the small particle fraction of particles collected in the dichotomous samplers by xrf versus soluble SO_4 by ion chromatography for the runs taken during the tracer periods. The two methods correspond fairly well, indicating that most, if not all, of the S is in the form of soluble SO_4.

ACKNOWLEDGMENTS

We are grateful to many staff members of the Division of Air Resources for taking part in the tracer gas release experiments and for providing moral support throughout this research program. Dr. G. Wotzak developed the computer logistics for data acquisition. Dr. N. Kolak and S. House, R. Peddada, and H. Whitney have carried out the laboratory analysis of the particulate samples. John Hawkins' frequent checks on the electronics at the site was a great aid throughout the study. Thanks are due to Gerard E. Blanchard for his constructive criticism and constant encouragement throughout the progress of this study. We are indebted to Dr. John Hawley for his continuous guidance during the course of the study. Thanks are extended to Beth Peck for typing the manuscript and Carol Clas for drafting the diagrams. This research was done with the support of the EPA, New York State Department of Transportation, and State University of New York at Albany.

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Integrated Planning and Management of Transportation and Air Quality

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Efforts to implement the transportation control provisions of the Clean Air Act Amendments of 1970 have generated much discussion but little implementation of transportation measures to improve air quality. Reasons for this include conflicts over transportation priorities, inadequate institutional arrangements for combined transportation and air quality planning, and insufficient information concerning the relation between transportation and air quality. The Clean Air Act Amendments of 1977 provide a framework for handling these problems. However, important questions remain to be answered concerning organizational roles in transportation and air quality planning, the structure of the planning process, and the responsibilities of transportation and air quality decision makers.

The Clean Air Act Amendments of 1970 directed the U.S. Environmental Protection Agency (EPA) to establish national ambient air quality standards whose attainment would protect the public health and welfare from the adverse effects of major air pollutants. The pollutants for which health-based air quality standards now exist include carbon monoxide (CO) and photochemical oxidants, whose presence in urban air is primarily attributable to emissions by motor vehicles of CO, hydrocarbons (HC), and nitrogen oxides (NO_x). The areas in which one or more of these air quality standards are exceeded include most large cities in the United States and contain approximately two-thirds of the nation's population. The automobile is the source of roughly 70 percent of the CO, 50 percent of the HC, and 30 percent of the NO_x emitted in urban areas. Other transportation sources are responsible for approximately 20 percent of CO, HC, and NO_x emissions in these areas.

Because of the importance of motor vehicles relative to other sources of CO, HC, and NO_x, the reduction of motor vehicle emissions is a major objective of programs to improve air quality. The principal means of achieving this objective is the control of emissions from new vehicles. However, in many large cities, the current and projected future magnitudes of motor vehicle emissions are such that the CO or oxidant air quality standards cannot be attained and maintained through the control of emissions from new motor vehicles and nonvehicular sources alone. Furthermore, motor vehicles will remain among the two or three largest emissions sources, even after controls on new motor vehicles have become fully effective. In effect, the transportation systems of large cities are now and will continue to be major emissions sources that, like other major sources, must be controlled if the air quality standards are to be achieved.

Emissions from urban transportation systems can be reduced by improving traffic flow conditions and reducing traffic volumes. The measures through which these objectives might be achieved include virtually all of the ones currently encompassed by the term transportation system management. The Clean Air Act refers to transportation system management measures as transportation controls and requires their implementation in areas

where they are needed to ensure the attainment and maintenance of the air quality standards.

Efforts to implement the transportation control provision of the Clean Air Act began in 1973. Thus, roughly 5 years of activity have been directed toward the broad objectives of identifying and implementing transportation measures that improve air quality and, conversely, identifying and minimizing the implementation of transportation measures that make air quality worse. This activity has entailed, among other things, much consciousness-raising in both the transportation and air quality professions. The transportation profession, for example, is learning that urban transportation systems are major causes of air pollution and that the problem of controlling transportation systems' emissions must be taken seriously. The air quality profession is learning that transportation planning is not a subspecialty of air pollution engineering and that the problems of controlling emissions from urban transportation systems are different from the problems of controlling emissions from industrial facilities.

