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Nuclear Power and its Opponents

Red Alert: The Worldwide Dangers of Nuclear Power, by Judith Cook (New English Library)

'For one side of the argument about nuclear energy British Nuclear Fuels urge you to write to this address.' The exhortation, in 144-point type, fills most of each side of a double-sided full-page advertisement in the national press in Britain. On the first side 'this address' is that of Greenpeace: on the second that of British Nuclear Fuels (BNFL). The ad epitomises a key problem of the 'argument about nuclear energy': it assumes that the 'argument' has two sides, and exactly two. If you are not for us - whoever 'we' may be - you are against us. If you are not 'pro-nuclear' you are 'anti-nuclear'.

A corollary of this attitude is the assumption that the two sides of the story are mutually exclusive: one side will tell you the good news, and the other the bad. For the good news about nuclear power you turn to BNFL, or the Central Electricity Generating Board, or their equivalents in other countries. You assume that they will not tell you any of the bad news, or that at best they will reveal it belatedly, reluctantly and partially. By the same token, if you want only the bad news you turn to, say, Judith Cook and *Red Alert,* with its unambiguous subtitle, 'The Worldwide Dangers of Nuclear Power'. Turn to her we shall, in due course: and the news is indeed bad, though perhaps not quite what she intends.

'Pro-nuclear' and 'anti-nuclear' are shibboleths by which to identify the good guys and the bad guys. If you're one of the bad guys, anything you say is suspect, to be ignored or challenged. Your motives are base, your outlook narrow, and you probably mistreat your children. It is an unhelpful, even pernicious dichotomy, which fails utterly to address the real issues of nuclear power: issues that cannot be wished away by either 'pro-nuclear' or 'anti-nuclear' sloganeering.

Like it or not, nuclear power is now a fact of life. We are where we are; we cannot start from somewhere else. October 1986 marked the 30th anniversary of the ceremony at which the Queen inaugurated the flow of electricity from Calder Hall on the north-west coast of Eneland, acclaimed internationafly as the world's first nuclear power station. Three decades later, 391 power reactors are operating in 26 countries, supply 265 000 megawatts of electricity. In some countries, notably France, Belgium and Switzerland, more than half the electricity used is supplied by nuclear power stations. Many millions of people are employed in building, operating and servicing the world's nuclear stations. No one is going to wave an 'anti-nuclear' wand and make all this vast panoply of nuclear hardware and nuclear materials disappear. On the other hand, only the most grotesque 'pro-nuclear' diehard could deny that nuclear power is in trouble; and the trouble is only incidentally to do with the 'anti-nuclear' opposition.

At the end of the Sixties, when I first became involved with nuclear power issues, the picture looked very different. The nuclear industry was contemplating a global electronuclear future. In the early Seventies, organisations like the International Atomic Energy Agency and the Organisation for Economic Co-operation and Development were anticipating that by the year 2000 nuclear energy would be supplying more than half the world's electricity, from a nuclear generating capacity estimated to be as much as 4,500,000 megawatts. The US Atomic Energy Commission foresaw 400 plutonium-fuelled fast-breeder power stations in operation in the US by the year 2000. In the UK, as recently as September 1975, the Atomic Energy Authority, in evidence to the Royal Commission on Environmental Pollution, put forward a reference programme that entailed having 104,000

megawatts of nuclear stations in operation by the year 2000, of which 33,000 megawatts would be fast-breeders.

The prevailing nuclear euphoria was only intensified by the oil price rise of 1973-74: nuclear power would spring the industrial world from the toils of OPEC. Orders for nuclear stations flooded in - more than forty in 1973 and a similar number in 1974 in the US alone. Alas for nuclear expectations: the oil shock triggered a global economic recession so severe that the use of energy of every kind - but especially electricity - flattened out almost to zero growth. Meanwhile the bills for the spate of new nuclear stations began to fall due; and as one station after another slipped further and further behind in its construction schedule, the bills mounted. The flood of nuclear orders subsided to a trickle.

