Prospectus for an Evaluation of Critical Aspects of the National Pollution Control Program: A Report to the U.S. Department of Energy (1984)

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EVALUATION OF CRITICAL ASPECTS OF
THE NATIONAL POLLUTION CONTROL PROGRAM

A Report to the
U.S. Department of Energy
prepared by the
Committee to Plan an Evaluation of the National
Strategy for Environmental Management

National Research Council
1984

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This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

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PREFACE

This report is the result of an ad hoc study performed at the request of the U.S. Department of Energy. The objectives of the study were to assess the potential for evaluating the experience gathered to date with our national pollution control program and to describe how such an evaluation might practically be undertaken.

The study was organized under the auspices of the Environmental Studies Board of the Academies' National Research Council. It was conducted by a committee comprising members of the Board. As part of its study, the committee conducted a three-day meeting to exchange views with knowledgable people who brought a variety of perspectives to the deliberations.

The committee gratefully acknowledges the interest and cooperation of the participants in the workshop. Their names are appended to the report. The committee also appreciates the support and contributions of the staff of the Environmental Studies Board.

Stanley I. Auerbach
Chairman
Environmental Studies Board

SUMMARY

Advances in scientific knowledge as well as the experience gained over the past fifteen years in implementing pollution control programs indicate that the time is ripe for a careful assessment of whether the current pollution control system of the U.S. accurately reflects and adequately uses available scientific and technical information. In particular, evidence of connections between pollution control activities for one purpose and the appearance of pollution problems elsewhere raises major questions about the existing approach to pollution control along media lines.

Accordingly, this report proposes a preliminary assessment to determine the extent to which the current media-oriented program incorporates the body of scientific and technical knowledge about the net transport, fate, and effects of contaminants. If the results of the preliminary assessment indicate that a more integrated approach to pollution control would be scientifically and technically sound, it may be desirable to undertake additional detailed studies to provide a basis for policy design.

INTRODUCTION

Over the past fifteen years, the United States has established a complex and ambitious system of laws and regulations intended to protect and improve environmental quality. The goals of the system include safeguarding public health, managing natural (e.g., wilderness) resources, and preventing damage to biotic communities and particular species. The cornerstones of the system are the laws and the regulations associated with them

designed to control pollution discharges--the disposition in the environment of the leftovers from the production and consumption activities of the Nation's citizens.

The laws and regulations may be characterized as a series of separate programs, each developed in response to specific perceived problems. Thus, for example, the Clean Air Act is aimed at control of local air pollution through motor vehicle emission standards and through the establishment of health- and welfare-based National Ambient Air Quality Standards with associated state plans for reducing point source emissions. Long-range transport of air pollutants is not one of the concerns of the current Act and the regulations promulgated to implement it. The Clean Water Act, on the other hand, establishes general goals for the use of natural waters and concentrates on the establishment of technology-based standards to be met by wastewater dischargers. Some threads common to both of these Acts exist; examples include reliance on permits or licenses to establish enforceable terms to be met by pollution dischargers and expressions of intent to encourage technical advances to reduce future pollution discharges.

Although the existing system apparently has brought about some significant reductions in particular emissions and concommitant improvements in ambient environmental quality (CEQ 1983, Conservation Foundation 1982), a wide variety of criticisms has been directed at it. Some critics have challenged specific decisions (e.g., the court cases contesting EPA standards and guidelines), while others have questioned the relative importance of implementing an environmental program, vis-à-vis achieving other national goals (Tucker 1982). Still others, while accepting the goals of the system, have questioned the design of its implementation (Kneese and Schultze 1975, Anderson et al. 1977, Drayton 1980). A question that underlies many of the criticisms is whether the current system accurately reflects and adequately uses available scientific and technical information.

A number of emerging problems appear to raise challenges that the current system of laws and regulations does not adequately meet. For example, as our scientific knowledge has increased we have come to understand that pollution can be transported great distances from its sources, reside in the environment for long periods of time, and be transferred from one environmental medium to another, thus reaching receptors through a variety of pathways and perhaps resulting in adverse effects long

after the original sources of pollution have disappeared. In addition, our abilities to measure ever smaller concentrations of potentially harmful substances and the possibility that there may be no thresholds for effects in important cases force us continuously to reevaulate our strategies for dealing with trace pollutants.

This growing body of knowledge and the accompanying awareness of the complexities of environmental management suggest that the time is ripe for an evaluation of how scientific and technical information is obtained and used in the current national pollution control program and the consequences of the nature of emerging problems for the environmental management system. The committee believes that a useful focus for such an evaluation could be the lesson provided by the laws of conservation of mass and energy, i.e., that "pollution control" may simply be "pollution transfer." For example, removing a chemical from a wastewater stream and spreading the resulting sludge on the land may transfer the chemical to groundwater, plants, or even the atmosphere (Josephson 1983, Pye et al. 1982, NRC 1977, Bailey 1981). Mandating the removal of lead from gasoline may imply large increases in refinery pollution loadings (Russell 1973). Some means of reducing local urban concentrations of air pollutants, such as sulfur dioxide, may result in their deposition at distant locations after transport (National Research Council 1983). In short, does our current program take into account what science can tell us about the results of pollution control activities themselves?

