BENDIX ENVIRONMENTAL RESEARCH, INC.

FOX PLAZA, SUITE 902 • 1390 MARKET STREET • SAN FRANCISCO, CA 94102 • TELEPHONE (415) 861-8484

Indoor Air Pollution

an

Annotated Bibliography

Compiled by

Bendix Environmental Research, Inc.

March 1983

Abu-Jarad, F. et al., A Study of Radon Emitted from Building Materials Using Plastic α-Track Detectors, Phys. Med. Biol., 25:683-694, 1980.

Discussion of measurement of radon emissions from crushed granite bricks and clay bricks using solid state nuclear track detectors.

Åkerblom, G. V. and Wilson, C., Radon Gas - A Radiation Hazard from Radioactive Bedrock and Building Materials, Bull. of the Int'l. Assn. of Engineering Geology, 23:51-61, 1981.

"The bedrock contribution to the radiation hazard relates directly to the uranium-bearing alum shale formation of Cambrian age and to certain Precambrian uranium- and thorium-enriched granites...Building materials incorporating these rock types, in particular alum shale, can also have high radium contents resulting in the release of radon gas to the indoor atmosphere."

This paper summarizes the recommendations of the Swedish Government Commission set up to investigate the radon problem.

Andersen, I., et al., Indoor Air Pollution Due to Chipboard Used as a Construction Material, Atmospheric Environment, 9:1121-1127, 1975.

A study of Danish homes in which chipboard (particle board) was used in walls, floors, and ceilings showed formaldehyde concentrations higher than the American limit value for outdoor exposure.

Auxier, J. A., Respiratory Exposure in Buildings Due to Radon Progeny, Health Physics, 31:119-125, 1976.

"The alpha radiation dose to the lungs of people who live in buildings constructed of some granites, low density concretes, and gypsum boards is higher than for residents of most other types of dwellings due to the airborne progeny of radon. There is evidence that sealing the interior surfaces with epoxy paint, for example, can reduce the alpha dose in the lung significantly without a compensating increase in whole-body exposure to the gamma rays from radon progeny."

Auxier, J. A., et al., Preliminary Studies of the Effects of Sealants on Radon Emanation from Concrete, Health Physics, 27:390-392, 1974.

Reduction in radon emissions from concrete were found with epoxy paint coating, but not with stucco or asphalt coatings.

Beall, J. R. and Ulsamer, A. G., Toxicity of Volatile Organic Compounds Present Indoors, Bull. N.Y. Acad. Med., 57:978-996, 1981.

"...more than 40 organic vapors have been found in homes or office buildings." Toxicity of indoor pollutants is discussed.

Berk, J. V., et al., Import of Energy-Conserving Retrofits on Indoor Air Quality in Residential Housing, Lawrence Berkeley

Radon, formaldehyde, total aldehydes, particulates, carbon dioxide, carbon monoxide, nitrogen dioxide, nitrogen oxide, ozone, and sulfur dioxide were measured in nine houses before and after retrofitting. Air quality impact was dependent on (1) the type and extent of the retrofit, (2) the operating characteristics of the heating/cooling system, and (3) the activities of the occupants.

Blakeslee, S., Energy Pinch Brings Smog Peril Indoors, Los Angeles Times, 23 May 1980.

"Data suggests 10% of all lung cancers in the United States are now caused by indoor radon, according to David Rosenbaum of the federal Environmental Protection Agency. Insulating buildings-without ventilation-could cause an additional 10,000 to 20,000 lung cancer deaths each year, he said."

Budiansky, S., Indoor Air Pollution, Environmental Science and Technology, 14:1023-1027, 1980.

"The discovery that pollutant concentrations are often higher indoors than out raises questions about energy conservation and casts into doubt much of the air pollution epidemiology done to date."

Budiansky, S., Indoor Air Standard Revised, Engineering News Record, 5 February 1981.

The American Society of Heating, Refigerating, and Air Conditioning Engineers, Inc. (ASHRAE) has revised its standard 62-1981 to guard against indoor air pollution - establishing different ventilation rates for smoking and non-smoking areas and outlining procedures for detecting the presence of toxic substances in construction and insulation materials.

Building Research Establishment, Mould Growth in Buildings - A Persistent Problem, Building Research Establishment (BRE) News, (United Kingdom), 53:2-4, 1981.

