JULY 1980 NUMBER 285

ATOM

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THE PISC PROGRAMME

THE NUCLEAR POWER EXHIBITION

BOOK REVIEWS

JULY 1980 NUMBER 285

ATOM contents

THE MONTHLY INFORMATION BULLETIN OF
THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY

Last month's cover caption should of course have said about 20 per cent of all energy supplied was for the provision of heat at **above** 120°C . . . our apologies.

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Front cover: Chapelcross, near Annan, Scotland, celebrates its 21st Anniversary this year. Chapelcross was one of the forerunners of the CEGB's Magnox stations

AFTER THE REFERENDUM

The nuclear debate in Sweden has — for the moment — quietened. But it is by no means dead. Sten G. Sandström, Secretary General of the Swedish Atomic Forum, surveys the scene, and concludes that the debate "can be expected to wake up again as soon as the anti-nuclear groups find a suitable starting point."

Plebiscites are not an integral part of Swedish legislation. Each time a referendum is to be held the Swedish Parliament has to pass a new law on the proposal of the Government; and the outcome of any referendum is taken as advisory only. The last previous referendum was conducted in 1957.

A referendum on nuclear power was first proposed in 1975 in a Parliamentary motion proposed by the Communist Party. It was, however, rejected. Nuclear power was an important issue in the debate in the run-up to the general election in the autumn of 1976; the main point in the programme of the Swedish Centre Party was the abandonment of nuclear power, which contributed substantially toward making that party a winner in the election. The Social Democrat Government was replaced by a coalition formed by the Centre Party and the two pro-nuclear Moderate (conservative) and Liberal parties. After two years cooperation between the parties in the Government broke down, however, owing to different opinions on nuclear energy policy, and a liberal minority government was formed.

In the summer of 1978 a so-called "People's Campaign Against Nuclear Power", a grouping of various environmental organisations, women's associations, field biologists and so on, began to collect names with the aim of abandoning nuclear power in Sweden as soon as possible and requesting a referendum on the matter. Several hundred thousand names had been collected when the accident at Three Mile Island occurred on 28 March 1979. A week later the Social Democrat leaders declared that they had changed their minds on the nuclear question because of the Harrisburg incident and proposed a referendum to be held after the general election in September 1979. The Liberals and soon afterward the Moderates agreed to the proposal, which meant that it was now supported by all the political parties. The Social Democrats evidently acted under the pressure of the collection of names mentioned earlier and of a group of dissenters within the party, who could not be disregarded. The intention was to remove nuclear energy as a question in the election campaign. All the political parties declared that they would this time abide by the outcome of the referendum.

After the election the coalition formed a government with a majority of only one vote in the Parliament.

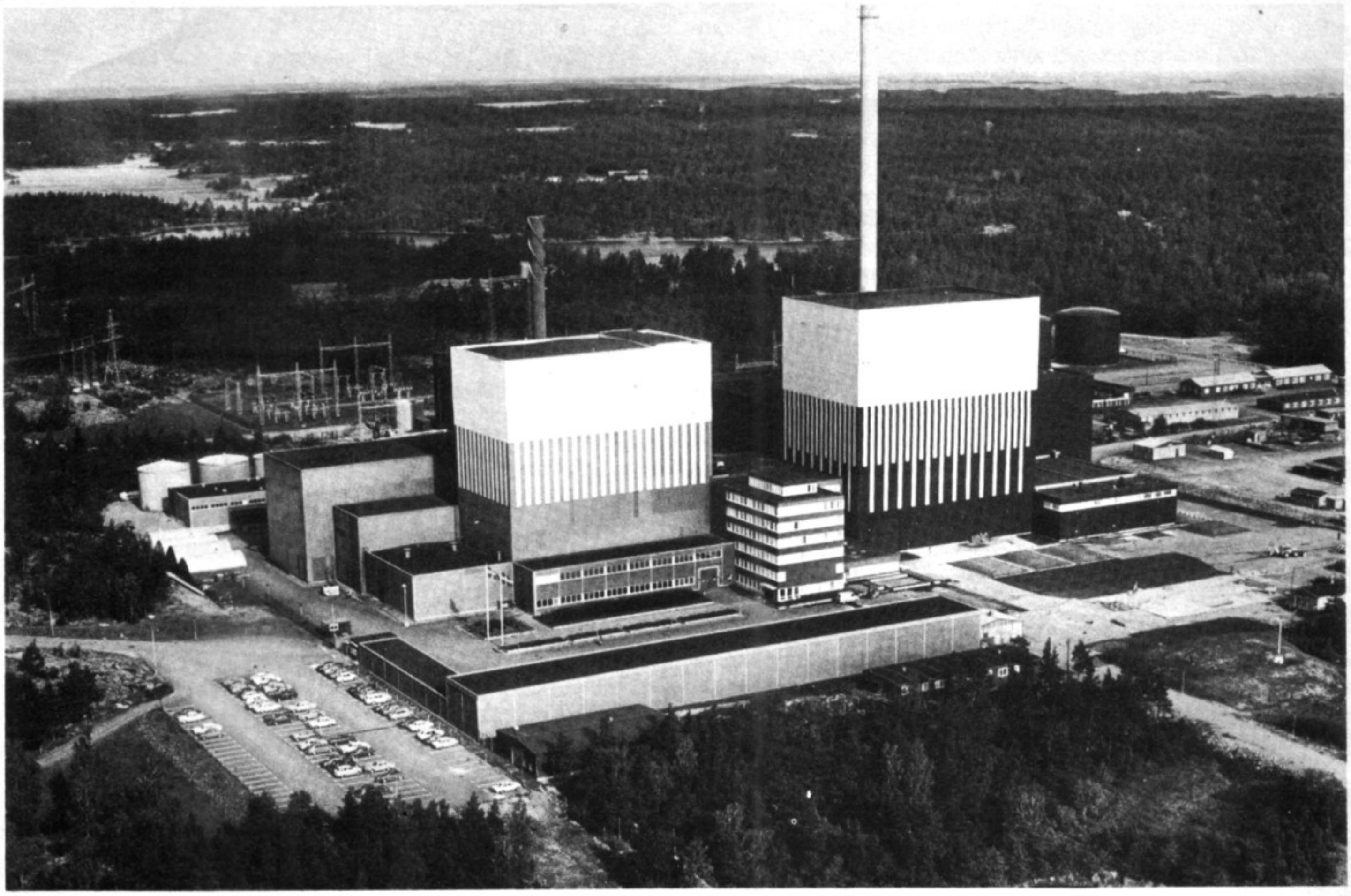
The referendum

After much discussion and political turning-about the Parliament finally, in December 1979, passed a law on a referendum to be held on 23 March 1980. The "no" alternative was drawn up jointly by the anti-nuclear groups, the Centre Party and the Communists. The other parties could not agree on a common text. The voters were therefore given three different alternatives to choose between, beside a blank ballot which remitted the question to Parliament. The alternatives offered were:

- Line 1, supported by the Moderate Party, proposing that all 12 reactors in the Swedish nuclear programme (six of a total of 3.7 gigawatts operating, four of a total of 3.6 GW ready for fuel loading and two of a total of 2.1 GW under construction) be used during their service life, estimated at about 25 years.

Ringhals 1 and 2

Lennart Olsson



Oskarshamn *Bo Dahlin*

• Line 2, supported by the Social Democrats and the Liberals, also proposing 12 reactors but also presenting a plan of gradually phasing them out up to the year 2010 and then replacing them with other energy sources, mainly renewable and domestic. Further public ownership of "large scale electricity production" was implied in this alternative.

• Line 3, supported by the Centre and Communist Parties, requesting phasing out of the presently operating six reactors within 10 years and an immediate cessation of work on the other six, which would never be brought into operation.

In practice the campaign on line 3 began during the autumn of 1979, but the other two "lines" could not start work until January 1980. A hectic and sometimes strident campaign dominated the media and public discussion until the voting day. As time went by the level of the arguments in the debate fell lower and lower — especially those from supporters of line 3, who in the end purveyed propaganda depicting all the perils to which the continued use of nuclear power would expose mankind. Beside environmentalists and politicians a number of representatives of the "cultural elite" — pop stars and the like — participated in the "no" campaign. A desire to create a new, ecologically-sound and more human society was for many people in these groups determinant of their standpoint.

The main arguments of the other two groupings were the risk of shortage of energy and its consequences for employment and the Swedish economy, which were emphasised in a report entitled "Suppose we go non-nuclear. . .?", presented last November by a commission set up by the Government in June 1979 "to study the consequences of dispensing with nuclear power."

The result of the referendum was:

Line 1	18.9 per cent
Line 2	39.1 per cent
Line 3	38.7 per cent
Blank	3.3 per cent

There was a turnout of 74.5 per cent, or about 15 per cent lower than is normal for general elections. As it was agreed between the political parties before the referendum that the voters for line 1 and line 2 should be added, the result meant that the anti-nuclear initiative was defeated by a three-to-two majority.

Yet, from the "no"-side it was maintained that the votes for line 2 and line 3 should be counted together as both these lines marked a distinct intention to replace nuclear power with other energy sources, and presented plans to achieve this goal, and anyway due consideration should be given to the fact that 40 per cent of the voters wanted to abandon nuclear power as soon as possible. It was also pointed out that there would be a surplus of electricity in the latter part of the 1980s if all the reactors were to be completed, which would prevent the introduction of "alternative" energy sources to the energy system: therefore, the eleventh and at any rate the twelfth reactors should not be completed.

The Prime Minister, leader of the anti-nuclear Centre Party, however, declared that the public had now given its approval to the use of *at most* 12 reactors and that it was up to the utilities to decide whether they would finish the construction of numbers 11 and 12.

Repercussions of TMI

In May 1979 the Government set up a Commission on Nuclear Reactor Safety (RSU) to re-evaluate the risks associated with nuclear power in Sweden in the light of the TMI-2 accident and to suggest steps to be taken to increase the safety of reactors. The National Radiation Protection Institute (SSI) was also commissioned "to overhaul the organisation and the available resources as to preparedness against accidents in nuclear power plants". Reports from both commissions, presented at the end of 1979, were often referred to in the referendum campaign.

The main conclusion of the RSU was that there was no basis for a major re-evaluation of the accident risks associated with nuclear power as they had been described in earlier Swedish studies. Considerably higher safety standards must, however, be maintained in the future in the nuclear industry on the part of the power companies, suppliers and the regulatory agencies. To increase further the safety of Swedish reactors, the RSU recommended measures to be taken on 49 items in various areas. Among other things the RSU recommended that reactor containments should be provided with additional filter systems to further reduce the risk of the release of radioactive substances in the event of a major accident.

SSI recommended in its report a number of steps to be taken to remove some deficiencies in the organisation for dealing with emergencies. It also painted a very alarming picture of what might happen in the event of a reactor core meltdown under the worst conceivable circumstances.

The nuclear authorities and the industry immediately started studies of measures to improve the safety of Swedish reactors recommended by the RSU. Thus, for instance, in February 1980 a joint project called "Modified Containment" was set up with a budget of about $ 4 million (20 million Swedish Crowns) "to develop conceptual designs of vent-filtered containments". As a further step to promote nuclear safety the four Swedish power utilities have formed a Nuclear Safety Board, which started its activities on 1 April 1980. The board is to sponsor safety R&D work and also to some extent perform assessment and analysis work. One of its main tasks will be to collect information about incidents and accidents in Swedish and foreign nuclear stations and to assess and analyse that information.

The SSI report has been sent for comment to a number of different organisations representing industry, authorities, research institutes and so on. On the whole it has received a positive response, but the risk assessment in the report has been criticised by many of the bodies which have commented.

Loading new reactors

The operating reactors in Sweden are Oskarshamn 1 and 2, Barsebäck 1 and 2 and Ringhals 1 and 2. Four days after the referendum the Government approved the loading of Ringhals 3 and Forsmark 1 with fuel (the so-called Respite Law of May 1979 prevented the start-up of any new reactor until after the referendum). Two weeks later the Government approved as well the loading of Ringhals 4 and Forsmark 2 with fuel but limited the permission to operate these reactors to the period up to and including 1986. This permission may, however, be prolonged if the reactor owners can, for example, present an extended reprocessing agreement or a plan for direct final disposal of used reactor fuel without reprocessing which is approved by the Government.

Fuel loading of Forsmark 1 started on 10 April and will begin at Ringhals on 1 July, pending a limited safety analysis to be approved by the Nuclear Power Inspectorate. Test operation at Forsmark 1 began in May. Forsmark 2 will be loaded with fuel at the end of 1980, and Ringhals 4 a year later.

