Ms. Fedak: We will hear next from Dr. Richard B. Ward, a native of England and a research associate for E. I. du Pont de Nemours & Co. After taking a BSc degree and a PhD at the University of Birmingham, Dr. Ward studied as a fellow at Ohio State University, then joined du Pont in 1959. Currently, as technical consultant for liaison on toxicology and environmental effects, he works in research and development of fluorocarbon aerosol propellants. His previous assignments have included research in carbohydrates, radiation chemistry, fluorocarbon synthesis, fluorinated polymers, permeation, and dye production.

The Future of Fluorocarbons, Status Report

Dr. Richard B. Ward, E. I. duPont de Nemours & Co.

During the period between 1970 and 1974, a program to determine the environmental impact of fluorocarbons was initiated and funded by industry. Dr. J. E. Lovelock, at the University of Reading, England, developed an extremely sensitive analytical device called an electron capture gas chromatograph. This device is capable of measuring a few parts per trillion of compounds such as the common fluorocarbon propellants, FC-11 and FC-12. Dr. Lovelock found these fluorocarbons in the "background atmosphere," away from sources of release. Measurements showed the background concentrations were increasing and were comparable to, but less than, the estimates of total release to date. The first conclusion was that these fluorocarbons have a long lifetime in the atmosphere.

Dr. Taylor and Dr. Pitts, at the University of California, Riverside, showed that fluorocarbons had no effect on smog formation and were not destroyed by smog reactions in the atmosphere. Dr. Sandorfy, at the University of Montreal, Canada, showed that very energetic ultraviolet light could break down fluorocarbons. This light is absorbed in the stratosphere, and does not reach ground level. Given enough time, long-lived compounds can diffuse high enough to encounter the energetic radiation. At high altitudes, the fluorocarbons would be dissociated to give chlorine atoms. It was expected, early in 1974, that the chlorine atoms would be converted to chloride ion and eventually return harmlessly to the oceans. The environmental impact appeared negligible.

Ozone depletion hypothesis

Coincident with this environmental study was a major research program, the federally supported Climatic Impact Assessment Program (CIAP), which attempted to define the effect of supersonic transports on the upper atmosphere. Important developments in our understanding of the stratosphere emerged, including speculation that chlorine atoms may catalytically react with ozone. In June of 1974, Dr. Molina and Dr. Rowland, at the University of California, Irvine, postulated that fluorocarbons could provide the chlorine and, thus, the catalyst to convert ozone to ordinary oxygen. A computer program was used to "model" atmospheric processes and hence to calculate ozone depletion. Such depletion might cause serious biological effects since ozone filters out some of the ultraviolet light from the sun. Among these potential effects is the incidence of certain types of nonmalignant skin tumors in light-skinned people (Caucasians), which appears to be correlated to the amount of ultraviolet exposure (e.g., in sunbathing and other outdoor activities).

The issue became news immediately and has resulted in extensive technical, legislative, environmental, and political activity.

The key questions were rather promptly defined. What additional information is needed to determine whether the theory is quantitatively correct? Who can get this data? How long will it take?

The questions were resolved rapidly in 1974, resulting in a substantial expansion of the industry program under the auspices of the Manufacturing Chemists Association. Federal recommendations made in 1975 were in close agreement with industry recommendations. The time period for the work was estimated at about three years, with frequent reassessent during that period. Over $1.5 million was funded in 1975 by the fluorocarbon industry, and estimates for the three-year period now exceed $5 million.

At the Federal level, an analysis report of the Federal Task Force on Inadvertent Modification of the Stratosphere (IMOS) concluded that the question was a legitimate cause for concern, and charged the National Academy of Sciences with the task of reporting on its technical aspects. The report, originally expected about April 1 of this year, has been delayed as a result of new technical developments.

We must assess two areas; First, is the chemistry included in the model quantitatively accurate? Second, is our understanding adequately complete?

