Pollution and Public Health: Taconite Case Poses Major Test

In essence, defendants are using the work force at [the Reserve Mining Company's taconite refining plant on Lake Superior] as hostages. In order to free the work force at Reserve, the court must permit the continued exposure of [the citizens of Duluth, Minnesota, and other North Shore communities] to known human carcinogens. The court will have no part of this form of economic blackmail.—From the opinion by U.S. District Judge Miles W. Lord last spring in the suit against Reserve and its parent companies, the ARMCO and Republic Steel corporations, by the U.S. government, the states of Minnesota, Wisconsin, and Michigan, and several environmental groups.

Some bad problems of industrial pollution have a way of dragging on year after year, with little or no progress made toward abatement. The pollution of Lake Superior by the Reserve Mining Company, a matter first taken up in federal-state abatement proceedings in 1969, has fallen squarely in that category. For more than a decade, Reserve has been dumping into the lake each day about 67,000 tons of tailings, the residues from the grinding and magnetic separation process used to extract magnetite or iron oxide from taconite, a low grade of iron ore. And, even with the trial judge warning of a possible calamity and severely denouncing the defendants, the massive discharge of tailings may continue for several more years.

The Reserve Mining case poses two questions of overriding urgency and importance: First, how clear must the scientific evidence be for a court to find that pollutants from an industrial plant represent a threat to public health? Second, how great must that threat be for the court to close a plant, particularly one that is important to the local economy?

In this instance, especially, these questions cannot be answered lightly. The Reserve plant employs some 3200 workers—virtually all of the breadwinners of the town of Silver Bay, Minnesota—and represents a capital investment of several hundred millions of dollars.

After hearing more than 100 witnesses during a 139-day trial and reviewing over 1600 exhibits and 18,000 pages of testimony, Judge Lord bit the bullet. He held unequivocally that the 200,000 people who live along the western arm of Lake Superior are endangered by asbestos—or asbestos-like—fibers in the taconite tailings. Some are also threatened, the judge held, by fibers in the emissions from the Reserve plant's stacks. As the judge noted, asbestos is a proven human carcinogen, although its effects remain latent for 20 to 30 years or longer before cancers begin appearing among persons who have been exposed. Judge Lord ordered that the Reserve plant be closed—and remain closed until Reserve has prepared an on-land disposal basin to receive the taconite tailings and has stopped emitting fibers into the ambient air.

Shutdown Order Stayed

This shutdown order, which made sensational news when issued last April, was in effect for only 2 days. It was stayed by a three-judge panel of the U.S. Court of Appeals for the Eighth Circuit, and the Supreme Court subsequently refused to vacate the stay.

The panel, in a preliminary ruling reached after a quick analysis of the massive trial record, had concluded that Judge Lord's finding that the public health was endangered was not supported by the evidence. The Eighth Circuit Court is not scheduled to review the case en banc until December, but, given the public health aspects of the matter, there is at least the possibility that the leisurely pace of judicial events will quicken.

The states of Minnesota, Wisconsin, and Michigan and most of the other plaintiffs are again asking the Supreme Court to vacate the three-judge panel's stay of the trial court's order closing the plant. Their appeal will doubtless carry more weight if the U.S. government joins in it. In mid-July the chairman of the Council on Environmental Quality, Russell W. Peterson, urged the Justice Department to promptly and "aggressively pursue all means to eliminate this unwarranted potential public health menace." At this writing, Assistant Attorney General Wallace Johnson, who is responsible for environmental matters, has decided that the government should join in the appeal, but Solicitor General Robert Bork and Attorney General William Saxbe will have the final say.

Before looking more closely at the question of whether the taconite plant should be closed, consider some of the circumstances of the Reserve mining case.

First, there is the fact that two immensely important natural resources are involved—Lake Superior on the one hand, and the Mesabi Range of northeast Minnesota on the other. A half century ago, the Mesabi was one of the world's greatest iron mining regions. But its once abundant and easily mined deposits of rich iron ore have now long since been depleted. The Mesabi remains an important domestic source of iron only because of its taconite rock, which the Reserve Mining Company, beginning its operations in 1955, was the first to exploit.

