for outpatient care. . . ." Handler said it was "deeply regrettable" that the reception of the report "should have been colored, indeed, soured by the unfortunately constructed press release" issued by the Academy's public information office. Handler said, "Perhaps out of zeal to secure maximum attention to the report, the staff of that office highlighted what they understood to be potentially controversial policy recommendations in the report while they neglected to direct attention to the many strongly positive comments concerning the quality of the Veteran's health care system also found in the report."

On the main issue of the mandate, Handler stuck to his guns, saying, "As your committee will be aware, . . . it has been alleged that, strictly speaking, our report was not responsive to the literal language of the charge stipulated for this study by the Congress in PL 93-82. We believe otherwise. We consider that not only is the report fully responsive to that charge, it would prove far more useful to the Congress than would have been simplistic literal adherence to the charge."

Handler and committee chairman Farber both insist that the policy recommendations should not have come as such a surprise to the VA or Congress because a series of conferences were held with both VA officials and members of the veterans' committees staffs on the Hill during which the academy committee's plans and intentions were made clear.

Will the experience make the Academy gun-shy about venturing policy recommendations unless the invitation is expressly stated in the contract? Handler says that he has looked at the question, and so have the governing board of the NRC and the chairman of the report review committee, and "there has been no determination to avoid policy formulation." Handler does say that "the lesson to be drawn from this incident is that when such occasions arise, we should look very carefully at policy recommendations and ask if they should go forward." Handler does see a possibility that the run-in "could cause a loss of confidence in the institution, concern in some quarters about being told things you don't want to know."

Handler, however, says he does not feel the incident will harm the academy in the long run and he is personally more distressed about possible damage to his friendship with Representative Olin E. Teague (D–Texas) for whom he has high regard. Teague is chairman of the House Committee on Science and Technology, but is a combat veteran of World War II who has been a long-time major force in veterans' matters on the Hill. Handler and Farber have carried on quiet diplomacy to assure doubters in Congress that the Academy committee's only motive was, as Handler says, "to assure veterans of the best possible care."

How did the Academy get itself into the unfamiliar and unwelcome spot of having its good name questioned by congressmen and its books audited by GAO? In taking on the very ambitious VA study it was attempting the first comprehensive study of a national health care system, with all the uncertainties that implies. Furthermore, the social and political dimensions of the task were as significant as the technical ones. It was not like looking at the state of the ozone layer, no matter how complex that may be. The Academy's encounter with the VA buzz saw was, in a sense, the result of a two-cultures clash. The Academy committee followed where logic led and did what it saw as its duty, bringing significant policy questions out into the open. In the process, it triggered a powerful, protective, conditioned reflex. The report certainly didn't win friends for the Academy, but it could influence people.—JOHN WALSH

Breeder Reactors: Fast Flux Fuel Rods Subject of Silkwood Charges

The Carter Administration's program to develop breeder reactor technology—apart from its decision to cancel a demonstration breeder reactor at Clinch River, Tennessee—could be in for some difficulties thanks to a little-publicized chapter in the Karen Silkwood affair. Silkwood was a 28-year-old worker at the nuclear materials plant at Crescent City, Oklahoma, which belonged to the Kerr-McGee corporation. She died under unusual circumstances in November 1974, after starting to turn over information to the government and to a union on poor safety and health practices at the plant. Among other things, Silkwood alleged that plutonium fuel rods being produced at the Kerr-McGee plant might be defective because the company doctored its quality assurance records. The rods soon will be used in the government's large-scale experimental breeder reactor in Hanford, Washington.

Silkwood was killed when her car ran off the road at night while she was driving to a meeting with a representative of the Oil, Chemical, and Atomic Workers (OCAW) Union and a *New York Times* reporter. The story received considerable press attention because she was last seen with a file of papers that were never found, and because a union-hired investigator concluded that her car had been pushed off the road by another one. Subsequent investigations of the allegations that she and other workers made about conditions at the plant found them to be, in many cases, correct.

