

I am unhappy with some of the attitudes implied by these four questions. The last three seem to suggest that we should begin by looking for model techniques and improving the input data. And only after nearly complete success with these components should we start making system analyses. On the contrary, it is quite clear that it is only by beginning some analysis in an admittedly exploratory way that we can find out enough about the true needs for techniques and input data to be able to attack their improvement effectively. Today's need is to begin to work on the job. Systems analysis can and should be valuable. They are not cure-alls. They require learning by doing.

The words, "waste management systems analysis," as used in the first question of this paragraph can easily mean both too much and too little. Some would read it as meaning systems analyses covering all of waste management. Today that is too much, for our urgent need is for systems analyses of specific problem areas. In the very near future, it will be too little because there are many problems where the systems analysis need to extend beyond waste management into other related questions. The need for a unified study of sewage treatment and water purification is already such an example.

Turning to question 13 from paragraph B(3) :

Is enough of the basic environmental quality research being done in industry to establish necessary support for applied research and development?

In view of the small overall costs of basic research as compared to development, I would urge that this question be rephrased thus: "As industry undertakes more development founded upon more applied research, how much basic research should it undertake?"

There are two very strong and important conflicting pressures involved in answering this question. On the one hand, we know that good basic research in the same organization will improve both applied research and development. On the other, we know that almost every scientific subfield important to pollution is in the throes of a severe manpower crisis, one whose end is not in sight. To deflect good basic researchers completely into industry away from the critical functions of graduate teaching and undergraduate stimulation would help a little now, but hurt much in the future.

My own advice would be to so manage the industrial applied research and development program as to make it easy for industry to use basic research personnel effectively both as regularly visiting consultants and as summer or one-term full-time participants, and to encourage industry's employees to do some of their applied research at basic research centers with adequate financial compensation to these centers. It is important to us to eat our cake and still have it. We need to keep the good basic research men and women turning out students at the same time that they contribute to industry's R. & D. activities.

Turning now to question 15, the second question from paragraph B(4) :

How should industrial research be allocated between process changes and effluent treatment?

If the question means how should industry allocate that research on its own processes which it itself supports, there are two simple answers: First, since each industry faces different economic balances