Indoor Air Pollution : Is Your Home or Office Making You Sick?

by Brenda J. Bengston

Stanley Watras worked at a nuclear power plant. One morning in 1985, the plant's alarm system alerted Watras to high radiation levels. The radiation was not in the plant, however, but in Watras' home. The source? Radon, a colorless, odorless gas that occurs naturally in the soil.

Radon is one of the 1,000 identified indoor air pollutants invisibly infiltrating our homes, our offices, and our lungs. During the past decade, research on indoor air pollution's health effects escalated. The legal ramifications of this research have only begun to emerge.

Although outdoor air pollution received considerable attention during the 1960s, the indoor air pollution problem was not widely recognized until the mid 1980s. This relatively recent recognition occurred for two interconnected reasons. The first reason is the time lag between introduction of a pollutant and appearance of its injurious effects. In some cases, 20 years or more may elapse. Hence, "delayed manifestation injuries" from products used in the 1950s surfaced a short time ago. But perhaps more significant than the lag time is the decreased ventilation in today's energy efficient buildings. In these buildings, up to 95% of the air is recirculated. Lack of fresh air flow dramatically increases the concentration of indoor air pollutants, leading to numerous related health problems, including "Sick Building Syndrome."

"SBS" -- A GENERAL TERM FOR WHAT AILS YOU

In office buildings worldwide, workers report similar symptoms: headache, cough, chest tightness, fatigue, and eye and mucous membrane irritation. Dubbed "Sick Building Syndrome" or SBS, this problem is estimated to cause low productivity and absenteeism in 20 to 60% of the workforce every day.

SBS encompasses a wide variety of symptoms caused by differing pollutants. Documented causes include infectious agents and chemical contaminants, but in about half the reported cases, no specific cause can be identified other than inadequate ventilation. Exposure to volatile organic compounds (including benzene, ethylbenzene, trichloroethylene and other elements present in hundreds of products and materials) produces the same symptoms, and thus, could be a cause. Gaseous and particulate contaminants emitted from building materials, ventilation ducts, or consumer products may also result in SBS. Identifying and removing the offending source or improving ventilation often solves the SBS problem.

In addition to acknowledging SBS's existence, researchers have successfully established relationships between some indoor air contaminants and adverse health effects. These contaminants include asbestos, radon, formaldehyde, tobacco smoke (including carbon monoxide, acetone, and benzene), and certain biological contaminants. Scientists continue to study other indoor air contaminants such as nitrogen dioxide, but have not yet established definite links between low level contaminant exposure and specific injuries.

THE MAJOR POLLUTANTS AND THEIR HEALTH EFFECTS

ASBESTOS

Of those pollutants conclusively linked to specific health problems, asbestos has been studied most extensively. Widespread commercial asbestos use began in 1878 after large deposits of the natural rock compound were discovered in Canada. Due to its fire retardant and insulating properties, asbestos use in building construction escalated from the 1950s to the 1970s.

Asbestos' effects are well documented. Medical researchers discovered a link between asbestos and disease as early as 1931 when a study showed that 53% of workers with three or more years of asbestos exposure exhibited signs of asbestosis. Shortly thereafter, scientists determined asbestosis was progressively debilitating disease. By 1963, medical research indisputably established an abestos-cancer connection. Yet industry officials ignored the evidence and continued asbestos production for use in homes, schools, and office buildings until the 1970s. A February 1988 EPA report estimates that 500,000 public and commercial buildings contain damaged, friable asbestos.

Friable asbestos, the most dangerous form of asbestos, poses a health threat because it releases asbestos fibers into the air. When inhaled, the asbestos fibers embed permanently in lung tissue. These fibers may result in asbestosis, a lung disease,

mesothelioma, a rare chest and abdominal lining cancer, or numerous other cancers.

RADON

Radon gas is more pervasive than asbestos, and it may be more difficult to regulate. Radon, a natural, short-lived decay product of soil radium and uranium, seeps upward as decay occurs. It infiltrates homes and other buildings through dirt floors, porous blocks, cracks in foundation floors and walls, and floor drains. Well water may even emit radon gas. The EPA estimates that 1 out of 14 U.S.homes have radon levels above the acceptable level of 4 picoCuries per liter (pCi/l).

The Environmental Protection Agency (EPA) ranks radon gas as lung cancer's number two cause, estimating it leads to 20,000 cancer deaths per year. In its 1986 publication, "A Citizen's Guide to Radon", the EPA gives risk estimates, using data from miners to extrapolate the risks from indoor radon to the general population. Radon's high variability gives individuals some control over exposure and risk. Radon varies both seasonally and locationally, and lower radon levels are measured in upper stories of buildings and when fresh air flow is increased. Radon testing may cost only $20, but making single-family homes radon-safe can cost anywhere from $500 to over $2000.

