The Anti Nuclear & Safe Energy Journal

SCRAM

NUCLEAR POWER? NO THANKS

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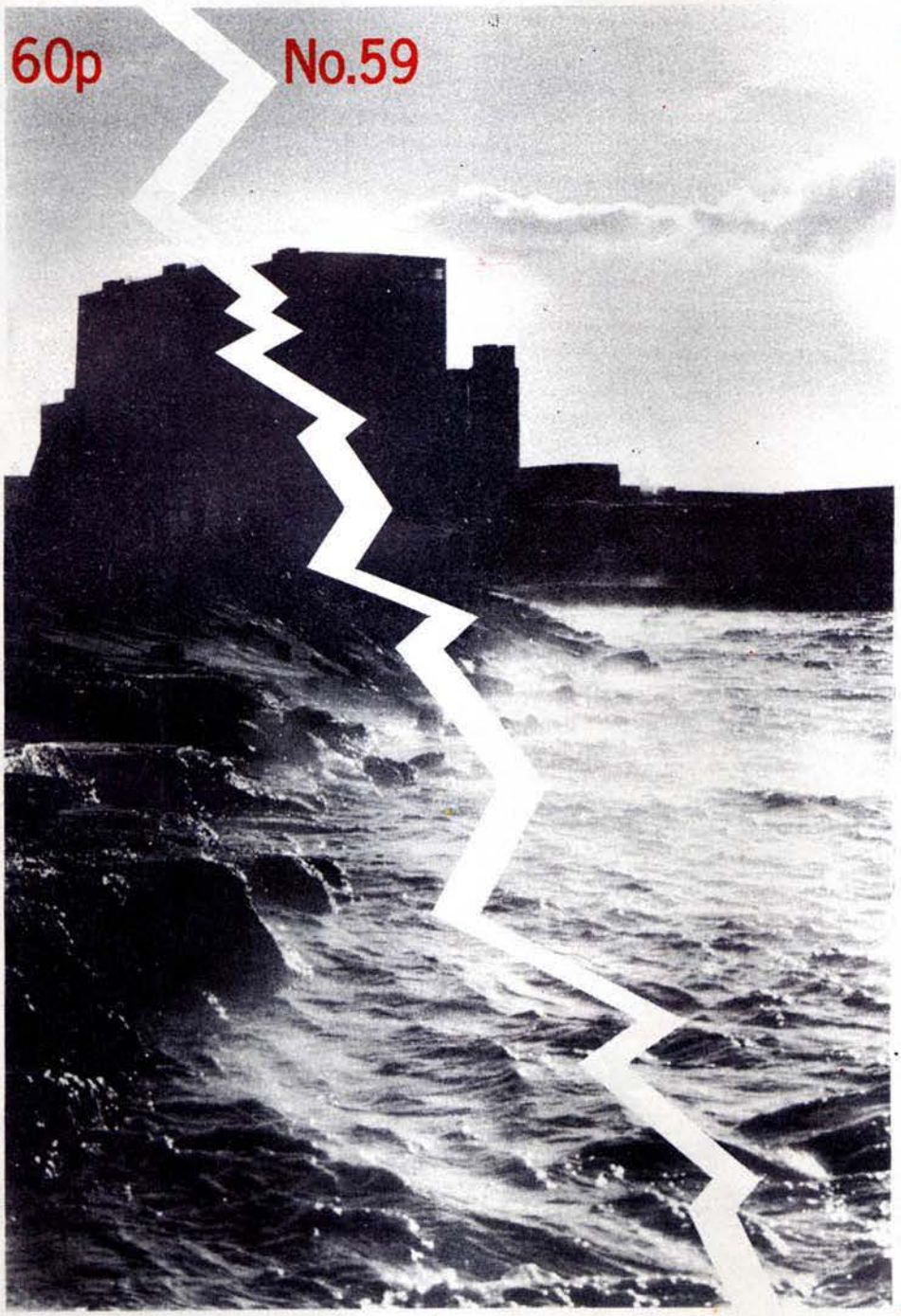

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COMMENT

The important nuclear development since the last SCRAM Journal was the Government's go ahead for Sizewell B: the world's first reactor order since Chernobyl, and Britain's first since the go ahead was given to Torness and Heysham 2 in 1978. Of great concern is the CEGB's announced intention to build "a small family" of PWRs, starting with Hinkley Point C. At the time of the campaign in the south west to close the Hinkley A Magnox station, and a concerted push in Scotland to prevent the opening of Torness, another nuclear announcement is designed to divide and demoralise the opposition. But, it should make us more determined. The article on the facing page gives us hope: the local authorities on Severnside are joining forces to oppose Hinkley C, and hopefully they will work closely with local authorities in other threatened areas - Lothian Region, Northumberland, the County Council Coalition against waste dumping and the Nuclear Free Zones - to formulate a national anti-nuclear strategy. And remember: only the Tories support the PWR - in the coming general election we have the opportunity to vote out Sizewell B, Hinkley C, Torness, Heysham 2, and all the rest. Vote tactically.

Can nuclear waste be safely disposed of under the seabed? An important question surely. SCRAM has always believed that there must be three conditions on any method of dealing with nuclear waste: the source of that waste, the nuclear power and weapons programmes, must be stopped; the waste must be monitorable; and it must be retrievable should anything go wrong. Instead of considering this angle, the Press preferred to cover the fact that George Pritchard left Greenpeace to work as Trade Union liaison, on the advice of the Unions, with the company which is investigating the subject. They didn't know all the facts. To further the debate, this issue of SCRAM includes an interview with George Pritchard, in which he describes his resignation as "an agonising decision", and explains his reasons. Until their study is published, SCRAM cannot oppose or support the proposal; but we must keep an open mind. And we all must remember that the company concerned is not in a position to stop the nuclear power programme: it is only the politicians, responding to pressure from the people, who can do that.

Distorted logic. A recent report by the Bradford School of Peace Studies reveals that, conventional strikes on nuclear power stations could produce as much fallout as a nuclear exchange. The megadeath enthusiasts therefore argue that we might as well keep the nuclear weapons, when they *should* conclude that we must get rid of nuclear power stations too.

Nuclear Family Planning

With the go ahead for Sizewell B now given, attention has shifted to the next PWRs. HUGH RICHARDS has followed the debate and describes the changes in CEGB policy over the years. He also urges everyone to support the Severnside Local Authorities in their objection to Hinkley Point C.

What happens after Sizewell B? The Central Electricity Generating Board (CEGB) have said that they want a "small family" of Pressurised Water Reactors (PWRs). But their often inconsistent notions about family planning, and the Chairman's tendency to make strategic decisions "on the hoof", have created confusion. To understand the implications for England and Wales it is necessary to return to an earlier riddle: what is a programme?

That is the question we have asked ever since the December 1979 Government announcement of a 15GW nuclear "programme" (equal to a dozen Sizewells) over 1982-92.

Part of the CEGB's confidential 1978/79 Development Review of "Station Siting Possibilities" was submitted to the Sizewell Inquiry by the Suffolk Preservation Society. Sites considered were for inclusion in programmes for start up in the period 1985-90. The assumption was that site work on a PWR would start in 1982, followed by a further four stations, or more, depending on whether Advanced Gas-cooled Reactor (AGR) or PWR plant were chosen. 11 sites were considered, with comments on factors ranging from safety to local reaction.

Connah's Quay was regarded as unacceptable to the NII (Nuclear Installations Inspectorate) because of population density. Didcot was seen as possible for an AGR, but there were worries about polluting the Thames with liquid radioactive discharges, particularly those following an "incident". Fawley and Hartlepool were not favoured because of adjacent petrochemical works, and strong NII concern about potential hazards. Bradwell and Denver would be unnecessary if Sizewell went ahead. Portskewett was unsuitable for a PWR: the NII had asked for assurances that the site could be protected from the blast of railborne explosives on the main south Wales-Midlands line, but the CEGB regard the site as "conveniently situated" at the point where the national grid crosses the Severn.

On 25 August 1982 the CEGB announced the list of candidates after Sizewell: Dungeness, Hinkley, Bradwell, Druridge (Northumberland), Winfrith (Dorset) and Sizewell C. Of these, Hinkley C was to be regarded as a "firm commitment".

By March '83 changed economic circumstances meant, according to the Department of Energy at the Sizewell Inquiry, that there was no longer a sound planning basis for a 15GW programme. No fixed programme existed, and nuclear plant ordering would be on a step-by-step basis (Layfield, chapter 91, para 91.2)

CEGB POLICY CHANGED

The CEGB began the Inquiry maintaining that Sizewell B was a single project: there was no final sequence of reactor types on identified sites. In December 1984 Lord Marshall stated: "Layfield permitting, we shall build 6 PWRs by the end of the century in the south of the country." By the end of the Inquiry they stated that Sizewell B should be considered as the first of a small family, of 3, 4 or 5 PWRs.

In his report, Layfield was scathing in his comments on the CEGB's approach. He said the significance they attached to Sizewell B, for its future plans, could and should have been made clear from the outset (para 91.11). He regarded the case for Sizewell as one for a single station. If Sizewell is approved, the CEGB consider it likely that other PWR applications will follow, but Sir Frank accepted their assurance that approval would not remove the need for a proper comparison of the alternatives when decisions are taken on future sites. If and when other alternatives, such as the Severn barrage or CHP, reach the stage of economic alternatives, they should be included in the analysis (para 2.179). These conclusions make a substantial case for re-examining the economics of the PWR against alternatives.

On 15 March 1985, eight days after the end of the Inquiry, Lord Marshall announced the existing Magnox reactors at Trawsfynydd would probably close in 1955, and one option would be a PWR on the site, using either cooling towers or direct cooling from an enlarged lake. Wylfa was also added to the list.

We anticipate strong pressure from the CEGB and the Government to truncate any public inquiries into the CEGB's "small family". The first task of ahe combined opposition will be to resist the "streamliners" who would restict the terms of the inquiries to local planning considerations.

At Hinkley the battle lines are already being drawn. Somerset County Council have asked the Severnside Local Authorities to consider taking part in a joint opposition to the anticipated application for a PWR.

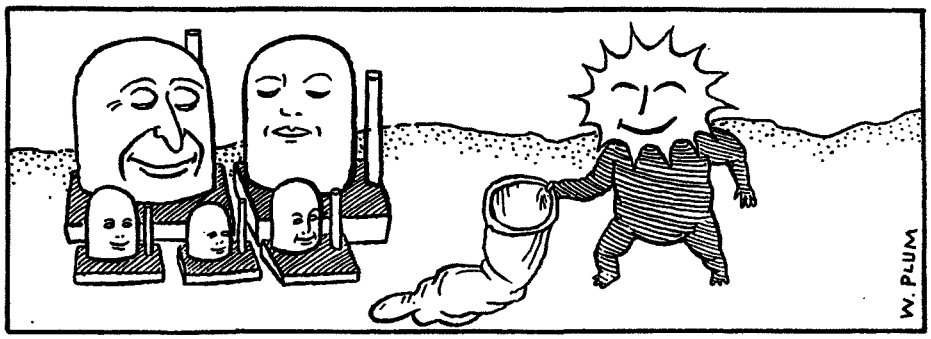
The four County Councils in the "Standing Conference on Regional Policy in South Wales", namely Gwent and the three Glamorgans - South, Mid and West - are opposed to the further development of nuclear power and are worried about the effects on south Wales of a serious accident at Hinkley Point. Avon County Council and the City Councils of Gloucester, Bristol and Exeter have all passed motions opposing the further development of nuclear power. Devon County Council have avoided a head-on approach by commissioning an alternative energy strategy for the County from the SW Energy Group.

Somerset County Council have allocated £250,000 to fight Hinkley C at the Public Inquiry, and believe that safety and general evironmental issues merit a joint approach from the Severnside Local Authorities.

It is vital that individuals and organisations, as well as local authorities, register their protest at this folly. Write NOW asking for details of the CEGB's planning application for Hinkley Point C, because you intend to object, to:

County Planning Officer
Somerset County Council
County Hall
Taunton TA1 4DY
0823 73451

District Planning Officer
West Somerset Disrict Council
Killick Way
Williton
Taunton TA4 4AQ
0984 32291



Chernobyl

Friends of the Earth have called into question two recent estimates of cancer deaths resulting from Chernobyl.

The NRPB estimate of 1000 EEC deaths is based on risk estimates which are out by a factor of at least two and maybe five according to Stewart Boyle, of the FoE safe energy campaign.

Mr Boyle told SCRAM that the ICRP (International Commission on Radiological Protection) risk estimates, used in the survey are likely to be revised upwards by a factor of two later this year. "But evidence available says that they should go up by a factor of five." If these figures were used, then the maximum number of deaths in the EEC would be around 15,000. Non fatal cancers could be as many as 60,000.

Mr Boyle described a recent Russian estimate of 600 deaths in the USSR as a "nonsense with no scientific basis." He said that the figure is being pushed forward without the normal scientific process of putting forward a paper, justifying the results, for peer review: "frankly, just to come out with these figures is sheer propaganda."

Convertion

Two contracts for converting the Zimmer nuclear reactor in Ohio USA to coal firing have been awarded.

When conversion was proposed in 1984, the nuclear and financial communities were sceptical of the project. They thought that little of the nuclear plant would be suitable for coal fire. The signing of the new contracts indicates that any problems have been overcome.

The contracts are to supply a 1300MW pressure boiler and a "topping turbine" for the existing turbine generating system. This will allow the turbines to run at the higher temperatures and pressures necessary for coal fired generation.

Namibia

West Germany and South Africa are planning to dump nuclear waste in the Namibian desert, according to the leader of the South-west Africa People's Organisation.

The allegation, which was made by Mr Sam Nujemo following a meeting with President Sarney of Brazil, has been denied by the West German authorities. However, investigations by the *Namibia Nachrichten* reveal that the South African backed "interim" government in Namibia are in favour of such a project. They believe that it could earn Namibia an "annual income which is four times the amount of the national budget".

According to the *Namibia Nachrichten*, the planned repository is north east of Luderitzbucht.

Waste Row

The CEGB and BNFL are at loggerheads over where to site a dry interim waste store for AGR fuel.

The £200 million buffer store was first proposed in April last year, as "insurance" against delays at the Thermal Oxide Reprocessing Plant (THORP) at Sellafield. It would be used to store spent fuel from the seven AGR stations around the country.

BNFL and the CEGB have now proposed two contending sites for the store. BNFL want it at Chapelcross in South West Scotland. They are concerned that the site, which houses Britain's second oldest magnox reactors producing plutonium for the military, will soon have to close if they cannot find an alternative use for it.

The CEGB, however, want the dump at Heysham in Lancashire. They claim that it will create work for people who are laid off when Heysham two is completed. The local Labour PPC, Jos Galagher does not agree. He told SCRAM "it will only be a fraction of the work force and will only be for a very short period". He is concerned that the area will become the "dustbin lid" of the nuclear industry.

NII

The second report of the House of Commons Energy Committee expresses deep concern over the ability of the Nuclear Installations Inspectorate (NII) to adequately discharge their responsibilities at current levels of funding.

The NII are responsible for the safe running of all civil nuclear facilities and the licensing procedures for Sizewell B. The recently privatised nuclear submarine refitting yards at Rosyth and Devonport will now be part of the NII's remit. They will not be receiving any extra resources for this role.

The Energy Committee found that the NII were over 17% understaffed, out of a projected total of 120 inspectors: "In such a small organisation a shortfall of this nature must produce considerable strain - *and of all areas, nuclear safety is one in which corners should never be cut.*" The report describes Government policy on the NII as "folly". Yet understaffing at the NII is not new.

In 1985, a pamphlet produced by the NII staff union (the IPCS), stated that staff shortages and other commitments have dramaticaly effected inspection of nuclear sites "...with potentially serious consequences for reactor safety".

The NII told SCRAM that they are taking the Committee's recommendations "very seriously". They are hoping to have 110 inspectors in post later this year and to reach the full complement of 120 by next April. They are prepared to "take whatever steps are necessary to ensure that these inspectors are in place."

Tour

Pat Hewiss of Lincs and Notts against Nuclear Dumping (LAND), is interested in visiting Scotland for a speaking tour in late May.

Pat is still under a high-court injunction for the heinous crime of being "suspected" of being a local Friends of the Earth organiser. If she appears on her local NIREX site at Fulbeck, she will be fined £6000 per day.

Any person or group interested in booking Pat to speak, on a shared expenses basis, should contact Lindsey Stevenson on 041-889-5343

Iran

The Iranian civil nuclear programme, dormant since the Shah's demise in 1979, is to be revitalised using Argentinian expertise.

There are two known nuclear plants in Iran: a small, US supplied research reactor, using 93% enriched fuel, in Tehran, and an unfinished 1000 MW PWR at Busher on the Persian Gulf, supplied by KWU of West Germany.

The Americans are unwilling to continue supplying fuel to Iran for obvious reasons. The West German Government have blocked the export of the final parts of the Busher reactor, as this would contravene their policy against exporting to a "region of tension". Busher, near the oil terminal of Kharg, has been hit by Iraqi missiles several times.

The final parts of the Busher reactor, including a consignment of fuel, are in store in West Germany. KWU now plan to export them to Argentina, from where they will be exported to Iran. The Argentinians are also negotiating to refurbish the research reactor and supply 20% enriched fuel under International Atomic Energy Association safeguards.

