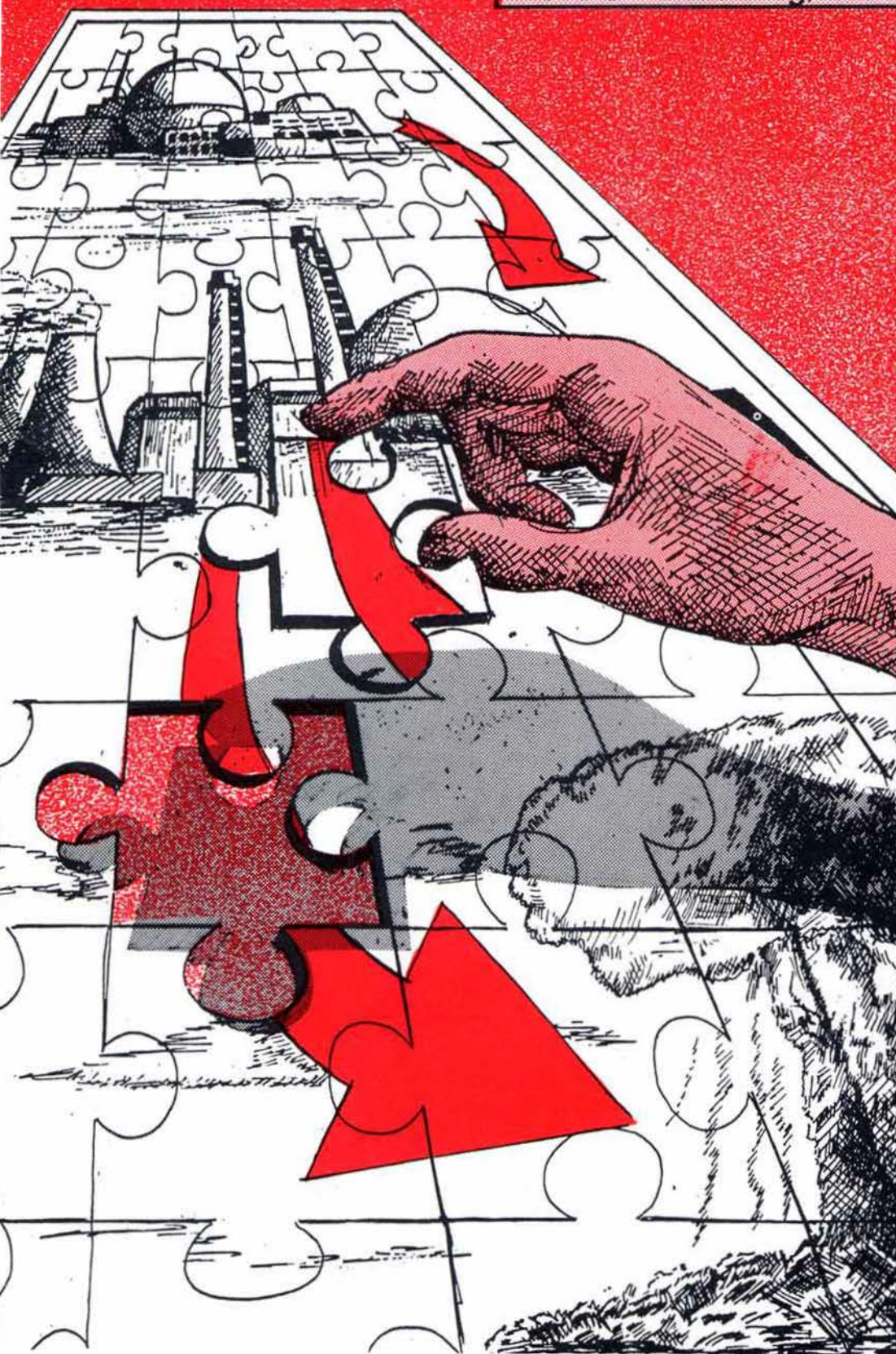


**The  
Plutonium  
Puzzle**

THE SAFE ENERGY JOURNAL

# SCRAM

No.75 February/March '90 £1.00



**After  
Hinkley**

**Food  
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**S**COTLAND is very much towards the top of the world league table in terms of per capita nuclear use, most of the country's electricity will be produced by a state-run company - Scottish Nuclear. This will be a novel experiment, to say the least. Ian Preston, who was to run the nuclear wing of the privatised industry has decided not to wait around to see if the experiment works. He will take his chances with the privatised, non-nuclear, Scottish Power. The search is on for a successor.

No decision has yet been made on the timing of the Scottish privatisation, but despite the Scottish Boards pleas to be first "reliable sources," according to Power in Europe (PiE) magazine "are predicting that the Scots ... will be privatised last." PowerGen and National Power had been pencilled in for floatation during Spring 1991, but preparations for privatisation are running about 3 months behind schedule. It's now looking more and more doubtful that the Scottish Boards will be sold this side of the next General Election.

**O**NE OF the major benefits of the Government's abortive attempt to privatise nuclear power has been the exposure of financial problems - in particular the cost of decommissioning.

The estimated cost of decommissioning Berkeley has risen from £613m to £1.636bn in the course of one year. This, of course, is only a provisional figure, but the CEBG makes no attempt in its latest Annual Report to explain why the cost has rocketed. The total cost of cleaning up after the Magnox programme is likely to be at least £10bn. Decommissioning the AGRs will cost a further £10bn, according to PiE.

There is still considerable uncertainty about the cost of decommissioning the AGRs. But one thing is certain, despite the fact that both Hinkley B and Hunterston B are at least half way through their useful life, no money has been set aside for decommissioning.

Nuclear power may not be getting sold off, but it is still the electricity consumer who will have to pay these back-end costs through the nuclear levy - not the Treasury.

**N**EWs of problems for nuclear waste disposal programmes in Japan, France Argentina and the US can only add to the headache of clearing up the mess, which the industry must somehow to cure.

The US Department of Energy has been refreshingly honest in declaring a lack of confidence in its research on the Yucca Mountain project in Nevada. This means it has effectively scrapped \$500m-worth of research, adding yet another burden to the back-end costs of the US nuclear industry.

Any attempt by BNFL or Nuclear Electric to revive the fortunes, before or after 1994, of the PWR or to introduce yet another reactor type at Chapelcross, Calder Hall, or Hinkley will obviously be fiercely resisted. But this time industry will have to contend with the anti-nuclear movement and our new 'allies' in the City.

The **SCRAM 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 (SCRAM)**. Views expressed in articles appearing in this journal are not necessarily those of SCRAM.

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# SCRAM

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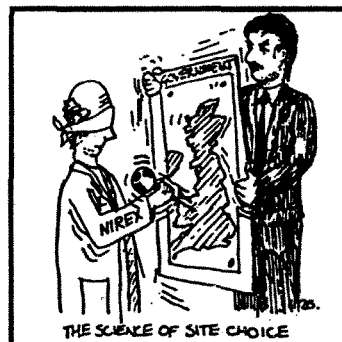
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**SPECIAL: Four Page Pull-out Nuclear Waste Broadsheet**



## Japanese waste protests

**P**LANs to dispose of high level nuclear waste in Japan are being seriously hampered by public opposition.

Currently 350m<sup>3</sup> of high level liquid waste are being stored in tanks at the reprocessing plant in Tokai-mura. If the Tokai plant continues operating as planned, and a new reprocessing facility is built at Rokkasho, this quantity will multiply. After vitrification and storage for 30 to 50 years, the waste is expected to be buried several hundred metres underground.

As part of the repository site selection process, the Japanese Atomic Energy Commission say they need two large research facilities - an 'Environmental Engineering Laboratory' where experiments with radioactive materials would be carried out, and a 'Deep Underground Experimental Facility' where disposal technology would be developed and tested without using radioactive substances.

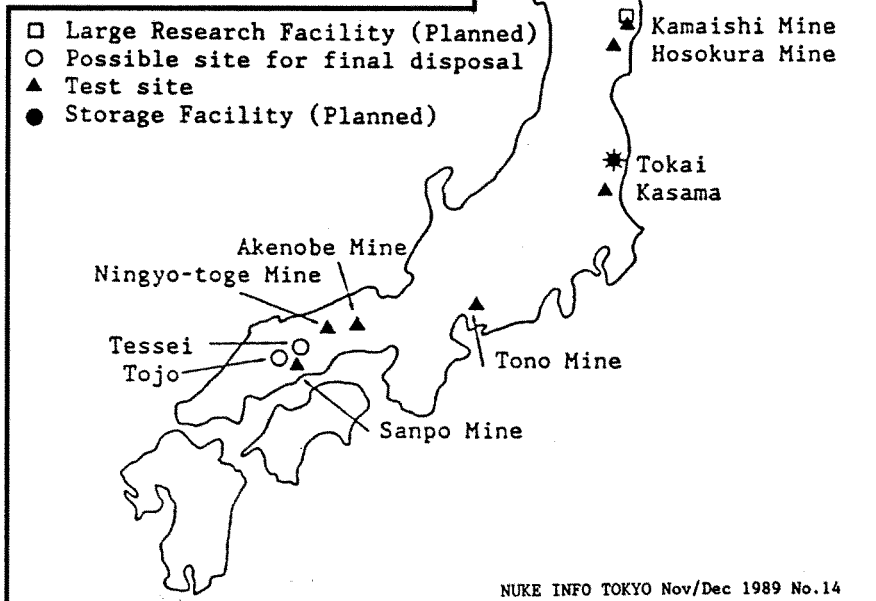
The original plan, announced in 1984 by the Power Reactor and Nuclear Fuel Development Corporation (PNC), was to site both research facilities, together with an intermediate level waste repository, at Horonobe on Hokkaido. However, this plan had to be suspended because of opposition from the Hokkaido Government.

PNC decided in August last year to build the 'Deep Underground Experimental Facility' at Kamaishi. But strong opposition from local residents forced the owners of the

Kamaishi mine to withdraw their invitation to PNC.

Meanwhile, at Rokkasho a temporary store for waste returning from European reprocessing plants is also planned. A uranium enrichment plant is already under construction there, and is due for completion by 1994.

Villagers in Rokkasho recently voted for a Mayor who wants the whole project to be frozen. On an unprecedented 94% turnout, Hiroshi Tsuchida narrowly beat the incumbent Mayor who is in favour of the nuclear complex.



## US scrap waste research

**U**S Department of Energy (DOE) plans to build a high level waste repository have been sent back to the drawing board following admissions by a DOE official that the Department lacks confidence in its research on the facility and will completely revise the project.

The announcement effectively scraps the \$500 million-worth of research on the repository site at Yucca Mountain in Nevada. The repository will not now open until 2010 at the earliest - 12 years beyond the deadline set by Congress.

News of the programme's setback has been greeted with dismay by the nuclear industry. The cooling ponds at the country's 110

nuclear power stations are filling rapidly, and some plants have already been forced to build new temporary waste facilities to allow operations to continue.

Most observers believe that the revised timetable is still extremely optimistic. The Nevada State Government is opposed to the repository and has denied the DOE a permit to dig an exploratory shaft at the Yucca Mountain site, but the Department of Justice are planning to sue the State to force it to accept the site. For their part, the Nevada State Government has asked the Court of Appeals to order the DOE to cease studies and declare Yucca Mountain unsuitable for a high level waste repository.

Meanwhile, the DOE is bound by contract to start accepting spent fuel from utilities by 1998, so they are expected to ask Congress

to allow them to build a Monitored Retrievable Storage (MRS) facility. Congress originally tied authorisation for an MRS to the Nuclear Regulatory Commission's authorisation of the repository, in such a way that the MRS could only begin operation three years before a repository.

The MRS Review Commission, set up to investigate the need for an MRS has baffled everyone by recommending that two smaller storage facilities should be built with a joint capacity of only 9,000 tonnes (metric tons) of uranium (MTU). Supporters of the MRS, with a capacity up to 15,000 MTU, believe the two smaller facilities "may be nearly as difficult to site, construct, and license as an MRS while not providing the same benefits."

## BNFL goes international

**B**NFL are to set up a US subsidiary to compete for contracts to clean up nuclear sites owned by the US Department of Energy (DOE), and seek business in decommissioning US commercial reactors. Cost estimates for cleaning up the DOE facilities range from \$50 to \$200 billion.

BNFL are also proposing to set up International Nuclear Fuels Ltd (INFL) to promote overseas trade. This comes at a time

when "it is more important than ever to lift our eyes from the difficulties at home and consider BNFL's position in the international scene", according to Chief Executive, Neville Chamberlain.

**BNFL**

## Argentina scraps dump

**A**RENTINE President, Carlos Menem, has "ruled out" a proposed medium and high level nuclear waste repository at Gastre in the Chubut province. Menem told the Comision Nacional de Energia Atomica (CNEA) that more seismic, geological, and hydrological tests are needed to determine whether the arid desolate Sierra del Medio region is dry and stable enough to be suitable for a waste repository.

## Risk estimates rise

**EXPOSURE** to low level radiation is three to four times more likely to cause cancer than was previously thought according to the US Biological Effects of Ionising Radiation Committee (BEIR).

In their 5th report, published at the end of December, they also said that foetuses exposed to low levels of radiation between the 8th and 15th week of gestation have a higher risk of mental retardation than previously recognised.

The higher risk estimates are a result of revised risk models, revised dose estimates for survivors of the Hiroshima and Nagasaki atomic bombings, and additional epidemiological data on cancers and other health effects experienced by both A-bomb survivors and persons exposed to radiation for medical purposes.

Radiation from neutrons, for example, was previously considered an important component of the Hiroshima survivors' doses but has now been shown to be only a small contributor. The resulting lower estimated doses for most of the Japanese survivors, say the committee, means that lower levels of radiation were responsible for the clear excess of cancers in the group.

Risk estimates are still uncertain, say BEIR, due to sampling errors and other factors, they comment that, the true number of excess cancer deaths from a given exposure could be higher or lower by a factor of 2.

Strong reliance on the A-bomb survivors

has attracted considerable criticism in the past. One British epidemiologist, Dr Alice Stewart, has denounced the use of the A-bomb data as misleading. She believes that using the health data of workers in the nuclear industry would yield far more accurate risk estimates.

In 1978 she calculated that the current accepted ICRP estimate was between 10 and 30 times too low. It was based on extensive details of worker exposure at the US military reprocessing plant, at Hanford. Her findings were rejected by the establishment amid considerable controversy.

Now, however she is once again engaged in challenging the established view. Currently a legal case is being fought in the US, under their Freedom of Information Act, for access to the world's largest data bank on the health of workers in the nuclear industry. The data bank is part of a US government programme to study the effects of low level

radiation on human health, and contains information on 300,000 people over a 25 year period..

The case is being paid for by the Three Mile Island Health Fund, which was established after the TMI nuclear accident in March '79, which believes in the need for independent assessment of industry statistics. The lawyer handling the case, Daniel Berger, told SCRAM, "Either we are going to get it [the data bank] as a result of settlement, or the case will run for another 4, 5 or 6 months and we will get it then."

Stewart believes it would take about a year after receiving the data to produce something "fairly concrete." If, and when this happens the nuclear industry - civil and military - will have to face a barrage of compensation claims and expensive calls for the tightening up of procedures within the industry. Pushing their economic case over the precipice once and for all. □



## BNFL reactor plans

**T**HE suspension of plans to build more PWRs after Sizewell B will make no difference to BNFL's plans for a programme of well tried "off the shelf" reactors, according to the company's Chair, Christopher Harding.

BNFL are currently conducting a feasibility study into a 600 - 2,400MW reactor programme, which is due for completion by late summer. The aim of the study is not necessarily just to replace the eight ageing Magnox reactors, four each at Calder Hall and Chapelcross, with a total of 480MW capacity, "We're looking to see whether or not we can get further into electricity generation as a commercial venture in its own right," says Harding.

Reactor designs being studied include the Sizewell B type PWR, the Advanced Gas-cooled Reactor, and various overseas designs, mostly PWRs. But the reactors have to be "well tried and tested," says Harding, "we're not interested in a development project."

BNFL would not wait until the Magnox stations closed, especially as they are hoping to keep them open for a further 10 years. "If the feasibility study shows it's going to be a sensible investment, we would want to get on and make that investment just as soon as it was practicable." Harding believes "nuclear generating capacity coming on line around the turn of the century should be capable of competing with new coal-fired generation." □

## Troubled Torness

**T**ORNESS Reactor One, which had been shut down since 24 November because of unfinished work on the refuelling machine, returned to service on 13 January, three weeks later than scheduled.

The giant refuelling machine - which squats above both of the station's reactors - and the rest of the station's fuel cycle have still to receive full operating consent from the Nuclear Installations Inspectorate (NII), even though the station has been running for more than a year.

The SSEB now expect to run the reactor until mid-February when engineers hope to be able to unload the excess of burnt-up fuel from the core. Reactor two, which came on line 8 months later than number one, is expected to continue operating at reduced power until its statutory overhaul in March.

Refuelling problems have been a thorn in the side of all seven AGRs in Britain, particularly the five-strong first generation. The AGRs were designed to refuel at full power, but none have yet done so. Only Hunterston and Hinkley Point can refuel on-line, at 30% power. The problem has cost the electricity industry millions of pounds each year. At Torness, the SSEB is hoping to be refuelling on-load at 40% power by the end of the year. Judging by the way things are going, this is optimistic to say the least.

■ At the start of the Hinkley Inquiry the CEBG said they would only be able to import "higher operating cost fossil fuelled" power from Scotland, lest they "deprive Scottish consumers of the output of nuclear stations." More recently Scottish Office Minister, Ian Lang, spoke to Channel 4 News about the "considerable potential for nuclear to be exported down the line to the South."

Malcolm Rifkind, Secretary of State for Scotland, says the decision to cancel the PWR programme should mean much larger electricity exports from Scotland to England, and that the interconnecting transmission lines between the two countries could be expanded from the current capacity of 850MW to 2000MW rather than the 1600MW previously announced.

Originally it was thought that the two privatised Scottish utilities would strongly resist sales of nuclear electricity to the South, because this would mean Scottish consumers losing the benefits of the 'cheap' electricity.

