

Legislation for Clean Air: An Indoor Front

Finding new turf to spade has become increasingly difficult for the environmental muckraker. Ten years ago, when the full effects of air and water pollution were only vaguely perceived, a book on the ecological impact of bug sprays could become a national best-seller.¹ Today, however, there is little doubt that the environmental movement has forced the pollution problem to a high level of public awareness. To be sure, debate continues over the size of anti-pollution expenditures² and the ultimate changes required to abate fully the environmental crisis;³ but few deny the existence of a widespread pollution problem. Thus, for those inclined toward the dramatic exposé, the environmental field is becoming increasingly barren. Once the demise of post-industrial society has been predicted⁴—and denied⁵—arguments about topics such as the amount and effect of mercury in swordfish seem rather inappropriate for public debate.

The suggestion that indoor air pollution is a problem may therefore appear to be either facetious or over-zealous environmentalism. However, the available evidence suggests that the problem is serious, and because it is primarily a problem of laws and the institutions that administer them, it deserves attention from lawyers and legislators. Following a brief discussion of the current scope of federal outdoor air pollution legislation, this Note will consider the dimensions of the indoor air pollution problem. Concluding that indoor air pollution is a menace to the health of millions, it will then argue that existing regulation of indoor contaminants is inadequate and that comprehensive federal legislation is needed.

I. Federal Air Pollution Law: No Inside Curbs

Congress' initial approach to the problem of air pollution was characterized by cautious incrementalism. The first legislative effort was

1. R. CARSON, *SILENT SPRING* (1962).

2. Disagreement between President Nixon and Congress over the magnitude of federal appropriations for the construction of sewage treatment plants is an example of such debate. See 3 ENVIRON. REP. (CURRENT DEVELOPMENTS) 711, 736, 879, 937-39 (1972) & 1100, 1370 (1973).

3. Compare D. MEADOWS, D. MEADOWS, J. RANDERS & W. BEHRENS, *THE LIMITS TO GROWTH* (1972) with P. PASSELL & L. ROSS, *THE RETREAT FROM RICHES: AFFLUENCE AND ITS ENEMIES* (1973).

4. See, e.g., Ehrlich, *Eco-Catastrophe!* in *THE ENVIRONMENTAL HANDBOOK* 161 (G. DeBell ed. 1970).

5. See, e.g., P. PASSELL & L. ROSS, *supra* note 3, at 19-49.

a 1955 act providing "research and technical assistance" for the control of air pollution.⁶ That act was amended repeatedly⁷ and finally restructured entirely in the 1970 Clean Air Act.⁸ In its present form, the Act essentially federalizes responsibility for air pollution. The establishment of national air quality standards and control regions is the responsibility of the Environmental Protection Agency (EPA).⁹ Although enforcement of the standards within these regions is carried out by the states, supervisory and ultimate enforcement responsibility belongs to the EPA.¹⁰ In addition to the EPA's extensive regulatory powers, the Act also establishes a broad right of private actions both to compel enforcement of emission standards and to require the EPA Administrator to discharge his duties.¹¹

That this elaborate regulatory framework for air pollution is no paper tiger can be seen in the magnitude of its compliance and administrative costs. Between 1973 and 1977, the EPA estimates that private expenditures to achieve compliance with national air quality standards will be \$42 billion.¹² One estimate for total compliance costs for the period 1971 to 1980 is \$106.5 billion.¹³

The primary rationale underlying such expenditures is not, as some suppose, the elimination of aesthetic nuisance. Rather, health is the dominant concern. The principal goal of the 1970 act is to:

6. Air Pollution Control Act, ch. 360, 69 Stat. 322 (1955), as amended 42 U.S.C. § 1857 (1970).

7. For a thorough discussion of these amendments see Comment, *A History of Federal Air Pollution Control*, 30 OHIO S.L.J. 516 (1969).

8. Act of Dec. 31, 1970, Pub. L. No. 91-604, 84 Stat. 1705. The Act is now codified in 42 U.S.C. § 1857 (1970). For a brief description of the administrative and enforcement procedures established by the 1970 amendments to the Clean Air Act, see Golemon, *The Clean Air Amendments*, 34 TEX. B.J. 411 (1971).

9. 42 U.S.C. § 1857 c-2 (1970).

10. See 42 U.S.C. § 1857 c-5 to 9 (1970). Failure by states to devise acceptable enforcement plans, or to enforce a previously established plan, can lead to the EPA's assumption of a direct enforcement role. 42 U.S.C. § 1857 c-8 (1970).

11. 42 U.S.C. § 1857 h-2 (1970). A dramatic example of a private suit under the act was initiated in September of 1972 by several smog-afflicted cities near Los Angeles to compel the EPA Administrator to promulgate an air pollution compliance plan for the Los Angeles air quality control region. The court-ordered plan, promulgated in January of 1973, proposes, *inter alia*, an eighty percent reduction in auto travel in the area to be effected by such means as gasoline rationing. The Administrator subsequently expressed "grave reservations" about the plan's feasibility and doubted that it would be put into effect. See N.Y. Times, Jan. 14, 1973, at 1, col 3; N.Y. Times, Jan. 16, 1973, at 1, col. 6. Hearings on the proposed transportation controls were scheduled by the EPA for March 1973. 3 ENVIRON. REP. (CURRENT DEVELOPMENTS) 1259 (1973).

12. EPA, *The Economics of Clean Air; Report to Congress*, cited in 2 ENVIRON. REP. (CURRENT DEVELOPMENTS) 1353 (1972). The EPA itself budgeted \$134.2 million in Fiscal Year 1972 and \$158.7 million in Fiscal Year 1973 for air pollution programs. See *id.* By comparison with the current rate of federal expenditures, it should be noted that the total appropriation authorized by the 1963 Act was \$25 million for FY 1965, \$30 million for FY 1966 and \$35 million for FY 1967. Act of Dec. 17, 1963, Pub. L. No. 88-206, § 13(b), 77 Stat. 392.

