should not be included in the alert system because broad international publicity will attract curiosity seekers. But others maintain that, if the right people are notified first, measures can be taken to protect these tribes from disease and governments can be pressured into protecting them from exploitation.

There appears to be little doubt that the center is filling a gap that needed to be filled. While it is not necessarily the first agent to pass on the news of a major event, it has created a more systematic means of communication among scientists and scientific institutions throughout the world than previously existed. News travels faster and gets to the right people sooner. And, as only a quasi-governmental organ, it is free to make contacts where it chooses. The center has contacts in 138 countries, and although the People's Republic of China does not participate, reports are regularly sent to a handful of top Chinese scientists.

The biggest category of event reports emanating from the center involves earthquakes, followed by volcanic eruptions (Citron claims volcanologists thought there were only about 10 major eruptions a year, but since 1968 the number has been found to be closer to 20) and oil spills. The way things are going, man-induced dislocations will undoubtedly soon top the list. Appropriately enough, one of the center's major activities aside from its reporting network is the designing of a Global Environmental Monitoring System (GEMS 1), part of the United Nations environment program. Citron says the center, because of its unparalleled array of contacts, has been asked to help survey environmental monitoring programs throughout the world in order to assess the feasibility of setting up a comprehensive, internationally coordinated system, possibly to be located in Nairobi.

The center is also pulling students into its act through what it calls its International Environmental Alert Network, established last January. Some 50,000 students are plugged in, most of them in the United States, and program director John Whitman says their contributions accounted for 16 percent of the event reports sent out this year. Students are also being invited to contribute to field research projects, the first of which has been to collect samples of the *ma-dake* bamboo, a species that flowers and then dies once every 60 to 120 years. The samples are being forwarded for scrutiny to two Smithsonian botanists.

Nature holds the secrets close when things are running smoothly; it is the exceptional event—a meteorite fall, a volcanic eruption, a mass whale beaching, a worm invasion—that yields insights into the nature of the steady-state universe. And the center, as a collector of pieces of a vast, multidimensional puzzle, may help scientists press toward a deeper understanding of the order underlying all things.

—Constance Holden

Energy in Britain: Shopping for a New Reactor

Europe has been hard hit by the energy crisis. More dependent than the United States on imports of Arab oil, most European governments are now facing up to the real prospect of a drop in living standards next year and a continuing heavy burden on their balance of payments produced by the increased oil prices.

In Britain the situation has been made a great deal worse by bans on overtime working by coal miners and electricity power engineers. Neither group can be persuaded to return to normal working because the government insists on maintaining its income policy—which means that neither miners nor power engineers can get enough to satisfy their members. A 3-day working week designed to make stocks of oil and coal go further is to be imposed by the government, thus underlining how serious the situation is.

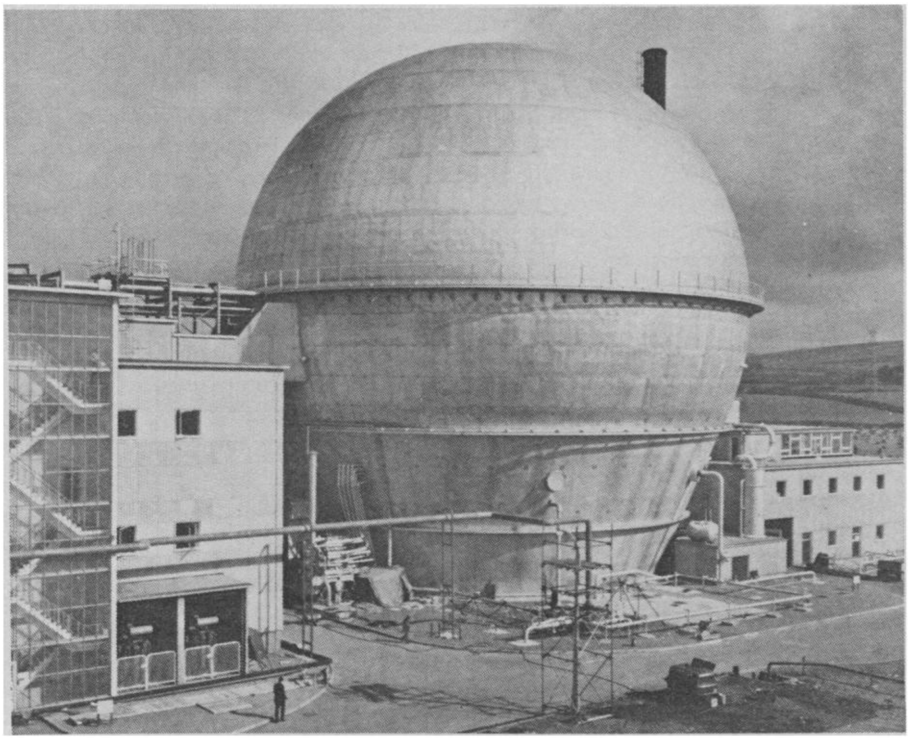
If these problems were not enough, the government is also engaged in the process of selecting a new nuclear reactor system. The British nuclear power industry, weak at the knees after years of very mixed success, is turning to the United States for a technology to get it out of trouble. The candidate chosen, the light water reactor (LWR), is not perhaps everybody's idea of a savior, but there is no doubt that LWR's are now nearer than ever before to being built in Britain.