Experts on nuclear proliferation are concerned about the implications of Argentina exporting to a country as distant as Iran: local tensions will not then have the affect of halting any export of nuclear weapons technology. While current exports are covered by international nuclear "safeguards", Argentina is under no obligation to safeguard future exports. Although the experts doubt that Iran intends to build the Bomb, it has been pointed out that following the recent "Irangate" fiasco, "anything could be going on".

Hinkley Point

A welder involved in building the Hinkley Point 'B' AGR in Somerset, has revealed severe irregularities in safety procedures during the station's construction.

Councillor Bob Brooks was employed by Bristol Piping Company in 1971 to work on welds in the reactor turbine hall. He alleges that during this time his employers substituted X-rays of good welds for welds that were faulty.

All welds in the station were routinely X-rayed during construction, to see that they were perfect. If not, then the weld would have to be replaced. Instead of replacing shoddy welds, Bristol Piping Company substituted X-rays of perfect welds, so that the work would not have to be carried out. The faulty welds are still in place and could have serious implications for safety.

Cllr. Brooks told SCRAM that if one company could get round quality control procedures, "then so might other contractors in more safety sensitive areas". He is also worried about the way in which the Nuclear Installations Inspectorate are handling his allegations as they have delegated all responsibility for the investigation to the CEGB.

Cllr. Brooks has consistently offered to enter the station and locate the welds that he knows were not mended, this he believes is the only way that he can prove his allegations. This offer has been rejected, indeed, an open invitation by Mr. Outram, the station manager, for any member of the public to visit the station and examine the records was withdrawn as soon as Cllr. Brooks attempted to take it up. Controversy over Cllr. Brooks' allegations has lead to six local Labour councillors resigning from the Party. They are opposed to Labour's policy of phasing out nuclear power.

● During a simulated emergecy exercise at Hinkley Point, ten anti-nuclear campaigners took over two hours to inform the 500 households inside the emergency evacuation zone. Emergency planners claim that it can be done in 45 minutes.

The Stop Hinkley Expansion Alliance say that this proves that the evacuation plans are over optimistic and that in a real crisis, peoples lives would be at risk.

Torness

The evacuation zone around Torness should be "immediately reviewed", according to the Lothian Regional Council.

The Council have written to the Secretary of State for Energy to request that this be done, following the recommendation in the Layfield report that the extent of evacuation zones around all nuclear power stations should be reviewed. The Government has replied that they are looking into the matter. The result of the review is awaited with interest, because of the large number of authorities who have been pressing for a review since Chernobyl.

The SSEB presented their solution to the Torness control rod problem (SCRAM 58) at the March meeting of the Joint Consultative Committee. They now believe that they know how to solve the difficulties and will be able to get onto the next stage of the commisioning process by October. As far as SCRAM can ascertain, this could be up to one year behind schedule. However, the NII have still to test the modifications and give them their approval.

Meanwhile, Lothian Regional Council are continuing their campaign to stop the commisioning of Torness. A series of recommendations have been made to local authorities in the Nuclear Free Zone movement, on ways to help their campaign. To date, 34 authorities have supported some or all of these.

Dounreay

The ongoing leak of sodium from the French Fast Breeder, (page 7) could have important implications for Dounreay expansion.

The future of the proposed European Demonstration Reprocessing Plant (EDRP) for fast reactor fuel is dependent on the existence of fuel from Superphenix to reprocess.

According to Mycle Schneider of World Information Services on Energy (Paris), the importance of the leak is not the environmental impact, but the effect that it will have on the political acceptance of the Fast Breeder.

Mycle told SCRAM that "within the nuclear industry, problems have not been solved that go back years. The fact is that the political impact is going to accelerate the process of public opinion opposing the Fast Breeder. Basically the European collaboration on the Fast Breeder is falling apart."

NIREX

NIREX have failed in an attempt to jail an anti-dumping protestor at the Elstow site for threatening and intimidating behaviour.

The protestor, Ms Mieke Wood, had threatened and intimidated the burly contractors, by using the sneaky and shocking tactics of calling meetings and writing articles. On one occasion she also sat in front of a drilling rig. The High Court judge who heard the case ruled that the only relevant action was when Ms. Wood sat in front of the drill. However, this did not amount to intimidation, so she was released with costs.

Ms Wood is now faced with an estimated bill of some £3000 for the priviledge of being brought to court by NIREX. Donations towards her expenses may be sent to: "Mieke appeal fund", Ivor Assinder, The Mill House, Mill Lane, Kempston, Bedfordshire.

DRURIDGE NO! THE WRITING'S IN THE SAND FOR LORD "PWR" MARSHALL

Members of the Druridge Bay Campaign left Lord Marshall, Chair of the CEGB, in no doubt about what they think of his plan to despoil picturesque Druridge Bay with a PWR, when he visited the North East recently.

Australia

Australia is to resume sales of Uranium to France, despite the continued testing of French nuclear weapons in the South Pacific.

The announcement was made last year, during the Australian budget, ostensibly to save the Government millions of dollars compensation to Queensland Mines Ltd., for not supplying Electricite de France with uranium. However, the contract would have lapsed if last year's supply commitments had not been met.

A more likely reason for lifting the ban is because of pressure on the Government by mining companies. Confidential documents, leaked from the Roxby Downs mining companies in South Australia, (BP and the Western Mining Corp.), show that they too are intent on obtaining a uranium export licence for France. So far, only two contracts for sale of Roxby uranium have been signed: with the CEGB and Sweden, although Taiwan has signed a letter of intent.

The sale of uranium to Taiwan is potentially worth over $40 million annually. BP and WMC see this sale as important, "both in itself and as a positive indication of sales to Asian countries." They would not however, be able to sell direct, as Taiwan has not signed the Non Proliferation Treaty. The companies have already explored the possibility of obtaining a special export licence for Taiwan, but as the Government is "very lukewarm on the matter", they will need an

intermediary. France is ideally placed for this role, as an existing exporter of nuclear materials to Taiwan.

A further feature of the Roxby documents, is BP and WMC's contempt for matters of health and safety at the mine. The companies have been secretly lobbying senior officials of the South Australian Government, in an attempt to influence proposed legislation bringing the mine into the area covered by the Radiation Protection Act. To date the mine has been exempt from the Act's licencing provisions, which the companies regard as "draconian".

The greatest fear of the companies is that the enforcement of both the Radiation Act and a new Occupational Health and Safety Act would rest "outside the mining industry," in the Departments of Health and Labour. The State Health Commission considers that the standards at Roxby are, and will be, inadequate and constitute a health risk.

Italy

The Italian referendum on nuclear power (SCRAM 57) seems unlikely to take place following the collapse of the Craxi-led five party Government.

The Italian constitution does not allow the holding of referenda in the same year as an election. The Christian Democrats, who are the only party in the Government who do not want the referenda to go ahead, are determined to force an early election, before the referenda are due to take place.

The remaining parties have been desperately attempting to form an interim Government. As we go to press the issue is still unresolved, although it has been said that if a week is a long time in politics, a day is even longer in Italian politics.

Sweden

The Swedish government has announced that the country's abandonment of nuclear power will start in 1993.

Sweden voted to shut down all its nuclear plant by 2010, in a referendum in 1980. The first two reactors are now scheduled to be phased out by 1996. Although the Government refused to say which reactors are to be shut, it is assumed that they will include the controversial Barsbeck plant on the Norwegian border close to Denmark.

France

The 1992 Winter Olympics are to be held at Albertville, just 40 miles from Malville, home of the French Fast Reactor, Superphenix.

Anti-nuclear activists are calling for pressure to be exerted on the Olympic committee to change the venue for the Games, because of the dangers of holding them so close to the reactor. They point out that Superphenix has already been the subject of one, succesful, terrorist attack, and that to hold the Games so close would be not far short of madness.

But nuclear terrorism is not the only reason for changing the Games' venue. The recent leak of liquid sodium from the reactor has clearly illustrated how fallible it is to accidents. Moreover, a recent study of the Chernobyl disaster by French nuclear scientists has revealed that the mechanical energy released in the explosion would be sufficient to destroy the Superphenix containment vessel. An explosion like the first at Chernobyl is possible at Superphenix.

Contact: Michel Barnier
President du comite d'Organisation
des Jeux Olympiques
Prefecture de la Savoie
73000 CHAMBERY
FRANCE

The French waste management agency: ANDRA, has announced four study sites for depositing high level nuclear waste.

ANDRA intend to choose one of the sites to locate an underground laboratory by 1990. The four sites are: Lion d'Angers, in Main-et-Loire; Nauvy-Boiun in Deux Sevres; Moncornet in Aine and Montcornet in Aisne.

EUROPEAN DEMO PARIS JUNE 20/21

An international gathering of anti-nuclear groups in Paris has been called for 20/21 June.

Paris has been chosen for the venue as the French Government is seen as the most pro-nuclear government in Europe.

The organisers hope that an international European event will bring together the considerable anti-nuclear fealing that has been growing since Chernobyl.

WE ARE ALL THREATENED BY FRENCH NUCLEAR POWER.

For more information contact:
Erick Marchandise
Reseau pour un avenir sans nuclear
90 rue Vergniaud
F-75013 PARIS
FRANCE

West Germany

The April elections in the West German state of Hessen were won and lost over the issue of nuclear power.

The elections were forced by the resignation of the Green Party from a coalition with the SPD. Although the two parties had been able to come to a compromise over the closure of the nuclear industry, when the majority SPD refused to take positive action over the ALKEM plant in Hanau, (page 7), the Greens withdrew.

A leading Green party member, Brigitte Berthold, told SCRAM before the election that the closure of the ALKEM plant is "decisive for the question of West Germany entering the plutonium economy". The plant, which produces fuel for the Fast Breeder, has commited numerous safety violations over recent years. These have culminated in the recent prosecution of two of the plant's managers for illegally operating the facility.

German commentators say that the SPD's refusal to take a principled stand on the ALKEM closure lost them the election. The right wing CDU/FDP coalition won by a narrow margin of 49.9% of the vote to the Green/SPD alliances 49.6%.

Accidents Will Happen...

HARTLEPOOL

● The number one reactor at Hartlepool suffered what has been described as the worst accident at an AGR yet, on 17 March.

The accident occured inside the reactor containment vessel, when a pipe in one of the boilers developed a hole, "about the size of a pin prick", according to the CEGB. Almost three tonnes of water escaped into the CO_2 coolant before the problem was discovered.

This is the second such leak at an AGR. According to the CEGB, boiler tube accidents "can occur from time to time". What disturbes many observers about this incident is that the leak occured in a reletavely new reactor.

Although the leak was discovered on 17 March, the CEGB were unable to inform SCRAM how long it had been going on. They did however say that "it was unlikely to have been very long." Monitoring equipment picked up the increased moisture content in the coolant and the reactor was immediately scrammed ("shut down in a controlled manner").

The afflicted boiler was isolated, but not before water had entered electrical components in 4 of the 8 gas circulators, causing them to fail.

According to John Large, an independent nuclear consultant, this incident exceeds the worst conceived scenario for the AGR. This assumes that a failure will only occurr in two of the circulators, which are vital for cooling the core.

● In a separate incident, the site faces prosecution under the Factories Act, for failing to submit a heat exchanger to statutory checks.

The exchanger is in the CO_2 store. Although no radioactivity was involved, the CEGB have been attacked for their "cavelier attitude."

HUNTERSTON

● Power output from the number one AGR had to be reduced on April 7, following the failure of one of the gas coolant circulators.

The SSEB claim that the incident did not affect plant safety. The failure was caused by a fault in "electrical switch gear".

AUSTRALIA

● Two workers were contaminated in a fire at Australia's only nuclear plant on March 17.

The fire occurred in a building adjoining the research reactor at the Lucas Heights nuclear complex in the suburbs of Sydney. A carbon filter in a hot cell block caught fire. Local fire fighters were kept away from the blaze, although the acting lab director said that a "quarter of the permissible release in any week" was emitted.

HANAU

A spate of accidents and safety violations in West Germany's fuel fabrication plants have recently come to light.

● The NUKEM plant at Hanau, in the state of Hessen, was closed in March, when at least 16 workers were contaminated with plutonium.

Precisely how this occurred is not known, as the plant does not have a licence to use plutonium. The plant's management claim that a 4.3g sample of uranium, containing plutonium, was not labelled as such. NUKEM received the sample from the Karlsurch research centre, who in turn say that they got it from the Transuranium Institute in 1970.

This begs the question as to how the sample managed to travel around the country for 16 years, without it's plutonium content at any time being documented.

● A worker at the ALKEM plant, also in Hanau, was contaminated with plutonium in March, when a remote handling glove broke.

The ALKEM plant, owned by KWU and NUKEM, was the scene of a similar incident in 1984. Unlike the NUKEM accident, no plutonium was ingested.

● At the Karlstein laboratory in Bavaria, run by KWU, another 125 workers are being investigated for plutonium contamination.

This follows the discovery of traces of americium 241, a decay product of plutonium, in the stools of 10 workers at the plant. Until this incident, it was not generally known that KWU had a licence to handle plutonium, despite the fact that West German law stipulates that there must be public participation in granting such a licence.

The plutonium elections-page 6

DOUNREAY

● The prototype fast reactor (PFR) at Dounreay had to close down on 27 Febuary because of leaks in the heat exchangers.

Small amounts of liquid sodium leaked into the steam circuit. The PFR has been plagued with similar faults since it first started. It was thought that the problem had been solved by internally lining the welds in the exchangers. The exact position of the leak has not been discovered, but it is known to be in one of the mended welds.

PIERRELATTE

● The Uranium Hexaflouride (Hex) production plant at Pierrelatte near Lyon was closed on 11 April because of a hex leak.

Seven workers were injured repairing the leak. The plants operators said that a "weak amount" of the hex gas escaped into the atmosphere. A second leak occurred five days later.

SELLAFIELD

● A worker was contaminated whilst taking a sample in a chemical separation area of a high level waste store on April 14.

He is reported to have received an external dose of twice the annual permitted level. This means that he will not be allowed to be exposed to any more radiation at work for the next two years.

SCRAM understands that the government were not informed of the incident for over 24 hours, although BNFL refused to confirm this as they did not want to pre-empt the official enquiry. In it's 1986 safety audit of Sellafield, the NII criticised delays in reporting incidents. At the time, BNFL said that it would not happen again...

PEACH BOTTOM

● The Peach Bottom nuclear power station in Pennsylvania USA, has been shut, following the discovery that workers and supervisors were sleeping whilst on duty.

The Nuclear Regulatory Commission received information on 24 March that "control room operators had been observed sleeping while on duty in the control room and were otherwise inattentive to their licence obligations." The NRC ordered that the plant's two 1098MW Boiling Water Reactors be shut down until they are satisfied that the operators will no longer sleep on duty.

SUPERPHENIX

● The world's first commercial Fast Breeder Reactor at Creys-Malville in eastern France has sprung a liquid sodium leak.

The leak, of over half a tonne of sodium a day, started on 8 March, but was not discovered until 31 March. The plant's operators refused to shut the plant down, although the exact location of the leak had not been discovered.

The Fast Breeder uses liquid sodium to cool the reactor core. The leak is not, however, in the primary coolant circuit, but in a tank through which the plutonium fuel passes on its way to and from the core. The sodium, which ignites spontaneously on contact with both air and water, has been contained in a second, "safety" tank.

Implications for Dounreay-page 5

FLAMENVILLE

● The PWR at Flamanville, on the English Channel near Cherbourg, suffered a leak of radioactive water on March 18, the second accident in nine days.

The plant's operators broke an agreement to inform the Channel Islands, just 35 miles from the plant, immediately of any accidental radiation release.

Hinkley Seismic Shocker

By now many people will know that Hinkley Point in Somerset, already the site of two nuclear stations, has been chosen by the CEGB for the next PWR after Sizewell B. But, how many people know of the geological fault running through the middle of the site? JAMES GARRETT describes the CEGB's attempts to conceal earlier siting errors, and reveals the forthcoming NII 20 year reviews on Berkeley and Bradwell may ignore their own seismic safety standards.

The Central Electricity Generating Board (CEGB) and the Nuclear Installations Inspectorate (NII) appear to have reached a cosy agreement over the future of Britain's oldest nuclear power stations which seems to skate over a key safety issue.

The NII is due to announce in the next few weeks that the two oldest civil Magnox plants, at Berkeley in Gloucestershire and Bradwell in Essex, have passed their 20 year safety reviews and can carry on operating into the 1990s - even though they come nowhere near meeting the minimum seismic safety standards.

The ability to withstand earthquakes is a key factor in the reviews, according to the NII. Unfortunately, not a single nuclear power station operating in this country was built to withstand any kind of seismic shock. The NII explains, "in those heady days when we started building nuclear power stations those things weren't considered in the way that they have been in later years." And yet, both the CEGB and NII have stated on the record that Bradwell and Berkeley have passed on siesmic safety grounds.

"MOVING THE GOALPOSTS"

The Liberal MP for Yeovil, Paddy Ashdown, has demanded that Energy Secretary Peter Walker explain how the nuclear industry is being allowed to get away with "moving the goalposts." He says, "after Chernobyl, safety standards have to be treated as absolute and, as for everything else, nuclear power stations have to meet the current standards or be closed down."