By the mid-Seventies opposition to nuclear power had become vigorous and outspoken in many industrial countries. Nuclear manufacturers and electricity suppliers had to defend their nuclear plans in court cases and planning inquiries, and saw more and more judgments go against them. The international nuclear community lamented long and loud that their opponents were causing delays and cost increases; misguided environmental opposition, they said, was the main reason for the malaise settling over the nuclear dream. Dispassionate analysis suggested a different conclusion. The delays, cost-overruns and disappointing performance which beset the industry in the UK and the US, for instance, were in large measure a result of over-optimistic cost estimates, inadequate design work, late delivery of essential components, low productivity, labour disputes on site, and other failures of project management which had nothing whatever to do with the opponents of nuclear energy. The nuclear industry blamed its critics for problems that were mainly self-inflicted, if not indeed inherent in the technology.

By 1986 nuclear-power programmes throughout the industrial world had slowed almost to a standstill. The reasons were manifold. Electricity use had fallen short of the growth rates anticipated a decade earlier: electricity supply organisations found themselves with far more generating plant than they could use. The capital cost of nuclear power stations, on the other hand, was increasing relentlessly. In 1985, even the Atomic Industrial Forum, the industry's most vociferous cheerleader, was forced to acknowledge that in many parts of the US nuclear electricity was more expensive than electricity derived from coal. Nuclear power was thus far from being the obvious choice even to replace obsolete plant. The US had much the largest nuclear programme in the world: exactly 100 reactors operable as of 31 May 1986, with a capacity of 85,535 megawatts. However, every nuclear unit ordered in the US since 1973 has been either cancelled or indefinitely deferred; and no US reactor manufacturer has sold a unit to anyone anywhere since 1978.

Throughout the nuclear industrial world - from Canada to Switzerland to Spain - the same story could be told, with local variations. Even in France, obsessively cited by proponents of nuclear energy as the paradigm of a successful nuclear policy, closer examination revealed a picture which was by no means so unambiguously healthy. France has the third largest foreign debt of any country in the world, exceeded only by Mexico and Brazil; and fully one-fifth of this foreign debt - some 200 billion French francs, or more than twenty billion dollars - has been incurred by Electricite de France, borrowing to finance its headlong nuclear power programme.

Framatome, the French reactor manufacturer, was tooled up to handle at least six nuclear station orders per year. By the mid-Eighties, however, dogged official insistence on a programme of orders meant that France had far more generating capacity than it could possibly use, even after shutting down almost all its fossil-fired plant. However, once a nuclear station has been built and the capital costs committed, it is better to run the station and sell the electricity at a loss than to keep the station off line while still incurring capital charges. Electricite de France accordingly began exporting electricity to almost all its neighbours, at prices that always seemed just to undercut the cheapest in

the neighbouring country. France nevertheless denied that it was 'dumping' electricity below cost.

French nuclear enthusiasts and their opposite numbers in other countries claim that cheap French nuclear electricity is giving the country a competitive edge. Others suggest that French electricity is cheap mainly because the French Government will not let Electrici16 de France raise prices enough to cover its costs; and that no one will know how expen sive French nuclear electricity really is until the stations are paid for. Meanwhile, even France has cut its ordering programme to one plant a year -if that; and Framatome is already laying off staff and shutting down facilities. The remainder of the Eighties may see France's nuclear-power programme lose its gloss.

The world's major power-reactor manufacturers are huge multinational corporations, or subsidiaries of even larger corporations. They can weather a long hiatus in orders for nuclear plant, and are essentially reconciled to it, busying themselves with contracts for spares, servicing and upgrades for existing stations. Meanwhile several manufacturers - among them Westinghouse of the US, Mitsubishi of Japan and ASEA of Sweden - have embarked on the design of a new generation of power reactors intended to eliminate or overcome some of the shortcomings of existing reactors.

