# SCRAM

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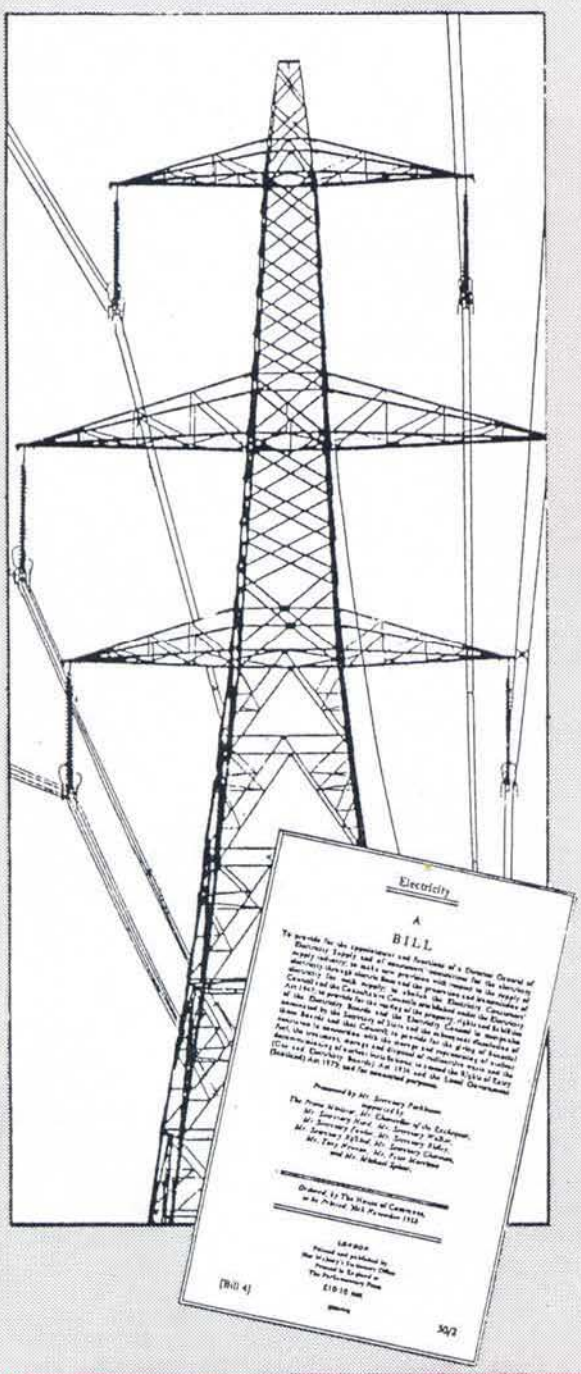


# Who'll pay the Electricity Bill?

Also -

Leukaemia Clusters

Greenhouse Effect

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This Journal is produced for the British Anti-Nuclear and Safe Energy movements by the Scottish Campaign to Resist the Atomic Menace (SCRAM).

We welcome contributions of articles, news, graphics and photographs.

**Deadline** for feature articles for the next issue: **6 March.**
(Please try and keep contributions to 600 words per page)

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# COMMENT

As we go to Press another wadge of news cuttings on Chernobyl have appeared, and our file on the subject is still very active - almost three years on. we expect it to continue to be so for several years to come

The latest revelations indicate that official monitoring does not seem to have improved, despite assurances that it would. These results were obtained by aerial survey, which can effectively cover large areas in a relatively short time. It is imperative, therefore, that such a system of monitoring should be capable of being implemented as soon as possible after any future accident, either overseas or in this country. Without the valuable information that this would provide, no adequate system of countermeasures - eg milk and water bans, iodide tablets and evacuation - could possibly be directed properly. The results should be published immediately, which should go a long way to allaying public fears that they are being kept in the dark.

This issue of SCRAM examines two theories of childhood leukaemia cluster causation: the virus hypothesis is discussed on page three; and the possibility that non-ionising electromagnetic radiation may play some role is detailed in the centre four pages. We have devoted this space due in part to the number of requests for information on these two aspects of the debate which our office regularly receives. We hope it helps to broaden the debate.

SCRAM's financial appeal has attracted an amazing response - we are over one third of the way to our target of £6,000 in just two months. Donations promised from institutions could substantially boost this figure. However, as we described in the last issue, this target was to cover this year's projected deficit - to allow expansion and an increase in staff wages we will need much more. So, PLEASE, if you promised yourself that you would give us a donation after Christmas, and before you begin to save for your summer holiday, now is the time to honour that promise. You know it makes sense!

On a more personal note, at SCRAM we are about to lose the services of our editor, Steve Martin, who is about to take up the post of Projects Officer with the National Steering Committee of the Nuclear Free Zone Local Authorities, based in Manchester. Steve has worked with SCRAM for over eight years. The two of us who remain will continue to improve the style and content of the Journal, and as always we welcome contributions of news and features from our readers.

# Another Leukaemia Theory

**Considerable publicity was given to an article in The Lancet at the end of last year which asserted that increases of leukaemia in young people near Dounreay and Sellafield may be caused by a virus. ANTHONY CLAYTON investigates.**

Leo Kinlen, of the Cancer Research Campaign Cancer Epidemiology Unit of Edinburgh University in his article, **Evidence for an infective cause of childhood leukaemia: comparison of a Scottish new town with nuclear reprocessing sites in Britain,** hypothesises that as Dounreay and Sellafield were built in isolated places, 'herd' immunity to a postulated virus infection would tend to be lower than average. Thus a large influx of people to these areas might be conducive to epidemics.

He looks for evidence to support this hypothesis, and arrives at Glenrothes, which he describes as "the only other rural area that received a large influx at the same time, when it was much more cut off from the nearest conurbation than at present." Kinlen found a significant increase of leukaemia below age 25, which he takes to support his theory.

The argument is as follows: there is an increased incidence of leukaemia in young people near the only UK nuclear sites that reprocess spent fuel, Dounreay and Sellafield: various reports conclude radiation levels are far below those necessary to account for the excesses: there was no increase in leukaemia due to fallout from atmospheric nuclear tests in the 1950s and 60s: therefore, either radiation levels must have been higher than stated, or some other factor must be involved. Kinlen devotes the paper to the latter possibility.

Firstly, people who live in isolated areas may escape exposure to common infective agents. Incomers may introduce infective agents with "dramatic consequences." A lower level of natural immunisation may occur because of fewer opportunities for person-to-person transmission or because the population is not large enough to maintain the disease in endemic form.

Secondly Dounreay is isolated and Sellafield was so in the 1940s and 1950s. Both had rapid population increases between 1951 and 1961.

Thirdly, specific viruses are known to cause leukaemia in adults. Childhood leukaemia might be of viral origin.

## GLENROTHES POPULATION DOUBLED 1951-61

The study examines 11 Scottish local authority districts which experienced even a 25% population growth in 1951-61, and concludes that only Kirkcaldy District is comparable, because the population doubled due to the development of Glenrothes, from a relatively rural status before.

Other differences between Thurso and Glenrothes are relevant. According to the hypothesis, the inhabitants of Thurso should include most of the susceptibles, while the incomers should include the carriers. By contrast, the largest group of incomers to Glenrothes came from other parts of Fife: many would be as susceptible as the original inhabitants.

Locally born children near Dounreay and Sellafield show the increase in leukaemia, not those born outside and attending school there, and Kinlen argues that the former group would be most susceptible.

So how likely is the hypothesis of a viral cause for the childhood leukaemia increase around Dounreay and Sellafield, where a population influx has disturbed the virus-host equilibrium? There are a number of serious flaws in the argument.

## FIFE ISOLATION "LARGELY NONSENSE"

The definition that the Glenrothes area was "much less exposed to outside contact than most places," largely on the basis that the Forth Road Bridge was not opened until 1964, is largely nonsense: Fife has had perfectly good rail connections to Edinburgh, Stirling, Glasgow and the North since last century, and people from Fife have travelled regularly in and out of the area since then. Furthermore, the Glenrothes area has been semi-urban for rather longer than the defined study period, with a number of industrial plants sited in the area. Thurso, on the other hand, was a genuinely isolated area.

The hypothesis collapses when applied in reverse, ie if Thurso is regarded as the comparison area. Thurso does not show the pattern of increase that his hypothesis predicts. Thurso was a genuinely isolated community, and had the highest percentage population increase, with genuine incomers making up these numbers. Thurso should have exhibited the higher prompt increase. Thurso actually exhibits no, or trivial, increase in the 1951-67 period, but an increase in the 1968-85 period. This is compatible with a radiation-induced cancer hypothesis, but not compatible with Kinlen's viral hypothesis.

There is insufficient distinction between incomers and indigenous people: a child of incomers would have certain immunities transferred from its parents, and thus should be considered as an incomer. Kinlen also fails to address the possible 'healthy worker' effect at Dounreay.

It should also be noted that no virus that can cause childhood leukaemia has ever been identified.

He states that the risk estimate of leukaemia is "unlikely to be much too low, since there was no increase after the fallout from atmospheric nuclear weapons tests in the 1950s and 1960s." (Darby and Doll, 1987) That study looked for an apparent increase in cancer incidence among the population as a result of the relatively high levels of radiation during 1963-65 when the test programme was at its peak. They did not find a peak in the incidence of cancer. However, more recent research looked at the geographical distribution by high and low rainfall areas, on the basis that more fallout would be washed down by rain. (Haynes and Bentham, 1988) This study found an increase of childhood leukaemia in high rainfall areas. Thus it can be no longer stated that the risk estimates are "unlikely to be much too low."

In summary, all this paper does is to demonstrate that the quest to find the cause of childhood leukaemia clusters has a long way to go.

**Dr ANTHONY CLAYTON is an Associate at the Edinburgh University Centre for Human Ecology.**

## Dungeness

The Magnox Dissolution Plant at Dungeness A power station was commissioned under a blaze of TV and Press publicity on 25 November. To allay public fears both Lord Marshall, CEGB Chair, and local MP Michael Howard drank a sample of the liquid effluent from commemorative glasses, hastily followed by a whisky chaser.

The plant, which received its licence from the NII on 14 November, is designed to process 60 tonnes of nuclear waste accumulated in vaults at the site between 1967 and 1976. The waste is dissolved in a water and carbon dioxide solution which is filtered in two stages. The resulting low level liquid waste is then discharged into the English Channel after it has been passed through an optional 'ion exchange system' (IXS) to reduce the radioactivity below a predetermined level (SCRAM 65).

There is some doubt whether the IXS was operating at the time of the 'stunt'. A local reporter on the **Hastings News** told SCRAM that he was explicitly informed by CEGB SE Region press officer Trevor Seeley that it would be operating. However, coverage after the event implied the beverage they quaffed came from **before** the IXS. This gave the impression that the 'celebrities' were risking their health.

Also, technical papers describing the process presented it as a 'lead demonstration plant' and "consideration will be given to the installation of similar plant on other Magnox stations following successful operation of the Dungeness plant."

This now seems unlikely, however, following a Ministerial Declaration from the Department of the Environment issued after the November 1987 International Conference on the Protection of the North Sea. As the DoE state in the evidence to the Hinkley C Inquiry, the UK is committed to "apply the best available technology to minimise and, as appropriate, eliminate any pollution caused by radioactive discharges from all nuclear industries."

According to John Large, an independent nuclear consultant, this means "the CEGB will not be allowed to build such a plant at any other magnox station." If the CEGB are still keen on this method of waste management, it could mean waste from other magnoxes being transported to Dungeness to be processed.

## Nirex

The long awaited analysis of responses to **The Way Forward** has been published by Nirex. The study, carried out by East Anglia University's Environmental Risk Assessment Unit (ERAU), shows that the vast majority of respondents offered no view on the question of nuclear waste storage versus deep disposal.

Ray Kemp of ERAU points out that "a good proportion of those who don't specify any solution do so because they reject outright the idea of a radioactive waste facility of any kind."

The report doesn't ignore above ground storage options, or criticisms of the consultation process. However, the 'matrices' in the Appendix only include respondents who specifically answered Nirex's questions. Therefore, the results tend to be biased against those in favour of storage, many of whom will have objected to the way the consultation was being conducted.

One must therefore question why ERAU used this rather obscure method of presenting their results, when it neither truly represents the responses, nor aids public understanding.

The category most in support of Nirex are classified as giving "qualified support for deep disposal." This group includes Cumbria County Council, who recently rejected BNFL's application to carry out test drilling at Sellafield and who called for the establishment of a Planning Inquiry Commission into all aspects of radioactive waste management. The report doesn't mention the Association of County Council's support for Cumbria's call.

Events in Caithness have overtaken the report. The District Council have reversed their decision to invite Nirex to carry out test-drilling. A vote by over 800 Dounreay workers also showed that 55% of the members of industrial trade unions are opposed to test-drilling in Caithness.

The consultation exercise comes in for some severe criticism for not discussing high-level waste, reprocessing, liquid discharges and for not undertaking a major public consultation exercise at a local level. Supporters of above ground storage include COSLA (Confederation of Scottish Local Authorities), Nuclear Free Zones (Scotland), Highland Regional Council, most environmental groups and the Water Authorities Association.

Even though the results have been tabulated in a way which is most sympathetic to the Nirex proposals, it is difficult to detect any kind of consensus emerging, except that there is almost no support for sub-seabed options. The majority do not specify any solution, although most reject Nirex's deep disposal options. Storage gets comparatively little support, but it wasn't put forward as an option. It therefore seems quite reasonable to conclude that the British public have resoundingly rejected the concept of deep disposal.

**Responses to The Way Forward** is available from Nirex, Curie Avenue, Harwell, Didcot, Oxfordshire OX11 0RH.

● The Nirex Board failed to approve the short list of sites suitable for dumping low and intermediate level nuclear waste, at their meeting on 13 January. No submission has therefore been made to the Government. Instead, the Board called for "more information."

Kit Strange of Nirex denied reports in **The Independent** that Sellafield has emerged as the clear favourite. "Sellafield will be bound to appear on that list," he said, but "it isn't a clear favourite." There is also a "probability that Dounreay will be on the list."

Nirex are now expected to make their recommendations at the end of February, or beginning of March. "It is likely," according to Strange, "that there will be 3 or 4 [sites on the short list] - it is unlikely to be more than 5."

### Table 4.1 County/Regional Councils

| | England | | Wales | | Scotland | | Overall | |
|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % |
| Deep | 9 | 26.47 | 0 | 0.00 | 1 | 9.09 | 10 | 20.83 |
| Under Land | 3 | 8.82 | 0 | 0.00 | 1 | 9.09 | 4 | 8.33 |
| Accessed From Land | 1 | 2.94 | 0 | 0.00 | 0 | 0.00 | 1 | 2.08 |
| Under Sea | 2 | 5.88 | 0 | 0.00 | 0 | 0.00 | 2 | 4.17 |
| **Total Disposal** | 15 | 44.12 | 0 | 0.00 | 2 | 18.18 | 17 | 35.42 |
| **Not Specified** | 16 | 47.06 | 3 | 100.00 | 3 | 27.27 | 22 | 45.83 |
| **Storage** | 3 | 8.82 | 0 | 0.00 | 6 | 54.54 | 9 | 18.75 |
| Other | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| **Total** | 34 | 100.00 | 3 | 100.00 | 11 | 100.00 | 48 | 100.00 |

## Tolerability of Risk

Friends of the Earth have described the Health and Safety Executive's (HSE) public consultation on the risks of nuclear power as "the modern day equivalent of reading the entrails of a sheep in order to determine our future actions."

Sir Frank Layfield, the Sizewell Inquiry Inspector, recommended that the HSE formulate and publish guidelines on the tolerable levels of risk from nuclear power stations. He said that "the opinion of the public should underlie the evaluation of risk ... there is at present insufficient public information to allow understanding of the basis for the regulation of nuclear safety."

The HSE responded by publishing a public consultation paper called **The Tolerability of Risk from Nuclear Power Stations** in February 1988. The report suggested that the public would accept nuclear power provided that the risk of a major accident is no greater than 1 in 10,000 per annum, compared with current regulations which insist on a risk of between 1 in 100,000 and 1 in a million.