In 1976, Kerr-McGee shut down the part of the Crescent City facility where Silkwood had worked—the part that produced plutonium fuel rods. An adjacent building at the site, where many of the same workers were employed and where uranium powder and fuel pellets were produced for the commercial nuclear industry, was closed in 1977.

Among her other allegations, Silkwood claimed that there was cheating in the quality assurance programs at the plant. Silkwood and other employees were telling union investigators that the plant's product—thousands of 8-foot fuel rods filled with plutonium-uranium pellets—could be defective because welding imperfections were being overlooked. Silkwood had said, for instance, that one worker was using a felt-tip pen to touch up negatives of photographs of sample welds on the rods. And her diary noted, "Still passing all welds no matter what pictures look!" Silkwood worked as a lab technician at the plant.

The plutonium fuel rods in question were produced at Kerr-McGee from 1972 to 1976 under a contract with Westinghouse Hanford Corporation, which manages the Fast Flux Test Facility (FFTF) at Hanford, Washington, for the government. The FFTF has been planned for more than a decade as the major research effort for breeder reactor

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technology in the United States; it consists mainly of a large test breeder reactor that will try out various kinds of nuclear fuel "cores," consisting of assemblies of thousands of fuel rods. Westinghouse is using 12,916 Kerr-McGee rods in the first core for the FFTF reactor and 3,380 of them in the second core. The first core will be used when the $1.15 billion FFTF goes critical in August 1979, according to FFTF sponsors in the Department of Energy (DOE).

In 1976 Westinghouse decided not to renew its contract with Kerr-McGee, which caused the plutonium plant to shut down. Rods for the remaining FFTF cores are coming from another supplier.

There is also evidence that Westinghouse repeatedly complained both to the Atomic Energy Commission (AEC), the DOE's predecessor agency, and to Kerr-McGee about the quality of the rods it was getting; that Westinghouse found an unusually high percentage of them less than acceptable; and that the early batches of fuel rods produced by Kerr-McGee were particularly problematic. It is not immediately clear whether these problems were due to Westinghouse's exceptionally high standards—as Westinghouse says—or due to exceptionally poor performance by Kerr-McGee—as the OCAW and others allege.

Nuclear experts say the defective fuel rods would pose no immediate, major safety hazard to the operation of the FFTF. If the rods leak, fission gases inside them would escape into the sodium that cools the FFTF reactor, and have to be somehow drawn off. If the rods proved a continuing problem, they would have to be replaced, necessitating the shutdown of the reactor and more delay in the already delay-ridden project.

After Silkwood's death, Congress, the Federal Bureau of Investigation, other agencies of government, and a number of private organizations pursued the various allegations that she and others had made. Among other things, it was alleged that a substantial amount of bomb-grade plutonium was missing from the plant, and that workers on occasion tramped around in a plutonium-contaminated solution on the floor. One private group that took an interest was the Environmental Policy Center (EPC), which aided getting congressional hearings on the Silkwood affair started in 1975. Bob Alvarez, an EPC nuclear specialist who amassed evidence on the quality control cheating issue, says that it has never been satisfactorily resolved: "All the investigations of the quality assurance charges have been made by groups with a gross conflict of interest. The AEC investigators were all people with a stake in the breeder program, and Battelle Northwest Laboratories [which also looked into the matter] gets $80 million a year from the government to develop the nuclear fuel cycle."

Indeed, while the official investigations turned up interesting new information on defects in the rods and tended to confirm that there were irregular practices at the plant, they all concluded, with sometimes ambiguious logic, that the rods must be all right.

For instance, Silkwood and her coworkers charged that at least one analyst in the Metallography Laboratory at the plant was touching up negatives of photographs of the welds at the ends of the fuel rods, so that the photographs would be passed by supervisors at the plant; this in turn enabled the entire batch of some 60 rods from which the weld sample was taken, also to pass inspection.