Not all reactor manufacturers are so sanguine; doubts linger, for instance, about the future of Atomic Energy of Canada and its distinctive CANDU heavy-water design. But the reactor manufacturers' problems are slight compared with those of the uranium-mining companies. Uranium has never been traded as a conventional market commodity. From the Forties onwards, its price has always been strongly influenced, if not actually set, by government policies. In the Fifties, the US Atomic Energy Commission paid $6 a pound for 'yellowcake' - uranium oxide from ore. In the early Sixties, with its bomb-programme sated, the AEC stopped buying uranium, and a wave of mine closures followed. In the early Seventies, as the hopes for nuclear power burgeoned, pundits declared that the expanding nuclear programmes would soon exhaust available uranium supplies. The price of uranium shot skyward in response, attaining a level of more than forty dollars per pound of yellowcake. Exploration resumed; and almost everywhere the prospectors looked they found uranium, some of it in deposits of startling richness.

Unfortunately, by the time these fresh supplies reached the international market, nuclear-power expectations had faded almost as swiftly as they had flared. In the resulting buyers' market the price of uranium fell precipitately. By the mid-Eighties, it was hovering stubbornly at about seventeen dollars per pound. According to the Uranium Institute, the international forum of uranium suppliers and users, there is little prospect of significant price increases until into the 21st century: indeed, in September 1986 the Institute conference was told that the prevailing price would be too low to support further exploration and development. Uranium-mining companies found themselves hard-pressed to sell their uranium at a price high enough even to earn back the cost of mining it. For smaller companies the prospects were bleak.

Uranium enrichment, too, was drastically out of step with the requirements of its clientele, and for similar reasons. Enrichment capacity had been stepped up dramatically in the Seventies to meet the anticipated upsurge in demand from all the new nuclear stations. When the stations failed to materialise, so did the demand for enrichment, leaving the enrichers underbidding each other for the available business. In 1985, the US Department of Energy, operators of the US enrichment plants, abruptly announced that they were cancelling their enormous new gas centrifuge enrichment plant - having spent $2.3 billion on it. The Department declared that it would instead pursue laser enrichment, in the confidence that it would be ready by the time it might be needed - perhaps in fifteen years. No one appears to have asked what US taxpayers thought of the whole affair: but this is not untypical of nuclear research, development and demonstration policy over the past three decades - and not only in the US.

Thus, although they ought to be symbiotic - since they depend absolutely on each other with no alternative markets or users - uranium-mining, enrichment and reactor-manufacture are increasingly out of step with each other. Their relationship is, however, positively symphonic compared with the chaos at the back end of the reactors. The problem is again historical. The first large reactors were operated to use the chain reaction to produce the neutrons that would convert uranium-238 into plutonium for bombs. The accompanying release of heat was a nuisance or worse. After the chain reaction had run for a few weeks the uranium was removed for chemical processing to separate out and recover the freshly-created plutonium. The technology was called 'reprocessing'. A nuclear-power reactor, on the other hand, used the chain reaction specifically to produce heat, to raise steam to run a turbo-alternator and generate electricity. The nuclear planners nevertheless assumed that the so-called 'spent fuel' eventually discharged from the reactor would have to be reprocessed.

They expected to need both the unused uranium and the plutonium in order to manufacture more fuel; and they expected that reprocessing would be much the same whatever the fuel. They were comprehensively wrong on both counts. Uranium, as we have already noted, proved to be, if anything, embarrassingly abundant. Furthermore, the spent fuel from a power reactor has undergone a chain reaction lasting not months but years, and is at least ten times as radioactive as the spent fuel from a weapons-reactor. Reprocessing of modern power-reactor fuel has thus proved to be both technically acutely difficult and prohibitively expensive. In consequence, neither the recovered uranium nor the plutonium come close to repaying the cost of recovering them. Furthermore, the act of reprocessing dramatically increases the volume and variety of radioactive waste which then requires disposal.

Until the mid-Seventies, nuclear-power planners had relied on chemists and physicists to develop waste-disposal options. When, belatedly, the geologists were consulted, they at once pointed out that the chemists and physicists were making geological assumptions that had little if any foundation in actual geological data or experience. By the mid-Eighties, nuclear-waste management and disposal policy in almost every nuclear industrial country was in utter confusion - especially in the matter of spent fuel. Nobody wanted a nuclear-waste dump nearby, no matter what category of waste it might accommodate. Scarcely anyone was even prepared to tolerate preliminary research, lest the research become merely the first stage in an inexorable fait accompli. As nuclear-station cooling-ponds rapidly filled with spent fuel, nuclear operators began to turn away from reprocessing towards long-term storage of intact spent fuel, pending a whole catalogue of overdue research.

