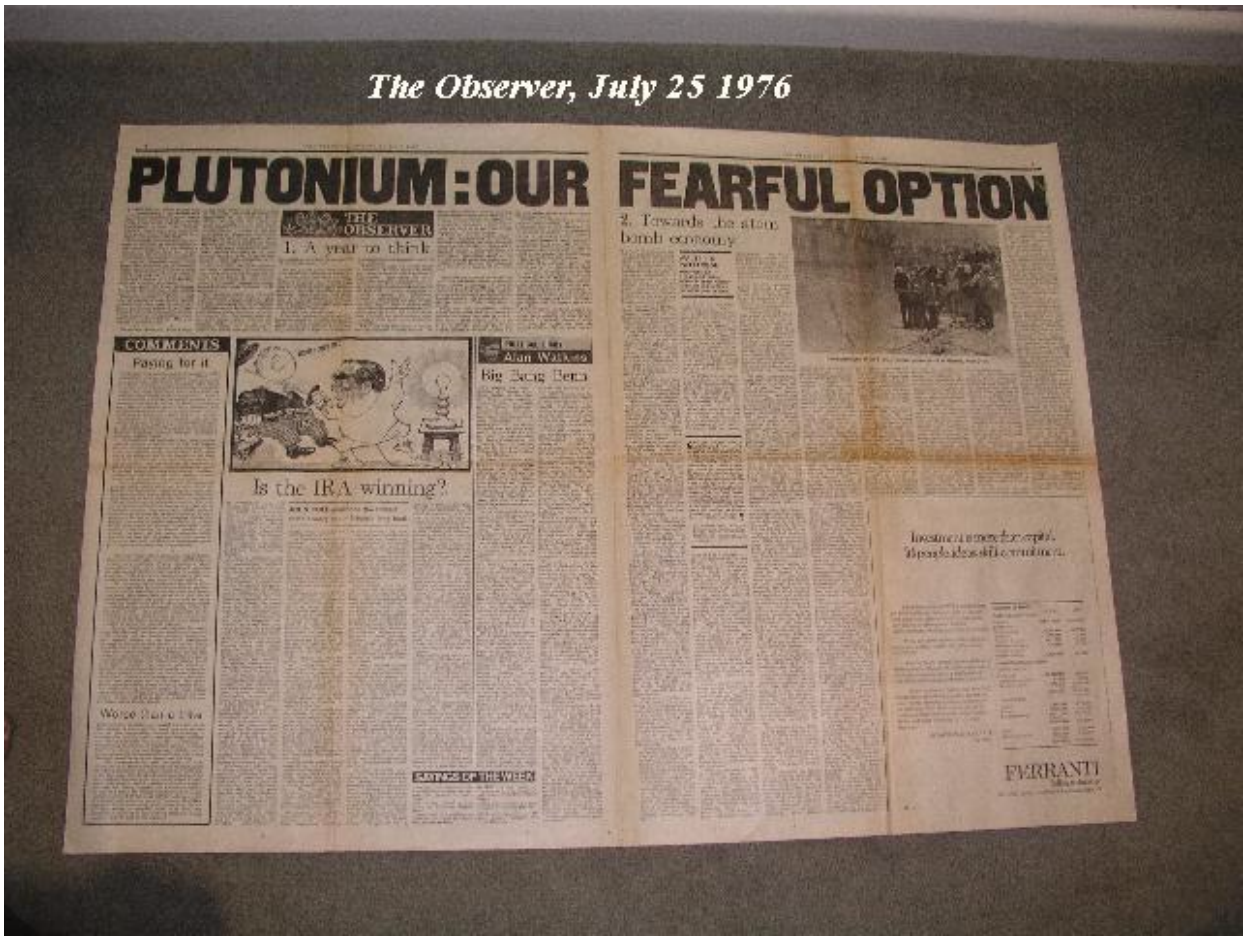

(Reprinted with permission from The Observer*, Sunday 25 July 1976)*

PLUTONIUM - OUR FEARFUL OPTION

(As the photo above indicates, The Observer *ran a double-page centre spread under the above stark headline. The left-hand page had a main leader headed '1. A year to think'. The right-hand page was filled by the piece reprinted here.*

Thirty years later, in 2006, in his State of the Union address to Congress, US President George W. Bush suggested reawakened interest in the policy here discussed.)