"Airborne concentrations normally found in buildings colonised by mould are not high enough to elicit a response except in some allergic individuals."

Building Research Establishment, Formaldehyde Vapour from Urea-Formaldehyde Foam Insulation, Building Research Establishment Research Paper IP 25/82 (United Kingdom), 2 pp., 1982.

Discussion of various types of wall construction common in the United Kingdom in terms of the possibility of formaldehyde vapor entering the building.

Burkart, W., Radon and Energy Efficient Homes, Eidg. Institut für Reaktorforshung, Bericht No. 435 (Switzerland), 23 pp., 18 April 1981.

Energy efficient homes could cause an increase from 10 to 100 lung cancer deaths per year per million population due to radon exposure.

Consumer Product Safety Commission, Urea-Formaldehyde Foam Insulation; Proposed Ban, 46 Federal Register 11188-11211, 5 February 1981.

Studies of the health effects of formaldehyde are cited. Reasons for the proposed ban include cancer risk and immediate reactions varying from "short-term discomfort to long-term impairment," including cases requiring hospitalization.

Comptroller General of the U.S., Indoor Air Pollution: An Emergency Health Problem, GAO, 34 pp, 24 September 1980.

A discussion of radon, carbon monoxide, formaldehyde, nitrogen dioxide, respirable particles and asbestos in indoor air; a review of currently inadequate federal efforts on the issue; and recommendations for federal action. "Many school children daily may undergo excessive exposure to carbon monoxide."

Culot, M. V. J., et al., Development of a Radon Barrier, Health Physics, 35:375-380, 1978.

A multilayered seamless epoxy floor coating reduced radon concentrations in a building built over uranium mill tailings.

Dockery, D. W., et al., Relationships Among Personal, Indoor, and Outdoor NO_2 Measurements, Environment International, 5:101-107, 1981.

"Gas-cooking homes had indoor levels [of NO_2] three times the outdoor levels."

Dodge, R., The Effects of Indoor Pollution on Arizona Children, Arch. Environmental Health, 37:151-155, 1982.

Children in homes using gas cooking fuel had higher rates of cough. Parental smoking was related to higher rates of cough, wheeze, and sputum production.

Eichholz, G. G., et al., Control of Radon Emanation from Building Materials by Surface Coating, Health Physics, 39:301-304, 1980.

The coatings tested were found to reduce radon emanations to a limited extent. Reduction of the use of uranium-bearing aggregate in building materials is recommended.

Fitzgerald, J. E., Jr. and Sensintaffar, E. L., Radiation Exposure from Construction Materials Utilizing Byproduct Gypsum from Phosphate Mining, in Moghissi, A. A., et al., editors, Radioactivity in Consumer Products, U.S. Nuclear Regulatory Commission, NUREG/CP-0003, pp. 351-368, 1978.

Discusses phosphogypsum building materials and recommends that standards be set for construction materials to provide "(1) the necessary controls on radiation exposure received by the population from all present and future construction materials which by ficant long-term impact; (2) guidance to commercial industry to serve as input for the utilization of acceptable source term raw material and for the development of new products; (3) numerical guidelines for construction materials being imported and exported from this country if such trade should be realized; and (4) guidance on acceptable indoor radon daughter concentrations in structures constructed with such materials."

Fritsch, Al, Ed., The Household Pollutants Guide, by Center for Science in the Public Interest, Anchor Press/Doubleday, 309 pp., 1978.

Discusses health hazards of aerosol sprays, asbestos, fiberglass, formaldehyde, spot removers, indoor pesticides, paints, plastics and air fresheners, and more. Recommends safer products for those who want to remove dangerous pollutants from their homes.

Geomet, Inc. and Technology of Economics, Inc., An Evaluation of Formaldehyde Problems in Residential Mobile Homes, U.S. Dept. of Housing and Urban Development, 124 pp., 1980.

"Specific areas researched included the relevant physical and chemical properties of formaldehyde, monitoring techniques, source identification, and formaldehyde emission strengths as they pertain to the mobile-home environment, observed formaldehyde levels, health effects, formaldehyde standards, and abatement techniques."

Gesell, T. F. and Prichard, H. M., The Technologically Enhanced Natural Radiation Environment, Health Physics, 28:361-366, 1975.

"A new category for human radiation exposure, technologically enhanced natural radiation (TENR), is proposed. The purpose of the new category is to permit clear distinction between truly natural human radiation exposure and exposure which occurs due to alteration of the natural sources by non-nuclear technology." (Includes building material sources.)