13. COUNCIL ON ENVIRONMENTAL QUALITY, THIRD ANNUAL REPORT TO CONGRESS 276 (1972).

protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population.¹⁴

Yet Congress' willingness to require major technological change and massive expenditure in the name of health stops at the doorsill. While wording in the legislative findings and purpose of the Act suggests that it might encompass both indoor and outdoor air,¹⁵ subsequent language in the legislation restricts the promulgation of air quality standards (and by inference the entire regulatory scheme) to outdoor air.¹⁶ If there were no sources of air pollution within buildings and if interior-exterior ventilation were sufficient, Congress' failure to consider indoor air would be of no concern.¹⁷ Unfortunately, there are a number of indoor contaminant sources and few ventilating systems which can effectively disperse their emissions. Indoor air is dirty. But just how dirty it is, and the health hazards of such pollution, have not, until recently, been the subjects of systematic research.

II. Indoor Air Is Dirty—and Unhealthy

The average person spends about eighty percent of his time indoors, and those most susceptible to the adverse effects of pollution, the elderly and the chronically ill, spend even more.¹⁸ Although extensive measurements have been made of outdoor pollution, very little information has yet been gathered on the presence, concentration, generation, and effect of contaminants indoors.¹⁹ Existing research does suggest that indoor pollution levels are determined primarily by the level of outdoor concentration.²⁰ Nevertheless, significant sources of pollu-

14. 42 U.S.C. § 1857(b)(1) (1970). According to the Senate report, the whole concept of an air quality standard was pegged to a health criterion:

An ambient air quality standard . . . should be the maximum permissible ambient air level of an air pollution agent or class of such agents (related to a period of time) which will *protect the health of any group of the population*.

S. REP. NO. 91-1196, 91st Cong., 2d Sess. 10 (1970) (emphasis added).

15. See 42 U.S.C. §§ 1857(a)(3) & (4), (b)(1) & (2) (1970).

16. See 42 U.S.C. § 1857c-3(a)(1) (1970). Regulations by the EPA Administrator confirm the limitation of the Act's standards to "that portion of the atmosphere, external to buildings, to which the general public has access." 40 C.F.R. § 50.1(e) (1972).

17. If both of these conditions were met, air pollution levels indoors would always be very close to their level outdoors. Hence, by regulating outdoor air pollution, the EPA could indirectly, but effectively, regulate indoor air pollution.

18. F. BENSON, J. HENDERSON & D. CALDWELL, *INDOOR-OUTDOOR AIR POLLUTION RELATIONSHIPS: A LITERATURE REVIEW* 1 (1972).

19. *Id.* In this EPA-commissioned study over seventy-five publications are listed that contain some information relevant to the problems of indoor pollution, but the authors note that "only recently have comprehensive investigations of the problem been initiated." *Id.*

20. Except for bacteria and, perhaps, for fungus spores, indoor pollution levels appear to be controlled primarily by outdoor concentrations. Other factors that

tion exist indoors which can and do create pollution levels far exceeding standards established under the Clean Air Act for those same pollutants in outdoor air.

Within non-industrial buildings, there are three major sources of indoor pollutants—smoking, cooking, and heating.²¹ The first, smoking, is, of course, a well-known health hazard to smokers themselves.²² But while less well known, the hazards to nonsmokers are also quite significant.²³ One average cigarette pollutes the air with approximately seventy milligrams of dry particulate matter and twenty-three milligrams of carbon monoxide.²⁴ There are three related, but distinct, classes of health problems associated with this contamination.

First, an atmosphere containing tobacco smoke can contribute to the discomfort of many by causing nasal irritation, coughing, hoarseness, difficulty in breathing, headaches, nausea, and inflamed eyes.²⁵ An estimated 1.5 million people are allergic to tobacco smoke itself;²⁶ smoke also exacerbates the symptoms of those suffering from various

influence indoor pollution levels include internal activities and pollution generation, atmospheric conditions and natural ventilation, time, location, type of building, and air conditioning and filtration systems.

Id. at iv.

A recent EPA study of two buildings in New York City found indoor levels of carbon monoxide significantly in excess of levels permitted by federal health standards. Almost all of the carbon monoxide was generated by motor vehicle traffic passing around or under the buildings. N.Y. Times, Feb. 26, 1973, at 23, col. 1.

21. *Id.* at 19. Buildings such as factories and manufacturing plants may contain other contaminant sources which create special problems, but these are already the subject of specific federal occupational safety and health regulation. See pp. 1047-49 *infra*; S. REP. NO. 91-1282, 91st Cong., 2d Sess. 1-3 (1970).

22. See generally U.S. DEP'T OF HEALTH, EDUCATION & WELFARE, THE HEALTH CONSEQUENCES OF SMOKING; A REPORT OF THE SURGEON GENERAL: 1972, at 4-12 (1972) [hereinafter cited as 1972 SURGEON GENERAL'S REPORT]; U.S. DEP'T OF HEALTH, EDUCATION & WELFARE, THE HEALTH CONSEQUENCES OF SMOKING (1973).

23. See 1972 SURGEON GENERAL'S REPORT, *supra* note 22, at 177-206. Former Surgeon General Jesse Steinfeld considered the threat of harm to the nonsmoker from tobacco smoke to be serious enough to warrant a ban on smoking in public places. NEWSWEEK, Jan. 25, 1971, at 90.

24. 1972 SURGEON GENERAL'S REPORT, *supra* note 22, at 182. The manner in which smoking contaminates the atmosphere is described in the Surgeon General's Report: Atmospheric pollutants caused by smoking are derived from two major sources: mainstream and sidestream smoke. Mainstream smoke emerges from the tobacco product through the mouthpiece during puffing, whereas sidestream smoke comes from the burning cone and from the mouthpiece during puff intermissions. The tobacco released into the atmosphere consists of all the sidestream smoke as well as that part of the mainstream smoke which has been either held in the smoker's mouth or taken into his lungs and then expelled.

Id. This sidestream smoke is the most toxic, containing almost twice as much tar and nicotine as does the smoke which the smoker inhales. See *id.* at 184; 115 CONG. REC., 91st Cong., 1st Sess. 40382 (1969).

