

# Ozone Depletion: Early Evidence Comes In

Since 1974, when scientists first voiced their suspicions that chlorofluorocarbons attack the ozone layer of the stratosphere, heated controversy has marked use of the chemicals. Now the debate continues: NASA's Goddard Space Flight Center reports the first experimental evidence that the ozone layer gradually is being depleted.

Stressing the word "preliminary," Donald F. Heath cites findings based on satellite data that stratospheric ozone about 40 kilometers above the earth's surface (within the ozone-rich layer between altitudes of 25 and 54 kilometers) decreased at a rate of half a percent a year between 1970 and 1979. The findings reflect a very slight depletion at the 40-kilometer altitude and would represent an even smaller change, if any, in ozone in the total column. The depletion is significant, however, because it occurs at the precise altitude where chlorine released from chlorofluorocarbons is thought to be most effective in destroying ozone. Further measurements are underway to augment and verify the data.

Chlorofluorocarbons are synthetic chemicals used in industrial processes, in the manufacture of plastic foams, in refrigerants and, to a diminishing extent, as spray propellants. Chemically stable at ground level and in the lower atmosphere, over several decades chlorofluorocarbons diffuse and rise to the stratosphere where solar radiation causes them to break down. Chlorine is released, which reacts with and destroys the ozone, the earth's shield against ultraviolet rays that damage fish and crops and cause skin cancers.

Using data from the NASA satellite, Heath determined the amount of ozone in the total column and its vertical distribution between 25 and 54 kilometers. Measurements of vertical distribution of ozone made from a satellite far above the stratosphere are more precise than similar measurements taken from the ground. Instruments on earth cannot detect ozone depletion of less than two to four percent and so cannot be expected to measure a loss, for example, of one percent from the total column to date.

In 1979 the National Academy of Sciences reported that ozone depletion could reach 16.5 percent over the next 100 years if chlorofluorocarbon releases continue at the 1977 rate (SN: 11/17/79, p. 340). Many scientists now predict slower depletion—between five and eight percent in the next century. World production and sales of two chlorofluorocarbons thought to be most damaging to the ozone, CFC-11 and CFC-12, have decreased a total of 18.3 percent since peak production in 1974, the Chemical Manufacturers Association reports. Internationally, nations are agreeing

to curtail aerosol uses of CFC-11 and CFC-12, and not to increase production capacities for the chemicals.

As the debate continues, so does research. The next step is to establish a firm causal relationship between the breakdown of chlorofluorocarbons and depletion of stratospheric ozone. In April 1982, James G. Anderson, an atmospheric chemist at Harvard University, plans to launch in New Mexico a giant helium balloon 100 times larger than the Goodyear blimp. From its 45-kilometer altitude, the balloon will lower an instrument package 20 kilometers through the ozone layer, taking measurements along the way. Because ozone levels may vary according to altitude, season, time of day and sunspot activity, the balloon is equipped, yo-yo-style, to hoist up the instrument package and send it back down for additional rounds of measurements.

"We're studying whether the presence of chlorine and the decrease of ozone can be observed simultaneously. Preliminary indications [such as the NASA satellite findings] are that this is happening, although it

would be premature to jump to a firm scientific conclusion," Anderson says. He anticipates initial results from the balloon tests, which will be funded by a \$150,000 grant from NASA, within a year after the launch.

Whether new evidence will lead to greater regulation of chlorofluorocarbon production is unclear. An advance notice of proposed rule-making issued by the Carter administration in October 1980 drew more than 2,000 public comments, but so far, the Environmental Protection Agency has no proposal in the works that would regulate non-aerosol uses of the chemicals. While it is clear that chlorofluorocarbons do destroy ozone, estimates of the magnitude and implications of depletion are highly speculative, says Herbert Wiser, principal science adviser in EPA's Office of Research and Development. "There will be damage, and there is damage being done now," he said. "What we don't know is the magnitude of the effect. If the magnitude is large, we need regulatory action. If the magnitude is small, we may do nothing." □

## Rent-a-womb at the zoo

A common dairy cow gave birth to a rare wild ox at the Bronx Zoo last week in the fruition of an experiment with embryo transplants that may eventually brighten prospects of survival for several endangered species. The transfer of the several-day-old embryo from a gaur, a large ox native to remote forests of India and Nepal, to the uterus of a Holstein cow, resulted in the first successful use of a domestic animal as a surrogate mother for a member of a vanishing wild species.

Janet Stover led the researchers from the New York Zoological Society who primed several Holsteins last autumn with prostaglandin injections, hormones that synchronized the cows' reproductive cycles so they would be receptive to housing gaur embryos when fertilized eggs became available. (Its similar reproductive system, gestation length, and comparable size at birth made the Holstein, another member of the genus *Bos*, a promising surrogate for the gaur, Stover says.)

Next, the scientists selected a female from the zoo's herd of 16 gaurs and administered hormone injections that stimulated her to superovulate, releasing several ripe eggs, instead of the usual one per cycle. Of the five fertilized eggs flushed



Wild ox calf (above) born to Holstein cow may stand 2 m high and weigh 1,000 kg as a 5-year-old adult (below).

Photos: Meng/N. Y. Zoological Society