The AEC's investigation, made in early 1975, yielded a confession from a laboratory analyst, William S. Dotter, to the effect that, for several months in 1974, he indeed touched up negatives with a black felt-tip pen, to make them pass. But a study of some of the negatives made by Battelle, on contract to the AEC, supported Dotter's explanation that he was touching up defects in the film, not defects in the welds, and that the defective welds he photographed were rejected. While the AEC confirmed that one person in the laboratory had been cheating, it could conclude that, in terms of the quality of the rods themselves, no harm had been done. Critics of this investigation say AEC investigators never looked at negatives for any other period, nor did they follow up Dotter's statement that he "had the distinct feeling that others used the same technique."

Silkwood and other informants alleged that analysts in the General Analytical Chemistry Laboratory at the plant, who made chemical analyses of the plutonium-uranium pellets going into the rods, had access to test results on samples of control pellets. The control data were developed by Westinghouse, and the results were turned over to Kerr-McGee, where they were kept in a locked drawer in the laboratory. To assure the integrity of Kerr-McGee's quality control, laboratory analysts turned their results over to a supervisor, who checked them against the more reliable, "right" answers provided by Westinghouse and kept in the drawer.

The AEC investigation essentially confirmed that cheating on this system took place, that many analysts had access to keys to the drawer, and that one worker, who performed most of the tests and was favored by management, got the "right" answers the first time, all the time. Morever, the AEC obtained a sworn statement from another analyst, Virginia Barnes, who said that this employee had shown her a sheet of data and compared it with Barnes's results, telling her that her results would "pass." She said she had understood the sheet he was consulting to be the control group data he was not meant to have.

But the employee in question simply denied the allegation, and was transferred to another part of the plant. Critics of the AEC investigation note that the fuel rod batches processed by this employee were not rechecked by the AEC.

But new material was also discovered in this AEC investigation, in subsequent studies by Battelle, and in an investigation by the Energy Research and Development Administration (ERDA), the agency that succeeded the AEC in 1975 and continued to sponsor the FFTF work at Hanford.

An ERDA study made by government personnel at Hanford looked at Westinghouse's and Kerr-McGee's audits of the pellets and rods that were part of the quality assurance program. The study found that one out of every four problems that Westinghouse raised with Kerr-McGee went uncorrected. It found also that Westinghouse was far stricter in its audits than was Kerr-McGee, so that Westinghouse often found problems that had been ignored or overlooked by Kerr-McGee.

"Anomaly" Found

Another interesting discovery was made when Battelle, with the aid of the Los Alamos Scientific Laboratory, went over the question of the quality of the welding of the ends of the Kerr-McGee fuel rods. (Such welds on uranium fuel rods have been a long-time problem in the commercial nuclear power industry.) The study examined four welds, one from each end of two rods. The rods were from group number 233, which a worker at the plant had told the OCAW was "exceptionally bad. . . .welds in those pins [rods] contained many inclusions, voids, etc." Battelle found three of the four welds to be satisfactory; but one of the four contained a large, pancake-shaped "anomaly" which repeated testing failed to identify.

A source close to that study described it as having caused a "fight between two welding experts" over whether the

anomaly was a serious sign that the entire lot of fuel rods contained similar defects. However, the final Battelle report concluded that lot number 233 met "the specified quality requirement."

In a lengthy interview, a Westinghouse vice president, Ursell Evans, explained that Westinghouse had been very mindful of its commitment to the success of the FFTF project. Therefore, he said, it was understandable that the Westinghouse standards for the fuel rods were higher than those of Kerr-McGee. "We argued back and forth," he said, "especially in the beginning." He said that Westinghouse objected to Kerr-McGee's practice, in the beginning, of ignoring pieces of silica on the surfaces of the fuel pellets. The silicon "couldn't hurt anyone," Evans said, but Westinghouse insisted on it being eliminated from the surfaces of the pellets. Likewise, he said, rods would arrive at Hanford with scratches or other imperfections which were also harmless, but which Westinghouse insisted be corrected by Kerr-McGee. None of these defects were specifically prohibited under the contract, apparently.