25. See Speer, *Tobacco and the Nonsmoker*, 16 ARCHIVES ENVIRON. HEALTH 443, 444 (1968).

26. This estimate was made by Drs. Edward J. O'Connell and George B. Logan in an address before the American Medical Association. See New Haven Register, Jan. 16, 1972, at 28a, col. 1. See also Bridge & Corn, *Contribution to the Assessment of Exposure of Nonsmokers to Air Pollution from Cigarette and Cigar Smoke in Occupied Spaces*, 5 ENVIRON. RESEARCH 192, 193 (1972).

other allergies.²⁷ Such discomfort is not confined to a handful of individuals: A recent FAA survey of airline passengers found that sixty-three percent of the nonsmokers and forty-three percent of all passengers were sufficiently annoyed by tobacco smoke to suggest corrective action.²⁸

Second, the carbon monoxide in smoke may be quite harmful.²⁹ The level of carbon monoxide attained in experiments using rooms filled with tobacco smoke has equalled or exceeded the maximum health levels permitted in outdoor air.³⁰ In some cases it has exceeded the safety levels for work areas established under the federal Occupational

27. See 1972 SURGEON GENERAL'S REPORT, *supra* note 26, at 168. There are many people with allergies and illnesses which can be aggravated by the cigarette smoke of others. For those over seventeen, bronchitis has an estimated prevalence of 29.5 per 1000; emphysema, 9.8 per 1000; asthma, 29.7 per 1000; hay fever, 64.1 per 1000; and sinusitis, 140.2 per 1000. Wilson, Cigarette Smoking, Disability Days and Respiratory Conditions (unpublished paper presented at Conf. on Respiratory Diseases in Skytop, Pa., May 17-19, 1972, on file with *Yale Law Journal*).

28. U.S. DEP'T OF HEALTH, EDUCATION & WELFARE, HEALTH ASPECTS OF SMOKING IN TRANSPORT AIRCRAFT 40, 43, 47 (Dec. 1971) [hereinafter cited as SMOKING IN AIRCRAFT]. The corrective action suggested included segregating smokers and banning tobacco smoking entirely onboard aircraft. *Id.* at 47.

29. The best known biological effect of carbon monoxide is its combination with hemoglobin in the blood to form carboxyhemoglobin. This reduces the oxygen-carrying capacity of the blood and the readiness with which the blood surrenders its available oxygen to the body tissues. Nat'l Air Pollution Control Ad., *Criteria for Carbon Monoxide*, cited in ENVIRON. REP. (FED. LAWS) § 31: 1951, 1952 (1970). Exposure to carbon monoxide produces varying symptoms depending upon the concentration of the gas, the frequency and duration of exposure, the temperature and humidity, the age and general health of the individual and the amount of physical exercise during exposure. Rose, *Carbon Monoxide Intoxication and Poisoning*, 59 J. IOWA MED. SOC'Y 909, 912 (1969). See generally U.S. DEP'T OF HEALTH, EDUCATION AND WELFARE, CRITERIA FOR A RECOMMENDED STANDARD. . . . OCCUPATIONAL EXPOSURE TO CARBON MONOXIDE III-1, V-3 to 4 (1972) [hereinafter cited as OCCUPATIONAL EXPOSURE].

30. Regulations passed under the Clean Air Act set the maximum eight-hour concentration for carbon monoxide (not to be exceeded more than once per year) at 9 parts per million (ppm). 40 C.F.R. § 50.8 (1972).

In a recent experiment in Germany, forty-two German filter cigarettes were smoked in a room with a volume of fifty-seven cubic meters (the equivalent of a twelve by fourteen foot room with a ten-foot ceiling). In the absence of ventilation, the atmosphere contained up to 50 ppm of carbon monoxide. With substantial ventilation, the level fell to approximately 10 ppm. Nine cigars smoked in thirty to thirty-five minutes produced similar concentrations, while eight pipes smoked over the same period produced much lower levels. Harke, *Zum Problem des "Passiv-Rauchens"* (*The Problem of Passive Smoking*), 112 MÜNCHENER MEDIZINISCHE WOCHENSCHRIFT 2328 (1970).

In a second German experiment, carbon monoxide levels of up to 80 ppm were reported in a ninety-eight cubic meter room (the equivalent of an eighteen by twenty foot room with a ten-foot ceiling) in which sixty-two cigarettes were smoked in two hours. Harmsen & Effenberger, *Tabakrauch in Verkehrsmitteln, Wohn-und Arbeitsräumen* (*Tobacco Smoke in Transportation Vehicles, Living and Working Areas*), 141 ARCHIV FÜR HYGIENE UND BAKTERIOLOGIE 383 (1957). See generally 1972 SURGEON GENERAL'S REPORT, *supra* note 22, at 184-85 (discussing these and similar experiments).

In a subsequent experiment, two cigarettes were smoked, but not inhaled, in a hospital conference room measuring eighteen by thirty by nine feet and having a ventilation system that provided 12.5 volumetric air changes per hour. Samples of air collected at a position corresponding to that of a person seated next to a smoker showed carbon monoxide concentrations of 20.5 and 32.5 ppm. Letter to the Editor from Dr. W.B. Dublin, 117 CAL. MED. 76 (1972). But see Bridge & Corn, *supra* note 26, at 206.

Safety and Health Act.³¹ Exposure to such levels of carbon monoxide has been shown to alter auditory discrimination, visual acuity, and the ability to distinguish relative brightness.³² It has also been associated with impaired time interval discrimination³³ and diminished performance on certain psychomotor tests.³⁴ If cigarette smoke is allowed to accumulate in a poorly ventilated room, the carbon monoxide concentration can cause an increase in the heart rate and blood pressure of nonsmokers³⁵ and may have an adverse effect on cardiopulmonary responses to exercise.³⁶ A recent study also offers compelling evidence that even relatively brief exposure to such concentrations aggravates angina pectoris.³⁷ As more information on the effects of carbon monoxide is accumulated, some experts are concluding that it has no "safe" level, no level below which adverse effects do not occur.³⁸

Third, nonsmokers exposed to other components of tobacco smoke, such as particulate matter,³⁹ nitrogen dioxide,⁴⁰ and various hydrocarbons, may suffer additional adverse effects.⁴¹ Measurements of sus-

31. The maximum allowable time-weighted-average concentration of carbon monoxide for an eight-hour workday is set at 50 ppm. 29 C.F.R. § 1910.93, Table G-1 (1972). The National Institute for Occupational Safety and Health (NIOSH) recently recommended that this limit be lowered to 35 ppm. See OCCUPATIONAL EXPOSURE, *supra* note 29, at I-3.

32. These effects were noted after exposure to 50 ppm of carbon monoxide for periods varying from twenty-seven to ninety minutes. 1972 SURGEON GENERAL'S REPORT, *supra* note 22, at 189.