THE EVALUATION

The first step in the proposed evaluation should be to assess available data to determine whether in fact our current system has led to practices that differ substantially from what might practically be expected from implementation of an integrated system. The assessment of available data is necessary because while theoretical arguments can be made that an integrated approach would be preferable to the current one, the magnitude of the practical difference has not been systematically appraised. If in fact the outcomes of the current system and those of a practical integrated system are not markedly different, major changes in the current system, with their attendant political and institutional implications, may not be justifiable. Are the differences such

that our entire approach to pollution control needs to be radically changed, or can the problems be alleviated through incremental changes in the existing system? Would an integrated system deal with problems inherent in environmental issues--such as scientific uncertainty and the need to balance incommensurate values--better than the existing system? Would an integrated system be better at allowing for flexibility in adapting to currently unforeseen environmental problems or to information gained from advancement in scientific knowledge? Questions such as these emphasize the importance of a preliminary assessment of the actual extent of the problem.

Data for such an assessment are available from a variety of sources. For example, studies have been done with the explicit aim of investigating transfers of pollution from one medium to another (see Spofford et al. 1976 on the Delaware Regional Model and Spofford 1983 for an application to sulfur oxides emissions). More recently, EPA's Office of Policy Planning and Evaluation has been involved in industrial and regional studies of toxic materials with the goal of demonstrating the importance of integrated management and ways to achieve it (U.S. EPA 1983). Even more practical would be an assessment of the several state programs (such as those in New York and Illinois) that include integrated reviews of applications to construct new facilities that generate pollution in any form. A comparison of the decisions implied by single medium and multimedia methods in the modeling studies and in actual cases will provide some initial indication of whether a cross-media perspective will generate significantly different results.

If the preliminary assessment determines that an integrated approach is likely to lead to substantially different management decisions, two subsequent questions must be raised. First, what methods are required and available for performing the scientific and technical analyses required for an integrated approach? How, for example, are risks associated with different pathways to exposure to be compared? The second question is what institutional implications must be faced in changing the current system to achieve more integrated control of pollution?

Thus, an analytical evaluation of our experience to date with the national pollution control program and its adequacy for addressing emerging problems should comprise two steps: first, a preliminary assessment of the extent of the problem; and second, a subsequent appraisal of the

scientific and technical methods available or required to support a more integrated approach to managing environmental quality.

THE PRELIMINARY ASSESSMENT

We recommend that the preliminary assessment concentrate on establishing the strengths and weaknesses of existing pollution control efforts in dealing with natural or anthropogenic transfers of pollutants from one medium to another. We believe that such an assessment, without losing a practical focus, could highlight critical aspects of the national pollution control program.

Three approaches to the study should be considered:

1) Source-oriented approach. This approach would examine the extent to which single sources of pollution (e.g., a coal-fired power plant or a municipal waste treatment plant) do or could emit the same pollutant into more than one medium, identifying for each route paths through the environment, sinks of the pollution emitted, and human exposures. Do current control requirements actually reduce human and environmental exposure to harmful pollutants when the full path of these pollutants through the environment is considered? Is there an identifiable optimum disposal route for various types of pollutants from an environmental and health viewpoint? How does this optimum route compare with current disposal methods? How is the choice of disposal routes influenced by the availability of control technology and by current technology-based regulatory requirements?

2) Receptor-oriented approach. This approach would focus on the degree to which humans or portions of the environment are subjected to cumulative doses of the same or related pollutants from different media. The classic example is lead, to which humans are exposed through air, water, and food. To what extent do existing standards recognize these cumulative exposures? What mechanisms are available to take account of exposures from different parts of the environment? Have there been any adverse consequences from failure to take them into account?

3) Pollutant-oriented approach. The questions posed in the first two approaches could also be examined by focussing on pathways of various contaminants through the environment. This approach could concentrate, for example, on selected classes of heavy metals and organic

chemicals to see how they are transported in the environment, how control measures affect their transport paths, and what their ultimate sinks are. Synergisms with other substances in the environment might also be considered.

Whether the preliminary assessment should employ one, two, or all three of the above approaches will depend in part on the resources available for its conduct. Since the approaches are obviously closely interrelated, any one approach, pursued far enough, will tend to come to terms with the same questions posed in the other approaches. Each approach, however, is likely to provide its unique scientific insights into the problems of future environmental management.

FOLLOW-UP STUDIES

If the preliminary assessment concludes that a more integrated approach to pollution control would result in significantly different decisions, follow-up studies of the scientific and technical analyses available or required to implement such an approach would be appropriate. The nature of these studies will depend on the results of the preliminary assessment, however, so that it is premature to conclude now that such studies are necessary or how they might best be carried out.

It is likely that the follow-up studies, if they were to be conducted, would include such subjects as:

- Risk assessment. How can the total risk from a pollutant, both to human health and the environment, be assessed? What scientific methods are available or must be developed to compare risks from different routes of exposure?
- Monitoring. What monitoring data are necessary to deal with pollution problems on an integrated basis? To what extent does the existing system provide such data? What new systems, if any, are necessary?
- Biogeochemical cycles. How can knowledge of natural biogeochemical cycles be related to pollution control programs? How can we monitor the status of such cycles?
- Costs. How could a more integrated approach to pollution control affect the costs of control? What types of incentives and what types of technology are available to implement an efficient integrated control system?

• Institutional Effects. What are the implications of integrated scientific assessments of risk for decision-making processes? What institutional changes may be needed for a more integrated approach to pollution control? What are the implications for the locus of decision-making as between federal, state, and local levels?

CONCLUSION AND RECOMMENDATION

The committee is convinced that an evaluation of the type called for in this report is both necessary and feasible. The evaluation should start with a preliminary assessment of the practical extent of the problem as outlined earlier. Any proposal for such a preliminary asssessment should describe the organizational approach to it and the funding that would be required to conduct it. In addition, the proposal should describe how interested sectors of society are to be kept informed of the objectives, procedures, and progress of the study and how these sectors in turn are to provide information, data, and advice for consideration by the study group.

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