Drinking Water: Health Hazards Still Not Resolved

During the 2300-mile journey seaward from its source high in Minnesota, the Mississippi drains more than two-fifths of the land area of the United States. As the river debouches at New Orleans, its waters carry all the wastes a modern society produces, including a slew of industrial chemicals.

It was not surprising that New Orleans should have become the focus of concern about the health significance of the organic chemicals found in drinking water. On 7 November 1974 the Environmental Defense Fund issued an epidemiological study which suggested a link between cancer deaths and drinking water obtained from the Mississippi*. A survey published the following day by the Environmental Protection Agency confirmed that trace amounts of numerous chemicals, some of them suspected carcinogens, were detectable in the New Orleans water supply.

These findings had an electrifying impact in Washington. In scarcely more than a month, Congress dusted off a bill that had been languishing for 4 years and passed into the law the Safe Drinking Water Act.

The Environmental Protection Agency has now had 2½ years to implement the act. What is different about the way New Orleans treats its water supply?

"Absolutely nothing," says Robert Harris, the author of the Environmental Defense Fund study. Harris, a civil engineer with public health training from Caltech and Harvard, believes strongly in the likelihood of a link between certain cancers and the chemicals often found in drinking water. He also believes that a safe, cheap, and proven method exists for removing the bulk of the chemicals—that of filtering the water through a bed of granular activated carbon.

Stewart H. Brim, director of the Sewage and Water Board of New Orleans, agrees that nothing has changed since Harris's study. But that is because the study, in his view, was not worth considering and so there was no reason to change anything.

The Mississippi, says Harris, is "the colon of America—in essence, our industrial society flushes its wastes through New Orleans." "That is an asinine statement," counters Brim. The river's sheer volume—7½ million gallons per second at flood stage, and never less than 1½ million gallons per second—has enormous power of dilution. It is true that traces of many chemicals can now be detected in the water supply—67 different substances at last count, doubtless hundreds more as analytical techniques improve still further. But Brim does not believe the chemicals, in the quantities present, have been shown to be harmful. So there is no point in replacing his sand filters with carbon, which would both be more expensive and would interfere with the chlorination needed to prevent waterborne disease.

Chlorination, says Harris, "could conceivably be an important cause of cancer, probably not as important as cigarettes but maybe not dramatically less." The reason is that chlorine has recently been found to react with the humic acids often present in water to produce a family of compounds known as trihalomethanes, one of which is chloroform, a confirmed cause of cancer in animals. In Harris's view this is yet another reason for improving the time-honored ways of treating drinking water, and for paying serious attention to the growing number of epidemiological studies of the possible link between drinking water and cancer. Brim is not impressed: "It is one thing to sit in a lab and play with mice; it is another to live in the real world where you have to keep the water clean and safe and do it in a way that people can pay for."

The ultimate source of discord between these opposing views reposes in an issue which lies just beyond the grasp of present knowledge, that of whether the minute amounts of organic chemicals in drinking water, some of them known to cause cancer in laboratory situations, do indeed present a threat to human health. In the view of many state health departments and water engineers, the health hazard is distinctly dubious, certainly not proved; they therefore have no basis for asking consumers to bear the extra cost of removing the chemicals. "To institute expensive procedures for something which may have no health significance may be a little out of line," says Eric Johnson, director of the American Waterworks Association in Denver.

Environmentalists are more impressed by the possibility that the threatened health effects of contaminated drinking water may turn out to be real. Since 70 percent of the population is served by large water systems which could afford to install carbon filters for only a small increase in water rates, they should be required to do so. "Americans going to Europe used to be told not to drink the water," says Harris: "Now it is the Europeans who won't drink our water. They laugh at us because we rely on the primitive technology of sand filters."

Caught in the cross fire between the utilities and the environmentalists is the Environmental Protection Agency. The two officials chiefly responsible for drinking water are Victor J. Kimm, EPA deputy assistant administrator for water supply, and Joseph Cotruvo, director of the criteria and standards division. Kimm and Cotruvo believe that they are taking a balanced approach which is regarded as reasonable by everyone except the Environmental Defense Fund, and that even the EDF differs only with the pace, not the basic philosophy, of their approach.

The utilities consider EPA's approach to be reasonable so far, but the EDF's objections seem more than merely philosophical. EPA's role in implementing the Safe Drinking Water Act "has so far been that of a reluctant regulator, paying greater heed to the views of those whose misfeasance and nonfeasance prompted passage of the act, than to the Congressional mandate to begin *now* to make the nation's water supply safe to drink," says EDF attorney Jacqueline M. Warren. According to Harris, "You have to sympathize with Kimm and Cotruvo: their constituency is a group of engineers and 19th-century-minded public health officials whose only knowledge and concern is about waterborne diseases. So the problem is one of public education, and that in my view is where the EPA has failed miserably. If anything they have supported the skepticism of the state health officials."

The EDF is suing the EPA in the Court of Appeals for its alleged foot-dragging in implementing the Safe Drinking Water Act. The agency's basic response is that until more facts are in about the health hazards of chemicals in drinking water, it would be imprudent to go faster.

The Safe Drinking Water Act accords the agency an unusual degree of discretion as well as mandating a gradual, three-stage approach in regulating drinking water contaminants. In essence, Congress told EPA to take three cuts at

*Later published in *Science*, **193**, 55 (1976).

the problem. The first, a set of regulations which was proposed 18 months ago and comes into effect on 24 June, only confirms the status quo for the amounts of various contaminants permitted in drinking water. A revised set of permitted contaminant levels is to be proposed on the basis of a National Academy of Sciences study which was delivered to EPA this month, and a third revision of the regulations will follow thereafter.