But the switch to American technology, if it happens, is going to be controversial. Already a whiff of the battle going on in the United States over the safety of the LWR has drifted across the Atlantic, and nuclear power safety has become an issue in Britain for the first time.

Environmental groups like Friends of the Earth, with volumes of technical material from their cousins in the United States, have made much of the running, but there are also engineers inside the nuclear industry in Britain who would regard the introduction of LWR's as deeply depressing and perhaps also dangerous. Despite occasional mishaps in British fuel reprocessing plants (one occurred only a few weeks ago at the Windscale plant) and a fairly serious reactor accident, again at Windscale in the 1950's, the British public has so far been successfully reassured on the issue of nuclear safety.

The initiative for building LWR's has come from Britain's largest utility, the Central Electricity Generating Board (CEGB), which provides electricity for the whole of England and Wales. (Scotland, as in many other things, makes its own arrangements.) There are signs that electricity consumption, after several years of sluggish growth, is about to increase at a steady rate of 5 percent a year.

Looking ahead a decade, the CEGB finds itself short of plants to meet this demand. Its total capacity today is 57,000 megawatts, which ought to be comfortably sufficient to meet the peak demand expected this winter of 44,500 megawatts. But a plague of problems with conventional generating capacity makes even this healthy gap between demand and capacity look alarmingly narrow. If the growth in demand does materialize and nothing is done about the CEGB's low plant availability, some new plants are going to be needed soon.



Britain's advanced gas-cooled reactor at Windscale, Cumberland.

The CEGB believes that this new plant should be nuclear, but none of the home-grown designs quite seems to fill the bill. It is no secret that the CEGB wants to build LWR's, and there are hints that its preference is for the Westinghouse pressurized water reactor (PWR). So far it has done no more than make a presentation of its case to the Nuclear Power Advisory Board, a committee recently set up to advise on nuclear power policy. There are still a few hurdles ahead before Westinghouse (or less likely, General Electric), can begin to count its British royalties.

The CEGB's case, as it is understood, goes like this. The obvious British contender for any immediate orders, the advanced gas-cooled reactor (AGR) has turned out to be a flop. So far, not a single commercial AGR is generating power, although the prototype has been working at Windscale in Cumberland for many years. The first commercial station, at Dungeness in Kent, has had even more problems than the Concorde supersonic transport, and its construction is running at least 5 years late. Later stations in the AGR program are little better off, and all of them are going to cost much more than their budgeted prices, assuming they work at all.

The CEGB is therefore being no more than prudent in not wanting to start on another AGR until the problems are nearer solution. And the other British contenders have also fallen by the wayside, for a variety of reasons.

The high temperature gas reactor (HTGR), which the CEGB believes to be a good design, is not sufficiently developed yet to build in large numbers without risking another AGR fiasco. (The American HGTR, now being jointly developed by Gulf General Atomic, and Shell, seems to have been dismissed for the same reason.) And Britain's other design, the steam generating heavy water reactor, has been ruled out on grounds of engineering complexity, high cost of heavy water, and, some say, excessive radiation levels inside the generating plant. There is left only the Magnox design, abandoned in the early 1960's in favor of the AGR and hardly given more than cursory examination this time. In fact, the most vocal critics of the CEGB believe that Magnox is the design which should be picked, despite its age and high capital cost.

The CEGB's cost comparisons are believed to show that, of all the designs considered, an LWR would cost the least and thus, since capital cost is the determining factor, would produce the cheapest electricity. But critics argue that too much weight is being given to figures on paper which cannot be turned into reality.

The program being talked about is a large one, involving something between six and ten separate power stations, each of 2400 megawatts. As the first few of these will be ordered at rapid intervals, there is no chance of learning from the first station to avoid mistakes on later ones. The program must go well right from the start, or it will suffer from the same "bunching" that has turned the AGR program into a nightmare.

Critics doubt that any such program is possible with a new reactor type, however well proved it may be elsewhere in the world. (Some, of course, contest that the LWR *is* a well-proved design.) And, on the basis of past experience, the CEGB has a habit of making expensive mistakes where any new technology is involved. The present low availability problems in conventional fossil-fired plants are a direct result of the decision to go for standardized 500-megawatt generating units, which have turned out to be unreliable. If the CEGB cannot even make conventional boilers and turbines work efficiently, critics argue, what hope has it with a completely new technology from abroad?

In order to make the LWR palatable to British industry, the CEGB is arguing that even the early stations in the program would be largely homebuilt. This is an assumption which appears not to be shared by at least one of the American companies bidding for British business. The managing director of the British division of General Electric, R. P. Davidson, has said that the major portion of the first station would have to be built by his company and that only in the second or third stations would the "British" content of the stations increase. Westinghouse, the favorite at present, has said nothing so far but would probably agree with General Electric.

