first line of attack against high blood pressure but were not included in the MRFIT protocol, in part because they were not available 10 years ago.

The MRFIT investigators now are frantically reanalyzing their data and are looking at the HDFP data to see if there is any evidence of adverse effects of chlorthalidone in that population. One finding that stands out in the MRFIT data is that if the group of men with hypertension and abnormal electrocardiograms is eliminated, the special intervention group has almost exactly the predicted 22 percent lower mortality rate when compared to the usual care group. But this sort of subgroup analysis is statistically shaky.

One reason that high doses of diuretics might adversely affect men with abnormal electrocardiograms, Friedewald says, is that these men have damaged hearts to begin with and the diuretics are known to lower potassium concentrations in the body. The lower potassium levels could precipitate heartbeat disturbances leading to sudden death. The MRFIT investigators did find an unexpectedly high incidence of sudden death, according to Friedewald.

Asked how he would advise physicians and their hypertensive patients, Friedewald said, "We feel that routinely the patients should get an ECG. If abnormalities are found, and the patient is given a drug, he should get very low doses of a diuretic. If that doesn't lower his blood pressure, he should go to the next level of drugs [when diuretics were insufficient in the MRFIT trial, the men were given reserpine, a different kind of antihypertension drug]. Propranolol would also be logical."

As for now, says William Insull of Baylor College of Medicine, who is head of the MRFIT policy advisory board, "We're obviously very concerned about this. We've obviously got a problem and it's not a trivial problem. We are making every effort to find the exact dimensions of the problem and the exact cause of these deaths." But, if the diuretic toxicity can be conclusively demonstrated, the MRFIT study will have made a major and completely unanticipated contribution to American medicine.

—GINA KOLATA

Can the Administration Sell Reprocessing?

The unfinished nuclear fuel reprocessing plant at Barnwell, South Carolina, symbolizes Administration difficulties with plutonium policy

The Reagan Administration wants a pristine nuclear fuel reprocessing plant at Barnwell, South Carolina, completed and brought on-stream as part of its plan for a major revision of U.S. nuclear policy. In its campaign for reprocessing, however, the Administration is encountering the same conflicts that afflict its nuclear grand design.

To achieve its aim at Barnwell, the Administration will have to overcome industry's skepticism that reprocessing can be done at a profit and the fears of congressional critics that domestic reprocessing will encourage the international proliferation of nuclear weapons. These issues are expected to come to a head in coming weeks when the Administration issues two long-overdue policy statements affecting reprocessing.

Nearly $400 million was spent on the Barnwell plant by its private sector owners before work on it was stopped in 1977 as a result of a Carter Administration policy decision. President Reagan reversed that decision after he took office, but ruled out government purchase and operation of Barnwell, which had been suggested by Department of Energy (DOE) officials. The President told DOE to seek a formula to give a firm footing for commercial reprocessing in line with his free enterprise preferences.

Finding such a formula means making the terms attractive enough to induce private industry to undertake reprocessing while not violating Reagan precepts on the proper restraints on public expenditure. The Administration's problems are compounded because completion of Barnwell requires construction of additional facilities costing an estimated $700 million in mid-1980 dollars; a completed Barnwell would represent an investment of well over $1 billion. Needed are a facility for waste storage and solidification and another to convert plutonium nitrate yielded by reprocessing to plutonium oxide suitable for fabrication into fuel.

What makes Barnwell's operation highly controversial is this capacity to extract plutonium. For the critics, plutonium is synonymous with nuclear proliferation. They argue that domestic reprocessing would seriously weaken the U.S. position in international nonproliferation efforts. To bolster their case, they contend that reprocessing is not only dangerous, but that, in the present market for nuclear fuel, it is uneconomic and, therefore, unnecessary. In addition, the critics increasingly cite experience with commercial reprocessing to warn that it is technologically trouble-prone.

