30 October 1970, Volume 170, Number 3957 **SCIENCE**

Pollution by Organic Chemicals

A survey of efforts to secure a livable environment leaves one with the impression that progress is being made in a number of respects. One area that has not received as much attention as it should is pollution by organic chemicals. Of particular concern should be the large group of molecules that are fat-soluble and only slowly biodegradable. Organic chemicals that are fat-soluble often tend to be accumulated in living systems. If not biodegradable, they may be concentrated by the food chain or other mechanisms so that their level in tissue comes to exceed that in the environment by orders of magnitude.

An example of a fat-soluble, slowly degradable compound is DDT. Its tendency to be accumulated by fish, birds, and humans has been repeatedly discussed. A large number of chlorinated aromatic hydrocarbons and chlorinated phenols and their derivatives are also concentrated in living forms. Many of these chemicals are known to have adverse biological effects. The most toxic chlorine-containing compound known is 2,3,7,8-tetrachlorodibenzodioxine ($C_{12}H_4O_2Cl_4$), often called dioxin. The acute oral LD_{50} dose of dioxin in male guinea pigs is about 10^{-6} g/kg. Other animal experiments have resulted in a variety of pathologic phenomena, including neurological disturbances and birth defects. Dioxin is an unwanted contaminant* of the herbicide 2,4,5-T. When manufacture of the herbicide is carefully controlled, the dioxin content is less than 1 part per million. Higher concentrations have been noted, however. Dioxin was identified in 1962, after 5 years of dedicated research. In 1957 a mysterious disease had caused millions of dollars of damage and the death of uncounted numbers of chicks. Careful chemical detective work ultimately pointed to dioxin as the culprit. Apparently the herbicide 2,4,5-T or derivatives of it had been taken into plants and had ultimately appeared in vegetable oils. These were processed at high temperatures to liberate fatty acids, but inadvertently some dioxin, which has extreme thermal stability, was formed. Once the problem was identified, the chemical process was modified. Oddly enough, in spite of its great toxicity, the behavior of dioxin in the food chain has not been worked out.

The broad-scale and dramatic deleterious effects of dioxin were manifested in chicks. How much damage has this substance caused in humans? We know that all of us carry substantial quantities of DDT. How much damage has been caused by other related fat-soluble compounds?

When we use DDT and 2,4,5-T, presumably we obtain benefits that tend to balance, or even more than compensate for, the hazards attending them. Moreover, we can test the toxicity of manufacturers' products and be alert to possible problems. However, how do we cope with other possible dioxins? We are manufacturing thousands of chemicals. In their preparation, side reactions are producing many thousands of unwanted and even unidentified substances. To what extent are these strangers being discarded into rivers, lakes, and the sea? To what extent are such substances finding their way into humans? Modern analytical techniques could furnish at least part of the answer. We need much better monitoring of food, water, and human body constituents.

Companies producing fat-soluble, nonbiodegradable, organic chemicals should give careful attention to the question of what they may responsibly set loose on the environment. Failure to act now will surely lead to some new tragedy, aroused public opinion, and harsh federal regulations.

—PHILIP H. ABELSON

* *Effects of 2,4,5-T on Man and the Environment*, Hearings before the Subcommittee on Energy, Natural Resources, and the Environment of the Committee on Commerce, United States Senate, Ninety-first Congress, Second Session, 7 and 15 April (Serial 91-60, U.S. Government Printing Office, Washington, D.C., 1970).