

THE SAFE ENERGY JOURNAL

# SCRAM

No.83

June/July '91

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**Sea-change for wave power**  
**1994 – getting beyond the hype**  
**Chernobyl – after the fire**  
**Time and tide right for Skye Barrage**  
**Children of Chernobyl**  
**When savings cost the earth**  
**The risk business**

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## COMMENT

**T**HE cat is finally out of the bag - although parts of it have been exposed for some time. Nirex have finally, and irrevocably gone on record and stated that Sellafield is the preferred site for low and intermediate level nuclear waste dumping.

This does not, however, mean Dounreay is off the hook. As Nirex admitted: "Nothing we have found at Sellafield or Dounreay has made us walk away from either site. If we opt for Sellafield that doesn't mean it's the end of the story."

What could he possibly mean? Does it mean as some people in Highland Region now believe that the ground is being prepared for an investigation into a high level nuclear waste dump at Dounreay? Or, is there a hidden agenda operating between Nirex, the Ministry of Defence and AEA Technology, preparing the way for nuclear submarine decommissioning at Dounreay? It could even be both.

If the Scottish people are to be given a brief respite from the advances of Nirex, they will not spend that time idly. They will put their full support, and considerable expertise, at the disposal of objectors to the Sellafield site. They are, and will remain resolutely opposed to the deep disposal of nuclear waste anywhere. The only sensible option is above ground dry storage of spent nuclear fuel at the site of production until a sane solution can be worked out for the problem.

Sellafield, contrary to some press reports, will be no easy ride for the nuclear industry. Their scientific justifications for deep disposal are so shaky that all that will be required is one good push at a public inquiry.

The fight will go on both north and south of the border.

**A**FTER five years, the political fall-out from Chernobyl continues to grow. All attempts by the nuclear industry to quell the growing unrest within the Soviet Union and Europe have failed.

The most recent attempt to play down the consequences of the accident, made by the International Chernobyl Project, under the aegis of the International Atomic Energy Agency, has graphically illustrated the scientific compromises the industry is willing to make for the sake of pro-nuclear propaganda.

Their study, which was clearly geared towards vindicating the official Soviet line that only 31 deaths have occurred as a result of the accident, is, on their own admission, based upon data that was "not always adequate." They even left out the people most likely to be suffering from radiation exposure: the 600,000 or so people conscripted to clean up the site immediately after or the 100,000 people evacuated from the 30km exclusion zone around the disaster site.

Their scientific credibility, like the sarcophagus surrounding the stricken Chernobyl reactor, has now deteriorated beyond repair.

**W**AVE power is making a comeback five years after the Chernobyl accident, as predicted by the designer of the Salter's Duck, Professor Stephen Salter. A report soon to be made to the UK Department of Energy is widely expected to recommend re-considering the 1982 decision to halt funding of wave power. More good news comes from the European Commission who are to fund 'preliminary' research on wave power.

Both these decisions go some way to vindicating the line taken by Professor Salter and other supporters of wave power. Perhaps even more encouraging is that the hard-headed engineering giant Asea Brown Boveri have decided to invest in wave power on purely commercial grounds.

These three encouraging signs are only a beginning, but wave power may finally be about to emerge from the doldrums.

**scram, skram, v.**  
to shut-down a nuclear reactor in an emergency.

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

**No.83 - June/July '91**

## CONTENTS

<i>Comment</i>	2
<i>Nuclear News</i>	4-6
<i>Features</i>	7-21
<i>Safe Energy</i>	22-25
<i>Reviews</i>	26-27
<i>Letters</i>	27
<i>Little Black Rabbit</i>	28

## FEATURES

### **7 Sea-change for wave power**

David Ross, a freelance journalist and author of *Energy from the Waves*, reports on recent developments for the future of wave power. There are some encouraging signs that increased funding could see Salter's duck and other wave devices revived and revitalised.

### **10 1994 - getting beyond the hype**

Preparations by the nuclear industry for the 1994 review are already well underway. Fred Barker, a freelance writer and researcher on nuclear affairs, reports on the industry's activities, and calls for a commitment from the Government to an open and balanced review.

### **12 Chernobyl - after the fire**

Five years after the Chernobyl accident, the official death toll remains resolutely at 31. Mike Townsley takes a critical look behind the establishment veneer.

### **14 Time and tide right for Skye Barrage**

A proposal for a tidal power station offers an alternative to a planned Skye road bridge, as well as electricity. Peter Findlay, a retired civil engineer, describes his plans, which have been given impetus by the toll bridge scheme.

### **16 Children of Chernobyl**

Polish families offer respite holidays to children from Chernobyl-contaminated Byelorussia. Bridget Gubbins has met some of these children and relates their experiences.

### **18 When savings cost the earth**

A report on energy efficiency, by the House of Commons Energy Select Committee, fails to make sense of the Government's recent cutbacks in the Energy Efficiency Office. Dave Spence finds that, beyond the superficial, environmental considerations are sadly lacking in UK energy policy.

### **20 The risk business**

Recent reassessment upwards of the risks from radiation, by a factor of four to five, have not seen equivalent changes in dose rate limits. Dr Patrick Green, Friends of the Earth's radiation campaigner, questions the work of the International Commission on Radiological Protection.

## Sellafield or bust

**N**IREX have made their opening gambit on announcing the preferred site of the UK's deep underground repository for low and intermediate level nuclear waste. They have come out in favour of Sellafield, two months before an official announcement is expected.

Nirex's Managing Director Tom McInerney told the *Observer* newspaper on 2 June: "We are just about reaching the stage where we can make a decision for Sellafield, given the positive information that is coming from the geological investigations on that site."

"The transportation costs have been the big difference. All the other factors, like geology and environmental impact, have been roughly equal for the 2 sites."

The announcement has been welcomed by British Nuclear Fuels (BNFL), the operators of the Sellafield site, who are drilling the test boreholes at the site which will yield much of the information on which the decision will be based. BNFL said, "We are considerably further in our investigations than Dounreay. We are drilling our 4th borehole while Dounreay is still in the early stages of the investiga-

tion" - neglecting to mention that originally the plan was to sink only 2 test bores, but the first 2 collapsed (*SCRAM 81*).

They continued: "But no decision can be made until all the investigations have been completed and studied. There are two further boreholes to be drilled at Sellafield." This would take the total to 6, four more than planned, and two more than previously declared.

The preference for Sellafield has come as no surprise to anti-dumping campaigners, who have been suspicious of this position for some time. Suspicion which was confirmed during the 25 April debate in the House of Commons of the controversial Scottish Natural Heritage Bill when Scottish Under-Secretary Lord James Douglas-Hamilton declared: "Nirex has made it clear that, other factors being equal, Sellafield - not Dounreay - will be the preferred site because of transport considerations. It would simply be much cheaper to site the repository near Sellafield, where most of the waste arises."

According to official costings it would be £1.05 billion cheaper. However, for a civil engineering project openly admitted to be on a scale similar to that of the Channel Tunnel, where official cost estimates spiralled out of control, any men-

tion of money should be taken with a large pinch of salt.

Scottish anti-dumping campaigners have received the news with considerable caution. Gordon Calder, spokesperson for Caithness Against Nuclear Dumping, echoing the concerns of many, said: "When Nirex actually pull out of Caithness then we will believe that Dounreay is no longer in line for this particular project. But until then the fight goes on."

However, according to a news report on ITV's TV-AM, contrary to press reports, Nirex have no intention of leaving Caithness, were they say further investigations would produce interesting results.

Their fears were further fuelled by another recent waste dumping announcement, made on 10 May. When Scottish Secretary Ian Lang upheld an appeal lodged by the Atomic Energy Authority at Dounreay against Highland Regional Council's refusal to grant planning permission for up to 6,000 holes around Dounreay for seismic tests.

The question on everybody's mind is, if the Government and the nuclear industry are so gung-ho for Sellafield, why create a political storm in Caithness and run the risk of turning the people of the area against the whole nuclear industry? □

## Dounreay and nuke subs

**D**OUNREAY'S operators, AEA Technology, are bidding for the site to become a national centre for the decommissioning of nuclear submarine reactors.

Four nuclear submarines have so far come out of service: Dreadnought which is laid up at Rosyth and Churchill, Conqueror and Warspite at Plymouth. They will be joined by a further 8 before the end of the century.

Currently the Government have no policy regarding the safe disposal of these vessels, since the International Maritime Organisation's London Dumping Convention placed a moratorium on seabed disposal of military equipment - their preferred solution because of its convenience and low cost - in 1983. The moratorium is expected to be reviewed next year.

In the latest report from the House of Commons Defence Committee the Ministry of Defence (MOD) expressed considerable reservations over Nirex's ability to complete their waste dump by the target date of 2005, and said it was now looking at plans for interim disposal.

AEA Technology believes it could provide the ideal solution and that it has the necessary expertise to win the contract. At an estimated cost of £4.5 million for each reactor compartment disposal, the Committee heard that cutting up the reactor would involve similar dosage levels to the workforce as encountered during a nuclear refit.

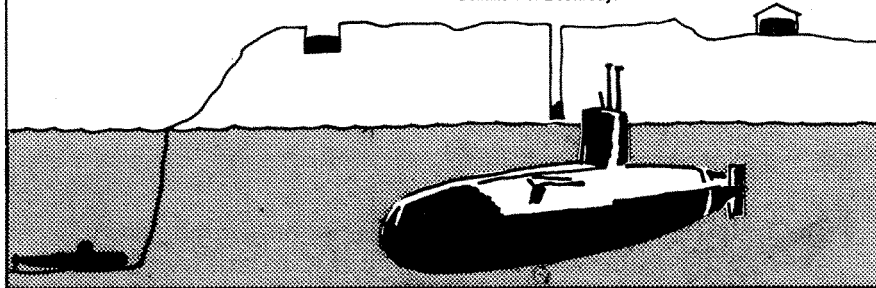
## FOUR WAYS TO DISPOSE OF SUBMARINES

**SEA DUMPING:** The whole submarine is towed out to sea, its reactor compartment filled with concrete, and then sunk. This is the method favoured by the MOD, but banned by the international community.

**SHALLOW BURIAL:** The reactor compartment is detached from the submarine and put in a 15ft trench, where it can be monitored. This is the method favoured by the Americans.

**DEEP DISPOSAL:** The reactor compartment is detached from the submarine, cut into small pieces and packaged so it can be buried a mile under ground in the kind of repository currently being developed by Nirex for either Sellafield or Dounreay.

**ON-SITE STORAGE:** The reactor compartment is stored above ground in dry conditions where they can be constantly monitored and, if necessary, retrieved.



However, AEA Technology think that long-term storage followed by shallow land disposal of the compartments at a designated nuclear site would be the best approach. They could store "a large number in a cost-effective manner" at Dounreay.

AEA Technology say: "The past decommissioning record for facilities at Dounreay shows the submarine decommissioning would be carried out safely, with minimal dose uptake by personnel, and with very low environmental discharges."

"These factors combined with having carried out a feasibility study for the decommissioning of the land-based submarine prototype [at HMS Vulcan

adjacent to the Dounreay site] makes Dounreay an appropriate choice for interim storage and decommissioning of submarine reactors."

Ken Butler, an assistant director at the plant, said that detailed discussions have taken place with the MOD, but added "No further progress can be made until the MOD adopts a clear policy on submarine decommissioning with the will and finance to proceed."

As the fast reactor dies a slow death and the prospects for attracting the Nirex dump fade, spent research reactor fuel reprocessing and nuclear submarine disposal are being grasped by the AEA in a desperate bid to keep Dounreay open. □

## Leukaemia and Dounreay

**C**LAIMS by the nuclear industry that the latest study into the high incidence of non-Hodgkins lymphoma (NHL) and childhood leukaemia\* has "cleared" Dounreay have been rejected by the reports principle author James Urquhart.

AEA Technology point out that "these finding do not support the findings published early last year by Professor Martin Gardner."

While the statistical survey failed to verify the earlier findings of Gardner - whose study into the Sellafield childhood leukaemias suggested a link with occupational exposure in the fathers prior to conception - Urquhart said: "Because Dounreay and Sellafield are both reprocessing plants doesn't necessarily mean you would expect to find the same or similar underlying causes."

14 cases of leukaemia and NHL, occurring in children under the ages of 15 in the area between 1970 and 1986, were examined. The report found no link between occupational exposure in the father, nor did it support the theory linking the cases with microwave beams from the nearby by US Naval communications base at Forss (SCRAM 69).

The only positive finding was "an apparent association between the use of the beaches around Dounreay and the development of childhood leukaemia and NHL." As much of the information relating to this relied upon the memory of the parents filling out a questionnaire, it might be "influenced by recall bias".

However, when asked at the press launch in Edinburgh if he would take children on to the beaches Urquhart replied: "On balance and given the absence of an alternative explanation, the answer to your question must be that I would not."

He told a meeting of local medical practitioners, and staff and union representatives at Dounreay: "To give it [Dounreay] a clean bill of health, we would have had to have covered every aspect of its operation, which we didn't. That was not our remit and we only addressed the particular hypotheses of possible causes which we set out to examine."

"It was never our intention to focus on Dounreay and a number of the risk factors we looked at had nothing to do with Dounreay."

He believes that people have every right to be concerned about the excess of leukaemia and wants to see more

work done to find an explanation.

The solicitors, Leigh, Day & Co, acting on behalf of Sharon Coghill, who was one of the children in the study, welcomed the report saying, it "greatly supports the claims of damages being pursued by Sharon Coghill, a local inhabitant, against the United Kingdom Atomic Energy Authority."

Adding: "The key finding of this report is that children who live within 25km of Dounreay and who played on the local beach appear to have an enhanced risk of contracting leukaemia. Statistically, there is an 88% probability that this finding is not due to chance."

A High Court writ was issued on 26 March in London for damages against the UKAEA and British Nuclear Fuels by the solicitors, who are also representing other leukaemia victims. Coghill, who is now 21, is fighting the case using Legal Aid. She has always believed that Dounreay was the cause of her illness. "I am confident that we will prove this to be the case." □

*\*Case-control study of leukaemia and non-Hodgkins lymphoma in children in Caithness near the Dounreay nuclear installation. British Medical Journal, 21/3/91.*

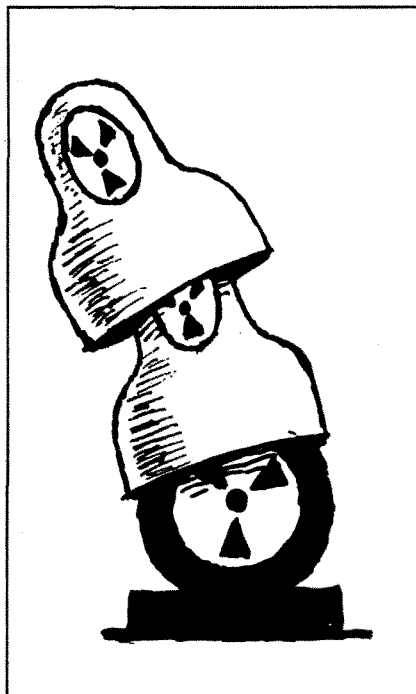
## Crumbling sarcophagus

**S**OVIET scientists working to contain the mass of highly radioactive debris within the stricken reactor at Chernobyl have issued an international call for help, as fears mount over the structural integrity of the sarcophagus.

Constructed in haste following the accident in 1986, it was originally intended that the huge concrete structure would last for 20 to 30 years. Designed to withstand high winds and seismic shocks, the Soviets describe its present state as "non-hermetical". However, visitors to the site estimate that 1,000m<sup>2</sup> of cracks have appeared, some so big that birds fly in and out.

Part of the sarcophagus is held up by the lift shafts and some of the roof of the old reactor hall. As the head of the Sarcophagus Diagnostic Lab told BBC2's *Horizon* programme: "The upper part of the building is in a bad state. During the explosion, the shock wave struck the walls, and the top of the building opened up like a flower. You can see how the massive walls and pillars have moved outwards from their original positions and stayed there. The upper part of the building remains a big problem, and it is hard to predict what might happen - whether it will hold out much longer or will start to collapse."

The reactor still contains much of its



original radioactive inventory: around 180 tonnes of uranium; 570 kilograms of plutonium; and large quantities of transuranic elements. There is also a large quantity of highly radioactive dust.

One of the main concerns is that water will now be able to enter the crumbling reactor. Water coming in contact with the hot core could lead to further explosions.

Also, the more water that enters, the more it is likely to lead to contamination of ground water.

However, the most serious threat is posed by the possibility of parts of the structure collapsing. This could lead to the radioactive fuel still contained within, forming a critical mass, prompting a self sustaining fission reaction.

Three possible courses of action have been identified. The first would involve decontaminating the entire area and returning it to 'green field' site status. A plan favoured by the Ukrainian independence movement. However, as pointed out by the Soviet authorities, it would require technology "so far unknown in the world". Even if it was possible, it would still leave the problem of what to do with the waste.

The second option is to cover the sarcophagus with earth and form a gigantic artificial hill. This would still leave the potential for massive ground water contamination.

