CANCER

XC for

TOXIC SUBSTANCES

HOW SHOULD WE PROCEED?

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"Toxic Substances" certainly have captured the attention of the public and put the chemical industry in the news media on a regular basis the past few years.

Concerns have arisen over a number of chemicals and their impact on man and his environment. These included DDT and its threat to certain species of wildlife; PCB's and their accumulation and effects on aquatic organisms; mercury, and its effects on man; and several others. But more recently the concern that seems to have captured the attention of the press, and therefore the public and Congress more than any other, is the role of chemicals as causitive agents for cancer. EPA Administrator

Douglas Costle has broadly implicated industrial chemicals in "the occurrence of silent epidemics of cancer and other health risks". Nothing has contributed so much to the fear of chemicals as statements of this type in the highest levels of our government. The flames of fear have been fanned by statements relating to the rising incidence of cancer, and implications that in just a few years it will overtake all of us. Such statements may lead to new laws and increased Agency funding, but ignore reality.

Consider the following facts:

1) There is no overall increase in cancer mortality rates in the United States if the national cancer mortality statistics are adjusted for the growth in lung cancer, 90% of which, experts believe is attributable to smoking, and for the increased length of life in the population. This increase in life span, incidently, is from about 46 years in 1900 to 74 years in 1974.

2) The United States, the country with by far the largest chemical industry, is not the world leader in cancer death rates. We rank about in the middle of the 44 countries for which statistics were given by the American Cancer Society.

3) An epidemiological study in Dow's Midland, Michigan plant, one of the largest and most diversified chemical plants in the world, showed the mortality rate due to cancer was slightly less than that of the U.S. population. If industrial chemicals were really a major cause of cancer, it should show up first in the industrial work environment.

A recent editorial in the Journal of the National Cancer Institute by Drs. E. L. Wynder and G. B. Gori of NCI placed in perspective the issue of environmentally caused cancer. Their editorial was prompted by the often repeated statement that 90% of human cancers are of environmental origin. They concluded that lifestyle factors, such as cigarette smoking, exposure to sunlight, alcohol consumption, and improper diet are the prime causes of "environmental" cancer.

Contrary to popular belief, "specific carcinogens play a minimal role in the relationships between nutrition and the development of cancer". There are no data "that identifies food additives or industrially produced contaminants in food as causes of environmental cancer". Air pollution does not play a major role in causing cancer. Studies by NCI in 44 states found no difference in lung cancer rates between industrialized and rural areas when smoking habits were taken into consideration. In addition, research by the American Cancer Society discovered no evidence that general urban air pollution contributes to an increased risk of lung cancer.

So much for the good news. There is some bad news.

Excessive exposure to cancer causing agents in the workplace does increase the risk of cancer. The experience with VCM, asbestos, certain aromatic amines, and several other chemicals does indicate that prolonged exposures to certain materials can cause cancer as well as other serious forms of disease. Although such instances are relatively rare, they are real, and excessive exposures that lead to such adverse health effects must be detected and avoided.

My point is this. I do not believe we are in danger of having a "Silent Spring", as Rachel Carson predicted in the 1960's, nor are we about to "experience an occurrence of silent epidemics of cancer and other health risks". But there are risks associated with chemicals we should and can avoid. Chemicals are toxic, and I don't mean just a few, I mean all chemicals are toxic. In fact, it is this very property that makes some of them useful. I am thinking of chlorine as a disinfectant, pesticides and many pharmaceuticals. But in every case, whether it be the oxygen we breath, the water we drink or the most exotic chemical in the laboratory, if excessive or inappropriate exposures occur, serious adverse effects will result. The toxicity of chemicals is not a yes or no proposition. It is strictly a matter of degree, and it must be dealt with as such.

