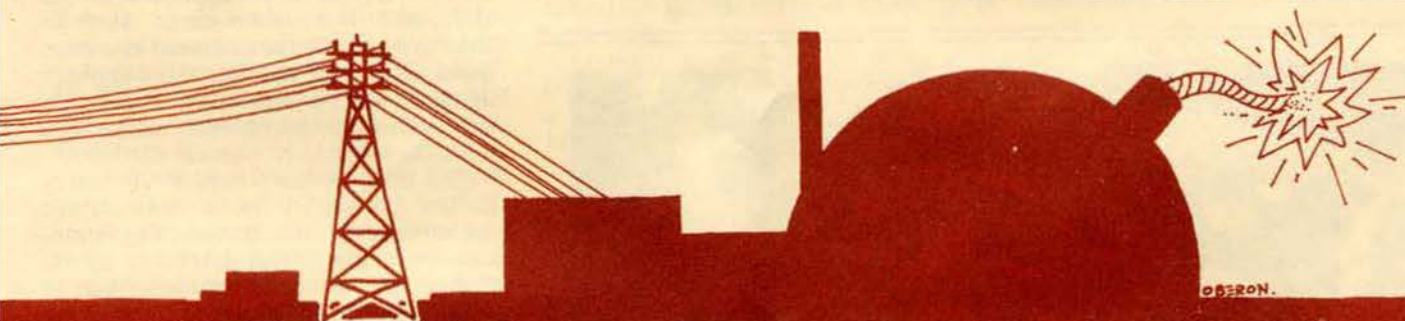


SIZEWELL REACTIONS

News of opposition to the PWR in Britain



One of the most important events in the history of the nuclear industry is about to take place in a remote Suffolk village. In January, the Government will open its enquiry into whether to build another nuclear power station at Sizewell and whether to have Pressurised Water Reactors in Britain.

At a time of falling orders for nuclear power stations world-wide — there have been no new orders in the United States since 1978 and France is about to cut its projected programme in half — the nuclear industry is looking to Britain. If the Sizewell PWR goes ahead Britain will be the only country in the world to have an expanding nuclear programme. In 1979, the Government announced its intention to build one new station a year in the decade from 1982, of the PWR type which came so near to a meltdown at Three Mile Island. The Government seems hell-bent on a massive ordering programme. There is no case for nuclear power on the grounds of need, demand, economics, safety or employment.

So why do the Government want it? One answer lies in the minutes of the Cabinet meeting which first announced the Government's plans. They say, "A nuclear programme would have the advantage of removing a substantial proportion of electricity production from the dangers of industrial action by coal miners and transport workers." Another is the power of industry — the PWR can be largely factory built. Hence there are more profits for the companies involved and theoretically more export orders — except that no-one is ordering nuclear power stations.

By the end of the Enquiry, the CEBG will have spent £100 million of taxpayers money on the Enquiry; tenders have already gone out to industry and companies are tooling up for the PWR. The decision has already been made. The Enquiry is only a face-saver for democracy. Nuclear power is eroding our freedom of choice — it is this we must fight, both inside and outside the Enquiry.

What we want and need is a small-scale, safe energy system which is sufficient to meet our needs and is accountable to us. Conservation could reduce current consumption, by up to 40%. Britain also has some of the world's best tidal, wind and wave power potential-energy sources which will last indefinitely. So why bother with nuclear? As Stephen Salter, one of our leading wave power researchers says, "We are attempting to change a status quo which is buttressed by prodigious investment of money and power and professional reputation. For 100 years, it has been easy to burn and pollute. One hundred years of tradition won't be swept away without a struggle. The nearer renewable technologies get to success, the harder the struggle becomes."

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Acceptable risk?

According to the proponents of Sizewell B, one of the attractions of investing in a programme of PWRs is that, being the world's most popular reactor type, research and development work is shared between many different countries, reducing the burden on each. One of the less attractive results of this worldwide research is the list of generic safety problems published by the U.S. Nuclear Regulatory Commission and designated Unresolved Safety Issues. The official definition of an Unresolved Safety Issue is "a matter affecting a number of nuclear plants that poses important questions concerning the adequacy of existing safety requirements for which final resolution has not yet been developed and that involves conditions not likely to be acceptable over the lifetime of

the plant." 17 of these Issues applying to PWRs were listed in 1977. Despite continued research, few of these problems have been solved and others have been added. In 1982 the list had grown to 27.

