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EDITORIAL

Chlorine and Organochlorine Compounds

Concern continues that the U.S. Environmental Protection Agency (EPA) might curtail or ban the production of chlorine and compounds containing it. This perception has been fostered by indications that EPA policy is being predominantly influenced by Greenpeace and its allies. Part of the impetus for banning organochlorine compounds has been an imbalanced media treatment of controversial assertions about hormonal effects of some of them. The concern has also been fostered by the tone of a leaked EPA draft of a chapter of an extensive report on dioxin.

Even were manufacture of chlorine-containing chemicals to be prohibited, their creation would not cease. Nature produces many of them.* The number identified exceeds 1500, and more are being discovered. Some are highly toxic. Others are benign and present in edible seaweed. The simplest natural organochloride is methyl chloride (CH_3Cl). It is produced by marine algae, kelp, wood-rotting fungi, and some terrestrial vegetation. In addition, when plants and trees are burned, CH_3Cl is one of the many products containing chlorine. Chloride ion is normally present in plants and trees and participates in the complex chemistry of partial combustion. In total the annual global emission rate of CH_3Cl is 5 million tons.* Annual anthropogenic emissions total only 26,000 tons.

The smoke of burning wood contains more than 100 organochlorine compounds. These include scores of polychlorinated dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs). Among them is the extremely toxic dioxin (2,3,7,8 tetrachlordibenzo-*p*-dioxin — $C_{12}H_4O_2Cl_4$). The PCDDs can withstand temperatures of nearly 800°C in the presence of excess oxygen. Two research groups have concluded that forest and brush fires are major sources of PCDDs. It has been estimated that annually on average as much as 60 kilograms of PCDDs are produced in Canadian forest fires.* This is 10 times more than the amount formed in the 1976 Seveso plant accident. In addition to Canadian emissions, forest fires elsewhere and domestic wood burning in the developed and especially in the less developed countries create a much larger amount. This in turn is supplemented by slash-and-burn agriculture. Anthropogenic production of dioxin has decreased during the past two decades and is smaller than that created by combustion of wood.

Products of wood combustion are spread around the world by winds. In consequence PCDDs are found in soils in remote areas. Because most forest fires are caused by lightning, our ancestors were exposed to dioxin long before the first cave dweller. Approximately 15,000 different organochlorine substances are commercially available. The chemicals differ greatly in their physical and chemical properties. Most are not very toxic and are biodegradable. However, some are not easily metabolized and are lipophilic. They tend to be bioconcentrated in the food chain. All of us carry detectable amounts of DDE, a degradation product of DDT. Industrial production of most of the bioconcentrating chemicals was stopped during the 1970s. Since then their presence in the environment has diminished in some instances by factors of 10 or more. During the 1960s and early 1970s pollution of the Great Lakes was followed by morbidity and mortality of carnivorous birds. With diminution of concentrations of pollutants, the health of avian populations has improved.

Banning production of chlorine and its compounds would potentially have greatly deleterious effects on health and on the economy. In addition to disinfecting water, chlorine and its compounds are used in the manufacture of pharmaceuticals and in their content. A serious outbreak of cholera followed when chlorination of water was temporarily stopped in Peru. Waterborne diseases cause the deaths each day of 25,000 children in less developed countries. A costly gamble in the United States to use means of disinfection less effective than chlorine would be irresponsible.

There is reason to hope that the EPA will not continue to act like a tool of Greenpeace. A plethora of EPA regulations and unfunded mandates coupled with examples of brutality in enforcing them has cost the EPA support in Congress.

Philip H. Abelson

*G. W. Gribble, *Environ. Sci. Technol.* **28**, 310A (1994).