

possible to count on the necessary security of international nuclear fuel supply, without running unjustified risks or providing temptations to would-be nuclear weapons proliferators. It took its stand on four main issues: the need for security of supply in such a vital sector as energy; the need to honour contracts once entered into; the undesirability – if only on grounds of unpredictability – of case-by-case controls over national energy policies of consumer countries by governments of supplier countries; and IAEA inspection.

The committee has so far issued four reports based on these themes, the first three in connection with Infce. Recognition of the contribution of the committee to thinking in this important area of intergovernmental policy may be found in the Institute's close associations with the International Atomic Energy Agency and with other international organizations. There is no doubt that the committee has helped to promote an international consensus on how these issues should be handled at government level – not least because a number of national advisers are participants in the Institute's work in their industrial capacities.

In addition, one third of the Institute's members are publicly owned corporations, which enjoy close and confidential access to their own national delegations to IAEA and its working groups. One diplomat, commenting on the first report of the committee, observed that "a unanimous report by 22 organizations from 11 countries, is in political terms very nearly unassailable". Favourable reactions of this kind have been instrumental in promoting a willingness on the part of members to spend the not inconsiderable time needed to prepare such reports, away from more directly commercial activities, as a public service to the industry.

The third committee began as an Environment Committee, but over the past year has been evolving into its present form of a *Committee on Nuclear Energy and Public Acceptance*, with wide terms of reference, covering both the presentational, and in some respects the technical, aspects of the nuclear case.

More immediately visible within the industry than these specialist committees is the *Annual Symposium*, which since its inception in 1976 has become a major occasion in the industry's calendar. The symposium takes place each September in London, and is organized not only as an industry forum, but also as a deliberate attempt to extend the documentation covering uranium production and use. With that in mind a number of major review papers are commissioned each

year. Publication of the proceedings takes place within about four months in hard-cover form. Since the series started about one hundred major papers have been presented, dealing with almost every aspect of the nuclear industry.

Management. These various activities, together with a second main members' meeting which takes place away from London in March or April of each year, are supervised by the council of management – which fulfils the normal functions of a board of directors – and by a small executive committee, assisted by the three committee chairmen.

It will be clear from what has been said that the main strength of the Institute lies in the wide professional and technical knowledge of its members. The role of the staff at the headquarters in London is then to provide a small but high quality effort to assist in collecting and presenting that knowledge. Their personal experience extends over the whole field of interest to the work programme – including nuclear technology, geology and geochemistry, energy forecasting, economics and political economy.

A specialized library is an important element in the work of the headquarters. The Institute subscribes to a large number of mining, nuclear and general economic journals, and a special-classifi-

cation system has been developed to ensure easy retrieval of information. An index of press cuttings is a particularly valuable feature. The library is extensively used by outside organizations. Literature searches are carried out for members, and annotated bibliographies can be prepared on request.

The Institute, in its relatively short period of operation, has demonstrated the value of an international forum where the nuclear fuel industry can acquire information of value to its future planning, and develop a collective approach to the major and often very difficult issues of international trade in nuclear fuels – including security of supply, non-proliferation, energy policy, and environmental protection. The broad coverage of the membership, which now extends across the whole nuclear fuel cycle and which is drawn from fourteen countries, is of major assistance in adding weight to the views developed in the Institute's committees and conferences. The personal and professional understandings which emerge from discussions round the Institute's committee tables between producers and consumers cannot fail to be of significance for the future health of the industry. The wider the scope of the Institute's membership, the better it will be able to fulfil these functions.

Meeting the needs of developing countries

By Vice-Admiral Dr Carlos Castro Madero*

The development of nuclear energy in developing countries encounters many difficulties: some are due to the prevailing local conditions while others are caused by problems affecting the flow of trade between these countries and developed countries. The need is to restore a climate of confidence.

