cases where serious harm could be caused.

Community funds allocated to these objectives amount to some 9 million EUA for 1979. The work of the European Commission has been closely coordinated with that of Member States. In reality the risks involved with nuclear energy do not stop at national frontiers and the problems they pose are just as basic everywhere. The success of these efforts is illustrated by the fact that the majority of national organizations and numerous university institutes — some 550 scientists in all — participate in the European programme.

Cooperation is necessary in the following areas:

- dosimetry or radiation measurement and its interpretation;

- the behaviour and control of radionuclides in the environment;

- the short and long-term somatic effects of ionizing radiation;

- the genetic effects of ionizing radiation;

- evaluation of radiation risks.

These constitute a coherent whole and, amongst the problems dealt with, some are very topical such as the effects of low dosage and the improvement of methods of medical diagnosis, which currently constitute the greatest source of non-natural radiation. Other problems such as the toxicity of tritium will become more important in the future when energy produced from nuclear fusion may be used. These results will have a bearing on decisions about the production of 'safe' energy.

Finally, research into the behaviour and control of radionuclides in the environment should enable models to be developed which describe their transfer. The aim is both to evaluate and prevent possible damage. The data collected will be particularly useful to those persons responsible for fixing limits for the dumping of radioactive substances and who issue dumping authorizations.

☐ *Radiation protection norms:* the European Commission has prescribed common radiation protection norms which fix the maximum radiation levels for workers and the general public as well as methods of inspection and monitoring. These norms are reviewed periodically in accordance with the progress of scientific knowledge. The European Commission monitors their application — which is occasionally too lenient — in the legislation of Member States. To provide better diffusion of information in this field the Commission organizes regular meetings with doctors, physicists, power station operators, trade unionists, etc. It also publishes manuals dealing with the surveillance of nuclear sites and techniques for measuring radiation dosage.

☐ *Control of radioactive effluents:* national authorities have the responsibility for authorizing or rejecting installations which can emit radioactive effluents, but national governments must, nevertheless, inform the European Commission of these projects. The Commission has six months to give its opinion on contamination risks. Such information has enabled the Commission to undertake a general stocktaking of the effluent discharged by nuclear power stations in the Community between 1959 and 1972. It is generally 1% lower than the limit prescribed in the Community's basic norms for the general public and also 1% lower than the level of natural radioactivity.

☐ *Monitoring ambient radioactivity:* individual irradiation resulting from natural radioactivity sources stands at a level of 80 to 500 millirems per year according to region. 55 to 70 millirems arise from medical applications of radioactivity. The operation of a 1000 megawatt water-cooled reactor normally adds less than one millirem to this dose level. The Nine's national governments are responsible for monitoring the levels of radioactivity in the air, in water and in the earth, and the results of their work are sent to the European Commission which periodically publishes reports and can oblige a national government to take the measures necessary to adhere to Community radiation protection norms.

3. The choice of nuclear site

It is Member States' responsibility to decide on the location of their nuclear power stations. The choice is not an easy one. Technical criteria have to be taken into account as do rural planning and environmental protection considerations. The population density in Europe also restricts the number of available sites.

At the European Commission's initiative, national experts from the Nine have been meeting to exchange information on the technical and legal problems of site selection. But the Commission wishes to go further than this. Nuclear power stations located close to national borders or international water courses can have an effect on the territory of a neighbouring country. A 1000 MWe nuclear power station cooled by the total-loss system emits 40 to 50m³ of water per second approximately 10° above its normal temperature. The heating of water courses is likely to disturb the ecological balance of the water system. As the bilateral contacts over siting projects have not always produced substantial results, the European Commission proposed to the Nine at the end of 1976 that a Community consultative procedure be set up to ensure the collection of information from the countries concerned, upon which the Commission would give its opinion. This proposal has not yet been approved by the Nine. A directive adopted in 1978, however, has fixed the maximum water temperature suitable for fish life.

4. Reactor safety

The Community research effort in the area of reactor safety is considerable. It deals with both the widely-used light water reactors whose safety problems are now well understood, and with the sodium-cooled fast breeder reactors which are still being developed. These research programmes are carried out for the most part in the establishments of the Commission's Joint Research Centre. In addition, the Community partly finances (through its multi-annual programmes) work carried out in national research centres or in specialized organizations. Total Community funds involved amount to 25 million EUA for 1979 and the figure is expected to increase in the future.