2. Towards the atom bomb economy

WALTER C. PATTERSON
describes the chequered history of fast-breeder nuclear reactors and outlines possible alternatives.

A LUMP of plutonium the size of a grapefruit is enough to make a bomb like the one which wiped out Nagasaki. A speck of plutonium the size of a dust particle can cause cancer. Should Britain plan to depend on plutonium as a major source of energy in the years to come? Within five months, the British Government is expected to take the first definitive step in that direction. If the past is any guide, very few people in Britain will even notice.

Two months ago, Mr Tony Benn, Secretary of State for Energy, revealed that the Government would announce this autumn its decision on the construction of a new nuclear power station, twice the size of any other unit in Britain. It was to be the first commercial-scale plant of an advanced design, called a 'fast breeder reactor'. Unlike existing commercial nuclear stations, it would be fuelled not only by uranium but also by plutonium. (Plutonium is a man-made element, first produced in quantity in World War II as the raw material for the atom bomb.)

Even in Britain, where nuclear policy has always been formulated behind closed doors, the plutonium-fuelled fast breeder is making some people increasingly nervous, It raises dramatic uncertainties about operating safety and security. Recognising this unease, Mr Benn last week issued an open invitation to all concerned, to put forward in public the questions they would like the Nuclear Inspectorate to answer. Mr Benn promised to publish both questions and answers.

His invitation was undoubtedly prompted in part by Sir Brian Flowers, Chairman of the Royal Commission on Environmental Pollution. In September the Commission's sixth report is due, on 'Nuclear Power and the Environment.' Last month, at the National Energy Conference, Sir Brian gave Mr. Benn and the conference advance notice of the Commission's findings. The Commission will declare itself satisfied that some areas of interest - such as health and safety, and radiological protection - offer no cause for alarm. However, in Sir Brian's words :

'We believe that nobody should rely for something as basic as energy on a process that produces in quantity a by-product as dangerous as plutonium, unless he is absolutely convinced that there is no reasonable alternative course of action. I am bound to say that we have not been convinced that this is the case by the evidence submitted to us.'

Sir Brian's carefully measured phrases electrified the conference, not least the participants from the British nuclear industry - because Sir Brian, a Fellow of the Royal Society, is also a part-time member of the UK Atomic Energy Authority, and one of its most senior figures. His words did not endear him to his colleagues.

In its evidence to the Royal Commission, published on 10 June, the Authority had put forward a 'reference programme' for future nuclear development. It would entail having in operation within 25 years, in addition to conventional nuclear stations, some 28 breeders, each requiring a fuel charge of over four tons of plutonium. By the year 2000, according to this programme, the amount of plutonium in use in Britain - in power-stations, in storage and in transit - would total some 250 tons. If separated for use as breeder fuel, so much plutonium would also be enough for 25,000 atom bombs.

The security problem thus created defies imagination. What if plutonium - even a comparatively small amount of plutonium - were to fall into the wrong hands? The possibility of nuclear blackmail or terrorism may be too horrible to contemplate. But it can no longer be discounted, as Sir Brian grimly acknowledged:

'Plutonium offers a unique and powerful weapon to those who are sufficiently determined to impose their will. In these circumstances I do not believe it is a question of ***whether*** someone will deliberately acquire it for purposes of terrorism or blackmail, but only of ***when*** and ***how often***. In dealing with tirne-scales of decades and longer, the history of this century offers little comfort. Even the recent events at Entebbe airport serve, perhaps, to remind us both of our manifest political instability and what can be achieved by dedicated audacity.'