Implementation of transportation measures to improve air quality also has created considerable controversy. The issues involved in this controversy range from the highly technical to the highly political and include questions such as: What are the air quality effects of specific transportation measures (for example, priority bus treatment or downtown parking restrictions)? What changes in urban transportation planning and decision-making processes are needed to accommodate the Clean Air Act's implicit requirement that air quality improvement be a major objective of these processes? Is the implementation of transportation measures to improve air quality consistent with the achievement of other transportation objectives, and if not, how should trade-offs be made between air quality improvement and other objectives? The controversy has stimulated a significant quantity of research on the relations between transportation and air quality. Although much remains to be learned about these relations, they are far better understood now than they were in 1973.

The consciousness-raising, controversy, and research that have taken place since 1973 have not been accompanied by significant implementation of transportation measures to improve air quality. There are, of course, many reasons for this. First, increasing the emphasis placed on air quality in transportation planning and decision making requires changing urban transportation priorities. In particular, it requires that increased priority be assigned to developing and implementing measures to reduce traffic volumes. Changes in the lines of authority among organizations involved in transportation and air quality also are likely to be needed. For example, effective air quality planning requires a strong element of regional coordination. Accordingly, it may be necessary to strengthen transportation agencies that have regional responsibilities at the expense of agencies that have more localized concerns. Clearly, such changes in priorities and authority are difficult to achieve, thus making the planning and implementation of transportation measures to improve air quality difficult.

Another source of difficulty in achieving the implementation of transportation measures to improve air quality has been the relative isolation of transportation agencies from the air quality planning process. Air quality planning and transportation planning typically have been done by different agencies, often at different levels of government. Air quality agencies tend to be state-level organizations and usually are oriented toward industrial pollution control. They have neither expertise in nor responsibility for urban transportation. Urban transportation planning, on the other hand, tends to be the responsibility of local agencies that, until recently, have had little expertise in air quality matters and have felt little need to be involved in these matters. The Clean Air Act Amendments of 1970 assigned the principal responsibility for planning and implementation of air quality improvement measures to state governments. State governments, in turn, tended to assign the responsibility to state air quality agencies. These agencies frequently failed to involve local transportation agencies in the air quality planning process. Moreover, in the relatively few areas in which transportation agencies were involved, problems of achieving cooperation between different levels of government and among agencies that were unfamiliar with one another's responsibilities, objectives, and operations hindered effective planning of transportation measures to improve air quality.

Finally, the method for identifying, evaluating, and gaining public and political acceptance of coherent packages of transportation measures that both improve air quality and serve other community objectives is unclear. This problem is, to a large extent, a consequence of the relative newness of air quality as a transportation issue and the resulting lack of information, technical tools, and institutional processes to deal with it. The problem was aggravated, however, by the Clean Air Act Amendments of 1970, which failed to recognize either the need for or the complexity of the various technical and political activities associated with planning and implementing transportation measures to improve air quality. The amendments established a schedule for air quality improvement that did not provide time for even the most rudimentary activities.

The problems of implementing transportation measures to improve air quality have received widespread recognition, including that of the Congress, and one of the consequences of this has been the Clean Air Act Amendments of 1977. These amendments contain several provisions that are designed to encourage the integration of transportation and air quality planning and to alleviate the problems that have prevented this integration in the past; for example,

1. They require that transportation planning and air quality planning be coordinated at the local level;
2. They specify that, where possible, planning for the control of transportation-related air pollutants be conducted by an organization of elected local officials in each affected metropolitan area, and they encourage the designation of either the metropolitan planning organization (MPO) or the air quality maintenance organization (AQMO) for this purpose;
3. They place increased emphasis on process-related activities (such as evaluation of options, consultation with the public, involvement of elected officials, and programming) and they provide additional time (although perhaps not enough) for these activities to take place; and
4. The amendments require federal agencies whose programs affect transportation and air quality to give priority to implementation of transportation plans to improve air quality.