In his reply, Mr Walker contradicts the CEGB and NII by stating, "the NII is actively discussing nuclear power stations' seismic resistance with the CEGB and it is wrong to assume that any decisions have been made." Asked to explain the difference between Mr Walker's understanding of the situation and that of the CEGB and NII, an Energy Department spokesman said, "the reports have not yet been published, and the seismic safety issue isn't signed, sealed and delivered. What Mr Walker says in his letter is quite correct." The mystery has yet to be explained.

Seismic safety has always been an important factor in the construction of nuclear power stations elsewhere in the world. Britain is finally conforming, 30 years after the first of the country's 20 stations came into operation. The two latest plants, Torness and Heysham 2, have been earthquake-proofed, with the work adding 10% to the total cost.

"HIGHLY PESSIMISTIC"

Major earthquakes, although uncommon in Britain, could cause considerable damage to the miles of pipework in a nuclear power station if unsupported. And a particularly severe jolt could knock out of alignment the interlocking blocks which form the nuclear core, making it impossible to lower the control rods into a reactor to close it down in an emergency.

The CEGB has done tests on paper which show Berkeley and Bradwell could withstand a seismic shock of 0.1G, which they describe as a "highly pessimistic" calculation. However, the NII's minimum requirement is that a nuclear plant can withstand a 0.25G shock.

The NII explains its decision not to press for improvements before extending the operating lives of the stations by saying, "we live in a fairly stable country as far as earthquakes are concerned. All our old and new power stations could withstand those earthquakes which have occurred."

The Inspectorate adds that "it would cost millions to add additional safeguards" to existing stations to bring them up to modern standards. And yet, in apparent contradiction, the NII stress that "one of the requirements of the safety reviews is to make the safety case for earthquake action. It is one of the *key* factors." (emphasis added).

Aware that not everyone will understand its generous concession to the CEGB, the NII has told the Board to continue the tests to determine the maximum shock the power stations could withstand. The CEGB are confident that they could withstand a 0.2G earthquake; but the crucial safety certificates will be awarded on the basis of the lower figure - 0.1G.

photo: Rob Scott

Steam rising from the cooling water outlet from Hinkley B. The outlet channel follows the line of the fault

SUBSTATION OVER FAULT

At Hinkley Point in Somerset, and Dungeness in Kent, the CEGB's task in making the seismic safety cases for the Magnox stations there is complicated by the presence of geological faults running thorough the sites. The CEGB claim that it has known from the start about the existence of the fault at Hinkley Point. However, evidence we have uncovered suggests that they only became aware of the fault's existence when planning the construction of the B station . . . ten years after work began on the A station.

If this is correct, it may only be through good fortune that the 22 year old Magnox reactors of the A station are not sited directly over the fault. As it is, the fault runs under a substation which feeds 275,000 volts of eletricity into the national grid.

CEGB spokesman Terry Pratchett says, "in 1956 the consultant engineers drew our attention to the existence of the fault and repositioned the A station to the west of it. In 1966 they did some more detailed studies on the fault and then positioned the B station to the east of it."

Further, he says that the fault is clearly visible on the surface and that its position couldn't have been ignored. Yet our evidence suggests otherwise. Undoubtedly the presence of a fault was discussed in 1957. The minutes of a private meeting

between senior members of Somerset County Council on 1 January 1957 records that, "it was understood that there was a fault in the rock which might create dificulties, but Lord Hylton expressed the view that the possibility of getting the Central Electricity Authority (the CEGB's predecessor) to resite the station should be explored at once."

SITING RECONSIDERED

On 28 January, the County Council sub-committee set up to investigate the Hinkley Point A project noted, "the CEA believe there is a fault . . . and are not willing to incur the expense and risk of constructing heavy buildings on or immediately adjacent to that line." An accompanying map shows where the fault was thought to run. However, a quick glance at the official map published by the British Geological Survey shows that, whatever might have been thought in 1957, no fault exists there.

But the map does clearly mark a fault a few hundred yards away - running right through the middle of the power station site. Is it possible that, in seeking to avoid an imaginary fault, the CEA built Hinkley A just yards from a real one? The CEGB say no, but the theory is strengthened by evidence contained in a document relating to the development ten years later of the B station.

This is a record of a meeting on the site in which Somerset's County Planning Officer met top CEGB officials from London. The report notes, "a minor geological fault had been found running across the site and this would involve some reconsideration of possible siting." The suggestion that the discovery would involve "reconsideration of possible siting" implies the fault was found only after plans for siting the new station had been drawn up, and that it had only recently been made: certainly not 10 years before.

Indeed, the CEGB acknowledges that Hinkley B's position was changed during construction. Mr Pratchett says this was on the advice of the architect, Sir Frederick Gibbard, and had nothing to do with the fault. Sir Frederick's firm, which also designed Hinkley A, and could presumably shed some light on the matter, refuses to answer questions and refers all enquiries to the CEGB.

But if the CEGB really knew of the fault's exact position in 1957, why build the electricity substation on top of it? Mr Pratchett acknowledged that, "it's an integral part of the station. Without it the electricity generated on site could not be fed into the national grid." However, he adds, "its failure, should it ever occur, isn't related to the safety of the reactors."

30 QUAKES IN 800 YEARS

For an organisation which claim to have studied the fault extensively in the 1960s and 1970s the CEGB seem to have left a lot of basic research into its age, the likelihood of seismic activity along it, and its relation to the regional fault network until the present decade. Over the past few years the Board have employed a number of the country's most eminent geologists to draw up a report which will form part of its evidence to the planning inquiry into the proposed Hinkley C station.

One of the consultants, Dr Charles Melville, an expert on earthquakes from Cambridge University says, "it's almost impossible to demonstrate that earthquakes were associated with the fault. Hinkley Point is on a fault, but then everything is. It is an area where there are more earthquakes than usual. The overall area, generally speaking, has more earthquakes than the south and east."

Dr Melville has come across some 30 earthquakes in the area over the past 800 years, most of them "pretty small." However, a contemporary account of the Glastonbury earthquake on 11 September 1275, yesterday in geological terms, said it was "so terrible and horrible that churches were overturned in various places and people killed." Glastonbury is less than 20 miles from Hinkley Point. Two other nearby towns, Wells and Taunton, have both experienced sizeable earthquakes in the past.

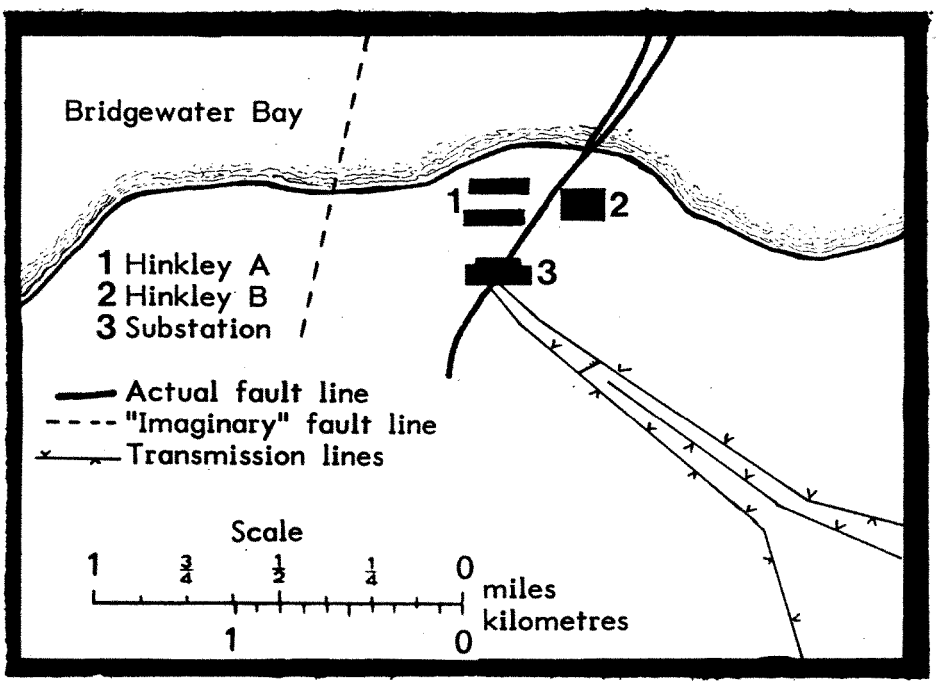
Dr Peter Smart of Bristol University's geography department was recently asked to date the fault and try to establish when there was last any movement on it. He concluded, "I can see no problem so far from the work I have done. If you take the United States recommendation that a fault shouldn't have moved in 35,000 years the evidence that I have got is that it hasn't moved for well in excess of that time."

GREAT UNCERTAINTY

However, other geologists we have spoken to say testing the stability of faults in Britain is notoriously difficult because of the effects of the last Ice Age. The ice pack and permafrost which covered Britain 10,000 years ago disturbed deposits so much that it's very difficult to tell if there has been any movement on a fault.

One structural geologist who specialises in Middle Eastern earthquakes says, "all you can say with any certainty about any fault is that it must be younger than the rock it cuts." This geologist said he would want to study the history of activity along the fault for at least a million years before committing himself on saying whether or not it was inactive. And even then he would be unwilling to say categorically that a lack of movement in the past meant a fault would never move in the future.

The chances of a major earthquake occurring along the fault during the lifetime of the two power stations at Hinkley Point must be considered extremely remote. However, one is left wondering whether elderly nuclear plants built in such circumstances should be allowed to carry on operating beyond their original design lives.



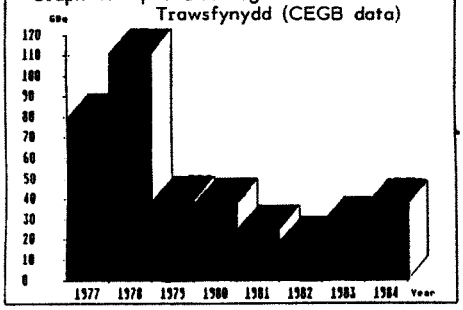
Trouble at Trawsfynydd

Investigations carried out by Friends of the Earth at the lake into which Trawsfynydd nuclear power station discharges its liquid effluent show that the levels of radioactivity are rising. PATRICK GREEN, who prepared FoE's report on the study*, compares the CEGB/MAFF figures with their own, and claims that things are not as they should be at the plant.

Friends of the Earth's attention was unexpectedly drawn to Trawsfynydd, whilst undertaking our post-Chernobyl monitoring programme in north Wales. We were given a mud sample with an unexpectedly high caesium activity (1447Bq/Kg). The sample came from a stream, the source of which is Llyn Trawsfynydd, the lake into which the plant discharges its liquid effluent.

Trawsfynydd is unique as the only UK nuclear power station to discharge into an inland lake. Consequently the "dilute and disperse" approach to radioactive discharges practiced by the CEGB (Central Electricity Generating Board) is more problematic, as a limited volume of water is available for dilution. The problem is acknowledged by MAFF (Ministry of Agriculture, Fisheries & Food) who state that the discharges are of "greater radiobiological significance than those from other UK nuclear power stations."

Graph 1: liquid discharges of Cs-137 from Trawsfynydd (CEGB data)



The sample was independently analysed by Edinburgh Radiation Consultants, and the results suggested the source of the caesium was unlikely to be Chernobyl, and was probably Trawsfynydd. However, as only one sample was involved it was not enough on which to base any conclusions.

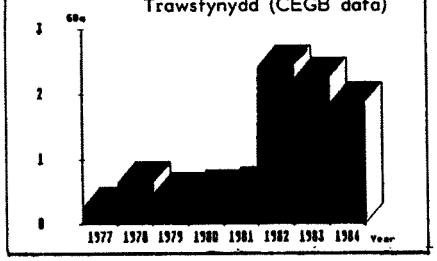
FoE took further mud samples and the investigation, coupled with an analysis of CEGB and MAFF data (1977 onwards) provides firm evidence that problems exist within the station.

The site licence granted by the Department of the Environment (DoE) specifies the numerical limits for radioactive discharges. Within these limits the CEGB must take steps to ensure that the actual amounts discharged are "as low as is reasonably practicable" (ALARP). It is also the CEGB's responsibility to monitor the radioactivity they discharge into the environment.

The CEGB data shows that:

- The levels of argon-41 gas discharged from the plant are the highest of any operating CEGB nuclear power station for the years that were assessed.
- Liquid discharges of tritium are extremely erratic, ranging from 1% to 15% of the authorised limit.
- The authorisation permits a total of 1480GBq of radionuclides other than tritium to be discharged into the lake each year. The actual amount discharged is within this limit, and has fallen in recent years. In 1984 the discharges reached 25% of their authorised limit.
- The actual discharges of specific radionuclides vary enormously. The single largest proportion is due to sulphur-35, which varies between 28% and 68% of the total discharge.
- Peak discharges of caesium-137 and 134 (Cs-137,134) occurred in 1978. The current levels are below this, but have been increasing steadily since 1982 (graph 1).
- It is not possible to comment with any certainty on the levels of cobalt-60 (Co-60) discharged, as the CEGB have changed the way they express the levels in their reports. For the years preceding 1982 the reports stated precisely 0.1% or 0.2% of the total discharges were due to Co-60; since 1982 they have stated less than or equal to 0.5%. This could mean that the amounts discharged have increased (graph 2).
- The discharges of strontium-90 (Sr-90) show an erratic picture, but peak in 1978 and 1980.

Graph 2: liquid discharges of Co-60 from Trawsfynydd (CEGB data)



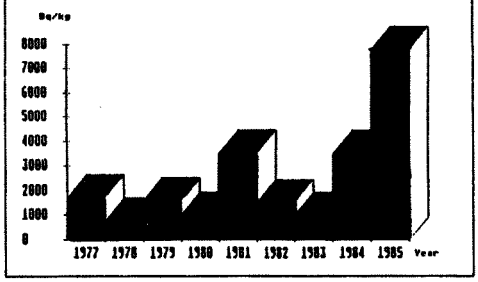
MAFF are responsible for monitoring the environment around nuclear installations and assessing the impact of the discharges on the local critical group. At Trawsfynydd they monitor mud and fish. The latter form the basis of their assessment of critical group exposures. The critical group is the section of the population which receives the highest effective doses from the discharges. In this case they are the people who catch and eat fish from the lake.

MAFF data show:

- For both Cs-137 and Cs-134, the mean levels of contamination in mud have increased in recent years. The Cs-137 increase has been dramatic, from 1700Bq/kg in 1977 to 7800Bq/Kg in 1985: an increase of 359%. This has occurred mainly since 1983 (graph 3).
- The Co-60 level has increased in recent years, from 1.9Bq/kg in 1982 to 37Bq/kg in 1985: an increase of 1847%! (graph 4). This would suggest that Co-60 discharges have increased in recent years, although the CEGB data are too vague to definitely conclude this.

Considering the MAFF mud monitoring data show increasing contamination, it is surprising their fish data show a general decrease. The MAFF reports state that mud from the lake bed is analysed because this forms a part of the fish diet (they are browsers). Levels in fish should show similar trends to levels in mud.

Graph 3: levels of Cs-137 in mud (MAFF data)



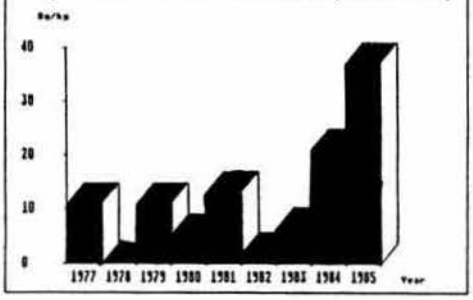
A possible explanation for this discrepancy could lie with the sampling techniques used by MAFF. Only 24 fish are taken each year. The trend to lower levels could be a reflection that the fish are caught younger than in previous years, and will not have been alive long enough to accumulate large quantities of radionuclides in their tissues. This explanation seems likely in the case of rainbow trout. These are not an indigenous species but are reared in hatcheries controlled by the CEGB. If this is the case the monitoring is failing in its purpose, since a misleading picture of contamination levels will be produced.

The MAFF monitoring data also appear to be incomplete. They state Sr-90 is important in terms of exposure of the critical group; yet mud is never analysed for its presence and fish are only monitored for some of the years.

The levels of contamination in fish are important because they form the basis for estimating the average dose to a member of the critical group. It is questionable if a sample size of 24 fish a year is sufficient for such an assessment, especially considering that the lake is one of the most popular fishing lakes in north Wales.

Since 1968 the average effective dose for a member of the critical group is the *highest of any CEGB nuclear power station.* As indicated these doses could be underestimated.

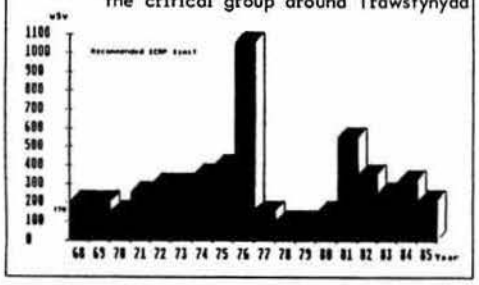
Graph 4: levels of C-60 in mud (MAFF data)



These average effective doses are within the 5mSv public dose limit, but they *consistently fail to meet the CEGB's own target dose* for critical groups. This is based on 1/30 of the dose limit, ie 0.17mSv. However, the NRPB have recommended that the public dose limit should be 1mSv. If the target dose were based on this figure, ie 0.033mSv, the average effective dose to the critical group would exceed this by an order of magnitude. In 1976 the 1mSv level was exceeded because of the reduced volume of the lake during the exceptionally hot summer (graph 5). Because of the current problems with the dam, the CEGB have reduced the water depth by about 5%, consequently a rise in the critical group average effective dose can be expected.

