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Air Pollution and Urban Freeways: Making a Record on Hazards to Health and Property

**Michael Schneiderman
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Urban freeways carry vehicles powered by the internal combustion engine. The exhaust emissions produced can have substantial and serious effects on human health, but the possibility of such harm is virtually ignored in highway location proceedings today. Basic data telling the air pollution story is never assembled. Instead, highway planners rely on incomplete and unsophisticated generalizations. The ingredients of an adequate record on air pollution effects of a proposed new urban freeway are available. Only with such facts on health hazards can the legal and psychological momentum of the freeway be overcome.

Health Effects of Highway Air Pollution

The Pollutants

The primary dangerous substances produced by internal combustion engines are carbon monoxide (CO), unburned hydrocarbons, oxides of nitrogen (NO_x), lead, partial oxidation products, and particulate matter.¹ These emissions contribute 50 to 80 percent of urban air pollution.² Some, such as CO and hydrocarbons, are emitted most heavily when the engine is idling and at low speeds;³ others, such as NO_x and lead, are produced most heavily at high speeds and during rapid accelerations.⁴

1. Hurn, *Mobile Combustion Sources*, in 3 AIR POLLUTION 56-63 (2d ed. A. Stern 1968).

2. NATIONAL TUBERCULOSIS AND RESPIRATORY DISEASE ASSOCIATION, AIR POLLUTION PRIMER 34 (1969).

3. 3 AIR POLLUTION, *supra* note 1, at 57-60.

4. *Id.* at 60-61. See also Hirschler, *Particulate Lead Compounds in Automobile Exhaust Gas*, 49 INDUS. & ENG'R CHEM. 1131 (1957).

These substances are harmful and impair human ability to function normally. Auditory discrimination deteriorates significantly at CO concentrations as low as 50 parts per million (ppm).⁵ Ability to perform simple mathematical tasks is impaired at 100 ppm,⁶ and athletic performance declines as CO concentrations increase.⁷ The visual function is adversely affected by concentrations between 50 and 250 ppm.⁸ Measurable toxic effects on humans have been reported at as low as 10 ppm,⁹ and toxic effects in the cardiovascular system and central nervous system have been reported at high concentrations of CO.¹⁰ People with coronary heart disease or emphysema may be particularly susceptible to CO exposures.¹¹ Animal studies show that chronic exposure to relatively low concentrations of CO (15 ppm) hastens the process of arteriosclerosis.¹²

Little is known about toxic effects of NO_x. They may cause increased susceptibility to respiratory infections.¹³ There is evidence that nitrogen oxides can cause damage to lung tissue.¹⁴ Hydrocarbons, by themselves and in reaction products with NO_x, are not well understood in their effects on humans. Eye irritation and changes in pulmonary function have been associated with these substances.¹⁵ Most effects have been measured at very high concentrations over 100 ppm. Hydrocarbons combine with other substances in the atmosphere to produce a variety of acids which can harm metal. However, effects on humans, even at concentrations found near busy highways, is not known. Other exhaust products cause damage. Ozone, lead, and asbestos are known to cause serious illness under some conditions. On the other hand, little is known about numerous other exhaust emission products.

5. Beard & Wertheim, *Behavioral Impairment Associated with Small Doses of Carbon Monoxide*, 57 AM. J. PUB. HEALTH 2012 (1967).

6. *Id.* at 524.

7. NATIONAL ACADEMY OF SCIENCE AND NATIONAL ACADEMY OF ENGINEERING, *EFFECTS OF CHRONIC EXPOSURE TO LOW LEVELS OF CARBON MONOXIDE* 55 (1969).

8. Beard & Grandstaff, *CO Exposure and Cerebral Function*, Paper presented to Conference on Biological Effects of Carbon Monoxide, New York Academy of Sciences, Jan. 12-14, 1970.

9. NATIONAL AIR POLLUTION CONTROL ADMINISTRATION, *AIR QUALITY CRITERIA FOR CARBON MONOXIDE* 10-6 (Dep't of HEW Pub. No. AP-62, 1970); Schulte, *Effects of Mild Carbon Monoxide Concentration*, 7 ARCHIVES OF ENVIRONMENTAL HEALTH 524-30 (1963).

10. *AIR QUALITY CRITERIA FOR CARBON MONOXIDE*, *supra* note 9, at 8-52.

11. *Id.* at 8-31.

12. Goldsmith, *Carbon Monoxide and Coronary Heart Disease*, 71 ANNALS OF INTERNAL MEDICINE 199-200 (1969).

13. Blair, *Chronic Toxicity of Nitrogen Dioxide*, 18 ARCHIVES ENVIRONMENTAL HEALTH 186 (1969).

14. Ehrlich & Henry, *Chronic Toxicity of Nitrogen Dioxide*, 17 ARCHIVES OF ENVIRONMENTAL HEALTH 860 (1968).

15. NATIONAL AIR POLLUTION CONTROL ADMINISTRATION, *AIR QUALITY CRITERIA FOR HYDROCARBONS* 7-19 to 7-26 (Dep't of HEW Pub. No. AP-64, 1970).