The Clean Air Act Amendments of 1977 provide a framework for an improved transportation and air quality planning process. However, it is only a framework; many complex issues still must be resolved. One such issue concerns the designation of regional agencies to plan for the control of transportation-related air pollutants. Transportation systems are not the only

sources of these pollutants. Therefore, if an MPO is the designated planning agency, how will it arrange for the planning of stationary-source controls? Conversely, if an AQMO is the designated agency, what arrangements are needed to coordinate its activities and those of the MPO?

Another set of issues concerns the structure of the transportation planning process. How does one identify transportation measures that improve air quality? How does one combine these measures into coherent packages that both improve air quality and serve other community objectives? How should potential measures and packages of measures be evaluated? When and how should elected officials and the public be consulted?

A final set of issues concerns decision making and priorities. What criteria should be used to determine whether the transportation sector is making an adequate contribution to air quality improvement? Who should apply these criteria? How should conflicting claims on scarce planning resources by air quality planning activities and other planning activities be resolved? How should decisions be made as to the relative priorities of improving air quality and achieving other objectives when trade-offs must be made?

There clearly are no simple answers to these questions. Attempts to answer them must rely heavily on the experience of people who have dealt with them. The sharing of experience in transportation and air quality planning will contribute to an improved, integrated transportation and air quality planning process.

Experience With Consistency Reviews in Four Metropolitan Areas

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This paper reviews the experience of Region 3 of the U.S. Environmental Protection Agency in enforcing the section 109j consistency review process. After a description of the process, U.S. Environmental Protection Agency and Federal Highway Administration positions on consistency are examined and some reasons for differences are discussed. U.S. Environmental Protection Agency's experience in reviewing consistency in the Delaware Valley Region (Philadelphia), Southwest Pennsylvania Region (Pittsburgh), Baltimore Region, and National Capital Region is discussed. An assessment is then made of the status of the consistency process and future directions for consistency review are proposed. Although some progress has been made, the section 109j consistency review process has been generally ineffective. Some basic changes in attitudes and policies of metropolitan planning organizations and state and federal agencies are needed if the consistency review process is to become a useful tool for improving air quality.

The Federal-Aid Highway Act of 1970 added section 109j to title 23 of the U.S. Code, which requires that all highways constructed with federal funds be consistent with state implementation plans (SIPs) to attain and maintain national ambient air quality standards (NAAQS). In 1974 the Federal Highway Administration (FHWA) published regulations (1) for determining consistency with state air quality plans. These regulations set out the procedure that the state highway agency and metropolitan planning organization (MPO) first assess consistency and solicit comments from state and local air pollution control agencies. Differences should be identified and, if possible, resolved. The MPO annually makes a determination of consistency. This determination is forwarded through the state to the FHWA. FHWA, in consultation with the U.S. Environmental Protection Agency (EPA) annually assesses the degree of coordination between transportation and air quality planning and reviews the determination of consistency. Significant deficiencies are grounds for FHWA to withhold planning certification.

In 1975, FHWA and EPA published joint guidelines for analysis of consistency between transportation and air quality plans (2). The guidelines were intended to identify levels of technical analysis required, commensurate with the severity of the air pollution problem in an urban area. The guidelines also set out five criteria that transportation plans and programs should meet in order to be consistent with SIPs. These criteria are

1. MPO transportation plans and programs must not exacerbate any existing violations of the NAAQS.
2. MPO transportation plans and programs must not contribute to a violation of the NAAQS for a pollutant for which no concentrations in violation of the NAAQS have been measured.
3. MPO transportation plans and programs must not delay the attainment of NAAQS.
4. MPO transporation plans and programs must not interfere with maintenance of the NAAQS once the standards are attained.
5. MPO transportation plans and programs must include all appropriate portions of state plans to implement NAAQS, including transportation control measures either adopted by a state or promulgated by EPA to reduce vehicle miles of travel (VMT), such as exclusive buslanes or carpool matching programs.

POSITIONS ON CONSISTENCY

After several years of experience reviewing consistency of urban transportation plans, it has become apparent