The results of the consultation have now been published.(*) The document contains comments by 24 institutions and individuals, many of them government bodies. However, FoE described the consultation exercise as a "complete failure." They say that the small number of replies should be compared with the 20,000 objections received, so far, against the Hinkley Point C power station.

The HSE have completely failed to carry out Layfield's recommendation regarding the public's evaluation of risk. Layfield also recommended that the HSE should address "the benefits of nuclear power." This they have also failed to do.

The FoE submission contends that, if we are serious about enabling the public to balance the benefits with the costs and risks of nuclear power, then we must start by telling people what the choices are, and what information they require to make these choices.

It is not relevant to compare the risk from nuclear power to those from, say, air travel, because the latter is not an alternative to the former. We should instead compare nuclear risks with the risks associated with coal-fired stations or increasing insulation levels.

In their response to the consultation, the National Steering Committee (NSC) of Nuclear Free Zone Local Authorities argue that the public has insufficient information to assess the risks of a major accident.

They call on the HSE to arrange for the publication of Pre-Construction Safety Reports (PCSR) for all nuclear power stations - the Sizewell B PCSR is the only one ever published, and then only after the inquiry had finished and the NII had granted the CEGB a licence. They also want the HSE to publish fuller accounts of power station incidents, so that proper independent assessments can be made.

Whatever choices we make about our energy strategy, some people will die prematurely, so it is only right that everybody is fully informed about all the available options. It is time the Government recognised the HSE have singularly failed in their responsibility to do this.

*** Comments received on the tolerability of risk from nuclear power stations. HSC 1988. HMSO, £4.50.**

## Plutonium Flights

Current packaging regulations and testing procedures for the air transport of plutonium are inadequate, and an acceptable level of safety may be impossible to achieve. This is one of the conclusions of a new 164 page study published in January by the Nuclear Free Zones National Steering Committee.(*)

The study demands that the movements be stopped so that a publicly debated review of the safety and security issues raised can take place.

As a result of THORP's commissioning in the early 1990s plutonium transport in the UK will increase nearly ten fold - about 60,000kg of the material will be separated over a ten year period.

BNFL plan to export 40,000kg of plutonium by air, a method chosen largely for security and cost reasons, over that period, to Japan and continental Europe. (SCRAM 64-68).

In November 1988, the Advisory Committee on the Safe Transport of Radioactive Materials (ACTRAM) published a report on the safety of current and likely future transports which concluded that some tightening of the IAEA regulations for packaging may be appropriate when the increased movements take place.(**)

UK government plutonium export policy passively accepts assurances of consignee's compliance with the the Non-Proliferation Treaty and IAEA safeguards. However, these safeguards are no guarantee against diversion to non-peaceful uses, but can only sound the alarm after the event. Also, they contain no prohibition on a non nuclear weapons state stockpiling as much plutonium as they want.

Some experts are worried that plutonium sent to Japan could be diverted for weapons use. The NFZ report argues that it is time to assess the role and need for plutonium in our society, that more information should be disclosed to permit public scrutiny of the safety and security procedures, and that these procedures should be improved.

It asserts that an argument can be made for no plutonium shipments, but if carried out, they should be timed so as to minimise stockpiling in the receiving nation.

Ultimately the authors, Paul Helliwell and Jonathan Spink of the European Proliferation Information Centre, conclude "there is no valid place for non-trivial quantities of separated plutonium in our society, and that no justifiable case can be made for continued plutonium transportation."

*** The Transport of Plutonium by Air and Sea by EPIC (ed David Lowry) for the NFZ National Steering Committee. £25 inst, £10 indiv. from Town Hall, Manchester M60 2LA.**

**** The Transport of Civil Plutonium by Air by ACTRAM. HMSO, £5.20.**

● Japan's Power Reactor & Nuclear Fuel Development Corp have agreed to pay the US Nuclear Regulatory Commission $3.5 million to develop draft criteria, as the first of four phases for certifying a plutonium air transport flask, by 30 September 1990. The other phases are: developing final test criteria, physical testing and actual certification.

## VDU Risks

The House of Lords have rejected calls from the EC for legislation to promote health and safety standards for the use of visual display units (VDUs). They believe there is insufficient scientific evidence and public concern to justify new legislation.

Their findings turn a blind eye to the mounting concern and growing evidence that VDUs are a source of various health hazards, such as skeleto-muscular problems, repetitive strain injury, stress, eye disorders, dermatitis, and abnormal pregnancies.

Perhaps the most worrying aspect of VDUs is the electromagnetic radiation which they emit. VDUs are one of three major sources of low frequency radiation, the others being power lines and radio/microwaves.

The high occurrence of leukaemia clusters around power lines has been a focus of recent research (p13-16). Pulsed magnetic fields have been linked with abnormal pregnancies in mice and chicks, and the **American Journal of Industrial Medicine** (June 1988) VDU operators working more than 20 hours per week during their first trimester of pregnancy showed a doubling of the rate of miscarriages, and a 40% increase in malformations among offspring.

Low frequency radiation is very often used in communications devices. Through manipulating the frequencies, the waves can carry various signals and sounds. The use of Extremely Low frequency (ELF) radiation in communications systems is proving to be a concern. The Navy are to propose the construction of a £300 million 13½ mile long ELF aerial, in Glengarry, north of Fort William, to communicate with submarines deep under the sea.

The proposals are set to meet opposition, both from the local community council and the Highland Federation of CND groups. This could well force the Secretary of State for Scotland to call a public inquiry.

In 1982, the public inquiry into transmission lines from Torness nuclear power station concluded that until the safety of 400kW power lines "has been proven beyond doubt.. it would be prudent to avoid siting such lines within 15 metres of houses."

Since 1982 a lot more research has failed to prove safety. A public inquiry into the Glengarry proposals could open a whole new can of worms for the MOD and the electricity industry.

## Leukaemia Clusters

Two recent reports have added to suspicions that there is a link between leukaemia in young people and nuclear power stations.

A report by the Somerset Health Authority, submitted to the Hinkley Inquiry before Christmas, revealed for the first time a substantially higher incidence of childhood leukaemia in the area around Hinkley Point.

During the whole study period (1959-86) there were 22 cases of leukaemia in people under 25 within a 12.5km radius of Hinkley Point, whereas only 11 would have been expected.

More crucially, in the 10 years 1964-75 there were 14 (mostly fatal) cancers, where only 4 would have been expected. Hinkley A started operation in 1965.

Dr Richard Taylor, head of the CEGB's health and safety division, told the inquiry that levels of radioactive emissions from nuclear plants could not account for the increased incidence of leukaemia. He was especially keen to promote the theory that a virus brought into isolated communities by power station workers was causing the disease.

Under cross examination, he was forced to admit that no virus has been identified, excesses of leukaemia at Dounreay occurred 20 years after the plant started operation, and that most of the children who developed leukaemia at Sellafield were from families which had moved into the area. He also admitted that although excesses of leukaemia had been identified at Aldermaston and Burghfield, these are certainly not isolated communities.

The second report, published by Cumbrians Opposed to a Radioactive Environment (CORE), is the result of months of painstaking research by the group. They have discovered 13 cases of cancer and leukaemia in under 25 year olds which were not included in the 1984 investigation by Sir Douglas Black into childhood cancers around Sellafield.

CORE have also uncovered six additional cases of leukaemias and cancers since the end of 1983 - the year up to which the Black Report examined.

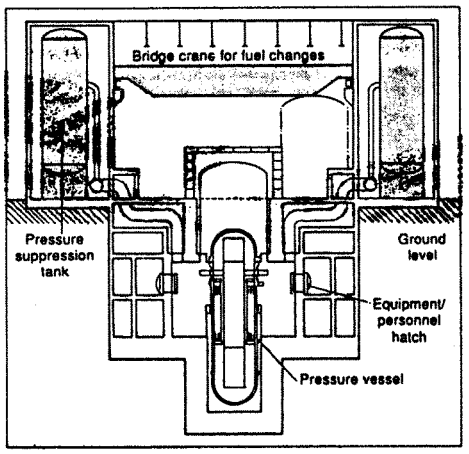
*** Leukaemia Incidence in Somerset. Available from Somerset Health Authority, County Hall, Taunton.**

*** Black Report Up-Date. Available from CORE, 98 Church Street, Barrow in Furness.**

## Novel Nukes

BNFL expect to complete their assessment of the options for replacing their ageing Magnox station at Chapelcross in Dumfriesshire by the end of this year. The Ministry of Defence will be consulted, as they are expected to require a new production reactor for the tritium and plutonium needed for nuclear weapons.

BNFL are hoping to keep the four small 50MW reactors, already 30 years old, operational for another 10 years. However, they need to plan now for their replacement, and the Long Term Safety Review, which should be published later this year, may curtail their life.




*Upside-down Safe Integral Reactor takes radioactivity underground*

One reactor type which BNFL are expected to consider is the new 300MW Safe Integral Reactor (SIR), which is being promoted by an Anglo-American consortium. The consortium includes Rolls Royce, the UKAEA and American engineering groups Combustion Engineering and Smith and Webster.

The group are seeking $50m funding from the US Department of Energy, and a similar sum from private sources in Britain, in the belief that a substantial international market will open up in the 1990s for a smaller reactor with 'passive' features (eg use of natural convection to prevent overheating in an emergency). The SIR is expected to be inherently simpler and therefore cheaper with less reliance on human operatives.

The UKAEA would like to see the first SIR built at their Winfrith site in Dorset - with the entire pressure vessel buried in an underground silo.

## Privatisation Notes

Parliament's electricity privatisation committee is trying to unravel the justification for a 15% rise in power prices in England and Wales over last year and this.

Cecil Parkinson told the first session of the committee that the industry needed £13bn (1987 prices) to meet growing demand, and to replace existing plant up to the year 2000.

Yet in November 1987, when Parkinson announced the price rises, he said they were to enable the industry to raise the £40bn of necessary investment funds (at prices likely to prevail in the year 2000).

Tony Blair, Labour's Energy spokesperson, pointed out that if £13bn were to translate to £40bn by the year 2000, this would imply an inflation rate of 8% per annum. Labour claims the price rises are simply to fatten up the industry prior to privatisation.

At the committee's second session Michael Spicer, Parkinson's junior, was sent to apologise: "My Right Honourable Friend has asked me to say that the figure of £13bn should have been £30bn." The industry is expected to invest £15bn in new generating capacity by the year 2000 and £5bn on the grid; a further £10bn will be committed for capacity in the following few years.

Blair has been pressing the Government for an independently verifiable estimate of the likely level of investment needed by the end of the century. He says it is absurd to rely on CEGB predictions.

### NORTHERN IRELAND

The Energy Select Committee have called for Northern Ireland Electricity (NIE) to be broken up into competing companies if it is to be privatised. Leaving the Board intact would bestow an unacceptable degree of monopoly, since the Province has no gas supplies.

NIE is, like the Scottish utilities, vertically integrated; it is slightly smaller than the North of Scotland Hydro-Electric Board; it is heavily dependent on oil; and there are no connections to Eire or Britain.

Government subsidies of about £350m have been given to NIE since 1981 to keep electricity prices the same as the highest in England and Wales, but for the last two financial years a subsidy hasn't been necessary due to falling oil prices.

Since September 1987 it has been possible for private generators to supply the grid, but preparations are now being made for privatisation.

NIE's Kilroot-2 power station is to be converted from oil to dual oil/coal-fired generating units in preference to a private sector proposal for a lignite-fired power station at Crumlin. (SCRAM 64)

The Select Committee express their concern over the length of time it has taken NIE to reduce its dependence on oil. They expect any utility in that position to make every effort to investigate demand management and energy conservation.

They are also concerned that NIE still do not know whether flue gas desulphurisation (FGD) will be required at Kilroot-2. Any decision on this will have implications for refurbished plant elsewhere in the UK. If the EC Directive classifies them as new plant then they will require FGD, which will affect the economics.

### NATIONAL POWER

National Power hope to reduce staff levels by 10%, involving the loss of 3,000 jobs. The figures were revealed in a leak of a speech by their new personnel director, R J Jackson. He also disclosed a surprising difference in the ratio of staff to megawatts between coal and nuclear - coal and oil stations employ 0.47 staff per MW whereas nuclear employ 1.03 - more than double.

Also leaked were some rather candid comments on privatisation from John Baker, National Power's Chief Executive. Baker expects fossil fuel costs to average about 3.5p/kWh and nuclear about 5.0p/kWh. New plant competing for business and replacing existing stations as contracts come up for renewal (starting in about 5 years) should provide power at between 2.5 and 3.0p/kWh.

"We have to find a formula in negotiation with the Government that makes nuclear power worth the hassle ... and would justify the further investment of new capital in new nuclear plants ... If we can't negotiate the right terms then of course the right course is not to proceed at all," suggests the speech.

## Superphenix

Superphenix the French prototype commercial fast reactor, has been restarted after a 20 month shut-down, even though its leaking fuel drum has not yet been fixed.

Anti-nuclear groups in France and Switzerland will now seek legal help to try to shut down the reactor permanently.

Superphenix was closed in May 1987 when liquid sodium coolant was found to be leaking from the fuel drum. The French government have agreed to electricity production being resumed for an eight-month period, without the fuel drum.

Electricite de France intend to replace the sodium coolant with inert argon gas and then run the reactor without the fuel drum, while it is modified. The core is already charged with fuel so the reactor can therefore, run for about a year without needing to use the fuel drum, provided there isn't an accident, in which case the fuel drum is the only place where the fuel rods can be safely stored.

## Briefly...

- Following allegations that the German Government kept secret an accident at a PWR near Biblis, which nearly lead to a meltdown, the nuclear industry have suffered another scandal. The public prosecutors are now investigating whether two companies illegally exported nuclear plant to Pakistan, India and South Africa.

- The cargo-handling company, Exxtor, have refused to continue importing spent nuclear fuel and uranium hexafluoride for BNFL through the port of Immingham, due to growing public concern and increased insurance costs.

- Belgium have cancelled plans to build their eighth nuclear reactor, bringing to an end five years of political infighting.

- Mexico's first nuclear power station began operation at the end of October 1988, despite strong protests from anti-nuclear groups.

- Indonesia are planning their first nuclear power station, in the face of strong protests from from environmental groups.

# Hinkley Radiation Risks

**At Hinkley the CEGB claim that developments since the Sizewell Inquiry have not altered the conclusion reached by the Inspector: the PWR design would be acceptably safe. FoE evidence on low level radiation disputes this main point and shows that because of recent changes in radiation risk estimates the situation has in fact significantly worsened. PATRICK GREEN and PAUL WATTS review the FoE evidence.**

One of the central points in the safety philosophy of the Central Electricity Generating Board (CEGB) is to ensure that the risk to their workforce is not greater than in comparable industries. They believe that this can be achieved by compliance with a number of worker dose targets, namely a **collective dose target** of 2.4 person-sieverts for the station, an **individual dose target** of 10mSv and an average **dose target** of 5mSv per year.

The Friends of the Earth evidence on radiation is concerned with two main areas:

- the risk to workers at these target doses;
- whether the CEGB can meet these targets.

The CEGB do not accept that increases in risk estimates as a result of the re-analysis of the atomic bomb data affects Sir Frank Layfield's (the Sizewell Inspector) conclusion. However, their discussion of the epidemiological evidence can at best be described as limited. As the A-bomb data now clearly show risks far in excess of those quoted by the International Commission on Radiological Protection (ICRP), they attempt to claim that other sources of data, ie medical and occupational studies of workers, suggest that risks have been substantially underestimated.