This certainly appears to make more sense than the CEGB's assumption that Britain's National Nuclear Corporation (NNC) could simply obtain a license for an LWR and start building. At issue are both the total foreign exchange costs for buying American technology and the ability to get the job finished on schedule. Critics doubt that the NNC could do the job. One experienced nuclear engineer told this reporter that there was no British company capable of building the steel pressure vessel for an LWR, and he also doubted the ability of the turbine manufacturers to produce turbines suitable for LWR steam conditions, distinctly different from those of the AGR.

More fundamental are questions about the LWR itself. The arguments that have been going on in the United States for the past few years over the efficacy of the emergency core cooling systems are now finding audience in Britain. The CEGB believes that the LWR is a safe reactor, although it is not clear how detailed an examination has been made of American literature on the subject.

The Nuclear Installations Inspectorate (NII), the body responsible for licensing nuclear plants, seems less certain. In an appearance before the Parliamentary Select Committee on Science and Technology, E. C. Williams, head of the inspectorate, said that it would take his department at least 2 years to examine the PWR thoroughly enough. He was not convinced, he said, that catastrophic failure of the pressure vessel was impossible, and he would have to carry out all the calculations again himself before he could be sure of it. If Williams were to demand extensive changes in the PWR—a prestressed concrete vessel instead of the steel vessel, for example—the LWR's prospects would be seriously hurt. The additional cost of the redesign and the risk of mistakes would reduce the attraction of a system that could otherwise be bought almost off the shelf.

The critics of the LWR have been hampered by the lack of a convincing British design to put up against it. So far, the most persuasive case has been made for the Magnox system—a gas-cooled graphite-moderated reactor in which natural uranium is used; nine of these were built in the 1950's and 1960's at a total cost of about $1500 million. The Magnox reactors have given good service, marred only by corrosion of some unimportant components so that it has been necessary to downrate the stations by lowering gas temperatures. The problem could be avoided in a new Magnox at a cost of a few thousand dollars.

The major drawback of the Magnox reactors is their high capital cost. At a time of inflation, however, critics argue that that may be less important than the fact that the Magnox is a proven design which the CEGB is used to building. A Magnox reactor completed on time, they argue, could compete with an LWR which was nominally cheaper, but which took longer to build because of the newness of its technology.

The calculation depends on just how wide the price gap is between Magnox and LWR. Some figures suggest that it is not as wide as the CEGB suggests. Moreover, Magnox reactors require no expensive enrichment capacities and would thus be independent of the supply of enriched fuel which has already caused an argument in Europe and which some industry analysts see as a future problem.

However hard the LWR's critics try, though, they are not quite convincing that an LWR would not be a cheaper option than Magnox. At best, the difference for a 2400-megawatt station would be $24 million and it could quite easily be two or three times as great. A difference of this order could only be made up if the Magnox system could show a much higher availability and shorter building time than an LWR, or if it could be demonstrated that the safety aspects of the LWR simply do not come up to acceptable levels.

Safety is probably the crucial issue in the debate, and the only one in which the LWR's position is in any doubt. The decision probably rests on the CEGB's ability to convince the government and the NII that the LWR can be built without compromising safety standards.

If they can do this, and if the government has the courage to throw overboard nuclear research that has cost Britain around $1300 million (not including the construction costs of commercial stations), then Britain is likely to come into line with the rest of the world by ordering LWR's. The best the British nuclear community can hope for as a sop to its pride is that the CEGB will also place an order for a single high-temperature reactor, as a "demonstration plant."

But nobody is yet taking any bets on the outcome. Peter Walker, Secretary of State for Trade and Industry and also Chairman of the Nuclear Power Advisory Board, has said that a decision will be taken early next year. If he backs the CEGB, it is likely to prove one of the most contentious decisions in industrial policy ever made by a British government.

—NIGEL HAWKES

Mr. Hawkes is the science correspondent of the London Observer.

Helium Conservation Program: Casting It to the Winds

After 10 years of criticism by the Congress, 4 years of dispute within the Administration, and nearly 3 years of litigation in the courts, one of the country's oldest conservation programs has been canceled. It was a plan to put away for future generations vast quantities of helium—a unique natural resource that is being rapidly wasted. The helium conservation program, by which the government paid private companies to extract helium from natural gas and store it underground, ran into serious financial problems in 1969. A drive to eliminate the program, which apparently originated within the Office of Management and Budget (OMB) during the first Nixon Administration, now seems to have succeeded. Late last year, the government ceased stockpiling helium under conservation contracts, and two large extraction plants are now simply letting helium stream up into the sky at the rate of more than 1 billion cubic feet per year.

Critics of the government's action are concerned that the United States is wasting a unique substance for which there may be no real substitute in many applications. Helium may be irreplaceable in providing the low temperatures needed for practical applications of superconductivity, because liquid helium is colder than any other fluid. Helium is also chemically inert, nonflammable, and does not become radioactive. Helium is used as an undersea breathing gas, for industrial welding, and to provide the controlled atmosphere necessary for manufacturing solid-state electronic devices and for processing nuclear fuels. The largest use of helium at present is in the space program, as a