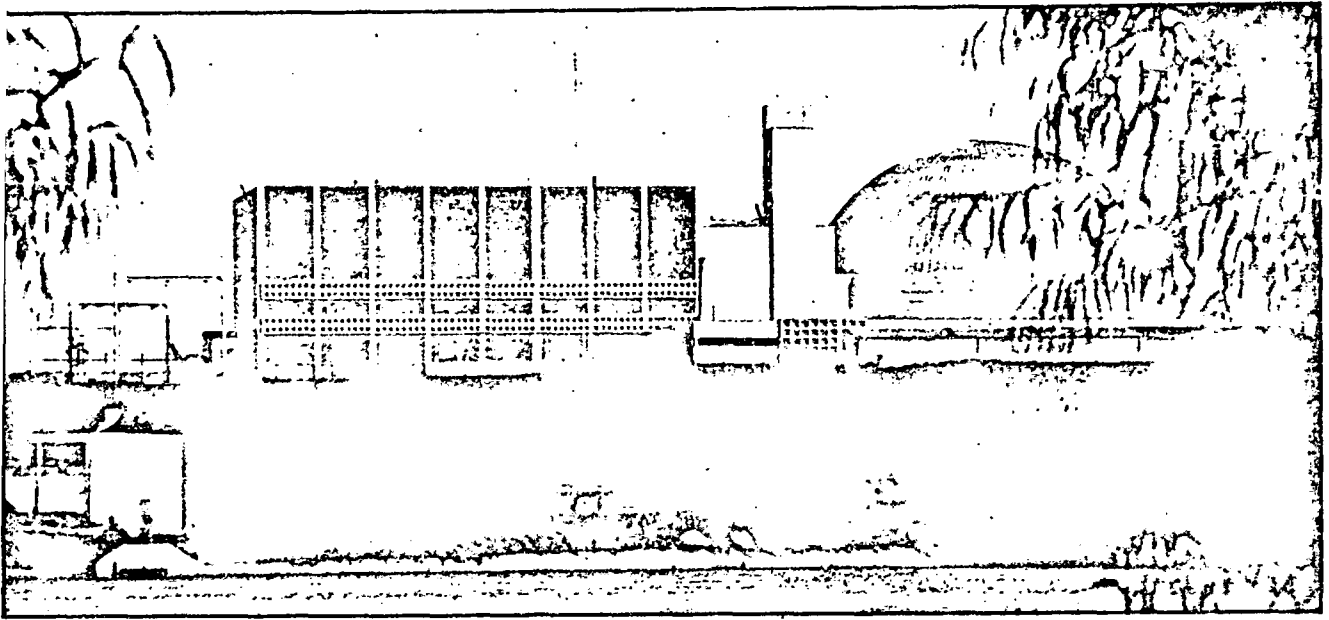
It is not necessary to emphasize that an adequate supply of energy is essential for the normal development of any country and that nuclear power is a safe and technically proven option which is economically competitive. These facts are only contested by interested or misinformed groups.

On the other hand, it is often said that the use of nuclear power by developing countries should be discouraged. Several reasons are given, among them that nuclear power is expensive, that it is too sophisticated for the industrial infrastructure and human resources of these

countries, and therefore that other non-conventional energy sources are a more convenient way for them to reduce their consumption of fossil fuel.

However, facts have proven otherwise. They unequivocally show that the most expensive energy for a country is missing energy. They also show that nuclear power is fully competitive, considering the unfortunate experience of countries which have stopped their development and even mortgaged their future to purchase the fuel required by their conventional power stations. Much has been said about other sources of energy, but none could stand as a solution in the short or medium term, and at most they

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The Atucha nuclear power station in Argentina has generated 15 955GW since it was commissioned in 1974

could only mitigate particular situations.

In spite of their diversity, probably most developing countries share the view that nuclear power is of vital importance at some stage for their technological development and hence for their future and security. For this reason, proposals to freeze the present world situation regarding nuclear power are perceived by those developing countries which are beginning to use this power as requests for a moratorium in their historical evolution. They feel that these requests are unjustified.

