

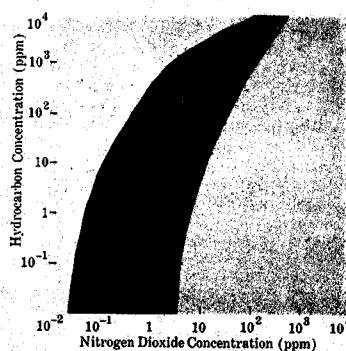


Fig. 11. Pioneering work by A. J. Haagen-Smit of CalTech established field of hydrocarbon and nitrogen dioxide concentrations—shown by tint—within which ozone is produced. Ozone concentrations are themselves quite low, < 1 ppm, but enough to be nasty in several ways.

verting the latter to sulfuric acid, which is apparently recoverable in amounts sufficient to at least partly defray the costs.

It's an ill wind that blows pollution your way

When you think about the huge dimensions of the ocean of air that lies above us, it's hard to believe that the activities of urban man, which are carried on over just about 1% of the total land surface, can create vast, slowly drifting, Sargasso-like seas of pollution. In fact, the major portion of man's airborne effluvia is carried away by turbulent winds and vertical updrafts and diluted to undetectable concentrations throughout the entire 10-mile thickness of the lower atmosphere. But a considerable proportion often cannot be dispersed this way.

With surprising frequency—an average of perhaps one-third of the time over much of the U.S. for example—there is an effective limit to the upward dispersion of contaminants, at altitudes of 500 feet or less.

This upper limit to dispersion is created either locally or over large regions by a thermal inversion, a condition you're probably familiar with, in which the normal decrease of air temperature with height above the ground which heats it is reversed. At some elevation above the ground—known as the inversion base—air temperatures begin to rise instead of continuing to drop (see margin). This anomalous temperature gradient persists upward throughout the inversion layer to an altitude which is determined by large-scale weather patterns that create the inversion in the first place. The base of the inversion layer

acts as the effective lid.

Imagine a bold parcel of polluted air—such as a hot, high-velocity jet of stack gases—one that has the temerity to try to rise into the inversion layer itself. Although it cools markedly on the way up, on penetrating the inversion layer it finds itself much cooler and more dense than the surrounding air, in which the temperature is going up not down. Consequently, it quickly sinks back toward the inversion base and has little if any time in which to disperse its pollutants to higher altitudes. It and its burden of pollution are confined to the appropriately named "mixing layer" that lies below the inversion base and extends to the ground.

The average prevailing thickness or depth of this mixing layer varies with time and place—if it reaches a mile or two at times—but it is always far less than the full thickness of the lower atmosphere. Yet, in general these mixing depths would suffice to dilute pollutant concentrations, if the winds that handle horizontal circulation blew hard enough and with enough turbulence for enough of the time. At some seasons of the year and at many places they don't. Still worse, winds that are too weak can compound pollution troubles.

Helmut Landsberg, head of the climatology section of the U.S. Weather Bureau, has shown this for the northeastern chain of cities, extending from Richmond, Virginia, to Portland, Maine. When weak winds involving 100 miles or less of net air transport a day blow the right way—in this case mostly from the south or southwest (see margin)—the pollutants emitted in any one city either stay in the local area or are wafted gently toward the next city in the chain, perhaps adding to its pollution burden. Such weather conditions are far from rare for at least parts of the chain.

This doesn't mean that recent comments by New York City's Mayor Wagner, in which he described the city as lying at the end of a "3000-mile long sewer" of air pollution, are technically correct (as pollution control people in California are at some pains to point out). It does mean however that regional airsheds exist. These, at some seasons and some places, are in many ways analogous to watersheds. In both cases pollution can increase in the downstream direction. But air, unlike water, cannot be cleaned up for general use. Pollution in it can only be controlled at the source. In order to do this we're going to need more and better ways to monitor and trace the movements of pollution clouds that migrate downwind, from the central cities into suburbs and the surrounding countryside. Characteristic patterns of pollution-caused damage to plants offers some grim help here.

In the U. S. some data vital for these and other purposes are starting to come in from a PHS National Air Sampling Network of more than 200 stations—urban and rural—