On 8 July, at a London conference on 'Nuclear Power and the Public 1nterest,' Sir Brian repeated and amplified his observations. Of the plan to build a commercial-scale fast breeder, he said there was no doubt that it could be 'built and operated, given adequate safeguards and adequate resources, so as to be environmentally acceptable as an object in itself; we therefore do not oppose it. Nevertheless, [it] is a billion-pound step down a technological path which may later prove unacceptable or even catastrophic.'

***"*Let me tell you about a nightmare I have. The Mayor of Boston sends for me for an urgent consultation. He has received a note from a terrorist group, telling him that they have planted a nuclear bomb somewhere in central Boston. The Mayor has confirmed that 20 pounds of plutonium is missing from Government stocks. He shows me the crude diagram and a set of the terrorists' outrageous demands. I know - as one of those who participated in the assembly of the first atomic bomb - that the device would work. Not efficiently, but nevertheless with devastating effect. What should I advise? Surrender to blackmail, or risk destroying my home town? I would have to advise surrender."**

- Dr Bernard Feld, Head of Department of Nuclear and High Energy Physics, Massachusetts Institute of Technology and Vice-President of the American Academy.

The British nuclear industry has been pursuing this path for 25 years; and it is not alone. The first nuclear electricity was generated by a fast breeder in the United States. On 20 December 1951 the Experimental Breeder Reactor-1 (EBR-1) in Idaho lighted four small bulbs. But the ensuing history of the fast breeder has been profoundly gloomy, lit by flashes of dismaying drama. On 29 November 1955 an experiment at EBR-1 misfired. An operator touched the wrong button. In a fraction of a second the fuel core of the reactor overheated, melted, collapsed into a heap and was destroyed. Although the accident was messy and expensive, no one was hurt. But the ' melt-down ' reinforced worries about the safety of the breeder design.

Most other types of reactor use fuel in which the chain-reacting 'fissile' material is dilute. No conceivable malfunction can bring damaged fuel together in such a way as to set off a runaway chain reaction. Accordingly, the industry has been at great pains to stress that 'a reactor cannot explode like an atom-bomb.' However, in a plutonium-fuelled fast breeder, the fissile material is much more concentrated. Anything that goes wrong does so very fast indeed, and no one can be quite certain what might happen in the event of an accident. Reactor experts have disagreed among themselves for more than 20 years. This uncertainty was one reason why, 20 years ago, the United Auto Workers Union and other citizens of Detroit took such exception to the building of the first prototype fast breeder power station in the United States.

In 1956, Detroit Edison applied for permission to build the Enrico Fermi-1 power station, 30 miles from Detroit. The UAW and other objectors carried their battle against the plant all the way to the Supreme Court. But in 1961 a four-to-three Supreme Court decision gave the plant the go-ahead. From its start-up in 1963, the Enrico Fermi-1 fast breeder was plagued with every kind of problem, and operated only sporadically. Then, on the afternoon of 5 October 1966, radioactivity alarms in the plant began to sound. Something had gone seriously wrong. The reactor was shut down, and plant staff began a gingerly investigation. They knew that fuel had melted. But they did not know how much, or whether they could safely poke around inside the reactor without disturbing the damaged fuel core and triggering something much more serious,

Late in 1975, *Reader's Digest* published a book-length life-history of the Fermi plant by John Fuller. It took its title from the comment of a Detroit Edison engineer about the accident: 'We Almost Lost Detroit.'

It took Fermi staff more than a year of delicate probing to find out the cause of the trouble. It turned out, ironically, to be part of a safety device, which had come adrift and blocked the flow of molten sodium cooling fluid, letting two fuel assemblies overheat and melt. Subsequent efforts to repair and operate the Fermi plant were unavailing. In 1972, it was permanently shut down, leaving Detroit Edison with the costly and difficult task of dismantling its radioactive hulk.

The Fermi accident left the safety question unanswered. In March 1976, Robert Pollard, of the United States Nuclear Regulatory Commission, resigned, charging that important

safety information was being withheld from the public. In response, the NRC published a collection of internal documents, including one from Dr Stephen Hanauer, a top nuclear safety expert on the NRC staff. The Hanauer memo, dated 13 March 1975, indicated that one of the areas needing urgent investigation was the possibility of 'core nuclear explosions' in breeders.