Then came 26 April 1986, and the accident which nuclear people had never believed possible. Chernobyl put nuclear safety once again at the top of the front page all over the world. For the nuclear-power community it was the worst possible way to mark a 30th anniversary. Its effects, physical and political, will continue to reverberate for years to come. Coming on top of all the other problems facing the technology, Chernobyl made many wonder how long nuclear power could survive.

All this cumulative disarray, it should be noted, had little if anything to do with the opposition to nuclear power - except in one crucially important way. Since before the inauguration of Calder Hall, the nuclear industry had been making expert use of the media to publicise its achievements and potential. In films, glossy publications, press briefings and hand-outs, nuclear-power propaganda almost invariably conveyed the impression of a brilliant elite leading the world into a bountiful future, thanks to nuclear fission. From the late Sixties onwards, however, nuclear opponents devoted increasing effort and energy to calling attention - especially media attention - to the underside of the nuclear industry: to questions of reactor safety and radioactive waste, to the biological effects of low-level radiation, the alleged economic advantages of nuclear power, and the link between nuclear power and nuclear weapons. Instead of applauding the achievements of the

nuclear elite, books, newspapers, magazines, television and radio began questioning its judgment, its competence and even its integrity. Instead of hailing the latest nuclear breakthrough, they started running items about the latest nuclear breakdown. Before long the body of popular nuclear literature adopting a more critical approach had vastly expanded - so much so that it eventually became impossible to keep up with, even for those working on it full-time.

When the *London Review* asked me to write about Judith Cook's book I had not seen it; nor did I realise how much I had inadvertently contributed to it. The title, to be sure, struck a chord: 'Red Alert' was the series title for my own first book on nuclear technology. It was written for a publishing house called Earth Island, set up by Friends of the Earth in Britain shortly after their inception. It flourished briefly, then foundered. When it collapsed in 1973 it took with it the finished copies of *Nuclear Reactors,* the book I had written for 'Red Alert'. The book was never distributed; in the subsequent administrative shambles the entire print run, apart from a handful of review copies, disappeared. But *Red Alert: Nuclear Reactors* became the springboard for my Penguin book *Nuclear Power.* First published in 1976*, Nuclear Power* has now sold over a hundred thousand copies in English, as well as appearing in four other languages; the latest edition came out only a week before the Chernobyl accident. *Nuclear Power* proves to have been a major source for Ms Cook's *Red Alert.*

My original purpose in writing *Nuclear Power* was to save myself time and energy. People kept asking me to tell them all about nuclear power: rather than endlessly rehearsing the basics I could refer them to *Nuclear Power,* and expect their questions to be much better informed and much more alert to the subtleties of the subject. The book was more successful than I had dreamt possible. Quotations from it kept cropping up in more and more unexpected places; and to be thus quoted was gratifying. The book was written to inform, and was obviously doing so.

I confess, however, to a certain ambivalence about the latest manifestation. Page after page of Judith Cook's *Red Alert* bears a more than passing resemblance to my own *Nuclear Power,* or to other books of mine. In principle, I don't object to being used as a source. I do, however, object when my work is cited as the source for a statement that does not appear in it - especially if the statement is inaccurate. I also object when chunks of my prose are lifted bodily, slightly rearranged to avoid direct quotation, and retailed as the work of another writer - especially when the rearrangement degrades the prose, muddies the meaning or makes it factually wrong. The offence, in this case, is only compounded by an offhand reference at the back of the book to 'Patterson, *op. cit.'*

Let me start at the beginning and be specific. Ms Cook does not cite references for her Glossary. Out of 88 entries, 23 at most are significantly different from the equivalent entries in the glossary included in my own *Nuclear Power*. For example: 'Dose: amount of energy delivered to a unit mass of a material by radiation travelling through it' (Patterson); 'Dose: amount of energy delivered to a unit mass of material by radiation travelling through it' (Cook). Or: 'Vitrification: fusing of high-level waste into glass-like solid' (Patterson); 'Vitrification: fusing of high-level waste into glass-like blocks' (Cook). Of the entries that do differ significantly, several are simply wrong. For example, under the heading 'Fuel' Ms Cook writes: 'Enriched fuel contains plutonium-235.' Plutonium-235 is a rare isotope with a half-life of only 26 minutes, and has nothing to do with enrichment.

