SAFE ENERGY

No.98 December 1993/January 1994 £2.00

Managing the nuclear legacy

Small-scale hydro in Eastern Europe

Chernobyl: the forgotten victims

Motoring ahead?

Dounreay: weird scenes from the goldmine

COMMENT

CAUGHT in the crossfire between free market dictates and lingering allegiance to all things nuclear, it has not been a good year for government.

The coal review laid bare the serious conflict between national interest and the still Thatcherite faith that 'left to its own devices, the market knows what's best for us.' The market wanted to axe the jobs of 30,000 miners using Michael Heseltine as executioner, there was a public outcry.

The so-called 'coal crisis' brought home to the public what analysts and campaigners having been saying for years: the government's only energy policy is that there is no policy. The review also illustrated that far from there being a new 'open door' policy about information on the industry, its plans and economics are still shrouded in secrecy. Nuclear Electric (NE) tasked those trusty 'free marketeers' and defenders of national interest Ernst and Young — British Nuclear Fuels' auditors — to provide the Select Committee on Trade and Industry with an economic appraisal of NE's magnox stations, the report which was published had so much information blanked out, on the grounds of "commercial confidentiality", that its conclusions were unverifiable.

The nuclear review was brought forward as a direct consequence of the coal crisis, or at least it was supposed to have been. The 1994 review became the 1993 review and then back again. We know the reason for its being brought forward, but precious little is being said about the delays. The cabinet is split. The Treasury, saddled with a £50 billion public sector borrowing requirement, wants to take away the nuclear industry's credit cards, the Department of Trade and Industry would like the industry to have a future and the Department of the Environment is confused. No terms of reference will be announced until the government decides what it wants the outcome to be. The wider the terms of reference, the less chance the industry has of surviving.

The industry itself isn't helping. At first Nuclear Electric seemed to think a wide-ranging review, allowing it to play the diversity of supply and greenhouse effect cards, would be best, while its northern cousin, Scottish Nuclear, was pinning its hope on being economically viable. Now, however, James Hann and John Collier seem to have swapped speech writers. The government just doesn't know what to think. The perennial problem of the industry's deadly legacy doesn't help.

Should he or shouldn't he? John Gummer just doesn't know whether or not he wants to be responsible for tonnes of deadly plutonium criss-crossing the world's major transport routes and derailing the progress made in reducing the Cold war threat of mutually assured destruction. He doesn't know whom to listen to. The Pentagon tells him that Thorp poses a serious threat to world security, that it threatens to spark an arms race in the Korean peninsula; British Nuclear Fuels tells him that independent accounts — which he doesn't even have a copy of — show that for the £500 million profit over the plant's first ten years of operation it's worth the risk. Probably the most important environmental decision to be taken in Britain in 1993 and the Secretary of State is asked to place his faith in the word of an industry which invented that classic of double speak "clean, cheap, safe and reliable."

Confused? It's been a hell of a year. Relax and enjoy the seasonal festivities, next year will be worse. 1994 is make or break. For the first time since its inception the nuclear industry is on the ropes, the chance, no matter how slim, is here for the UK to change course. In meeting the environmental challenges posed by globally pervasive pollutants and the challenge of improving the quality of people's lives — both financial and environmental — the chance has come to nail the nuclear myth and move forward to an energy mix based on a policy of energy efficiency and renewable energy sources.

The *Safe Energy* journal is produced bi-monthly for the British anti-nuclear and safe energy movements by the Scottish Campaign to Resist the Atomic Menace. Views expressed in articles appearing in this journal are not necessarily those of SCRAM.

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to shut-down a nuclear reactor in an emergency.

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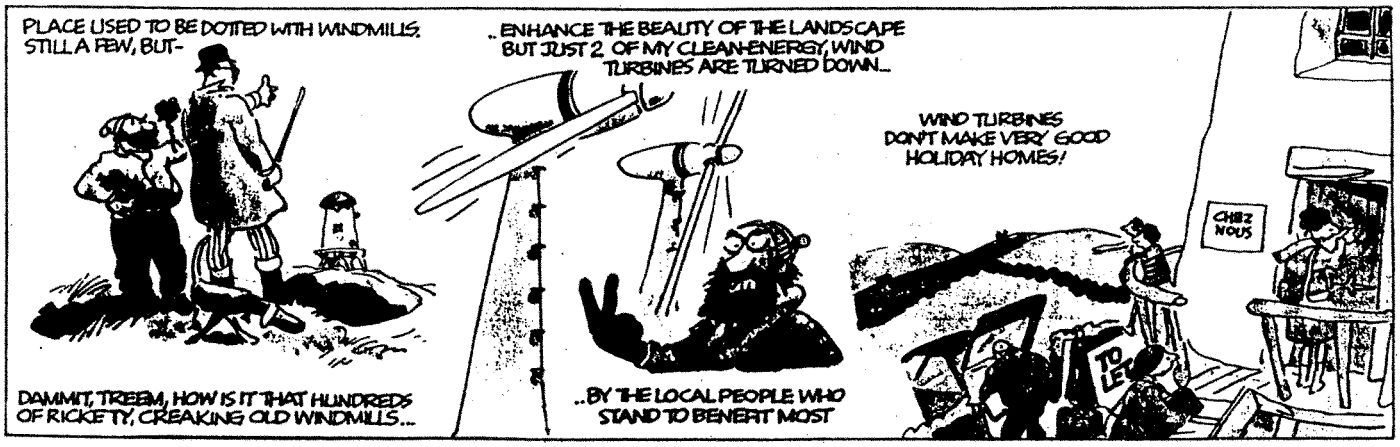


Bill Tidy, *New Scientist*

Nuclear privatisation

NUCLEAR ELECTRIC (NE) has set out its stall in a campaign to be privatised in 1995-96 at the same time as doubts are being expressed about the privatisation route by both Scottish Nuclear Ltd (SNL) and the government.

Bolstered by increased operating profits of £463 million, NE's chairman, John Collier, said its future lay in the private sector. NE's interim financial report, for the six months to 30 September, shows that once the nuclear levy's contribution of £615 million is taken into account then the real figures give a loss of £118 million compared to last year's loss of £337 million for the corresponding period.

However, NE argues that the decreasing loss is evidence that it will meet its target of being profitable without the levy by 1995-96. The main reasons for its success, says NE, lie with an increase in its power market share in England and Wales by 3.4% to 25%, a 6% reduction in staffing levels and a 23% increase in productivity from their Advanced Gas Cooled reactors. NE expects to axe a further 10% of its staff by the end of the financial year.

"We believe the best way of achieving our commercial objectives is to have the freedom to make our own decisions," argues NE's executive director Mark Baker.

In the absence of any details about the government's nuclear review which will not take place this year as promised, following the coal review, but will return to its original 1994 timetable, NE's campaign is understandably low key. However, its chartered accountants, Price Waterhouse, has been making its views of a nuclear future known to the City.

According to its head of European corporate finance, Howard Hyman, "We think the company is privatisable." Quoting the improved performance of NE, he believes that the centre-piece of any privatisation campaign will be NE's record in building Sizewell B, which he argues, somewhat prematurely, has been completed to budget and on time ("Sizewell software", p5)).

Calculated improvements

Hyman also points to four years' further experience in calculating NE's liabilities, in particular improvements in calculating and keeping down the cost of decommissioning and to developments in handling radioactive waste and spent fuel.

According to John Collier there has been a big decrease in the forecasts for decommissioning costs, prices have fallen by 25% since 1990, he says. These reductions have mainly been due to the company's plans to delay the second and possibly most expensive phase of decommissioning, that is the handling of the reactor vessel, for 135 years under the guise of allowing radiation levels to fall to more handleable levels. However, the real justification is obviously financial. Discounting for decommissioning over such long periods vastly reduces financial provisions needed now and certainly doesn't harm NE's current cash flow.

City analysts are not hostile to some from of privatisation but suggest that the Magnox reactors should be excluded unless the government offers to limit liabilities.

Lending banks are also mindful of new environmental legislation which is under discussion by the European Commission which would make lenders liable for polluted land if customers go bust. Liz Christie, electricity analyst at Goldman Sachs, says: "It comes down to a question of government needing to answer questions about open-ended liability and whether it will be responsible for decommissioning. Until it answers, it is practically impossible to value NE."

John Collier, chairman of NE

SNL is taking a different view. Its outlook has changed radically since the beginning of this year when it was holding itself up as an example to the rest of the industry and calling for early privatisation. SNL's chairman, James Hann, now sees the world a little differently: "Some in government apparently regard their main task as being to get the energy industries that remain in public ownership off their hands in the quickest time and the cleanest possible way, all in the expectation that the private sector will then be able to cope with the difficult global challenges we shall face in the future.

"I have to say I regard this attitude with concern. Before we go much further Britain needs a new framework for energy policy. It is time to challenge the conventional wisdom of the last decade."

Hann believes that the current path will lead to massive over-dependence upon gas for electricity generation and quotes government forecasts which see gas providing 57% of electricity by 2020. If that happens, with 75% of the world's gas reserves in Russia and the Middle East, Hann warns that this country could soon be exposed to monopolistic price increases and political blackmail: "The Arthur Scargills of the future may well have foreign, unpronounceable names but they could pose the same threat to our standards of living and our democratic way of life."

Broad remit

To prevent leaving Britain at the mercy of the 'mad mullahs' it is Hann's "profound belief that the government as a priority needs to alter the existing energy framework in order to promote and preserve diversity.

"Instead of the narrow focus on the commercial viability of nuclear power and the privatisability of its operations, the review should have a much broader remit."

While the nuclear industry gets increasingly edgy about the nuclear review, energy minister Tim Eggar took the opportunity to answer some of his critics during a speech to a gathering of Trade Unionists for Safe Nuclear Energy. His speech was strong on rhetoric but short on information.

Clearly upset by NE's repeated calls for privatisation, he said that such a decision will be taken by government "when it is appropriate to do so and not before."

His speech nailed the myth that the nuclear levy was required to cover NE's inherited liabilities saying: "The nuclear generating industry has come a long way since 1989 when it was perceived by commentators as overmanned, overpriced and unreliable. I do not think I exaggerate if I say there was some truth in those charges. The AGRs were seen as splendid examples of British engineering, yet not all of them worked. Nuclear electricity, once described as too cheap to meter, required a levy to bridge the cost gap with other fuels ... Despite what has been achieved since 1989 ... there is still a long way to go before those perceptions will be fully corrected."

While refusing to announce the terms of reference for the review — mainly because he doesn't know what they are as the cabinet is deeply split on the issue — he did offer this: "The review will look to the future. It cannot be assumed that the government will provide the finance for new nuclear capacity. We are currently going through a tough public spending round ... In this context, the industry has to ask itself: why should the taxpayer be willing to finance new nuclear stations costing several billions, when the money could fund hospitals, schools or policeman on the beat?" ❑

Sizewell software

SAFETY software for the Sizewell B nuclear power station is far from perfect after failing almost half of the 50,000 tests run on it over the past nine months.

The problem was revealed in an internal Nuclear Installations Inspectorate (NII) report written in July and recently leaked to the trade paper *Computer Weekly*. The NII which must pass the software before the reactor can be commissioned has insisted that it must be checked again.

Nuclear Electric (NE) which built and will run the UK's first PWR does not believe there is any problem with the safety software. It believes the problem lies with the programs written to test the software.

Originally designed in the 1970s by Westinghouse, NE has substantially altered the program for use in Sizewell B. To test it, NE commissioned Rolls-Royce to develop the programs capable of mimicking the variety of signals which the reactor could possibly send to the safety software.

This "test harness" was then run to check that the safety software met its specifications. In 48% of the 50,000 tests run on the safety software the expected response was not given. NE contends that this is because the harness failed to mimic the reactor properly.

"Given that this was a new way to test software, its not surprising that the harness does not work properly," says Victor Beckett, NE's engineering manager for the station: "The safety software hasn't really failed half the tests. In fact it hasn't failed at all."

However, as one industry expert quoted in *New Scientist* points out: "If they can't get the test harness right, why do they think they can get the original software right?"

There has also been criticism of the NII report which appears to contradict itself. It concludes that "we cannot be fully confident ... that the original integrity target for the system has been achieved," while describing the shortfall as "not unacceptable."

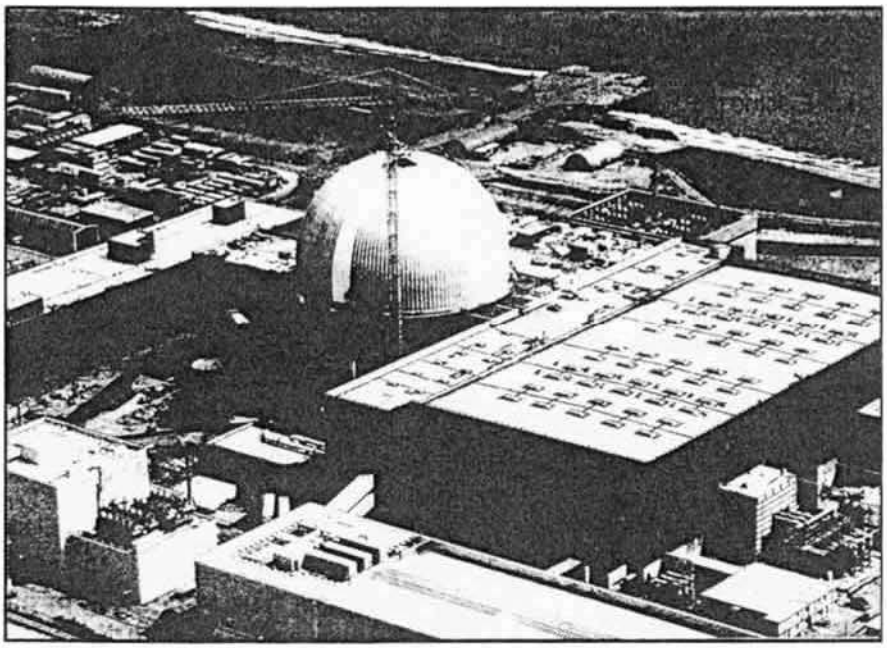
The Health and Safety Executive — the NII's parent organisation — has refused to make the document pubic, arguing that it would only do so if there was a question of "immediate risk to public safety".

Sizewell B will be the first nuclear station to rely so heavily on computers for safety. The software will form the core of the primary safety system in the station, detecting problems and automatically shutting the reactor down if necessary. If the primary system fails a secondary system relying on human operators and a mechanical systems will take over.

