although polluters will have to take effective corrective measures before that time or face retroactive charges.

The framers of Vermont's new land use law intended to prod local governments to deal more effectively with planning and zoning problems. But the effect of the new law has been to shift power over development to the state government. Many Vermonters originally viewed the land use law as defending the state against land speculators and "summer people." Now they find that the law restricts the local land developer, as well as the big land company. In the same way, effluent charges hit not only the industrial polluter, but the farmer with a faulty septic tank. The signs are that many people are having second thoughts.

By American standards, Vermont has had a virtually static population and homogeneous society. Vermonters are slow to accept outsiders, and their feelings about individual rights and local self-determination make them view the state government's burgeoning role with suspicion. Old patterns of life are breaking up, and the process is painful to many Vermonters who feel that the outsiders, rather than themselves, are profiting from the changes. Vermonters are proud of their state's natural beauty, but, in practical terms, they resent seeing the cost of land and of decent housing soar out of reach, and they worry about the lack of jobs that would make it possible for their children to remain in the state. A sign of the times is a fairly widespread tendency to blame Act 250 for the current housing shortage in the state.

All of this has implications for environmentalists and is not lost on politicians. Serious consideration, for example, is being given to a system of preferential taxation, under which lower taxes would be levied on land kept in farming use than on land sold to developers. And, although environmentalists cannot be described as politically isolated, one state official who is generally sympathetic to the environmental cause may have shown which way the wind is blowing when he observed, "The trouble with your silver-haired, starry-eyed environmentalists is that they have only a small following and little clout."

The state's environmental activists seem to be facing up to the problem. At its last annual meeting, the Vermont Natural Resources Council, the leading statewide environmental organization, featured a panel on the operation of Act 250, and panelists dealt at some length with housing problems. The council is also the recipient of a $120,000 grant from the Ford Foundation to be used in a statewide program to inform the public on the purposes of Act 250 and to get the public more deeply involved in implementation of the act.

At this point, the question of how the new laws will operate in practice is still open and only time will tell whether the critics are correct in predicting that the laws will be administered permissively.

Vermonters, of course, should have no illusions that they will be left alone to settle their problems. Vermont exercises as strong an attraction in its region as an oasis in the Sahara. And as the state develops industrially, its interdependence with neighboring states will grow. For example, decisions must soon be made on a proposed East-West highway from Calais, Maine, to Amsterdam, New York, and its routing through Vermont will have a powerful effect on development. The public is more aware and perhaps more wary of new power plant construction in the state. A debate is now in progress over licensing of the first nuclear power plant constructed in the state, and Vermont faces early decisions on the location of other major power plants within its borders. Big power development as a local, state, and regional issue will be discussed in a second article on Vermont.

—JOHN WALSH

High Energy Physics: In-Group Talks Funds, Possible Closeouts

The Joint Committee on Atomic Energy (JCAE), the congressional overseer of the Atomic Energy Commission, has been putting pressure on the AEC Division of Research, and on the administrators of the six AEC-sponsored accelerator laboratories, to come to grips with one of their most sensitive problems: which accelerators should be shut down if money for high energy physics stays constant or dwindles again in fiscal year 1973.

Decisions on this issue will be made within the AEC and then by the Office of Management and Budget (OMB) by the time the Nixon Administration submits its fiscal 1973 budget to Congress next January. And when Congress reviews the Administration budget next spring, the JCAE will pass, among other things, on the fate of the big accelerators.*

In preparation for this process, the JCAE report on the fiscal 1972 budget made an unusual request—itself a masterpiece of ambiguity—which has set those who administer the six laboratories and hence direct high energy physics research in this country trooping to and from Washington like pilgrims flocking to Mecca.

The Committee asked the AEC to report back by 31 December 1971, with a "priority listing" of which accelerators should "be kept operating should future money be less than the minimum. . . ." But then it added a few sentences of praise for the six laboratories. It called them "highly deserving" of support "to keep them operating at their maximum level of productivity." It praised the "fundamental knowledge" that high energy physics provides to other fields, and it expressed the hope that the United States "remain in the forefront of this field."

No one knows for certain quite what the mention of minimum funding combined with lavish praise means; one school of thought is that JCAE is warning the labs to expect more cutbacks. However, it is clear that the second part of the passage, the praise of the six laboratories, has sent happy visions of sugar plums dancing through the

* The six accelerators sponsored by the AEC are: National Accelerator Laboratory, Batavia, Ill.; Brookhaven National Laboratory, Upton, N.Y.; Stanford Linear Accelerator, Palo Alto, Calif.; Argonne National Laboratory, Argonne, Ill.; Bevetron, Lawrence Berkeley Laboratory, Berkeley, Calif.; and the Cambridge Electron Accelerator, Cambridge, Mass.

heads of some lab administrators. Among them, Wolfgang K. H. Panofsky, Director of the Stanford Linear Accelerator, reads the passage as an "exhortation" for the scientists to lobby for more money. "I interpret it positively to mean that 'if you push hard, we'll help you.'" And one AEC Division of Research staffer involved in compiling the requested report said that he personally views the passage as giving the physicists a chance to "make a strong case for high energy physics."

