sphere was generated in 1976 when West Germany concluded a multibillion dollar nuclear power deal with Brazil that included reprocessing facilities, and France signed contracts with Pakistan and South Korea which also called for reprocessing plants. Subsequently that year, both France and Germany announced nuclear export policies under which they forswore exports of sensitive technology-reprocessing and enrichment plants.*

*The French contract with South Korea was canceled; reportedly, heavy U.S. pressure was exerted on the Koreans. The Brazil and Pakistan deals still stand. In Brazil, economic and technical considerations are said to be slowing proceedings. In Pakistan, the overthrow of Premier Ali Bhutto resulted in a period of political tension. In recent talks the French made clear that they intended to go through with their commitment to provide the Pakistanis a capacity to meet their needs for irradiated fuel, but only under conditions which would not make weapons-grade plutonium available.

The Ford Administration in March of 1976 signaled a shift in policy by expressing the hope that nuclear suppliers would find alternatives to the export of "sensitive technologies." In late October, just before the election, the Administration adopted a domestic policy which, in effect, deferred both reprocessing and plutonium recycle. Both Carter and Ford, therefore, went into the election with strong and rather similar nonproliferation commitments.

Soon after Carter took office, his Administration launched a diplomatic frontal attack aimed at getting the German-Brazilian deal canceled. Deputy Secretary of State Warren Christopher was dispatched to Brazil and Vice President Mondale raised the question on a trip to Germany. In both countries the overtures were firmly rebuffed and the United States got the unmistakable message that its nonproliferation campaign was off on the wrong foot.

In April of 1977 Carter set forth his policy in fuller form. He sought to take a middle course, emphasizing that he was not antinuclear, but was opting to halt the commercialization of plutonium domestically by stopping work on the Clinch River breeder and the Barnwell reprocessing plant and proposing the INCFE study, which would take into account European fears about nuclear fuel supplies.

Congress has been divided on the Carter nuclear program. It has gone against him on the breeder and Barnwell, voting funds to continue both projects. At the same time, it has backed him in his concern about nuclear proliferation through the spread of nuclear technology. The

Briefing

Medical Marijuana Substitute Under Development

There is considerable medical interest in the potential of THC (tetrahydrocannabinol), the active ingredient in marijuana, for relief of the agonies of nausea and vomiting experienced by cancer patients undergoing chemotherapy. But research with THC has been slow going, what with the difficulties of working with an illegal drug whose properties have not been deeply explored.

Several drug companies have been working on synthetic analogs to THC. Farthest along is Eli Lilly and Co., which for several years has been doing research with a drug called Nabilone. Thus far it appears that Nabilone exerts effects very similar to THC—minus the euphoria—and is significantly more effective in relieving emesis than the phenothiazines (primarily Compazine) now in use.

Lilly has not wanted to publicize its work with Nabilone for fear of raising false hopes among victims of cancer and of glaucoma, the other medical condition for which THC has shown some promise. Also it wants to avoid any association with THC that might attract federal regulatory agencies.

The National Cancer Institute did not find out about Nabilone until last May, according to NCI's Brian Lewis. At that time the institute called together a conference in response to the Administration's new policy calling for reevaluation of the medical properties of controlled substances.

Nabilone, a white crystal that cannot be synthesized from THC, was first synthesized in 1972 when Lilly was looking for a new minor tranquilizer. Interest then shifted to its use as an antiemetic. Two years of clinical trials have been completed, and now Lilly is setting up a phase III study, which involves large number of patients. The company hopes that if all goes well it can apply for an NDA (new drug application) early next year.

At the NCI conference, two researchers reported findings comparing Nabilone with Compazine. Lawrence Einhorn of Indiana University found that with 85 patients, 81 percent experienced less vomiting with Nabilone, whereas only 15 percent were helped by Compazine. Terence Herman of the University of Arizona said that of 37 patients, 24 preferred Nabilone. The most common side effects noted were somnolence, dry mouth, dizziness, and loss of coordination.

Nabilone has not yet been compared with THC in clinical trials. Paul Stark of Eli Lilly says this should be done "somewhere down the line," but right now the need is to establish its efficacy in comparison with approved drugs now commonly in use. Nabilone does appear to have some advantages though: it is soluble in various substances and therefore potentially easier to administer intravenously or in capsule form. (Oral THC is absorbed erratically by the body.) Also, the absence of the euphoric effect may be an advantage not only legally but practically, because this can increase discomfort when experienced in the context of nausea and vomiting.

Nabilone, although a central nervous system depressant, acts differently on the mechanisms of vomiting than Compazine. Herbert Borison of Dartmouth College explains that Compazine, which does not work at all with many anticancer drugs, probably works on certain chemoreceptors for vomiting in the brain, whereas Nabilone (like THC) has a "more generalized influence involving more complex pathways . . . conceivably through some indirect action on opiate receptors."

The Lilly people are being cautious in their claims about Nabilone and emphasize that much testing remains to be done. But an effective antiemetic could be a great boon to cancer patients, not only in relieving nausea but in enabling them to keep themselves well nourished. So ghastly are the side effects of chemotherapy that many patients choose to forego it altogether. Borison, for example, heard of one case where the sight of his doctor on a television program caused a patient to start vomiting.

Research is also being done on the use of Nabilone to reduce intraocular pressure in glaucoma. Frank Newell at the University of Chicago has been conducting phase II studies with glaucoma patients and has found that a single oral dose reduced the pressure by an average of 34 percent. Lilly hopes eventually to get Nabilone approved for glaucoma treatment. Investigation of its use as a minor tranquilizer is still in the phase I stage.