The FoE proof reviews all available evidence and concludes that all sources of data suffer from a number of limitations. However, the best source remains at present the A-bomb data, although because the doses of radiation are large and were delivered in a short time, the results may not be directly applicable to radiation workers. This criticism equally applies to the medical studies which have the added problem that their subjects are already ill. Ideally the occupational studies should be the best source of data. However, the number of workers included is frequently too small to generate accurate results and the period of follow-up too limited to detect a trend.

| | Annual Dose (mSv) | | |
|---|---|---|---|
| Risk Estimate per Sv | 5 | 10 | 15 |
| NRPB ($3.4 \times 10^{-2}$) | 1:5882 | 1:2941 | 1:1961 |
| FoE Average ($5.2 \times 10^{-2}$) | 1:3846 | 1:1923 | 1:1282 |
| CEGB Upper ($12.2 \times 10^{-2}$) | 1:1639 | 1: 819 | 1: 546 |

Table 1: Fatal Cancer Risks at Varying Levels of Annual Dose

A central question is how applicable data derived from high doses and dose rates are to doses encountered occupationally and environmentally. So the FoE proof suggests that because of the uncertainty in the epidemiological evidence, a range of risk estimates should be used in assessing the risks to workers at Hinkley. Three levels are suggested:

- the NRPB's latest estimate;
- an estimate derived by FoE as an acceptable mid-point - 5.2 times the ICRP estimate;
- the estimate quoted by the CEGB as a "reasonable" upper bound risk estimate.

| Industry | Rate |
|---|---|
| Deep Sea Fishing on Vessels Registered in UK | 1:1136 |
| Quarries | 1:2564 |
| Coal Extraction and Manufacture of Solid Fuels | 1:9433 |
| Construction | 1:10,870 |
| Agriculture | 1:11,494 |
| All Manufacturing Industry (Average) | 1:43,000 |
| Including: | |
| Metal Manufacturing | 1:10,000 |
| Instrument Engineering | 1:500,000 |
| Premises Inspected by Local Authorities | 1:222,222 |

Table 2: Annual Industrial Fatal Accident Rates (Calculated from Rates/Million/Year, quoted HSE 1987)

To demonstrate that the risks to their workforce are "tolerable" the CEGB consider two levels of risk. Those faced "by a hypothetical worker" who receives the target maximum dose of 10mSv per year, and those faced by a worker "who receives a dose of 5mSv per annum which would be typical of the average dose for workers at Hinkley Point C if the collective dose target was just met."

In their analysis the CEGB use the 1987 NRPB estimate. For the worker exposed to 10mSv a year this leads to an annual risk of developing a fatal cancer of 1:3300 per year. The CEGB state "this lies towards the upper end of the range of risks run by industrial workers." The average fatal accident rate for all industry is 1:50,000 per year. In fact as shown in **tables 1 and 2** the risk at the 10mSv target is higher than the average for any industry in the UK with the exception of quarrying and deep sea fishing.

For the worker exposed to 5mSv a year this would correspond to an annual fatal cancer risk of 1:6700 per year. The CEGB state that when the total risk of death is considered this "is broadly comparable with the average for the risk of industrial accidents in some heavy industry, but exceeds that in many industries in the UK." The risk is in fact higher than the average level of risk in industries traditionally considered to be hazardous, namely coal extraction, construction and agriculture.

What these two comparisons in the CEGB's proof clearly show is that on the basis of their own assessment the risks faced by radiation workers at Hinkley within their dose targets will be in the upper range of risks faced by workers in the UK.
The CEGB state "in conclusion the average risk to radiation workers at Hinkley Point C is, on a limited measure of mortality, likely to be higher than in some other comparable industries."

However, the CEGB neglect to assess the risk based upon their own upper bound estimate. When this is done the risk at their own 10mSv target dose is in fact higher than in any industry in the UK and is in excess of the level defined by the

Health and Safety Executive (HSE) as the maximum level of risk tolerable for workers (1:1000 per year).

Furthermore, the CEGB present their 10mSv target as the maximum dose likely to be received by any worker at Hinkley C. However, they also emphasise that such figures are only targets and that "failure to comply with the target does not necessarily mean that the design is unacceptable, nor does non-compliance automatically mean that ALARP (As Low As Reasonably Practicable) has not been achieved." This can be interpreted as an acknowledgement that some workers will receive annual doses in excess of the target. Indeed, operating experience of PWRs worldwide suggests that around 5-10% of the workforce can be expected to receive in excess of 10mSv per year. If these figures were applied to Hinkley C, between 30 and 60 workers can reasonably be expected to receive annual exposures in excess of 10mSv.

## CEGB NOT COMPARING LIKE WITH LIKE

The CEGB point out that comparisons between fatal cancer risks and occupational accident rates are not comparing like with like. Clearly, there are differences between a fatal accident that leads to an immediate loss of life, and exposure to radiation that leads to a delayed fatal cancer developing. The CEGB have emphasised an approach based upon ICRP Publications 27 and 45, which attempt to produce an **Index of Harm** which quantifies all possible causes of death and expresses the resultant risk as days lost per life. Under such methods fatal accidents lead to a greater number of days lost per life. While it is beyond the scope of the FoE proof to evaluate which method of death should rank as more important, it is clear that the claim that such methods of analysis are more correct than conventional comparisons is debatable.

Furthermore, such methods of comparison were criticised by the Royal Society in 1983, who note that "such an index might help administrators to plan health protection and to assess relative levels of safety under circumstances in which hazards differ. An individual, however, is likely to be confused by a single figure that combines his risk of a possibly fatal cancer with the risk of a 'major' hereditary effect in his offspring, and combines so many disparate detriments into one index."

Consequently, such methods are as open to criticism as straight comparisons with fatal accident rates. As such, they will be of little use to radiation workers who want to know if they are working in a hazardous environment. To such workers, to be told that one's occupational exposure to radiation may lead, on average, to less days loss of life than if they were to die of a fatal accident tomorrow is of little comfort. That occupational exposure puts them at a high risk of developing a fatal cancer that will not show itself for another twenty years, and may take five years to kill them. This is particularly the case if the risk these workers face is in excess of what their employer tells them.

## COMPARISON WITH OTHER CARCINOGENS

A further comparison would be between fatal cancer rates from exposure to radiation and a number of other occupational carcinogens. However, this method of analysis is equally fraught with difficulties. For many chemicals the dose response relationship is not known; most chemicals act on one particular site to produce a cancer, whereas radiation can induce both solid cancers and leukaemia. Consequently, for chemicals, unlike radiation, little information has been published on risk estimates. Furthermore, most of the published information is concerned with exposure levels in the past, as opposed to current exposure levels.

| Asbestos | Cancer Type | Rate per 1000 |
|---|---|---|
| @ 0.25 fibres/ml (average exposure) | Mesothelioma | 4.24 - 6.29 |
| | Lung Cancer | 0.17 - 1.40 |
| | Total Risk | 4.41 - 7.69 |
| @ 0.5 fibres/ml (control limit) | Mesothelioma | 8.48 - 12.48 |
| | Lung Cancer | 0.34 - 2.80 |
| | Total Risk | 8.82 - 15.28 |
| **Radiation Exposure (NRPB Risk Estimate)** | | |
| @ 5 mSv | All | 5.95 |
| @ 10 mSv | All | 11.90 |
| @ 15 mSv | All | 17.85 |
| **(FoE Average)** | | |
| @ 5 mSv | All | 9.10 |
| @ 10 mSv | All | 18.20 |
| @ 15 mSv | All | 27.30 |
| **(CEGB Upper Bound)** | | |
| @ 5 mSv | All | 21.35 |
| @ 10 mSv | All | 42.70 |
| @ 15 mSv | All | 64.05 |

**Table 3: Lifetime Risks (35 years) following occupational exposure to asbestos and ionising radiation (Asbestos data from Doll and Peto 1985)**

**Tables 3 and 4** show predicted risks for radiation exposure compared to current risk estimates for asbestos and benzene. (Rates have been expressed in the same form as the asbestos and benzene data to allow comparisons, ie a lifetime is taken as 35 and 45 years respectively.)

**Table 3** shows that a lifetime working with ionising radiation within the CEGB targets produces comparable levels of risk to those faced by asbestos textile workers. Using the current NRPB estimate, the risk at the 5mSv per year is comparable to the risk at the average 0.25 fibre per millilitre (Doll and Peto). The risk at 10mSv per year is comparable to the risk at the 0.5 fibres/ml limit. However, on the basis of NRPB risk estimates, any worker who receives an annual exposure in excess of 10mSv will face a higher risk than that faced by asbestos workers. If on the other hand, at the CEGB upper bound, the level of risk at all exposures in excess of 5mSv is in excess of the risk faced by asbestos workers at the control limit.

Good epidemiological data is also available for benzene, particularly from the US where the benzene standard is more stringent than that applied in the UK. Following the establishment of a link between benzene and occupational leukaemia, the US exposure limit was reduced in 1987 from 10 parts per million to 1ppm, with a 0.5ppm action level, although a limit of 0.1ppm is currently recommended in the US. The UK limit is 10ppm.

From **Table 4**, again using the NRPB's risk estimates, a worker who receives an annual dose at the CEGB's average dose level for a working

| Benzene | Cancer Type | Rate per 1000 |
|---|---|---|
| @ 10ppm | Leukaemia | 95 |
| @ 1ppm (USA TWA limit) | | 10 |
| @ 0.5ppm (Action level) | | 5 |
| Radiation Exposure (NRPB Risk Estimate) | | |
| @ 5 mSv | All | 7.65 |
| @ 10 mSv | All | 15.30 |
| @ 15 mSv | All | 22.95 |
| (FoE Average) | | |
| @ 5 mSv | All | 11.70 |
| @ 10 mSv | All | 23.40 |
| @ 15 mSv | All | 35.10 |
| (CEGB Upper Bound) | | |
| @ 5 mSv | All | 27.45 |
| @ 10 mSv | All | 54.90 |
| @ 15 mSv | All | 82.35 |

Table 4: Lifetime Risks (45 years) following occupational exposure to benzene and ionising radiation
(Benzene data from Federal Register 29 CFR Part 1910, 1987)

lifetime of 45 years (5mSv) faces a larger risk than lifetime benzene exposure at 0.5ppm. At the CEGB's target dose the risk is in excess of working with benzene at 1ppm.

## RISKS TO MEMBERS OF THE PUBLIC

The CEGB state that the maximum dose to a member of the public from the combined operations at Hinkley A, B and C is 126.4 micro-sieverts per year. They claim this is equivalent to an annual risk of 1:200,000 which "takes into account increased risk factors." However, the NRPB now apply a risk estimate for the general UK population that is 4.5 times the ICRP's estimate (compared to 3 times in 1987). Using this to calculate the annual risk at the maximum dose produces an annual risk of 1:176,000. This is between "just tolerable" (1:10,000) and "broadly acceptable" (1:1,000,000) regions defined by the HSE (1987).

If the CEGB's upper bound estimate is used the risk at their maximum does increases to 1:65,000 per year. Again, it could be argued that this is within the boundaries defined by the HSE, although it is a level of risk only six times the "just tolerable" defined by the HSE. However, the Royal Society presented a slightly different view of risk acceptability in 1983. They stated that there was "a widely held view ... that few people would commit their own resources to reduce an annual risk of death that was already as low as 1:100,000." If, however, there were grounds for suspecting a real risk at an annual level of 1:10,000, the imposition of that risk is likely to be challenged.

In 1987 the NRPB interpreted this to mean an unacceptable imposed risk will lie between a level of 1:10,000 and 1:100,000. A risk of 1:100,000 can therefore be taken as the boundary at which risks start to become acceptable, rising to definitely unacceptable at a level of 1:10,000 a year.

The emphasis of the Royal Society paper is thus different to the HSE's. Clearly, on the basis of the Royal Society's report, written by some of the most eminent scientists in this country, the level of risk from exposure at the CEGB's maximum dose would be unlikely to be acceptable if the radiation risk estimate is three times greater than currently claimed by the NRPB.

As the NRPB have revised the risk estimates twice within the one year, it would be prudent to assume that their proof of evidence to this Inquiry does not represent their final judgement on the rapidly changing subject of risk estimates. Consequently, the CEGB should be prepared for further possible increases in risk estimates and should plan for a lower maximum exposure resulting from routine discharges at Hinkley C.

## CAN THE CEGB MEET THEIR TARGETS?

In their proof the CEGB claim that recent international PWR operating experience supports their confidence that their targets can be met. And they are confident they can reduce worker exposure further by a number of modifications to the basic design, material changes and a better understanding of primary circuit water chemistry.

Firstly, their method of comparing international experience with dose targets for Hinkley produces falsely favourable results:

- a number of plants in their sample are smaller than Hinkley and as a result have lower occupational exposures;
- they have picked a number of plants with good operator dose records and have basically said "if they can do it, then so can we;"
- many of these plants have design differences to Hinkley C;
- many of these plants have only been operating for a few years when low exposures would be expected and, despite a large body of evidence showing a correlation of plant age with operator doses, the CEGB do not think exposures significantly increase with age.

By correcting the faults in the analysis, it can be shown that international experience since Sizewell has not improved sufficiently to provide confidence that the CEGB's operator dose targets can be met.

Secondly, much of the CEGB's confidence is based on the changes they have made. FoE's proof questions the effectiveness of those changes which have been specified, especially in terms of other dose saving features incorporated in many other plants abroad which will not be available at Hinkley.

Thirdly, it is quite common for employers dealing with occupational hazards to display a certain amount of technological arrogance with respect to their ability to reduce exposure and risk. As such, FoE have adopted a position of healthy scepticism when faced with these claims. Layfield was also sceptical, and concluded he was not happy with the case on operator doses.

To conclude, CEGB evidence to Hinkley has failed to convincingly demonstrate that their ambitious targets can be met. Layfield considered the position would be "further substantially worsened" if risk estimates were increased. Since Sizewell, risk estimates have increased. We therefore conclude that the position has "substantially worsened".

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# Who'll pay the Electricity Bill?

**With the publication of the Electricity Privatisation Bill, it is now perfectly clear that nuclear power will not be exposed to the full rigours of the market, which some had hoped would kill it off. However, it is also clear that some of the industry's most firmly held convictions about nuclear power have already been abandoned. PETE ROCHE reviews the Bill.**

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"This is not the time to abandon nuclear technology," according to Cecil Parkinson, Secretary of State for Energy. Nuclear power will be protected from the vagaries of the free market by forcing the 12 privatised distribution companies to take around 15-20% of their power from non-fossil sources. But Parkinson warns that nuclear power has not been given a blank cheque: "over the next decade or so, the technology will either make its case on economic grounds or not." However, for the time being, "it is worth distorting the market to maintain this component and diversity of sources of supply."

The Government have also published draft licences, which are designed as key instruments for the regulation of the privatised industry. These require nuclear power to be accounted for separately, and no cross-subsidisation from fossil-fuelled plant will be permitted.

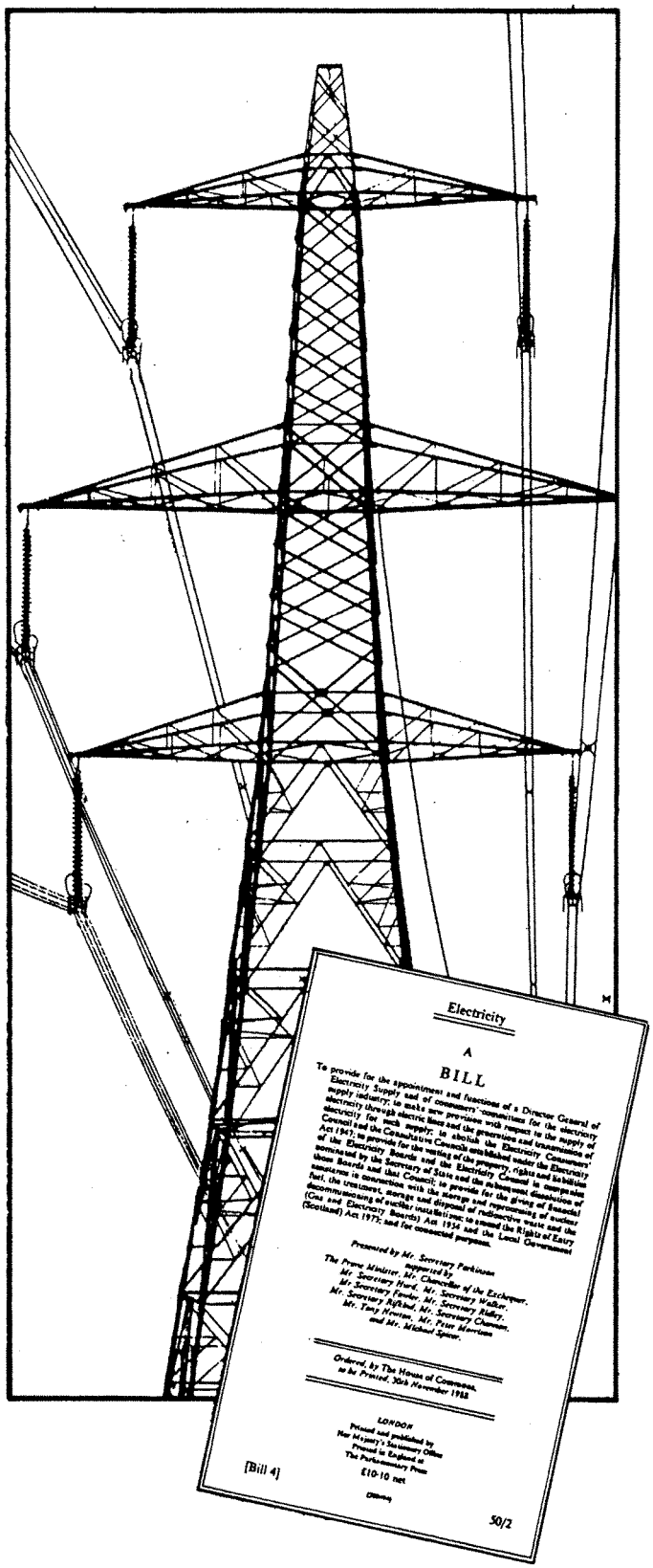
Nuclear power has caused the Government more problems than any other single issue in the electricity privatisation saga. Because of their obligation to buy a certain level of non-fossil generated electricity, the Area Boards complained that they would be at a disadvantage when competing against new independent (non-nuclear) companies for industrial customers.

