His reference to the breast study was by way of example of on-going work and was not intended to be a thorough discussion. As it turned out, many people wish he had chosen some other example. In glossing over the details of the study, Potter was apparently assuming that the board members were as familiar with the protocol as members of the old council had been. This was not the case. As a result, some of the members of the board began asking rather penetrating questions about the program's validity. On the face of it at the time, some members got the impression that women being treated in the breast study might be getting less than the best possible care. "Are we being asked to endorse this project?" Amos inquired, seeking clarification.

Having heard a great deal about the promise of chemotherapy, some members asked whether women in the study would get drugs after their surgery. The answer is no. That too raised questions, and again their resolution is difficult. Potter said there is not "one scintilla" of evidence that drugs after surgery do any good. He could find a long line of supporters for this opinion. He could find just as long a line of opponents. The board, aroused by the issue, did not try to express any coherent feeling at the time but took the matter up again the next morning in executive session.

Many of their concerns were apparently allayed when they received a fuller explanation. They learned that the old cancer advisory council had gone over the study protocol in great detail before approving it. They found out that only those women whose tumors are small and localized are included in the study and, then, only with their consent.

Some board members, contacted after the executive session, said they felt that things had been explained to their satisfaction. Others said they felt the breast study should continue because of the importance of resolving the conflict over the simple versus radical surgery but added that they were still not entirely comfortable about the situation. In any case, the matter has not been dropped. Stressing the fact that much of the concern about the breast study arose because of lack of good communication, Schmidt said that, nevertheless, "We can't afford to have any experiment in which one group gets treatment thought to be better than another. And it is important that whatever is done happens with the full understanding of the patient. Clearly, this study is not as arbitrary as it first seemed to some of us. However, there will be a full report at the next meeting of the board."

And that, at the moment, is the way it looks that things will go. The board is struggling to come to grips with its own role in the life of the cancer program. Its members are not in full accord on all points; indeed, they do not all even know each other very well yet. But they are operating with a fairly large measure of goodwill toward each other in spite of differences. And, as a body, they fully intend to have a strong hand in the development of the massive program they are supposed to oversee.—BARBARA J. CULLITON

Reactor Safety: AEC Concedes Some Points to Its Critics

Esoteric pieces of hardware that they are, the emergency cooling systems of nuclear power plants have thoroughly replaced radiation standards as the Atomic Energy Commission's leading technological millstone. A long and convoluted internal debate over the adequacy of these backup cooling systems has placed a drain on the energy and resources of the commission's regulatory staff, has inflamed philosophical differences among reactor safety experts, and has helped to strain relations between elements of the AEC's headquarters staff and safety researchers in the commission's national laboratories.

More than that, the internal debate on emergency core cooling has incited a growing public discussion of reactor safety, which may or may not reach an apex early next year with the first public hearings on the subject ever to be scheduled by the congressional Joint Committee on Atomic Energy.

Against this background, the long tussle over emergency core-cooling systems (ECCS) took a new twist last week—one that may have opened the way to a resolution of the issue, and one that may also lead to some minor, if irritating, economic problems for utilities and reactor manufacturers in the United States. In a news conference, the commission's Director of Regulation, L. Manning Muntzing, announced that his side of the agency was contemplating a "more conservative" or cautious stance on the issue that could well manifest itself in the form of operating restrictions on nuclear power plants. Such restrictions would remain in force until technical uncertainties surrounding the performance of the backup cooling systems were cleared up.

"We find the added conservatism to be dictated by safety," Muntzing told a handful of newsmen gathered for the occasion. One practical implication, he added, might be that "several" of the 26 water-cooled nuclear power plants now operating would be obliged to reduce their output of electricity by as much as 20 percent. Thus, for example, a nuclear plant designed to generate 1000 megawatts, as many of the newest plants are, could be restricted to an output of 800 megawatts.

Such "deratings" are anathema to utilities and, accordingly, are almost unprecedented. But if public safety seemed to dictate such a cutback, Muntzing said, "Then that's the way the ball bounces."

This new element of conservatism is contained in a tentative set of rules drawn up by the regulatory staff to govern certain key aspects of reactor operation. These proposed regulations —upon which the five-member Atomic Energy Commission will not take final action for about 6 months—are intended to compensate more "realistically" than a previous set of rules had for the uncertain adequacy of emergency cooling systems, Muntzing said. In several respects, the proposed new rules seem to vindicate the critics, both

inside the AEC and out, who have contended for more than a year that the agency had not previously treated the issue with all the caution it deserved.

This marks the second time that the AEC has laid down or proposed special guidelines for operating nuclear plants, as a holding action, until new research on the performance of these last-resort safeguard systems could be completed by the national laboratories and by the manufacturers themselves. The first occasion was in June 1971, when the AEC issued what it described at the time as "clearly conservative operational guidelines" that would remain in force indefinitely, "pending the development of further data."