While radon presents a serious health hazard, it is an unseen hazard. Radon's injurious effects occur years after exposure. For these reasons, stimulating public action may be the biggest obstacle to solving the radon problem. In 1987, researchers told Maine homeowners about the significant risk of lung disorders due to radon. The homeowners, nonetheless, greatly underestimated the magnitude of the actual risk. Richard Guimond, chief of the Criteria and Standards Division in the EPA's Office of Air and Radiation, noted that despite the serious health threat, individuals may not be willing to spend $20 to have radon testing done on their homes. According to a New Jersey survey, 90% of those surveyed knew radon, a potentially carcinogenic gas, could be present in their homes -- but 50% said they were not concerned about the problem.

FORMALDEHYDE

Formaldehyde, like radon, is a colorless, volatile gas. Unlike radon, however, it has a characteristic odor. Most formaldehyde related lawsuits today involve urea formaldehyde (UF) adhesive, previously used extensively in the building industry. UF, used in cabinets, walls, and carpets, may cause dizziness, chronic headaches, and nausea. UF exposure also often results in burning skin and eyes, wheezing, and coughing. Occupants of mobile homes constructed with large amounts of UF have suffered from memory lapses and drowsiness.

Formaldehyde's health effects are concentration-dependent. Effects range from "none" at concentrations less than 0.5ppm, to death at concentrations greater than 100ppm. Upper airway irritation and neurophysiologic effects (determined through optical chronaxy electroencephalography) may occur at concentrations as low as 2ppm. At concentrations of 50-100ppm, possible effects include pulmonary edema, inflation, and pneumonia. Hence, high formaldehyde levels pose serious health risks.

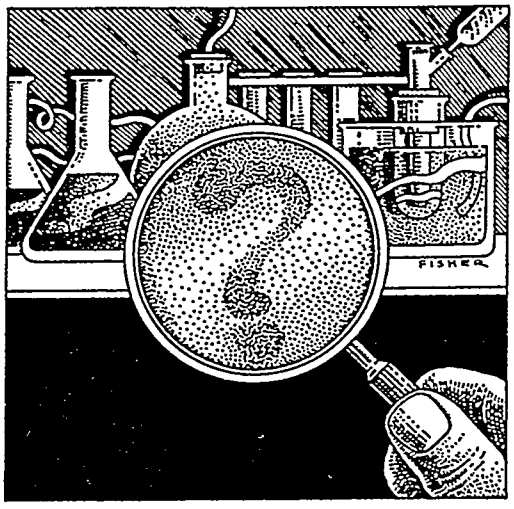
TOBACCO SMOKE

Despite the magnitude of formaldehyde's side effects, tobacco smoke may still be the most notorious indoor air pollutant. Tobacco smoke contains toxic, mutagenic and carcinogenic substances. Individuals who live or work with smokers breathe increased amounts of carbon monoxide, acetone, and benzene, among other things. In fact, indoor levels of carbon monoxide and other toxic substances from cigarette smoke may exceed those in an outdoor air pollution emergency!

In 1986, the Surgeon General recognized that "passive" smoking causes lung cancer, emphysema, and other related diseases. Chronic exposure may double the risk of lung cancer as well as aggravate heart disease. One study suggests there is no "safe" level of involuntary exposure. Other studies acknowledge that high secondhand smoke levels present a serious hazardous. In areas where air continously recirculates, as on airplanes, the toxic substances from tobacco smoke can build up to dangerous, perhaps life threatening, levels. Recognizing this, the federal government recently banned smoking on all airplane flights less than 2 hours long.

BIOLOGICAL CONTAMINANTS

Biological contaminants, such as mold spores and air borne bacteria, also add to the indoor air pollution problem. These contaminants can grow if a building experiences water damage or has a dirty or inadequate ventilation system. Inadequate ventilation systems recirculate too much indoor air, and thus, little or no fresh air enters the system. Airborne pathogens build up, recirculating and dispersing throughout the building. Researchers recently



determined that due to this contaminant concentration, Army trainees housed in modern, energy efficient barracks have a 50% greater risk of contracting communicable respiratory infections than those in drafty older buildings. Legionnaires' Disease resulted from biological contamination of a water cooling tower.

Electrostatic air cleaners can reduce the amount of many biological particulates, but negative ionizers intended to merely clean the air may have no effect on the contaminants. The American Society of Heating, Refrigeration and Air Conditioning Engineers is currently revising its ventilation standards to provide for greater fresh air flow. In this case, dilution may be the best solution!