## COMPULSORY 'NUCLEAR TAX'

To meet these fears the Electricity Bill requires producers of fossil-fuelled electricity to charge a compulsory levy which will be used to finance the non-fossil quota. Much to the Government's annoyance this 'levy' has become known as the 'nuclear tax'. It's not clear yet exactly how this will work, but it won't be used to raise capital before and during construction of new PWRs. National Power - as Big G will be known - will have to raise this capital on the open market, armed with contracts from the distribution companies.

The extra cost of generating electricity by nuclear means compared with the alternatives will be recouped via the 'nuclear tax' after the new PWRs have come into operation. Producers of power which is neither nuclear nor fossil will not be required to make this levy, so renewable energies may gain a small competitive advantage.

Incidentally, this 'nuclear tax' will not apply to Scotland, except when the Scottish utilities export fossil-fuelled electricity to England. However, Scottish utilities are likely to have another kind of subsidy. The Secretary of State has taken powers to write off the £2,700m debts of the two boards, which could mean the Government effectively giving them away to new shareholders. Nor will Scottish utilities be required to maintain a specified non-fossil fuel generating capacity, but the Secretary of State has powers to change this in the future if necessary.



The Electricity Bill also makes provision for a public subsidy to private nuclear power, because of its perceived importance in maintaining a diversity of sources of supply. Although the consumer will be expected to pay the anticipated costs associated with the nuclear fuel cycle, where costs increase for unforeseeable reasons, the Government considers that it will be unreasonable to expect future electricity consumers to meet the additional cost. The Government, therefore, intends to contribute up to £2,500m per year towards unforeseen costs associated with decommissioning, reprocessing and storage of nuclear fuel or the treatment, storage and disposal of radioactive waste.

This £2.5 billion might prove small beer when decommissioning starts. Even then it is the annual upper limit - there is nothing which states how generous the Secretary of State will be, nor how much future Secretaries of State will provide, if anything.

## HINKLEY C 50% MORE EXPENSIVE THAN COAL

The CEGB have now admitted to the Hinkley Inquiry that at commercial rates of return of about 8-10%, the cost of electricity from a nuclear station could be about 50% more expensive than coal-fired electricity.

To avoid the risk of throwing good money after bad we should examine the idea of nuclear power being a strategic necessity to see whether or not we are gaining greater security of supply. Recent industrial relations history might suggest that nuclear power is necessary to prevent the NUM having too much power. But there are other ways to provide diversity: imported coal or burning natural gas; investment in electrical end-use efficiency; combined heat and power to make better use of fossil fuel inputs; and renewables.

To replace the projected need for Hinkley Point C would require, for example, an increase of about 2.5% in electrical end-use efficiency - a very modest improvement even compared to the Energy Efficiency Office's demonstration schemes in lighting and power drives. It is Government policy that energy efficiency improvements should be left up to the market-place. If, following privatisation there are rapid developments in the market for electrical end use efficiency, we would find that the large capital expenditure made by National Power to achieve the targets set for the non-fossil fuel fraction, have been undermined.

## ENERGY EFFICIENCY - A GLIMMER OF HOPE?

There is a glimmer of hope in the Electricity Bill. The Regulator is required "to promote efficiency and economy on the part of the licensees and efficient use of electricity supplied by them." However, the Supply Licence only requires companies to "make available a statement of guidance on the efficient use of electricity approved by the Director." Labour's Shadow Energy Secretary, Tony Blair, has already criticised the licences for failing to give the industry enough incentive to promote energy conservation. Yet most of the Area Boards are already considering ways of providing their customers with incentives to use energy saving equipment.

The various subsidies for nuclear power have not solved all the Government's problems. Donald Miller, the Chairman of the South of Scotland Electricity Board is demanding even more guarantees. He says the Government will have to make a number of firm assurances that the industry will not be exposed to the full financial consequences of unforeseen changes, such as the election of an anti-nuclear government, or one which might want to accelerate the closure of Magnox reactors. Miller says these assurances "will have to be signed and sealed before one writes a prospectus - otherwise it will not be worth writing." Satisfying these demands would tie the hands of future governments on nuclear policy.

## 'COMPETITION' DISAPPEARED FROM BILL

Although the word 'competition' featured quite prominently in the White Paper it has virtually disappeared from the Bill. The Bill fails to reconcile the conflict between the need for competitive contracts between generators and suppliers and the need to maintain the merit order. But the Secretary of State's response to the Select Committee suggests that this might be done by the Grid Company operating a 'generators' pool': the 12 distribution companies would pool their contracts, but power would still be dispatched according to a merit order. But, what part does competition play in all this? The contractual arrangements are likely to be so complicated that it will be almost impossible for the Regulator to stop cartels developing.

Parkinson insists that as there are now at least 20 major generating projects representing over 8% of current generation being prepared by independent companies, this will boost competition. The trouble is that National Power and PowerGen will be able to subcontract-out production if they so wish, and as they have carved up all the best power station sites between them, they will be in a very good position to control the newcomers entering the market. It seems that when it comes to the crunch the word 'competition' is not one which investors want to hear.

## GOVERNMENT INTERFERENCE NOT REDUCED

Another aim of privatisation, according to the White Papers, was to free the electricity industry from government interference. Yet the industry will be very closely regulated, and the Secretaries of State for Energy and Scotland will both have wide ranging powers to interfere. **Power in Europe**, the influential Financial Times Business Information fortnightly, commented: "it is hard to identify a single power which the Secretary of State for Energy is giving away or even loosening."

Privatisation is also supposed to protect the consumer. Yet the licences fail to explain how the price control formula will work, and thus fail to allay fears that privatisation will continue to drive up electricity prices. The Government still have a lot of work to do to convince the public that privatisation will bring the promised benefits.

Privatisation of the electricity industry involves 16 companies. Given the complexity and scale of the operation, both the flotation and regulation of the industry will be fraught with difficulties. It is still far from clear whether the Government have solved the problem of nuclear power's financial risks to the satisfaction of potential investors and consumers so we can expect a few surprises yet.

# THURSO & McFARLAND

**The debate over cancer clusters has progressed in recent months, with two hypotheses suggesting variously that a virus or atomic bomb test fall-out could be the cause. The nuclear industry and medical community admit that they don't know the answer. LOUIS SLESIN offers a further explanation, and provides supporting evidence from the US.**

## A second look at two childhood cancer clusters

The cause of the leukaemia cluster among children in and around the small town of Thurso on the northern coast of Scotland remains a mystery. Because Thurso is less than ten miles from the Dounreay nuclear power station and because this was the second cluster reported near a UK nuclear complex, suspicions grew that ionising radiation was responsible. But last summer after a detailed investigation, the Committee on Medical Aspects of Radiation in the Environment (COMARE) announced that they could not link the cancers to either authorised or accidental discharges of ionising radiation from the Dounreay station.

The National Radiological Protection Board (NRPB) have estimated that the Dounreay nuclear complex contributed only one percent of the Thurso's children's lifetime dose of ionising radiation - far too little to account for the excess cancers. COMARE could not identify an alternative cause and concluded that, "The evidence does not point to any particular explanation and therefore all possible explanations need to be investigated further." In other words COMARE are stumped. *

### CALIFORNIAN CANCER CLUSTER

Six thousand miles from Scotland in the small farming community of McFarland, California, epidemiologists cannot explain why 13 children have developed cancer since 1975. They agree that McFarland, with a population of only 6,000, should have had only a fraction of this abnormally high number of cancer cases. California health officials have focused on cancer causing pesticides but they too have found nothing unusual - nothing to distinguish McFarland from the many other farming towns in the pesticide-intensive San Joaquin valley. In a lengthy report issued in early 1988, the California Department of Health Services, like COMARE, could not offer a plausible explanation; only that, "What we saw were commonly used pesticides in usual amounts."

Trying to find the cause of cancer clusters is a difficult task which often ends in failure. The cause may be long gone and impossible to trace. Many cancer clusters may in fact be simple statistical accidents - the tragic equivalent of being dealt four aces in two consecutive hands of poker.

Perhaps it is only coincidence but, both in Thurso and McFarland, there are high-power communication stations only a few miles away from the children's homes. These sources of non-ionising electromagnetic radiation (NIER) have so far received little more than scant attention from the investigating committees because, until recently, few scientists believed that NIER could play a role in the development of cancer.

At Forss, approximately halfway between Thurso and Dounreay, the US Navy operates a communications complex to send messages to aircraft, surface ships and submarines. There are a large number of transmitters at the base - some broadcasting in the high frequency band (2-30 MHz) with one tall antenna sending signals at 50-150 kHz.

In Delano, up the road from McFarland, the **Voice of America** broadcasts at 9 and 11 MHz to Latin America and Asia. The 250,000 watt transmitters beam radiowaves over the McFarland children's homes.

### CLUSTER COINCIDENCE COMPOUNDED

To compound the coincidence, there have been additional mysterious clusters. Between 1979 and 1985, children living outside another US Navy communications complex at Lualualei in Hawaii suffer from leukaemia incidence at four times the expected rate. The Cancer Research Center of Hawaii tried, without success, to raise money to study the cluster. And when Dr Fred Dodge, a general practioner at the community health centre, tried to enlist the Navy's co-operation to measure the radiation levels in the community, he too came away frustrated.

NIER has also been linked to diseases other than cancer. In the small town of Vernon, New Jersey, the Centers for Disease Control have confirmed a cluster of Down's Syndrome cases. Here again there is no explanation. The resort community has no radon or toxic chemical problems, but it does have one distinguishing characteristic: it has one of the largest concentrations of satellite earth stations in North America.

All modern communications technologies - for in-

** A Scottish researcher has recently suggested that the Thurso and Sellafield clusters may be caused by an as yet unidentified leukaemia virus. Writing in the The Lancet (10.12.88), Dr Leo Kinlen presents an elegant argument for his hypothesis; nevertheless, a genetic explanation is not necessarily incompatible with the argument presented here: NIER may play a role in activating latent genetic instructions. In addition, it should be remembered that a childhood leukaemia virus has never been isolated despite considerable effort to do so.*

stance radio, television, satellite stations, cellular telephones - exploit NIER to send messages. Electronic engineers have devised ingenious ways of piggybacking information onto carrier waves and of decoding them to hear the transmitted words and music. After decades of proliferation, most of the electromagnetic spectrum is now allocated to some type of communication system. Even the extremely low frequency band (0-300 Hz), used primarily to deliver electricity at 50 Hz in the UK (60 Hz in the US) has been harnessed to send signals to submarines because the ocean is essentially transparent to these frequencies.

Up close to a transmitter, high intensity radio waves and microwaves can cause bodily heating - as in a microwave oven - but further away, these and other types of NIER had long been thought to be innocuous because the radiation decays quickly with distance. Since the 1970's, this **thermal** dogma has had to be reassessed to take into account non-thermal effects - those unexplained by a radiation induced rise in temperature. In 1986, the National Research Council, an arm of the US National Academy of Sciences, put an end to the controversy by concluding that, "Bioelectromagnetics research has produced abundant reports of a wide variety of individual biological responses to low-level non-ionising radiation."

But, a mechanism of interaction - ie a biophysical explanation for how low-level NIER can exert such a profound effect on living systems - is still missing. Nevertheless, there is now an abundance of data pointing to a link between NIER and cancer.

Of particular importance are the many recent papers implicating NIER in the aetiology of occupational cancer, specifically leukaemia and brain tumours. Indeed, last summer, in an editorial published in the **American Journal of Industrial Medicine**, Dr Baruch Modan of the Tel Aviv University Medical School, shifted the burden of proof onto those who maintain that NIER exposure is safe: it "must be considered an environmental hazard and dealt with accordingly, until proven otherwise."

In 1987, the Hawaii Department of Health reported that in Honolulu, where radio and television towers are in the downtown residential areas to preserve the scenic beauty of the surrounding hills, people living near broadcast antennas had "significantly higher" cancer rates than those living in other parts of the city. The Honolulu findings added credibility to a previous epidemiological study by Dr William Morton of the Oregon Health Science University in Portland linking low levels of broadcast radiation to leukaemia.

In all countries, the military are the largest users of NIER. Transmitters are used to communicate between far-flung units, to detect intruders with high powered radars and to confuse an enemy's electronic warfare systems. Soldiers, sailors and fliers are therefore the obvious people to study for long-term effects from NIER exposure. But only Poland has dared to monitor its servicepeople. A study by Dr Stanislaw Szmigielski of the Centre for Radiobiology and Radioprotection in Warsaw revealed a clear association between NIER and cancer. He found certain types of cancer related to leukaemia were nearly seven times more common among exposed soldiers. The younger the soldiers the greater the observed effect, indicating the latency period, from exposure to disease, may be shorter than the 20 or more years associated with carcinogenic chemicals. Preliminary results from his follow-up effort support this association.

Studies on NIER from power lines and video display units (VDUs) point to a very low threshold for adverse effects. Three independent epidemiological studies all show an increased risk of cancer among childen living near neighbourhood power lines. Magnetic fields as low as three milligauss - more than a hundred times smaller than the Earth's magnetic field - are implicated.

Extrapolating from these power line reports, Dr David Carpenter, the Dean of the New York School of Public Health in Albany, has estimated that 30% of all childhood cancer may be due to exposure to power frequency (60Hz) magnetic fields. According to his calculations, if the NIER-cancer link is confirmed, power line magnetic fields could account for 2,000 childhood cancer cases a year in the US alone. Based on occupational surveys, Carpenter estimates that 4,000 adult cancers a year may also be attributable to magnetic fields.

Dr Leslie Hawkins of the Robens Institute at Surrey University and Dr Denis D'Auria alerted the readers of the **British Medical Journal** (December 5 1987, p1488) to the possibility that cancer clusters around nuclear installations may be due to, or aggravated by, the electromagnetic fields generated by the power lines going in and out of the plants.