The main problem with the Sizewell software is that with more than 100,000 lines of program code running on 300 microprocessors and a further 100,000 lines setting the limits of acceptable outputs from the reactor, it is simply too large to test. As the *New Scientist*'s expert says: "Nobody's saying that there's evidence that the software is unreliable. It's just that there's not enough evidence that it is reliable."

Fuel cannot be loaded into the reactor without the NII passing the software. NE also needs NII backing for the software if it is to win a contract believed to be worth up to £1 billion to build a PWR using the same software at Lung Men in Taiwan. It also plans to use the software in the proposed Sizewell C plant.

NE has admitted that the Sizewell project is now about 4 months behind schedule but contends that it will open no later than October next year. The delay, says the company, will cut about £15 million a month from their expected operating profit. ❑



Sea dumping

BRITAIN was among 5 nations abstaining from a vote which transformed the worldwide moratorium on dumping of radioactive waste at sea into a permanent ban, at a meeting of the London Convention in November. The meeting also agreed to help the Russians clean up their nuclear waste in a bid to prevent them dropping it into the oceans.

Although only 42 of the 71 signatories to the London Convention, formerly the London Dumping Convention, attended the meeting, 37 voted to make the ban permanent. The five abstentions were from Britain, France, Russia, China and Belgium.

While a scientific panel set up by the Convention in 1986 to review the environmental impact of marine radioactive waste disposal reported to the meeting, it failed to make any recommendations either way. Its contribution was to note that sea disposal brought special problems, including "transboundary transfer of radioactive materials" and the difficulties of monitoring waste on the seabed.

Britain argued against making the ban permanent, promoting instead an extension of 15 years. The British delegation said that studies indicated that for some categories of low and intermediate level radioactive wastes dumping in the deep oceans might be the best practicable environmental option: "It would be irresponsible to foreclose that option now when alternatives could be more damaging."

The rules of the Convention allow ministers 100 days to enter a reservation on the vote which would in effect give them the right to defy the ban.

A spokesman for the British delegation said that no decision has been taken on whether to opt out. The Ministry of Defence, the Ministry of Agriculture, Fisheries and Food, and the Department of the Environment will now discuss what response the government should make.

Both Britain and France are experiencing great difficulty in finding a land-based solution to the problems of redundant nuclear power stations and submarines; it has been their intention to tow them out to sea and sink them.

Russia had proposed to abide by the ban after 1995, arguing that it needed to continue dumping over the next year to handle the legacy of the former Soviet Union's nuclear programme. The meeting rejected its proposal and offered to establish a task force to help find alternatives to dumping its stockpile of radioactive waste into the oceans. ❑

Chernobyl aftermath

DESPITE Ukrainian estimates putting the death toll from the Chernobyl nuclear disaster at over 8,000, a team of European Union scientists says only 42 people have died as a direct result of the accident.

The team, which visited the stricken reactor earlier this year, has dismissed the Ukrainian claims as an attempt to attract greater levels of Western funding. "We are not saying there will be no effect — just that much of the cancer we expect will not show up for years," said one member of the group.

The only part of Ukraine's appraisal of Chernobyl's aftermath which the team agreed with was that there has been a sharp increase in thyroid cancer amongst children, resulting from exposure to radioactive iodine. They confirmed 186 cases in Belarus between 1986 and mid-1993. Ukraine and Belarus report that three children have died. Jaak Sinaeve, head of the European Commission's radiation protection research unit, says "scientific consensus is that there is a link with the accident."

The European delegation cites the republic's lack of past health data as one reason why other estimates cannot be confirmed. The delegation is calling for a joint research programme to improve the quality of health and environmental data quickly, so that the effects of the radiation can eventually be measured. "A third of people get tumours anyway. Our best guess is that there may be a 1% increase in that number, or some may get cancer earlier than they would have done. We will miss that if we don't put monitoring systems in place now."

Over the next 30 years, Belarus scientists predict an excess of 40,000 thyroid cancers in children. This, they say, will involve 10,000 malignancies and 1,000 deaths. While these finding are broadly agreed with by Western experts working alongside the Belarussians specialists and by critical UK-Swiss collaborative studies of the pathology, they have been dismissed as an artefact of poor data by some influential US and UK statisticians. Scientific papers written about the problem jointly by Byelarussian and Western experts are being blocked from publication in the West. One reason for this being promoted is that iodine-131, the principle thyroid-seeking fallout isotope, is high amongst the nuclear industry's routine discharges. Iodine-131 is also one of the most abundant isotopes to be found following nuclear weapons tests and the US government is besieged by compensation claims from thyroid cancer suffers who live, or lived, around the Nevada test site.

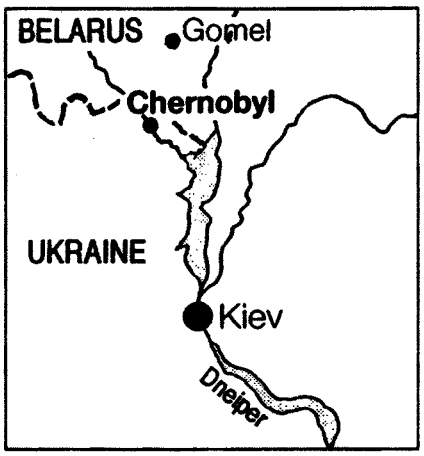
■ Dangerous levels of radioactive elements from Chernobyl are very close to invading the Kiev water supply, according to the Chernobyl Commission of the Ukrainian Parliament.

Russian geochemist Valery Kopeykin, who has been engaged in monitoring the after-effects of the disaster since 1986, has warned that traces of plutonium and other radioactive isotopes have been found in water beneath the power plant and will eventually seep into the Dneiper River that runs through Ukraine.

Kopeykin said the substances were leaking from the radioactive waste "graveyard" surrounding the Chernobyl plant. They have already reached the underground water supply 6 to 12 feet below ground and leeched into evergreen forests within the 10km Chernobyl zone.

"What's most unexpected is that the process is happening so quickly. No one expected this," said Kopeykin. "Never have I read about plutonium spreading so quickly."

He complained that the recent findings have met a wall of silence from Ukrainian officials and the Academy of Sciences. Only the ministry which deals with the aftermath of Chernobyl has endorsed the finding. Volodymyr Yavorivsky who heads the commission in parliament has appealed to the public to put pressure on the legislature to rescind its recent decision to keep the Chernobyl plant open. ❑



Cancer studies

NUCLEAR workers exposed to one of five radioactive isotopes are 2.5 times more likely to get prostrate cancer, according to a study by the Imperial Cancer Research Fund (ICRF). Meanwhile the incidence of increased cancer cases around Sellafield is to be the subject of a new study by the government's Committee on Medical Aspects of Radiation (Comare).

The ICRF study, carried out by Dr Valerie Beral, has found that workers who might have been exposed to tritium, chromium-51, iron-59, cobalt-60 and zinc-65 are 2.5 times more likely to suffer from prostrate cancer. Men who were actually contaminated by them were 5 times more likely to suffer. All of the isotopes are linked with the irradiation of steel casing and piping, or with moderator fluid of heavy water reactors. "There is only one that I know ends up in the prostrate and that is zinc-65," she said. "If I had to go in one direction, I'd start with zinc."

She said the risk "may be due to very particular circumstances and might not apply elsewhere in the nuclear industry."

The Atomic Energy Authority, which co-funded the study, said: "The only facility with a significantly raised risk noted in the study was the steam generating heavy water reactor at Winfrith, which closed in 1990."

Dr Keith Pilling, an occupational physician with the Authority, said: "Our own information shows that the overall mortality rate of men who have worked on heavy water reactors is low, indicating a good health record. Nevertheless, we are giving careful attention to the results of the study and will give medical counselling to those of our employees who may be particularly concerned about the results."

Yet another investigation is to be conducted into the increased incidence of cancer around the Sellafield nuclear reprocessing plant. Comare is engaged in a three-part investigation. One study will take a fresh look at the epidemiology of cancers in people living around Sellafield and other nuclear plants. The second will draw together all available information relating to radioactive contamination around Sellafield and the doses local people may have received.

The third project will follow up the work of the late Professor Martin Gardner. It will attempt to establish a mechanism by which fathers exposed to radiation can pass on genetic defects which result in their children getting cancer.

The announcement of the new investigation came only a week after the government's Health and Safety Executive (HSE) published a report arguing that the 'Gardner' hypothesis is only statistically valid for the village of Seascale, some 3km from Sellafield. Ed Varney, HSE's deputy chief inspector for nuclear installations, said that the risk does not exist for the 90% of Sellafield workers who live outside Seascale. ❑

Pu flights of fancy

NEW calls opposing plutonium flights from Germany to Scotland have been made after the former head of transportation at the US Nuclear Regulatory Commission said the flasks to be used could not be guaranteed to prevent a disastrous release of radioactivity in the event of a crash.

The plans to fly some 123 unused plutonium fuel elements have been criticised by Charles MacDonald in a letter to the US pressure group the Nuclear Control Institute (NCI). MacDonald rejects assurances given in the Bundestag by the German government that the nature of the mixed oxide fuel pellets is sufficient to dispel any fear of serious contamination following a crash and fire.

MacDonald states: "Apparently no account is taken for the packaging since it is tested to a 48km/hr impact on a rigid surface; much less than it may be subjected to in an air crash. Credit is taken for the temperatures the fuel pellets are exposed to during the fabrication process. However, the fabrication process is a controlled condition where the presence of oxygen may be reasonably excluded. Transport fires are not controlled conditions and it may not be reasonable to exclude the presence of oxygen during the fire. This is important since, when the pellets are exposed to high temperatures in the presence of oxygen, there may be a change in form of the fuel pellets which increases the dispersability of the plutonium."

Flask doubts

In a letter to the German environment minister, Klaus Toepfer, the NCI states that it is clear from Mr MacDonald's letter that the type B flask to be used "would not be sufficient to protect the fuel elements in a crash such as the one involving the El Al cargo plane in Amsterdam in 1992, in which the impact speed was 335mph.

"While admittedly the probability of such a crash is low, these events do happen from time to time, as the El Al crash vividly illustrates. If MOX fuel rods had been aboard in that crash, our understanding is that they would have 'twisted like pretzels' and fuel pellets would have been released. Exposure to that intense and sustained air-fed fire could have broken down the pellets and caused a catastrophic release of extremely toxic plutonium."

NCI President, Paul Leventhal, concludes that such flasks would be barred under law from use in both the US and Japan: "If you could not ship this fuel by air to the US or Japan for safety reasons, why are you about to ship it from Germany to Scotland? We do not see how your government can responsibly allow this flight to go forward at this time."

The Hesse government, in whose state the elements are currently being stored, has protested about the plans for the flights but comments: "We consider the project poses unacceptable risks for the inhabitants of Germany and Scotland. We have protested but can't do anything to stop it as legally only the federal government in Bonn can decide. They are trying to keep it secret."

AEA Technology, which is to receive the fuel elements at its Dounreay site in the north of Scotland, says it is "completely confident that they [the flights] are perfectly safe." It has, however, admitted that a new type C flask is being developed. ❑

Thorp questions

AS the government stumbles and fudges over making an announcement about opening the Thermal Oxide Reprocessing Plant (Thorp) at Sellafield, the arguments over the plant's economics, environmental implications and the threat it places on international security rumble on.

In the US, a report drawn up by two former CIA directors and two US nuclear weapons designers, commissioned by the Pentagon from the Rand Corporation's National Defense Research Institution, has strongly rejected assertions by British Nuclear Fuels — which is to operate the massive plant — that it will not increase the risk of nuclear proliferation.

The report is being used by the US Defense Department to lobby President Clinton to intervene to stop the plant opening. It says that the opening of the plant would put some countries "within days" of acquiring nuclear weapons. Clinton, however, has so far refused to bow to pressure from either congress — which voted unanimously for a global ban on reprocessing — or the Defense Department.

The US could effectively kill Thorp by stopping the plant's biggest customer, Japan, from using it. The US supplies Japan with its nuclear fuel under conditions that would enable it to ban reprocessing. In a letter to congressmen, Clinton said that "the continued production of plutonium ... creates serious proliferation and security dangers." But a ban would "lead to a confrontation with our allies."

New calculations based upon figures released by the National Radiological Protection Board (NRPB) show that the operation of Thorp would result in 200 deaths worldwide if the plant operates for the 25 years planned. Of the 200 fatal cancers, only 4 would be in the UK, 17 in the rest of Europe and the rest elsewhere in the world.

These figures come in stark contrast to assurances given by the Ministry of Agriculture, Fisheries and Food to government that the new discharge limits for Sellafield "would effectively protect human health, the safety of the food chain and the environment."

It has also been revealed that BNFL's much trumpeted independent analysis of a report by chartered accountants Touche Ross on economic appraisal of the plant was conducted without the analysts being shown the original report. It has further been revealed that not only were the independent economists not to be trusted with the report but that not even the Secretary of Sate for the Environment, John Gummer, has been entrusted with a copy. These revelations have prompted one senior government official to doubt that such a report even exists.

Bizarre, but true! ❑

Fusion heats up

A breakthrough in developing nuclear fusion power has been hailed in the US, where scientists at the Tokamak Fusion Test Reactor (TFTR) have succeeded in heating a tiny quantity of hydrogen to a temperature 20 times greater than that at the core of the sun.

Although the reactor consumed 24 million watts of power to produce only 3 million watts, the scientists, at Princeton University which hosts the TFTR, say the results confirm calculations used over 20 years ago to design the reactor. They believe that the results mean they are on course for delivering the first fusion power to the grid in 2030.

However, there are still many uncertainties to clear up. It is not yet known whether the holy grail of fusion, a self sustaining fusion reaction, can be attained. So far, no one has ever sustained a reaction long enough to light a 60W bulb. They also hope, but do not know, that such a reactor couldn't melt down and there are no reliable estimates of the nature and quantities of radioactive waste which could be produced.

On the positive side, say fusion scientists, the fuel for the reactor — deuterium or heavy hydrogen — exists wherever there is water. Lake Geneva for example, they say, holds enough fuel for the entire world for over 3,000 years. ❑

The nuclear industry around the world is now faced with managing the radioactive wastes from forty years of reactor operation and fuel processing. Dr RACHEL WESTERN, of Friends of the Earth's energy campaign, looks at the technical problems and calls for a new radioactive waste management body, independent of the nuclear industry.