However, reports that the companies are being asked to pay higher prices for nuclear electricity than expected may lead to a change of attitude.

■ Colin Sweet, in evidence for the NUM, told the Hinkley Inquiry he calculated Torness was 40% over budget. □

## European energy market

**O**RIGINALLY it was thought too difficult to include energy in the Single European Market planned for 1992. But now the European Commission is considering the possibility of an Internal Energy Market (IEM). The Commission's proposals are the subject of a new report\* by the Royal Institute of International Affairs and the Science Policy Research Unit at Sussex University.

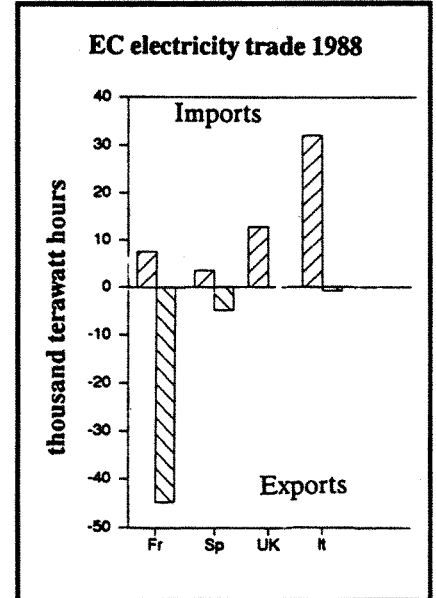
Creating an IEM will be problematic - taking a set of industries which have mostly been organised nationally and monopolistically and applying to them the principle of trade without barriers. The Commission estimate that the absence of a free market in energy is costing as much as 0.5% of Community GDP.

The area where the Commission's proposals have raised the most controversy is that of electricity supply: nowhere have the issues of competition and security of supply conflicted more acutely. If carried to their logical conclusion the IEM proposals would transform the electricity supply industry. How far they will get, however, is another matter. The German power industry, for example, is obliged to buy a set quantity of German coal until 1995 and is compensated through a fund financed by a levy on electricity prices. The French regard this as a block on energy trade - not least in French nuclear electricity. The claimed cost advantage of French nuclear power will certainly come under fire. Even if it is

accepted that any aid to the French nuclear industry is purely historical, it is doubtful whether it would be wise to allow that industry to dominate the European Market. The very virtue of the French system - its standardisation - could render it susceptible to major disruption. A generic fault, for example, could render not just France deficient in electricity, but also much of the rest of Europe. There will have to be much greater cost transparency if the system is to work.

One question which consistently arises in the run up to 1992 is "in member states with stringent [environmental] standards, will it be possible to market products complying with less stringent standards?" The Commission's answer is that this dilemma will be solved by taking as a base a 'high level of protection'. The problem is that 'high level' is open to a wide range of interpretations. Environmentalists insist that member states should have the right to adopt environmental standards higher than the EC norm. US experience has been that state-level legislation has often been instrumental in leading federal standards.

The Commission's proposals centre on conventional supply industries and fail to examine either renewables or energy efficiency. Renewables, particularly wind, tend to be shielded from international competition in order to help them over the initial development and deployment hurdles. If the IEM is to be enforced in this sector, then wind industries in Holland, Germany and the UK have only three years to establish themselves or they will be swept away by



Danish technology.

The authors of the report conclude that it is difficult to see any tangible benefits to consumers coming out of the IEM, except for large energy-consuming industries. Nor do they expect dramatic changes in the European energy industries, with the exception of the German coal industry. □

\* A Single European Market in Energy is available from the Energy and Environmental Programme, Royal Institute of International Affairs, 10 St James's Sq, London, SW1Y 4LE. Price £10.

## Nuclear subsidies challenged

**T**HE National Steering Committee (NSC) of Nuclear Free Local Authorities, which represents 177 local authorities, is to make a formal complaint to the European Commission on the issue of proposed subsidies to the nuclear industry and levies on fossil fuels.

The NSC allege that these intended measures will be a breach of the Treaty of Rome, and will increase electricity and tax bills. "We are determined," says Vice Chair, Councillor Margaret Crampton, "to ensure that the nuclear industry's excessive costs do not create additional burdens for the families already struggling to cope with fuel poverty this winter."

Following privatisation, the Secretary of State for Energy will have powers to: require the distribution companies to buy a fixed, but yet to be determined, proportion of their electricity from non-fossil fuel sources; levy a tax on fossil fuels to "compensate" for the non-competitiveness of nuclear energy; and subsidise decommissioning of nuclear power stations and reprocessing and disposal of radioactive wastes.

Councillor Ian Leitch, Chair of the NSC says "The Energy Commission of the EEC has signalled that it is determined to apply the rules of the Treaty rigorously so as to examine direct and indirect aids and support to the nuclear industry. We believe this is a particularly propitious opportunity to have these proposals thoroughly and impartially scrutinised."

Advisers to the NSC are already in contact with authorities elsewhere in the EEC, and it is predicted that further complaints will be lodged, both from other countries and other energy sectors which will be disadvantaged by the proposed subsidies.

"We believe these potential new subsidies can be outlawed," says Margaret Crampton. □

## ROCK SOLID

The Geology of Nuclear Waste Disposal  
by Elspeth Reid

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**ROCK SOLID** presents a clear, accessible and up to date account of the geological problems involved in building a nuclear waste repository. The author describes the geology of some of the possible UK repository sites (Sellafield, Dounreay, Altnabreac and Billingham), explains how sites are investigated (including computer models), and finally considers the crucial question: 'Would geological containment of radioactive waste actually work?'

Elspeth Reid is a lecturer at Inverness College and a tutor with the Open University.

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## French folly

**E**LECTRICITE de France (EdF) have, under normal circumstances, an enormous surplus of electricity capacity, which they have been attempting to find markets for. They have ambitions to become the power house of the European Community. However, towards the end of 1989 things started to go badly wrong. A combination of drought, and an exceptionally high number of nuclear stations closed for maintenance put EdF in the rather embarrassing position of having to import electricity in December.

Although, the French nuclear programme meets 70% of France's electricity demand, EdF has accumulated a debt of FF233bn (£24.5bn) in acquiring its nuclear capacity. A further 8 PWRs are expected to come on-stream between now and 1993, further adding to the surplus. The company is anxious to reduce its debt, and surplus capacity, by promoting electricity consumption. EdF offers favourable terms to attract major industrial developments, and has been increasing its exports to the UK, Spain and Italy.

With drought problems affecting French hydro production and causing a shortage of cooling water for some nuclear stations, EdF found it difficult to cope with a strong summer demand. By December the utility was forced to import power from the UK and Spain.

The peculiarly French strategy of standardisation lies at the heart of the problem. Although maintenance costs are reduced because all reactors need the same equipment, any generic fault will be repeated in all the reactors, involving repairs which could take a large number of plants off line at the same time.

The idea that once the initial capital outlay had been paid for, nuclear power stations would be cheap to run has been painfully dispelled over the years as operating and maintenance costs escalate. Most recently a new generic fault has been discovered in the 1,300MW series of PWRs. Denting has occurred in the steam generator tubes due to a mysterious build up of metallic sludge, which could lead to their rupture. For safety reasons EdF will now have to carry out, in the first half of 1990, an expensive examination of all 14 of their 1300MW reactors.

The utility has already been forced to begin replacing the steam generators in all 25 of its 900MW PWR series over the next 15 years, at a total cost of FF8.5bn.

If EdF has to replace all the steam generators in the 1,300MW series, it will be a nasty financial shock. Even if, as EdF insist, the steam generators don't have to be replaced, the cost of inspection which takes 5 weeks, and tube cleaning which takes ten weeks, is estimated at a total of FF1.5bn, not including the cost of replacement power.

Meanwhile protests continue at the nearly completed Golfech nuclear plant, in the Tarn-et-Garonne area in south-central France. On 3 December six people began a long-term fast to draw attention to the problems of nuclear power. The growing anti-nuclear movement in the area has forced previously supportive elected officials to cast doubts on the project, notably over the volume of cooling water it will require in an area increasingly affected by drought. The opposition group "Vivre Sans le Danger Nucleaire de Golfech", which has been campaigning to stop the first reactor being loaded, took its protest to Paris on 12 December, the day of a parliamentary debate on the nuclear programme. The reactor was loaded on the same day.

Growing protests also face the French nuclear waste disposal programme. In October the administrative tribunal of Marseilles overturned a regional authorisation to allow Cogema to store short-term radioactive waste at Istres, near Etang de Berre in southern France. Cogema had intended to store 36,000 containers of

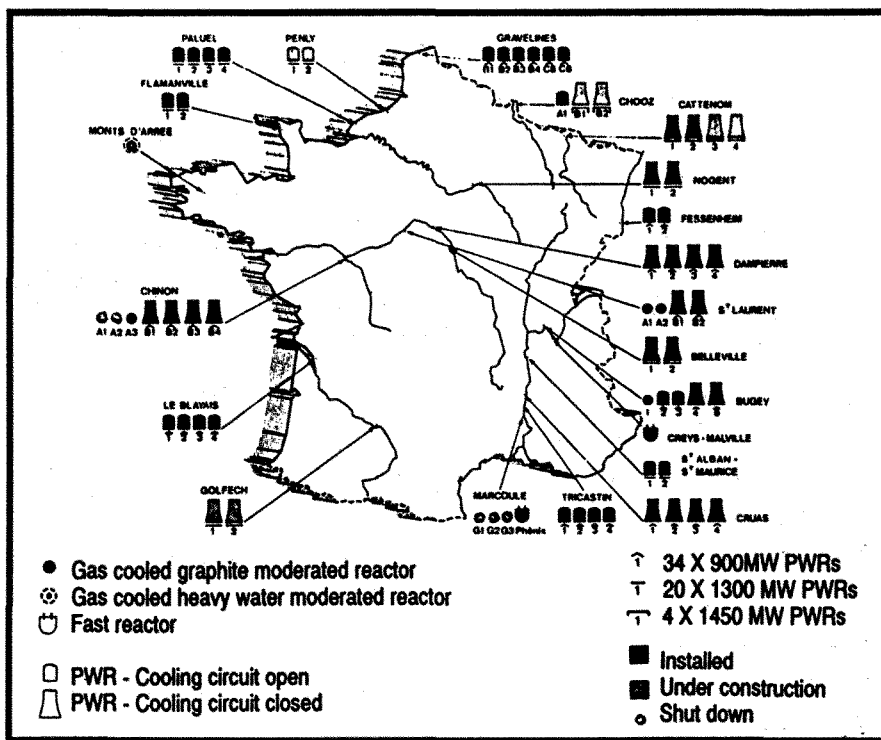
uranium oxide in 14 buildings for at least 20 years. The judge ruled that the Cogema feasibility report insufficiently addressed the hazards of nuclear waste storage at the site. Local political leaders had chained themselves across the road to deny access to delivery trucks on 28 September and 5 October.

Prospects for France's disposal of long-term nuclear wastes continued to worsen as conservative officials at two potential dump sites, in Aisne and Deux-Sevres, announced they would work with the Socialists and Greens "with the greatest determination" to oppose plans by the radioactive waste management agency, Andra.

A report commissioned by the association of regional mayors in the Aisne region estimated that a nuclear dump could cost the area upwards of FF600m annually in its impact on tourism, agriculture, and industry.

The search for a site to dispose of long-term nuclear wastes began in November 1987, when a report by a team of nuclear security specialists and geologists recommended four potential sites. One site is to be picked for tests with final selection in 1995.

France's nuclear industry, which is held up by some as an example of a cheap and efficient programme, has now joined the world wide herd of nuclear white elephants. □



## French fiasco

**T**HE 'fertile' subassemblies around the core of the French Superphenix fast reactor will be replaced with steel reflector assemblies when they are extracted by 1996.

NERSA, the owners of the plant have decided to run down the plutonium production of the plant until it has virtually

lost its breeding role, because it costs more to produce plutonium within Superphenix than at the French reprocessing plant at La Hague. NERSA also say that the value of plutonium is lower than expected. La Hague is already having difficulty finding a market for its plutonium output.

Many commentators have heralded this as the end of the breeder option in France. In particular during the parliamentary debate on 12 December, the Environment Minister,

former Green Presidential Candidate Brice Lalonde, noted "the option of non-reprocessing is all the more real [in France today] since the future of the breeder is no longer" on the agenda.

Lalonde also indicated that he had not received adequate information from Cogema to take a decision on their application to build a Mox fuel fabrication plant. (Mox, or Mixed Oxide Fuel, is used to recycle plutonium in thermal reactors.) □

# After Hinkley

**COLIN SWEET, former director of the Centre for Energy Studies at South Bank Polytechnic, London, and now energy consultant to Friends of the Earth and the National Union of Mineworkers (NUM), gave evidence at the Hinkley Inquiry on behalf of the NUM. His evidence compared the economic costs of coal and nuclear generation. Following the revelations by the CEBG about cost escalation at Sizewell B, he submitted further evidence which showed that the cost of electricity from Sizewell B and the proposed PWR at Hinkley C would be somewhere between 6p/kWh and 10p/kWh. Here he looks at the role of public inquiries and summarises the evidence given by the NUM at Hinkley.**

**N**OW that the Hinkley Inquiry is over, the anti-nuclear movement will be asking: "Was it worth it?"

Public Inquiries are punishing events for underfunded organisations. On this occasion the collapse of the nuclear case during the Inquiry meant that the objectors morale was raised to a high level by the end of the Inquiry. The Inspector had to extend the life of the Inquiry to take evidence from the CEBG on the upward revision of the construction costs of Sizewell B, (37% above the original estimates). This demarche turned into a rout when Wakeham announced, on 9 November, that the nuclear industry would be neither privatised nor proceeded with.

It would be an over statement to attribute this collapse solely, or even mainly, to what was said at Hinkley. Those relatively subdued deliberations were periodically overshadowed by the fierce in-fighting that went on within the establishment, consequent on the attempt to privatise nuclear power. But following the first of the leaks in January 1989 (they continued to appear throughout the year in the Financial Times Business Information Journal "Power in Europe"), the spectacle of the CEBG contradicting what it was saying at the Inquiry, accelerated the collapse of confidence.

## Economics

The Hinkley and Sizewell Inquiries witnessed an impressive build up of the anti-nuclear case. For seven years a formidable intellectual offensive has been sustained both against the Government and the powerful nuclear industrial complex. They not only sustained it, they won the argument. The area in which their case proved most effective was that of economics. This is not necessarily the most important in terms of the society's security and future, but it was the one where the nuclear industry proved in the end to be the most vulnerable.

In my view the time, money and effort invested in these two Inquiries, and no less in the Windscale Inquiry (1977) and the Dounreay Inquiry (1986), has been justified. Should there be any more Inquiries I think the opposition should mount the strongest possible case. This

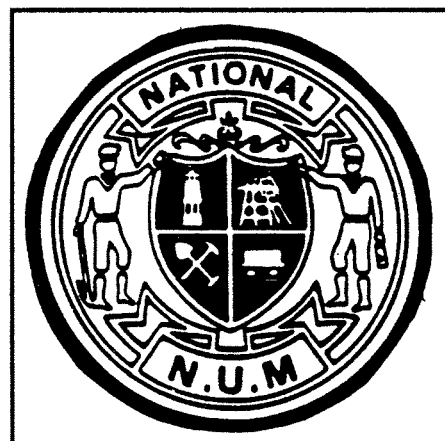
certainly would have happened at Wylfa, where the total number of objections was even greater than those registered for Hinkley, and where the local authorities were even more united and resolute than in the South West.

Unease about becoming involved in the Inquiry system has been present ever since the 1977 Windscale Inquiry, principally because it is said that the results are a foregone conclusion. Certainly there must be a predisposition for major Public Inquiries to be skewed towards the government case, though this does not always mean that it underwrites government policy. But, the importance of the Inquiry does not lie in the Inspector's report. A look backward will show that most such reports are out of date within a few years of publication - and in the case of the Layfield report, even before it was published.

## Time factor

The importance of the Inquiry lies in its broader political role:

- it provides an opportunity for the case against nuclear power to be advanced from a public platform;
- the establishment have to address that case;
- evidence otherwise not available has to be produced, raising the level of debate above the normal level of supply side propaganda;
- it involves large numbers of people, many in the role of objectors, in active opposition. The more they learn the more determined they become;
- there is the strategically important time factor - the CEBG's interest in PWRs began in 1972, in 1978 the government agreed to an option for





two PWRs, in 1979 this was raised to ten, and ten years later one half of one has been built. During this period the Fast Reactor has been relegated. Seven of those ten years have been taken up with Public Inquiries. Seven valuable years.

The nuclear industry is now in a parlous condition, but it is by no means dead. It may have made itself look foolish in the closing days of the Inquiry by pretending that its case then was as good as when it was opened in October 1988 (clearly Wakeham's decision of 9 November had put the future of the whole nuclear programme at serious risk), but not withstanding the egg on its face, it is proceeding with the application. A case so badly flawed in 1989 will hardly bear looking at in 5 years time when the Wakeham moratorium will have ended, but such trivial matters as lack of relevance or factual accuracy has never stopped the Board in the past. We should not underestimate their will to survive.

### Pyrrhic victory

The future of the nuclear industry now hangs by a thread. Failure to bring it into the private sector may have been a relief to those in the ESI (electricity supply industry) like Lord Marshall, who had opposed such a step. They, and perhaps they alone, knew that the consequent exposure to close scrutiny, not just by Parliament and public but by the 'City' and CBI interests, would damage their case, perhaps fatally. And so it has proved. Their victory over the Government is pyrrhic; Whitehall will never again let energy policy be made by the nuclear barons. The truth is out about nuclear power and the credibility of those like John Collier (head of the new nuclear corporation Nuclear Electric) - who continues to bleat that both Fast and Thermal reactors remain beautiful, safe and cheap - could hardly be lower.

It will be impossible to regain the ground that was lost at Hinkley, so far as economics are concerned. The astronomical costs of the back end of the fuel cycle (reprocessing, decommissioning and waste disposal) now dominate the total cost of producing nuclear power. The basic stereotype, deployed for two decades, which purported to demonstrate that nuclear may be dear to build but cheap to operate, is blown out of the water.