One of the most notorious unresolved issues is that of steam generator tube integrity. Corrosion or cracking of the thousands of thin tubes that carry pressurised water and pass heat from the reactor core to steam used to drive the turbines has occurred in the majority of U.S. PWRs. The failure of a few of these tubes during an accident could prevent cooling water reaching the core. These problems have proved extremely difficult to solve. NRC's proposed solution earlier this year (in itself only a proposal for further research) had to be suspended after

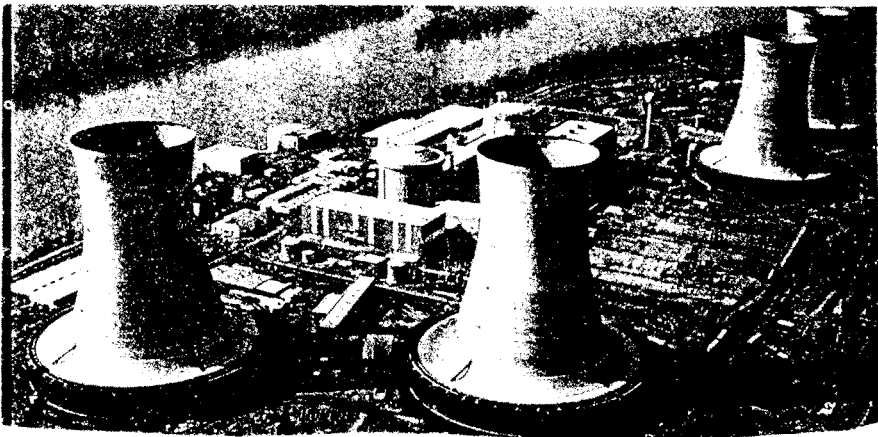
new problems appeared, including the Ginna accident in January and severe vibrations in all new Westinghouse plants which have cost the manufacturers millions of dollars in repairs and replacements.

The steam generator issue has had repercussions for another safety hazard which is particularly serious in PWRs — that of radiation exposure to staff. CEGB calculations have estimated that exposure levels in a PWR could be 5 times greater than in an AGR, and that this may require greater numbers of staff to keep individual exposures down to legal levels. Even this figure is likely to be an underestimate, since it takes no account of unplanned maintenance. Steam generator repairs have accounted for 25% of all radiation exposure in the U.S., and in extreme cases, such as the Surry plant, replacement of steam generators has resulted in exposure levels of 4200 person-rem in a single year. This compares with about 200 for an average U.K. nuclear station.

The main concern over PWR safety is the possibility of a catastrophic accident and these generic uncertainties make the CEGB estimates of the risk of such an accident (described in Appendix M of their Statement of Case) look rather optimistic. In this study, carried out by Westinghouse, they estimate the risk of a core melt to be one in a million reactor years — a figure 50 times lower than that predicted by the Rasmussen Study, carried out by the Atomic Energy Commission, for American reactors in 1975. On top of this, a core melt is calculated to result in a major release of radioactivity one in 40 such events. To further de-emphasise the risk, 2 sets of radioactivity release levels have been calculated for an accident of this sort, one similar to previous studies, and the other described as "a reasonable interim judgement of the reductions which may be justifiable in the longer term."

Many criticisms have been levelled at the techniques which were used in the Rasmussen study — criticisms which apply equally to the Sizewell risk assessment. The major problems arise from the difficulty in guaranteeing that all possible accident sequences have been considered, and with a plant as complex as a PWR such a situation is difficult to envisage. The lack of sufficient real-life experience means that all predictions of risk have to be based on expert judgements. The quality of such judgements has recently been demonstrated by a study carried out for the NRC by Oak Ridge Laboratory. Based on empirical data this came up with a core melt probability between 30 and 100 times higher than Rasmussen.

Will Cannell



Harrisburg - What Went Wrong

Workers doing maintenance on the cooling pumps accidentally cut off the main supply of cooling water to the turbines. The turbines shut down automatically, and a standby supply of cooling water started pumping. But **the valves were closed**, so the water could not reach the cooling circuit. The fuel got hot and the coolant pressure rose. A safety valve opened to relieve the pressure. It did not suffice, so four seconds later the reactor shut itself down. So far there was no real harm done.