This initial taconite mining venture was eagerly encouraged by state officials, and Reserve had no trouble obtaining permits to dump the tailings into Lake Superior. Now only one of several taconite companies in the Mesabi, Reserve is mining deposits of the hard, gray taconite rock in the area around Babbitt, Minnesota. The rock is transported some 60 miles by rail from Babbitt to the refining plant at Silver Bay, on the lake. Reserve, which has deposits extensive enough to keep it in business another 40 years, is the only taconite mining company in the Mesabi not using an on-land, closed-cycle system for the disposal of its tailings.

Lake Superior, used for the past 18 years as a dump for Reserve's wastes, is the largest body of freshwater on earth—350 miles long, 160 miles across at its widest point, and up to 1333 feet deep. The lake water has, until recently, been considered of such purity that Duluth and most other cities have used it freely for drinking, without filtration or treatment. Also, this enormous lake is the centerpiece of a lightly developed and still largely wild region. Its re-

markably clear waters, together with the rocky bluffs and evergreen forests that line its shores, represent an important recreational and scenic resource.

Huge though it is, Lake Superior is by no means large enough to assimilate Reserve's discharge of taconite tailings, this being true from an esthetic and ecological standpoint as well as from a public health standpoint. The discharge is fivefold greater than the 12,000 tons of solids generously estimated to enter the lake naturally each day from the inflow of some 200 rivers and the erosion of many hundreds of miles of shoreline. Indeed, this discharge of polluting solids is much greater than any other in the United States and possibly greater than any other in the world.

Contrary to the intent of the disposal plan which Reserve has followed all these years, the tailings have become widely diffused, "despoiling" (Judge Lord's word) some 2000 square miles of the west end of the lake. According to the plan, the coarse tailings would immediately drop out of the discharge slurry and form a delta. This has in fact happened. The tailings delta extends some 4000 feet offshore from the point of discharge and is nearly a mile wide.

"Excessive Bureaucracy" Found in R & D at EPA

Reading between the lines is not required to get the message contained in the National Academy of Sciences' recent report on the Environmental Protection Agency's Office of Research and Development. With a bluntness seldom seen in NAS reports, this one states flatly that EPA's R & D planning and management procedures are "excessive[ly] bureaucratic" and "must be abandoned."

The report, made public on 12 September, is a summary six-page document that was prepared by a National Research Council committee headed by Robert W. Berliner of the Yale University School of Medicine. It represents the first fruit of the $5 million study that NAS is doing under contract for EPA (*Science*, 23 August). It also represents a response to questions addressed to the NAS by Russell E. Train, the EPA Administrator. Train wanted advice as to the suitability of EPA procedures and organizational arrangements for fixing and meeting R & D priorities—advice that could be especially timely now when a new assistant administrator for R & D is about to be appointed.

Train has written Philip Handler, NAS president, expressing appreciation for the NAS report's "candor" and stating that its recommendations will be "the basis for changes." Less grateful to the NAS-NRC committee is EPA's Acting Assistant Administrator for R & D, Albert C. Trakowski, Jr. To hear Trakowski tell it, he is in the position of one who has spoken softly and reasonably, only to have his words echo in a screech. "I personally gave them every bit of information they gave back to us," he told *Science*. "Why the Academy chose to release it in somewhat sensational terms, I do not understand." (According to the NAS report, the Berliner committee was briefed by senior EPA officials. It also obtained the views of a number of the agency's scientists and of R & D office personnel.)

The EPA research and development program is a large and growing activity. The fiscal 1975 budget of the R & D office totals $140.6 million, not counting up to $54 million in special energy R & D funds. There are more than 1750 people employed in the R & D program, with the professional research staff constituting about a third of the total. Headquarters staff people number about 250, with the rest of the R & D personnel distributed among four "national environmental research centers" located in North Carolina, Oregon, Nevada, and Ohio, together with their ten satellite laboratories, and a Washington Environmental Research Center.

In essence, the Academy report says that there are some unnecessary bureaucratic layers between the directors of the research centers and the assistant administrator for R & D, and that these should be peeled away to permit direct reporting from the centers to the top. "The Assistant Administrator should have a small staff to perform only staff functions and not to serve as a filter or layer through which the [center] directors report," the NAS-NRC committee said.

Trakowski says that the committee's recommendations "are worded in such a strong way that they imply a degree of difficulty that I don't believe exists." And, while acknowledging that the headquarters bureaucracy is overblown, he adds that this has long been recognized by his office. "We are taking steps right at this moment to reduce the paper shuffling and the detail in the planning process at headquarters," he says.

