Dioxins Have Been Present Since the Advent of Fire, Says Dow

In 1977, officials at the Dow Chemical Company plant in Midland, Michigan, were gravely concerned when company scientists detected the presence of dioxins in fish from the river into which Dow pours its manufacturing effluent. Dioxins are unavoidable contaminants of three pesticides made at the plant; dioxins are also toxic to man. Included among those found was TCDD, a contaminant of the notorious Agent Orange defoliant used in Vietnam and one of the most toxic substances known.

Also concerned was the Michigan Department of Natural Resources, which after learning about the contamination from Dow immediately warned everyone not to eat fish from the river, the Tittabawassee. This move—backed by the federal Food and Drug Administration (FDA)—prompted even greater alarm at Dow because the company's water pollution permit made no mention of dioxins. And either the Environmental Protection Agency (EPA) or the Michigan agency could shut down the plant—Dow's only facility for making the pesticides in the United States—until either the permit was altered or the contamination ceased.

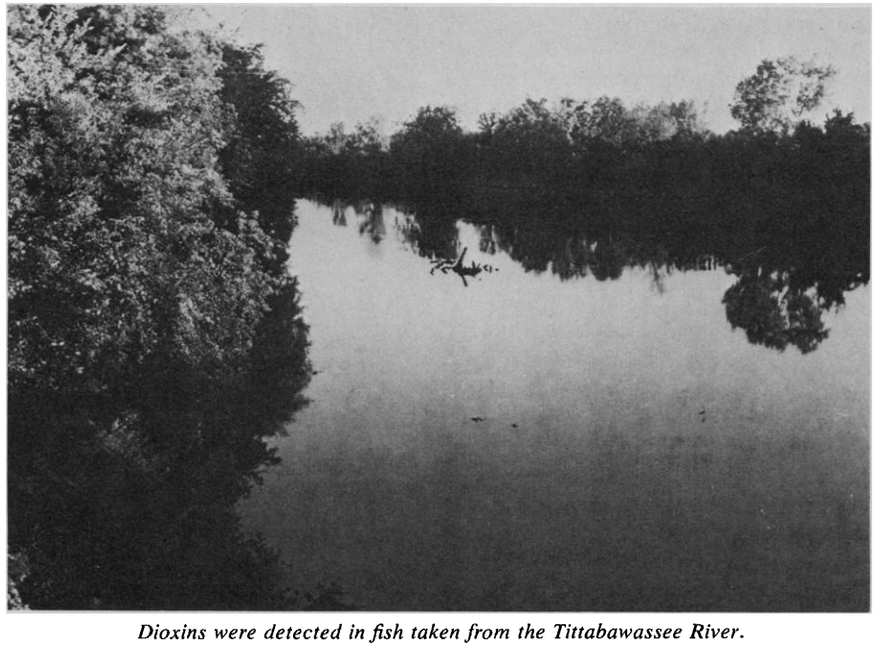
To forestall such a disaster, Dow officials vowed to locate the contamination's source. On 15 November, after a months-long search by an 18-member task force, company officials announced that they had found it. The entire environment, the company said, was to blame. Dioxins had been located not only in the fish but also in ash from refuse incinerators, fossil-fueled power plants, fireplaces, charcoal grills, cigarettes, and the emissions of automobile engines—everywhere, in fact, that combustion took place. It was ash from a nearby power plant that floated into the river and sullied the fish, Dow postulated, not the pesticide production. "We now think dioxins have been with us since the advent of fire," a company official volunteered.

Although released to the general public, Dow's report need only impress two groups. Thus far, officials of EPA and the Michigan agency have barely blinked; the report, they say, does not definitively get the company off the hook for the river. That is apparently not Dow's only goal, however; company officials hope the report will puncture the EPA's possible interest in a zero effluent limit for dioxins. As Warren B. Crummett, the technical director of Dow's analytical labs, stated recently, "We can be assured that all the materials ever made in any quantity are present at some level in all environmental samples and we should not be surprised or alarmed when they are found at parts-per-trillion or lower levels. We need to educate both the scientific community and the general public of these facts." The theme has been struck by several Dow officials in interpreting the study. Ronald Kagel, the Dow scientist who directed the dioxin research, said that because of analytic techniques now available, "The term 'No level is presently considered safe for human consumption' will become a phrase found only in history books."

Actually, the significance of the report to human health is less than clear, because little is known about any of the four contaminants. Neither the EPA nor the FDA has established a safe level of exposure to TCDD (2,3,7,8-tetrachlorodibenzo-*p*-dioxin) and the other dioxins, hexa, octa, and hepta, which contaminate the pesticides 2,4,5-T, trichlorophenol, and pentachlorophenol. Dow insists there is no cause for alarm because the concentration of the dioxins in the samples tested was low—in all cases, lower than the concentration in herbicides or pesticides themselves. Moreover, the dioxins were found mainly in airborne particulates, and the hazard to human health exists primarily when they are in the food chain. Still, all are regarded as hazardous, particularly TCDD, which has caused birth defects and assorted tumors in test animals when fed in concentrations below 100 parts per trillion (ppt). The other dioxins are considered to be anywhere from three to 1000 times less toxic than TCDD, but Dow has learned that some of the others may be broken down into TCDD once in the environment.

Dow officials, in press releases and statements, termed their discovery, in and of itself, a "key scientific breakthrough" in the trace chemistry of fire. Two previous studies, in Switzerland and the Netherlands, linked dioxins with emissions from garbage incineration, but Dow's scientists searched more thoroughly with more sophisticated analytical techniques. The levels of detection in their report—occasionally as low as 3 ppt—are state of the art. "Dow knows as much as or more than anybody about dioxin detection, as well they should," says an EPA official.

