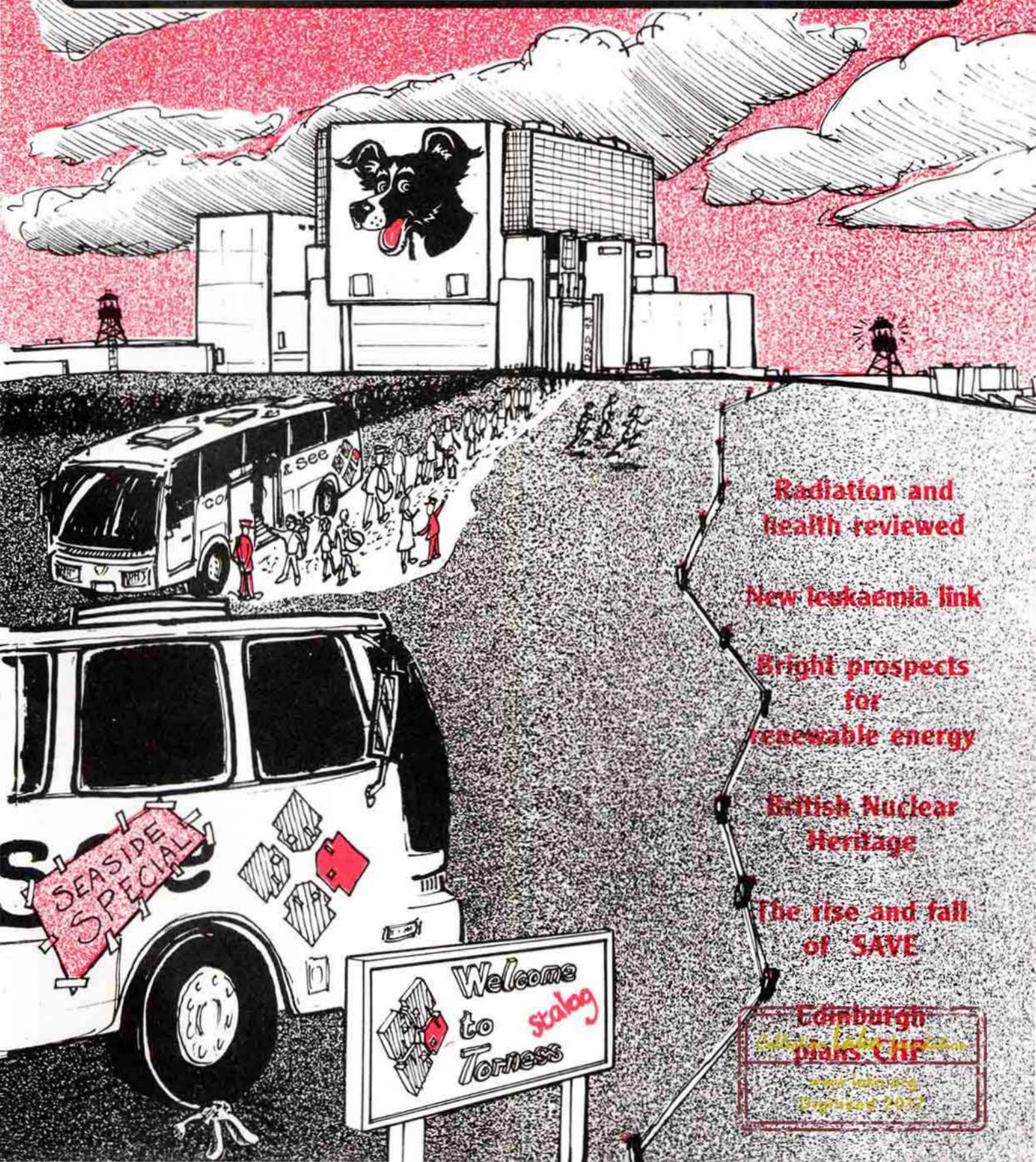


# SAFE ENERGY

No.94

April/May 1993

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**Radiation and  
health reviewed**

**New leukaemia link**

**Bright prospects  
for  
renewable energy**

**British Nuclear  
Heritage**

**The rise and fall  
of SAVE**

**Edinburgh  
plans CHP**

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## COMMENT

**N**INETEEN NINETY-FOUR has become 1993, yet we are still no closer to knowing what form the government's review of the nuclear industry is going to take. However, a worrying indication that it will be far from open came in the Department of Trade and Industry's review of the pit closures.

A vital consideration in trying to decide on how many pits could be saved was to first decide whether or not the UK's ageing Magnox reactors were worth keeping open. To this end, the government hired British Nuclear Fuels' auditors, Ernst and Young, to review the economics of Magnox reactors based on figures supplied by Nuclear Electric. After discounting all fixed — and some not so fixed — costs they decided that Magnox electricity is so cheap that closing any of the stations would be economic madness.

Yet in Ernst and Young's published report, all the significant figures had been deleted under the guise of protecting Nuclear Electric's commercial confidentiality. Without access to the same figures as Ernst and Young, it is impossible for anyone to verify the work.

In choosing an 'independent' assessor it would perhaps have been more prudent to opt for a company with no connections to the nuclear industry. After all, one of Ernst and Young's clients, British Nuclear Fuels, has a substantial interest in ensuring the continued operation of the Magnox reactors.

Whatever form the review takes, it is simply unacceptable to expect people to trust the conclusions of examinations conducted behind closed doors.

For the nuclear generators Scottish Nuclear (SN) and Nuclear Electric (NE) the review means privatisation and the sooner the better. Putting forward 'modest plans' the industry no longer sees itself as providing all of the UK's electricity, but is promoting itself as the natural complement to fossil fuelled power. It wishes merely to maintain its current level of generating capacity. However, to maintain that level they will need to order four new power stations in the next few years, at a total cost of over £8 billion. Realising that the days when the government handed over blank cheques are well and truly over, the industry believes that such an investment will have to come from the private sector. To make this a reality the generating companies will have to be privatised. And here's the sting: in order to be an attractive proposition to the city both SN and NE say that all historic liabilities such as decommissioning and waste management would have to be retained in the public sector and paid for by the taxpayer.

Yes, not only has NE been receiving over £1 billion a year from the non-fossil fuel levy in order to meet these costs — which they spent on Sizewell B — but they want us to pay a second (or possibly third) time. SN too has already been given the funds to cover its liabilities: it received a £1.4 billion tax write-off and is receiving money towards the decommissioning of the Hunterston A Magnox reactor.

If the events of the last few months are anything to go by then the public can have little faith in the review process, and can only hope that the industry will be 'hoist by its own petard'. It seems unlikely that the city will be willing to invest in an industry with so small a grip on reality. Remember, in the US, where nuclear power stations are paid for by the private sector, no nuclear power stations have been ordered since 1977.

SCRAM's *Safe Energy* journal is produced bi-monthly for the British Anti-Nuclear and Safe Energy movements by the Scottish Campaign to Resist the Atomic Menace. Views expressed in articles appearing in this journal are not necessarily those of SCRAM.

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to shut-down a nuclear  
reactor in an emergency.

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A new study on childhood leukaemia, which looked at the areas around the Burghfield and Aldermaston nuclear weapons establishments, was recently published in the British Medical Journal. Pete Roche of Greenpeace compares this study with similar findings in the 1990 Gardner report on Sellafield, and sees plutonium as a possible link.

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The 1,160 page book *Renewable Energy: sources for fuels and electricity* has already been dubbed the renewable energy bible. Dr Nigel Mortimer, of the Resources Research Unit at Sheffield Hallam University, reviews the book and the economic prospects for renewables.

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The UK has been slow to develop CHP (combined heat and power) which uses the waste heat of electricity generation, but there has been a recent increase in interest. Following an initiative by local councils, a private consortium plans to introduce CHP in Edinburgh, and Graham Stein explains some of the details.

## Nuclear review hastened

MICHAEL Heseltine's decision to bring the nuclear review forward by a year, to 1993, has been greeted with enthusiasm by both Scottish Nuclear (SN) and Nuclear Electric (NE).

The announcement made in the white paper on coal was just that: "The Government will bring forward its review of the prospects for nuclear power and work will begin on the review later this year." No mention has yet been made of what form the review will take, on how any public consultation will be made, on a timescale for completion, or anything else for that matter.

The Trade and Industry Select Committee report on "British energy policy and the market for coal" had recommended "that the nuclear review be brought forward to 1993." However, the white paper ignores the Committee's reasoning: that "we find it difficult to see how decisions can be made on future energy policy without considering the future of nuclear power." No matter how soon the nuclear review is held it will still come after the conclusion of the coal review, making a mockery of the whole process.

NE's commercial director, Mike Townsend, told a conference held in London in March that he "would have liked to see the review happen during evidence to the DTI Select Committee. It would have made sense to do that." Since nuclear power was withdrawn from privatisation, Townsend said, it had "changed beyond recognition". Market share was up 25% and productivity up by 52%.

Townsend also backed another of the Select Committee's opinions that NE should cease to receive any income from the non-fossil fuel levy and cease to be responsible for discharging inherited nuclear liabilities: "I believe this is entirely right. It would free NE from the shackles of the past."

Dr Robin Jeffrey of Scottish Nuclear

also welcomed the decision to bring forward the review, saying: "This gives us an earlier than expected opportunity to demonstrate the key role that nuclear generated electricity must play in the UK energy market." Jeffrey said that Heseltine's statement also recognises that privatisation is the only way of enabling the coal industry to realise its full potential: "Is there a lesson here for the nuclear industry?"

### Fierce attack

However, SN is not entirely impressed with the performance of Heseltine et al. The company's chair, James Hann, launched a fierce attack on the government's handling of the energy sector, saying: "It is astonishing to think that the last time a white paper on fuel policy was published in the UK was in 1967, before the discovery of north sea oil. Since then there has been a fundamental change in the energy market and a much greater realisation of the impact of energy on the environment.

"That is why we really cannot wait any longer for a sensible long-term energy strategy."

Hann believes the pits closure crisis "should never have happened ... But it did, and if it has achieved nothing else, it has thrown into sharp perspective the difficulties inherent in leaving decisions on energy to a market which is clearly incapable of serving our long term national interests."

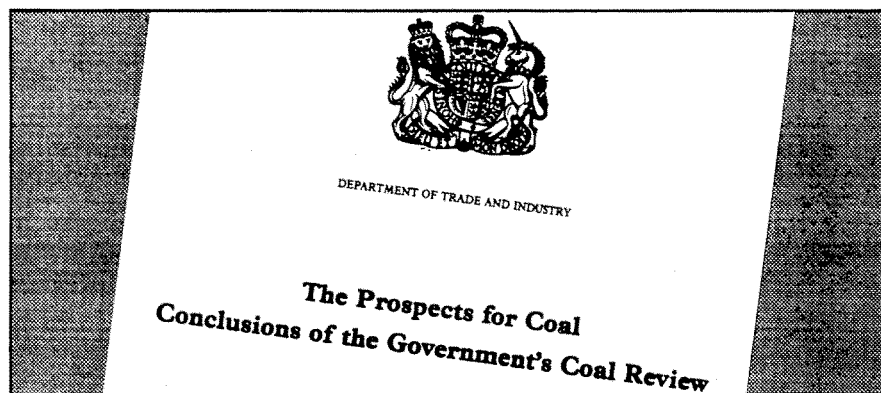
Hann believes that the electricity

production should come from a mixture of sources: 50-55% coal "mainly domestic"; 15% gas; 20-25% nuclear "which would mean simply replacing the older Magnox plants at the end of their useful lives"; and 5% renewables early next century.

SN has already declared its intention to build a new nuclear power station at Hunterston. With the station's AGR due to come to the end of its working life by 2005, the company believes: "If we are going to maintain our nuclear capacity in Scotland we should be starting to plan our next nuclear station in the very near future."

Hann believes the most likely way forward is for the company to be privatised in 1995: "In order to simply maintain the 20% proportion of UK electricity supply currently accounted for by nuclear power, given the ten-year lead time for a nuclear station, up to four new PWR stations would need to be ordered over the next five years.

"The scale of the PSBR (Public Sector Borrowing Requirement) suggests that providing funding of at least £8 billion over a ten-year period may not be acceptable to the Government and it is likely that such funding would need to be raised privately. That implies privatisation of the industry, which would not be achievable without the Government writing off reprocessing, waste management and decommissioning liabilities incurred before the two companies were established." □



## Magnox economics

NO "economic justification" exists for the early closure of England's ailing Magnox reactors as part of a plan to save coal mines, according to the white paper on coal.

Much of the cost associated with the Magnox reactors lies in capital expenditure, ie the cost of construction and decommissioning, and as these costs will have to be met regardless of whether or not the reactors continue operating, the DTI opted to base their decision on the cost of electricity from the plant after all fixed liabilities had been discounted.

Applying this logic to figures supplied by Nuclear Electric (NE) — the operators

of the seven Magnox stations — the DTI concluded that: "The range of 1.3 to 1.5p/kWh as the avoidable costs of additional output from the Magnox stations compares favourably with the avoidable costs of generation from existing coal fired stations as given in evidence to the Review, and with the range of figures quoted by the Trade and Industry Select Committee ... (from 1.84p/kWh at inland stations without FGD [flue-gas desulphurisation] and coal priced at £1.33/GJ to 2.57p/kWh at an inland station with FGD and coal priced at £1.51/GJ). The avoidable cost of electricity from the Magnox stations is also substantially below the current pool price for electricity."

In reaching their decision the DTI hired

British Nuclear Fuels' auditors Ernst and Young to conduct a "Review of Magnox Avoidable and Unavoidable costs". However, in the published report much of the data supplied by NE had been removed on the grounds of 'commercial confidentiality', making truly independent verification of the stated costs impossible.

Once again, decisions on the future of the nuclear industry have been taken behind closed doors, under the veil of 'commercial confidentiality'. NE is state-owned and in receipt of a massive public subsidy. The fact that they operate a monopoly in a protected market makes a mockery of any suggestion that the company needs to maintain 'commercial confidentiality' over any aspect of its operations. □

## Thorp under threat

**A**S British Nuclear Fuels' (BNFL) £2.8bn Thermal Oxide Reprocessing Plant continues to lie dormant the prospects for its eventual commissioning are fading.

Currently the subject of top level Whitehall reviews — involving the Treasury, the Department of Trade and Industry and the Department of the Environment (DoE) — the plant is now to be scrutinised by the White House. In a letter to seven leading US congressmen, President Bill Clinton said he would raise the issue with the British Government following the completion of an investigation into the growing problem of nuclear proliferation. The congressmen had written to Clinton arguing that "a decision by the UK against commissioning the Thorp plant would be a significant contribution to efforts to stem the proliferation of nuclear weapons."

Preventing the spread of nuclear weapons is, according to US Secretary of State Warren Christopher, one of the new administration's top concerns.

While the DoE is considering granting BNFL a licence to increase the radioactive discharges from the Sellafield site — to accommodate the new plant — the company now appears to be taking things into its own hands.

There were two 'unauthorised' leaks of radiation from the plant at the beginning of February. The first led to over ten times the plant's annual authorised plutonium discharge being released in just one day. The second leak, of iodine-129, occurred on the day officials from HM Inspectorate

of Pollution and the Nuclear Installations Inspectorate (NII) turned up to investigate the first leak. It also occurred at a time when BNFL was being prosecuted by the normally court-shy NII.