This does not mean that attempts will not continue to be made to hoodwink the public: see Donald Miller for example, on the publication of the SSEB Annual Report, arguing that while the

### The Costs of Generation of Hinkley C (p/kWhr) Based on Evidence of Sizewell B Capital Costs

#### Low Capital Cost Case - £1690m

Discount Rate	Availability		
	50%	60%	75%
8%	5.7	4.9	4.1
10%	6.8	5.8	4.8
14%	9.6	8.1	6.7

#### Central Capital Cost Case - £1828m

Discount Rate	Availability		
	50%	60%	75%
8%	6.0	5.2	4.3
10%	7.2	6.2	5.1
14%	10.2	8.7	7.1

#### High Capital Cost Case - £1940m

Discount Rate	Availability		
	50%	60%	75%
8%	6.3	5.4	4.5
10%	7.6	6.4	5.5
14%	10.7	9.1	7.4

back end costs of nuclear have put the SSEB a billion pounds in the red in 1990, nuclear power is still the cheapest source of power!

Critics of nuclear power now have a task to catch up with the way the economic case has shifted. This was dealt with comprehensively in the evidence given by the NUM at Hinkley, which (making extensive use of CEBG data) was the only evidence that evaluated, in total, the past and present cost of nuclear power.

### The real cost

The evidence tracked costs in three ways. Firstly, it exploded the CEBG costs on the fuel cycle. Based on the real costs of the fuel cycle, PWR costs would be between 5.7 and 6.3p/kWhr, ie. twice what the Board argued. Secondly, taking historic costs back to 1962, and adjusting them for realistic load factors and interest rates (60% and 10% respectively), it confirmed a figure of 6.0p/kWhr. This was in accord with the central estimate of the Consortium of Opposing Local Authorities and most of the objectors. On this basis the NUM went on to show that the nuclear levy (the extra cost of producing nuclear power compared with coal generation) would be 10% of unit cost by 1995, and

rising to 30% in the next century, assuming that the PWR programme and AGRs were sustained.

Thirdly, the NUM evidence added to this basic estimate of 6.0 pence the full cost of Research and Development, and Operation and Maintenance, with the result that the cost of PWR output is placed between 7.3 and 9.2p/kWhr, ie. 3-4 times that given in the CEBG evidence. This proved to be very close to the figure of 8p/kWh which rose to 10p/kWhr put forward by the Board in seeking to negotiate long term contracts for Sizewell and Hinkley output with the distributing companies.

It was these figures that eventually frightened first the 'City' and then the Government into dropping the notion of privatised nuclear power. Compared with its main competitor, coal, nuclear is a non starter. If international coal is taken to be the marginal cost fuel, then the advantage tips even more in favour of coal generation. Gas combined cycle technology is even more attractive. Likewise, most of the renewables, especially wind, not withstanding that they are only at an experimental stage in the UK, would be more worthwhile. So far as the economics are concerned, the nuclear industry has come to the end of the road. □

# Food irradiation: the 'experts' choice

**Those opposed to food irradiation are no more than "food faddists", according to Agriculture Minister, John Selwyn Gummer, who promises to "to step on those who create anxiety without need". Here, food faddist PAUL WATTS, the coordinator of FoE's Radiation Monitoring Unit, asks, if food needs to be irradiated what was wrong with it in the first place?**

**A survey conducted jointly by The London Food Commission and FoE shows that 12 of Britains biggest food retailers will not stock irradiated food. The message from consumers and retailers to Gummer is clear, "walk on".**

**T**HE UK Government has decided to lift the ban on food irradiation. The proponents of food irradiation claim it is an effective and safe means of preserving food, at minimum risk to the public. However, the prospect of irradiated food being on the shelves has created considerable opposition from environmental, consumer, public health groups and trade unions. The long list of unanswered health and safety questions means the public could be exposed to a whole new range of risks.

In June 1989 the Minister for Agriculture published a working party report describing a framework for the introduction of irradiation. Its recommendations form part of the new Food Bill to be debated in the 1989/90 session of Parliament, with the necessary legislation expected to be in place by the end of 1990. The Government wants to legalise irradiated food in the UK before the EC Council of Ministers discusses the framework legislation for food irradiation, which the European Commission wants to have in place by 1992. If Britain has already lifted the ban, it will have a stronger say on how the European Commission's legislation should work. The European Parliament has already overwhelmingly opposed irradiation.

## The Irradiation process

The irradiation process involves exposing food to very large doses of ionising radiation - up to 10 kilogray, using cobalt-60, caesium-137 or an X-ray machine as the radiation source. Properly controlled these sources should not make food radioactive. The radiation at these high exposure levels will: kill insects and prevent post-harvest loss; inhibit sprouting of vegetables such as potatoes and onions and delay the ripening of fruits such as strawberries and; will kill many bacteria and other microbial food contaminants.

Irradiation cannot be used with all foods, the fat in dairy products turns rancid, for instance, and with some fruit and vegetables irradiation produces softening and bruising. In some cases smells are produced which may be masked by the use of additives. The provisional list for the EC indicated the following foods may be on the permitted list - strawberries, mangoes,

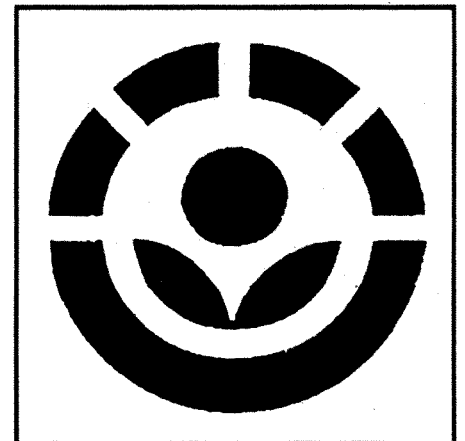
papayas, dried fruits, dehydrated vegetables, cereal flakes, bulbs and tubers, aromatic herbs and spices, shrimps and prawns, poultry and meat, frogs legs and arabic gum. The European Parliament in 1989, however, called for a complete ban with the exception of dried herbs and spices. These may be the first legally irradiated food products in the UK, after ethylene oxide, a harmful fumigant currently used on these products, is finally banned at the end of next year. Poultry and seafood will most likely be next on the UK list.

## Objective Science or Fraud

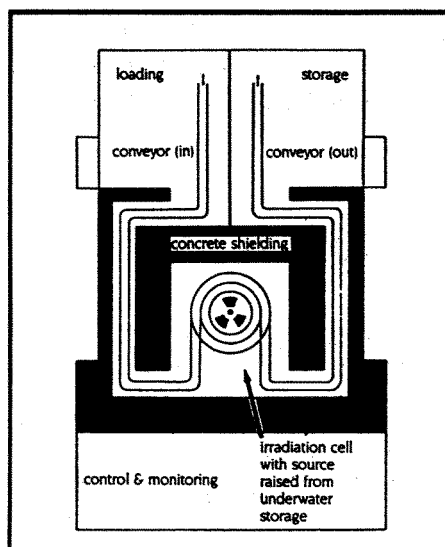
The UK Government's Advisory Committee on Irradiated and Novel Foods (ACINF) reported that there were no special safety reasons why food should not be irradiated. The joint scientific expert committee of the International Atomic Energy Agency, the World Health Organisation and the Food and Agriculture Organisation (IAEA/WHO/FAO) also concluded that there was no problem with irradiated food.

So why are 70-90% of the public, the majority of food retailers (except J Sainsbury) and a string of public health bodies, flatly opposed to irradiation? Who are the 'irrational' lay public, making gut-reaction judgements, to question the wisdom of those learned and lofty scientific 'experts'?

Justification of these natural responses are found in a litany of scientific studies which have shown that the process creates free radicals (reactive molecular fragments with unpaired electrons) and potentially harmful chemical changes.



The Radura symbol - being promoted as the international symbol for irradiated food



Layout of a food irradiation plant

Some animal feeding studies found adverse effects including: low birth rates, lower growth rates, heart and kidney damage, cancers, birth defects, lower immune response, and chromosome damage. Other studies which did not find these effects used massive vitamin supplements. Irradiation can adversely affect the nutritional quality of food, by destroying up to 80% of vitamins, especially vitamins A, B, C, E and K.

As results of this scientific evidence, the Australian Government has recently agreed to a three year moratorium on food irradiation stating "we are not prepared to risk the long term health of consumers". The British Medical Association has called for further research stating that the UK Government's investigation "may not sufficiently take account of, still less exclude, possibly long term medical consequences". Even the UK Government admits there has been insufficient research into the effects of irradiation on pesticide residues, on packaging materials and chemical additives.

The apparent display of scientific arrogance by 'experts' from ACINF and IAEA/WHO/FAO is a characteristic which has been observed in the past. There are lessons to be learnt from asbestos, thalidomide and many suspect food additives which were declared safe in their day. With food irradiation the public are being asked to put faith in one school of 'expert' opinion and to assume that something is safe.

What then are the benefits of irradiation which might offset the potential risks? Proponents of irradiation claim that the process is a major step towards solving the problems highlighted by the recent food poisoning revelations in the UK. While irradiation destroys some of the harmful bacteria in food, it also destroys

beneficial bacteria such as those which cause food to smell when it is going off. High levels of bacteria are a warning sign of the breakdown in food hygiene. Irradiation will reduce levels of salmonella in poultry but not prevent re-growth of the remaining bacteria or re-contamination after irradiation, and may therefore create a false sense of security. Some bacteria, such as deadly *C. botulinum*, are resistant to irradiation. The chemical toxins created by bacteria are a major source of food poisoning, but are not destroyed by irradiation. Irradiation will do nothing to improve bad hygiene - the cause of the recent food poisoning revelations in the UK - it will merely cover it up. Improved hygiene and farming practices are a better option.

### A Solution to Famine?

Irradiation will not have any significant impact on food losses in the 'developing' countries. It will be used on exotic foods, such as mangoes, papayas and seafood, for export to rich countries who can afford food which the local hungry and malnourished cannot. It will be used on food surpluses in developed countries allowing these, now nutritionally depleted foods, to be dumped on the developing countries; in some cases adding insult to injury by calling it "aid". Food irradiation is not one of the appropriate technologies needed to help the world's hunger problem. It is a large scale, capital-intensive technology and has no role to play in the growth of the more human-scale and self-servicing technologies which are necessary for real development.

### Food Irradiation and the Nuclear Industry

A prominent question which has been rattling around in the irradiation debate is the extent of the nuclear industry's involvement, particularly as the major promoter of food irradiation, the IAEA, developed a global marketing plan in 1986. Along with the perceived PR advantage, the other possible benefit is the commercial prospect of selling radioactive sources. This is particularly relevant in the US, where the irradiating sources are mostly of caesium-137, an abundant waste-product of reprocessing.

The favoured source in the UK is cobalt-60, which is produced by bombarding the stable isotope cobalt-59 with a high flux of neutrons. Only some nuclear reactors, such as the Canadian CANDU reactors, can supply this flux. (The neutron flux of the UK's reactors is not high enough to produce sources of the necessary activity.) If the UK

irradiation plants only use cobalt-60, then the UK nuclear industry will benefit little, but should cobalt-60 sources go out of favour, BNFL Sellafield could have much to gain.

### Control of Abuse and Labelling

The Ministry of Agriculture consider that so long as irradiated food is labelled, those who do not want irradiated food will have the choice not to buy it. This however is not an issue of choice, but of public health, comparable to the marketing of dangerous toys for children.

There is no diagnostic test available, to environmental health officers, for determining if food has been irradiated and, therefore, no way for trading standards officers to assess if a retailer has correctly labelled fruit and vegetables. Many shops might be tempted not to advertise that produce has been irradiated, to avoid consumer objections. Doubts remain over the ability to enforce the labelling of food in restaurants and cafes; numerous cases of abuse have been uncovered where irradiation has been used to cover up bad hygiene and contaminated food. Irradiation is a technology capable of allowing traders to by-pass existing public health controls on food quality and food safety.

### Food Irradiation and Green Consumerism

One of the basic tenets of the green movement is giving power back to the individual - replacing harmful, wasteful and over processed products with ones that are environment and people friendly. Compared with many advanced technologies which provide real benefits to people, food irradiation is a technology which takes power away from the individual and puts it in the hands of 'experts'. In the age of green consumerism and increased sales of organic produce, food irradiation is not only irrelevant, but a startling backward step.

Irradiation clearly has no part to play in solving many of the problems associated with the supply and quality of food. The consumer can justifiably say:

*"If food had to be irradiated, what was wrong with it? Good food doesn't need irradiated."*

The real answer to food contamination is not irradiation, but improved hygiene and training in farm, factory and shop. These are measures which the Government has the power to enforce. □



DAVID ROSS, a freelance journalist, attended a wave energy conference in November where he found an extremely cynical wave power community. The Government are currently reassessing wave technology, however, the review is being conducted by ETSU: "It's like asking the West Midlands Police to investigate themselves."

## Britain waives the rules

**T**HREE of Harwell's leading experts on wave energy were given a cool reception when they met the survivors of the official wave power programme in Coventry during November.

The three are conducting a new review into wave power for the UK. The Harwell men come from ETSU, the Energy Technology Support Unit, which conducts the Government's research into renewables from its headquarters in the grounds of the UK Atomic Energy Authority. The review was initiated after concern had been expressed by the House of Lords Select Committee on Europe. It had heard Professor Stephen Salter of Edinburgh University, inventor of Salter's Duck, criticise strongly the way the Government's previous wave programme had been handled and in particular the way evidence about his device had been treated. He repeated the criticisms as an objector at the Hinkley Point inquiry and attracted considerable publicity.

The Government responded by setting up a new study which was announced, as though the Government was ashamed, in a throwaway line at the end of a statement by Baroness Hooper, then an Energy Minister, in the Lords. It almost elluded attention which was presumably the intention.

The Coventry meeting was attended by many of the members of the wave power research teams who had been cast adrift in 1982 when Nigel Lawson, as Energy Secretary, ended funding for their work.

The prevalent view was expressed by Professor David Evans, a mathematician from Bristol University and inventor of one of the most revolutionary wave devices, the Bristol Cylinder, which is held by cables below the surface and rises, falls and rotates as the sea above it is swept by the waves.

He told the ETSU men; "It is very difficult to *turn on* a community which has been switched off for seven years. I would like to be assured that something will come out of this review.

"One needs to have a spark, a seed, that what happens is going to be taken up.

"Why should I think in wave energy terms? What are you going to discover about offshore wave energy that you did not know in 1982? What has changed?"

### Suspicious

The ETSU men did their best to defend their study. Roger Price, Programme Manager for Tidal, Wave and Small-scale Hydro, said: "There is no programme for offshore wave energy. There is no budget for it. This will not be considered until the review has been completed. We cannot tell you what the outcome of the review will be."

The wave energy teams are suspicious for two reasons. They remember how their efforts were abandoned last time. They want to know why the Government plans to spend two years on the new study when there are no developments which change the

general picture and could account for the long time which it will occupy.

"Two weeks, not two years, would be enough", said one participant. Is the Government, some of them are wondering, playing for time simply to avoid political difficulties?

The other worry is over the fact that ETSU is in charge. There is no tendency to accuse the individuals involved of bad faith but it is recalled that it was ETSU which played a major part in sinking the original programme. The study is officially described as an update of Energy Paper 54. That document, produced by ETSU in Feb 1987, contained a table which described wave energy as being "cost-effective in NO scenario." By contrast, it described Magnox nuclear power stations as "cost-effective in ALL scenarios!"

One researcher has said privately that putting ETSU in charge of a reassessment of its own a policy is like asking the West Midlands police to investigate themselves.

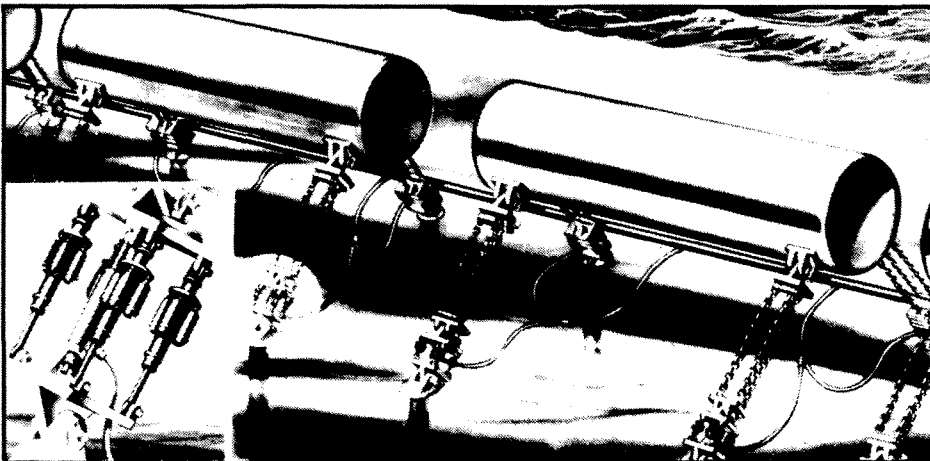
### Hard battle

ETSU is part of the UK Atomic Energy Authority, headed by John Collier who also is chairman of Nuclear Electric. Is it reasonable to expect the leaders of such a body, who are fighting a hard battle to save their cherished nuclear power, to declare that research and development funding should be diverted into wave power, which could make their own favourite energy source redundant?

Wave energy, not to be confused with a tidal barrage, is the one technology which the Government has said has no environmentally damaging features.

The latest survey, published by the EEC, said that we could obtain 30 gigawatts (30,000 megawatts) of electricity from the seas around the UK. That is our average demand on the grid and five times as much as we obtain from nuclear power.

The Coventry meeting was organised by the Solar Energy Society, a voluntary body. All those taking part had to pay for their own travel, food, accommodation and attendance. □



Artist's impression of the below water Bristol Cylinder

ANDREW WARREN, Director of the Association for the Conservation of Energy, previews the decade which he believes will be dominated by consideration of the environment, and concludes that industry would be well advised to find their own solutions to the problem of global warming before they have draconian measures imposed upon them.