In Sweden, 20kHz magnetic fields designed to mimic those emitted by the horizontal deflection coils of a VDU have been shown to cause serious malformations or foetal death among exposed mice embryos. And last summer, in a project sponsored

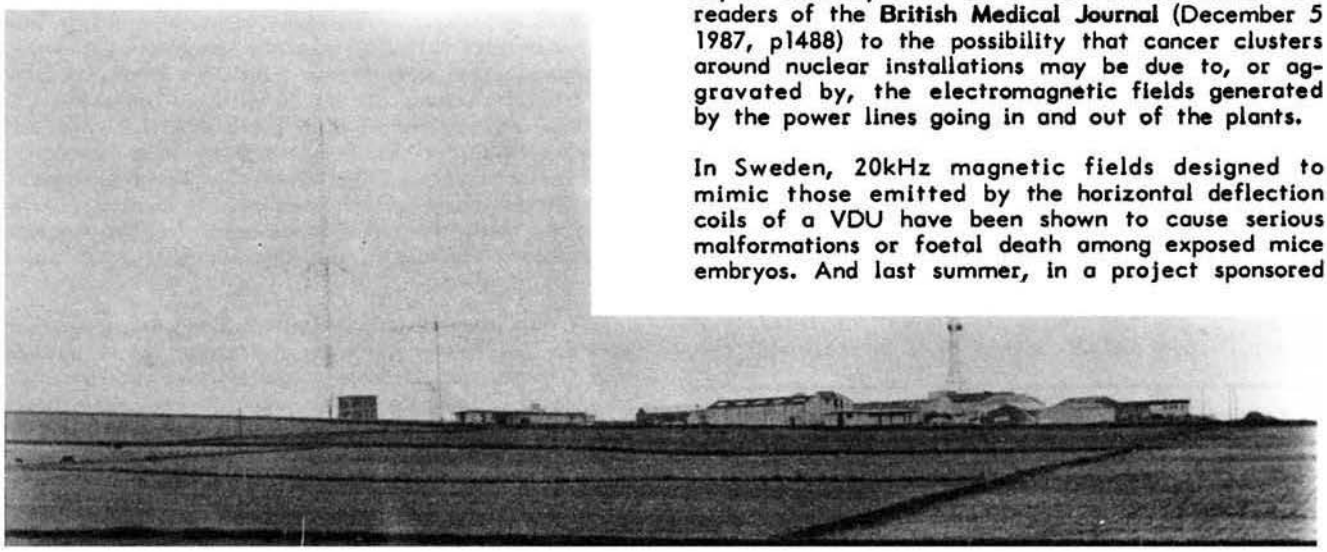


Photo: Robert Moore

***US Navy communications base at Forss in Caithness***

by the US Office of Naval Research, scientists from six laboratories in four countries agreed that extremely weak (10 milligauss) magnetic fields could upset the development of chick eggs. Still to be explored is how the magnetic field wreaks havoc. As Jack Monahan of the US Food and Drug Administration, who participated in the project, put it, "The effect is real. It is produced by a low-level magnetic field, but we don't yet know what the important parameters of the field are."

### US SPENDS MORE ON PROTECTING EQUIPMENT

The levels of NIER at the Forss base are not known, but they are strong enough that the US Navy placed its receiving antennae thirteen miles away in West Murkle, six miles east of Thurso, to mitigate electromagnetic interference (EMI) problems with their equipment at Forss. (The US Department of Defense spend much more money to protect against EMI than against personnel exposure hazards.) Under normal operation, the NIER in Thurso from the various transmitters in operation at Forss should be well below all health standards, which are still based on protecting against thermal effects. Similarly, the electromagnetic fields in McFarland are below those known to cause heating.

Interestingly, the majority of the childhood cancer cases in Thurso all live in the same housing development located on a hill. Since radio transmitters aim their signals into the air, the power density of NIER is likely to be greater on high, rather than low, ground.

The key question is: how small an electromagnetic field can cause harm? But there is no answer because the thresholds have never been properly investigated. According to Dr Robert Becker, a leading researcher and the author of the **Body Electric**, "The present attitude that bioeffects cannot occur at low field strengths has no scientific basis. We simply do not have the data."

### JOINT ACTION OF NIER & TOXIC CHEMICALS?

In towns such as Thurso and McFarland, there is the added complication of possible synergistic interactions with ionising radiation and toxic pesticidies. Experiments in the laboratory of Dr Ross Adey at the Veterans Administration Hospital in Loma Linda, California, show that certain types of NIER can significantly enhance chemical cancer promoters. Adey, a pioneer in the study of low-level effects, predicts that, "The joint action of environmental electromagnetic fields and toxic chemicals is a new frontier in the epidemiology of cancer."

A second possibility is that the huge antennae at Forss and Delano have operated at higher than authorised power levels - the electromagnetic equivalent of midnight dumping of toxic or radioactive wastes. But, unlike these examples, once the signal has been transmitted, no evidence of the radiation pulse remains. Such a hypothesis, even if true, would be next to impossible to prove.

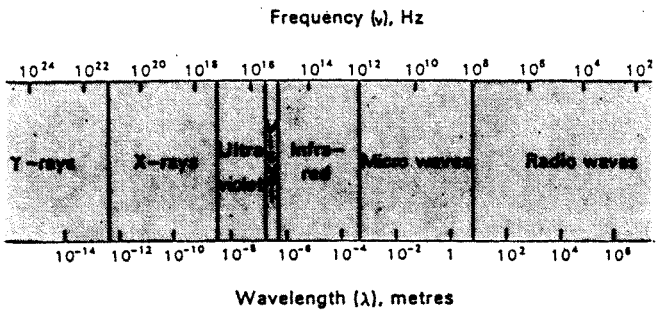
### US TO MEASURE McFARLAND LEVELS IN 1989

In early 1989, officials of the US Environmental Protection Agency (EPA) will measure the levels of NIER in McFarland. As EPA Administrator Lee Thomas wrote to the head of the California Department of Health Services, "I share the public's concern about the suggested link between electromagnetic fields and human cancer ... I believe that our involvement in your investigation of the McFarland situation may produce information valuable to our understanding of the relationship between environmental electromagnetic fields and carcinogenesis."

COMARE has no similar plans to measure NIER in Thurso. It may be too early to blame the Navy station for the excess rate of childhood cancer in Thurso, but it is not too soon to investigate.

# What is Non-Ionising Electromagnetic Radiation?

The electromagnetic spectrum may be conveniently divided into two parts. In the middle, at approximately $10^{14}$Hz, is visible light; at higher frequencies is ionising radiation, associated with x-rays and nuclear radiation, and at lower frequencies is non-ionising electromagnetic radiation (NIER).




According to Planck's Law, the higher the frequency, the greater the energy in each quantum of radiation. Ionising radiation has enough energy to strip electrons from atoms or molecules, creating 'ions'. NIER cannot ionise, but can cause molecules to vibrate. Microwave ovens operate at 2.45GHz (2.45 billion Hz) because water molecules absorb energy at this frequency; their vibrations generate heat which cooks the food.

As an energy source, NIER is used to dry paper, seal plastics and vulcanise rubber. Doctors apply microwaves therapeutically in diathermy to deep heat muscles and in hyperthermid to shrink cancerous tumours. Bursts of high-intensity microwaves are being developed as weapons to burn out the electronic circuits of hi-tech armaments.

### VERSATILITY OF NIER

But the versatility of NIER lies in its ability to be transformed into an unlimited variety of shapes and forms. Beyond changes in frequency - and its inverse, wavelength - the radiation can be 'modulated' to carry messages, as in frequency modulation (FM) or amplitude modulation (AM) radio stations. The diversity becomes apparent with the realisation that radiation carrying a violin concerto is different from that carrying reggae music.

The radiation can also be 'pulsed' by turning the source on an off very quickly. This is the principle

behind radar. By aiming the radiation at a target and then monitoring the reflections, the target's size, speed and location can be deduced.

As its name implies, NIER is a mixture of electric and magnetic fields. Above approximately 300MHz ($3 \times 10^8$Hz), there is a fixed relationship between the two - knowing the strength of the electric field implies knowing the magnetic field, and vice versa. But at lower frequencies the relationship is more complex and both electric and magnetic fields must be measured separately. At frequencies in the kHz ($10^3$Hz) band and below, NIER does not radiate very efficiently and it is preferable to refer to electromagnetic fields rather than radiation. Thus, when standing under a 50Hz power line, one is in its electric and magnetic field which is changing direction 50 times a second.

# Can NIER Influence Cancer Development?

Until recently, experts believed that NIER could only do harm by heating body tissues. The prevailing attitude was that if the dose did not cause a thermal response, there was nothing to worry about. Unlike ionising radiation, NIER is too weak to produce highly reactive ions and thus few thought that there could be any connection between NIER and cancer.

All that has changed. Today the emphasis is not on the amount of radiation - its power density - but on its component electric and magnetic fields, and how these can interact with biological tissues. The search is on to explain how NIER can promote cancer.

## FIRST CLUES OF A NIER/CANCER LINK

The first clues of a link to cancer came from epidemiological studies which showed that children living near high-current power lines and workers engaged in electrical occupations had higher than expected rates of cancer. Three independent studies now implicate 1-10 milligauss residential 50Hz and 60Hz magnetic fields with higher rates of childhood cancer. More than 15 surveys indicate that workers exposed to various types of electromagnetic fields also have an increased incidence of cancer - four different studies of electrical and electronics occupations found an elevated risk of brain tumours.

Experiments at the cellular level provide support for these epidemiological observations. Dr Jerry Phillips of the Cancer Therapy and Research Foundation in San Antonio, Texas, has shown that cancer cells thrive in power line electromagnetic fields, proliferating at a rate of up to 24 times that of the controls. The cell colonies continued to multiply at an increased rate months after exposure had ceased.

## SYNERGISTIC RESPONSE WITH BENZOPYRENE

A further indication that tumour cells grow more rapidly in an abnormal electromagnetic environment came from Dr Craig Byus of the University of California at Riverside and Dr Ross Adey of the Veterans Administration in Loma Linda, California. They showed the activity of ornithine decarboxylase (ODC), an enzyme necessary for cell growth, was significantly greater in various types of cancer cells after a one-hour exposure to a weak 60Hz field. According to Byus, "After one hour's exposure, the enzyme's activity increased by 50% for the next four hours." Increased ODC activity is not sufficient to show that electromagnetic fields are cancer promoters because many different agents can stimulate it, but the Byus-Adey observation is consistent with such a hypothesis.

At higher frequencies, Dr Stanislaw Szmigielski at the Centre for Radiobiology and Radioprotection in Warsaw, Poland, has shown that microwaves can act synergistically with benzopyrene, a well-known carcinogen found in soot ash and cigarette smoke, to accelerate the development of tumours in mice. Szmigielski believes that the microwaves may be compromising the animal's immune response.

## US GOVERNMENT COVER-UP ALLEGED

What happens when animals are exposed to low levels of radiowaves or microwaves over long periods of time? Health officials do not know because so little research has been done. In his 1971 book, **The Zapping of America**, Paul Brodeur argued that NIER is so critical to the military-industrial complex that the US government had no interest in funding health studies and tried to cover-up all indications of a potential hazard.

Only one chronic exposure study has ever been attempted and it supports the cancer threat. Rats exposed for a lifetime to microwaves at levels allowed under current US health standards had a significantly higher incidence of tumours than the control group. Dr Bill Guy and co-workers at the University of Washington in Seattle found that the tumours were concentrated in the animals' endocrine glands and that their immune systems appeared to be functioning abnormally.

## INDUSTRIAL SOCIETY BREAST CANCER LINK?

Some fascinating work suggests that the pineal gland may be the missing link between NIER and cancer. Low and high frequency NIER, such as power line fields and visible light, can suppress the secretion of melatonin from the pineal. Melatonin not only regulates our daily biorhythms, but it also inhibits the growth of certain types of tumours. Exposures may thus block our natural protective mechanisms. Indeed, Dr Richard Stevens of the Battelle Pacific Northwest Labs in Richland, Washington, has suggested that electromagnetic fields from electric power systems may be responsible for the increasing incidence of breast cancer in industrialised societies.

Recently, Dr Harry Brown, the editor of **Cancer Biochemistry Biophysics**, concluded in a review article, "Animal carcinogenesis studies and human epidemiological data indicate that exposure to NIER can play a role in cancer causation." Unfortunately, it will take a lot more work to elucidate that role.

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# Environmental Assessment

**Environmental Impact Assessment is the latest concept in the lexicon of planning law: but what is it; and what does it mean? Here MIKE TOWNSLEY gives a brief history and translates the White Papers outlining the new legislation, unveiling a potentially powerful new ally for environmentalism.**

Planning law is a quagmire of bureaucratic red tape, and as such is invariably the domain of the legal profession, at the expense of the people it is supposed to protect, or serve, as anyone attempting to follow a public inquiry will have discovered.

However, the European Community (EC) have introduced a directive (*) aimed at increasing public involvement in planning, and at giving greater credence to the transboundary nature of some pollutants (SCRAM 66). As European Community business legislation spirals towards 1992 it has become necessary to standardise planning legislation, otherwise nations with lax environmental protection could be overwhelmed with industrial plant serving the Community.

This is the Community's first excursion into planning law. It is not only bold but could yield profound changes in the way development proposals are evaluated in this country.

The central tenet is that "the best environmental policy consists in preventing the creation of pollution or nuisances at the source, rather than trying to counteract their effects; whereas they affirm the need to take effects on the environment at the earliest possible stage in all the technical planning and decision-making processes."

The directive, number 85/337/EEC, instructs that for all projects likely to have a "significant effect" on the environment, consent should only be given after a rigorous assessment of such effects has been carried out. Interpreting "significant effects" is open to abuse, and is the subject of some controversy.

## ENVIRONMENTAL ASSESSMENT

Although originally the Community had intended that the directive would cover all development projects, in order that the deadlock of objections could be broken it was conceded that developments promoted by specific Acts of Parliament would be exempt. This position was forced by the Danish Parliament who were concerned about the implied loss of sovereignty.

In the UK this means projects promoted by Private Member's Bills, or Hybrid Bills, could by-pass the new regime. However in such cases member states are bound to inform the European Commission of the proposals. The Commission will then immediately relate them to other member states. If there are any objections, arbitration would fall to the Court of Justice. The much debated Severn Tidal Barrage may eventually be promoted by such a Bill.

The new legislation has major implications for both the quality and quantity of information made available to those wishing to protect the environment. An Environmental Impact Assessment, or in this country Environmental Assessment (EA), "comprises a document or series of documents providing for the purpose of assessing the likely impact upon the environment of the development proposed to be carried out." The body of this will be called the Environmental Statement (ES), and will consider:

- a description of the proposed development;
- data necessary for identifying, and assessing the main effects of the development;
- "a description of the likely significant effects, direct and indirect, on the environment of the development, explained by reference to its possible impact on: human beings; flora; fauna; soil; water; air; climate; the landscape; the interaction between any of the foregoing; material assets; the cultural heritage;"
- where such effects are identified a description of any measures "envisaged" to avoid, remedy or reduce its impact; and
- a summary in non technical language of all the information specified above.

An EA may include "by way of explanation...further information" such as land-use requirements during construction phases, and "in outline" the main alternatives studied by the developer "and an indication of the main reasons for choosing the development proposed, taking into account the environmental effects." In terms of the Hinkley C Inquiry it seems likely that the CEGB, will discard the alternatives under the auspices of the, Government-given, need for "diversity of supply."

The costs of researching the factors given above, and producing the ES will be met by the developer, under the 'polluter pays' principle. This should have considerable financial implications for any company planning to operate after privatisation.

Given the extended body of research, the main advantage is that all this information is to be made available to the public. Where an ES is to be submitted, the developer must first notify those with an interest in neighbouring land, ie the local population, of the availability of the Statement, this will usually take the form of advertisements in local papers. Copies may be found in local libraries. They must also notify specified "third party statutory consultees", including: the Nature Conservancy Council; the Countryside Commission; the Health and Safety Executive; and HM Pollution

*** THE EUROPEAN COMMUNITY**

For maintaining and promoting directives, which are binding on all member states of the community there are four important bodies: the European Commission; the European Parliament; the European Council; the Court of Justice.

A Directive is essentially promoted by the Commission and the Council acting together. The power to propose a Directive lies only with the Commission, and the power to adopt is the responsibility of the Council. The Parliament is not a legislative body, but they are a statutory consultee; their voice must be heard and their opinions must be taken into account. The Court of Justice have no place in the formulation of legislation but interpret it when cases are brought before them.

Inspectorate, who will then have 4 weeks to make representations to the governing planning authority, which in the case of major electricity generating projects will be the relevant Secretary of State. For projects likely to have implications in adjoining Regions, the Regional Planning Authorities must also be notified.

## GOVERNMENT REACTION-INACTION

So far the Government have produced two Draft Statutory Instrument Papers, one for the general application of the directive, and the other for the Scottish Office. The new regulations for the electricity industry in England and Wales have been prepared, by the Department of Energy, but have not been debated in the House of Commons. Such a debate is necessary before adopting new legislation.