But who will assume the responsibility for obtaining the information that will allow us to determine the degree of toxicity of a chemical, and how will we make sure excessive exposures are avoided? I believe the responsibility rests squarely with the chemical industry -- with those who make and use the chemicals that have proven so useful to our society. I also believe that leaders of the industry have accepted this challenge and are working hard at it. In my own company we call it Product Stewardship, which according to our president means: "We are committed to exercising responsible care for our products both in manufacturing and distribution and use by our customers. This means assessing the environmental impact of the products and then taking appropriate steps to protect employee and public health, and the environment as a whole. In addition to safe production and distribution, as well as judicious customer use, it means we have a continuous concern for the ultimate disposal of our products in the environment".

Other major chemical companies have adopted very similar positions, and I think it's clear the industry has accepted this responsiblity.

I am most familiar with the health and environmental testing aspects of our Product Stewardship program. Such testing didn't start just yesterday. Our Toxicology Laboratory dates back to the early 1930's as do other industrial toxicology labs. Most of the toxicological information on chemicals available

in the literature today came from industrial laboratories or through industry-sponsored studies. The recent formation of the Chemical Industry Institute of Toxicology is an indication that activity is accelerating in this area as the needs are becoming more broadly recognized throughout the industry.

The major thrust of our efforts is in understanding the effects on man caused by exposure to chemicals. This is necessary not only because of our high degree of personal interest in the human race, but also because man is exposed or potentially exposed to chemicals during their manufacture and use.

But we also need to consider the environment around us, and what effects those chemicals might have on the environment. Here things get even more complicated, since we know there is a vast array of organisms living in the biosphere. The number of known species of fish is believed to be in the neighborhood of 32,000. About 1/3 of these are freshwater fish. There are about 9,000 known species of birds, 6,000 mammals, 7,000 reptiles, and 3,000 amphibians. Add to this the tremendous number of invertebrates, lower organisms, and the entire plant kingdom, and the task of testing chemicals for their impact on environmental organisms becomes mindboggling.

How do we decide which organisms to do our testing on and what tests to do? A careful look at exposure potential provides a clue to the direction our testing should take. Terrestrial

organisms, or those that live on the land, will be exposed to industrial chemicals mainly as they are transported through the atmosphere. Industrial chemicals placed in confined land areas or in water have very little potential for broadly exposing terrestrial organisms. This is because of the nature of the use and disposal patterns for these materials, and because of the way they tend to move in the environment once they are released.

Consider the atmosphere. It can be conveniently divided into three compartments according to the way materials move in it. These are: (1) the northern troposphere, (2) the southern troposphere, and (3) the stratosphere. The troposphere extends up about 10 km or about as high as an airplane flies, where the atmospheric pressure is about 200 mm of mercury. There a temperature inversion takes place, and the movement of materials across that layer, called the tropopause, is relatively slow. It requires about 50 years to transfer chemicals across that boundary into the stratosphere. Within the northern troposphere mixing takes place quite rapidly. The same is true for the southern troposphere. Materials that enter either the northern or southern tropospheres are fairly uniformly mixed within their respective tropospheres within a matter of a few weeks. However, because of the wind patterns around the globe, transfer of materials from the northern to the southern troposphere is relatively slow, requiring about a year. The overall results are that most industrial chemicals that enter the atmosphere are very rapidly mixed in the northern troposphere, are more slowly transported to the southern troposphere, and only very slowly move into the stratosphere.

The troposphere is extremely large. It is about 100 times bigger than the total volume of water on the surface of the globe. Because of the rapid mixing in the troposphere, and because of its large size, the concentrations of industrial chemicals found there are extremely low. Even for those materials that are used and released in very large quantities, and are persistent such that they tend to accumulate in the atmosphere, the concentrations do not exceed a few hundred parts per trillion.

One additional point about the atmosphere. It contains many reactive molecules and radicals generated by the interaction of sunlight with oxygen, water vapor and the oxides of nitrogen. One such radical is the OH radical, and it tends to react with any organic compound containing a hydrogen atom or a carbon-carbon double bond. For this reason we know that most synthetic organic chemicals will decompose in the atmosphere, a further indication that the concentrations of these materials in the atmosphere will be extremely low.