## Negotiating the Nineties

**T**HE nineties will be the quality-of-life decade. Nowhere will this be more evident than in the generation and use of energy. Probably within two years and certainly within four, there will exist Protocols on Greenhouse Gas Emissions Abatement, which will have been signed by a substantial - hopefully all - of the developed countries, and with a bit of luck most of the developing ones too.

They will probably take as a model the protocol introduced in Montreal in 1988, covering just one of the greenhouse gases, chlorofluorocarbons (CFCs). They will certainly focus predominantly upon the dominant greenhouse gas, carbon dioxide, which is responsible for over half the emissions which are heating up our planet. And as every SCRAM reader must know by now, carbon dioxide (CO<sub>2</sub>) emissions come mainly from the burning of coal, oil and natural gas.

The protocols will be binding agreements to reduce the amount of these noxious gases around. By how much, is still not entirely clear: many scientists believe that we need to reduce the amount of CO<sub>2</sub> our energy profligacy is creating by 20% within 15 years, and by 50% within 30 years. Already our Government, along

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### *binding agreements to reduce the amount of these noxious gases*

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with 60 others, has agreed to 'stabilise' emissions by the year 2,000 - although whether at 1989, 1995 or merely year 2,000 levels has not been made entirely clear.

That agreed, the question now remains: how do we get from here to there? How do we achieve stabilisation, let alone reduction, particularly in the present circumstances when demand for energy conservation equipment is actually falling by 12% year on year? It has been established that the technology certainly exists already to achieve, at least, the 20% reduction in CO<sub>2</sub> levels. But, where are the mechanisms available to ensure that it is installed?

First, let us look at where these emissions come from. Forty two percent come from coal - mainly when turned into electricity, 28% from oil and 22% from natural gas. If that is so, we must by definition identify our fuel suppliers as the big polluters; and therefore require that it be they who take

the steps, whether directly or indirectly, to help reduce the levels of pollution they cause.

In theory this is easy to do. In the best traditions of the 'command economy', you simply tell these Great Polluters that they must reduce the quantity of the fuels they sell by the required amount. That would effectively reduce the problems of growth of CO<sub>2</sub> pollution, as they say, at a stroke.

The trouble is that simply imposing such draconian measures from above would be exceptionally disruptive, not least to the shareholders in the business told to cut their turnover with no questions asked. But if we continue to spend too much time in the 1990s merely talking about the subject and not doing anything much, it may yet come to such totalitarian requirements. We can still safely say we have not reached such a total impasse. Yet.

Effectively, what we need to do is to find a way whereby the electricity supply industry or British Gas can make money by encouraging their customers to consume less. Of course they do that at the moment by tangentially, by at any rate selling equipment - be it low energy electrical lighting or gas condensing boilers - which works far more efficiently than its conventional counterparts. It has to be said that neither industry's track record on such sales policies is particularly good at present, and even were they to become exemplary this would not in itself solve all our problems.

Because, apart from specific (and one-off) profits from the sales of more efficient goods, there is nothing in the existing licence controlling British Gas or that proposed for the electricity industry, which makes successful demand-reducing energy efficiency commercially interesting for the suppliers.

Logically if a customer wants the lighting output of a 60W incandescent light bulb, an Area Electricity Board could either:

- Contract for 60W of supply from generating company, or
- Contract for 10W of supply, and install a low energy light bulb that will for 10W provide the same quality of lighting as the standard 60W bulb.

In both cases, customer demand for lighting is met. But in the second option there will be 80% less electricity needed - and hence about 80% less pollution produced.

In order to meet customer demand, area boards could choose contracts from generators providing conventional energy supply. Or they could go to energy service companies, providing energy savings who will in turn strike up sub contracts with individual electricity users to undertake a variety of energy efficiency measures at agreed prices and paybacks, as contract energy management companies currently do. The details of these sub-contracts would not be of concern to the board - its direct involvement would be with the energy management company, not the customers.

Changing the licences to allow energy suppliers to earn a return on improving energy efficiency, provides an opportunity for the area boards or British Gas to operate in a more environmentally sensitive manner, without compromising their commercial viability.

On environmental grounds this is understandably preferable to the current position. It has positive benefits

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### *the lower costs of energy efficiency compared with generation costs*

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for customer service, and the development of energy efficient technologies and services. It would allow suppliers to take advantage of the lower costs of energy efficiency improvements compared with generation costs, and pass on the benefits to the customer via lower prices.

At present, I am not aware that any of any the suppliers is positively approaching their regulators to propose this. Or indeed of any other means they may have discovered of making money from saving energy. They are fools for this omission.

Come the time for signing the Greenhouse Protocols, they will suddenly find the onus is on them - as it was on the chemical companies that made CFCs - to greatly reduce the pollution they cause. If they haven't found a way of doing so voluntarily and making money into the bargain, the Command Economy will force them to do so - compulsorily and without compensation. At the beginning of the environmental decade, they have been warned. □

**DAVID LOWRY** of the European Proliferation Information Centre (EPIC), who gave evidence to the Hinkley Inquiry on behalf of CND, reviews the evidence to date that plutonium from Britain's civil reactors has gone into weapons stockpiles in the United States.

# The plutonium puzzle

**I**N January 1983, a week after the Sizewell B Inquiry opened, Lord Hinton of Bankside told me "I don't know whether it is right they [the CEBG] should get permission for a PWR at Sizewell or not, but what is important is that they shouldn't tell bloody lies in their evidence" <sup>(1)</sup>.

As Sir Christopher Hinton, he had been the builder of Windscale in the early 1950s, and from 1957-64 became the first Chairman of the newly created CEBG. Lord Marshall described him, after his death in 1983, as having "immense dedication" and with "a strong, usually deadly accurate, sense of judgement".

Lord Hinton was made so irate by a statement from John Baker, the CEBG's chief policy witness at Sizewell (now chief executive designate for National Power), saying that no plutonium produced by CEBG reactors had ever been applied to weapons use in the UK or elsewhere. Hinton called the statement "deplorable".

The issue became a cause célèbre at the Sizewell Inquiry through 1983-84, and was again a controversy at the Hinkley Inquiry in 1988-89, with CND being the key participant organisation <sup>(2)</sup>.

## Telling lies

Last November, when the Secretary of State for Energy finally 'pulled' nuclear power from privatisation, the media made merry over the institutional economising with the truth by the CEBG over nuclear costs. But, does it matter if a nationalised industry tells lies to its sponsoring government department for 3 decades? Lord Marshall received a spanking quarter of a million pounds pay off for his pains, before he finally resigned last December.

The truth may be out on nuclear waste and decommissioning costs, but what about the full facts on the most potent product in irradiated 'waste' - plutonium. Here is a summary of the most important facts:

The most recently released official government papers, those for 1959, show the Conservative Government of the day was most anxious to consolidate its newly revamped atomic

accommodation with the Americans, and in May 1959 agreed to swap plutonium for highly enriched uranium for military use. A secret note by the top nuclear boffin, Lord Plowden, to No.10 said, "Had we to build all production plant in the UK the capital cost of meeting the present UK hydrogen bomb programme would be some 100 million over the capital cost already incurred to meet the fission bomb programme."

What was politically important about the US-UK deal was that the plutonium from the UK was earmarked to come, at least in part, from the new civil Magnox reactors, then in their planning and early construction phase. In May 1959 Prime Minister MacMillan told Parliament: "Any plutonium which we may exchange with the Americans will come from the civil nuclear power stations or from the Atomic Energy Authority's own reactors at Calder Hall and Chapelcross" (since inherited by BNFL).

## Imposition

A year earlier, in June 1958, the Minister with responsibility for nuclear power (Paymaster-General, Reginald Maudling) was challenged in Parliament over the efficacy of militarisation of the UK's civil nuclear programme. Would military modification to the Hinkley Point Magnox reactors be a "disgusting imposition" on what had been termed a "peaceful programme in nuclear energy?" Maudling was asked. "The Hon. Gentleman says that it is an imposition", he replied, "the only imposition on the country would have arisen if the Government had met our defence requirements for plutonium by means far more expensive than these proposed in this suggestion". (The MOD issued a press statement on 19 June 1958 announcing the Hinkley "modification".)

And indeed, even at this point, the planned "official diversion" of plutonium was not only to meet British bomb needs, as hearings before the US Congress Joint Committee on Atomic Energy, on 5 March 1958, clearly demonstrate.

US Atomic Energy Commissioner Harold Vance told Congress members it was thoroughly consistent that the

plutonium which other NATO members produce and sell the US "could be used for making the very weapons they want". The State Department later expressed jitters about the militarisation of the whole Western European civil nuclear programme, so to compromise, only America's closest atomic ally, the UK, would be co-opted to divert civil plutonium to military uses in the future.

The official agreement which enabled this US-UK barter was the Mutual Defence Agreement on Atomic Energy matters (MDA), signed on 3 July 1958 (after 6 months of Congressional hearings in secret). The amendments agreed, on 7 May 1959, specifically promoted nuclear materials exchanges solely for the furtherance of defence purposes unless otherwise agreed.

## No evidence

As we have seen above, Lord Hinton was concerned that the swaps for military purposes went ahead as planned. The official Government line at the Sizewell Inquiry - and up to April 1986 when Mrs Thatcher said she was not able to answer for previous governments on the matter - was that although civil plutonium from CEBG and SSEB Magnox reactors was sent to the US under the MDA, the US used the plutonium for purposes other than military ones.

There is no evidence for this assertion. In fact, all the US or UK governments know is that the plutonium was delivered. Once it got into the managerial hands of the old US Atomic Energy Commission (USAEC), charged with civil and military nuclear material control, it almost inevitably lost its specific identity. The only issue that interested the USAEC was the quality of the plutonium - and thus the possibilities for end use in various warheads.

Despite this, in January 1976, the then Secretary of State for Energy, Tony Benn, confidently told Frank Allaun MP in a parliamentary reply that he was "satisfied" with the arrangements for plutonium exported from the UK "and with the purpose for which these exports are undertaken". A decade later, in May 1986, in a Parliamentary debate two weeks after Chernobyl, Tony Benn



vociferously recanted on his previous satisfaction with plutonium exports, complaining of "the biggest cover-up of all". "Throughout the period when I was Minister" said Benn, "plutonium from our atoms-for-peace reactors was going to America to bombs and warheads that would return to American bases here."

Benn had bravely disowned his own parliamentary assurance given as a Minister. This put the Conservative Government in the extraordinary position of insisting that Benn's disowned statement was still correct! Indeed Benn had re-inforced his own suspicions over the plutonium deal (initially raised by CND's detailed evidence to the Sizewell Inquiry during November 1984) when he was universally rebuffed by the Government in a reply by the Department of Energy in January 1985. Benn had wanted the Government to publish any exchange of letters between the UK and US governments that constituted an agreed waiver on the stipulation in the MDA that nuclear materials bartered be used for the furtherance of defence purposes. He was told it was "not Her Majesty's Government's practice to release details of exchanges" on the MDA.

The Government could have proved wrong Benn's (and CND's) worst suspicions about the destiny of the plutonium exported to the US. By declining to publish proof of their numerous assertions, this inevitably fuelled further justified suspicion that no such let-out arrangement had ever been agreed.

The prime reason why so much duplicity has been possible by successive governments over the use of civil origin plutonium, is the secrecy that has shrouded Sellafield. Because Sellafield has primarily been operated for military

purposes, international inspectors were barred from any oversight for decades.

Limited access has been permitted since 1986, but this glimmer of glasnost was only achieved after substantial political pressure, brought about by a report by Llewellyn Smith MEP, for the European Parliament's Energy Committee, and from hundreds of parliamentary questions posed by Dr D E Thomas, Paul Flynn, Chris Smith, Paddy Ashdown, Tony Benn and other MPs since 1984. Even now, the Government and Euratom refuse to make clear what access to Sellafield safeguards inspectors are permitted.

Deep dissatisfaction with the overseeing of plutonium production and accountancy prompted CND's major critique of government, nuclear industry and international regulatory and safeguards bodies' policies, in their evidence to the Hinkley Inquiry<sup>(3)</sup>. CND pointed out that even though the UK government said it would implement the recommendation - Number 13 - of the 1987 Sizewell Report on plutonium accountancy, in practice this had not been carried out. In particular, the commitment to publish "at regular intervals full and accurate records of the quantity and isotopic content of plutonium produced in UK civil reactors" has not been fulfilled.

### Loopholes

Even if the Hinkley C reactor is never built, it is important that the loopholes currently existing in safeguards and overseeing of nuclear materials and facilities are properly closed (SCRAM 73). The current annual government contribution to the IAEA is \$7.7 million (or 5% of its total budget). Mrs Thatcher

told Parliament in December that "when the Agency's board of governors discusses the budget for 1991-92, the United Kingdom will continue to argue that safeguards activities deserve the highest priority". The lack of co-operation shown by UK authorities over safeguards implementation, especially at Sellafield, suggests that the Government does not practise what it preaches.

On 5 December 1989, late in the afternoon ensuring press deadlines were missed, the Department of Energy released its third annual report on production and stocks of civil plutonium, in the form of a news release (No.180). Up to 1986, such details had been published in April or July in a parliamentary reply. Since the Sizewell recommendation 13(b), the information has been published as a press release, and not placed on the parliamentary record, despite various requests by MPs.

### Rounding errors

In a written parliamentary reply last December to Dr D E Thomas, the DoEn stated that "the estimates of fissile content [of plutonium] are shown to the same accuracy [in press release 180] as in the estimates given by the electricity boards to [the] Department". Yet Dr Peter Wilmer, Head of the CEB Nuclear Fuel Cycle Department, when asked by CND's Dr Keith Barnham at the Hinkley Inquiry whose decision it was to present the plutonium data in the news release in a "rounded form" - to the nearest 50kg, replied "That decision was taken by the Department of Energy, both in terms of the principle, and in terms of that rounding." He added that the CEB had "no objection in principle" to rounding to the nearest 10kg. Later in reply to a question from the Inspector, Dr Wilmer admitted there was in fact a deterioration in the precision of plutonium figures quoted due to rounding. He described this as "coarsening"!

Even though the CEB are the creators of the 'civil' plutonium, the ownership of which is disputable as the European Commission could in theory under article 86 of the European Treaty lay claim to the title of ownership, the management of the plutonium once it is transported in spent fuel to Sellafield becomes the responsibility of BNFL. Dr Wilmer explained that the CEB accepted a pro-rata allocation (minus process losses of around 3%) of plutonium after reprocessing, and justified this practice thus:

"We have never denied that the whole matter of reprocessing is an inter-related one once the fuel gets to



Sellafield. Now, I have indicated that the computer program we use has been based on the results of reprocessing campaigns at Sellafield and so too have those of BNFL's other customers. So we rely on the skills and integrity of BNFL, indeed, in ensuring that we are getting our appropriate allocation."

Considering that a major reason why the nuclear industry was withdrawn from the privatisation plans was that apparently BNFL had been economical with the truth over the real projected costs of reprocessing and waste management, perhaps the CEBG ought to have been more cautious in accepting their figures on plutonium.

CND's own conclusions in its closing submission to the Hinkley Inquiry state "past experience provides no sufficient assurance that plutonium resulting from [any future reactor constructed] would be managed and accounted for with adequate candour and competence"; that the government's publication of plutonium data in press releases is "an inadequate and evasive response" to the Sizewell Inspectors recommendations; that the safeguards arrangements purported to have been agreed in principle in June 1986 to cover Sellafield "should be published in full" (excepting details of access routes to sensitive facilities to protect security); that the EEC's nuclear inspectors from Euratom "be and be seen to be accorded full access to all parts of the Sellafield plant processing or reprocessing civil plutonium or material containing civil plutonium, to make appropriate tests and checks" - which was something the Conservative Government of 1962 agreed to in principle.

### Withdrawal

In light of the Government admissions that on at least 58 occasions civil nuclear material had been withdrawn from safeguards (even if only temporarily on occasions) since 1978, under the so-called IAEA-Euratom-UK Tripartite Safeguards Treaty, CND further argued that the UK government "give a public undertaking that it will not exercise its rights under article 14 of the Tripartite Agreement to withdraw materials from safeguards" and seek to negotiate the abrogation of the withdrawal clause.

In order to ensure appropriate oversight of these changes in procedure, CND propose that to avoid "continuing mistake and misinformation" that a "monitoring body drawn from concerned and suitably expert organisations outside the nuclear industry" be established, including membership of university faculties, Chambers of Commerce, farming and

trades union organisations, as well as specialist groups such as the Verification Technology Information Centre (VERTIC) and the Political Ecology Research Group (PERG).

Recognising the importance of the 141 member state Nuclear non-proliferation treaty (NPT) in controlling proliferation CND suggested that the range of changes set out above be implemented before the fourth review conference of the NPT, to be held in Geneva in August/September. In fact at the last NPT review conference in 1985, the final declaration called for an extension of safeguards to all civil activities in nuclear weapons states and for the implementation of a complete separation of civil and military nuclear cycles; these were seen as the essential pre-requisites for genuine nuclear disarmament developments.

### 140 bombs worth

The CEBG accepted under cross-examination at Hinkley, that present accounting methods for plutonium mean at least 140 bombs worth of plutonium could have gone into the weapons stockpile as a result of errors inherent in the procedures. With around 53,500kg of civil origin plutonium in various stages of storage and separation at Sellafield, should the government decide to divert the stockpile for weapons, this could provide 5,350 warheads.

Speaking at a nuclear industry sponsored lunch in September 1987, the Sizewell Inquiry Inspector, Sir Frank Layfield said that he was concerned

"above everything [else] at the Sellafield Inquiry, that we need to remove permanently and effectively the 'sense of secrecy' which has tended to surround nuclear power". For those from the small band of researchers dedicated to divulging the truth rather than the received unwisdom over plutonium, no words could ring truer. There are still many pieces yet to be overturned in the plutonium puzzle. □

### NOTES

1. The full interview (excepting parts Lord Hinton specifically requested were 'off-the-record') was published in ERG-048, "Reflections on Britain's Nuclear History", £7.50 from the Energy and Environment Research Unit, Open University, Milton Keynes MK7 6AA (0908-653335).