Building a second sarcophagus around the first and filling the three levels of chambers beneath the reactor with whisked concrete to bind the radioactive dust is the most likely to be adopted. This can only be considered a temporary solution, as the reactor hulk and its contents will remain deadly for thousands of years. How many concrete over coats can they build? □

## Nuclear target

**E**LECTRICITY privatisation could spell the end of Scottish Nuclear, if they fail to meet minimum performance standards set out in the "Pathfinder Prospectus" for Scottish Power and Hydro-Electric published 8 May.

A clause in the prospectus states that if the output from the stations falls below 30,000GWh over 3 years up to or beyond 31 March 1988 then the 2 privatised com-

panies can terminate their contracts with Scottish Nuclear. The maximum annual output from the stations is 19,000GWh.

The prospectus binds the private boards in to buying the full output of Scottish Nuclear - which remains in State possession - for the next 15 years. A move sanctioned by the European Commission which has temporarily suspended their anti-cartel rules under Article 85 in the Treaty of Rome. A similar concession was made for the English and Welsh privatisation but they insisted that such contracts

could only be valid for 8 years.

According to Friends of the Earth (FoE), the clause means that the two AGRs - Torness and Hunterston B - must maintain an annual availability of more than 52%.

While both stations have so far performed above this target, the prospectus warns, "the dependence on reactors based on the same design could make the output of Hunterston B and Torness vulnerable if significant generic faults develop in later life." □

## Uranium mines go under

**D**EEP uranium mines, no matter how sophisticated, will be unable to meet the new International Commission on Radiological Protection (ICRP) recommended dose limits, according to a secret Organisation for Economic Cooperation and Development (OECD) document\*.

Prepared for a closed session of the OECD on nuclear safety, it says: "Although the problem of uranium mines is not dealt with in the new ICRP recommendations it is impossible to disassociate it from other installations of the fuel cycle.

"Because of the current technology, the mineral content and the low costs of uranium it is not possible to improve the current situation in the French and African mines, in particular those in Niger."

The new limits - based on a re-evaluation of the atomic bomb survivors data from Hiroshima and Nagasaki which showed that radiation is 4-5 times more dangerous than previously thought - mean that radiation doses to miners in Australia, for example, should fall from 50mSv to 10mSv, according to Greenpeace Australia.

It will cause severe problems for the countries proposed Jabiluka mine in Northern Territory, which is one of the world's most radioactive uranium deposits. The future of Roxy Downs, Australia's only underground mine, will also be placed in some doubt.

The mining industry can either spend vast sums of money to reduce worker exposure - pushing the nuclear industry further into economic oblivion - or adopt a policy of worker rotation.

In the early days of the nuclear industry worker rotation - where workers receive up to the maximum radiation dose and are then replaced - was common place. However, increased union opposition has led to the abandonment of the policy in many countries. It was also recently abandoned in the Eastern bloc countries.

There is no safe level of radiation. This practise spreads out the risk of cancer, but does not negate it. □

*\* A nuclear fuel cycle operator's point of view of the applicability of the new ICRP recommendations to the aspects of nuclear safety. By G Sheppard and R Berry, British Nuclear Fuels and P Henry, Cogema.*

## Torness off the rails

**T**RANSPORTATION of spent nuclear fuel from Torness in East Lothian has been postponed for the 4th time in a year, raising considerable doubt over the stations competence to get the fuel to Sellafield for reprocessing.

Scottish Nuclear said they are still attempting to complete the complex spent fuel handling processes along the route travelled by the spent fuel within the plant. The process, once perfected, will have to be licensed by the Nuclear Installations Inspectorate.

As design work started on the station over 15 years ago, it is clearly ludicrous that such an integral part of the plants operation is experiencing such difficulties.

Perhaps it is all a ploy by Scottish Nuclear to get out of expensive reprocessing contracts with British Nuclear Fuels. As Lord James Douglas-Hamilton, Under-Secretary of State for Scotland, pointed out in the recent Commons debate on the Scottish Natural Heritage Bill, "Recently, however, Scottish Nuclear Ltd put forward proposals to store spent fuel on site at Torness and Hunterston rather than send it to Sellafield." These proposals are currently under consideration by the Scottish Office. □

## German nuclear freeze?

**G**ERMANY appears to be on the verge of deciding to phase out nuclear power according to the news magazine Der Spiegel.

Fed up battling with fickle political parties and angry protesters, the heads of the nations two largest electricity utilities, Friedhelm Gieske (RWE) and Klaus Piltz (VEBA) have declared that they will not build any new nuclear plant unless they receive all party support. Such support is unlikely as the party of opposition in Germany, the Social Democrats, have a no new reactors policy and plan to phase out nuclear power within about 10 years of coming into government.

It is thought the announcement was geared towards forcing the Government's hand to ease Atomic Energy Law on licensing - from a system of partial construction licences to a single full operating licence,

confirmed by courts, to be granted before construction begins (SCRAM 82).

Their gambit may have been based on pro-nuclear comments made by Federal Economy Minister Juergen Moellmann earlier this year. When, following a meeting with the utilities, he announced his support for the construction of two nuclear power stations in east Germany (SCRAM 82). He has now modified his position, declaring that there is no compelling reason in terms of electricity demand (which fell by 25% in January and February this year) or on economic grounds for the new stations.

He has also said that he would welcome a larger contribution from renewable sources of energy and support the spread of their use.

■ Kalkar, the west German fast breeder project, has finally been put out of its misery (SCRAM 79). Federal Research Minister Heinz Riesenhuber has declared that the breeder will not go on line.

After waiting since 1986 for the North Rhine Westfalen (NRW) State Authorities to grant a licence for the next phase of construction - which would have allowed the reactor to be fuelled - the partners in the project have decided to cut their DM250,000 per day losses.

RWE-Energie, the largest shareholder (68.85%), have suggested that the plant should be converted to oil-firing.

While Riesenhuber points the finger of blame at the MRW authorities, accusing them of procrastination, they point out that until the full documentation detailing significant planning changes for the plant were evaluated by independent experts licensing was impossible. The documents have not been available.

Both the Belgian and Dutch Governments are now considering lodging compensation claims from Bonn for their investment of DM470m each. Their involvement in the breeder ended in 1983 when costs shot up. □



The realignment of the barbed security fence around the headquarters of the UKAEA at Harwell, leaving the Energy Technology Support Unit outside the jurisdiction of the nuclear police may be the precursor to more important changes, at least for wave power. DAVID ROSS, a freelance journalist, author of *Energy from the Waves*, and a tireless campaigner for wave power, reports on recent events and heralds the technologies return from Davy Jones' Locker.

## Sea-change for wave power

**W**AVE power – the “most promising” of the alternative sources as the energy tycoons called it just before they tried to kill it off – is coming back to life. Professor Stephen Salter, designer of the eponymous Duck, always forecast that 5 years after a major nuclear accident it would do so. And it was five years, to the hour, after the night shift at Chernobyl switched off power to see what would happen that 35 wave power people sat down in Brussels to discuss the future.

They heard about three important developments:

- 1) The UK Department of Energy is about to receive a report recommending re-consideration and a decision is likely by the end of the year;
- 2) The EEC is ready to spend a part of its £1,400 million research programme budget next year on wave energy; and
- 3) The world's largest heavy electrical engineering company, Asea Brown Boveri (ABB), has decided to invest in wave energy on purely commercial grounds – a fact which makes a deep impression in both Brussels and London, where money is power.

The change results from a variety of factors. The most important is the campaign led by Salter, before two Select Committees, the Hinkley Point inquiry, on television and in the press, which was making it increasingly difficult for the energy establishment to appear credible in its opposition to wave power.

The UK report is being written by Tom Thorpe at ETSU, after two years spent investigating the subject with the cooperation of the research teams. The expectation is that it will be favourable.

There are straws in the wind: ETSU is about to be given a token liberation when the barbed wire fence around its headquarters at the home of the nuclear industry, Harwell, is to be re-aligned, leaving the renewable energy people outside. Until now they have been an indistinguishable group inside the AEA

compound, guarded by an armed nuclear police force.

In addition, the head of the wave energy programme, Dr Roger Price, who had become increasingly disenchanted with the waves, has moved to tidal power and a new man, Dr John Clarke, appointed. Among his first actions was to send out a circular to the wave energy researchers asking what they will want if funding is resumed. ACORD, the powerful Advisory Council on Research and Development, has had its membership shuffled. The three representatives of the Atomic Energy Authority and the one from British Nuclear Fuels have been removed.

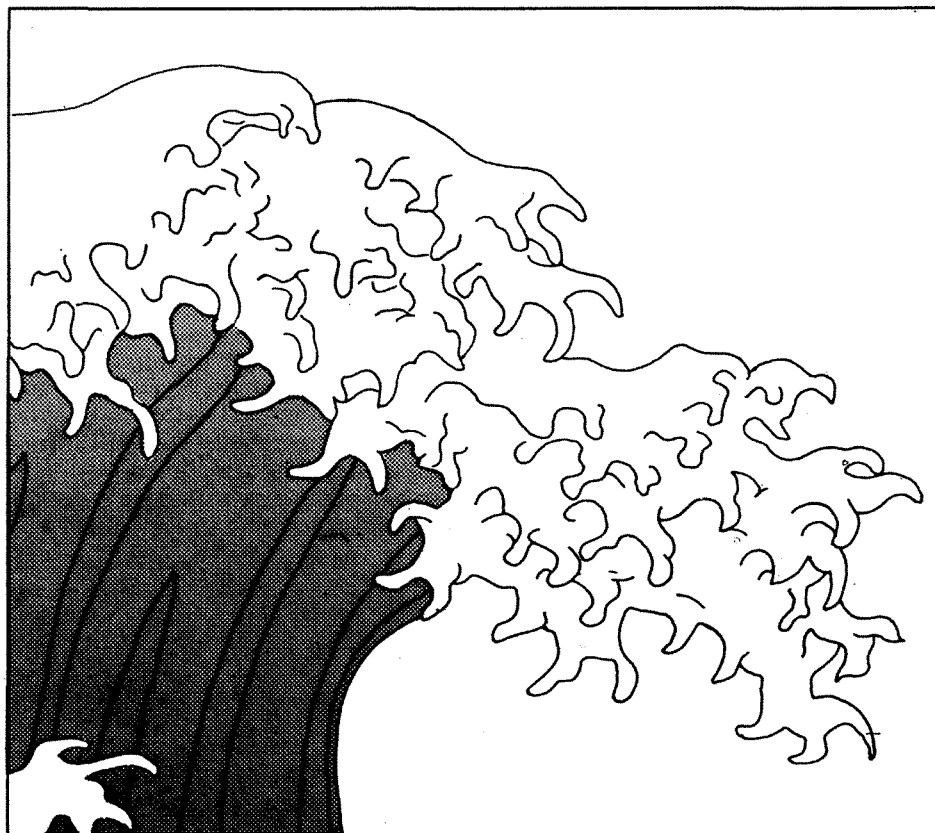
### Investment

None of this will be significant unless the Government follows it with substantial investment. Token gestures butter no parsnips. But these are the first hopeful signs since the disastrous blunder of pulling the plug on wave power in 1982.

A second factor has been the success of the Norwegians in winning a contract to build a 1MW Tapchan in Tasmania. Then came ABB to support Norwave, the small company which had pulled off the deal to build one of its Tapchans there.

Finally, the Common Market was persuaded to look again at the technology which (under the influence of the British energy establishment) it had rejected for so long. This development was least expected and is the most hopeful.

It came about because Dr David Lowry, an expert on nuclear matters, wrote to his friend and fellow Welshman, Llewellyn Smith MEP, to ask why the European Commission had excluded wave power from its research programme. Smith put down a Parliamentary Question and Signor Filippo Pandolfi, the Vice President with special responsibility for research and science, replied that a Commission report had found that any programme would be “premature.”



This was not true. The 1985 report by Dr Tony Lewis, oceanographer and maritime civil engineer at Cork University, recommended a 4-year research programme costing 13.7 million ECUs (£9.5 million). It was ignored by the EEC.

I pointed this out, Smith promptly tabled another Question. The response was better than could be expected.

Pandolfi gave a handsome apology, allocated 1.2 million ECUs (£860,000) to a programme of "preliminary" research and summoned a seminar in Brussels of wave energy people. I was among those invited.

The Brussels gathering was stimulating. It brought together wave energy researchers, public servants and academics from the UK, Norway, Portugal, Denmark, Sweden, Italy, Ireland, Germany, France, Holland and Belgium plus two MEPs, Smith and Winnie Ewing and all the top people from the EEC's Directorate-General for Science, Research and Development.

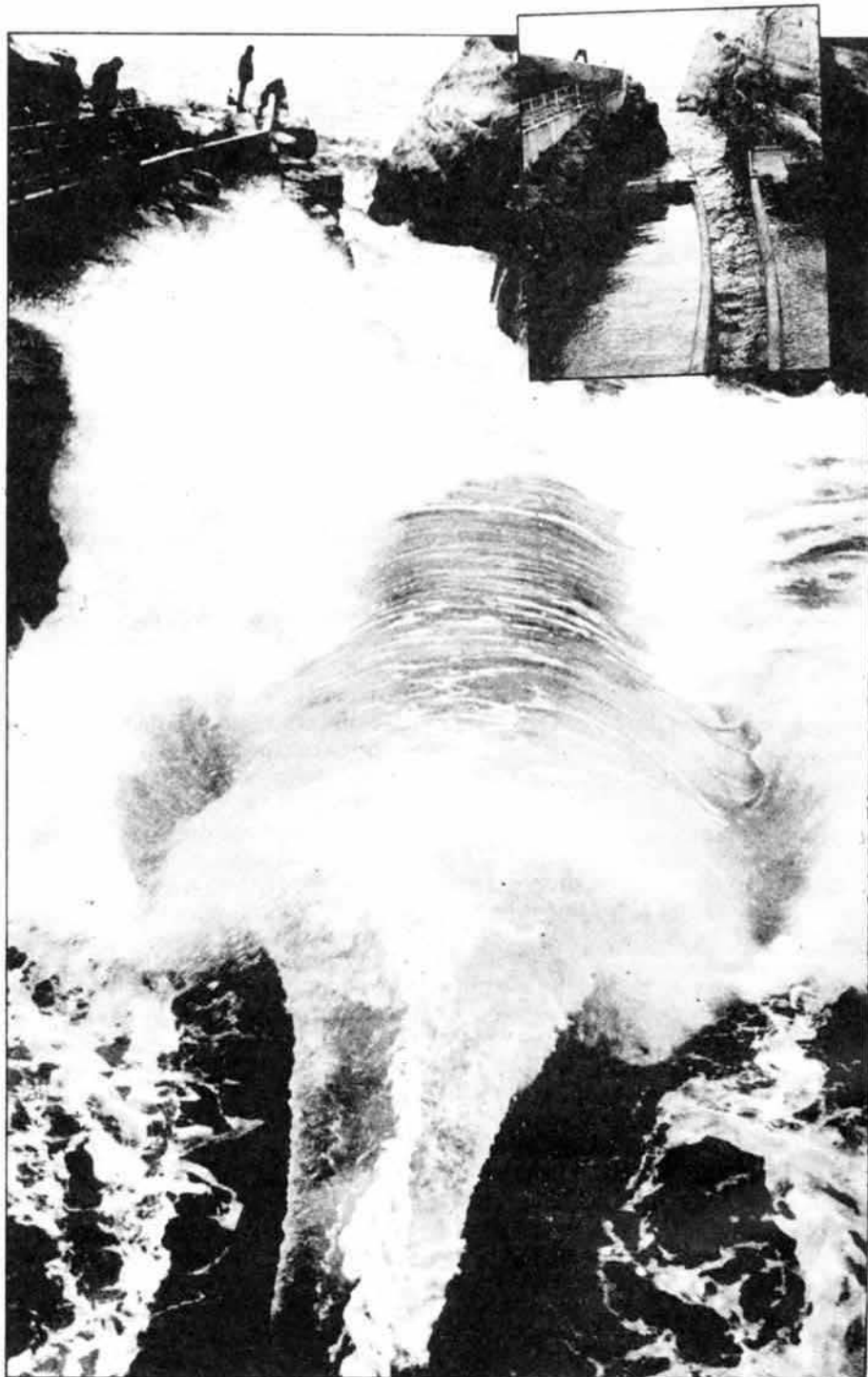
### Research programmes

Pandolfi, who had been expected to do no more than put his head round the door and say hello, stayed to the end and gave as near as he could a pledge. He said that he expected to have 2 billion ECUs (£1,430 million) for his research programmes next year. "We will spend more on programmes which look more interesting." Of wave energy specifically he said: "If we can find a path that is promising, the MECUs [millions of ECUs] will follow, particularly if we get strong industrial interest."

This is why the ABB's involvement is so important. For the EEC, the fact that a private company is prepared to risk its own money is justification for public money being committed. An official EEC report describes the ABB action as "the best indicator to date of the commercial potential."