Gockel, D. L., et al., Formaldehyde Emissions from Carbonless Copy Paper Forms, American Industrial Hygiene Assoc. J., 42:474-476, 1981.

"Formaldehyde released to the air from carbonless copy paper forms is suspected of causing eye, skin and respiratory irritation among There is evidence that the residual formaldehyde dissipates to the air as a result of handling and storage."

Goldstein, B. D., Indoor Nitrogen Oxides, Bull. N.Y. Academy of Medicine, 57:873-882, 1981.

"Reasonably strong evidence associates the use of a gas stove for cooking with a small but statistically significant risk of potentiating acute respiratory tract infections."

Goldstein, B. D., et al., The Relation Between Respiratory Illness in Primary Schoolchildren and the Use of Gas for Cooking - II. Factors Affecting Nitrogen Dioxide Levels in the Home, Int. J. Epidemiology, 8:339-45, 1979.

Nitrogen dioxide levels in children's bedrooms in gas cooking homes were found to be more than twice the levels in electric cooking homes.

Gunby, P., Fact or Fiction about Formaldehyde?, Journal of the American Medical Assn., 243:1697-1703, 1980

"A patient complains of eye, nose, or throat irritation. There may be coughing, dyspnea, dizziness, epistaxis, eczema-like rashes, headaches, and other complaints." The cause may be exposure to formaldehyde gas from building insulation, plywood, or particleboard.

Harley, J. H., Radioactivity in Building Materials in Moghissi, A.A., et al., editors, Radioactivity in Consumer Products, U.S. Nuclear Regulatory Commission, NUREG/CP-0003, pp. 332-343, 1978.

Discussion of radioactivity levels in building materials in several countries. Notes that it is unwise to produce building materials from waste products high in radioactivity.

Hollowell, C. D., et al., Building Ventilation and Indoor Air Quality, University of California Lawrence Berkeley Laboratory, 12 pp., January 1980.

Carbon monoxide, nitrogen dioxide, formaldehyde, and radon are measured "in conventional and energy-efficient buildings with a view of assessing their potential health risks and various control strategies capable of lowering pollutant concentrations."

Hollowell, C. D. and Miksch, R. R., Sources and Concentrations of Organic Compounds in Indoor Environments, University of California Lawrence Berkeley Laboratory, 18 pp., July, 1981.

Summarizes sources and types of indoor air pollutants. Study of an office building revealed that: "While no single compound was present in high enough concentration to be singled out as a health hazard by existing OSHA criteria...The existing criteria may be inadequate given that: (1) additive or synergistic effects are not adequately addressed; (2) the criteria are generally based on acute exposure studies whereas here the exposure is chronic; (3) the population at risk is more diverse including women and elderly workers; (4) annoyance from odorant effects is not considered."

Holub, R. F., et al., The Reduction of Airborne Radon Daughter Concentration by Plateout on an Air Mixing Fan, Health Physics, 36:497-504, 1979.

"A series of experiments...to study the effects of condensation nuclei, humidity and turbulence on the rapid deposition or plate-out of radon daughter activity on chamber walls."

Industrial Environmental Research Laboratory, Draft Indoor Air Quality Research Strategy/Plan, EPA, 26 pp., 17 November 1980.

"It is the purpose of this Plan for a National Program of Indoor Air Quality Research to provide a basis for coordinated government-sponsored research on indoor air quality problems."

Itow, L., Proposed Removal Rule Fuels UF Foam Dispute, Engineering News Record, pp. 12-13, 24 July 1980.

Massachusetts banned urea-formaldehyde foam insulation in November 1979, and in 1980 proposed to require manufacturers to remove it where it poses a health hazard.

Itow, L., Kitchen Cabinets Make them Sick, San Francisco Examiner, 20 August 1980.

One hundred residents of an apartment complex suffered headaches, congestion, sore throats, itchiness, dizzy spells, swelling and diarrhea due to formaldehyde gas from particleboard kitchen cabinets.

Itow, L., Colorado Restricts Use of Disputed Insulation, Engineering News Record, pp. 46-47, 20 October 1980.

Colorado banned urea-formaldehyde insulation from schools, nurseries, and state-licensed health facilities in 1980.