To admit ignorance of health effects is not to say that no effects exist. Extreme caution is required; medical science is continually discovering unsuspected hazards in air pollutants. Particularly where substances are known to cause damage in animals, or to vegetation, the lack of available data on humans cannot be interpreted as an "all clear" signal.

Concentrations

The average automobile in 1968 produced approximately 53 grams of CO per mile.¹⁶ Vehicle and speed variations produce individual deviations from the average. Mean CO concentrations of 15 ppm are typical on busy streets.¹⁷ Eight hour average concentrations of 40 ppm have been estimated for some off-street central urban areas, 75 ppm for the worst arterial streets, and 115 ppm for the worst city streets.¹⁸ Garages, tunnels, and loading docks tend to show higher concentrations.¹⁹ Nitrogen oxides have not been extensively measured. Levels of from one to three ppm are sometimes reached in polluted atmospheres.²⁰ Similarly, hydrocarbon concentrations rarely exceed one ppm.²¹

Use of Air Pollution Data in Highway Location and Design

Highway planners should have a complete record of the air pollution effects of a proposed road. In addition, they should be told what to do with the information. Under existing practice, the record on air pollution is never adequate; air pollution is rarely considered seriously; and, air pollution factors are given virtually no weight in decisionmaking.²²

16. AIR QUALITY CRITERIA FOR CARBON MONOXIDE, *supra* note 9, at 4-2.

17. Bove & Siebenberg, *Airborne Lead and Carbon Monoxide at 45th Street, New York City*, 167 SCIENCE 986 (1970).

18. AIR QUALITY CRITERIA FOR CARBON MONOXIDE, *supra* note 9, at 6-22.

19. *Id.* at 6-23.

20. AIR POLLUTION PRIMER, *supra* note 2, at 41.

21. AIR QUALITY CRITERIA FOR HYDROCARBONS, *supra* note 15, at 3-1 to 3-15.

22. Highways do not cause air pollution; they are places where polluters congregate. Although air pollution can be eliminated from a proposed highway corridor by eliminating the highway, cleansing vehicle emissions has the same effect. The propriety of relying on improved emission control technology, and therefore the relevance of this article, depends in substantial part on the likelihood that vehicle emissions will be eliminated within the foreseeable future. Current enforcement programs will not reduce vehicle air pollution in the long run. S. REP. NO. 64, 91st Cong., 2d Sess. 31 (1970). Standards are being tightened. Compare 45 C.F.R. § 85.21 (1969), with proposed amendments to § 85.21 in 35 Fed. Reg. 11339 (1970). New legislation with tough provisions has been passed by the Senate, and House conferees have tentatively agreed to the provisions. See S. 4358, 91st Cong., 2d Sess. (1970); S. REP. NO. 1196, 91st Cong., 2d Sess. 23-35 (1970). The chances for a "clean" automobile are extremely cloudy. Predictions range from very soon to very far away. See, e.g., *Hearings on S. 3229, S. 3466, S. 3546 Before the Subcomm. on Air and Water Pollu-*

An Adequate Record

The Federal-Aid Highway Act of 1968,²³ and the regulations under it,²⁴ set no standards for the minimum information on air pollution which must be assembled by a highway planner before approval of a project. The Act requires the state highway department to consider the "impact on the environment" of the proposed route.²⁵ Federal Highway Administration guidelines, set forth in Policy and Procedure Memorandum 20-8 (PPM 20-8), define the "environmental effects" to be considered to include: "Noise, and air and water pollution."²⁶

The only guidelines for assembling the facts which are to form the basis for consideration of air pollution are these:

Consideration of social, economic, and environmental effects shall include an analysis of information submitted to the State highway department in connection with public hearings or in response to the notice of the location or design for which a State highway department intends to request approval. It shall also include consideration of information developed by the State highway department or gained from other contacts with interested persons or groups.²⁷

PPM 20-8 also requires location study reports to contain

[d]escriptions of the alternatives considered and a discussion of the anticipated social, economic and environmental effects of the

tion of the Senate Committee on Public Works, 91st Cong., 2d Sess. 197 (1970); STAFF OF SENATE COMM. ON COMMERCE, 91st Cong., 1st Sess., REPORT ON THE SEARCH FOR A LOW-EMISSION VEHICLE (Comm. Print 1969); AMERICAN CHEMICAL SOCIETY, CLEANING OUR ENVIRONMENT: THE CHEMICAL BASIS FOR ACTION 46-56 (1969). "No significant reduction in automotive air pollution is expected to result in the next decade from the advent of vehicles with unconventional power sources." *Id.* at 56. Substantial amounts of research money are being devoted to the search for a cleaner automobile. *Hearings on S. 3229, supra* at 360-62. See also *NAPCA Announces Incentive Program for Unconventional Power Sources*, 1 ENVIRON. RPTR. 282 (1970). When the uncertainty that alternative technology will be developed soon is combined with the problems of phasing out old vehicles even after new technology is available, and the problems of policing the efficacy of pollution control devices, the propriety of relying on emission control technology to solve urban highway air pollution problems is doubtful.