2. For an account of the political background to the emergence of plutonium as a potent policy issue see the chapter by David Lowry "Nuclear Weapons and Nuclear Power: Bias and Mythology in the Making of the British Magnox Nuclear Reactor Programme" pp127- 166, in "Science and Mythology in the Making of Defence Policy", edited by M Blunden and O Greene; Brasseys, 1988.

3. CND presented 6 documents, including statement of case and closing submission (October 1988-December 1989). CND-4, "Public and Private Plutonium: reprocessing the truth", by David Lowry, presented April 1989 contains the main criticisms of present safeguards arrangements in the UK. Obtainable from EPIC, 258 Pentonville Road, London N1 9JY (01-278 2069).

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Energy policy is the key to unlocking the heat trap. The US Environmental Protection Agency says that between 60 and 65% of the greenhouse gases are produced either directly or indirectly by energy use. MIKE TOWNSLEY asks how can we get out of the global greenhouse?

# Unlocking the 'heat trap'

**W**ITH 1989 rated the fifth warmest year since records began in the mid 1800s, according to both the University of East Anglia and the Meteorological Office; the '80s can now boast of the 7 warmest recorded years.

Phil Jones, of East Anglia, believes "the greenhouse effect is the most likely cause ... We'll not really have concrete proof for another decade or so. But if we are changing the climate, it is much easier to do something about it now rather than waiting until the warming is more severe."

What can be done and how? Three major reports on the greenhouse problem have been published recently, one from the House of Lords <sup>(1)</sup>, one from The Royal Institute of International Affairs (RIIA) <sup>(2)</sup>, and one from Friends of the Earth <sup>(3)</sup>. Each has a different focus, and jointly they give a clear picture of the current state of play.

FoE concentrate on the UK by setting out "An Agenda for UK Action on Energy Policy." They show, by leaving aside the transport sector, that the "adoption of the most cost effective measures would produce a 46.5% cut in CO<sub>2</sub> emissions from 1987 levels by 2005, whilst meeting predicted energy demand increases, and with no need to build nuclear power stations." If nothing is done CO<sub>2</sub> emissions will increase by 25%.

FoE have produced a table giving measures for reducing CO<sub>2</sub> in order of cost effectiveness. However, it does not fully embrace the cost of other environmental consequences associated with each option. They comment, "while this acts as a constraint on the final conclusions which can be drawn, such costing would act to improve the standing of the energy efficiency measures and renewable energy technologies." Also, in their economic assessment they used 4.9p/kWh as the price for nuclear generated electricity, in light of recent revelations about the true cost of nuclear, about double the 4.9 figure, they comment, "This would clearly act to further disadvantage nuclear power in relation to other options in the analysis."

The most publicised recommendation of the Lord's select committee was: "Nuclear power is the only proven adequate alternative to fossil fuel energy generation. Abandonment of research into the fast reactor technology is short sighted. Under section 3 of the Electricity Act the Secretary of State should exercise his duty to promote R&D into new techniques for generation and reconsider the future of the Dounreay PFR." They would have us throw away money that

should be channelled into the measures outlined by FoE, or spent much more effectively in helping the developing world avoid repeating the industrialised nations' mistakes.

They also want the UK to "maintain an independent national effort in research relating to climate change, especially in those areas where UK scientists occupy a leading role." Surely an international effort, involving leading scientists from all nations sharing funds and facilities would be a more effective course to take.

The 'short sighted' nationalism expressed in the Lord's report highlights the problems of building an effective international framework for cutting greenhouse emissions. It is with this in mind that the RIIA have drawn up their report. It is the only one, of the three, to tackle the international issue of emissions abatement. It is a realist solution.

## Energy measures in merit order of marginal cost of CO<sub>2</sub> cuts, and potential saving (10<sup>6</sup> tonnes CO<sub>2</sub>) by 2005.

1. Fuel switching (electricity to gas)	8.07
2. Electrical appliances e.i.	25.97
3. Industrial CHP	20.80
4. Lighting e.i.	32.72
5. Small scale CHP	6.89
6. Cooker e.i.	4.05
7. Commercial and service sector space heating e.i.	31.63
8. Gas-fired combined cycle power generation	35.28
9. Water heating e.i.	8.63
10. Motive power e.i.	22.92
11. Domestic sector space heating e.i.	34.69
12. City-wide CHP	12.17
13. Process heat e.i.	15.44
14. Renewable energy sources	17.29
15. Nuclear power stations	49.85
16. Industrial sector space heating e.i.	7.77
17. Advanced coal combustion power generation (non CHP)	3.19

e.i. - efficiency improvements

Recent intergovernmental meetings have attempted to agree target reductions to be met by all industrial countries, as was used for CFC emissions in the Montreal Protocol, "they have failed," observe RIIA. "The idea that an agreement on limiting the greenhouse effect will be like the Montreal Protocol writ is an illusion best dispersed before it leads us irretrievably down a blind alley", comments Mike Grubb, the report's author.

Global warming, as the name suggests, is a global problem, its solution will require cooperation on an unprecedented level.

Although, currently, the bulk of the emissions problem lies in the industrialised world, the effect of industrialisation, or development, in the less developed countries (LDCs) and the economic circumstances which force many countries to clear vast tracts of rainforest cannot be underestimated. Any agreement will need to involve the LDCs. It is, however, difficult to believe that they will simply agree to stop burning rainforests or ignore industrialisation in order to avoid the effects of global warming sometime in the future. Their problems are here and now. Any agreement would need to address those problems.

"Some problems will be greatly compounded by the need to include developing countries, for most of whom the question is not how to reduce emissions but how to limit the rate of their growth while developing, and how to finance the programme for such limitations. The associated problems will further magnify the complexity of negotiating targets," argues Grubb. He proposes introducing carbon permits; "a per capita entitlement to emit carbon ... in the form of carbon permits which can be leased in return for technical assistance, for aiding development in the most efficient and least polluting manner." This has numerous benefits, not least of which is the justice of the polluter pays principle.

"If there is to be an agreement," argues Grubb, "it must have the flexibility of a tradeable system. Why should Japan agree to reduce national emissions when it could reduce global emissions by more, for less money, by assisting less efficient countries." This system would work in the short term, but a long term solution to greenhouse emissions will also have to be found. A programme of replacing systems which produce greenhouse gasses for cleaner alternatives would have to be run in tandem, or else in 50 or 100 years time we would be back to square one.

Sadly, the question still remains: can governments ignore their political differences and petty self interest, and develop a frame work to cool global warming? □

## REFERENCES

1. "Greenhouse Effect" The House of Lords Select Committee on Science & Technology, 6th Report. HMSO, £7.20. 1989
2. "Negotiating Targets" by Mike Grubb. RIIA, 10 St James Squ, London SW1Y 4LE, £10. Dec 1989.
3. "Getting out of the Greenhouse: An agenda for UK action on Energy Policy." by Simon Roberts and Tim Jackson. FoE, £2.50. Dec 1989.



## Windpark controversy

**P**LANNING permission for what could have been the UK's first windpark has been refused by the North Cornwall District Council (NCDC), because of fears over noise pollution.

The plan to build a 3-4MW windpark at Delabole, near Camelford, was rejected by only one vote. Those who voted against the application are believed to have been influenced by two factors: the advice of district and county officials; and a spoiling operation launched by a Cornish wind energy expert, Geoffrey Williams.

The officials' motives are perhaps understandable, as it is their duty to guard against excess noise generation in the area.

Williams is well known in the wind industry and has plans of his own for setting up a windpark not far from Delabole, he heads a wind company called Windfarms Ltd. Had the council accepted the proposal it would have set a precedent which would have worked in Williams' favour.

However, Williams' company leafleted 3,000 homes in the area urging residents to lobby their councillor to vote against the proposal. The park would have used about ten medium sized Wind Energy Group (WEG) wind turbines. Williams calculated that the machines would generate considerable amounts of noise. His calculations were based on outdated information according to Charmain Larke, coordinator of the Cornwall

Energy Project, an independent group set up to promote renewable energies in the area (SCRAM 68). WEG have recently agreed to abide by the British Standard Code of Practice which sets limits for industrial noise in rural areas. CEP are promoting 50MW of windparks in Cornwall.

Larke believes that Williams has done the industry a serious disservice by spreading misinformation and untruths about potential environmental degradation. Some observers believe that Williams may have been acting to protect his patch from an invasion of WEG turbines; his company markets wind turbines he designed.

Peter Edwards, the local farmer who proposed the park, invited the councillors to visit the Wind Turbine Testing Centre at Carmarthen Bay, in South Wales and it seems that only those who declined his invitation voted against his application.

Edwards must now wait and see if a full meeting of the NCDC takes the unusual step of overruling their planning committee's decision, before deciding whether or not to appeal against the decision to the Department of the Environment.

Whatever Williams' motivation, by helping to foil the first planning application for an independent windpark in the UK he may have set a dangerous precedent which will lead other councils to reject windpark proposals, including his, in their area. Wind Power Monthly comments: "the outcome could put back wind energy in Britain for years." □

## Offshore development

**O**FFSHORE wind power is set to become a reality by the end of next year. Denmark plans to build a 5MW windpark 1.5km off the coast of Lolland.

This will not be a commercial venture; Elkraft, Denmark's Utility Association, do not expect it to produce power as cheaply as a land based park, nor do they believe it will make a profit. It is intended to test the water, to establish whether offshore wind is feasible.

Eleven 450kW machines will be arranged in two rows, on metal caissons weighing 445 tonnes with a filling of sand weighing a further 1,100 tonnes, with nine or ten rotor diameters between each. Normal practice for on-land installations allows at least seven rotor diameters between machines to avoid wind shadow effect.

Costing £6.6 million, about £700,000 of which is being met by the EEC, the offshore park will be twice as expensive as an onshore development. Its electricity is expected to cost around 5.5p/kWh, whereas a good coastal site produces at 3.2p/kWh. It will be brought to shore by a 10kV submerged cable.

Denmark already has a windpark situated on the outer rim of a harbour, along the harbour wall, at Ebeltoft. The pioneering spirit shown here is one of the qualities that will put Denmark in the driving seat of the European wind industry when the markets are opened up in 1992. □

## Serious blow

**W**IND POWER is "prohibitively expensive", according to the North of Scotland Hydro Electric Board (NOSHEB). At the beginning of December prospects for the Scottish wind industry were dealt another serious blow, when NOSHEB announced that they had no plans for developing wind power on Shetland.

Following their experiences with the 750kW Howden's machine, on Susseter Hill in Shetland - which was synchronised with the local grid over a year ago, but is yet to become operational - they have decided not to pursue any further projects. A spokesperson for the Board said: "Our experience to date leaves us with the view that wind power is not as simple as it may sound. It is prohibitively expensive - it costs twice as much as diesel - and it is not as reliable." They added, however, that renewables were being given a higher priority, reflecting peoples concern for the environment.

John Twidell, a council member of the British Wind Energy Association (BWEA), and Director of Strathclyde University's Energy Studies Unit, disputes the Board's dismissal of wind energy. He believes, "You could get all your energy from the wind for ever and ever. You just need to look across the water to Denmark where they have over 2,000 machines - and that's with second hand wind from Shetland."

He suggests that if Shetland's electricity was not controlled from Edinburgh then perhaps wind generators would be more common on the islands. According to the BWEA wind power could provide over 20% of the UK's electricity needs and prevent 50 million tonnes of CO<sub>2</sub> from being released into the atmosphere annually.

However, given the current state of the Scottish industry - Howden have pulled out and both of Scotland's electricity boards declaring no interest - it is unlikely that Scotland will make a contribution in the near future. □

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## Woodfuel

**SURPLUS** farming land would be best used to grow trees for electricity generation, the Oxford Farming Conference was told at the beginning of the January.

6% of Britain's electricity could be generated from trees grown on 1 million hectares of farm land, according to Murray Carter, chair of the Wood Energy Development Group. Carter, who has visited Canada and the US on a Churchill Scholarship to study wood crops, believes the present European Community (EC) "set aside" policy for taking surplus land out of production is a "short term

expedient" which is failing.

EC food surpluses mean that up to 1.5 million hectares of UK farmland may be surplus to requirements by the year 2000 and 5.5 million by 2010, according to Cambridge University's Department of Land Economy.

Carter told the conference that a scheme could be devised to tackle the food surpluses and find other productive uses for the land. It would create jobs, attract investment in the countryside and provide a long term, self-sufficient future, independent of public subsidies.

Willows and poplars would be ideal, they grow quickly and could be harvested every 2-5 years. They could be heated to produce hydrocarbon gases which would then be burnt in an internal combustion engine

linked to a generator. Surplus heat would not be wasted, it could be used to dry the fuel before burning. Small stations of about 500kW are envisaged, producing power for the national grid between November and February when demand is at its peak.

Farmers who grow trees as a cash crop could receive £60 per hectare for the first five years, under the present set aside rules, but the target cost of such a power station is £50,000. Carter called upon the Government to fund trials and research into on-farm woodfuel power stations. He complained that current Government agriculture research centres concerned with wood-cropping were suffering staff shortages, he described this as a "gross mismanagement of national resources." □

## Acid map

**AN ACID RAIN** map of Scotland, has been commissioned by the Scottish Office. It will be produced over the next 3 years by the Macaulay Land Use Research Institute.

Costing £100,000 it will "identify sensitive catchment areas and assess the critical loads of pollutants which they can bear so that they can be managed in an environmentally sensitive way," announced Lord James Douglas-Hamilton, Minister for the Environment at the Scottish Office.

He also called for a "further emission reduction of at least 50%," and admitted, contrary to Forestry Commission arguments that, "trees may themselves by trapping airborne pollutants play some part in determining the levels of acidity reaching surface waters."

Over a year ago the Scottish Development Department organised a symposium which highlighted the acidification problem in

Scotland, the map is a response to that. A report from the symposium has also been published\*.

Dr Jeffery Watson, of the Institute, said, "The main areas which seem to have been affected are in Galloway and some areas in the south-west Highlands around Loch Ard ... But, there are many areas where it is simply unknown whether critical loads are being exceeded." No mention has been made of the effects of acid rain on public health, or on the tourist and fishing industries off the affected areas.

Much of the acid rain that falls on Scotland comes from abroad, Europe and England. While some hope can be gleaned from the UK's agreement to meet the European Community directive calling for a 60% reduction in acid emissions by 2003, it now seems extremely unlikely that the UK will meet the target. An intermediate step of 20% by 1993, was also set and agreed to by the Government. Most environment pundits wouldn't even give odds on this being met in the UK. Steve Elsworth, Greenpeace

campaigner on air pollution, comments, "It's not a particularly challenging target, but they are not going to meet it," adding that estimates suggest only a 10% reduction by 1993.

Prof Fred Last, honorary professor of Forestry at Edinburgh University, who chaired part of the symposium, called for the adoption of a European attitude to pollution, where people are seeking to abate emissions on the grounds that they should not be pumped into the atmosphere until their effects are known. He said: "In Britain the attitude has been, we will not abate emissions until we know what they do: it is a fundamental difference."

Action will be further delayed whilst we await confirmation of what we already know to be a problem. □

\*Acidification in Scotland, 128pp, £8.00. Published by The Scottish Development Department, Environmental Protection Division, 27 Perth Street, Edinburgh EH13 5RB

## Snowdonia hydro attack

**NATIONAL** Power has launched an attack on Snowdonia National Park: they plan to flood large areas of the park and build a 6 mile pipeline, above ground, through some of the UK's most precious wilderness.

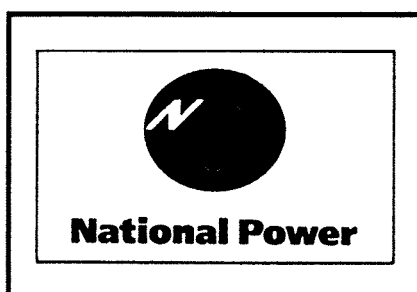
The plan to create three lakes which will feed a pipeline connected to turbine generators capable of producing 40MW of electricity has angered local environmentalists. Alan Jones, national park officer for Snowdonia, said "We know little detail about the scheme but there must be reservations. There will be little support for a power station as it goes against national park principle."

News of the scheme came on the 40th anniversary of legislation to protect areas of outstanding natural beauty. Snowdonia already suffers from the presence of Trawsfynydd Nuclear Power station, and another hydro scheme. The existing hydro scheme has a pipeline above ground at Cwym Dyli. At the time the CEGB said that it needed to be 6 feet off the ground to allow

grazing for sheep, however, it has since been fenced off and painted dark green. It can be seen for miles.

Amanda Nobbs, of the Council for National Parks, said "National Power should not even contemplate putting forward a proposal for development in a national park unless there is an overriding national need that cannot be met in any other way."

It is difficult to see this proposal as in the national interest, it is just another display of the power companies contempt for the environment. □



## Green data

**WIDER** access by the public to industrial pollution data will be built into the Government's so-called 'Green' Bill.

The move comes after the House of Lords Select Committee on the European Community published their report on a European Community draft directive on freedom of information.

The Earl of Cranbrook, the Tory chair of the Committee, said "We felt that all data on pollution required by regulatory authorities for emission control should be open to the public examination."

The Bill will also incorporate the Lord's recommendation that industry will need "particularly weighty reasons" to justify non-disclosure of emission details on the grounds of industrial secrecy.

However with the current crisis in Her Majesty's Inspectorate of Pollution it is difficult to see who would enforce this law.

Plans for similar laws in Scotland are being prepared by the Scottish Office and will be incorporated into the Bill at a later stage. □

## Barrage across the Mersey

**A**N APPLICATION has been made to the Department of Energy by the Mersey Barrage Company for inclusion in the initial tranche of the post privatisation non-fossil fuel obligation (NFFO).

Its acceptance, says Energy Minister Peter Morrison, depends on an agreement being "reached between area boards and the company on a suitable contract, and [if] the project is commercially viable."

Such contracts have not yet been negotiated, it had been hoped that inclusion in the NFFO would create a market for the Barrage's electricity and help secure investment in the project.

According to the latest estimates, the barrage will generate 50% more electricity than previously thought. Twice a day, during the 12 hour period of the ebb tides, it should produce 700MW, enough electricity to meet three quarters of Liverpool's needs - about 0.65% of England and Wales' demand. Merseyside and North Wales Electricity Board is the most likely customer for the scheme's output, in fact they were amongst the original 15 investors in the project.