The meeting was given a new report by Lewis on Europe's wave power. His 1985 survey was amended slightly but the broad sweep was the same. He estimated the wave energy resource to be about 1,000TWh, with 740TWh around the NW European shelf, 15TWh in the North Sea and 220TWh in the Mediterranean.

"Even if only 12% is recoverable, this amount at around 120 TWh will still exceed the electricity consumption of those peripheral countries near to where the resource is located." The choice of 12% is ultra-cautious. The



Norwave's Tapchan power station on an island near Bergen

Photo: David Ross

standard practice at Harwell has been to divide the potential resource by two for efficiency and another two for transmission, bringing the total down to 25%. Even that was disputed by many experts who thought that the reduction at each stage should be only 10%. Lewis has gone one step further than the most cautious.

But there is, at this stage, no reason to take issue with him. He is making conservative estimates which can be improved as efficiency improves but for the present, when there is not a single wave energy converter functioning in the open sea, it does no harm to be excessively modest. Lewis noted that

Professor Denis Mollison of Heriot-Watt University, who has been closely associated with Salter and Trevor Whittaker, the designer of the Islay Oscillating Water Column (see page 24), puts the recoverable resource at 400TWh.

If we stay with the lower figure of 120TWh, this argues Lewis, "is equivalent to about 60% of the present electricity production in Europe and about equal to the projected incremental electricity demand for the year 2010."

It would need an installed capacity of 16GW, which is not an over-ambitious



target. It is the equivalent of eight large (2,000MW) power stations for the whole of Europe, three of them supplying the UK. They would provide twice the capacity of a "family" of three PWRs after Sizewell B.

Is it within our ability? Yes indeed, we have now reached a stage where the problem of collecting and delivering wave energy can be solved by throwing money at it, to use the vulgar Thatcherite phrase. But how much will wave-electricity cost? This is, like the discussion about the size of the resource, a pointless question at this stage of development.

Wave energy is capital-intensive and is given no credit for the fact that its "fuel" arrives f.o.b. (free on board). It suffers from the "discounting" accounting system favoured by the Treasury, and accepted by the Department of Energy, which penalises those enterprises which require heavy expenditure at the start and provide their benefits later on. It gives an apparent advantage to get-rich-quick methods like gas turbines which have small initial expense but will suffer increasing costs as the price of their fuel rises.

The solution is for Government (and EEC) to recognise that this is inappropriate and unfair for a new, experimental technology. It relies on unknowable assumptions about future inflation and interest rates. It gives no credit to the design life of, for instance, an Oscillating Water Column which can be expected to stand for 120 years or more, just like a harbour wall, while a PWR has a design-life of perhaps 30 years.

### Rational costing

The rational way would be to take the capital cost, add on maintenance and fuel where appropriate, plus such extras as waste disposal and decommissioning, and divide by the number of units of electricity which a power plant is expected to generate during its lifetime. And for new technology building experimental prototypes, there should be soft loans of perhaps 1-2% which the Channel Tunnel is getting from the European Investment Bank.

Wave energy is, as Lewis pointed out, particularly disadvantaged because there is no way of building a small trial device in the open sea. The nearest is a unit on the beach, where the waves are smaller, like the one on Islay. But it still leaves a lot of question marks about what will happen in the real sea, in what Sir Hermann Bondi in his

Hungarian-English used to call "a green sea site." And, as he always insisted, "the real sea will always have a trick up its sleeve."

Godfrey Bevan, Head of the Renewables Branch at the UK Department of Energy, put in a stout defence of the remnant of Britain's wave power programme. He said that the UK had spent "1,000 times 1,000 ECUs," meaning that the Government had spent £650,000 on its review of wave energy and of shoreline sites. He said that the building of a 1MW Oscillating Water Column, the development of the Sea Clam and of other devices were now to be the subject of decisions.

"Towards the end of this year, my Ministers are going to be faced with a series of decisions about what to do next. Do we build a 1MW shoreline device? We are discussing options for siting it ... We are strongly supportive of the initial research programme proposed by Tony."

This is promising, but it leaves open the question for the UK and the EEC of just what will be the next step.

EEC officials are plainly concerned that there is no consensus on which device should be developed. The Oscillating Water Column is being used by the UK and the Portuguese (in the Azores). Norway has the Tapchan. The Clam is a strong contender for offshore siting. And then there is Salter's Duck.

### Next step

This will be the main discussion point. What worries some of the wave energy people is that there may be an attempt to fob them off with the smallest credible support. The British Government seems to be thinking of a 1MW Gully as the next step. It has the virtue, noted by Bevan, that it is "the sort of size which you expect to build commercially." That means that it could be used on a stand-alone basis for small island or coastal communities, or as the size of a module in the build-up to a normal-sized power station.

To be fair to that view, it should be said that it could have the support of Trevor Whittaker, who is perhaps being persuaded that it would be best not to go to sea just yet. He may fall in with the idea that ETSU has been discussing of constructing a bigger Gully device with a concrete "designer" entrance instead of a natural rockface, at 1MW instead of the present 125kW.

In this, he has the full support of Salter who with his customary style and eloquence told the seminar: "I don't

want to be the first wave power device at sea. I want to be the last one. I want to make all the mistakes in private, with instruments to tell me what mistakes I have made so that I don't do it again. I want to do all the difficult things in the laboratory. The money I will need is so small that it won't make any difference."

One understands this attitude but, much as I admire Salter who has done more than anyone to make wave energy real, and Whittaker who has had most success in winking a little money out of the British Government, I think it is mistaken. If the money is available, then the thing to do is to go to sea as fast as possible. That's where the big waves are. It will need more investment. It will produce more electricity. There was money available in the '70s which the wave energy teams did not grasp because they preferred to be more sure of themselves. When they were ready, the money had disappeared.

### Going to sea

It is easy to understand the fear of a premature launch ending in failure. But that has to be accepted with prototypes, whenever they are launched. Wind power seized the moment in California and went ahead perhaps faster than advisable on technological grounds. It suffered quite a few upsets but now it is a contender.

Who is ready to go to sea? The National Engineering Laboratory at East Kilbride has a plan for a 4MW unit off Lewis and Coventry Polytechnic wants to build a floating Clam.

If the British Government decides at long last to return to the technology which it pioneered, then it should set out to regain the lead that it lost to Norway by initiating the first practical programme designed to capture and deliver the vast store of wasted energy out in the open sea. That, after all, is where we came in. And went out.

And the EEC, which is rolling in money, should recognise that, with some of its member-countries lacking fossil fuels and natural resources, it would be short-sighted folly to delay the long task of developing substantial wave energy.

Whether it comes in pounds sterling or in ECUs, the need is the same - for substantial investment in the resource which has been studied for 15 years, has overcome repeated man-made obstacles, to make its message known. That it is now ready to take on the other sort of difficulty - the natural one. □

An increasingly buoyant nuclear industry has its sights set firmly on the Government's review of the prospects for nuclear power, scheduled for 1994. Here, FRED BARKER, a freelance writer and researcher on nuclear affairs, explains the reasons for the industry's growing confidence, and calls for an early commitment from the Government to an open and balanced review.

## 1994 – getting behind the hype

**A**FTER the battering received during the privatisation fiasco, recent Government statements must sound very sweet indeed to the leading figures in the nuclear industry.

In March the British Government, along with those of Germany, France and Belgium, signed a joint declaration backing the revival of nuclear power in Europe. The strongly worded statement provides evidence of the Government's support for maintaining the nuclear option, despite its formal commitment to the 1994 review.

In April, John Wakeham added further words of encouragement in a speech to staff at the Heysham nuclear power station: "A combination of circumstances is providing Britain's nuclear industry with new opportunities – in effect a second chance ... Nuclear Electric's new record for nuclear electricity output in England and Wales, coupled with 10% lower unit costs and 10% higher productivity, seemed to offer substantially improved grounds for optimism about the future."

### Industrial effort

Such comments will boost morale in an industry already confident that it has found some winning arguments. These centre on the alleged "environmental case for nuclear power" and the "inherent vulnerability" of other energy supplies.

In his President's address to the Nuclear Engineering Society in October of last year, Christopher Harding, chair of British Nuclear Fuels (BNFL), pointed to the increasing awareness of such factors amongst "opinion formers and decision makers". He expressed the view that: "We can now be confident that we have a future. Just how successful that future will be depends very much on the efforts of every one in our industry".

As would be expected, the industry is making a very great effort. Its build up to the review has been underway for some time.

The British Nuclear Forum, which represents some 70 organisations engaged in funding, planning, building, operating and supplying services to the country's nuclear power stations, is campaigning to "convince the majority of the public that nuclear power stations are desirable". The Forum also places a high priority on lobbying senior political figures, officials and independent experts whose views, it anticipates, "will be sought by the Government of the day come the 1994 review."

It also came as no surprise to learn in February that the Chairs and Chief Executives of Nuclear Electric, Scottish Nuclear, the UKAEA and BNFL have been meeting on a regular basis to identify key issues to address in preparation for the review. The group, which calls itself the Nuclear Utilities Chairmen's Group (NUCG), has set up working groups on nuclear economics; waste management and decommissioning; health, safety and the environment; and research and developments. A fifth group – the Policy Presentation Group – will determine how and when the resultant information should be presented.

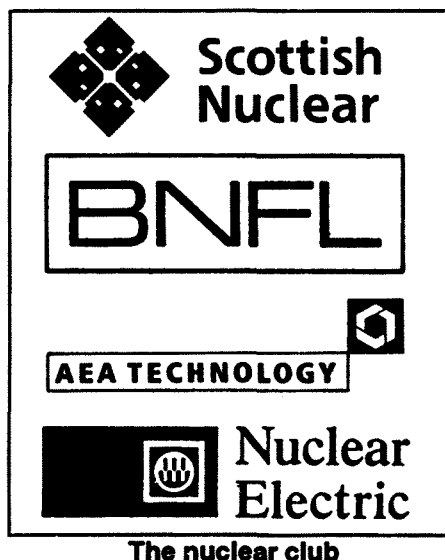
### A complex picture

It must be remembered that behind the industry's bold public assertions of environmental and strategic benefits lies a much more complicated picture. On global warming, the Hinkley Point Inquiry Inspector pointed to the need for "more certain information" to be considered in the 1994 review. As to exactly how more nuclear power can be justified on the grounds of helping to ameliorate global warming, the Inquiry Inspector warned that it is "obviously too early for governmental decisions on such strategic issues to be taken in advance of

forthcoming scientific information."

The Inquiry Inspector was also adamant that if arguments about achieving a diversity in sources of electricity supply are to be relied upon as a justification for an expanded nuclear power programme, then models must be developed to quantify the benefits. This view derived from the Inspector's concern to see political judgments about diversity of supply underpinned by more rigorous analysis. Nuclear Electric and the Department of Energy are both working to develop the necessary models.

There are enormous difficulties in accurately calculating the costs of nuclear power. In its Fourth Report the House of Commons Energy Select Committee criticised the "systematic bias in CEBG costings in favour of nuclear power, both in ignoring risk and failing to provide adequately for contingencies". Although there is widespread agreement that currently there is a cost advantage in favour of fossil fuel plant, the drive to reduce nuclear costs is on, with insiders describing Nuclear Electric's new corporate plan as being based on a "much more aggressive strategy". The 1994 review will need to take a long hard look at the industry's claims for the costs of nuclear power.





Some headlines from British Nuclear Forum's magazine

Assessments of the need for new generating capacity are also fraught with difficulties. The Economic Assessor to the Hinkley Inquiry was concerned to point out that only limited evidence was available about need in the early years of the next century. Electricity demand forecasting is sensitive to a range of factors, not least of which is the state of the economy. Added to this are the as yet unknown effects on pricing policies, peak demand and capacity requirements, which will result from the structural and ownership changes in the electricity supply industry.

Clearly, Government decisions about the future of nuclear power must be backed by more detailed research on the key issues - including global warming, diversity of supply, generating costs and future electricity requirements.

### The conduct of the review

The complexities of these issues must not be overlooked in the face of the nuclear industry's increasingly bold campaign. As a first step the Government should establish a process for the 1994 Review which will enable the necessary research to be carried out and a full and open assessment of the future of nuclear

power to take place.

In early March, the Adam Smith Institute published a report by Professor Colin Robinson which contained a proposal for the way in which the review might be conducted to "avoid the repetition of past errors". In essence the proposal consists of the following steps:

- groups with anti-nuclear and neutral views should be invited, by the Secretary of State, to prepare evidence;
- public funds should be provided to enable these groups to prepare their evidence;
- other fuel industry and outside observers should be invited to participate;
- the Government should publish a Green Paper which would set out the evidence gathered and list the issues to be determined;
- time should be set aside for outside groups and observers to comment;
- the House of Commons Energy Select Committee should consider the Green Paper and prepare its own response;

- after a period of debate, the Government should make a statement, possibly in the form of a White Paper, analysing and discussing the main points to emerge, and setting out conclusions;
- if the Government wished to proceed with the development of nuclear power, it should set out specific reasons, describing the benefits that would follow and, as far as possible, quantifying them.

Such a process has much to commend it. At the very least, it would allow the review to be conducted in accordance with the views of the House of Commons Energy Select Committee. The Committee stressed that the review should enable the full costs and risks of nuclear power to be assessed, and a proper public examination of the issues to take place before decisions are taken.

It is time to remind John Wakeham of the Government's commitment to the review, and to impress upon him the need to conduct it in an open and balanced way. □

Reference: *The Power of the State: Economic Questions Over Nuclear Generation*, 1991, Colin Robinson, Professor of Economics, Surrey University.



After five years, the shadow cast by the Chernobyl disaster continues to grow longer and darker. Many conflicting estimates of the number of resultant deaths have been made - the official Soviet figure is still only 31, yet the former controller of the Chernobyl 30km exclusion zone has claimed that between 7,000 and 10,000 have died. MIKE TOWNSLEY reports on the gulf between the official and unofficial.

# Chernobyl - after the fire

**T**RUTH is the first casualty of war and is always among the first customers for a 'body bag' in times of political crisis. The accident at Chernobyl, at 1.25am on Friday 26 April 1986, has been no different.

It was the result of an experiment conducted by the plant's operators, apparently without the knowledge of the Soviet nuclear authorities. Because it takes 20 seconds for the control rods to reach their most extreme position in the case of a defect, it is of vital importance to know if the RBMK 1000 - Chernobyl type - reactor's turbine could deliver the necessary power until the back up generator takes over. Yet during the trial of the 6 operators blamed for the accident it came out that the test had been conducted several times before, never successfully. Despite this, the trial Judge's verdict states that Director Bryukhanov signed a document in 1983 testifying that all tests had been carried out.

Further, a secret report was sent out to the Supreme Soviet in February 1990, by the State Atomic Energy Advisory Committee, which warned: "The design and construction of the RBMK reactor in Block No 4 at the Chernobyl Atomic Power Station ... like that of all of the other RBMK 1000 reactors ... blatantly contravenes the requirements of the rules for nuclear safety."

## Design faults

Signed by Nikolai Shteinberg, Deputy Chairman of the State Atomic Energy Supervisory Committee, it lists 32 major design faults and admits: "The statements made by the Soviet experts to the International Atomic Energy Agency (IAEA) conference of August 1986 do not correspond to reality."

"A serious accident", in an RBMK reactor, "with a loss of cooling is practically impossible", reported the IAEA Bulletin in 1983. Yet, immediately after the accident members of the IAEA individually denounced the design as "rather simply constructed" and "A nuclear plant such as the one in the Soviet Union ... would never be given a licence in Germany." Not one government has so far called for the closure of the other RBMK reactors.

Information on the adverse effects of energy, on employees, the public and the environment, are not suitable for publication by newspapers, radio and television, decreed the Soviet Ministry of Energy in 1985 - a position which became further entrenched in the immediate aftermath of Chernobyl.

Between 26 April and 6 May journalists were banned from visiting the site. After that only Soviet 'hacks' were allowed to enter the disaster area, and only to cover the "heroic fight against radiation" - technical details were censored.

The 1987 trial of the operators was closed and only edited summaries were available.

## Evacuation delay

Two days elapsed before the Soviet Authorities informed the world of the disaster, and it took until 2pm on Sunday 27 April to decide to evacuate the nearby town of Pripyat. The 50,000 population were then bundled into buses and told they would be away for 3 days. They have still not returned. At the same time the authorities confiscated all dosimeters, a move which could only have been designed to keep the extent of the radioactive contamination a secret.

According to Volodymyr Yavorivsky MP, the head of the Ukraine's Chernobyl Investigation Committee, in mid-May 1986 the Ukrainian Health Minister, at that time, Anatoly Romanenko, was instructed by the Moscow Ministry of Health to change the diagnosis on all cases of radiation sickness to heart disease.

Against this backdrop of secrecy and cover-up we must consider the official estimates of the number of casualties. The Soviet figure remains 31. This is difficult to swallow, yet the latest Western study into the effects of the accident, requested by the Soviets in 1989, conducted under the aegis of the United Nations nuclear watchdog the IAEA, finds "no reason to doubt the account given by the Soviet authorities 6 months after the accident."