23. 23 U.S.C. §§ 101-511 (Supp. V, 1970).

24. 23 C.F.R. §§ 1.1-1.38 (1970).

25. 23 U.S.C. § 128(a) (Supp. V, 1970).

26. Policy and Procedure Memorandum 20-8, ¶ 4c(15), 23 C.F.R. ch. I, pt. 1, app. A (1970). Policy and Procedure Memoranda are statements by the Federal Highway Administration (FHWA), issued under 23 C.F.R. § 1.32 (1970) which provides:

The Administrator shall promulgate and require the observance of such policies and procedures, and may take such other action as he may deem necessary for carrying out the provisions and purposes of the Federal Laws, the policies of the Federal Highway Administration, and the regulations in this part.

27. *Id.* § 9.

alternatives, pointing out the significant differences and the reasons supporting the proposed location or design.²⁸

Minimum standards are nowhere prescribed for the information needed to support required considerations of environmental effects.

Vague guidance produces vague results. One highway report submitted under PPM 20-8 disposed of the air pollution problem in the following way:

An expressway along any route will reduce per-car exhaust emissions by permitting faster and more efficient vehicle operation. Other methods of reducing air pollution impact on adjacent land use include the use of an elevated alignment or the provision of planted park strips along the edges of depressed alignments.²⁹

In the report and supporting materials no evidence appears of specific analysis of the impact of the proposed highway on air pollution at any particular adjacent location. Nor is there evidence of consideration of the impact on the total air pollution burden of the city or neighborhood.³⁰ We have found similar treatment of air pollution problems in the records on other urban freeways.³¹ Such cursory disposition of complicated air pollu-

28. *Id.* § 10b(1).

29. CROSSTOWN ASSOCIATES, CHICAGO CROSSTOWN EXPRESSWAY—ROUTE LOCATION: MIDWAY/SKYWAY—ADDENDUM ON SOCIAL, ECONOMIC AND ENVIRONMENTAL EFFECTS 12 (1970). The letter transmitting this document states that "this material is designed to meet the requirements of paragraphs 10b of PPM 20-8." Letter from Crosstown Associates to George T. March, Feb. 2, 1970.

30. Something more of the learning available to the highway officials responsible for the Chicago Crosstown Expressway can be seen in a letter from the local Commissioner of Public Works to a citizen seeking information about the air pollution effects of the proposed highway. He replied:

The question of air pollution has been investigated with the Department of Air Pollution Control. Generally speaking, research into air pollution and highways indicates that the amount of pollution produced by automobiles and trucks is less on limited access highways than on arterial or local streets. For example, hydrocarbons produced by the exhaust of automobiles on expressways are reduced by 25 to 50 per cent over arterial streets, and 50 to 160 per cent over local streets. This reduction is even more dramatic for carbon monoxide emissions. It should also be noted that the Motor Vehicle Air Pollution Control Act of 1965 required that all new automobiles be equipped with air pollution control devices which conform to standards set forth in this Act. As a result, the total volume of pollutant emissions will be reduced.

Letter from Milton Pikarsky to Citizen, July 20, 1968. Letters such as this are part of the public record maintained in the Division 10 office of the Illinois State Highway Department.

31. We did not make a careful sample. We inspected files covering urban freeways in several states. The treatment of air pollution found in the Chicago Crosstown report appeared everywhere. For example, in the District of Columbia, complaints about air pollution effects of proposed freeways were handled as follows:

Air pollution has been cited as a reason for not building freeways. The fact is this: We're going to continue having air pollution even if not a single mile of freeway is built. . . . Stopping freeway building would simply keep vehicles on surface streets where stops and starts make engines burn the dirtiest, in-

tion problems reflects an almost totally bankrupt record in the highway department. The rationale that higher freeway speeds actually reduce pollution is misleading and incomplete. It overlooks substantial risks of harm to human health and increases in pollution which may result from the freeway.

While it is true that automobiles travelling at high speeds emit less carbon monoxide and hydrocarbons per mile than vehicles travelling at lower speeds,³² emissions of oxides of nitrogen and of lead increase with higher speeds.³³ Furthermore, a new high speed corridor tends to generate entirely new automobile traffic entering the city, making up for some reduction in per-car emissions with more cars.³⁴ Even if a new road merely transfers existing traffic from other routes, air pollution effects are serious. The outputs of certain pollutants from a freeway may be less than the total accumulation of outputs from a large number of arterial streets; but, the freeway, as a single line source of concentrated pollutants exceeds the emissions from any one of the arterial streets. The implications for surrounding land use are clear. The situation is particularly alarming for joint and multiple use projects which are located over, under, and immediately adjacent to the freeway.