These guidelines were a response to growing conviction among safety researchers that little reliable evidence existed to prove that emergency cooling systems would do what they were supposed to do, namely, to protect a reactor's heat-generating uranium core from melting and releasing its burden of radioactive fission wastes should the reactor suddenly lose its main supply of cooling water through a ruptured pipe. While the AEC has always maintained that the probability of such an accident was extremely small, this probability has never been quantified. Moreover, the critics have been quick to point out that whatever comfort might be derived from that small probability should be tempered with the knowledge that a major, uncontrolled "loss-of-coolant accident" could be costly indeed for a nuclear power plant, if not deadly for the surrounding public.

The "interim criteria," as the regulations of June 1971 were called, did three main things. For some reactors they ordered stepped up maintenance and monitoring, with the aim of preventing or detecting the small leaks of cooling water that might presage a major rupture; they ordered some reactors to modernize or beef up their emergency cooling systems by 1974, an order that has affected 68 out of the 80 plants currently operating or under construction; and most important, the "interim criteria" imposed a set of operating guidelines that were meant to limit the severity of a loss-of-cooling accident. The assumption was that even a faltering emergency cooling system could handle a medium-sized accident.

One main feature of this prescription for a manageable accident, and one that was to prove highly controversial in the nuclear community, was an edict that under no circumstances should the temperature of reactor fuel exceed 2300°F (1260°C). This implied that some utilities might have to make "minor adjustments" in operating their plants, although in practice none was obliged to lower operating temperatures and, hence, electrical output.

By the summer of 1971, environmental activists had caught wind of the internal debate over emergency cooling. With the aid of a small number of scientists who were knowledgeable, but by no means expert, in nuclear technology, environmental groups succeeded in injecting the issue into the operating license hearings of a number of nuclear plants. In an effort to draw fire from individual plants (most of which had already suffered long delays in construction and licensing) and also to give the issue a single public forum, last January the AEC began a public hearing that has since become legendary in Washington for its length and complexity.

The hearing has convened for 105 days since January and has produced 20,000 pages of oral testimony, as well as several thousand pages more of written arguments and some embarrassing internal AEC memoranda (*Science*, 5 May). Along the way, the hearing has revealed that safety researchers and advisers to the regulatory staff had raised a number of fundamental objections to the interim criteria months before they were issued, and that they continued to press their criticisms right up to the start of the hearings.

The AEC's Rebuttal

The new guidelines proposed last week are contained in an inch-thick explanatory document that comprises the AEC's rebuttal to this criticism. This "supplemental testimony," as it is called, will be the main subject of the ECCS hearing's final, month-long phase, which begins in Bethesda, Maryland, on 14 November.

In its new testimony, the regulatory staff seems to concede several of the objections that reactor safety experts have been pressing for well over a year. Muntzing, for his part, was unwilling to call these shifts in position "concessions," although he acknowledged that "we agreed with some of the things they've been saying, and we disagreed with other things."

Three main changes are evident from the new testimony.

► The maximum temperature that reactor fuel will be allowed to reach will be set on a "case-by-case" basis in which avoidance of embrittlement of the metallic fuel is to be the main concern. This reflects an objection from researchers at Oak Ridge National Laboratory, among others, who argued that the long, thin, fuel rods could lose their ductility and break at temperatures well below the uniform maximum of 2300°F if the rods were allowed to "cook" long enough.

► In no case will reactor temperatures be allowed to exceed 2200°F, a reduction of 100° from the previous limit. To ensure that this maximum is not passed during an accident, some utilities may have to lower the operating temperatures—and hence the electrical output—of their plants.

► Setting of temperature limits for individual reactors is now supposed to take into account the likelihood that the closely packed fuel rods might swell from excessive heat during an accident. This swelling could impede the flow of emergency cooling water, and a number of critics had argued that the first set of guidelines had all but ignored this phenomenon.

What prompted these changes? Muntzing suggested several reasons, including an attitude conveyed by the commission that the regulatory staff was to reevaluate its testimony "without regard to previous biases." The hearing record had an influence, and regulatory officials have been holding conversations lately with safety researchers from the national laboratories. Moreover, Muntzing said, the Oak Ridge investigators have produced some persuasive new experimental data to back up their earlier objections.

There may also have been other, less obvious forces at work, pressing for an extra measure of caution. The AEC's semi-independent Advisory Committee on Reactor Safeguards, for one, has begun openly to advocate improvements in ECCS design. Another impetus toward caution may have come from the dismaying problems of damaged fuel that have cropped up in Swiss and American reactors lately (*Science*, 28 July). Hundreds of dented, bowed, and partially crushed fuel rods were found in April in a nuclear plant near Rochester, New York. And earlier this month similar damage was discovered during refueling operations at the Wisconsin Electric Power Company's Point Beach 1 plant on the western shore of Lake Michigan. (An AEC spokesman said damage is restricted to fuel rods that do not contain an internal pressur-

izing gas which would give them added strength. The Point Beach 1 plant will remain shut down until December.)