Managing the nuclear legacy

WHEN nuclear power was first introduced, the public was told that it would be cheap, clean and safe. However, the industry's track record has not lived up to these expectations and the nuclear industry has generally lost the public's confidence. As with nuclear energy as a whole, the industry's pronouncements on nuclear waste are met with scepticism by an untrusting public.

Be it 'too cheap to meter' or 'safe for all time', the claims of the industry worldwide have not been matched by performance. Nuclear power stations have been expensive to build, operate and maintain; weapons' proliferation has been linked to nuclear power; there have been serious accidents; radiation is more dangerous than we were first told; the nuclear waste and decommissioning problem has not been solved; and the much-vaunted nuclear fuel 'cycle' has never been closed.

Given the failure of the industry to meet the expectations generated by its own hype, Colin Duncan, director of corporate communications at British Nuclear Fuels believes "the outside world has and will continue to listen critically to the words of our industry, which it perceives as arrogant and self-satisfied." Despite this, Duncan states unambiguously: "disposing of nuclear waste does not represent a technical problem. We already have the technical capability to build a safe repository."

Safety claim

Similarly, the UK's nuclear waste management executive, Nirex, has variously claimed:

- "The safe disposal of radioactive waste is very straightforward."
- "The technical ability to deal finally with these wastes exists now."
- "All radioactivity in nuclear waste can be made safe, for all time, if a combination of barriers is used — steel, concrete and rock."
- "A combination of all these processes will ensure that even if radioactive material eventually moves away from the engineered disposal centre, even the longest lived components will have decayed to negligible levels before they reach man."

These are absolute statements.

Examination of the research prepared by the nuclear industry to support the supposition that the safe disposal of nuclear waste presents no technical difficulties demonstrates quite the opposite.

Under the "multi-barrier" concept it is assumed that the incorporation of a multiplicity of barriers in the containment system of the repository will provide a very high level of radionuclide containment. For example, in the Nirex reference repository design it has been assumed that radionuclides will be physically contained for 300 years. Thus, the safety assessment calculations used to select Dounreay and Sellafield for detailed site investigation assumed "total containment" for 300 years.

The validity of this assumption collapses when it is realised that the containment system, designed to prevent the release of radionuclides from the repository, must simultaneously allow the release of gases.

Gas problem

Nirex proposes to bury two million cubic metres of radioactive waste in the repository and it has estimated that these wastes will produce their own volume in gas every ten years. In total, one billion cubic metres of hydrogen will be generated due to the corrosion of steel and 3 million cubic metres of methane and 3 million cubic metres of carbon dioxide will be generated from the breakdown of paper and wood in the waste. Overall, Nirex has predicted that the volume of gas generated will be 400 times the volume of the repository.

If these gases are not released it is feasible that pressures may build up, posing a considerable threat to the safety of the repository. Nuclide containment and gas release are mutually exclusive.

For example, Nirex calculates that the use of 1mm diameter vents to allow gas release from waste canisters would result in the release of significant concentrations of activity. The diameters of the vents that Nirex is considering range from 10mm to 100mm. Design conflicts are also found in the specifications for the cement to be used in the repository.

These conflicts in repository design specification indicate that there are severe difficulties in the design of a safe repository which remain to be resolved.

Indeed in their recently published report *Review of the Department of the Environment's research programme on radioactive substances*, the government's Radioactive Waste Management Advisory Committee (RWMAC) calls for urgent research "To identify and evaluate measures of impact mitigation, compensation and participation in locations hosting radioactive waste disposal and storage facilities ..." A call which is not exactly in harmony with the nuclear industry's bland assurances that there are no problems.

Radiological impact

The regulatory requirements for the long term radiological performance of a repository is that the target risk to an individual in a year should be less than that associated with a dose of 0.1mSv — about one chance in a million of fatal cancer. In October 1993 Nirex stated that: "Radioactive waste will not be disposed underground unless it can be shown that nobody will ever be exposed to a significant risk."

However, Nirex does not possess sufficient scientific understanding of radionuclide behaviour to allow the accurate quantification of radiological impact required by the regulatory authorities.

The solubility of uranium, for example, is very significant in making the safety case for a nuclear waste repository. There is a large amount of uranium in nuclear waste. Consequently, the radioactive decay products (the daughter elements) of uranium are likely to dominate the long-term radiological impact of the repository. Nirex has assumed that low "uranium solubility" will ensure that the release of uranium from the repository is spread over time and consequently that a low peak dose of radioactivity will be achieved.

The calculation of radionuclide solubility is problematic, as it is highly dependent on the specific details of the chemical environment of the radionuclide which is assumed for the

safety assessment. Subtle adjustment of the assumptions made concerning the nature of the solid material holding the radionuclide, or the composition of the groundwater dissolving the radionuclide, may result in substantial variations in the results obtained.

To by-pass these difficulties Nirex uses a parameter described as the "solubility of the element" which aims to subsume these complexities within one piece of data. To generate 'elemental solubilities', Nirex first identifies a solid that will be assumed to contain the radionuclide. Second, Nirex defines the composition of the groundwater that will be assumed to dissolve the radionuclide. Different solids have widely different solubilities.

For example the solubilities of plutonium compounds such as plutonium dioxide, plutonium hydrous oxide and plutonium hydroxide differ by many orders of magnitude. This presents significant difficulties as it is often the case that the identity of the relevant solid is unknown.

Determining the value to use for the solubility of uranium in the safety assessment is complicated by uncertainties over the nature of the solid that should be used in the calculation. Experiments reported by Nirex in 1988 gave a one hundred-thousand-fold variation between different uranium compounds.

This level of uncertainty translates directly into large errors in Nirex's safety assessment calculations. For example, in 1991 Nirex reported the results of a field test, carried out at the Pocos de Caldas uranium mine in Brazil, of uranium solubility calculations. It was assumed for the solubility calculation that the uranium would be present as uranium dioxide. On this basis, the predicted solubility of the uranium was calculated to be 1.4×10^{-11} milligrams per litre (mg/l). The measured concentration at the site was 3×10^{-3} mg/l — a 200 million-fold error.

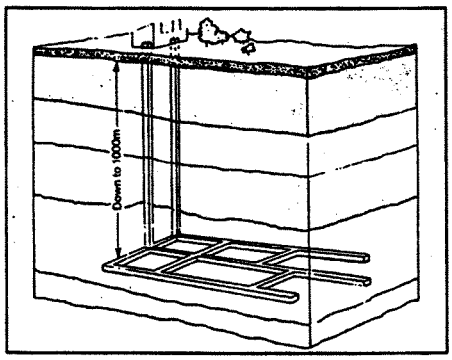
Modelling problems

The chemical systems in a nuclear waste repository will be extremely complex and present prohibitive computational difficulties for the repository safety assessment models. The simplistic 'elemental solubility' approach that has been taken by Nirex to attempt to overcome these difficulties confounds chemical authenticity and therefore validates the public's scepticism concerning the safety of nuclear waste disposal.

The risk of contaminated groundwater from the repository reaching the human environment depends fundamentally on the way that groundwater travels from the repository. This is known as the hydrogeology of the site. It is important to select a repository site such that the quantity of radionuclides carried by groundwater from the repository back to the human environment is minimal.

In March 1989, when Nirex announced that future site investigation work would be limited to Sellafield and Dounreay, Nirex predicted that radioactively contaminated water that migrated from a repository at Sellafield would be carried directly towards the sea. On this basis it calculated the safety of a repository at Sellafield for the next one hundred million years. These initial calculations were carried out using estimates rather than real data as there was little direct information available about the Sellafield site. However, when real data became available, an additional feature of the hydrogeology at Sellafield was discovered.

The water at the Sellafield site was up to six times more saline than sea-water. The effect of salt water is to drive



contaminated water back upwards to the surface. In April 1992, John Mather, Professor of Geology at London University, commented: "Any sort of upward migration is what they do not want in that area and they have got it".

Similarly, in May 1993, RWMAC stated that: "The recognition of upward head gradients requires careful investigation and explanation, since it could indicate the potential for relatively short groundwater flow paths a few hundred metres in length upwards from a repository site into the Sherwood Sandstone Aquifer above. As a consequence relatively short return times of groundwater flow from the vicinity of the repository into the biosphere could result ... it is an open question as to whether the observed variability in the hydrogeological conditions at Sellafield will provide unequivocal evidence that the stringent hydrogeological conditions required for a deep radioactive waste repository can be met at this site."

Thus it may be seen that the hydrogeological assumptions underlying the repository safety assessment are undermined by the same confusion and uncertainty that is found in the repository design specifications and in the chemical modelling of the repository.

The nuclear industry does not have technical credibility; this general problem has permeated radioactive waste management strategy. The continued incantation that 'there is no technical difficulty associated with the disposal of nuclear waste' in the face of all the evidence only serves to further increase public distrust.

Suspicion

In addition to the widespread technical mistrust of the nuclear industry, the economic and political motives underlying the nuclear industry's waste management proposals are also subject to scepticism. As long as the nuclear industry openly identifies a need to 'solve' the waste problem in order to secure an expansive future the public has every reason to suspect that it is acting in its own short-term interest rather than in the interests of environmental protection and long-term public safety.

Unless the planning of nuclear waste management strategy is separated from plans to expand the nuclear industry, the public will continue to view the industry's waste management proposals with scepticism. In order to overcome this difficulty radioactive waste management should become the responsibility of a new organisation that is independent of the nuclear industry.

This new institution must be given free rein to start from scratch on nuclear waste management strategies, with a comprehensive approach encompassing all aspects of nuclear waste, from strategies to minimise waste arisings to the rationale for reprocessing, including the decommissioning of reactors, submarines and other irradiated civil and military equipment.

The new body must start from the assumption that public consensus is necessary and can only be built on involvement and consultation rather than decree, exclusion and secrecy. This means building up slowly on the basis of open public debate and discussion of the criteria for measuring the success of waste management strategies, followed by an examination against those criteria of all possible options. ❑

A longer, fully referenced version of this article is available from FoE, 26-28 Underwood Street, London N1 7JQ.

With much of eastern Europe in economic crisis and suffering from energy shortages, journalist Matthew Shelley reports on a recent conference held in Romania to look at the potential for small-scale hydroelectricity.

Small-scale hydro in Eastern Europe

BITTER experience has pushed Romania into serious research on how small-scale hydro-electric projects could answer the energy needs of its communities.

The national economy is in a precarious condition, inflation is sending some prices up by 20 per cent a month and there is widespread awareness of the damage done by pollution during the Ceausescu era.

Much of Romania is covered by wooded mountains, down which run innumerable streams. These factors alone make the prospect of cheap, clean electricity a highly attractive one.

Add to this a highly vocal green movement which has been vigorously represented in parliament since the fall of the Communist regime in 1989, and the pressure for micro-hydro plant is almost irresistible.

In October a high-level conference was held in the city of Timisoara to examine the social and economic impact of small-scale hydro power.

The three-day event, funded by the Regional Environment Centre for central and eastern Europe, looked not only at Romania, but also brought together experts from the Republic of Moldavia, the Czech Republic, Hungary, Poland and Russia.

Potential resource

Hosting the conference was the Romanian state-owned hydroelectric generator manufacturers Hidrotim-SA, headed by Dr Iacob Voia.

A central issue was whether they could cost-effectively and without pollution harness the energy available in the mountain regions.

According to Voia the potential for hydro power is demonstrated by the 200-plus turbines currently at work in the country.

Indeed, some of these have a quite remarkable pedigree. In the village of Topletz there are two small water turbines which feed into the national grid. Previously they provided for the energy needs of the 1,000-worker Semag-SA agricultural machinery factory. One of the turbines has been operating since 1941, the other since 1929.

In another part of Topletz, the villagers are using a chain of four water mills to grind maize. The ownership of small water mills between several farming families either for producing flour or for use in textiles production is still quite common in parts of Romania.

Voia said: "There is a long tradition of using water energy in Romania. It is one we want to build on. No one knows the exact potential of micro-hydroelectric power here, but there is a great deal which can be done."

The need for action is clear, according to members of the green movement including Seban Buretea, secretary of the influential non-governmental organisation the Ecologist Youth Movement of Romania. Many villagers suffer brown-outs daily and in a country where living conditions for a vast peasant population have seen little change in centuries, electricity is a key resource.

Environmental campaign

Buretea's organisation is planning a campaign in 1994 for environmentally-friendly energy: "Our aim will be to encourage communities to develop alternative energy sources to suit their needs and resources. In some cases this will be hydro power, in others it could be wind turbines".

The campaign will have three stages. The first will be an awareness-raising drive in selected areas. Second, a series of seminars at which community representatives will be able to meet with expert advisers and discuss their needs. Finally, the pressure group will work with those who are interested in order physically to develop new power sources.

Another organisation which is committed to the development of small-scale hydro plant is the state electricity company, whose representative Mihai Paun believes hydro can play a significant role in Romania's future.

Paun said his company was "happy to see the development of these projects but, on the whole, must leave it to private investors due to the shortage of money. Once created we would always be interested in looking at arrangements with the owners."

But, Paun wants to see the creation of small-scale hydroelectric plant carried out with care. He does not agree that they are automatically benign.

The ones at Topletz, remarkable for their resilience, have been criticised by some experts for causing oil pollution due to their age and poor maintenance.

What Paun wants to see is a full evaluation of the impact of hydro technology on the environment in which it is to be situated. Among the criteria suggested to determine acceptability is the impact on the ecological system of the river or stream.

Minimising impact

Paun, along with experts at Hidrotim, wants to ensure that there is as little impact as possible on overall water flow, that larger animals such as fish are not sucked through the turbines and that there is no oil pollution.

Other concerns include ensuring that the turbines and associated piping are not visually intrusive. The suggestion is to use local materials and plant, even carefully chosen shades of paint, to disguise the presence of the machinery. Furthermore, Paun's recommendations to the conference emphasised the need to ensure that the equipment does not cause noise pollution. He went on to say: "It is very important to apply all the means at our disposal to ensure the manufacture of hydroelectricty and to guarantee the future of our fishermen. I must also insist on the need for a public debate regarding the laws on the protection of nature."

Some estimates suggest small-scale hydroelectric projects could supply around six per cent of Romania's energy requirements.

In neighbouring Moldavia the situation is different. The republic had a substantial industrial base and a number of hydroelectric generators when it was annexed by Stalin after the second world war. These are now derelict and the industry is dead. It is said that the Soviets dismantled all the

machinery they wanted and took it north in the 1950s.

