

SAVING THE SHIELD

MARIO MOLINA describes the success of the

Montreal Protocol

in protecting the Earth's endangered ozone layer

There has been enormous scientific and technological progress during the past 100 years. The quality of life has increased in many ways - average life expectancy, for example, has more than doubled. On the other hand, it is now clear that the degradation of the environment is an unintended consequence of this progress. People first started altering the surface of this planet thousands of years ago, when they began to establish settled communities and develop an agriculture that required ploughing, irrigation and the clearing of forests. In the past, most environmental problems were local or regional. But, in recent years we have come to recognize that the impact of human activity on the environment has reached global proportions. The problems are now affecting the entire planet because they occur so often and in so many places.

International action to save the ozone layer

Perhaps the best understood global environmental issue involves chlorofluorocarbons, CFCs, and the ozone layer. CFCs are chemical compounds developed as replacements for toxic refrigerants. Once CFCs are released from the components in the atmosphere, they stroll all the way to the stratosphere where they deplete the ozone layer that protects life on Earth from harmful solar ultraviolet radiation. CFCs are released predominately in the Northern Hemisphere, yet the most striking effects of their release occur over the South Pole - far removed from the sources.

There are two important lessons to be learned from the CFC-ozone depletion phenomenon: first, that people are clearly capable of perturbing the environment on a truly global scale; and second, that people are also capable of solving such global-scale problems.

The CFC problem is now under control, thanks to the [Montreal Protocol on Substances that Deplete the Ozone Layer](#) - an unprecedented international agreement negotiated under the auspices of UNEP. Formulating the Montreal Protocol required the participation of scientists, industry representatives, policy makers and environmentalists: it is a very important precedent demonstrating how all these different sectors of society can work together and can be very productive functioning collaboratively. The Protocol also established a new way of addressing environmental problems: the original agreement

was negotiated on the basis of the ozone depletion theory which predicts that human-made CFCs would deplete the stratospheric ozone layer.

In another important precedent, the Protocol includes procedures for periodic revisions of its terms: as new scientific evidence of globally occurring ozone depletion became available, the agreement is modified and strengthened. The agreement also attempts to make the phase-outs fair for the developing countries: the revised agreement established the Multilateral Fund - provided by developed nations - to help developing countries adopt 'ozone-friendly' technologies.

It is clear that ozone depletion causes ultraviolet radiation levels to increase at the Earth's surface - though much remains to be learned about the overall impact of these increased levels on the biosphere. Despite this incomplete knowledge, the decision to call for a worldwide CFC phase out is well justified. The ozone layer is a very large natural system that provides an essential life-support function: the amount of solar energy absorbed by atmospheric ozone is more than ten times larger than the total amount of energy utilized by humankind. Scientific research has provided several crucial examples of ecological systems that are very sensitive to the level of ultraviolet radiation, such as certain fish larvae, amphibian eggs, and soy bean crops, etc. There are effects on humans themselves: excessive exposure to UV radiation is linked, for example, to higher incidence of skin cancer, eye cataracts and weakened immunity. There is also a basic understanding of these effects down to the molecular and biochemical level, in terms of damage to the DNA molecule.

Our heritage for the future generations

Fortunately much of the basic scientific research in stratospheric chemistry was in place when the ozone hole was discovered in 1985, thus allowing policy makers to take decisive action to protect the ozone layer. Ozone depletion is expected to reverse and recover measurably towards the middle of this century. And, of course, society still enjoys the benefits of refrigeration, air conditioning, plastic foams, aerosol cans, etc. - but now with new, CFC-free technologies.

My own experience with the CFC-ozone depletion phenomenon prompts me to believe that we can meet the challenge presented by global environmental issues in the 21st century. My optimism stems from observations of major changes in people's attitudes about environmental problems when considering that the health of the entire planet is at stake. We must change our view of the world and adopt new ways of thinking. The quality of life of future generations will be based to a large extent on our ability to deal intelligently with these global problems.

One of the key steps in any rational approach to addressing global environmental issues is to promote internationalism - a widespread understanding that all our human problems are interconnected. Regional and international cooperation will be essential to the solution of environmental problems, and UNEP has shown us the way to achieve it successfully.