The Barrage, spanning the Mersey between Liverpool and Rock Ferry, south of

Birkenhead, would not pose any threat to shipping because the bulk of it comes into Liverpool Docks and the Tranmere oil terminal, which are both downstream of the crossing. Any shipping wishing access upstream would be able to pass through navigation locks. It would create an initial 5,000 construction jobs, and would be capable of supporting a road, improving the currently poor access from the Wirral and North Wales to Liverpool Airport. An option to build the road has been offered to the Government. It could also attract 500,000 tourists each year, say MBC, drawing over £10 million to the region, bringing with it further new jobs.

The scheme has been criticised by Professor Patrick Minford, a former economic advisor to Mrs Thatcher, who described the proposal as "irrelevant" and "potentially damaging". His criticisms form part of the recently published Merseyside Economic and Business Prospect report.

The economic study states: "The need for it to meet demand for electricity is very questionable and the disturbance to the natural environment would be significant, with unpredictable consequences."

Minford believes that the rate of return on the £880 million investment would be about 4%, well short of that required by private

investors who demand at least 10%.

MBC have rejected Minford's assessment, arguing that he has neglected the schemes potential for flood pumping - reversing turbines to pump water into the reservoir during flood tides.

Barrage economics are curious, conventional methods of accounting make no allowance for their 120 year minimum life span. MBC are trying to put a financial package together that reflects the schemes longevity. Barclays de Zoete Wedd, MBC's merchant banker, has devised a funding mechanism which would reward early investors with premiums and enhanced returns for foregoing the usual early returns.

Nick Hammond, of MBC, said that an eventual rate of return of nearly 10% would be achieved, however, returns in the first five years while building was underway would be nil. During the first 25 years of operation the scheme's electricity would cost about the same as that of a conventional plant, but once the investment was paid back, electricity generated over the following 95 years would be a great deal cheaper.

All going well, MBC hope to float the proposal by a Parliamentary Bill in 1992, and estimate that generation could begin in 1998. □

## Denmark tests the waves

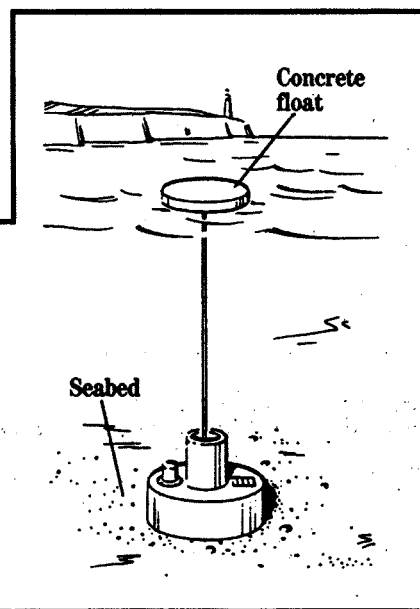
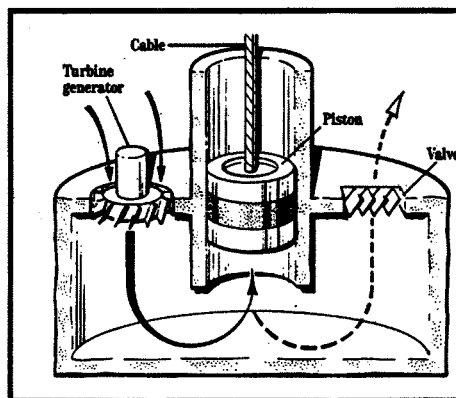
**D**ENMARK has begun sea trials of a very simple wave energy device.

The device consists of a 21 tonne concrete float connected to a generator on the sea bed, as the float rises it pulls a piston which in turn causes water to be sucked through a turbine - generating electricity - when the float drops the water is pushed out through a rectifying valve. The prototype is rated at 65kW, and has been developed, with financial backing from the Department of Energy and Elsam the state utility, by the Danish Wave Power Consortium (DWP).

By keeping the design simple it is hoped that mass production and maintenance costs can be kept to a minimum. Mass produced models, say the developers, could be carried by barge to the generation site and installed at a rate of 2 or 3 a day.

DWP hope to improve the economics of the device by improving its conversion

efficiency. Perhaps they should consider using a Wells bi-plane turbine which would enable them to generate on both the up and down stroke of the piston. This option may not however be politic, as a key member of DWP is the turbine manufacturer Flygt, who will presumably prefer to use their own conventional turbines. □



## Wave power clams up

**R**ESearchers at Coventry University are dismayed at the Government's decision to freeze funding for wave power pending the results of a 2 year review of the British wave option.

The Coventry team have managed to continue working on their device 'the Clam' since the Department of Energy's controversial decision to stop funding wave research in 1982, by attracting funding from the Ready Mixed Concrete Group.

In 1987 the team applied to the Government for £370,000 to take the project to the next stage, it was refused and almost

no work has been done on the device since. Tony Peatfield, of the Coventry team, warns, "unless we get Government funding by the end of this year, we will fold." If that happens, and the wave review proves favourable, they may not be able to re-group.

The Clam has a row of air bags which are attached along the front of a box shaped spine made out of pre-stressed concrete. Each bag collapses and expands with the motion of the waves and the resultant air flow is used to drive turbines mounted within the spine. A full scale device would be about 300m long with an output of about 10MW. □

## Ocean thermal energy

**H**AWAII is exploring the possibility of using the ocean's thermal energy to generate electricity.

The Natural Energy Laboratory of Hawaii is planning to build an experimental plant at Keahole, where in the summer surface water temperatures are 27°C and water at a depth of 700m is only 5°C. The plan is to use the 2 constant streams of water to evaporate and recondense ammonia fluid which circulates in a closed cycle connected to a turbine.

To get around the high capital costs they will also use the deep sea water, which is rich in nitrates and phosphates, for a fish farm. □



## Efficient homes

**A**CCORDING to a new report\* by Neighbourhood Energy Action, 1.7 million council tenants have inadequate loft insulation, 3.5 million have draughty homes and 3 million have uninsulated cavity walls.

The report calls on central Government to "use its powers to influence energy efficiency standards in local authority and housing association properties occupied by low-income families and pensioners."

It points out that from 1990 even tighter controls on local authority capital spending will be exercised, through a new system of

credit limits, and that local authorities will not be able to subsidise housing from community charge accounts. "The 'carrots' of additional credit approvals, permission to use capital receipts, and Housing Corporation finance could be used to ensure that energy efficiency was more systematically built into home improvement and that nationally recognised standards were adhered to," argues the report.

"The needs of low-income households for affordable warmth should make action in this field a priority for any government," say NEA. Adding this "social need" to the increasing environmental concern and the Government's desire to reduce fossil fuel

burning gives NEA's case considerable weight.

The Government pays lip service to the need for action in the domestic sector, to help alleviate the pressure on the environment. The report comments: "For those 6 million households in local authority and housing association property though, the task is much simpler, as Government has only to influence the landlords - 450 local authorities in England Scotland and Wales and around 2,600 housing associations." □

\* **Energy Efficiency in Social Housing: Progress and Prospects for Improvement.** £3. NEA, 2-4 Bigg Market, Newcastle Upon Tyne NE1 1UW.

## New generation of gas stations

**P**OWERGEN have placed an order for a £300 million gas-fired power station, to be built at Killingholme by the West German company Siemens.

The Killingholme plant is being billed as the first of its kind in the UK. It will be a combined cycle gas-fired station rated at 900MW. Consent to build the station has been granted by the Secretary of State for Energy. Powergen, who have as yet not signed any deals for its output, plan to begin construction later this year and hope to have the plant up and running by October 1992.

Combined cycle stations are likely to

become increasingly popular as the greenhouse debate warms up: they produce much less CO<sub>2</sub> than a conventional coal-fired station. They will also help to fight acid rain, as their sulphur dioxide emissions are virtually zero - eliminating the need for expensive desulphurisation plant.

Powergen is examining plans for a further 1,000MW of gas-fired plant, and National Power have lodged planning applications for 2,000MW of gas plant.

It is estimated that orders worth £1.6 billion will be placed by private electricity generating companies after privatisation. □

## People power

**G**LASGOW District Council have reversed their decision not to award a grant of £750,000 to the Easthall Residents Association (ERA) for energy efficiency improvements to their housing (SCRAM 74).

As a result of the award ERA have secured the balance of the funds required from the European Community's Energy Demonstration Programme, £380,000. The remaining £250,000 for the project is coming from the Greater Easterhouse Initiative.

The project centres round the infamous Wilson Block which boasts 32 mouldy, damp ridden, flats. ERA secretary, David Humble, said "It's a project which will turn houses into homes ... lucky tenants selected for the pilot project stand to cut their average weekly heating bills from £30 to £5." They, in particular the children, will also be liberated from the depression and constant danger of illness brought about by housing conditions where mould and fungus thrive.

Yet, there are 7,000 Wilson Block-type homes in Glasgow, the tenants of each one will now want to know why they are being deprived of the basic human right to a clean, dry and warm place to live. Perhaps this is why Glasgow District Council were reluctant to award the ERA grant: they may now have opened the flood gates of protest. □

## Dounreay studies wind

**A**TOMIC Energy Authority Technology (AEAT), at Dounreay, are to take part in a feasibility study aimed at examining the prospects of wind power in the area.

AEAT are joining the Department of Energy, the Scottish Development Agency and the Highland and Islands Development Board in a £138,000 study of Caithness and Sutherland. They will assess both the economics and environmental impact of a system based on wind.

A spokesperson for AEAT said that their involvement was part of Dounreay's planned diversification which was being pursued as a result of the run down of the fast

breeder programme.

"We have been in Caithness a long time and have a lot of information and data that will be useful to the investigation, such as our meteorological figures, which our health and safety people have had to keep.

"I don't think anyone is arguing that wind power could ever replace hydro power or nuclear power, but we would want to see if it could complement these energy sources," he said.

Indeed nobody would want to see wind power replace hydro power, but there are many who not only see it replacing nuclear power, but are arguing for just that. □

## Chicken power

**A**NOVEL electricity generating station will be fuelled by 1100,000 tonnes of Chicken droppings, straw and wood shavings: Fibropower want to build Europe's first Chicken dropping-fired power station.

The plant costing £20 million would be rated at 10MW - enough power to heat and light 10,000 homes. Fibropower have applied for permission to build it on a disused airfield, in Suffolk, one of the centres of Britain's intensive poultry-farming industry.

The litter would be burned in a special Danish furnace, steam produced in a water-tube boiler would be used to drive a

turbine coupled to an electricity generator.

The plant would also be fitted with scrubbing equipment to remove emissions of nitrogen and sulphur. Its ash would be recovered and sold as Nitrogen-free fertiliser.

Chicken litter currently causes environmental problems. If used directly as manure its nitrates leach into the soil and waterways, says Simon Fraser, chair of Fibropower. It also produces methane, a greenhouse gas and is a health hazard because of bacteria generated.

The Energy Technology Support Unit plan to monitor the scheme, presumably from a safe distance. □

## Fuel-cells

**T**HE Department of Energy has begun studying the potential of fuel-cells for the UK.

The fuel-cell, which uses a chemical reaction to generate electricity, was invented by a British lawyer called William Grove, in the 1830's. Its extremely slow generation rate led to it being abandoned, however, recent improvements to the basic design have led to a revival in interest in this potentially green electricity source.

At a meeting of the Royal Institution in London, to mark the 150th anniversary of Groves work, scientists were told that the DoEn's efforts may be made more difficult by the fact that most of the UK's experts on fuel-cell technology now work abroad. □

## THE GREENPEACE BOOK OF THE NUCLEAR AGE

by John May  
Gollancz; 378pp, £6.99

"Please God" said a top US Defense Nuclear Agency scientist, "don't let us have killed John Wayne."

This book is a magnus opus - covering everything from the early nuclear weapons tests, which with cruel irony are alleged to have killed that most American of Americans, John Wayne - he played Genghis Khan in 1954, the desert scenes where shot in Snow Canyon a radioactive 'hot spot' just 137 miles from the Nevada test site, he died of cancer - to the referendum in June 1989 which killed the Rancho Seco nuclear power plant in California.

Opening with a couple of chapters giving the necessary

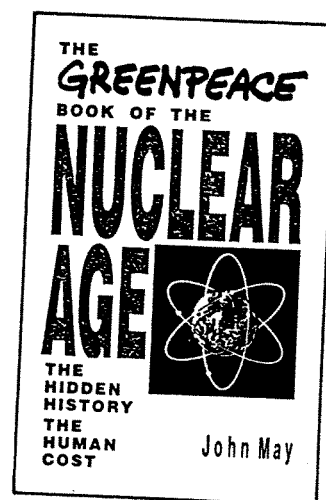
scientific background, John May has crammed in the story behind over 200 accidents worldwide, ranging from major disasters to lesser-known mishaps, both civil and military. This is surely the most comprehensive record of nuclear accidents ever compiled.

By including full references, May has made this not only essential reading, but an invaluable campaigners tool. He has even tracked down the elusive source of that well worn phrase "too cheap to meter" (it was made by Lewis Strauss, Chair of the US Atomic Energy Commission at a National Association of Science Writers' Founders Day Dinner in New York on 16 September 1954).

I wish I'd had this book when I was trying to get a painting of the nuclear capable HMS Edinburgh removed from our City Chambers. A retired US Admiral is quoted saying "My experience ... has been that any ship that is capable of carrying nuclear weapons, carries nuclear weapons."

Buy two copies - the first one will probably fall apart through overuse!

PETE ROCHE.



## THE GLOBAL ENVIRONMENT MOVEMENT

by John McCormick  
Pinter Publishers; 1989, 229pp, (hbk) £27.50.

The global environment movement, like many over night successes, is the product of a vast history of grassroots activity.

McCormick takes us back in time, as far back as Ancient Greece, where, 2,400 years ago, Plato "bemoaned the deforestation and soil erosion brought to the hills of Attica by overgrazing and the cutting of trees for fuelwood."

He has produced a litany of key events, each, in their way, adding weight to the current avalanche of public protest over the state of our environment.

In 1863 Britain passed the world's first broad ranging air pollution act and created the first pollution agency. The world's first private environmental group formed in 1865 was the UK's Commons, Footpaths and Open Spaces Society, according to the author. Now over 15,000 such groups exist, one third of which have been founded since 1972.

As he charts the progress, both social and political, of environment groups, it is not difficult to believe that this book started life as a doctoral thesis, six years ago, for the University of London. It is, by association, a weighty volume, which makes a pleasant change from the no less worthy deluge of 'green' books which have come my way recently.

His insights on the current system of international governmental organisation concerned with the environment, most of which he has worked for over the last 10 years, are reason enough to read the book.

It is not the definitive volume on environmentalism, but it is the best I have read so far. It is expensive and not for the faint hearted, however, it's extensive notes and index make it an invaluable reference text.

MIKE TOWNSLEY

## ROCK SOLID: The Geology of Nuclear Waste Disposal

by Elspeth Reid.  
Tarragon Press; 1990, 204pp, £8.95.

Elspeth Reid continues the theme, introduced by her article in SCRAM 65 that "almost everyone accepts - or possibly ignores - the claim that it is geology which is at the heart of the safety argument for underground disposal of nuclear wastes".

The author lucidly explains the geology we need to understand before we can make an informed contribution to the debate about the deep disposal of nuclear waste. It's clear from the start that geologists don't yet know enough about the geosphere to assure us of the safety of deep disposal. Doubts are cast on whether we will ever have sufficient knowledge: "What happens in a small piece of rock in a laboratory, or in a single fracture in the wall of an underground research site in a field experiment, may not represent the wider geosphere very well." There are difficult problems to overcome to reach a good understanding of groundwater pathways which might carry radionuclides back to the biosphere: "Even in a well-investigated site, the flow rate through the

fractured zones is calculated from limited observation and may not represent an average over the whole zone".

The book has chapters, amongst others, covering hydrogeological containment, retardation (knowledge of which "is not, so far, well developed"), gas and microbes and earthquakes and climatic change. In a chapter on specific repository sites, which includes Altnabreac and Billingham, as well as Dounreay and Sellafield, the author points to the many questions which still have to be answered before any site can be selected.

With the knowledge of the complexity of the subject, which can be gleaned from this book, "it is not easy to have confidence that the theory of geological containment of radioactive waste is well enough developed to form a firm basis for national policy." Elspeth Reid concludes, geological containment, like ecology and weather forecasting, can never pretend to be an exact science.

PETE ROCHE

Dear Editor

The last issue of your journal contained information about compact fluorescent lightbulbs (CFLs), promoting them as an energy efficient alternative to standard incandescent bulbs. While it is true that CFLs require less energy to operate, your article did not mention - and you may not be aware - that these bulbs contain mercury and radioactive material, usually Krypton-85, Promethium-147 or Tritium (H-3). In addition, many of these bulbs are made by nuclear weapons contractors such as GE, GTE Sylvania and Philips. Nuclear Free America believes that consumers should be made

aware of these facts so that they can make an informed choice - between radioactive compact fluorescent bulbs and the non-nuclear energy-saving alternatives that exist.

In alerting consumers to this information, NFA does not want to alarm those already using CFLs. The actual amounts of mercury and radioactive material they contain is quite small. The unregulated disposal of these bulbs, however, does pose a threat to the environment. What is of greatest concern to NFA, and what we hope both environmentally-responsible distributors and consumers will consider, are the hidden costs and broader implications

of the compact fluorescent technology.

The isotopes used in these bulbs are by-products of nuclear fission reactions created in specially designed production reactors. The continued operation of these reactors is fraught with hazards and compounds the myriad of unresolved problems associated with the nuclear industry. While NFA recognises the need for energy conservation and the energy saving potential of CFLs, it firmly opposes any technology requiring a continued reliance on the nuclear industry. The risks and costs simply outweigh the benefits.

For those who want both an

energy saving and nuclear free alternative NFA plans to begin distributing ecological, economical Ecolights early this year. Made in the USA by a nuclear free company, Ecolights are incandescent bulbs that use 10% less energy than standard bulbs while providing approximately the same amount of light, and they last an average three times longer than standard bulbs.

