# NOTES, NEWS & COMMENTS

## DuPont Position Statement on the Chlorofluorocarbon–Ozone–Greenhouse Issues*

In 1974, two United States scientists advanced the hypothesis that chlorofluorocarbons (CFCs), emitted at the Earth's surface, would gradually migrate to the stratosphere where they would break down to release chlorine which, in turn, would catalytically reduce the concentration of ozone. A reduction in ozone would permit more ultraviolet light from the Sun to reach the Earth's surface, with possible adverse consequences such as increased incidence of non-melanoma skin cancer and damage to some crops and marine life.

Concern over this hypothesis led US Government regulatory agencies in the mid-1970s to begin to phase out the use of CFCs as aerosol propellants—their then largest use. Some other, but not all, CFC-producing countries also took action shortly thereafter, although generally less severely. As a result, total world-wide combined production of CFCs declined and stayed below the 1974 peak level through 1983.

*Concern for Stratospheric Ozone Shield*

Since the theory was announced, DuPont has actively promoted, sponsored, and conducted, research to develop sound scientific understanding of the potential effects of chlorofluorocarbons on stratospheric ozone. Because the theory hypothesizes that ozone depletion would occur only gradually over a long period, and it was thought that answers to the scientific questions could be obtained in a fairly short period, we at DuPont have reasoned that there was time to develop the needed scientific understanding without harm to health or to the environment. This assessment, in combination with the lack of growth in total world-wide CFC production, led us to take the position in the late 1970s and early 1980s that further regulatory decisions should await the findings of the scientific research. Our position has been supported by actual measurements which show no persistent change in total global atmospheric ozone over the last 20 years, and by computer model simulations of the atmosphere which predict no significant change in total ozone over at least the next several decades.†

During the past twelve years, research by industry, government, and academia, has made significant progress in broadening our understanding of the atmosphere, but also has made us much more aware of its enormous complexity. Several aspects of the above-mentioned theory have now become well defined, but the overall uncertainties regarding the potential long-term effects of CFCs on ozone remain large, and we now conclude that it will be many more years before an adequate scientific understanding can be achieved. Furthermore, although science continues to indicate no immediate danger from CFCs at current emission-levels, the science is not yet sufficiently developed to define with certainty a safe CFC-emissions growth-rate, and all the models now predict that high sustained CFC growth-rates (i.e. leading to emission-levels from 3 to 5 times the current levels) would result in significant future ozone depletion.

It has also become apparent that the computer models will have to be upgraded, taking into account even more complex chemistry, physics, and meteorology. Moreover, the computer calculations must be tested against improved and more comprehensive physical measurements of chemical 'species' in the atmosphere, in order to increase our confidence in the predictive accuracy of the models.

*Concern over Greenhouse Effect*

Recently, the contribution of CFCs to the 'greenhouse effect' also has been cited as a matter of concern. Although the greenhouse effect is essential in maintaining the Earth at its current habitable temperatures, increases in atmospheric concentrations of carbon dioxide, nitrous oxide, methane, and CFCs, might increase that effect beyond a societally acceptable level. Additional greenhouse warming could lead eventually to rising sea-levels and altered rainfall patterns, with implications for coastal areas and agriculture.

As of now, we do not have a good knowledge of how much warming is likely, when it might occur, or the magnitude of any potential impact. As with the ozone issue, resolution of the uncertainties surrounding an increased greenhouse effect will probably take many more years.

Over the last few years, total world-wide CFC-use has begun to grow again and total combined production has reached the pre-regulation levels of the mid-1970s. Although we continue to believe that *no immediate hazard* to health or the environment exists from current levels of CFC emissions, the wisdom of permitting continued growth must be weighed against the existing inability of science to specify a safe long-term growth-rate. Resolution of this and other key scientific uncertainties in the ozone issue and greenhouse effects could take decades; therefore, we conclude that it now would be prudent to limit world-wide emissions of CFCs while science continues to work to provide better guidance to policymakers.

*Cooperation for Globality*

Because these environmental issues are global in nature, and because there are significant trade and economic equity questions associated with control measures, only cooperative action among countries will be effective. Therefore, DuPont supports the development and adoption of a protocol under the United Nations Vienna Convention for the Protection of the Ozone Layer, to limit world-wide CFC emissions.

We also call upon the United States Environmental Protection Agency (EPA) to employ the regulatory negotiation process for these issues and to appoint an advisory committee consisting of CFC users, producers, environmental groups, and the appropriate federal agencies. Consensus on the future of CFCs developed in this process could be used to guide the US Department of State in international negotiations, and to establish the basis for any further US regulation consistent with international agreements.

*Alternatives Available*

Because CFCs have so many important uses around the world, DuPont began a research programme in the mid-1970s to identify and develop safe, environmentally acceptable, and commercially viable, alternatives. Our findings, published in 1980, concluded that there were a number of alternative compounds which both met the environmental safety criteria and possessed the physical properties required for application in some (but not all) of the existing

* Received with a detailed circular letter dated 26 September 1986 from the Author.—Ed.