Critical facts such as these are repeatedly overlooked by highway planners, primarily because the information is never assembled. This performance is inconsistent with the congressional intent behind the urban impact amendment in the Federal-Aid Highway Act of 1968.³⁵ The purpose of the amendment was to "insure that proper consideration will be given to the needs of communities through which highways are to be constructed."³⁶ It grew out of extensive hearings, one premise of which was:

We must provide those who make the decisions with more accurate information regarding the effects on the local areas, on their neighborhoods, and their people.³⁷

stead of on higher speed freeways, where they burn the cleanest. . . . The way to reduce pollution produced by motor vehicles is by attacking the cause: the engine emissions.

D.C. DEP'T OF HIGHWAYS AND TRAFFIC, RECOMMENDATIONS FOR A FREEWAY IN THE NORTHERN SECTOR AND RELATED POLICY 24 (1970). This District of Columbia report was not submitted under PPM 20-8.

32. See 3 AIR POLLUTION, *supra* note 1, at 57-60.

33. *Id.* at 60-61.

34. BUREAU OF PUBLIC ROADS, HIGHWAY CAPACITY MANUAL (1969).

35. Act of Aug. 23, 1968, Pub. L. No. 90-495, § 24, 82 Stat. 828, amending 23 U.S.C. § 128(a) (1964).

36. SENATE COMM. ON PUBLIC WORKS, REPORT ON THE FEDERAL-AID HIGHWAY ACT OF 1968, S. REP. NO. 1340, 90th Cong., 2d Sess. 28 (1968).

37. *Hearings on Urban Highway Planning, Location, and Design Before the Subcomm. on Roads of the Senate Comm. on Public Works*, 90th Cong., 2d Sess. 185 (1968) [hereinafter cited as *Senate Urban Highway Hearings*].

Methods exist for creating an adequate record on air pollution more consistent with congressional intent. On such a record, highway planners can decide intelligently whether and where to build the road. Reasonably sound measurements can be made of the amounts of pollutants produced by each automobile. Traffic estimates, required to be made by state highway departments seeking federal approval,³⁸ can then be used to estimate total pollution on the highway. Forecasts of altered traffic patterns can be used to estimate the total increase or decrease in pollution burden for the entire city, or broad regions within it. Mathematical tools, based on observations of the dispersion of pollutants from sources such as freeways, can be used to estimate pollution concentrations at any distance from the road.³⁹ The latest medical research can be consulted to determine the effects on human health of concentrations estimated in this way.

This sort of record should be made before any urban freeway is approved. It can be guaranteed if standards for the information to be assembled are included in the Federal Highway Administration's (FHWA) regulations in something like the following form:

State highway departments shall obtain and consider the following information in considering the air pollution effects of the proposed location:

- 1) Estimated future concentrations of each of the following substances measured at intervals of 50 feet horizontally and vertically from the center line of the proposed highway to a distance of 2500 feet from the center line:

38. See 23 U.S.C. § 109(b) (Supp. V, 1970); PPM 21-1 § 8b(3). See also Bureau of Public Roads Form PR-1.

39. See, e.g., AIR QUALITY CRITERIA FOR CARBON MONOXIDE, *supra* note 9, at 6-26 to 6-27; METEOROLOGY AND ATOMIC ENERGY (Atomic Energy Comm. Pub. No. TID-24190 1968); OTT, CLARKE & OZOLINS, CALCULATING FUTURE CARBON MONOXIDE EMISSIONS AND CONCENTRATIONS FROM URBAN TRAFFIC DATA (National Air Pollution Control Administration Pub. No. 999-AP-41 1967); D. TURNER, WORKBOOK OF ATMOSPHERIC DISPERSION ESTIMATES 40, 53 (Public Health Service Pub. No. 999-AP-26, 1967). The mathematical models described in these and similar sources account for the following factors: quantity of emissions, velocity of emissions at the source, turbulence of the atmosphere, and height of the source relative to the surrounding landscape. These methods have significant limitations. They fail to account for other nearby sources of pollution with the result that they frequently tend to underestimate true concentrations at given distances from the pollution source being measured. See AIR QUALITY CRITERIA FOR CARBON MONOXIDE, *supra* note 9, at 6-26 to 6-27, which notes that diffusion models usually predict CO concentrations one-half to one-tenth of those actually measured. Diffusion models also fail to account for the wide variations in urban landscape, including tall buildings. Even so, these mathematical tools provide enough information to be an improvement over a complete absence of information. See AMERICAN CHEMICAL SOCIETY, CLEANING OUR ENVIRONMENT: THE CHEMICAL BASIS FOR ACTION 44 (1969). "Diffusion" refers to the mixing of pollutants with surrounding air by means of random particle or molecular motion. "Dispersion" refers to transport of pollutants by atmospheric currents. Despite their technical distinction, these words are often used loosely and interchangeably.