The error is one of many in the book which suggest that Ms Cook's own understanding of the subject is at best superficial. Pretending to knowledge you do not possess - and purporting to convey this knowledge - is precisely the kind of intellectual sharp practice that Cook herself castigates in her opening chapter, 'The Alchemists'. She describes how Ben Jonson's Alchemist, offering to transmute base metal into gold, deals with clients who will not 'be fobbed off with

simple explanations of how it is done': 'at this point the Alchemist bursts into a torrent of supposedly technical jargon' which is in fact gibberish. The nuclear industry, Ms Cook proposes, is like Jonson's Alchemist, promising 'something similar to the elusive stone which transmutes base metal into gold - a process which will produce unlimited energy'. The analogy is seductive. As she says, 'ministers of governments of all shades, energy ministers such as Tony Benn and Peter Walker, civil servants, employees of public utilities, have sat, like Jonson's Puritans, open-mouthed and bemused, listening to the flood of jargon which has promised that the millennium is just around the corner. Billions of pounds of taxpayers' money have been poured into the nuclear industry all over the world ... Keep the money coming and we'll get it right in the end.'

'Overshadowing the industry,'Ms Cook continues,'is the question of safety. For the nuclear industry there is no question. Nuclear power is perfectly safe, they say.' Ms Cook begs to differ: 'This book is an attempt, in layman's language, to explain some of the problems and hazards of nuclear power' - an entirely reasonable objective. Unfortunately, she then presents a description of the atom and the nucleus, recognisable as a garbled echo of the opening pages of my *Nuclear Power,* followed by a straight reprint of four pages from *The PWR Decision* by Friends of the Earth, out of context and therefore just as unintelligible as the jargon spouted by Jonson's Alchemist. She acknowledges the FOE reprint, but not the lift from *Nuclear Power;* nor does she acknowledge that the three diagrams she reproduces come straight from *Nuclear Power.*

Most of *Red Alert* seems to be a scissors-and-paste reassembly of material from other writers. Ms Cook contributes a striking assortment of errors of fact, some of them simple misquotations. For instance, her paraphrase of the description of the Canadian NRX accident from *Nuclear Power* gets the date of the accident wrong by two years - it was 1952, not 1950; the confusion is then compounded by an allusion to an alleged US Atomic Energy Commission report on the accident dated '9 February 1951' - remarkably prescient. Such slapdash editing is unhappily typical. Nevertheless, the most unsatisfactory aspect of this unsatisfactory book is its aimlessness. It is from first to last a recital of horror stories, or what purport to be horror stories. They are presented in no discernible order, nor are they ranked as to priority or seriousness. No conclusions are drawn, nor recommendations offered. If the purpose of writing it was only to induce a brief frisson of paranoia, it could be said to succeed. As information for serious opponents of nuclear energy it signally fails the fundamental test. Its inaccuracies are so obvious that any public relations hack from the nuclear industry could cut it to ribbons.

The nuclear industry's resources, and its access to the inner sanctum of political power, have given it a grossly disproportionate influence on the political process even in democratic societies. But when the industry has told only part of the story the critics have been able to tell the rest - often with profound effects on ensuing decisions. The nuclear-power establishment accordingly hungers for the opportunity to discredit those who challenge it: to discredit 'one side of the argument about nuclear energy', leaving the 'other side' - the industry's side - triumphant. No one who is really concerned about nuclear power can afford to play that two-handed black-white game. Critics of the nuclear industry must aim to tell the truth - the whole truth and nothing but the truth. As nuclear problems multiply, the truth may yet be sufficient.