The debate over Barnwell is fired by differing visions of the nuclear future. The Administration is attempting to push through an integrated nuclear policy dominated by development of the fast breeder reactor, which both uses and produces plutonium; reprocessing goes in tandem with the breeder. The Administration position is that reprocessing is vital to the long-term development of American nuclear industry. Barnwell is the key to Administration plans to close the back end of the fuel cycle. In nuclear parlance, this denotes the reprocessing of spent fuel from light-water reactors so that a substantial part of it can be reused.

Proponents of reprocessing claim that a major point in its favor is that it would significantly reduce current problems with high-level radioactive wastes, since such wastes are converted by reprocessing into a form more readily disposed of. Spent fuel is now kept in indefinite storage on reactor sites and a large backlog is accumulating.

Internationally, the Administration view is that domestic reprocessing would strengthen the U.S. competitive position in nuclear commerce. It would also give the United States greater influence in nuclear nonproliferation efforts than provided by the Carter Administration policy, which Reagan officials describe as one of "technological denial."

The Carter Administration after 1977 followed a broad policy intended to discourage development of an international plutonium economy. As part of this policy, work was ordered deferred on Barnwell and the breeder. The Reagan Administration is already following a more flexible policy in international dealings

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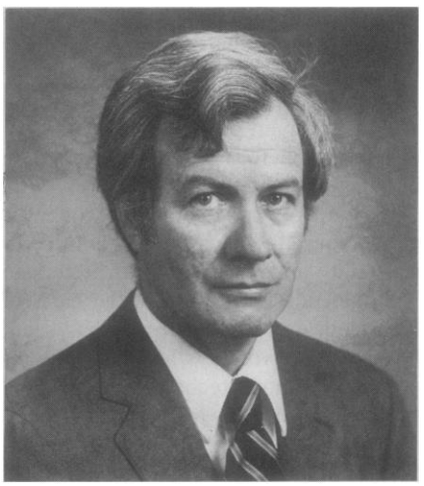
on U.S.–supplied nuclear fuel and technology (*Science*, 25 June, p. 1388).

On the subject of domestic nuclear policy, Administration pronouncements have been general in nature. An official statement on reprocessing, laying out the government position on Barnwell, is thought to be in the offing, since a draft of the DOE paper surfaced last spring. And a more comprehensive pronouncement on plutonium is in the works and is also expected to emerge from the White House this fall.

Unless the Administration acts reasonably soon on Barnwell it faces the possibility of seeing the plant dismantled. (With no other reprocessing facility even on the drawing board, the demise of Barnwell would effectively delay commercial reprocessing for at least a decade.) Barnwell is owned by Allied General Nuclear Services, a partnership involving subsidiaries of the Allied Corporation—formerly Allied Chemical—which holds 50 percent, and Gulf Oil and Royal Dutch/Shell, which each hold 25 percent. No ultimate deadline has been set, but the owners, Allied in particular, have said that they are unwilling to continue the plant on caretaker status with no prospect of their investment paying off. Interest in the plant has been shown by potential purchasers, notably the Bechtel Corporation. A sale appears likely, however, only with solid government guarantees, probably including a pledge to purchase plutonium from the plant.

The Barnwell dilemma could hardly have been predicted a decade ago. As late as the middle 1970's there was an effective consensus, reflected in government policy, that reprocessing would become an integral part of the fuel cycle for nuclear power. It was assumed that a rapid buildup in the number of light-water reactors would cause a rise in uranium fuel costs to prohibitive levels. Reprocessing was seen as offering a way to salvage spent fuel and also as a better means of dealing with high-level radioactive wastes. In the longer run, plutonium would be needed for fuel in breeder reactors when they succeeded light-water reactors. Until the transition to the breeder occurred, plutonium could be used in existing reactors by being mixed with low-enriched uranium fuel in what is called "thermal recycle."

The consensus on reprocessing, however, began fraying in the mid-1970's. An upping of estimates of the proliferation dangers of plutonium led the Carter Administration to take measures to thwart emergence of a "plutonium economy," including the hold on Barnwell. In this period also, the U.S. nuclear industry ran into trouble and orders for new nuclear plants virtually dried up.



Shelby Brewer

"If you simply ran the arguments through an economic sieve, you'd never have gotten to electricity and automobiles."