The reactor was now producing only 6% of its normal power. So the fuel got cooler and the water pressure began to drop. **The safety valve should have closed but it didn't.** So water continued to pour out of it. It looked to the operators as though there was too much water in the reactor. So **they shut off the pumps.** The pressure fell rapidly and the reactor boiled. The steam blew so much water out through the open valve that the fuel boiled dry. So it got hot. Some of the fuel rods melted. The rest began to react with the water, producing half a ton of hydrogen which settled as a bubble in the top of the pressure vessel. Some of it escaped into the reactor housing through the open valve. There was a bit of a bang, but the containment building held it without difficulty.

Only then did the operators begin to understand what was going on. They started up the pumps again. They had no choice. They had to stop the fuel from melting any further. There was a risk that driving the hydrogen into the reactor housing would prompt a really big explosion, perhaps cracking the containment or wreaking further damage to the already crippled reactor. But it was a risk they had to take.

After sixteen hours, they knew they had got away with it. The radioactive hydrogen was out of the building. They had dumped 400,000 gallons of radioactive water in the Susquehanna River. But all in all they could count themselves lucky. They were still alive. The reactor pressure vessel and its housing were still intact. Although a lot of radioactivity had got out, the consequences were trivial compared with what might have been. Maybe we won't be so lucky the next time.

Cracking up

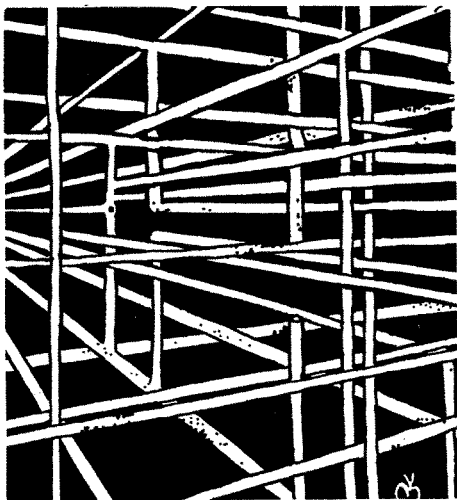


France has one of the largest domestic nuclear programmes in the world, consisting entirely of Westinghouse licensed PWRs similar to the proposed Sizewell B. It also has the reputation of being one of the safest. Yet all is not well with the French PWRs....

In 1978 cracks were detected in a heat exchanger (an integral part of the cooling system) in a Framatome workshop. The public heard nothing of this until a year later, when two unions decided to speak out.

Since then, all exchanger plates have been tested and all have been found to be defective, containing from 32 - 200 defects. However, those built before 1978 are already fitted, and are no longer accessible to inspection. Repairs of these cracks cost Framatome £13.5 m. in one year. Cracks in heat exchangers of operative reactors would result in increased radioactivity to workers and could, Dr Sene, a nuclear physicist at the College de France believes, be "catastrophic".

After finding these cracks, Framatome investigated the reactor vessels. In September 1979, they announced they had found cracks in the nozzle end of the hot and cold legs of the primary circuit (which carries cooling water and supports the pressure vessel.)



Dr. Shoja Etemand was selected to be the leader of a research group to study the cracking problems and to assess the rate at which the cracks would spread under normal operational conditions. Dr. Etemand stated in a Guardian article (25th Oct '79) "we found that the cracks propagated most rapidly under the stresses imposed by normal operating conditions. The cracks are irreparable by any known technology." He continued, "we are now talking about cracks in primary structure who propagation could lead to catastrophic failure of reactors." Dr. Etemand resigned from Framatome when they failed to make these facts known to either the public or

those responsible for nuclear safety.

In late October 1982, Electricité de France announced that, because of faults in control rod guides, it will have to close 20 nuclear power stations over the next two years for repairs. The cost is estimated to be about £100 million. The decision follows the discovery of metal fragments in the emergency cooling circuit of the Gravelines reac-

tor and of broken clips with missing fragments at Fessentein and the reactors at Bugey. The broken clips could be extremely dangerous through impeding shutdown when they might prevent the closure of critical valves. Nucleonics week (29.7.82) quoted another source as saying, "We're following the same problems as the US with a few years of delay."

Lives at stake



At the safety debate over Sizewell B PWR rages, two workers at the Sizewell A nuclear power plant have died from leukaemia and a third has the disease. Another five workers died last year of haemolytic anaemia, a blood condition associated with exposure to radiation.