NAL Poses Problem

The other side of the coin, literally, is the possibility that fiscal 1973 will turn out to be the hardest year yet for the six accelerators. For then, the world's biggest accelerator, the 200-Gev National Accelerator Laboratory (NAL) will have begun routine operations. NAL says it will need $25 million in operating costs alone in fiscal 1973, not to mention capital equipment and construction costs. By 1975 or thereafter, when NAL is fully operational, it plans an operating budget of some $60 million—or, for comparison, half the total operating budget of $116 million for all AEC high energy physics for fiscal 1972.

At present, after years of declining budgets for high energy physics, there is no separate provision for obtaining money for NAL's operation. Unless Congress or the Administration is willing to deal out an overall increase in the high energy budget for NAL, the other five accelerators will have to pay for NAL from their own budgets. As one official said, the JCAE request merely gives the physicists a chance to decide among themselves "whether to cut their throats from left to right or right to left."

Most of the accelerator administrators contacted by *Science*—roughly half of those who have been in Washington recently—were unwilling to be named since the issue of throat-cutting is a sensitive one. When promised anonymity, they spoke frankly about the future. Although they seem divided on some issues, they appear to have reached a certain consensus on what to do if the worst hits, i.e., if the funding situation becomes bleak enough so that one of the accelerators would be forced to close down altogether.

Because it is so big, a glamorous focus of international scientific attention, and exciting experimentally (as well as being one of the best-managed large physics labs in the country) NAL, the consensus is, should be affected as little as possible by the vicissitudes of funding which will plague everybody else. At the moment, the world's highest energy accelerator is the 76-Gev machine in Serpukhov, U.S.S.R. At full energy NAL will operate at 200 Gev and above; it will attain at least ten times the energy level of the next biggest United States accelerator, the 33-Gev machine at Brookhaven National Laboratory. NAL, then, is considered relatively immune.

Like NAL, the Stanford Linear Accelerator Center (SLAC) occupies a unique international position as the highest energy electron accelerator. It runs at 22 Gev and draws 20 AEC user groups from all over the country; the next highest energy machines include a 2-Gev linear electron accelerator in Orsay, France, a 2-Gev installation in Kharkov, U.S.S.R., and the 7.5-Gev electron synchrotron, known as DESY, in Hamburg, West Germany. Most laboratory administrators agree that SLAC is a national asset. In addition, SLAC has taken a share of the funding cuts. For example, it requires all staff to take 1 day off per month without pay, which stretches the payroll about 5 percent further. For fiscal 1973 and beyond it would be difficult to foresee any drastic reduction or closeout at SLAC.

The consensus that Brookhaven should remain is only slightly less unanimous. One or two of the administrators polled by *Science* argued that the 33-Gev alternating gradient synchrotron is as regional a facility as some of the smaller accelerators, since a fair percentage of the user groups there come from Columbia University and the East Coast area generally. But most administrators agreed that Brookhaven is an international asset almost as much as SLAC, since its current research is considered competitive with ongoing research at the 28-Gev proton synchrotron at CERN, in Switzerland. In addition, they argue, Brookhaven has already taken its share of the punches, having closed down its 3-Gev Cosmotron in 1966, and abandoned a major modification program last year at a cost of about 200 staff members. Current staff is estimated at about 1020.

This leaves the Cambridge Electron Accelerator (CEA), the 12.5-Gev zero gradient synchrotron (ZGS) at Argonne National Laboratory, and the 6.2-Gev Bevatron at the Lawrence Berkeley Laboratory in Berkeley, Calif. All of these have been variously described as "useful, but older" machines, and "doing very good work, but not at the frontier" and as "local" facilities, associated primarily with one geographic area or one or two institutions.

One criterion the administrators apply to these lower energy, older machines is the extent to which they have become diversified by moving into new areas of research where they can claim to be unique. In this regard the Berkeley Bevetron has been changing, and is the most promising candidate to survive. (It announced last week that it can speed nitrogen nuclei to a total level of 36 Gev, an example of heavy ion acceleration that could lead to applications in biology and medicine, including cancer research).

CEA and Argonne

The situation at the Cambridge accelerator—whose budget is a tiny $2.15 million compared to the others—is more ambiguous. By valiantly preparing to run a projected 2- to 3-year series of colliding beam experiments, and by cutting out all other work, CEA is making a dramatic attempt at diversification. In addition, CEA has agreed to let the AEC reclassify it as an "experiment" instead of as an "accelerator"—in an attempt to save CEA from the financial axe. But on the other hand, there are indications that the Office of Management and Budget may be far less agreeable to exempting CEA, as well as the other accelerators. In 1970, for example, the $2 million Princeton-Penn Particle Accelerator (PPA), already cut back by the AEC, was abruptly declared "obsolescent" as part of an Administration-wide economy move and funds ran out on 30 June 1971 (see *Science*, 2 July 1971). A similar fate could await CEA.

