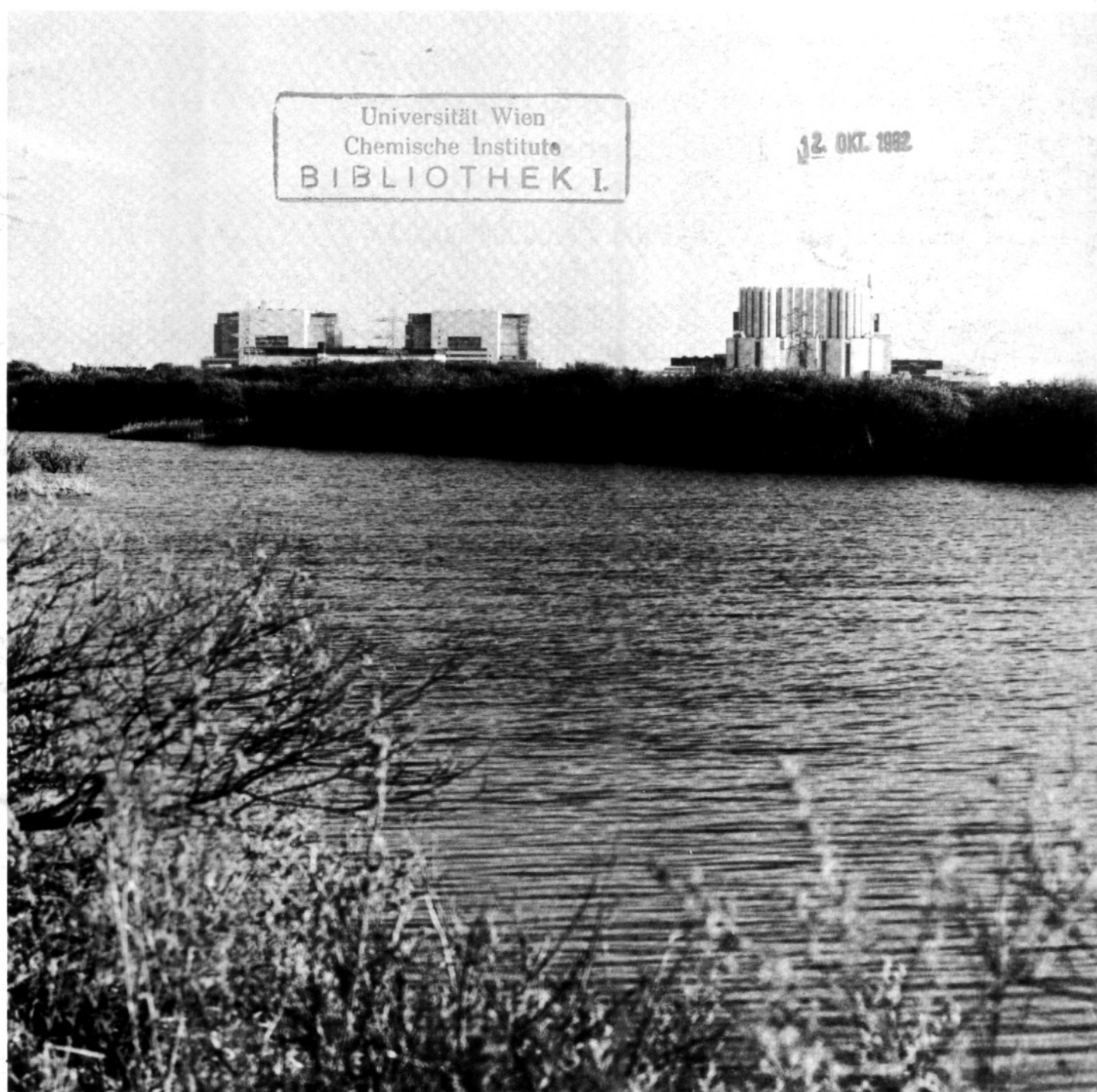


SEPTEMBER 1982 NUMBER 311

ATOM

ENERGY: BOON OR BIRTHRIGHT
RADIOACTIVE WASTE MANAGEMENT
REVIEWS



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THE MONTHLY INFORMATION BULLETIN OF THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY

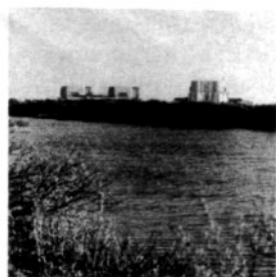
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Information on advertising in ATOM can be obtained from
D.A. Goodall Ltd., New Bridge Street House
30-34 New Bridge Street
London EC4V 6BJ
Telephone 01-236 7051/4

ISSN 0004-7015



Front cover: Past, present and future—the 550 MW Dungeness A Magnox station, to the left, and the 1 200 MW Dungeness B AGR station on the Kent coast, near Lydd. Dungeness B is expected to start producing electricity in this financial year, according to the annual report of the CEGB: page 194

ENERGY: BOON OR BIRTHRIGHT

"In the industrial world the problem is to convince the decision-makers and the public of the need to press ahead with nuclear power plant construction programmes at a time when there is an apparent glut of oil and surplus electrical generating capacity . . ."

Simon Rippon, European editor of Nuclear News, reports the eighth FORATOM congress, held in Lausanne in late June.

An impressive turnout of leading personalities from the European nuclear industry, together with a sizeable participation from North America, Japan and developing countries, found no new answers to the many problems confronting their industry but refused to be downhearted. It seems that most of the industrial organisations are making the most of construction projects still in the pipeline and the developing market of services to improve the performance of operating stations to tide them over the current recession. The hope is that the example being set by the French nuclear power programme will eventually demonstrate to political decision makers in other industrial countries that nuclear power is reliable and economically desirable even if load growth projections cannot demonstrate a pressing need. At the same time the industry is continuing to explore all possibilities for new markets in the developing world despite the many false hopes and set-backs that have been encountered.

Leon Schlumpf, of the Ministry of Energy for the host nation, Switzerland, presented an example of the sort of frustrations being encountered by the nuclear industry in many different parts of the world in his opening address to the Congress. He recalled that back in 1975 it was predicted that his country would have 8 000 MWe of nuclear generating capacity in operation by 1982, but in the event there were only four reactors operating with a total capacity of 2 000 MWe and one further project of 1 000 MWe in construction at Leibstadt due to start up in 1984. Under a new law, narrowly approved by a referendum in 1980, it is now necessary to establish a clear need for future additions in generating capacity before new projects can be authorised. This has been done—the government has accepted studies that indicate a need for a further unit of at least 700 MWe by 1990 and accordingly the Federal Council recommended in March the issue of a licence to proceed with the construction of the Kaiseraugst project. But the issue has to be debated in both houses of parliament; it faces ever more opposition from the citizens of the Basle area; and the necessary signatures have been collected by anti-nuclear forces to require a further referendum on an initiative calling for no further expansion of nuclear power after Leibstadt. It was not possible to find any Swiss delegate to the congress who was optimistic about the outcome of this domestic situation.

In much the same way, speakers from other countries presented persuasive arguments about the need to press ahead with further nuclear power plant construction both nationally and globally only to be followed by different tales of woe about intractable problems being encountered in getting actual projects under way.



"The plight of developing countries in the energy sector has so far failed to make much impression on the public at large . . ."

Picture Point

Looking for new markets

Invited speakers from South America, South East Asia and the Middle East represented an effort on the part of the organisers of the Foratom Congress to seek brighter prospects in new market places. But these prospects, while real, are not developing fast enough to be described as bright.

The plight of the developing countries in the energy sector has so far failed to make much impression on the public at large, according to Joachim Grawe of the Federal German Ministry for Economic Cooperation. He said, however, that the developing countries were hit just as hard as the industrial states by the explosion in the price of crude oil in the 1970s, in many cases harder. While their oil consumption is relatively modest in comparison with the industrial world, they are 75 per cent dependent on imports for energy requirements and, in 1980, the Third World expenditure on oil imports stood at some \$67 billion—three times as much as the official development aid from the West.

On a par with the oil crisis, in Grawe's view, is the "firewood crisis". In rural areas traditional fuels such as timber, dung and crop residues are still the main fuels, particularly for cooking, and they account for at least a quarter of the total primary energy consumption of the Third World. In Africa and South and South-East Asia firewood has now become scarce for over one billion people. In some places one member of the family is constantly occupied in collecting material for fuel while in others wood, which used to be a free commodity, now has to be bought. Quite apart from the burden this is putting on the poorest people, it is also resulting in large scale deforestation—100 years ago 60 per cent of India was covered with forest but today only some 10 per cent are left. Every year 10 or 20 million hectares of forest are lost to provide fuel or to gain agricultural land.

The well-known prerequisites of a suitably large grid system, financing and qualified personnel that are needed for

the introduction of nuclear power in developing countries were mentioned by Grawe, but he went on to give an interesting perspective on the arguments about the appropriateness of centralised and decentralised concepts of energy supply. He noted that there is a fundamental difference in the pattern of energy consumption in large cities and in rural areas. In urban centres of the Third World the specific energy consumption and consumption density approach those found in the industrial countries—that is between 2 and 5 kW per capita and 7 to 12 W per m². In rural areas the figures are one or two orders of magnitude lower. Thus, while there might be appropriate renewable energy systems for the rural areas, they are not suitable for the cities due to their low energy density—barely more than 1 W per m². But, like it or not, large cities are growing rapidly in the developing world. It is expected that by the year 2000, half the population of the developing countries will live in cities creating a need for high density centralised energy supplies such as nuclear power.

Concern that the current North-South imbalance in energy consumption is being extended to the use of nuclear power, was expressed by Adnan Mustafa, Assistant Secretary General of OPEC. He pointed out that the developed world, as well as accounting for 84 per cent of world oil and gas consumption, has 98 per cent of the world's nuclear energy electrical generating capacity. He suggested that more developing countries are determined to join the "nuclear club" to meet their need for a reliable and assured source of energy. After some criticism of the nuclear export policy of the US, Mustafa mentioned the possible role of an OPEC fund in providing important financial assistance to developing countries. With major priorities in the area of energy and food, this fund would provide help, "not on the small scale envisaged by the World Bank but by something much bigger", he said.

Mustafa suggested that any real breakthrough in the use of nuclear power will depend on successfully achieving four major tasks:

- Standardisation of nuclear technology which aims mainly at establishing an advanced type of light water reactor offering improved performance, safety and reliability; reduced inspection time and occupational exposure to radiation; and process heat.
- Commercialisation of all aspects of the nuclear power industry to allow smooth transfer of nuclear technology to the private sector, industrialization of the nuclear fuel cycle and industrialization of the fast breeder reactor.
- Enhancement of uranium exploration and production in the developing world.
- Development of a new practical and assured non-proliferation system, which could be based on the wide experience of the IAEA.

A paper by Juan Eibenschutz from Mexico on the "introduction of nuclear power in a semi-industrial country" might have been the highlight of the Congress. This was, however, prevented by an eve-of-meeting decision of the Mexican government to return unopened the bids for the first power station in their ambitious new programme due to prevailing financial problems. Eibenschutz still presented a business-like paper on the planning and introduction of a nuclear power programme such as that proposed by Mexico but in a subsequent discussion period he was unable to give any clear answers about the immediate prospects for the programme. He said that the intention to have some 20 GWe of nuclear capacity by the end of the century remained but financial problems, resulting mainly from the present situation in the oil market, prevented them from proceeding at this time with the ordering of the first units. He expected that the work would continue when the general economic situation had improved—"perhaps from where we left off or perhaps from a different perspective."

In Brazil a nuclear programme of similar proportions to that which was being proposed for Mexico has got underway. The multiplicity of collaboration ventures established with German industry to implement the construction of eight nuclear power plants and the supporting fuel cycle services, as described by Carlos Syllus of Nucleabras, is in many ways a model for other large developing countries. Syllus emphasised the long time scale involved in the planning of such a programme. It started in 1975 some 20 years ahead of the perceived end-of-century need for a significant nuclear contribution to Brazil's energy consumption. He did not, however, have any comment to make on the shorter term problems of escalating costs and slippage of the programme that has been widely reported elsewhere.

Another model for the developing world is being set by South Korea with a substantial programme of nuclear power plant construction aimed at reducing the country's 67 per cent dependence on imported fuel. The schedule of bringing nuclear units on line at roughly one per year for the rest of the decade seems to be well on line with few of the cost overruns and slippages that have been experienced elsewhere. There should be an installed capacity of 10 000 MWe by 1990 meeting 41 per cent of the country's electricity requirements. Nack Chung Sung of Korea Electric also described how, after the first two units, they had moved to non-turnkey ordering of plants with steadily increasing participation of the domestic industry.

Acceptance of need

In the industrial world the problem is to convince the decision makers and the public of the need to press ahead with nuclear power plant construction programmes at a time when there is an apparent glut of electrical generating capacity. The former French Prime Minister, Raymond Barre, who was responsible for much of the political decision making that kept the French nuclear programme going through the previous brief period of complacency before the second oil crisis of 1979, told the Foratom Congress how at that time he had warned the National Assembly that the oil crisis was not behind us but in front. The same is true today. He said that, in the absence of viable energy alternatives to oil, any return to economic growth would be cut off almost as soon as it started by the increase in oil prices that it would provoke. Energy policy should, he thought, be guided by three principles:

- The development of diversified sources of energy is a necessity for the restoration of economic and political stability in the world.
- Developing countries should have a right to an increasing share of world oil.
- It is the duty of the most developed countries to mobilise all potential sources of energy production to reduce as far as possible their imports of oil.