- (a) carbon monoxide
- (b) oxidants
- (c) nitrogen oxides
- (d) hydrocarbons
- (e) asbestos
- (f) lead
- (g) particulate matter.

Such estimates shall be based on estimates of traffic contained in FHWA Form PR-1, and shall employ the method set forth for estimating diffusion from line sources in D. TURNER, *WORKBOOK OF ATMOSPHERIC DISPERSION ESTIMATES* (Public Health Service Pub. No. 999-AP-26 1967). Such estimates shall be made for the various climatic conditions prevailing in the area throughout the year on a 24-hour, 8-hour, and peak hour basis.

2) Existing concentrations of pollutants for each 50 foot interval shall be made for the proposed route of the highway. Such measurements shall be made under the various climatic conditions prevailing in the area throughout the year and shall be made on a 24-hour, 8-hour and peak hour basis.

3) Existing average concentrations and estimated concentrations after construction of the highway of each of the pollutants listed in section (1) for the metropolitan area as a whole and for each geographical sub-region of the metropolitan area through which the proposed highway will pass.

4) Existing land use in each 50 foot interval for which estimates and measurements are made under subsections (1) and (2) and land use shown on any official regional or metropolitan plan.

5) The most recent medical and scientific research of the effects upon humans, animals, vegetation, and property of the estimated concentrations of the substances at each 50 foot interval.⁴⁰

This method has been tried. Data of this sort was assembled in a limited way for hearings on the proposed Lower Manhattan Expressway in New York City.⁴¹ A simple dispersion model was used; meteorological effects were, for the most part, ignored.⁴² The following estimates were made for carbon monoxide concentrations on the assumption of 15,000 vehicles per hour:

40. In the absence of a regulation, this prescription serves as a model for the evidence which should be assembled for presentation at location hearings required by Section 128(a). A similar procedure should be followed for noise, producing estimates of perceived noise at 50 foot intervals from the proposed highway.

41. The study was conducted by the New York City Department of Air Resources.

42. Failure to consider meteorological factors was probably not fatal to the study's usefulness. The proposed road was to be in a sunken trench in which the movement of pollutants to adjacent areas most probably is dominated by true diffusion, rather than by wind and heat dispersion.

roadway surface	90 ppm
adjacent streets	60 ppm
covered roadway	300 ppm
streets adjacent to covered roadway	300 ppm

This sort of data is particularly critical for joint and multiple use projects. Each such project is, by definition, in close proximity to the freeway. Many of these projects have been planned and completed without a study of air pollution problems. Among the many joint use projects are the following: a medical center (over a road), a high school (adjacent), a public library (over), an exhibition and convention center (over), apartments (over), and office buildings (over and adjacent).⁴³

The Lower Manhattan Expressway study projected CO concentrations at the location of a proposed school over the roadway to be at least 60 ppm. A study after the fact of the George Washington Bridge Apartments, constructed over an interstate highway in New York City, shows carbon monoxide levels as high as 22 ppm inside third floor apartments, and 24 hour average concentrations of 14 ppm.⁴⁴ Similar levels were found in apartments on the 30th floor. These levels could have been predicted with an adequate study in advance of approval of the highway and the joint use air rights project.⁴⁵ Air pollution data such as this is plainly relevant. It is available to any highway planner who seeks it. He should be required to assemble this material and, if necessary, he should be explicitly instructed to think about the air pollution facts which are produced.⁴⁶

43. FEDERAL HIGHWAY ADMINISTRATION, *HIGHWAY JOINT DEVELOPMENT AND MULTIPLE USE* (1969). This publication contains a complete catalogue of joint development projects in connection with federal-aid highways in the United States.

44. NATIONAL CENTER FOR AIR POLLUTION CONTROL, *SPECIAL CO SURVEY*, (George Washington Bridge Apartments, New York City, July 3-14, 1967). It is ironic that joint use projects may create serious new urban freeway problems. The Senate Committee on Public Works is particularly fond of such projects as a solution to urban freeway problems. "We encourage the Department of Transportation, the Federal Highway Administration, and individual state highway departments to give continued strong support to this so-called 'joint development' concept." SENATE COMM. ON PUBLIC WORKS, REPORT ON THE FEDERAL-AID HIGHWAY ACT OF 1968, S. REP. NO. 1340, 90th Cong., 2d Sess. 8 (1968).

45. Noise pollution requires similar pre-study. "Schools neighboring busy airports and roadways in this country have reported severe disturbances in classroom activities from intruding noises from these transportation activities." *Hearings on S. 3229, S. 3466, S. 3546 Before the Subcomm. on Air and Water Pollution of the Senate Comm. on Public Works*, 91st Cong., 2d Sess. 203, 207 (1970) (Statement of Dr. Alexander Cohen, Chief, National Noise Study, Bureau of Occupational Health and Safety, Dep't of HEW).