On 26 February the company was convicted for unauthorised modifications to a safety interlock at its vitrification product storage facility at Sellafield, the second such modification uncovered since the plant opened. BNFL put up no defence but proffered mitigating circumstances, and was fined £6,000 and ordered to pay the NII £10,750 costs.

However small-scale BNFL proclaims the leaks to be, there is no doubt that its relationship with the DoE is becoming increasingly strained. The DoE is reported as being frustrated by the delayed and minimal information it is receiving about leaks.

It took BNFL nearly two weeks to report the iodine discharge and the NII was not informed about the first, more serious, leak for over 24 hours and even then they were not told the quantities involved.

### Angry Jack

Further, BNFL have managed to alienate one of their staunchest supporters, local labour MP Dr Jack Cunningham. Although Cunningham and a fellow Labour MP were visiting the plant at the time of the plutonium release, they were not informed. Cunningham reacted angrily saying there had been a "totally unacceptable series of events," adding that it is "unacceptable that it took the management of British Nuclear Fuels longer than one might expect to make this incident public, especially bearing in

mind that Dr Lewis Moonie [a Labour front-bencher] and I actually visited this site on Thursday and Friday of last week and were not informed that these excessive discharges had taken place."

Further evidence that the Government is seriously considering abandoning the plant has come with the news that it has commissioned legal scrutineers to scour the contracts signed between BNFL and overseas contractors, to evaluate the financial implications of abandonment.

The Office of Fair Trading and the electricity supply industry watchdog Offer are also examining contracts with Thorp; they are concerned that the contract between the state-owned companies Nuclear Electric (NE) and BNFL is contrary to the public interest.

The two companies are linked through a £14 billion 'fuel cycle' contract — for reprocessing both NE's Magnox and AGR spent fuel — which is not yet finalised because the government has refused to underwrite certain risks. The investigation will be trying to establish whether it would be cheaper to close NE's Magnox stations and avoid the expense of reprocessing. However, since Magnox reprocessing accounts for three quarters of the contract with BNFL, closing the reactors would inevitably lead to Thorp's abandonment.

■ Meanwhile, BNFL's corporate affairs director, Harold Bolter, has resigned following the revelation that repair work to Bolter's home carried out by contractors who regularly work for his employers had been charged to the company. Let's just hope it wasn't vastly over budget and massively behind schedule. □

## Cancer studies

**T**HE link between nuclear activities and childhood cancers has been further highlighted following the publication of three new reports, while another report argues that the so-called leukaemia clusters around nuclear sites are a consequence of workforce migration.

Men whose jobs meant that they would have inhaled radioactive dust had a 2.7 times greater chance that their child would get cancer according to a survey of 15,000 case histories. Dr Tom Soraham of the Oxford Survey of Childhood Cancers, who undertook the study, said: "Radiologists and dentists did not seem to carry any increased risk. Those who worked with nuclear materials, scientists and nuclear technicians who could have suffered internal contamination, were at risk."

"My own feeling is that alpha emitters like plutonium, are going to prove an important pathway through fathers to their unborn children."

The second study conducted by the Imperial Cancer Research Fund at Oxford, examined 54 children diagnosed

with leukaemia or non-Hodgkin's lymphoma between 1972 and 1989 near the military nuclear plants at Aldermaston and Burghfield ("New leukaemia link", p11). Here too a link was uncovered between fathers' exposure at work and the cancers. However, Dr Eve Roman who carried out the study says the records covering external exposure do not justify the link and suspects exposure to other hazards "such as chemicals or other radioactive substances which are breathed in or swallowed."

The third study concerned a rare eye cancer, five cases of which — a twenty-fold excess — have been found in the village of Seascale next to Sellafield. According to scientists from the Lancaster Moor Hospital and Lancaster University the common feature to all five cases is that the mother lived in Seascale at some time since Sellafield opened in the 1950s.

Meanwhile, Dr Leo Kinlen, director of the Cancer Research Campaign's Epidemiology Unit at Oxford, has published a report in the British Medical Journal, highlighting the connection between the North Sea oil boom and a near-trebling of childhood cancers in some rural areas.

Kinlen believes the cancers are being caused by an unknown micro-organism which has been introduced to rural communities during the massive inflow of oil workers from urban communities which have developed an immunity to the infection.

Comparing the rates of leukaemia and non-Hodgkin's lymphoma with those that would have been expected, Kinlen says: "A significant excess was found between 1979 and 1983 in a group of rural areas with the largest proportion of oil workers, following closely on large increases in the workforce."

The category of rural areas with a high density of oil workers includes the area surrounding Dounreay. Kinlen believes his "findings support the infection hypothesis that population mixing can increase the incidence of childhood leukaemia in rural areas. They also suggest that the recent excesses in the Dounreay-Thurso area is due to population mixing linked to the oil industry." Robert MacLennan, the pro-nuclear MP for the Dounreay area, welcomed the Kinlen study, arguing that it was "as near a clean bill of health for Dounreay as you can get." □



## Dounreay waste problem

FOR the first time since its creation in 1975, Highland Regional Council has voted down a request from Dounreay by rejecting a planning application from the plant for an extension to one of its low-level waste pits.

A meeting of the full council on 15 April voted 26 to 21 to uphold an earlier decision from its planning committee to refuse permission for a 12,000 cubic metre extension to Dounreay's waste pit six. The council is now calling for AEA Technology to draw up a new strategy for the storage of all of nuclear waste above ground, in line with council policy.

Although the region's planning director recommended that the application be approved he had attached several conditions: full studies to be undertaken to assess the radiological impact of the development; no open storage of the waste drums on the site or adjacent land other than those properly emplaced within the pit — the packages are to be grouted in a "regular and recurring manner"; and a plan for the removal, packaging and treatment of all

existing low-level waste (LLW) presently in open surface storage to be submitted to the planning authority prior to the new pit being started.

However, following a visit to the existing storage pits on 10 March, where the councillors saw for themselves a sorry collection of open pits into which barrels of plutonium-contaminated waste had been dumped — some of the drums had been lying rusting since 1985 — the application was rejected 12 votes to 10.

Dounreay manager, Roger James, who attended the full council meeting said: "We believe we have put forward a coherent strategy in line with Government policy based on the advice of eminent academics and experts in this field for the disposal of LLW to engineered shallow pits."

"We won on the balance of arguments at today's meeting but we were let down by the visual impact of the pits ... Clearly an appeal is open to us."

James also said another option was to send LLW from Dounreay to Drigg in Cumbria. However, the Dounreay waste is contaminated with plutonium and would not be accepted at Drigg. AEA Technology has two choices, either clean

up its act and come back to the council with a proposal which embraces the concept of above ground dry storage, or appeal to the Scottish Secretary, Ian Lang, to overturn the Region's decision. □



## Sizewell safety shock

PARTS which are causing serious problems throughout the world's stock of pressurised water reactors (PWRs) are to be used in the new Sizewell B PWR.

Nuclear Electric has opted to fit extra monitoring equipment and scheduled extra safety inspections rather than replace the parts, which would cause an expensive delay in starting the station which is due to be

commissioned next year.

However, in France, where the problem of cracking in the pressurised dome which houses the reactor has been found in eight out of ten PWRs, Electricité de France (EdF) has decided to replace the domes at a cost of £30 million each. EdF has also ordered that no new reactors be started up until their domes have been replaced.

According to Greenpeace the problem occurs because of the failure of a special nickel-based steel alloy, Inconel-600. Cracks are appearing in the casing of the

rods which control the temperature at which the reactors operate and which shut them down in an emergency. The cracks are occurring in the welds at the point where the rods enter the reactor core. Given the enormous pressure the water in the reactor is under, it could escape through the cracks and force the control rods out of the reactor altogether, making it impossible to shut down.

Anthony Froggatt of Greenpeace International believes: "The meltdown potential of western reactors has risen alarmingly." □

## Clinton's nuclear cuts

SHOCK waves have been sent through the US nuclear industry as President Bill Clinton's proposed budget and economic plan signifies a fundamental shift away from nuclear technologies towards renewable energies and energy conservation, for the first time since the dawning of the nuclear age.

Funding for advanced reactor research and development (R&D), including the Integral Fast Reactor, the high-temperature gas-cooled reactor and the liquid metal reactor will be stopped. The budget would also eliminate the SP-100 space reactor programme. According to the Clinton Administration this will save some \$820 million over two years.

Clinton also plans to shut down one of the two existing uranium enrichment plants, opting instead to import large quantities of Russian highly-enriched uranium from nuclear weapons, to be

downblended for use as a commercial reactor fuel. This, according to the proposed budget, would save \$1.2 billion over five years.

However, the budget actually increases the funding available for the fusion reactor programme and includes new funding for a neutron source reactor to be built at Oak Ridge. Both programmes are believed to have been included at the insistence of Vice-President Al Gore.

In a move designed to illustrate the nuclear industry's new status, Energy Secretary Hazel O'Leary is restructuring her department to "mirror the new priorities of a changed world." Specifically O'Leary has abolished the top nuclear staff position, that of Assistant Secretary for Nuclear Energy. Instead there will be a downgraded "office of nuclear energy."

Ed Davis, President of the American Nuclear Energy Council, described the axing of the top nuclear job as an "oxymoron, a non-sequitur [that] will prove to be myopic in the long run." Adding that "... this and the other nuclear

R&D cuts really reflect the de-emphasis of nuclear power."

O'Leary has also announced that the Department of Energy will not restart the tritium producing K-reactor at the Savannah River plant, as had been planned for later this year. Instead the reactor will be placed on "cold standby" and be readied for decommissioning.

David Rossin, president of the American Nuclear Society has urged the nuclear power industry to launch a letter writing campaign to Congress to fight Clinton over the destruction of advanced reactor research. He said the fact that Clinton singled out nuclear power during his State of the Union address to Congress "... sent shivers through the nuclear community."

The proposed budget will now be placed before Congress. American analysts believe that if Congress decides to consider the package in its entirety then the nuclear cuts are likely to go through; however, if they decide to take it item by item then the nuclear industry will be in a far more favourable position. □

## Explosive waste problem

**A**PRIL'S explosion at the former Soviet plutonium factory, Tomsk, was not so much a reminder of the Chernobyl disaster but a taste of things to come, many observers are warning.

As *The Guardian's* David Fairhall points out: "The former Soviet Union is littered with dilapidated nuclear installations of every kind — power stations, redundant missile silos, waste storage and reprocessing plants, abandoned submarine propulsion reactors — all of which require the skilled attention that shattered industries and demoralised armed forces can no longer deliver.

"Every such installation has the potential for disaster, if not in a spectacular explosion like Chernobyl seven years ago and now in Tomsk, then through seeping environmental contamination."

While the Russian authorities claim that the five-reactor site in Siberia had not been operational for over a year, Viktor Mikhailov, Russia's minister for nuclear energy, told Greenpeace that the explosion occurred when a tank containing plutonium and uranium was being filled with nitric acid. According to the Natural Defence Council in the US the addition of nitric acid is the first step in the reprocessing procedure.

According to International Atomic Energy Agency (IAEA) inspectors the tank contained 8,773 kilograms of uranium and 310 grammes of plutonium. Some 7,000 kilogrammes of uranium were blown out of the tank by the explosion and "228 grammes of plutonium are not accounted for" says the IAEA.

While the Kremlin admits that this was the worst disaster since Chernobyl, government officials said that contamination was minor and there were no casualties. However, children from the

small town of Georgievka, which lies within the area contaminated by the blast, have been evacuated for 2 months as a safety precaution. Radiation doses in the village are believed to have reached 30 microsieverts an hour — the international safety limit for nuclear workers is 50 millisieverts per year.

Despite the heavy damage at the plant, said Burton Bennet, head of the IAEA team, plutonium production is continuing "on a reduced scale". This is probably because the plant earns valuable foreign currency, about \$20-30 million a year, by reprocessing spent fuel and producing enriched uranium for the State owned French company Cogema. While Cogema admits that it has a contract with the Russian atomic ministry, it claims no knowledge of where the work is carried out. According to Nikolao Yegorov, Russia's deputy minister for atomic power, the enrichment is done in Tomsk. □

## Dash for cash

**A**FTER almost a year of prevarication the G-7 group of the world's wealthiest nations have finally agreed an aid package to finance nuclear plant safety improvements in eastern Europe.

Meeting in London on 27 January, representatives of the G-7 nations (US, Japan, UK, France, Germany, Canada and Italy) and the European Community (EC) endorsed the creation of a special fund which will be administered by the European Bank for Reconstruction and Development (EBRD). Klaus Toepfer, German minister for the environment and nuclear safety described the agreement as "extremely significant ... we must eliminate this potential for danger and risk in the heart of Europe". However the initial funds, to be provided by France, Germany and the EC, will be a mere \$78 million, with the hope that eventually the

account will grow to around \$700 million. This is far short of the \$12 billion which Germany's engineering multinational Siemens believes is required. The initial funding is also considerably less than the £200 million that the EBRD has spent over the last two years on fitting out its swanky new London offices.

While the fund's launch has been promoted as "a real success" in getting the Japanese and Americans on board, they have so far not set the amounts they will contribute. According to French industry minister Dominique Strauss-Khan said "the Americans and Japanese agreed to put in a small amount of money," but stressed that their participation will allow decisions to be taken collectively to avoid duplication of effort. Both countries favour a bilateral approach to the problem of eastern Europe's Soviet nuclear legacy.

Indeed the US aid programme, known as the Lisbon Initiative, is already limping into action. Of the \$25 million set aside by the US Agency for International

Developments (AID) \$3 million has been awarded to the Nuclear Regulatory Commission and £22 million to the Department of Energy (DOE). The funds awarded to the DOE will be handled by the Brookhaven National Laboratory, which has already announced in *Commerce and Business Daily* — the government's journal of contract offers — a solicitation for reactor design services to reduce the risk of operating VVERs and RBMKs in Russia and the Ukraine. According to one unnamed US official, quoted in the industry magazine *Nucleonics Week*: "Most activities would be competitive bids for hardware and software in the US."

It is this determination that US origin aid funds should go to US companies which has delayed the G-7 initiative, with the US and other western countries being more concerned about giving a boost to their failing nuclear industries than tackling the crisis of eastern Europe's nuclear time-bomb. □

## Sea dumping

**N**OT only have Russia and the former Soviet Union dumped more than twice as much radioactive waste into the sea than the rest of the world but it is still going on, according to a report commissioned by Boris Yeltsin and due to be presented to the London Dumping Commission in May.

In 1989 the Soviet government announced that it "did not dump, does not dump radioactive waste at sea." However, the report reveals that some 92PBq (92 x 10<sup>15</sup> becquerels) of radioactive waste have been dropped into the Arctic and Pacific Oceans, while the

International Atomic Energy Agency (IAEA) says other countries have admitted to dumping a total of 46PBq overboard.

Although the report reveals the shocking extent of Soviet dumping it also highlights the massive waste management problem faced by Russia. At present the country's military fleet and Murmansk Shipping Company together have 225 nuclear powered submarines, three nuclear powered battleships and seven icebreakers in the Barents and Kara seas, and the sea of Japan. They account for 407 reactors, produce 20,000 cubic meters of liquid radioactive waste a year — mainly

cooling water — and 6,000 cubic meters of solid waste.