Ironically, the whole affair is an example of a private corporation going to extraordinary lengths on a point of scientific curiosity in order to protect itself from regulation. As such, it confounds the adage of Dow spokesmen that regulation inhibits innovative research. John Davidson, a Dow scientist, says candidly



Dioxins were detected in fish taken from the Tittabawassee River.

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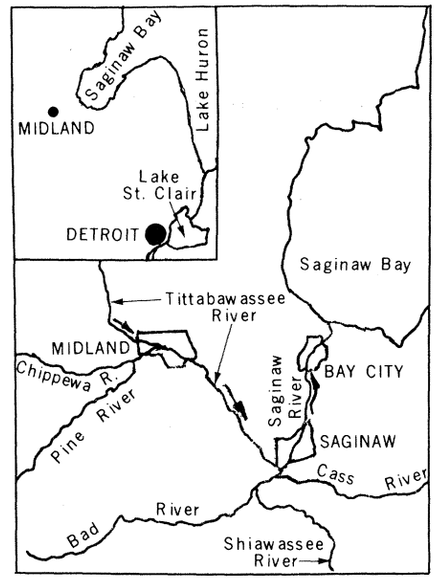
that "We learned so much about dioxins in order to defend our pesticides."

Dow learned of the combustion-dioxin connection in a roundabout manner. First, it confirmed the presence of dioxins in the Tittabawassee by placing fish in cages submerged at points upstream and downstream from the point of discharge from its plant. Dow determined, and the Midwest office of the EPA later confirmed, that dioxins were present at low levels in the fish downstream from the discharge and, except for the presence of octa in one fish, in none of those from a point upstream from the discharge. Next, in an attempt to locate the source of the contamination, Dow sampled soil on the plant grounds and found concentrations of the dioxins ranging from 0.3 part per billion to 20.5 parts per million (a maximum of 0.1 ppm for TCDD, the most toxic). Dioxins were also found in dust samples from a Dow research building, and, in order to obtain control samples, Dow also tested the dust from several metropolitan areas. After finding that dioxins were present in the urban dust, it was but a short step to discovering them in auto mufflers, fireplace ash, cigarette smoke, and charcoal grills.

Although Dow officials believe their study points the finger at other sources



Map by Eleanor Warner

of TCDD river contamination, EPA officials note that the highest levels of dioxin were found by Dow to be in and around the Dow plant. "Dow's own incinerators could even be the cause," says Lyman Condie, an EPA toxicologist in Chicago. In the study, Dow expresses reservations about the reliability of data showing contamination of the plant's own sewage water, noting that the amounts uncovered are near the limits of detection; similar reservations were not expressed about data collected outside the plant that are also near detection limits. And Dow admits, "We cannot demonstrate that some of these chlorinated dioxins did not come from manufacturing plants."

Why, if the report does not provide a definitive explanation for the contamination of the Tittabawassee, did Dow so earnestly pursue the dioxin search and so loudly proclaim that a component of its pesticides may be present naturally throughout the environment? After all, the EPA, which is currently requiring Dow to prove the safety of 2,4,5-T or remove it from the market, could reason that the danger to humans from the deliberate addition of dioxins to the environment is more severe because dioxins are present there already. The answer to the question is apparently in the assertion of Kagel that "our research proves that dioxins are present not just in Michigan. . . . Because dioxins are ubiquitous, we need not be concerned about them." The EPA, however, is not likely to accept such a view. As Condie says, "The report has not changed our basic position on dioxin-contaminated pesticides, which is that they pose a threat to human health."—R. JEFFREY SMITH

Anti-Semitism Alleged in Soviet Mathematics

Last summer, mathematicians gathered in Helsinki at the International Congress of Mathematicians to award Fields Medals—the equivalent in mathematics of Nobel Prizes—to their finest young researchers. Four Fields Medals were awarded, but only three of the winners were present to accept their awards. The fourth winner, Gregory Margoulis of the Soviet Union, was not permitted to attend the Congress. When Margoulis applied for a visa, he was told his work was not good enough to represent the Soviet Union. Naturally, this incident caused quite a furor. Writing in the Research News section of *Science* (20 October), George Mostow of Yale University said of Margoulis' absence, "In homage to [Margoulis'] achievements, the entire audience . . . rose to its feet, in a spontaneous gesture of admiration for the medalist who was so conspicuously absent."

Margoulis is Jewish. That is the reason, sources say, that he was refused permission to go to Helsinki. The Margoulis incident is only the latest of a series of alleged instances of anti-Semitism in the Russian mathematical community. Jewish students are prevented from entering universities, even when they display impressive mathematical talent. Jewish mathematicians are prevented from receiving advanced degrees, from publishing, and from attending international meetings.

Recently a group of Soviet émigrés wrote a white paper describing the situation in Soviet mathematics. The paper was widely circulated among mathematicians in the United States and at last summer's International Congress in Helsinki. A number of copies of the paper are also circulating in the Soviet Union. An edited, some say whitewashed, version of this paper was just published in the November issue of the *Notices of the American Mathematics Society*. Although the émigrés did not sign the paper, it was signed by 16 leaders of the U.S. mathematical community, who vouched for the trustworthiness of the authors.

Science obtained details of the repression of Soviet Jewish mathematicians from the original version of this white paper as well as from conversations with informed sources (who wish to remain anonymous because they fear reprisals against their Soviet contacts) and from a paper written by Soviet Jewish mathematician Grigori Freiman. Freiman is professor of mathematics at the University of Kalinin, and his paper was published in the underground samizdat journal in Moscow.

American scientists with close Soviet contacts say the situation in the Russian mathematics community is worse than in

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