The water environment is somewhat different. As we mentioned, the volume of water available on the surface of the globe is only about 1% of the volume of the troposphere. Of the 1.4×10^{21} liters of water present on earth, 97% is in the oceans, an additional 2% is frozen in the polar ice caps, about 1% is subsurface ground water, and only about 0.02%

is present in freshwater lakes and streams. Water bodies are not well mixed like the atmosphere, and for certain freshwater bodies the residence time of a chemical may be extremely long. For example in Lake Michigan, through which very little water circulates compared to its size, the residence time for a chemical that doesn't decompose or volatilize is of the order of a hundred years, and the same is true for Lake Superior. However, for smaller, shallower lakes, such as Lake Erie, we are dealing with residence times closer to two or three years. For most freshwater rivers which move quite rapidly, materials which are soluble in water are swept out of the river and eventually to the ocean in a matter of weeks.

This means that for chemicals which enter and travel in water, the volume available for dilution is not very large. Even for relatively small chemical releases, it is possible for significant concentrations of chemicals to be encountered in freshwater environments.

Considerations such as these have caused us to concentrate our environmental studies on the impact of chemicals on aquatic rather than terrestrial organisms. We have been at it at Dow for about 15 years now, and we find that fish are good indicator organisms for water quality. Toxicity testing is extremely important, but it is necessary to be selective in terms of what tests are run. We also need to be realistic in the

exposure levels tested. To do otherwise will misdirect our laboratory studies, and we may miss the most important discoveries that need to be made.

The testing requirements imposed on industry by the pesticide law are a good example of a cookbook approach to environmental testing that we need to avoid. Many tests are required under FIFRA whose results are predictable from the basic chemical and physical properties of chemicals. We are using valuable scientific resources to do some of these tests that could be much better utilized in other areas.

After completing our laboratory studies, in keeping with our Product Stewardship philosophy, we decide what extraordinary measures, if any, must be taken to assure that a (new) product will not pose an unreasonable risk to health or the environment. We may voluntarily withdraw a product, as we did with an organo-arsenic compound several years ago; we may recommend only limited uses of a chemical, or we may work closely with customers to train their personnel in proper handling procedures. We have done and will continue to do these things to promote the safe use of chemicals <u>without</u> governmental "help" or motivation.

Sure, people will cite DDT, PCB's, Hg, and VCM as examples of chemicals which may have caused problems. Think for a moment, and add to these four chemicals those materials which you believe were improperly tested, used or handled. What is your

total? 10? 14? 20? Now compare your total to the approximately 50,000 existing commercial chemicals, and I think you will agree that the chemical industry has had a good track record.

So how do we deal with "Toxic Substances"? We have discussed several points:

1) Although chemicals have been much maligned in the news media and in high places in government, there is no data to support the statement that we are about to succumb to a silent epidemic of cancer or other health risks induced by chemicals.

2) All chemicals are toxic to varying degrees. We must understand the important biological properties of the products we produce, use, and release.

3) The chemical industry must and does accept the responsibility for evaluating its products and for appropriately controlling them. We won't always be perfect, and we will always have some risk, but we will continue to do out best to minimize it.

4) We must be selective and realistic in our approach to toxicity testing. To do otherwise will concentrate our resources in the wrong areas.

5) The nature and extensiveness of toxicity testing required for a chemical depends to a large degree on the degree of exposure expected. Testing should be concentrated on representative organisms where exposures will be significant.

We need to recognize the role of government in dealing with Toxic Substances. We now have about 30 "environmental laws" on the books, and several government agencies are involved in implementing those laws.

EPA, a cosponsor for this meeting, has a big responsibility in this area. EPA has some excellent scientific talent in its research organization. It is indeed unfortunate that they are not properly used in the regulatory program. Etcyl H. Blair of Dow, in a public address some time ago, recommended that EPA elevate its scientists to at least equal prominence to the lawyers in the decision-making regulatory process. The recommendation is still appropriate. Regulations need to be based on scientific fact, and not on emotion, politics, or the opinions of the uninformed.