Dr Petra Plesca of the Universitate Agrara, in the capital Chisanau, is now anxiously trying to rebuild links with Romania in order to develop small hydro plant in his republic.

The least of his problems is that after two generations of separation and enforced speaking of Russian his Romanian is archaic. More significant is his county's cash crisis. While a conference representative from the Czech Republic was saying how poor Romania seemed to be, the Romanians were in turn expressing shock at the poverty of their Moldavian cousins.

Lack of money

Plesca believes he has identified a total of 88 potential sites for micro-hydroelectric plant in Moldavia. But the catches are enormous. He told the conference: "We have not the technology to manufacture the turbines we need or the hard currency to buy them from abroad. What we can offer, and I am authorised to do so, is to barter with food. Our farms are very good."

The low maintenance costs of small hydroelectric plant makes it enormously attractive in Moldavia.

During the 1930s and '40s, around 20 small hydroelectric units were built on Moldavian rivers, none are now working. They were allowed to fall into disrepair as large-scale power stations were developed. Plesca said: "The increasing costs of liquid and solid fuel now makes it necessary to return to the use of river water. It is also important to mention that the existing dams would reduce the expense. Many of them are provided with bottom outlets for water discharge that is not being used to generate energy."

While Moldavia is struggling because it has little manufacturing capacity and negligible foreign currency, it has neighbours who would love to cater for its needs.

The Hidrotim laboratory in Resita, Romania, offers a range of four different micro-hydro units — from 0.5 to 35kW capacity. These have been designed to operate either as part of a national grid or as stand-alone. Between 1972 and 1990 Hidrotim sold 30 of its smallest units, to supply forest huts, fish farms, timber plantations and the like.

A main target is the burgeoning private sector, which may have the capital to invest and the foresight to want to keep fuel bills low.

In the Czech Republic, turbine manufacturer CKD Blansco is aiming to compete on the world stage. It already has a steady export trade and an annual profit from its ten divisions of 140 million Koruna (£3.3m).

The technology for CKD's turbines is, according to senior engineer Jaromir Cerny, as good as anything available in the West — and clean.

Their made-to-measure turbines are specifically created to suit customers' needs. One advantage cited is that the parts are self-lubricating, ensuring that they do not become the source of oil pollution. But CKD products, being of the highest standards, do not always come cheap.

While CKD seeks new markets and Moldavia will have to rely on barter, Romanians are searching for the best way to exploit its own hydroelectric potential.

A paper by Ioan Auton, of the Technical University of Timisoara, says it is a great paradox that it is the developed world which has, so far, gained the most from small hydro plant.

Full consultation

He estimates that there is hydroelectric potential at around 1,000 new sites in Romania, with a production capacity of 678 GWh/year.

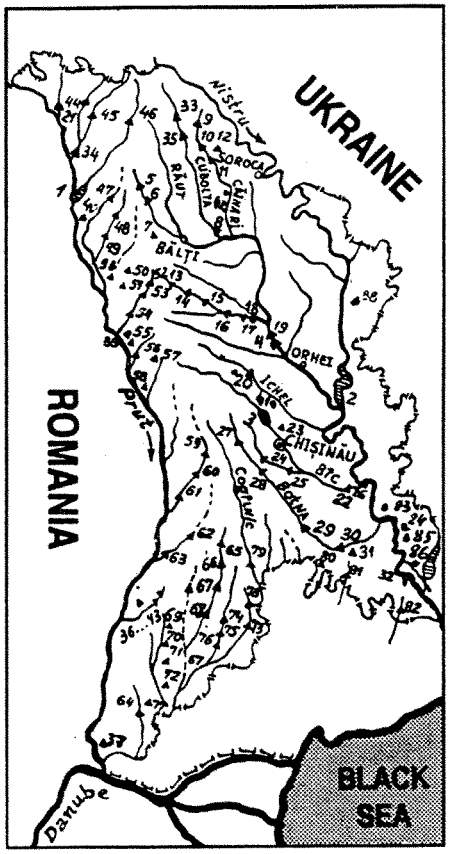
Amongst the benefits of small hydro plant, Auton mentioned the 50 to 70-year life expectancy. But, he too recommends extensive study of their impact on the local eco-system before installation.

Beyond this, he says "The studies on whether the small hydro-powered plant should be built have to be carried out on the basis of full consultation with all interested parties. This will make the rapid realisation of a project much easier.

According to Auton, the development of small hydro is essential: "As long as mankind and state governments lack deep understanding of the necessity of saving eco-systems, the earth is going to be rapidly destroyed."

He believes small hydro plant must be purpose-built to suit its environment and should be used not just on mountain rivers and streams but also to take advantage of industrial outflows.

The future of small-scale hydro power in Romania depends on a number of



88 potential basins for hydro-electric plant with a volume exceeding 1 million m³ identified in Moldavia

factors according to Auton. Chief amongst these are the speed of development, the attitude of the national power company, Remel, and the availability of capital.

Potential sources of cash include the government, Remel, private firms and local authorities. Some of this could come through the environmental youth movement's project to encourage the use of alternative sources of energy.

In order to satisfy environmental concerns, a team from Hidrotim has made a series of recommendations about small hydro plant.

Letitiu Ardeleanu, Bogdana Marinca and Adrian Iancu advised that all small hydro plant should be able to stop and start automatically according to water level, should have displays showing relevant information like the unit speed and be protected against overload.

Overall, there is a degree of confidence about the future of micro-hydroelectric power in Romania, not least because of the widespread reaction against the grandiose projects of Ceausescu. There is also a deep distrust of nuclear power following the Chernobyl accident, the memory of which is firmly imbedded in many people's minds. ❑

Having visited the Oncology Institute of Ukraine, Kiev, with a medical team from the Alix Spurling Memorial Trust*, GRAHAM STEIN reports on the continuing Chernobyl disaster and the West's failure to provide adequate assistance.

Chernobyl: the forgotten victims

IT was in the early hours of Saturday 26 April 1986 that a reactor meltdown led to two explosions, first of steam then of hydrogen, which tore open the unit four reactor building at Chernobyl. The graphite fire and radioactive eruption which followed lasted for ten days.

Five per cent of the reactor inventory, including caesium, iodine, strontium and plutonium, spewed into the atmosphere. Tens of millions of curies of radioactivity were spread across Europe.

An initial 10 km zone around the reactor site, in the north of Ukraine bordering Belarus, was sealed off almost immediately, but evacuation of the 50,000 people within the zone did not take place until the Sunday afternoon — using more than 1,000 buses requisitioned from Ukraine's capital, Kiev. In the 36 hours between accident and evacuation, no precautionary measures to reduce inhabitants' exposure to radiation were implemented.

The 'exclusion zone' was extended to 30km on 3 May and around 90,000 people within this area were evacuated between 4 and 7 May.

In the first few days, winds blew the radioactive plume north and north-west across Belarus. By 30 April a northerly wind was blowing radioactive aerosol and dust towards Kiev, a city of 2.5 million people 80km south of Chernobyl. Despite increasing levels of radiation, the authorities insisted that there was no health risk, and as part of a business-as-usual policy the May Day parade on Thursday 1 May went ahead, bringing most of the inhabitants of Kiev out onto the streets.

It wasn't until May 6, ten days after the accident, that a news blackout was lifted and the first medical advice was issued in Kiev. The decision to evacuate children and pregnant mothers form Kiev and other cities and towns in the area was not made until the 15th. In all, around 1 million people were evacuated, but the delay had subjected them to the peak levels of radio-iodine contamination on 1 and 2 May. Children are particularly vulnerable to radioactive iodine which accumulates in the thyroid gland.

Continuing disaster

Now, almost eight years on, Chernobyl has become a distant memory for most people, the fear and outrage caused by that nuclear accident have receded. But in Ukraine, which regained its independence in 1991, it is a continuing disaster. Tumours and other solid cancers take years to develop and only now are the consequences of the accident becoming apparent.

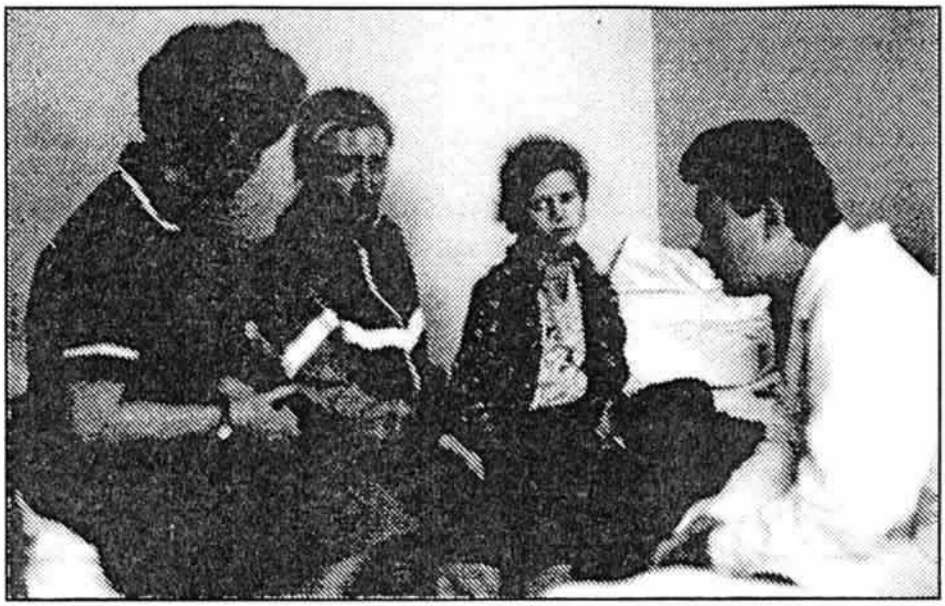
The Oncology Institute of Ukraine is the country's elite (and only) centre for the treatment of solid cancers. In its children's ward youngsters lie dying without painkillers to relieve their distress. They are amongst the forgotten victims of an accident which once touched us all.

While the West finds hundreds of millions of pounds to keep eastern Europe's decrepit and dangerous nuclear reactors running, it appears that the cost of basic drugs is too much.

Diagnostic facilities in Ukraine are poor — virtually non-existent outside Kiev. Doctors at the Institute believe that many cancers go undiagnosed, and most of the patients who do reach the Institute have third or fourth stage cancers; their chances of survival are virtually nil. Earlier diagnosis, together with adequate treatment, would save lives.

Most Westerners would be horrified by the state of the Institute's hospital: blood stained mattresses, obsolete equipment and few drugs. Although the medical staff are well trained, they have to work with the available resources; even 'disposable' scalpel blades are used again and again.

In the nuclear medicine unit, there is little activity — the supply of radio-isotopes from Russia has stopped and much of the aged equipment is broken. One corridor is half blocked by the disassembled parts of a huge gamma camera — a second-hand gift



Eight-year-old Sergei, one of the patients at the Oncology Institute, Kiev

from the United States which even the resourceful Ukrainians have never been able to get working.

The gloomy corridor of the children's ward, lit only by the daylight from a window at the far end, gives a depressing first impression of the department, but this is misleading and all things considered the atmosphere on the ward is pleasant and relaxed.

Most of the children have their mother or grandmother living and sleeping in the ward with them, and many mums cook meals for their children in the rooms, preferring this to the poor-quality hospital food. With up to 8 beds in rooms 16 feet square, conditions are cramped, but the mothers make the best of it and are grateful for the care their children receive from the dedicated staff.

Staff at the Institute fully expect that Chernobyl contamination together with chemical pollution will increase the numbers needing treatment. A new eight-storey building is being constructed — financed by the country's Chernobyl Institute.

Ukrainians report that 190 people have acute radiation sickness, 20,000 have lost the capacity to work and only 28% of the 180,000 people involved in the clean-up operations do not have health problems. There are people with respiratory disease, heart troubles and nervous system disorders. There are increases in digestive problems, tonsillitis, anaemia and stress. The suicide rate has increased and children suffer from 'Chernobyl syndrome'.

Parts of Russia have similar problems. With 2.6 million people living in 7,608 contaminated towns, there have been increases in a range of diseases including tumours (25% increase) and cardiovascular disorders (50% increase).

And in Belarus, which suffered the worst from the accident — receiving 70% of total fall-out — the situation is even worse. Some 23% of the land of Belarus, on which 20% of the population live, is contaminated. More than 250,000 hectares of farmland has been abandoned.

One third of all children in Belarus have some type of thyroid gland deficiency, and the World Health Organisation (WHO) has found the incidence of childhood thyroid cancer up to 124 times the normal rate. The authorities are now expecting 140 cases every year — with a 10% death rate — and scientists have observed that the tumours are "large" and "aggressive". The incidence of breast cancer is increasing, as is that of blood circulation disorders.

According to Dr Alexander Demenok, head of blood transfusions at the First Children's Clinic, in the Belarus capital of Minsk, "around 99% of all children from the region suffer from immunological deficiencies."

While he cannot tell whether the cause was Chernobyl or a combination of many factors, he says: "All we know is that in the past three years the incidence of cases of leukaemia has soared. Moreover, six years ago children of five or older suffered from it; now we are treating children under five. These cases of leukaemia are determined genetically, which suggests that the parents themselves were exposed."

Petr Kravchanka, the Belarus foreign minister, told *The European* newspaper: "The whole genetic future of our country is in jeopardy. We are talking about the survival of a nation ... we are only just beginning to see the consequences of the tragedy."

The costs faced by these three countries are unbearable. They desperately need 'clean' food, diagnostic equipment, radiation instruments, medicines and rehabilitation centres. Belarus estimates that it will need to spend $400-$500m between now and 1995. The Ukrainian ministry for Chernobyl affairs reports that 3% of its gross domestic product (11% of the national budget) is spent on the aftermath of the accident, a figure which could rise to 15%.

Chernobyl vote

Despite the Chernobyl legacy, on 21 October this year the deputies in the Ukrainian parliament voted by 221 to 38 to keep Chernobyl units 1 and 3 operating, reversing a decision taken two years earlier to shut the reactors by the end of 1993.

The vote also lifted a 1990 moratorium on construction of new nuclear plant. This clears the way for work to restart on three VVER-1000 reactors (1,000MW Soviet design PWRs) at existing nuclear sites: Zaporozhe-6 in southern Ukraine, Khmelnitsky-2 south-west of Kiev and Rovno-4, between Kiev and Warsaw. Chernobyl-2, damaged by a turbine hall fire in October 1991 may also be brought back into operation.