Unveiled on 21 May, at a 4 day IAEA conference in Vienna examining its

medical and radiological findings, the International Chernobyl Project (ICP), focused on 3 affected areas, the Ukraine, Byelorussia and the Soviet Federation. The 800 page report comments: "Reported adverse health effects attributed to radiation have not been substantiated ... by the project."

Confined to a 25,000km<sup>2</sup> area, it did not include the 30km exclusion zone around the reactor, or the 100,000 people evacuated from the zone. Nor did it examine the health of the 600,000 plus people - known as the 'liquidators' - conscripted to clean up the site, the surrounding area and construct the reactor's now crumbling sarcophagus.

Many of the liquidators would have received extremely high doses of radiation. In particular those who were forced to clean up the roof of the reactor building - where only 90 seconds exposure would have produced lethal consequences.

"The health of this occupationally exposed population is reportedly being monitored at medical centres throughout the USSR", say the ICP (emphasis added). This implies that they don't in fact know what happened to the 600,000 plus liquidators. This is unacceptable.

## Contamination secret

In reality, the Soviet 3rd Main Department of Public Health passed a secret directive, U2617, paragraph 9 of which reads: "No information concerning the degree of contamination by people who took part in the liquidation of the consequences of the breakdown at the Chernobyl Power Station may be disclosed."

While presenting a bleak picture of the health of Soviet citizens, the ICP said, "The official data did not indicate a marked increase in the incidence of leukaemias or cancer. However, the data was not detailed enough to exclude the possibility of an increase in the incidence of some tumour types." Dr Pad Green, Friends of the Earth's Radiation Campaigner who has recently returned from Chernobyl, notes the use of the word "marked" and argues: "This implies that there is a slight increase, which is all that would

be expected 5 years after the accident. The leukaemia incidence will not peak until about year 10 and solid tumours will still be appearing 40 years after exposure. In atomic bomb survivors, with the exception of bone cancer, it does not appear that the incidence of solid cancers is declining. Indeed 40 years later the incidence of cancer is still increasing."

The vast bulk of the Project's data is just Soviet data translated into English. Not only that but free access to data was obviously denied. The report states: "Available data reviewed do not provide adequate basis for determining whether there has been an increase in leukaemia or thyroid cancer as a consequence of the accident. The data were not detailed enough to exclude the possibility of an increase in the incidence of some tumour types." This clearly contradicts the statement made above by the ICP. For the study to be worth the paper it is printed on a fundamental prerequisite would be free access to all Soviet material on the disaster. Clearly this was not the case.

### Chromosome aberrations

For example, it is important to examine chromosome aberrations in lymphocyte cells as a biological indicator of genetic damage in an organism as a whole. Such an analysis must be done quickly because these cells rapidly reproduce and the aberrations disappear. Supposedly it was undertaken by Soviet investigators. However, the Project team was told the data was "unreliable". As John Willis, Project Coordinator Nuclear Power Greenpeace International, points out: "Surely it is the world's scientific community who should decide what is 'unreliable'; the ICP report gives us useless data masquerading as independent confirmation of Soviet sources."

"The vast majority of adults examined in both the surveyed contaminated settlements and surveyed control settlements visited, either believed or suspected they had an illness due to Chernobyl", says the report. This is at the heart of their findings; they place more emphasis on the stress and worry thrown up by Perestroika to explain the poor health encountered than on Chernobyl.

On the efficiency of protective measures taken at the time of the accident, the ICP found, in those cases the project could assess, that actions taken were broadly consistent with international guidelines.

Their main bone-of-contention is over Soviet evacuation guidelines. They



express deep concern at the psychological consequences of the Soviet's evacuation policy. 218,000 people are expected to be resettled by next year according to Viktor Gubanov of the Soviet State Committee on Chernobyl. The ICP warns: "The adverse health consequences of relocation should be considered before any further relocation takes place."

However, the Soviet Council of Ministers have adopted a limit of 350mSv lifetime radiation dose, and exercise an evacuation policy accordingly. This is based on an annual accepted dose to members of the public of 5mSv. Since 1987, the UK National Radiological Protection Board, for example, has recommended an annual exposure limit of 0.5mSv to members of the public.

### Media interest

In stark contrast to the bland assurances of the IAEA, Chernobyl's 5th anniversary was marked by considerable speculation as to the true consequences of the disaster. Both from former Soviet nuclear industry insiders and representatives of the Ukrainian and Byelorussian State Governments, producing thousands of newspaper column inches and countless miles of TV documentary footage.

The most publicised of these was made by Dr Vladimir Chernousenko, former scientific director of the Chernobyl exclusion zone, who has been given only four and a half years to live because of radiation exposure. He told a packed press conference in London that between 7,000 and 10,000 of the 'liquidators' have died so far as a result of taking part in the clean-up process. Expressing deep despair over the Soviet response to the disaster, he said: "I expected some measures and some attempt to honestly deal with the situation. Now that I have seen, over 5 years, that no attempt has been made, before I die I must make the world

aware of what they are facing."

When addressing a demonstration in London's Trafalgar Square, Lesya Fedorak, a member of the Ukrainian Environment Council, said: "Child mortality is two times higher than in developed countries and 20 freaks of nature are born per 1,000 births. We are now a nation of no future."

Lubomyr Mazur, chair of the Chernobyl Committee, added: "There has hardly been any effort to alleviate the problems caused by radiation poisoning. A huge effort is needed if the Ukraine is going to be brought back to some semblance of normality."

1.5 million Ukrainians are estimated to have been exposed to Chernobyl fall-out. At least 20,000 children have been born to 'group-risk' parents. Uterus bleeding in irradiated pregnant women has increased 3 fold and only 5% of affected school children are considered healthy by the State.

On the anniversary of Chernobyl, now a national day of mourning in Kiev, Vladimir Yaborivsky, head of the Ukrainian Parliamentary Commission on Chernobyl, told an audience of thousands gathered at St Sophia's Cathedral: "Two more Chernobyl graves are dug in the Ukraine each day. We are living with the consequences and shall be doing so for at least the next 150 years."

Both the Byelorussians and Ukrainians have raised major objections to the ICP report, and have submitted extensive evidence of illnesses linked to Chernobyl fall-out. It has been dismissed. Fred Mettler, a US radiation expert, said the new data had not been given in time to the Project, but at first glance it contained "statistical abnormalities and inconsistencies". A glance which obviously had not been applied with anywhere near the same rigour to the data provided by the Soviet authorities. □

Plans for a road bridge crossing to Skye, announced by the Scottish Office recently, have given an immediacy to the promotion of an alternative barrage proposal, as the first phase of a tidal power station. The schemes deviser, retired civil engineer PETER FINDLAY, explains the principles and practicalities of his project.

# Time and tide right for Skye Barrage

**W**E may well be concerned about the enormous amounts of energy used in the rich world. Compared to our parents and grandparents we are all profligate in energy, and wasteful of the fossil fuel heritage we should be passing on to our children. We are beginning to be alarmed at the thought that sources of easy energy will dry up in our generation and we will be left cold and hungry like the poor world. This lack of faith in the bounty of creation is simply refuted by the fact that the sun bestows on the earth each year more energy than the entire capital reserve of fossil fuels in the earth's crust. In fact, 500 times more. The source of this energy is of course nuclear but at a safe distance of 92 million miles.

Curiously enough, the one power source of which the sun is not the author is the tide. Tidal motion is primarily the work of the moon, alternatively augmented or diminished by the gravity of the sun from neap tides to springs. On a global scale the total energy involved in this tidal motion is not large, about 10,000 TWh/annum (10 million million kilowatt hours). There are about 16 stretches of coastline in the world where some of this energy can be conveniently tapped and converted into electricity. So far only one commercial tidal power scheme is in operation – the Rance estuary in Brittany. The other schemes, Kislaya Guba in the Soviet Union, Annapolis Royal in Nova Scotia and one in China, are small, prototype or experimental stations.

## La Rance

La Rance has an installed capacity of 240MW, about 15% of the total demand of Brittany, and produces 600 million units of electricity per year. Completed in 1966 at a cost of about £60 million, today its electricity is sold for 1.6p a unit. First mooted in 1906 the scheme had three main thrusts: the formation of a deep water port; a road link between St. Malo and Dinard; and a tidal power scheme. The countryside around St. Malo is of great natural beauty and has a big tourist trade. The crossing of the Rance estuary was not to disturb this. In fact it has become a great tourist attraction itself.

Thus, the Rance scheme has certain similarities with the author's proposals for Skye and Lochalsh. In both cases the scenery is of great importance; there is a long standing demand for a road crossing and a need to improve a good natural harbour. There is however a presumption against tidal power schemes in Scotland since our tidal ranges are far smaller than those of Brittany or west England and Wales. At Rance the mean tidal range is 8 metres and the tidal basin has an area of 22 square kilometres. The mean tidal range between Lochalsh and Glenelg Bay is only 3.7 metres but the basin area of Lochalsh, Loch Duich and Loch Long is 41 square kilometres. Since the available power depends on the basin area and the square of the mean tidal range it seems not unreasonable to expect 100–120MW of electricity from the tides in Lochalsh.

A study of the parametric model analysis presented by Clive Baker of Binnie and Partners to the Symposium on Tidal power of the Institute of Civil Engineers held in London in October 1986 confirmed this, and also predicted an annual output of 200 million units (200 GWh). This capacity is bigger than any of the conventional hydroelectric schemes in the north of Scotland, apart from the pump storage stations.

## Pump-storage

One of the drawbacks of tidal power is that it comes on and off at times dictated by the tides and the moon, whereas the demand for electricity follows the clock and the sun. The pump-storage power station at Foyers can give or take up to 300MW to or from the grid and could cope with the cyclic variations of Kyle Rhea. A tidal power station can also act as a pump-storage station itself, particularly at neap tides, thus increasing the flexibility of the hydro-electric network.

The Skye bridge plan has made the tidal power scheme relevant now. Because the high bridge over the lighthouse at the exposed West end of Kyle Akin is such a bad piece of design. It has high-lighted the need to think very carefully about the best way to connect Skye with Lochalsh. The island and a large piece of the mainland are now

linked socially as Skye and Lochalsh District Council, much more than before the re-organisation of local government when Skye and Glenelg were part of Inverness-shire, while Lochalsh, Kintail and Glenshiel were part of Ross and Cromarty County Council.

Up to now Skye has been linked to the mainland by three ferries as well as various cargo boats to Oban and Glasgow. This year the Kyleakin route has two new roll-on ferries carrying 36 cars each and will give a 24 hour service in the summer months. If the 24 hour service was to continue all the year round that could be one answer to the problem.

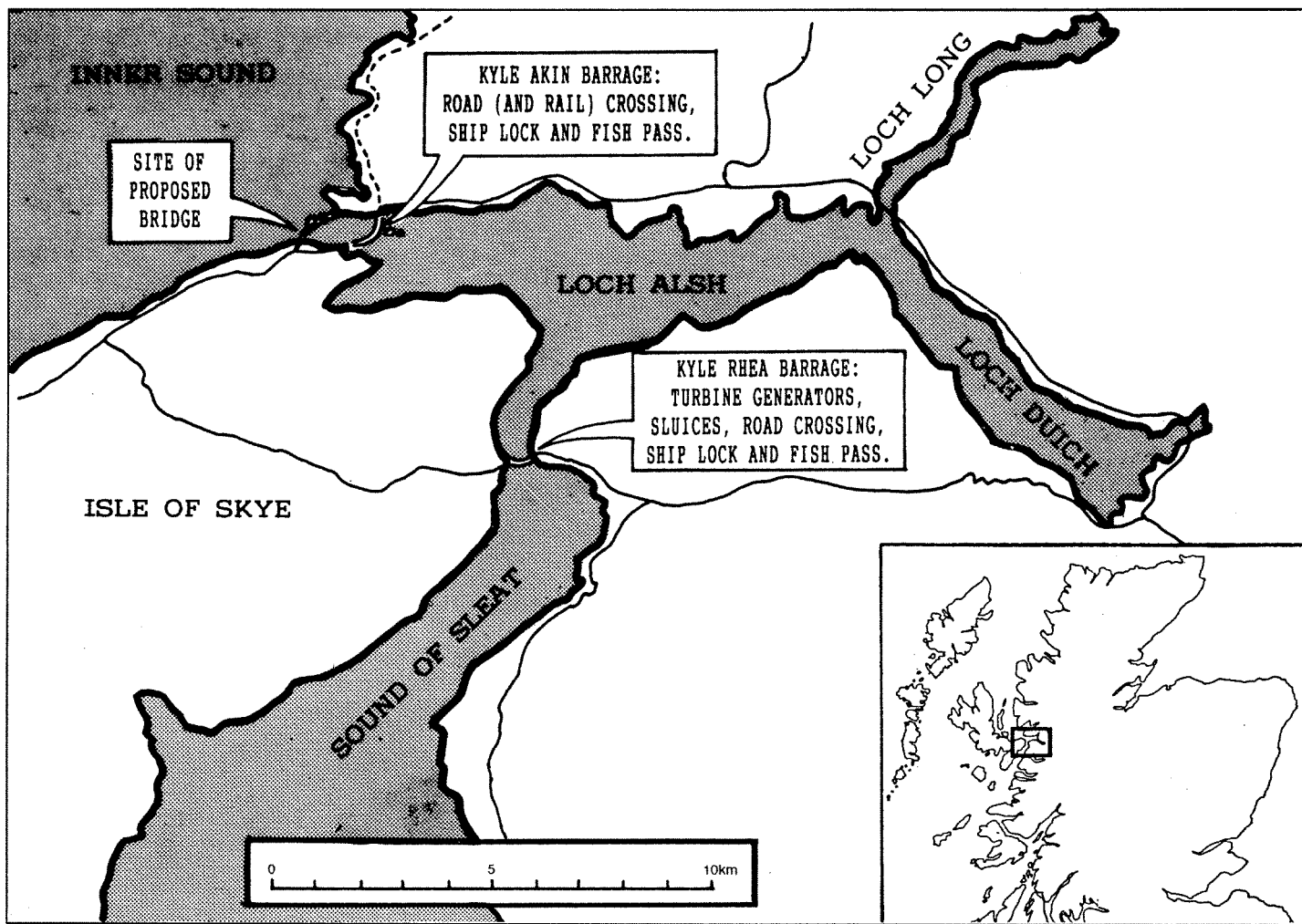
The Government solution of a high bridge requires a mile of approach roads with a second bridge and a great deal of blasting through the middle of the Kyle of Lochalsh. It also bypasses the village of Kyleakin and makes a 3km journey from there to Kyle of Lochalsh, in place of the short ferry link.

## First phase

The tidal power scheme needs a barrage across Kyle Akin. A proposed line is shown in the outline plan. It would link the road ends together at low level and join the two villages directly. It could be built as Phase 1 of the tidal power scheme but could stand on its own as a road crossing.

Before going on any further into the design of a scheme of this nature and scale, it is essential to bring into the planning process all the interests involved. The author has started to do this by inviting comment, criticism and correction of his proposals from the Scottish Office, the Department of Energy, Highland Regional Council, Skye and Lochalsh District Council and the Community Councils of Kyle, Kyleakin, Glenelg and Sleat. Also from the Royal Fine Art Commission, the Countryside Commission, the National Trust, the Scottish Marine Biological Association, the Marine Technology Centre at Glasgow University, the Centre for Human Ecology at Edinburgh University, the Energy Studies Unit at Strathclyde University, the Engineering Department at Napier College of Technology, Scottish





Hydro-Electric, the Energy Technology Support Unit at Harwell and AEA Technology at Dounreay, as well as contractors, manufacturers and interested individuals. There are some 29 other organisations or groups, voluntary and official who are yet to be consulted.

The basic method of working a tidal power scheme at Lochalsh would be the ebb generation method. When the water level in Loch Alsh was at a high, all the gates would be shut in both the sluices and the turbine caissons. When the sea level has fallen to about mean sea level the turbine gates would be opened and electricity would be generated for approximately 3 hours until sea level reached low tide, when the turbine gates would be closed. The sluice gates would then be opened to allow the water levels in the sea and loch basin to equalise and return to high level, then the cycle would be repeated. At any stage in the cycle, ships would pass through the locks in each barrage. Large fish, aquatic mammals and flotsam would pass through the sluices but would be prevented from passing through the turbines by grills across the entry tubes. There are variations in this basic cycle which would result in different water levels in Loch Alsh. Pumping on the flood tide at neaps

would increase loch water level above its natural Mean High Water Neaps too. All this will have an effect on the fauna and flora of the intertidal zones and mud flats at the head of Loch Long and Loch Duich, and should be the subject of a biological survey. Such a survey would be part of a Feasibility Study of the kind which has been done on the tidal power schemes proposed for the Severn, Mersey and Conway estuaries.

