# U.S. Skies Harbor Ozone Destroyer

Scientists have discovered unexpectedly large concentrations of ozone-destroying chlorine monoxide over the United States — an ominous sign that chlorine pollution is thinning the ozone layer not just over the poles, but also over the densely populated midlatitudes.

"This is the first direct evidence we have at midlatitudes that chlorine compounds can destroy ozone during the wintertime," says Darin W. Toohey of Harvard University, who coauthored the report in the January GEOPHYSICAL RESEARCH LETTERS.

Atmospheric scientists cannot yet gauge how much ozone destruction occurs over temperate regions. While the loss clearly remains small compared with the Antarctic "ozone hole," researchers worry that midlatitude depletions might accelerate dramatically during the next decade as atmospheric chlorine levels rise. Such ozone loss threatens humans and other life forms by allowing more ultraviolet radiation to reach Earth's surface.

Toohey and his co-workers describe measurements of chlorine monoxide made in 1988 and 1989 during a series of flights by NASA's high-altitude ER-2 research plane. This highly active form of chlorine is the main compound responsible for breaking apart ozone molecules over the poles. Scientists have dubbed it a "smoking gun" because elevated levels of the compound provide clear evidence that chlorine is destroying ozone. Most chlorine in the ozone layer comes from chlorofluorocarbons and other forms of pollution.

In flights over midlatitude regions during October and early December of 1988, the ER-2 measured normal chlorine monoxide levels of about 20 to 30 parts per billion at an altitude of 19 kilometers. But later in December, it detected double that concentration. And on Feb. 21, 1989, a flight from Virginia to California detected levels about five to 10 times higher than the October value. Even greater levels turned up the day before on a flight from Norway to Virginia.

"These are the largest concentrations of chlorine monoxide ever measured at midlatitudes," Toohey says.

The February levels, if they persisted for a month, could destroy as much as 2 percent of the ozone in an affected region, he calculates. While such slow destruction could not create an ozone hole over, say, New York, widespread increases in chlorine monoxide could gradually deplete ozone levels over the northern midlatitudes.

In fact, wintertime ozone values during the last two decades *have* dropped by 3 to 6 percent in the northern midlatitudes, according to satellite and ground-based measurements. While it's tempting to blame that decrease on chlorine pollution, scientists lack enough evidence to establish a causal link, says Michael Prather of NASA's Goddard Institute for Space Studies in New York City. Because the ER-2 only gathered data on a few days, researchers remain unsure whether the chlorine monoxide elevations last for any length of time. Moreover, the plane could not make measurements higher in the stratosphere, where the bulk of the ozone layer lies.

The ER-2 data leave researchers puzzling over the compound's origin. According to standard chemical theories, chlorine above the midlatitudes should remain locked up in "safe," inactive forms.

One possible answer comes from Anne R. Douglass of the NASA Goddard Space Flight Center in Greenbelt, Md. In the same issue of GEOPHYSICAL RESEARCH LETTERS, she and her colleagues describe computer simulations suggesting that the ER-2's February flights passed through polar air enriched with chlorine monoxide.

Chlorine monoxide levels skyrocket over the poles during winter as the stratosphere gets cold enough to form icy cloud particles, which allow inactive chlorine to become active chlorine monoxide. A globe-circling wind stream called the polar vortex keeps this polar air from mixing with warmer air over the midlatitudes. But in February 1989, the vortex shifted toward the United States, and Douglass suggests that the ER-2 passed close to, if not through, the edge of the polar air. She adds, however, that her theory cannot account for the high chlorine monoxide values measured in late December, when the plane flew nowhere near the vortex.

This fall, scientists plan to launch a six-month project to study the stratosphere over the midlatitudes and the north polar region. ER-2 data collected during this period will indicate where high levels of chlorine monoxide exist and how long they persist. The project will also seek the cause of the ozone decrease over the midlatitudes in winter. Some researchers believe that blobs of polar air break off from the vortex, lowering ozone values in midlatitude regions as they carry the ozone-poor air southward. The abundant chlorine monoxide in this polar air would further deplete midlatitude ozone.

Others believe that very little polar air migrates toward the equator. Instead, they suggest that tiny droplets of atmospheric sulfuric acid transform inactive chlorine into chlorine monoxide over the midlatitudes. — *R. Monastersky*

## Brain killer stable in soil

It reads like a script from a grade-B horror movie: A mysterious infectious agent turns the brains of cattle and sheep spongy, forcing ranchers to bury the dead animals in mass graves.

Yet the story is true, and a new report adds a frightening twist: The agent seems to persist underground, its lethal powers intact.

Scientists have yet to nail down the virus-like particle responsible for bovine spongiform encephalopathy in cows and scrapie in sheep, but whatever causes these diseases appears to remain infectious even after three years in soil, according to Paul Brown and D. Carleton Gajdusek of the National Institute of Neurological Disorders and Stroke. Their finding implies that the current practice of burying infected carcasses may be imprudent.

In an experiment that has stirred, in Brown's words, "a little electricity" among scientists worried about environmental contamination, the researchers loaded soil-filled pots with doses of the infectious material and buried the pots in Brown's backyard garden. Three years later, they dug up the pots. Experiments in hamsters confirmed that the material was still lethal, they report in the Feb. 2 LANCET.

Brown says the degree of infectiousness remaining after three years leads him to suspect that the material could remain deadly in soil for a decade or more. And although most infected animals are buried with corrosive quicklime, he doubts that ranchers use enough of the chemical to kill all the infectious particles. Brown recommends research to determine the concentration of corrosives needed to render infected carcasses harmless.

"I would at least think that burial sites ought to be identified so someone doesn't 10 years down the road use it as a pasture," he says. In the past, he notes, flocks of sheep have developed scrapie after grazing in areas where infected carcasses had been buried.

Two researchers studying the infectious particle told SCIENCE NEWS that while the backyard experiment lacked some scientific rigor, the warnings may prove appropriate. — *R. Weiss*