The five unfinished VVERs, which have already cost £4bn, were mothballed because of public opposition to nuclear power following the Chernobyl accident. Although public opinion is still generally opposed to nuclear power, severe energy shortages, a powerful nuclear lobby and a crippled economy all contributed to the deputies' change of mind.

Ukraine currently relies on 14 reactors (the two RBMKs at Chernobyl and 12 VVERs) for around 25-30% of its electricity — as much as 40% in the winter — and nearly half its energy is imported. Russia, which supplies 90% of these imports, is now demanding hard currency for its oil and gas. It is money that Ukraine doesn't have and a debt of £470m has built up. Negotiations to swap debt for Ukraine's share of the Black Sea fleet have stalled.

The position is now so serious that prime minister Yefim Zviagilsky has called for an "economic state of emergency" to force energy saving measures — during the coldest winter in 50 years with temperatures touching minus 20°C. The energy ministry has warned that there is only one month's fuel reserves and that £200m worth of oil and gas is needed immediately. Energy minister Vilen Semenyuk announced that: "Since we can't stop heating homes or supplying agriculture with fuel, we must close down a number of high-energy-use enterprises."

Since the collapse of the Soviet Union, the Ukrainian economy has taken a battering. For political reasons, links with their traditional trading partners have been disrupted, but they cannot afford to buy goods from the West — the average Ukrainian wage is just eight dollars a month. The former breadbasket of the Soviet Union does not have enough fuel to harvest all its crops.

Heavy and light engineering have declined rapidly in the past few years, and there is hyper-inflation with the currency, coupons, at 30,000 to the dollar in mid-October, it was 12,000 in September. A small tin of fish costs 5,000 coupons, that's only ten pence, but it's half a day's pay. Somehow the people survive, and there are just about enough staple foods to go round; but the quality of the food, together with industrial pollution and the effects of Chernobyl all have their impact on people's health.

The country needs help to re-establish its industry and open up new trading links. In the meantime, Western aid is urgently needed but will have to be carefully targeted and supervised if it is to benefit the people who need it rather than line the pockets of a few. Ukrainians have a strong sense of community and society, with law-breaking generally confined to black-marketeering and corruption, but the influence of the West and the lure of dollars are undermining the old values.

Doctors at the Oncology Institute are looking to the West for assistance, and not just for handouts. They are keen to promote their own medical developments — including a blood test for cancer diagnosis — but they cannot afford to patent, let alone develop and market them.

The European Union is supplying some help, and a team including epidemiologists, cancer experts, radiation biologists and engineers has been established, with a budget of several million ecus, to measure the effects on human health and the environment, work out the best ways to mitigate the consequences of the accident, and improve emergency management.

The radiation arm of the WHO European Centre for Environment and Health has detailed plans for a collaborative programme in Belarus, but it has yet to receive approval and funding from the WHO which has been accused of squandering £12m of Japanese aid on smart equipment without producing useful results.

The site of a planned eight-storey building at the Oncology Institute, Kiev

In general, support from Western countries has been poor: donor countries gave only $1m towards United Nations' Chernobyl projects, which were budgeted at $646m in 1991.

Much of the blame for this inadequate response is put on a 1991 report by the International Atomic Energy Agency (IAEA) — criticised at the time by the Belarus and Ukrainian governments — which downplayed the effects of the accident, concluding that "no health disorders could be attributed directly to radiation exposure".

Furthermore, scientific papers on the increased incidence of cancers, written jointly by Belarussian and Western experts, are being blocked from publication in the West having been dismissed by some influential UK and US medical statiticians as an artefact of poor data and improved diagnosis.

Health and environmental groups have highlighted the conflict of interest for the IAEA — which has as its remit the promotion of nuclear power — and are calling for a new study on the health effects of the Chernobyl accident. ❑

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* The Alix Spurling Memorial Trust, which sends medical aid, clothes and toys to the children's department of the Oncology Institute, Kiev, can be contacted at Burnfoot, New Galloway, Castle Douglas DG7 3RZ (Tel: 06442 717).

MAMA 86 is a Kiev organisation created to unite the mothers whose children were born and are growing up in Kiev. Contact: Anna Syomina, MAMA 86, Michailovskaya Str, 22-A, 252 001 Kiev, Ukraine (Tel/Fax: +7 044 228 3101).

Extending the idea of the electricity and gas industries as service providers, ANDREW WARREN, director of the Association for the Conservation of Energy, proposes a radical change in private transport in order to promote energy efficiency in this important sector.

Motoring ahead?

ONE of the greatest difficulties facing energy conservation is the strength of the vested commercial interests currently lined up against it. There are a substantial number of big businesses which lose out when less fuel is consumed.

I am not here talking about the major energy users — the glassmakers, the chemical companies, the steel barons. In principle, they have every bit as much interest as does the householder — as does each environmentalist — in reducing the amount of energy that they need to buy. Their commercial motivations are (in theory) thoroughly compatible with energy saving.

The real problem is with those who sell us fuel. Particularly within the immediate post-privatisation culture, their product has tended to be increasingly regarded as a commodity. And the definition of a commodity is that it is sold, quite simply, on price and volume. The more you sell, the more money you make.

It is now recognised by government, regulators and much of the relevant industries that it was a mistake to privatise the gas and electricity industries on such a 'cost plus' basis. Other than at the margins where there was some genuine inter-fuel competition, there were precious few reasons for either industry to seek to minimise their customers' consumption. Pile it high, sell it as expensively as you can get away with became the philosophy.

This is changing. Swiftly. Ofgas, the gas regulator, was the first to move, introducing its 'E' factor to stimulate efficiency investments. Its electrical counterpart, Offer, started, in November 1992, to alter the supply price control, so as to remove the disincentive for regional electricity companies against helping their customers to reduce demand. Changes in 1994 to the distribution price control system should create specific incentives for electricity distributors to invest in energy saving measures.

This is all about turning traditional energy suppliers into providers of energy services. Which is, after all, what their customers want. As the old saying goes, I never met anyone who wanted to buy a kilowatt hour. What they want is light or heat.

For that matter, nobody ever wanted to buy a litre of petrol. What they want is to visit the shops, or a customer, or even Istanbul — if that is their choice. The same principle remains: it is not the commodity of a given fuel that the customer seeks, it is the services that it brings.

The trouble is that the transport market is not so easily regulated as those of electricity and gas. There is no captive market. There has long been genuine competition amongst sellers of petroleum products. There is no Ofgas or Offer equivalent. Nor any likelihood of one.

Efficiency incentives

That being the case, it is difficult, at first sight, to see how the same incentives for energy efficiency can be provided for oil companies, as they can for the gas and electric ones. But transport — and particularly personalised transport — is already responsible for 22% of fuel consumption. And that percentage is rising steadily.

If we are serious about seeking to restrain the amount of fuel used, we have two options. Either we assume dictatorial powers, ordering people to reduce the amount of motoring done, or we find a means whereby those who currently profit from our profligacy acquire a financial interest in reducing it.

The former method is objectionable — and, frankly, political suicide. But I think I may have an idea about how this latter option might be achieved. It is to turn the oil companies into service companies.

How? In essence, by having the oil companies own the cars we drive. We, in turn, lease our vehicles from the oil companies, paying for them (like traditional car-hire contracts) on a cost-per-mile basis.

Why might that work? Quite simply because the oil companies would now have every interest in ensuring that we obtained the greatest mileage-per-gallon, not the least. In that way, they could provide the services we require (travelling from A to B), but with a strong commercial incentive to provide us with the minimum amount of fuel to do so. They would be paid not on fuel consumed, but miles driven.

Additionally, as in standard leasing contracts, the oil companies would also be responsible for regular servicing of cars — thereby ensuring that they are tuned to the greatest efficiency.

Practically every motor manufacturer around the world has a prototype car which can give three, four or even five times more than the current average mpg. Which itself is currently improving only marginally (in the USA and Japan over the last couple of years scarcely at all). The motor manufacturers, at present, argue that these prototypes do not come on the market as there is no demand for them. So let us create the demand.

Altering the patterns of ownership enables this to happen in a market-driven way. For the first time, it would offer Big Oil a real incentive to minimise production costs, and maximise the return per barrel without having a vast inflationary effect. For this scheme to work there is no reason *per se* for the perceived cost of motoring to the driver to alter any faster than is currently considered politically feasible.

Of course, such a concept would require a radical re-orientation of who sells what in the transport market. But not, please note, to whom. The Great Car Society, so beloved of Margaret Thatcher, would still continue. It would just use one-quarter of the energy in achieving the same objective. And it removes one of the main commercial interest barriers to progress on energy efficiency — which must be worth having. ❑

When, in 1988, the US contracts for the return of spent research reactor fuel lapsed, Dounreay was quick to step into the gap. A gap described by the station's assistant technical director Ken Butler as a "gold-mine." That gold-mine is now in danger of collapse, writes MIKE TOWNSLEY.

Weird scenes from the gold-mine

SINCE 1959 several tonnes of Highly Enriched Uranium (HEU) fuel for research reactors has been despatched around the world as part of America's commitment to the so-called Atoms for Peace programme.

Realising that HEU is a nuclear weapons-grade material — only around 13-15kg is required to make a bomb equivalent to those dropped on Hiroshima and Nagasaki — the US stipulated in its supply contracts that the spent fuel rods must be returned to the US where they would be reprocessed and the resultant nuclear waste stored. This was a cosy deal for all involved. The research reactors received fuel without having to worry about the dangerous radioactive legacy and the US used the uranium recovered from reprocessing as driver fuel for its military plutonium-producing reactors at the giant 300 square mile Savannah River plant in South Carolina. So much for Atoms for Peace.

However, in December 1988 the US policy governing the importation of spent fuel expired. All deals were off while the administration fought complex legal battles with anti-nuclear groups and while an environmental assessment was carried out. Such an assessment is required under US legislation before an application can be made to renew the policy.

No one expected the policy to be in suspense for over 5 years, but only now is the US government preparing to take back spent fuel from US-origin HEU. While it will still be around 2 years before the necessary paperwork is completed to end the 1988 ban, US Energy Secretary Hazel O'Leary has secured a Presidential waiver for the early return of some 550 spent fuel rods over the next couple of years. This represents only about 4% of the 15,000 US-origin spent fuel rods in more than 50 countries. The waiver also allows for the return of a further 150 spent fuel elements should the need arise.

A statement issued by the US Department of Energy (DOE) says it has been instructed by Bill Clinton "to accelerate steps in taking back spent fuel of US origin from foreign research reactors. The purpose of this directive is to prevent commerce in weapons-grade uranium. Separation of weapons-grade uranium from spent fuel enables the material to be readily handled, transported and diverted."

In its draft policy statement published in October, the DOE states: "Because most foreign research reactors do not have extensive fuel storage facilities or national repositories, six foreign research reactors are facing shut-down in the near future because they have, or will soon, run out of storage space for their spent nuclear fuel, or are subject to regulatory requirements that would result in reactor shut-down in the absence of near-term arrangements for disposition of their fuel.

"Several of these foreign research reactors are unwilling to shut down and are considering shipping their backlog of spent nuclear fuel to Great Britain for reprocessing. Thus, continuing US refusal to accept the foreign research reactor spent nuclear fuel may have serious consequences.

Proliferation risk

"First, it would encourage reprocessing, thus risking the uncontrolled proliferation and distribution of HEU. Second, DOE is concerned that foreign research reactors will seek alternatives sources of fuel (possibly by even converting [non-weapons-grade] low enriched uranium (LEU) fuelled reactors back to the use of HEU fuel). The latter course of action is particularly undesirable under US non-proliferation policy because it would encourage international commerce in material directly usable in nuclear weapons and undermine efforts by the US to substitute LEU for HEU.

"In addition, the split-up of the former Soviet Union has resulted in the potential availability of HEU ... increasing the risk of nuclear weapons proliferation."

The draft policy asserts that: "Failure to accept spent nuclear fuel from the six reactors would seriously jeopardise US government efforts to reduce and eventually eliminate the use of HEU by civilian programmes. Failure to accept the foreign research reactor fuel would also be contrary to the spirit of the Treaty on Non-Proliferation of Nuclear Weapons (NPT)."

Under the exiting US-Euratom agreement US-origin spent fuel may be moved freely inside Europe without the knowledge of the US. All countries outwith Euratom using US-origin HEU must seek approval from Washington before it is moved.

The US is known to be furious with the European Union for using the Euratom clause to keep the whereabouts of several tonnes of US-origin HEU secret. The US-Euratom agreement is up for renegotiation in 1995 along with the NPT.

The six research reactors highlighted by the US for urgent relief are BR-2 (Belgium), Astra (Austria), FRG-1 (Germany), R-2 (Sweden), Hifar (Australia) and HFR Petten (European Union). Of these, the US says the Belgian BR-2 is facing "the most critical situation."

The draft policy comments: "Both the reactor operator and the Belgian government have appealed to the Department of State and the Department of Energy for assistance. If a minimum of 144 spent fuel elements ... cannot be evacuated before the end of 1993, inspection and maintenance of the [storage] pool mandated by the licensing authorities will not be possible, and the reactor will have to be shut down.

"Because of the age of the beryllium matrix in the reactor and the build-up of helium in this moderator, the reactor could not be safely made critical after a prolonged shut-down of one or two months. This would result in permanent closure of the reactor.

"The operators have made it clear that they will begin shipment of their spent nuclear fuel to Great Britain for reprocessing before they allow their reactor to be shut down due to the delay in addressing the foreign research reactor acceptance policy."

The draft policy concludes: "Belgium has the most critical need for renewal of the spent fuel acceptance policy. Acceptance of these shipments by the US will do more than any other single act to restore credibility to DOE and faith in the reliability of the US as a partner."

The Belgians had 150 spent fuel elements packaged and ready for transportation to the US just before the expiry of the US policy. It has now negotiated a deal with AEA

Technology, the operators of Dounreay in the North of Scotland. Prior to the publication of the draft policy, the Belgian nuclear operator SCK-CEN had been discussing two deals with Dounreay: one for the immediate shipment of some 144 spent fuel elements which would allow BR-2 to meet regulatory requirements and reputed to be worth £3 million, and a second, much larger, contract covering about 1,000 elements and believed to be valued at over £15 million.

