REFERENCES


2. For example, see: Economics of Clean Air, Annual Report of the Administrator of the Environmental Protection Agency to the Congress, Senate Document No. 92-67, March 1972.

3. Under most circumstances, proportionate reduction requires a different mix of source-specific pollution control than does marginally allocated reduction. Therefore, regional pollution control benefits, both in magnitude and distribution, are likely to differ under the two enforcement schemes. Here, this complication is ignored in order to keep the analysis relatively simple; it should, of course, be taken into account in any real-world analysis.

4. In some instances, marginal costs may also be highly uncertain in which case upper and lower confidence limits on marginal costs should be provided to the decision-maker. This would tend to spread even wider the range of efficient control levels.

5. Economics of Clean Air, op. cit.


17. For a more in-depth discussion of this limitation, see Lave (1972), op cit.


In particular, see: H.O. Nourse, The Effect of Air Pollution on House Values. Land Econ. 43, May 1967; and Ridker (1967), Chapter 6.


30. Spore (1972), p. 32. Actually, the presence of relocation costs reduces receptor losses below what they would otherwise be.


35. Such figures tend to be very misleading for they ignore the locational seriousness of, or concern with, the problem. For example, in a survey taken in the state of Oregon by Louis Harris (The Public's View of Environmental Problems in the State of Oregon. Prepared for the Pacific Northwest Bell Telephone Company, Study No. 1990, March 1970, 28% of the population sampled said that they would be willing to accept a $200 increase in family expenditures per year to improve the environment. Some 47% said that they would be willing to spend $100.

36. A number of these studies were reviewed by Ido DeGroot (1967).
37. While the economist does not necessarily need to know this kind of information, work by R. Creer, R. Gray, and M. Treshow (Differential Responses to Air Pollution as an Environmental Health Problem. JAPCA 20 (12), December 1970) will be helpful in understanding the psychology of differential responses to environmental pollution.


42. For specific examples of this kind of information, see: From the State Capitals. Published by Bethune Jones at 321 Sunset Avenue, Asbury Park, New Jersey. This bi-monthly review state, local and municipal political decisions relating to environmental pollution.


48. For example, Salvfn (1970), using this approach in Philadelphia, found that knowledge of the effects of air pollution on textiles was generally lacking. This kind of information can be used by local abatement agencies in their public relations-educational programs.

49. For a similar but more simplistic communication model see: M. Crowe. Toward a Definitional Model of Public Perceptions of Air Pollution. JAPCA 18 (2), March 1968.
50. This knowledge should be important for purposes of securing public support for an abatement program. A number of studies have shown where people do not consider themselves polluters. For example, see: R.J. Simon. Public Attitudes Toward Population and Pollution. Public Opinion Quart. 35, Spring 1971; and, Public Opinion on Environment Sampled, op. cit.


60. Ibid., and Flesh and Weddell (1972).


62. An anonymous reviewer suggested that damages will reflect all the influence of both pollutants if, and only if, there exists a linear relation between the included and excluded pollutants.


64. This is consistent with R.F. Muth's, (op. cit.) treatment of consumer behavior and derived conditions for household equilibrium.

65. Crocker (1969), p. 189-190. This proposition is also supported by Crocker (1971) Spore's (1972) attempt to discover the shape of the marginal damage function was less fruitful (p. 102).
66. A study by Crocker (1971) of site value differentials in Chicago provides some empirical data in support of Figure 3. For other cities with conditions different than Chicago, the case outlined in Figure 4 is also plausible. Obviously, in order to make better extrapolations, additional points on property value-pollution curves are needed. Unfortunately, such estimates are not now available. In the meantime, we choose to use linear extrapolation and hope that this is a reasonable first approximation. Thanks to William Watson for this suggestion. For further discussion on the validity of these assumptions, see: A. Myrick Freeman, III. On Estimating Air Pollution Control Benefits from Land Value Studies (In Press).


68. Ibid.

69. Data on housing units were taken from General Housing Characteristics: United States Summary. Bureau of the Census, U.S. Department of Commerce. 1970 Census of Housing, December 1971. Where estimates of housing units for metropolitan areas were not available, 49% of the total number of units in the SMSA were taken. This percentage factor is based on statistics that indicate 49% of the housing units are in the central cities.

70. Lave (1972), op. cit., p. 216-217.

71. These are discussed in Lave (1971).


75. Health costs by disease were estimated in: Dorothy Rice. Estimating the Cost of Illness. Health Economics Series Number 6, PHS Publication No. 947-6. U.S. Department of Health, Education, and Welfare, Washington, D.C. Flay 1966. Rice included the cost of premature death, of treatment and of absenteeism. Costs were broken down by major disease category, except for some types of treatments, and by costs of personal or non personal nature, such as drugs, eyeglasses, and school health services. The cost of premature death is the loss of earnings discounted at 6%. All costs are for 1963. This estimate is developed by taking 4.5% of the sum of total national health
expenditures identified in Table 1 in Rice (p. 3) plus the total mortality and morbidity costs identified in Table 32 (p. 110), also from Rice.