NITROGEN DIOXIDE

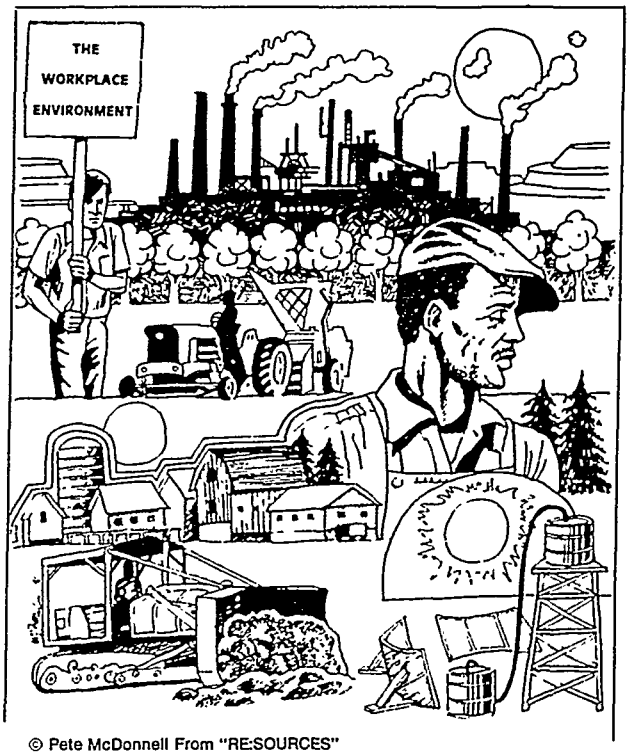
Finally, nitrogen dioxide (NO2) is not understood by the general public as well as the previously discussed contaminants, yet concerns about NO2's health effects stimulated a 1987 research agreement between the Health Effects Institute (HEI) and the Gas Research Institute. Cigarette smoking, gas ranges, unvented kerosene, gas space heaters, and some gas floor furnaces create NO2. High concentrations of NO2 cause lung damage, but the effects of lower concentrations present in indoor air are not certain. NO2 may either directly cause lung damage through its oxidant properties, or indirectly cause lung damage by increasing susceptibility to respiratory infections. The HEI study will attempt to correlate infant respiratory infections and nitrogen dioxide levels.

LEGAL RAMIFICATIONS

As with the scientific community, the legal community recently realized the health threats caused by indoor air pollution. Plaintiffs filed hundreds of lawsuits over the last few years, many of them successful. Because so many sources of indoor polution exist, plaintiffs must choose from a variety of legal theories. For example, an action against the manufacturer or seller of a product like asbestos or formaldehyde will probably require a different approach than an action based on a naturally occurring contaminant like radon or bacteria. The latter actions probably have the most pitfalls for prospective plaintiffs because liability could be difficult to establish.

Of all the indoor air pollutants, litigation over asbestos probably occurs most often. Asbestos litigation usually involves removal of the hazardous fibers. At this time, causation may be easier to prove in an asbestos case than with other types of indoor air pollutants. Asbestos fibers obviously cause asbestosis, for example. Establishing that radon, on the other hand, caused (or will cause) the plaintiff's cancer may prove more difficult. Also, industry's relatively early knowledge of asbestos' hazards could be important when establishing liability.

Where the lawsuit involves poor ventilation or faulty construction leading to radon buildup, biological



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contamination, or excessive exposure to any other contaminant, several causes of action exist. In recent years, employees irritated by tobacco smoke have successfully sued employers under the common law right to a safe and healthful workplace. Courts could extend this common law theory to other indoor air pollution complaints, based on accumulating data supporting poor ventilation as a cause of recurring illnesses. Causation will be the critical element, however, because plaintiffs must present convincing evidence of the condition or product's harmful effects.

Real estate purchasers could bring lawsuits against the sellers for breach of warranty, either express or implied. Plaintiff purchasers could argue that defendant sellers breached the implied warranty of habitabity by selling a building with dangerously high radon levels or inadequate ventilation. Additionally, with increasing recognition of the radon problem, sellers may be required to test for radon. Thus, testing reliability becomes particularly important. If contracts contain express provisions warranting freedom from stated defects and buyers find high radon levels, the buyers may have an action for express breach of warranty.

Similarly, if sellers know of high radon levels, buyers may argue fraudulent concealment or misrepresentation. This action does not require actual physical injury. Buyers must prove that sellers intentionally concealed material facts (such as inadequate ventilation or high radon levels) and that they detrimentally relied on the sellers' statements. Today, wise purchasers should either personally have testing done or insist on viewing test results. Courts may not sympathize with a detrimental reliance argument unless plaintiffs take such precautions.