For more information contact Nuclear Free America, 325 East 25th Street, Baltimore MD 21218; (301)-235-3575.

Sincerely  
Albert Donnay  
Director NFA

## ■ David Olivier reply's

I am aware that compact fluorescents contain small amounts of mercury and traces of radioactive material and are made by companies who also make weapons (and incandescent bulbs). The main aim of my article was to ask why, when their advantages were so great, compact fluorescent lamps (CFLs) with electronic ballasts weren't more widely available and promoted. Like the Rocky Mountain Institute, I consider that the advantages of CFLs far outweigh the disadvantages.

Nuclear Free America appears to support incandescent lamps which save 10% of the electricity used by normal incandescent lamps and last about 2,000 hours. However, such lamps compare very poorly to CFLs, which save over 80% of the electricity and last 8 times longer, or even to low-voltage halogen lamps,

which can save over 60% of electricity and last about 2,000 hours. I would rather save several gigawatts of generating capacity and remove a great deal of environmental pollution than do without the advantages of CFLs.

The basic fluorescent tube was invented before a commerce in radioactive materials began. This alone suggests the the CFL technology can be redesigned to use less or no radioactive isotopes, since they and present day 0.6m and 1.2m tubes are only an evolution of the early fluorescent tube. I pointed out that development of electronic ballasts in the USA has been revolutionised by government funding. Such funding could, and should, also be used to make CFLs more environmentally sound in other ways.

I suspect that one can find fault with most electronic devices. Old non-electronic fluorescent lighting ballasts, in

many countries, are also pretty dubious, as they contain fairly large amounts of polychlorinated biphenyls.

Surely, the solution is to recycle hazardous materials and to speed up the development of CFLs which use non-radioactive isotopes. If this proves difficult, it hardly strains credulity to believe that the necessary isotopes could be produced from research reactors used in universities and hospitals since the 1940s, instead of from so-called 'civil' nuclear power stations.

I accept that used fluorescent lamps should be treated, in effect, as toxic waste (like a lot of other household refuse). The mercury used in CFLs and the many hundreds of millions of existing fluorescent tubes should be recycled. Mercury emissions from sources like coal burning should be reduced by burning less coal, more cleanly. Mercury could also be restricted to unsubstitutable uses and not used in trivial items like

throw-away batteries. If this is done, I suspect that mercury emissions could be cut by over 99% even if the CFLs replace every incandescent lamp in existence.

Yours sincerely  
David Olivier  
Milton Keynes

■ Following the article in SCRAM 74, we have had a few reports of Wotan Dulux ELs starting low brightness and taking 5 mins. to reach their full light output. Dealers seem unwilling to acknowledge that there is a genuine problem. This has happened at room temperature, so it is unlikely that the lamps are just unexpectedly sensitive to low temperatures. To repeat, all electronic ballast lamps should reach full brightness, as judged by the human eye, almost immediately. If not, we suggest that you complain directly to the company and send the lamp back.

Dear Editor

Your article (High level waste disposal 'safe', SCRAM 74) quoting from the report in the November issue of Atom, had an all too familiar ring about it:

"Calculations for the study site in France showed 'no significant radioactivity is expected to reach man in less than one million years after disposal'."

One cannot help but remember other assurances from the nuclear industry: 'too cheap to meter', for instance, and an accident 'only once in every ten thousand years'.

Intriguingly, they continued with this assertion after accidents had happened - these apparently didn't count and included: Windscale, Enrico Fermi, Brown's Ferry, Three Mile Island, Cap la Hague, etc. It took Chernobyl to silence that

particular chapter of nuclear clairvoyance.

The industry has, we were assured, a 'fail safe' system of accounting for fissile material. Not a bequerel could go missing. Then it is discovered there is a periodic plutonium auction in an aircraft hanger in Khartoum. Uranium is transported in hand baggage through international airports and offered for sale.

It is not that I am anti-nuclear - it's just that the industry's track record does not inspire confidence. Assertions of high level waste disposal being safe tend to make me lose sleep.

Thanks, but no thanks.

Yours sincerely  
Felicity Arbuthnot,  
London

Dear SCRAM

At a meeting last May I was asked to 'wind up' the South of Scotland Anti Nuclear Consumer Campaign Trust. I have since sent letters to 'Withholders' who had money in our account, but a considerable number have been returned by the Post Office. If any of SCRAM's readers think they have money in our account and would like it back, they should contact me at the address below before 16 March 1990. Otherwise we will donate the money to SCRAM. Sums involved range from £1 to £40.

Yours sincerely  
Linda M Hendry  
2a West Preston Street  
Edinburgh EH8 9PX  
(031-667 6488)



# LITTLE BLACK RABBIT



LBR has been looking through 'Hansard' for some indication of reform at the Department of Energy, now that nuclear power has been exposed. Dafydd Wigley, the Plaid Cymru MP for Caernarfon, asked John Wakeham if his departmental library subscribed to the SCRAM Energy Journal. "No" he replied. Perhaps, if they had subscribed they wouldn't have had to wait for the impending privatisation to make costs transparent before they realised they were on a loser.

Michael Jack, Conservative MP for the Fylde, took it into his head to ask the Secretary of State for Scotland a question. (Probably because Tories are an endangered species north of the border, and we wouldn't want Malcolm to only have questions from opposition MPs, would we?) "What reports", he asked, "has [he] received on the economic and environmental benefits to Scotland of nuclear power." "None" came the reply. Of course not - there are, to paraphrase, none!

A questions from Harry Barnes, the Labour MP for NE Derbyshire, shows how frustrating it must sometimes be in opposition. He asked the Prime Minister if she would "initiate a review of all statements since 1979 made to the House by Ministers having responsibility for military and civil nuclear energy projects and programmes, to assess whether they require revision in the light of official information made public under the 30 year rule on 1 January 1990."

After a thorough examination of the Tory book of parliamentary replies, she answered "No". 'A veritable burrow of information', thinks LBR.

Another attempt to get a Government reply other than "No" was made by Dafydd Elis Thomas. He asked Mr Wakeham if he would "make it his policy to request" Nirex and the UKAEA "to conduct feasibility studies to assess the suitability of the Falkland Islands geology for nuclear waste disposal." The answer had to be "No", and was: Roy Carryer, the scourge of EDRP, when working for Shetland Islands Council, is now working in the Falklands.

Tony Benn succeeded in eliciting the other famous reply: "the information requested could be obtained only at disproportionate cost" when he asked Mr Wakeham "on how many occasions since May 1979 [has] he or Ministers of his Department stated ... that nuclear generated power is cheaper than coal generated power?" LBR would like to count how many times Tony Benn said that nuclear power is cheaper, but it would cost too much.



Recent revelations about MPs being paid by commercial concerns to provide 'confidential' political advice are nothing new. But, apparently the World in Action Team investigating the subject recently

received a leaked memo from merchant bankers, Hill Samuel, detailing a briefing they had received from Tim Eggar, Tory MP for Enfield North. He was advising them on how to get appointed as advisers to electricity companies being privatised.

He advised Hill Samuel to pitch for the SSEB, it would be an excellent bet for a swift and successful privatisation, he told them. because it already had a tremendous amount of nuclear power which would make it even more attractive to the market.

Luckily for Hill Samuel they've ended up with the Grid company as clients, and their Edinburgh based subsidiary has Norweb. Presumably, merchant bankers, a crafty bunch, employ MPs to give advice and then cunningly do exactly the opposite.



An indication of how the nuclear surcharge might work after privatisation comes from the London Electricity Board's bill to the Vine Housing Co-operative. They were offered the amazing opportunity to pay a £50 quarterly bill at £105 per month. Perhaps they'll get a lifetime's worth of nuclear waste to keep in the broom cupboard as a free gift.

## 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.

1. I would like to subscribe to the **SCRAM Safe Energy Journal**, and I enclose an annual subscription fee of:

- |  |   |
|--|---|
| <input type="checkbox"/> £12.50 (ordinary)   | <input type="checkbox"/> £5 (concession)  |
| <input type="checkbox"/> £15 (overseas)      | <input type="checkbox"/> £20 (supporting) |
| <input type="checkbox"/> £30 (institutional) | <input type="checkbox"/> £100 (life)      |

2. I would like to make a donation to SCRAM and enclose a cheque for:

£10 ☐ £50 ☐ £100 ☐ other £ \_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_

Post Code \_\_\_\_\_

TO: SCRAM, 11 Forth Street Edinburgh EH1 3LE.

3. I would like to help pay SCRAM's wage bill with a regular monthly donation of:

£1 ☐ £5 ☐ £10 ☐ other £ \_\_\_\_\_

To the Manager: \_\_\_\_\_

\_\_\_\_\_ (your Bank)

Address \_\_\_\_\_

\_\_\_\_\_ Post Code \_\_\_\_\_

Please pay on \_\_\_\_\_ (date) the sum of

\_\_\_\_\_ (amount) from my account number

\_\_\_\_\_ to the Royal Bank of Scotland,

142/144 Princess Street, Edinburgh (83-51-00) for the credit

of SCRAM No.2 Account 258597 and make similar

payments monthly until further notice. [www.laka.org](http://www.laka.org)

Signed \_\_\_\_\_ Date \_\_\_\_\_





# Nuclear Waste

## The History

**I**N March 1989 Nirex finally chose two sites they believe merited further investigation as potential repositories for low level (LLW) and intermediate level waste (ILW). Both sites - Sellafield in Cumbria and Dounreay in Caithness - are existing nuclear installations. They were chosen from a shortlist of 12 sites, the remainder of which have been kept secret.

This is just the latest round in the long-running saga to find a 'final resting place' for nuclear waste. Government and nuclear industry efforts, over the last decade or so, have met with considerable public opposition, which has forced the government to back down every time, so far.

Investigations began in the late 1970s to find a deep repository for high level waste (HLW). The government's geological research institute identified several sites around Britain where they wanted to carry out test drilling to check the suitability of the rock. However, before such drilling could take place, planning permission was required.

In February 1980, a public inquiry was held into an application by the Atomic Energy Authority to carry out test drilling on Mullwharchar Hill in south-west Scotland. A further inquiry, looking at the Cheviot Hills on the Scottish/English border, took place later that year.

These inquiries fuelled massive public opposition to the waste programme. The government backed down and abandoned the HLW programme in December 1981.

They decided that HLW should be vitrified (solidified into glass blocks) and "stored for at least 50 years until the rate of heat-generation has been substantially reduced" (1).

Meanwhile, after the HLW repository was abandoned, the campaign against the dumping of LLW and ILW at sea was gathering pace. This method of disposal had been used since 1949, and in the last annual dump in 1982 nearly 3,000 tonnes were abandoned at a site about 500 miles from the north-west coast of Spain.

## Sea dumping

The disposal of waste at sea is controlled by international agreement - the London Dumping Convention (LDC). Early in 1983, a two-year moratorium, later to be extended, was agreed upon while scientific investigations were carried out.

Initially Britain, not surprisingly, intended to ignore this and carry out the 1983 annual dump. However, action taken by a number of trade unions, including the National Union of Seamen - who refused to handle the waste - prevented it. The Government was forced to announce its intention to abide by the moratorium.

With HLW now being stored for 50 years, and sea dumping ruled out, attention shifted to

devising a new plan for dealing with LLW and ILW.

In 1982, NIREX, the Nuclear Industry Radioactive Waste Executive, was set up to implement a strategy for the disposal of LLW and ILW. It was set up by British Nuclear Fuels plc (BNFL), the Central Electricity Generating Board (CEGB), the South of Scotland Electricity Board (SSEB) and the United Kingdom Atomic Energy Authority (UKAEA). It was reconstituted as a company, UK Nirex Ltd, in 1985. Shares are held by each of the above organisations, with one special share being held by the Secretary of State for Energy.

In 1983 a new policy was announced: a deep anhydrite mine under Billingham, in Cleveland, was proposed as a site for ILW, and Elstow in Bedfordshire, was proposed as a site for the shallow burial of LLW.

Opposition groups sprang up in both areas. The Billingham site was abandoned in January 1985. One reason given was that ICI, the mine's owners, refused access to the official survey



team because of huge pressure from the local community.

Three further sites joined Elstow on the short-list for a LLW shallow burial site in February 1986. To avoid another embarrassing public inquiry, Special Development Orders were granted by Parliament to permit survey engineers to gain access to the sites.

Opposition groups grew in all four areas. When test drilling was due to start in August 1986, hundreds of people formed human barricades and successfully prevented the contractors from gaining access to three of the sites for three weeks. History repeated itself at the fourth site in September. Contractors eventually gained access only by the use of court injunctions and a heavy police presence.

On 1 May 1987, the Government abandoned the four proposed LLW sites, in response to a letter from John Baker, the head of Nirex. Mr Baker suggested "a major change of approach". He said efforts should concentrate "on the development of options for the deep disposal of intermediate level wastes with the additional

intention to piggy-back low level wastes in the same facility."

Though the announcement was camouflaged in technical language, it was clear that this was a political decision. Three of the proposed sites were in constituencies held by Government ministers, and unpublished polls showed Conservative support waning. With a General Election on the horizon the sites were reprieved.

This latest attempt to find a 'final resting place' for nuclear waste began in November 1987, with the publication of a 'consultation' document called "The Way Forward" (2). This document initiated a six-month 'consultation' process, during which the public were invited to choose the 'best option' for dealing with LLW and ILW.

## Restricted consultation

Nirex carefully limited the options to burying the waste, either beneath the seabed via some kind of offshore platform; beneath the seabed accessed from the land; or beneath the land. Long-term storage of nuclear waste above ground, at the site of production, proposed by environmentalists and many local authorities, was not included in the consultation document.

One year after the 'consultation' process was launched, Nirex published an analysis of the results, produced for them by the University of East Anglia (3). Its authors have been accused of seriously distorting the results.

Local authorities are said "on the whole to appear to favour some form of deep disposal". How they can claim this in the light of the actual statistics is mystifying. Of the 48 County or Regional Councils in England, Scotland and Wales which responded, only 17 are classified as "giving qualified support for deep disposal". Of the 204 District Councils, only 51 are shown as "giving support".

Councillor Ian Leitch, Chair of the National Steering Committee of Nuclear Free Local Authorities, says to suggest that local authorities support Nirex's preferred option "is a travesty of the truth... It distorts the total picture."

The distortion doesn't stop there. Orkney and Tayside were the only Regional or Island Authorities in Scotland said to support deep disposal, and both have accused Nirex of misrepresenting their views. In fact local authorities in Scotland are virtually unanimous in their opposition to Nirex's plans. It is difficult to see how Nirex can justify continuing their search for a deep disposal site at Dounreay in Caithness.

In a referendum on plans for a repository at Dounreay, organised by Caithness District Council and held in November 1989, 74% of voters opposed Nirex's plan. Nirex, however, were unmoved. Spokesperson Liz Morgan-Lewis said the result "confirmed... there was a significant measure of support in Caithness for the proposal".



## The Science of Nuclear Waste

**N**IREX are currently spending over £5m a year on their repository research and development programme.

The aim of deep disposal is to isolate nuclear waste from the human environment, until its radioactivity has decayed to harmless levels. However, in order to demonstrate that the waste will remain isolated for sufficient periods of time, ie. many thousands of years, Nirex are relying on computer modelling techniques to ape highly complex geological and ecological systems. To do this they will rely on grossly oversimplified data.

Nirex admit that groundwater will eventually saturate the repository. They are banking on the groundwater being so slow moving that it will take hundreds of thousands of years to carry radionuclides back to the surface. When the long-lived radionuclides do eventually reach the surface they hope that dilution and dispersion will spread them throughout the living environment, so that concentrations are reduced to 'harmless' levels.

### The unforeseen

Although various attempts have been made to describe the flow of radionuclides through fractured rock "none of the theories has proven adequate enough to be universally applicable"<sup>(4)</sup>. It is possible that water will carry radionuclides back to the surface by an unforeseen process. Already there have been unpleasant experiences; of six commercial 'low level' waste dumps in the US, three have been closed due to off-site radioactive contamination<sup>(5)</sup>. (The American definition of 'low-level' waste includes much of what we would call ILW.)

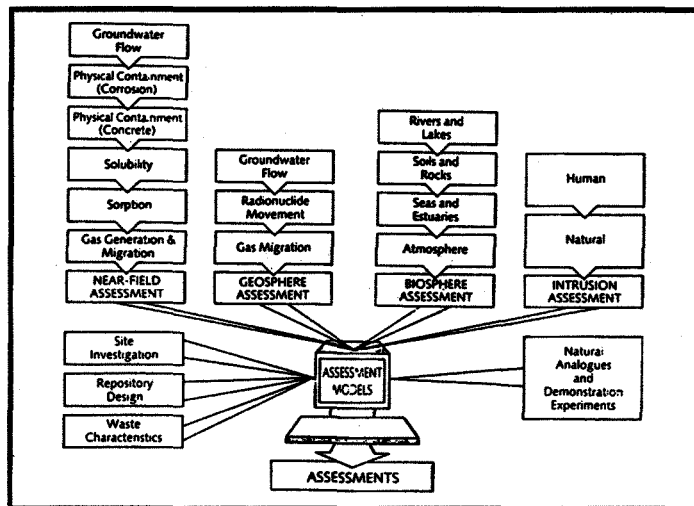
Steel packaging in which the nuclear waste is wrapped will eventually corrode and form hydrogen. Methane and carbon dioxide will be formed in the repository by the breakdown of organic wastes and the activity of micro-organisms. Nirex are developing computer models to explain how these gases will move through the rock to the surface. Pathways in fractured rock could transport gas containing radionuclides back to the human environment quite rapidly. On the other hand, if the gas was unable to escape there might be a build up of pressure around the repository which could open up fissures in the rock and accelerate the movement of contaminated groundwater to the surface<sup>(6)</sup>.

### Corrosion

The diversity of micro-organisms and their ability to survive in hostile environments is astonishing: "There is almost no such thing as a bug-free environment"<sup>(7)</sup>. As well as producing large amounts of gas, micro-organisms in a repository could cause steel corrosion, degradation of the cement used to fill the spaces between the containers, and significant changes in the chemistry of the groundwater. In other words, by a variety of methods, micro-organisms could quicken the return of radionuclides back to the human environment.