Ju, C. and Spengler, J. D., Room-to-Room Variations in Concentration of Respirable Particles in Residences, Environmental Science and Technology, 15:592-596, 1981.

Mean levels of respirable particles were found to be significantly higher indoors than outdoors in the four communities studied, with some variation between rooms of an individual house.

Kolb, W., Building Material Induced Radiation Exposure of the Population, in Moghissi, A.A. et al., editors, Radioactivity in Consumer Products, U.S. Nuclear Regulatory Commission, NUREG/CP-0003, pp. 344-350, 1978.

A study of radiation in dwellings in the Federal Republic of Germany. On the average, terrestrial radiation was found to be 33% higher indoors than outdoors, except in prefabricated timber houses. Significant radiation levels were found in building materials containing pumice, furnace slag, gypsum, and granite.

Leaderer, B. P., Air Pollutant Emissions from Kerosene Space Heaters, Science, 218:113-115, 1982.

Emission factors for nitrogen oxides, sulfur dioxide, carbon monoxide, carbon dioxide, and oxygen depletion for portable convective and radiant kerosene space heaters are presented. The data suggest that the use of such heaters in residences can result in exposures to air pollutants in excess of ambient air quality standards and in some cases in excess of occupational health standards.

McCullough, R. S., et al., A Four Factor Model for Estimating Human Radiation Exposure to Radon Daughters in the Home, Health Physics, 40:299-305, 1981.

(Title is self-explanatory)

Melia, R. J. W., et al., Indoor Air Pollution and its Effects on Health, Royal Soc. of Health J., (United Kindgom), 101:29-32, 1981.

"An association between gas cooking and respiratory illness has now been found in three different groups of children in the U.K."

Moghissi, A. A., et al., editors, Indoor Air Pollution, special issue of Environment International, 8:1-534, Pergamon Press, 1982, proceedings of the International Symposium on Indoor Air Pollution, Health and Energy Conservation at Amherst, Massachusetts, 13-16 October 1981.

This collection of 67 articles is one of the most comprehensive looks at indoor air problems available in one source. Topics include (1) policy and public health concerns; (2) sources, concentrations, and exposures to radon, organics, formaldehyde, nitrogen dioxide, carbon monoxide, and aerosols; (3) health and comfort aspects of indoor air pollution and indoor climate; (4) engineering aspects of ventilation, contaminant control, and energy conservation. This volume also includes articles on some problems not written about elsewhere, such as respiratory irritation caused by carpet shampoo.

Morin, N. C. and Kubinski, H., Potential Toxicity of Materials Used for Home Insulation, Ecotoxicology and Environmental Safety, 2: 133-141, 1978.

Both the catalyst-surfactant and formaldehyde-urea resin components of home insulation were found to affect DNA.

Moschandreas, D. J., Residential Indoor Air Pollution Quality and Wood Combustion, USEPA-600/9-81/029, 1981.

"The av. indoor total suspended particle concn. during the wood-burning period is 3 times greater than that during the non-wood-burning period; the av. indoor benzo[a]pyrene (a carcinogen)... concn. is 5 times greater; the av. indoor respirable suspended particles, 2-4 times greater."

National Research Council, Committee on Indoor Pollutants, Indoor Pollutants, National Academy Press, 537 pp., 1981.

Discussion of sources, health effects, geographic factors, monitoring, and control of indoor air pollution from radioactivity, aldehydes, consumer products, asbestos and other fibers, smoking, other chemical pollutants and microorganisms.

Nazaroff, W. W., et al., The Use of Mechanical Ventilation with Heat Recovery for Controlling Radon and Radon-Daughter Concentrations, University of California Lawrence Berkeley Laboratory, 21 pp., May 1980.

"The use of mechanical ventilation systems with air-to-air heat exchangers may offer a practical, cost-effective, and energy efficient means of alleviating not only the radon problem specifically but also the general deterioration of indoor air quality in houses designed or retrofitted to achieve low infiltration."

NIOSH, Hazard Evaluation and Technical Assistance Report, NIOSH-HE/TA-79-45, NTIS Order No. PB80-192057, 8 pp., 1980.

An Internal Revenue Service office building was found not to have dangerous levels of carbon monoxide, asbestos, or fibrous glass. Both smokers and non-smokers had elevated carboxy Hb levels due to smoking in the office.

NIOSH, Formaldehyde: Evidence of Carcinogenicity, NIOSH Curent Intelligence Bulletin 34, 15 pp., 15 April 1981.