If it had been operating in West Germany or the United States where more stringent public dose limits exist, Trawsfynydd would have been closed down.

Graph 5: effective dose equivalent arising to the critical group around Trawsfynydd



The CEGB have consistently maintained that their target dose is more stringent than the dose limits applied abroad. Trawsfynydd clearly demonstrates that this is not the case, since the CEGB do not keep to the target. This constant failure could mean a breach of the ALARP principle: a prosecutable offence.

Trawsfynydd nuclear power station and lake.

The MAFF data further suggest that the radiological protection requirements of the International Commission for Radiological Protection (ICRP) are not complied with since not all exposure routes are considered. The ICRP state that, to ensure compliance with ALARP, optimisation techniques should be used. This means that the total health detriment to a population must be considered. Therefore it is necessary to consider the full range of foodstuffs consumed and *all* the radionuclides which reach the food, not just those considered to be the dominant contributors to radiation exposure. The MAFF data are incomplete, concentrating on the radiocaesiums, and is likely to lead to an underestimate of the true exposure of the critical group.

The mud data obtained by FoE for Cs-137 are in broad agreement with the MAFF data. Our results, although somewhat lower than the MAFF data show that high levels have continued into late 1986.

Our levels of Cs-134 and Co-60 are consistently higher than the mean data provided by MAFF. This discrepancy is not easily explained. Chernobyl fallout makes the data more difficult to interpret. Our data are consistent with the suggestion that the mud in the lake has taken up an appreciable amount of caesium activity which originated at Chernobyl. This cannot be the whole explanation for these reasons:

- The mean Cs-134 level recorded by MAFF in 1985 is 59Bq/kg; the mean value from the FoE mud samples was 429Bq/kg: the FoE mean is 627% higher than the MAFF figure. If all this activity originated from Chernobyl it would be reasonable to assume a larger increase in the Cs-137 levels (in Chernobyl fallout, for every one Becquerel of Cs-134 there is two Becquerels of Cs-137). However the FoE Cs-137 readings are in broad agreement with MAFF.
- The FoE samples also contained high levels of Co-60. The 1985 MAFF mean value was 37Bq/kg; the FoE mean value was 130Bq/kg: an increase of 251%. A peak figure of 238Bq/kg was also recorded by FoE. Co-60 is an activation product or a corrosion product. Its presence in the lake at such high levels cannot be due to Chernobyl, and indicates there may be corrosion problems in the plant.

The fact that such discrepancies can occur between two sets of environmental monitoring data raises important questions about the reliability of official monitoring data and consequently the reliability of the assessment of the critical group effective dose is open to question.

The FoE report was launched in Bangor on 9 March. It called on the CEGB and MAFF to:

- explain the anomalies in discharge and monitoring data;
- explain the discrepancies between the FoE and MAFF data;
- provide full details of their monitoring programme;
- explain the nature of the corrosion problems;
- justify the discharges under the ALARP principle;
- demonstrate that they comply with the ICRP's system of radiological protection.

The report also called on the Nuclear Installations Inspectorate (NII) to investigate a possible breach of the ALARP principle; to complete the outstanding 20 year safety review and to make this fully available; to provide assurances as to the safety of the plant; and stated that until such assurances can be given the plant should be shut down.

As expected the CEGB have tried to dismiss the evidence in the report. They have not succeeded. The station manager has however admitted in a radio interview that the source of the increasing Co-60 levels in the mud is the springs that hold the fuel rods in place, but he denies they are corroded.

* Trawsfynydd - Power at a Price: a report on the radioactive discharges from Trawsfynydd nuclear power station. £3.50 from: FoE, 377 City Road, London EC1.

Pandora's POX

This article continues the debate on plutonium transport in relation to the Dounreay fast reactor establishment. 2 issues ago we printed a letter from Brian Durrans of Dounreay in response to an article by PETE MUTTON. Pete has replied with this article, and we hope to carry an article from Mr Durrans in the next issue.

Rarely do proponents of things nuclear air their views when the opportunity exists for those of us of an anti-nuclear persuasion to challenge those views. Full marks, therefore, to Mr B Durrans, Chair of the Dounreay Staff Side, for replying (Letters - *SCRAM 57*) to my article about plutonium nitrate (PUN) transportation (*SCRAM 53*). Less than full marks, however, for both the tone and the content of that reply.

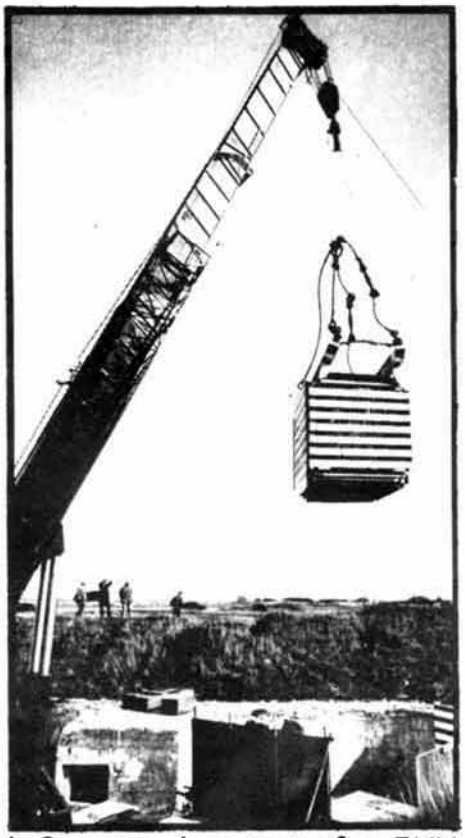
Mr Durrans starts his letter by claiming that my article "contains so many inaccuracies and untruths that is difficult to know where to start." In fact, he neither starts, continues or ends with any criticism of the main thrust of the article. I can only assume that he shares my concern about the secrecy surrounding the PUN shipments. But of course, if he can supply me with the information his employers keep suppressed, or if he has some special exemption from the Official Secrets Act, then perhaps he could answer some of the points I raised in my original article.

UNACCEPTABLE HAZARD

Coming back to his specific criticisms. Mr Durrans criticises me for failing to mention a paper which was only presented to the Dounreay European Demonstration Reprocessing Plant Inquiry after my article was published. The paper - "The Transportation of the Plutonium and Uranium Products from the EDRP" - is a mere five pages in length and gives the barest of detail about the proposals, and even less about the associated safety studies. It is, perhaps, surprising, that Mr Durrans mentions this paper because what little the paper does reveal is rather interesting.

The paper informs us that the containers used must be so secure that any leak must be less than one hundredth of a millionth of a gramme an hour. What does this mean? It means that the regulatory authorities consider plutonium to be so toxic that if a single gramme was to take *10,000 YEARS* to leak out, then the rate of leakage would be unacceptably high. Imagine the hazard involved should an accident release several kilogrammes into the environment!

One might expect that in order to ensure that such an extraordinarily hazardous cargo is not released to the environment, extraordinarily exhaustive safety studies would be carried out. That, however, is not the case. Apparently, only one drop test has been performed from 5000 feet, and that "although the container was damaged, no material was released from the container." From this limited testing, the UK Atomic Energy Authority (UKAEA) conclude that it is safe to transport plutonium dioxide (POX) by air! Such irresponsibility is almost beyond belief.



A 9 metre drop test of a PUN container onto a 30 ton concrete block.

The fact is, as the paper concedes, air transport of POX is preferred for security reasons. The same, of course, will be true for PUN transport but as Mr Durrans points out in answer to my question - "why does PUN go by sea if POX goes by air?" - the PUN containers are too bulky to go by air. Quite so, Mr Durrans! I was fully aware of the answer when I asked the question. I enquired because the answer highlights a situation where security risks are taken with PUN transportation because it is inconvenient to take it by air, whilst safety risks are taken with POX transportation for security reasons. Their list of priorities therefore appears to be: convenience, security, then safety.

And what are the safety and security risks? That was the whole point of my previous article - we haven't been told! Safety studies either haven't been carried out or, if they have, the results have been suppressed under a security blanket. And what are these security measures protecting? It may be news to workers at Dounreay, but regular SCRAM readers will know that security measures are required because the plutonium product is a prime nuclear weapons material (eg. *SCRAM 56*).

PLUTONIUM FOR MILITARY

Mr Durrans takes me to task for suggesting that Dounreay's plutonium has a military potential. Is he serious? Does he not know that the French regard the fast reactor as the "technological basis of the French nuclear military force"? He avoids the issue by talking about the isotopic mix of high burn-up fuel rods. How about the isotopic mix of the *blanket* plutonium, Mr Durrans, particularly after a relatively short period in the reactor? In any case, as far back as 1976 the influential "Flowers Report" (the Sixth Report of the Royal Commission on Environmental Pollution) commented that: "weapons of comparatively low (and uncertain) yield can nevertheless be made from 'civil grade' plutonium containing appreciable concentrations of plutonium 240" (para 95).

If Mr Durrans seriously believes that plutonium from fast reactors cannot be used for nuclear weapons production then perhaps he would be good enough to write to SCRAM unequivocally stating so. He could also inform us why specific information about the quantity, isotopic composition and transport of plutonium produced at Dounreay is withheld from the public, and why safety studies relating to PUN transportation are classified documents. Finally, he could tell us what the armed guards of the UKAEA's Special Constabulary are doing at Dounreay.

Until safety information about PUN and POX transportation is published, we can only assume the UKAEA is hiding something. A desire for the facts prompts the slogan:

"POX - Don't Die of Ignorance"

"An Agonising Decision"

As present land and sea disposal routes for nuclear waste remain unacceptable, GEORGE PRITCHARD explains to STEVE MARTIN the disagreement which led him to leave his job as nuclear campaigner with Greenpeace and take up a post with a company which claim to have developed a safe method of undersea disposal of nuclear waste.

Steve Martin: George Pritchard, you've recently resigned after a number of years as the nuclear campaigner for Greenpeace. Some people may not understand why: could you give us the background to your decision?

George Pritchard: Certainly. I got involved in the anti-nuclear campaign in 1980 when the CEGB announced three new nuclear power stations on my doorstep down here in Cornwall. I was mainly interested in the threat to the Cornish seal but, as I learnt more about nuclear power, I realised that it was also a threat to myself and my family. I became the secretary and full-time organiser of the Cornish Anti-Nuclear Alliance. We went on to win the campaign.

After a period working with the fishing community of Cornwall on sea dumping, Pete Wilkinson (then Chairman of Greenpeace) asked me to work for them full time.

At that time there were three of us on the campaign and we split up the work between us: my job was working with the Unions on the waste dumping issue. As an ex-seaman, the NUS was my Union.

The campaign resulted in the Unions' sea dumping ban. In fact the ban came just as I joined Greenpeace, so Pete Wilkinson must get the credit as he did the work.

SM: Attention then switched to on-land waste dumping, with two sites being announced.

GP: Yes. Frank Cook, the new MP for Stockton North, found himself in 1983 with the Billingham proposal on *his* doorstep and asked us to help. It was because of my association with the people of Billingham, and Elstow, that I took a keener interest in the question of disposing of nuclear waste. That campaign was also won. It is very gratifying to have been involved in those successes, but it was, of course, all down to the people involved.

SM: Now you've moved on to another phase in your anti-nuclear career. Although you've now left Greenpeace, you're still involved in the anti-dumping campaign. Could explain your decision?

GP: Yes. Three years ago, a man called Alex Copson told Jim Slater at the NUS that he had a proposal for the disposal of nuclear waste under the seabed. Jim asked Pete and myself to meet him. We told Alex we weren't interested in his scheme at that time because it wasn't retrievable or monitorable. He asked us what we would like to see, so we explained what he would have to do to persuade us. For 3 years Jim and myself (Pete had gone off to Antarctica and New Zealand) have worked with Alex on the scheme.

Because people don't want the Government forcing nuclear waste dumps onto their backyards, my feeling is that we've got to look for some other method. At the same time I'm very aware, having been a Greenpeace member and supporter for a long time, that the sea is very precious, and we cannot afford to pollute it.

It's now got to the stage where I believe that Greenpeace should talk seriously with Copson about his scheme. When I put that to the Greenpeace Board they were not prepared to do that. They have a policy of on-site storage of waste. I pointed out that the people of Bradwell don't want it on-site, and I don't believe the people near any other site want it either.

I wanted to go to a recent meeting where Alex Copson was presenting his latest plans to the Trade Unions. The Board didn't want me to attend. That was the final straw, and that was the reason I resigned. It was an agonising decision for me. People who don't know me well are likely to think I've been bought out in some way. All I can say is, hopefully my campaigning record speaks for itself - I'm still totally opposed to the nuclear industry, but at the same time I'm totally dedicated to finding a way, if it's possible, to deal with nuclear waste.

I attended the meeting and explained to the Union leaders that I had resigned. They asked me what I was going to do - I said I had no idea. Jim Slater persuaded me to take the job Alex had offered me before, as a liaison between him and the trade unions. I started that job in March. Graeme Searle, founder member of FoE and the Stop Sizewell B Association, is also working with Alex and me.

SM: So, is the plan feasible? When will it start, how much will it cost?

GP: There's a lot more work to be done. It's looking very promising. Over the years Alex has done all we've asked him to. I told him the people he had to persuade, as far as I am concerned: he immediately replied that they would get everything he publishes. Now John Large is working on the engineering, Mike Heath's working on the geology - the area around Orkney is totally unsuitable, by the way - and Peter Taylor, hopefully very shortly, will be taking a contract to look at the radionuclide dispersion.

As far as costs go, it's not going to be cheap. I believe no real safe answer to the nuclear waste problem has been found in the past because it's always had the "£" sign hanging over it. This has meant that you can't put money into solving the problem because of the cost of nuclear electricity.

Now the Labour Party has removed that; they have said they'll get rid of nuclear power. The electricity costs don't come into it any more - we can put money into solving the problem. This is an expensive way of solving it but, let's face it, we've produced the stuff - it's there - and somehow we've got to deal with it. And the question of cost shouln't come into it. The only question is the safety of the environment and the safety of the public.

SM: Should the nuclear industry accept this scheme, if they are genuine in their desire to dispose of nuclear waste in a safe manner?

GP: The scheme will not be going public probably for a couple of months yet, but some people in the nuclear industry are already aware of it. But they want to get rid of nuclear waste in the cheapest way they can, because they want nuclear power to stay competitive. And that goes for the present Government.

But, at the end of the day it's going to be up to the public, and if they can support this scheme, then they have got to force the Government, if necessary, to adopt it. I believe if it's adopted nuclear power in its present form goes out the window. However, it may be that one day they'll develop a safe reactor.

SM: So, we look forward to the publication of the report.

GP: Yes, indeed. The company is not called ENSEC anymore. It's now Consolidated Environmental Technology.

SM: Thank you very much, George.

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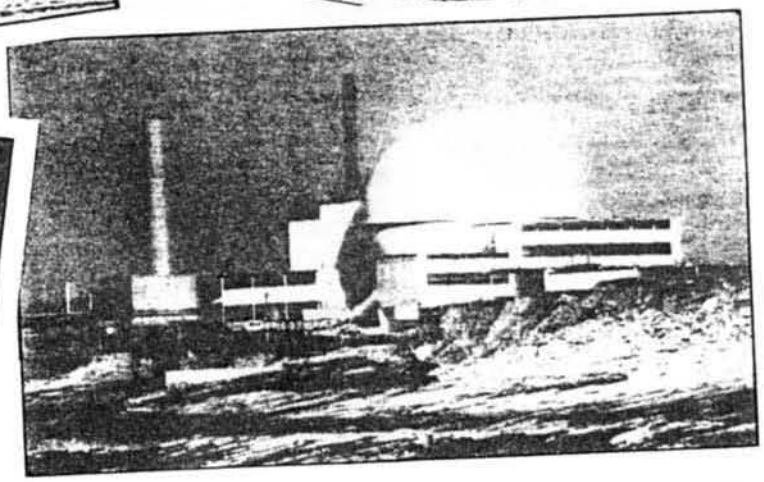

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Birds in a Flap over Barrage

Tidal barrages have received a lot of coverage in *SCRAM* over the years. In particular, the proposal to build a barrage across the Severn estuary has generated much debate: we carried articles against and for in our October 1984 and June 1985 issues. Those articles addressed the technical and political aspects of the development. Here, MICHAEL LEVEN looks at the ecological arguments against the Severn barrage, with particular reference to the wader and wildfowl populations of the estuary, and concludes that the threat to these communities will far outweigh any benefit from the generation of 5% of England and Wales' electricity.

In view of the limited level of support for renewable energy sources, it is superficially encouraging that the present government would appear to be enthusiastically proceeding with proposals for the development of a barrage across the Severn estuary; providing a new road link between the Bristol area and Wales, and incorporating a tidal power station.

Those who are opposed to the further development of nuclear energy might see the development of tidal power as the harnessing of an unlimited resource which could be developed without incurring either the known dangers of nuclear power or the pollution problems arising from conventional coal burning power stations.