In all probability, the AEC's new position in the matter of emergency cooling will receive a mixed reaction from critics within the agency. On the one hand, the new testimony candidly acknowledges flaws and gaps in existing knowledge of ECCS performance. But at the same time it stops short of still more conservative positions held by a number of safety researchers—so short, in fact, that some critics believe that the agency's new position represents little more than a sop to dissidents.

"It takes the industry to the hurting point," says one. "But it stops short of measures that might cause real economic pain."

Moreover, there is a great deal of skepticism as to whether nuclear plants would actually be forced to cut power under the new guidelines. The AEC has not yet applied them to a real reactor, not even for a trial run just to see what happens. And in any case, one source confides, "you can probably juggle the numbers to make your system come out right."

Nevertheless, it can at least be said that the AEC's regulatory staff is talking with safety researchers out in the laboratories. And that has not always been the case.—ROBERT GILLETTE

West Virginia: Strip Mining Issue in Moore-Rockefeller Race

Charleston, West Virginia. The race for the governorship in West Virginia is noteworthy for having an environmental question—strip mining—as a major campaign issue. But the West Virginia campaign has been attracting national attention not because of the debate over the orphan banks, but because one of the candidates is John D. Rockefeller IV.

"Jay" Rockefeller, 35, is challenging incumbent governor Arch A. Moore, Jr., 49, a Republican with a record of winning elections in the predominantly Democratic border state. Moore was a six-term congressman when he won the governorship in 1968 as Hubert Humphrey carried West Virginia against Richard Nixon. Moore is asking the voters to reelect "a good governor" and is seeking to project the image of an energetic executive. When he refers to Rockefeller, it is usually by some term such as "wonder boy," and then only to deprecate his youth and inexperience. Moore is a formidable campaigner, and polls, public and private, indicate a very close election.

For Rockefeller, the campaign represents the first major political test for a young man whose biography seems to reflect a deliberate preparation for public life. In the background are Exeter and Harvard and 3 years of study and teaching in Japan. In the early 1960's, he went to Washington to work first as an assistant to Sargent Shriver at the Peace Corps and then in the Far East section of the State Department—almost pro forma experience at the time for someone of Rockefeller's generation and connections.

Then in 1964, as the Johnsonian war on poverty began, Rockefeller went to West Virginia to live in a mining area and work as a community organizer. After 2 years, he ran successfully for a seat in the lower house of the West Virginia legislature on the not unreasonable grounds that he could accomplish more as a legislator than as a community action worker. A Rockefeller in electoral politics is not, of course, a new phenomenon. Jay Rockefeller's Uncle Nelson is, after all, governor of New York and his Uncle Winthrop was governor of Arkansas, but they are Republicans and Jay is unmistakably, and it seems irrevocably, a Democrat—and that is a novelty for a Rockefeller.

In 1968, Jay Rockefeller ran a vigorous statewide campaign for Secretary of State and again won decisively. Both the powers and the demands of the office are modest, but Rockefeller has made the most of the job, particularly in exercising the Secretary of State's responsibilities in election matters to purge the rolls of thousands of the phantom voters that tend to be summoned up on election day in West Virginia. Last January, not unexpectedly, he announced for the governorship and proceeded with the kind of indefatigable campaigning that has come to be expected of him. In the Democratic primary last spring, running against two opponents, he won over 70 percent of the vote and was victor in every county.

The chief issue in the primary was Rockefeller's stand advocating abolition of strip mining in West Virginia. His two Democratic opponents keyed in on the issue until it became clear that they were playing to his strength. In two other primary races, anti–strip mining candidates won big victories. Democratic Representative Ken Hechler defeated another incumbent congressman, James Kee, in a primary shootout caused by redistricting. An even bigger surprise was the defeat by a young Democratic challenger of an apparently entrenched state senator who happens to be one of the leading independent strip mining operators in West Virginia.

In the general election campaign, the strip mine issue has not dominated. Moore has proclaimed himself a strong reclamationist and, while affirming the economic importance of strip mining to the state, has not taken the Rockefeller position as a special target. For his part, Rockefeller has concentrated on plans to help create jobs and to improve secondary roads, needs that he argues have been neglected by the Moore administration. There are indications, however, that Rockefeller will be hitting harder on the strip mine issue in speeches in the closing phase of the campaign. References to his stand in his speeches draw a strong response, and any candidate likes to fire up the audiences as election day nears.

Rockefeller, of course, did not inject strip mining into West Virginia politics. State regulation of surface mining goes back to the late 1930's, and a major political showdown occurred in 1967, resulting in enactment of what is generally regarded as one of the stronger state regulatory laws. That law requires operators to obtain permits for each site