Barre said that these three principles had been followed in France since the first oil shock of 1973. This was confirmed by the latest statistics presented at a luncheon address by Gaston Rimareix, under-secretary to the Energy Minister in the present French Government and of very different political persuasion to Barre. He reported with satisfaction that so far this year nuclear power has provided 44 per cent of the country's electricity and the contribution is expected to pass the 50 per cent mark by the end of next year. By that time there will be 34 units of 900 MWe and 18 of 1 300 MWe in operation or under construction to meet a target of 58 GWe of capacity by 1990. This will supply 70 per cent of the country's electricity or 28 per cent of total energy consumption. At the same luncheon, Andre Giraud, who as head of the French Commissariat à l'Energie Atomique and then Minister of Industry was a major driving force behind the French nuclear power programme, was honoured with the Foratom award.

In attempting to analyse the continuing public concern about nuclear power, Jeanne Hersch, Honorary Professor of Philosophy at the University of Geneva, described what she called the "historical-futurist" myth which characterises much of the opposition argument to nuclear energy. This looks back with nostalgia to the good things of an earlier "simple" lifestyle and at the same time looks forward with great optimism to the results of research which promise an abundance of energy from new concepts. Much of this is attributable to the basic human emotions of envy and fear—a desire for a better life but fear of the technology that can provide it. The fear of nuclear energy is also associated with its scale—both the large amounts of capital expenditure and the large amount of power produced. Risk is perceived as being proportional to power and it is for this reason that it is not possible to disassociate public concerns about nuclear power from the picture of massive destruction caused by atomic weapons.

John Dunster, former Deputy Director General of the UK Health and Safety Executive and now Director of the NRPB, presented some interesting analyses of the comparative environmental aspects of different forms of electricity production, but while his figures of risk (set out in the table) clearly contradict many of the myths about nuclear energy, he had few illusions about their ability to influence the perception of the public. Such comparisons are of very little value unless they lead to decisions, but do we make decisions on the basis of best estimates or on the most serious consequences? On the best estimate, Dunster considered that none of the environmental consequences of the different sources of electrical energy was sufficiently serious to influence decisions and areas such as economics, strategic reserves and reliability of supply were more likely to be determining factors.

On the other hand it is possible to compare the most serious consequences with the same very small probability of actual occurrence. Thus there might be a chance of about one percent that the greenhouse effect from carbon dioxide emission is real in which case the consequences could be disastrous involving hundreds of thousands or even millions of deaths. There is a similar chance that sulphur dioxide emission does actually cause cancer in which case it could cause 100 000 deaths per year in a large population experiencing 10 million deaths from other causes. There is about the same chance that there will be one really serious nuclear accident somewhere in the world which could result in 10 000 deaths in a population of a million. On this degree of pessimism there will also be several dam failures and several major oil refinery accidents. If we do make decisions on the small chance of these worst consequences, Dunster concluded that we would not be making the optimum use of limited resources and we would let more people die from large numbers of lower consequence effects than are much more likely to happen.

For and against PRA

An evening workshop session of the Foratom Congress addressing the familiar question of "how safe is safe enough?" finished up as an interesting discussion on the value of probabilistic risk analysis (PRA) in safety assessment. Wolfgang Braun, Vice President of Germany's Kraftwerk Union, took a strong position against PRA while Roy Matthews, Director of Health and Safety of Britain's Central Electricity Generating Board, was in favour of its use. In fact, their positions were not diametrically opposed.

Braun, from a country where licensing is based on long lists of safety criteria, was arguing the case against inclusion of rigid probability goals within these criteria—"the licensing bodies would like it because they could leave everything to the computers", he said.

Matthews, coming on the other hand from a country where the licensing body sets only general guidelines and leaves the applicant to develop a safety case, maintained that the

inclusion of probability targets within these guidelines had already provided a good practical yardstick in developing the safety case for three recent projects. He insisted, however, that such targets are not mandatory—failure frequencies above the target can still be considered.

Pierre Tanguy, Director of France's Institute for Nuclear Protection and Safety (IPSN), said that eight years after the first Rasmussen report the techniques of PRA are now well proven but there remain two areas of uncertainty—the extreme accident conditions such as steam explosions and core disruption, and human factors that can transform minor incidents into major accidents. Nevertheless, he felt that numerical safety goals could be of great help in the nuclear controversy and mentioned in passing that French studies had indicated that risks from the fast breeder reactor were even less than those from present thermal reactors.

Accident risks per GWe installed in Britain		
	Number of deaths	Annual probability
PWR	10 to 100	up to 10^{-5}
	1 000 to 10 000	10^{-7} to 10^{-9}
Oil	1 500	10^{-5} to 10^{-6}
	18 000	10^{-6} to 10^{-7}
Coal	10 to 50	3×10^{-5}
	600	10^{-8}
Dam	10 to 2 000	10^{-3} to 10^{-4}

From the Japan Atomic Industrial Forum, Tasaburo Yamada noted that accident probabilities for present reactors are likely to be a good deal better than those considered by Rasmussen in WASH 1 400 and almost all light water reactors should now be able to pass the test of numerical safety goals currently being considered by the US Nuclear Regulatory Commission (NRC). But he expressed some concern about the NRC which he said "always goes its own way in relation to the rest of the world". He thought that they might have learned too much from TMI and had been suffering from the "Class 9 accident disease". But there were now some signs of recovery.

A further word on this subject was provided in the final summing up of the Foratom Congress presented by Sir Walter Marshall on the eve of his departure from the UK Atomic Energy Authority to take up the Chairmanship of the CEBG. He said: "The plain fact of the matter is that nuclear power is very, very safe indeed. We all know that but the public do not". There had, he thought, been a gross failure of communication between the scientific and technical society and the general public which is not scientific, not technical and in many cases not numerate. "There is no value in explaining to the public that the chance of a large accident in a nuclear reactor is only 10^{-6} . They do not understand that numerical number. It is no use explaining that the risks from nuclear power are much less than the risks they run from earthquakes or the bursting of dams. These analogies . . . merely fix in the public mind an association between nuclear power and vast disasters in which thousands of people are killed overnight". He was confident that we could find ways of communicating with the public using better analogies than these.

In conclusion Sir Walter returned to the conflict between the psychological problems to which nuclear power gives rise and the stark reality of the energy problems in the developing world. "What a tragedy it would be if the psychological problems, which mainly arise in the prosperous developed countries, were to destroy the future of millions of people in the developing countries who cannot afford the luxury of philosophical doubts but want only to have enough to eat and to live their lives in reasonable comfort: a boon which anti-nuclear protestors in the developed countries accept without question as their birthright". □

NIREX established

The British nuclear industry has established a new organisation, the Nuclear Industry Radioactive Waste Executive — NIREX — to coordinate its plans for the management and disposal of low and intermediate-level radioactive waste, it was announced on 22 July.

Control over the disposal of waste will continue to be exercised by authorising departments under the Radioactive Substances Act 1960.

The announcement was contained in a White Paper on radioactive waste management* reporting on action taken in response to recommendations contained in the Sixth Report of the Royal Commission on Environmental Pollution (Cmnd 6618), published in 1976†. (An earlier statement of the Government response to that report was published in 1977.)

NIREX has been set up by British Nuclear Fuels Ltd, the Central Electricity Generating Board, the South of Scotland Electricity Board and the UKAEA. Dr Lewis Roberts, a member of the UKAEA and Director of AERE Harwell, is chairman of the NIREX Directorate, and each of the partners will be represented at Board or senior management level. The work of NIREX will be carried out by a small unit based at Harwell and headed by Mr Maurice Ginniff. BNFL, the generating boards and the UKAEA will each contribute a third of the running costs of NIREX, the generating boards' share being split between them on an agreed basis.

NIREX will be responsible for the planning and development of new transport and disposal facilities where required for *intermediate and low-level* radioactive wastes arising in the UK. The industry will continue to co-operate with the appropriate regulatory authorities and Government Departments so that the most appropriate solution for each category of waste can be evolved within the overall strategy determined by the Environmental Departments. In particular, proposals for new storage and disposal facilities will be discussed at an early stage so that the radiological conditions likely to be associated with the operation will be acceptable to the regulatory authorities, including the Nuclear Installations Inspectorate.

From 1983 NIREX will be responsible for arranging the annual sea disposal operations and will review future operational requirements.

The new organisation will also examine sites considered potentially

suitable for the land burial of *low and intermediate level* wastes. Where new sites are required for disposal, NIREX will be responsible for all activities leading up to their acquisition and the construction and operation of repositories using sub-contractors from the private sector where appropriate. New facilities for radioactive waste storage treatment and/or disposal will continue to be subject not only to the normal statutory planning procedure but also to the licensing requirements of the Nuclear Installations Inspectorate. Particular new activities may be undertaken by NIREX or by one or other of its parent organisations if this is more appropriate.

Activities for NIREX will also include the collecting together of regular updated inventories for different categories of untreated and treated wastes arising in the UK, and consideration of the waste disposal options for each category. It will examine the standardisation of packages for the containment and transportation of treated wastes.

A general summary of work carried out by the industry and NIREX's plans will be provided regularly to the relevant Government Departments and to the Radioactive Waste Management Advisory Committee (which advises the Environment Secretaries of State). The summary will also be published.

Welcome

Mr Tom King, Minister for Local Government, said in a statement in the Commons that the Government attach the highest importance to the safe management of radioactive wastes. "As a result of research undertaken in this and other countries over the last five years, the Government is satisfied that all the wastes currently envisaged can be managed and disposed of in acceptable ways."

The main task, he said, was to identify the most appropriate method for each category of waste, and then to ensure its efficient implementation. In this, the Government would continue to be advised by the independent Radioactive Waste Management Advisory Committee, set up by the previous Government following the

recommendation of the Royal Commission.

Mr King said the Government believed that NIREX would be the most suitable form of organisation for the development and management of radioactive waste disposal facilities, as outlined earlier. "Its establishment in no way affects the clear responsibilities of the Secretary of State for the Environment, together with the Secretaries of State for Scotland and Wales," he said. "They are responsible for the overall strategy on waste management. In addition, in conjunction with the Minister of Agriculture, Fisheries and Food and the Nuclear Installations Inspectorate they retain the regulatory powers to ensure that the Executive maintain the necessary high standards."

Mr King added that the cost of waste management measures—expected to be about £65 million over the next ten years—must be met by the industry and be reflected in its accounting practices. The industry had confirmed to him that it fully accepted this. Secondly, there was a need to secure public confidence in the management of both existing radioactive wastes and those that would arise. "As [the] White Paper confirms, the Government attaches great importance to keeping the public properly informed, and will seek to ensure that this is done at all stages," he said.

Sir Denys Wilkinson, chairman of the Radioactive Waste Management Advisory Committee, also welcomed the setting up of NIREX which, he said, "fills the major need which RWMAC had identified in current waste management arrangements."

"There is not generally any technical advantage in storing intermediate level wastes prior to disposal, nor are there technical difficulties in providing appropriate land disposal facilities at an early date. The two types of facility which will probably be required are an engineered trench about 20-30 metres deep, and a modified mine or purpose-built cavity at a greater depth. Such facilities have already been constructed in France and Germany, and they were described and illustrated in RWMAC's Third Annual Report."

The first stage, said Sir Denys, was to designate the organisation to develop and run such facilities—NIREX. This would permit an immediate start on the task and rapid progress, with costs falling as they should on the producers of the wastes. NIREX would not be dealing with high-level heat-generating wastes, and it did not close the door on the creation in the longer term of a Nuclear Waste Disposal Corporation as envisaged in the Flowers Report.

"Although the operations of NIREX

*Radioactive Waste Management, Cmnd 8607, HMSO, £2.70.

†Royal Commission on Environmental Pollution, Sixth Report: Nuclear Power and the Environment. Cmnd 6618, 1976.

will of course be subject to stringent statutory safeguards, including provision for planning permission for the use of sites for disposal facilities, we felt that they should also be subjected to independent scrutiny," said Sir Denys. "We therefore welcome the intention that NIREX should submit periodic reports, covering both progress achieved and in due course plans for further facilities, and also that the advice of RWMAC will be sought on them. I am sure the Committee will respond fully and constructively to such requests, and make the substance of its advice generally available in its published reports."

White Paper

The White Paper sets out the Government's conclusion that there is no evidence of major scientific obstacles in the way of the safe management and disposal of all the wastes currently envisaged in the UK. As a result of research undertaken in this and other countries over the past five years, and taking into account the advice of the RWMAC, the Government considers that waste problems need not be a barrier to the further development of nuclear power as now foreseen. The main task would be to identify the most appropriate method available for each category of waste, and then to ensure that this method was implemented according to an agreed programme and in a way that meets the objectives for radiological protection. This will depend on securing public confidence in the management of both existing radioactive wastes and those that will arise in future.

The White Paper notes that public attention has in the past focused on heat-generating—high level—wastes resulting from the reprocessing of spent fuel and containing by far the largest part of the radioactivity with which they were concerned for waste management purposes. Such wastes had been safely stored in cooled stainless steel tanks at Sellafield for more than 25 years; the volumes involved were small—about 1 000m³ plus a smaller volume at lower concentration at Dounreay resulting from R&D on fast reactors. However, storage in solid form was more cost-effective in terms of the protection required, and such a form was also more suitable for eventual transport and disposal.