46. Such well-tested devices as mandatory findings of fact encourage the decision-maker to process the information presented to him. *See* FED. R. CIV. P. 52(a). Shifting the burden of proof also works. If the proponent of a new road is required to prove the absence of air pollution effects, evidence of air pollution must be dealt with carefully. *See* *Scenic Hudson Preservation Conference v. FPC*, 354 F.2d 608 (2d Cir. 1965), *cert. denied*, 384 U.S. 941 (1966); *Texas E. Trans. Corp. v. Wildlife Preserves*,

Weight of Air Pollution Factors

The importance of air pollution health hazards in highway decision-making is not prescribed in existing law. No threshold of unacceptability tells the planner when he must return to his drawing board and eliminate the hazardous effects. States are required only to "consider" air pollution; no standards dictate which highways cannot be built. The Secretary of Transportation is guided only by the National Environmental Policy Act of 1969.⁴⁷

In view of its potential for havoc in human health, air pollution arguably requires an absolute rule, barring a proposed highway until its harmful effects are eliminated. It is difficult to conceive of any benefits of the road which are sufficiently great to outweigh properly defined and adequately proved health hazards.⁴⁸ Under such a rule, where harm to human health caused by air pollution is clear, the road would have to be redesigned, relocated, or eliminated.

But most air pollution information is not totally clear and distinct. Health effects on humans at concentrations found near highways are shown in a relatively small proportion of the medical studies. Only recently have studies begun to appear which reveal effects upon humans at commonly encountered levels of concentration.⁴⁹ The result is that literature often

Inc., 48 N.J. 261, 225 A.2d 130 (1966); Tarlock, *Recent Natural Resource Case*, 8 NATURAL RESOURCES J. 1, 5 (1968). See also H.R. REP. NO. 1125, 88th Cong., 2d Sess. (1964); Krier, *Environmental Litigation and the Burden of Proof: Some Comments and Suggestions*, Sept. 11-12, 1969 (paper given at Conservation Foundation Conference on Law and the Environment).

47. 42 U.S.C. §§ 4331-47 (Supp. V, 1970). DOT environmental policy statements on new interstate highways such as California's I-5 and I-80, required by Section 102(2)(C) of the Act, do not mention air pollution. Several contracts have been let by DOT to help it implement the Act, including a \$228,594 contract for assisting it in making its planning more responsive to environmental considerations. See 116 CONG. REC. S16,881-86 (daily ed. Oct. 1, 1970); 2 CLEAN AIR & WATER NEWS No. 30 at 4 (1970). DOT considers the Act to be "the criterion for evaluating environmental and ecological considerations." *Id.*

48. This contrasts with congressional policy on disruption of parkland for highways. Section 138 of the Highway Act bars invasion of parks unless "there is no feasible and prudent alternative to the use of such land." 23 U.S.C. § 138 (Supp. V, 1970). Congress has stated that this section is not "a mandatory prohibition against the use of the enumerated lands, but, rather, is a discretionary authority which must be used with both wisdom and reason." CONFERENCE REPORT ON S. 3418, H.R. REP. NO. 1799, 90th Cong., 2d Sess. 32 (1968). Compare Michigan Environmental Protection Act of 1970, Enrolled House Bill No. 3055 § 3(1), with ME. REV. STAT. ANN. tit. 38, § 484 (1964). "The commission shall approve a [commercial or industrial] development proposal whenever it finds that . . . the proposed development has made adequate provision for fitting itself harmoniously into the existing natural environment and will not adversely affect existing uses, scenic character, natural resources or property values in the municipality or in adjoining municipalities." *Id.*

49. See, e.g., Hodgson, *Short-term Effects of Air Pollution on Mortality in New York City*, 4 ENVIRONMENTAL SCIENCE & TECHNOLOGY 586-89 (1970).

shows studies of effects on animals or humans at concentrations far higher than those to which humans are normally exposed. Extrapolations to human health hazards at normal highway concentrations are uncertain. Thus, the record before the state highway department, even if developed in accordance with the standards suggested above, will show a series of risks of varying intensity, and only a few clear instances of harm.⁵⁰

Commitment of evaluation of these uncertainties to administrative decision without guidelines fails to give adequate protection to what should be an important issue of public health. Not only is the administrator more or less free to ignore the risks, but reviewing courts have no usable standards for examining his action.⁵¹ Regulations should prescribe the quantum of proof necessary to require the proponent of the highway to change the project. Models for such regulations exist, covering the spectrum from a very high burden of proof to a very low one. Under the traditional tort rules for proving causation in a suit to abate a nuisance, the burden is comparatively high—proof of cause in fact by a preponderance of the evidence.⁵² Most highway air pollution proof may not rise to this rather high tort standard.