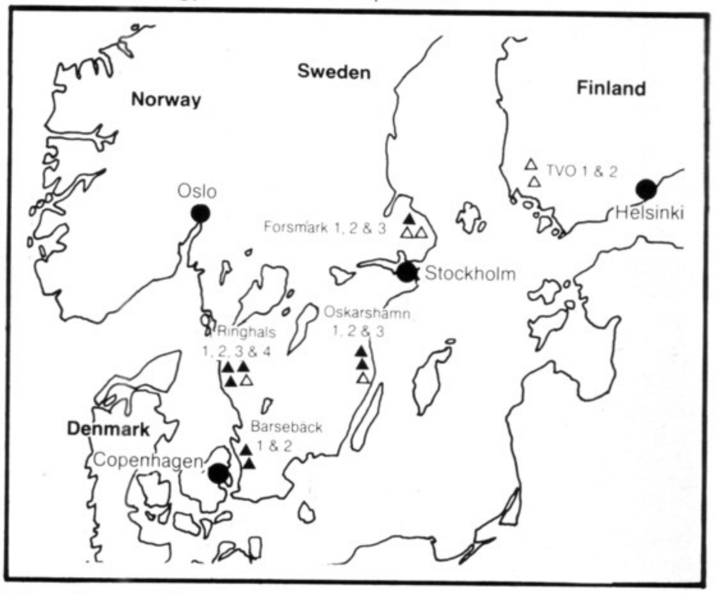
Energy policy

One month after the referendum the Government presented an Energy Bill to the Parliament. The Minister of Energy declared that the long-term objective of the energy policy would be "to abandon nuclear power at a rate which may be possible considering the need for electric power to maintain employment and welfare." At most the 12 reactors in the programme were to be used during their technical lifetime, estimated at 25 years from the start of operation. Measures to improve reactor safety which had been recommended by the Reactor Safety Commission (RSU) such as venting filter systems should be carried out by the end of 1985 at the latest. The safety analysis of each reactor should be intensified; and the Nuclear Power Inspectorate would be reorganised and get increased personnel and economic resources.

To some extent, said the Minister, the reactors would be used to reduce the consumption of oil for heating, but coal would replace oil during the 1980s and 1990s. The use of domestic alternative fuels, such as peat and biofuels, would be promoted, and the Government would propose a fund to be set up to support investments in oil-replacing techniques. Steps were also to be taken to introduce natural gas for heating in the energy system from the autumn of 1985.

A more detailed and complete Energy Bill is to be presented at the beginning of 1981.

In a motion laid before the Parliament the Social Democrat Party has proposed among other things that the Government should elect a representative to negotiate with the owners of the Oskarshamn reactors (at present 55 per cent privately owned) on a takeover by the community, and that there should be a public representative on the board of each of the country's hydro-electric power plants and the like. The party also asks that the Government's intention to replace nuclear power with other energy sources should be expressed more clearly. In motions from the Centre Party and from the Communist Party concrete steps to develop domestic and renewable energy sources are requested.



The aftermath

The intense referendum campaign virtually wiped out all other activities of national interest in Sweden. All the media concentrated on matters concerning the referendum only. No major economic policy initiatives were taken by the Government, and central labour-contract negotiations were at a low level pending the outcome of the referendum. Soon after it was over it seemed, however, to be forgotten. Some editorial comments on the outcome were made in the media and in a few articles some social scientists tried to analyse the result; but after only a week there was no more public debate on the nuclear issue, and interest turned to other matters.

The attitude of the nuclear opposition after the referendum was that they did not consider themselves losers, as they had anyhow created the biggest national movement in the history of Sweden. They declared that their fight would continue until all reactors were shut down. Soon it became clear, however, that there were many different views within the opposition about how to continue the work. It was decided that a conference should be held at the end of April to discuss future activities, but this was called off because of strikes. The only action so far taken by the anti-nuclear groups at the time of writing has been to request an evacuation area of 80 kilometres around the nuclear power plants.

At the beginning of May the first scientific study of the outcome of the referendum was presented by a research team at the University of Lund. It showed that if the votes for lines 1 and 2 were added, the two "yes" lines had a majority in 228 municipalities and the remaining "no" line a majority in the remaining 49 only. To a large extent the result became a reflection of the party political picture of the general election in September 1979. With increasing nearness to the nuclear power plants, however, lines 1 and 2 improved their results. An interesting observation is that in housing areas dominated by universities and other academic institutes line 3 was very successful in the referendum.

Even if the nuclear debate seems to have disappeared from the public scene it is, however, by no means dead, and it can be expected to wake up again as soon as the anti-nuclear groups find a suitable starting point. □

THE PISC PROGRAMME

Assurance of the integrity of the thick steel sections used in the fabrication of pressure vessels for power reactors is essential. R. O'Neil, of the UKAEA Safety and Reliability Directorate, discusses a major programme undertaken by the Plate Inspection Steering Committee.

The reliability and efficiency of ultrasonic non-destructive examination (NDE) of thick steel sections is a feature in assessing the integrity of nuclear reactor pressure vessels. This was recognised at a very early stage, and as far back as 1965 the US Pressure Vessel Research Committee (PVRC) began a programme to determine the reliability and capability of such assessments. This programme concentrated essentially on ultrasonic testing (UT) techniques. Some 12 thick-section test plates, all with welds and some with nozzles, were prepared; all had defects implanted during the course of fabrication. Three of the plates, two with straight welds and one with a forged nozzle insert, were offered to the EEC to form the basis of a collaborative programme. SRD were asked to manage such a programme and the Plate Inspection Steering Committee (PISC), now operating as a sub-committee of the EEC/OECD, began preparatory work in 1975. The plates were delivered first to the UK, where inspection began early in 1976, and thereafter inspections were carried out at various national centres throughout Europe, involving some 34 organisations from ten countries. As well as being a major technical project this also became a major exercise in international collaboration and goodwill.

The programme

The programme required the plates to be moved from country to country as indicated in the Table. In order finally to assess the reliability and compatibility of the NDE tests used it was necessary to examine the plates destructively by methodically cutting out and examining the characteristics of individual defects. A major contribution to the success both technically and in terms of time taken was the contribution of the EEC Joint Research Centre at Ispra where the bulk of the destructive examination (DE) was carried out, as well as the setting up and running of the computer program which compared predicted results with those actually observed. There were of course inputs from various national authorities both in physical examination and in determining methods of analysis, some of which received EEC funding; but the basic inspection costs were borne by the individual test organisations.

The American Society of Mechanical Engineers (ASME) was the first group to produce a coherent and cohesive set of NDE standards, and all the American work was proceeding on that basis. In order to extend the total data base and to permit a comparison, all teams were asked to work to a very tightly controlled version of the ASME XI procedure, which became known as the PISC procedure. In addition teams were encouraged to submit results from alternative ultrasonic methods, and these were the subject of separate analysis.

The results produced by the various inspecting teams were reported first as raw data (Data Sheet 5) and the inspectors' interpretation of this data (Data Sheet 6). The method used, as far as was practicable, was that defined in the relevant ASME procedure, namely, that the defect was given bounding dimensions in terms both of position and size. Where there were several defects, each of which would be acceptable in itself, sufficiently close together these were combined by the application of the ASME "proximity" rule, and a version of this was used for such clusters of defects in the specimens.

Destructive examination of the plates was necessary in order to determine the precise size and location of all defects, natural and implanted. The cutting up procedure is a complex one if evidence on the precise end characteristics of defects is not to be lost or

UK (start 5.1.76)	30.04.76	04.05.76
Netherlands	30.06.76	30.08.76
Belgium	30.09.76	18.11.76
Sweden and Denmark	31.11.76	20.12.76
Fed. Republic of Germany	28.02.77	10.05.77
France	30.06.77	07.10.77
Italy	30.10.77	21.01.78
Spain	—	19.05.78
25.05.78 Plates to JRC Ispra for destructive examination		
Finland	—	05.06.78 at JRC Ispra
Preliminary Report	31.01.78	March 1979

Table 1: The PISC programme

completely missed; it consisted of systematic cutting up, clear of the areas shown to be most likely to contain defects, followed by systematic cutting until defects were isolated in blocks of material of minimum size. This procedure is one which of necessity requires fresh decisions to be made after almost every cut, and could only be carried out effectively in a machine shop with the capability and flexibility of that at the JRC at Ispra.

Where doubts existed on the next step, sub-committees of the PISC group were quickly assembled to review the evidence and to make recommendations. When all the defects had been sized and positioned, they were entered into the computer in the same way as those reported by the inspecting organisations, these data being identified as the Reference Defects. It was now possible to analyse the differences between the reported defects and the Reference Defects in a number of ways.

All the plates were stress relieved in accordance with the appropriate ASME requirements. However, cutting the first plate indicated that considerable residual stress still existed, and arrangements were made for the nozzle plate to be cut under controlled conditions in order to determine the extent, if any, of residual stress. The cutting and analysis of the strain indicated clearly that despite a 17-hour "soak" at the full stress relieving temperature as shown on the furnace records, supplied tensile stresses of the order of 30 per cent of yield were present. Although interesting, this was not part of the basic PISC programme; it is the subject of a separate report by one of the Committee members, Miss K. Gott of Studsvik Energiteknik AB.

Destructive examination showed that on at least two plates there were "cloud" defects. These were bands of defects of about 1 mm or less in length, usually quite tight and not detectable with normal etching and polishing. Nevertheless, they could spread over a significant area (e.g. over a band more than 2.5 cm deep almost halfway round the nozzle in the heat affected zones). Such clouds are extremely difficult to detect. However, their effect on the physical characteristics of the material or the structural integrity of any vessel made from such material has not yet been determined and is the subject of a separate investigation.

Methods of analysis, and results

Many methods of analysis are possible, particularly with the use of a computer. Parameters were chosen to reflect straight detection probability, accuracy of positioning, accuracy of sizing in the various planes and so on, and the results presented in a variety of ways. For this summary two principal sets of results are presented:

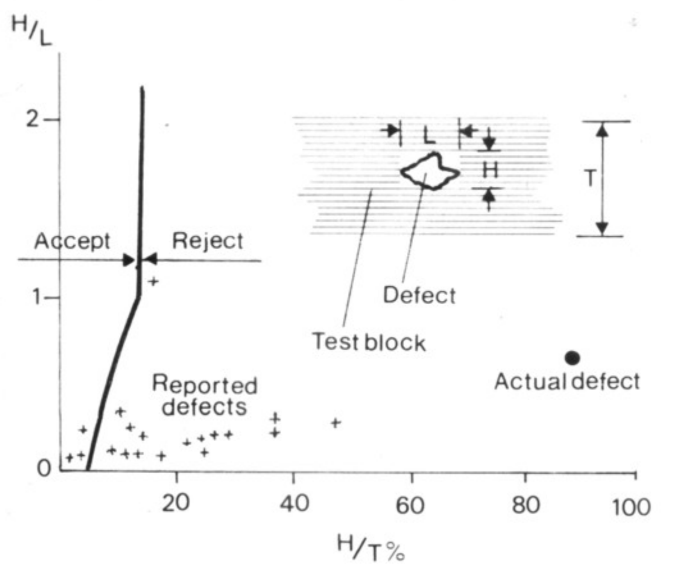


Fig. 1 Typical acceptance/rejection diagram

- The probability of detecting a defect (DDP) of a given size. This is estimated as the number of teams who reported a given defect divided by the total number of teams who had attempted it.
- It is not sufficient to detect a defect, it must be sized with sufficient accuracy to determine whether the indications are acceptable, or are rejected at this stage for further consideration. This is a conditional probability: that is, that the defect, having been detected, is correctly accepted (CAP) or correctly rejected (CRP). Again, this was estimated as the number of teams succeeding divided by the number who attempted. The acceptance criterion used for this purpose was again that used in the ASME procedure, as shown in Fig. 1. (In this the actual defect found is shown for reference purposes together with the reported defects, which were invariably optimistic.)

A few of the more salient results are now presented.

Defect detection — PISC procedure Fig. 2 shows the defect detection probability (DDP) for defects ranging from 1 mm up to nearly 250 mm, probabilities ranging from 0 to 1. Three groups of defects have been identified.

Group 1 consisted of 32 small defects of all kinds between 1 and 10 mm in size; the best correlation that could be obtained gave a coefficient of only 0.13, suggesting that there is no real correlation between DDP and size for such small defects. Many authorities however would consider such defects to be "acceptable". The validity of this assumption was not within the PISC terms of reference.

Group 2 consisted of planar defects ranging from 11 to 236 mm. These correlated very well (the coefficient being as high as 0.99 up to 70 mm). Even so, it should be noted that the mean probability of detecting a one-inch (25 mm) defect is only about 0.5. Since some 28 teams inspected identical defects by identical processes they can be considered as a single population, and confidence limits have been established. Fig. 2 shows the 95 per cent level, and it will be seen that the probability of detecting a one-inch defect at the 95 per cent lower bound is about 0.3.

Group 3 comprised seven sets of defects of what might have been individually acceptable size, but which combined by the ASME "proximity" rule were unacceptable. Their sizes ranged from 11 to 148 mm, and correlated reasonably well (R = 0.9). The mean probability of finding a one-inch defect is shown to be about 0.2, while the 95 per cent lower bound would be 0 probability at about two inches (50 mm).