Work is going ahead on the design of a vitrification plant at Sellafield which is expected to come into operation in 1987. The resultant glass blocks within metal containers will be placed in a store of the kind already in use at Marcoule, France, and it is envisaged, the White Paper says, that they will be

Revised guide published

A revised guide to the administration of the Radioactive Substances Act 1960 was published on 23 July [this issue, *In Parliament*].

The purpose of the Guide* is to help the ordinary user of radioactive substances by explaining what the law is and how he can comply with it. It summarises the disposal methods which are appropriate to the various kinds of low-level wastes that such users produce.

The administration of the Act was reviewed by an Expert Group which reported in 1979, and the Radioactive Waste Management Advisory Committee has since endorsed the Group's conclusions about disposal methods. On the basis of the Group's report, the Guide now gives more detailed guidance about the methods of disposal, changes in organisation which have taken place since it was first published in 1963, and the change to SI units.

Announcing publication in the House of Commons, Mr Giles Shaw, Parliamentary Under-Secretary of State at the Department of the Environment, said the government were confident that current practices and standards were radiologically satisfactory and fully safeguarded the public, "but we shall also ensure that they continue to be reviewed from time to time in the light of new developments." □

stored for at least 50 years. "By the end of that period, heat generation and radiation will be much reduced because the shorter lived radionuclides will have decayed. This would greatly simplify disposal, although some heat will continue to be generated as a result of the remaining radionuclides. But (as RWMAC have emphasised) to say that there are technical advantages in deferring disposal is not to say that storage is a substitute for disposal.

"In leaving the decision on disposal to a future generation, we in the present generation have a clear moral duty to formulate the options as we see them at present, and to develop the supporting scientific and technical knowledge, so that they will be better placed than we are to make the eventual choice," the White Paper continues. "Moreover, it is desirable to ensure as far as possible that the vitrified blocks produced are compatible with the eventual management systems. This is to avoid the need for repackaging and other operations at a later stage which, as well as being expensive, would involve contamination and exposure to radiation. Financial provision is being made in advance for the future costs of waste management,

but it is important to gain sufficient knowledge to ensure that the scale of this has been correctly assessed."

The White Paper says the practical options for disposal are already clear in outline, and were identified by the Royal Commission: burial deep underground, or emplacement on or under the ocean bed. There has been extensive research in a number of countries into geological disposal, and its feasibility has been established in principle. The Department of the Environment will be publishing a comprehensive review of the relevant studies. The UK programme is now concentrating on checking the applicability of findings from other countries to UK conditions; and research into other disposal options is continuing to bring knowledge about them to the same level. At the same time, studies are being made to determine what would be the maximum safe lifetime (without major reconstruction) for various forms of store.

The White Paper says however that the major current gap in waste management is the lack of suitable disposal facilities for intermediate-level wastes, of the type now to fall within the responsibility of NIREX.

With the establishment of the new body, the overall organisation of waste management would have three elements: government, the nuclear industry and the generating boards, and the private sector. At the government level, the regulatory bodies would ensure, by general oversight and the use of their statutory powers, that high standards of waste management are maintained; that potential hazards are reduced to levels that are not only acceptable but as low as are reasonably achievable; and that the public are fully safeguarded, both now and for future generations. The implementation of the strategy would fall to the new executive, without derogating from the responsibilities of existing bodies in the industry: "the creation of the executive will enable the bodies in the industry to arrive at a common view and take common action, in particular through the promotion of schemes which will benefit more than one body. In this way it will provide a means of achieving at the practical level the objectives of the regulatory bodies in ensuring on a continuing basis safety and the protection of the environment."

The White Paper adds that the executive will be expected to use the private sector, wherever feasible, for the design of facilities and plant and for the actual disposal operations, subject to the full range of regulatory safeguards and whatever financial conditions might be appropriate. □

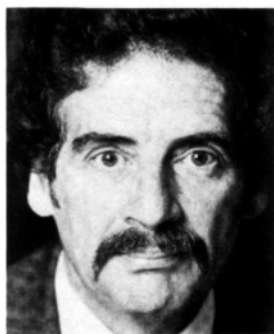
PWR safety issues to be resolved

Assessment work on the "safety case" for the CEBG's proposed Sizewell B PWR nuclear station is still at an early stage, and a number of safety issues remain to be resolved before the specific design can be accepted, the Nuclear Installations Inspectorate concluded in a report* published on 15 July.

The NII said however that the information so far available to them suggested that sufficient safeguards could be incorporated into the design to satisfy them that a nuclear site licence could be granted—in line with the NII's view expressed in its review of the generic safety issues of PWRs† published in 1977.

The report, published by the Health and Safety Executive, is intended primarily to assist the public inquiry into the project, which is to open on 11 January next year. It summarises the position reached by 1 April 1982 in the NII's assessment of the CEBG's Pre-Construction Safety Report (PCSR) for a PWR based on the Westinghouse SNUPPS design [ATOM 309, July 1982, pp 144-146]. The NII's review places particular emphasis on those matters of safety principle or of design intent which are thought likely to have significant effect on the main features of plant provision or layout, and need to be settled before the CEBG's existing licence for the Sizewell site can be varied to include a new station and consent given to start construction. The NII stressed that the assessment is part of a continuing process which began with the generic review and which, if approval is eventually given, will continue through design, construction, commissioning, operation and eventual decommissioning of the station.

In a foreword to the report Mr Ron Anthony, Chief Inspector of Nuclear Installations, noted that in deciding whether to recommend the issue of a licence for a nuclear installation the NII's aim is to be satisfied that the installation's siting, design, construction and operation will meet the NII's health and safety standards. "These standards



Mr Anthony

are stringent both for the protection of persons on the plant and for those outside who may be affected by an incident on the site. We are not concerned with the need for additional electricity generating capacity or how this is to be provided."

Mr Anthony recalled that following the NII's generic review they had concluded that, based on the information provided, there was no fundamental reason for regarding safety as an obstacle to the selection of a PWR for commercial electricity generation in the UK. "Though assessment of the specific design for Sizewell B as set out in the PCSR is at an early stage, the work which has been done so far . . . confirms the earlier conclusion. This means that no difficulty has so far been identified which needs to be regarded as insuperable. However, there are a number of safety issues remaining where more work needs to be done or more information needs to be provided to satisfy the Inspectorate that an acceptable design and safety case has been put forward and licensing and construction can be allowed to proceed. . . . They consist mainly of a number of matters on which we require further information and analysis but where we believe that this will show that the necessary standards can be achieved. There are also matters for which we believe some modification to the original proposed design intent may be needed before we can be satisfied and, finally, there are a few issues where the most appropriate solution has yet to be found.

"The Inspectorate's general conclusion is that a satisfactory design is achievable and can be developed so as to meet the safety objectives. Only when this has been achieved, and our concerns have been met, will our recommendation be made with regard to licensing. This conclusion has been endorsed by the [Health and Safety] Executive."

The outstanding issues are summarised in 27 main conclusions at the

end of the 88 page report. Generally, the Inspectorate's assessment of the PCSR to date "suggests that, while there are still concerns outstanding, a substantial number are now judged to be satisfied, or should be capable of being satisfied, mainly by provision of further information and argument in support of the CEBG's case. The Inspectorate is satisfied with the progress being made with these issues and they should not be a bar to licensing although, as has been indicated, a position acceptable to the Inspectorate will have to be reached before a decision on licensing is made."

The report says however that there are some important areas remaining where the position is not yet satisfactory:

- hazards presented by fire, aircraft crash and earthquakes, where an improved case needs to be made or design changes may be required;
- fuel clad ballooning, where an acceptable strategy for developing a safety case had been presented but the case was awaited. If this did not prove to be acceptable then an alternative case, possibly based on changes to the fuel design or to the mode of operation of the reactor, would need to be made;
- the Inspectorate still had reservations about the case made for steam generator tube integrity and the effect of multiple tube failures in fault conditions. Some development work or design changes might be necessary;
- the reactor protection system, including the integrated protection system (based on microprocessor technology), where further justification of the proposed design was necessary and more time would be needed to develop the case;
- and safety analysis assessment, which would require more time and more information and where the Inspectorate had concerns which required attention, such as the validation of computer codes and the adequacy of protection against the full range of faults in anticipated transients without trip (ATWT).

In addition, the case for severe accidents was to be made as a separate submission, which had not yet been received.

The report notes that in considering the NII's views and the conclusions reached it should be borne in mind that the pre-licensing procedure involves a dialogue between the licence applicant and the Inspectorate which, in the normal course of events, would extend

*Sizewell B: A review by HM Nuclear Installations Inspectorate of the Pre-Construction Safety Report, HMSO or booksellers, price £5.50 plus postage. ISBN 0 11 883652 8.

†PWR: A report by the Health and Safety Executive to the Secretary of State for Energy on a review of the generic safety issues of pressurised water reactors, HMSO or booksellers, price £4.50 plus postage. ISBN 0 11 883653 6.

over some two or more years. This process had been temporarily suspended at an early stage in the NII's assessment work so as to provide a review of the position for the public inquiry.

Both during and since preparation of the report the process had taken place, and it would continue with further development and improvements of the design and the safety case as a result of both internal appraisal and re-appraisal by the industry and the CEBG, and discussion with the NII of the case presented and the safety issues.

At a press conference to introduce the report Mr Anthony stressed that the NII was no part of the nuclear "establishment", as some objectors to the CEBG's proposals claimed. The objectors were also seeking public funding to support their participation in the Sizewell inquiry; Mr Anthony suggested that in many senses the NII might be seen to be "on their side", devoting a great deal of their interests in terms of costs and resources. The report now published had cost some £200 000 to produce, some £3½ million had already been spent on work on the

PWR and another £3½ million on other aspects, and the NII was currently spending about £2 million a year including outside consultancies.

CEGB response

The CEBG in a statement said the review now published was "a snapshot at an early stage of a long procedure of safety assessment which starts at the design stage and continues throughout the operating life of the reactor."

"The licensing process in the UK places full responsibility on the CEBG for the safety of its nuclear stations," the statement continued. "For a new station, it requires the CEBG to provide a comprehensive case demonstrating that the plant meets safety objectives and satisfies the NII before licence approval for construction is given."

"The PCSR presents the basic safety case. Further information is made available in the period up to and during construction and commissioning phases, which is taken into account by the NII before giving approval for fuel loading, raising of power, and opera-

tion. In this process, which covers a period of years, there is continuing dialogue between the CEBG and NII. The safety concerns identified by the NII are resolved by providing further explanation, detailed information or analyses, or in some cases by making design modifications. The NII Review well illustrates this procedure, which is one of the reasons for the excellent safety record of British nuclear power stations over the past 20 years."

The CEBG said the five important issues identified by the NII had already been identified by the CEBG in its assessment, and had referred to them in its Statement of Case. "The Board has and will continue to provide further information to substantiate the safety case in these areas before the public inquiry begins. Other points also call for submission of further clarifying or supporting information by the CEBG. Many of these are expected to be resolved before the inquiry commences. The CEBG is confident that those remaining will be resolved on a timely basis and this will lead to the necessary licence being issued." □

ELECTRICITY COUNCIL, CEBG REPORTS

Nuclear contribution rises

Output from nuclear stations operated by the Central Electricity Generating Board rose by 3 per cent in 1981-82 compared with the previous year, Mr Fred Bonner, CBE, deputy chairman of the CEBG, told a press conference on publication of the Electricity Council and CEBG annual reports on 29 July.

Mr Bonner said the Board expected to increase their production of nuclear electricity still further in 1982-83. Magnox reactors which had been out of service for prolonged inspection were being returned to service, and three more AGR stations—Dungeness B, Hartlepool and Heysham I—would begin to produce electricity.

The CEBG's annual report includes a summary of the Board's reasons for wishing to build the proposed Sizewell B PWR station. "As we see it, there is no reason why the Sizewell B public inquiry should reject the PWR," said Mr Bonner. "There are no fundamental differences in safety between the PWR and the AGR because the same criteria are applied to both reactors. There are clearly many technical differences between the two systems, but both are proven designs for the safe generation of electricity."

The Board's annual report this year includes as an appendix a statement on the Board's plans for dealing with its nuclear stations when they reach the



Heysham Stage I: on line in this financial year

end of their useful lives. The Board continues to provide for the eventual full costs of decommissioning its nuclear stations, charging £55 million for this purpose against revenue in 1981-82.

Mr Bonner noted that the Board had not this year included an appendix on comparative generation costs at the

Board's nuclear, coal-fired and oil-fired stations. However, later in the year the Board would be publishing a self-contained document dealing comprehensively with this subject which "we hope . . . will clear up any misunderstandings that may have arisen on the interpretation of these cost figures in the past."



Scientists from AEE Winfrith in the course of testing in-pile nucleonics at Dungeness B

Depressed economy

The annual report of the Electricity Council shows that the electricity supply industry in England and Wales made a current cost accounting (CCA) operating profit of £475 million during the financial year ended 31 March 1982. After charging interest, however, the industry made a CCA loss of £80 million, compared with the previous year's loss of £272 million.

Total sales of electricity, at 196 200 million units (kWh) were only 0.1 per cent down in the year reviewed, despite the continuing economic recession and a fall of 1.7 per cent in sales of electricity to industry. However, domestic sales increased by 0.2 per cent and commercial sales grew by 2.9 per cent, despite little change in the overall level of economic activity.