### Crossing costing

In SCRAM 81 the writer was quoted as saying "It would cost much less than a bridge". This comment applied to the road crossing part of the barrage across Kyle Akin and not to the whole tidal power scheme. At the present stage of design it seems probable that a rock-fill barrage with ship lock and bascule bridge from Kyle of Lochalsh railway pier to the old ferry ramp at Kyleakin could cost £15.5 million. The barrage at Kyle Rhea with power station, sluices, locks and road-way could cost £138 million. This is more than twice as much as a gas-fired power station of the same capacity and under the present regulations relating to the price of Scottish electricity supplies to the Grid would be a non-starter.

In Scotland electricity is bought from

private generators by Hydro-Electric or Scottish Power for about 1.5p a unit. However, in a recent Parliamentary Answer the Scottish Secretary, Ian Lang, said agreement had been reached for the companies to buy output from existing small Scottish renewables generators or those whose planning is far advanced at a price of 5.3p per unit. This is limited to 24 GWh per annum in the case of Scottish Power and 34 GWh for Hydro-Electric. The contracts will run from July 1, 1991 to December 31, 1998.

In his forward to the 1989 general report on the Severn Barrage Project, Energy Secretary John Wakeham said: "Renewable sources offer the potential to increase diversity of supply and will assist in reducing the threat of the greenhouse effect. The Government is determined to stimulate their development to the fullest practical extent where they have prospects for being economically attractive and environmentally acceptable."

A great deal of public and private money has been spent in studying tidal power schemes in the Severn, Mersey, Humber and Conway. Is it not unreasonable to demand a thorough feasibility study for the Kyles of Lochalsh? □

On a visit to Poland last year, BRIDGET GUBBINS\* made contact with Byelorussian families on a respite holiday from their contaminated towns and villages. Their experiences belie the reassuring noises coming from the International Atomic Energy Agency.

## Children of Chernobyl

**F**IVE years after the Chernobyl accident, hundreds of thousands of people are still living in radiation contaminated areas of the Soviet Union, and consuming contaminated foods. Of the estimated three million people exposed to chronic radiation, 2.2 million live in Byelorussia, the republic north of the Ukraine and east of Poland, where much of the Chernobyl radiation fell. This was the area visited by Patrick Green, who reported that 100,000 people are living in areas of gross contamination (SCRAM 81).

Although over 135,000 people have been evacuated from some of the worst contaminated areas near Chernobyl, the numbers at risk are increasing rather than lessening. Zhores Medvedev, in his book *The Legacy of Chernobyl*, explains that as people consume contaminated food, more and more are approaching the accumulated dose of 35 rem, the highest level deemed permissible by the Ministry of Health of the USSR. Some villages as far as 300km from Chernobyl are now having to be evacuated. Medvedev says, "What emerges is a clear picture of an increase in contaminated area, caused by erosion, normal ecological processes and human activity."

### Polish respite

Last summer when I was in Poland with my daughters our hosts introduced us to a Byelorussian student, Vera Astahnovich, from Minsk who had escorted a group of 114 children from contaminated areas of Byelorussia for a holiday in Poland.

Since that time, Vera and her friends have corresponded with me, and recently have sent photographs with a request for help and support from people in the west. They belong to an organisation called Otluk, meaning Response. It is a registered charity in the Soviet Union, and has close links with the Byelorussia National Front, a political organisation campaigning for regional independence within the Soviet Union. Response also has connections with the Polish Catholic Charity Caritas. Byelorussia National Front has links with Solidarity in Poland. The visits of the children we met were arranged through Solidarity in Gdansk, with some financial assistance from the Lions Club International.

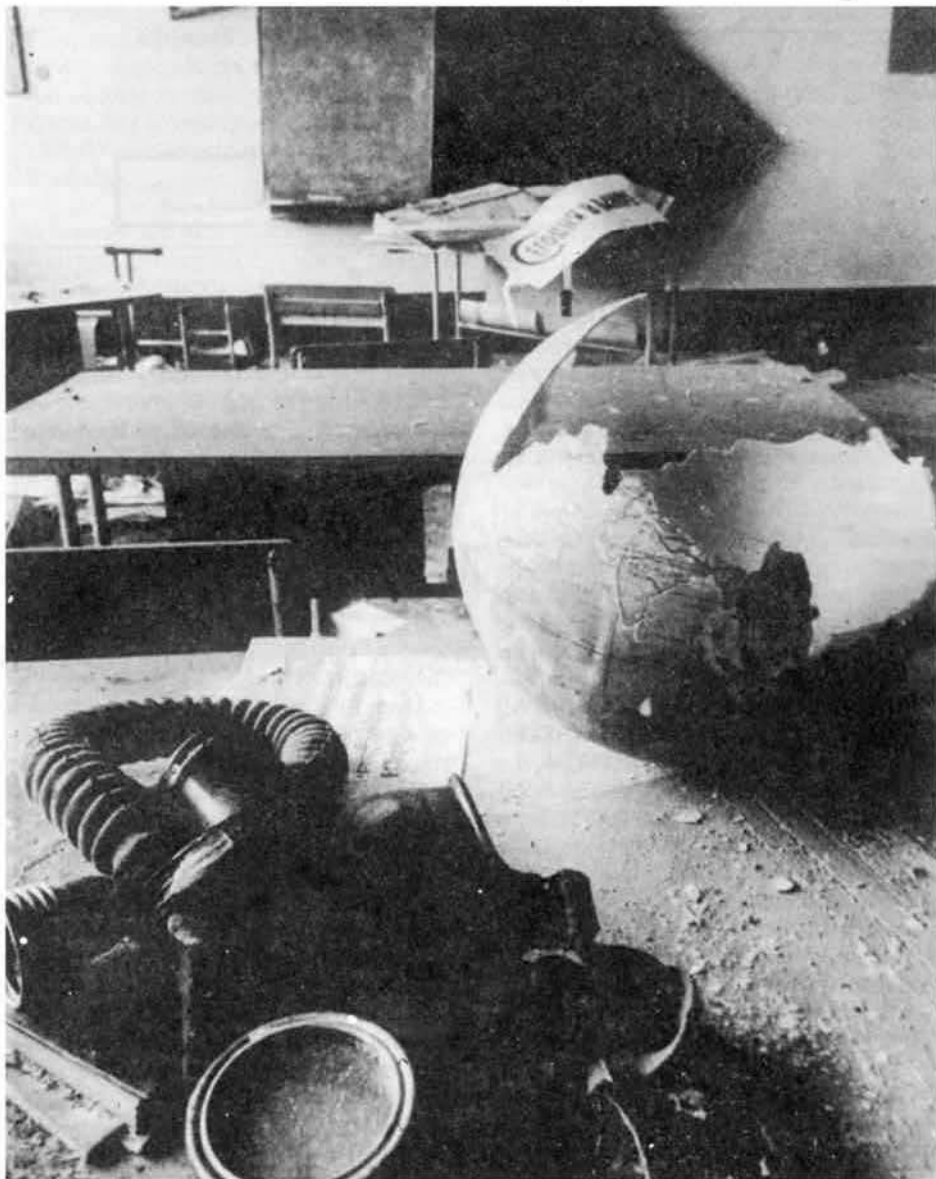
The children were from areas with up to 15 Curies per km<sup>2</sup> contamination. They live in hot spots 300-400km from Chernobyl. The distance gives an idea of the scale of contamination. From Edinburgh to Thurso is 300km, Edinburgh to Doncaster 300km, and London to Newcastle 400km.

Vera writes, "Byelorussia occupies about 2,076km<sup>2</sup>, one third of which is affected by Chernobyl. The dangerous zone is inhabited by 500,000 children who can't be moved. Our Government has not enough money to build houses for them."

She continues, "people who are living in the contaminated zones are

constantly subjected to the radiation. This influences the state of mind, gives them a sense of doom. They get only infinitesimal financial help to enable them to buy clean food. People call the payments 'coffin benefits'.

"More and more people are contaminated every day, as they eat mainly local food. Inhabitants of the contaminated zone eat products from the clean regions of Byelorussia, and at the same time inhabitants of the clean regions eat contaminated products. It is the conception of our government that, at some time, levels in clean and contaminated zones will become equal. Our government cannot provide



Schoolroom at Bragin, 50km north of Chernobyl. This village was evacuated, and attempts made at decontamination.

Byelorussian people with enough clean food."

The reason that Response organises the visits of these children to Polish families is to give the children a chance of eating uncontaminated food for a brief period, to allow some improvement in their health. Another advantage for them is that the children make contact with Polish families, who are likely to help them in the future. Although the Polish families see themselves as much worse off materially than west Europeans, there is no doubt that they are wealthy compared to the Russian families from which these children come.

Mrs Sobolinska of Gdansk, mother of four, took in Elena aged 10, from the village of Volozin, 40km west of Minsk: "She is very pale in complexion. It is very hard to tell how badly she has been affected by radiation, but we are paying for her to have a full medical examination before she goes home."

### Medical check

Gdansk GP, Dr Jazzkowsky, was host to a family from the small Byelorussian town of Lida. He gave medical examinations to 24 of the 114 on that particular visit. He said, "It is important not to make them too anxious, so I only gave them basic examinations. Some of these children have never had a medical examination in the Soviet Union. One of them had a white blood cell count ten times higher than normal."

Leonid and Margarita Misiukewicz and their two sons Jaroslav age 6 and Julian age 4, were staying with Dr and Mrs Jazzkowsky and their 6 children. Despite the hot summer weather to which this family and all the Russians we met had been exposed, their complexions were noticeably white.

Leonid described how worried he was about his boys: "They frequently have nosebleeds during the night, as often as once a week. When we go to them in the morning, their pillows are covered with blood. I asked the doctor about it, and was told not to give the children cow's milk. When I asked the doctor if other children had the same symptoms, he shook his head and wouldn't answer."

Leonid and Margarita then decided to get a goat so their sons could have fresh milk. They fed it on grass grown locally. Leonid said, "I took a sample of the milk for testing for brucellosis. While there, I asked the technician to check for radioactivity. She did it rather reluctantly. The reading was 12 times the normal level for radiation. Her face went grey. I asked the official in charge



School steps in Bartolomeska, 280km north of Chernobyl, last summer. Contamination is 13 Curies per km<sup>2</sup>; the sign over the door reads "Welcome".

for a report. He told me the milk was safe to drink, but refused to give me a signed certificate."

The office of Response is based in Minsk. In 9 months, until February 1991, 5,000 children have been to Poland for holidays. They plan to send 10,000 more by the end of 1991. All the children they send are from contaminated zones, and many of them are from boarding schools for orphans. Response would dearly like to make further contact with groups or people in Britain. It can be contacted via Vera Astanovich, Logoyski Tract 37/1 - 238, 220131 Minsk, USSR.

However, Vera and her friends would like contact with British people whether they can help with the Chernobyl children or not. She writes, "My friends

are students of Minsk College of education, like me. And we would like to extend our contacts with the world. Dear Bridget, could you help us somehow. Maybe you have contacts with a British secondary school or college, so you might help us make friends with students. We want them to visit the Soviet Union. And we'll be very glad to visit them.

SCRAM readers interested in gaining first hand knowledge of life after the Chernobyl accident or making contacts with Byelorussian students for its own sake should write to Vera, in English, French, German or Russian. □

\*Bridget Gubbins is Publicity and Information Officer for the Druridge Bay Campaign, but is writing in a personal capacity.



Given the contribution energy saving can make to ameliorating global warming, recent cuts in the Energy Efficiency Office budget appear nonsensical. DAVE SPENCE finds the House of Commons Energy Select Committee report on energy efficiency offers little in the way of explanation of Government policy.

## When savings cost the earth

A lot is expected of energy efficiency these days either as a fifth fuel or the cornerstone of an energy policy. Given the environmental imperatives, little encouragement can be found in the Energy Select Committee's review of the Government's record over the nine years since they last focused on the issue. Their report makes for somewhat confusing and depressing reading.

Inevitably, all witnesses claim 'green' credentials yet disturbingly little common ground is displayed. Characterised by vagaries, conflict and even subterfuge, the script has the mixture of venom, scandal and banality typical of a soap – mildly entertaining but disconcerting, as something better could be done.

Years of research promoting the benefits of conservation have produced meagre advances. Energy labelling has been discussed for over a decade and the Department of Energy's Energy Efficiency Office (EEO) is still talking about problems to setting it up – problems overcome in many countries as in the US mandatory and the German voluntary schemes.

As the Committee puts it, "the most striking feature of our enquiry has been the extent to which improvements in our energy efficiency ... are almost universally seen as the most obvious and effective response to the problem of global warming ... [yet] widespread opportunities to invest profitably in cost-effective measures to improve the efficiency of energy conversion and use are being ignored."

Peter Walker's efforts when setting up the EEO attracts some approval although doubt remains over the viability of his initiatives (SCRAM 64). In 1983, he set the national objective of improving energy efficiency by 20% within 10-15 years. He believed that the nation "could go from the bottom to the top of the international energy efficiency league table" by 1988. In 1986 the Government was party to a European Council of Ministers resolution aimed at a 20% improvement in energy efficiency by 1995. More recently the Energy Secretary, John Wakeham, maintained that the Government White Paper target of

returning CO<sub>2</sub> emissions to their 1990 level by 2005 is "a demanding target with real costs to the economy."

These targets are considered by many to be within easy reach but not unfortunately by Mr Colling, Head of Division, Energy Efficiency, the European Commission witness, who sees present trends continuing to give savings of 14%. This is not a target for all countries but a Community target, the weak link being the assumption that those countries best able will do more.

### Britain off course?

Government and energy officials claim that Britain has done more than most, but under scrutiny, as a nation, our efficiency has improved because of industrial restructuring resulting in the closure of energy intensive industries rather than through conservation measures. The target set by Walker has not been met and, since it is based on extrapolation it is considered unreliable and "there is major uncertainty over whether the nation is in fact on course to achieve Mr Walker's target".

Dr Elliot Finer, Director General and Dr Neil Williams, Director Building and Education Directorate, of the EEO come in for intense criticism. In part this appears valid. As top civil servants they came forward with little meaningful information with which to evaluate their departments contribution. They were evasive unless affirming an area to be not within their remit. Only under extreme pressure does anything of value emerge – such as the EEO budget being cut from £24.5 million in 1986-87 to £14 million in 1991-92 (SCRAM 80). The memorandum implied an increase but it transpires £12 million had been transferred from the Department of Employment, money already ear-marked for grants.

On the other hand, given that the EEO is the smallest office in the smallest of government departments it is not surprising that the Committee sense an undermotivated staff lacking interest. The result, according to Peter Rost (Conservative) is a Department that "offers quite a lot of rhetoric and hot air about its so-called promotion of energy efficiency but we seem to be a little slower in getting actual programmes and action."

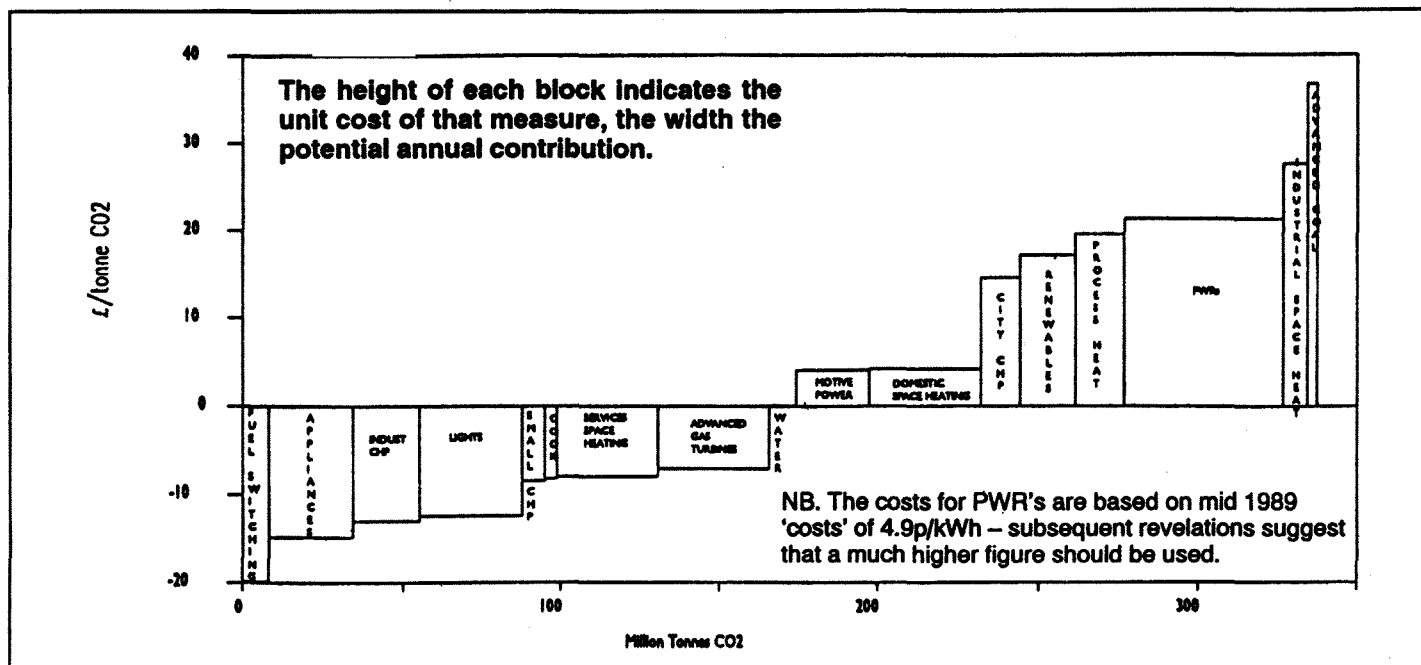
A further worrying feature is the lack of imagination shown by the newly privatised electricity companies. The case put forward by Eastern Electricity is that "far from perceiving a conflict between giving advice on the efficient use of electricity and selling more ... to our customers, we see the two as complimentary" and "the increased use of electricity as the efficient route for energy supplies will lessen the overall emissions of greenhouse gases whilst at the same time meeting the energy requirement for sustained economic growth."

