

ated. Extensive investigations conducted by the U.S. Army Environmental Hygiene Agency have been reviewed by the National Academy of Sciences Advisory Center on Toxicology, and again cooperative efforts are being undertaken on an interagency basis to develop appropriate guidance as to permissible concentrations of these materials in the environment, and to use these as the basis for engineering design of abatement works.

Of special interest are the programs regarding environmental pollution associated with rocket and space propellants. Many of the materials which have a possible use in this program are known to possess toxic and hazardous properties. In some instances there is incomplete data even with regard to routine occupational exposures. In other instances difficult situations are presented in attempting to determine the environmental quality values for non-occupational off-site situations. A major effort has been undertaken within the Department of Defense to provide for adequate protection against air and general environmental pollution hazards arising from our research, development, test and evaluation programs. This matter has been of some concern in recent hearings of the Senate Special Subcommittee on Air and Water Pollution, and is a matter of major opinion by the military departments concerned. Considerable testimony regarding this subject was presented in the 1964 Senate Subcommittee hearings and in 1965 before the Subcommittee on Public Health and Welfare of the Committee on Interstate and Foreign Commerce of the House of Representatives. A summary of information on the precautions associated with this material are included in the report of the hearings on S. 3112 before the Subcommittee on Air and Water Pollution of the Committee on Public Works, United States Senate (reference pages 443-453). It is worthwhile to point out in addition that here again, in the absence of definitive legislative or other regulatory requirements, initiative has been taken by the Department of Defense to provide to the extent consistent with available knowledge for the protection of the health of the population. The actions taken by the Air Force and the other military departments involved have been based upon appreciation of the need for the most thorough evaluation of the many facets of the problem. During the four year period of Fiscal Years 1964-1967, approximately \$1,700,000 was expended in investigations on the atmospheric dispersion of beryllium particles from testing of rocket propellants; on testing and evaluation of sampling and analytical procedures and on fundamental toxicological studies. The Department of the Air Force has maintained close coordination with the U.S. Public Health Service so as to provide for an exchange of information. We have recognized that the problem is one in which there are major epidemiological implications and are depending upon the U.S. Public Health Service to furnish us with the necessary evaluations and guidance in that regard. Micrometeorological studies and investigations on this and other rocket propellants provide information which may be useful in civilian industry and communities.

It is generally agreed that the industrial occupational exposure limit values should not be used as a basis for establishment of air pollution quality values insofar as continuous exposures are concerned. The rocket propellant test operations, on the other hand, represent air pollution situations generally discontinuous in nature and of extremely short duration. Some guidance as to permissible exposures can be obtained for on-site personnel from the industrial guidelines. Careful scrutiny of epidemiological data, toxicological studies, and the application of value judgments on the industrial levels can be utilized while more precise information is being accumulated. The application of the science of micrometeorology is also involved in determining and assessing possible distribution of contaminants in the environment. A summary of some of the more important air quality criteria for liquid propellants is provided in Figure 5, and for some other chemical substances in Figure 6. It is emphasized that these are not community air quality values, and are furnished only to give an appreciation of the difference in effects of various concentrations.

There is a major possible contribution to knowledge and technology needed in air pollution resulting from this work. Among these are the improvements in diffusion prediction methodology, environmental sampling techniques, and in the realm of administrative rule making. This last, in company with the experience in interdepartmental coordination and industry cooperation may be of the greatest significance to the future.