The CEBG's annual report shows that because of improved operational performance and higher productivity its trading profit rose from £190 million to £296 million for the year, exceeding the Board's financial target (a 1.7 per cent net return on average net assets excluding work in progress, as against the target of 1.3 per cent). After the payment of interest the Board made a loss as planned, since to cover interest payments in full would have pushed electricity prices beyond an economic level. The CCA accounting loss was £167 million for the year, compared with a loss of £281 million in the previous year.

The Board brought 2 312 MW of new generating plant into service

during the year. The latest construction projects, Heysham II nuclear station and the completion of the Drax coal-fired station, proceeded within programme and budget, and further progress was made on the three AGR stations nearing completion.

The report notes that in the light of a re-appraisal of UK economic prospects for the 1980s the Electricity Council had adopted substantially lower load estimates for 1988-89, the planning year for new plant commissioning, than those adopted a year earlier. The Board decommissioned 3 832 MW of generating plant in 1981-82, the largest programme yet, and a further 2 900 MW of plant is scheduled for closure in October this year. At 31 March 1982 the number of power stations was 108, compared with 183 ten years earlier.

The report refers to new arrangements for load management and hence assistance to electricity-intensive industries through the Bulk Supply Tariff. "Beyond such measures the Board sees no scope for significantly reducing the price of electricity—either by tariff adjustments or by any other means—while the price of fuel, its primary input, continues to rise. In this context fuel means chiefly coal, National Coal Board coal, which provides the bulk of electricity supplies." The report recalls that in past years the CEBG deliberately sited a number of its largest stations in the lowest production cost coalfields, but the Board's intentions had been frustrated by the NCB's pricing policy, which had been to

reduce the differentials between various production areas. An overhaul of the coal pricing structure, relating prices to the cost of production, was now urgently needed.

● The CEBG's report was presented by Mr Bonner as Sir Walter Marshall, the new chairman, took up his appointment only on 1 July. During the year reviewed the chairman was Mr Glyn England, whose term of office expired on 8 May. □

The Electricity Council's Annual Report is available from the Council, 30 Millbank, London SW1P 4RD. The statement of accounts and statistics is available through HMSO, price £2.25. The CEBG Annual Report and Accounts are available from the CEBG at Sudbury House, 15 Newgate Street, London EC1A 7AU, price £2.00. A leaflet on decommissioning is available free of charge from the same address.

UKAEA re-appointment

Mr Nigel Lawson, Secretary of State for Energy, has re-appointed Mr Fred Bonner, CBE, as a part-time member of the United Kingdom Atomic Energy Authority from 1 July until 15 April 1984.

Mr Bonner became a part-time member of the UKAEA in July 1977. He joined the CEBG in 1958 and was appointed chief financial officer in 1965. He has been deputy chairman of the CEBG since April 1975, and a full-time member of that Board since 1969. □



Nuclear issues

Nuclear power in perspective, by Eric Addinall and Henry Ellington; 214pp, indexed; Kogan Page, London, and Nichols Publishing Co., New York; £10.95. ISBN 0 85038 510 5 (UK) and 0 89398 110 3 (US).

World energy needs and resources, by Peter Hodgson. Grove Booklet on Ethics No. 44, 24pp; Grove Books, Bramcote, Notts; 70p. ISBN 0 907536 12 3.

Nuclear issues: International control and international cooperation, by D.A.V. Fischer; 126pp; limited edition published by the Department of International Relations, The Australian National University, Canberra as Canberra Studies in World Affairs, No. 5. ISBN 0 86784 049 8.

Three seemingly disparate titles; I group them here because their authors are equally concerned to review arguments and to urge reasoned conclusions.

Addinall and Ellington are senior lecturers at Robert Gordon's Institute of Technology, Aberdeen, and their experience as teachers shows. They have an evident distaste for the disputations of "highly polarized pro- and anti-factions . . . each almost incapable of listening to, let alone appreciating, the other's point of view", though they are themselves persuaded that the lives of their children "will almost certainly be cleaner, healthier and more prosperous as a result of nuclear power".

This book is in four parts. In the first the authors discuss factually the nature of nuclear power; in the second, why it is needed as a component of energy supply. Here, they acknowledge that the only safe conclusion that can be drawn from any technological forecast is that the further it looks ahead the more likely it is that it will be wrong, but they conclude that in Britain and the US (the only two countries whose energy future they examine in detail) significant amounts of nuclear power

will be needed in coming decades. In part three the authors argue that a mixed thermal and fast reactor programme could sustain the industrialised nations of the western world at least until the potential of fusion has been evaluated thoroughly or the various alternative technologies have proved themselves to be practicable substitutes for present sources of energy.

In the fourth part of the book the authors discuss social and environmental considerations. They set out to look at both sides of the argument and conclude that "on the basis of the available evidence we ourselves are fairly satisfied that, *provided the agreed regulations and procedures are rigidly adhered to* (their italics), nuclear workers are not put at special risk"; "we are satisfied that there is no real cause for public concern" with respect to hazards presented to the general public; and on the vexed questions of civil liberties and the risks of nuclear weapons proliferation they conclude first that there is no case for the industry to answer, and secondly that provided the spread of nuclear power is subject to responsible international control the risks of proliferation could be kept to a minimum.

To my mind, this fourth part of the book—essential if it was to reach any perspective—could have been longer: at the expense if need be of the earlier parts. There is a useful, if brief, bibliography, and the book as a whole will serve as a good introduction for the layman.

Needs and resources

Peter Hodgson's pamphlet aims to be no more than a snapshot of the world energy scene concluding with a discus-

sion of "the Christian response". He is head of the Nuclear Physics Theoretical Group of the Nuclear Physics Laboratory at Oxford, and is working on another book dealing with the "energy crisis" with special reference to nuclear power; this pamphlet might therefore be taken in part as a potted version of the longer work. He argues from considerations of resource limitation, concluding that "sooner or later the world will experience a severe energy crisis, and this will increase the danger of nuclear war"; resources of both coal and uranium are enough to last for hundreds of years; we cannot hope for a risk-free power source, so our increased power needs must come from a combination of these two, coupled perhaps with conservation. The concluding discussion of the Christian response amounts to a plea for responsible stewardship: familiar, nevertheless compelling.

Proliferation

Hodgson reminds us that "an axe can be used to cut down a tree or to split a skull". David Fischer, formerly Assistant Director General for External Relations at the International Atomic Energy Agency in Vienna, addresses directly the overwhelming need to prevent the spread of nuclear weapons. The book derives from two seminars he gave at the Australian National University in April last year, updated to take account of some recent developments—notably, the bombing of the Iraqi research centre at Tuwaitha in June 1981.

Fischer suggests that attempts to restrain the spread of sensitive



The new headquarters of the IAEA and other UN agencies in Vienna: nerve centre of world efforts to restrict nuclear weapons proliferation

technologies cannot succeed in the long run; the Treaty on the Non-Proliferation of Nuclear Weapons (the NPT) and IAEA safeguards against diversion of nuclear materials "probably represent the most that can be done at the present time by international safeguards systems to deter the spread of nuclear weapons", though "the universal application of 'full-scope' (comprehensive) safeguards should remain the chief objective".

He argues that the fact that a particular country has accepted NPT and full-scope safeguards should not automatically suspend political assessment of the wisdom of exporting certain types of nuclear plant or technology, irrespective of the politics of the region and the circumstances of the country. Self-imposed or mutually agreed restraint in relation to exports to politically volatile regions is still a valid, though limited, option; it could not be effective for more than a couple of decades, but it might give time to find solutions to the underlying political or security problems which provide the incentive to get hold of nuclear weapons, or of the means to make them.

It is a pity that this book has been produced only in a limited edition. Although Fischer writes solely as an individual (without committing the IAEA) he is a thoroughly well-informed commentator; and his logic is impeccable. If proliferation feeds upon itself, he says, the converse is also true: a non-nuclear-weapon state that ratifies the NPT is obviously contributing to the confidence of its neighbours or potential adversaries and reducing, in turn, their incentive to acquire nuclear weapons. That said, "it has become almost impossible to believe that we shall ever again have a world free of nuclear weapons, that we shall return to a state of innocence. . . . As Goldschmidt has said, as long as there are sovereign states able to go to war with one another no system can effectively prevent them from using for military purposes the resources of science and technology, nuclear and non-nuclear, if they believe that their existence or liberty depends on such use. History suggests that H.G. Wells may be nearer the mark than the fine biblical words on the walls of the United Nations Plaza about beating swords into ploughshares and making war no more. When he heard of Hiroshima, Wells is reported to have said: 'At last, the idiot child has got hold of the box of matches'." Chilling words; but they reinforce Fischer's thesis that international cooperation is today essential.

J. Daghish

Nuclear "to be preferred" for base-load generation

There are economic reasons in most OECD countries for preferring nuclear power for electricity generation when new electrical base-load capacity is installed, the OECD Nuclear Energy Agency and the International Energy Agency conclude in a new study*.

The agencies say nuclear power is "invariably much less costly than oil and in many situations is considerably cheaper than coal as a means of producing electricity. Although analysis of safety and environmental effects are uncertain they generally favour nuclear power plants and their associated fuel cycle activities over plants using fossil fuels."

In spite of the technical and economic arguments, however, the perceived lack of public acceptance "often appears as the major constraint on the near-term development of nuclear power," the study says. ". . . The public's confidence is particularly influenced by the issues of reactor safety and of spent fuel and high level radioactive waste management. In particular, nuclear power often elicits public fears of accidents involving substantial radiation release. The fact that experts assess the probability of such accidents to be extremely low given the high standard of safety designed into reactors, and that the effect on the environment of most accidents is likely to be small, is often insufficient to allay these fears."

"In order to ease these concerns, continuing efforts need to be made to ensure the safe operation of existing and planned reactors, and to reduce the risk of further incidents. Similarly, even though there is no urgency from the technical or economic point of view, the availability and adequacy of technologies for the disposal of high level wastes should be demonstrated promptly by member governments, and solutions should be fully supported by appropriate international cooperation, in order to reduce public and political concerns about radioactive waste management."

Forecasts

The study notes that installed nuclear capacity in OECD countries had risen to more than 130 GWe at the end of 1981. "While this is a considerable achievement, and reflects an increase in the nuclear share of electricity generation from a little over 1 per cent [in 1970] to about 12 per cent, it is less than half the installed capacity expected by energy planners around ten years ago.

Only part of the reduction can be explained by lower energy growth.

"Furthermore, despite the consequences of the 1973-74 OPEC oil embargo and two subsequent Persian Gulf oil supply disruptions that have stimulated public and governmental interest to reduce oil consumption by conservation and greater development and utilisation of alternative energy resources, the prospects for nuclear development over the next twenty years are extremely uncertain and, without further policy action, may continue to slip significantly, thereby increasing pressure on other fuel sources and particularly on oil imports."

Unless the rate of installation and licensing of nuclear reactors is improved in the near term, national estimates of installed nuclear capacity by 1990 are unlikely to be achieved, and the outcome for the year 2000 will most probably be toward the lower end of the range, the study says. This would have a serious impact on the overall energy situation of OECD countries, particularly in the 1990s.

The study concludes that future electricity demand (which will be influenced by renewed economic growth and electrification and also by increased efficiency of energy use) together with the accelerated replacement of existing oil-fired generating plants "will have to be met by greater nuclear and coal capacity." The share of electricity produced by oil-fired plant could decline from about 15 per cent to a little over 2 per cent by 2000, while that of nuclear could rise from about 12 per cent to almost 30 per cent.

"Such development, which assumes only the technical minimum of oil generation by the year 2000, would reduce future pressures on oil supply and oil prices. Failure to increase the contribution of nuclear power, particularly during the 1990s, would put greater pressure on other parts of the energy system of OECD countries and increase the risks of reduced oil market flexibility. . . . The risk exists . . . that a nuclear shortfall would be at least partly compensated by a higher oil use either in the form of electricity or direct use, or by lower energy supply and economic growth. Either alternative would have negative implications for the economics of OECD countries."

The study says the uranium resource base, levels of enrichment and fuel fabrication capacity, as well as the capacity of the reactor manufacturing and construction industry, are more

than adequate to meet requirements well into the future. "In fact, there are no technical reasons why nuclear power could not grow much more rapidly than presently forecast if renewed economic growth, continued electrification and penetration of nuclear into non-electric (e.g. process heat) set the necessary parameters.

"However, the prolonged stagnation of most national nuclear programmes could endanger the viability of the nuclear industry and so limit its ability to meet future requirements."

The study concludes that in those countries where licensing and regulatory processes are effectively open-ended "steps should be taken to

limit the time and reduce the uncertainty of such processes. At the same time safety standards must be maintained and public confidence reassured. Such rationalisation of the licensing and regulatory processes has already been carried out in some countries with economic benefits and no lessening of high safety standards. The removal of regulatory uncertainties is essential to the future implementation of nuclear power through restoring utility confidence."

*The 129pp, bilingual (English/French) report, *Nuclear Energy Prospects to 2000*, is available from OECD publications offices and sales agents including HMSO: ISBN 92 64 023 26 7.

resulted in a depression in the price of uranium. If these continue and demand remains slack, it is to be feared that mines will close and exploration will be cut back. This will lead to a loss of resources due to the prohibitive cost of re-opening mines. The significance of this is magnified by the lengthy lead times involved in the discovery and development of new deposits. Uranium exporting countries require long-term assurances of demand in order to develop their uranium industries in a stable and timely manner."