According to Trakowski, however, there are requirements placed on the R & D office that make for a sizable headquarters staff. The office must be ready at all times to help the other assistant administrators cope with the variety of problems—in air and water pollution, solid waste disposal, pesticides regulation, and the like—for which EPA is responsible. "Our headquarters structure is dictated to a large extent by the interfaces with the other assistant administrators' offices," he says.

Stanley M. Greenfield, a scientist trained in physical meteorology, served as assistant administrator for R & D from EPA's beginning in 1970 until this past May when he left to go into private consulting work in San Francisco. Trakowski is a retired Air Force officer who was the founding director of the geophysical program at the Air Force's Cambridge Research Center. He joined EPA as Greenfield's deputy several years ago, and, although he plans to remain with the agency, he is not a candidate for the job of assistant administrator.

According to an officially unconfirmed but undenied report in the 15 September issue of the *Environmental Health Letter*, the new assistant administrator will be Wilson Talley, a Ph.D. in nuclear engineering and former White House Fellow who has been studies director for Nelson Rockefeller's Commission on Critical Choices for America. The new assistant administrator, whoever he may be, will find the sternly worded NAS report on his desk when he arrives.—L.J.C.

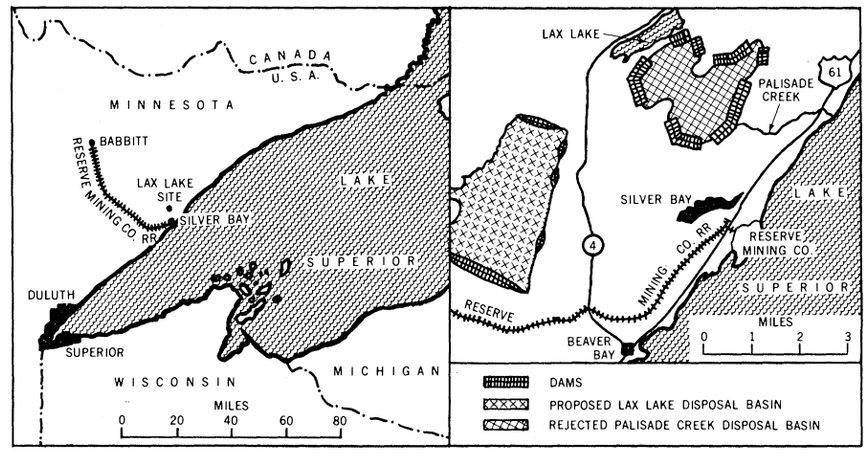
The trouble has been caused mainly by the fine tailings, particles so minutes that some are less than 2 micrometers (0.000078 inch) in diameter. These tailings were expected to form a "density" or gravity-driven current that would quickly descend into the Great Trough, where the tailings would be deposited in a quiescent and harmless state some 900 feet below the surface of the lake. The density current is a reality, but the complex natural phenomena affecting the lake—currents, thermoclines, wind and wave action, upwellings, and the like—nevertheless have caused the tailings to be transported hither and yon.

Under some circumstances, the density current breaks up and the tailings spread out to form a turbid layer up to 37 miles wide, 3 miles long, and 100 to 300 feet deep. Also, tailings have settled to the bottom over wide areas beyond those designated in the disposal plan, smothering benthic organisms and thus harming the lake's ecology. In addition, there is the all too common "green water" phenomenon that occurs over many square miles of the lake when great quantities of light-reflective tailings appear at the surface.

The several federal-state pollution abatement conferences that were held during the years 1969 to 1971 in regard to the tailings discharge, and a subsequent (and also unavailing) abatement suit in the Minnesota state courts, all had to do with the kind of esthetic and ecological pollution problems just described. And, at its outset, the same was true of the suit brought against Reserve in federal court.

What gave the federal suit a new thrust was the discovery last year that tailings fibers indistinguishable from amphibole asbestos fibers were present in the drinking water of Duluth and other communities such as Two Harbors, Beaver Bay, Silver Bay (all in Minnesota), and Superior, Wisconsin.

The discovery came about largely by chance. One evening in December 1972, Arlene Lehto, a Duluth woman who organized the Save Lake Superior Association, was attending a meeting when she happened to fall into conversation with Joseph Mengel, a geologist at the University of Wisconsin–Superior, whom she had never before met. Mengel mentioned that the asbestos fibers suspected of causing a high incidence of stomach cancer in Japan (the talc-dusted rice popular in Japan has asbestos contaminants) were similar to the fibers in the taconite rock. He showed Lehto a report from the 17 September 1971 issue of *Science* that made the association between the talc-dusted rice and cancer and that displayed a photomicrograph revealing asbestiform fibers.