Russia has nowhere to put the waste and current facilities are overflowing. Ageing vessels and disarmament have brought the problem to crisis point. Alexei Yablokov, Yeltsin's environmental advisor and chair of the commission which drew up the report says the immediate priority is to measure how much radiation is being released from submerged waste. The military has not allowed civilian scientists to examine the disposal sites for 25 years. Yablokov believes that this alone will take "several tens of millions of dollars." But building facilities for decommissioning the fleet will cost "several billion dollars." □

As the nuclear industry is quick to point out, man-made radiation in the environment is only a small addition to background radiation, but Dr CHRIS BUSBY of Wales Green Party argues that differentiating between external and internal radiation could explain the rise in cancers and other diseases which has coincided with nuclear development.

# Radiation and health reviewed

ON 19 February, as part of the Green Party Radiation Campaign, "Green Dragon", the Plaid Cymru/Green MP for Ceredigion in Wales, Cynog Dafis, tabled the following question in the Commons:

"Why is it, in the age of information technology, that the cancer incidence statistics, produced each year from 1971 by the Office of Population Census and Surveys (OPCS), has increased its lag between data year and publication from three years (for publication years 1983, 84 and 85) to seven years in 1993 and that, therefore, the most recent published data relates to 1986, the year of Chernobyl, and furthermore, in view of the increasing public disquiet over possible links between radioactive and other pollution and the increase in adult age specific and childhood cancer which is occurring, is the Government intending to ensure that more up to date figures are made available as a matter of urgency?"

## The problem

Of all the dangers facing humanity, perhaps the most insidious and frightening is the damage done to human genes by induced mutations: for the human race is defined by its genetic structure, and alteration of this is the most pervasive direct attack on it that can be imagined. The largest single mutagen is ionising radiation, and the study of its biological effects is arguably one of the most important areas of human research undertaken.

Ionising radiation is now known to cause genetic damage under all conditions of irradiation and for the smallest dose which can occur. There is no safe or threshold dose. But most alarming, is the emerging evidence that, in the case of radiation safety, instead of following normal scientific research procedures in order to establish the biological effects of radiation and determine valid safety levels, the situation is that a research monopoly has been set up and given statutory authority. Research funding goes to selected laboratories whose members largely control the scientific peer review literature through the referee system. In this way, and through the various Official Secrets Acts both here and in

other countries, the nuclear/military establishment continues to minimise any perception of the seriousness of radiation effects on health and to keep its self-selected organisations, the International Commission on Radiological Protection (ICRP), the UN Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and their satellites like the UK's National Radiological Protection Board (NRPB) in control of the arguments and the statutory dose limits.

These limits show only the agreement reached over how far the ill health of populations can be balanced against their own needs and plans: a black comedy cost benefit analysis. Whose cost? Whose benefit? This control of the conventional wisdom came about when the pathological secrecy associated with the cold war spilled into scientific research. Nothing could be allowed to suggest that nuclear weapons development might be having lethal side effects. And its success has been immense. The anti nuclear battleground has moved from radiation biology to the Chernobyl accident scenario and the economic cost argument. Yet even with a guarantee of no accidents it has been calculated that 99.9% perfect containment of Caesium-137 produced by 100 nuclear power stations throughout their 25 year lifetime would still contaminate the world environment with the equivalent of four Chernobyl accidents.

The time is overdue for an evaluation of the health effects of novel pollutant isotopes produced by nuclear fission. The last ten years has seen increasing awareness that such effects are possible, occur and are increasing.

## The evidence

Health in developed countries has improved immensely in the last hundred years. Indices of this improvement, like normal lifespan and infant mortality show general advance throughout the period. But following the Second World War, rates of change became subject to some odd effects. Figure 1 shows these effects for the US population. The bumps in the curves, which showed slowing down of improvement, and in some cases, actual deterioration in certain mortality classes, followed the injection into the world environment of fallout from atmospheric nuclear testing.

The relationship between fallout levels (which peaked in 1962 to 64) and human mortality and morbidity was first pointed out by Ernest Sternglass but he was ridiculed by the nuclear establishment, who argued that the doses involved were too small. It now seems that Sternglass had made a crucial observation, marking the beginning of a general slide in the quality of health which continues today.

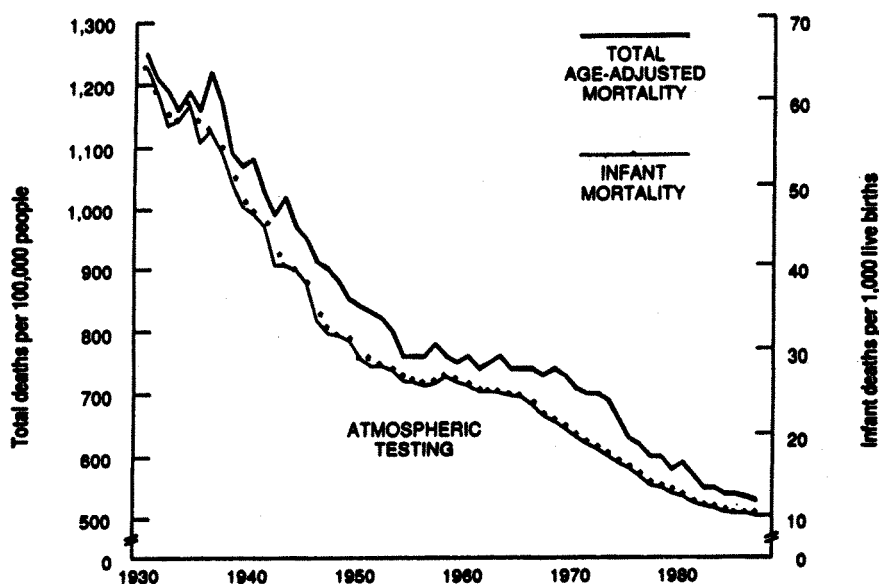


Figure 1. Total and infant mortality trends since 1930, USA



The last twenty years have seen increases in age-standardised cancer, leukaemia, cardiovascular disease (known to be mutation related) and immune system conditions such as AIDS. There is an epidemic of cot death, a condition recently shown to be due to inhibition of foetal development. One in ten babies born are of low birth weight, and only major technological advances keep many of them alive. Sperm counts have been falling. Intra uterine scanning and genetic testing followed by therapeutic abortion is all that is checking increases in congenital malformation rate. Figure 2 shows the crude death rate from leukaemia by year since 1945.

There is no doubt that the Government is aware of the problem. Cancer incidence statistics are now seven years out of date. They have begun a £6 million study into childhood cancer to discover the cause and to "reassure". The study will investigate chemical mutagens, electromagnetic fields and ionising radiation.

Following the work of Sternglass and since the environmental contamination from Chernobyl, increasing numbers of independent reports, bypassing the scientific literature as books, have questioned the nuclear establishment's safety assurances. Rosalie Bertell, John Gofman, Jay Gould and Abram Goldman have assembled evidence linking low-level radioactive pollution with ill health. Many examples of correlation now exist; indeed, the case of the Sellafield leukaemia victims and their fight with British Nuclear Fuels (BNFL) for compensation shows how far these suspicions have become common tender. But it is again clear that there is no point in looking to the Radiation Biologists and Health Physicists to save anybody. Sellafield was highlighted, not by the medical epidemiologists in the public health system, or the NRPB, but by Yorkshire TV. And the first response from the establishment was to set up an inquiry which exonerated radiation.

Many now ask if it is possible that all these mutation-related illnesses are being caused by low-level radiation from radioisotopic pollution by novel isotopes which didn't exist before 1945. Is this not central to the anti-nuclear debate?

Epidemiological findings which support this range from the Alice Stewart childhood cancer study through Sternglass to the latest findings by Gould and Goldman and to the Sellafield and Dounreay leukaemia 'clusters'. But all attempts to implicate low-level radiation in morbidity and mortality sooner or later run on to one of two rocks.

They are the Japanese A-bomb lifetime study, which is largely responsible for

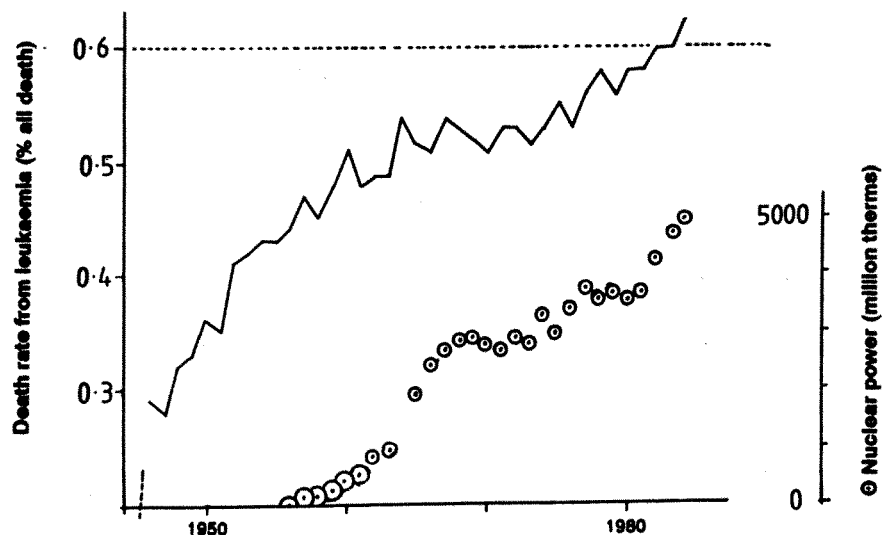


Figure 2. Death rate from leukaemia and nuclear power output, England and Wales

the accepted dose response relationship, and secondly, the natural background radiation (NBR) argument.

Recent work in radiation and cell biology relating to cellular repair mechanisms now suggests how these two arguments are invalid and how errors have become incorporated into the assessment of radiation dose.

### Dose measurement errors

Pollutant doses are, of course, partly received from the chronic internal decay of ingested isotopes; the dose limits and understanding are based on external irradiation in a single acute burst. If there is no equivalence, then such a comparison is meaningless. The Japanese A-bomb survivor study has been questioned on grounds of dosimetry and masking effects. More recently, it has been suggested that the study could not distinguish between irradiated and control groups on the basis of internally ingested isotopes. By the time the study began, 12 years after the bomb, both irradiated and control groups would have had substantially the same level of internal contamination, and if there were any qualitative difference between the chronic doses from this and from external acute irradiation, the study would be invalid and its findings meaningless. Some evidence exists that supports this. Elevated cancer risk amongst the irradiated survivors in Hiroshima, 12 years after the bomb, was found to be either 400% or none at all depending on whether the control group was chosen from Hiroshima or from nearby Miyagi, where weather patterns and mountains resulted in smaller fallout doses. The US 'none at all' study has formed the basis of the present safety case.

Recent research has shown that radiation damage to cells is bypassed by repair mechanisms which clearly have evolved to cope with damage from NBR.

These mechanisms may be extremely effective, but it is important to recognise that the lifespan of mammals correlates well with species resistance to radiation and with each species' repair mechanism efficiency. Both lifespan, and the onset of cancer can be modelled as an opposition between genetic damage and genetic repair. We live as long as we can keep repairing. Although these repair mechanisms can cope with single attacks, they are not designed for a second attack occurring within the repair process itself. This exceedingly improbable event, the '2nd Event', is the origin of an error in the conventional way of assessing radiation dose as acute energy transfer.

### The 2nd-event

Incorporation of genetic damage into cells may be divided into three general phases which follow one another in sequence: misincorporation, repair and fixation. Each is capable of further subdivision. Any sequence of events which involves the initiation of these processes and subsequent attack at a critical point in the sequence has *a priori* higher probability of introducing mutation. For example, it is now well known that cells can be interrupted during their normal lifespan by a sub-lethal pulse of radiation and in consequence suffer a forced repair replication sequence known as G2 arrest. The cell stops what it is doing on receipt of a receptor signal telling it that damage has occurred and sets itself up to repair that damage. This process takes about ten hours and is followed by forced rearrangement of nuclear structure and then cell division.

The existence of a critical period within the repair sequence is confirmed by work with cell cultures which have been given single and split doses of X-rays. Splitting the dose causes a higher yield of cancerous transformation at low

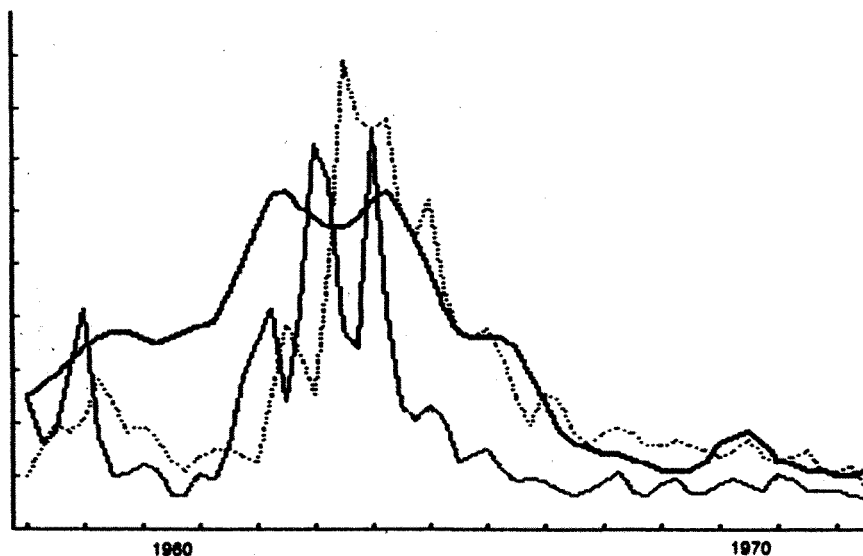


Figure 3. Sr-90 & infant mortality from congenital heart & circulatory system defects.

Heavy line: Infant mortality in England and Wales from congenital heart and circulatory system defects; Full line: Sr-90 precipitation in UK; Dotted line: Sr-90 in milk in the UK

doses than the same dose given in one burst, if the gap between doses is critically within the repair time. It seems that cells can deal with one hit, but not two hits separated by five to ten hours. For external irradiation in the low dose range, the probability of this double hit sequence is vanishingly low.

But there do exist certain novel radioisotopes, called '2nd event emitters', which have specific biochemical affinity for genes, and which have sequential decay pathways. Strontium-90 (Sr-90), a component of fallout and nuclear industry pollution is such a substance. Its atoms bind to chromosomes. They decay twice sequentially, firstly setting up the cell mechanism to repair the damage and then attacking this process at some critical point. Calculation shows that the probability of this sequence from internal Sr-90 is over a million times greater than that from the same dose externally delivered. Such an enhancement of effect upsets any attempt to use energy transfer as a measure of radiation dose and to treat all radiation as the same whether it be external or internal.

This prediction that Sr-90 has enhanced potential for genetic damage is supported by animal studies. In 1962, Luning et al compared Sr-90 with Caesium-137 (Cs-137) by injecting the same small dose into male mice before mating them, within the hour, to untreated females. Many Sr-90 embryos died, but not those of the singly decaying Cs-137, whereas the opposite effect was expected theoretically. These effects continued into embryo offspring of matings of surviving Sr-90 infants. Another study from the 60s investigated Sr-90 effects on rat bone marrow, and showed the occurrence of pathological changes at levels of dose down to one two-hundredth of natural background. A Russian investigation in

1969 showed that small amounts of Sr-90 given to mother rats, caused heart development defects in their offspring. This, therefore, was the likely cause of infant deaths in the Luning study. Later Russian work confirmed the Sr-90 infant mortality effects in wild mice, and although other studies confirmed the enhanced genetic hazard from Sr-90, after 1980, despite there being no resolution of these anomalies, interest disappeared.