The report says public perception of the benefits and acceptability of nuclear power is influenced in most member countries by spent fuel and radioactive waste management issues. In some countries—the Fed. Rep. of Germany, Sweden and Switzerland for example—the authorisation of new plants has been linked to the requirement that satisfactory solutions for spent fuel management and waste disposal be demonstrated. Intensive national and international efforts are currently under way to apply in practice the various solutions which have already been developed, either conceptually or at the pilot scale. Typical deep underground repositories for various types of geological formations have been defined, and have been used to evaluate the safety of this mode of disposal. However, the report adds, "despite the progress being made in the technical areas the perceived lack of public acceptance often constitutes a major constraint to the near-term development of nuclear power."

NEA activities highlighted in the report include the publication of two major reports, on *Uranium resources, production and demand* and on *Nuclear fuel cycle requirements to the year 2025*; a scientific programme to increase knowledge of the possible effects of the disposal of low-level radioactive waste in the marine environment; the completion of a reactor Incident Reporting System for rapid information exchange among operators; adoption by the NEA and three other international organisations of Revised Radiation Protection Standards, intended to serve as a basis for legislative and regulatory developments in member countries; and the completion of an international project for testing the preservation of food by irradiation (a joint FAO/IAEA/WHO Expert Committee was able to recommend the unconditional acceptability of irradiation as a food preservation process).

The 60-page report is available free of charge from OECD Publications offices including HMSO; or from the NEA at 38 Boulevard Suchet, 75016 Paris Cedex 16.

NEA ACTIVITY REPORT

Nuclear share rises slowly

The nuclear option for electricity generation is often not being chosen even when there are good economic and technical reasons for doing so, the OECD Nuclear Energy Agency says in its tenth annual Activity Report.

The report, published in July and covering 1981, says growing recognition of the economic benefits of nuclear power and the lack of "resource constraints" on its growth could be the basis for a greatly expanded nuclear electricity generating programme in OECD countries. Electricity from existing and projected nuclear plants in general is much less expensive than that from fossil-fuelled plants—between 33 and 66 per cent of the cost of electricity produced from oil, and between 50 and 80 per cent of that from hard coal.

"However, in spite of changing attitudes towards nuclear power and its fuel cycle, both at decision-making level and among the public, the future trends of nuclear growth are projected to be much less than previously expected," the NEA acknowledges. "Installed nuclear capacity in OECD countries has risen from a little over 17 GWe in 1970 to some 134 GWe in 1981. This is an increase in the nuclear share of electricity from a little over 1 per cent to around 13 per cent in that period. Projections for the next 20 years now indicate levels of installed nuclear capacity between 450 and 680 GWe, with a figure of about 500 GWe being commonly used, corresponding to some 20 per cent of the total installed generating capacity in 2000. The figure of 500 GWe is a quarter of what was predicted as recently as five years ago."

The report says that although the technical and economic incentives toward renewed nuclear power growth are generally recognised several factors



Ore crushing in progress at a uranium mine: if imbalances in uranium supply and demand continue "it is to be feared that mines will close . . . This will lead to a loss of resources" RTZ

are "exercising constraining influences on its further deployment". Safety, siting, radioactive waste management, protection of the environment and public health considerations are technical areas of concern which require continuous attention; these have significant psychological and political influence, depending on the perception of the risks associated with nuclear activities.

The report notes that following earlier forecasts of high nuclear power growth, industry geared up to high capacity for the production of both fuel and reactors with the result that there is a large over-capacity in most areas of the fuel cycle. "Unless there are firm near-term commitments, the resources of the industry will be under-used and will be dispersed," the report says. "This problem also arises in connection with uranium mining. The imbalances in uranium supply and demand have

ENS statement

The European Nuclear Society is "convinced that the controlled disposal of suitable radioactive wastes [by disposal in the North Atlantic] can be continued with a negligible impact on marine life or on human health."

The ENS reaches this conclusion in a public policy statement published in the June issue of *Nuclear Europe*, the Society journal. The statement notes that a number of European countries including the UK organise an annual operation for the disposal of solid radioactive wastes on a suitable site in the north-east Atlantic. "The protection of the marine environment is ensured through adherence to all provisions, guidelines and controls established by the environmental protection agencies of the countries involved" and by three levels of international agreements.

The acceptability of deep-sea disposal of radioactive wastes rests on simple, but important considerations, says the ENS:

- the wastes are packaged in heavy containers so that they reach the ocean floor intact and the release of

radioactivity thereafter is minimised;

- since a slow release of radioactivity will sooner or later take place, the safety and environmental impact of sea disposal *assumes* that the contained radioactive products will be released much more rapidly. Even in the least favourable case, current guidelines promulgated by the IAEA warrant that no damage to the environment or to human health will ever result from the sea disposal of lower level radioactive wastes. These considerations, together with the proper selection of a disposal site, form the basis of the ENS conviction that radioactive wastes can be safely disposed of at sea, the statement says.

The statement also notes that the oceans contain an enormous amount of natural radioactivity—a total of about 50 billion curies, including more than a billion curies of radium, an element more toxic than plutonium. "The additional radioactivity introduced by the sea disposal of wastes is so small that it would be impossible to measure directly any concentration in

potential food chains leading back to man. One must therefore rely on calculations which show conclusively that the practice is safe.

"In late 1979 a group of experts convened in Paris to review the available information about the north-east Atlantic disposal site now used. This group included physicists, marine ecologists and engineers from governmental offices (health, environment, fisheries) of most OECD countries. They concluded:

- that the site complies with the requirements of international conventions and recommendations;
- that the irradiation hazards for the most exposed critical group (fishermen consuming fish from the site vicinity) are at least a thousand times below the limits of the International Commission on Radiological Protection; and
- that the site is suitable for further use in disposing of radioactive wastes at the current annual rate, but that the scientific and technical investigations should nevertheless be actively pursued."



Amersham International reports

Amersham International plc expects another year of growth in 1982-83, the company chairman, Sir John Hill, said in his introduction to the group's annual report published in July.

In the year to 31 March 1982 net profit before tax increased by £4.4 million to £8.5 million, exceeding by £200 000 the forecast made in the offer for sale made to shareholders earlier in the year. With 83 per cent of sales arising from overseas trading, the weakening of sterling which took place during the year reviewed augmented the substantial improvement over the previous year which had been anticipated. Profit attributable to the shareholders was £5.7 million; and the final dividend of 2.1 pence per ordinary share recommended by the directors brought the total for the year to 3.5 pence per share—the same as that forecast at the time of the offer for sale.

Sir John said that in the past year further reviews of the group's objectives had been carried out, resulting in a redefinition of the strategies to be followed in exploiting and developing their resources and intensifying their drive for markets in America, Europe and Japan. Planning for the future development of the business had proceeded with thoroughness and with



Amersham International's new laboratories at Whitchurch, Cardiff

careful selection of the opportunities to be pursued. Recent achievements had been substantial, and the prospect of using these opportunities to create new business worldwide was challenging.

Sir John noted that manufacture had continued to be carried out predominantly in the UK. The new plant at Forest Farm, Cardiff had been opened officially by the Secretary of State for Wales in May 1981; its performance had been excellent and it was meeting in full measure the purpose for which it was built. The transfer of work to Cardiff had released space on the Amersham site for product development work, thus enabling it to make an increasingly important contribution in this vital field.

Sir John said that although there were uncertainties in the international scene, both economic and political, "their presence need do no more than add caution to the confidence which the board feels about the future. It is expected that 1982-83 will be another year of growth of the business and the profitability of its operations. The foundations for progress have been soundly laid and the upward trend of sales is well supported by the resources which have been marshalled behind the group's product development and marketing. The task of converting our extensive technological skills into new business worldwide presents a major challenge but offers the equivalent potential rewards."



Renewables face the challenge

The UK Government believes that it has a renewable energy programme that faces up to the challenge of the future, Mr David Mellor, Parliamentary Under-Secretary of State for Energy, told the Parliamentary Liaison Group for Alternative Energy Strategies in London on 29 June.

Mr Mellor said the inescapable truth of the energy situation in Britain was that it possessed rich hydrocarbon resources, and abundant reserves of coal. Additionally, the country had the proven technology of nuclear power available to play a more significant part in energy supply. There was no shortage of energy reserves in the UK, nor was there likely to be for many years.

"I say this neither to create a false sense of complacency nor to belittle renewables, but to try to keep this discussion in necessary proportion," he said. "Government actions on the renewables are bound to be conditioned by the overall energy scene."

"But, and I stress this, renewables do have a real importance to us. Our renewables programme is an insurance policy for which we are prepared to pay

a substantial premium. We are also ready and able to spend a good deal of time and ingenuity devising and carrying forward the best programme to meet our needs. For renewables represent a fascinating and tantalising aspect of the energy scene. They have considerable potential—just a part of the sunlight falling on the UK, or of the heat locked in basement rocks less than 10 km below the surface of the ground, could meet all our national power requirements.

"The problem is that this energy is either spread out very thinly or is hard to get at or both. We have to be practical about this, tempting though it always is to be starry-eyed about such matters. For us the central question has to be 'at what cost can this energy be produced in a useful form?' The Department of Energy's programme of R&D on renewable sources of energy is aimed at answering this question."

Mr Mellor outlined the reasons for Government decisions on the various renewable energy programmes: decisions which would enable efforts to be concentrated on the most promising technologies. Particular emphasis

would, he said, be given to the wind and geothermal power programmes, including the construction of the 3 MW windmill on Orkney and the hot rocks work at Camborne. Solar work would get just over £1 million this year, and a modest biofuels programme would continue to be funded at about £600 000 a year. Work on "waves" would be completed at a cost of more than £3 million in 1982-83. Thereafter, limited research on waves was contemplated as all evidence suggested that the commitment of a large sum of money on a major sea trial was not justified.

"As we move from R&D to demonstration, and costs multiply, we have to be selective," Mr Mellor pointed out. "I believe that the selection we have made is soundly based and has been carried out thoroughly and carefully. As a result, we believe that we have a renewable programme that faces up to the challenge of the future. We are carrying out this work with enthusiasm and determination. Several of the renewables are nearing or have entered the stage of commercial application, not only for the home market but also for exports. I trust that British industry will take note of these opportunities." □

Harwell R&D sales £41 million

Despite current pressures on industrial and Government spending, AERE Harwell again maintained its income from contract research and development work in 1981-82. R&D sales for the year totalled £41 million.

During the year Harwell undertook work for more than a thousand customers, including major public and private sector companies, Government departments, local authorities, statutory bodies and many small and medium sized firms. A developing feature of Harwell's non-nuclear contract R&D activities has been the formation of R&D "clubs", through which industrial consortia sponsor research on topics which are of general importance to their industry. Several Harwell clubs are well-established: the Heat Transfer and Fluid Flow Service, and the Separation Processes Service, for example, provide design technology for the process and chemical industries; and the Internal Combustion Engine Project is developing laser optical instrumentation for the automotive industry through its Petrol and Diesel Engine Clubs.

More recently, a Composite/Metal Joining Programme has been established. This is aimed at saving energy through reducing vehicle weight. The programme is sponsored

by British and European companies and the Commission of the European Communities. A three-year multi-company sponsored programme to develop new materials for gas sensors has also been launched, and an Off-shore Inspection and Monitoring Club has been formed with leading offshore operators and certifying authorities as members.

Early in 1982 the National Chemical Emergency Centre launched a new microcomputer-based chemicals data bank known as CHEMDATA to assist fire brigades in dealing with accidents involving hazardous chemicals. This scheme is supported by 43 of the UK's county and metropolitan fire brigades.

Contract work for the UK nuclear industry is a priority activity which allows the specialised nuclear facilities of the laboratory to be used to maximum national benefit. Nuclear contract programmes include fuel fabrication and testing, safety instrumentation, safety analysis, fuel reprocessing and radioactive waste management.

Two materials testing reactors at Harwell are used in the production of a large proportion of the industrial and medical isotopes which are sold worldwide from the UK. A leading position has been secured in supplying the international market with

phosphorus-doped silicon, used in the manufacture of semiconductors. The Harwell Variable Energy Cyclotron is used to produce active iodine-123 for hospitals throughout the UK, and has recently begun production of the radioisotope gold-195m for use in the diagnosis of heart disease. □

Waste management conference

An international conference on radioactive waste management is to be held in Seattle, Washington from 16 to 20 May 1983 under the auspices of the International Atomic Energy Agency.

Announcing the conference, the IAEA notes that the development of nuclear power cannot proceed without public understanding and confidence in the safe management of radioactive wastes generated in the nuclear fuel cycle. There is, in particular, a need for assurance that long-term safety requirements will be properly met and that the consequences of waste disposal operations will not place a burden on future generations.

Although a number of symposia and other international meetings have been held in the past on specific areas of waste management, no IAEA conference of the magnitude envisaged has

reviewed the various technical, environmental, regulatory, institutional and economic aspects of waste management, their inter-relationships and their implications for the development of the nuclear industry.

The organisers aim to provide a broad forum for the international exchange of views and information on waste management for both policy makers and technical experts; to highlight issues of current importance; and to identify possible approaches to their solution on the basis of knowledge accumulated from past experience, R&D work and policy considerations. The results of the conference deliberations will be made available in press releases and technical publications.