This is an attractive and deceptive argument where 'sustainable' amounts to 'business-as-usual'. No need for a change of direction is acknowledged and arguments based on the central tenets of economics are ignored. With no distinction being made concerning environmentally-friendly technologies, but differentiation between fossil fuels and electricity, the power companies take a swipe at all competitors and lay the ground for a nuclear revival. The reference to greenhouse gases is as glib as their use of the term sustainable.

### Internalisation

The exchange of ideas dries up and dialogue withers. The case is exemplified by the contribution from Robert Malpas. Despite only a short spell as chair of PowerGen he regularly claims his views were not the cause of friction with his employers. His arguments closely mirror those above and would seemingly suit any power company, except as an engineer he is keen to see waste internalised into the system leading to increased efficiency. The others must have been horrified as they sensed the erosion of profit such internalisation would bring.

Most of the distribution companies contribute very little to the debate, referring to the memorandum from Eastern Electricity as their standard position. At the same time they denounce least cost planning as inappropriate in the UK since it is no longer a vertically integrated industry (is this a plea for renationalisation?). In fact, it is a clear example of companies working as an oligopoly with no pretence at competition.



Savings curve for CO<sub>2</sub> abatement options (assuming a 10% discount rate)

However, their aversion to regulation is not consistent. Companies take the view that, through discussion as opposed to regulation, companies will be enthusiastic for voluntary agreements which will contribute significantly to energy efficiency. Many contributors refer to lack of information as a major and persistent barrier. After a decade of discussion about labelling, there have been no advances and industrialists now openly call for mandatory legislation.

### The opposition

The Association for the Conservation of Energy (ACE), looking for a sea-change towards conservation, give a more critical assessment. "No UK energy suppliers undertake least cost planning and none pursue energy efficiency as a resource ... energy efficiency programmes ... have been largely cosmetic ... this difference between the UK and other countries must reflect on our comparative success in improving energy efficiency."

ACE criticise the EEO for not setting relevant targets, for example, they argue that registering the number of seminars attended by Energy Efficiency Officers are measures of activity not energy efficiency.

What is possible is further shown by the National Energy Foundation (NEF). It aims through information and education programmes to raise energy awareness among the public, business and Local Authorities. It has made significant progress towards National Home Energy Rating (NHER), an energy audit indicating energy efficiency of both new and existing housing. In the world's largest energy park at Milton Keynes 600 homes and several commercial buildings are all required to be at least 30% more

efficient than those built under current regulations. These tangible examples of increasing energy efficiency without significant additional cost prompted one Committee member to ask Wakeham why money going to the EEO should not be redirected to the NEF. He praised their work and effectiveness but did not consider them to be hampered by money shortage.

The Committee does speak out against the Government and "are not satisfied that it is envisaging a role for energy efficiency which adequately reflects its cost-effectiveness relative to other measures ... or even that it has assessed the degree to which additional promotion of energy efficiency would be cost-effective for this purpose."

### Social costs

Crucial to ACE's perception of barriers is that externalities do not reflect the wider social costs and benefits, and "there appears to be very little input of the environmental costs to the financial costs that you and I pay for our fuel". The gap was filled by Friends of the Earth with a chart indicating the relative cost-effectiveness of different ways of reducing CO<sub>2</sub> emissions. These are ordered by merit; those saving money are beneath the axis, those imposing costs, above (see figure).

The present situation looks dismal and reality is some way from Government assurances. The conservation industry is in decline, cavity wall insulation, for example, is down 49% and double glazing down 34%. Energy conservation is still burdened with Value Added Tax, unlike domestic and some commercial use of electricity and gas, maintaining the bias towards consumption.

The EEO is hamstrung, short of cash, undermotivated, barely capable of stimulating awareness raising initiatives. Conversely good projects are occurring at grass-roots level, proving that energy efficiency is not constrained by either technical limitations or financial viability, although this does not mean they would not benefit from Government support.

Half the cost of energy efficiency audits was once paid by government. This has been scrapped despite estimated savings, according to the National Audit Office, of around £30 for every £1 spent.

Industry plays a very short-sighted stalling game. It feels that to delay energy efficiency measures is to avoid some costs competitors will have to meet. However there is a very real danger that industries failing to respond will be left behind in future market opportunities. Despite the obvious potential here for Government intervention, it promotes energy efficiency measures only reluctantly, a stance that is at odds with many authorities.

Underlying all of this is the failure to grasp the importance of the environmental component in a sustainable energy policy or even an energy policy per se. Whilst everyone appreciates the role of energy efficiency in combating global warming, mention of global environmental change rarely occurs beyond the first few paragraphs. Unless the environmental component is inbuilt into the policy making process environmental problems will remain just a sexy preface. □

### Reference:

House of Commons, Energy Committee on Energy Efficiency: Third Report, 13 March 1991.

The failure of the International Commission on Radiological Protection (ICRP) to adjust public dose limits in line with changing assessment of the risks, raises the question of who decides what are acceptable risks. DR PATRICK GREEN, Friends of the Earth's radiation campaigner, looks at the issues and considers the role of the ICRP.

## The risk business

**R**ADIATION is now recognised by the International Commission on Radiological Protection (ICRP) as being five times more dangerous than when the present public dose limit of 1mSv was first set, yet it has not reduced this limit. Instead, the way dose limits are set has been completely changed. The ICRP proposes to allow members of the public to face a level of risk that would have previously been considered unacceptable.

Currently 26 nuclear establishments and about 1,600 non-nuclear establishments hold authorisations under the 1960 Radioactive Substances Act to discharge low level radioactive waste to the environment on a routine basis.

Both industry and its regulators frequently justify public exposure by claiming it is "within nationally accepted limits", based upon the recommendations of the ICRP. By implication, this statement suggests that as long as the dose limit is complied with, then the risks from the exposure are acceptable.

Who decides what is acceptable and how is the decision made?

### Defining a tolerable risk

This decision is made on behalf of the public, which includes groups, such as children, who may be particularly vulnerable to exposure to pollutants like ionising radiation - who do not make a decision to be exposed to radiation. The ICRP's principles of radiological protection do not only specify dose limits. They also require that exposures are both as low as reasonably achievable and justified. Justification means: "No practice involving exposures to radiation should be adopted unless it produces sufficient benefit to the exposed individual or to society to offset the radiation detriment it produces".

However, in reality, justification does not mean a balancing of risks and benefits. Where the nuclear industry is concerned, it arises out of Government policy. Reprocessing, even though it offers no environmental benefits is the corner stone of the Governments

Radioactive Waste Management (read dumping) Policy. Equally, nuclear power, even though it has been shown to be uneconomic and is widely viewed as unsafe, is viewed by the Government as important for maintaining the diversity of supply. This can hardly be considered sufficient justification for the risk involved.

Nevertheless, the issues of benefits and who, if anybody, receives them, does not feature in the adoption of a numerical dose limit. Nor do they European Community Directives which bind the UK to accept ICRP limits.

Consequently, dose limits, at least in the past, have been based upon a simple magic number which is viewed as representing the maximum tolerable level of risk.

For instance, a risk of death from fatal cancer of 1 chance in 100,000, per year, has been generally accepted as representing the border between tolerable involuntary risks and risks that are not. This judgment formed the basis of the ICRP's 1 mSv dose limit, ie exposure at the limit was viewed as producing a risk of 1 in 100,000 per year. By this criteria, exposures which were within the limit were viewed by the regulatory authorities as tolerable.

The ICRP now accepts that radiation is five times more hazardous than previously recognised. Yet, they have not reduced their limit.

### Are the limits adequate?

They managed this by changing the way the limit is derived. They now justify the limit by suggesting it is equivalent to the variation in natural background radiation, excluding radon gas. Yet, a number of authorities, including the ICRP, have argued that the level of exposure from background radiation has nothing to do with exposure arising from discharges into the environment. This was emphasised by the NRPB in its comments on the draft ICRP recommendations: "It has been noted on many occasions that the existence of a natural risk does not justify the imposition of an artificial risk of similar magnitude".

The Commission have also argued that

instead of judgments over the maximum level of tolerable risk, judgments also have to be made about whether the time at which the risk is received is important.

Some members of the Commission, like former NRPB director John Dunster, believe the risk of death cannot be increased. We are all going to die, therefore the risk is always one. If you contract a cancer, as a result of radiation exposure, you will die, on average, later on in life. Therefore, radiation exposure alters only the time and nature of your death it does not increase your risk. Consequently, they have suggested that: "Added risks late in life may be less important than risks added earlier in life".

This judgement has nothing to do with a scientific assessment of the risk from cancer. It is a value judgment, made on your behalf by people you have not elected and over whom you have no control.

The public could legitimately argue that any reduction in life expectancy is unacceptable. A cancer, even a non-fatal one, is likely to be equally unwelcome at age 30 or age 65. Given the choice most people would rather not contract a cancer at all. For them it is the additional risk of contracting cancer arising from exposure to ionising radiation and not the time that the cancer develops, or the time that it kills you, that is important.

A further justification for retaining the limit at 1mSv was offered by the ICRP in its draft recommendations. This was that their limit had not caused any operational problems in the past: "The ICRP is also aware that its previously recommended long-term limit of 1mSv has been widely adopted in practice and now gives rise to no serious difficulties of application, except in a few transient situations".

This suggests that the ICRP's limit is not related to its assessment of the risks of exposure, but instead to what industry can easily achieve. This statement did not appear in the final recommendations.

It can be seen that the Commission has dispensed with any pretext of



maintaining that its limit is related to judgments about tolerability of risk. Even if one ignores the inadequate basis of these judgments, and the failure to consider benefits, one is entitled to ask why the Commission has changed its arguments? If radiation is now viewed by the Commission to be five times more dangerous than previously recognised then their limit should now be 0.2mSv per year.

### Implications of a lower limit

If this were to happen, it can be seen that the most highly exposed members of the public around UK nuclear installations are far from being exposed within "accepted limits".

The table shows that, for the nuclear installations listed, exposures either produce a risk that exceeds the a maximum tolerable level of 1 in 100,000 per year, or which approach this level. In all cases, the discharges from these installations were well within the authorised limits.

Industry might suggest that in some cases the exposures are coming down and that some of these installations comply with a risk limit of 1 in 100,000 per year. Maybe, but what has brought about the reduction. The levels of discharges from installations like Sellafield may have come down in recent years, but this is not because of a benevolent attitude at BNF. Lowered discharges have come about because of public pressure - without this pressure exposures would probably be much higher.

Lower annual doses are also not just a reflection of lowered discharges. People's habits change - for instance if people eat less locally caught fish around Sellafield then their exposures will be less. Estimates of annual doses can also be artificially lowered by changing some of the metabolic models used in the assessment. For instance, MAFF and the NRPB have recently recommended that the gut uptake factor for Americium-241 and plutonium be reduced. This has lead to a reduction in the estimates of exposure from Sellafield.

Consequently, industry claims that good management practices have lead to a reduction in public exposure warrant extremely careful examination.

When industry or its regulators assess the exposure of children all parameters used are appropriate to the age of the child, except when they calculate the risk arising from the exposure. Risk rates recommended by the ICRP for exposure of the public are for the whole population.

### Public Exposure from Aquatic Pathways (MAFF Monitoring Data)

Station	Exposed Group	% of maximum tolerable risk (fatal cancer risk only)		
		1983	1987	1989
Capenhurst	Fish consumers	<50	<50	<50
Chapelcross	Shellfish, external from mud	<150	<100	<50
Heysham	Fish consumers	275	60	75
Sellafield	Fish consumers	1125	165	95
Springfields	Houseboat dwellers	150	120	85
Trawsfynydd	Fish consumers	125	125	45
Winfrith	Fish consumers	<50	55	<15

### Public Exposure from Terrestrial Pathways (BNF, CEGB/NE Data)

Station	Exposure Route	% of maximum tolerable risk (fatal cancer risk only)	
		1987	1989
Dungeness	Inhalation Ar <sup>41</sup>		55
Sellafield	Inhalation	<50	80
Trawsfynydd	Inhalation Ar <sup>41</sup>	110	350
Berkeley	Direct gamma	250	Shut
Bradwell	Direct gamma	350	150
Chapelcross	Direct gamma	170	135
Dungeness	Direct gamma	—	150
Other stations	Direct gamma	<100	45
Sellafield	Direct gamma	100	100

Yet, in the atomic bomb survivors the highest risks are seen in people who were aged under 10 when the bombs were dropped - although there are some unresolved scientific questions surrounding this. Nevertheless, the risk is approximately three times higher for young people.

An important question, therefore, is whether the ICRP dose limit is adequate to protect the most vulnerable groups in society? Alternatively public dose limits could be derived using a risk rate based on the most sensitive group. Consequently, on this basis, a maximum risk of 1 in 100,000 per year, would be produced by an exposure of around 80 micro-sieverts.

While such a limit may over-protect older people, as a point of principle, safety standards should be designed to protect those most at risk and not average members of society.

### Risk versus benefits

However, it must be stressed that simple compliance with a limit, whatever its value, does not automatically mean that the risk is either tolerable or justified.

As I stated earlier, no level of risk can be considered tolerable unless there are compensatory benefits, either to the individual or to society in general. A simple number as a measure of tolerability does not fulfil this objective.

Consequently, any assessment of risk must also examine the processes producing the risks and the benefits produced. Furthermore, even simple identification of a benefit alone should not be sufficient to judge that a risk is tolerable. A further question, is whether, all else being equal, the same benefit could be produced by another technology or policy that leads to less overall risk. If this is the case the first risk cannot be considered tolerable. Yet, when the regulators issue, or renew, authorisations to discharge radioactivity into the environment the justification for the practice is not mentioned.

### Conclusions

Organisations like the ICRP and the nuclear industry may view public concern as irrational. However, the new ICRP limits are unlikely to lessen this concern and if anything, they will quite justifiably lead to an increase in concern. If authorities like the ICRP now acknowledge that radiation risks have previously been underestimated, then the public will legitimately expect, at the very least, a proportional improvement in safety standards. When this does not happen many will ask why not and question the role of the regulatory authorities who use the ICRP recommendations. In this context, a relevant question is who are the regulatory authorities and organisations like the ICRP striving to protect? Those at risk, or those producing the risk? □

## Acid rain imagery

**D**AMAGE from acid rain in Britain is far worse than originally expected according to, as yet, unpublished Government maps which mysteriously appeared in the House of Commons library. They show that present targets for power station emission reductions are totally inadequate.

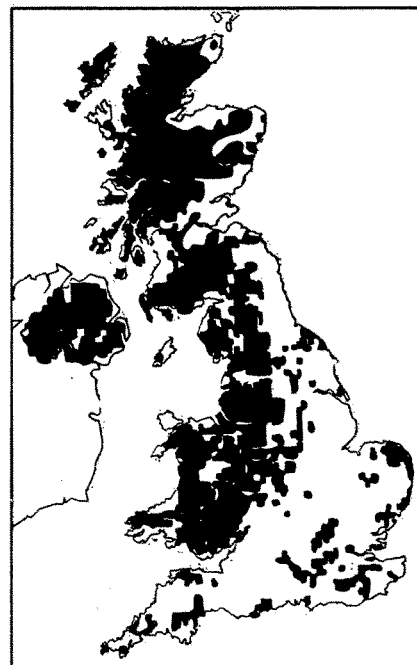
Early this year, Friends of the Earth complained that Department of the Environment maps showing the extent and degree of acidification in Britain had been withheld. They were promised for 1990 but have been sat-on, initially to avoid criticism during a sensitive privatisation period. It now appears that they won't be released until the Autumn, when projection maps, showing the effects of acidification reduction measures by the year 2005, can be included, thus diminishing their impact.

The criteria for tackling acid emissions are dominated by political expediency rather than adhering to environmental or scientific needs. Four stations have now

been earmarked for the retro-fitting of Flue Gas Desulphurisation equipment: Drax and Ferrybridge in Yorkshire; Ratcliffe in Nottinghamshire; and most recently Longannet in Fife.