If Sr-90 was causing infant mortality in rodents it would support Sternglass' findings for humans. The isotope was a major component of fallout and its concentration in milk increased by a factor of ten then decreased again between 1955 and 1975. On the basis of the rat heart development findings a more specific investigation would look at infant mortality from congenital heart defects. When this is done there turns out to be an excellent correlation (Correlation Coefficient +0.8, Standard Error 0.13) and this is illustrated by Figure 3.

The only attempt to counter Sternglass was Nishiwaki et al who claimed no correlation between fallout and infant mortality in Japan. On close inspection, their argument was that doses were too small to be able to explain the effects. They did not question the existence of an effect; this is strangely like the Sellafield leukaemia defence. "The theory cannot explain it — it cannot exist."

We have recently been looking at another possible echo from fallout. Bone cancer has an age related incidence peaking in the age group 15 to 20. Sr-90 is stored in the bone and causes the disease. A comparison of incidence in Wales with England shows a significant and anomalous increase, peaking in 1984, 20 years after the fallout. Wales had much higher fallout and has remained more

highly contaminated owing to higher rainfall, the presence of the radioactive waste lake at Trawsfynydd and the Sellafield-polluted Irish Sea. According to a leaked CEBG report, the lake contains 25GBq of Sr-90 and 109GBq of assorted plutonium isotopes. Plutonium, another bone-seeking substance, has very recently been shown by scientists working at Harwell for the Medical Research Council to have "infinite biological effectiveness" for the introduction of genetic damage. The waste in the cooling lake at Trawsfynydd exceeds the statutory defining level for low-level waste by a factor of ten and in quantity is greater than all the low and intermediate-level waste being disposed of by Nirex.

If external and internal radiation are not equivalent, and if internal irradiation hazards depend upon both biochemical affinity and fractionation in time of sequential doses, the famous radiation dose pie chart which compares natural radiation with man-made medical and nuclear power pollution and so forth needs major readjustment. Continued use of the NBR as a baseline for hazard or the use of A-bomb acute studies to define dose response relationships, whether linear or quadratic or extrapolated, however, is clearly unsafe and must be urgently reconsidered. If we have shown theoretical reasons, based on known cell cycle behaviour, why certain isotopes should have enhanced hazard; and if we have looked at these predictions, firstly in animal studies and then in human populations and found confirmation then all the presently accepted dosimetry for internal isotopes is suspect.

## The campaign

The Wales Green Party campaign is based on a booklet,\* commissioned by the Wales Green Party and financed, in part, by the Wales Anti-Nuclear Alliance. The booklet reviews the evidence for links between illness, death and low-level nuclear pollution and has been sent to councils, MP's and opinion formers as a counterweight to the nuclear industry propaganda. The campaign calls for an independent (of the nuclear establishment) investigation and for more recent cancer incidence data to be made available. It asks for a moratorium on nuclear power and reprocessing until the results of the inquiry are known; and finally, it demands the immediate fencing and exclusion of the public from Trawsfynydd lake, the most radioactive lake in Europe. □

\* "Low-level radiation from the nuclear industry: the biological consequences" by Chris Busby. 23pp; £2 (inc p&p) from Green Audit (Wales), Ivy House, Mallwyd, Machynlleth, Powys SY20 9HJ. A fully referenced version of this article is available from SCRAM (75p inc p&p).



Controversy continues over high incidences of leukaemia around nuclear sites, with the nuclear industry denying responsibility. PETE ROCHE of Greenpeace considers a new study around the Aldermaston and Burghfield nuclear weapons establishments which has similar findings to the 1990 Gardner report on Sellafield.

## New leukaemia link

A new study carried out by a team led by Dr Eve Roman and published in the *British Medical Journal*\* has found a similar association between the risk of childhood leukaemia and employment in the nuclear industry to that found by Professor Gardner in 1990 (SCRAM 76) at Sellafield. It suggests that occupational exposure to radiation prior to conception increases the risk of a subsequent child developing leukaemia by 9 times.

In March 1987 Roman et al published a detailed study of childhood leukaemia. The study concluded that there was a statistically significant excess of leukaemia amongst children aged 0-4 during the period 1972-85 within a 10km radius of Aldermaston and Burghfield.

The Committee on Medical Aspects of Radiation in the Environment (COMARE) examined Roman's first study, confirming the excess of childhood leukaemia. It also looked at data from the National Registry of Childhood Tumours maintained by Oxford's Childhood Cancer Research Group and discovered a statistically significant increase for other childhood cancers in the age group 0-14 over the period 1971-82.

However, when it looked at the authorised and accidental discharges from the two plants it concluded that they were too low to account for the increase in cancers — but could not "exclude completely the existence of some hitherto unknown and unexpected route by which some individuals could be exposed to increased levels of radiation." COMARE recommended that "such speculative pathways, including those of radiation workers, should be explored".

However, Gardner's results at Sellafield implied that there must be a second causative effect (possibly environmental radiation). The children who contracted leukaemia, and whose fathers worked at Sellafield, tended to live at Seascale on the shore front.

The new Roman report studied 54 children aged 0-4 years with leukaemia or Non-Hodgkin's lymphoma diagnosed during 1972-89 in the area around Aldermaston and Burghfield.

Roman et al conclude that: "The results of this study suggest that the children of fathers who had been monitored for exposure to external penetrating ionising radiation in the nuclear industry may be at an increased risk of developing leukaemia."

The highest relative risk (an increase of between seven and eight-fold) discovered by Gardner was associated with external

gamma radiation exposure of over 100mSv to the fathers. The external doses recorded at Aldermaston are less than 5mSv — although Ministry of Defence (MoD) record keeping leaves something to be desired.

The MoD argues that these doses are too low to cause any effect. They are also keen to highlight Roman's conclusion that "because the numbers are small ... the results could be due to chance".

However, Professor Nick Day, a well known radiation epidemiologist, believes that "chance seems an unlikely explanation" and that "it is very likely that fathers in the nuclear industry who were being exposed to one type [of radiation] which was being recorded by the badge would also be exposed to radiation of other types such as neutrons or ingested radionuclides."

After COMARE's investigations around Sellafield and Dounreay, it concluded that the evidence of a raised incidence of leukaemia at both sites "tended to support the hypothesis that some feature of these two nuclear plants leads to an increased risk of leukaemia in young people living in the vicinity."

### Beyond Gardner

Roman also comments that there are a large number of leukaemias in the Aldermaston and Burghfield area not explained by the Gardner theory. In other words the number of children with leukaemia whose fathers work at Aldermaston "was insufficient to account for the increased rates of leukaemia in the area". Roman's first study found 29 children with leukaemia in the 0-4 age group between 1972 and 1985, whereas only 14.4 would have been expected. The new study doesn't give the number of expected cases in the 1972-1989 period, but out of 54 children with leukaemia and non-Hodgkin's lymphoma, at most 4 had fathers exposed to radiation at work.

There could, therefore, be several factors at work. The Sellafield data suggests that children who become genetically predisposed to contracting cancer when their fathers have been exposed to radiation at work still require an environmental radiation dose before contracting leukaemia.

COMARE's investigations at Aldermaston and Burghfield did not use environmental monitoring to estimate doses to the population, unlike its investigations at Sellafield and Dounreay, because: "The extent of environmental monitoring around Aldermaston and Burghfield has varied over the years ... no environmental monitoring was carried out by the Atomic Weapons Research Establishment between 1960 and 1978."

The Atomic Energy Research Establishment at Harwell carried out some monitoring for COMARE. Levels were generally found to be low. However, only 12 samples were taken within 0.5km of each site and one distant point (5km) from each site. "This additional information on environmental monitoring data ... is not sufficient to enable dose estimates to be calculated, nor can it be used to verify NRPB (National Radiological Protection Board) models. Further, more detailed sampling programmes around the sites would be needed to address [these] questions."

COMARE, therefore, used figures supplied by the MoD on discharges to the environment by Aldermaston and Burghfield to estimate doses to the population. It concludes that the discharges "are so low that the magnitude of this uncertainty would have to be particularly large to make any appreciable difference in the estimated dose".

However, during the Sellafield Childhood Leukaemia Court Cases currently underway it has emerged that estimated plutonium discharges from Sellafield have in some cases been four times higher than previously thought. The discharge data for Aldermaston will, similarly, have been underestimated. It could be re-calculated using the correction factors calculated for Sellafield.

Professor Stephen Jones of BNFL told the Court that "Measurements of radioactivity in the environment are the most satisfactory starting point from which to make estimates of radiation exposure to the public".

It is therefore urgent that an extensive radiation monitoring programme is carried out and should include monitoring within the boundary fences. (No information on environmental monitoring inside the Aldermaston and Burghfield sites is currently made public).

It is clear that working at Aldermaston or Burghfield does not explain the entire excess of cancers — there must be another factor at work. The one factor that Aldermaston, Burghfield, Dounreay and Sellafield have in common is plutonium.

Whilst further studies are important to determine the role played by plutonium, it should be declared 'guilty until proven innocent'. The production and use of plutonium should cease immediately. It is time to start cleaning up the legacy of Britain's love affair with the Bomb. □

\* "Case-control study of leukaemia and non-Hodgkin's lymphoma among children aged 0-4 years in West Berkshire and North Hampshire health districts." *BMJ* 6 March 1993.

Taken as a whole, renewable energy is a very large subject and it takes a big book to cover all the aspects of all the technologies encompassed by this subject: so it is not surprising that "*Renewable Energy: sources for fuels and electricity*" is a big book. Dr NIGEL MORTIMER of the Resources Research Unit at Sheffield Hallam University assesses this 1,160 page renewable-energy Bible.

## Bright prospects for renewable energy

**W**ITHIN *Renewable Energy*, the technical, resource, economic and environmental factors for almost all the most promising renewable energy technologies are examined, by individual expert authors, in extremely impressive detail.

The technologies considered include hydro, wind, solar-thermal electric, solar photovoltaics, tidal, wave, ocean thermal, geothermal, biomass solid fuels, biogas, liquid fuels from biomass and solar hydrogen. Unfortunately, the list is not quite complete because passive and active solar heating seems to have been excluded from proper coverage. However, as the potential contributions of renewable energy technologies are set within the context of a comprehensive assessment of future energy supply and demand, it may be that solar heating is regarded as an implicit aspect of the significant energy efficiency improvements incorporated in the adopted scenario.

### Energy scenarios

As an extensive catalogue of renewable energy technologies, this would be considered to be a very useful work of reference. However, *Renewable Energy* goes beyond this by including an interlinking introductory chapter on the potential role of renewable energy sources in world energy supply up to the year 2050. The book was commissioned by the United Nations Solar Energy Group for Environment and Development in 1990 as an input to the UN Conference on Environment and Development in Rio in 1992. The underlying rationale of the work is that attaining sustainable development requires "new policies or programs, as appropriate, to increase the contribution of environmentally safe and sound and cost effective energy systems, particularly new and renewable ones, through less polluting and more efficient energy production, transmission, distribution and use." Although the nuclear lobby has attempted to steal a place in this new energy scene, it is the renewable technologies which are rightly cast as the stars.

Their contribution is established by referring to an energy scenario

developed by the Response Strategies Working Group of the Intergovernmental Panel on Climate Change. Here the growth in energy demand is moderated by energy efficiency gains, providing an eight-fold increase in world economic output by 2050. Over this period, a 123% increase in primary energy consumption is forecast while carbon dioxide emissions fall from present levels by 26%. The reason for this is, principally, that a renewable-intensive strategy is adopted to meet growing energy demands in an environmentally-acceptable and sustainable manner. For the convenience of analysis, energy supplies are separated into electricity and direct fuels, which include solid and gaseous heating fuels, and liquid transport fuels. By 2050, it is envisaged that renewables could provide 60% of world electricity generation, compared with 21% at present, and 42% of direct fuel, in comparison with their current contribution of only 2%.

Obviously, major changes in patterns of energy supply and demand are implied by this scenario. Some of these changes might be regarded as questionable. For example, a substantial shift from direct fuels to electricity is assumed by the middle of the next century. At the moment, electricity accounts for about 20% of primary energy consumption but, by 2050, it is assumed to equal almost half the total. Additionally, over the same period, the use of natural gas for electricity generation is envisaged to jump by over 600% whilst general fossil fuel consumption declines. The lower environmental impact of natural gas is the important consideration behind this assumption, but it remains to be seen whether adequate low-cost reserves in suitable locations will be available to support the wasteful use of such a convenient fuel in electricity-only generation.

There may also be a more fundamental unease about the illustrative energy scenario adopted by the authors. Although not a forecast of what will happen, a scenario approach must incorporate some assumptions about what life will be like in the future. This energy scenario must do this and, in keeping with so many others, seems to concentrate on energy demands rather than the services actually required by

energy consumers. Hence, it could include the possibly flawed assumption that future needs will be much as those of the present, only distributed fairly amongst all the world's population instead of just amongst our rather privileged selves. Obviously, all scenarios must include some basic assumptions but, when these are formulated, it is instructive to examine how the future looked to those as far back in time as the projected period of the scenario under consideration. This scenario projects almost 60 years into the future and yet it is hard to believe that our forebears in 1930 could have imagined the nature of the world that we currently inhabit. For example, one popular and prominent visionary, H. G. Wells speculated in *The shape of things to come*, which was published in 1933, that our present most pressing concern would be transport; but air not motor transport! This demonstrates the problems facing all forecasters and scenario-builders; the future is neither embodied wishful thinking nor a simple extrapolation of the past or present.

### Scenario building

Of course, present day forecasters have computers which extend the number of calculations performed, adding detail but not necessarily accuracy. Because of past failures, forecasting has become unfashionable and has been replaced by the more cautious art of scenario building. Used correctly, this involves formulating a desired possible outcome and, most importantly, determining the conditions which will bring about this outcome. This is partly the approach adopted in *Renewable Energy*. Considerable attention is given to the policies, strategies and developments essential to a renewable-intensive strategy. In particular, thinking on environmental economics (though not referred to as such) is used as a means of redressing the balance away from environmentally-damaging sources of energy, implicitly, favouring most renewable energy sources. Thankfully, *Renewable Energy* goes further than just evoking environmental economics as a theory which will magically transform the prospects for renewable energy technologies. Instead, in an agenda for action, a preliminary look is taken into how environmental economics might be applied in practice,



through taxation, the removal of subsidies, etc, to internalise the costs of the environmental damage caused by conventional energy sources. Whilst such ideas need to be developed further, this is an essential step in translating academic theory into workable action.

## Economics

Although these and other policy measures are important, the most fundamental factor which will probably determine whether the renewable-intensive strategy becomes reality is the comparative conventional costs of renewable energy technologies. In essence, these technologies are more likely to be used if they are demonstrably cheaper than competing sources of energy. This essential consideration is dealt with quite extensively in *Renewable Energy*, as may be illustrated by examining the specific economic prospects for wind power, solar photovoltaics and the production of methanol liquid fuel from biomass. These technologies are selected here because they are probably the most important individual renewable energy technologies included in the renewable-intensive strategy.