There are expected to be about 800 participants, from many countries. □

Radiation exposures remain low

For most people, exposure to radiation from the nuclear industry amounts to about 0.1 per cent of their total exposure from all sources, including medical irradiation and natural background radiation. People living in the vicinity of nuclear installations can receive doses amounting to a higher percentage, but this occurs to a significant extent only at BNFL Sellafield—and even in this case the doses are below the limits recommended for the general public by the International Commission on Radiological Protection.

These are central conclusions of two reports* published in July by the National Radiological Protection Board, containing estimates of the radiation dose to the UK public due to radioactive discharges from UK nuclear installations. These include all the nuclear power stations operated by the CEBG, the South of Scotland Electricity Board and the UKAEA; from installations operated by BNFL for manufacturing nuclear fuel, spent fuel storage, reprocessing and radioactive waste management; and from the laboratories of Amersham International.

The NRPB estimated doses for a typical year's discharge using specially developed computer models and a comprehensive data base. One study

*Kelly, G.N., Jones, J.A. and Broomfield, M. *The radiation exposure of the UK population from airborne effluents discharged from civil nuclear installations in the UK in 1978*. Report NRPB-R118; HMSO, £4.00; and Camplin, W.C., Clark, M.J. and Delow, C.E. *The radiation exposure of the UK population from liquid effluents discharged from civil nuclear installations in the UK in 1978*. Report NRPB-R119, HMSO, £4.00.

Reactor monitoring

A self-synchronising 'fail safe' remote data acquisition system for reactor monitoring is being supplied by Base Ten Systems Ltd to the UKAEA establishment at Winfrith, Dorset.

The system uses pulse code modulation (PCM) techniques to transmit 128 channels of information on reactor core temperatures on a single cable pair, as part of a trial computer-based reactor protection system. In the UKAEA application a uniquely ordered pattern of test inputs confers self diagnostic and fail-safe properties on the data acquisition system.

The Base Ten system is designed to assist in remote monitoring of the temperature of the liquid sodium coolant used in fast reactors. It is necessary to monitor the outlet temperature of coolant as it leaves fuel channels: allowing for replication to achieve the required reliability, about 3 000 sensors are typically required. Traditional techniques call for a separate pair of wires from each thermocouple used, all being led to an instrument room. In the new system two wires replace the 256 that have been required for each group of 128 thermocouples; and the data are generated in a form suitable for direct input to computer.

The system was designed originally for aerospace use, and meets stringent reliability and harsh environmental requirements. □



Loading fuel into the Winfrith reactor

estimates the collective dose from airborne effluents to be about 14 man-sievert (1 400 man-rem) and the other estimates the collective dose from liquid effluents to be about 134 man-sievert (13 400 man-rem).

The main contributor to the dose from liquid effluents, which represents 90 per cent of the total dose to the public, is BNFL Sellafield (formerly known as Windscale), through discharges of the radionuclide caesium-137. Most of the dose from airborne effluents comes from nuclear power stations. The NRPB says the total estimated dose from the nuclear industry is broadly comparable with previous estimates, and for the liquid effluents from Sellafield there is good agreement with doses calculated by the Ministry of Agriculture, Fisheries and Food for the same year. The reports contain sufficient information, the NRPB says, to estimate doses from radioactive discharges made in other years.

Further information is available from the Information Officer, NRPB, Chilton, Didcot, Oxon. OX11 0RQ; Tel. Abingdon (0235) 831 600, ext. 410.

BNFL discharges

At no time during 1981 did radioactive discharges from works operated by British Nuclear Fuels Ltd exceed those laid down in authorisations issued by the Department of the Environment and the Ministry of Agriculture, Fisheries and Food.

The fifth annual survey issued by BNFL's Health and Safety Directorate shows that the radiation dose to the small group of the general public (the 'critical group') who received the highest dose in 1981 resulting from BNFL's operations was less than a fifth of the annual dose limit recommended by the International Commission on Radiological Protection.

Sellafield The report shows that discharges of radiocaesium and other fission products to the Irish Sea from BNFL's works at Sellafield—formerly known as Windscale—were again significantly lower than in the mid-1970s. Discharges of alpha-emitting isotopes continued at a considerably lower level than in the first half of the 1970s, though BNFL note that some fluctuations take place from year to year due to the phasing of operations

including maintenance, and the timing of discharges from delay storage tanks.

The most highly exposed group of the general population, consuming fish and other seafoods caught in the Sellafield area, was estimated to have received about 17 per cent of the ICRP dose limit, as in 1979 and 1980. Doses to typical members of the public eating fish landed in the area were much less, at about 1 per cent of the ICRP annual limit.

BNFL say in the survey report that the refurbishing of the Magnox reprocessing plant at Sellafield which is now under way is expected to reduce the discharge of a number of radio-nuclides to the sea from Sellafield. As a result, the radiation exposure of the general public will be further reduced.

Chapelcross Environmental monitoring of the vicinity of these works, in Dumfriesshire, showed that the critical group radiation dose was about 6 per cent of the ICRP annual dose limit. The dose received by the general public was much less.

Springfields Works Monitoring in the vicinity of these works, near Preston, showed that the radiation dose to the people in the area was estimated to be less than 1 per cent of the ICRP dose limit.

Capenhurst Works The critical group radiation dose, resulting from discharges from the Meols pipeline to the sea near Chester, was shown by monitoring to be less than 0.1 per cent of the ICRP annual dose limit.

● The report was issued by the Health and Safety Directorate, BNFL Risley, Warrington, Cheshire WA3 6AS. □

NDT symposia

The British Institute of Non-Destructive Testing is to hold three symposia in the closing months of 1982.

The first, on the ultrasonic inspection of austenitic materials, will take place in Northampton on 26 October. The Institute notes that considerable progress has been made in solving the severe difficulties posed for inspection of austenitic materials, and ultrasonic inspection techniques are now possible for a range of austenitic structures. At the symposium leading workers in the field will discuss the inspection of such materials, and the implications of recent developments: they include Dr A.R. Wagg and Dr A.B. Wooldridge (CEGB); Dr J.M. Farley (Babcock Power Ltd); Dr A.D. Whapham (AERE Harwell); Herr Xavier Edelmann (Sulzer Bros., Switzerland); and Mr B. Gray (UKAEA Risley).

The second symposium, on 2 November, will consider aspects of NDT in the railway industry; and the

third, on 7 December, ultrasonic imaging, visualisation and display. These symposia will also be held in Northampton.

Further information may be obtained from the British Institute of Non-Destructive Testing, 1 Spencer Parade, Northampton NN1 5AA; tel. (0604) 30124/5; telex 31612 OTSSG. □

Bearing the standard

The British Standards Institution has published a comprehensive revision of BS 292 under the new title *Rolling bearings: ball bearings, cylindrical and spherical roller bearings*. The revision is in two parts, Part 1 covering metric series bearings and Part 2 maintaining the inch-series ball and cylindrical roller bearings previously specified.

Both parts specify the external dimensions affecting the dimensional interchangeability of bearings as complete units, together with their radial internal clearance. They do not deal with other features of internal design or dimensions, nor with materials and methods of manufacture which may affect functional interchangeability.

An additional new part of BS 6107, *Rolling bearings: tolerances, Part 2: Specification for tolerances of radial bearings* is also now available. This is identical with ISO 492 and gives tolerances for boundary dimensions and running accuracy of radial rolling bearings in the metric series. This standard does not cover radial bearings of particular types such as drawn cup needle roller bearings, nor some applications such as airframe bearings and instrument precision bearings.

Copies of BS 292: Parts 1 and 2, and of BS 6107, Part 2, may be obtained from the BSI Sales Department, 101 Pentonville Road, London N1 9ND; prices £18.00, £9.50 and £9.50 respectively (half-price to BSI subscribing members). □

Tribology course

Pump problems in the process industries

26 October 1982

This course is intended to appeal to engineers concerned with the selection, maintenance and use of rotodynamic pumps. Information will be presented by pump manufacturers and users, and by specialists on seals and bearings with emphasis on industrial problems.

The course fee is £97.75 inclusive of VAT, refreshments and course notes. The programme and application forms may be obtained from The Course Organiser, National Centre of Tribology, UKAEA Risley, Warrington, Cheshire WA3 6AT; tel. Warrington (0925) 31244, exts. 2640 and 3232. □

Flow induced vibration

An international conference on flow induced vibrations in fluid engineering is to be held at the University of Reading from 14 to 16 September.

The conference is being organised by BHRA Fluid Engineering. Its rationale is that the vibration of components subjected to significant fluid dynamic loads is a problem experienced in a range of industries from civil engineering to electricity generation and chemical processing. The demand for the increased thermodynamic performance of heat exchangers has led to the use of longer, more slender tubes, more closely spaced, and to higher fluid flow rates. A concomitant has been increased likelihood of tube failure caused by excessive vibration.

Instabilities must be avoided at the design stage; among the 30-odd papers to be presented at the conference is one from Electricité de France on the results of studies carried out to forecast the vibrational motion of tube bundles; and a paper from the Argonne National Laboratory, USA, deals with the instability of flow in tube arrays in cross flow. Other papers consider the cause and effects of flow induced vibrations in gates, buildings and cylinders, bridges, reactors and pipes.

Registration forms and further details are available from the Conference Organiser, Flow Induced Vibrations, BHRA Fluid Engineering, Cranfield, Bedford MK43 0AJ; tel. (0234) 750422; telex. 825059. □

Centrifuge standard

Accidents involving laboratory centrifuges tend to be both spectacular and highly dangerous. Guard barriers around rotating assemblies must be capable of preventing debris from a disintegrating ultracentrifuge head being hurled into the laboratory.

This is one of the subjects dealt with in a revised British standard recently published by the British Standards Institution. Entitled BS 4402, *Specification for safety requirements for laboratory centrifuges*, it applies to all electrically-driven centrifuges of current designs likely to be used for laboratory purposes, with the exception of Gerber and basket centrifuges.

In the previous edition of BS 4402 the only method of specifying the strength of the centrifuge casing was to require compliance with type tests carried out on typical production models. The tests involved the deliberate breaking of a rotation assembly to determine the containment, or otherwise, of the fragments. Such tests were costly; the revised standard incorporates in addition an

alternative, non-destructive method of specifying guard barriers, based on a consensus of current design practice among leading UK and other manufacturers. An appendix giving recommendations to users of laboratory centrifuges is intended to help laboratory safety managers draft safety notices for display in laboratories.

The revised BS 4402 supersedes the 1969 edition, which is withdrawn. Copies of BS 4402 may be obtained from the BSI Sales Department, 101 Pentonville Road, London N1 9ND; price £9.50 (BSI subscribing members £4.75). □

Design to ASME III

The American Society of Mechanical Engineers and the UK-based Defence Customer Services are organising a series of seminars to be held at the Beaufort Hotel, Bath, Avon, on subjects related to nuclear power.

The first, on the design of nuclear power plant components to ASME III, takes the form of an intensive course during which a lecturer will highlight the general requirements of the ASME code in the field. The seminar will run from December 6 to 8. Later seminars will be on nuclear standard welding to ASME IX (25-27 January 1983) and the safety analysis of nuclear power plant (15-17 March 1983).

Further information and registration forms may be obtained from the Seminar Registration Secretary, Defence Customer Services, Prudential Buildings, 42 Milsom Street, Bath BA1 1DU. □

Occupational hygiene

The Suffolk College of Higher and Further Education is offering a new two week course leading to award of a Preliminary Certificate in Occupational Hygiene, No. 8: Radiation (Ionising and Non-ionising).

The British Examining and Registration Board in Occupational Hygiene, established in 1968, certifies the attainment of recognised standards of competence in the practice of occupational hygiene, and has established and maintains a public register of people who have achieved such recognised standards. There are at present 11 preliminary certificates; provision is made for people who have acquired such certificates to proceed to the full certificate. Alternatively, people with professional qualifications in related fields might wish to study a particular area in more depth. The completion of the course now offered could be one rung on a ladder toward a professional qualification in this field, or might develop in-depth competence in a particular aspect.

The course, which will run from 25 October to 5 November, will cover elementary physics, relevant legislation, criticality, elementary medical and radiological aspects, measurement and calibration of instruments, standards, units, limits and TLVs, use of radiations, and protection of personnel. There is a two and a half hour examination on completion of the course.

Further details on the course may be obtained from Mr R.M. Guest, Course Tutor, Suffolk College of Higher and Further Education, Rope Walk, Ipswich, Suffolk IP4 1LT; tel. (0473) 55885, ext. 245. Applications to attend should be addressed to Mr R.R. Davis, Head of Department of Science, Suffolk College of Higher and Further Education, at the same address and telephone, ext. 290. □

Hydraulic modelling

An international conference on the hydraulic modelling of civil engineering structures is to be held from 22 to 24 September at the University of Warwick, Coventry under the auspices of BHRA Fluid Engineering.

Model studies for civil engineering structures can lead to considerable savings in construction costs, and by proving the design can eliminate the possibility of later modifications while improving a scheme's efficiency and safety, the organisers note. Despite the increased use of mathematical modelling, the civil engineer still needs physical models to enable him to assess the hydraulic efficiency of a variety of structures.