Correct rejection probability — PISC procedure This is shown in Fig. 3. Group 1 defects of below 10 mm have been eliminated; the mean probability of finding a one-inch defect has dropped to about 0.4 for planar defects of Group 2, while the lower 95 per cent confidence limit has dropped to about 0.1. The mean results for sets of defects (Group 3) were even more disappointing, the mean probability being 0.

Alternative procedures

A total of 12 alternative techniques were also employed to examine the test plates, and analysed in a manner comparable with the PISC analysis. There is however one very important distinction between the two studies. With the PISC procedure, 28 teams finally presented usable results produced by a common procedure on common test blocks. All teams were supposed to follow the same procedure and their results could form the basis for a limited statistical analysis. However, in the case of the alternative procedures, each was an individual trial and, while the mean results can be plotted, they have no statistical significance.

Defect detection — alternative procedures Fig. 4 shows the defects detected and, again, three groups of defects are identified. The other results show a significant improvement on the PISC procedure results.

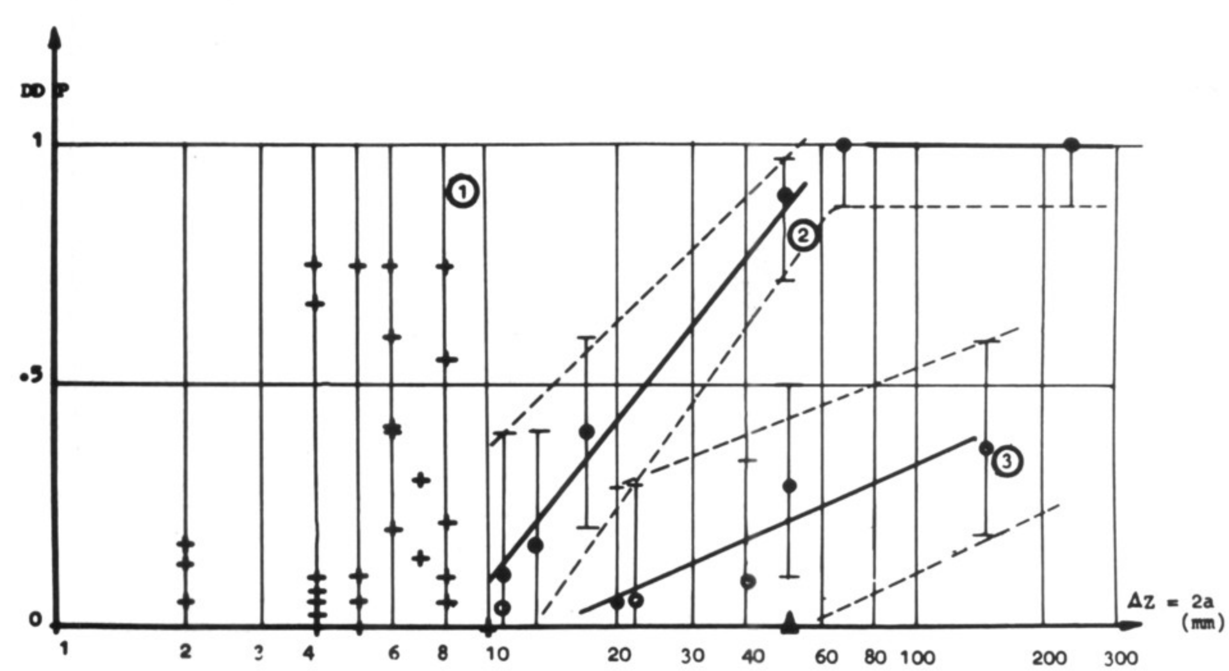


Fig. 2 Defect detection probability as a function of defect size. In this and later figures the dotted lines shown are the 95 per cent confidence limits based on a binomial distribution

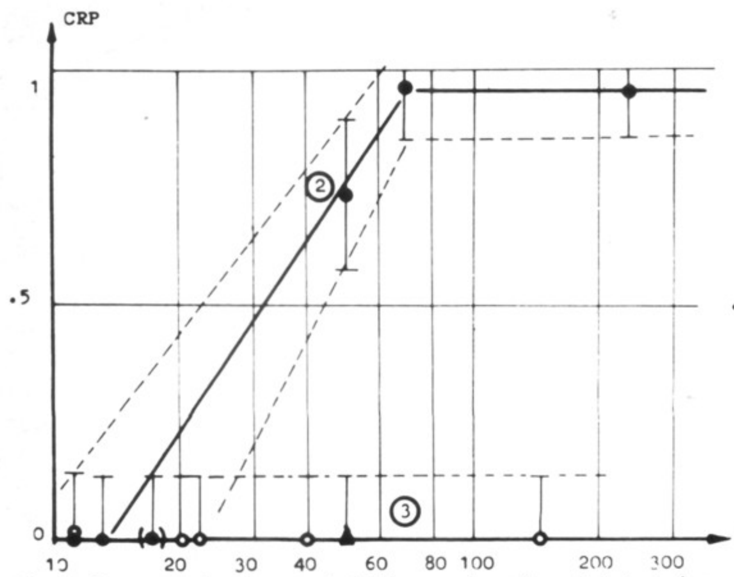


Fig. 3 Correct rejection probability as a function of defect size

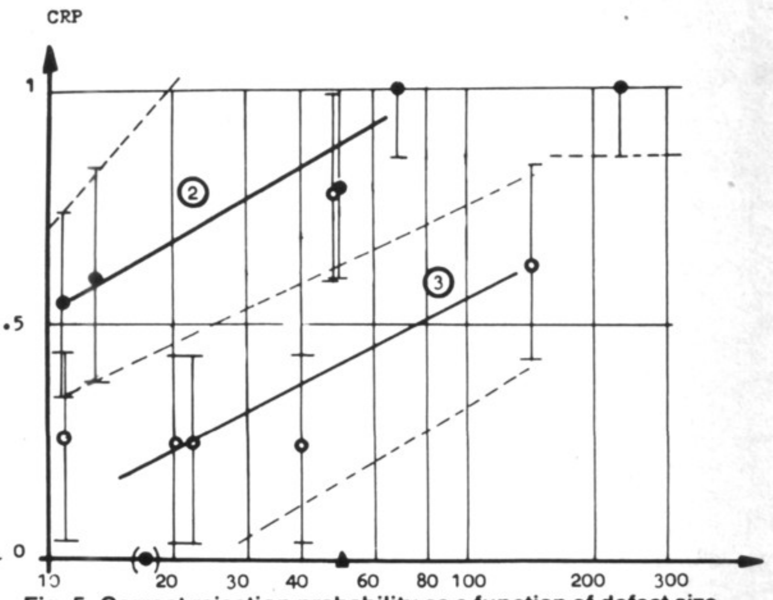


Fig. 5 Correct rejection probability as a function of defect size

Correct rejection — alternative procedures Fig. 5 indicates the condition for CRP and, while the best results achieved for Group 2 defects are very encouraging, the Group 3 results, although better than PISC, still leave something to be desired. This may be a function of the ASME "proximity rules" or of the way they have been used. It should also be noted that the mean values used take results from many differing procedures. These are currently being examined and a report will be produced which should highlight the most successful of the alternative procedures.

Summary and conclusions

The PISC project was originally conceived as a means of augmenting the American PVRC programme using test blocks supplied by the US. It was originally organised by an EEC sub-committee under SRD management and, in the first phase, all participants paid their own inspection, transport and other costs. The programme was later transferred to the Nuclear Energy Agency of the OECD, where the PISC group became one of the sub-groups of the Committee on the Safety of Nuclear Installations (CSNI), now with a joint OECD/EEC secretariat. For the second phase the major burden of costs and much of the enhanced effort were provided by the EEC Joint Research Centre at Ispra. Apart from its technical merit, the project has been an outstanding example of international collaboration and goodwill directed to a common and very worthwhile goal.

The results show that while the ASME XI objectives may well be sound and generally acceptable, they are unlikely to be achieved by the proposed methods of ultrasonic examination. However, a number of improved methods of ultrasonic examination are now available, some already in use in examination of European reactors, and first results from a small sample of these used on the PISC plates show encouraging trends. It is hoped that these will be considered in more detail in a later issue of ATOM.

As a result of the project to date, now termed PISC 1, a new programme, PISC 2, is now being prepared. This, which will be carried out in collaboration with the US and Japanese groups working in the same field, is to be presented shortly for endorsement by CSNI.

Full details of the work carried out in PISC 1 can be obtained from the HMSO in five volumes of EEC reports (EUR 6371 — a sixth is in the course of preparation) or in summary form in a companion OECD report (PISC, ISBN 92 64 12028 9). A further article containing more detail is also to be published in *Nuclear Engineering International*. □

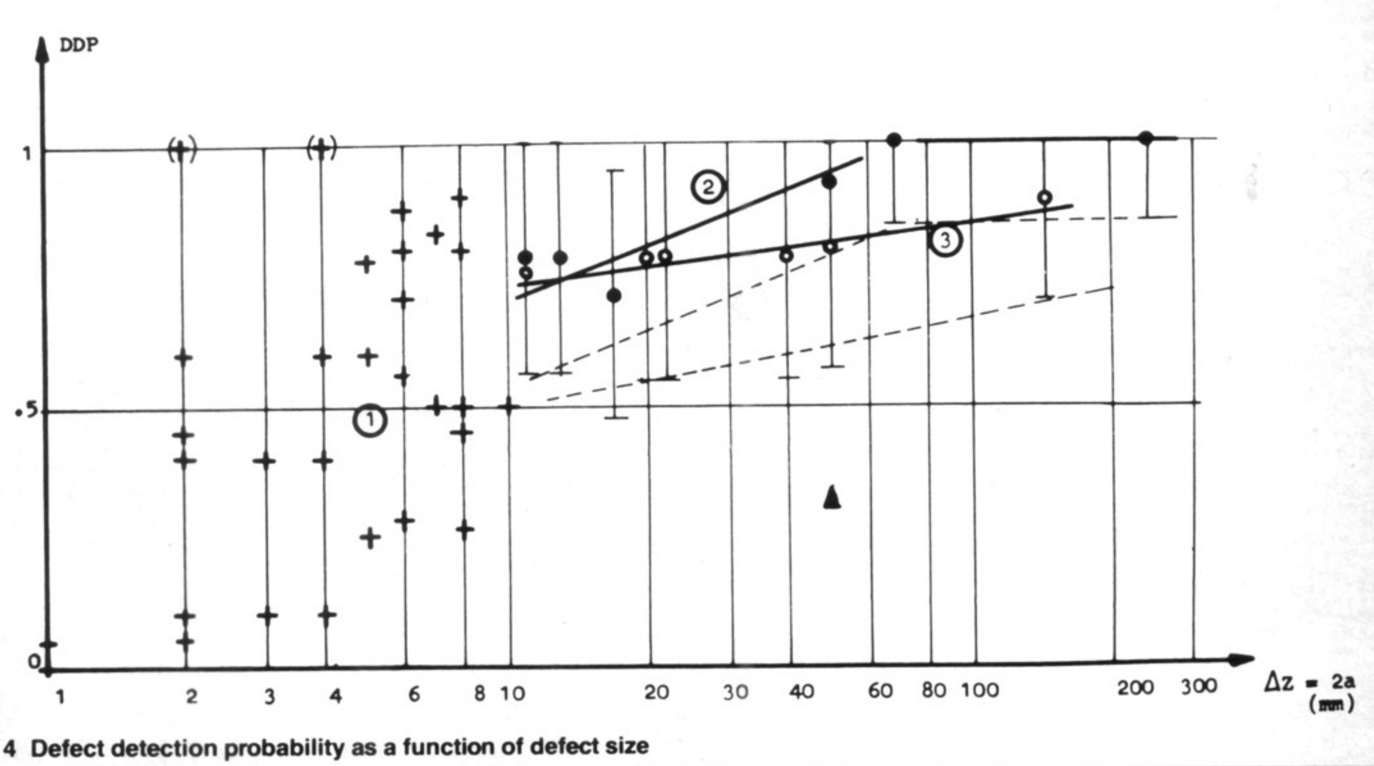


Fig. 4 Defect detection probability as a function of defect size

'ATOM FOR ENERGY' IN ABERDEEN

Given that there was division and conflict over the right course for Britain in the Eighties, "surely the fact that both the major political parties and both the CBI and the TUC endorse the nuclear power programme unreservedly and wholeheartedly should convince the doubters that this is the right and wise course," Mr David Nickson, chairman of the Confederation of British Industry in Scotland, said at the opening of the nuclear power exhibition in Aberdeen on 1 May.

"I think it is most significant that Mr James Milne, general secretary of the Scottish TUC, opened this same exhibition when it ran in Glasgow last month," said Mr Nickson. "There are sadly not many platforms which the CBI and STUC can share confident that they will be speaking with the same enthusiastic voice in positive support. But nuclear energy is certainly one. When the Government confirmed the previous administration's decision to build Torness. . . they too were acknowledging a bi-partisan approach."