Both wind power and solar photovoltaics are regarded as intermittent renewables which, along with other sources, are projected to supply 30% of world electricity generation by 2050. A 62% reduction in the unit cost of electricity produced by wind power in California between 1985 and 1990 is used to demonstrate the improving prospects for this technology and a further fall of 60% is expected by 2020. However, such expectations, just as those of the early advocates of nuclear power, can amount to no more

than articles of faith unless based on a thorough analysis of the factors which govern costs. In the case of wind power, expected lower costs arise from reductions in the capital, operating and maintenance costs, and increased electrical output. Reduced capital costs are expected to be achieved because of the use of lighter weight materials and improved designs which result in lower manufacturing costs. Reduced operating and maintenance costs derive from the virtual elimination of replacement parts due to better component design and production techniques. Higher electrical output is expected from improved aerofoil designs and the adoption of variable speed systems. One factor that fundamentally reduces capital costs per unit output is the assumption of economies of scale with larger machines, although it should be noted that cost modelling work for the Energy Technology Support Unit does not appear to support this expectation.

Solar photovoltaics are devices which convert sunlight directly into electricity. Although initially very expensive devices for generating electricity in remote locations and special circumstances, a three-fold reduction in photovoltaic module costs has been observed between 1976 and 1990. A further eight-fold fall in module costs, resulting in an 85% fall in unit costs for electricity, is envisaged by 2010 for polycrystalline thin-film photovoltaics which are considered by some to be the most promising form of this technology. The factors which are expected to cause this unit cost reduction are an increase in electricity conversion efficiency from 10% to 15% due to the use of new materials, and economies of scale in module manufacturing which arise from a growing market for photovoltaics.

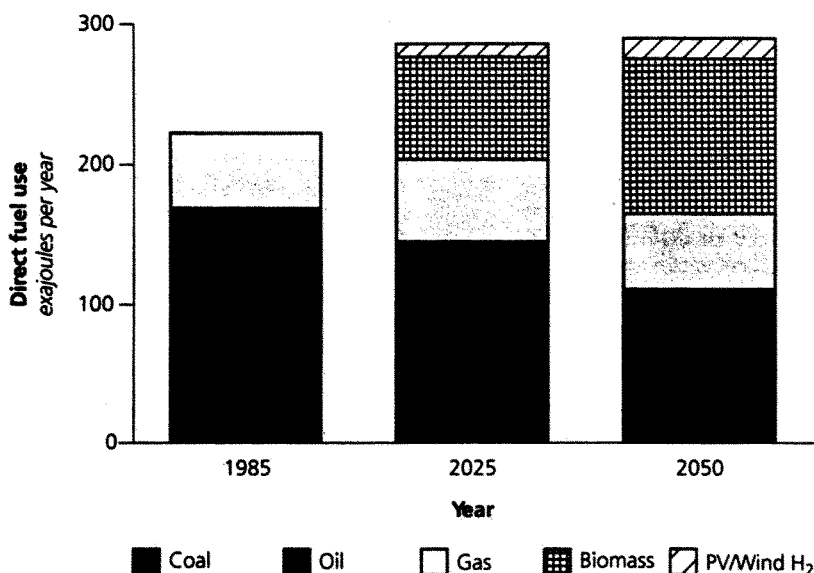
Although *Renewable Energy* tends to concentrate on electricity-generating renewable energy technologies, the production of liquid transport fuels, specifically methanol, from biomass is a very important component of the renewable-intensive strategy. Indeed it is assumed that methanol would provide almost half the world's liquid fuel supplies by 2050. This is one area of the book where the use of different authors for different aspects of renewable energy technologies does cause problems. Given this approach, it is not possible to achieve a wholly comprehensive assessment of this technological option and it suffers by being less convincing. Biomass production and conversion to useful fuels are tackled by separate authors and it is not easy to form an overview of the economic prospects of biomass-derived liquid fuels.

This problem is compounded by the fact that it would probably be necessary to write another book of the same length just to cover the different sources of biomass which could be used in the future. These problems apart, it seems that methanol from biomass is regarded as cheaper than its main competitors in the 21st century. However, these competitors are methanol from coal or natural gas which are more expensive than current supplies of petroleum. The inherent assumption, on which this economic comparison is based, is that "the production of petroleum is expected to decline in most regions outside the Middle East in the decade ahead ..." In other words, cheap petroleum may not be available as a major transport fuel in the next century. Some oil economists may question this rather fundamental assumption.

## Essential reading

In this review, it has only been possible to convey an impression of the wealth of useful information available in *Renewable Energy*. The book has its limitations and, undoubtedly, its fair share of minor errors. Some aspects are open to question and debate. However, its potential use as a catalogue and major work of reference on renewable energy technologies cannot be overstated. However, it is more than this. It is a statement of intent for the prospects of renewable sources of energy as a major component in global sustainable development. It provides a vision to guide our aspirations and, as such, should be part of the essential reading of anyone concerned about our energy future. If you cannot buy it, borrow it! □

\* "Renewable Energy: sources for fuels and electricity" edited by Thomas B. Johansson, Henry Kelly, Amulya K. N. Reddy and Robert H. Williams. Earthscan Publications, £30 paperback.



Electricity generation for the renewables-intensive energy scenario

The government and the nuclear industry have failed to develop responsible management strategies for the UK's growing legacy of nuclear waste. This failure derives from the current institutional structure of the nuclear industry which, argues Friends of the Earth's senior energy campaigner SIMON ROBERTS, the government must alter if effective policies are to emerge.

# British Nuclear Heritage

**T**HE management of the UK nuclear power programme's economic and environmental legacy is in a deep crisis. A crisis dominated by five increasingly serious problems:

- the economic, environmental and waste management justifications offered by British Nuclear Fuels plc (BNFL) for the reprocessing have been discredited, and the environmental and health impacts of the Sellafield facility are a cause for increasing concern;
- UK Nirex Ltd, the body to which the nuclear industry has delegated the task of establishing a 'disposal' route for low and intermediate-level nuclear waste (LLW and ILW), has failed to do so, in spite of ten years' sustained effort;
- credible long-term strategies have yet to be formulated for decommissioning any of the UK's nuclear power stations or for the long-term management of the high-level nuclear waste arising from reprocessing;
- all but one of the seven operating Magnox stations are beyond their 25-year design life, producing vast quantities of nuclear waste, and distorting the post-privatisation market in electricity supply – the latter is also true for several of the AGRs, notably Dungeness B and Hartlepool;
- the UK's plutonium stockpile now stands at about 30 tonnes and, if the Thermal Oxide Reprocessing Plant (Thorp) is allowed to open, will be 65 tonnes by 2005.

That there are problems is not in question,<sup>(1)</sup> what is in question is whether the Government and the nuclear industry have a coherent strategy to address these problems. Clearly, they have not. Indeed, the current institutional structure of the nuclear industry exacerbates these problems rather than addresses them.

The continuation and expansion of reprocessing at Sellafield, represented by the government's decision in 1978 to allow BNFL to build Thorp, was based on two outdated assumptions: that plutonium was a valuable fuel for the imminently commercial Fast Breeder

Reactor (FBR); and that reprocessing was the most attractive spent fuel management option available.

The UK's FBR programme has been abandoned, after nearly four decades and more than £4 billion. Similar failures are being experienced with FBR development in other countries.

In terms of spent fuel management, reprocessing operations increase the volume of nuclear waste (compared with the spent fuel input) by more than 100-fold and produce waste forms which are more difficult to handle and more unpredictable in their behaviour. Nearly 60 per cent of nuclear waste arisings in the UK over the next 40 years will be produced at Sellafield if reprocessing is allowed to continue.

Scottish Nuclear Ltd, in common with nuclear utilities in other countries, has turned towards spent fuel storage as its favoured management option instead of reprocessing. Environmental groups have long recognised the use of such facilities as the 'least worst' option for spent fuel management.

Yet, BNFL still claims that the new Thorp plant will be economically viable. However, BNFL's calculations ignore the increasing risks of losing income due to the cancellation of foreign contracts, underestimate the likely cost of meeting tougher future radiological protection standards, and are wildly optimistic in 'guesstimating' the decommissioning costs. Moreover, the issue of what radioactive waste associated with reprocessing foreign fuel should be returned to the country of origin remains unresolved.

## Nirex

In spite of 10 years of effort, Nirex has failed to develop acceptable proposals for the management of low and intermediate-level waste. Moreover, Nirex has developed a distinct and worrying tendency, particularly in relation to the proposed Sellafield repository, to press ahead in advance of (and often in spite of) scientific evidence. This has undermined the authority of its own technical experts and created legitimate distrust amongst the potential host community.

The nuclear industry denies this, claiming to have 'technical solutions'. Such claims underestimate the problem of hydrogeological site data which are inconsistent with Nirex's theories and conspicuous technical problems dealing with gas generation within an underground repository.<sup>(2)</sup>

The nuclear industry also believes the public is misinformed, misreading genuine and rational public distrust and concern for ignorance. As long as Nirex is owned by the industry and the industry openly identifies a need to 'solve' the waste problem in order to secure an expansive future, the public has every reason to suspect that Nirex is acting in the industry's interest rather than in the interests of environmental protection and long-term public safety.

## Magnox

Of the seven remaining Magnox stations in operation in the UK, only Wylfa has been operating for less than its 25 year design life. The observed long-term effects of irradiation on welding in the Magnox reactor pressure vessel has given rise to serious safety concerns, and has led to the suspension of operation at the apparently worst affected, Trawsfynydd.

In addition, the avoidable costs of continued operation are higher than the costs of substitute power sources. The continued operation of the Magnox stations is thus distorting the electricity market, causing higher electricity prices.<sup>(3)</sup>

Their continued operation will also result in continued prolific nuclear waste production. Lord Marshall of Goring, former chairman of the Central Electricity Generating Board, has said that Magnox stations produce "a remarkable amount of nuclear waste per unit of electricity."<sup>(4)</sup> Adding that the British Magnox programme "has probably produced more radioactive waste than all the rest of the world put together."<sup>(4)</sup>

This prolific production record can be expected to rise by at least 20% if operating lives are extended to 30 years. Using figures derived from nuclear industry sources,<sup>(4)</sup> FoE has estimated that extending the lives of the remaining



Magnox stations to 30 years will generate 14,000 m<sup>3</sup> of ILW, for which no disposal route exists. There will also be significant production of waste at Sellafield from reprocessing the additional spent fuel.

According to nuclear industry estimates of waste management costs, this could increase the bill for managing the legacy of nuclear waste in the UK by £560m.<sup>(4)</sup>

## Decommissioning

Understanding of the problems connected to decommissioning nuclear stations is currently in its infancy. Given the timescales involved and the fact that no commercial scale nuclear reactor has ever been fully decommissioned this is hardly surprising. Decommissioning strategies proposed to date reflect this uncertainty and ignorance, though they completely fail to acknowledge it. The nuclear industry's decommissioning strategy has gone full circle in the last decade.

Rather than clear sites and, as originally promised, return them to 'green-field' status, Nuclear Electric (NE) now wants to leave the reactor core on site under concrete and a landscaped mound of earth. No safety case has been published for this strategy and most justifications for it are couched in terms of financial savings. However, it should be noted that the nuclear industry's own experts told the Sizewell B Inquiry that such a plan would be 'unacceptable'.<sup>(5)</sup>

Like other decommissioning strategies, this latest plan fails to recognise that decommissioning is essentially a nuclear waste management problem – how to isolate the highly radioactive reactor body from the environment for the long timescales necessary. NE is presenting its 'solution' without acknowledging either the nature of the problem or the limited extent of knowledge about the long-term containment properties of concrete and earth.

## Institutional inertia

Nuclear waste management policy and decommissioning strategy in the UK are, in essence, in the hands of the nuclear industry. While the government may lay down broad principles and objectives, the industry is itself in the driving seat.

However, the industry appears to be convinced that its failure to demonstrate 'safe disposal' of nuclear waste is behind negative public opinion on nuclear power. There is, therefore, a clear conflict of interest between: the optimal nuclear waste management strategy in terms of public safety and environmental protection; and the industry's desire to present a 'solution' to its waste problem.

As outlined above, there is reason to believe that this conflict of interest has already shaped Nirex's operations and plans. Indeed, the waste management strategy developed to date by Nirex appears to be shaped more by a desire to win public approval than by scientific analysis of empirical data. The same can be said of NE's latest decommissioning proposals.

The nuclear industry's continued commitment to reprocessing and its absurd presentation of this as the 'best management option' appears designed to defend the nuclear status quo rather than establish the optimal waste management strategy. Likewise, with the continued operation of the Magnox stations which will significantly (and expensively) increase nuclear waste arisings.

This conspicuous and consistent choice by the nuclear industry in favour of its own interests, rather than those of the environment and the public, exposes the inadequacy of the current arrangement. Unless the responsibility for planning the management of nuclear waste is separated from the waste-producing activities this choice will continue to be made.

Change can happen only by government-driven reform within the nuclear industry itself. The recommendations below should achieve the necessary outcome by creating a new body of waste handling and decommissioning expertise that would itself no longer be contributing to the nuclear legacy.

## Recommendations for reform

The following measures are proposed for institutional and policy reform:

- Stop BNFL opening Thorp and phase out the reprocessing of Magnox fuel (stopping the 'production' of nuclear waste at Sellafield, in effect removing it from the 'nuclear industry').
- Establish Sellafield as a centre for excellence in nuclear waste management and decommissioning.
- Disband Nirex and give its responsibilities for waste management, and the responsibilities of NE and SNL for decommissioning strategy, to a newly constituted body which runs Sellafield under the auspices of the Department of Environment.
- Shut down the Magnox stations by the end of 1993.
- Institute a major programme of public consultation to establish criteria to guide the development of a coherent UK decommissioning and waste management strategy.

The new body would be independent of the nuclear industry, as the 1976 Flowers report recommended.<sup>(6)</sup> It must be given free rein to start from scratch on nuclear waste management strategies, with a comprehensive approach encompassing all aspects of nuclear waste. This would include: high-level waste and plutonium management; strategies to minimise waste arisings; examination of the rationale for reprocessing; the decommissioning of old reactors, submarines and other irradiated civil and military equipment. 'British Nuclear Heritage plc' would appear to be a suitable moniker.

The new body must start from the assumption that public consensus is a necessary precondition of success and can only be built on involvement and consultation rather than diktat, exclusion and secrecy. It also requires the official acceptance that finding an accepted strategy for managing waste does not, in itself, justify further production of waste.

That means building up slowly on the basis of open public debate and discussion of the criteria for measuring the success of waste management strategies. This should be followed by an examination, in public, of all options against those criteria.

In this way, the UK may find a method of dealing with its nuclear legacy which is built on a foundation of public understanding, trust and a sense of responsibility to future generations. Without this, the management of nuclear waste in the UK will continue to be a litany of confrontation and suspicion and, above all, failure. □

## Notes and References

- (1) Briefing material on these problems is available on request from Friends of the Earth Energy and Nuclear Campaign on 071 490 0224.
- (2) For further discussion of this issues, see S Roberts, Dr P Green and R Western (1992) "The Public Requirement to Demonstrate Safety: Where Nirex keeps going wrong and why" paper to IBC Conference Radioactive Waste Management and Decommissioning, Cambridge, July 1992. Available from Friends of the Earth Energy and Nuclear Campaign.
- (3) For more detail see "Energy for a Future: Friends of the Earth's evidence to the Government's Review of Energy Policy," FoE, November 1992, sections 4.1.3 and 4.4.2.
- (4) Lord Marshall (1990) "Memorandum submitted by Lord Marshall of Goring on evidence by Mr Gordon Mackerron", in House of Commons Energy Committee (1990), *The Costs of Nuclear Power, Fourth Report, Session 1989-90, Vol II*, p 165.
- (5) Sizewell B Public Inquiry, Transcript of Proceedings, Day 273, 12 October 1984, page 18F.
- (6) Nuclear Power and the Environment, Royal Commission on Environmental Pollution, Sixth Report, HMSO, London, 1976.