The US government had made an eleventh-hour bid to break the initial contract. However, despite a US offer of £405,000 to indemnify SCK-CEN against any claim filed by Dounreay, Carl Malbrain, the company's general manager, said it is "not in a position to cancel its contract" because of the time required to complete paperwork necessary for the spent fuel to be returned.

According to Malbrain, "up to six casks would be needed on one dedicated nuclear cargo to the US, the casks would have to be provided from at least three different suppliers and would still have to be relicensed in Belgium and the US."

However, the company has indicated that it will send the rest of the spent fuel to the US rather than sign the second contract with Dounreay.

Washington is offering to take the spent fuel rods off the hands of research reactors for around $3,000-4,000, substantially less than that charged by Dounreay. If the spent fuel returns to the US it will stay there. Dounreay, however, has 'return to sender' clauses which means that, after 25 years, the client countries must take back all the waste generated by reprocessing.

In a letter to the DOE at the beginning of November, Malbrain said SCK-CEN "together with the other research reactor operators around the world who all have large amounts of spent fuel of US origin, are very pleased that after five years of uncertainty and indecisiveness on the renewal of US policy, important decisions are finally being made" to renew the spent fuel importation policy.

He says the prices quoted by the DOE are acceptable and looks forward to a finalised version of the contract to begin moving fuel from Belgium to the US before the end of 1993, "as a first step in a renewed long-term relationship with the US DOE, serving the mutual interest of both parties."

Not everyone is pleased about the US's re-entry into the research reactor spent fuel management business. Dounreay for one is not best pleased; after a long and hard struggle to attract research reactor reprocessing contracts it now looks as though the cheaper prices and no 'return to sender' clauses offered by the US will leave them high and dry.

Dounreay does "not accept that reprocessing presents a proliferation risk and many in the USA agree with us ... But obviously we are very concerned by all this. We have a highly skilled workforce here which needs work, a workforce that has helped ensure Dounreay's safe operation for the past 30 years."

Dounreay has warned that hundreds of jobs depend upon its research reactor reprocessing campaign. Dounreay's fuel services division has offered to work in tandem with the Americans in an attempt to save its market. The US government is, however, refusing to sanction third party storage or reprocessing of HEU. It is firmly of the opinion that the Dounreay research reactor reprocessing plant (D1204) should be closed in the interests of world safety.

Waste dump

South Carolina State Governor Carroll A Campbell jnr is horrified at the prospect of Savannah River becoming a "worldwide nuclear waste dump."

In a letter to the US Energy Secretary he said he was "frankly shocked" to discover in the *Washington Post* that the government had offered the Belgian reactor a binding contract for the receipt of spent fuel at Savannah River. He continued: "I support beneficial and productive activities at the Savannah River site, conducted in an environmentally responsible manner, and I certainly support maintaining our national security.

"However, in the present situation, the Belgian reactor fuel would go to England (sic) for reprocessing if it does not come [here] ... The British facility is a secure facility and operated by our oldest ally.

"I have serious doubts as to whether DOE's extraordinary action is justified in the name of 'national security'. I don't want to see the Savannah River site become a worldwide nuclear waste dump."

In its response to the draft policy statement, Greenpeace welcomes the Clinton administration's serious approach to proliferation fears but rejects its methods: "The US government, individually and in concert with the international community, has numerous means by which to block further reprocessing and the trafficking in weapons-usable nuclear materials. This can and should be resolved without the violation of US environmental law." It is the opinion of Greenpeace International and Greenpeace USA that the issuing of the Presidential waiver is a violation of US environmental law.

Greenpeace also lays the blame for the dangerous quantities of HEU around the world firmly at the feet of successive US governments: "The US has so far provided countries around the world with nearly 26,000kg of HEU — enough to build more than 1,000 nuclear weapons. Fresh fuel provided to these countries can be turned into nuclear weapons in only seven days and spent fuel can be converted for use in a nuclear bomb in as little as one month."

Further it says: "The US has provided this material to 43 countries — a number of which are known to have clandestine nuclear weapons programs. The US recklessly and irresponsibly continued this program for decades despite growing evidence of concern about nuclear proliferation."

Because of the international political dynamics and the use by research reactor operators of Dounreay as a stalking horse, Greenpeace believes, "the DOE has been forced to define the proliferation danger in countries like Belgium, Britain and Germany as greater than that existing in states with known proliferation records like Israel, Pakistan, South Africa and South Korea — all of whom are sitting on stores of weapons-usable HEU provided by the US ... while the PDD [draft policy] has quite rightly emphasised the threat of reprocessing, it appears to have done so to the relative exclusion of specifically analysing and addressing the risk of HEU under control of known proliferators or unstable governments."

Clearly the problem of what to do with several tonnes of HEU and spent HEU fuel which is currently spread around the world is a difficult one. However, bypassing normal democratic procedures and choosing political expediency rather than environmentally driven solutions will only serve to exacerbate the problem. Reprocessing is not the answer, nor is a blanket policy covering all nations.

Those countries with the technical expertise to dry store their own spent research reactor fuel should do so under the strict control of new non-proliferation safeguards. What to do about countries which do not have the technical expertise should be tackled on a country by country basis. If they have a research reactor then it will need decommissioned, a package which incorporates this should surely be considered. ❑

Rio rumblings

FOLLOWING the November Budget the government's plans for meeting its commitment on CO_2 stabilisation are finally complete, though not necessarily adequate. A cut of 10 million tonnes of carbon (mtC) in annual emissions is believed to be needed to counter projected business-as-usual increases throughout the 1990s.

The annual increase in fuel duty of 5% will, according to the government, produce a 2.5mtC saving — a 1mtC increase in transport sector savings on those announced in the spring budget. Critics doubt that this target will be achieved without investment in public transport.

Measures to encourage energy saving in the home, including extension of the Home Energy Efficiency Scheme ("Energy efficiency moves", p19) and VAT on domestic fuel, are meant to save 4mtC — this is slightly lower than previous estimates which contained some double counting on potential savings. Businesses are expected to save 2.5mtC, and the final 1mtC of the package is to come from savings in the public sector.

Environment minister Tim Yeo declared the Budget "better for the environment than expected," adding that the UK is determined to go its own way in imposing energy taxes and oppose co-ordinated European energy taxes.

■ The deadlock over European Commission (EC) plans for an energy/carbon tax — main stumbling block the UK government — has led the Belgian presidency to propose an alternative system. The suggestion is to harmonise excise and VAT on fuel within the European Union (EU — formerly European Community).

In reality, the plan is little different from that of the EC. The national excise and VAT rates would be applied to energy across the EU on the same 50-50 carbon/energy content basis and have the same $3 per barrel of oil equivalent (boe) starting point. However, it avoids the idea of a new tax and the $10/boe target for the year 2000 would be open to negotiation.

■ President Bill Clinton has produced a 50-point plan to meet US commitments on climate change. Relying heavily on voluntary measures by industry and individuals, it has been strongly criticised by environmental groups for failing to impose enforceable new environmental standards.

Clinton has failed to take on the car and oil lobby, making no attempt to reduce car pollution. It is just 18 months since Vice President Al Gore was proposing a fuel efficiency standard of 45 to 50 miles per gallon by the year 2000. ❑

Research funding

THE European Commission has outlined the funding and research it will support during 1994-98. While the total proposed budget of Ecu13.1bn is supported by the European Parliament, it exceeds the expenditure of Ecu10bn-12bn supported by the governments of France, Germany and the UK. Negotiations over a compromise figure are expected to stretch well into 1994.

Energy efficiency, clean technologies and renewable energies are budgeted to receive slightly more than Ecu1bn. Support for coal technologies for electricity generation is a top priority, including the development of integrated gasification combined cycle twinned with biomass, or industrial, municipal and agricultural waste. This, the Commission believes, could produce a 10-20% reduction in CO_2 emissions.

Funding is also proposed for wave, tidal, micro-hydro, wind generators exceeding 1-2MW and biomass for decentralised generation of electricity.

Fuel cells for a wide range of uses, including combined heat and power, road vehicles, ships and trains, will also receive support. ❑

Coal collapse

THE decline of Britain's coal industry continues apace; 28 British Coal pits closed in the eight months following publication of President of the Board of Trade Michael Heseltine's *The prospects for coal* white paper on 25 March 1993.

And at the beginning of December, miners at the last two pits in Staffordshire — Littleton and Silverdale — voted not to put their collieries through the discredited review procedure, meaning immediate closure. Silverdale was one of the pits "reprieved" by Heseltine, and Littleton is the first of BC's 19 "core" pits to close.

The precise timing of BC privatisation, announced in the Queen's Speech in November, will depend on parliamentary progress of the bill, but at the earliest it will be mid-1994, and could take until mid-1995. With already closed pits being offered for sale and full privatisation in the pipeline, the government has repealed legislation, passed at the beginning of this century, which limited underground mine working hours.

■ The role of Hanson, the British owned multinational, in the coal privatisation is looking as suspicious as the part it played in the electricity sell-off — through its aborted bid for PowerGen. Hanson lobbied the government for BC to be sold off pit-by-pit when others, including BC's directors and the mining unions argued against. Hanson's campaign was partially successful, with BC to be sold off as five regional divisions, each of just a few pits. But Hanson has now ruled out bidding for any of these pits.

■ As part of the shift from coal to gas-fired electricity generation, National Power has announced that it is likely to close ten of its existing coal-fired stations by the end of the decade, reducing coal capacity from 16,000MW to 11,000MW. Only eight 500MW plus coal-fired stations are likely to remain in operation, and of these only Drax to provide base-load. ❑

sell-off. But Hanson, the UK-American conglomerate, is pressing the government to allow it to bid for selected collieries. It was Hanson which, during a crucial phase in the troubled privatisation of the electricity industry, were reported to be interested in buying PowerGen. Though this eventually came to nothing, it attracted a number of other bidders and revived the sell-off. The full story of Hanson's curious role in that privatisation will probably never be revealed. ❑

***Safe Energy 95*, June/July 1993**

Energy group set up

AFTER a delay of six months, energy minister Tim Eggar has announced the membership of the Energy Advisory Panel (EAP), which was promised in the white paper on coal ("Little help for coal", *Safe Energy 94*), *writes David Ross.*

It contains only one person connected with non-polluting energy — Lady (Mary) Archer, a paid-up member of the Conservative Party, who is rapidly becoming the acceptable alternative token for the government. She served on REAG (Renewable Energy Advisory Group) which offered (in Chesterton's words) naught for your comfort, and will certainly say nothing to embarrass the government.

The panel will be chaired by Dr Martin Holdgate who became chair of REAG after Colin Moynihan was defeated at the general election. Holdgate is a biologist who said openly that he is not himself "a specialist in energy technology of any kind" and as he lived and worked in Geneva had been unable to attend any of REAG's meetings. This obviously made him the Department of Trade and Industry's (DTI) ideal choice.

Other members include: a man from the nuclear power group of Babcock; the leader of the strongly pro-nuclear Engineers and Managers Association; the managing director of Caminus, which is regularly employed by the DTI on lucrative contracts; and a man from National Grid.

On a brighter note, the panel also includes David Green from the Combined Heat and Power Association (which is much appreciated by British Gas) and Dieter Helm the Oxford economist highly critical of the lack of intervention shown by electricity regulator Professor Stephen Littlechild during the 1992/93 coal debacle.

The new body is to replace ACORD, which covered itself in shame when it provided the government with a cover-story to drop wave energy in 1982. The DTI seems determined to ensure that a majority at EAP will do as well. ❑

Energy efficiency moves

EXPANSION of the Home Energy Efficiency Scheme (HEES) was announced by the Chancellor, Kenneth Clarke, in his November Budget. An extra £35m a year for the next three years will be provided to include all pensioners and disabled people in the scheme. This is expected to double to 400,000 the number of households receiving grants for draughtproofing and insulation which was previously available only to those on income-related benefits.

The change follows the recent abolition of the client contribution which required a payment of up to £16 from the householder ("Energy saving", *Safe Energy 97*).

While the move goes some of the way to meeting calls from energy conservation charity Neighbourhood Energy Action (NEA), the grants will still not cover low-energy lighting and heating controls. And a recent study by NEA and London Electricity showed that there was a poor uptake of the HEES grants mainly because of lack of awareness of the scheme. The report recommended promotion of HEES to local authorities, housing associations and the voluntary sector as an immediate priority.

■ Sales of compact fluorescent lamps soared during a six-week promotion which reduced the price of the bulbs by £5. The cost of the price cut was met by the Energy Saving Trust (with funding of £600,000 from the regional electricity companies), the manufacturers and the retailers.

■ Despite the government's message that "saving the earth begins at home", analysis by the Association for the Conservation of Energy has shown that central government's fuel bills grew by 4% last year. The government has set itself a target of a 20% reduction by the end of the decade, but last year's increase followed a 13% rise the year before. ❑

Select findings

A report* highly critical of government action on energy efficiency was published by the House of Commons Environment Committee days before the November Budget. While moves by the Chancellor to extend the Home Energy Efficiency Scheme ("Energy efficiency moves", above) will have gone some way to placate the committee, they produced over 70 recommendations to "provide an action plan for government and the organisations charged with carrying out its policies".

Committee chairman Robert Jones MP pronounced the committee "deeply disappointed that such little progress had been made in implementing energy efficiency since the Energy Committee's report on the subject in 1991."

Amongst the committee's recommendations are:

- that the government place stronger duties on the electricity and gas regulators to protect the environment;
- that the government develop, by the end of 1995, a rolling programme of emissions targets for the years up to 2010;
- tougher government action to ensure its own departments meet the energy efficiency targets they have been set;
- a boost to the development of combined heat and power, including changes to electricity regulation;
- government action to secure proper funding for the Energy Saving Trust;
- raised energy efficiency standards for new and refurbished properties in the Building Regulations;
- mandatory energy labels for homes at the point of sale;
- measures to improve energy efficiency in offices, social housing and privately rented dwellings; and
- better information and standards on energy-consuming appliances.

The committee concludes that "if energy consumers are to behave in an energy efficient way, then the government, energy utilities and their regulators need to develop whole new approaches and attitudes to funding and implementing energy efficiency schemes." ❑

*** "Energy efficiency in buildings", Environment Committee, (HC 648, 1992-93); HMSO, November 1993.**

French waste-heat

A district heating scheme is planned for Nancy, France, as part of a Ffr330m (£20m) waste treatment project designed for low pollution and energy efficiency.