Mr Nickson continued: "The UK has a basic need for a large-scale, reliable source of energy that will carry us on to the end of the century and beyond. We all know that there is sufficient coal to last this country for possibly 200 or 300 years, but no amount of economically worthwhile effort by men and machinery will enable the industry to dig enough coal out of the ground fast enough to meet Britain's energy needs. This is not to denigrate the absolutely vital contribution made by the mining industry but merely to put it into perspective.

"Even if we were able to dig out the coal in sufficient quantities we would soon find that it was essential to use much of it as a feedstock for the petro-chemical industry. And surely I need hardly remind you that on present prospects supplies of both North Sea oil and gas will inevitably start to decline in the 1990s.

"What about the renewable sources of energy such as wave, wind and solar power? That is the question people up and down the country are asking today and they certainly want a straight answer. To enable us to develop these sources effectively we as a country will need large sums of money as well as great strides forward in technological development. In time they may make an extremely valuable contribution. Present estimates suggest that we might achieve in the region of 10 per cent of our energy requirements from these sources. And remember we as consumers still want electricity on the days when the sun does not shine or when the wind does not blow."

All this led back to consideration of how we could meet the energy gap which would begin to occur over coming years, said Mr Nickson. "Let us make no mistake about it: we will need another source of power even if there is no real increase in demand for electricity; that source will have to meet the shortfall from gas and oil. We in CBI Scotland firmly believe that we must have nuclear power — and more of it. Otherwise we will be heading literally for the dark ages. The [North of Scotland Hydro-Electric] Board brought the people of the north-east out of the era of candle and paraffin lamp. None of us would like to see this industry lead the self-same people back into that same era. But without nuclear power, everyday life as we know it will change dramatically for the worse."

Commitment

The CBI and the electricity industry shared a commitment, said Mr Nickson. They faced either stagnation of industry, or regeneration. "There is no doubt in my mind that the existence or otherwise of a plentiful supply of electricity will be of vital importance in determining which. Some people of course say that the solution lies in greater conservation and argue persuasively that if we spent X million pounds on insulating our houses to a much greater degree we would not need so much electricity in the first place. This argument simply will not stand up to scrutiny. Again, we have to remember that existing forms of producing energy are shortly going to start to run out. And whatever people say about increased growth or rather lack of it, demand is also likely to rise."

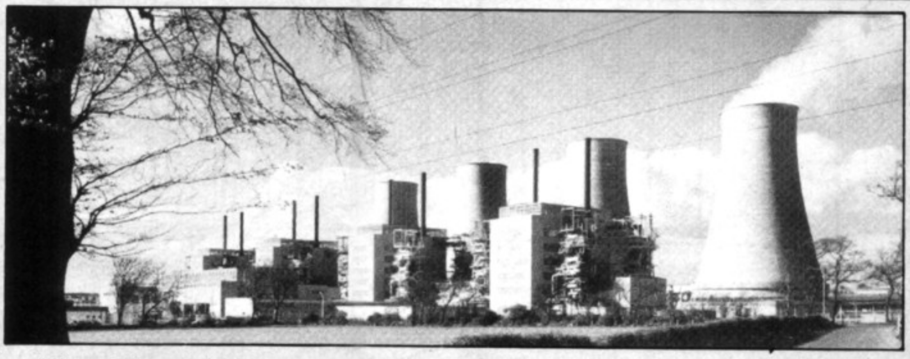
Those who buried their heads in the sand about the growing need for nuclear power grossly distorted the inherent dangers in technological development of this kind, and seemed to forget that there was an element of risk in nearly everything we did. Could the hazards in other industries seriously be ignored? In coal mining alone there were about 50 deaths and 500 serious injuries every year, and there were more than 30 000 cases of pneumoconiosis in the mining community. Could anyone deny that this was a high price to pay for one particular source of energy? And what about the dangers faced by divers in the oil industry?

"I sincerely believe that while risks do face any community which seeks to develop power from nuclear sources, they are risks which are acceptable," said Mr Nickson.

The exhibition might not necessarily convert anti-nuclear campaigners into enthusiastic supporters; but it would certainly give them a great deal to think about. "People are forever asking for more open government, for opportunities to debate the critical issues of the day. I feel that 'Atoms for Energy' provides the information essential for people to debate on a basis of understanding. I commend it to your attention."

The exhibition will be mounted in Exeter until 9th July; and in Portsmouth in the second half of September. □

Chapelcross is 21



Scotland's first nuclear power station — the four-reactor Magnox station at Chapelcross, two miles from Annan — was the venue for the 'Atoms for Energy' exhibition for two weeks in late May and early June.

Chapelcross is 21 years old this year, and the exhibition was mounted there as part of the anniversary celebrations. The station is owned and operated by British Nuclear Fuels Ltd., one of the seven sponsors of the exhibition.

A fifth of all electricity generated in Scotland is nuclear. One of the aims of the exhibition is to take some of the myth and mystery out of nuclear power, explaining the subject in clear, everyday terms with the help of pictures, models and films. The exhibition incorporates a simulated reactor, which members of the public can operate.

The controls of the simulator are based on those of an Advanced Gas-cooled Reactor such as those at the Hunterston B and Hinkley Point B stations, and the new AGR being built at Torness. Using push-button controls visitors can start the reactor and take it to full 'power' in minutes; it can be switched to automatic control and visitors can regulate the amount of 'steam' reaching the 'turbines' by working a throttle. They can also shut the reactor down if they wish. □

BOOK REVIEWS

The nuclear power decisions

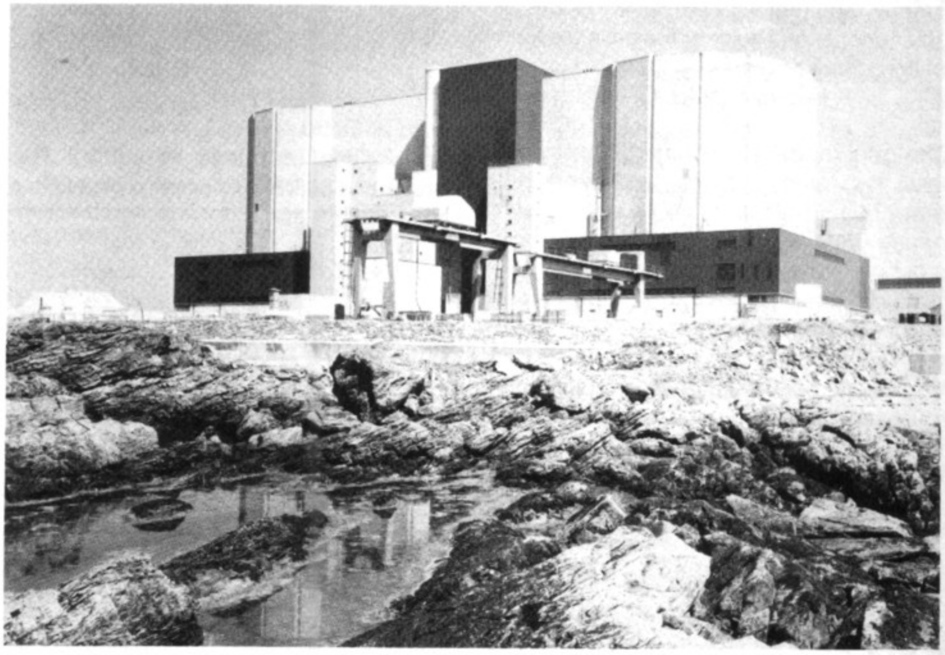
By Roger Williams; *Croom Helm Ltd, 1980; 365 pp, indexed; £19.95. ISBN 0 7055 0265 4.*

Professor Williams' book is a most useful and refreshingly balanced addition to the literature on nuclear power (although a paperback edition at a less daunting price would be welcome), and makes essential reading for anyone interested in the subject.

Although it is 25 years since Britain's, and the world's, first nuclear power programme was launched, there have been surprisingly few detailed studies of it. Various polemical publications, for or against nuclear power, have appeared — by, for instance, Hoyle, Lovins and Patterson — but there have been only three book-length evaluations of the British civil programme. Of these, R.F. Pocock's[1] is informative and reliable, but unanalytical; Duncan Burn's two books[2] are challenging but subjective and the earlier of the two is alleged to contain "pretty glaring inaccuracies". Professor Williams' book is therefore particularly welcome in that it combines an analytical approach with objectivity.

Roger Williams — a scientist as well as Professor both of Government and of Liberal Studies in Science at Manchester University — is well qualified to comment on the intricacies of nuclear power. In chapters 1-8 he traces systematically the history of the whole nuclear programme from 1953 to 1978, examining thoroughly the events which led up to the landmark decisions of 1955, 1957 and 1960 on the Magnox reactor, the choice of the AGR as against the LWR (with a brief but excellent sketch of the background of the American LWR intervention) for the second nuclear programme, and the later alternative systems, the PWR and SGHWR. A great deal of important material has been gathered together in these chapters, and it is admirably organised; the division in Part 1 between people, technology, economics and politics is especially helpful in furthering understanding of such a complicated story. The discussion of economics in chapter 3 is very lucid. The political chapter includes a succinct description of the essential differences between the AEA and the CEGB; but the account of the "Wylfa Imbroglio" would have had greater import if it had been backed by a more detailed commentary on the formation and nature of the consortia. One other point: although military matters are beyond the scope of the book, Professor Williams takes perhaps too little account of the link between the civil programme and military requirements. Apart from this there is a strong sense of the prevailing atmosphere in which decisions were made and options taken, Professor Williams having successfully avoided the temptations of hindsight.

The last four chapters lack the clarity of the rest of the book and are difficult for even a reasonably informed reader to absorb; for example, chapter 9's critique of the AGR and discussion of alternative reactor systems is most bewildering and lacks cohesion. Chapter 11 leaves the territory of reactor decisions and "closed" policy making for a jungle — the rise of pressure groups and anti-nuclear organisations in the 1970s; demonstrations, campaigns and mass meetings; the increasingly active media; the Flowers report[3] of 1976; BNFL's THORP proposals, the 1977 Windscale inquiry, the Parker Report and the aftermath; concern about radioactive waste, reactor and plant accidents and incidents; nuclear proliferation and the so-called plutonium economy. This diverse and tightly packed chapter must have been difficult to write and it is disappointing. However, the later period is much harder to divide into convenient sections, made more so because of its proximity to the present.



Wylfa: 'Imbroglio'

Professor Williams' impartiality throughout the book is to be commended, but chapter 12 is dissatisfying in its conclusions; at this point in a book, the reader would expect a more definite statement of the author's view on specific issues. On the more general level, he deplores the unnecessary secrecy which he finds in the nuclear industry; while cautious about "participatory" procedures, he points out the corrective value of the maximum openness in discussion and policy making. Above all he emphasises the need for greater public accountability, and the development of informed critical institutions to monitor nuclear affairs "with full techno-economic rigour". Government departments have been ill-equipped to do so, and Parliament and Parliamentary Committees have not in general been effective in this area. In contrast, he points to the way nuclear health and safety have developed in Britain, with the formation of independent organisations having expert knowledge of radiological health and of nuclear safety (NRPB and NII — and also the virtually independent SRD). No such expert and independent body, he notes regretfully, exists in the field of nuclear power economics. He compares the emphasis — perhaps over-emphasis — on nuclear health and safety, with the apparent public indifference to economic questions even when billions of pounds of money are involved.

This absorbing and well-documented book exemplifies both how much can be extracted from published sources alone, and how many questions will remain unanswered until the papers are opened.

Lorna Arnold and Stephanie Zarach
Authority Historian's Office

References:

1. R.F. Pocock, *Nuclear Power.* Gresham Press, Old Woking, Surrey, 1977.
2. Duncan Burn: *The Political Economy of Nuclear Energy.* IEA, London, 1967; *Nuclear Power and the Energy Crisis.* Macmillan, London, 1978.
3. *Nuclear Power and the Environment:* Sixth Report of the Royal Commission on Environmental Pollution, Cmnd 6618, September 1976.

Energy in transition 1985-2010

Final Report of the Committee on Nuclear and Alternative Energy Systems (CONAES) of the US National Research Council

W.H. Freeman, 660 Market St, San Francisco, CA 94104. $11.95 (paper), $24.95 (hard cover).

"For the transitional phase, coal (including synthetic fuels derived from coal), certain unconventional and expensive forms of oil and gas, and currently developed and deployed forms of nuclear power are available. The duration of the transition will depend on the extent to which they can be extracted and used in an environmentally acceptable manner.

