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# Emission Modifications: Overview

by Robert E. Neligan*

The theme of this conference is "to explore instances in which unexpected and perhaps unwelcome secondary effects, repercussions and or feedbacks have developed in biometeorological relationships as a result of the imposition of some environmental control measure." I would like to speak on this theme from the viewpoint of the control strategist.

The Clean Air Act of 1970, in brief, established a national air pollution control program which called for the measurement of health effects to determine air quality standards and the development of a schedule of emission controls or regulations which would achieve these standards within certain time frames.

In order to carry out the mandates of the Clean Air Act, control actions had to be developed and implemented. Such actions in almost all cases were of an extremely complicated nature and in many cases aroused two extreme reactions. At one pole, so to speak, is a group that recommends that control actions wait until all scientific solutions have been explored and completely validated before control programs are established. At the other pole is a group that insists on immediate action, abandoning any scientific approach and that actions be made on the basis of arbitrary judgment or intuition.

The first group, who believe that all of the scientific information must be known before actions are taken, are in effect making a decision that no action be taken until all the results are in, no matter how long it took. This position was untenable from the viewpoint of the congressional mandate and public policy issues. The second group, who desired immediate action, no matter how arbitrary, is also in error, as such precipitous actions could lead to control programs that increase the probability that resulting control measures would be technologically or economically impractical or result in social upheavals that would not be acceptable to the vast majority of the public.

The pollution control official is exposed to the arguments of these two groups daily. He is faced on many occasions with decisions that must be made, knowing full well that the information available to him to arrive at a decision is uncertain at best. He fully realizes that if the decision to control emission is unnecessarily strict, that it may result in wasted money, natural resources and possible adverse biometeorological effects. Yet the prudent control official must set his control policies by resolving any uncertainties in favor of the public's health, even if such decisions may prove to be unnecessarily strict. He must also make his decisions with the realization that he does not know, and may not for many years, that the control measure may have some unknown side effects that could be detrimental to the public health and welfare. His decisions in science, engineering, and particularly business, must and usually are made on data and information

* National Environmental Protection Administration Research Center, Research Triangle Park, North Carolina 27709.

available at the time that the decision must be made. The decision maker is, and perhaps always will, be faced with a degree of risk in the making of his decisions.

I will attempt to relate only a few instances where to my knowledge unexpected and unwelcomed secondary effects have taken place in the imposition of environmental control measures. Certainly, the replacement of more highly reactive hydrocarbons with less reactive hydrocarbons appears to have improved the oxidant problem in local areas, but has resulted in higher oxidant formations in downwind receptor sites. The substitution of aromatic hydrocarbons for lead to enhance the octane rating of gasoline would result both in higher local oxidant formation and increased concentrations of polynuclear compounds having carcinogenic properties unless some type of catalytic control device is used. Certainly, the catalytic muffler has come under suspicion lately, due to the possible oxidation of sulfur in the gasoline to a sulfate form. The use of after-burners, when not properly maintained, can result in the formation of more highly reactive hydrocarbons that those it is designed to control. The tall stack is another instance of a control strategy providing relief to a small local area causing detrimental effects many miles away downwind.

In the area of solid waste control, we have experience various detrimental side effects. If material is buried in an unsatisfactory way it can cause pollution of underground water supplies or produce volatile hydrocarbons decomposition products which ultimately percolate up through the soil, and, if buildings are built above the landfill, can accumulate and explode. When solid wastes are burned, emissions of such metals as lead or mercury may result. Even the use of sludge as a fertilizer or soil builder has its drawback: trace metals present in the sludge can be taken up by crops and introduced into man and animal via the digestion of food. Yet we must dispose of our waste materials or their sheer bulk would overcome us.

This thought leads me to a rather interesting fact that I read some time ago. The point was made that the invention and proliferation of the automobile, even with its effect upon the quality of the air, had overcome a serious waste disposal problem: if horses were still used for transportation and services on the island of Manhattan, horse manure would accumulate to a height of 10 ft daily. No one consciously determined around the turn of the century that the automobile was a solution to a waste disposal problem; if he had, he would not have been able to foresee, through the scientific information available at that time, the great effect that the motor vehicle would have by mid-century on our ambient atmosphere.

In the technological society in which we live in today, there are, and will continue to be, actions taken in the form of control measures which undoubtedly will have some unexpected side effects. The answer to reducing or avoiding such effects in the future is, of course, to call for more research to be performed and information obtained, before such environmental control actions are put into widespread use. I am sure that there is no one present today who would not desire more information in any field of endeavor that he is associated with, before he has to make as significant decision. He must, therefore, be prepared to continue to insist that more resources be put into research and the development and the collection of information in a timely manner so that he might be better informed at the time critical decisions have to be made. Certainly, the most prudent course of action would be that we not allow any man-made pollutant to go into the atmosphere. However, as we all know, this is not technically or economically feasible at this time.

Before closing, I would like to quote Senator Muskie speaking on the topic of air pollution control: "You cannot wait in this field until you eliminate all the uncertainties or unveil all of the unknowns. If we had done that, we would not have the Clean Air Act. You have to work with the best available information." I believe that it is the task of all

of us concerned with the control of pollution to do our utmost to see that the best information is available.

## Discussion

G. C. HASS (*Vehicle Emissions Control Program*, California Air Resources Board): The abatement of systems which change the composition or content of effluents would call for the undoing of almost every vehicle emissions control measure undertaken in the United States since 1960. Most of the control schemes in use involve to some degree a change in the composition of the exhaust gases.

The first step was crankcase emissions control, which inherently had the undesired effect of increasing carbon monoxide exhaust emissions as blowby rates increased from engine wear. The advent of engine modifications to control exhaust emissions of hydrocarbons and carbon monoxide coincidentally increased the emissions of nitrogen oxides. Abatement of the nitrogen oxides introduced further changes in the composition of the organic fraction of exhaust emissions. Even evaporative emission controls result in the introduction of hydrocarbons into the carburetor after a soak period, with consequent temporary increase in cabon monoxide emissions.

The response of the California regulatory authorities to these events was first outright prohibition of undesired emissions, followed closely by more or less successful attempts at their limitation. These efforts are currently tied to the General Standards statement in the Federal Register: ". . . shall not in its operation or function cause the emission into the ambient air of any noxious or toxic substance that would not be emitted in the operation of such vehicle without such system, except as specifically permitted by regulation;" This prohibition may be read as qualitative, quantitative, or both.

Making tradeoff decisions in vehicle emissions control has been made more difficult by the concentration on threshold levels as exemplified by the Air Quality Standards approach. Real-life decisions frequently involve tradeoffs between two or more pollutants at levels far above threshold. In the absence of understandable inputs concerning the relative undesirability of the pollutants, decision-makers can only apply their emotions and intuition, or, like Hamlet, decide rather to "bear those ills we have than fly to others that we know not of."