However, the needs of developing countries to be able to introduce successfully nuclear power vary largely in consonance with the widely differing situations in these countries. The concept of a standard developing country is unrealistic, as different developing countries live in different historical circumstances, have reached different stages of technological development, are endowed by different natural resources, and exhibit different drives and objectives.

Supplies from abroad. The nuclear power option of a developing country, which usually has a weak scientific and technological infrastructure, implies a range of supplies from abroad, as well as the need for a continuing assistance in all related areas. This dependence on outside suppliers can conceivably make the developing country very vulnerable to pressures. Dependence on outside suppliers is likely to continue for most developing countries, for a period of time according to their stage of development.

It is natural, therefore, that some developing countries are aiming at achieving independence in the nuclear

field, particularly in the fuel cycle, since nuclear fuel is the continuing requirement during the lifetime of the power stations. Additionally, a comprehensive nuclear development programme requires the achievement of a capacity for the design and construction of nuclear power stations, as well as the development of an industry capable of producing the essential supplies.

The more ambitious the nuclear development programme is, the more important it becomes for a developing country to obtain the pertinent technology. The relative proportion between imported and indigenous technology will vary according to particular conditions, but it is a fact that none of the developing countries has all the technical and human means to instrument at present a completely independent nuclear programme.

The special needs of developing countries, namely assured supplies and technology, should be seen in the perspective of their relatively small demand, which is usually less attractive for suppliers. They should also be seen in the light of the long time required for developing a significant use of nuclear power. The effort to develop the human resources needed to make and implement decisions in the nuclear field takes at least one decade. It also takes decades to explore and develop potential natural resources, or to build a nuclear research establishment and wait sufficiently for it to contribute to the country's development. Ten years may also elapse from the moment the

decision is made to introduce a nuclear power station in to the electricity grid, until it actually feeds the grid.

Good examples. Due to their special needs, the developing countries find co-operation in the nuclear field particularly appealing. By amalgamating their efforts, co-operating and giving mutual support, they can achieve the desired objectives. Many good examples of such co-operation exist. One is the co-operation between Argentina and Peru in the construction of a nuclear research establishment near Lima. Another example is the co-operation agreements between Argentina and Brazil, which include industrial and commercial aspects together with a complete exchange of information and experience.

Co-operation between developing countries can involve several possibilities: (a) exchange of experience, mainly having resulted from transfer of technology from developed countries; (b) complementary activities to reach the "critical mass" required to generate technology; (c) optimization of the use of human resources, and (d) adaptation of existing technology to the needs of the partners.

The need for supplies and technology underlines the great importance placed by developing countries on the assurance of nuclear supplies from developed countries. In this regard, it must be accepted that, no matter how well-meaning, unilateral decisions by supplier countries cannot govern international relations, if it is truly desired to maintain and strengthen such relations.

These unilateral decisions are normally explained by non-proliferation

reasons, but most of the time they are attempts to protect the political and economic interests of the nuclear suppliers. The result of such decisions has been to paralyse almost completely the international trade in this field. Only in a few cases has trade been accomplished, and this occurred when the legitimate position of those requesting the supplies were duly recognized and accepted.

Safeguards. I believe that the safeguards system of the IAEA is the adequate way for providing non-proliferation assurances. Technology and supplies transferred under safeguards generate a network of safeguards controls which increase in size and interconnections with the total volume of what has been supplied. All additional requirements, technological denials and conditions of prior consent, especially when introduced unilaterally, do not promote international co-operation and introduce an element of arbitrariness and of discrimination.

Moral principles shared by all should not be preached to protect the political and, in some cases, the economic interests of a few. As a result, the principles lose their value and mistrust and disbelief are generated among those who feel they are to be the discriminated victims of a moral fraud and materially damaged. It is not possible to discriminate and expect that the victim will accept the fact without making every effort in his power to free himself from discrimination. Under discriminatory conditions, the possibilities of international co-operation are nullified.