However, the direct ecological consequences (as opposed to the indirect effects) of a tidal barrage will inevitably be far greater, for a given level of electricity production, than for coal-fired or nuclear plant. Thus, the Severn Barrage Committee's preferred scheme (the Bondi scheme) discussed in *SCRAM 44 and 48* would have an installed capacity of 7200MW which compares with an installed capacity of 1320MW for Hinkley Point B. However, it is anticipated that, because of tidal flows, the barrage will generate electricity at only one third the rate of a nuclear plant so annual electricity output is estimated at only 12.9TWh compared with an output of about 7½TWh from Hinkley B in 1986.

TIDAL REGIME CHANGES

To achieve this output, about 5% of the present electricity demand in England and Wales, the Bondi scheme requires the erection of a 17km barrage which will irrevocably change the ecological regime of approximately 500 square kilometres of the Severn estuary. This can be compared to the area of the entire Torness site which occupies only 80 hectares: about 1½% of the size.

Of course the principal opposition to the ecological effects of nuclear power lies in the possible consequences outwith the site, and the type of effects are not directly comparable. However, the adverse consequences of a Severn barrage are such that it is suggested that the benefits derived from the generation of only 5% of England and Wales' electricity are far outweighed by the consequences.

The principal problem with the formation of a barrage is that the daily tidal regime of the estuary will be altered. At present the Severn estuary includes large areas of mudflats which hold important populations of wildfowl and wading birds (see figure and table). These birds are adapted to a habitat where areas of mudflat and saltings are inundated by the tide periodically and they make use of this habitat primarily outwith the breeding season as a source of food and as a safe, relatively undisturbed roost site.

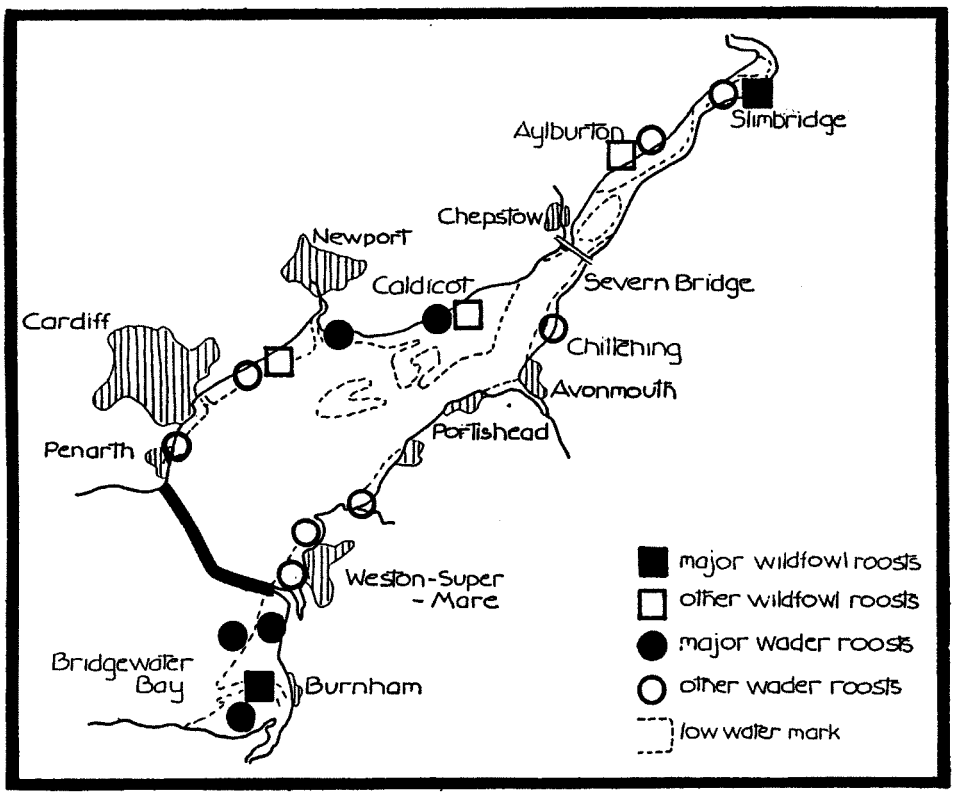
REDUCED POPULATIONS

As the table shows, a substantial number of the species of waders and wildfowl which occur on the Severn do so in internationally significant numbers, reflecting both the value of Britain's estuaries as relatively frost-free winter habitats for birds from a wide part of Eurasia, and the importance of the Severn as one of the ten most important estuaries in Britain for birds.

The habitat which these birds use has evolved over the course of thousands of years and varies from communities only just above the low water mark, which are principally important for birds as a source of invertebrate food, to higher saltings which may only be inundated during spring tides and which have complex and easily damaged plant communities.

The retention of water behind the barrage will mean that the lower tidal mudflats will never be uncovered whilst the stabilising effect of the barrage on the tides will leave the higher saltings permanently above the high water mark where, in the absence of periodic inundation, they will gradually change to grassland. Even the middle reaches will not necessarily be unaffected as the

MAP OF THE SEVERN ESTUARY
SHOWING WILDFOWL AND WADER ROOSTS



barrage eliminates the differences between different heights of tides and subjects these areas to a constant twice daily regime leading to a simplification in vegetational cover and invertebrate fauna and hence a more limited series of niches for birds.

Thus the effect of the barrage will be to simplify the botanical and invertebrate communities as well as eliminating those that depend on the present tidal regime; some birds will adapt to the changes but others will be unable to do so. It is unlikely that displaced birds will find equally satisfactory habitats elsewhere in the region and overall populations will be reduced.

POLLUTANTS ACCUMULATE

This discussion has concentrated on the ornithological value of the estuary, both because the effect of the barrage on birds will be immediate and obvious, and because quantifiable information on the value of the Severn for birds is readily available. It is more difficult to assess the value of the various plant communities and almost impossible to determine the significance of the marine vertebrate and invertebrate animal systems. However, the effect on these parts of the ecosystem will be arguably even more severe because there is no prospect of sessile communities moving to alternative habitats elsewhere.

Finally, it seems that virtually no worthwhile investigation has been carried out into the effects of increased sedimentation above the barrage, and altered currents in its vicinity. It is inevitable that the creation of the barrage will be a further factor altering the existing intertidal ecosystems, scouring established mudflats and depositing sediments in new locations.

The effect of increased sediment deposition above the barrage may not be limited to these direct effects; there remains the problem of accumulation of pollutants in these sediments and their incorporation into the food chain. At present the Avonmouth/Bristol area is a significant source of chemical pollution, and Oldbury and Berkeley nuclear power stations would be above the barrage. It can be anticipated that levels of contamination arising as a consequence of routine discharges from these sources will rise as the dilution of pollutants and their transfer to the open sea becomes restricted. Similarly, flushing of the estuary following accidental discharge of pollutants such as industrial chemicals or petroleum products would be inhibited.

Overall therefore, the immediate and long term effect of a barrage over the Severn would be the destruction of an ecological community of considerable importance and the creation of an unquantifiable pollution hazard. Much argument has been devoted to whether tidal power could compete in cost with electricity generated from coal-fired or nuclear stations. This is surely an irrelevance - a Severn barrage would have unacceptable ecological consequences and is an alternative which should now be abandoned without reservation.

WILDFOWL & WADER POPULATIONS ON THE SEVERN ESTUARY 1969-75

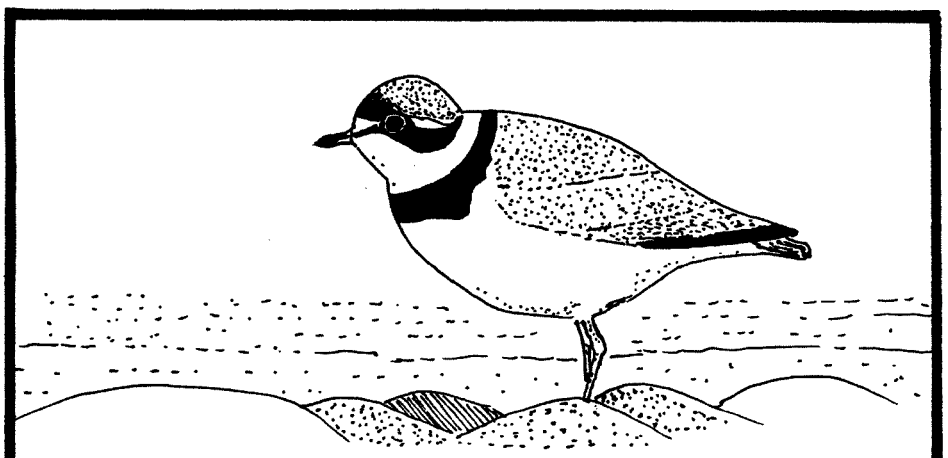
	Highest average monthly count	% of British population	
Bewick's swan	320	16.0	*
White-fronted goose	4500	45.0	*
Shelduck	2090	3.5	*
Wigeon	3070	3.0	
Teal	780	1.0	
Shoveler	100	2.0	
Ringed plover	308	2.6	*
Grey plover	420	4.2	*
Lapwing	14500	(1.5)	
Knot	5400	1.8	*
Dunlin	47000	8.5	*
Black-tailed godwit	1070	21.4	*
Whimbrel	1500	+	*
Curlew	2620	2.6	*
Redshank	2200	2.2	*
Turnstone	280	1.1	

* Population of international importance.

\+ No full census available but includes most of the population passing through Britain to breed in the Arctic.

() British population of Lapwing derived from Lack, 1986; data obtained during 1981-84 and thus not directly comparable with estuary population.

Sources: Prater, A J "Estuary Birds in Britain and Ireland"; Poyser, 1981. Lack, P "The Atlas of Breeding Birds in Britain and Ireland"; British Trust for Ornithology, 1986.



RINGED PLOVER:
ONE OF THE SEVERN'S IMPORTANT WADER SPECIES

References:

Lack, P "The Atlas of Breeding Birds in Britain and Ireland"; British Trust for Ornithology, 1986.

Prater, A J "Estuary Birds in Britain and Ireland"; Poyser, 1981.

Roberts J & Rowe J "Tidal Power - The Case Against"; SCRAM 44, 1984.

Shaw, T "Tidal Power - A Reply"; SCRAM 48, 1985.

When the Wind Blows

The British Wind Energy Association's 9th annual conference was held in Edinburgh in early April. It was an international gathering, with papers delivered on all aspects of the wind energy industry. MIKE TOWNSLEY was there to record the event for SCRAM.

BWEA

British Wind Energy Association

The wind energy industry received an encouraging boost when over 250 delegates attended the 9th annual BWEA (British Wind Energy Association) conference: the largest attendance to date.

Around one quarter of the delegates attracted to Edinburgh were from overseas. Such a high turnout SCRAM was told, is due to the British wind industry's leading edge in the development of larger machines, 300kW and above.

Concern over the maintenance of this lead was expressed, as the industry cast a worried glance over its shoulder, at increasing manufacturing interest in Japan, Taiwan and Korea. (Care must be taken to avoid repetition of the wave technology farce in 1982, when the Government killed off the research programme, allowing the Norwegians to step into its wake.)

The paper delivered by Prof Lipman, a past chair of the BWEA, targeted China as a major area for export of aerogenerators. He visited China recently and believes the potential lies mainly with peasant farmers, many of whom have no electricity supply at all and no access to a grid system.

In the final session of the first day Dr Swift-Hook, chair of the BWEA research committee, presented a lecture on the BWEA's January 87 position paper (the "Red Book"). With infectious enthusiasm he reiterated its main points and optimistically promoted generation costs below the 2p/kW barrier.

Heralding the publication, later this year, of an EWEA (European Wind Energy Association) equivalent of the "Red Book", the "Blue Book", he stressed the presence of an important British contribution.

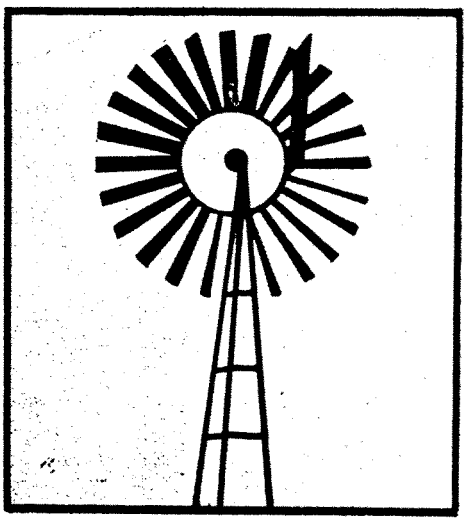
Putting the question of decommissioning into perspective, he estimated aerogenerator decommissioning costs at 5% of construction costs, which is roughly the scrap value. Thus we can ignore decommissioning, adding wryly "everyone else does".

On the second day a session entitled "Environmental Aspects of Wind Turbines" provided some of the most interesting papers. Jean Galt the Scottish Branch chair and conference organiser opened the session saying, "Environmental aspects are becoming increasingly important and over the next few years we will find it becoming a centre stage issue."

An excellent paper delivered by Ms Mackie from Dundee University, "Wind Energy Implications for Rural Communities", posed the important question of public awareness. An illustration of this low public awareness, is the fact that the 1983 Energy Act, which compels the regional generating boards to buy surplus electricity generated at a preset rate, eluded her for a long time.

A major threat to multi-megawatt wind generators is their interference with electromagnetic waves. The paper presented by R J Chignal, "Electromagnetic Interference from Wind Turbines a Simplified Guide to Avoiding Problems", sought to clarify this situation. To summarise: although complicated, this problem is not insurmountable.

The final paper of the session delivered by Mr R O'Brien, "Wind Energy Education in Grampian", also promoted the need for greater public awareness. Mr O'Brien heads a project he described as "a fifth column", teaching renewable energy through the wider aspect of environmental education. (see future SCRAM).



There was general agreement in the need for improved publicity and education. I was told that the BWEA do have a small plan for putting information into schools, but high costs involved in such a scheme, combined with the BWEA's limited budget, mean it will not be as comprehensive as necessary.

The day concluded with a well attended public lecture given by Geoff Watson, the chair of British Trade Winds. He helped set up the BWEA ten years ago but told me: "Trade Winds was formed a year ago at the wind energy conference, when it was decided there wasn't enough force being put into the political and various other pressures that can be brought to bear on the British government". Trade Winds is run specifically for manufacturers of aerogenerators.

His address aimed at those who may be interested in running their own generator, stressed the importance of professional advice. Adding that, although the windiest sites are best for aerogenerators, in the case of SWECS (Small Wind Energy Convertors), it is more important to build next to where the power is required, because of power transmission losses.

He believes there are "lots of people out there who would like to run wind turbines". A belief backed by the Department of Energy, whose own research estimates that over 2000 farms could run wind turbines economically.

During the Open Forum on the final day, many points of confusion and interest reappeared, with the delegates having the opportunity to air their thoughts.

Many of the delegates were worried over the question of rates payable on an aerogenerator. It was felt the extremely high level of rates seriously affected the economic viability of SWECs. Currently the rates work out at around 2p/kW compared with less than 0.001p/kW for a nuclear plant. Unfortunately no clear solutions were presented, and a call was made for a document to clarify the position; action may be taken.

The subject of machine availability was raised, bringing to mind Peter Walker's show-stopping observation that "the wind doesn't blow all the time". It was agreed that machine availability is at worst equal to that of any other generating form.

The session came to an end with a minor debate on the future of multi-megawatt aerogeneration; the conventional vertical axis wind turbine (VWAT) versus the usurper, horizontal axis wind turbine (HWAT) with its greater structural stability.

In all it had been an interesting if not inspiring conference, conducted with friendly informality, with future deals presumably being struck in the bar.

The wind industry is growing but requires greater public awareness and government backing, which is unlikely while they pursue the nuclear line: a link conspicuous by its absence.

Energy Efficiency

Local authority buildings in Britain use an estimated £800-900 million worth of energy a year. Given the current state of the building stock, it is generally thought that a 25% reduction in annual energy costs could be achieved in return for an investment of £400-500 million. This is an annual saving which will accrue to the authorities year after year, once the initial investment has paid for itself.

Local authorities are, however, under extreme financial pressure. They are subject to capital expenditure controls, so energy efficiency projects must compete with other capital projects, and they are usually the first to be dropped from the programme.

They are also subject to pressure to reduce revenue expenditure and staffing levels. As the simpler and more obvious efficiency measures, such as insulation, are completed, the more complex measures desired may require increases in staff. Automatic controls and heat recovery devices, for example, demand more staff time for analysis, design supervision etc. Authorities may actually need to increase their engineering staff to implement such programmes.

Some authorities are spending as much as £1 per head of population a year on run-of-the-mill conservation improvement programmes which are expected to take up to 15 years to complete. But many others are spending less. The backlog of work is, therefore, immense, and newly emerging technical possibilities are adding to the scope for cost effective investments, with two-year payback periods - a rate of return too good to ignore.

This is where the Energy Efficiency Office's new booklet - "Guidelines for Local Authority Shared Savings Energy Performance Contracts" - comes in handy. Under a Shared Savings Energy Performance Contract, a local authority can employ an energy management company, who will put their own capital and expertise into the authority's buildings. In return they are paid from the cost savings, resulting from lower consumption, for the period of the contract. At the end of an agreed period the new equipment would become subject to a hire agreement at a nominal charge, and the authority would take over responsibility for its operation and maintenance and enjoy the full benefit of the energy cost savings.

This form of contract is already offered by a number of firms in the UK, and is used in various other countries, including France and the US.