Evans also said there was more "back and forth" with Kerr-McGee early in the production runs. This partly confirms a statement made by Westinghouse's quality control official stationed at the Kerr-McGee plant, that early on, the rejection rate of fuel rods produced by Kerr-McGee was "90 per cent."

According to Westinghouse spokesmen, Hanford received a total of 19,568 fuel rods from Kerr-McGee, of which 688, or 3.5 percent, were found unacceptable and sent back to Kerr-McGee. Kerr-McGee did not agree that most of these were rejectionable and refinished or repaired many of them. Thus in the final count only 91 were rejected. Westinghouse spokesmen say that, of the group they finally accepted, some 541 are not deemed good enough to be used in the FFTF reactor, and are being kept for assay and destructive testing, and other purposes. Nuclear experts at the Environmental Policy Center say the overall industry figure for fuel rod acceptance is 1.5 percent. Thus, although Westinghouse initially rejected 3.5 percent of the Kerr-McGee pins, in the end, only 91, or 0.4 percent, are being counted as rejected.

Westinghouse spokesmen deny that poor quality assurance on the Kerr-McGee rods was the reason that it terminated the Kerr-McGee contract, whereas it continued another contract with Babcock and Wilcox for rods from its Apollo, Pennsylvania, plant. At present, all the fuel rods for the third and fourth "cores" of the FFTF reactor are being supplied by Babcock and Wilcox.

To those in private organizations who followed the Silkwood affair, the quality assurance issues at Kerr-McGee raise the question of whether the nuclear industry can regulate itself. For "quality assurance" is the name for the series of procedures by which the federal government expects the nuclear industry to police its products to be sure that they are safe.

And environmentalists, such as EPC's Alvarez, as well as lawyers for the Silkwood estate in Oklahoma (who are suing Kerr-McGee for damages), are beginning to raise another concern, namely the quality of the products of the plutonium plant and the adjacent uranium plant—which used the same workers—supplied to other government clients and the commercial nuclear industry. Thus, besides raising questions at the FFTF breeder reactor at Hanford, there are other threads leading from the Silkwood matter still to be investigated.—DEBORAH SHAPLEY

Sweetness and Light from Industry and Environmentalists on Coal

The National Coal Policy Project (NCPP), which began about a year ago under the leadership of a former president of the Sierra Club and the corporate energy manager of Dow Chemical Company, represents a unique and ambitious attempt to reach an accommodation between environmentalists and industry on issues arising from the nation's increasing reliance on coal (*Science*, 21 October 1977). This is borne out by the project report issued a few weeks ago. As this document shows, the NCPP has in fact led to a surprising amount of accommodation and agreement between its environmental and industry participants, although it is by no means clear yet how much the project will actually influence industry and environmental groups in their behavior.

Nearly 100 persons, divided about half and half between environmentalists and individuals identified with companies that produce or burn coal, have taken part in the NCPP, most of them as members of its five task forces on mining, air pollution, transportation, pricing, and fuel utilization and conservation. Each task force has been led by an environmentalist and someone from industry; in the case of the mining task force, for instance, the cochairmen have been Michael McCloskey, executive director of the Sierra Club and John Corcoran, a former board chairman of the Consolidation Coal Company. Laurence I. Moss, an environmental consultant and former Sierra Club president, and Gerald L. Decker of Dow Chemical are the prime movers behind the project. They have chaired the environmental and industry caucuses and guided the plenary sessions at which agreements worked out by the task forces were approved.

As the project was getting under way early last year, Congress was already far along in its deliberations over the strip-mining and clean air bills, The NCPP leaders decided that to try at that late date to address directly the controversial issues raised by these measures would be needlessly divisive and quite unproductive. But, as the NCPP report makes clear, there were scores of issues that the project could address, including some that might have a bearing on how the strip-mining and clean air acts are implemented or observed or even ultimately amended.

Report Highlights

Here are some of the highlights from the report's findings and recommendations:

▶ A continuing large-scale expansion in the mining of western coal is not going to happen. Given the fact that its sulfur content is not particularly low in relation to its modest Btu value, this coal will not

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