33. Such an effect has been associated with a level of blood carboxyhemoglobin that would be produced by an eight-hour exposure to a carbon monoxide concentration of 10 to 15 ppm. *Id.* at 193.

34. This impaired performance has been associated with a blood carboxyhemoglobin level that would be produced by an eight-hour exposure to a carbon monoxide concentration of 30 ppm. *Id.*

35. Luquette, Landiss & Merki, *Some Immediate Effects of a Smoking Environment on Children of Elementary School Age*, 40 J. SCHOOL HEALTH 533 (1970). This study has been criticized, however, because the children were shown a movie on the ill effects of smoking while being tested for exposure to tobacco smoke. See 1972 SURGEON GENERAL'S REPORT, *supra* note 22, at 195.

36. Chevalier, Krumholz & Ross, *Reaction of Nonsmokers to Carbon Monoxide Inhalation*, 198 J.A.M.A. 1061 (1966).

37. In this study ten patients with angina were driven for ninety minutes during heavy morning freeway traffic where ambient carbon monoxide ranged from 42 to 63 ppm. As a result of breathing the contaminated air, the patients experienced a significant decrease in exercise performance until angina, in systolic blood pressure at angina, and in heart rate at angina. Aronow, Harris, Isbell, Rokaw & Imparato, *Effect of Freeway Travel on Angina Pectoris*, 77 ANNALS INT. MED. 669 (1972). Animals exposed continuously to levels of carbon monoxide only slightly higher than those found in smoke-contaminated rooms have shown evidence of heart and brain damage. 1972 SURGEON GENERAL'S REPORT, *supra* note 22, at 190. See also OCCUPATIONAL EXPOSURE, *supra* note 29, at III-21.

38. See Knelsen, *United States Air Quality Criteria and Ambient Standards for Carbon Monoxide*, 32 STAUB-REINHALTUNG DER LUFT (English edition) 60, 63 (1972). Cf. Goldsmith, *Carbon Monoxide and Coronary Heart Disease: Compelling Evidence in Angina Pectoris*, 77 ANNALS INT. MED. 808, 809 (1972).

39. Yocom, Clink & Cote, *Indoor/Outdoor Air Quality Relationships*, 21 J. AIR POLLUTION CONTROL ASS'N 251, 256 (1971). See also Marchesani, Towers & Wohlers, *Minor Sources of Air Pollutant Emissions*, 20 J. AIR POLLUTION CONTROL ASS'N 19, 21 (1970).

40. Abelson, *A Damaging Source of Air Pollution*, 158 SCIENCE 1527 (1967).

41. 1972 SURGEON GENERAL'S REPORT, *supra* note 22, at 199.

pended particulate matter in non-air-conditioned public buildings found a mean level of 158 micrograms per cubic meter⁴²—well above the seventy-five microgram standard of the Clean Air Act.⁴³ The nitrogen dioxide in smoke reduces the efficiency of the major cleansing mechanism of the respiratory tract, leading to increased susceptibility to respiratory diseases and the aggravation of existing viral infections.⁴⁴ Hydrocarbons have been measured in a smoky restaurant at levels well above the outside atmospheric level;⁴⁵ and the hydrocarbon benzo(a)pyrene, a carcinogen in cigarette “tar,”⁴⁶ has been found in smoke-filled airplanes at levels in excess of those reported for typical urban areas.⁴⁷ Further research is clearly necessary to determine just how these substances contribute to the illnesses of those exposed to them in smoke-contaminated atmospheres,⁴⁸ but it is clear that the infamous “smoke-filled room” produces much more than suspect political deals.

The second major source of indoor air pollution is cooking, most notably with gas stoves. Such stoves can produce substantial quantities of carbon monoxide⁴⁹ and particulate matter⁵⁰—pollution which may be a frequent cause of ecologic mental illness.⁵¹ Research into the effect of stoves on indoor air pollution is far from comprehensive, however,

42. Goldwater, Manoharan & Jacobs, *Suspended Particulate Matter, Dust in “Domestic” Atmospheres*, 2 ARCH. ENVIRON. HEALTH 511, 515 (1961). Levels as high as 539 micrograms per cubic meter were measured. See also Bridge & Corn, *supra* note 26, at 207.

43. 40 C.F.R. § 50.6 (1972).

44. Children exposed to tobacco smoke in the home have more respiratory diseases than those in nonsmoking families. Cameron, *et al.*, *The Health of Smokers’ and Non-smokers’ Children*, 43 J. ALLERGY 336 (1969). The meaning of these results is, however, uncertain since smoking by children was not considered, and the concentration level of cigarette smoke in the children’s homes was not measured.

An examination of the sputum of nonsmokers who worked in offices where they were exposed to cigarette smoke suggests that bronchial diseases and infections could result from such exposure. Fullmer, Short, Allen & Walker, *Sputum of Chronic Cigarette Smokers*, 66 ROCKY MTN. MED. J. 42, 45 (Utah issue 1969). For descriptions of several experiments studying the effects of passive inhalation of cigarette smoke on the respiratory tracts of animals, see 1972 SURGEON GENERAL’S REPORT, *supra* note 22, at 196-97.

45. 1972 SURGEON GENERAL’S REPORT, *supra* note 22, at 185. Hydrocarbons are one of the six pollutants currently monitored under the Clean Air Act. See 40 C.F.R. § 50.10 (1972).

46. 1972 SURGEON GENERAL’S REPORT, *supra* note 22, at 101.

47. SMOKING IN AIRCRAFT, *supra* note 28, at 20. This finding becomes more startling when the extraordinarily effective ventilation systems of the airplanes involved in the survey are considered. See *id.* at 19, 80.

48. 1972 SURGEON GENERAL’S REPORT, *supra* note 22, at 199.

49. Yocum, Clink & Cote, *supra* note 39, at 253-54. HEW believes that “faulty or unvented heating appliances may release unusually high levels of carbon monoxide in a million American homes occupied by three million persons.” N.Y. Times, Mar. 4, 1973, at 71, col. 2.