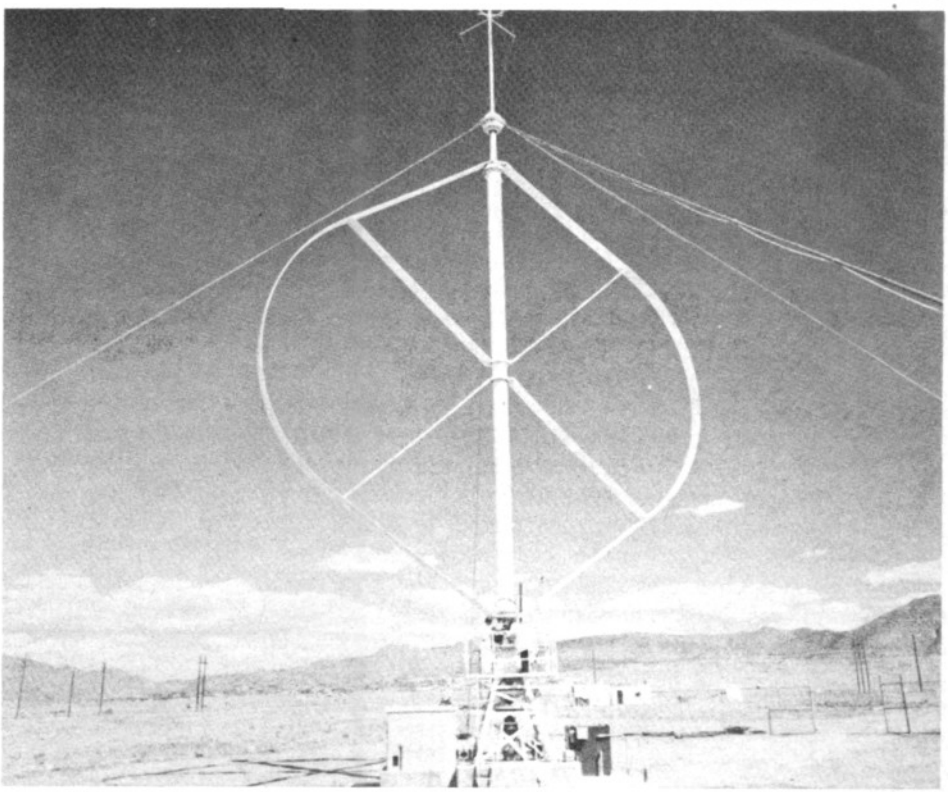
"The only long-sustainable energy alternatives, available with some degree of confidence on a scale sufficient to make a meaningful contribution to US and world energy requirements, are several forms of solar energy and nuclear fission in the form of breeder reactors."

— Harvey Brooks, Co-chairman of CONAES

The general debate on energy policy, no less than other subjects, has produced many "fashionable" opinions upon which nearly everyone can agree. No matter how much we may have argued about UK policy we could all point an accusing finger at the United States and despair at their wasteful use of energy. With consumption of energy per head at twice European levels and an energy dependence in GDP some 50 per cent higher, there seems to be strong evidence of energy profligacy. But the situation is changing; the US has improved its energy efficiency far more than the other major western nations in recent years. But what of the longer term? The CONAES study, presented to the US Energy Secretary on Christmas Day 1979 and published earlier this year, urges policies for continuing improvement in the US to achieve long-term balance between supply and demand for energy.

The report attempted a detailed analysis of all aspects of the US energy situation. It is assured of wide readership and deservedly so. Any report of this length (783 pages), itself a summary of numerous background studies and funded to the extent of $4 million over four years must command an audience. Equally important, however, the CONAES panel itself was systematically selected to ensure as far as possible a balance of the many different interests within the energy debate, plus some avowedly neutral members. In the circumstances, the measure of agreement achieved is considerable and a credit to those responsible for drafting the final report.

CONAES above all emphasises the need to reduce reliance on imported oil in the face of growing international uncertainty on supplies and the longer term oil resource position. They concluded that there was nothing which was likely to shake the market dominance of OPEC (and it is possible, we may conclude from other studies, that oil production levels have already reached their peak). In the short term conservation was seen to be the key to energy balance. But taking the next 30 years as a whole a transition would be required away from depleting oil and gas to other fuels: coal, nuclear power and the varieties of solar power. The question, as CONAES put it, is whether the US "are diligent, clever and lucky enough to make this inevitable transition an orderly and smooth one", bearing in mind that there will be economic and social effects of *any* energy policy over the period.



The shape of things to come? This developmental vertical axis wind turbine produces 60 kW of electrical power in a 28 mph wind *Sandia Labs*

The importance CONAES placed upon coal and nuclear power was striking; they were regarded as the only economic alternatives for electricity generation in the near term. Bearing in mind the uranium resource picture, for higher economic futures the fast reactor "can be regarded as a probable necessity" early in the next century. (A strong statement for the US, one of the world's major uranium producers.) If the US were permanently to forgo reprocessing and the fast reactor, CONAES estimated they might achieve a maximum capacity of 400 GWe in 2000 (it is currently approaching 60 GWe) with a decline thereafter. If reprocessing and the fast reactor were introduced, the figure could rise to 600 GWe in 2000 if necessary and of course there could be further expansion using fast reactors. The Committee acknowledged the greater need of European countries to develop the fast reactor and reprocessing options since their indigenous uranium reserves were very small.

By contrast CONAES believed that the contribution of solar power would not rise above 5 per cent of total US energy requirements this century without massive Government intervention and fuel market distortion. Their views on funding of solar were salutary — too much funding too soon could in fact foreclose some possibly attractive solar options once larger prototype plants were constructed. They felt that in any case it would be better to concentrate research into direct solar heating applications rather than into solar-generated electricity, where coal and nuclear were clearly preferable options to 2010. CONAES also warn that "decentralised solar technologies, if deployed on a scale sufficient to provide a significant fraction of national energy needs, will require a large-scale mass production, distribution and service industry that might not look so very different from existing electric- and fuel-distribution networks."

Indeed, CONAES were clear about the benefits that electricity had brought the US:

- electricity's share of the energy market has grown over the period from 1920, as energy consumption per unit of GDP decreased;
- despite the simplistic observation that electricity generation is thermally inefficient, it has transformed the way production is undertaken and all other fuels are used;
- the result has been massive gains in the productive efficiency of the economy and thrift in the use of other raw materials and fuel.

"This committee has studied at length the many factors and relationships involved in our nation's energy future. It offers here some technical and economic observations that decision makers may find useful as they develop energy policy in the larger context of the future of our society.

Our observations focus on

(1) the prime importance of energy conservation;
(2) the critical near-term problem of fluid fuel supply;
(3) the desirability of a balanced combination of coal and nuclear fission as the only large-scale intermediate-term options for electricity generation;
(4) the need to keep the breeder option open; and
(5) the importance of investing now in research and development to ensure the availability of a strong range of new energy options sustainable over the long term".

CONAES' major observations

The Committee also looked at fusion. They argued for continued work and a further evaluation in five years. By that time they expected that large scientific breakeven experiments in both magnetic and inertial confinement would have been attempted. More realistic engineering designs and guidance for further research on technological obstacles should then emerge naturally, they believed. But it was too early for them to say that fusion could be included as a candidate technology for long-term sustainable energy sources.

On all the issues the Committee developed more than one view and on nuclear power there were those who regarded it as a fuel of last resort, while others regarded nuclear power as the safest and least environmentally damaging among the alternatives. Such was the balance of the panel that these two views were evenly held with some intermediate views. There is a danger that the casual reader might interpret this as a draw! It would be equally unenlightening to pick out all the points favourable to one side or the other. The sad truth for those of us in a hurry is that reports such as CONAES [and, one might add, the Royal Commission on Environmental Pollution's Report on Nuclear Power and the Environment, and the reports of INFCE] need to be read in some depth. However, there was a consensus that the US should maintain the fast reactor option, with a majority counselling against early US commercialisation. Those opposed to nuclear expansion were chiefly concerned with the danger of proliferation of nuclear weapons. Again, within the generality of views there was one point of full agreement: "Stopping the spread of nuclear power, or limiting its evolution to forms considered proliferation resistant, cannot stop proliferation. Countries with sufficient determination will get bombs by other routes". In the aftermath of INFCE the political nature of proliferation is now perhaps better understood and while efforts continue to find technical means of minimising proliferation risks, including safeguards, political initiatives will also be valuable.

There is an equally fair discussion of risks in the energy industries, which echoes the remarks of F.R. Farmer published in ATOM [No. 282, April 1980]. On electricity-related risks in particular they noted that in the US light water reactors and natural gas systems had shown the lowest historical incidence of fatal accidents (0.2 deaths per GWe-plant-year). The rates for oil and coal were 0.35 and 4.0 respectively.

The report shows that adequate supplies of energy to the US will require large and sustained efforts to meet likely demands, even with concerted conservation programmes which, they feel, would only materialise if energy prices were pushed much higher. CONAES felt that high energy prices could be sustained without undue negative impact on the economy as a whole. But this is not accepted by most energy economists. Certainly CONAES believe we should not rely for our energy salvation on sources which guarantee high prices, and they acknowledge that while we should pursue conservation, this "should not be taken as a dependable basis for forgoing simultaneous and vigorous efforts on the supply programme."

J. Sargeant
Economics and Programmes Branch

Consumer products containing radioactive substances

The Secretary of State for Trade intends to make regulations requiring consumer products to be approved by the National Radiological Protection Board. The Board has therefore started work on establishing criteria against which particular applications for approval could be considered; its initial proposals, prepared with the help of an Advisory Group reflecting both manufacturers' and consumer interests, have been published as a Consultative Document* for public comment.

The NRPB points out that a basic assumption in radiological protection is that any level of exposure to radiation entails some risk of subsequent harm. Three requirements must therefore be satisfied before any practice involving radiation exposure can be accepted as "safe":

- the benefits of the practice must outweigh the harm;
- any exposures must be reduced to levels which are as low as reasonably achievable; and
- certain radiation dose limits must not be exceeded.

The Consultative Document puts forward the NRPB's proposals for the detailed interpretation of these requirements for consumer goods.

The proposals relate to the limitation of radiation doses to users of consumer products and any other persons who may be exposed to radiation from such products. The doses considered are those arising during normal use, through accidents and misuse, and as a consequence of uncontrolled disposal. Account is taken of the benefit derived by the user.

The approach suggested is to specify dose restrictions related to various categories of benefit. The Board recognises, however, that the use of radioactivity in some products is likely to be considered unacceptable in principle by most people. These are quack remedies for improving health, jewellery, toys and art forms. Their use would not be approved; nor would the supply of radioactive sources not incorporated within complete products.

Other uses of radioactive substances are divided into two categories: those that relate to safety and all other uses except those that are unacceptable in principle. The proposed dose restrictions for the individual user of a product in these categories are 0.05 mSv (5 mrem) in a year and 0.005 mSv (0.5 mrem) in a year, respectively. However, for long-established products such as radioluminous clocks and watches the former of these restrictions might be applied. The proposed dose restriction for the most exposed group of non-users (those who receive no direct benefit but who may be irradiated as a consequence of the user's activities) is 0.001 mSv (0.1 mrem) in a year for a given type of product.

To put these values into perspective, the Consultative Document points out that on the basis of current risk estimates 0.05 mSv carries with it an overall risk of producing deleterious health effects of about 1 in a million. This is comparable to the risk estimated to result from smoking one cigarette, drinking half a bottle of wine, travelling 50 miles by car or 400 miles by air, rock climbing for 1-2 minutes, canoeing for 6 minutes, doing typical factory work for 1-2 weeks, or simply being a male aged 60 for 20 minutes.

The Board suggests that the dose limits should be used as a guide against which to evaluate the significance of doses received from the more likely accidents and misuses. It also suggests that good design can reduce the probability of accidents and misuse. Design factors would be taken into account when considering particular applications for approval.

The Consultative Document also includes the following proposals:

- That at low levels of risk it would be unreasonable to refuse to approve a product containing a radioactive substance solely on the grounds that there are non-radioactive alternatives. Account would be taken of the existence of non-radioactive alternatives only if the average whole body dose to the user during normal use of the radioactive product exeeds 0.01 mSv (1 mrem) in a year; and
- That compliance with the dose restrictions is not sufficient for approval to be given. It is also necessary to ensure that all doses are as low as reasonably achievable. This implies the application of judgements regarding the design and construction of products.

The Board hopes that its proposals will be widely discussed and is seeking comments from any who would like to express a view — not just those with a professional interest. Comments should be made to the Secretary of the Board by the end of August. The Board will discuss these comments with its Advisory Group before deciding upon its criteria.

Further information is available from the Information Officer, NRPB, Harwell, Didcot, Oxon. OX11 0RQ; Tel: Abingdon (0235) 831600. □

Criteria Relating to the Approval of Consumer Goods Containing Radioactive Substances: A Consultative Document HMSO £1.00.

Portugal joins IEA

The Governing Board of the International Energy Agency at their meeting on 23 April unanimously approved the application of the Government of Portugal to become a member of the IEA. □

THE NUCLEAR DEBATE: Contd.