A loan of Ffr130m has been approved by the European Investment Bank and research support will come from the French Environment and Energy Management Agency and the City of Sciences and Industry of Paris.

The waste centre will deal with 120,000 tonnes of domestic and hospital wastes per year, which will be recycled or burned. Heat will be fed into a 4,000 house district heating scheme. Due for completion in October 1995, it will include an experimental unit to test new methods of recycling and waste disposal. ❑

CHP licence change

WITH the government committed to a target of 5,000MW of combined heat and power (CHP) plant in the UK by the year 2000, as part of its package on CO_2 stabilisation, Michael Heseltine, the President of the Board of Trade, has announced a change in supply licence rules to encourage CHP.

The previous requirement for a supply licence when less than 51% of generated electricity was for own-use, which made it difficult for companies to opt for CHP, has been removed. The change will also exempt self-generation from the 10% nuclear levy in England and Wales.

Although there has been a recent growth in CHP, with 1,000MW installed or committed since 1989 — when there was a total of just under 2,000MW — National Power has estimated that total capacity will reach only 4,200MW by the end of the century. The combined heat and power association has called for further measures to encourage the technology, including: a change in the NFFO to allow the heat element of waste-burning CHP to qualify for the subsidy; further support for CHP from the Energy Saving Trust; and an increase in the 10MW limit above which CHP operators are required to have a generating licence and to join the complex electricity pool system. ❑

Power link-up

THE £85m upgrade of the West-Coast interconnector between Scotland and England, which will be used mainly for increased electricity exports from Scotland, is now complete.

It increases capacity on the link by 750MW to 1600MW, though it will be restricted to 1200MW until a new line is constructed in Yorkshire. ❑

Cumbrian incinerator plan

THE controversial plan for a £40m waste incinerator near Carlisle, Cumbria ("Waste not", *Safe Energy 91*), has received backing from ScottishPower (SP).

Bob Brown, business manager for SP's new ventures, expressing an interest in his company being part-owner or operator of the plant, said: "We see this as an appropriate solution to the local problem in Carlisle."

Cumbrians Opposed to Waste Incineration reacted angrily to SP's involvement in the scheme, the future of which had been in much doubt.

As well as concern over emissions from the plant, opponents have criticised the failure to use the most appropriate techniques: anaerobic digestion for organic waste, and pyrolysis for tyres and plastics. Further they argue that the planned recycling of 5.2% of the waste material does not compare favourably with other European schemes. ❑

English & Welsh wind

THERE are now 19 operational windfarms in England and Wales following the commissioning of two more developments, one in each country.

National Wind Power's 12 Vestas Windane 400kW turbines at Kirkby Moor, Cumbria, began operating in mid-September and the windfarm was formally opened in October by Lord Wakeham. As energy secretary, it was Wakeham who salvaged the privatisation of electricity from the mess created by his predecessor, Cecil Parkinson, by cobbling together a package which included the Non Fossil Fuel Obligation (NFFO). Though the chief beneficiary of this subsidy has been nuclear power, it has also given birth to the fledgling wind industry.

South Wales' first windfarm, at Taff Ely, Mid Glamorgan, was commissioned in early September. The 20 Danish Nordtank 450kW turbines are jointly owned by Nordtank's UK agent, Perma Energy, and East Midlands Electricity.

Planning consent

Planning permission has been granted for a 22-turbine windfarm at Bryntitli near Rhayader, Wales. The development, by National Wind Power, has met with opposition over visual intrusion and noise and was originally refused planning permission by the local council on the casting vote of the Chairman. The scheme will use 450kW Bonus turbines rather than the Mitsubishi machines which have been the subject of noise complaints at Ecogen's 103-turbine Llandinam windfarm 20km to the north (see below).

Parys inquiry

A plan for an eight-turbine, 4MW windfarm on Parys Mountain has been turned down by the Welsh Office following a public inquiry ("Wind round-up", *Safe Energy 97*).

Anglesey Mining Ltd, which had hoped to use windpower to supply the National Grid, providing income until metal prices rise to the point where the mining of zinc, lead and copper would be economic at its Parys mine. The company has denied that the decision has put in jeopardy its plans to employ 150 people, but admits that it will make financing of the mining project more difficult.

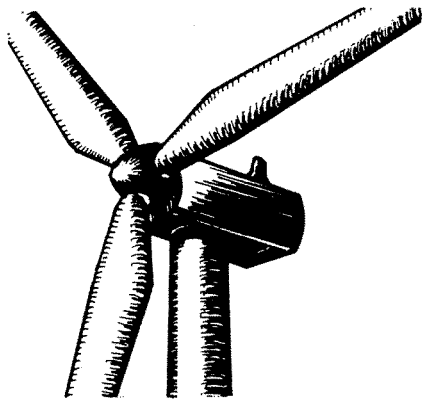
While much of the debate at the inquiry centred on noise levels, the Welsh Office inspector concluded: "I do not consider that the effect of noise would sustain the refusal of planning permission." However, on the grounds of unacceptable visual impact, the inspector dismissed Anglesey Mining's appeal against refusal of planning permission by Anglesey Borough Council.

CPRW rejects windpower

The rapid development of windpower in Wales has not met with the approval of the Campaign for the Protection of Rural Wales (CPRW). In a change of policy, the organisation's National Council has called for a moratorium on the NFFO subsidy to windpower.

CPRW argues that the subsidy would be better invested in energy conservation measures, and has called for the money to go to the Energy Saving Trust.

Recognising that "the Welsh countryside [is] threatened by the way energy is currently generated and used (eg through pollution, acidification, opencast



mining [and] radioactivity)," CPRW believes that "renewable energy must make an increasing contribution to our energy supply needs over the long term."

However, it will oppose all new windfarms "until such time as substantial results have been achieved through conservation measures and windpower generation is proven to be cost-effective." This begs the question of how windpower is to progress to proven cost-effectiveness if no new windfarms are built.

Reporting opinions

With complaints about windfarms having grown rapidly, two new reports have canvassed people's views on their impact. A study by the government's Energy Technology Support Unit, *Attitudes towards wind power*, examined public opinion on the UK's first windfarm near Delabole, Cornwall. Having carried out a survey in 1990, before the windfarm was built, ETSU did a follow-up study six months after start-up in 1992. Forty per cent of people had thought that visual intrusion would be a problem, but this dropped to 29% once the turbines had been erected. While in 1990 only 14% had thought there would be no problem from noise, in 1992 80% said it was not a problem. Four fifths of people also said the windfarm had made no difference to their daily lives. 44% of those surveyed approved of the development and 40% approved strongly.

A second report, *Down on the windfarm* by Sue Walker, published by the Network for Alternative Technology and Technology Assessment (NATTA), looked at the Llandinam windfarm in North Wales which has received much attention over complaints of noise problems. The report involved a series of interviews with local people, environmental groups and the developer, Ecogen. Although only around 20 households are significantly affected by noise from the 103 turbine development, Walker concludes that "problems with noise do exist, and actions must be taken to face up to the problems and solve them. If the solution lies in increased community involvement, then it is time for the windpower industry to take steps in this direction."

Wind rules

Certification for wind turbines will be introduced in 1994 with the establishment of a conformity assessment (CA) system to be developed by Lloyd's Register of London.

Lloyds, together with turbine manufacturer Wind Energy Group, consultants Garrad Hassan and the National Engineering Laboratory, which runs the National Wind Turbine Centre, have been awarded a one year contract by the government's Energy Technology Support Unit to produce a CA system similar to those already used in Denmark, Holland and Germany.

Certification of turbines reduces the risk for investors, so lowering financing costs, but there are now a whole range of different certificates and safety standards worldwide which causes problems for manufacturers and developers. The British CA is to be as similar as possible to the Danish and Dutch systems in the hope that a European or international system of certification can be introduced in a few years time.

FoE planning checklist

Friends of the Earth (FoE) is putting together a checklist of best planning practice designed to encourage windfarm developers in Britain to be more sensitive to local fears when planning and building their projects. While FoE supports windpower, it is concerned that some local communities are being alienated by the actions of some developers.

FoE is seeking views from wind developers and local groups to help in compiling the checklist.* ❑

*** Friends of the Earth, 26-28 Underwood Street, London N1 7JQ.**

Scottish wind stirrings

SCOTTISHPOWER is planning what could be Scotland's first commercial windfarm, at Burnt Hill, Cunninghame. A planning application has been submitted to Cunninghame District Council for 19-21 three-bladed turbines, with a generating capacity of 9.5MW, at a site in a remote rural area 6km from the nearest town, Largs.

ScottishPower already operates Europe's largest windfarm: the 31MW, 103 turbine development at Llandinam, North Wales.

The Burnt Hill project, if accepted, would provide 4MW declared net capacity towards the 30-40MW first tranche of the new Scottish Renewables Obligation, which will require ScottishPower and Scottish Hydro-Electric to increase their renewables capacity.

■ Another Scottish windfarm application, for seven turbines at Wardhill, Whitecairns, near Aberdeen has been refused planning permission by Gordon District Council.

While the council is sympathetic to the development of windpower, this particular scheme ("Wind round-up", *Safe Energy 97*) was not considered suitable. The director of planning had recommended refusal as there were "too many noise sensitive residential properties within the zone of influence" in accordance with the Scottish Office *Draft Planning Advice Note on Wind Energy Developments.*

While some councillors expressed concern over visual intrusion — an issue raised in written objections from, amongst others, the Association for the Protection of Rural Scotland — on the casting vote of the Chair the application was refused on grounds of noise alone.

The unnamed backers of the project have the options of submitting an appeal to the Secretary of State for Scotland and/or submitting a fresh planning application, for different or fewer turbines, which might meet the noise requirements.

■ Concern has been expressed that the development of windfarms in Scotland will be for the financial profit of absentee landlords and opportunist speculators rather than the benefit of local people.

Speaking at the Caithness area executive meeting of the Scottish National Farmers' Union, Colin Mackenzie, a former branch president, said: "If we must have these things, there must be some benefits to the communities involved."

Mackenzie went on to argue for more appropriate renewables development: "We've got hydro power and we could develop it to much better effect and to the greater benefit of the community." ❑

Costa Rica wind plan

PLANS are underway for a 20MW windfarm in Costa Rica: preliminary studies by the state utility, Instituto Costarricense de Electricidad (ICE), have identified a suitable site following detailed anemometer measurements.

In 1992, the US Agency for International Development and ICE sponsored the first phase of a feasibility study and ICE is now looking to secure funding from the Global Environment Facility, which is run by the World Bank in conjunction with the UN. Total investment cost for the project is put at $29.7m.

ICE believes that the development could serve as a model for other grid-connected windpower projects in Central America. ❑

Dutch wind subsidy worry

SMALL private investors in the Netherlands claim that their government's new system for allocating wind energy subsidies will favour large development companies and make it harder for farmers and wind co-operatives to obtain support for their projects.

The new system — which maintains the subsidy of up to 35% — will allocated funding through a tender procedure including an assessment of viability. Opponents argue that this will benefit large project developers who will have the strength to push through applications for building permits, quickly secure financing and efficiently sort out any grid connection difficulties. ❑

French biofuel progress

DIESTER, a variant of the biodiesel fuel derived from rapeseed oil, developed by the French Petroleum Institute is finding a growing market. The fuel mixed with diesel is designed to run any vehicle with a standard diesel engine, and tests have shown that a mixture with up to 30% Diester does not affect engine performance, longevity or maintenance.

Already many ELF service stations, particularly in the Paris region, offer diesel fuel with up to 5% Diester. Jacque Delors, president of the European Commission, believes that the fuel will become accepted throughout the European Union (formerly European Community).

France's first Diester factory, a £5.8m pilot plant at Compiègne, north of Paris, plans to double output to 40,000 tonnes a year. Luc Schorter, general manager of Ouroumoff which built the plant, believes that within five years there will be five such plants each producing 100,000 tonnes a year — 5% of French diesel fuel use. ❑

Coalbed methane

PLANS for a coal bill and a National Coal Authority, announced in the Queen's Speech in November, could pave the way for development of coalbed methane.

The methane, chemically bonded to the walls of cracks and fractures in coal, can be extracted by pumping high pressure water down drill holes opening up fractures and releasing the gas. (Natural gas fields are derived from the same source having been squeezed from the coal by the heat of the earth and the pressure of overlying rock.)

There are already 3,000 such wells in the USA which account for 17% of US gas reserves, but in Britain there is just one exploratory well.

Energy minister Tim Eggar wishes to see exploitation of this "potentially significant energy source" which could be equivalent to a major North Sea gas field. ❑

Heat pump water heater

DEVELOPERS in the USA have produced an advanced heat pump water heater which it is claimed can cut costs by two-thirds.

The 500W E-Tech device, for domestic and small commercial use, can heat up to 1,135 litres a day with a heat output more than two and a half times the electricity input. Its coefficient of performance of 2.6 compares with existing heat pump devices which operate typically between 1.5 and 2.

The heat pump, developed by Crispaire and Electric Power Research, can extract heat from a variety of sources, including outside air, in the range of 1.6-37°C to provide water at a maximum temperature of 57°C.

The initial US price for the E-Tech heater will be $595 (£400) but this is expected to drop to $395 (£267) with volume production. ❑

REVIEWS

The global greenhouse regime: who pays?; Peter Hayes and Kirk Smith (Eds).

UN University Press/Earthscan; 1993, 376pp, £24.95.

This book takes a thorough look at the implications of the Climate Change Convention agreed at the Rio Earth Summit in 1992. Its primary purpose is to examine how the convention can be implemented — particularly with regard to North-South divisions.

Part one, "Measuring responsibility", explains the complexity involved in assessing the relative effects of different greenhouse gasses, from both a scientific and a political perspective. While CO_2 is the most talked about greenhouse gas, the range of less prevalent but more potent gases, the complex interaction between them, their indirect effects and their widely varying durations in the atmosphere make comparison between gases highly complex. From a political perspective, different countries will have different views about which gases should be included, which sinks credited, and whether or not to include historic emissions. As the authors suggest, the perspective of a New Zealander who lives in a country with 20 ovine methane emitters for every human may be very different from that of a fossil fuel burning Swiss; and someone from a newly industrialised country like Singapore might feel more strongly that past emissions are important.

In part two, the authors consider resource transfer, how the North should help the South in the battle against climate change. This whole area makes the political divergence highlighted in the previous section seem inconsequential by comparison.