50. F. BENSON, J. HENDERSON, & D. CALDWELL, *supra* note 18, at 21.

51. Randolph, *Domiciliary Chemical Air Pollution in the Etiology of Ecologic Mental Illness*, 16 INT’L J. SOC. PSYCH. 243, 264 (1970). Randolph differentiates ecologic mental illness from psychiatrically interpreted mental syndromes by the ability of ecologically oriented medicine to demonstrate cause-and-effect relationships. *Id.* at 263. Examples of the kinds of mental illness which can be ecologically caused include confusion, depression, and irritability.

and it is therefore difficult to estimate accurately the scope and gravity of the problem.

Heating systems are the third major source of indoor air pollution. It is widely known that dangerous concentrations of carbon monoxide can develop as the result of faulty heating equipment or chimneys.⁵² Faulty heating systems burning oil or coal can also generate hazardous levels of sulfur dioxide.⁵³ Here again, however, comprehensive studies of the problem have not yet been conducted.⁵⁴

III. Existing Indoor Air Pollution Regulation

Despite the absence of comprehensive data on indoor environments, existing information nevertheless strongly suggests that air pollutants regulated in the outdoor air exist at hazardous levels indoors. Though immune from the Clean Air Act, indoor air is not, however, completely unregulated.

A. *Occupational Safety and Health Act of 1970*

In 1970 Congress enacted the most comprehensive job-safety statute in the nation's history—the Occupational Safety and Health Act (OSHA).⁵⁵ Earlier federal⁵⁶ and state⁵⁷ statutes applied to some workers some of the time; OSHA, by contrast, covers virtually every em-

52. See Biersteker & DeGraaf, *Air Pollution Indoors, A Neglected Variable in Epidemiology?*, 45 OVERDRUK UIT HET TIJDSCHRIFT VOOR SOCIALE GENEESKUNDE 74, 76-77 (1967); Knelson, *supra* note 38, at 61.

53. F. BENSON, J. HENDERSON & D. CALDWELL, *supra* note 18, at 19; Yocom, Clink & Cote, *supra* note 39, at 254. Sulfur dioxide in the air causes increased airway resistance and partial ciliary paralysis. Rossano, *Adverse Health Effects of Air Pollution—General*, in AIR POLLUTION CONTROL: GUIDEBOOK FOR MANAGEMENT 87, 90 (A. Rossano ed. 1969).

54. In addition to the three major indoor pollution sources noted in the text, other possible sources of non-industrial contamination include pesticides; solvents and solvent-containing paints, adhesives and hair sprays; tar-containing adhesives; rubber-based paints; sponge rubber bedding, upholstery and padding; plastic constructional materials, toys and furnishings; synthetic carpeting, upholstery, curtains, and clothing; certain cosmetics; pine, creosote and phenol. See Randolph, *supra* note 51, at 264. See generally Foote, *Mercury Vapor Concentrations Inside Buildings*, 177 SCIENCE 513 (1972); Marchesani, Towers & Wohlers, *supra* note 46.

Comprehensive study of major pollution sources in homes may have begun. HEW recently announced that it is undertaking a twenty-six city survey of carbon monoxide pollution in private residences. N.Y. Times, Mar. 23, 1973, at 71, col. 2.

55. 29 U.S.C. §§ 651-78 (1970). For an analysis of the act, see Moran, *A Critique of the Occupational Safety and Health Act of 1970*, 67 NW. U.L. REV. 200 (1972).

56. See, e.g., 1936 Walsh-Healey Government Contracts Act, 41 U.S.C. § 35 (1970); Longshoremen's and Harborworkers' Compensation Act, 33 U.S.C. § 941 (1970); Federal Coal Mine Health and Safety Act of 1969, 30 U.S.C. §§ 801, 811 (1970); Service Contract Act of 1965, 41 U.S.C. § 351(a) (3) (1970).

57. Thirty-seven states, the District of Columbia, and Puerto Rico have some type of job safety and health standards. CCH EMPL. SAFETY & HEALTH GUIDE ¶ 5035 (1971).

ployer and employee in the country.⁵⁸ Included within its broad scope is the regulation of work-place air environments.⁵⁹

In spite of this comprehensiveness, however, OSHA is not in itself an adequate policing mechanism for all indoor air pollution. First, pollutant standards set pursuant to the Act⁶⁰ protect only *workers*. They are not designed to protect those who do not work, particularly the young, the old, and the ill—groups often the most susceptible to the adverse effects of air pollution.⁶¹ Second, the standards are established with an eye toward *healthy* workers; they may not provide adequate protection for workers with existing physical impairments.⁶² Third, the Act protects workers only *at work*. The standards are designed to protect employees working a normal eight-hour day, forty-hour week;⁶³ they assume a recuperative factor⁶⁴ which may not exist if the worker is subjected to a contaminated environment away from his job. Finally, the Act's air pollution standards themselves are extremely difficult to enforce.⁶⁵ There are only sixty hygienists in the Depart-

58. Moran, *supra* note 55, at 203. Shortly before the passage of the act, the Bureau of Labor Statistics estimated that it would cover fifty-seven million workers. That estimate, however, excluded agricultural workers, who are now included. *Id.* at 203 n.26.

Under the act employers have three primary duties: to furnish a safe place to work, 29 U.S.C. § 654(a)(1) (1970), to comply with specific safety and health standards promulgated under the statute, 29 U.S.C. § 654(a)(2) (1970), and to keep accurate records of work-related deaths, injuries, or illnesses, and of employee exposure to certain toxic or harmful agents. 29 U.S.C. § 657(c)(2), (3) (1970).

59. 29 C.F.R. § 1910.93 (1972). *See also* 29 U.S.C. § 655 (1970).

60. The authority to promulgate safety and health standards is vested in the Secretary of Labor. 29 U.S.C. § 655 (1970). To assist him the act created the National Institute for Occupational Safety and Health (NIOSH), a new agency within the Department of Health, Education and Welfare. 29 U.S.C. § 671 (1970). Among the various standards promulgated to date are exposure levels for over 400 air contaminants, including carbon monoxide. *See* 29 C.F.R. § 1910.93 (1972).

61. *See id.* at 1042 *supra*.

62. *See* OCCUPATIONAL EXPOSURE, *supra* note 29, at I-1 to 2. By contrast air quality standards established under the Clean Air Act are "designed to protect the population-at-large and [take] into consideration 24-hour per day exposure of the very young, the very old, and the seriously ill." *Id.* at VI-2.

63. *See id.* at I-1.