In June 1984 the Energy Efficiency Office commissioned a study to develop a form of contract which could be widely adopted, and this booklet is the result of that study. Make sure your local authority has seen a copy of it. It can be obtained from:

EEO, Thames House South,
Millbank, London WS1P 4JQ.
Tel: 01 211 6684.

An economic method of wringing the last watt from deisel generators, has been developed by Sultzer Brothers, a Swiss engine company.

The method, to be incorporated into a power plant in Guernsey later this year, channels the exhaust gases from a 14,000kW diesel engine through a turbine to drive an AC generator. This will provide electric power equivalent to 3% of the engine's rated output.

The new system is expected to pay back the £128,000 installation cost during its first year of operation.

Insulation

The Department of Energy propose a £14.5m draughtproofing grant to bridge the gap between the abolition of DHSS single payments in 1988, and the implementation of a wider home improvements grant.

The money will be made available to the Manpower Services Commision, enabling them to meet material costs.

The Government have, so far, decided the money will only cover 90% of the cost of materials for each household. Eligibility will be extended to all households getting income support (which replaces suplementary benefit), housing benefit and family credit.

Labour's energy spokesperson, Stan Orme, stressed "The Government's new proposals represent a .... , cut in existing provision. Once again, the poorest will have to pay to get help."

At least it does guarantee the future of the 384 local draughtproofing projects. Neighbourhood Energy Action, the National coordinating body for the projects, welcomed the announcement. Yet, they are concerned by the problems that will arise from only 90% grant assistance, and that households outwith areas covered by projects, will have no right to help with the cost of draughtproofing materials.

Coal

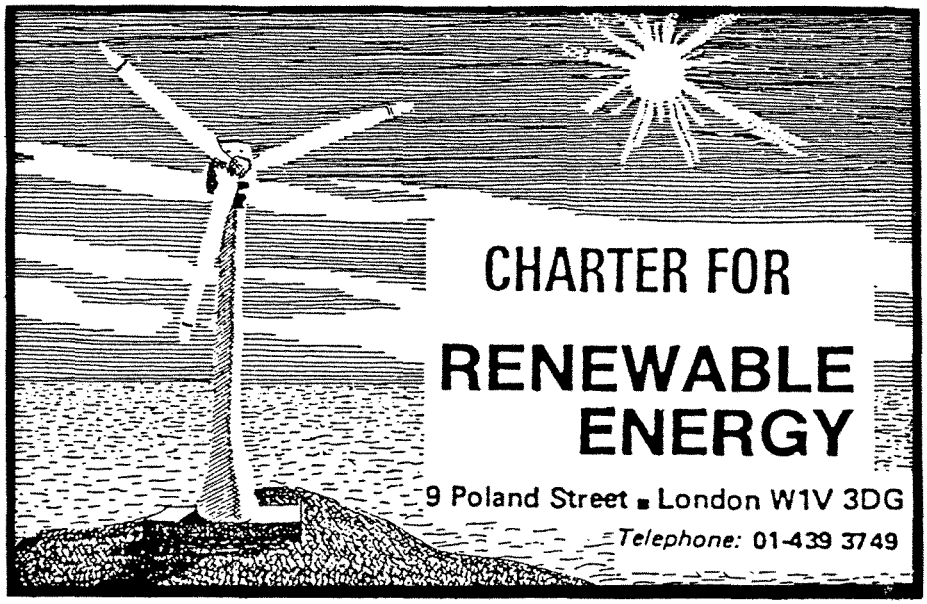
The CEGB have announced plans to close the small coal fired Shoreham power station outside Brighton.

Generation is to be stopped this spring, with the plant fully decommissioned by mid 1988. Over 300 jobs will be lost, with further losses threatened as a result of the "knock-on effect".

Steve Bassam, Labour PPC for Brighton Kemp and deputy leader of Brighton City Council, opposes the closure: "The CEGB should be planning to refurbish to gaurantee the future rather than prematurely closing it down."

He points out that "closing-off the options now - by shutting down stations like Shoreham - leaves us dependant on imported electricity from France and on nuclear power."

Shoreham is also thought to have potential for use in a CHP scheme. Its closure makes sense only to those wishing to propel us further into the nuclear insanity.



The Charter For Renewable Energy provides a much needed reference source for all advocates of a sane, sustainable energy policy.

Following in the wake of the very successful Charter For Energy Efficiency (SCRAM 52) it has similar aspirations. The distribution list contains; concerned individuals, unions, local authorities, environmental groups and industry. It aims to initiate serious discussion and cooperation between these groups, to promote major investment in renewable technologies.

The Charter calls for:

O Profits from North Sea oil and gas being used "to help move toward a sustainable energy economy."

O 2GW to be installed in on-shore wind farms, to feed the grid; with "an important role for smaller independent, wind turbines".

O 2GW of off-shore wind turbine capacity to economically provide 50% of our current electricity requirements.

O A commitment to one or more tidal barrages. There are 11 possible sites for tidal barrages in the UK, with a total potential of some 15% of current UK electricity requirements.

O Re-funding of the wave energy programme, with at least £50m allocated to the development of a number of full-scale prototype systems.

O Increased funding for solar, biofuel and geothermal developments. The potential for direct and indirect solar energy could be up 10% of the UK primary energy requirements, in the form of heat; geothermal could provide 10% of our electricity.

Finally the Charter suggests that an independant Renewable Energy Agency, responsible to the Secretary of State for Energy, be set up. "This could sponsor research into environmental impacts; manage demonstration projects and technical research; examine institutional and other barriers to the implementation of renewable energy technologies; and propose legislation to remove such barriers.

The document is a front, behind which the advocates of an energy policy based on renewables, can unite, creating pressures the Government and Industry cannot ignore.

Biomass

A new refuse fuelled power station for Merseyside has recently been granted planning permission. The plant, to be built by Urban Waste & Power Ltd, will be the first privately built and operated power station in Britain since the war.

The proposed plant would burn 250,000 tonnes of refuse a year to generate 24MW of electricity which will be sold to the national grid, under the 1983 Energy Act.

Construction of the plant, which is expected to begin by the end of this year, is dependent on the local waste diposal authority switching from landfill disposal. Peter King, managing director of Urban Waste & Power Ltd, told SCRAM that he does not anticipate any problems with this since the proposed gate price payable by the authority will be less than landfill costs. If all goes according to plan, the plant will be supplying electricity by 1991.

The plant, costing around £30M, centres on two Multi-Solid Fuel Bed (MSFB) steam generators, incorporates emission control processes which fullfil Peter King's stated objective of processing waste and generating electricity, "for maximum profit in an environmentally acceptable way".

The refuse will first be processed to remove potential pollutants, while a long "residence time" in the combustor will further destroy toxins. Finally, an electrostatic precipitator will reduce emissions to the proposed EEC level of 50 milligrammes per cubic metre of flue gas, less than half that of the current UK level.

It may be possible to use the low level waste heat to provide warm water for local industry and commerce. MANWEB, the region's generating authority, are currently canvassing interest in such a scheme.

Peter King enthusiastically promotes the scheme's positive benefits: local long term job creation not only in the construction, operation and maintainance of the plant, but in the making of bricks and compost from the process's by-products.

This is widely recognised as the most economic method of waste disposal. If widely implemented, it has an estimated potential of 1000MW electricity generating capacity, in a locally flexible manner. Sizewell B will supposedly generate 1300MW. Peter King comments: "It is a tragedy that 1000MW of generating capacity should not be used."

An important pollution abatement prize has been awarded to Cistercian Monks from a monastery farm in County Antrim (see SCRAM 58).

The award was for their biomass converter, which takes two of the farm's most toxic wastes: slurry and silage effluent converting them to a peat-like compost and high energy gas.

The annual awards sponsored by the Environment Foundation, were presented in Birmingham on 6 April by William Waldegrave, the Government's "green" Minister for the Enviroment.

Geothermal

The technical and economic viability of hot rock schemes, is currently under review, in a joint European research project.

Among the objectives of the Franco-German research team is a solution to the problem of connecting the crack zone created by the first bore hole to that of the second. This would complete the loop through which heated water can be retrieved.

Also under consideration is system efficiency: optimisation of flow rate and the number of bore holes per installation.

The project site Haguenau in Alsace, France is in a relatively young geological fault zone, where hot rocks lie close to the surface.

Experience gained at Los Alomos, New Mexico should prove invaluable to the new project.

The £2.5M project costs are being met jointly by the EEC (£1.5M) and the German Government (£1M).

Power Politics: Meeting Energy Needs

The conference promoting initiatives to eliminate fuel poverty and examining effective democratic control of energy production has been organised jointly by Greater Manchester Sera & Energy Prospects Standing Conference.

The conference will be held on 23 May, in Manchester Town Hall.
For further details phone: 061-432 2188.

Wind

Construction of a hybrid power source for the small island of Faula off the west coast of Shetland, could start this summer.

The hybrid - a combination of aerogenerator, hydro scheme, and back up deisel generator set - would replace the expensive, limited output deisel generators currently relied on by the island's fifty inhabitants.

The beauty of such a scheme lies in the complimentary nature of the power sources. The excess aerogeneration when winds are strong is used to pump water to the hydro reservoir for subsequent release to compensate for when wind generation is insufficient. It is hoped this combination will make the gen-set back up redundant.

Costs of this project are expected to be met entirely by grants. The Shetland Islands Development Council has recommended a £90,000 grant towards the first phase, and the EEC is expected to make up the balance, although the Highlands and Islands Development Board have also been approached.

The first phase of construction, costing £315,000, involves building the aerogenerator and part of the hydro scheme. The system could be semi-operational this autumn.

The final phase, planned for next year, involving further work on the hydro scheme and completing the connections to the houses, will cost a further £63,000.

Jack Burgess, director of R&D for the Council, proposes that a community with a proper power supply has a much greater chance of survival, and is positive money will be found for the second phase of this enterprising venture.

The Council are also investigating how another island, Papa Stour, may be supplied from the scheme using a submarine cable.

The designers believe that valuable lessons are to be learnt here, with special significance in the Third World.

The blades for Orkneys 3MW wind turbine, LS1 on Burgar Hill, are to be put together over the next few weeks.

LS1 will be the largest wind turbine in Europe, with its electricity going to the NSHEB (North of Scotland Hydro-Electric Board), after synchronisation with the grid in July.

The Wind Energy Group (WEG), who are responsible for the development of the generator, comprimise British Aerospace, GEC Energy Systems and Taylor Woodrow Constuction. The £11m development and construction costs of the giant wind turbine, were met by the Department of Energy.

Work on a successor to LS1 has already begun. Bernard Manders, the project manager, believes that, based on WEG's work, they will have greater insight into comercial viability of multi-megawatt machines.

Peat

A £240,000 grant has been awarded to examine the potential of peat as a fuel and added-value product in Scotland. The grant was announced at a two-day Peat Conference, staged by the Finnish Foreign Trade Association in Edinburgh.

The Finns - pioneers of peat technology - already have the world's biggest peat fired power station, equal in size to the PFR at Dounreay. They are also in the process of building the world's first ammonia factory using peat as a raw material.

The project, spanning three years, will recieve its funding from both the EEC and the UK Department of Industry. The first two years will be spent examining the peat resources, to estimate the potential of peat for power production.

Another avenue for development is the production of added-value products: peat coke, barbecue charcoal and activated carbon.

The project will be carried out by the Macaulay Institute for Soil Research and the Scottish Institute for Agriculture and Engineering which is shortly to amalgamate with the East of Scotland College of Agriculture.

Dr Allan Robertson, a former head of department for peat and forest soils with Macaulay, stresses expansion in peat utilisation need not be at the expense of conservation aims. He adds: "We know that we have substantial resources of peat in Scotland, that up to now have been under-utilised. Despite what the conservation people say, we have something like 800,000ha of it and less than 1,000ha of this is being used for production, so I don't see why this should be a big problem."

John MacKay, the Scottish Agricultural Minister, who opened the Conference on 24 March, admitted there is a substantial peat reserve, with possibilities for development. Yet he could shed little light on the Government's intentions, despite the Industry Department's role in awarding the grant!

Wave

Permission to carry out experiments in wave power on Islay, is being sought by a team from Queen's University, Belfast.

Headed by Dr Trevor Whittaker, from the Universty's Department of Civil Engineering, they plan to set up a demonstration prototype in a gully bellow Claddich Farm, Portnahaven which falls under the jurisdiction of Argyl and Bute District Council.

Capable of generating 180kW, the installation will be monitored by a four-man team aided by computers over five years. Dr Whittaker thinks several Scottish islands could benefit from wave power.

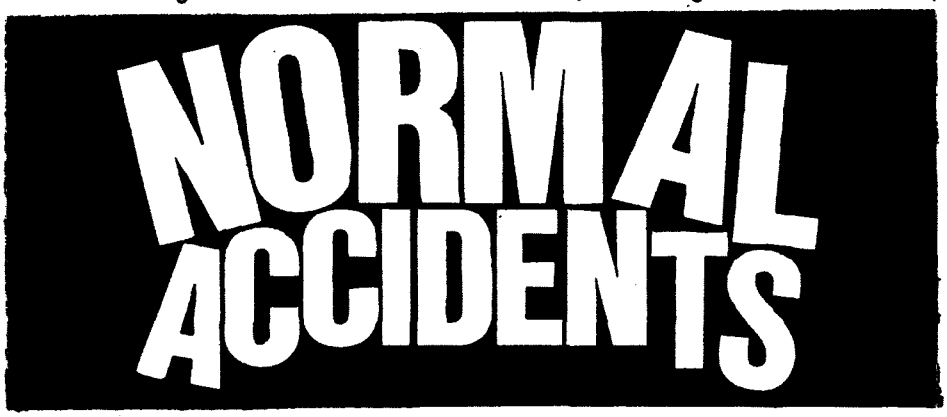
Normal Accidents: Living with High-Risk Technologies by Charles Perrow; Basic Books, New York. 386pp, £7.50.

This book predates Chernobyl by two years, but the arguments it explores and the conclusions it reaches are only confirmed by the Russian disaster. In Perrow's terms, Chernobyl was a "normal accident": that is, it occurred in a system which, because of its inherent characteristics, was predisposed towards having such an accident.

Charles Perrow is a sociologist, and a specialist in organisational theory. He served on the President's Commission on the accident at Three Mile Island (the Kemeny Commission) and it was this experience that formed his ideas around a theory of accidents in high technology systems, and brought him to write this book.

It is a vital book for the anti-nuclear movement, because for the first time it puts on a firm foundation that uneasy yet ill-defined feeling that we have when the risk experts talk of probabilities of "one accident in a million years", or similar statistics. We know that such figures are wrong: they offend commonsense. But *how* are they wrong? What characteristics does nuclear power have, in common with other high-tech systems, that make them wrong? The answer is here, in this book.

Perrow's thesis is that accidents are inevitable ("normal") in systems that have two characteristics that he terms "interactive complexity" and "tight coupling". His theory concentrates on the systems themselves, rather than on the errors that designers, owners and operators make in running them.



"Complex interactions" are those in which branching paths, feedback loops, jumps from one sequence to another allow system components to interact in ways that were not foreseen in the system's original design, and which could not be anticipated or reasonably guarded against. "Linear interactions", in contrast are those in which one action follows another in a straightforward, comprehensible and predictable way.

"Tight coupling" is an engineering term, meaning that two elements are joined in a way in which there is no slack or buffer or give between them, so that what happens in one directly affects the other. "Loose coupling" is its opposite.

Nuclear power, argues Perrow, exhibits both interactive complexity and tight coupling. Given these characteristics, an accident that would in other contexts be minor can lead to a catastrophe - as was shown by Chernobyl, which was a systems accident *par excellence*, being compounded by operator error and a particularly unforgiving reactor design. As Perrow (pre-Chernobyl) says, "the case for shutting down all nuclear plants seems to be clear. There will be more system accidents; according to my analysis, there have to be. One or more will include a release of radioactive substances to the environment in quantities sufficient to kill many people, irradiate others, and poison some acres of land. There is no organisational structure that we would or should tolerate that could prevent it."

What distinguishes this book from the many others arguing against nuclear power, is that it is not *only* about nuclear power. There is an enormous amount of reference detail on all kinds of systems accidents - marine transport, petrochemical plants, aircraft and airways, dams, mines, lakes - which serves to reinforce Perrow's analysis. Flixborough, DC-10s, liquified natural gas tankers, non-collision course collisions, Apollo 13 and the Grand Teton Dam all make an appearance. Recombinant DNA research (bio-technology) is flagged as perhaps having the potential for the "ultimate accident". It is also (for a scientist) extraordinarily well written.

David L. Sills, Perrow's erstwhile boss at the Social Science Research Council, reviewing the book in *Nature*, said that it "will markedly improve discourse on the nuclear power debate; it should not have attempted to decide it." In no way does Perrow attempt to decide the issue, he simply draws conclusions and puts forward his opinions. After Layfield's pronouncements on Sizewell the anti-nuclear movement in this country may well feel some despair at the apparent powerlessness of reasoned argument. Perrow's book provides powerful intellectual support for the case; it should be widely read and its foundations should be built upon.