Reserve Mining Company mines taconite at Babbitt and refines it at Silver Bay. The tailings, now dumped into the lake, ultimately may be disposed of on land.

A Seminal Talk

Knowing that she was to speak the next day at a meeting of the International Joint Commission (a U.S.–Canadian pollution control body), Lehto stayed up well into the night looking up information about asbestos and its health effects. Her talk at the commission meeeting had a seminal effect. Scientists from the Environmental Protection Agency's National Water Quality Laboratory in Duluth and the Minnesota Pollution Control Agency (MPCA) immediately began to look into the question of a possible asbestos contamination of the lake and the air.

On 15 June 1973, EPA announced that high concentrations of asbestos fibers had indeed been found in the drinking water of Duluth and other communities. Further, the agency, while not having yet concluded that the water was unsafe for human consumption, said that "prudence dictates that an alternative source of drinking water be found for very young children." Meanwhile, scientists of the MPCA had found asbestiform fibers in the ambient air of Silver Bay.

Epidemiological studies conducted in countries such as the United States, Finland, and South Africa have established that a high incidence of cancer occurs both among persons exposed to asbestos in their jobs and among those exposed only environmentally. Forty-five to 50 percent of asbestos workers have been found to die of cancer, whereas among the general population cancer deaths represent not more than 15 to 20 percent of mortalities. A number of cases of mesothelioma—a fatal tumor that occurs in the linings of the lung and gastrointestinal tract—have been traced to markedly brief environmental exposures to asbestos, as in the case of a 30-year-old man (found on biopsy to have asbestos in his lungs) who had lived in the neighborhood of the Brooklyn Navy Yard as a child.

Much of the evidence presented to Judge Lord as to the degree of exposure which people in Duluth and other cities are experiencing was alarming. In water samples analyzed at Duluth, the mean fiber concentration was 12.5 million per liter. The limited ambient air sampling done at Silver Bay, site of the Reserve plant, yielded widely varying results, but some samples showed concentrations of up to 11 million fibers per cubic meter and even up to 140 million if a sample taken at the top of one of the plant's smokestacks is included. No safe level of exposure to asbestos has been established. Scientific proof is, however, lacking with respect to whether a high incidence of cancer will result from the *ingestion* (as opposed to the inhalation) of asbestos fibers.

Before concluding that there is a substantial cancer risk, Judge Lord made an unusual effort to assemble and analyze the available evidence. To ensure that all aspects of the case would be presented, he had some court-appointed witnesses testify in addition to the large number of witnesses put on by the plaintiffs and the defense (the trial is estimated to have cost some $5 million to each side).

Irving J. Selikoff, director of the environmental sciences laboratory at the Mount Sinai School of Medicine, New York, was a principal witness for the plaintiffs on the hazards of asbestos fibers in occupational settings and the environment. Others who testified came from a variety of institutions such as Mount Sinai, the Mayo Clinic, the University of Wisconsin School of Medicine, the Johns Hopkins School of Medicine, the National Institute of Occupational Safety and Health, the Industrial Health Foundation, the Free University of Berlin, and the National Water Quality Laboratory at Duluth.

Virtually every issue in the case was contested. For example, Reserve witnesses sought to show that the tailings disposal plan had not failed and that the tailings were not widely diffused; and, further, that the fibers in municipal water supplies were not identical to asbestos and hence could not be classified as a carcinogen.

Judge Lord did not behave simply as an umpire calling balls and strikes, but intervened vigorously in the proceedings, questioning and challenging witnesses whenever he felt it necessary. Lord sometimes made his own independent analysis of technical evidence, as in personally studying a large number of transmission electron photographs and challenging Reserve's witnesses to point out how the morphology of the tailings fibers was distinguished from that of asbestos fibers. In this instance and in nearly every other, he concluded that the plaintiffs had made the more convincing argument.

In its preliminary review of the case, the three-judge panel of the court of appeals concluded that Judge Lord's "resolv[ing] all doubts in favor of health safety represents a legislative judgment, not a judicial one." The panel further stated that, as in the case of an inconclusive study of tissue taken from recently deceased residents of Duluth, the district court had chosen to disregard or downplay some important evidence undercutting the argument that a compelling health hazard exists.