A limited form of environmental impact assessment is already carried out in this country. The developer is obliged to submit certain information and the public are given a chance to comment. A decision on an application must consider information supplied by the developer and objectors, and it is then published, but the reasons for the decision need only be published if an application is rejected. However the new directive widens access to information, and more significantly it increases the quality and quantity of information that must be made available to the public.

## THE NEED FOR ENVIRONMENTAL ASSESSMENT

Planning applications will be split into two categories once the directive is properly implemented. Category One, referred to as Annex-1 by the EC, and Scheduled-1 by the Government, covers all proposals requiring a "mandatory" Environmental Impact Assessment. It includes:

- "A thermal power station or other combustion installation with a heat output of 300MW or more, other than a nuclear power station or other nuclear reactor."
- "An installation designed solely for the permanent storage or final disposal of radioactive waste."

In interpretating the word of the legislation, both are apparently open to abuse. The first can be taken to mean that nuclear reactors are exempt from Scheduled-1. The Department of Environment assures that this "is not the case." All nuclear reactors they argue, regardless of their rating, are liable to Environmental Assessment.

In the second area the key words are "solely" and "permanent". Temporary storage of nuclear waste could represent fraction of the time before high level wastes become 'safe', a time span almost beyond comprehension. Although this vagueness is probably not deliberate, the Government's 'legal eagles' could have done a little better. We can perhaps take heart from Nirex's intention to provide "information in the form of an EA to planning Authorities, a series of Environmental and Radiological Assessments to the Authorising Departments, and a series of Safety Proposals to the Nuclear Installation Inspectorate." All of which, under the directive, will be public documents.

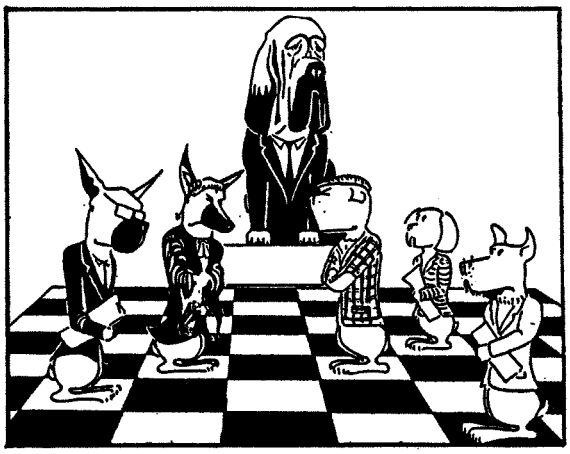
It is worrying that the threshold for a mandatory EA for conventional thermal power stations is 300MW, as recent proposals from private companies wishing to build and operate power plant have mainly been on or under the 300MW mark. Incidentally 300MW is also the threshold for fitting flue-gas-desulphurisation equipment.

## DISCRETIONARY ASSESSMENTS

Annex-2, or Scheduled-2, gives a tentative list of proposals which may require an EA. These include:

- any electricity producing installation not covered by Scheduled-1;
- power lines;
- installation for the production of irradiated nuclear fuels, the reprocessing of irradiated nuclear fuels, collection of processing of radioactive waste, and the production or enrichment of nuclear fuels.

For Scheduled-2 proposals "an environmental statement shall be required only where, in relation to the application, the Secretary of State determines that in his opinion the proposed development would be likely to have significant effects on the environment by virtue of factors such as its nature size or location." Such an opinion can hardly be relied upon to satisfy environmentalists.



The Department of the Environment argue that "it has been the Government's aim in implementing the requirements of the directive to ensure that no unnecessary additional burdens are placed on either developers or [planning] authorities." This can be taken to read that they intend to avoid, so far as possible, adhering to the wishes of the European Community. "It must be emphasised that the basic test of the need for EA in a particular case is the likelihood of significant environmental effects, and not the amount of opposition or controversy to which a project gives rise," states a DoE hand out. The Government expect that "no more than a few dozen projects a year," of all projects falling into Scheduled-2 will require an EA.

Many environmental organisations are referring to the Government's approach as "minimalist", the least they had to do to implement a directive which is much watered down from the original 1980 proposals. The final decisions on development proposals will still be made by the same people we have been banging heads with for years: a Government appointed inspector; a Secretary of State; or a Local Planning Authority. However, with increased access to information, and the increased scope of factors to be considered it will be increasingly difficult for them to justify proposals which arouse considerable "opposition or controversy."

# Cold, Old & At Risk Targetting Cuts

**Ozone depletion; acid rain; radioactive waste; fuel poverty - energy conservation has a contribution to make in mitigating the causes of each of these problems. Yet, at a time when environmental issues are the Government's flavour of the month, the local energy project network is at risk. BILL SHELDRICK reviews the nature and achievements of local energy projects and the implications of recent changes.**

Making more efficient use of our energy resources will reduce our energy demands however they may be met, whether from fossil fuels, nuclear or the most benign renewables. The most visible and successful aspect of UK domestic sector energy conservation policy, has been the local energy project network. They have experienced a range of changes during 1988 - and there are more to come: energy projects are now at risk.

Local energy projects have come a long way. The first, a voluntary effort, was launched in 1975. By 1981, the total had reached five. The growth since 1981 has been quite rapid so that by September 1988, 444 projects, employing about 8,000 people (although the majority of these were employed on a temporary basis only), were operating across the country (**Table 1**). Through the activities of these projects, over 500,000 dwellings in the UK have been draught-proofed (**Table 2**), approximately 100,000 have had their loft space insulated, and many households have received advice on fuel use and heating benefits.

Less tangible have been the savings on energy resources that have accrued through these activities. One report has estimated that in the households studied fuel consumption was reduced by about 5% on that of a control group.(1) Larger reductions would be possible if the majority of the clients of energy projects were not low fuel consumers; not because they live in well insulated housing but just the opposite.

## INADEQUATE & INAPPROPRIATE INSULATION

In the UK, the situation generally is one where those on the lowest incomes live in the worst of the housing which is often characterised by inadequate and inappropriate insulation and heating systems. Maintaining reasonable temperatures in such circumstances can only be achieved at a high cost - often a cost too high for the level of household income so that reasonable temperatures are not maintained, that cut-backs are made elsewhere in the household budgets (for example, on food), debts are incurred, or some combination of these.

| Year | Number of Operating Projects |
|---|---|
| 1975 | 1 |
| 1981 | 5 |
| 1982 | 40 |
| 1983 | 60 |
| 1984 | 95 |
| 1985 | 172 |
| 1986 | 336 |
| 1987 | 421 |
| 1988 (September) | 444 |

**Table 1: Growth of Local Energy Projects**

Draught-proofing and loft insulation are not the answer to all these problems. However, they can bring about some improvement in the comfort conditions within low income households. As heat will be lost from a house less quickly after these actions, higher internal temperatures can be had for the same level of expenditure. Savings on energy resources may not be immediate, but with a long term trend towards higher internal temperatures, energy demand will not increase ultimately to the level it would have done otherwise if improvements in the insulation had not been made.

| Year | Draught-proofing Jobs Completed |
|---|---|
| 1980-83 | 26,000 |
| 1984 | 41,000 |
| 1985 | 68,000 |
| 1986 | 124,000 |
| 1987 | 163,000 |
| 1988 (*) | 99,000 |

**Table 2: Draught-proofing Jobs Completed by Local Energy Projects (* First six months of 1988 only)**

The success of local energy projects was founded initially on the imaginative exploitation of 'the system'. Utilising the government's temporary employment schemes to cover labour costs, and the Loft Insulation Grants and the DHSS Single Payments to pay for materials, allowed energy projects to provide an effective, low cost, if not free, service; how effective a service, was eventually recognised and then actively encouraged and supported by the Energy Efficiency Office (EEO).

What prior to 1983 was a geographically patchy provision, quickly became national in its coverage. This network thrived through satisfying the non-energy policy related objectives of government schemes. As has been noted elsewhere, "If one was designing a national network of local energy conservation schemes from scratch one would not adopt the rules of the Community Programme or patch together the grants and resources that make up Neighbourhood Energy Action."(2)

## FINANCIAL SUPPORT PROGRAMMES CHANGED

This symbiotic relationship has always been susceptible to changing government priorities simply because energy projects were carried forward on the back of other priorities rather than in their own right. Just how vulnerable energy projects were, became readily apparent during 1988 as each of the three main financial support programmes - the DHSS Single Payment system, the Loft Insulation Grant, and the Community Programme (CP) - underwent significant change.

With the Social Security reforms which came into effect in April 1988, the system of Single Payments was abolished. In the process, the method whereby draught-proofing materials were paid for, and thus the very survival of many projects, was threatened. This problem was resolved through the introduction of the 'Energy Grant' which would be paid for draught-proofing a dwelling to a registered energy project via the Manpower Services Commission. While this Energy Grant had both its strengths and weaknesses compared to the Single Payments, it was intended as an interim arrangement until the Government could complete a thorough review of energy conservation grants.

## TARGETTING PRINCIPLE INTRODUCED

The Loft Insulation Grant was first introduced in 1978 and has been modified and amended regularly since. In April 1988, in an attempt to target the grant better on those households deemed to be in most need, the percentage payable and the maximum amount were both increased. The general eligibility however was replaced by the grant only being available to low income households.

The rationale was that it was in the financial interest of more affluent households to pay for loft insulation themselves. For low income families, finding even the remaining 10% of the cost can be extremely difficult. Whether this change will have a significant impact on the number of lofts being insulated will not be known until later in 1989.

In September 1988, the CP with its twin objectives to create employment and to benefit the community, was replaced by Employment Training (ET). Under ET, the emphasis is on training. The most contentious issue, to the point where some organisations and local authorities have refused to participate in ET, however, has been the substitution of the notion of paying 'the going rate for the job', as occurred under CP, with the payment of one's welfare benefit entitlement plus £10.

## DRAMATIC IMPACT OF ET

The impact of ET has been dramatic. As of December 1988, only four months after ET had come into effect, the number of operating projects had fallen from 444 to 253. The number of places allocated to energy projects reflects this decline with only 3,500 under ET compared with over 8,000 under CP. More worrying has been the inability to fill these places, with only 1,200 of the 3,500 places taken up, compared to about 7,700 under CP.

As a result, an estimated 50,000 fewer dwellings will have received draught-proofing during 1988 compared to 162,000 in 1987. Unlike the changes to the Loft Insulation Grant eligibility, these reductions effect directly those households least able to pay, and those most at risk from the cold, ie low income families and pensioners!

Being eligible is not a guarantee that a household will be draught-proofed, as the Energy Grant is only payable to projects operating inside ET. With the decline in the number of operating projects, and the boycott of ET in some areas, energy projects no longer cover the country.

Not participating in ET means being excluded from the Energy Grant system, and effectively no longer being able to service low income households, as it is unlikely that such households will be able to afford the full cost of installing the draught-proofing. What started out as a community based approach to tackle fuel poverty and carry out practical energy conservation work, has effectively become a delivery mechanism for government schemes.

But, all is not bleak! Under the proposed changes to the Home Improvement Grant system, the separate loft insulation grant will disappear, but insulation would be part of the target standard for which a grant would be available. The grant, as proposed, would cover both labour and materials and up to 100% of the costs of the work. Importantly for energy projects, this grant would not be tied to ET.

Further, Neighbourhood Energy Action have recommended to the EEO that a new grant be set up to enable energy projects to move away from ET, as a prelude to their taking advantage of the opportunities that would be available under the proposed Home Improvement Grants. For energy projects the only draw back is that the new development grant will not be available until later in 1989, if at all, and the new Home Improvement Grants, not until at least 1990.

## NO COMPREHENSIVE IMPROVEMENT SCHEME

Energy projects have been an undoubted success. This success, however, appears to have become a substitute for the EEO undertaking other initiatives. For many households, draught-proofing and loft insulation only tinker with the problem, a palliative instead of a comprehensive heating and insulation improvement programme. Yet, the Government appear content to translate "500,000 draught-proofing jobs" into "500,000 homes insulated" and bask in the reflected glory!

At a time when energy conservation is back on the political agenda as part of the new found interest in the environment, the Government appear to have ignored the reasons for the success of local energy projects: the availability of grants, the partnership between the voluntary sector and local and central government, and the interventionist nature of their activities.

Instead, the Government are again talking of increasing fuel prices to encourage consumers to invest in energy conservation. For low income households, such a pricing policy will lead to a reduction in energy demand, not because of the more efficient use of energy, but because they cannot afford to use it or have been disconnected.


1 S Hutton, J Bradshaw, G Gaskell, R Pike & A Gordon (1985) Energy Efficiency in Low Income Households; an Evaluation of Local Insulation Projects, Energy Efficiency Series 4, HMSO, London.

2 J Bradshaw, S Hutton, L Warren & B Sheldrick (1986) Assessing the Productivity of Local Energy Conservation Projects, WP307, Social Policy Research Unit, University of York, York.



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# Through the Greenhouse Window

**As environmentalism has captured the public's imagination, the nuclear industry and their supporters are trying to capture environmentalism: nuclear power is being promoted as the only answer to the greenhouse effect. MIKE TOWNSLEY looks through the greenhouse window and concludes that nuclear expansion would make it worse.**

After years of bad public relations and appalling safety and pollution control standards, we have become wise to the nuclear panacea. The promise of limitless power, generated in a clean, cheap and reliable manner, has failed to materialise. In a desperate bid to protect their industry the proponents of a nuclear future have adopted a green mantle and are trying to hijack the greenhouse effect; they now expect us to believe that nuclear is the key to an ecological utopia. It is interesting that, now they have lost the economic argument, they are using 'ecology' and 'diversity of supply' to justify their existence.

In all the Government's proclamations about the greenhouse effect they have concentrated on $CO_2$ and CFCs, the latter because an agreement has been signed to control the emissions of CFCs. Their current concern with $CO_2$ from coal fired power stations is nothing but an extension of their obsession with destroying the mining unions.

However power station emissions represent just a fraction of all $CO_2$ emissions, and $CO_2$ is believed to account for only half of the gases which are causing global warming; the remaining gases (**diagram**) must also have limits placed on their use.

## THE IGNORED GREENHOUSE GASES

CFCs have received a considerable amount of publicity recently for their role in the destruction of the ozone layer. But CFCs are also extremely effective greenhouse gases. Because there are very few natural processes to remove them from the lower atmosphere (troposphere) their 'life expectancy' lies anywhere between decades and centuries. However, they do break down in the upper atmosphere (stratosphere), under the influence of ultraviolet light, a by-product of which is chlorine. The chlorine is believed to destroy the ozone layer.

Although the 1987 Montreal Protocol calls for CFC use to be phased out by the year 2000, we need a total ban on their use now. CFCs are used in a variety of different products, including aerosol sprays, refrigerators, air conditioning and plastic foams. Substitutes do exist. Many brands of aerosol spray are now labelled as 'ozone friendly', and major fast foods chains advertise ozone friendly packaging. Unfortunately, without a government ban on their use, this will never amount to anything but tokenism; it does however demonstrate the power of public pressure.

Nitrous oxides, more common for their role in acid rain, are another of the major global warmers. They are mainly a result of fossil fuel combustion, and the use of fertilisers. Reducing dependency upon fossil fuels will help to reduce these emissions. Fertilisers, used in increasing quantities in agriculture, gain less publicity for their role.

It is not necessary to use as many, if any, man-made fertilisers. Farming in this country is intensive - it need not be. We produce too much from our farms, illustrated by the European food, dairy and grain mountains. Our environment is being destroyed to grow food no one will eat, and the cost of storing and disposing of the surplus is enormous. Modifying farm production incentives could have an immediate effect. Also, current spray methods of fertiliser application are very inefficient, and lose a high percentage to the winds - more precise methods can be used.