As for reprocessing, costs increased and plant performance here and abroad in the 1970's did not encourage total confidence in the technology. The United States has successfully engaged in reprocessing activities to obtain plutonium for military purposes since World War II. Plutonium from military reactors is typically obtained from nuclear material that has been irradiated for a relatively short time and contains a low level of fission products. Fuel in commercial reactors is characteristically subjected to a so-called "high burnup" which increases the level of highly radioactive fission products, however, and critics argue that this makes such reprocessing substantially more difficult.

Commercial reprocessing in the United States has been limited to a plant at West Valley, New York, which closed down in 1972 because of contamination problems after a few years of operation. A second plant was built in Morris, Illinois, and was completed in the early 1970's but never put into operation because of shortcomings attributed to design.

For all these reasons, reprocessing is now surrounded by economic, political, and technological uncertainties.

What incentives are necessary to lure private enterprise back into reprocessing? In March, Ashton J. O'Donnell, a Bechtel executive, told an industry group that the basic conditions the government would have to meet were assurance against "exploitation of investor capital" and creation of a "stable licensing environment." He went on to say that "If the financial community looks favorably upon such undertakings, if the utilities are prepared to commit for reprocessing services, if the Government is prepared to contract for the plutonium, and for timely acceptance of a specified nuclear waste form, then a viable enterprise is conceivable."

No offer to purchase Barnwell has been made, he said, but his company had taken a careful look at the proposition and the investigation had "not uncovered any obstacles that would preclude commercial ventures."

Reflecting industry attitudes, he said, "The next step must be taken by the United States Government. That step must be clear, unambiguous, responsive to industry and utility needs, and credible in the financial and international communities."

The reference to the international community is in recognition of Administration intentions for Barnwell to include participation by other countries. Germany and Japan have already conducted negotiations with the owners. German interest appears strongest since that country's laws require its nuclear power companies to present evidence of firm future reprocessing arrangements; Barnwell offers the best prospect for these until the mid-1990's when a German facility is expected to be ready. Reprocessing of foreign nuclear wastes at Barnwell is regarded as politically acceptable here only if the customer agrees to accept the return of high-level wastes.

According to DOE assistant secretary for nuclear energy Shelby T. Brewer, the department's recommendations on reprocessing will be before the Administration "within several months."

In Congress, opposition to reprocessing remains rooted mainly in concern about proliferation. The opponents of reprocessing, however, have been paying more attention to technological and economic criticisms. Interest was sparked this summer, for example, by a study on reprocessing by a small Washington public interest group, the Health Energy Learning Project. Its report, entitled "Bubble, bubble, toil and trouble: Reprocessing nuclear spent fuel," presents an analysis of the operating experience of reprocessing plants in this country, Europe, and Japan. In its conclusions, the report says, "Of the five reprocessing factories with any length of operating experience, four were shut down after only a few years of operation. The fifth, at La Hague in France, has been in operation since 1976, running at about 10 percent of rated capacity.

In the course of work on the report, the Freedom of Information Act was

used to obtain an evaluation of Barnwell by a team from Argonne National Laboratory. The team suggested that shortcomings in Barnwell's design in respect to maintenance might cause contamination problems such as those that led to the shutdown in the early 1970's of the reprocessing plant in West Valley and "give the industry a further black eye."

While focusing on technical operations, the report also included an economic assessment of reprocessing. The report asserts that the costs of reprocessing spent nuclear fuel are much higher than of purchasing uranium and emphasizes this disparity in its conclusion that reprocessing is not commercially viable. The report's author is Arjun Makhijani, whose technical background includes an electrical engineering degree from Bombay and a doctorate in controlled fusion from Berkeley. Makhijani's facts and findings have drawn fire from industry, but the report has also been seized on by critics of reprocessing. Makhijani, for example, was a member of a panel on reprocessing on 10 August at a hearing on amendments to the Non-Proliferation Act of 1978 held jointly by two House Foreign Affairs subcommittees. A chief topic in the question and answer period was the differences between the report's findings and those of a study conducted for the Atomic Industrial Forum which yielded results much more favorable to reprocessing. The discussion left the advocates of opposing analyses very much at odds. A main point, however, is that congressional foes of reprocessing are broadening their critique.