Recommends that formaldehyde be handled as a potential occupational carcinogen as well as citing studies showing mutagenic and other adverse health effects. Lists 29 categories of products made with or containing formaldehyde, including several categories of building materials.

P., L. A., Indoor Air Quality vs. the Energy Crisis, Technology Review, 81: 20-21, Dec. 1978/Jan. 1979.

"A single gas stove burner can accumulate enough carbon monoxide and nitrogen dioxide in a room 27 cubic meters in volume to exceed the existing U.S. ambient air quality standards in less than an hour."

Pfeiffer, G. O. and Nikel, C. M., The Household Environment and Chronic Illness, Charles C. Thomas, 187 pp., 1980.

"Guidelines for Constructing and Maintaining a Less Polluted Residence" for hypersensitive individuals.

Pensko, J. and Geisler, J., Evaluation of the Probable Biological Effects on the Population of Poland due to Ionizing Radiation from Building Materials, Nukleonika, 26(1):91-107, 1981.

"It was estimated that, owing to the increasing contribution of buildings constructed of industrial wastes to the entire building development, the additional somatic effects in the six consecutive decades, (1951-2010), will amount to approximately 31,500 cases of cancer deaths, (in Poland). Expected number of severe genetic effects due to the additional doses of ionizing radiation absorbed by parents indoors may amount to about 80 cases in the first generation of their offspring and to about 2300 cases in succesive generations. In the 1971-1980 decade about 3.5% of fatal lung cancers and about 0.7% of all cancer deaths were probably caused by additional irradiation inside dwellings."

Pohl-Rüling, J., et al., Investigation of the Suitability of Various Materials as ^{222}Rn Diffusion Barriers, Health Physics, 39:299-301, 1980.

Of the three plastics and rubber tested, polyamide film was found to be most effective as a barrier against radon diffusion.

Porstendörfer, et al., The Influence of Exhalation, Ventilation, and Deposition Processes upon the Concentration of Radon, Thoron, and their Decay Products in Room Air, Health Physics, 34:465-473, 1978.

A technical discussion of indoor radon and thoron concentrations.

Rundo, J. et al., Observation of High Concentrations of Radon in Certain Houses, Health Physics, 36:729-730, June 1979.

Higher indoor radon concentrations were found in houses with unpaved crawl spaces, due to soil emanations.

S., J. D. and C., S. D., The Inside Story: Health and Regulations, Technology Review, pp. 37-38, August/September 1982.

"It is irresponsible for government not to research people's exposure to indoor pollution and explore policy alternatives. Such funding could be justified by comparing it with current and projected multibillion-dollar projects for controlling outdoor sources, which may have less effect on personal exposure... Source controls, product performance specifications, building ventilation requirements, and construction codes are...reasonable regulatory options."

Sardinas, A. V., et al., Health Effects Associated with Urea-formaldehyde Foam Insulation in Connecticut, Journal of Environmental Health, 41:270-272, 1979.

"In 75 percent of the homes, people were not asked to vacate at the time of installation. No one was warned that the fumes might endanger their health...It is conceivable that these high initial exposure periods could have sensitized some individuals to formaldehyde."

Sawyer, R. N., Indoor Asbestos Pollution: Application of Hazard Criteria, Ann. N.Y. Academy Sci., 330:579-586, 1979,

Asbestos contamination of relatively contained environments within structures can occur under many conditions and in association with various activities. Such contamination persists and can potentially expose all structure users. Levels found in some situations exceed those considered potentially carcinogenic.

Sebastian, P., et al., Indoor Airborne Asbestos Pollution: From the Ceilings and the Floor, Science, 216:1410-1412, 1982.

Elevated indoor airborne asbestos levels were associated with weathering of asbestos floor tiles and ceilings sprayed with asbestos containing material in a 10 year old building.

Selway, M. D., et al., Ozone Production from Photocopying Machines, Am. Ind. Hyg. Assoc. J., 41:455-459, 1980.

Nine out of ten photocopying machines tested produced ozone emissions. "Most of the copiers produced enough ozone to clearly affect the work room air quality..."

Shair, F. H. and Hectner, K. L., Theoretical Model for Relating Indoor Pollutant Concentrations to Those Outside, Environmental Science and Technology, 8:444-453, 1974.