TEN COMMANDMENTS

A few months ago the Council of the United Church of Canada organised a three-day conference on the moral issues of nuclear power, attended by about 80 participants from across Canada representing both church organisations and the nuclear industry.

The conference chairman, Rev. Gerald Paul of Kincardine, Ontario, laid down the following ground rules for the conference.

1. Thou shalt not attempt to resolve energy issues in isolation from those who have technical knowledge.
2. Thou shalt not use the Bible as an answer book.
3. Thou shalt recognise the close relation between facts and values, objectivity and subjectivity.
4. Thou shalt not evaluate any energy source by itself but always in relation to alternatives.
5. Thou shalt not consider present costs/benefits in isolation from future costs/benefits.
6. Thou shalt remember that human beings and Nature are inter-related, and there is a connection between what is good for one and what is good for the other.
7. Thou shalt recognise that the edges of ethics and theology are speculative.
8. Thou shalt not forget that the edges of science and technology are also speculative.
9. Thou shalt not worship Margaret Maxey or Helen Caldicott, Fred Hoyle or Amory Lovins, the atom or sun, consumption or conservation, non-renewables or renewables.
10. Thou shalt lay open, assess, and attempt to resolve the moral issues (involved in energy issues generally and more specifically in nuclear power) always bearing in mind that humility and unity in Christ are to be preferred over arrogance and needless strife.

Magnox stations save £100 million

The electricity consumer has benefited by about £100 million from the Central Electricity Generating Board's eight Magnox nuclear power stations so far, Mr Glyn England, CEGB chairman, told staff at the Board's Transmission and Technical Services Division in Guildford on 21 May.

Mr England said that up to the end of March 1980 the cash outlay needed to produce the three hundred thousand million units of electricity that the Magnox stations had generated came to £1930 million, including capital charges. The cost of the coal-fired alternative would have been £2040 million.

Although it was too early to make the same kind of comparison for the CEGB's Advanced Gas-cooled Reactor (AGR) stations, "we can assess the performance of the first station to come into operation, Hinkley Point B, by comparing its annual generation costs with those of our newest coal-fired station, the first half of Drax," said

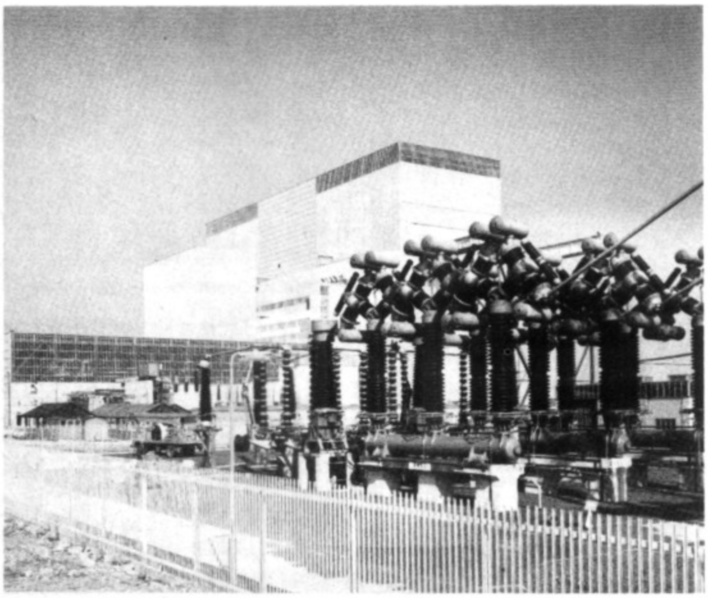
Mr England

Mr England. "On the provisional figures for the last financial year Hinkley Point B generated at 1.32 p per unit compared with 1.51 p per unit for the first half of Drax."

Mr England said steady progress was being made with all three AGR stations yet to be completed. Dungeness B was now scheduled to begin supplying electricity to the grid early in 1981, and at about the same time fuel would be loaded into the first reactors at Hartlepool and Heysham.

"In pressing ahead with the next AGR project, the second station at Heysham, we are doing all we can to learn from past experience," he continued. "We are keeping basically to the proven Hinkley Point design. We also aim to reduce the construction delays by ensuring that as much design work as possible is completed and safety clearance obtained before site work begins. This, we expect, will be in August. We shall also learn from the pioneer work on construction site management now being introduced during completion of the Drax coal-fired station, aimed at shortening construction times and reducing costs."

Mr England stressed that the CEGB's nuclear stations had maintained their excellent safety record. "We have now accumulated a total of 230 reactor years of operation and for the whole of that experience there is no evidence of harm attributable to radiation having been caused to any power station worker or member of the public". □



Hinkley Point B: 1.32 p/kWh . . .

Drax: 1.51 p/kWh

CEGB photos

Harwell commercial receipts increase

AERE Harwell met its financial targets for the year 1979-80. Receipts for research and development work carried out under contract (excluding funds granted by Parliament for atomic energy research) reached £30 million.

Contract R&D accounts now for more than 55 per cent of the laboratory's activities, and Harwell maintains a position as one of the largest contract R&D laboratories in Europe. Its customers range from the largest national companies, public sector industries and government departments, to the smallest firms and local authorities, for whom it carries out a range of programmes.

Harwell's nuclear research facilities are the focus for expanding contract programmes on behalf of the UK nuclear industry. Topics include radioactive waste management, fuel reprocessing, radiological protection and environmental safety, and the reactors at Harwell are used continuously in the production of isotopes.

Current non-nuclear activities include work on advanced batteries for electric-powered vehicles, the development of oil and gas field modelling techniques for the offshore industry, and the development of new biochemicals purification and separation techniques for the food, pharmaceuticals and fine chemicals industries. Harwell has as well a range of programmes under multiple sponsorship, including the Mining Instrumentation Development Advisory Service, the Heat Transfer and Fluid Flow Service for the chemical engineering industry, and the Petrol and Diesel Clubs in which major engine manufacturers support the development of laser instrumentation for the study of internal combustion engines.

In the field of environmental safety, Harwell carries out work on inhalation toxicology, contaminated land reclamation and industrial waste disposal, and runs the Waste Management Information Bureau and the Chemical Emergency Centre as national services. The HAZFILE scheme helps fire brigades throughout the UK to deal with chemical transport emergencies.

Dr Ron Sowden, Commercial Director at Harwell, said of the 1979-80 results: "I am encouraged by this performance which reflects, in particular, the strength of our links with industry. The laboratory is maintaining a healthy balance between its nuclear and non-nuclear activities, with considerable benefit to the technical quality of both programmes." □

Protecting lives and plant

Countless lives and millions of pounds worth of industrial plant are being protected in Britain and around the world as a result of a decision taken ten years ago. The Systems Reliability Service, founded at the UK Atomic Energy Authority's Safety and Reliability Directorate in 1970, has grown from a small engineering consultancy into a leading research and advisory organisation with an international reputation.

The SRS celebrated its tenth anniversary in London on 16 May with a lunch for clients and staff. The main speakers were Sir John Hill, Chairman of the UK Atomic Energy Authority, and Mr John Locke, Director General of the Health and Safety Executive.

The Systems Reliability Service was set up in response to an increasing demand from industry for access to the know-how in safety and reliability engineering accumulated by the AEA's Safety and Reliability Directorate. It had been seen that experience gained in the nuclear field was equally applicable to other high technology industries.

When the demand for help became too great to deal with on a casual basis, SRS was set up with Department of Industry approval as a service to industry. Within four years it became clear that the SRS would have to stay in the forefront of safety and reliability technology if it was to keep pace with clients' demands. A research unit was formed and the computer section was reorganised so that three units — Systems Reliability Service, Reliability Technology Research Unit, and Data Bank formed a new overall organisation, the National Centre of Systems Reliability (NCSR). When NCSR came into being, its Head, Dr Eric Green, launched an Associate Membership scheme whereby companies, government departments, state corporations and research and educational institutions came together to pool and exchange data on thousands of pieces of equipment and processes.

The Systems Reliability Service gained a new Head in April, Dr David Worledge, a PhD in experimental nuclear physics with a scientific background that includes the Rutherford Laboratory, the Sandia Laboratories in New Mexico and the Los Alamos research station, and the UKAEA's Safety and Reliability Directorate. He believes that the SRS's commercial success will be limited only by its ability to recruit or train suitably qualified staff in an engineering discipline still in its infancy.

"It is a question of expanding sufficiently to take on all the work we are being offered" he said. "We must earn enough money to support our research unit because in our commercial activities we must stay in the forefront of knowledge.

"It is, however, only by going out and doing project work that we can discover what people want and ensure that we are researching on the right lines and the right problems. It is all too easy to get carried away on a promising line of research which may be fascinating academically but has little value to the man operating a plant. Our commercial activities give a sense of direction to our research".

In the photo Mr George Kinchin explains a point in the exhibition mounted at the luncheon to a visitor. Sir John Hill is second from the right, and Dr Green third from the right. □

R&D in uranium exploration

"Most authoritative projections of energy needs recognise that nuclear power must continue to be developed to make an increasingly significant contribution to total energy requirements up to and well beyond the end of the century. Increases in the price of fossil fuels have resulted in accelerated research into alternative forms of energy. This has confirmed that, apart from coal, uranium is likely to be the only energy source available to meet the bulk of the increasing energy demand for the foreseeable future. As known uranium 'reserves' correspond to about 20 years of forward requirements, greater quantities of uranium must be brought into the reserves category."

Thus, the first paragraph of a new newsletter on *R&D in Uranium Exploration Techniques* produced by the Nuclear Development Division of the OECD Nuclear Energy Agency (NEA). The Agency began publishing analyses of uranium resources, production and demand in 1965; since then the NEA work programme has been extended to include evaluation of the complete nuclear fuel cycle and the implications of its development for the evolution of the nuclear option, particularly in the long term.

One new area in which the NEA is developing an operational programme is in uranium exploration techniques, which the Agency sees as of growing importance as it becomes increasingly difficult to discover additional uranium deposits to meet rising demand. Since 1976 a joint NEA/International Atomic Energy Agency Group of Experts has held a series of workshops to select exploration techniques suitable for collaborative R&D projects; the NEA says the main aim of the new newsletter is to publicise the progress made in the projects now being coordinated by the Joint Group. The newsletter also discusses general trends. It is available in English and French, and the Agency says that if there is sufficient demand it is proposed to publish further issues at about six-month intervals. It is free of charge.

Further information is available from The Secretary, Uranium Exploration R&D Group, OECD/NEA, 38 Boulevard Suchet, F-75016 Paris, France. □

This 4-channel gamma spectrometer developed by Harwell measures simultaneously uranium, thorium and potassium concentrations

URENCO is 10

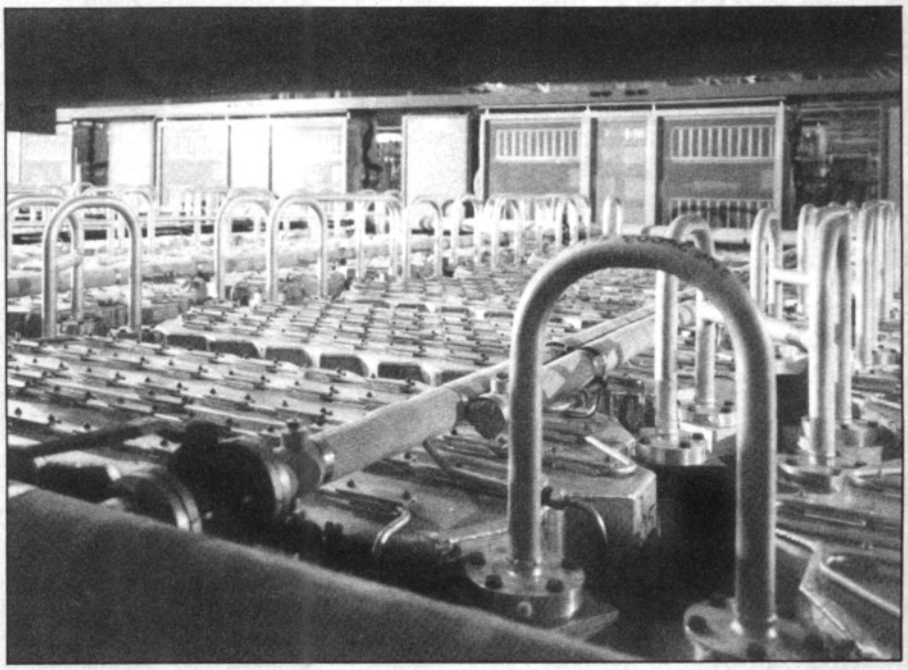
The tripartite uranium enrichment collaboration, URENCO, celebrated its tenth anniversary with a Government reception in London on 20th May.

URENCO came into being under the Treaty of Almelo, signed in 1970, between the UK, the Federal Republic of Germany and the Netherlands. The collaboration is at both industrial and commercial levels.