A case in point, to be discussed at the conference, was the unusual problem of discharging cooling water at right angles to the tidal flow from a large CEGB power station on a very confined site. The CEGB used a hydraulic scale model to study the discharge and to assess the likelihood of its recirculation. The CEGB paper will describe the model study in detail and discuss how the results were used, with other data, to gain an understanding of the flow conditions and to assess the structure's proposed design and location.

In all, 39 papers from 19 countries will be presented. Further details and registration forms are available from the Conference Organiser, Hydraulic Modelling, BHRA Fluid Engineering, Cranfield, Bedford MK43 0AJ; tel. (0234) 750422, telex 825059. □

Culham safety

Dr P.F. Little, formerly head of the Lightning Studies Unit at the UKAEA Culham establishment, has been appointed Head of Section, Culham Laboratory and JET Safety Services, in succession to Mr J.C. Chicken. □

AEA REPORTS

The titles below are a selection of reports published recently and available through HMSO.

AERE-M 3235 *Analysis of zirconium alloys using inductively-coupled plasma emission spectrometry*. By G.F. White and C.J. Pickford. March 1982. 11pp. HMSO £2.00. ISBN 0 70 580725 8

AERE-R 9887 *The uptake of radionuclides by plants: A review of recent literature*. By P.A. Cawse and G.S. Turner. February, 1982. 47pp. HMSO £3.00. ISBN 0 70 580565 4

AERE-R 10306 *The calculation of spectra and effective energies of β -decay*. By L.J. Baker. May, 1982. 25pp. HMSO £2.00. ISBN 0 70 580815 7

AERE-R 10402 *Some Monte-Carlo calculations of resolution effects in neutron detectors for resonance neutron radiography*. By G. Robertson. April, 1982. 16pp. HMSO £2.00. ISBN 0 70 580764 9

AERE-R 10429 *#TF—A library of TSO facilities*. By D.A. Lever and P.C. Robinson. April, 1982. 57pp. HMSO £3.00. ISBN 0 70 580774 6

AERE-R 10432 *MORSE-H: A revised version of the Monte Carlo code MORSE*. By N.P. Taylor and J. Needham. May, 1982. 32pp. HMSO £3.00. ISBN 0 70 580795 9

AERE-R 10521 *The characterisation of precipitated magnetites*. By D.F. Rush and D.L. Segal. June, 1982. 25pp. HMSO £2.00. ISBN 0 70 580875 0

CLM-R 216 *Atomic and molecular data for fusion, Part 1. Recommended cross sections and rates for electron ionisation of light atoms and ions*. By K.L. Bell, H.B. Gilbody, J.G. Hughes, A.E. Kingston and F.J. Smith. December, 1981. 120pp. HMSO £6.00. ISBN 0 85 311103 0

CLM-R 220 *Simple analytic form of the relativistic Thomson scattering spectrum*. By A.C. Selden. January, 1982. 21pp. HMSO £2.00. ISBN 0 85 311102 2

CLM-R 224 *The toroidal field coil structure for the Culham Mark IIC Tokamak reactor*. By S.F. Calvert, D.H. Prothero and W.R. Spears. 1982. 61pp. HMSO £3.00. ISBN 0 85 311107 3

Radioactive waste management

The Government attach the highest importance to the safe management of radioactive wastes, Mr Tom King, Minister for Local Government in the Department of the Environment, said in a statement to the Commons on 22 July.

Mr King told the House that the Government had published a White Paper on radioactive waste management reporting on action taken in response to recommendations contained in the Sixth Report of the Royal Commission on Environmental Pollution, and setting out the Government's priorities for further action.

"The Government attach the highest importance to the safe management of radioactive wastes," he said. "As a result of research undertaken in this and other countries over the last five years, the Government is satisfied that all the wastes currently envisaged can be managed and disposed of in acceptable ways. The main task is to identify the most appropriate method for each category of waste, and then ensure its efficient implementation. In this we shall continue to be advised by the independent Radioactive Waste Management Advisory Committee, which was set up by the previous Government following the recommendation of the Royal Commission.

"The Royal Commission also identified the need for an executive organisation to develop and manage radioactive waste disposal facilities and accept solid waste from those who create it. The Government has now reached agreement with the United Kingdom Atomic Energy Authority, British Nuclear Fuels Ltd and the generating boards, that they will set up forthwith such an executive to be called the Nuclear Industry Radioactive Waste Executive (NIREX). In the first instance the Executive will take responsibility for intermediate-level wastes. It will also take over responsibility, as from next year, for the sea-disposal operations for low-level waste. It will have a staff at Harwell, provided by the UKAEA on a repayment basis, and will be supervised by a Directorate made up of senior representatives of the component bodies. The cost of disposal operations, which are expected to be roughly £65m over the next 10 years, will be met by the producers of the waste. The Government believes that this Executive is the most suitable form of organisation for these present tasks. Its establishment in no way effects the clear responsibilities of my Rt. Hon. friend, the Secretary of State, together with my Rt. Hon. Friends, the Secretaries of State for Scotland and Wales. They are responsible for the overall strategy on waste management. In addition, in conjunction with the



Minister of Agriculture, Fisheries and Food and the Nuclear Installations Inspectorate they retain the regulatory powers to ensure that the Executive maintain the necessary high standards. The new executive will make periodic reports to the Secretaries of State. These reports will be published.

"Radioactive wastes vary very widely in radioactivity and toxicity. For the small quantities of high-level heat-generating liquid waste, work is going ahead on vitrification plant. The solid blocks thus produced will then be stored for a period likely to be at least 50 years, until the radioactivity and heat generation have substantially declined. Meanwhile further research will be undertaken to help identify the most suitable of the available methods for longer-term management.

"For intermediate-level waste, there is a need for the early development of land disposal facilities employing existing technology. This will be the first main task of the new Executive.

"For low-level wastes, satisfactory methods of disposal are already in use, and the Advisory Committee have confirmed that these should continue to be used, subject to the continuing monitoring of appropriate controls. In the case of liquid discharges from the Sellafield works of BNFL, which have been substantially reduced in recent years, a new and more stringent authorisation will be issued after the treatment plant now under construction comes into operation.

"I should like to make two further points. The first is that the cost of waste management measures must be met by the industry and be reflected in its accounting practices. The industry has confirmed to me that it fully accepts this.

"The second is the need to secure public confidence in the management of both existing radioactive wastes and those that will arise.

"As this White Paper confirms, the Government attaches great importance to keeping the public properly informed, and will seek to ensure that this is done at all stages."

Reaction

Mr Denis Howell, responding from the Opposition Front Bench, welcomed the statement but said the Opposition doubted whether it was wise to exclude "an independent element" in the new executive when dealing with the critically important matter of the disposal of nuclear waste. Mr King however said Mr Howell misunderstood the purpose of NIREX. "The executive is meant to carry out work," he said. "It will have to submit any proposals it makes to the Radioactive Waste Management Advisory Committee, the majority of whose members are independent of the nuclear industry. That is the whole point: we do not want to muddle up executive action with independent assessment."

Dr John Cunningham urged that the development of the nuclear industry could not outstrip public acceptance of what was proposed. "Will the Minister assure the community in West Cumbria that the views of the Windscale local liaison committee—on which the local authorities, trades unions and others are represented—will be given particularly careful consideration before any final decisions are taken?"

Mr King said he hoped Dr Cunningham would recognise that the closing words of his statement were an acceptance of his point, and that the views of the liaison committee would be taken fully into account as it was important to maintain its confidence and support.

Later, Mr King added: "Commanding public acceptance is a problem. The campaign will be continuing. Acceptance depends upon the intelligence and responsibilities of Ministers and on the continuing determination and vigilance of all concerned in the industry. Any problem is a major setback to public confidence. I have always made it clear to the scientists . . . that two obstacles stand in the way of the development of nuclear power—the technical problems and public acceptability, which is just as important. We all have a role to play."

IN PARLIAMENT



BY OUR PARLIAMENTARY
CORRESPONDENT

Plutonium

29 June 1982

Mr Wigley asked the Secretary of State for Energy what changes, if any, had been made or were about to be made to the agreement entered into with the Central Electricity Generating Board, when the Anglesey aluminium smelter was established, concerning the transfer of plutonium from Dungeness B power station to the Department of Energy; and if he would make a statement on future policy on this matter with particular regard to the effects on fuel costs for Anglesey Aluminium and on the control over plutonium produced at CEGB owned reactors.

Mr John Moore: Discussions are taking place with the board about the arrangements that would be necessary to transfer the Government's share of the plutonium to it. Any such transfer would have no effect on the position of Anglesey Aluminium. The board would then have full control over all plutonium produced in its reactors.

Grants to non-official bodies

22 June 1982

Mr James Pawsey asked the Secretary of State for Energy to list the non-official bodies to which his Department made grants in the last financial year; and how much was paid to each.

Mr David Mellor, Parliamentary Under-Secretary of State: Estimated payments of grants in the 1981-82 financial year are as follows:

£000

The British National Committee of the World Energy Conference	3
The Watt Committee	2
The UKAEA (net)	205 404
The National Coal Board	337 361
The Central Electricity Generating Board	8 620
The Department, acting as agents for the European Community, also makes payments to the gas and electricity industries from the European Regional Development Fund.	

Contributions

22 June 1982

Mr James Pawsey asked the Secretary of State for Energy how much had been paid by his Department to (a) the International Atomic Energy Agency, (b) the Nuclear Energy Agency, (c) the International Energy Agency and (d) any other international organisation in the past financial year.

Mr John Moore, Parliamentary Under-Secretary of State: Estimated payments, including subscriptions and contributions to projects for the 1981-82 financial year, are as follows:

£000

The International Atomic Energy Agency	2 657
The Nuclear Energy Agency	136
The International Energy Agency	5 425

The UKAEA contributed £5 052 000 toward the Joint European Torus sited at Culham and £94 000 toward the NEA data bank in France. These costs were met from part A of Class IV Vote 7: Scientific and Technical Assistance: Nuclear Energy.

ACORD

28 June 1982

Mr Hardy asked the Secretary of State for Energy if he was satisfied that the summary of advice proposed by the Advisory Council on Research and Development adequately reflected the views of those serving on the council; and whether the views of those involved in renewable energy projects were excluded from the council's consideration.

Mr Mellor: Yes. There was no question of excluding the views of those involved in my Department's renewable energy projects. The reports of all the renewable energy steering committees were made available in full to the council and the chairmen of the committees attended and took part in the discussion.

New sources

28 June 1982

Mr McNally asked the Secretary of State for Energy if there had been any recent change in the relative priority his Department gave to the development of new energy sources in comparison with the development of existing sources; and Mr Tilley asked the Secretary of State for Energy what had been the percentage change between 1981-82 and 1982-83 in public expenditure on research and development into renewable energy resources.

Mr Mellor: There has been no such change. The total expenditure by my Department on renewable energy sources, including the research and

development management services of the Energy Technology Support Unit at Harwell, but excluding tidal studies, will fall in 1982-83 by about 11 per cent from the 1981-82 figure of around £16.3 million.

Mr McNally: Does not the cut in research and development signify a change in the order of priorities? Are not the Japanese already thinking of putting British research in this area to commercial use? Does Mr Mellor accept that, despite his earlier remarks about EC involvement in the Severn barrage, there is a feeling that he has boxed himself into nuclear and conventional options although he should be investing in alternative energy sources?

Mr Mellor: When Mr McNally was advising the Prime Minister three years ago, the amount spent on renewable energy was about one-fifth of what it will be in the coming year. I do not know what interest he took in it at that stage, but it is somewhat difficult to accept his criticism today. We have a rolling programme of research into the renewables to arrive at the most promising renewables for use in Britain. The ACORD report, to which I believe Mr McNally refers, is a further step down that road.

Combined heat and power

6 July 1982

Mr Gordon Wilson asked the Secretary of State for Energy to report on progress made for development of combined heat and power.

Mr Mellor: . . . On industrial combined heat and power the Government have taken a number of measures to encourage the development of worthwhile schemes. The extended energy survey scheme has been expanded so that grants of up to 50 per cent can be given toward the costs of employing a consultant to provide an assessment of the possibility of installing combined heat and power; we are also considering proposals for a number of projects under the energy conservation demonstration projects scheme. The Government have also given consent for the construction of two industrial CHP schemes by the Midlands Electricity Board and intend next session to legislate to allow the private generation of electricity as a main business. Consultations on these legislative changes are in progress.

Fast reactor spending

12 July 1982

Mr MacLennan asked the Secretary of State for Energy to indicate expenditure to date on the development of the

fast reactor, expressed both in annual figures and as a total.

Mr Moore: The total expenditure incurred to date on development of the fast reactor is some £900 million. I am asking the deputy Chairman of the UKAEA to write to Mr MacLennan giving him the annual breakdown of this figure.

Nuclear transport

14 July 1982

Sir David Price asked the Secretary of State for Transport (1) how many people had died as a result of the movement of radioactive substances by rail over the past ten years; (2) how many people had been injured or suffered ill-health as a result of the movement of radioactive substances by rail over the past ten years.

Mr Eyre: There has been no known case of death, injury or ill-health attributable to radioactive material in the course of movement by rail.

19 July 1982

● Mr Arthur Lewis asked the Secretary of State for Transport why he had refused the request of nine London borough councils including the borough of Newham to discuss the question of the transport of nuclear waste; and whether he would now reconsider his refusal.

Mr Eyre: The Government's position on this matter is already well known, and in the absence of any relevant new evidence such a discussion would serve no useful purpose. I have said that I will consider any such evidence that may be submitted to me.