A technical model for ventilation claimed to have the potential for use to reduce indoor ozone concentrations to 20% of outdoor ozone concentrations on smoggy days.

Spengler, J. D., et al., Home is No Refuge from Air Pollution, Conservation News, 1 January 1978.

Six family homes in the San Francisco area were studied and found to have indoor air more polluted than outdoor air on a smoggy day.

Spengler, J. D., et al., Sulfur Dioxide and Nitrogen Dioxide Levels Inside and Outside Homes and the Implications on Health Effects Research, Environmental Science and Technology, 13:1276-1280, 1979.

Indoor SO_2 levels were found never to reach varying outdoor levels, but NO_2 levels ranged up to twice outdoor levels.

Steinhäusler, F., Long-term Measurements of ^{222}Rn, ^{220}Rn, ^{214}Pb, and ^{212}Pb Concentrations in the Air of Private and Public Buildings and their Dependence on Meteorological Parameters, Health Physics, 29:705-713, 1975.

Radioactive radon and radon progeny concentrations were found to vary with barometric pressure, temperature, windspeed and humidity in brick, concrete, stone and wood buildings in Austria.

Stranden, E., A Simple Method for Measuring the Radon Diffusion Coefficient and Exhalation Rate from Building Materials, Health Physics, 37: 242-244, 1979.

Detailed technical description of a radon measurement method.

Strandon, E., et al., A Study on Radon in Dwellings, Health Physics, 36:413 -421, 1979.

Radon concentrations in Norwegian dwellings were found to be twice as high with concrete walls as with wood or brick walls. Effects of ventilation and atmospheric pressure were studied and average respiratory radon dose determined for Norwegians.

Sun, M., EPA Said to Bar Official from Meeting, Science, 214:639, 1981.

Outlines the government's efforts to phase out attention to the indoor air pollution issue.

Sun, M., Building Makes People Sick, Engineering News Record, 17 June 1982.

Story of a California government building which makes its occupants sick due to elevated levels of formaldehyde, carbon dioxide, and polynuclear aromatic hydrocarbons due to "inadequate removal of off-gassing from furniture, human respiration end-products, and cigarette smoking."

Sun, M., Radon Levels High in Passive Solar Homes, Engineering News Record, 1 July 1982.

New, well-insulated homes in Colorado were found to have "potentially unsafe levels of radon gas."

U.S. Radiation Policy Council, Report of the Task Force on Radon in Structures, U.S. Radiation Policy Council, 53 pp., August 1980.

"The Task Force reviewed the physical and biological bases for concern about radon exposures to the general public and examined the status of Federal activities...The Task Force concluded that Council attention to this problem is warranted because of the possible prevalence of relatively large exposures, a trend toward even higher exposures due to improved energy efficiency in inhabited structures, the risk from such exposures, and the potential large population at risk."

Wadden, R. A., and Scheff, P. A., Indoor Air Pollution - Characterization, Prediction, and Control, Wiley Professional Books, 288 pp., 1982.

A guide to evaluating and controlling indoor air pollution and health hazards caused by reduced ventilation, energy saving measures, and other factors. Contains "extensive talbes of emission factors for indoor areas not available elsewhere in collected and evaluated form." [Not yet reviewed].

Zarubin, G. P., Hygienic Prediction of Indoor Air Pollution by Toxic Substances Released from Polymeric Materials, Gig. Sanit. (USSR), 4:51-54, 1981 (in Russian).

A review with many references.

Zimmerli, B. and Zimmermann, H., Einfaches Verfahren zur Schätzung von Schadstoffkonzentrationen in der Luft von Innenräumen Mitt., Gebiete Lebensm. Hyg. (Germany), 70:429-442,1979. (in German)

"A [technical] procedure to estimate the concentrations of certain toxic chemicals in the indoor atmosphere is proposed...The procedure has been applied to estimate the concentrations of pentachlorophenol, tetrachlorophenol and lindane in the air of different rooms treated with wood protecting agents."

_____. School Makes Students Sick, Engineering News Record, p. 15, March 1983.

Polurethane insultation caused eye irritation, sore throats, headache, and nausea in three New York schools.

_____. The Health Effects of Cooking with Gas, Science News, 24 October 1981, p. 262.

Describes findings of two studies presented at the International Symposium on Indoor Air Pollution, Health and Energy Conservation about the respiratory effects on users of gas-cooking ranges.