64. Regulations adopted pursuant to OSHA have set an eight-hour time-weighted-average limit for carbon monoxide at 50 ppm, 29 C.F.R. § 1910.93, Table G-1 (1972)—considerably higher than the 9 ppm maximum eight-hour concentration set under the Clean Air Act, 40 C.F.R. § 50.8 (1972). One reason for this disparity is that the OSHA standard incorporates a recuperative factor which assumes that individuals can recover from the stress of exposure to a contaminated atmosphere while at work if they live in a less toxic atmosphere at other times.

65. The enforcement mechanism is implemented primarily by Department of Labor area offices throughout the country. *See* Moran, *supra* note 55, at 207. Each office has a director and a team of safety inspectors who patrol places of employment, both on their own initiative and in response to reported complaints. *Id.* *See* 29 U.S.C. § 657(a), (b)(1) (1970). If a violation is found, the employer is issued a citation fixing a time limit for abatement. 29 U.S.C. § 658 (1970). Penalties may be assessed for violations, 29 U.S.C. § 666(a)-(c) (1970), or for failure to abate a cited hazard within the required time. 29 U.S.C. § 666(d) (1970).

Determining whether the air at a particular work place is in compliance is not easy. A safety inspector's experience might enable him to pare down the list of the more than 400 contaminants for which standards have been established, 29 C.F.R.

ment of Labor currently charged with enforcing all of the Act's health standards, of which the more than 400 air contaminant levels⁶⁶ comprise but one small part.⁶⁷

B. *Miscellaneous Indoor Air Pollution Regulation*

Airplanes, trains, and buses have long been subject to some regulation of interior air contamination. The FAA has promulgated regulations on harmful or hazardous pollutant concentrations inside airplanes, though their goal is prevention of fire rather than of health hazards.⁶⁸ Recently, the FAA⁶⁹ and the ICC⁷⁰ have taken steps to implement no-smoking rules for carriers under their jurisdiction, and the CAB has proposed a new rule to require the segregation of smokers on airlines.⁷¹ Several states currently regulate smoking in public carriers,⁷² and many other carriers have voluntarily adopted such regulations.⁷³

§ 1910.93 (1972), to a relatively small number of pollutants which, in a particular type of business, are likely to exceed the maximum permitted level. However, in order to conduct a careful test, he still must check for a large number of possible contaminants. For each, he must take air samples from the workers' breathing zones at random intervals throughout the day and then compute a time-weighted average. See OCCUPATIONAL EXPOSURE, *supra* note 29, at VIII-1. Each contaminant test may be a complicated measuring process. For the requirements for calculating air contaminant levels, see 29 C.F.R. § 1910.93 (1972).

66. 29 C.F.R. § 1910.93 (1972).

67. See Sherrill, *Asbestos, the Saver of Lives, Has a Deadly Side*, N.Y. Times, Jan. 21, 1973, § 6 (Magazine), at 12, 63. In testimony before Congress, federal officials conceded that to enforce the health standards of the act, they would need one hygienist per 35,000 workers. The present sixty represent one per 1.2 million workers. *Id.*

68. Each aircraft passenger compartment must be ventilated; crew and passenger air supplies must be free from harmful or hazardous gas concentrations; and carbon monoxide concentrations in excess of 50 ppm are considered hazardous. 14 C.F.R. § 25.831 (1972).

69. The FAA proposed a rule regulating smoking on airplanes in March, 1970, 35 Fed. Reg. 5045 (1970), but deferred implementation pending voluntary compliance by the airlines. Letter from Dennis S. Feldman, Dpty. Dir. of Public Affairs for Dep't of Transportation, to the author, Aug. 15, 1972, on file with the *Yale Law Journal*.

70. On November 8, 1971, the ICC determined that smoking was a nuisance and an irritant. The Commission promulgated a rule requiring segregation of smokers on buses effective January 6, 1972. Smoking by Passengers and Operating Personnel on Interstate Buses, 114 I.C.C.-M.C.C. 256, 276, 277 (1971). However, an indefinite extension was granted by the ICC to the National Association of Motor Bus Owners at the request of the U.S. District Court for the District of Columbia, and the rule has not yet gone into effect. Letter from Henry U. Snavelly, Dpty. Dir., Sect. of Operating Rights, ICC, to the author, Aug. 18, 1972, on file with the *Yale Law Journal*.

71. 37 Fed. Reg. 19146 (1972). Airlines have now voluntarily promulgated regulations segregating smokers. See note 73 *infra*.

72. See, e.g., CONN. GEN. STAT. § 53-198 (West 1960) (prohibits smoking on buses); CAL. PUBL. UTIL. CODE § 561 (West Supp. 1971) (requires public carriers to provide designated space for nonsmokers); N.J. STAT. ANN. § 2A:170-65 (West 1971) (prohibits smoking on buses); UTAH CODE ANN. § 76-11-3 (1953) (prohibits smoking in a variety of public areas unless rooms or compartments are provided for that purpose).

73. The Air Transport Association, the trade organization of domestic carriers, recently adopted a resolution requiring all airlines to provide separate smoking and non-smoking sections on all flights. Previously each airline had established its own policy.

In addition to these public carrier regulations, a hodge-podge of federal, state, municipal, and voluntary measures partially regulate other indoor environments. Food sanitation laws in one state ban smoking in bakeries⁷⁴ or pasteurizing plants;⁷⁵ in another, fire-prevention statutes prohibit smoking in elevators⁷⁶ and at certain athletic exhibitions.⁷⁷ Several states have statutes authorizing their health departments or county commissioners to regulate the ventilation of buildings.⁷⁸ Smoking is also restricted or prohibited by the managers of some hospitals⁷⁹ and sports arenas⁸⁰ and by some private and public employers.⁸¹

Thus, indoor air is not totally unregulated. But the present crazy-quilt of supervision, directed in large part toward fire prevention, affords only incidental protection to the health of people indoors.

IV. A Proposal: A Federal Clean Indoor Air Act

The gravity and scope of the problem of contaminated indoor air require comprehensive regulation. Specifically, the solution lies in the

Segal, *Travel Notes: Caution, Smoking is Hazardous to Passengers' Comfort*, N.Y. Times, Dec. 31, 1972, § 10, at 4, col. 1.