Other aspects of the breeder's performance, if less potentially catastrophic, are also perennially unsatisfactory. For the breeder raises steam for turbines by passing hot molten sodium cooling fluid through tubes submerged in water. The welding of these complex 'steam generators' has to be immaculate, to keep the sodium and the water apart. Such perfection has proved in practice acutely difficult to attain.

Every large fast breeder built so far- the Fermi plant, Britain's Prototype Fast Reactor at Dounreay in Northern Scotland, France's Phoenix, and the BN-350 in the Soviet Union - has had persistent problems with steam generators. With such a question-mark over reliability, it is little wonder that Britain's Central Electricity Generating Board is unenthusiastic about the breeder.

The plutonium fuel for fast breeders has already given cause for concern. On 21 December 1972, the plutonium fuel fabrication facility of Gulf United Nuclear at Pawling, New York, was destroyed in a fire which involved two explosions and scattered an undetermined amount of plutonium into the surroundings. At the time, British Nuclear Fuels Ltd, who manufacture plutonium fuel at Windscale for the British experimental fast breeders, had a joint agreement with Gulf to collaborate on fuel and plant design. BNFL do not appear to have commented on the experience of their American partners.

On 13 November 1974, Karen Silkwood, an employee at the plutonium fuel plant of Kerr-McGee at Crescent, Oklahoma, was killed in a car accident. The accident occurred when she was en route to meet an official of her union and a reporter from the *New York Times*. She had arranged to tell them about malpractice in the plutonium plant. But the dossier she had promised them was not found in the wreckage of her car. Private investigators hired by the union declared that her car had been forced off the road.

The Silkwood case highlighted graphically the possibility of theft and misuse of plutonium. Facilities servicing fast breeder reactors are especially vulnerable, because they must use the plutonium in a separated form, which can be readily converted into a crude nuclear weapon.

The response of the British nuclear industry to the charge of insecurity is to insist that British plutonium stocks are stringently guarded, and will continue to be. On 1 July Sir John Hill asserted on television that, for security purposes, Windscale was still looked upon as a military installation, with detailed work with other Federal agencies, including the FBI and the CIA, to identify 'those thought likely to attempt' nuclear theft or sabotage. The American Civil Liberties Union and others look askance at the implications of such legislative proposals.

Many spokesmen and commentators, among them Mr Benn, have declared that without increasing amounts of nuclear electricity we must face 'drastic changes' in life-style. However, the advent of plutonium as an article of commerce will likewise entail changes, possibly yet more drastic. According to Sir Brian Flowers, the necessary security arrangements would have implications for the nature of our society 'which have not so far been taken into account by the Government'. In even more uncompromising terms, he continued: 'Not only are we as a nation not aware, but the Government seems to have preferred, at least until today, that we should not be made aware of these problems'.

Across the Channel a substantial number of the French public are well aware of the issues raised by the plutonium-fuelled fast breeder. But the French Government has taken a stubbornly intransigent attitude toward nuclear dissidents. In early 1976 it started building a commercial-scale fast breeder, the Super-Phenix, at Creys-Malville on the Rhone, 30 miles from Lyons. Early this summer several hundred objectors, including women and children, set up camp near the site. On the first weekend in July rnore than 10,000 others joined them and managed to establish a foothold of peaceful occupation within the electrified boundary of the site itself. On 8 July a battalion of French riot police moved in. Using tear-gas and truncheons, they drove the objectors from the site, injuring four.

British breeder advocates are now looking to France as a possible partner. The main reason for international collaboration is the breeder's rapidly spiralling cost. In the US the Fast Flux Test Facility at Hanford is still incomplete, and has seen its cost increase by 800 per cent. The Clinch River Breeder Reactor is planned to be built near Oak Ridge, Tennessee, to launch the re-vamped US programme: since 1972, its estimated cost has increased from 700 million dollars to over 2000 million dollars, and the plant is not even under construction yet. West Germany, Belgium and the Netherlands are collaborating on the construction of the SNR-300 fast breeder at Kalkar, just inside the West German border. But its cost has already risen over 50 per cent since 1972. The next stage of the project is to construct a commercial-scale SNR-2; but the cost escalation has made the Dutch Government reluctant to participate, and it is expected to withdraw.