The uncertainty inherent in relying on medical studies of health hazards is accommodated in the food additive amendments to the Federal Food, Drug and Cosmetic Act, by establishing a very low burden of proof as the trigger to banning proposed action. The Act provides:

[N]o additive shall be deemed to be safe if it is found to induce cancer when ingested by man or animal, or if it is found, after tests which are appropriate for the evaluation of the safety of food additives, to induce cancer in man or animal.⁵³

50. The certainty of the evidence is further undermined by the imprecision of traffic estimates, pollution estimates, and diffusion models. See note 39 *supra*.

51. Courts willingly seize upon statutory standards if there are any. See, e.g., *Scenic Hudson Preservation Conference v. FPC*, 354 F.2d 608 (2d Cir. 1965), cert. denied, 384 U.S. 941 (1966). The National Environmental Policy Act of 1969 may provide the statutory peg for judicial protection of the environment. However, explicit statutory protection is probably required. One lawyer suggests that the ninth amendment may provide judges with a basis for deciding cases in favor of environmental protection. Roberts, *An Environmental Lawyer Urges: Plead the Ninth Amendment*, NATURAL HISTORY, Aug.-Sept. 1970, at 18.

52. See W. PROSSER, LAW OF TORTS 245-47 (3d ed. 1964). The plaintiff "must introduce evidence which affords a reasonable basis for the conclusion that it is more likely than not that the conduct of the defendant was a substantial factor in bringing about the result. A mere possibility of such is not enough." *Id.* at 247.

53. Food, Drug and Cosmetic Act § 409(c)(3)(A), 21 U.S.C. § 348(c)(3)(A) (Supp. V, 1970). Identical language appears in the Color Additive Amendment, Food, Drug and Cosmetic Act § 706(b)(5)(B), 21 U.S.C. § 376(b)(5)(B) (Supp. V, 1970). A similar standard is in effect under the pesticide provisions of the Act. Section 408 provides that "the Secretary may establish the tolerance applicable with respect to the use of any pesticide chemical in or on any raw agricultural commodity at zero level if the scientific data before the Secretary does not justify the establishment of

Under this standard, food additives are banned even though the studies which show inducement of cancer involve laboratory situations which offer little basis for extrapolation to humans. This gap between evidence and administrative action is explicitly recognized by enforcement officials. In restricting cyclamates, one official said:

We can in no way at this time extrapolate the new data from rat experiments to human beings. Nevertheless, we in this Department—whether from a legal or from a scientific point of view—cannot afford to ignore any possibility of the rat data being applicable to human population. As long as this possibility exists, a prudent concern for the health of the public dictates that precautionary action be taken.⁵⁴

This enforcement philosophy has been upheld in court, where a food additive ban was upheld despite the fact that the amounts used by humans were relatively small.⁵⁵

The range between the tort standard's "cause in fact" and HEW's "possibility" test, offers many options for design of a regulation which provides explicit protection from new air pollution dangers caused by urban freeways. Given the nature of much of the medical evidence, however, any test requiring substantially more than a showing of a possibility of harm will offer relatively little protection.

Required Action

When the record shows an air pollution hazard with sufficient certainty to meet the applicable test, the highway planner must respond by changing his plans. He may have several options, although many of these may be freighted with such enormous social or economic costs that they are alternatives in theory only.

Elimination of the proposed road is required when no other device will avoid the air pollution hazard. This is most likely to occur when the new highway will encourage so much new traffic into the city that the total air

a greater tolerance." 21 U.S.C. § 346a(b) (Supp. V, 1970). The regulations under Section 408 provide that a zero tolerance may be established because:

- (a) A safe level of the pesticide chemical in the diet of two different species of warm-blooded animals has not been reliably determined.
- (b) The chemical is carcinogenic to or has other alarming physiological effects upon one or more of the species of the test animals used, when fed in the diet of such animals.

21 C.F.R. § 120.5 (1970).

54. Statement of Jesse L. Steinfeld, Deputy Assistant Secretary of Health, Education, and Welfare for Health and Scientific Affairs, Oct. 18, 1969. *But see* PROSSER, *supra* note 52, indicating that under the tort standard "a mere possibility" is not enough.

55. *See* Bell v. Goddard, 366 F.2d 177 (7th Cir. 1966).

pollution burden in the city, or a region of it, will be increased. Even with reductions in per-car emissions that accompany higher freeway speeds for some pollutants, the offsetting effect of the increase in amounts of other pollutants and new traffic may produce a new hazard. It is a hazard which cannot be avoided easily by redesign or relocation.