DOE's Brewer says the department is conducting a technical review of the critical study and he, therefore, prefers to withhold full comment. On the basis of data from other countries he has seen, however, Brewer says he thinks the report is "without technical merit" and that he regards it as a "political issue."

As for criticism of Barnwell's design, Brewer notes that the plant incorporates technology that has been in use for three decades and says that Barnwell's designers took into account difficulties experienced by other reprocessing facilities.

On the matter of costs, the Administration's case for reprocessing is not, in fact, made on narrow economic criteria. It is necessary to "broaden the incentive," says Brewer. "If you simply ran the arguments through an economic sieve you'd never have gotten to electricity and automobiles." The heart of the Administration argument, in favor of reprocessing, as the DOE draft paper put it, is "to provide access to significant remaining fuel value for future generations as well as significantly reduce the volume of high-level waste." According to the paper, "Through reprocessing and the use of the breeder reactor, the amount of energy generated from a given quantity of uranium will increase almost 70 times beyond that generated in a conventional reactor with no uranium and plutonium recovery."

As this illustrates, the opposing sides in the debate over Barnwell disagree fundamentally on the risks and benefits of proceeding on a course that even a decade ago appeared to be manifest destiny for the nuclear enterprise. To critics in Congress, Barnwell, the breeder, and the shift in nuclear foreign policy all would increase the availability of plutonium and, thus, pose too great a risk.

The outcome of the contest over Barnwell is hard to predict since Congress has shown itself to be of two minds on the larger issue. While it has been consistently sensitive to proliferation dangers, Congress, at the same time, deflected Carter Administration intentions by keeping the Clinch River Breeder project alive and voting Barnwell about $10 million a year, enough to maintain it and to provide the basis of a fairly extensive program on safeguards for plutonium. In its impending decisions on funding for the breeder and the fate of Barnwell, Congress will find it harder to continue to have it both ways.—JOHN WALSH

The Academy Under Frank Press

His mild manner masks an ambitious agenda to raise the academy's visibility, influence the White House, and launch policy debates

Frank Press, president of the National Academy of Sciences (NAS), has installed a device just beside his desk that none of his predecessors had: a small Sony TV. Its presence hints at the kind of change taking place at the academy under its 19th president.

A staffer says of Press that he "loves television," meaning that he likes to keep an eye on the network news and to have an impact on it. Millions of Americans get a version of truth from television, and Press wants to contribute to it. He is proud of the fact, as he said recently in an interview, that one night he appeared on all three network broadcasts, talking about the distressed state of high school science. Reporters had interviewed him in connection with a national "convocation" he held at the NAS in May to dramatize the problem. "Can you imagine what it would cost to buy that much prime time?" he asks.

Press does not regularly make the headlines. He was installed officially as president of the academy a little over a year ago, in July 1981. Although he has made some broad changes in the staffing and structure of the NAS since his arrival, these have not stirred much publicity. This is just as Press would like it, for he aspires to discreet success. He describes his ideal method of operation, for example, in an article elsewhere in this magazine ("Rethinking science policy," p. 28), in which he explains how the President's science adviser should influence budget decisions: "quietly, without fanfare, without public pronouncements of successes, with the noises of bureaucratic battle muted, and often without responses to public criticisms. . . ."

This perfectly fits Press's own style, both as President Carter's science adviser from 1977 to 1980, and as a leader of the NAS. His mild demeanor does not denote a modest ambition, however. Nor does it mean he avoids publicity.

A glance at Press's plans reveals that he has a massive agenda. Some of these projects have been completed already; most are just a-borning. Among them are a complete overhaul of the academy's report writing agency, the National Research Council (NRC); an administrative cutback to bring about a 15 percent reduction in personnel and overhead costs next year; a drive to raise private capital for each of the three honorary institutions under the academy's roof; the creation of a separate $3.8-million kitty for special projects of interest to the academy; a variety of new "outreach"

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