Leukaemia is very uncommon in people of working age. Official cancer statistics show the incidence of Leukaemia in men aged between 40-65 is about 1 in 5000, but three cases have occurred at Sizewell A where since 1966 five hundred workers have classified as "exposed to radiation". The incidence of Leukaemia at Sizewell is 30 times the national average!

Dr. Alice Stewart, a senior research fellow at Birmingham University, has called it "a little epidemic" and has demanded a full investigation. Doctors in the area are also concerned. Dr. Spencer, of a three doctor practice, with 6800 patients had already instigated a morbidity study suspect-

ing that they were busier than other practices throughout the county...

Dr. Bush, the district medical officer of the East Suffolk Health Authority, says he will be looking further into this, as there certainly seems to be something worth looking into.

Yet Sizewell is well down the CEBG's table for exposing its workers to radiation. The highest yearly average dose recorded by one of the men involved was 200 milligrams, less than half the limit set by the International Committee for Radiological Protection. It seems as though there is no safe level of radiation.

Sizewell B won't be any better. Experience of existing PWR programmes in the US and Japan shows radiation risk to be even higher in PWRs. The US National Academy of Science estimated that the 1980 level of exposure - 578 rems compared to Sizewell A's level of 64 will produce genetic damage at the rate of 3000 per 100,000 children with 3-10 cancer deaths as a direct result of radiation.

U.S. downfall



A coded memorandum from the US Nuclear Regulatory Commission was released in August by the US anti-nuclear group Critical Mass. The memo reveals that 22 operating reactors have below average safety records, the safety records of 10 of which were found to be "far below average" in 1981.

Critical Mass said "the multitude of serious safety problems is a sure sign that without major changes, it is just a matter of time before another serious accident occurs."

The memo also disclosed that x-ray films of cooling piping welds had been "enhanced" with a pencil by technicians to make it appear they conformed more closely to safety standards. 29 x-rays were found among 3200 checked, although "only one possible defective pipe weld" was found by Associated Piping & Engineering Corp. and it was fixed, "but it didn't really amount to anything" a spokesman said.

Another report from NRC staff to the Commission's Advisory Committee on Reactor Safeguards concerning reactor vessel wall embrittlement has sparked off

hearings in the US Congress, due to be held soon.

The Advisory Committee was told that "the staff concludes that some plants will require hardware and procedural (operating) modifications in the near future." The problem seems to arise in PWR's where the bombardment of reactor walls by radiation is constantly raising the vessels' "reference temperature" — the temperature at which the walls lose their ability to handle thermal shock. This is particularly important when the walls of an operating reactor, heated to as much as 290°C, are suddenly cooled by emergency core cooling water at 1-30°C.

Of 16 PWR's thought to be most at risk, the 665MW H.B. Robinson unit at Hartsville, South Carolina, is ranked as most susceptible. The Utility Carolina Power & Light, described the embrittlement problem as "nothing new", and explained that the Robinson plant had been examined because it's one of the "older facilities in the country". It was put into commercial operation in March 1971 and was manufactured by Westinghouse

Too much power

Objectors to nuclear power have argued consistently over the last few years that further nuclear power stations are not needed. The Central Electricity Generating Board (CEGB) appears to have accepted this argument, at least in part. On the Board's central energy demand projection, Scenario C, Sizewell B is not justified on demand grounds until 1990. CEGB scenarios A&B, however, show demand increasing more rapidly.

Probably the most important constraint on energy (and electricity) de-

mand is economic activity. The consumers' propensity, and willingness to pay for it, is usually regarded as a constraint ie. supply must match demand. For the reasons outlined below, the CEGB refuses to follow this rationale.

Over the past 15 years, the CEGB has continually overestimated demand. Its Medium Term Development Plan, published annually for the seven year future period, shows that demand is down, supply is up and costs are rising. When the CEGB makes mis-

takes in forecasting, it is the customer who pays. Over supply means higher prices because of large interest repayments for example. Demand is curbed by rising costs; demand falls as consumers can no longer afford to "think electric". The CEGB is caught in a vicious circle of its own making.

CEGB estimates put the 1980 maximum demand at 55 GW (55,000 MW), but the actual figure was 43 GW; in crude terms they had overestimated by the equivalent of 9 Sizewell B's.

Between 1980 and 1981 maximum demand fell by 10 GW, while the forecasts made in those years for the 7 years ahead increased by the same amount. If the trend continues, it will leave the Board's expectations further from reality than ever.

