

three departments with some variation. If these procedures are followed, it ought to be possible to ascertain at an early point in any community or environmental or industrial activity the anticipated requirements for maintenance of environmental control through pollution abatement. These involve the following:

- a. The most economical approach is the early involvement of the pollution abatement specialists in the planning and conceptual phases.
- b. There should be evaluation of the process, operation, or situation with a view to substituting in the case of industrial operations less dangerous materials, or the use of waste materials in a recycle basis as a raw material or part of the process.
- c. The design of process controls to minimize the production of wastes. A classic example in this regard is the control of trichloride ethylene vapors through proper use of a degreaser and the reduction of pullout of plating solutions by proper movement of the plated objects out of the plating tank.
- d. The design of the appropriate waste control or environmental pollution prevention devices.

In arriving at ultimate recommendations, it is obviously necessary that there be thorough information on all aspects of the problem, that all possible means of achieving the desired result must be undertaken and the most suitable selected. Then there must be examination and check of the efficacy of the final product. The military departments and agencies operate a large industrial complex. The effort to control pollution at the source through application of the foregoing procedures results in a lessened cost insofar as abatement works and techniques are concerned. There are no clearly defined means of discerning which requires the most attention. Rather, the cost versus benefit approach must be taken here as in the case of the entire pollution abatement question.

FEDERAL RESEARCH AND DEVELOPMENT PROGRAM

Short-term solutions vs. long-range remedies

Department of Defense Environmental Pollution Control Programs have been planned with a view toward long-range requirements. Those research, development, test and evaluation activities conducted under the auspices of the military departments have ranged, however, from consideration of problems having an immediate implication and demanding an urgent solution, to those providing information useful in the approach to the problems extending over a period of years. Several examples should be cited to provide better appreciation of this spectrum of interest and action.

The case of investigations on air pollution from diesel motors on tanks and their effect on both crews and nearby personnel, discussed in the testimony before the Senate Special Subcommittee on Air and Water Pollution in 1964, is typical of those projects undertaken to deal with a more urgent situation. As is the case with many other investigations of this sort, there is developed information which may be useful in attacking the long-range problems.

Another typical case of an investigation conducted on a specific near-term situation is the extensive studies conducted for the Department of the Air Force on the problems associated with a suitable treatment method for plating plant wastes at Patrick Air Force Base, Cape Kennedy, Florida. Here again, although directed toward a single problem, the information obtained has been useful in developing design criteria and guidance for similar projects.

The nature of military development programs generally involves the development of hardware end items. While some research is conducted to ascertain principles, the majority of our efforts in relation to environmental pollution have an ultimate end product as a goal. Studies conducted under the auspices of the Army Medical Research and Development Command on such subjects as water disinfection have as their objectives the determination of critical parameters which may be utilized for definitive engineering design criteria.

Another evidence of our appreciation of the need for long-range considerations are the programs concerned with closed ecological systems. The Air Force and the Navy have engaged in extensive research as previously indicated in this testimony, on this subject. The Navy's studies with regard to the nuclear submarine program contribute much in the way of knowledge as to permissible concentrations of atmospheric contaminants. These, along with investigations conducted by the Air Force on space cabin problems, provide useful points in