Some data have been obtained which are compatible with postulated steps in the model, such as the diffusion of fluorocarbons to the stratosphere and breakdown to yield chlorine atoms. Some reaction rates have been remeasured more accurately, resulting in downward revision of ozone depletion estimates. Continuing progress in this area is anticipated.

It is the omissions from the model which have taken the spotlight recently. Later measurements of the amount of hydrogen chloride in the stratosphere were dramatically different from predictions. Chlorine nitrate, introduced as new chemistry not previously included, has the potential for a major revision of the theory. Higher oxides of chlorine are also being reconsidered. The importance of this new chemistry is that it tends to short-circuit the chain or catalytic reaction at the heart of the ozone depletion theory. This new work has resulted in the National Academy of Sciences delaying its important technical report.

Examination of actual ozone measurements (in contrast to calculations) must contend with large natural variations, and the small calculated amount of depletion would be difficult to detect. A number of attempts to detect, globally and locally, the effects of trace gases, volcanic activity, and atmospheric nuclear weapons on ozone concentrations have been unsuccessful. While not refuting the theory, such assessments do establish an upper limit for depletion effects.

On the legal scene, Section 107 of the Clean Air Act Amendments (HR 10498) and comparable Senate legislation have been supported by the fluorocarbon industry. Such legislation expands Federal research programs and would appoint an agency to review the research. A finding of probable harm would be required prior to restrictions or bans, the so-called positive burden of proof. A number of states have bills under consideration, but to date only Oregon and New York have passed bills. Industry has opposed legislation at the state level since, if action is needed, a national or even an international approach is desirable. Also, it is only at the Federal level that adequate technical resources can be mustered to produce a technically sound assessment.

One important question is, if the ozone depletion should be verified, what would be the incremental effect on ozone if action were delayed to 1978 so that decisions could be based on the research results? Computer calculations show this effect would be an undetectable 0.5 percent incremental depletion from all worldwide fluorocarbon use. This maximum effect would, the calculations predict, occur in the mid-1980s and be followed by a recovery. Considering just the use of aerosols in the United States, the maximum depletion is reduced to just over 0.1 percent. Since the ozone overhead naturally lessens toward the equator, the 0.1 percent depletion is equivalent to a southward move of about eight miles. When reduced to such understandable terms, we see why the incremental effect can be termed insignificant. This analogy assumes the model is correct, and, as mentioned before, important new chemistry, which is emerging, is expected to reduce the calculated impact still further.

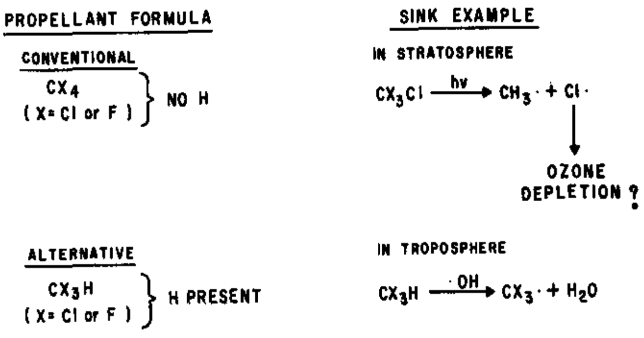
Alternative fluorocarbon propellants

While the environmental or ozone depletion issue is not yet resolved, we recognize that fluorocarbons perform important functions in our life, including, but certainly not limited to, aerosol propellants. Under these circumstances, no one is well served by waiting until the last minute to plan for possible contingencies.

At du Pont, we have initiated a search for alternatives for the major uses of fluorocarbons as a contingency plan. Alternative aerosol propellants have a priority position in the event that environmental research generates creditable scientific evidence that existing products must be restricted. The key interdependent criteria include: toxicology, environmental advantage, efficacy in use, production capacity, raw material availability, and economics.

Extensive, complex, and time-consuming studies are needed to develop possible alternative fluorocarbon compounds. These include measurement of environmental acceptability and toxicology as well as product formulation and performance testing. In addition, it is necessary to invent new process technology that is economically reasonable and to establish a source of raw materials.