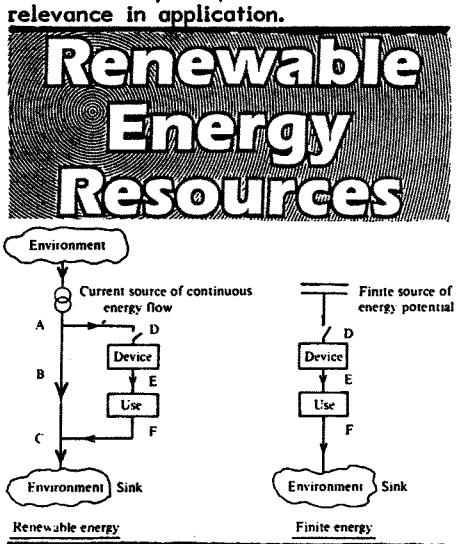
TIM WILLIAMS

Renewable Energy Resources by John Twidell & Tony Weir; E & F N Spoon. 439pp, £14.95.

By the virtue of a well written and structured text book, the authors have provided a unique essential reference book, for anyone interested in renewable energy.

The first chapter, "Principles of Renewable Energy", stands well on its own as a rational treatise expounding a sane energy strategy; it postulates that renewable energy would promote a "just and sustainable society, increasingly free of poverty and the threat of cataclysmic war."

The independence of the chapters and comprehensive index are the key to its value as a reference book. A basic science knowledge is preferable but specifics are not, as each chapter takes the reader through the fundamental principles to their wider relevance in application.



The full spectrum of disciplines are covered, from the obvious solar, wind and wave, to biomass, including anaerobic digestion for biogas and agrochemical fuel extraction.

It provides interesting general descriptions, clear concise definitions and simple illustrations. For example, we find that the definition of renewable energy is "energy obtained from the continuous or repetitive currents of energy occurring in the natural environment.

The authors, who have extensive experience in both the field and the classroom have a gift for clear communication. Originally targeted as a course companion for physical science undergraduates, it contains a chapter on "Essentials of Fluid Mechanics" and one on "Heat Transfer". Although the authors expect "a basic understanding of ... calculus", I feel this is not necessary to understand the fascinating principles of this increasingly important subject.

Although applications are undergoing rapid change this will continue to be an essential definitive volume on the principles of renewable energy resources.

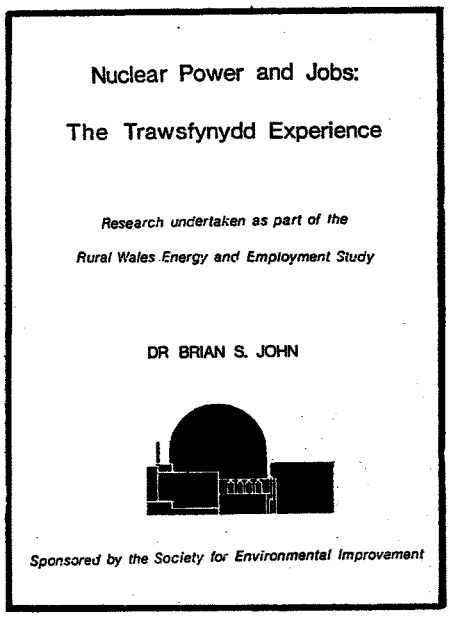
MIKE TOWNSLEY

Nuclear Power and Jobs: the Trawsfynydd Experience by Dr Brian John; Rural Wales Energy and Employment Study. 36pp, £3.

(Available from Trefelin, Cilgwyn, Newport, Dyfed SA42 0QN).

The publication of a study about the economic impact of the closure of Trawsfynydd has sent a ripple of confusion through the political world in Gwynedd. The report comes to the alarmist conclusion that nearly 1000 jobs presently dependent on the power station will be lost on closure. Politicians are, as a result, seriously considering inviting the CEGB to build a PWR on the site to avoid this employment disaster.

It is perfectly understandable that some local authorities and politicians have started to panic and decided to press for the continuation of nuclear power in north Wales. In this pamphlet, Brian John explores some of the myths which have led to these fears.



The economic impact study, he alleges, is seriously flawed. In the first place, economic theory which may be suited to the investigation of national or large-scale economic relationships, has been inappropriately applied to a small rural area. Secondly, the real impacts of the power station have been greatly exaggerated.

By looking at local statistics, he shows that the station has actually had a negative impact on local employment. To make matters worse, ach local job created by building a Trawsfynydd PWR would cost £8m; light industrial jobs can be created at a cost of £20,000. So, for the cost of one local job in the nuclear industry, no fewer than 400 equivalent non-nuclear jobs could be created.

Brian John looks at rural economics in a new way. I have no doubt that some of his methodology will be challenged by other economists. But this pamphlet will hopefully be the beginning of a new line of research which will directly confront the nuclear industry's latest line of attack. The industry are obviously hoping that their task will be made easier by convincing communities around existing stations that they are "hooked" on nuclear power. If this can be proved, they will find it a lot easier to introduce the PWR.

Unfortunately the "jobs panic" appears to have set in already in north Wales. But, if we use Brian John's ideas to research the areas around other magnox plants, coupled with plans for alternative job creation (unfortunately missing from this pamphlet), we can expect the support of an increasing number of anti-nuclear local politicians, and make the nuclear industry's hopes turn into nothing more than a bad dream.

PETE ROCHE

Before and After Chernobyl: Nuclear Power in Crisis, A Country by Country Report by Åsa Moberg; Greenpeace Sweden. 107pp.

(Available from Greenpeace Sweden, Box 7183, 402 34 Gothenborg, Sweden.)

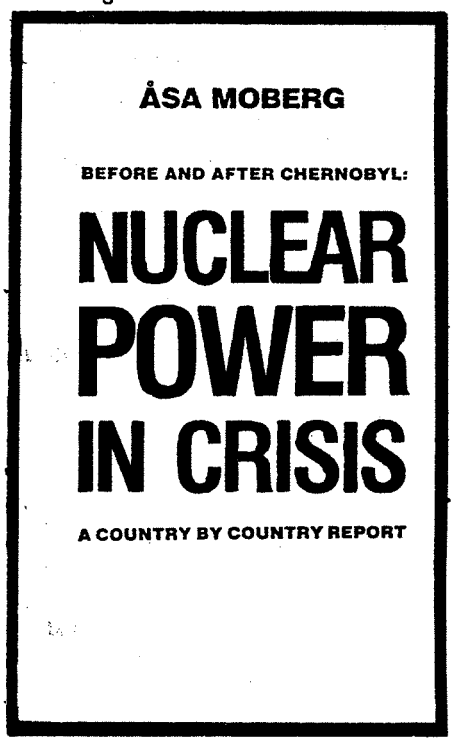
This is a valuable book for anti-nuclear power activists. It examines the nuclear power programmes, country by country and contains a very useful appendix showing the reactors on-line worldwide as of March 1986 (by the end of 1986 the total number only has increased by about 10).

Asa Moberg produced the booklet in Swedish at the beginning of 1985 following a request from a Swedish publisher to prepare a short collection of facts about nuclear power in the world. As she writes in the acknowledgements, her work with the Swedish Energy Research Commission made the book possible.

Much of the information arranged here has been drawn from Nucleonics Week, the nuclear industry newsletter. She finds their reporting to be "more down-to-earth" than the official information from governments and the industry. But, she also points out that "unfortunately an annual subscription costs $1120." The information has been updated to take account of events in 1986, not least of which was Chernobyl and its effects on worldwide nuclear power.

She took out a sub to Nucleonics Week in 1980, after the Swedish referendum vote to phase out their nuclear contribution by 2010, "with the purpose of finding out exactly which countries were doing such profitable nuclear business" as Swedish nuclear advocates claimed. The facts were very different: apart from the communist bloc, only Japan and France have ordered new reactors in the 1980s. And, after 1990, new orders will not keep pace with closures of older ones, so the total number of operating reactors in the world will start to decline from the projected 1990 figure of about 400.

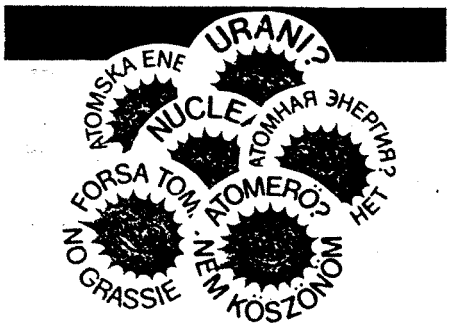
A major reason for this move away from nuclear power is the aging of the "young heroes", who began its development after the War, into the "grey-haired, rather disillusioned men on the verge of retirement". They understand each other, but they don't understand others people; they regard them as a problem of "public acceptability". The young technological geniuses today are found in other technologies.



The booklet contains a chapter which gives basic information on nuclear power; one on the nuclear power crisis in the USA; six chapters covering Canada, Europe, the Middle East and Africa, Latin America, Asia, and the Soviet Bloc; a chapter on developing countries' programmes; and a Chernobyl postscript.

In short, a booklet I would strongly recommend, and the author will permit reproduction of the information in any form free of charge, so long as the source is given.

STEVE MARTIN



SCRAM have hundreds of smiley badges for sale, in dozens of languages. Price: 30p each (a third discount for over 50). Please state alternative choice, in case your first choice is not in stock: *11 Forth Street, Edinburgh EH1 3LE.*

Another split in the Alliance over Dounreay? Jim Wallace, Liberal MP for Orkney and Shetland, has gone on record in the *Orcadian* (2.4.87) as forecasting that an Alliance Government would not give the go ahead for the European Demonstration Reprocessing Plant.

He is quoted as saying: "I cannot imagine any circumstances in which an Alliance Secretary of State for Scotland would not conclude that the go ahead for the Dounreay development should be refused, should that decision land on his lap in his early days in office." The double negative (an Alliance speciality!) makes it difficult to understand at first glance, but persevere.

The problem for the Alliance is that Bill Rogers of the SDP is their Energy Spokesperson for the coming election. In a reply to a letter on the subject of Dounreay, Mr Rogers wrote: "Frankly I cannot anticipate how an Alliance government will deal with the matter."

He went on to say that the feelings of the local MP will be taken into account when a decision is taken. (Does that mean that the decision is a political one, and not based on the technical merits?) But, the *most* local MP is the SDP's Robert MacLennan who is in favour of the development. How can the Alliance square that circle?

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A prestigious international press open day scheduled for 7 April at the Dounreay fast reactor development centre in Caithness was postponed at short notice.

Officially the event, entitled "Tomorrow's Technology Today", was postponed because the Prototype Fast Reactor was not operating ("tomorrow's technology"?). However, the reactor's problem was announced in February, and the invitations were not sent out until March.

The real reason (according to the trade unions) was that there was to be a picket at the gate to bring the union's current dispute to the attention of the media. The UKAEA industrial workers' union is pushing for a pay rise to achieve parity with BNFL workers doing the same work at Sellafield.

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Following the allegations in the last *SCRAM* that the CEGB Chairman Lord Marshall is refusing to buy electricity from the SSEB because of a difference of opinion over the choice of the next reactor system, Little Black Rabbit has been doing some burrowing to confirm the claim.

A meeting in the House of Commons between George Foulkes, the MP for Carrick, Cumnock and Doon Valley, and Lord Marshall was meant to shed some light on it. George asked him for an explanation.

The Baron tried to blind the MP with science: "Not being an electrical engineer, you won't understand the details"; that sort of thing. But to summarise, there are overriding technical reasons why it is difficult for the CEGB to import Scottish electricity. (They can import it from France, though).

George was not satisfied, and pressed him. Lord Marshall eventually admitted that he held out some hope for a solution - if the SSEB would reduce the price! So, the technical difficulties can be overcome if the price is cut.

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George Foulkes has also been in contact with the SSEB. He wanted a copy of the Hunterston emergency plan and asked his researcher to get one. The researcher phoned the Board but was told that he had to make the request in writing on headed note paper. This George duly did.

The document arrived with a covering note: "When you have read it please return it because somebody else wants it."

When George returned it he enclosed a covering note thanking them for the loan of the plan, and pointed out that he had discovered a wonderful new invention - the photocopier!

• • • • • • •

News on the Dounreay Inquiry, or more precisely on the Inquiry papers. A colleague of LBR wanted to do some research so went to the Inverness public library to check on the papers. They had mysteriously disappeared.

It transpired that there was nothing sinister afoot - the Reporter had begun to write his report and discovered that he didn't have a copy of all the Inquiry papers, so the Scottish Office appropriated the set from Inverness. After all, Inverness is 80 miles from Dounreay, and it was a *local* inquiry.

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Remember the full-page advert from Friends of the Earth in the *Guardian* asking for support for their opposition to Sizewell B? One reply was very interesting. It had a note attached:

"Please help me. My editor keeps publishing letters saying I am a lunkhead suffering from astigmatism of the brain who would have difficulty reporting the activities of Thomas the Tank Engine. I only do it because I think you are very wonderful people and the sooner your party comes to power, the soooner I will be able to prove my very famous theory that man can live by ethyl alcohol alone.

PS. Why not propose me for a Nobel Peace Prize?"

The address was the "Science Fiction Correspondent of the Guardian," but the identity of the correspondent couldn't be verified as the form was signed with an "X".

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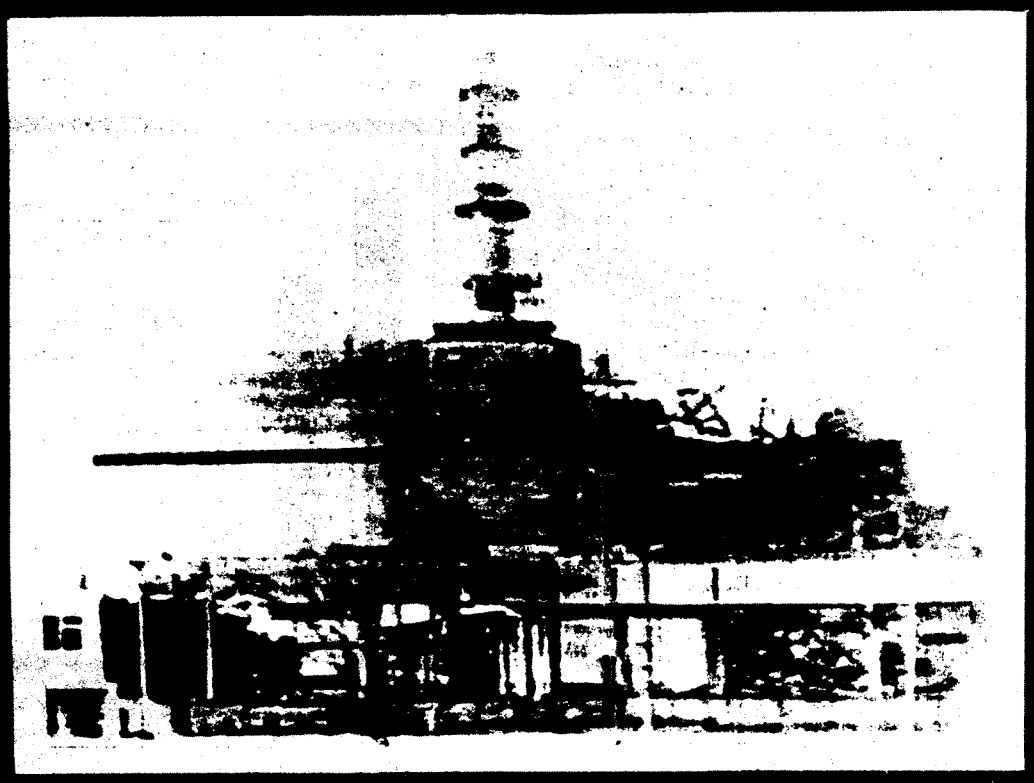
CHERNOBYL
Предупреждение - A Warning



Shortly after 1.00 am on 26 April 1986 two explosions ripped open the Unit 4 reactor building at Chernobyl in the Soviet Union; and with it the fragile myth of safe nuclear power.

As information filtered through, nuclear industry spokesmen appeared on our television screens, their once complacent expressions wiped from their faces to be replaced with expressions of fear: the public had found that the nuclear Emperor indeed had no clothes.

It didn't take them long to regain composure: "It was a major disaster for the Soviets, but it couldn't happen here," became the line. Certainly, the series of events which led to the Chernobyl accident could not happen here, because we don't have that type of reactor, but an accident on the same scale could; and according to some industry spokesmen the odds are that it will.

The effects of Chernobyl have been felt all over the northern hemisphere: fallout was detected from America to Japan. Some foods were banned in some countries; a ban was placed on sheep in the UK; the lifestyle of the Lapps in Scandanavia has been destroyed because of high levels of radioactive contamination in the reindeer.

The political fallout was just as great. The Swedes have accelerated their phase out; the Italians, Spanish and Belgians have declared a moratorium; West Germany are looking seriously at their nuclear programme. In the face of all this Peter Walker, the UK Energy Minister, gave the go ahead for Sizewell B.

This special supplement looks at some aspects of the disaster. The UK monitoring agencies were totally unprepared and under-resourced to cope with an accident over 1000 miles away: could they deal with a British, or French, accident? Our government preferred to sit it out and hope the problems wouldn't be too great. There should have been a ban on milk; and the ban on the movement of sheep came too late. Farmers are angry at the poor compensation and the government's delays.

But we must also remember the plight of the Soviet people: the emergency services who gave their lives; the scientists who are grappling with a totally new situation; and the thousands of ordinary people who had to leave their homes and who will have their health monitored for the rest of their lives.