Assurance of non-proliferation and assurances of supply are clearly interconnected. It is unrealistic to expect that developing countries with substantial nuclear programmes will give a blank cheque regarding full scope safeguards without the corresponding blank cheque regarding the transfer of technology, equipment and services, being given by supplier countries.

Mutual confidence. Many unrealistic ideas have been proffered in relation to proliferation risks of nuclear power. The proliferation risks of nuclear power programmes were examined by Infce, an exercise born as an attempt to justify a strengthening of non-proliferation measures. Some of its pertinent conclusions confirmed what was already known:

- Horizontal nuclear proliferation cannot be prevented by technical means. Like vertical proliferation, it is only a political problem.

- No fuel cycle is more or less proliferating than other fuel cycles. They all involve some risk of utilization of tech-

nology, materials or facilities for non-peaceful purposes. This risk can only be controlled by political means.

- The development of a nuclear power programme is not the logical, economical or technical way to produce nuclear weapons. It has not been the way actually used by those at present possessing nuclear weapons.

Infce was a unique experience, the value of which is the international consensus reached about what was largely known. It is the fashion to talk about the post-Infce period, but I believe that the Infce experience finished definitely at the 1980 plenary conference in Vienna. Nevertheless, several valuable initiatives taken at the IAEA stem from Infce. Dealing in particular with the new committee on assurances of supply, it must be emphasized that for developing countries the word supplies includes not only raw materials and equipment, but also the technology required to be able to use nuclear energy for peaceful purposes. Developing countries, therefore,

are not likely to accept an arbitrary subdivision of the issue to satisfy the raw material needs of some large consumers. Several other subjects relating to international nuclear co-operation can be foreseen, and the IAEA appears to be the natural and adequate forum for their treatment.

This short review of the needs and views of developing countries cannot be completed without recognizing that the main issue in international nuclear relations at the present time is the need to restore a climate of mutual confidence. This issue, equally important for developed and developing countries, is indispensable to stimulate the presently stagnant flow of nuclear trade.

Access to technology, equipment and supplies required by nuclear power programmes, without other restriction than the rational application of the IAEA safeguards, and a broad bilateral and multilateral co-operation, is the best assurance that nuclear energy will only be used for peaceful purposes.

Sharing safety experience in OECD countries

By Klaus B. Stadie*

The early approach of the nuclear industry to safety matters is contrasted with the present scale of spending on nuclear safety research. The economic incentive for sharing limited resources is a powerful one, and the contribution of the Nuclear Energy Agency to international co-operation is described.

Today with nearly 200 power reactors in service in the OECD area, and member countries spending more than \$1 billion a year on nuclear safety and regulation, one looks back with fascination and some nostalgia at the expectations and concerns of our predecessors in the nuclear industry some 25 years ago when *Nuclear Engineering*[†] first appeared. It cannot be denied: one's overriding impression is one of disappointment at the way in which faith in technological advance and its benefits has vanished. How little remains of the early hopes of the pioneers – and of the public alike – for this abundant, cheap and safe source of energy! What has become of the bright, young scientists and engineers who were attracted by this promising and challenging technology, what hap-

pened to their enthusiasm and dedication?

The early days of nuclear power were typical of the beginnings of any novel technology, with designers giving full rein to their inventiveness. The early issues of *Nuclear Engineering* are full of descriptions of the many reactor systems dreamed up, developed or discarded in the fifties.

In those days of course the main issue was the commercial outlook for nuclear power. Physicist and engineer alike struggled with interest rates and generating costs in trying to demonstrate that nuclear power would soon be cheaper than the more conventional ways of generating power: no easy task with oil at less than \$2 a barrel.

Authors writing in *Nuclear Engineering* stressed over and over again that building demonstration plants was the only way realistically to compare the plethora of competing reactor systems and fathom their true commercial poten-

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[†] *Nuclear Engineering* became *Nuclear Engineering International* in November 1968