Research looking at simulations of hypothetical accidents and the analysis of their cause and effects covers principally:

- ☐ accidents of internal origin — in particular coolant loss — and ways of countering the danger, particularly by emergency water injection systems. Research on the new fast breeder reactors has begun more recently and is concentrated on the behaviour of their various components and in particular on accidents which could affect the core;

- ☐ accidents of external origin and the protection needed against earthquakes, floods, aircraft crashes, explosion and fire;

- ☐ the dispersion of fission products into the atmosphere following an accident;

- the reliability of equipment and risk analysis.

In addition, since 1972, the European Commission has undertaken systematic actions to;

- harmonize regulations, safety criteria and standards for the design and use of commercially developed reactors. An examination of the codes and standards applicable to fast breeder reactors have also been undertaken;

- extending the exchange of information and strengthening coordination between national research programmes being carried out in this field.

5. Safety of nuclear fuel

It is necessary to ensure that nuclear fuel, including plutonium, is used and transported in the safest way. Waste produced by the nuclear industry poses a number of specific problems:

- *the plutonium cycle:* in this field Community funds allocated to research undertaken by the Joint Research Centre at Karlsruhe and to national centres and organizations will amount to about 10 million EUA in 1979. The Community is examining:

  - limits to the use of plutonium-based fuels;
  - the behaviour of light-water reactors when using these fuels;
  - the environmental impact of recycling plutonium in light-water reactors;
  - the environmental impact of the production, reprocessing and transport of plutonium fuel.

  A complete forward-looking analysis conducted at the Community level has established that by the year 2000 the radiological impact of plutonium recycling in light-water reactors on workers and the general public will be within the radiation protection norms currently in force.

- *Radioactive waste:* like all industries, the nuclear industry produces waste. This can be solid, liquid, gas and more or less radioactive. It has to be treated, packaged and stored under conditions of rigorous safety until natural radioactive decay renders it harmless. Storage and dispersion techniques vary according to the characteristics of the waste. Some needs to be isolated for thousands of years and the option most under consideration these days is to bury it far underground in suitable geological formations. Community funds allocated to research in this area will reach 11 million EUA in 1979 and should double during the years 1980-84. This programme represents the most important multilateral cooperation undertaken in this sector throughout the world. It is carried out in laboratories in Member States (under contract) and in those of the Joint Research Centre at Ispra whose action is then coordinated in the general interest. This work has enabled scientists to:

- develop improved processes for treating, packaging and incinerating certain solid wastes of relatively low activity;

- evaluate the effect of vitrification as a means of isolating high activity waste and verify the worth of the process;

- evaluate more in depth the possibilities offered by storage in stable geological formations (granite, clay and salt mines). Such storage methods today seem technically possible in proper safety if certain rules are followed;

- define methods for immobilizing and releasing certain gaseous wastes.

☐ *Transport of radioactive materials:* the volume of irradiated fuel transported in the Community will probably rise from 900 tonnes in 1980 to 2 400 in 1985 and 5 000 in 1990. In this sector, where great care is required, safety norms have been prescribed for packaging and containers, by, in particular, the International Atomic Energy Agency. But the ways of applying these norms varies from one country to another and technical and administrative problems often hinder the free movement of radioactive materials within the Community. The latter envisages taking action to increase the safety of workers and the general public and to focus and coordinate the attitude of the Nine in the competent international organizations.

6. Decommissioning power stations

Inevitably, power plants come to the end of their useful life. But how can these installations be made safe enough to permit access without danger or even transformed to other uses? At a time when existing knowledge in this field was partial and very theoretical, the Community has undertaken the first studies on the decommissioning of the large light-water power stations which dominate the nuclear scene. The Community programme, approved in March 1979, should permit:

☐ the promotion of research activity in areas such as decontamination, dismantlement techniques, transport and processing of building wastes;

☐ the establishment of the principle guidelines for decommissioning and also in the design and use of power stations to facilitate ultimate dismantlement.

△

Apart from those mentioned above, the Community is concerned with other safety problems, such as the control of fissile materials and the protection of nuclear materials and installations against theft and sabotage. The Community has particular responsibility to control the use of fissile materials in European industry. In general, its activity — like Member States — tends to aim for even higher degrees of security for the general public ◘

Commission of the European Communities

Information offices (countries fully or partially English speaking*)

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