Power stations are responsible for more than 70% of SO<sub>2</sub> emissions, but Longannet has been included despite using coal with the lowest sulphur content in Europe - around 0.4% compared with the 1.6% average in England and Wales. Scientists had argued for stations located in the west, where most of the acid pollution that falls on sensitive areas originates, to be fitted with FGD equipment. Already unexpected areas of the Inner and Outer Hebrides show high levels of acidification.

But the reduction targets - 40% by 1998 and 60% by 2003 - will not prevent damage increasing. By 2005, more than 10% of Britain, including the vulnerable ecosystems of the uplands, will be severely affected. Dr Paul Whitehead, having found unexpectedly high levels in Loughborough, has calculated that a saving nearer 80% will be needed to prevent damage. □



Areas of excess acidity above the soil's critical load

## Solar choices

**S**OLAR power technology could net the UK £700 million annually, from exports, according to a Department of Energy report\* which was published on the same day as Energy Minister Colin Moynihan announced a new £250,000 research programme into electricity production from solar cells.

The report expresses serious concern that the UK could fail to meet this potential because "The technological advances that foreign companies are making with the aid of government support, and the experience and publicity gained by them, may make it increasingly difficult for UK" companies to compete.

Yet, rather than choose to develop photovoltaics (PVs) the Government's re-

search programme will merely "assess the potential for PV electricity generation in the UK; and identify barriers to the installation and use of PV systems and seek methods for overcoming them."

In evaluating the environmental impacts of PV technology the report concludes, "None of the impacts ... appear prohibitive or insoluble. They should not constitute any barrier to the uptake of PV technology. Indeed, of all the renewable technologies, distributed (remote power or building) PV systems may be among the most environmentally acceptable."

Yet, the uptake of PV in Britain will be small for the next 30 years and financial support remains minimal. Thus leaving the British industry without a home market from which to fully exploit the international potential, a mistake already made in sectors such as wind and energy efficiency.

■ SOLAR energy could compete with fossil fuels in Britain's energy provision according to John Cadogan, head of research for BP. At the Royal Society of Chemistry's 150th Annual Chemistry Congress in April he said dwindling resources of such fuels as coal and gas were forcing companies like BP to consider alternatives.

The last 15 years has seen a steep decline in costs of power from solar cells, from \$14 to \$4 per watt. Cadogan said advances in solar cells using thin films of cadmium telluride instead of silicon could halve costs again within four years. Looking further into the future, he commented: "If we can get the costs down to around 25 cents, then we will be competing with fossil fuels." □

\*Review of Photovoltaic Power Technology; ETSU for the Department of Energy. HMSO publications, 1991, £20.00.

## Power Industry and IPC

**N**EW Government legislation aimed at forcing industry to make public information on its environmental impact is already being put to the acid test.

Integrated Pollution Control (IPC), the main plank of the Environmental Protection Act, goes beyond previous regulation by recognising that pollution is not media specific - that pollution moves between air, land and water. IPC focuses on "proscribed" sites - depending on the processes and substances involved - and will affect the energy, chemical and a large part of the manufacturing industries.

A second feature of the legislation is Batneec ('best available techniques not entailing excessive cost'). Those not conforming to the use of this will be liable for prosecution by the Inspectorate.

IPC has been designed, claim the Government, to "allow a significant degree of public involvement in decision making." The mainstay of this will be a system of public registers containing information on the pollution limits set for the companies by Her Majesty's Inspectorate of Pollution (HMIP), information on companies failing to meet the standards and on companies breaking the law. Effective from 1 April 1991 in England and Wales, IPC will not be introduced in Scotland until April 1992.

Already, National Power and PowerGen have applied, under article 7, for several exemptions from the public registers. This allows information which is judged commercially confidential to be withheld. So far HMIP have rejected all of their arguments. The electricity generators have now appealed to the Environment Secretary. □

## Wave power first

**H**OMES on Islay, in the Inner Hebrides, are the first in Britain to be supplied with electricity from wave energy. Since the power cable to the mainland broke in February, electricity has been supplied by diesel generators supplemented by the experimental wave device (SCRAM 70).

Although the device does not contribute greatly to the islands electricity needs, under favourable conditions it can produce 125kW. Being a development project also means that costs are higher than those of a full-scale commercial project.

Stephen McIlwaine, a researcher with the project, is optimistic that similar schemes will follow. "The main aim was to prove the technology works and we've proved it. It's up to the powers that be what happens in the future." □

## Wave tide turns

**W**AVE energy is to receive a major boost from the European Commission, putting it back on the Commission's list of alternative energy sources. Of the Commission's Ecu155m non-nuclear research programme, Ecu57.43m has been earmarked for renewables of which Ecu1.2m will go to wave energy.

It is hoped to gain the Council of Ministers approval for the expenditure, under the research and development series DGXII, before summer, in time for inclu-

sion in the third framework programme.

If approved, the funds will be more than all EC Member States are investing at present. It is also hoped that this figure will increase to Ecu2-3m in the next framework programme.

The Commission stressed that, despite the high level of public interest in the subject, progress would be steady and adhere to a programme of research to avoid counter-productive results from mis-directed funds, as recommended in a working paper by Dr Tony Lewis of Cork University. It involves three initial and interlocking areas of research: a technical evaluation programme, a device research

programme and supporting activities. He suggests these should be completed prior to large-scale exploitation offshore.

Following approval by the Council, the Commission will call for proposals on the offshore wave energy project based on the specifications presented by Lewis.

The new funding comes in the wake of recent controversy involving an apology to Parliament by Research Commissioner Pandolfi over wave power and MEP's concern that no money had been allocated in recent years. The Commission, however, claims this was not influential since the allocation had been made before the increase in attention. □

## Wave progress report

**G**ROUND rules for the UK's review of wave energy, commissioned by the Department of Energy, have been laid out in the first of the projects progress reports\*.

It will examine the technical and commercial feasibility of large-scale wave energy, as adopted by the previous Wave Energy Programme (WEP), as well as shoreline and small-scale offshore schemes.

Incorporating previous work from the WEP (1974-1983); Rendel, Palmer and Tritton, the consultants for ETSU; and the design teams; it will focus on three devices as representative of wave schemes: the National Engineering Laboratories' Oscillating Water Column, the Coventry Polytechnic SEA Clam and Salter's Duck.

Little has emerged as yet, but regular interim reports are available, reflecting an open-door policy to proceedings. Although they are keen to stress that the review will not be an inquiry into WEP

management and previous assessments, but note that especially in areas of estimates in capital costs and availability - areas of considerable dispute - previous results will be reviewed critically and it "would support the adoption of a methodology wherein the previous areas of greatest dispute should be minimised." □

*\*Wave Energy Review Progress Report No.1: Outline of the wave review by T W Thorpe and J E Marrow, Chief Scientists Group, ETSU.*

## Scottish renewables payments

**O**N May 15th the Scottish Secretary, Ian Lang, announced in the Commons that independent electricity generators will now receive 5.3p per unit of electricity from Scottish Power and Hydro-Electric.

Previously the independents were paid only about 1.5p per unit, in stark contrast to their counterparts south of the border who now benefit from payments of around 6p because of the English and Welsh Non Fossil Fuel Obligation (NFFO).

Scottish Power (SP) and Hydro-Electric (HE) will now buy fixed amounts of electricity from the independents - 34GWh by HE and 24GWh per annum for SP. The new rate is applied before charges for the use of the grid or any other costs are deducted.

Lesley Potts of the Association of Independent Energy Producers acknowledged the significance of the move: "At last it appears the Scottish Office

are listening." However, she said that this was the first small step of a transitional phase and whilst it covers the contribution from existing, 50 or so, small hydro generators, it does nothing for other nascent renewables.

Dr John Twidell, Director of Strathclyde University's Energy Studies Unit, adds "Both the scale and terms of the provision are totally inadequate for the development of wind energy projects, and will not enable Scotland's wind resource - the best in Europe - to be used for generating clean electricity."

His concern is that the new price will pacify the established hydro operators and dissipate the power of the renewable lobby. A view shared by many observers, who believe the announcement was made to avoid an untimely political wrangle during the publication of the "Pathfinder Prospectus" for Scottish electricity privatisation. □

## Environmental employment boost

**F**EARS that stricter environmental standards will impede employment and growth prospects are unfounded according to Professor David Pearce, economics advisor to the Environment Secretary, in a report for the Employment Institute.

Pearce proposes an environmental policy based on carbon taxes and tradable pollution permits to supplement traditional policies of environmental regulation. The undesirable macroeconomic effects of a carbon tax can be offset by the manipulation of Value Added Tax.

Entrenched belief among European and British politicians that the electorate will not accept non-monetary benefits to the environment if they exacerbate inflation, trade or jobs, has only a slim empirical or analytical basis, says Pearce.

Evidence from nine studies, three from the UK, suggest the impacts from such measures would have "a strong potential for increasing employment".

One study assuming a 20% cut in carbon dioxide emissions from their 1990 level by 2005 - more than presently pro-

posed by the Government - would result in effects, "rather different from what is often supposed; in particular, any loss of competitiveness will be short lived, in terms of loss of output, with a longer term boost to output due to enhanced productivity effects through scrapping of old equipment."

Another simulation study, from Norway, projecting a fuel oil price increase of 100% by 2010 shows only modest declines in Gross Domestic Product, trade and investments. Impact on employment also appears negligible. By including potential benefits, this study deviates from the norm. It found that while the price increase costs 27 billion krone, 19.1 billion krone would be recouped from savings made in medical care, reduced congestion, noise, accidents and road damage. □

*\*Growth, Employment and Environmental Policy, by Prof David Pearce. The Employment Institute, Southbank House, Black Prince Road, London SE1 7SJ. Vol 6, No 1, April 1991.*



## Wind obstacles

**A**EA Technology, at Dounreay, plan to expand their involvement in renewable energy sources by securing funding for a £150,000 project to assess the potential for renewables in the Highlands.

If successful this will double the amount of money being spent on renewables in the area, as AEA Technology have just embarked upon a £150,000 study to explore the economic viability of wind power in the Dounreay area. The new funding would be used to determine the extent of the wind, water and biomass resource within the Highland Region.

As well as economic viability, the second study will seek to appraise potentially controversial areas such as landscape, nature conservation and public acceptability.

It is hoped the appraisal will take

into consideration the high incidence of researchers and skilled labour force in the locality and the existing connection between Dounreay and the grid via a 250kV power line, plus the added stimulus of the run-down of the FBR (SCRAM 80).

When commenting on the economic feasibility research into wind generation around Dounreay, the scientist heading the research, David Glass said "The possibilities for renewable energy in the North of Scotland look very promising. Dounreay intends to play an important part in the development of this technology but we hope that the whole community can benefit."

He tempers his enthusiasm, however, expressing concern over local resistance. After writing to the area executive of the Scottish National Farmers' Union (NFU) he said, "Granting of permission to take measurements will not, of course, imply

that the land owner or tenant is willing to allow the site to be developed as a wind farm."

NFU Area President, Alister Swanson is optimistic that his members will view the proposals sympathetically, adding: "This could lead to diversification for the future. It's something we would welcome, and hope our members will co-operate."

Public acceptability is not the only potential bar to the development of renewables. Local MP Robert Maclellan is concerned that the price paid in Scotland for renewable generated electricity, in the absence of a Non Fossil Fuel Obligation, will hamper renewables development. He also believes that with only one interconnector joining Scotland to England and Wales, Ministers are enforcing a preference that generators supplying the grid must ensure continuous levels of power. □

## Lighting controversy

**T**HE efficiency of compact fluorescent lamps (CFLs) has been questioned following a report\* by Chalkline Energy Consultants. The Midlands Electricity Board have called for an end to the promotion of CFLs. However, the conclusions drawn from Chalkline's initial findings are incorrect.

Articles, which have appeared in respected journals, including New Scientist, said CFLs, in the worst case, use four times as much power as claimed by the manufacturers; making them no better than incandescent bulbs.

Chalkline measured the 'power factor' for CFLs and found them ranging from 0.23, at the worst, to 0.95. Power factor is a measure of the phase difference between the supply voltage and the current - the lower the power factor the greater the distribution losses.

Poor power factors are a significant problem, large industrial consumers have meters which measure this, and if found to be lower than 0.9 a financial penalty is imposed by the distribution boards.

The measured power factors, which were typically 0.5 or lower for CFLs with electromagnetic ballast and for those with the more modern electronic ballast 0.95, are thought to be accurate, but the conclusions drawn from this are not correct.

Although a poor power factor will

increase distribution losses in the grid, in the worst case this will mean losses similar to those for incandescent bulbs, but the total power used by the CFL will still be around a third that of an incandescent. The case for CFLs is also improved by considering the power factor for a house as a whole, rather than just the lighting. With typical values for domestic power factor of around 0.98, and lighting as 10% of the total consumption, even the worst CFLs would only reduce this figure to 0.96.

Any increased distribution losses from CFLs are far outweighed by the lower power consumption of the lamps.

Seemingly unaware of the inaccuracy of the conclusions drawn from the power factor measurements, the Chief Examiner Technical Division of Midlands Electricity Board (MEB), John Cooper, wrote to Prof Stephen Littlechild, head of electricity watchdog OFFER, calling for an end to the promotion of "the energy saving type of lighting on the grounds of energy efficiency".

Whatever the motivation of MEB, CFLs do have a major contribution to make in energy saving, with the more modern electronic ballast being slightly better than electromagnetic ballast; and both a great improvement on incandescent bulbs. □

*\*Compact fluorescent lamps performance evaluation; Chalkline Energy Consultants, 1991.*

## Fair wind

**S**INCE 1982, people on Fair Isle have made full use of their mean wind speed of 9.3m/s but last year they set something of a power production record. Their 50kW Windmatic wind turbine, with a load factor of 48.16% produced over 210MWh of electricity. The equivalent amount of power produced using diesel generators would have required 15,000 gallons of fuel.

The machine has proved highly dependable being in operating service 98% of the time for the last 5 years - and all for just 4p/kWh. □

## Oil under troubled waters

**S**PECULATION over oil and gas in the offshore waters of the Falklands has been revitalised. Local officials are hopeful that exploration licences could be available before the end of the year.

Previous surveys have found some hydrocarbons in the South Atlantic but have all been inconclusive. However, exploration fever gets regular stimulus from new developments in technology.

Nations may claim economic rights over the sea-bed up to 350 miles from the coastline, a fact which has always tempered further exploration due to sensitivity of relations with Argentina. How much of the recent excitement is due to Britain failing to get its way at the Antarctic Treaty is also highly speculative. □

## Recovery scrubber

**A**N innovative sulphur dioxide (SO<sub>2</sub>) scrubbing device, which makes use of waste gases in conjunction with waste material, has been developed by the Passamaquoddy tribe of American Indians.

Currently being used at a cement factory in Maine where it cuts down SO<sub>2</sub> emissions by more than 90%, it could revolutionise the clean-up of coal-fired power stations.

Known as the Recovery Scrubber, it involves mixing the hazardous kiln dust with water, and then combining it with the carbon dioxide (CO<sub>2</sub>) and SO<sub>2</sub> from the waste gases. The CO<sub>2</sub> reacts with the dust in the slurry producing reusable limestone. The SO<sub>2</sub> in the gas reacts with

potassium in the dust to form potassium sulphate, which is sold as a fertiliser.

At \$10-15 million, it costs no more than conventional scrubbing systems. However, unlike the other systems it requires no imported scrubbing agent and leaves no slurry residue to be disposed of.

Robert Gentile, US deputy Secretary for Energy says, "It uses a waste product to clean up the environment. It is so creative and innovative. And it's simple to install. You don't have to close your plant down to do it, it simply bolts on."

More than just praising its innovative nature, the US Department of Energy is backing the first commercial installation with \$6m (£3.5m) of the \$11m total cost, under their Innovative Clean Coal Technology scheme. □

## Euro conservation

**E**UROACE, a new European industrial association, with a campaigning approach, has been formed to make up the lost momentum in the energy efficiency market. In doing so it hopes to tackle greenhouse gas emissions as well as erode the lead of Japan and the North America in the industry of the future.

Director, Andrew Warren said, "We have formed EuroACE to put across the message that we can reduce pollution by increasing our energy efficiency. This is a view we hold in common with the environmental movement. Installing the relevant technologies - insulants, energy management systems, thermostats etc. - can produce a multi-billion Ecu industry, creating thousands of jobs."

Between 1974 and 1984 energy effi-

ciency improved through out the European Community by an average of 20%. But a further 20% saving target - set by the Community for the following ten years - is being allowed to slip. Between 1982 and 1987 a meagre 3% overall improvement was achieved.

European Commission officials have warned that there is "little likelihood of this objective being reached unless a series of active energy efficiency programmes are established." EuroACE's campaigning style means it will push vigorously in this area, campaigning for further EC initiatives and programmes along the lines of the current SAVE and THERMIE programmes.