Sulphur bacteria have been identified as the most hazardous micro-organisms. They fall into two groups: the sulphate-reducers and the sulphur oxidisers. They produce corrosive by-products. The sulphate-reducers are heat-loving, tolerant of pressure and indifferent to high radiation<sup>(7)</sup>.

The scientific adviser to the Scottish Nuclear Free Local Authorities, Martin Godfray, wrote to Nirex in August 1989 to



Nirex safety assessment modelling

ask for details of their research into the likely activity of sulphate-reducing bacteria in a nuclear waste repository. In their reply, Nirex said: "This is an aspect which could have been overlooked, and we thank you for drawing attention to it. Please make us aware of any other matters of this kind which occur to you"<sup>(8)</sup>. Obviously if the Nirex research programme is relying on things which 'happen to occur' to scientists around the country, there can be no assurance that their results are reliable.

### Earthquakes

Disruption of the repository could occur by gradual rock movement or more violent events such as earthquakes. Nirex admit that it is not possible to predict such disruptive events but say that "the frequency of natural events can be estimated"<sup>(9)</sup>. Quite severe earthquakes do occur from time to time in Britain, particularly over the timescales envisaged. Simply estimating their frequency is not good enough. Although it is very unlikely that earthquakes pose a direct hazard to a suitably sited repository in Britain, they might affect the flow of groundwater in the vicinity of the repository and open up new fractures and fissures, thus promoting the flow of radionuclides back to the surface<sup>(6)</sup>.

In building a nuclear waste repository we should also be reasonably certain that it will not suffer any kind of human intervention, whether deliberate or inadvertent, for a long period into the future. Nirex only appear to consider the possibility of future boreholes to exploit natural resources, there is no mention of war, malicious intent or even some form of future archaeological investigation<sup>(10)</sup>.

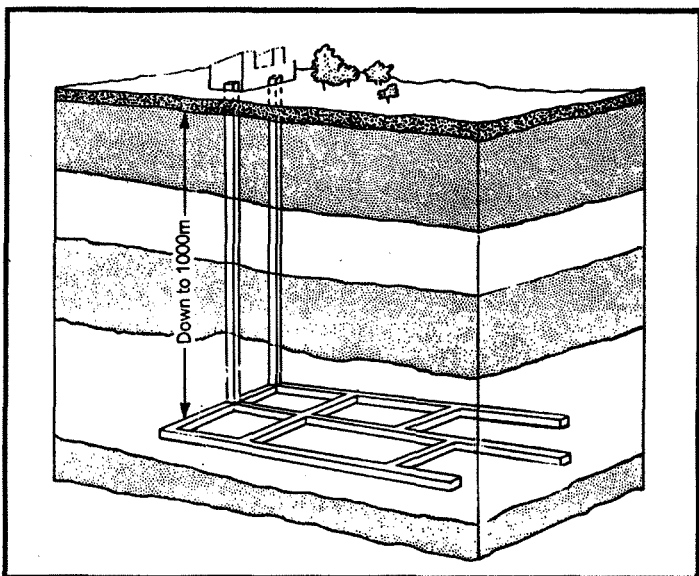
Even though separate tests are being done on each of the barriers which prevent radioactivity returning to the surface environ-

ment, the way in which each of these processes interact with each other should not be ignored<sup>(4)</sup>. Computer models used to measure the factors which might slow down the movement of radionuclides, back to the surface, have been described as "a rather brutal averaging technique" which "for a scientifically rigorous performance assessment ... is inadequate and must be replaced"<sup>(4)</sup>.

Nirex are relying on what they call 'The Multi-Barrier Approach', ie. the use of man-made and natural barriers (eg. steel and concrete containers, rock and dilution and dispersion in the surface environment) to prevent radionuclides returning to the surface. The theory holds that if one of the barriers "mysteriously transmits" radionuclides towards the surface environment faster than expected, then one of the other barriers will hold up the flow back to the surface. Professor Williams of the government's Radioactive Waste Management Advisory Committee (RWMAC) has criticised Nirex for not taking into account the worst possible scenario where everything goes wrong at once<sup>(11)</sup>.

### Not proven

Nirex's assertion that geological containment is proven is certainly not the case. We still have a very limited knowledge of radionuclide movement through geological formations<sup>(12)</sup>. Professor John Knill, chair of RWMAC, has warned that research has not yet gone far enough<sup>(13)</sup>. By the use of computer modelling techniques, which are fraught with difficulties, and some laboratory and field experiments, Nirex have set out to prove that deep disposal is safe, rather than keeping an open mind. They have taken on a task very similar to weather forecasting for the next hundred or so centuries. The work done by Nirex so far does not engender a great deal of confidence in the safety of deep disposal.



One of the Nirex options for nuclear waste dumping

## The Environmental Approach

**H**IGH-LEVEL liquid waste is currently stored at Sellafield, and will be for at least 50 years. Nirex has no responsibility for disposing of this waste. Low and intermediate level wastes pose less of a problem, because they are less concentrated; those that are liquid are easily solidified, and they do not generate sufficient heat to require cooling. In general they contain much the same type of radioactivity as the high level wastes but in less concentrated form. Much of the low level waste actually contains relatively short-lived and much less toxic radionuclides.

An integrated waste management strategy should be adopted for all forms of nuclear waste, from low to high level. Waste should be stored above ground at existing reactor sites. This would mean that spent fuel would no longer be transported to Sellafield. Reprocessing would be phased out as quickly as possible. This measure alone would dramatically cut the quantity of radioactive waste to be managed.

Surface storage requires no new technology, although research programmes and cost assessments should judge the best available technologies for reduction in volume, solidification, packaging and containment so that risks to workers are minimised, and resistance to leaching and other environmental factors is maximised.

Above ground storage would mean that the waste could be properly monitored for signs of

damage or deterioration which might lead to leakage. Any fault spotted could be dealt with immediately.

The presence of nuclear waste stores at existing reactor sites would present virtually no extra risk. As the reactor cores themselves contain large quantities of radioactive materials the risk profile for the site as a whole would not be significantly increased.

Obviously, there is no perfect

solution to the problem of nuclear waste. Above ground storage would allow the adoption of improved containment in the future. Research into the long-term stability and resistance to environmental factors should be carried out.

The majority of the population in the UK are in favour of curtailing the nuclear programme. Obviously the best way to minimise the nuclear waste problem is to phase out nuclear power <sup>(14)</sup>.

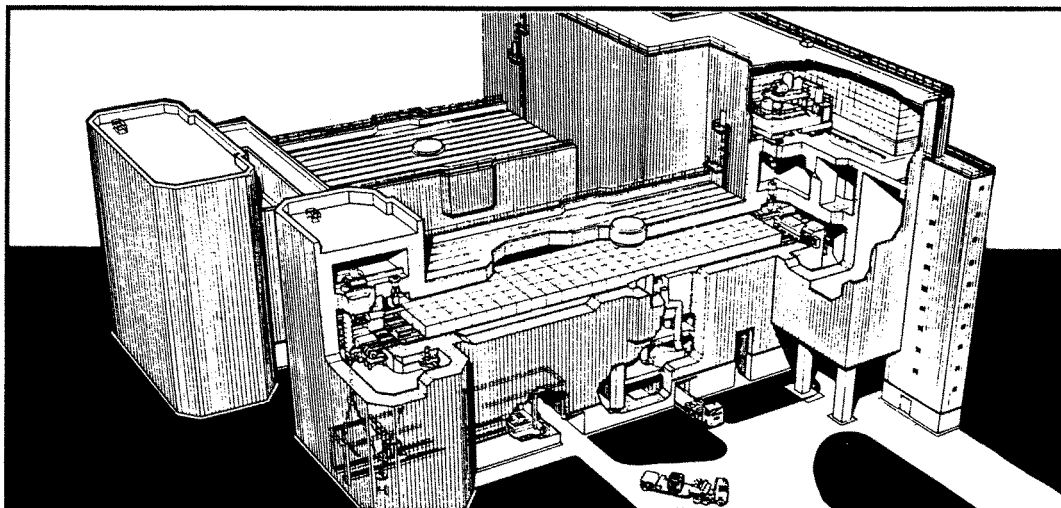


Diagram of the dry store at Wylfa Magnox Power Station, Anglesey

## Reprocessing

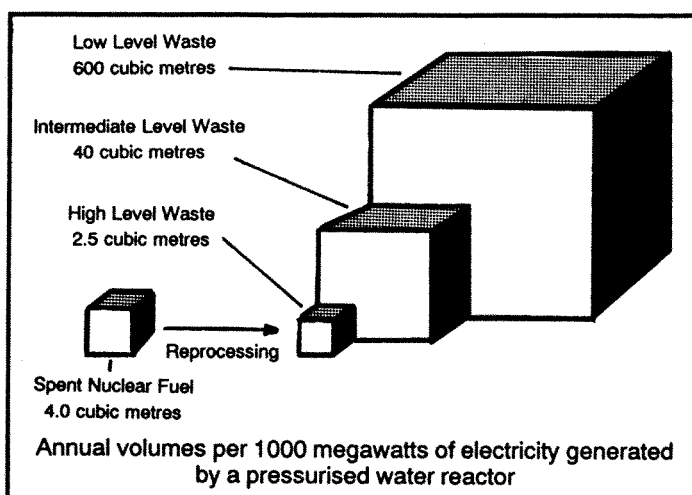
**R**EPROCESSING is a key element of Britain's so-called nuclear waste management strategy. During reprocessing plutonium and unused uranium are extracted from the spent fuel. The original purpose of reprocessing was to provide plutonium for Britain's nuclear weapons. In the 1960s when commercial nuclear power stations began to discharge spent fuel it seemed logical to the nuclear industry to continue using the fuel management method that had already been tried and tested. It was also considered necessary to recover uranium and plutonium for later use in fast reactors. In theory, the plutonium from civil nuclear power stations is kept separate from the plutonium produced in the military reactors at Chapelcross and Calder Hall. However, doubts have been expressed about the final destination of some civil plutonium <sup>(15)</sup>.

Reprocessing is also justified on the grounds that long-term storage of spent fuel is not feasible, and because it concentrates 95% of the spent fuel radioactivity into a small volume of highly active liquid waste <sup>(1)</sup>. The spent fuel from the older Magnox reactors is already reprocessed at Sellafield in Cumbria. Fuel from the newer Advanced Gas-cooled Reactors

and the Pressurised Water Reactor under construction at Sizewell will be reprocessed in the Thermal Oxide Reprocessing Plant (THORP) currently under construction at Sellafield, which is expected to be completed by 1993.

The benefits of recovering uranium from spent fuel are extremely marginal <sup>(16)</sup>. The Government told the Atomic Energy Authority in 1988 that funding for fast reactor research would be cut from £50m in that year to £20m in 1989/90 and £10m in 1990/91. The prototype fast reactor at Dounreay will cease to operate in 1993 - the very year that BNFL's £1.8bn THORP project will come on stream <sup>(17)</sup>.

Far from making spent fuel waste management easier, reprocessing dramatically increases the volumes and types of waste produced, all of which require appropriate treatment. The proposed PWR at Sizewell B is expected to produce about 4m<sup>3</sup> of spent fuel every year. If reprocessed this would produce about 6.25m<sup>3</sup> of high level liquid waste, 40m<sup>3</sup> of intermediate level waste and 600m<sup>3</sup> of low level waste. When vitrified the high level liquid waste would reduce to about 2.5m<sup>3</sup>. Using BNFL's own figures, it can be shown that reprocessing concentrates only 66% of the alpha activity and 94% of the beta/gamma activity in the high level liquid waste stream <sup>(18)</sup>.



Waste created by reprocessing spent nuclear fuel

## Decommissioning

**A**FTER 1995 the decommissioning of the old Magnox reactors will produce substantial quantities of LLW of a different character to that currently being produced. Some of this waste will pose novel transport and disposal problems, because of its bulk, for example Magnox heat exchangers will require particularly large transport operations if they are to be moved intact.

The first stage of the decommissioning process is to remove the fuel. Secondly it is planned to remove plant and buildings external to the reactor. It is expected that these two stages will be completed within 10 to 15 years of closure. The reactor itself will be left for about 100 years and then dismantled and disposed of.

The Royal Navy also have the problem of disposing of decommissioned nuclear submarines. The first one to come out of service was the Dreadnought in 1982. It is at present berthed at Rosyth. Another 9 are expected to join it on the scrap heap by the year 2000. The Ministry of Defence have yet to decide how to dispose of them, although their preferred option is to dispatch them to Davy Jones' Locker, ie. dump them at sea <sup>(19)</sup>.

## Transport and packaging

**O**F the different categories of solid radioactive waste arising from the civil nuclear industry only LLW is at present routinely transported from its site of origin. ILW is stored on the site where it arises, pending disposal. Spent fuel is also routinely transported from nuclear power stations to Sellafield. However, the nuclear industry do not consider this to be a 'waste' since they intend to remove 'useful' plutonium and uranium during reprocessing.

The main disposal site for LLW in the UK is Drigg in Cumbria, near Sellafield. However, Dounreay's LLW is disposed of on site, and some waste from BNFL's Springfields plant near Preston is disposed of locally <sup>(20)</sup>.

Over 50% of LLW arises at Sellafield, and this now goes to Drigg, almost exclusively by rail. From other destinations LLW goes to Drigg by road. If, and when, the Nirex deep repository opens LLW

will be transported there in steel drums carried in reusable freight containers or packaged in robust steel boxes.

ILW has to be shielded to protect workers and the public from exposure during transport and disposal. The packaging must undergo certain tests, as laid down by the International Atomic Energy Agency (IAEA). However, withstanding these tests does not necessarily mean that packages can survive a transport accident.

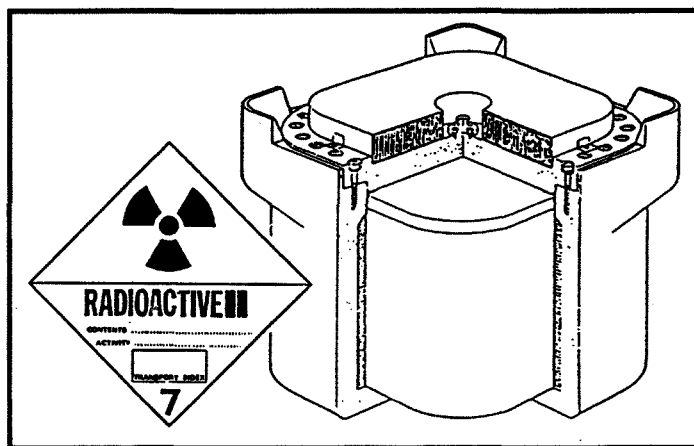
US experience shows that lorries carrying 'low-level' waste have accidents at the same rate as any other form of lorry transport. (The US definition of 'low-level' waste includes much of what we would call ILW). During the period 1971-85, there were 1,034 accidents or 'incidents' involving 'low-level' waste in the US, in which 90 containers actually released materials <sup>(21)</sup>.

On 25 January 1988, an improperly secured container, of a type tested according to the same IAEA regulations which cover our ILW

containers, fell from the back of a truck as it rounded a corner. A station wagon following the truck ran over the container releasing the radiographic source. Radiation doses on contact were the equivalent to 3 chest X-rays per second. By the time the thimble-sized radiation source was finally located several hours later, many people had been exposed <sup>(21)</sup>.

The US accident rate for lorries is one every 150,000 miles travelled.

Nirex say they will have 15 trains or 10 trains and 100 lorries per week arriving at the repository. In the case of 100 lorries arriving at Dounreay every week, we can estimate that each lorry will have travelled an average of at least 300 miles ie. 30,000 miles travelled each week. This means that we could expect an accident involving nuclear waste every 5 weeks. This 'back of the envelope' calculation makes no allowance for rail accidents <sup>(22)</sup>.



A packaging label and a transport container design

## Types of Radioactive Waste

**N**UCLEAR Waste, in Britain, is divided into three categories, Low level waste (LLW), Intermediate level waste (ILW) and High level waste (HLW).

HLW is defined as waste "in which the temperature may rise significantly as a result of [its] radioactivity, so that this factor has to be taken into account in designing storage or disposal facilities" <sup>(1)</sup>. It consists mainly of spent fuel from the cores of nuclear reactors (although the nuclear industry don't consider this to be a waste), and the

high-level liquid waste produced during reprocessing. HLW is typically a thousand times more radioactive than ILW.

ILW is defined as "wastes with radioactivity levels exceeding the upper boundaries for low-level wastes, but which do not require heating to be taken into account in the design of storage or disposal facilities" <sup>(1)</sup>. ILW is typically a thousand times more radioactive than LLW. It consists of metal fuel 'cans' which originally contained the uranium fuel for nuclear power stations; reactor metalwork, chemical process residues, ion exchange resins and filters. It has to be shielded to protect workers and the public from exposure during transport and disposal. At present it is mostly stored at the site of

production. Before disposal the plan is to fix it in a form of concrete and package it in steel or concrete containers for transport to a repository <sup>(23)</sup>.

LLW is defined as "Wastes which, because of their low radionuclide content, do not require shielding during normal handling and transportation" <sup>(24)</sup>. LLW consists mainly of items such as protective clothing and laboratory equipment which may have come into contact with radioactive material. LLW is the only form of radioactive waste arising from the civil nuclear industry, excluding spent fuel, which is at present routinely transported from its site of origin. The main disposal site for LLW is Drigg in Cumbria near Sellafield.

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## Useful Addresses

- SCRAM, 11 Forth Street, Edinburgh EH1 3LE (031 557 4283/4)
- Scotland Against Nuclear Dumping. Secretary, Anne Baxter, 4 Foun tainhead, Bunnissan, Isle of Mull, PA66 6DP.
- Friends of the Earth 26-28 Underwood Street, London, N1 7JQ. (01 490 1555)
- Greenpeace, 30/31 Islington Green, London, N1 8XE. (01 354 5100)
- Cumbrians Opposed to a Radioactive Environment, 98 Church Street, Barrow in Furness, Cumbria. (0229 33851).
- Nirex, Curie Avenue, Harwell, Didcot, Oxfordshire, OX11 0RH. (0235 835 153).

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