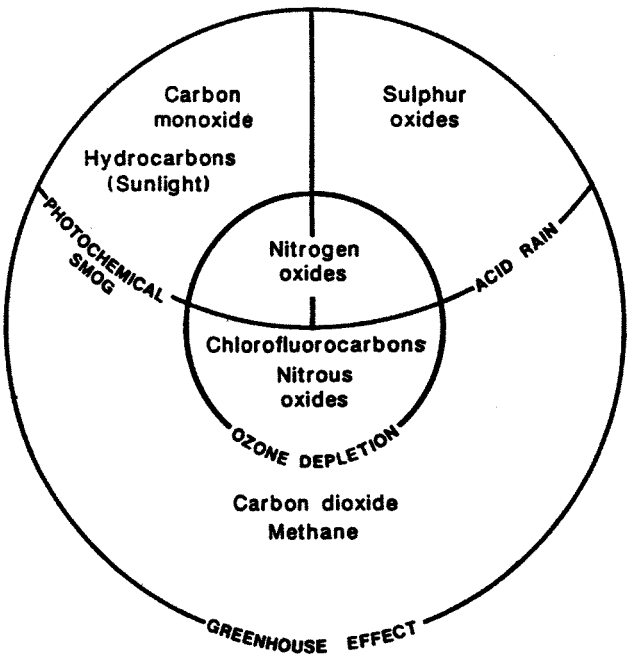
Intensive cattle ranching, oil and gas exploration, and biomass burning pump methane into the atmosphere. Methane is a greenhouse gas. Tackling these emissions presents a challenge, and would involve radical changes in land use and animal husbandry, and a move away from oil and gas exploration.

Ironically, ozone created in the lower atmosphere is also contributing to the warming. It is formed via a complex chain of chemical reactions involving a mixture of pollutants - carbon monoxide (CO), nitrous oxide ($N_2O$), and hydrocarbons - catalysed by sunlight. Internal combustion engines are a major source of CO and $N_2O$. Integrated public transport systems, backed up by tax disincentives for private transport, are an obvious, and neccessary response to this problem; and would also alleviate a considerable number of other air pollutants which are causing considerable damage to public health.

All of the above gases are increasing at a faster rate than $CO_2$.

## DEFORESTATION EFFECTS

The rate at which forests are cleared could play a vital role in controlling the warming. Trees and other plants assimilate $CO_2$, in the presence of sunlight, use the carbon to produce cellular material, and release the oxygen which we breathe.



Rapid deforestation could accelerate the warming, and therefore cut down the amount of time we have to prepare countermeasures. There is evidence to suggest that emissions of CO2 from the decomposition of forests, or indeed from the burning of forests, is likely to rise significantly.

The reasons for deforestation are varied, however. In some cases the developed world is forcing their destruction: LDCs (Less Developed Countries, as they are now to be called) clear forests for hardwoods export, for fuel, for subsistence agriculture, for the production of cash crops, for development schemes, and for cattle rearing. By writing off loans to LDCs, industrialised countries can remove some of these pressures. It is possible for LDCs to use the vast natural resource provided by forests in a sustainable manner, thus providing valuable economic benefits; such possibilities are illustrated by the work now being done by non-governmental organisations like the Intermediate Technology Development Group, and the International Institute for Envrironmental Development.

It is vital that LDCs are encouraged not to follow the environmentally destructive path towards industrialisation. Alternatives do exist. Three-quarters of the world's population live in LDCs, and if they choose the path followed by the industrialised nations the ecosystem will not survive. They must be helped by the developed world, not just for their sake but for everyone's sake.

## NUCLEAR SOLUTION - NO SOLUTION

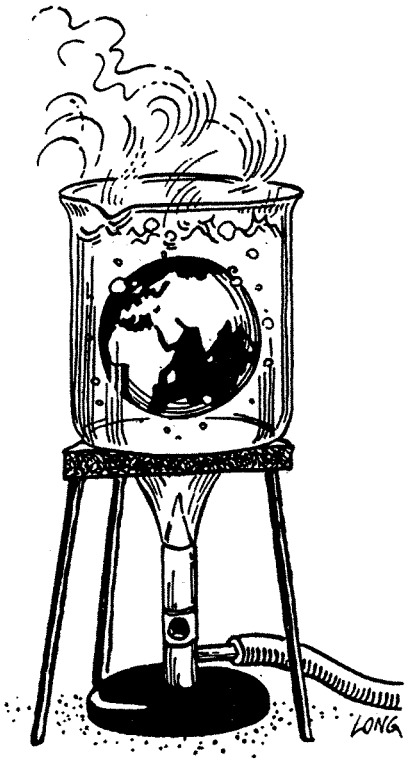
But what about energy generation? CO2 emissions from coal fired power stations do indeed pose a serious threat to the environment, and their use will have to be phased out. However we must consider how this is to be achieved.

Replacing the world's coal-fired power stations with nuclear plant appears to be the obvious solution. After all, coal is the dirtiest of the fossil fuels, and it has the largest known reserves. In a much publicised paper, Gregory Kats and Bill Keepin (*) examined the proposition that the nuclear industry is our only hope of salvation. They conclude that "nuclear power is a slow and ineffective solution to the greenhouse warming problem, whereas improved energy efficiency is the opposite: quick and highly effective. In addition a 'nuclear solution' would be economically infeasible for the developing world and is not the economically preferred solution in either industrialised or developing nations."

They examine the nuclear solution set against three energy scenarios: high, medium, and low. For the medium scenario they take the "standard scenario" published by th US Department of Energy, in which global primary energy demand rises to 21.3TW, by the year 2025. Unchecked, CO2 emissions would be 10.3Gt (billion tonnes) per year.

Assuming the transition from coal to nuclear is completed in 2025, it would have required a new nuclear plant to be commissioned every 2.4 days. The authors break this down into one plant every 4.1 days in developed countries and one every 5.7 days in LDCs. The total cost is given at $5.6 trillion (1987 prices), of which LDCs are responsible for about $64bn annually. Such a cost for LDCs is clearly untenable.

For this nuclearised scenario, CO2 emissions would jump from 5Gt/y to 6.48Gt/y at the turn of the century, and then level out at 5.27Gt/y - even more than at present! Therefore, for moderate growth in energy demand the nuclear solution, even if finacially possible, just doesn't work. The situation for the high scenario was considerably worse. Only in the low scenario would nuclearisation have any meaningful impact on global warming.




However, in the case of the low scenario, energy efficiency has already done the work. Kats and Keepin show that investment in energy efficiency and conservation is 7 times more effective than a similar investment in nuclear power, ie for every $100 spent on nuclear power we are pumping 1 tonne of CO2 into the atmosphere.

## EXTREMELY OPTIMISTIC STATISTICS

Not only do the calculations show that the nuclear solution is unworkable, but they have done so by using extremely optimistic statistics. They assume that a 1000MW station could be built in 6 years, at a cost of $1bn. The cost is based on Electricite de France who, it must be noted, have a nuclear debt of over £22bn. As for the timesscale, the Torness site has been under development since 1978, and the station is still not up to full power.

Their calculations have also discounted any consideration of safety, waste disposal and decommissioning costs, health consequences and proliferation or terrorist impacts. Their's is an optimistic first-order economic study which shows the nuclear option as pitifully inadequate.

The answer to the greenhouse effect is indeed energy efficiency. As regular readers of SCRAM will know, through the use of more efficient generating systems and end-use devices we can cut our energy requirements in half, without any reduction in standards of living. Also, it can be shown that by energy efficiency LDCs can achieve parity in living conditions with industrialised nations without increasing their present primary energy consumption.

The way forward is clear: by using less we can tackle the greenhouse effect, although given the latency in the effect some changes will occur; our task is to minimise these changes. Through increased use of energy efficiency and conservation, and a package of legislation and international agreement there exists some hope; but the Faustian nuclear bargain must be rejected.

*** Greenhouse Warming: A Rationale for Nuclear Power? by Bill Keepin and Gregor Kats; Rocky Mountain Institute, 1739 Snowmass Creek Road, Snowmass, Colorado 81654.**

## JOULE

The European Community have announced an £80m programme of support for non-nuclear research and development.

The scheme, to last 39 months and entitled JOULE (Joint Opportunities for Unconventional or Long-term Energy supply), is an extension of the EC's previous non-nuclear r&d programme. It places increased emphasis on environmental concerns and international collaboration:

- £31m will go towards renewable energy projects;
- "The rational use of energy," including technologies such as high-temprature super conductors, fuel cells and improved engines, will receive £23m. Energy efficient building design will also be included in this category;
- A further £22m will be targeted at improving extraction and use of fossil fuels, with special emphasis on combined cycle combustion design;
- The remaining £4m is to be spent on computer modelling for energy production and supply.

JOULE grants of up to 50% will be available for commercial projects, and academic projects could receive 100% of their marginal costs.

## Greenhouse Effect

The first tentative steps towards international co-operation in combatting the greenhouse effect were taken at the end of last year.

Government officials from 33 nations met in Geneva, under the banner of the United Nations Environment Programme (UNEP) and the World Meteorological Organisation (WMO), to formulate a strategy for international action to combat global warming. The collaboration will involve assessing the evidence for global warming, predicting the effects it might have, and formulating policies to prevent or mitigate the effects.

A full-time team of five British scientists, headed by John Houghton of the Meteorological Office, will co-ordinate and assimilate the results of research projects being conducted all over the world. It is planned that the results will be presented at the World Climate Conference scheduled for 1990.

"We must arrive at a general consensus, especially on assessing the uncertainty. We will package the conclusions in a framework where the policy people can take them up," said Houghton, who is particularly keen to clear up uncertai...es concerning world rainfall patterns which are vital to agriculture.

At the first meeting of the international panel set up by UNEP and WMO, at the end of January, climatologists said they expected the Government to announce extra funds to help fight the greenhouse affect shortly.

Higher fuel prices, increased energy efficiency, and protection for tropical forests are expected to be the first in series of recommendations from the collaboration.

The secretary of the intergovernmental panel on climate change, Ram Sundarman of the WMO, said that although saving energy would not stop global warming it would buy time to adapt to new climates: "We have to adopt some policies that have real teeth to them. They have to be in place five or ten years from now."

## Offshore Wind

The Swedish government are considering constructing 300 offshore wind turbines, in a bid to replace the nuclear component of their energy supply industry.

A report commissioned by the local authority of Belkinge County, on the Baltic coast near the proposed construction site, concludes that a wind farm costing just under 1bn, with the same output as a medium sized nuclear station, could produce electricity by the turn of the century at about the same unit cost as nuclear.

VBB, the consultancy which carried out the work, believe the windfarm would have no adverse effects on the environment. The proposed site, about 20km offshore, is far enough out to keep the problems of noise and television interference to a minimum, according to VBB.

Given that average wind speeds offshore are substantially higher than onshore, and more even, wind turbines would be one third more efficient than land-based counterparts, says the report.

Among other advantages promoted by VBB is the 3,000 person/years of local employment that the scheme would create.

Over the coming decade windfarms are expected to gain an edge over nuclear and coal fired stations, because as environmental considerations push the cost off both up, technical improvements and economies of scale are expected to bring the cost of wind generated electricity down.

Sweden plan to phase out nuclear power by 2010 and legislation was recently introduced to outlaw the building of reactors. They will now embark upon a major building plan costing over 7bn, which will mean a substantial electricity price increase. However, post-Chernobyl opinion polls show that most Swedes consider price increases an acceptable side effect of removing the direct threat of nuclear disaster from their country.

## Acid Rain

The Government are expected to offer commercial protection to power companies which operate coal fired power stations fitted with expensive flue gas desulpherisation units after privatisation.

Companies willing to install FGD, which represents an investment of £200m for an average power station, will be exempt from restrictions on length of supply contracts. The Department of Energy intend to restrict the length of most commercial contracts to ten years, in order to stimulate competition.

Installing FGD reduces the efficiency of plant, and since the National Grid will operate a 'merit order' system - taking power according to cost competitiveness. Stations fitted with FGD will operate on a special pricing system to compensate for the extra costs incurred.

John Baker, managing director of NatPower, the largest of the CEGB's 2 daughter companies, is holding negotiations with the Government, and the distribution companies over the sale of power post-privatisation: "One particular aspect is contracts arranged for power stations to be retro-fitted with FGD ... the programme requires substantial investment in each power station of £200m, or up to £500m for Drax, special consideration may be needed to be given to contracts relating to these power stations, to ensure an appropriate place in the merit order."

## US Green Bills

Two Bills have been introduced to the US Congress aimed at reducing the emissions of greenhouse gases.

Senator Timothy Worth wants to cut US emissions of carbon dioxide by 20% by the year 2000. He is arguing for a "Least Cost National Energy Plan", whereby the US would reduce its energy consumption by 2-4% annually, through energy conservation. The Bill also calls for $450 million to be spent in researching and developing alternative sources of energy. Unfortunately he also wants $500 million spent on the development of new, safe and cost efficient nuclear reactors; a dream many people are having difficulty giving up.

The second, and more extreme, Bill is being promoted by Senator Robert Stafford. He is calling for a cut in CO2 emissions of 50% by the year 2000. This would be achieved principally by reducing the emissions from automobiles, and power stations by half. Within five years of enactment, all homes would have to be fitted with furnaces and water heaters which meet the best available emission control standards.

It is believed both Bills are attracting significant support in Congress, and that they will be enacted, at least in part, sometime this year.

## REDA

The all party Parliamentary Alternative Energy Group (PAEG) is looking for an MP to promote a Renewable Energy Bill.

The Bill would call for the establishment of an independent Renewable Energy Development Agency, which would be directly responsible to Parliament for the research, development, application, demonstration and monitoring of "clean renewable sources of energy together with ways and means of proving and improving techniques of energy efficiency and fostering their positive adoption."

A previous attempt at establishing REDA failed, in the middle of last year, when the Government continuously blocked the second reading of a Bill being promoted by PAEG's vice chair, Frank Cook MP, under the Ten Minute Rule.

With privatisation looming on the horizon, it is becoming increasingly important that the control of renewable energy sources is taken away from the Energy Technology Support Unit,

who operate out of the UK Atomic Energy Authority's Harwell base. Recent revelations that a key report on the economic viability of wave power had been doctored by the ETSU-appointed consultancy Rendel, Palmer and Tritton, to give the impression that wave power was not viable, highlights the need for REDA.

In a privatised climate, nuclear power and renewable energy sources will be in direct competition to provide the non-fossil fuelled quota written into the Privatisation Bill. Such a situation represents a serious conflict of interests and suggests that the link between ETSU and the UKAEA is not in the interests of developing renewable energies.

## Wind Accident

The UK's first privately owned wind turbine, on Shetland, has been destroyed by high winds.

Winds up to 50 mph, on 28 December, caused the 22m high machine to buckle, and shed one of its blades, which severed a power line 80m away. Power to neighbouring islands was cut off.

The 55kW Vestas machine, installed in 1985, had weathered such conditions in the past. However, this time all safety systems failed.

In normal conditions the rotation of the three 8m blades is controlled by calliper brakes: the owner tried to use them to bring the machine under control. At this stage the fail safe should have come into play: it failed.

A team from Vestas have now dismantled the machine and taken it back to Denmark for examination. The cause of the failure is not yet known.

## North West Energy Studies

NORWEB, the North West Electricity Board, and the Department of Energy (DoEn), have begun a joint study to assess the potential of renewable energy sources for the Board's area.

The study, suggested by NORWEB in light of privatisation, will cost £200,000, and last about six months. It will examine all aspects of renewable energies. Paul Whitte, of NORWEB, told SCRAM they will be looking at "wind power, small hydro, small tidal barrages, geothermal power, waste incineration, and landfill gas." He said the study was being conducted because, "at NORWEB we believe that we are likely to be rich in renewables. And we are optimistic that we will get a good result."

"We are looking to see what is economic, and what is not," explains Whitte. It is important that, for those technologies judged to be uneconomic for the present, they can calculate at what point such technologies would be economic, "that way we can evaluate thresholds for future exploitation."

"NORWEB can boast some ideal sites for a study of this kind. We have the wind from the Pennines, the water from the Lake District, tidal power from our extensive coast-line as well as the incentive to preserve our environment by studying the production of electricity from waste products," adds Peter Goldworthy, their Chief Operations Engineer.

Post-privatisation, electricity area boards will be entitled to produce 15% of their own electricity requirements. The Renewable Energy Minister, Baroness Hooper, sees the project as a coup for the electricity privatisation Bill. "This is a significant example of how the bill to privatise electricity is already beginning to affect attitudes within the electricity industry," she informed the all-party Parliamentary Alternative Energy Group.