With energy efficiency having a crucial role to play in meeting international carbon dioxide abatement targets, Andrew Warren, the director of the Association for the Conservation of Energy, believes that European Community measures are failing to deliver energy savings.

# The rise and fall of SAVE

**B**ETWEEN 1974-84, across the European Community, energy efficiency improved by an average of 20%. This meant producing more wealth for the same — or even less — amounts of fuel consumed. It reduced the number of new power stations, gas and oil fields. Over the same period, however, Japan improved by 34%.

Now a further 20% savings target — set by the Community for 1985-1995 — is being allowed to slip. Investments in improving energy performance have declined — in some countries dramatically. Between 1985-1990 a meagre 7% overall improvement was achieved. The European Commission has noted: "If current trends in the consumption and efficient use of energy continue, there is little hope of the Community achieving its 1995 objective of improving by 20% the efficiency of final demand. Failure to achieve this will have serious consequences for energy supply. European Competitiveness ... and the environment."

The SAVE programme (Specific Actions for Vigorous Energy Efficiency) was the attempt by the Commission to reverse this trend.

In 1990, the European Community emitted 2,738 million tonnes of carbon dioxide (CO<sub>2</sub>). When stabilisation by 2000 was originally agreed in October 1990, the anticipated business-as-usual increase was 11%.

Simultaneously, East Germany joined the Community. Incorporating it, and acknowledging 4% growth in CO<sub>2</sub> emissions in the old Community during 1991 alone, the EC now estimates an increase of 14% in CO<sub>2</sub> levels by 2000 (based upon 2.4% GDP growth). Because of its acknowledged inefficiency, the EC now assumes that East Germany's CO<sub>2</sub> emissions will decrease substantially (by 20 million tonnes over the decade), thus bringing the anticipated EC growth back to 12%.

However, SAVE's original conception dates back further. It goes back to a

paper produced on May 13th 1987, entitled: "Towards a Continuing Policy for Energy Efficiency in the European Community" (COM87223). From this was developed the new programme entitled SAVE. Nobody should doubt the considerable expectations made for this programme.

For instance, in a proposal for a Council decision issued by the Commission on May 12th 1989, in paragraph 15 it is stated quite specifically that "a realistic target for SAVE would be to maintain energy consumption in 2010 at the 1988 level".

At the Council meetings on 31 May and 1 October 1990, the Council of Ministers expressed favourable opinions about the SAVE programme, and called for it to be formally adopted as soon as the opinions of the European Parliament had been received.

## Building measures

On 13 November 1990, a "proposal for a Council decision concerning the promotion of energy efficiency in the Community" (COM90/365 final) was sent to the President of the Council. This document set out in considerable detail all the proposed directives under the SAVE programme. They fell under three different headings: Technical measures; financial and taxation measures; and measures relating to user behaviour. Under technical measures, particular concentration was placed upon the building sector, which uses over 40% of final energy consumption — an irony bearing in mind the subsequent subsidiarity arguments dredged up to kill off SAVE.

In Annex 1 of that document, which was criticised by the Parliament for having insufficient finance and ambition, a chronology of legal actions and standards was included. This detailed very clearly some 13 different areas which were to be covered in each half year, beginning in the second half of 1990 with building

certification, heat generator standards, and heat metering on the basis of actual consumption; and closing in the second half of 1992 with motor vehicle performance requirements and minimum standards for a range of domestic appliances not previously covered.

Subsequently, on various occasions, a variety of different members of the Parliament asked the Commission about the progress — or rather lack of it — of many of these promised legal actions.

Meanwhile time moved on. On 16 October 1991, the Commission formally adopted its key strategy paper for the community to limit CO<sub>2</sub> emissions and improve energy efficiency. In practice, versions of this paper had been widely circulated for much of the previous six months.

According to Annex 6 of this document, the total additional savings from SAVE would be 15% of the 526.4mtoe (million tonnes of oil equivalent) required for the reduction in CO<sub>2</sub>. However, as a footnote, it was added that "it has to be noted that the impact of some SAVE measures are already included in gains from the market and other policies".

In paragraph 14 of this key document, it stated quite specifically that "a set of regulatory measures will need to be developed ... many of these are covered to some extent by Commission proposals like the SAVE programme, but will need to be strengthened".

Within these sectoral measures, there were due to be sections on power generation including a promise for a new proposal on least cost planning; industry; transport; and household/commercial. On all of these further regulatory measures were promised.

The final statement of the original SAVE programme was prepared under the Council decision 91/565/EEC and was placed in the official journal on 30 January 1992



(92/C23/04). This provided a short description of the SAVE programme, as originally proposed by the Commission in its document (COM90/365) to which I referred earlier, which was amended by the European Parliament at its session in July 1991.

The clock ticked on. Early in 1992, the Rio summit was looming. The Commission wanted to have a substantial presence at the conference, to demonstrate that it was leading the field. The "carbon strategy" announced the previous year had inevitably focused on the novelty of the proposed new carbon/energy tax. This was to be the Big Idea the EC would take to Rio.

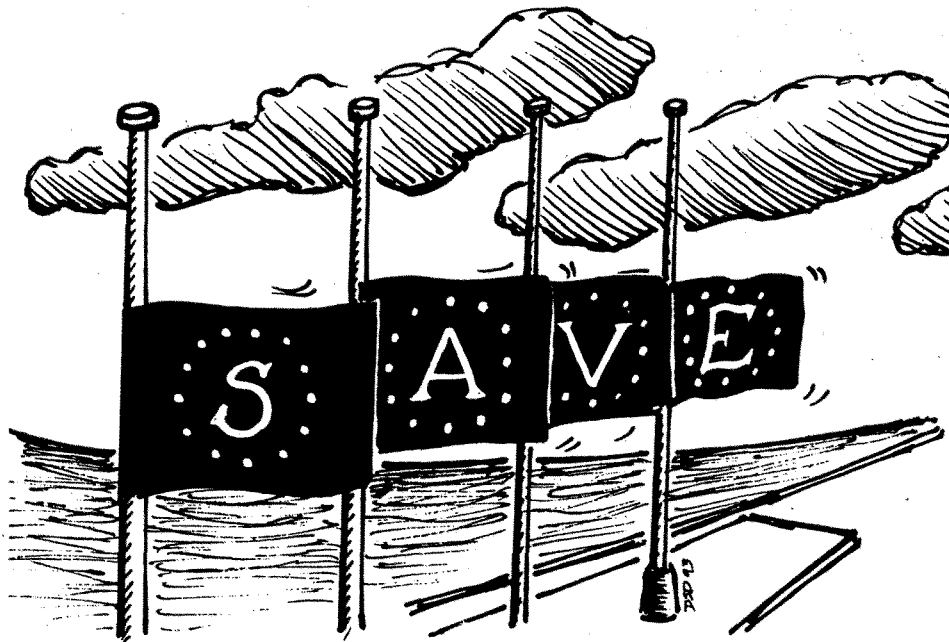
To its proponents the Tax had become a kind of macho-symbol for the true environmental believer. Other parts of the Commission were less convinced. But in a massive bargaining session in Chefs de Cabinets meetings in late April and early May, a deal was struck. The Tax would be endorsed — with the familiar caveats of "conditionality" and "opt-outs". But as a quid pro quo, the relating programmes SAVE and its sister for renewable energy, ALTENER — were effectively emasculated, under the convenient guise of subsidiarity.

### Horse trading

In practice, this was far more an example of good old-fashioned power politics horse trading. Which did the environment part of the Commission want most — a series of detailed, technical, almost mundane initiatives, which individually might seem pedestrian, or a Big Idea? No matter that on their own figures SAVE could contribute every bit as much as the Tax could (3% each, of the savings target). It was duly sold down the river. The concept of a super SAVE programme, championed only months before, was conveniently forgotten.

So now what do we have? Instead of a series of binding directives, the Parliament now has before it a paltry document. I gather now even the legality of this is being challenged by the Council, who say the Article should be the portmanteau unanimity Article 235, not 130 S as proposed.

But claims are still being made that SAVE will save 3% of emissions and that it will cut 61 million tonnes (rather than 77.8 million tonnes as before) —



which will apparently be "primarily achieved" by this paltry proposal. But nowhere does it specify what Member States will do in detail. The actual standards, even the timing are left up to them.

Let us take two examples, for both of which I have in my possession the original drafts which the Commission had prepared. They bear no resemblance whatsoever to what is now being placed upon the table. Take third party financing: to satisfy Article 4, Member States are merely asked to take the necessary measures to "favour third party financing for investment". What are those necessary measures? Will they be satisfied merely by issuing a few leaflets? Certainly, there is nothing binding whatsoever within this Article regarding specific actions. Then take energy certification in buildings: Member States are merely asked to take appropriate measures "in order to progressively" bring such certification into effect. By when? No firm time-table is suggested.

Under Article 189 of the Treaty, it states quite specifically that "a directive shall be binding as to results to be achieved upon each Member State to which it is addressed". I submit that the Parliament's legal services should consider: is this a Directive? Or is it just a Recommendation? There are no target results specified, certainly no quantifiable ones. It is a completely ill-defined document.

After two years, Member States are supposed to report upon progress. In theory, the Commission could then

prosecute under Article 169 for lack of activity. But how are they to argue that there has been non-compliance if there have been no targets set and no dates.

This is truly a test case for 'subsidiarity', to see whether Member States are genuinely delivering their part of the bargain. The auguries are not good. Back in 1990, every Member State said that they would provide the Commission with details of their CO<sub>2</sub> abatement plans. At subsequent Council meetings, it has been agreed over and over again that all Member States should try to do so. But even now, not every Member State has yet provided details of even their aspirations, let alone their detailed plans.

How can we know how the Community is doing, in working towards its agreed carbon targets, if we do not know how its component parts are faring? The long-promised monitoring mechanism is desperately needed.

Energy Conservation is the cheapest, swiftest, most effective means of achieving targets. Such a statement has become almost a mantra for everyone examining this issue. It is agreed that to achieve our objectives we need a regular 2.5% per annum improvement in energy efficiency. At the moment, we appear to be going backwards — in many places we are actually becoming more inefficient by the year. And yet the potential is so great, as the original SAVE programme set out so lucidly: "a realistic target for SAVE would be to maintain energy consumption in 2010 at the 1988 level". □

There is increased interest in combined heat and power development throughout the UK as a result of the structural changes brought about at privatisation of the electricity supply industry. GRAHAM STEIN looks at plans to bring CHP to Edinburgh.

# Edinburgh plans CHP

**E**DINBURGH looks set to develop combined heat and power (CHP) eight years after Scotland's capital was made one of the UK's three CHP 'lead cities'.

With a lack of support from government or the electricity industry, the UK has been slow to utilise the waste heat of electricity generation. Converting fossil or nuclear fuel to electricity has a thermal efficiency of only around 35%; by using the waste heat for district heating (DH), overall efficiency can be raised to 80%.

Under the old order, electricity industry wisdom dictated that generation should be in large stations away from centres of population. The expense and heat loss involved in piping waste heat over long distances restricted CHP development.

Changes in the industry made at privatisation have improved the prospects for CHP and several schemes are under development.

The Edinburgh project, backed by the District Council and Lothian Regional Council, will be developed by Citigen — a joint venture between British Gas and Utilicom of France. Citigen is already building a CHP system in the City of London and developing other projects in major towns and cities in the UK.

Edinburgh's scheme, starting in the city centre, will hopefully expand throughout the city. Phase one will be based around several large institutional buildings in the Old Town: council offices, public buildings, the Royal Infirmary and Edinburgh University. An area of tenements and terraced houses will be incorporated to demonstrate domestic use of the service. Hot water will be piped to mainly existing central heating systems, and electricity will be supplied either directly or via Scottish Power's grid.

This first stage should be completed by the middle of next year, and could be followed rapidly by extension into the New Town area north of Princes Street. The flexibility of the scheme, using small efficient generating plant, will allow further expansion to other areas of the city, and it is hoped to incorporate industrial waste heat and energy from waste into the system.

Plans in the mid-80s, when Edinburgh

was chosen by the government as a lead city ("CHP", SCRAM 48), would have brought waste heat to large areas of the city from Cockenzie coal-fired power station ten miles from Edinburgh ("Edinburgh heat plans", SCRAM 61). However, insufficient government support and difficulties over funding led to the proposals being quietly dropped.

Citigen's phased approach minimises financial risk with each stage intended to be financially free-standing. It is hoped that this initially less ambitious project will succeed where the previous plan failed.

## Boilerhouse

At the heart of phase one of the scheme is a boilerhouse at Edinburgh Royal Infirmary. One of the four existing steam generators will be replaced with two CHP engines, fired by gas or low sulphur oil, producing electricity and heat.

The generating capacity of this first phase will be 13MW of electricity and 13MW of heat. This will contribute 75% of total heat demand, with annual sales estimated at 79 million kWh of electricity and 103 million kWh of heat. Additional heat capacity of 24MW could be provided from the university boiler room. Standby and top-up electricity will be available from the existing public supply.

The hot water, at a seasonally varied temperature of 70–100°C, will be supplied through a network of pre-insulated pipelines to existing central heating systems. Electricity, at 11kV, will be sent out alongside the heat

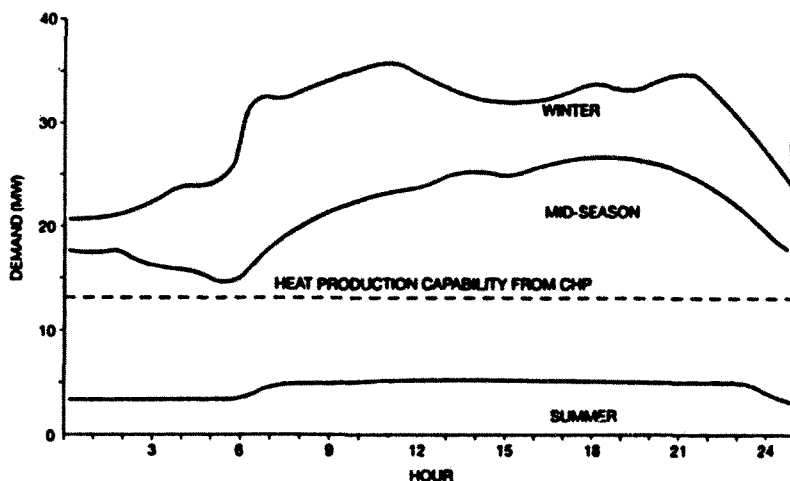
distribution mains to all customers, though smaller consumers may initially be supplied via Scottish Power's supply.

The CHP/DH system is projected to provide savings of at least ten per cent compared to present or any alternative methods of heating, and five per cent on electricity.