The Soviets are reported to have made improvements to their reactors, at a 20% increase in the cost of nuclear electricity. This will not ensure that another disaster will not happen. The only way to ensure that is to phase out nuclear power now, and introduce benign energy systems: energy conservation, clean coal technology and the renewables. Without this policy shift we will forever be hostage to an unforgiving technology, with the threat of destruction hanging over us.

Cock-ups and Cover-ups

The NRPB produced their estimate, that a "few tens" of people in the UK would eventually die of cancer as a result of Chernobyl, on 6 May last year. This was later refined to 40-45 in early September, when it was also stated that there would be an additional 110 non-fatal thyroid cancers. They have not yet conceded that there will be any serious hereditary defects, although some 25-30 would be implied by these figures. Nor have they discussed the risk of mental retardation to unborn children in the 8th to 15th weeks after conception, estimated by the ICRP at 1 in 2500 per mSv

These cancer estimates are very controversial, and many scientists would put them much higher. What really matters however is the risk to the most exposed individuals in the population.

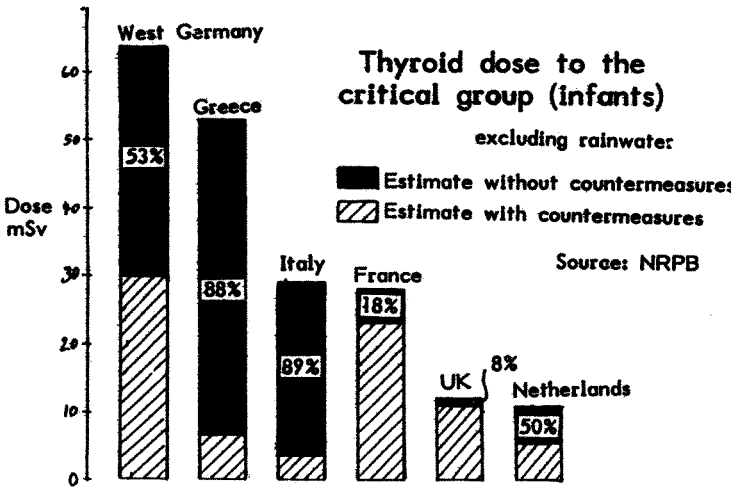
The NRPB have been very slow to divulge these figures. At the end of September Keith Baverstock of the Medical Research Council estimated that infants in the worst affected areas had received thyroid doses of 10-20mSv, increasing their risk of thyroid cancer by up to 40%. John Dunster, NRPB Director, responsed that the maximum thyroid dose was "rather smaller" than this and affected "much less than 10000" children.

Their Chernobyl compendium M139, published in December, said nothing further, although it tantalisingly mentioned an apparently secret "fuller assessment" which MPs have since asked for in vain. It is only the publication on 25 March of the NRPB's European Commission report that gives any "critical group" dose estimates (and we still await the methodological appendices, which will not be released before the end of April).

That report confirms that they have indeed had something to hide. Britain performed worse in reducing critical group dose through counter-measures than Greece, Italy, West Germany, Holland and even France (probably better than Belgium, Ireland and Luxemburg, where no measures were taken). Consequently we received the third worst level of critical group thyroid doses, after West Germany and France.

Allowing for rainwater, the first-year thyroid dose to the critical group of babies must be close to 20mSv, as originally suggested by Baverstock. What is more, the first-year committed effective dose equivalent (whole body) to the critical group of babies is put at 1.16mSv, above the principal annual dose limit of 1mSv. This confirms what I wrote in my *New Scientist* article (9.10.86). The authors say that these are likely to be overestimates - but a host of omissions and reservations point the other way.

Doses would have been greatly reduced by selective milk bans in the worst areas, and even by simple warnings that children should not drink undiluted farm milk and that the Milk Marketing Board should use the least contaminated sources of supply to meet the



reduced demand. The 48-hour delay in issuing the warning against drinking rainwater was important also, and significant inhalation doses could have been prevented if children had stayed indoors on the first

"Sacrificed to ... Nuclear Power"

Security for an informal gathering of EEC Agriculture Ministers last September was unusually tight. Armed police patrolled the hills and all roads leading to their hotel in the Westmorland and Lonsdale constituency of Michael Jopling, Britain's Minister, were sealed off.

These precautionary measures were an attempt to avoid angry farmers protesting at the delay in compensation payments following Chernobyl. These fears were not exaggerated. A couple of weeks earlier two Welsh Office officials had been taken hostage by farmers in the Conway Valley; their release was only secured after the farmers were promised a discussion with the Welsh Secretary on compensation.

The farmers had been kept in the dark about contamination of their livestock and the subsequent disruption to their livelihoods. The first inkling they had of the problem was on 20 June, when Michael Jopling announced a ban on the movement of sheep on 1500 farms in south-west Cumbria and north Wales. He failed to tell MPs that he had been contemplating this for the previous six weeks.

A national survey by the Institute of Terrestrial Ecology within days of the Chernobyl cloud reaching Britain pinpointed upland areas as the most severely contaminated by caesium-137 (Cs-137). All the Cumbrian samples exceeded the NRPB's "action level" for removing livestock from outdoor grazing. MAFF refused to follow the advice, mainly because hill farms don't have the necessary indoor accommodation, but they did start a programme to test slaughtered lambs for radio-caesium.

By mid-May the first results showed Cs-137 levels well above the EEC-approved 1000Bq/kg limit at which restrictions should come into force. Yet, at the end of the month, Jopling was still claiming that "we have always been a long way from the stage when we need to contemplate any restrictions."

The delay in imposing a ban sprang from the Government's commitment to rescue the tarnished image of the nuclear industry. Roger Ward, secretary of Cumbria's National Farmers Union, who was to fight for better compensation for his members, realised this: "1986 was an appalling year for nuclear power, especially here in Cumbria. Then came the terrible disaster in Russia. Banning of sheep was a straightforward political decision aimed at restoring the industry's credibility. Before Chernobyl, the action level was 10,000Bq, so when we heard that some of our sheep were over the 1000 limit we weren't that worried. As far as we are concerned, our livelihoods have been sacrificed to preserve nuclear power."

Roger Ward cannot forgive MAFF's failure to

day. None of these measures would have carried any significant cost or risk. The later, rather costly, action on lamb, vital though it was, has not been able to make up for these omissions, as the NRPB's own figures now show.

So what went wrong? The government's position, from Mrs Thatcher down, is that no mistakes were made at all. Implicitly, though it is accepted that there should have been a contingency plan to deal with a major overseas nuclear accident (but not a British one!) and we are now to get such a plan.

The NRPB has blamed primitive communication systems (including handwritten tables and blocked telephone lines) and geographical gaps in emergency monitoring cover. While these cannot have helped, it is hard to see them as important in this case - monitoring was best in exactly the places where fallout was worst. And if these problems were so serious, why did Kenneth Baker tell Parliament on 6 May that "the effects of the cloud have already been assessed.

INITIAL MISJUDGEMENT ON MILK

Dunster has claimed the cloud "crept up on us" and "it was not obvious that it was coming here, and if it did, it was felt it was not going to be serious." The first part of this statement does not square with the admission that they had two day's warning of its arrival. In relation to the latter part, it is possible that "mental set" could have played a role. Dunster was prominent in tracking fallout from the 1957 Windscale fire, when there was no significant rainfall, and may have expected the Chernobyl cloud to behave in the same way.

Allowing a 1mSv critical group dose to trigger a lamb ban but not a milk ban is certainly consistent with the view that there was an initial misjudgement. Moreover, Mrs Thatcher has stated that the government's "assessment of the situation following the Chernobyl accident changed with time as our extensive monitoring provided detailed information . . . Advice was given on the basis of that assessment."

There seems therefore to have been a large element of bungling, with a reluctance from the first to admit it. Unfortunately, there is also evidence that the government put pressure on the NRPB to play down the effects of the accident. In the *Listener* (18/25.12.86) Dunster said that Kenneth Baker, then Environment Secretary, expressed his displeasure on at Dunster's reference to a "few tens" of deaths - which contradicted Baker's statement to Parliament on the same day that there was "no health risk."

But it must have been the NRPB who supplied the extraordinary catalogue of misleading answers given to MPs by Ministers in May and June, and they have certainly played the episode down since. And they have compromised themselves by wrongly claiming that doses below the "emergency reference levels" of 5mSv whole-body and 50mSv to the thyroid can be disregarded altogether; that the need for countermeasures can be decided on the basis of a single "derived emergency reference level" even in a multi-radionuclide accident; and that the main requirement is to limit total collective dose rather than doses to individuals.

What should be done now? Seven MPs have called for an inquiry into the official handling of Chernobyl. In fact there has been one - by the Civil Contingencies Unit of the Cabinet Office. It should be published. Moreover, the new emergency plans should be published as a *Green Paper*, for consultation, contrary to the present proposal.

The NRPB also needs reform. In order properly to protect the public interest they need funding and Board members from sources other than central government. Likewise the absurd provisions whereby staff and Board members are subject to the Official Secrets Act, and the Atomic Energy Authority has a privileged position in relation to consultation, should be scrapped. There must be many people at the Board who would welcome such changes.

David Webster wrote the article "How Ministers misled Britain about Chernobyl" in *New Scientist* (9.10.86). He is a senior housing officer for the City of Glasgow.

forecast how long the ban would last. In a circular to Cumbrian farmers explaining radio-caesium's effects on sheep, MAFF claimed that, as the fallout had lasted only 6 days, the restrictions would last for a month at most. Six months later, levels of Cs-137 in sheep were as high as they had been in May.

MAFF's mistake was to base its advice on erroneous assumptions built into the NRPB's model. The model compares Cs-137 with naturally occurring potassium-40 (K-40) but Cs-137 stays in the body longer and concentrates in muscle and liver tissue, whereas K-40 is spread evenly throughout the body.

More crucially, the NRPB model is based on studies of lush lowland grazing, and not of the harsher environment of fells and mountains. Lowland soils contain clay which binds the caesium, preventing its absorption by livestock. This contrasts with the thin and peaty soils of the uplands where the caesium collects on vegetation, thereby allowing a greater uptake.

GOODWILL RAPIDLY DRAINING AWAY

Sheep farming on the uplands is a precarious business, and depends on a delicate balancing act between resources and systems. Over the year Arthur Lancaster, whose farm combines land in Wasdale Valley with extensive fell grazing, would move his sheep between the two to maximise their grazing and allow time for the pasture to regenerate. But, he was forced to keep lambs, which would have gone to market in July, on the lower fields for an extra month. This deprived the suckling cows he normally kept there of their pasture, so they had to be fed on the newly-cut hay which was earmarked for winter silage. Arthur Lancaster lost £5000.

If Chernobyl is in danger of slipping out of the public's mind, for Cumbrian farmers the events of last year have posed a question they had hoped they would never have to answer: if an reactor accident over 1000 miles away can wreak such havoc, what would happen if Sellafield went up? Some remember pouring their milk away after the 1957 Windscale fire.

Even more believe BNFL vented Sellafield's stacks under cover of the Chernobyl cloud. Wild as this allegation may sound, the fact that it is uttered suggests that any goodwill remaining among the farming community towards their nuclear neighbour is rapidly draining away. In the words of Geoff Brown, Cumbrian County Councillor and one of the farmers affected: "A lot of farmers came out of the closet over nuclear power after Chernobyl. They know how important it is for local employment but, with its dreadful accident record it has forfeited their trust. Sellafield is now seen as totally incompatible with a rural way of life."

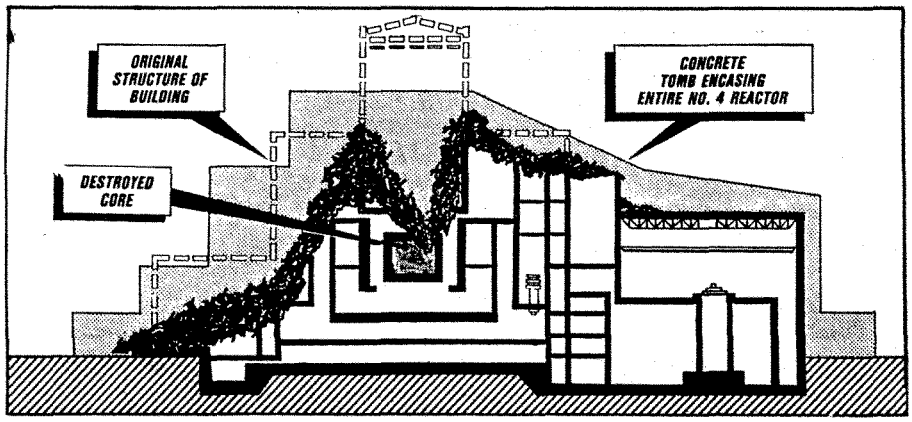
This is a shortened version of "Green and Poisoned Land" by Charles Searle which appeared in the April issue of *Sanity*. He is CND's NFZ worker.

The Soviet Experience

The first victim of the Chernobyl disaster was Valeriy Hodiemchuk, an operator on the unit 4 reactor; his body will remain in the now entombed reactor building. Most of the other fatalities were firefighters and emergency workers had to deal with the immediate effects of the disaster; and the operators who remained at their posts to close down reactors 1,2 and 3.

By the time the secondary fires, initiated by the ejected red-hot radioactive debris, were brought under control the firefighters were in poor condition. There were 300 with high radiation doses, of whom 129 were transferred to a special Moscow hospital by 3 flights the following day. Despite desperate efforts, such as bone marrow transplants, 28 of these died.

The heroic efforts of the emergency workers helped to contain a desperate situation and was crucial in lessening the releases in the early stages.



Pripyat, the workers' dormitory town, was evacuated the morning after the accident - one report said that residents were instructed to stay indoors overnight, where they would be safer. The radiation level, although initially high, had begun to fall - it was to rise again later. A convoy of 1100 buses, stretching 20 miles, led people to safety.

Further evacuation of the area within 30km, and other high risk areas, led to over 100,000 people being rehoused - new accommodation has been built for all of them. Some have since been allowed back to collect belongings, and they describe the area as overgrown and desolate. When I visited Kiev in February I was told that a 200km fence had been built to exclude those desperate to return home - people who had evaded the patrols had been found to have returned to their houses.

The accident was such that novel methods had to be devised to contain the core's radioactivity - a mixture of boron, lead, dolomite, sand and clay was dropped onto the remains of the still-burning reactor. The high "radiation field" meant that each helicopter pilot could fly only 22 missions, during which time 33 tons of material were dropped with great accuracy onto the reactor. Radioactive emissions were said to have ceased by 6 May.

Cleaning up operations still had to be carried out. Rapid sorties, timing exposure to the second on stopwatches, were made by the emergency teams. Fears of a possible meltdown required the installation of a protective layer in tunnels dug under the reactor. Miners from many places were recruited for this task which was accomplished manually. Experiments with tungsten, uranium and concrete were conducted in Moscow to design such a layer. The clearing of debris around the plant was performed by remote-controlled vehicles or by lead-shielded manned vehicles in the less badly affected areas.

The final stage at the plant was the construction of the enormous concrete tomb. Ventilation shafts, with built-in sensors to continuosly monitor the remains of the core were included. Recent pictures indicate that this 20-storey structure is complete.

Decontamination of the surrounding area had to wait until civil engineering work had been undertaken to ensure surface water did not reach the Pripyat and Dnieper rivers which flow through the contaminated zone to the Black Sea, and provide most of Kiev's water supply. Topsoil was removed from various areas and when all this preparation had been done, the roofs of houses in Pripyat were hosed down to remove fallout. Pripyat, remains uninhabited.

To prevent fallout affecting Kiev's water supply tributaries have been diverted and two new artesian wells have been bored. If necessary these will be used when the flood water from melting snow reaches the river.

In Kiev I met the head of the Nuclear Research Institute of the Ukranian Academy of Sciences who told us of measures taken to monitor food for each of the most important radionuclides released. This information is used to monitor their movement in the environment. New discoveries have been made - tomatoes don't seem to take up very much radioactivity, whereas blackcurrants do; fish concentrate the activity. Snow was also monitored.

Reactors 1 and 2 were brought back into operation five months after the accident, with crews working on higher pay and in strictly rotating shifts; they live in a new complex 50km away. Reactor 3 is said to be decontaminated but it is unlikely to be operating in the near future as it shares a building with the ill-fated Unit 4. Construction of two further reactors on the site has been halted.

An official at Kiev, with the benefit of hindsight, was critical of sighting the complex in the vulnerable Kiev basin. To cope with the movement of radioactivity in this area, the Academy of Sciences has constructed an elaborate computer model with which they are confident they can predict what may happen.

The disaster has so far killed 31 or more people with estimates from 1000 upwards of the possible excess cancer deaths. All the evacuees will be monitored over the long term, but it will be many years before the results can be evaluated. What Chernobyl can tell us now is that the level of preparedness for such a catastrophe is pitifully low. Although some precautions, such as distributing potassium iodide pills, were taken, in the early stages few knew what responsibilities they had or should take. Indeed the very nature of the disaster meant that new methods were being invented all the time, with no previous experience by which to guage possible success or failure. Unfortunately we now have that experience, which the Soviets are clearly willing to share with us. We should not ignore it.

Alan Walker is a physicist at the University of Edinburgh and a member of Scientists Against Nuclear Arms. He visited the USSR earlier this year and spoke to scientists in charge of the clean-up operations after Chernobyl.

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