Yet, in the opinion of attorneys for the plaintiffs, the panel itself ignored important evidence, especially in disregarding the health hazard from environmental (as opposed to occupational) levels of exposure to asbestos fibers. In its brief filed with the court of appeals, the U.S. Department of Justice commented acerbly on the panel's finding that Judge Lord had strayed from the judicial path and made legislative judgments. "We believe this court has resolved all close issues in favor of keeping the plant open and hence has done the very thing it finds erroneous in the District Court's action," the government said.

On 3 August, Judge Lord, in a further memorandum issued in the Reserve Mining case, indicated that, had Reserve proposed an acceptable abatement plan at the start of the trial last year, he would have been disposed to allow the company a "reasonable amount of turnaround time" without ordering the plant shutdown. But, in his view, Reserve had now forfeited any right to such consideration by repeated acts of "bad faith" chiefly involving misrepresentations with respect to the feasibility of building an on-land disposal basin. In one instance, the company had deliberately withheld from the plaintiffs and the court detailed engineering plans for such a basin which had been prepared months before the trial, apparently against the chance that the discharge into the lake eventually would have to stop.

On-Land Disposal Demanded

The court of appeals panel, although blandly saying that there are "neither heroes nor villians" in the Reserve Mining case, has itself held that Reserve must switch to an on-land disposal system. In beginning to face up to the inevitable, Reserve hoped initially to get by with building a disposal basin in the Palisade Creek area, the site nearest the plant. However, that area is of such scenic and natural value that the state of Minnesota is considering bringing it into its park system; also, if a Palisade Creek disposal basin were built, one of the major retention dams (immense structures, up to 450 feet in height, to be built of coarse tailings) would loom threateningly above the town of Silver Bay. It now appears possible that the disposal basin will be built at the somewhat more distant Lax Lake site, although this is subject to the granting of a state permit after thorough environmental impact analysis. Once work finally begins, construction of the disposal basin will take more than 2 years and, according to Reserve estimates, cost some $242 million.

But even if work on an on-land disposal system should begin within the next year, the immediate public health hazard perceived by Judge Lord will not be remedied unless the plant is closed soon to stop the discharge of tailings into the lake. On the other hand, Phillip M. Cook, the chemist at EPA's Duluth laboratory who discovered the contamination of municipal water supplies by asbestiform fibers, believes that, if the discharge is stopped, the contamination will be reduced by some 90 percent within 2 months. And, as for Reserve's 3200 workers losing their jobs because of the plant's closing, Judge Lord believes that that problem would be manageable. Many could be hired to work on building the disposal basin, and others could be hired by other companies in the taconite mining and refining industry, which is expanding.

There is no generally acceptable compromise solution available. If municipal water supplies could be effectively filtered pending the change to an on-land disposal system, that would help to resolve the dilemma. But, to take the case of Duluth, some 2 years would be required to build a filtration system—nearly as long as it will take to build a tailings disposal basin. Furthermore, there is the separate problem of the contamination of the ambient air of Silver Bay. For Reserve to install the equipment necessary to filter out the fibers from its emissions also could take up to 2 years.

The attitude of the public in the western Lake Superior region is curiously mixed. Quite a few people, perhaps as many as several thousand, are concerned enough about the contaminated water that they refuse to drink it. Arlene Lehto, the Save Lake Superior organizer, has put a special filter on her kitchen water tap. She knows of many others who either filter their water at home or seek uncontaminated supplies elsewhere. Some visit friends or relatives in the country and get well water. A local broadcasting station in Duluth maintains a well for the public, and some people go there to fill up their plastic water bags or other containers.

Although the city of Duluth is making filtered water available to the public at fire stations, the mayor has discounted the risk involved in drinking the regular municipal water and most local people are drinking that water. State and county health officials have themselves indicated that there is no real health risk (during the trial, Judge Lord rejected most of the testimony of one state health official as clearly unfounded). Lehto has publicly charged state health officials with criminal negligence.

The Lake Superior pollution problem is a difficult one for Minnesota politi-

cians because of the jobs that would be lost if the Reserve plant closed. Senators Hubert Humphrey and Walter Mondale are keeping a low profile on the issue; Representative John Blatnik, who represents Duluth and the Lake Superior region, maintains a position of consistent ambiguity. The United Steel Workers, which represents the workers at Reserve, is siding with the company, and the AFL-CIO central labor body has never challenged the company's position. "Labor has sold out for jobs, no matter what," Lehto says.