"We shall not sit back waiting to be consulted. We shall seek out alliances with those with which we have common ground. We are determined that Europe be in the forefront of the new concern to cut out waste and pollution" said Warren. □

## Green club

**B**NFL, National Power, Shell and British Gas are among 1,000 of Britain's largest companies invited to join Environment Secretary Michael Heseltine's 'green club'. It will seek to put industry on a environmental self-regulatory basis.

The club will be led by John Collins, chair of Shell UK - also head of a committee of top businessmen/representatives which will advise, and consult with Heseltine and Trade Industry Secretary Peter Lilley. It will run for 2 years.

Outwardly, the club aims to promote tougher business standards, to reduce pollution and change products and processes by adopting environmentally cleaner methods. Specifically, Collins has drawn up an agenda including environmental management, recycling and global warming.

Heseltine's vision of "a green renaissance of Britain's economy" was launched at the annual Shell lecture on the environment in May. He must have 'struck a chord' when referring to the need to restore the public's confidence in industry's environmental record. Several members, who shall remain nameless, have been struggling with their image for some time.

Countries like Germany and the Netherlands will be difficult to catch having already cornered the market in green technologies.

The message coming from Government Ministers is loud and clear. Unless other industries also realise that investment, though painful, means more than just succumbing to environmentalists, the future outlook will be bleak. □

## The National Home Energy Rating

Energy Rating	
10	Very energy efficient house
9	
8	
7	
	Range for typical new homes built to 1990 Building Regulations
2	
1	
0	Very energy inefficient house

## Home labelling

**T**HE energy performance of your home can now be assessed under the National Home Energy Rating (NHER) scheme by the National Energy Foundation (NEF). It hopes to reveal the most cost effective methods of increasing the thermal efficiency of a home.

At the heart of NHER lies a computer programme which can be used to produce one of four surveys:

- Surveyor, for mass rating of existing homes, information centrally collated;
- Homerater, produces a rating in the home from discussions with the homeowner;
- Builder, calculates ratings from plans; and
- Evaluator, for use on large housing stock, eg to assist housing agencies with refurbishment priorities.

The rating is obtained by a qualified assessor from a microcomputer which converts data directly into energy running costs. It will also provide a list of options

for improving the rating of the property, demonstrating graphically the results of proposed measures.

Average costs will be around £100, depending on location and property size.

Dr Mary Archer, Chair of the NEF, hopes the scheme will lead to a significant saving on the UK's annual domestic fuel bill of £11.4 billion. At the launch in Scotland, in April, she said, "If every property in the UK was to move just one point up the NHER rating scale, there would be savings of around £1.8 billion per annum and we could significantly reduce the UK's carbon dioxide emissions to the atmosphere."

Dr Eric Voice, a former Dounreay nuclear physicist, denounced claims that NHER would combat global warming as over-optimistic and tokenistic. Typically, Voice takes this one measure out of an overall energy policy context and ridicules its small impact. However, it is by tackling energy inefficiency on all fronts that the savings add to a significant reduction in greenhouse emissions. Here are measures which are not only environmentally beneficial, but cost effective and socially desirable. □

# REVIEWS

## Radioactive Waste: politics and technology; Frans Berkhout.

Routledge; 1991, 256pp, £14.99.

Frans Berkhout, co-author of a recent report on THORP and the economics of reprocessing (SCRAM 80) has turned his attention to nuclear waste dumping. His book looks at the "technical and institutional responses to the problem of safely managing waste materials in the fuel cycle in three European countries: the UK, Sweden and the Federal Republic of Germany."

The traditional engineering response to problem solving would be trial and error, learning by experience to make better and safer machines. Similarly, a scientist would develop a hypothesis and then test it by experiment. With nuclear waste the arguments

have to be conducted at a hypothetical level, and ultimately remain inconclusive. The only possible answer to the question 'is nuclear waste disposal safe?' is steeped in probabilism" says Berkhout. The industry has to admit to imperfect knowledge and an expectation of the unpredictable.

Berkhout argues that the commitment to reprocessing acts as an obstacle to the resolution of the conflict between industrial and environmental goals. The Swedish experience suggests dropping this commitment is the only way to solve the dumping problem.

In the UK and Germany reprocessing adds to the com-

plexity of waste management enormously. The volumes to be dealt with increase; solid spent fuel is converted into a variety of liquid, semi-liquid and solid waste streams, which increases the opportunities for diluting and dispersing radioactivity.

Country by country, rad-waste policy is formulated in a "highly idiosyncratic" manner. It is rooted in "cultural, legal and administrative traditions ... the stereotypes of national life shine through". The Swedes have been able to create an enlightened and measured consensus, the Germans are fighting disciplined and technical battles in courts, and the British establishment are trying to hold on to a rather quaint technocratic authority. In the UK "the strategic and commercial interest of successive British governments in protecting reprocessing from serious challenge has meant that the back-

end of the nuclear fuel cycle has never been open to full parliamentary scrutiny".

Berkhout concludes that "political acceptability will not, in the end, depend on a further growth in the knowledge of the geological environment of repositories ... rather it will depend on the performance and openness of the institutions which are charged with enabling this learning process." He believes storage simply shelves the problem, and that disposal is inevitable, but decisions should be made with the widest possible degree of social agreement.

If the success of future nuclear waste disposal projects depends on the nuclear establishment changing its lifelong addiction to obsessive secrecy we will have to wait a long time before a consensus is achieved in this country.

PETE ROCHE

## Radiation Game: a computer based learning package for schools

AEA Technology; 1991, £10.

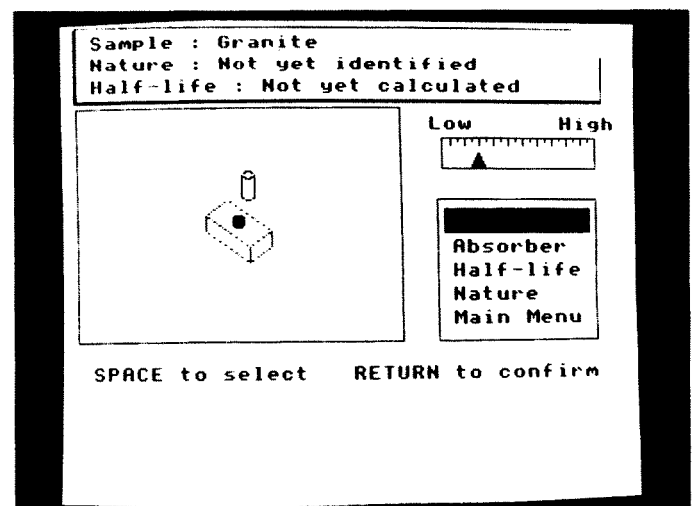
With a three page spread in *ATOM* (April 1991), the UKAEA promoted its latest computer package for use in schools. It was developed for use by 13-16 year olds, to make them aware that radiation is a natural phenomenon, and we come into contact with it throughout our lives. It allows pupils to make a series of tests on a simulated radioactive source (eg. milk, brick, nuclear fuel rod) and then by a process of elimination find the radioactive nucleide the source contains.

As part of a study on educational materials on nuclear energy and radiation, myself and an Oxfordshire teacher conducted an assessment of the package, to ascertain how accurately it represented the issue, and its usefulness as an educational tool. After a long period working through the program, we found it lacking in both these areas.

As an educational aid, the

package is virtually useless. The time taken to go through the program, especially for those not familiar with the package or the computer, makes its use in the classroom almost impossible. What can be easily be taught conventionally with books and diagrams in twenty minutes could take in excess of three-quarters of an hour in an average classroom situation. With the current pressures imposed by the national curriculum and the GCSE programme, such a length of time would not be available to teach such a simple subject.

In terms of the accuracy of information presented, that is really a matter of semantics. Yes, Strontium-90 does occur in milk, but no relationship is made between the dose equivalent for milk and other items on the list, such as nuclear fuel rods. Part of the simulation is a reading on a scale corresponding to the level of



radioactivity - presumably in dpm (decays per minute). Even on a logarithmic scale, the levels shown for milk and for fuel rods do not give a true comparison. The actual presentation of information on the all pervasive nature of radioactivity, and the relationship between radioactive materials, is therefore quite misleading. How can a truly accurate presentation of the nature of natural and artificial radioactivity, without giving true comparisons of specific activity or dose equivalents?

As a teaching aid, the package is virtually useless. The information presented is not

accurate, and the way it is presented and the amount of information required by the pupil beforehand, definitely makes it unsuitable for the 13-16 age range. As a total program, it is also very simple and basic, and gives no help, instructions or additional information to those using it. For a package produced by experienced educationalists, it is decidedly lacking! All in all, the money spent by schools buying it, and the money spent by the UKAEA producing it, would be better spent elsewhere.

PAUL MOBBS



# REVIEWS

## The Practical Solar Handbook; A A Parsons & A R Bushell.

A Bushell; 1991, 32pp, £5.95 (inc. p&p).

Sub titled "A step-by-step guide to installing your own solar hot water system" this little book, in fact, offers much more. The handbook falls between previously available books which are too superficial or too technical.

After some general information on installation, there is the first simple guide I have seen to sizing the collector and storage cylinder. Where other books get bogged down in latitude and hours of sunlight (all useful to the technically minded) we have a simple, practical rule of thumb related to household size.

The rest of the book follows this practical approach. Installing the collectors on the roof, location of water tanks and cylinders, connection to the existing hot water system and legal requirements are all covered in a simple, practical way.

There are however shortcomings. The concentration on unvented systems I found

odd. I've always considered simplicity to be desirable in anything. The expansion tank, filling loop, pressure gauge and safety valve necessary in a closed system seem to me an unnecessary (and expensive) complication. The same must be said for the emphasis on 'Thermomax' heat pipe collectors. Perhaps this is simply a reflection of the books apparent origins as an installation manual for a particular system. I feel the political benefits of easily available technology may be undermined by too much emphasis on 'high tech'. Developments such as vacuum heat pipe collectors have a place, but solar water heating is not just environmentally clean and sustainable, it is based on simple, available technology.

These few shortcomings don't detract from the general usefulness of the handbook, which is the most useful practical book I have seen on the subject. Essential reading for anyone who wants to install a solar hot water system without getting involved in too much theory.

Two leaflets from the Centre for Alternative Technology, Machynlleth, Powys fill the gaps left by the handbook. *Solar Water Heating* has a very good diagrammatic overview of the various system options, with the emphasis on vented systems.



## Transfer of Radionuclides in Natural and Semi-Natural Environments; Edited by G. Desmet, P Nassimbeni and M Belli.

Elsevier Applied Science; 1990, 693pp, £95.

This is the proceedings of a conference by the same name, organised by the European Commission and the Italian Directorate for Nuclear Safety and Health Protection in 1989. A specialised collection of papers from around Europe for the radioecologists amongst us.

It highlights the fact that 3 years after we were told that Chernobyl sheep restrictions would only last a few weeks, we still don't really know how radiocaesium behaves in upland environments.

One study collected data on the distribution and dynamics of radiocaesium deposited by Chernobyl, to test and validate models, and concluded that there is considerable complexity in the behaviour of radiocaesium in upland ecosystems. It does not show the same pattern of distribution as that present

prior to the accident. There are variations between plant species reflecting a number of factors including rooting depth and potassium status.

Results from Ireland show that by 1989 over 90% of the Chernobyl radiocaesium remained in the top 10cm of the soil, with 75% on average still within the top 5cm. Weapons fallout derived caesium has started to get leached out - only 83% of the activity left in the top 30cm of soil lies within the top 10cm layer. Which only goes to show that leaching is going to take a long time.

The nuclear age spawned a new science, which further illustrates the complexity of modelling ecosystems. Nirex would do well to plough through this book the uncertainty of everything is immediately obvious.

PETE ROCHE

*DIY Plan No.7 Clip-Fin Solar Panel* gives instructions for constructing a solar panel using a commercially pre-formed aluminium sheet. Interesting reading even for someone who intends to use commercial solar panels, giving an insight into panel design, construction, and function.

The handbook and leaflets should provide more than enough information for

anyone who can cut a copper pipe, solder and drill a hole to design and install their own system.

A kit for a 3-4 bedroom house using 'Thermomax' vacuum collector tubes costs just over £2000. My own proposed system, for a 4 bedroom house, using home made flat plate collectors is expected to cost under £500.

DAVE PREECE

# LETTERS

Dear SCRAM

I was very interested in the article 'Plumbing the Ocean Depth' (SCRAM 81). I believe that the technology described could have wider implications than electricity generation from warm sea water.

I am no engineer, but if it is possible to run turbines using a temperature gradient of only 20°C by careful selection of the

working fluid, then the same technology should be able to be used to generate electricity from fossil fuel power station waste heat.

This could be an alternative to Combined Heat and Power (CHP) for improving the efficiency of conventional power stations. I look forward to the views of others.

David C Catt

Dear SCRAM

Given the nuclear industry's use of 'educational' computer software, has anyone put forward the idea of the alternative energy lobby producing such information packages for schools?

I think it would be a good idea, and if anyone is interested in collaborating on such a project, please drop

me a line. (I have access to Amstrad PCW, RM Nimbus and PC compatible machines.)

Paul Mobbs

Banbury Environmental  
Research Group  
3 Grosvenor Road  
Banbury  
Oxon OX16 8HN  
(Tel. 0295 261864)

# LITTLE BLACK RABBIT

"Up and atom" shouted the Sun headline: one of Sellafield's tour guides by day, spends her nights as Miss Whiplash. The story, which revelled in revelations of sado-masochism and 'Miss Whiplash' offering to make £2,000 videos of herself and friends in action, have led to red cheeks amongst Sellafield management. She had been through the Sellafield security vetting system, and security staff were reportedly "concerned" that an employee was a potential blackmail victim.

Thanks to the Sun, the blackmail threat has been removed and the tour guide can, presumably, be brought back from 'special leave'.



LBR has news of more sponsorships by the nuclear industry. The Nailsworth Festival had two events, including one on Russian folk music, supported by Nuclear Electric; and they are sponsoring of a 67 foot yacht in the British Steel Challenge 'wrong way' race (how appropriate) around the world, to the tune of £250,000.

Not to be outdone, BNFL are throwing money around too: £100,000 for a competition "Quest for new musicals". LBR hears that one entry, from a former nuclear research manager, concerns a love affair between a Sellafield scientist working in the Reactor Development Lab and a Friends of the Earth supporter. The composer

hopes his musical "will help show that such scientists are just as human as anyone else".



This is, no doubt, because BNFL are enlightened employers, and couldn't possibly have anything to do with annual dose rates.



ETSU, the Department of Energy's renewables research team, being based within the UKAEA's Harwell site has always caused concern about ETSU's independence (or lack of it) from its landlord and paymaster. LBR hears that the high security fence surrounding the site is to be moved 50 yards, leaving the ETSU portacabins outside the jurisdiction of the nuclear police. This move may be a genuine attempt to weaken the link between the UKAEA and ETSU, or just a cheap PR gimmick. However, a third theory has emerged. The miniature (sorry, Minister) for Energy, Colin Minion (sorry, Moynihan the spell checker has a cruel sense of humour), tried to visit ETSU recently, but lacking a security pass, he was left standing at the entrance gates for some considerable time while his credentials

were checked out. LBR wonders if the embarrassment of a junior Minister could really be behind the move?



The European nuclear industry chose the fifth anniversary of the Chernobyl accident to launch a search for a new logo. The current image of electrons whizzing round a nucleus is thought to be dated, and also a little embarrassing as the atom featured is usually lithium, of little civil use but very useful to the military. Alongside this change, a number of words with morbid overtones are to be scrapped. The outlawed terms include 'criticality', 'decay', and 'casket'. But of particular interest to LBR, on its way out is 'scram'. LBR says "They might be able to get rid of scram, but they won't get rid of SCRAM!"



The May issue of ATOM, the journal of the UKAEA, carried a pullout section from British Nuclear Forum on Radiation and Radioactivity. The article concludes with a particularly daft statement, even by British Nuclear Forum's standards: "Maybe radiation should be regarded rather like gravity: a natural feature of the world which, if treated carelessly, can be a problem, but when properly controlled can be a great benefit." The Scottish Campaign to Resist Gravity?

## 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:

- ☐ £13.50 (ordinary)
- ☐ £6 (concession)
- ☐ £22 (supporting)
- ☐ £100 (life)
- ☐ £33 (institutional)

**Overseas (£ sterling please):**  
Europe add £2.50;  
Outwith Europe add £4.50.

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

- ☐ £10
- ☐ £25
- ☐ £50
- ☐ £100
- other £ \_\_\_\_\_

**3** I would like to help SCRAM with a regular monthly donation of:

☐ £1 ☐ £5 ☐ £10 other £ \_\_\_\_\_

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

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

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

\_\_\_\_\_

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

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

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

142/144 Princes Street, Edinburgh (83 51

00) for the credit of SCRAM No.2 Account

258597 and make similar payments

monthly until further notice.

www.uka.org

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

Name \_\_\_\_\_

Address \_\_\_\_\_

Post code \_\_\_\_\_ Phone No. \_\_\_\_\_

To: SCRAM, 11 Forth Street, Edinburgh EH1 3LE