The CEGB has a 36% surplus generating capacity, on top of a 28% planning margin to allow for peak demand. The planning margin was adjusted from 20% to 28%, presumably to disguise its remarkable overcapacity. The Select Committee on Energy estimated that revising these planning margins had cost £6 billion in capital costs alone. The CEGB forecasting methods are based on growth figures for the period 1954-73, a period of demand growth which has never been matched. The Board is therefore likely to continue to overestimate.

Why is the CEGB allowed to continue to order new plant when it already has a massive overcapacity? Private utilities in the USA have lost money on nuclear power stations and hence have begun to rethink their strategies (see Energy Bulletin no. 32), but the CEGB is state run and can afford to make mistakes. There is a long lead time for introducing new nuclear plant and so demand can fluctuate, particularly as large scale plants require longer lead times. Massive scale nuclear technology cannot match small scale demand which changes more rapidly than supply can. The CEGB is planning on full scale recovery from the depression, which looks increasingly unlikely. The Board fears being hit by power failures due to sudden economic recovery. This is more likely with nuclear power stations, which must close down in the event of any problem, than conventional stations which can 'limp along' at reduced load. Industry and Trade Unions also provide pressure to maintain over supply to secure contracts and jobs.

Ironically, to justify this expansion, the CEGB has plans for large scale closures of smaller coal burning units. This means a loss of more jobs than Sizewell B will create due to the resultant knock-on effect on the coal mining industry. A centralised power supply system means less jobs not more.

Lucky for some

Choosing between different nuclear reactor types is a complicated, technical affair - and the scientists will argue at the Sizewell Inquiry that it should be left up to them, "the experts", yet, of course, it's not purely technical. It's also commercial - nuclear power is a big business.

The Tory Government's nuclear programme will include several Pressurised Water Reactors (PWRs), Sizewell permitting. The PWR is the biggest-selling reactor type in the world. Until recently, the world market was dominated by two US corporations, General Electric and Westinghouse: now General Electric is cutting back its nuclear commitments, leaving the field clear for Westinghouse.

The British PWR will be based technically on Westinghouse's design, and commercially on a longstanding business arrangement between Westinghouse and the British engineering giant, GEC. For both of these companies, the Tory nuclear programme promises big contracts and rich profits. And furthermore, once a firm has won a big contract, it tends to develop an industrial momentum, by investing in the technology and collecting a skilled and specialised workforce, which leads to further contracts. The big get bigger, and power becomes concentrated in fewer and fewer hands.

GEC has long enjoyed a favoured position, as a major Government contractor in defence, energy, and other key sectors. Its influence is such that it not only serves Government policy, but plays an active role in formulating it. The energy establishment in particular is structured around GEC, to the point where it's difficult to tell where private interests end and the public interest begins: when the National Nuclear Corporation was set up by the Heath Government, it gave GEC a large shareholding, the Chairman-

ship, and a management contract to run it!

Since the early 1970's, GEC has been lobbying hard to get the PWR adopted for the next generation of nuclear reactors. Its influence extends to the CEGB, the major institutional force in the energy industry. Thus the CEGB's wildly-differing projections of energy demand and nuclear capacity, between 1972 and 1976, only make sense when they are seen as part of a campaign by the PWR-lobby. When it thought it could get the Government to adopt the PWR, the CEGB called for **thirty-two** new reactors: when it was less hopeful, it admitted that **no** new reactors were needed!

The reason why the PWR is favoured by firms like GEC and Westinghouse is that it lends itself to production-line methods, and is relatively cheap to build within the context of a major programme. Of course, this assumes that safety measures are not so tight as to drive the price up. It's interesting to note that Westinghouse is now almost exclusively in the export business: its domestic American market has dried up, because rising costs and fears about nuclear safety have scared off, or bankrupted, the banks, local authorities and utilities.

In Britain, things are different. Here, nuclear power is not open to the chances of the market. Here, firms like GEC can reap in their profits, secure in the knowledge that their activities are underwritten by the taxpayer - though most taxpayers were never consulted on the matter.

One thing we can be sure of is that these matters will be studiously ignored at the Sizewell Inquiry. There, the political and economic forces which drive the nuclear programme will be well hidden, behind a smoke-screen of technical detail. It's up to us to blow the smoke away.

Martin Spence