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Nonproliferation Act, shepherded through Congress first by Senator Abraham Ribicoff (D–Conn.) and then by Senator John Glenn (D–Ohio), generally follows the lines of Administration policy, changing nuclear export laws to sharpen nuclear safeguards. The bill originally had stiffer restrictions on export of U.S. uranium which would almost certainly have caused a more serious confrontation with the Europeans. The Administration persuaded Congress to soften them and give the President greater discretionary powers, thus cushioning the collison.

The President has also had some difficulty in keeping order in his own house on the nonproliferation issue. Some officials in the Department of Energy have been wedded to the industry view that the technical and economic case for pressing ahead with the breeder is overwhelming and that the dangers of plutonium have been exaggerated. On the other flank, officials in the Arms Control and Disarmament Agency (ACDA) and Council on Environmental Quality have been seen as advocates of even tighter sanctions. These differences fostered the impression that there was really no Administration policy, but rather a variety of contending viewpoints.

This summer the U.S. position was stated in what can be regarded as definitive form since all the relevant agencies had "signed off" on it. The statement was delivered in early July at a meeting of the Uranium Institute in London, a major forum for nuclear suppliers, by State Department official Joseph S. Nye, Jr., who has become the Administration's anchor man in nonproliferation discussions.

Nye is not a career diplomat, but an academic on leave from Harvard where he is a professor at the Center for International Affairs. As deputy to Lucy Benson, Under Secretary of State for Security Assistance, Science and Technology, Nye has had a main role in developing nonproliferation policy and has been State's most visible advocate for that policy abroad and in this country.

The Administration's top official on nonproliferation is Gerard C. Smith who, in June of 1977, was named by Carter as special representative for nonproliferation matters, with the rank of ambassador at large, and as U.S. representative to the International Atomic Energy Agency. Smith was director of ACDA between 1969 and 1972 and was chief of the U.S. delegation to SALT in

Briefing

Senate Votes to Cancel NASA's Moon Rock Money

NASA is thinking "unprintable" thoughts (according to one official) about Senator William Proxmire (D-Wisc.) whose latest attack on what he regards as federal frivolities has come in the form of a move to eliminate NASA's moon rock study program.

On 7 August the Senate voted to eliminate the $5.7 million contained in the NASA budget for research on lunar samples. "We didn't even know it was there or we would have done it sooner," says an aide to Proxmire, who was joined in the cost-cutting amendment by Charles Mathias (R–Md.) when the bill was in the Appropriations Committee.

So far, about $30 million has been spent, allocated among 70 principal investigators in 37 institutions around the country, on analysis of the approximately 300 pounds of moon rocks that were obtained on six Apollo missions between 1969 and 1972.

The Proxmire aide contends that it is silly for NASA to have its own "little pot of money" set aside for this research. This is just normal basic geological research, he says, and the program should be overseen by the National Science Foundation (NSF), competing with the rest of the nation's geological research.

NASA and NSF both emphatically disagree. Noel Hinners of NASA told *Science* the Senate vote was "an absolute catastrophic mistake." "We are trying to conduct an integrated research program," he says, that fits with the international program on lunar sample study (the Soviet Union and several European countries regularly exchange samples with—or borrow them from—the United States) and with long-range planning for future planetary missions. Besides, much work remains to be done—"many of the core tubes haven't even been opened!" (The cut would not affect the Lunar Curatorial Facility in Houston.)

As for NSF, William Benson affirms that there are no plans to expand the agency's earth sciences budget to accommodate moon rock studies. NSF's earth sciences budget is $24.1 million. About $10 million of that goes for geochemistry, which is the category most moon research would go under. NASA "has a well run program," says Benson. "To suddenly turn it over to us now doesn't seem very sensible."

The House voted to retain the lunar research money, so it may well be restored by the House-Senate conference committee.

Work at Seabrook Resumed

The Nuclear Regulatory Commission on 10 August gave the Public Service Company of New Hampshire permission to continue its struggle to complete its heavily opposed nuclear power plant in Seabrook. Construction was halted on 21 July pending a review by the Environmental Protection Agency of the plant's cooling system. Eighteen protesters promptly showed up on the first day work resumed and were arrested for trespassing and disorderly conduct.

Members of New England's Clamshell Alliance are violently opposed to the plant, which some have been fighting for nearly a decade. Construction was halted for 5 months in 1977 when the EPA regional administrator revoked approval of the cooling system, a "once-through" system that relies on two tunnels reaching 7000 feet out into the ocean. EPA has now ruled twice that the system will not be harmful to marine life, but this carries no weight to foes of the plant who also contend that the NRC has failed to conduct a thorough examination of possible alternative plant sites.

Now two groups, the New Hampshire Audubon Society and New England Coalition on Nuclear Pollution are appealing the EPA decision to the first circuit court in Boston. There are also decisions pending from four prior appeals of NRC decisions. If all these challenges are beaten back, work on the $3.4 billion plant may continue uninterrupted until it comes time to apply for an operating license.

The Clamshell people are not giving up, though. They plan to continue posting small groups at the site to conduct acts of "nonviolent civil disobedience.'

Seabrook, one of 88 nuclear plants currently under construction, has become a classic case in that it demonstrates the delays, redundancies, and second-guessing inherent in the nuclear regulatory process as it now stands.