"If the study shows economic potential, which I am sure it will," she told the MPs, "then further more specific studies will need to be undertaken with a view to developing specific proposals for individual plants. This will pave the way for other distribution companies to follow."

## Wave Movements

### NEL 'BREAKWATER DEVICE'

Scientists at the National Engineering Laboratories, East Kilbride, have begun feasibility studies into building the world's largest wave power generating station, in India.

Six years after the Government wound down UK wave power research, NEL's breakwater wave energy station looks set to be incorporated into a large port complex at Encore, north of Madras.

According to George Elliot, NEL's wave power expert, now head of NEL's National Wind Turbine Testing Centre, "The wave power station will be the biggest in the world so far, around 5MW," and will be built into the harbour wall of the new complex.

Elliot, who has just returned from a tour of the area, comments that India is "desperately energy hungry." The Indians are considering building much larger wave stations on their west coast, where much a better wave climate exists. They intend to use this as a test project.

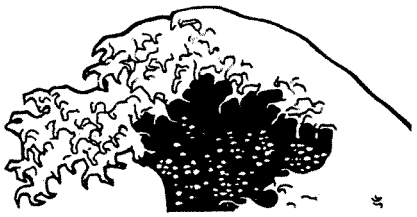
The breakwater, as the name suggests, can perform the dual role of generating electricity and providing a harbour wall.

Central to its design is the Oscillating Water Column principle, whereby waves incident on the device cause air to be sucked in and out of a turbine-generator, situated out of the water above each wave chamber.

Although the basic design has not changed since 1982, they will now use a Wells "biplane" turbine - developed by Professor Wells at Queens University Belfast - which has two tiers of blades and can accept air flow in both directions, thus eliminating the need for rectifying valves that would be necessary to drive a conventional turbine. It also increases operating efficiency, and it has proved itself in the Norwegian programme over the last few years.

The breakwater is built in a modular form, the size of each module is determined by the depth of water at the site, and the predominant wave characteristics. They can be constructed on shore using a slipway, or in situ, offshore. Each one is fixed to the seabed individually.

In 1982, NEL estimated generating costs of about 3-4p/kWh: considerably lower than the 8p/kWh (at 1982 prices) threshold demanded by the Government for funding. Indeed they have identified design modifications which could yield costs of 2.8p/kWh.



The price range for the Indian device will not be known until preliminary feasibility studies have been carried out.

The Indian project has an advantage: a harbour wall would have been required in any case. Elliot believes the breakwater can be installed for "not much more, or even the same price as the harbour wall" it will replace. The device could also be used, in a similar way, for desalinisation plants, coastal irrigation schemes, and even sea defences.

NEL, currently being shadowed by the spectre of privatisation, have been at the forefront of wave power technology since they began to examine it in 1976, at the instruction of the Department of Energy. Their original intention was to design a 2000MW wave power station for the north west coast of Britain, "an area subject to some of the most energetic and severe wave conditions in the world." It has an identified potential of 3-4GW.

However, they believe their device "can be located in virtually any sea." The fact that it can be used to perform two roles does not in any way detract from its use solely as an electricity generating power station, which is clean safe and reliable.

### BERGEN PROTOTYPE ACCIDENT

The world's first commercial wave power station, at Bergen in Norway, was sent crashing to the seabed on 26 December.

The station, a 500kW Oscillating Water Column, was the victim of two consecutive storms. It is thought that the first storm, on 23 December, which pounded the machine with 20m high waves, loosened the device from the cliff face to which it was bolted. Andreas Tommerbakke, from the Norwegian company which designed the machine, Kvaerner Brug, said "we did not have time to make a full inspection after the first storm."

The subsequent storm sent the device crashing 70m to the seabed. The £700,000 plant had operated for only 3 years of its expected 25 year life span. Odd Sandoey of Kvaerner comments, "We are very disappointed, but this shows how powerful the sea can be."

It is not yet known whether it will be possible to salvage the 16m high column, turbine and generator. However Kvaerner plan to either reinstate the original plant, in this site, or to have a new one operating by August.

The next station will be cemented to the cliff face, as will all future models. They will also place the turbine and generator on land in future.

Although this represents a setback for proponents of wave power, it is no more than that. This was a prototype and this is exactly the kind of thing which cannot be designed against in the laboratory. They have learned their lesson and will strengthen the mooring in future.

### OPEN SEA TIDAL BARRAGES

Open sea tidal barrages could provide 25% of Britain's current electricity generating requirements, according to Morgan Horne Consulting Engineers.

They have identified several areas along the coast of Lincolnshire, North Wales, Lancashire, Sussex and South Wales which have suitable conditions for 'open coast' schemes. An open sea barrage designed by Morgan Horne requires a shallow coast with a tidal range of around 6m.

A 420 square kilometre barrage off the coast of Lincolnshire, from Skegness to Mablethorpe, would produce power at 2-3p/kWh, less than that for the Severn or Mersey barrage, according to Morgan Horne. It could generate on both the ebb and flow of a tide, because unlike estuarine barrages, there is space to incorporate a series of sluice gates and extra turbines. As a result they believe their scheme would have a 45% conversion efficiency.

The Consultancy comment that their open sea design would not involve building expensive navigation locks, that are required in estuaries.

The proposal should also be less environmentally intrusive than estuarine proposals. Both the Mersey and Severn proposals have drawn considerable opposition from the 'bird lobby', who are concerned that the flooding in the wake of such barrages will destroy valuable feeding grounds for several key species of international importance.

## Energy Efficiency Office Cuts

At a time when energy efficiency is becoming increasingly important, the Government plan to cut funding of the Energy Efficiency Office (EEO) by over £5 million.

In the next financial year the EEO will receive only £15m, compared with £20.8m last year, and £26m in 1986. The Government argue that the work of the EEO is moving into a new phase "in which it will run more specific targeted service building on its past successes."

Andrew Warren, the director of the Association for the Conservation of Energy, describes the move as "manifest lunacy, a body blow against the battle to stop global warming." This is no more than cuts "hiding behind the fig leaf of targetting," he adds.

Peter Morrisson, minister of state for energy, said, "The programmes of the EEO have achieved some significant success since 1983. For example over


500,000 homes have been treated under home insulation projects. Savings of £75 million a year are being made through the monitoring and targeting programme; savings of £190 million a year have been achieved through the energy efficiency demonstration team; and savings identified through the former energy efficiency survey scheme total over £2000 million a year."

Given such incredible savings as a result of the EEO's work it would surely be logical to increase their budget. Cecil Parkinson commented that, through energy efficiency, a saving of £8 billion could be realised in this country, from an annual fuel bill of £39 billion. However in 1983 his predecessor, Peter Walker promoted a similar line, arguing that an annual saving of £8 billion was possible from £35 billion. The fuel bill has therefore increased by £4 billion over 5 years.

## Priorities

Almost in response to the swingeing cuts in the Energy Efficency Office budget, and John Baker's (managing director of NatPower) devotion to 'profits first', Robert Malpas (chair of PowerGen) has placed the environment firmly at the top of his agenda, in a speech to a meeting in London.

He has warned that privatisation of the electricity supply industry is a distraction from energy efficiency - "one of the great issues of our time."

Malpas said, "Concern with the environment and the world ecosystem is now a major public issue. Improving energy efficiency would alleviate the problem. Yet public resolve is allowed to weaken. As we in Britain are about to privatise electricity, the prime considerations are not about energy efficiency.

"Public policy measures," to promote energy efficiency, "through tax incentives, penalties. subsidies and taxes," are the way forward, according to Malpas.

Fridges, washing machines, and other electrical equipment should carry labels outlining their energy consumption, continued Malpas: "This should apply to domestic, commercial and industrial equipment regardless of the form of energy concerned."

Integrated public transport systems, and higher insulation standards in building regulations are among the other improvements he would like to see in Britain, to help combat pollution.

## Targetting

Community insulation projects are worried that changes in Government unemployment initiatives will leave millions of elderly and families on supplementary benefit without adequate heating.

The Community Programme was replaced earlier this year with Employment Training. Under CP, the unemployed were paid £67 for 21 hours work; the new scheme allows only £10, on top of benefits, for a 37 hour week.

Community insulation projects rely mainly on a workforce supplied by the Government initiative (p18-19). They are finding it increasingly difficult to attract employees under the new system where the 'incentive' is to work longer hours for less money.

So far out of the 6 million homes judged inadequately insulated only 500,000 low-income homes have been tackled. Under the £50 million a year Government scheme, people receiving state benefits are entitled to draught proofing, and in some cases loft insulation, for a nominal fee of £5.

It is estimated that 50,000 homes will not be treated this winter because of the shortage of labour, and next year that number is expected to jump to 90,000. Officials of the Community Programme insulation schemes are concerned that unless the Government reverse their decision to cut the wages and increase hours, the scheme will collapse in February.

## Saverplug

A cheap and simple device capable of reducing energy consumption in domestic freezers and refrigerators by about 20% should be on the market next spring.

The device, predictably called Saverplug, will cost about £19 and is expected to cut electricity bills by 10-15 annually.

The Department of Energy, are providing 40% of the £241,000 funds required to develop, test, and market the plug; and estimate that it could eventually save Britain £2.9billion annually.

The concept is not new: Savawatt, the Bidford company behind the device, have been selling a similar device to commercial and industrial marketsfor several years, and over 13,000 systems are currently in use. In some cases payback periods of under a year have been recorded.

It is thought that the domestic market is worth around £500m, £100m greater than the industrial market.

As the name suggests a fridge or freezer is wired into Saverplug which is then plugged into the socket, like a normal plug.

In addition to saving energy, the device will also reduce the heat and noise output of a motor and therefore prolongs its life.

Savawatt also believe that a considerable export market exists for their product. Hot countries with air conditioning units are thought particularly attractive. The market potential is estimated at £25,000m.

**International Environmental Diplomacy; ed John E Carroll. Cambridge University Press; 291pp, £35.**

"Perception equals reality," states John Carrol in the introduction to this compilation of essays. This is especially the case in regard to environmental politics and diplomacy.

Unfortunately this means that the reality of environmental action is based upon various perceptions of damage which are easily skewed. Taken into the international sphere, this basis for environmental policy can get even further lost in regional politics, social and economic issues, and in the 'inherent' sovereign rights claimed by nation states.

Due to the inescapable physical evidence of environmental damage and worldwide transboundary pollution, individual nations can no longer avoid responsibility for a global clean up. As Carrol concludes, "nature will not and cannot recognise our anthropocentric definitions of sovereignty and our political borders which defy reality."

The format of short and multiple essays gives the reader a broad introduction to environmental issues. This does not always make for the most enthralling reading, but it does manage to synthesise three aspects reasonably well: a sound presentation of facts on environmental damage; theories as to the role and consequences of environmental policies; and concrete ideas as to how these theories can be put into practice.

Approximately half of the book is devoted to the 'facts', with one section on acid rain and one section on marine pollution. The focus varies with each author, but one gets an idea of the far reaching consequences of acid rain and water pollution including the resulting attempts at bilateral and international regulations.

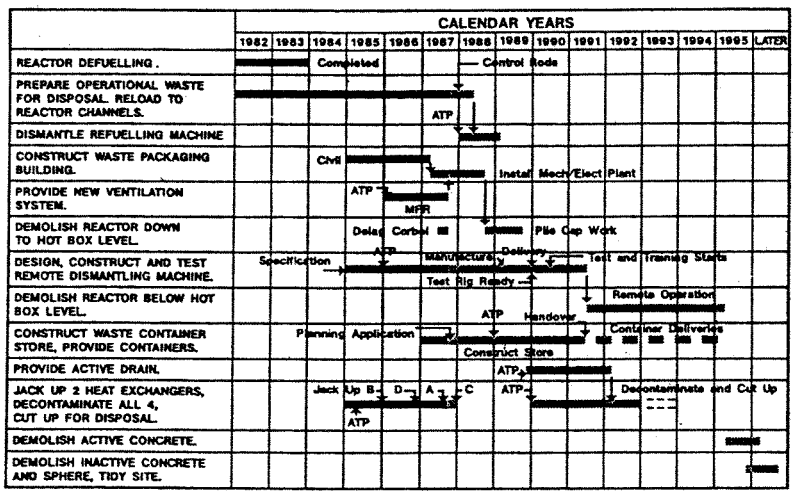
The other half of the book is devoted more to theories and ideas. Part One is entitled, "The Framework of International Environmental Diplomacy in the Industrialised World," and Part Two "Legal and Diplomatic Resolutions in International Environmental Diplomacy." Although some of the essays get weighed down in the legal and diplomatic technicalities, and on the monitoring of SO2 and NO emissions, they are written by people who have the experience and knowledge to reveal the encompassing nature of environmental issues.

A point a few of the writers focused on was the importance of the increasing role of Non-Governmental Organisations (NGOs). They propose that the more objective monitoring and information-gathering resources provided by NGOs have paved the way for greater co-operation, and thus greater achievements in environmental protection. This could prove very important in a world where there are great gaps due to economic and political differences among industrialised countries, not to mention the gap to be bridged between industrialised and developing nations.

It is said that environmental issues are emerging as the "third pillar" of the international system, alongside security and economic issues. This book is one of the first of its kind to place environmental policy in such an encompassing context. It is well prepared and is a very important piece of work.

PHEBE CONREY

**Decommissioning of major Radioactive Facilities: Proceedings of the Institution of Mechanical Engineers International Conference. 252pp, £68.**




Last October, an international conference on decommissioning was held in London. Planned originally to take place at the organiser's headquarters, the Institution of Mechanical Engineers, the venue had to be changed because of the large number of delegates. Decommissioning will, after all, become big business over the next decade.

We learn from the proceedings, just published, that the nuclear industry have left themselves with some difficult decommissioning and disposal problems. We're reminded that Nirex have not discounted the use of a coastal near-surface repository for large decommissioning items. We could see, over the next 10 to 20 years, Nirex searching for such a repository to accommodate lightly contaminated bulky items, such as Magnox reactor boilers. Rather than cutting up and packaging these items, they will probably be transported intact by sea to repository.

John Large, an independent engineering consultant, told the conference that current plans for decommissioning depend upon major advances in dismantling technology, automatic processes and radioactive waste disposal. UK reactor systems have not been designed with decommissioning in mind.

It is proposed to leave the reactor core for 100 years or so following closure, before dismantling to allow the radioactive inventory time to decay substantially. This assumes that the reactor containment support structures will remain intact for that length of time - 100 years is longer than current experience of ferro-concrete.

PETE ROCHE

# LITTLE BLACK RABBIT

David Fishlock, the well-known energy and science correspondent for the **Financial Times** had a two page article published in the November issue of ATOM, entitled **The rights and rights of nuclear energy.**

In the spectacularly objective article - "the 'nuclear threat' is nothing more than its ability to deliver low-cost, dependable power" - Fishlock claimed that nuclear power is controversial only because "a sector of western society, with political ambitions to revert from an industrialised to an agrarian and craft-based society, sees nuclear technology as the most potent force for stability in our present way of life."

The article first appeared in the June issue of **RTZ Review**, and David Fishlock was awarded an OBE in 1983 for his energy writing, and a national newspaper award for articles on the Chernobyl accident in 1987.

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SSEB are saving £224,000 a year by their staff using less electricity in the workplace. Their internal energy conservation campaign has reduced consumption by 16½% compared with five years ago despite increasing office hours from 8 to 10 due to flexitime working. Why then are they still exhorting the use of more electricity in their advertising campaign running up to privatisation?

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BNFL Springfields have produced the four millionth magnox fuel element - 33 years after they produced the first. And they still don't know how to deal with them after they've been in the reactor.

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The October issue of ATOM, the UKAEA's magazine, carried a diagram of the Windscale AGR remote dismantling machine - but it was printed upside down. It took until the December issue before a correction was printed.

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Michael Howard, Minister with responsibility for water privatisation and local MP for Dungeness, was wheeled out to prove the efficacy of the solution discharged into the English Channel from the newly commissioned Magnox Dissolution Plant.

Interesting to learn that within a few days his office was cancelling appointments "due to the Minister's indisposition."

"Oh no, SCRAM's financial appeal has been more successful than my own charismatic appeal."

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