Environment

Call for stronger ozone protection

Heeding recent scientific evidence that Earth's protective ozone layer faces greater jeopardy than previously believed, 81 nations indicate they want to halt the use of certain ozone-destroying chemicals by the end of the century. At a meeting in Helsinki last month, these nations adopted a declaration calling for a complete phase-out of chlorofluorocarbons (CFCs) by the year 2000, and for a ban on the use of very destructive compounds called halons as soon as feasible.

These requests go far beyond the provisions of the existing ozone-protection treaty, called the Montreal Protocol. Adopted in 1987, this agreement requires countries to halve their production and use of CFCs by 1999 and to freeze use of halons at 1986 levels. Although the Helsinki declaration carries no force on its own, it poses goals for upcoming negotiations on revising the protocol, scheduled to begin next April.

Thirty-nine nations have ratified the Montreal Protocol so far, but many less-developed countries such as China and India have yet to join because of concerns about the costs of replacing CFCs and CFC-using equipment. The Helsinki declaration calls for provisions to assist developing countries through funding and transfer of technology.

At the meeting, countries also showed support for setting limits on other harmful chlorine-containing chemicals, such as methyl chloroform and carbon tetrachloride, says Eileen B. Claussen of the U.S. Environmental Protection Agency. Past discussions have largely overlooked these compounds. But recent analysis, which Claussen presented at the Helsinki meeting, suggests a ban on CFCs alone will not stop the accumulation of chlorine in the stratosphere.

Rising seas may herald global warming

Have increasing amounts of greenhouse gases in the atmosphere warmed the planet enough to cause sea levels to rise? Though the answer remains far from clear, a new study hints it may be yes.

According to theory, a greenhouse warming could raise sea levels by melting continental glaciers and ice caps and by thermally expanding the oceans. Tide gauge records do indeed indicate that the sea levels around the world have risen over the last century by 10 to 20 centimeters. But scientists cannot be sure the oceans are truly swelling because a tide gauge doesn't measure absolute sea level; it only shows the relative levels between the coastlines and the oceans. If a coastline moves up or down while the ocean stays the same, a gauge will still indicate a change in relative sea level.

Many forces can affect the height of a coastline. In fact, Scandinavia and Alaska are rising because of a process called glacial rebound. Thousands of years after ice age glaciers retreated from these regions, the now unweighted crust is rising to its former level. This effect strongly influences sea levels around the globe, even in regions that remained ice free, says W. Richard Peltier of the University of Toronto in Ontario.

To get a clearer picture of the real sea-level trend, Peltier used a computer model to calculate glacial rebound around the globe and then subtracted this contamination from the tide gauge readings. The analysis indicates that sea levels are rising globally at a fairly uniform rate of 2.4 ± 0.9 millimeters a year, report Peltier and A. Mark Tushingham in the May 19 SCIENCE. "This signal could constitute an indication of global climate warming," Peltier says.

Tim P. Barnett at the Scripps Institution of Oceanography in La Jolla, Calif., says the Toronto researchers are the first to tackle the problem of quantifying the glacial rebound effect. But even with this removed from the records, it is not clear how much the seas are rising because other effects such as tectonic uplift and subsidence are altering relative sea level, he says.

Physical Sciences

More surprises from new superconductors

Although the search for new superconductors has focused largely on ceramic compounds containing copper and oxygen, one of the earliest ceramic superconductors, discovered in 1975, consisted of barium, lead, bismuth and oxygen. To gain a better understanding of the factors influencing superconductivity, researchers are now taking a closer look at the bismuth family. They find that very similar compounds can have strikingly different temperatures at which they lose their resistance to electrical current.

The original member of the family, barium lead bismuth oxide, becomes a superconductor below 12 kelvins. By using potassium instead of lead, researchers at AT&T Bell Laboratories in Murray Hill, N.J., can push the material's transition temperature to 30 kelvins – the highest transition temperature for a ceramic material not containing copper (SN: 5/14/88, p.309). But substituting the element antimony for bismuth in the original compound lowers the transition temperature to only 3.5 kelvins, even though the antimony- and bismuth-based compounds appear quite similar. This surprising result, reported in the May 25 NATURE, highlights the need to discover exactly why bismuth – rather than its close chemical relative, antimony – is the magic ingredient necessary for superconductivity at elevated temperatures.

Another puzzle concerns the behavior of recently discovered superconductors in which electrons rather than "holes" (the absence of electrons) carry the current (SN: 3/4/89, p.143). Almost all hole-doped copper-oxide compounds respond to increasing pressure by raising their superconducting transition temperatures, sometimes considerably. But a team of Japanese researchers, mainly from the University of Tokyo, reports in the May 25 NATURE that pressure appears to have almost no effect on the electron-doped superconductor neodymium cerium copper oxide.

According to the researchers, this difference in behavior may relate to the way copper atoms bind to oxygen atoms in the crystal lattice. In hole-doped superconductors, each copper atom usually sits at the base of a pyramid of oxygen atoms, with four oxygen atoms in the same plane as the copper atom and one oxygen atom above the plane. Electron-doped superconductors have copper-oxygen arrangements in which the upper oxygen atoms are missing. The new experiments suggest that pressure effects appear to arise from changes in the distance between copper atoms and nonplanar oxygen atoms.

Both recent discoveries illustrate how much scientists have to learn about the way ceramic superconductors work. "Every time we look, we find something new," says Robert J. Cava of Bell Labs. Theorists so far have provided little guidance on where to look for new superconductors or why known superconductors behave as they do. Adds Cava, "After two years of research, we still don't know why."

A quicker pace for magnetic fusion

For nearly 40 years, researchers in the United States and elsewhere have sought to harness the energy released when nuclei such as deuterium and tritium fuse. One approach – magnetic-confinement fusion – requires strong magnetic fields to confine the hot fuel mixture. A new report from the National Academy of Sciences, "Pacing the U.S. Magnetic Fusion Program," contends the United States has fallen considerably behind European programs for magnetic-confinement fusion. It recommends a 20 percent increase in funding for the U.S. program, currently $360 million, to permit the construction and operation of the Compact Ignition Tokamak by the early 1990s. Despite years of effort, researchers have not yet successfully operated a system in which the energy output exceeds the energy required to get the fusion reactions going.

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