David Somervell, Energy Manager at Edinburgh University, has welcomed the opportunity of the university to be involved in the scheme saying: "This project will realise a ten-year long dream to supply cleaner, greener heat and power to Edinburgh."

As well as the reduced emissions through increased efficiency, the Edinburgh project will have similar exhaust gas treatment to Citigen's development in the City of London which will, the company says, have the most advanced system currently available, including provision for the removal of nitrogen oxides, sulphur dioxide, hydrocarbons and carbon monoxide.

The recent modest upsurge in interest in CHP is to be welcomed, but the UK remains well behind other European countries. In Denmark, for instance, 40 per cent of towns and cities are heated and powered by CHP plants. Environmental groups, including SCRAM, have long argued the benefits of CHP, and as the environmental need for efficient use of energy becomes ever more urgent, it must be hoped that projects like the one planned for Edinburgh will encourage further development. □



24 hour seasonal heat demand profiles for phase 1 - Old Town

## Little help for coal

**T**WO months late, on 25 March, Michael Heseltine finally produced "The prospects for coal", his white paper designed to placate Tory backbenchers over pit closures. He succeeded, and with only four Tory rebels voting against and three abstaining, giving the government a comfortable 22-vote majority.

On 20 October last year, the day after Heseltine promised a three-month review of the pit closure plan ("Coal chaos", *Safe Energy* 91), Lord Wakeham, Tory leader in the Lords, told the Upper House: "There would be little point in having a pause and moratorium on the proposed pit closures if it was merely a device for getting the Government off the hook for today or tomorrow."

As it turned out, that is exactly what the review was. Many people — particularly those whose jobs were at stake had hoped for a genuine review, but the entire five-month process was nothing more than a cynical political manoeuvre.

The key outcome of the white paper is that 12 of the 31 pits originally to have been closed are, for the time being, reprieved; another six will be moth-balled; one will receive development

work only; and 12 will be shut.

Even the 12 'saved' pits are not expected to survive for long as Heseltine has done little to improve the market for coal. The generators in England and Wales are committed to just 160 million tonnes over five years; and a government subsidy for additional sales, to bring them in line with imports, will be phased out prior to privatisation of the industry — which will now take place "at the earliest practical opportunity".

### Pension fund

Even the money for the short-term subsidy, estimated at around £500m, may in effect end up coming from the miners' pension funds. The government is obliged to reimburse British Coal (BC) for £480m of staged payments due to be made into the fund, to cover redundancies. But, according to trustees of the fund, government ministers have instructed BC to make the payments from BC's share of an estimated £1bn surplus in the worker pension funds.

The 'dash-to-gas', having received the approval of the Electricity Regulator, is to proceed unchecked; no restrictions will be placed on imports of subsidised nuclear power from France; and the dangerously decrepit UK Magnoxes are to be kept running — though the 1994 review of

nuclear power has been brought forward to this year.

The sweeteners in the package were a total of £200 million to help areas affected by pit closures and an extra £12 million over three years for clean coal technology ("Clean coal reprieve?", p21). The white paper also welcomed British Coal's announcement that pits to be closed will be offered to the private sector for sale or lease.

Recognising to some extent the shambles caused by its hands off (or even Pontius Pilate) approach to the energy sector, the government will now publish an annual Energy Report, and an Energy Advisory Panel will be established to offer advice.

Opposition MPs attacked the white paper for failing to address long-term strategic energy policy. Closing pits almost inevitably means the loss of the natural resource — a loss that no change in market forces or political will can ever retrieve. The reliance on the market to decide the fate of coal mines, indeed to dictate energy policy as a whole, is flawed. The nuclear industry remains heavily subsidised; the dash-to-gas is based on short-term economics and preferential contracts; and imported coal is often subsidised and sometimes mined by child labour. □

## VAT's no carbon tax

**C**HANCELLOR Norman Lamont's budget announcement of VAT at 17.5 per cent on domestic fuel and power has shocked individuals and organisations concerned with fuel poverty, and the attempt to defend the move as a carbon tax has angered environmentalists.

The change from zero rating is to be phased in, with an eight per cent rate from 1 April 1994, and the full 17.5 per cent being levied a year later. Once such a change is made, under present European Community rules it would not be possible to return to zero rating in the future.

During his budget speech, the Chancellor assured the House that the effects on those people on income related benefits would be taken into account from April 1994. Subsequent statements from junior social security minister Ann Widdecombe and Chief Secretary to the Treasury Michael Portillo implied that the only adjustment would be through benefit changes in line with the retail price index. This would delay any increase in benefits until April 1995, and would take no account of the disproportionate effect on the fuel poor or regional variations in fuel costs.

It now appears that some compensation mechanism will be introduced in April 1994, but the level and scope of this has yet to be announced. Those households on incomes just above benefit levels are

unlikely to receive any help.

Opposition parties, charities and consumer groups have condemned the imposition of VAT on an essential commodity. David Blunkett, shadow health secretary, commented: "I am sure this change will mean an increase in hypothermia as many elderly people will go without heating because of the threat of increased bills." Amongst others, Fran Bennett, the director of the Child Poverty Action Group, pointed out that the proportion of their income spent by the poorest 20 per cent of households is twice that of an average household and that many live in hard-to-heat, energy-inefficient housing. For the Gas Consumers' Council, its director, Ian Powe, said: "This is a punitive tax on the warmth and comfort of low-income families, which must to some extent be returned through subsidised energy efficiency improvements to their houses."

The attempt to pass off the move as an environmental measure has been viewed with widespread scepticism. Though it removes the anomaly in taxation between domestic fuel and energy efficiency goods, the failure to provide wide-ranging energy efficiency programmes will exacerbate already serious fuel poverty problems while doing little to reduce carbon dioxide emissions ("Road from Rio", p20). In the absence of new measures to improve energy efficiency, the Chancellor's move is no more than a regressive method of raising revenue. □

## N Ireland power sell-off

**P**RVATISATION of Northern Ireland Electricity (NIE), postponed from last autumn, will now take place by June this year. The sale relates only to transmission and distribution, with the province's four power stations having been privatised in a series of trade sales in March 1992, raising £352m.

The sell-off, expected to raise £300-£400m, follows the delayed approval of a £61m European Community grant towards the estimated total cost of £175m for a 250MW interconnector with Scotland.

The Northern Ireland electricity system has been isolated since an interconnector with the Republic of Ireland was blown up by the IRA in 1976.

The link with ScottishPower is meant to increase competition in the province, but with two power stations nearing the end of their lives, there are fears that Northern Ireland will become dependent on imports along a vulnerable link which could become a terrorist target.

As well as the electricity link, an undersea gas pipe from Britain to Northern Ireland is being planned by British Gas. □



## Road from Rio

LIKE over one hundred and fifty other countries which signed up at the UN Earth Summit in Rio, the UK is committed to drawing up an inventory of its carbon dioxide (CO<sub>2</sub>) emissions, producing a reduction/stabilisation strategy, and stabilising emissions at 1990 levels by the year 2000 ("One small step", *Safe Energy* 89). So far, the government's efforts are looking extremely haphazard.

The Department of Environment (DoE) consultation document on CO<sub>2</sub>, "Climate change: our national programme for CO<sub>2</sub> emissions" ("Climate for change", *Safe Energy* 93) has been overtaken by events. VAT on domestic fuel, announced by the Chancellor, Norman Lamont, in his Spring budget ("VAT's no carbon tax", p19), is not a carbon tax as claimed, but it does seriously impact on environmental policy.

Introducing the VAT measures in his budget speech, Lamont dismissed plans for a European Community (EC) carbon/energy tax ("EC energy tax", *Safe Energy* 85) saying: "I remain unpersuaded of the need for a new EC tax".

Six EC countries have responded by challenging the UK over the tax, which they believe is necessary to meet the UN agreed targets. The six have threatened to pull out of the Rio agreement if the EC tax does not go ahead quickly. Ironically, UK

opposition to the tax comes at a time when moves in the US ("Clinton taxes fuel", below) have made the EC tax, which is conditional on similar measures being introduced in the US and Japan, more likely.

Of the six countries unequivocally supporting the EC-wide tax, Belgium, Denmark, Germany and the Netherlands intend to go further than their UN commitments and reduce CO<sub>2</sub> emissions below 1990 levels, while the other two, Italy and Luxembourg are aiming for stabilisation.

### Stabilisation shortfall

Recent European Commission studies have shown that the EC is set to fall far short of its stabilisation target, and as well as the UK's opposition to the carbon/energy tax other EC measures on energy efficiency have been blocked, as has funding for research into renewables and promotion of clean technology.

In an attempt to break the logjam, the Danes — who currently hold the EC presidency — arranged a meeting of energy and environment ministers on 23 April, at which all but the UK backed the principle of the tax. However, ultimately, any agreement will be subject to the approval of the finance ministers, who will meet in June.

The UK government appears to believe that it at least can meet its CO<sub>2</sub> emission targets without an EC-wide tax. The DoE

and the Department of Trade and Industry have estimated that without counter measures UK emissions will have risen from 160 million tonnes of carbon (MtC) in 1990 to 170MtC by 2000 — with 70 per cent of this increase in the transport sector. Fortunately for the DoE, Michael Heseltine's white paper on coal ("Little help for coal", p19), which will lead to coal generation being superseded by gas-fired stations, is in line with the forecasts.

VAT on domestic fuel and power is expected by the government to reduce CO<sub>2</sub> emissions by 1.5MtC per year by 2000, with a further 1.5MtC/y being cut through increases in road fuel duties also announced in the budget.

The government believes that a further 4MtC/y can be saved by: the new Energy Saving Trust, improved building regulations, the Energy Management Assistance Scheme, and labelling of consumer goods. But there is considerable doubt about the effectiveness of these measures which the Association for the Conservation of Energy, amongst others, considers are grossly underfunded.

Even assuming the government's estimates are achieved, a further reduction of 3MtC/y will be required. Unless the government is expecting a slower pick-up in the economy than it is prepared to admit, further measures will need to be brought forward. An EC carbon/energy tax may yet be back on the agenda. □

## Clinton taxes fuel

PRESIDENT Clinton's plans for a US energy tax, included in his inaugural budget, successfully passed through both the Senate and Congress. Some watering down of the proposals was necessary to placate influential Congressmen with strong regional interests.

Clinton's measures, which were developed in consultation with environmental groups, are based on the thermal content of fuels. The taxes, to be phased in over three years, will be 25.7 cents per million BTUs (British Thermal Units) on coal, nuclear, hydro (BTU equivalent) and gas, with an additional 34.2 cents on refined petroleum oil. Exempted from the tax are home heating oil; bunker and jet fuel used in international transportation; and petrol which will instead be taxed at a relatively low rate starting at about 2.4 cents a gallon rising to 7.4 cents by 1997. Ethanol and methanol, and renewable energy except hydro are exempt.

It is estimated that when fully implemented these taxes will bring in \$22 billion annually. Low wage earners will be protected from the fuel and other budget tax increases through expansion of the earned income tax credit for workers earning up to £20,980 a year.

The direct impact of the taxes is

anticipated to reduce demand by just two per cent from forecast levels, but they are only part of a package of Federal programmes to reduce energy demand. The budget for the Green Lights programme, to encourage the country's largest 500 companies and local government to use energy efficient lighting, is increased to \$69 million over four years, and is anticipated to produce savings by the year 2000 of 75 to 108 million tons of carbon. The Low Income Home Energy Assistance programme will be boosted, and State low income weatherisation programme budgets will be matched dollar for dollar. \$1.3bn over four years will be provided for development of new energy conservation research programmes and the establishment of minimum standards, while Federal buildings energy efficiency budgets will rise from \$150 million to \$500m a year with anticipated annual savings of \$350m by 1997. Wholesale customers of electricity from 123 Federally owned hydro stations will be able to resell energy saved through demand side management, sharing profits equally with the Federal Government.

These Federal measures are in addition to action being taken in a growing number of States where regulatory bodies require utilities to include costs for anticipated external environmental damage — effectively acting as a local energy tax. □

## Japan intervenes to cut CO<sub>2</sub>

IN surprising contrast to US moves for energy taxes, Japan is planning an interventionist approach to carbon dioxide (CO<sub>2</sub>) reductions. In rejecting free-market solutions, Japan's powerful international trade and industry ministry proposes low-interest loans and tax incentives to promote energy efficiency in industry commerce and the home.

The policy "Fourteen proposals for a new Earth" aims to meet Japan's commitment to return CO<sub>2</sub> emissions to 1990 levels by the year 2000. With a forecast annual economic growth rate of 3.5 per cent, Japan realises that stringent measures will be necessary. Energy taxes would, the Japanese believe, "invite the international migration of industry" and might reduce economic growth and cause inflation. The use of emission permits would incur "massive costs".

Producing 15 per cent of the world's wealth using just five per cent of its energy, Japan is the world's most energy-efficient country with half the per capita CO<sub>2</sub> emissions of the USA. □

## Tidal turbines

**T**IDAL streams around the UK coast could supply 20% of the country's electricity needs according to a study for the Department of Trade and Industry.\*

Powerful, predictable tides could be harnessed using technology similar to wind turbines. The underwater turbines could be attached to seabed towers, surface floats or mid-water buoyancy platforms.

Six of the best eight UK sites identified in the study are in the Pentland Firth - between

the Orkney Islands and the Scottish mainland - where tidal currents reach 12mph. The cost of electricity from these sites is estimated at 10p/kWh, but Peter Fraenkel, a director of IT Power and one of the study's authors, believes this figure could come down to 5p/kWh or less. The Pentland Firth alone could provide 3,000MW generating capacity with a load factor of 20 per cent or more.

Advantages of tidal turbines should include minimal environmental impact, modular design, short construction time and reliance on largely proven technology from wind power and offshore oil development.

This summer, IT Power, NEL at East Kilbride and Scottish Nuclear (SN) are to carry out a £200,000 'proof of concept' project, 85 per cent funded by SN, to test a 10kW unit in the Corran Narrows, Loch Linnhe, near Fort William.

If these trials are successful, the next phase would be to develop a device of several hundred kW supplying electricity, possibly to an island community. □

\* "Tidal stream energy review", ETSU. Department of Trade and Industry, April 1993.

## Energy efficiency moves

**E**LITTLECHILD is considering standards of performance on energy efficiency for electricity companies. After last year's energy efficiency review ("Energy efficiency", *Safe Energy 91*), he concluded "there was scope for the electricity companies to make an increased contribution to the promotion of the efficient use of electricity."

Standards of performance will be designed to ensure the companies make effective use of funds made available for energy efficiency.

■ Regional electricity company Manweb is on course to achieve an 11% cut in the 9MW electricity demand at Holyhead, north Wales. The £500,000 project - to avoid upgrading the supply system - has included offering cheap energy-efficient light bulbs and hot water tank insulation. □

## Bio-fuel for thought

**T**HE environmental benefit of bio-diesel derived from rapeseed has been questioned in recent studies in Germany and France.

While biodiesel cultivation and processing saves 65 per cent in CO<sub>2</sub> compared with diesel emissions, the German study for the Federal Environment Office shows that other greenhouse gases including methane and oxides of nitrogen reduce the advantage to just 35 per cent.

Problems with carbon deposits in engines discovered during trials can be overcome but require a more expensive and energy intensive production method - further reducing the benefit.