Consumers of hazardous products such as asbestos may also bring product liability or negligence actions. In strict liability actions, plaintiffs must prove the product was in unreasonably dangerous condition when it left the seller's hands. Or plaintiffs may bring product liability actions against manufacturers based on either a design defect or a failure to warn. Since many indoor contaminants result in "delayed manifestation injuries," however, such product liability actions may be difficult to establish. Yet where defendants know or should have known of the damaging effects and yet sell the product anyway, such an action may succeed. Courts could also award punitive damages, as they have in formaldehyde cases where defendants knew of formaldehyde's damaging effects but ignored complaints and failed to warn consumers.

In addition to consumer actions, employees have creatively found ways to avoid workers compensation laws which would prevent them from suing employers. Some claim intentional conduct by the employer, while others sue building owners and operators, who cross claim against employers. Two more possible actions are the common law right to a safe workplace (noted above), and fraudulent concealment of a workplace hazard. Where appropriate, plaintiffs have also brought actions for emotional distress and conspiracy. Plaintiffs will undoubtedly devise numerous other actions as the effects of indoor air pollution becomes more widely understood.

LEGISLATIVE RESPONSE

In the legislative arena, the typically snail-paced federal response to pollution problems makes increased state action imperative. In February's "State of the States Report" published by the Fund for Renewable Energy and the Environment (FREE), FREE scored the states in six categories, including eliminating indoor air pollution. Wisconsin, with the highest overall score, received top honors for having one of the most effective environmental programs in the U.S.. Responding to the award, Senator William Proxmire (D-Wis.) explained, "We don't wait for the federal government to come up with solutions; we lead the way ourselves."

Other states follow this philosophy as well. Most states have legislation restricting smoking in public places, and a few have passed legislation regulating smoking in privately owned workplaces. Eleven states regulate asbestos abatement, requiring asbestos removers to be trained or licensed. Both California and Minnesota operate comprehensive indoor air pollution programs. New Jersey distributes educational materials and provides free radon screening and low interest home loans to help reduce the radon problem. New Jersey also received FREE's award for efforts in eliminating indoor air pollution.

At the federal level, the EPA is primarily responsible for existing indoor air pollution programs, although other agencies, such as OSHA, are involved in regulation. Under the 1986 Asbestos Hazard Emergency Response Act, for example, the EPA last year sent $5 million to 12 states for asbestos inspection and management planning assistance. This year, the EPA may award as much as $15 million. To receive an EPA grant, a state must pledge matching funds equaling 5% of the total. Federal radon abatement programs, however, are practically nonexistent. Due to the natural, widespread occurrence of radon, until recently the EPA merely informed the publi of the radon problem. This method has proven ineffective in solving the radon problem since people tend to underestimate the magnitude of the risk or fail to understand the problem. Despite the public's lack of understanding, Congress, which governs the EPA's actions, has yet to mandate a specific course of action. A recent General Accounting Office (GAO) report evaluated federal housing agencies' response to the radon problem. The GAO found most housing agencies unaware of the problem or uncertain if they had responsibility.

Last year, witnesses told a Senate subcommittee that despite health risks greater than that posed by outdoor air, the Clean Air Act excludes

indoor air. In addition, they said, no single federal agency is responsible for controlling indoor air pollution. The reaction in Congress? Currently, at least four pending bills deal with the indoor air pollution problem, three focusing specifically on radon. At this time, all four bills are in various committees. A few hearings have been held, but no action has been taken. Senate bill 1629, introduced by Sen. George J. Mitchell (D-Maine) is the most comprehensive of the four bills. It would require the EPA to establish a research program, compile a list of all known indoor air pollutants, and publish health advisories on those air pollutants.

The other three bills are in the House of Representatives, and they deal specificly with radon. House of Representatives Bill 3915 (HR 3915)was recently introduced by Rep. Patricia Schroeder (D-Colo.). This bill would provide tax relief to builders, developers, and homeowners who test for radon contamination and install equipment to reduce indoor radon levels. HR 2837 (passed by the Senate as Senate bill 744) would provide funding to help states establish radon control programs. The third bill, HR 3110, would mandate EPA action in establishing a safe exposure level for radon.

So, if you are concerned about indoor air pollution, open the windows, check the building's ventilation system, and write or call your Congressman. If you would like more information on asbestos, call the EPA's Asbestos Hotline at (800) 535-6700.

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ACKNOWLEDGMENTS

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