At the reception Mr David Howell, Secretary of State for Energy, noted that URENCO developed gas centrifuge enrichment as a successful, reliable and competitive system. "The pilot plants constructed at Capenhurst and at Almelo have led on to the successful commercial-scale plants now operating at those sites," he said. "The output of these plants will meet the important contracts for enrichment services which have been obtained by URENCO. These plants at Almelo and Capenhurst will soon be joined by a third to be built at Gronau by URENCO Deutschland.

"Commercial expansion has not been as fast as originally hoped, due to slow down in world nuclear development. We are confident, though, that the collaboration will secure a good share of further demand as it revives. One of the advantages of the centrifuge manufacturing capability is that capacity can be readily expanded to match the demand as it arises.

"Looking to the future, I am confident that URENCO-CENTEC will continue to develop successfully on the basis of our tripartite support."



Part of the Capenhurst centrifuge plant *BNFL*

Among those at the reception were Dr Hauff, Minister for Research and Technology in the Federal German Government, Mr van Aardenne, Netherlands Minister for Economic Affairs and Mr van der Mei, Netherlands State Secretary for Foreign Affairs. □

ATOM BINDERS

Smart maroon binders are now available for ATOM. Each binder is designed to hold one year's issues; they are gold-blocked on the spine with the magazine title, and come with a pack of numerals which can be applied to the spine to identify the year.

The binders — which we can offer initially to UK subscribers only — cost £2.50 each including postage and packing.

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AEA REPORTS

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

AEEW-R 1346 *Comparison of neutron diffusion theory codes in two and three space dimensions using a sodium cooled fast reactor benchmark.* By A.T.D. Butland, J. Putney and D.W. Sweet. April, 1980. 75pp. HMSO £2.00. ISBN 0 85182 050 6

AERE-R 9641 *Volume reduction techniques for solid radioactive wastes.* By J.H. Clarke. January, 1980. 29pp. HMSO £1.00. ISBN 0 70 580981 1

AERE-R 9667 *Coherent Raman spectroscopy, some possible developments for concentration measurements and for fundamental spectroscopy.* By D.A. Greenhalgh. January, 1980. 18pp. HMSO £1.00. ISBN 0 70 580971 4

BSI issues new specification

The Nuclear Engineering Standards Committee of the British Standards Institution has issued a new specification concerned with reference radiations for calibration purposes.*

The new standard is identical with ISO4037. It specifies two series of X and gamma reference radiations, for both calibrating protection level dosemeters and dose ratemeters at exposure rates from 10^{-6}C.kg^{-1}.h^{-1} (a few mR per hour) to 10^{-2}C.kg^{-1}.h^{-1} (of the order of tens of R per hour) and determining their response. The radiations are:

- in the energy range 30 keV to 250 keV, continuous filtered X radiations and the gamma radiation of americium-241;
- in the energy range 8 keV to 100 keV, fluorescence X radiations; and
- in the energy range 600 keV to 1.3 MeV, gamma radiations.

Copies of the new specification may be obtained from BSI Sales Department, 101 Pentonville Road, London N1 9ND, price £10.50 (BSI subscribing members £6.30).☐

*BS5869, *X and gamma reference radiations for calibrating dosemeters and dose ratemeters and for determining their response as a function of photon energy.*

UKAEA course

The following course is to be held at the Education and Training Centre, AERE Harwell, OX11 0QJ, tel. Abingdon (0235) 24141 ext. 2469. Further information and enrolment forms can be obtained on application.

Process instrumentation
20-24 October 1980

The course offers a broad description of modern measurement and control techniques as applied to the instrumentation of industrial processes. A systems engineering view is taken and the interests and experience of designers, users and maintainers are combined in the discussion of a wide selection of applications from single measurements to large and complex systems. The sensing, manipulation and use of process data is reviewed and set in the context of reliability, economic and safety considerations. The approach is developed in lectures. Fee: £310 + VAT.☐

IN PARLIAMENT

BY OUR PARLIAMENTARY CORRESPONDENT

Nuclear timetables

19 May 1980

The Government are working out the precise timetable for the pressurised water reactor design and safety work, Mr Norman Lamont, Under-Secretary for Energy, said in the Commons. He said the date of the inquiry would be announced in due course; the CEGB had not yet applied for consent. Timing would depend on a number of factors, including completion of the necessary work on safety clearance.

Mr Peter Rost: How will the Government monitor the cost of the PWR power station and the timescale for construction so that we can get some idea of comparative performance with the AGR stations, which are about to be ordered as well?

Mr Lamont: On both aspects the industry keeps us informed of the details of projects, both as regards costs and time, and we shall be acutely interested to see how it is developing on the PWR as well. We are engaged in discussions about the different stages that must be gone through on both design and safety work before construction can start. We are working out the precise timetable for that.

Mr William Waldegrave: Does the Minister agree that in any discussion about a PWR, or any other kind of reactor programme, forecasts of electricity demand are crucial to a sensible assessment of the situation? Does he also agree that the industry's predictions about electricity demand seem to be shifting and that it might be in order for the Government to publish a White Paper on the subject in the fairly near future?

Mr Lamont: Mr Waldegrave is right about electricity demand being crucial. He knows that that was one of the factors that led to the review of the two AGRs. However, after considering it, we decided that it was right to confirm the investment approval that was given to the two AGRs. We are in the process of re-examining the forecasts. He will be aware that the energy projections are revised each year in the light of economic conditions.

NII manning

19 May 1980

It was nonsense to say that the nuclear programme could not go ahead with the present manpower level of the Nuclear Installations Inspectorate, Mr Norman Lamont said at question time.

Mr Robert Cryer sought confirmation that in 1979 there had been the lowest average number of nuclear installation inspections for seven years, that the NII was well below strength and that it could not possibly cope with an expanded programme. He suggested that the programme announced had been to satisfy the nuclear ambitions of Sir Arnold Weinstock and GEC and to attack the mining industry and particularly the miners.

Mr Lamont said the last two observations were pure fantasy, not deserving of a serious reply. There were 17 vacancies in the NII out of a total theoretical establishment of 104. There had been no further resignations in 1980. A recent pay increase would increase pay at all grades by about £2000 a year. Clearly the strength of the NII was extremely important; they were working on it and were engaged in discussions about it. The inspectorate was vital for the nuclear programme and it was nonsense to say that the programme could not go ahead with the level of inspectorate manpower as it stood.

Mr Selwyn Gummer said that if the programme was to be technically and economically feasible, in those areas where stations were likely to be sited the period of waiting and wondering whether there was to be one should be as short as possible. The Minister should therefore put pressure on the CEGB to announce its plans as quickly as possible and not hold up discussions in affected areas.

Mr Lamont said he had discussed the case Mr Gummer had in mind with the CEGB. They had a bank of sites and did not always apply immediately for planning permission or consent for a station on those sites, but he would communicate Mr Gummer's concern to the CEGB.

Mr Joe Ashton asked for an assurance that nuclear inspection would be kept firmly under Government control and that outside agencies would not be employed as supervisors.

Mr Lamont: The inspectorate is an independent agency, and that position will continue.

Mr Peter Rost: The programme will not be economically or technically feasible unless there is a major improvement in the organisation of the industry. The appointment of a new chairman to the National Nuclear Corporation is but a first step toward that objective.

Mr Lamont: I agree. The problem is not confined to the construction of nuclear power stations, as recent events have sadly emphasised. There are serious construction delays and cost overruns in conventional and oil-fired power stations as well. We need to strengthen the management further beyond the appointment of a chairman and he is working on that. We hope that the announcement of a programme will, at long last, encourage confidence in the industry.

QUESTION TIME

Nuclear waste

23 April 1980

Mr Stephen Ross asked the Secretary of State for Energy whether he would itemise the quantities of categories of nuclear waste stored in the UK and estimate the length of time required before such waste could be safely released to the environment.

Mr Lamont: Current holdings for nuclear waste, as categorised in my reply of 17 January to Mr Foulkes [ATOM 281, March 1980, pp. 83-84], are as follows:

	Holding at 1979 (Cubic metres)
Concentrated high-level waste in liquid form	1000
Fuel cladding, sludges and miscellaneous waste from earlier processes	19 000
Plutonium contaminated wastes	3500
Wastes stored at power stations	20 000

Liquid high-level waste will be vitrified and stored for a further period to permit cooling. The time scale for disposal depends upon establishing the route and on the optimum storage period, but it will not be before the beginning of the next century.

In general, the other categories of waste also need to be retrieved from storage, treated and packaged, before disposal. Some, including some of the plutonium contaminated waste, is being disposed of to the deep ocean under the London dumping convention. Disposal of other wastes of higher activity depends upon the development of treatment processes, the radioactivity of the treated waste, and the identification of disposal routes. Current research should enable disposal routes to be developed before the end of the century.

The safe management and disposal of nuclear waste is a matter to which the Government and the nuclear industry give the highest priority.

Plutonium handling and storage costs

24 April 1980

Mr Hardy asked the Secretary of State for Energy what had been the total cost at current prices of plutonium handling and storage in each of the last 20 years.

Mr Lamont: The cost of handling and storing the plutonium arising from the

Magnox power station programme is very small and is not separately identified within the price charges to the generating boards for reprocessing spent fuel.

Cap de la Hague 1

25 April 1980

Mr Cryer asked the Secretary of State for Energy if he would ask for a report from the French authorities on the accident at the Cap de la Hague nuclear fuel reprocessing plant; and if he would ask the Health and Safety Commission to examine reports of the accident at that plant and publish its comments on the accident.

Mr Lamont: I am advised by the Chairman of the Health and Safety Commission that the Nuclear Installations Inspectorate of the Health and Safety Executive is in touch with the French nuclear regulatory authorities about the incident at Cap de la Hague. This contact is being made under the terms of a formal arrangement, concluded between the HSE and the French government agency concerned, which provides for the exchange of information about nuclear safety matters. I expect to be further advised when the details have been received and evaluated and I intend the result of that evaluation to be made publicly available.

Magnox power stations

25 April 1980

Mr Hardy asked the Secretary of State for Energy what was the present output of electricity from Magnox power stations, and how this compared with forecasted output when these stations were commissioned.

Mr Lamont: I am advised by the CEGB that the present total net output capacity of the eight CEGB Magnox stations is 3427 megawatts, equivalent to 76 per cent of their design net output capacity of 4486 MW. Output from these stations in 1979 was 21.280 terawatt-hours averaging about 71 per cent of present net output capacity and 54 of design net output capacity. It was originally assumed that these stations would operate on baseload with an annual average load factor of 75 per cent subject to fluctuations from year to year arising from inspection and maintenance requirements.

- Mr Hardy also asked what was the expected life at current levels of operation of each of the Magnox power stations.

Mr Lamont: I understand that, subject to obtaining safety clearances and continued economic operation, the CEGB expects that all its Magnox stations will exceed their amortisation period of 20 years. Current estimates indicate that all these reactors are likely to have been withdrawn from use by the mid-1990s.

- Mr Hardy also asked what was the estimated cost of boiler defects and failures at the Wylfa Magnox station.

Mr Lamont: I am advised by the CEGB that the cost of the repairs to boilers at Wylfa carried out in the period 1971 to 1976 came to a total of £3.9 million.

- Finally, Mr Hardy asked what was the announced output of each Magnox station in 1979 compared with both performance figures notified to the European Economic Community and to original planned output.

Mr Lamont: The actual output of each CEGB Magnox station is given in [the accompanying table]. The load factor calculated on the basis of the declared net capability is shown in column 3 and on the basis of original design net output in column 4. Information supplied to the EEC, on the basis requested by the Commission, is that set out in columns 1, 2 and 3.

	Average load as a percentage of capability based on		
1	2	3	4
Station	*Electricity supplied (TWh)*	*Present net capability*	*Original net capability*
Bradwell	1.384	64	53
Berkeley	1.474	61	61
Dungeness A	1.165	32	24
Hinkley Point A	2.789	74	64
Oldbury	3.183	87	61
Sizewell	3.311	90	65
Trawsfynydd	2.774	81	63
Wylfa	5.200	71	51

CEGB Magnox stations: output in 1979

Cap de la Hague 2

28 April 1980

Mr Frank Hooley asked the Home Secretary what information he had received from the French authorities about the malfunction of the nuclear reprocessing plant at Cap de la Hague on 16 April: in particular, what hazards this implied for the residents of the Channel Islands.

Mr Leon Brittan: Information has been received from the French authorities that a fire in the transformer system at Cap de la Hague nuclear reprocessing plant on 16 April interrupted electricity supplies and led to the temporary shutdown of the plant.

I understand that electricity supplies were restored to the highly active fission product areas within three quarters of an hour, and to plant ventilation within two hours, that the consequent degree of contamination of plant was therefore extremely slight, and that the affected areas have since been decontaminated.

I also understand that there was no escape of radiation from the plant and consequently no hazard to people in France or the Channel Islands.