At each round in the process, the EPA has a choice of regulatory strategies. Either it can set particular levels for various contaminants and allow state authorities to use whatever techniques they please to meet them. Or the EPA can require use of a particular treatment method. If the agency selects the route of maximum contaminant levels, it again may choose between setting levels for individual chemicals—which could involve utilities in numerous costly tests—and specifying an overall contaminant level as measured by some general index test.

The Environmental Defense Fund's quarrel with the agency has to do with the regulations that come into force this month. Even though EPA has conceded that the discovery of possibly carcinogenic chemicals in drinking water "contributed to the passage of the Safe Drinking Water Act in December 1974," there is no standard for organic chemicals in the regulations, which means that EPA has so far done nothing to correct the situation, complains EDF.

The agency counters that it did not possess enough information 18 months ago to promulgate a feasible standard for organics. The whole problem is of very recent origin; better understanding is required of the long-term health effects of organics, and precipitate regulatory action could lock the utilities into particular methods of measurement and treatment that might later turn out to be wrong.

In EDF's view, the agency is being disingenuous in saying that more information is needed. An EPA report to Congress in 1975 listed 253 organic chemicals that had been identified in drinking water. And an EPA survey of the drinking water of 80 cities found chloroform, a known animal carcinogen, in all of them, in concentrations ranging from below 0.1 to 311 micrograms per liter. Trace quantities of other animal carcinogens, such as dieldrin, aldrin, and DDT, were detected in the water of several communities.

As for the health implications of these contaminants, Harris's finding of a statistical link between cancer and drinking water in Louisiana had since been generally supported by studies undertaken in New Jersey and Ohio, the EDF asserted. In any event, Congress did not mean EPA to wait for dead bodies before acting; evidence that a contaminant could be dangerous was basis enough for the agency to do something, EDF argued. What should be done, in EDF's view, is to require at least the largest utilities to replace the sand in their filters with granular activated carbon. According to an EPA publication, this is so far "the best method for removing environmental organic contaminants such as pesticides and aromatics from water." The utilities have stated that the costs would be "staggering." But according to EPA estimates, the costs for large utilities "would add from $4/year to $7/year to the water bill for a household of four."

Nine Studies Point to Problem

Since the EDF suit was filed, in September last year, more epidemiological studies have accumulated, but the EDF and EPA continue to differ on the urgency of their implications. Harris, while careful to stress that causation has not been proved, considers that the studies tend to support his original hypothesis, that drinking water is a possible factor in human cancer. The new studies point to a statistical excess of cancer deaths among people drinking chemically contaminated water: "If the excess does exist, it is likely to amount to between 30 and 50 percent of the types of cancer looked at," Harris says. Cotruvo, on the other hand, states that some of the new studies "show no relationship at all" between cancer and drinking water and that all of them are so inexact anyway "that you can't get very excited when they don't agree." Kimm, however, told the House health subcommittee in April that the EPA had reviewed the epidemiological studies of nine independent research groups, "all of whom seem to be finding some association between organic contaminants in drinking water and increased cancer rates, although the magnitude of these relationships is far from clear." Kimm added that although much of the work had not yet been completed, "these findings indicate a potentially serious public health problem."

The EPA has now decided that the problem of organics falls into two separate parts. Chloroform and the other trihalomethanes are "all but universally present where conventional chlorination is practiced." Synthetic organic contaminants, on the other hand, are randomly distributed and, where they exist, are found in relatively small quantities. The agency has not yet decided how to deal comprehensively with the pollutant chemicals, although preventing them at source is one approach being followed. But EPA is considering proposing a standard for trihalomethanes, probably to require that the total amount of the substances not exceed 100 parts per billion.

Harris denounces this level as "far too high." But Kimm and Cotruvo believe they have to move slowly in tampering with a practice as well established as chlorination. They agree with Harris that granular activated carbon is the leading candidate as a treatment method, but are reluctant to force it on the utilities because for many it may be unnecessary—they could improve their water quality by switching from surface water to groundwater and by chlorinating less—and for others it may be too expensive. Kimm says he is at present leaning toward setting maximum contaminant levels for pollutants, provided a suitable general index measure can be found, and leaving it to the states to decide how they will treat their water.

One drinking-water expert who concedes "mixed feelings" about this approach is Gordon Robeck, director of EPA's Water Supply Research Division in Cincinnati. Robeck has been advocating the use of granular activated carbon for years and believes he has demonstrated that the method doesn't cost too much, at least for large cities. Rather than having to measure for hundreds of trace contaminants at frequent intervals, the large utilities would do better to have a barrier there all the time, Robeck feels. "But many cities say they will use this technology only when EPA comes out with a standard for contaminants that compels it—there is always this excuse for waiting and waiting for years and years." The cities, however, are not convinced of the health risks, Robeck says: "So in fairness, the policy-makers have to take this into account. If they didn't, the states wouldn't enforce it."

The broad discretionary powers of the Safe Drinking Water Act place an unusually heavy burden on its regulators. If the EPA goes too fast, it risks locking the nation's water utilities into the wrong treatment and measurement technologies, at considerable expense to millions of consumers. Yet if the agency moves too slowly, it risks prolonging unnecessarily the exposure of a large population to a possibly definite health risk. A go-slow approach at the outset made sense. But with the steady accretion of apparently similarly suggestive health studies, the EPA now seems at greater future risk of being accused of excessive caution than of excessive haste.—NICHOLAS WADE