Nonsmoking cars are designated on the New Haven, Harlem, and Hudson divisions of the Penn Central Railroad (New Haven Register, Oct. 7, 1970, at 11, col. 5), and smoking is prohibited entirely on the Illinois Central's new air-conditioned double-decker commuter cars. Los Angeles Times, Apr. 6, 1971, at 15, col. 1. As the result of a complaint by Chief Justice Burger, Amtrack has banned cigar and pipe-smoking in the first-class club cars of the Metroliner running between New York and Washington. N.Y. Times, Dec. 14, 1972, at 59, col. 3.

74. CONN. GEN. STAT. § 9-289 (West 1969).

75. CONN. GEN. STAT. § 22-201 (West Supp. 1972).

76. MICH. COMP. LAWS ANN. § 408.820 (West Supp. 1972).

77. MICH. COMP. LAWS ANN. § 431.124 (West 1964) (prohibits smoking at boxing, sparring, and wrestling matches).

78. See, e.g., CAL. HEALTH & SAFETY CODE ANN. § 18900 *et seq.* (West Supp. 1972); HAWAII REV. STAT. § 322-42 (1968); KAN. STAT. ANN. § 65-101 (1964); LA. REV. STAT. tit. 40, § 35 (West 1965); MD. ANN. CODE, Art. 25, § s(s) (Supp. 1971); MASS. ANN. CODE ch. 143, § 42 & ch. 144, §§ 15, 21, 25, 26 (1972), ch. 149, § 113 (Supp. 1971); N.C. GEN. STAT. § 143-138 (Supp. 1971).

79. Five years ago the Board of Directors of the Jersey Shore Medical Center took steps to restrict smoking on the premises. N.Y. Times, Apr. 25, 1968, at 24, col. 5. More recently, a proposed program to limit smoking in New York City hospitals was sent to hospital administrators by the American Cancer Society, the New York Heart Association, and the Tuberculosis and Respiratory Disease Associations of New York. N.Y. Times, Feb. 4, 1973, § 1, at 54, col. 7.

80. Smoking by spectators is now banned during home contests of the Detroit Red Wings. N.Y. Times, Feb. 14, 1970, at 11, col. 3.

81. In 1964 employees of Franklin National Bank were forbidden to smoke during working hours except in washrooms and cafeterias. N.Y. Times, Jan. 9, 1964, at 33, col. 5.

While H.E.W. Secretary, Elliot Richardson agreed to establish no-smoking areas in conference rooms and auditoriums of H.E.W. facilities and no-smoking work areas wherever possible. Copy of letter from Elliot Richardson to John Banzhaf, Oct. 5, 1971, on file with the *Yale Law Journal*. In an order dated April 27, 1972, EPA Administrator William Ruckelshaus prohibited smoking in elevators, designated conference rooms, and poorly ventilated areas; he also asked regional administrators, directors of National Environmental Research Centers, and directors of other field facilities to issue similar guidelines. Letter from Stephen H. Barmakian, Office of Public Affairs, EPA, to the author, Aug. 7, 1972, on file with the *Yale Law Journal*.

adoption of a federal Clean Indoor Air Act, similar to the Clean Air Act of 1970.⁸² The need for uniform standards to prevent builders from fleeing states that enact strict standards, as well as the sheer complexity of air pollution regulation, calls for basic legislation at the federal rather than the state level.⁸³

Under this proposed act the federal government would establish air quality control regions⁸⁴ and standards for indoor air contaminants, much as it does under the present Clean Air Act.⁸⁵ In order to determine which pollutants to regulate and which standards to set, the act would also provide for federally financed studies of the levels and health hazards of indoor contaminants.⁸⁶ The role of the states in implementing the act would be analogous to their role under the Clean Air Act. With the assistance of the federal government, they would prepare plans to implement and enforce the federal standards, programs which would have to be approved by the EPA; in the event that a state fails to submit or enforce an acceptable plan, the EPA would assume a direct enforcement role.⁸⁷

Such legislation governing indoor air pollution would rest generally on Congress' power under Article I, Section 8, to regulate interstate commerce.⁸⁸ Constitutional limits on that power will determine the ultimate scope of the proposed act,⁸⁹ but it seems likely that Congress would have the power to combat air pollution at all places of public accommodation,⁹⁰ in businesses involved in interstate commerce,⁹¹ in

82. 42 U.S.C. § 1857 (1970). See pp. 1040-42 *supra*.

83. Of course, even without federal legislation, states and municipalities can act immediately to implement the policies suggested here.

84. Since indoor air pollution levels are determined primarily by the level of outdoor concentrations (see p. 1042 *supra*), buildings in regions with high ambient air pollution might be subject to more rigorous requirements than buildings in areas with relatively low ambient air pollution. For example, if the federal standard for maximum indoor concentrations of carbon monoxide were set at 15 ppm and if one building were located in a region with an average ambient carbon monoxide level of 5 ppm while another were located in a region with a level of 10 ppm, stricter restrictions would have to be applied in the latter building in order to prevent the indoor level from rising above safe limits. It may well be possible to utilize the air quality regions established under the Clean Air Act as similar regions for the purpose of policing indoor air pollution.

85. See p. 1041 *supra*.

86. Similar financing is provided for in the Clean Air Act. 42 U.S.C. § 1857b (1970).

87. Cf. Clean Air Act, 42 U.S.C. § 1857c-8 (1970). As under the Clean Air Act, private suits would also be permitted to compel enforcement of an emission standard or to force the agency administrator to perform his duties under the act. Cf. p. 1041 *supra*.

88. U.S. CONST. Art. I, § 8.

89. While Congress may not use a trivial impact on interstate commerce as an excuse for the regulation of state or private activities, where a general regulatory statute bears a substantial relation to interstate commerce, the de minimis character of individual instances arising under that statute are of no consequence. *Maryland v. Wirtz*, 392 U.S. 183, 196, 197 n.27 (1967).

90. See, e.g., *Heart of Atlanta Motel, Inc. v. United States*, 379 U.S. 241 (1964).

91. See, e.g., *NLRB v. Jones & Laughlin Steel Corp.*, 301 U.S. 1 (1937).

all federally financed buildings,⁹² and on all interstate carriers.⁹³ Private residences, however, would be generally outside the limits of such regulation.⁹⁴ This omission could be remedied in part, however, by encouraging the states, through federal subsidies, to extend their implementation plans to include private homes.

