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Methyl bromide doesn't stick around

Ozone-depleting chemicals are like strong perfume: The longer they linger in the atmosphere, the more effect they are likely to have.

Methyl bromide, a powerful ozone destroyer, may survive in the atmosphere for less time than previously thought and therefore pose less of a threat to Earth's protective layer, a new study suggests.

Methyl bromide gets into the atmosphere in many ways. Farmers use it as a fumigant to control insects. Marine plants discharge it into the air, as do humans when they burn biomass and leaded gasoline. Once the chemical reaches the stratosphere, sunlight breaks it down, releasing bromine atoms that help destroy stratospheric ozone.

Amendments to the Montreal Protocol, an international ozone-protection treaty, froze methyl bromide production at 1991 levels; the 1990 Clean Air Act amendments require U.S. companies to phase out production by 2001.

Scientists know that chemicals in the troposphere and the ocean break down some methyl bromide, rendering it harmless. They suspect that soil may play the same role.

A new study provides further evidence that bacteria in soil destroy atmospheric methyl bromide—and quickly, at that. Soil's fondness for the chemical reduces methyl bromide's estimated atmospheric lifetime to a little over 9 months, about two-thirds as long as previously thought, report Joanne H. Shorter of Aerodyne Research in Billerica, Mass., and her colleagues in the Oct. 26 NATURE. The Methyl Bromide Global Coalition, a group of agricultural and chemical companies, funded the research.

The new findings also reduce methyl bromide's ozone depletion potential by roughly 30 percent, Shorter and her colleagues assert. That rate of depletion is still high enough to bring it within the scope of regulation by the Montreal Protocol and the Clean Air Act, says coauthor Charles Kolb, also of Aerodyne.

The destruction of methyl bromide by soil throws off some existing calculations of its global atmospheric abundance, says James H. Butler of the National Oceanic and Atmospheric Administration in Boulder, Colo. Previously, global estimates of the emission and absorption of methyl bromide were consistent with measured atmospheric concentrations, he says. But the additional absorption by soil upsets that balance.

The new results, he and the researchers emphasize, are preliminary.

"The problem in this business always is extrapolation," says Butler. The scientists used only a few soil samples to calculate global averages of how much methyl bromide the soil absorbs. However, "the measurements seem reasonably sound," he adds.

The researchers tested in the laboratory and in the field different types of soil from four sites in the United States, Costa Rica, and Canada. They covered the soils with vials, then injected air containing methyl bromide into the vials. All of the surface soils consumed the chemical within minutes; forest soils in the temperate zone acted most rapidly, they report.

By applying antibiotics and fungicides to the soil samples, Shorter and her colleagues concluded that bacteria, not fungi or chemical processes, consumed methyl bromide.

Other researchers tracking the depletion rates of the large quantities of methyl bromide put on fields by farmers had found that soil decomposes the chemical slowly, says Butler. But that's because the fumigant kills the bacteria that would normally eat it, he points out.

Shorter and her colleagues studied lower concentrations of methyl bromide, much closer to typical atmospheric values.

— *T. Adler*