† *See*, however, the Guest Comment by Professor F. Sherwood Rowland (whom we think to have been one of the two US Scientists mentioned above) on pp. 193–4 of our latest issue, and the United States' National Ozone Expedition Statement on pp. 353–5 of this issue.—Ed.



*Environmental Conservation*, Vol. 13, No. 4, Winter 1986—© 1986 The Foundation for Environmental Conservation—Printed in Switzerland.

market uses of the CFCs of concern. One of these alternatives, CFC-22, is already produced in large quantities, and could be employed more broadly in refrigeration and air-conditioning in place of CFC-12 if appropriate use-equipment were developed.

Neither the market-place nor regulatory policy, however, has provided the needed incentives to make these equipment changes or to support commercialization of the other potential substitutes. If the necessary incentives were provided, we believe alternatives could be introduced in volume in a time-frame of roughly five years. This lengthy lead-time would be needed to complete required toxicity testing, to design and build production facilities, and to make the necessary changes in applications equipment. We have recently reviewed and updated our earlier work, and will share our assessment of the technically viable substitutes with EPA and our customers in the coming months.

Finally, we believe it is important for the CFC producer- and user-industries to develop improved conservation and recovery practices to reduce atmospheric emissions of CFCs. DuPont is studying a variety of technical and administrative approaches to reduce emissions, and we will share our views with the appropriate audiences in the coming months.

JOSEPH P. GLAS, *Director*
*Freon Products Division*
*Chemicals & Pigments Department*
*E.I. DuPont de Nemours & Company*
*Wilmington*
*Delaware 19898, USA.*

## Links Between Ozone Depletion and the Greenhouse Effect

The same gases which deplete ozone in the stratosphere contribute to the 'greenhouse effect' while they reside in the troposphere, or lower atmosphere. Chlorofluorocarbons (CFCs), which deplete ozone, are currently estimated to contribute about 15% of the annual increase of total global warming. Other so-called 'greenhouse gases' contribute the remainder.

Ozone exists throughout the stratosphere and the troposphere, where it acts as a 'greenhouse gas'. Ozone can increase in the troposphere as a result of ozone depletion in the stratosphere and as a result of the emissions of Man-made pollutants. Ozone in the troposphere currently is a significant 'greenhouse gas' contributing 7–8% of annual 'greenhouse warming'.

As ozone controls the temperature structure of the stratosphere, ozone depletion could have an impact on climate—adding to the changes brought about by the warming of the lower atmosphere by 'greenhouse gases'.

A general warming of the Earth's climate could increase demands for air-conditioning, thereby increasing demands for CFCs, emissions of which would further deplete stratospheric ozone and amplify warming. Increased air-conditioning could also lead to an increase in the emissions of carbon dioxide as a result of increased demand for electricity generated by fossil fuels, further amplifying global warming.

WORLD RESOURCES INSTITUTE
*1735 New York Avenue, NW*
*Washington*
*DC 20006*
*USA.*

## Waste Minimization Forums Delineate 'State of the Art' of Efforts to Eliminate Hazardous Effluents at the Source

A series of professional forums in the United States has documented the vast potential, as well as significant obstacles, that are in store for *waste minimization*—systems approaches to reduction or elimination of hazardous effluents in industrial processes prior to the treatment stage.

Formally introduced in 1976 as *non-waste technology* by the Economic Commission for Europe, the concept of waste minimization has recently become of great interest in the United States. As industries seek to reduce hazardous-waste disposal costs and avoid massive liability suits arising from improper disposal, they are turning increasingly towards waste minimization. Consequently late in 1985 the undersigned, Director of the Resource Policy Institute in Washington, DC, teamed up with the Washington-based Government Institutes, Inc., to put together what became the first major professional-level forum series on this topic.

According to information presented in the series, the total hazardous-waste 'stream' could be reduced by as much as 50% through vigorous waste-minimization programmes. Roughly half of this reduction could be achieved through relatively simple maintenance and redesign efforts, while the other half would have to be accomplished through basic—and potentially costly—redesign of industrial processes.

Lack of basic information, as well as reluctance in the industrial sector to share proprietary information, has hampered waste minimization, according to forum participants. At the same time procurement policies of industries and government agencies, contractual restrictions, and direct government regulations, can all prove to be significant inhibiting factors for changing standard processes to less-polluting ones.

As discussed in detail at these meetings, government action may be necessary to increase waste minimization activities in the private sector. While the economic incentives for waste minimization are strong, some streamlining of waste minimization mechanisms might be effected through government action. Technical assistance and information transfer—being effected to limited extents in state government agencies—are the most frequently cited forms of federal government involvement. Required reduction targets for the national waste 'stream', grants programmes, and even regulatory concessions which would allow industries to take extra time to develop waste minimization practices in lieu of end-of-pipe treatment systems, should also be mentioned.

While there is disagreement about the role of the federal government in waste minimization, there is considerable agreement about the role of corporate management in the field: the higher the level of management involvement is, the more effective will waste minimization programmes prove to be.

ARTHUR H. PURCELL, *Director*
*Resource Policy Institute*
*P.O. Box 39185*
*Washington*
*DC 20016, USA.*