76. Lave (1972), op. cit., p. 231.

77. Or, alternatively, the "true measure" would as likely be what a person would be willing to accept for reduced longevity.

78. Air Quality data for suspended particulates for 1970 taken from Air Quality Data for Suspended Particulates: 1969, 1970 and 1971. Environmental Protection Agency, Research Triangle Park, N.C. Publication No. APTD-1353. This report showed that the annual arithmetic mean for about 90 SMSA's was 102 µg/m³. Thus, a 26% reduction would be necessary to reduce this to the primary standard of 75 µg/m³. Since there was no obvious way to relate Lave and Seskin's minimum sulfation measure to the SO₂ standard, it was simply assumed that the mortality rate would respond to a reduction in both pollutants in like manner. In using the authors sensitivity coefficients, a 26% reduction in these pollutants would result in 2.34% reduction to the mortality rate.

79. Rice, op. cit.

80. This estimate is determined by taking 2.34% of the total value of direct expenditures, of morbidity, and of mortality as given in Rice. This total value is determined by summing the costs of morbidity and total mortality (Table 32 in Rice3 plus the value of direct expenditures (Table 1 in Rice).

81. Statistics on Private Health Expenditures and Personal Income-Wage and Salary taken from the 1966 and 1972 Statistical Abstract of the United States (87th and 93rd Editions), Bureau of Censuses, Washington, D.C., show that there was an annual growth rate in private health expenditures of 6.3% from 1963 to 1970 and an annual growth rate in personal income-wage and salary of 8.2%. By extrapolating the Rice direct expenditures at a rate of 6.3% and the morbidity and mortality (foregone earnings) costs at 8.2% an estimate of $3.73 is determined.


84. Data taken from the 1971 Statistical Abstract of the United States (92nd Edition), Bureau of the Census, Washington, D.C., Table No. 16, p. 16, shows that 73.5% of the total population in 1970 lived in urban areas.
85. This variance was determined in the following manner: (1) standard errors of the pollution coefficients were determined by dividing the coefficients by their t-statistics; (2) then by subtracting and adding two standard errors to the coefficients, changes in the mortality rate as a result of a 10% reduction in air pollution levels were determined; and (3) these percent changes divided by the mean mortality rate, and this multiplied by 2.6 (the number of 10% reductions) enabled the determination of the total variance.

86. Spence and Haynie (1972), p. 29.

87. Salvin estimates elsewhere (Textile Pollution Loss is in Billions. Raleigh News and Observer, March 29, 1970, Section IV, p. 10) that the total economic damage of air pollution to textiles and fibers is $2 billion annually. There seems to be little basis for such an estimate.


91. See also: H.M. Benedict, et. al. (1973).


98. Odors Ruled Not Illegal. Solid Waste Management, April 1972, p. 73.


103. Environmental Quality, op. cit., p. 72.


120. Ibid., p. 90-110.


129. See, for example: MACC Hears Representative Dinger. Missouri Air News, 2 (6), July-August 1970.


138. For a detailed discussion of this aspect, see: A. March. Smoke, The Problem of Coal and the Atmosphere, London, Faber and Faber, 1947. For example, Marsh has observed that the presence of pollution deposits in the smoky atmosphere inhibited growth of many plants with a consequent decrease in the population of insects that fed on the plants, and a corresponding decrease in the population of birds that fed on the insects.


143. See Watt, op cit., p. 29.


147. These relative weights are determined by dividing each sensitivity coefficient (.53 and .37 for particulates and sulfur dioxide, respectively as taken from Table 7) by the sum of the two sensitivity coefficients (.90).

149. Intuitively, one would predict that particulates would be more closely associated than sulfur oxides with the disturbances of aesthetic properties, but for the lack of more definitive information, equal weights will be placed on these two pollutants.


SECTION XV

BIBLIOGRAPHY OF LITERATURE ON THE ASSESSMENT OF AIR POLLUTION DAMAGES


Air pollution is a problem because it endangers man's health and the environment in which he lives. The information researched in this report indicates that the cost of air pollution damage in 1970 (for measured effects only) falls within a range of $6.1 to $18.5 billion, with a "best" estimate of $12.3 billion. A benefit-cost analytical framework for environmental decision-making is outlined. The methods that have been or can be used to estimate the damages of air pollution are identified. The strengths and weaknesses of each method are discussed. The technical coefficients method is utilized in estimating the value of air pollution damage to human health, to man-made materials, and to vegetation. A particular market study method, the property value approach, was used to estimate aesthetic and soiling-related costs. Economic losses associated with air pollution effects on domestic animals and wildlife and the natural environment are not estimated because of data limitations. Damages are allocated by major pollutant and source category. Comparison with other such estimates is made. Report contains bibliography.