A number of laboratory administrators believe that the AEC Division of Research, which oversees the six accelerators, will make a strong pitch to keep the CEA open at least another 2 or 3 years, and try to arrange an option to renew its lease on life then. They are willing to confirm—although hesitant to comment further—that the two chief rivals for extinction are the Argonne and Berkeley accelerators. However, there is quite a lot of agreement that diversification is a plus on the balance sheet, and that Berkeley is carrying out a rather conspicuous program of

diversification. None of those contacted were willing to deny, and some actually confirmed, that, by this reasoning, Argonne could be the least likely to survive.

The Argonne spokesmen contacted by *Science*, however, reply that the two lower energy accelerators—Berkeley and CEA—will be, so to speak, at the bottom of the list. They say that their lab is doing very good and useful work, and that their gigantic neighbor, NAL, should not be a factor in a decision concerning Argonne. In addition, one said, "There's always talk like that but I don't take it seriously . . . we're doing better than most accelerators."

At this point in time, the AEC Division of Research is still hoping to satisfy the JCAE request without naming candidates for possible shutdown. They hope to reply "positively" with estimates of "good" levels of funding to keep all six accelerator laboratories viable. They will probably agree with the lab administrators' desire for a step-function increase in funds for fiscal 1973; Panofsky, for example, mentions a need for 15 percent more money, which would mean about 17 million more dollars for high energy physics.

But in a wider context, the JCAE request has set the laboratories' and AEC's officials buzzing over the issue of future funding. But it also points up the weakness of the current system for deciding research priorities. Two additional accelerators, one at Cornell and one at Stanford, are not even being formally considered in this process because they are funded by the National Science Foundation and not reviewed by JCAE. In addition, the $17 million increase which the physicists glibly mention as "adequate" for 1973 is more than four times all AEC funding for computer research and mathematics, and 30 percent more than total support of medium energy physics. Finally, there is a distinct chance that the entire AEC budget may be cut in fiscal 1973, in which case trade-offs will have to be made between reactor development, nuclear weapons, and high energy physics. The Joint Committee has handed the physicists—faced with high unemployment rates and years of declining budgets—a much-longed-for opportunity for special pleading on their own behalf. But it has not opened the way to any broader discussion of priorities in science funding.

—DEBORAH SHAPLEY

PCB's: Leaks of Toxic Substances Raises Issue of Effects, Regulation

Sharp criticism of federal regulatory agencies has followed in the wake of a bizarre contamination of poultry feed marketed in a part of southeastern United States. The controversy reached full steam on 18 August when the Food and Drug Administration (FDA) meekly acknowledged that a shipment of some 60,000 eggs contaminated with toxic polychlorinated biphenyls (PCB's) escaped federal inspectors and apparently got into the stomachs of Washington, D.C., area residents. The announcement came on the heels of FDA's seizure of another batch of PCB-contaminated eggs (75,000) on 13 August—almost a month after the initial discovery that PCB's had gotten into fish meal eaten by millions of chickens in ten southeastern states.

Besides possibly threatening human health through direct contamination, PCB's are considered a long-term potential hazard to the environment. In the United States, PCB's are produced solely as a heat transfer mechanism and an insulating fluid, particularly in cooling systems and big power transformers. In response to mounting evidence that PCB's are a potential hazard, the single U.S. manufacturer of PCB's, Monsanto Chemical Company, in order to restrict their release into the environment has limited the chemicals' uses to sealed systems. In the past, Monsanto widely produced PCB's as an additive in such things as sealants, rubber, paints, plastics, adhesives, printing ink, and insecticides.

Infiltration of PCB's into the environment occurs mainly in three ways:

- From accidental leaks in industrial equipment, such as heat-transfer systems;
- Through the weathering or friction wearing of the many materials that have PCB's as an ingredient. (Since they are fire resistant, PCB's usually remain intact even as a waste product.)
- Through interaction with food products in their uses as an ingredient in substances like paint and plastic.

Before the fish meal contamination incident, however, PCB's were virtually unknown except to a few scientists and some professional environmentalists. Critics have now become quite vocal in warning about the threat of PCB's, and, more important, they have expressed doubt about the ability and desire of federal agencies to effectively shield the consumer and the environment from the potential long-term dangers of thousands of synthetic chemicals.

The controversy is fueled by a basic disagreement among the participants as to the precise threat PCB's pose to human health and the environment. Federal officials, while acknowledging a problem, do not feel that PCB's are a serious enough hazard to justify major governmental action. Research on composition of PCB's and toxicity is very incomplete. The actual composition of their product is known only by Monsanto. Present evidence indicates that severe injury or death from short-term exposure to PCB's is unlikely. Like so many other environmental hazards, the potential PCB danger is long-term, low-level exposure, perhaps making it difficult for "crisis prone" regulatory agencies to respond in a big way now. Except for isolated accidents, federal officials contend, PCB's in their present application will not get into the environment or the food chain in harmful amounts.

From an industrial standpoint, PCB is considered very valuable, mainly for its incredible persistence as a chemical, being capable of withstanding temperatures of up to 1600°F (870°C). Like DDT—another, related chlorinated hydrocarbon—PCB's are fat-soluble but do not dissolve in water. For these reasons, industry holds that PCB's are in fact "safety" chemicals that are needed in populated areas to reduce the chances of accidental explosions, especially in big power transformers. It is this very persistence of PCB's that makes them a