In Britain, however, energy planners have assigned a central role to the fast breeder. This is evident from the discussion document, 'Energy Research and Development in the UK,' prepared by Dr Walter Marshall and his colleagues for the Department of Energy, and published in mid-June. Dr Marshall is Chief Scientist at the Department of Energy and Deputy Chairman of the Atomic Energy Authority.

Of the seven scenarios of future UK energy use and supply he and his team put forward, six depend ultimately on the fast breeder. However, as Dr. Marshall told a nuclear industry conference in London on 8 July, there is no economic basis on which to build the breeders in Britain for at least the next decade. Dr Marshall suggested that throughout this lean period the nuclear industry would have to subsist on export business. He did not allude to the wider implications of exporting plutonium technology, but they can hardly be overlooked.

In any case, Dr Marshall's discussion document has come in for serious criticism - not only for its conclusions, but also for its assumptions. Among other observations, critics point out that in past years public spending on energy research and development has been massively unbalanced. Nuclear energy has been receiving as much as one hundred times the amount spent on any other energy option: of this, more than half has been devoted to the fast breeder alone. Until other energy options - conservation, advanced coal technology, and solar and wind energy, among others - are given more than nugatory support, they cannot be so lightly discounted in favour of the nuclear option.

To date, according to the Atomic Energy Authority's last annual report, some £289 million has been spent on the fast breeder. Sir John Hill told the Select Committee on Science and Technology in May that this figure might well be as high as £400 million. Mr John Surrey, of the Science Policy Research Unit at the University of Sussex, suggests that the figure might be double this. The proposed commercial-scale fast breeder is likely to cost at least another £600 million; estimates at this stage are no better than guesses.

The Government is now looking desperately for opportunities to cut public spending. There seems little likelihood that the Treasury will countenance any early expenditure on a risky adventure like a commercial-scale fast breeder. Why, then, is the Government proposing to announce so precipitous a decision authorising its construction?

In the present case, one analysis suddenly persuasive is that the Government has resigned itself to cancellation of the programme of six Steam Generating Heavy Water Reactors, authorised in July 1974. Neither the CEGB nor the South of Scotland Electricity Board are in any hurry to order these stations. They seem likely to be very expensive indeed, and the electricity supply system already has an absurd excess of generating capacity, more than 50 per cent above peak demand. If, while cancelling the heavy water reactors, the Government could give a positive commitment to the breeder, the nuclear industry's trauma might be somewhat assuaged.

However, the effect of such a premature Government decision would be similar to that of an earlier one this year, which gave British Nuclear Fuels approval to seek contracts to reprocess used fuel from reactors overseas. BNFL has since regularly referred to a contract to reprocess 4000 tons of fuel from Japan as ‘approved.' As it happens, negotiations between BNFL, the Japanese utilities and French reprocessing interests are still far from agreement. No contract is likely to be signed for months. However, since the Government has spoken, the nuclear industry considers further public discussion superfluous, however altered, confused and unsatisfactory the position.

Will Mr Benn's new invitation to public participation lead, within five months, to arbitrary termination of the debate? The breeder gives rise to a challenging complex of questions. By no means all of them can be answered by the Nuclear Inspectorate, or by Mr Benn himself. Some of the most urgent must be answered by the people of Britain, individually and as a community. Must we - can we - learn to live with the breeder? Is plutonium the fuel of the future? Is this really the best we can do? On every side creative

imaginations are now at work, devising fresh approaches to energy policy. There are bound to be many options cheaper, easier and safer than the atom bomb economy.

WALTER C. PATTERSON studied nuclear physics in Canada and now lives in Britain. He is Energy Specialist for Friends of the Earth and author of 'Nuclear Power'.