Cap de la Hague 3

28 April 1980

Mr Hooley asked the Minister of Agriculture, Fisheries and Food what release of radioactive gas or particles had been monitored over the Channel Islands or Southern England as a result of the accident at the nuclear reprocessing plant at Cap de la Hague on 16 April.

Mr Buchanan-Smith: I understand that there has been no detectable release of radioactive material beyond the site boundary as a result of this incident.

Oil reserves

28 April 1980

Mr Marlow asked the Secretary of State for Energy what was his estimate of the statistical likely recoverable reserve of oil (a) discovered but not yet exploited and (b) exploitable but not yet discovered, in terms of years' supply at current rates of use.

Mr Gray: Subject to a very wide margin of error, recoverable oil reserves on the UK continental shelf in existing discoveries yet to be exploited — i.e. discoveries not yet under development — are equivalent to around seven years of UK oil consumption at current rates. Similarly, recoverable reserves in future discoveries are believed to be around 15 years' consumption at current rates.

Spent fuel transport

29 April 1980

Mr Hooley asked the Secretary of State for the Environment whether flasks of radioactive spent fuel would be carried by rail on lines on which the advanced passenger train would be operating.

Mr Fowler: I have been asked to reply. The routeing of irradiated nuclear fuel flasks is a matter for British Railways Board. High safety standards enable these flasks to be moved within British Rail's normal freight operations and I am satisfied that there is no reason why fuel flasks should not run over lines used by any passenger train service, including the advanced passenger train.

Cap de la Hague 4

7 May 1980

Mr Hooley asked the Secretary of State for Energy what arrangements existed with the French Government for mutual advice or warning to populations in northern France, southern England or the Channel Islands of serious accidents in nuclear installations on either side of the Channel which might result in the release of radioactive contaminants.

Mr Lamont: The Government attach importance to close cooperation with the French Government in this field. An arrangement has been agreed by which, in the event of an emergency at the Cap de la Hague installation likely to affect the Channel Islands, the prefect of the La Manche area would notify the islands direct.

We are also in touch with the French Government over the establishment of general contingency arrangements covering the action to be taken in the event of a serious nuclear incident in either country.

LWR capacity

7 May 1980

Mr T.H.H. Skeet asked the Secretary of State for Energy what information he had on the capacity of light water reactor power stations operating in each European Community country by 1984 and of the capacity likely to be under construction by that date.

Mr Lamont: The capacities of light water reactor power stations officially projected for the International [Nuclear] Fuel Cycle Evaluation for 1984 were as follows:

	Gigawatts (electrical)
Belgium	5.5
Denmark	—
F.R. Germany	17-21.2
France	30.6
Ireland	—
Italy	2.2
Luxembourg	—
Netherlands	0.5
United Kingdom	—

No figures were given for the capacity under construction in that year but the projected additional capacity for the year 1990, all of which would need to be under construction in 1984, was:

	Gigawatts (electrical)
Belgium	1-4
Denmark	0-3
F.R. Germany	17-18
France	22-29
Ireland	—
Italy	22-30
Luxembourg	—
Netherlands	0-2
United Kingdom	1-4

These projections may be subject to revision and must be treated with caution.

The construction of a Pressurised Water Reactor in the UK remains subject to safety clearance by the Nuclear Installations Inspectorate and to a public inquiry.

Nuclear accidents

12 May 1980

Mr Hooley asked the Prime Minister which Government Department had the direct and immediate responsibility for warning the public in the event of a serious accident or malfunction at a nuclear power station and of supervising and controlling any necessary evacuation of population in the vicinity of the power station, whether the incident occurs in the UK or on the territory of some neighbouring state such as the Republic of Ireland, Belgium, Holland, or in Northern France.

Mrs Thatcher: In the event of any emergency occurring within the UK it is the responsibility of the police and local authorities concerned to provide appropriate warning to the public and to supervise and control any evacuation. Departmental responsibility for these general emergency arrangements in Great Britain is shared by the Home Secretary and the Secretaries of State for Scotland, Wales and the Environment. In Northern Ireland responsibility lies with the Secretary of State for Northern Ireland.

In the case of a serious accident at a nuclear power station, the station's operator would be responsible for providing the police with the advice and information on which a decision to evacuate could be taken. Departmental responsibility for nuclear safety rests with the Secretary of State for Energy, in England and Wales, and the Secretary of State for Scotland, in Scotland.

In the unlikely event of an incident at a nuclear installation overseas affecting the UK, it would be for the Secretary of State for the Environment in consultation with the Minister of Agriculture to assess the environmental effect and to advise the local authorities concerned who have standing arrangements for all incidents affecting their areas.

Uranium energy yield

16 May 1980

Mr Arthur Lewis asked the Secretary of State for Energy whether the energy consumed in extracting uranium was greater than the energy derived from its use.

Mr Lamont: The primary energy required to produce a kilogram of uranium ore concentrate from a typical mine is a very small fraction of the energy liberated from this quantity of uranium in a nuclear power station.

. . .and reserves

16 May 1980

Mr Lewis also asked the Secretary of State for Energy whether, in view of the fact that the economically usable reserves of uranium are only equal to one fifth of the world reserves of petroleum, and would be exhausted long before the oil supplies were exhausted, he would review his nuclear power programme.

Mr Lamont: I am advised that known uranium resources are likely to be adequate to meet the lifetime requirements of all nuclear reactors likely to be operating in the world (outside centrally planned economies) at the end of this century.

I am satisfied that the procurement policies of the utilities should be appropriate to ensure adequate supplies of uranium to the UK to meet the requirements of the programme I announced on 18 December 1979.

19 May 1980

• Mr Lewis also asked whether there were enough supplies of uranium to service the British nuclear programme; and whether there would be reserves of uranium before oil resources were exhausted.

Mr Lamont: I am advised that potential world uranium supplies, from countries outside those with centrally-planned economies, are expected to be sufficient to meet the requirements of currently planned power programmes. Currently available information on the size and quality of the UK's indigenous resources of uranium is inadequate to determine whether and when these could be economically produced. I am satisfied that the British civil uranium procurement policies are appropriate and should ensure the continued availability of uranium for the UK nuclear power programme.

Alternative energy spending

19 May 1980

Mr Parris asked the Secretary of State for Energy what the level of expenditure would be on alternative energy sources in 1980-81.

Mr John Moore: My Department's research and development expenditure in 1980-81 on wave, wind, solar, tidal and geothermal energy is expected to total about £11 million.

Nuclear stations

19 May 1980

Mr Palmer asked the Secretary of State for Energy when it was expected that the two advanced gas-cooled reactor nuclear power stations approved by the previous Government would be started; and what was the related statutory date anticipated for starting work on the pressurised water reactor nuclear power station approved by him.

Mr Lamont: Work on the design phase of the two new AGRs at Heysham II and Torness started in March 1979 and is at an advanced stage. Site construction work is expected to start in August and preliminary works have already been carried out. The CEGB has not yet applied for consent to construct a PWR station, but design work is in hand.

Hunterston costs

22 May 1980

Mr Gordon Wilson asked the Secretary of State for Scotland what was the now estimated or actual cost of the breakdown of the Hunterston B reactor in 1978 and the cost of its repair.

Mr Alexander Fletcher: Reactor 4 at Hunterston B power station, which was damaged as a result of an accidental ingress of seawater in October 1977, was brought back into operation in January. The South of Scotland Electricity Board estimates that the total cost of the necessary repairs will be of the order of £15 million and that the additional cost of replacing the output which was expected from that reactor amounted to some £42 million. ☐

Energy objectives

1 May 1980

The Government believe that the nuclear industry is well placed to make a full contribution to future energy supplies, the Earl of Gowrie, Minister of State for Employment, said when he replied to a debate on a Lords Committee report on energy objectives for 1990.

Lord Sherfield, chairman of the committee which had produced the report, said that the committee had set out to establish, on the basis of the European Commission's communication on energy objectives for 1990 and convergence of the policies of member states, what the EEC was, could, or should be doing about energy policy. The Commission had some time ago tried to promote a common energy policy for Europe. The present Commission communication, however, recognised that that was not at present politically feasible, since each Government was determined to be master in its own house.

The Commission now emphasised aiming at the highest possible degree of convergence of policies and had set out, in a draft resolution, five objectives at which to aim: to promote energy savings; to step up coal production; to restore nuclear programmes to their original levels; to increase indigenous hydrocarbon production to the maximum extent; and to ensure that pricing policies reflected rising supply costs. In considering the scope for common action, a common energy policy was distinguished from convergence of policies by the application of Community resources or acceptance of Community legislation with or without bugetary support.

One class of project falling under this head included developments involving a long timescale, high cost and high risk. The classic example was nuclear fusion, where there was already a well-developed Community research programme, the realisation of which, however, fell outside the timescales under consideration.

Other cases were the fast reactor, nuclear waste disposal, and reprocessing, which were appropriate for Community collaboration if not for a joint programme. The committee particularly urged that there should be collaboration on fast reactor development. They also felt that the EEC Commission might do more to gain public acceptance of the need for increased energy production. They had taken some steps in that direction in nuclear energy, and might do more.

Lord Tanlaw asked the Government to bring forward the dates of public inquiries so that the nuclear programme could be started at an earlier date than was apparent at present, and asked them also to consider instigating the public inquiry regarding the safety of the fast reactor so that promising developments in this field might not be held up due to hesitation on the part of the general public about the safety aspects of this form of electricity generation.

The Earl of Bessborough said that more work was necessary to establish consistent environmental and security standards for nuclear power stations within the Community.

Lord Flowers, a part-time member of the UKAEA, said it was important still to emphasise that nuclear programmes should proceed only under conditions of adequate safety. He drew attention to a "very important" article by Sir Alan Cottrell which had appeared in the *Financial Times* on 15 April this year, and continued:

"In it, Sir Alan, who is a world authority on the strength of materials, makes very clear his view that much remains to be done before we should accept the safety case for that most favoured nuclear system, the pressurised water reactor. But Sir Alan makes another point, too — and I quote — asking: 'With the commercial fast breeder reactor (FBR) quite properly claiming its place as yet another project ready for launching, would we have the scientific and engineering manpower to handle four different commercial reactor systems — Magnox, AGR, PWR, FBR — with full mastery in all cases?'

"I have to declare that I am a part-time member of the Atomic Energy Authority, although not one who has always spoken as my fellow members might have wished," said Lord Flowers. "But I do not think I shall cause much additional offence if I now say that I agree with Sir Alan that four systems are a bit too much for us to be handling simultaneously, especially if safety is to be given proper attention, as it must. I also believe that we should do our best to demonstrate the safe operation and economic performance of the FBR system by the year 2000 in case we should need it beyond that."

He had been impressed by the progress that had been made at Dounreay and elsewhere in recent years, but even so he doubted whether they could really commercialise the system on their own. It was foolish for the UK to be in competition with its European partners in something so complex and so expensive, intended for so small a market for many years to come, although of course with great potential in the long term. He therefore hoped that full cooperation on the development of a common FBR system could soon be an accepted part of European energy policy. British engineers could contribute much, and there was much for them all to gain by sharing the burden. After all, they had successfully developed the URENCO centrifuge plant in that fashion, and they were working together on the JET fusion project.

The Earl of Gowrie, winding up the debate, said he was a strong supporter of the fast reactor, but was sad that he could give the House no more information about that save that they were still taking advice from the UKAEA and others concerned. They were complex and sensitive issues, and the Government had to reach any decisions most carefully.

The most important existing collaboration on the fast reactor on the continental mainland was based on SERENA, which owned the technology of the full-scale fast reactor Super Phénix, now under construction in France. France and Germany had been the leading interests in that, but other European countries were also involved and the possibility of collaboration with SERENA was one option for fast reactor policy which the Government were considering. □

Cap de la Hague

13 May 1980

Lord Hylton asked the Government what were the causes and effects of the recent fire within the French nuclear reprocessing plant at Cap de la Hague; whether similar accidents were possible within British plants; and to what extent the Channel Islands were adversely affected by radiation and otherwise as a result of the fire.

The Earl of Gowrie, for the Government, said: The Government have received information from the French authorities that a fire in the transformer system at Cap de la Hague nuclear reprocessing plant on 16 April interrupted electricity supplies and led to the temporary shutdown of the plant.

I understand that electricity supplies were restored to the highly active fission product areas within three quarters of an hour, and to plant ventilation within two hours, that the consequent degree of contamination of plant was therefore extremely slight, and that the affected areas have since been decontaminated.

I also understand that there was no escape of radiation from the plant and consequently no hazard to people in France or the Channel Islands.

I am advised that electricity supply arrangements at the UK's reprocessing plant at BNFL Windscale differ from those at Cap de la Hague. Secure electrical supplies are provided from the national grid, and separate supplies are paralleled from the Calder generating station which adjoins the Windscale plant. The internal works distribution system incorporates both segregation and duplication of supplies. A fire in a single area could not therefore disrupt electricity supplies from both sources. The site does, in any case, have emergency stand-by generators in addition to the two parallel sources of electricity. □