The EPA has declared that toxic substances will be their primary target in the years ahead. I hope this implies selectivity along the lines we have discussed, and if so, I think a good program can evolve.

Sometimes the law seems to take away some of that selectivity. A case in point is the recent Amendments to the Water Pollution Control Act now before Congress. By legislative decree, Congress will declare 129 chemicals to be Toxic Pollutants to be regulated in water discharges, with apparently very little regard for which organisms will be exposed or for their importance. A far better approach could and should have been taken by regulation under the Water Quality Criteria section of the Law, which allows the EPA to take into account the effects of chemicals on specific portions of navigable waters so as to assure protection of public drinking water supplies, aquatic organisms living in the area, etc. If the Agency interprets Section 307 as they have in the past, we will have to treat the ocean as though it were a drinking water supply. Make no mistake. Such an approach will be expensive, and at a time when we are struggling with such major issues as energy supply and foreign competition, additional unnecessary economic burdens are not in the best interest of the American people.

I would like to leave one final thought with you. It's not original with me. It comes from Section 2 of the Toxic Substances Control Act, and I quote: "Authority over chemical substances and mixtures should be exercised in such a manner as not to impede unduly or create unnecessary economic barriers to technological innovation, while fulfilling the primary purposes of this Act .....". And further, "It is the intent of Congress that the Administrator shall carry out this Act in a

reasonable and prudent manner, and that the Administrator shall consider the environmental, economic, and social impact of any action the Administrator takes or purposes under this Act".

The Congress clearly intends that the chemical industry remains a dynamic, innovating force in our society. The American chemical industry has been a major contributor to the high standard of living we enjoy in our country, and to the world technological leadership we possess. Virtually every major industry in our country, including agriculture, transportation, energy, medicine, and many others use products and technology developed by chemical companies. Small wonder that Congress stated so clearly that the Toxic Substances Control Act be implemented within the framework of preserving this quality of the industry. Although not explicitly stated in the Air, Water and Solid Laws, I believe the Congress and the public expect these laws to be administered in the same spirit.

I would like to suggest that the EPA take this directive so seriously that a section be set up within the Agency to insure this mission is carried out. Here are some objectives for consideration:

1) Make sure standards promulgated by the Agency are realistic performance standards and not technology prescription standards. We need to be told what must be accomplished, and why, and not how to do it.

2) Under New Source Performance Standards and Best Available Technology, make sure the Agency asks for no more information than necessary to determine the level of performance achievable. Trade Secrets are the protectors of research innovations, and without such protection economic incentives for research are lost. Obviously, without research there will be no innovation.

3) Keep the Agency out of the business of technology development. That is the role of the private sector. If a particular substance must be removed from an effluent, tell us with the reasons why, and we will figure out how to get the job done.

4) Don't ask for all the information we have at the research and pilot plant level on removal of specific chemicals from water or air. Regulations can't be based on this type of information, so it is of very little value to the Agency. The effect on industry of making requests of this nature will only discourage them from doing research in this area, and in the long run will decrease our innovative capacity for improving the environment.

5) Make sure the health and environmental testing program under TSCA remains flexible and reasonable, with room for innovation, so that the science of testing itself does not stagnate.

These are just a few of the areas that need to be addressed to make sure innovation does not succumb to bureaucracy. The Department of Commerce could provide assistance in making sure the freedom to innovate is not lost. Industry, too, must be alert and hold fast to this point. It will be a challenge and will require a concerted effort by all of us. But, if the EPA will take the words of Congress seriously, just as industry must take its responsibilities seriously, I believe we can do much together to make sure that the public, the birds, the bees, the fishes, and other creatures of value to man that live on our earth will benefit from, but not be adversely affected by Toxic Substances.