There are two alternative models for state implementation under this proposed act. The first would follow the direct enforcement model developed under the Occupational Safety and Health Act;⁹⁵ however, requiring periodic on-site inspections in every building and carrier covered by the act would undoubtedly be cumbersome and costly. A more workable second alternative would be the indirect enforcement model of state and municipal building codes. State implementation programs would stress building design standards rather than on-site inspections. Designing new buildings (or renovating existing structures) to dissipate indoor air contaminants through adequate ventilation should make further regulation largely unnecessary.⁹⁶

Establishing such building codes would not be difficult. The total volume of a particular space, the number of people occupying it, and the nature of the activities carried on within it would determine the necessary mode of ventilation.⁹⁷ If the space were large, the number of occupants low, and the sources of pollution few, natural window ventilation might be sufficient. As the volume of the room decreases, the number of occupants increases, or the level of emissions rises, mechanical ventilation may be required.⁹⁸ If such ventilation still fails

92. See, e.g., *United States v. Jefferson County Bd. of Educ.*, 372 F.2d 836 (5th Cir. 1966), *decree corrected*, 380 F.2d 385, *cert. denied*, 389 U.S. 840 (1967). This power to regulate federally financed buildings derives not from the commerce clause but rather from the necessary and proper clause, U.S. CONST. Art. I, § 8.

93. See, e.g., *Houston, E. & W. Texas Ry. Co. v. United States* (The Shreveport Rate Case), 234 U.S. 342 (1914).

94. It might even be argued that the federal government could regulate the design of private residences whose mortgages were federally insured under the Federal Housing Act, 12 U.S.C. § 1707 *et seq.* (1970). See 12 U.S.C. § 1709(a), (b)(7) (1970).

95. See pp. 1048-49 *supra*.

96. Although under this model, state implementation would focus on building design criteria, it would also have to provide for some on-site inspections to identify such operational hazards as faulty heating furnaces. Carefully drafted design standards of both buildings and major potential emitters, however, should make these inspections largely unnecessary.

97. For a formula which determines the concentration of gases in indoor air spaces and accounts for the effects of filtration and ventilation systems, see Bridge & Corn, *supra* note 26, at 194.

98. For factors to be considered in designing ventilation systems to reduce indoor air pollution, see Kalika, Holcombe & Cote, *The Re-Use of Interior Air*, ASHRAE J., Nov. 1970, at 48; Leopold, *Tobacco Smoke Control—A Preliminary Study*, 51 ASHRAE TRANS. 255 (1945); Yaglov, *Ventilation Requirements for Cigarette Smoke*, 61 ASHRAE TRANS. 25 (1955). (ASHRAE is the American Society of Heating, Refrigerating, and Air Conditioning Engineers.)

Legislation for Clean Air: An Indoor Front

to lower pollution to acceptable levels, restrictions could then be placed on either the number of occupants⁹⁹ or the range of polluting activities. All these determinations could be incorporated in a series of building regulations similar to existing building codes.¹⁰⁰ Future buildings would have to meet these criteria.¹⁰¹ Owners of existing structures would be allowed some grace period during which to make necessary modifications, although variances might be allowed in cases of exceptional hardship.

The regulation of air pollution within public carriers would be left largely in federal hands. Each federal agency would be responsible for enforcing federal standards on carriers within its jurisdiction.¹⁰² Although no federal agency presently has jurisdiction over air pollution *within* private automobiles, the EPA, which now regulates pollution emitted by automobiles,¹⁰³ could also enforce design standards for their interior ventilation.

Finally, it should be noted that while this proposed act might conflict with the existing OSHA legislation,¹⁰⁴ there are several alternatives for resolving this possible overlap. The soundest approach would probably be to extend the protection of the proposed act to all places of employment to which the public generally has access.¹⁰⁵ All other job sites would be regulated exclusively by OSHA.¹⁰⁶

99. Such restrictions presently exist in many state or municipal fire prevention statutes or ordinances.

100. See, e.g., NEW HAVEN, CONN., TECH. ORD'S, BUILDING CODE §§ 803.1-805.1 (1972).

101. One possible means of meeting these criteria might be the construction of buildings with pollution-reducing materials. See Anderson, *Relationships Between Outdoor and Indoor Air Pollution*, 6 ATMOSPHERIC ENVIRON. 275, 275-78 (1972).

102. Cf. Clean Air Act, 42 U.S.C. § 1857f-10 (1970) (requires the Secretary of Transportation to prescribe regulations to insure compliance with all aircraft emission standards promulgated under the act).

The proposal made in the text is similar to the suggestion made by Senator Frank Moss of Utah that indoor air pollution legislation be enforced in interstate transportation by the carriers themselves. Enforcement provisions could be tied to the licensing mechanism. Letter from Senator Frank Moss to the author, July 26, 1971, on file with the *Yale Law Journal*.

103. See Clean Air Act, 42 U.S.C. § 1857b-1, f-1 to 7 (1970).

104. The conflict potentially arises because OSHA already provides for the regulation of air contaminants at all places of employment—indoor environments which the proposed Clean Indoor Air Act should also regulate to protect fully the general public. See note 105 *infra*.

105. OSHA's emphasis on protecting only healthy workers during an eight-hour period, p. 1048 *supra*, makes its air contaminant standards insufficient for the general public. New legislation covering only those areas not currently regulated by OSHA would allow many indoor work places to which the public has access, e.g., restaurants or stores, to contain potentially hazardous levels of pollution for those individuals not considered in the establishment of OSHA's standards. Thus, it seems necessary to extend the proposed Clean Indoor Air Act to all such areas and to restrict OSHA's air pollution scope exclusively to non-public work-place environments.

106. Another refinement would be to restrict the application of OSHA's air contaminant standards even further by limiting them to factories and manufacturing plants—areas in which special pollution problems are likely to be found. Other areas such as

A federal Clean Indoor Air Act, even if adequately funded and vigorously enforced, would not, of course, end the problem of indoor air pollution. However, the proposed act would go far toward filling a dangerous gap in our regulation of air pollution. No longer would we spend billions to purify our outdoor air at the same time that we permit hazardous concentrations of air pollutants to exist in our indoor environments.

office buildings and schools would be required to meet the stricter, though perhaps less comprehensive, standards of the proposed act. This division would provide added protection for many employees without imposing unnecessary costs on industries with unusual pollution sources.