Peter Hayes attempts to put an indicative figure to the financial commitment that will be necessary by the North to the South: "The incremental cost of abatement and coastal protection in the South that is justifiably the responsibility of the North is of the order of $30bn per year. To these costs should be added a sum for human resource development needed to realise the South's carbon abatement potential, perhaps as much again." To this he adds $100m for technical assistance, training and information, and a similar amount for monitoring and verification.

Part three looks at the very different positions of a range of countries and regions, including India, West Africa, Eastern Europe and Australia. Clearly a diversity of approach will be necessary to tackle the problem of climate change in such widely differing circumstances. There should be no doubt about the potential for disaster if the developing countries follow the path of the developed nations. As the authors of the chapter on India point out, "CO_2 emissions from the developing countries between 1870 and 1986 are estimated to be only 15% but, with 76% of the world's population, their share of energy-related CO_2 emissions in 1986 was about 27%." A share that is rapidly increasing.

The book raises far more questions than it answers, but it does provide options and guidance for future progress. With far simpler problems throughout the world unresolved, one can only hope that realisation of the dangers of inadequate action will prove a sufficient incentive for the world's political leaders to see far enough, in geographical and chronological terms, for solutions to be found and applied.

GRAHAM STEIN

REVIEWS

Facing the future: beyond the earth summit; by J Holmberg, K Thomson & L Timberlake.

International Institute for Environmental Development/Earthscan; 1993, 48pp, £4.95.

Was the United Nations Conference on Environment and Development (UNCED) a success? What does it mean for the future? Here International Institute for Environment and Development writers give their account and interpretation of the event.

The conference, or Earth Summit, held in June 1992, was the most complex ever organised by the UN. It was attended by 178 governments, and there were some 120 Heads of State at the Summit which concluded the Conference. This "is not simply an account of the conference as history. Rather it tries to explain how the Summit changed the face of the Environment/Development landscape and institutions, and it lists the targets and timetable agreed in Rio. Yet, given the size and range of the conference documentation, any attempt to draw conclusions must be subjective and coloured by the perspective of the onlooker," reads the introduction. Fortunately the IIED's chosen onlookers are sufficiently expert in their fields to provide a clear and lucid account of the event and its implications.

UNCED produced five main formal documents: treaties on climate change and biodiversity, a statement on forest principles, the Rio declaration and the action programme, Agenda 21. Each one is examined and its major features and weak points highlighted. On the climate change convention, for example, Mick Kelly and Sarah Granich comment that the "intensely political process of drafting the convention has resulted in a text not so much characterised by compromise but by an effort to avoid the resolution of conflicting positions through vagueness and ambiguity."

While recognising that many of the greenhouse abatement strategies "can be justified in their own right and can also help in solving other environmental problems" (what policy makers refer to as 'win-win' actions), the wording of the convention is so vague the authors report it "creates ample opportunity for endless negotiation on subsequent protocols."

Taken as a whole, the convention lends weight to a number of important environmental principles such as the 'precautionary principle' but it gives the overwhelming impression that the politicians have failed to grasp the true "import of climate change and its implications for the development process."

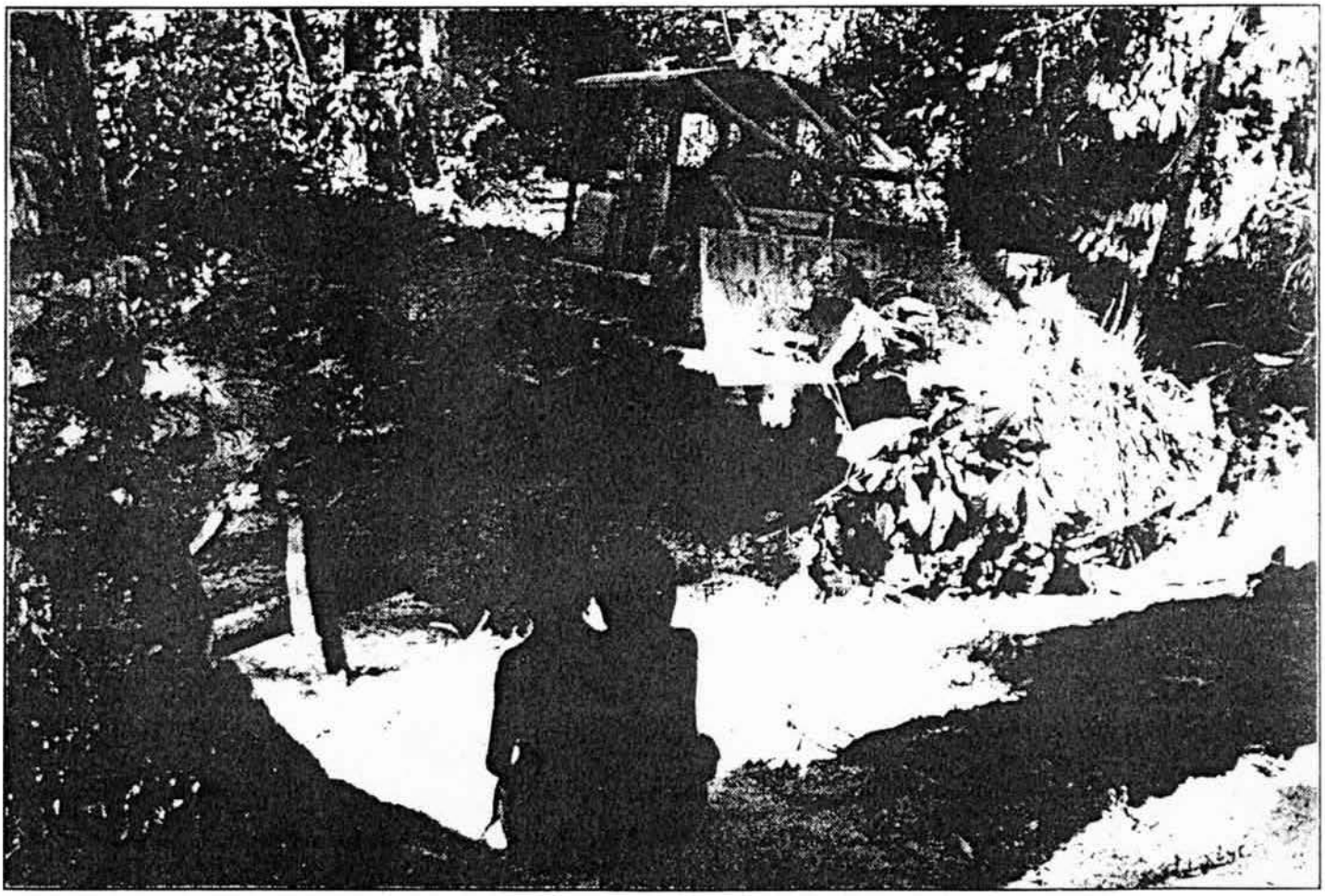
While not exactly waxing lyrical about the convention, Kelly and Granich believe: "Whatever its limitations, the framework convention does clearly signal the world's politicians are noticing global warming ...

"The climate treaty represents a tentative first step: whether it is a step in the right direction remains to be seen."

These comments on the climate convention can be easily applied to the rest of UNCED's output; it offers scope for progress but no guarantees. The guide concludes: "However you judge the Earth Summit, the work starts now to put some reality behind its words."

This is a book for all those, like John Major perhaps, who feel they don't understand what happened at Rio, but feel they should and lack the time and resources to trudge through the full documentation.

MIKE TOWNSLEY



Eggar variation

LBR has heard that Yorkshire TV is making a — presumably very short — programme on government energy policy. Energy minister Tim Eggar espoused the virtues of market forces, claiming that true costs lead to rational decisions.

The interviewer questioned Eggar further: "What about the nuclear levy? Do people know that their electricity bills are 10% a year higher than they need be, to keep the nuclear industry afloat?"

Showing signs of political astuteness not previously attributed to him in this column, Eggar played the reverse failure-to-get-the-message-across gambit: of course the public know about the surcharge, and they approve, that's why there's no fuss about it.

Brilliant!

Confused Offer

As head of Offer, Professor Stephen Littlechild, is the Jiminy Cricket of the electricity industry, ensuring that the electricity companies do not abuse their monopoly positions with excessive price rises.

Rightly or wrongly, Littlechild's failure to intervene as the dash-to-gas received much criticism during the debate over pit closures, turning him from hero to villain.

His reputation improved somewhat when he started changing the price control rules to allow the regional electricity companies to promote energy efficiency; it seemed that the economic and environmental arguments for energy efficiency had finally been accepted. But have they?

Giving a lecture in Boston, USA, Eileen Marshall, Offer's chief economist, announced that energy conservation money was only to go to help low income households, stressing that it would be wholly inappropriate for such "subsidies" to be environmentally oriented, rather than purely for social welfare.

Trading war

Electrical goods retailer Dixons has been not inconsiderably upset by the retail shops run by the regional electricity companies (recs).

While the privatised companies could chose to sell fruit and veg or cuddly toys, not surprisingly they persist in flogging electrical equipment.

As the recs shops have made a collective loss of £104m over the past three years, Dixons felt it had a strong case that illegal cross-subsidies from electricity sales were being used to prop up the retail outlets.

Offer does not agree, its investigations show that the loss has been borne not by electricity users but by rec share-holders. The recs can't be making excessive profits from electricity sales — Offer sees to that — and the shops are run at a loss, but they are highly profitable companies with buoyant share prices. Confused? LBR is!

Inquiry call

Amongst those keen to have a Public Inquiry over Nuclear Electric's plan for Sizewell C is the prestigious Aldeburgh Music Festival. It's not that the organisation has any particular interest in the outcome of the inquiry — just that like the marathon Sizewell B inquiry they'd like to host the event.

The Maltings at Snape financially benefited not inconsiderably from the two years Sir Frank Layfield spent taking evidence — helping to pay for conversion of several buildings for the arts centre. As there are still some buildings which need work done on them, another inquiry would be the perfect fund-raiser.

Barrels of laughs

Scientists monitoring radio-activity in the Gulf of Fallarones National Maritime Sanctuary off San Francisco are a little puzzled. A five square mile site at a depth of 3,000 feet is meant to be home for 3,500 barrels of radioactive waste — but there aren't any. Having checked the entire 50 square mile sanctuary, they have made just 100 'contacts', which may or may not be barrels of waste.

The scientists think that either the barrels have drifted outside the area or that they were dumped in an unauthorised site elsewhere.

Then again, maybe Neptune has got a reprocessing contract with Sellafield.

Summer holiday

For anyone planning their 1994 summer holidays who might be considering a trip to Cumbria, a word of warning from LBR. A tourist brochure for the area, "Cumbria: Western Lakes and Coasts", produced by local councils, suggests that "for a refreshing contrast to the inland beauty of the Central Lakes, a visit to the county's western coast can prove to be a great day out". Amongst their list of coastal attractions is Seascale Beach, better known for the outflow pipes from Sellafield than a place to take the kids!

Comment: Thorp update

JOHN GUMMER has finally decided that being responsible for a massive increase in the risks of nuclear proliferation and the death of some 200 people is preferable to scrapping the Thermal Oxide Reprocessing Plant at Sellafield (see Comment, p2, and "Thorp questions", p7, this issue).

Not for Gummer the political suicide of being the man who stood up to the nuclear lobby or the man who upset both the German and Japanese governments by making them face up to the immediate problem of what to do with their countries' radioactive waste.

A decision to axe the plant, which has been complete and standing idle for over a year, would lay open his own government to accusations of incompetence. Now, however, having to respond to such accusations have been postponed. He has passed the buck to future generations and their politicians.

As was widely anticipated, he announced (15 December) that "there was sufficient balance of advantage in favour of the operation of Thorp." He also claimed that increased discharges from Sellafield as a result of operating the plant "would not lead to unacceptable risks to human health or the environment." He has scaled down the planned massive increases in the levels of discharges from Sellafield that Thorp was to bring. However, they still represent a huge increase on current levels.

In weighing up the decision, Gummer barely considered the key question of justification for the plant, based upon whether its consequent radioactive discharges were justified by the plant's supposed net benefit to society. He paid little regard to whether or not BNFL's claim that the plant will make a profit of £900 million in its first decade was true: ministers "are not persuaded that so much weight should be based upon calculations relating to BNFL's profitability." Instead they conclude: "While it is important that BNF should be able to fulfil its financial and environmental obligations, this does not depend on any particular level of profitability."

Accepting "that circumstances have changed" since the plant was ordered, the bottom line is that "the contractual arrangements between BNF and its customers are the best and clearest evidence of the utility of reprocessing and Thorp": an aberrant strain of the free-market philosophy which treats commerce in weapons-grade plutonium and deadly radioactive waste as if they were no more than apples and oranges. No fear of Gatt-type arguments in the international trade in fissile material. The government has decided that if the nuclear industry — that bastion of honesty and good faith which brought you Windscale, Three Mile Island and Chernobyl — says it's OK, then it's OK!

Well it's not OK, and a clutch of legal actions challenging the legitimacy of the government's decision have been launched.

■ Friends of the Earth has described the decision as both "illegal and wrong" and is taking its case to the European Commission and ultimately to the European Court of Justice.

FoE contends that the government has failed to comply with its legal obligations under the Euratom treaty, to justify the harm caused by Thorp's nuclear discharges. The Commission is investigating FoE's complaint as a "matter of priority". FoE will take legal action against the Commission if it fails to prevent "this breach in European Community law by the UK government."

FoE believes that an alternative to Thorp does exist: "By storing spent nuclear fuel instead of reprocessing it, FoE concluded that BNFL could cover all the outstanding costs of building Thorp, increase its predicted profits by £180 million and offer its 'customers' a ten per cent discount on payments they were expecting to make over the next ten years."

■ Greenpeace is also making a legal challenge to Gummer's decision. In concert with Lancashire County Council, a statutory consultee on the Thorp issue, it is seeking a Judicial Review in the High Court.

Greenpeace hopes to establish that under the Radioactive Substances Act a public inquiry is required for a development of this nature. Like FoE, it will challenge the validity of the government's decision on the grounds that the discharges are not justified by a net gain to society.

The campaign to stop Thorp is not over yet. With the two legal actions we still have a chance. It is not too late to register your protest. You can, and should, write to your MP and MEP condemning the undemocratic way in which the government reached its decision and calling for a full public inquiry into the Thermal Oxide Reprocessing Plant. With the stakes so high we cannot afford to let the pressure drop!