BASIS FOR ALTERNATIVE PROPELLANTS



Some possible alternative fluorocarbon compounds are those from the methane/ethane groups which contain hydrogen. Present scientific evidence suggests that these compounds suffer hydroxyl radical attack in the troposphere, which FC-11 and FC-12 do not. This reaction could reduce to insignificance the volume of these compounds passing to the stratosphere. As a first study, we used FC-22 and FC-142b because of the potential availability of these compounds and their favorable toxicology. We recognize, however, the unfavorable flammability characteristics of FC-142b. In simulation studies, all major aerosol products have been successfully formulated and are undergoing or have completed life tests.

Our research effort continues with other fluorocarbon compounds, which may offer better end use performance and economic characteristics than those provided by FC-22 and FC-142b. The goal is to find propellants that present the greatest consumer advantages should circumstances dictate the replacement of the propellants presently used.

Until those circumstances arise, the use of the current fluorocarbons is in order. Clearly, we do not believe that there is good reason at this time to formulate away from FC-11 and FC-12.

Ms. Fedak: And now I wish to introduce our luncheon speaker.

Out in Cleveland—or to be exact—Lakewood, Ohio, there is a very solid and innovative cosmetic house, which is celebrating its fiftieth year in business. That, of course, is Bonne Bell.

Some of us have been lucky enough to visit the unusual Georgetown Row complex that is company headquarters there. And a few of us have had a peek at the drawings of the new manufacturing plant that will be ready this fall. As you might suspect, it won't look at all like a factory, but will suggest the rural charm of a blue-grass thoroughbred horse farm.

Behind these exciting creations is a bright and refreshing fellow, who has turned Bonne Bell into an extension of his own personality. He loved tennis, got to be a darned good player, and, sure enough, Bonne Bell became a staunch backer of the USLTA and, later, the sponsor of the Bonne Bell Cup matches. In skiing, the same thing happened. As he got sharper on skis, the company became actively involved with the U.S. ski team. It developed a line of products aimed at protecting skiers. That catchy slogan, "Out there you need us, Baby" became "Out there you need Bonne Bell," when he embraced backpacking, mountain climbing, and, especially, running.

He and his wife, Julie, jog to the office every morning. They have even run in a 26-mile marathon together. It's a pleasure to introduce a man who literally runs around with his wife—the president of Bonne Bell—Jess Bell.

The First 50 Years were the Easiest: How to Survive as a Family Business

Jess A. Bell, Bonne Bell Co.

The business called Bonne Bell began in 1927 with the establishment by Jesse G. Bell of a cosmetic company in Cleveland for the purpose of manufacturing and marketing cosmetic products. He had previously been a salesman for a wide variety of products, finally with a cosmetic company in Kansas City. The company had a general line of products, primarily creams and lotions, until the company purchased a formula and rights to 10-0-6 lotion from a Cleveland chemist. It quickly became the company's leading product and expanded the company's potential market and retail outlets enormously. The success of this product led the company into a wider range of skin care products for all ages, but particularly for the youth market.

The big crisis in the company's development came during the late 1960's when great inducements were made to merge the Bonne Bell company into very large conglomerate enterprises. After firmly facing and rejecting this alternative, Bonne Bell, Chairman of the Board, and Jess Bell, President and Chief Executive Officer, have directed the company toward balanced national and international growth. The third generation of Bells is John Eckert, Managing Director of Bonne Bell, Canada, and son of Bonne Bell and William J. Eckert, Vice President—International for the company.

The newest development in the Bonne Bell story is the construction of a new manufacturing and shipping headquarters in Westlake, Ohio. This new 100,000 square foot plant on an 18-acre site will bring all of Bonne Bell's manufacturing, shipping, and laboratory facilities under one roof. From the street, the new Bonne Bell factory will look more like a Kentucky horse farm rather than a modern manufacturing plant. This building will be known as the Robert W. Gould Memorial Building and pay tribute to the man who was the first Vice President