Council of Energy Ministers

15 July 1982

Sir Geoffrey Johnson Smith asked the Secretary of State for Energy to make a statement about the meeting of the European Communities' Council of Energy Ministers on 13 July.

Mr Lawson: The Council of Ministers—Energy—met on 13 July. Sir Donald Maitland, permanent under-secretary of state at the Department of Energy represented the UK.

The Council discussed recent developments in the energy markets and reviewed the progress made by all member States in reducing dependence on imported oil and in more efficient use of energy. The Council reaffirmed this strategy. The Council saw no evidence that the more relaxed oil market was leading to any slackening of effort towards achieving the Community's agreed goals.

The Commission is to report to the next meeting of the Council in

November on the outcome of its sectoral studies on the application of pricing policies.

The Council adopted recommendations on further efforts to achieve a more rational use of energy, including arrangements for the Commission to monitor progress. These recommendations emphasise the importance of applying sound energy pricing policies. The UK delegation welcomed this and stressed the need for the Commission to use realistic indicators in assessing progress.

The Council adopted conclusions on nuclear energy. These underline the conviction that nuclear energy can make a greater contribution to the electricity needs of the Community as well as the economic advantages which industry can derive from nuclear energy through lower costs.

The Council agreed to make a fresh attempt to devise a Community strategy for coal. I welcome this initiative, which I hope will lead to practical recognition of the long-term importance of coal production on an economic basis within the Community.

Scottish electricity

19 July 1982

Mr Norman Hogg asked the Secretary of State for Scotland what was his estimate of Scotland's electricity generating capacity and demand once Torness nuclear power station was commissioned.

Mr Alexander Fletcher: The forecasting of electricity demand is the responsibility in the first instance of the Scottish electricity boards. I understand from recent load forecasts that by the early 1990s the boards estimate that the all-Scotland demand will be approaching 7 000 MW. At that time the operational capacity is expected to be of the order of 10 000 MW, excluding plant in store.

Capenhurst

20 July 1982

Mr Cryer asked the Secretary of State for Defence what was the cost of the modified proposals for the new uranium enrichment plant at Capenhurst; and what agreement covered the final processing to highly enriched uranium in the United States.

Mr Pattie: It would not be in the interests of security to disclose the cost of this programme. The services needed for the final processing to highly enriched uranium in the United States will be made available under the terms of the 1958 US-UK agreement for cooperation in the uses of atomic energy for mutual defence purposes.

Hunterston costs

20 July 1982

Mr Ancram asked the Secretary of State for Scotland how the capital costs of the South of Scotland Electricity Board's Hunterston B power station were to be met since the termination of the SSEB's 1967 contract with the British Aluminium Company.

Mr Alexander Fletcher: Under its 1968 contract with the North of Scotland Hydro-Electric Board the British Aluminium Company met approximately 21 per cent of the capital cost of Hunterston B station. The balance was met by the Scottish electricity boards through their joint generating account. When the 1968 contract was terminated last December the company received from the board the residual value of its share in the station. The capital charges on this residual value payment are being met by the boards.

BNFL board

20 July 1982

Mr Cryer asked the Secretary of State for Energy to list the seven full-time board members and chairman of British Nuclear Fuels; and what had been their background experience in industry.

Mr Moore: The chairman of BNFL's board of directors is Sir John Hill. The seven full-time board members are: C. Allday, Dr D.G. Avery, J. Tatlock, G.H. Inglis, A. Johnson, J.M. Hayles, R.L. Pilling.

Each of the above has worked in the nuclear industry for at least the last 22 years. If Mr Cryer would like fuller information on any of the directors mentioned above, I shall be pleased to write to him with further details.

Fast reactor

22 July 1982

Mr MacLennan asked the Secretary of State for Energy (1) if he would make a statement on the progress of his discussions on the possibilities of international collaboration in the development of the fast breeder reactor in the UK; (2) if he would indicate the expenditure to date on the development of the fast reactor, expressed both in annual figures and as a total; and (3) if he would assess the employment indications for the UKAEA's establishment at Dounreay of his policies for the development of nuclear power.

Mr Moore: (Pursuant to an earlier reply on 12 July): I can confirm that there have been discussions between British Ministers, officials and industry representatives and their counterparts in France, Germany and the United



The UKAEA site at Dounreay

States of America, aimed at identifying the scope for international collaboration in the development of the fast reactor. These discussions have made useful progress and will be an important factor in the Government's current consideration of fast reactor policy alongside other factors such as the long-term potential of the fast reactor. The Government accepts the desirability of maintaining and where possible improving the level of employment in the Highland region; and recognises the contribution of the Dounreay operation to employment in the region.

The Government's objective is to ensure that we have access to fast reactor technology so that commercial fast reactors can be built in this country when we need them.

The Secretary of State for Energy will make a further statement on fast reactor policy in due course.

Sizewell B inquiry

22 July 1982

Mr Chapman asked the Secretary of State for Energy if he was in a position to announce the assessors to assist the inspector at the Sizewell B inquiry.

Mr Lawson: I have appointed Dr J. Vennart, director of the Medical Research Council's radiobiology unit, as an assessor to the inquiry. He will assist the inspector, Sir Frank Layfield QC, on matters relating to the biological effects of radiation and related issues. Further appointments are under consideration.

Radioactive Substances Act

23 July 1982

Mr Michael Spicer asked the Secretary of State for the Environment when the revised explanatory memorandum to

the Radioactive Substances Act 1960 would appear.

Mr Giles Shaw, Parliamentary Under-Secretary of State: An updated and expanded version of the Explanatory Memorandum has been published today by HMSO under the title *Radioactive Substances Act 1960: a guide to the administration of the Act*. This is a joint publication of the Department of the Environment, the Scottish and Welsh Offices, and the Department of the Environment for Northern Ireland, and replaces the Explanatory Memorandum published in 1963, when the Act came into force. Copies have been placed in the Library of the House.

The purpose of the Guide is to help the ordinary user of radioactive substances by explaining what the law is, and how he can comply with it. It summarises the disposal methods which are appropriate to the various kinds of low-level wastes that such users produce.

The original Explanatory Memorandum was based on the report of an Expert Panel which formed an appendix to the 1959 White Paper (Cmd 884). The administration of the Act was reviewed by an Expert Group set up for the purpose by my Department and drawn mainly from the regulatory bodies and the nuclear industry, but with some independent members. Its report was published in September 1979. The independent Radioactive Waste Management Advisory Committee has endorsed the conclusions about disposal methods, and expressed general satisfaction with the system of control under the 1960 Act and the way it is operated.

On the basis of the Expert Group's report, the Guide now gives more

detailed guidance about methods of disposal, and this is followed in the current practice of the inspectorates. References have been added to various administrative procedures which supplement the Act, for example for radioactive substances in National Health Service hospitals, and for consultation with local authorities even in cases where the act does not require that. The Guide also now takes account of changes in organisation since 1963 and the change to SI units.

The exemption orders under the 1960 Act are being reviewed and, as recommended by the Expert Group, certain further categories of very low-level radioactive substances will be exempted. A supplement to the Guide will be issued when the amending orders have been made. The government are confident that current practices and standards are radiologically satisfactory and fully safeguard the public. But we shall also ensure that they continue to be reviewed from time to time in the light of new developments.

Emergency arrangements

23 July 1982

Mr David Atkinson asked the Secretary of State for Foreign and Commonwealth Affairs on what date the Government began the negotiations with the French Government on bilateral emergency warning arrangements concerning the notification of incidents occurring at nuclear installations which could result in radiological hazards in the other's territory; and when he expected these to be completed.

Mr Hurd: In May 1980 the French Government agreed with HM Government in principle to the negotiation of a formal agreement concerning exchanges of information in the event of emergencies occurring in one of the two States which could have radiological consequences for the other. As I informed Mr Atkinson on 28 June these negotiations are nearing completion and we hope that the agreement will come into force before the end of the year.

Reporting procedures

26 July 1982

Dr John Cunningham asked the Secretary of State for Energy whether he had completed his review of reporting procedures for nuclear incidents.

Mr Moore: Yes. Following the incident at Sellafield last October, involving a release of radioactive iodine, I asked HM Nuclear Installations Inspectorate to examine the existing reporting procedures for nuclear in-

cidents and to make recommendations on how these might be improved.

This they have now done and the revised procedure amends the criteria for reporting so as to ensure more prompt reporting of nuclear incidents and in particular those which could give any cause for concern to the public living in the vicinity. The revised procedure should also eliminate the reporting to Ministers of minor incidents on the sites which have no significant safety implications either for the public or for personnel on the site. This procedure should ensure greater consistency, and promptness in the reporting of significant incidents, than under existing arrangements.

Reports will normally be made to Ministers within 24 hours. A note on the revised criteria for reporting has been placed in the Library of the House.

I should emphasise that the proposed changes relate only to what is reported by the operator through HM NII to Ministers. I am satisfied that the removal of the requirement to report incidents on the sites which have no significant safety implications will not have any effect on the high standards of safety enforced in the industry. Minor incidents will continue to be reportable to HM NII under statutory regulations and licence conditions. Arrangements have also been agreed between HM NII

and the operators of each site to inform their Local Liaison Committees and the local population promptly about all incidents reported to Ministers as well as their own workforce. I have been particularly concerned to ensure that local people are kept properly informed about incidents which might have or might be thought to have any consequences outside the site.

The commercial fast reactor

26 July 1982

Dr J. Dickson Mabon asked the Secretary of State for Energy what further progress had been made toward establishing a commercial fast reactor in the UK.

Mr Moore: The National Nuclear Corporation, in association with the UKAEA, is further developing the reference design for a commercial scale fast reactor which was announced by the AEA last year. The Authority is undertaking a major programme of fast reactor research and development in support of this work based on the prototype fast reactor and associated fuel plant at Dounreay.

Dr Mabon: In what year does the Minister estimate that the commercial fast breeder reactor will be built? Will the experimental establishment at Dounreay be the basis on which the commercial fast breeder reactor will be

established?

Mr Moore: It would be impossible for anyone to specify when that reactor would be built. This is a factor in the review of all the policy options that are involved in the Government's review of the fast breeder. With regard to Dounreay the Government have made it clear that all aspects of fast breeder development must be examined in their policy debate.

Mr Gordon Wilson: Bearing in mind the importance of Dounreay to the Highland economy, will the Minister give a guarantee that that establishment will not be closed?

Mr Moore: I should have thought that it is not the time to give guarantees when one is considering policy options . . . The policy is being reviewed, as the Government have made clear. Dounreay has an important role in the Highlands development area, and there are important employment opportunities at Dounreay, which is a key factor in any such review.

[Mr Moore added in later exchanges]: The development has been going on for nearly 30 years. . . It is clear that the fundamentals of nuclear development have also changed. The thermal programme in the world has developed slower than had been anticipated. It is normal to review the current position on the basis of fundamental economic change. ☐

IN THE LORDS

Fast reactor policy

15 July 1982

The scope for international collaboration on fast reactor development, and the future of the UKAEA establishment at Dounreay, were discussed at question time.

Viscount Thurso asked whether the Government had reached any conclusion as a result of the review which they had been conducting into fast reactor systems and into possible collaboration with other countries, and was assured by the Earl of Mansfield, Minister of State at the Scottish Office, that the Government's consideration of the scope for such collaboration was making satisfactory progress. When the Secretary of State for Energy had had opportunity to consider all the implications he would make a statement on fast reactor policy. The Earl of Mansfield added: "The Government's objective is to ensure that the country has access to the technology necessary to enable the fast reactor to be introduced on a commercial scale as and when the country needs it."

The Minister added that he expected the Secretary of State would be in a position to make a statement some time after the summer Parliamentary

recess. Exploratory discussions had been held at Ministerial, official and industrial levels with the United States and with the French and Germans; and contact had been made also with the Japanese.

The Earl of Lauderdale urged that even if a fast reactor were started today "we should not have something until the late 1990s; therefore there is considerable urgency in this matter, in terms of general energy policy for the UK." The Earl of Mansfield, however, said that on the information he had fast reactor technology was unlikely to become commercially viable before the next century. "At that time the need for generating capacity and the fuel supply situation may well be very different. The objective of the Government therefore is to ensure that we have access to that technology when we need it."

The Earl of Mansfield told Viscount Thurso in answer to his second question that the Dounreay Nuclear Establishment currently has a full programme of work in support of the UK fast reactor programme. The importance of the establishment to the economy of the Highland region was well recognised by the Government.

Viscount Thurso noted that the

Minister had already indicated that there was no decision yet about the future of the fast reactor, and that it must therefore be assumed that the programme lying ahead of the Dounreay establishment was limited. The Minister agreed that the long-term future of Dounreay was of necessity dependent on the outcome of the Government's present consideration of fast reactor policy; and the Secretary of State was aware of the importance of the establishment and its work to the Highland region.

Lord Wynne-Jones suggested that it might be desirable to look at the present thermal reactor programme. "Will he pay attention to the report from the [Nuclear Installations] Inspectorate today stating that they are not prepared to approve of immediate progress with the proposed pressurised water reactor, and will he not therefore suggest that it would be better to scrap this ill-considered programme and, rather, go over to the fast breeder reactor, which is known to be safe?"

The Minister replied: "I will certainly draw that to the attention of the Secretary of State although, as Lord Wynne-Jones will appreciate, he is going slightly wide of future work at Dounreay." ☐