The Minnesota Pollution Control Agency, supported by Governor Wendell R. Anderson and (to judge from a Minneapolis *Tribune* poll) by the people of the state at large, is vigorously pressing its case against Reserve and its parents, ARMCO and Republic. In a recent action, the MPCA asked Judge Lord to levy $73 million in penalties against Reserve for violations of its discharge permit.

The full Eighth Circuit Court of Appeals seems unlikely to reverse its three-judge panel and lift the stay of Judge Lord's order to close the plant. Three of the court's eight judges are not participating in the case. Two own stock in either ARMCO or Republic Steel, and the third is ill. Thus, of the five other judges, three already have decided, at least provisionally, that no compelling health hazard is present.

With proceedings in the case continuing to drag on, it is conceivable that the Supreme Court will now decide to intervene, despite its earlier eight to one decision (Justice Douglas dissenting) not to do so. A prudent man would not bet on it, however.

In sum, there is a very real prospect that the discharge of tailings into Lake Superior will not cease until late in this decade, with the citizens of Duluth and other communities having to ingest asbestiform fibers along with their drinking water for another several years. Senators Philip A. Hart (D–Mich.) and Gaylord Nelson (D–Wis.) have found this prospect disturbing enough that they are seeking a legislative remedy. At their urging, the Commerce Committee has reported legislation that would make clear that, in this and other similar situations, the failure to prove that a demonstrable health hazard exists shall not be a bar to relief. As stated in the committee report, a court would, in the absence of proof, consider "the likelihood and magnitude of the risk of harm. . . ."

In his testimony before Judge Lord, Selikoff compared the continuing pollution of Lake Superior with asbestiform fibers to a game of Russian roulette. "I don't know where the bullet is located," he said. "But if we are wrong, then the consequences of that error are disastrous. Moreover, the consequences are particularly bad because, while we play the game, others will pay the penalty."

—LUTHER J. CARTER

Blood Strategy Approved by HEW

Pushed along by 2 years of stern and unrelenting pressure from the federal government, a group of seven private health-related organizations, including the nation's three major blood-banking groups, has come up with a strategy for giving the country a unified system of blood collection and distribution.

The goal of the plan is to ensure adequate supplies of top quality blood at consistent costs throughout the country, with all-volunteer donors.

The parties involved have agreed to give responsibility for implementing the policy to a newly created body called the American Blood Commission. The commission is to have built-in consumer representation as well as representatives from numerous health, medical, and blood organizations.

The key to the plan is regionalization of blood services into what are called integrated regional programs (IRP's). The optimal size of these regions is yet to be worked out, but to qualify as an IRP, the blood banks and transfusion services in a given area will have to get together and show the commission that they can provide a full range of blood collection, processing, and distribution services. The regional systems will be self-supporting (that is, most income will come from insurance payments) in line with the desire on the part of all parties to keep blood services the responsibility of the private sector. Each IRP will be designed, at least theoretically, to fill all the blood needs of its area. Participation in the system by individual organizations will be voluntary.

When the commission gets going, the country can probably expect to be subjected to a heavy public education campaign to stimulate voluntary blood donation. If this is successful, two aspects of the present system will gradually fade out: one is commercial blood banks, the other is the complicated system of blood credits and nonreplacement fees which involve a lot of fancy paperwork and put an added financial burden on patients who can't round up donors to replace the blood they have received.

The federal government got moving on the blood issue in 1972, spurred by widespread publicity given to the seedy operations of some commercial blood banks and the evidence that there was a high incidence of hepatitis contracted from the blood of paid donors. The Department of Health, Education, and Welfare conducted a study and came up with a proposed National Blood Policy which espoused a number of goals relating to efficiency, cooperation, a uniform system of data collection, and conversion to an all-volunteer system. HEW ordered the private sector to come up with an acceptable strategy and warned that if it didn't the government would have to step in. The federal threat now seems to have effectively bludgeoned private blood organizations into agreeing on a plan.

With the plan approved in its broad outlines, the next step will be for the American Blood Commission to convene an "inaugural convention" probably within the next 6 months to work out some details.

The existence of the commission means that there will be, at long last, one central body to coordinate private activities and act as a focus for policy-making in a field that until now has been dominated by two organizations—the Red Cross and the American Association of Blood Banks—whose relationship has been characterized by at least as much competition as cooperation (see *Science*, 24 and 31 March 1972).—C.H.