The French study has shown no economic or environmental benefit from biodiesel, but the farming lobby has ensured the French government's support for pushing ahead

with an expensive plan to increase biodiesel production - taking advantage of the EC 'set aside' scheme for agricultural land.

The environmental impact of biodiesel could be reduced by using less fertiliser in cultivation and using renewable energy for processing.

■ A 5MW biomass-fuelled generating plant is being planned for St Boswells in the Scottish Borders. Border Biofuels aims to use wood chips from willow trees grown on agricultural land under the set aside scheme.

The Ministry of Agriculture doubts that the EC subsidy would apply but the House of Commons Environment Committee recently called for tree-planting to be included in the scheme.

Even without EC funding, the company believes the project could be viable with some fiscal pump priming through the expected Scottish Renewables Obligation. □

## Renewables obligations

**M**ICHAEL Heseltine's white paper on coal included an increase in the renewables target for the year 2000 from 1,000MW to 1,500MW. This is the rather unambitious target proposed by the Renewable Energy Advisory Group ("Reaaargh!", *Safe Energy 93*), well short of the 3-4,000MW proposed by the House of Commons Energy Committee.

It now looks as if the renewables part of the Non Fossil Fuel Obligation (NFFO) in England and Wales will be extended beyond 1998, and that similar measures will finally be introduced in Scotland and Northern Ireland. New European Community (EC) Competition Commissioner Karel van Miert has formally told the UK government that the Commission would not object to the NFFO being extended for renewables.

According to *EC Energy Monthly*, a 50MW DNC (declared net capacity) target for the year 2000 is proposed for Northern Ireland, with schemes being subsidised over 15 years. In Scotland a 35MW DNC obligation is planned for 1993, with subsidies lasting around ten years; similar obligations are expected in future years.

The government has already notified the Commission of its plans for a renewable obligation in Northern Ireland, and formal approval for all these schemes could be completed by June this year. □

## Dam shame

**T**HE Indian government has announced that it is to turn down further World Bank funding for its massive \$3bn Narmada dams project. With two major, 135 medium-sized and 3,000 small dams, the scheme is designed to supply drinking water to 30 million people, provide irrigation to feed 20 million and generate electricity.

In addition to not receiving the final \$187m loan from the World Bank, the Indian government is unlikely to receive \$200m in aid from Japan, which was frozen in 1990.

Environmental and human rights opponents of the scheme who doubt the benefits will ever materialise and criticise the treat-

ment of the 100,000 people being displaced, believe the move was to pre-empt the World Bank withdrawing from the project over India's failure to meet resettlement and environmental criteria.

■ Deadlock between Hungary and Slovakia over the Gabčíkovo hydro-electric project ("Dam discussions", *Safe Energy 92*) will now be referred to the International Court of Justice in The Hague.

With Hungarian reports of dried up wells and creeks along the stretch of the Danube where most of the flow is being diverted to the Slovak turbines, the European Community has persuaded the antagonists to agree in principle to a temporary water management scheme ensuring flow along both the original river and the new canal. □

## Clean coal reprieve?

**T**HE Coal Research Establishment (CRE) at Cheltenham was given £12m over three years in Michael Heseltine's coal white paper. While this lifts the immediate uncertainty over the centres survival, its long-term future will depend on private sector funding to meet its £18m annual budget.

The white paper states that the CRE's most promising project, the Topping Cycle, should be taken over by private industry and that the CRE should become an independent research organisation. □

## Floating wind turbines

**A** 1.4MW offshore wind turbine on a floating concrete hull is being developed by three UK companies. It would be moored in water 70-300m deep up to 15km offshore and a prototype could be at sea by the end of 1994.

Offshore engineering consultancy Tecnomare UK, wind energy specialists Garrad Hassan and British Maritime Technology have been working on the project for a year with backing from the Department of Trade and Industry's Wealth of the Oceans project. □

# REVIEWS

## Managing energy, by Paul O'Callaghan

McGraw-Hill; 1992, 416pp, £40

"So you're an Energy Manager are you? What exactly do you do ...?" enquired my maiden aunt. "Well, I manage the energy, don't I ...", was my flippant reply, because it takes a 400 page book (and some) to explain what I could be doing. The tome in question *Energy Management — a comprehensive guide to reducing costs by efficient energy use*, is the collected wisdom distilled from the MSc course which Paul O'Callaghan has been evolving for twenty years at Cranfield Institute of Technology. Now Professor O'Callaghan, he has seen over 600 students graduate as potential energy managers; and this book ranges over much of his theoretical basis for energy engineering decision-making.

The first chapter sets out the imperative for energy efficiency improvements as a key element in containing the burgeoning human impact on the environment, now seen to be seriously at risk. In the second and third he launches into an energy audit of an imaginary widget manufacturer with annual energy costs of £280,000. The audit trail is well polished, with fairly obvious recommendations emerging early, eg "Investigate use of electricity for heating purposes" — having shown that it is not only a bad thing but also prohibitively expensive. Loads of histograms, pie charts and tables of energy indices show different views of consumption and costs of various fuels delivered to the site in 1991-92.

The initial review completed and presented, several pages of questions are then fired off at Mr Jimmy, Chief Works Engineer, by our intrepid interviewer Mr Probe. These range widely, if a little generically, eg "Boilers: Is plant operating efficiently?" — one of 120 questions listed.

They are followed by a general fishing expedition request for all plans, schematics, layouts, ratings, operating hours, etc for every piece of equipment in the place.

After cooking all this data up in some mean-looking flow charts it is announced that potential savings amount to £85,000, or 35% of the initial energy bill. Next he spells out how the savings from each of three years can be re-invested to achieve a capital spend of £85,000 entirely from revenue. My experience is that there are rarely so many unconsidered opportunities, and I'm certainly unclear how far £1,000 would go on

new textbook on BEMS by GJ Levermore at UMIST (pub. E&FN Spon). Pages on Discounted Cash Flow, Net Present Value and Option Conflict Correction Charts follow to fine-tune the investment appraisal. Now, apart from a few exceptionally large or complex projects I've never heard of anyone using anything more complex than Simple Payback — ie dividing total project costs by estimated annual savings gives the number of years needed to repay the cost. Greater sophistication relies on inflation and fuel cost forecasting and we all know how dodgy a science that is! Appendices provide more tables, a summary list of low cost, medium cost and higher cost options and 20 checklists for different items of equipment or building elements.

The whole lot appears comprehensive, but it's not.

What is most disturbing is the absence of any genuine reference to the recent work of the Energy Efficiency Office (EEO). Literally millions of taxpayers' money have been sunk into what is emerging as an excellent set of advisory documents and case studies under the EEO Best Practice Programme and the Making a Corporate Commitment Campaign (MACC). Much recent emphasis has been on the need to *manage* energy management in a coherent way and build it into the normal decision-making and investment procedures of the organisation rather than it being an ad-hoc activity to be funded if an exceptionally good case can be made for it.

This book only really touches on aspects of energy engineering and my feeling is that an aspiring energy manager would do better to dig out all the mostly free reports and booklets published by the Building Research Energy Conservation Support Unit (BRECSU) — mainly building-related, and the Energy Technology Support Unit (ETSU) — mainly processes and production, but including renewables. *Organisational Aspects of Energy Management* (GIR 12 from BRECSU) and *Computer Aided Monitoring and Targeting for Industry* (GPG31 from ETSU) are but two noteworthy items from the lists available free on request.

Lastly, there is much good sense in the promotional literature emerging from the Making a Corporate Commitment Campaign (MACC) run by the EEO itself. A literature request form is available free from the EEO. My enthusiasm for the maturing output from the Best Practice Programme is only tempered by the difficulty in knowing of the existence of much of the very well considered information, let alone how to get it. A six-monthly compiled list of the publications published and sponsored by the EEO would be of inestimable value.

DAVID SOMERVELL

### USEFUL ADDRESSES

EEO MAC Campaign, 1 Palace Street, London SW1E 5HE (071 238 3339)

BRECSU Enquiries, Building Research Establishment, Garston, Watford WD2 7JR (0923 664 258)

ETSU Enquiries, Harwell Laboratory, Oxfordshire OX11 0RA (0235 436 747)

improving/installing temperature controls in an 8,000m<sup>2</sup> factory, and wonder whether £37,000 pa could be saved through this measure.

Ploughing on through chapter 4, "Fundamental Concepts", he introduces no fewer than 114 complex equations in 80 packed pages covering Thermophysical Transport Properties through U-values to Vapour Migration and Condensation. Chapter 5 contains a curious bundle of unrelated elements, from boiler efficiency tables to human comfort scales, with a quantity of useful reference material.

Chapter 6, "Instrumentation, Measurement and Control", introduces 52 more equations, but barely three sides on Building Energy Management Systems, and no reference to the useful

I kept wishing for the rules of thumb, the more directive advice, which is passed on by people with years of practical experience, to do this or avoid that. As an example ten pages on the theory behind electrical power factor correction fails entirely to mention that electricity invoices need checking every month in case the installed capacitors or their fuses fail, leading to lower power factor and higher charges. Water conservation only rates a single paragraph, but when some organisations' annual water bills are now higher than their gas bills, then this is inadequate. Too often the advice is in the form "Check the boiler" rather than which aspect is the crucial one leading to potential improvement.



# OBITUARY

## Sir Kelvin Spencer

Sir Kelvin Spencer was a long-time supporter of SCRAM, and his interest and backing will be greatly missed. The following obituary by Tony Benn first appeared in *The Independent* and is reproduced with permission.

The death of Kelvin Spencer deprives this country of one of its finest scientific public servants, whose contribution to contemporary society has never been fully appreciated.

He served, and was decorated for gallantry, in the First World War, played a large role in the development of the post-war aircraft industry, and in 1952 moved to become the Chief Scientist at the Ministry of Fuel and Power where he supervised the early work in the formulation of Britain's new civil nuclear programme.

For his generation, and those of us who had been shocked by Hiroshima, this was a classic case of the

conversion of "swords into ploughshares" and the public were then persuaded that our nuclear power stations offered endless supplies of energy that would be cheap, safe and peaceful.

Later, as a result of his own experience and concern at certain safety aspects of this programme (in particular the accidental fire at Windscale in 1957), Spencer, in his retirement in the Sixties, concluded that he had been wrong and that the whole nuclear power policy should be scrapped, a view which I later came to share.

When, as Energy Secretary, I decided to convene a representative weekend conference at Sunningdale in 1977 to discuss policy I asked civil servants to invite Kelvin Spencer, hoping that he would be a counterbalance to the conventional view.

I was strongly advised against inviting him, by senior civil servants, on the grounds that he was senile. A scandalous charge to make against a man of immense

experience whose only problem for Whitehall was that he had taken a line that was unacceptable to the nuclear lobby, which was, at the time, deeply entrenched at the heart of government.

Kelvin Spencer came to the conference and it was there that I met him — a wise, experienced and kindly man whose interests extended well beyond technology of energy to the widest social and political implications of any decision that might be made. He was clear, modest and incisive and made a formidable contribution to our discussions that weekend.

Later I met him again on various occasions and he retained that combination of sharp intellect and humane sensitivity that is so rarely to be found in one person. He was always shrewd and generous in the presentation of his arguments but there is no doubt that he was a victim of the same sort of marginalisation that is used to exclude anyone whose views do not fit into the establishment consensus of

the day. In short he was treated as a dissident, whose isolation was intended as a punishment for his defection from what had become a central item of almost religious belief among top people — that nuclear power was the right and proper course to be followed.

As a result of his principled stand he won the respect and affection of the younger generation who suspected that the "Atoms for Peace" programme was really a thin cover for the development of nuclear weapons, and was unsafe and far more expensive than coal — as it is.

Such men are precious and his admirers — amongst whom I count myself — well miss him greatly.

**Tony Benn**

Kelvin Tallent Spencer, scientist: born 7 July 1898; MC 1918; CBE 1950; Chief Scientist, Ministry of Power 1954-59; Kt 1959; married 1927 Phoebe Wills (died 1989; one son); died 28 February 1993.

## The advertising rates for *Safe Energy* are:

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Half page (190 x 130mm)	£75
Quarter page (90 x 130mm)	£40

The above prices are for camera ready copy, an additional charge may have to be made for design and lay up of adverts.

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For further information phone 031-557 4283, or write to Safe Energy, 11 Forth Street, Edinburgh EH1 3LE.

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# LITTLE BLACK RABBIT



## That's Rich

Congratulations to Offer, on granting the first licence to a foreign company to sell electricity in the UK. The lucky recipients: Swiss-based Rich & Co. Unfortunately, chairman Marc Rich can't come over to collect the award, as he'd be extradited to the USA to face charges involving racketeering, fraud, tax evasion, and illegal trading with Iran. Mr Rich happens to be reputedly the greatest indicted tax evader (at \$48m) in American history. It's good to know our electricity is in safe hands.



## Waste sight

Highland Region councillors visited Dounreay on 1 April to assess AEA Technology's application to extend their low-level waste pits. A council report revealed that the proposed extension was to be 8,425 metres deep. Disappointingly, this figure turned out to be an unintentional April Fool's joke, as the council explained that the comma should have been a point.

In any case, AEA Technology failed to 'drum up' enough support in the council, and the application was turned down — in spite of their noble efforts to provide the press with a favourable view of the existing dump. Unfortunately, their photo of haphazardly dumped drums and bin

bags provided the public with a far from reassuring image: a case of 'beauty in the eye of the beholder', perhaps?



## Good thinking, Robin!

Scottish Nuclear have welcomed the Government's announcement that the review of the nuclear industry is to be brought forward to this year. Noting the white paper's assertion that privatisation is 'the only way of enabling the coal industry to realise its full potential', Chief Executive Dr Robin Jeffrey wondered, "Is there a lesson here for the nuclear industry?" There may well be: LBR knows of a few ex-miners who could explain to Dr Jeffrey just how painful it can be, preparing to 'realise your full potential'.



## Knowledge and power

The locals at Trawsfynydd are not impressed with Nuclear Electric's miserly approach to information sharing. The good proprietors of the (no-)power station are proposing to build an incinerator to burn off contaminated oil. The people want a public inquiry, and asked for details such as the expected increase in radiation doses. No problem, said NE — they're yours for only £4,500. I suppose you can't blame them for grabbing at the rare chance to generate some revenue, but it does make the Safe

Energy subscription look like exceedingly good value. Which it is, of course.



## One Hann and his ...

Scottish Nuclear's latest advertising campaign, funded by a grateful nation, features Meg (a sheepdog with some intriguing behavioural quirks) rounding up customers for the Visitors' Centre at Torness. Unfortunately, a furry friend tells LBR that the scenes around Torness had to be refilmed because the original footage turned out to be fogged ... Look out for the sequel, in which Black Bag (the faithful border bin-liner) is expected to give a practical demonstration of waste management techniques at Dounreay.



## Watchdog

And on the subject of silly advertising campaigns: a complaint against one of Scottish Nuclear's 1992 newspaper ads has been upheld by the Advertising Standards Authority. In short, the advert claimed that 'alternatives ... can provide no more than 10% of our energy', but as the Scottish Greens pointed out, hydro already provides more than 10% of Scotland's electricity. So at £1.9 million, Scottish Nuclear's 1992 information campaign makes the Trawsfynydd offer look like quite good value, really.

## Three ways to promote safe energy

Three ways to help SCRAM: fill in the appropriate section(s) together with your name and address and return the form to the address below.

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