Highway engineers claim that air pollution effects of urban freeways can be reduced substantially through the use of such devices as elevating the road and planting green belts around it.⁵⁶ Such solutions may create problems of their own. An elevated roadway is likely to be extremely offensive to the eye.⁵⁷

When air pollution dangers can be localized in particular adjacent properties, acquisition of these properties solves the health problem. The Highway Act provides, as it must, for acquisition of land within the path of the road.⁵⁸ Acquisition of land for other purposes, such as scenic enhancement of the road⁵⁹ and fringe parking,⁶⁰ is also authorized. Control of adjacent land is encouraged through incentive payments to bar billboards on nearby private land,⁶¹ and to screen and control junk yards.⁶² Relocation assistance is provided for a "displaced person" whose property is acquired "in whole or in part" for a highway.⁶³ But neither acquisition nor relocation is provided to persons faced with air pollution hazards as a result of the new road. It is one of the uncompensated non-construction costs of the highway.⁶⁴ Acquisition of adjacent properties exposed to new air pollution hazards would solve the problem. However, extending the sweep of land acquisition may cause social and economic disruption exceeding that which is already considered undesirable in urban freeway construction.⁶⁵ The result may be that the highway simply cannot be built because the costs are too high.

56. See, e.g., CHICAGO CROSSTOWN EXPRESSWAY, *supra* note 29, at 12.

57. The planners of the Chicago Crosstown Expressway, who suggest "an elevated alignment" as one method of reducing air pollution, *id.*, should be familiar with this problem. Part of the Crosstown was originally planned as an elevated alignment and was severely criticized as an eyesore "stiltway."

58. 23 U.S.C. § 109(f) (Supp. V, 1970).

59. *Id.* § 319. See also PPM 21-17 (Feb. 18, 1966); PPM 21-4-6 (Jan. 24, 1966).

60. Act of Aug. 23, 1968, Pub. L. No. 90-495 § 11(a), 82 Stat. 820-21, amending 23 U.S.C. §§ 120-21 (1964).

61. 23 U.S.C. § 131(b) (Supp. V, 1970).

62. *Id.* § 136.

63. *Id.* §§ 501-11.

64. *Hearings on Urban Highway Planning, Location, and Design Before the Subcomm. on Roads of the Senate Comm. on Public Works*, 90th Cong., 1st & 2d Sess., pt. 2, at 313, 343, 352 (1968) (Report by Anthony Downs). Whether excessive air pollution constitutes a "taking" of land for constitutional purposes is beyond the scope of this article.

65. With respect to Section 138 of Title 23 which attempts to preserve parklands, Congress has said: "The Congress does not believe, for example, that substantial numbers of people should be required to move in order to preserve these lands." CONFERENCE REPORT ON S. 3418, H.R. REP. NO. 1799, 90th Cong., 2d Sess. 32 (1968).

Use of the completed highway can be controlled to meet pollution control standards. Access controls have been authorized on federally-financed highways, although for different reasons.⁶⁶ Limiting the number or type of vehicles using the highway will limit pollution. A toll, or special tax, to use the highway would provide an economic incentive to limit road use. Such a charge would also impose an appropriate assessment on the automobile owner for his use of the air to dispose of his engine combustion wastes. Finally, the highway might be restricted to vehicles complying with strict standards on emissions.⁶⁷

Conclusion

Ignorance of air pollution effects of proposed highways is common and inexcusable. Information which can form the basis for an intelligent estimate of the new risks to human health is available. On the basis of such information, highway planners should be required to eliminate hazards to health. While some area for dispute may exist as to how much proof is necessary to require redesign, relocation, or elimination of a road, the current practice of refusing to see the air pollution problem should stop.

66. See *Statement of Position of the Federal Highway Administration on the Reservation of Freeway Lanes for Buses*, INSTRUCTIONAL MEMORANDUM 21-13-67 (Aug. 1967); AMERICAN AUTOMOBILE MANUFACTURER'S ASS'N, *THE POTENTIAL FOR BUS RAPID TRANSIT* (1970).

67. Presumably such restrictions would not be illegal under the federal pre-emption of state emission control activity provided by 42 U.S.C. § 1857f-6a(a) (Supp. V, 1970). See Currie, *Motor Vehicle Air Pollution: State Authority and Federal Pre-emption*, 68 MICH. L. REV. 1083, 1096 (1970).

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Mr. Reilly explores the legislative history and administrative implications of Section 102(2)(C), which he calls the "action-forcing mechanism" of the National Environmental Policy Act.

This section of the Act generally requires federal agencies to prepare statements delineating the environmental consequences of federal programs. Coordinating the efforts of the federal agencies in this regard is the Council on Environmental Quality, created by the Act and delegated the dual role of keeper of the nation's environmental conscience and advisor to the President.

Although the National Environmental Policy Act applies to nearly every federal agency, Mr. Reilly here concentrates on its application to the federal highway program within the Department of Transportation. In discussing the implementation of the Act with respect to the 8,000 highway projects assisted annually by the federal highway program, the author examines the required evaluation of alternatives to highway projects, the uses of environmental impact statements, and the adequacy of existing highway planning procedures.