The Indoor Air We Breathe:
A public health problem of the 90's

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The Indoor Air

If the 1976 outbreak of legionnaire's disease in a Philadelphia hotel sounded the first alarm on indoor air quality, today's rising rates of asthma and multiple chemical sensitivity--plus new findings of building-related hypersensitivity pneumonitis--should be setting off a cacophony of warning bells. Yet they haven't. Poor indoor air quality is a problem that can be prevented and remedied. However, prevention and remediation will not occur until we as a society recognize the scope of the problem and mobilize the proper resources to appropriately address it. As more workers are exposed to indoor environments, particularly in the growing service sector; as the number of older workers increases; as the buildings in which we live, work and are educated age; and as new chemicals continue to be introduced, the problem will worsen. The cost of remediation and the cost of prevention will grow. The time to act is now. Historically, indoor air quality has been an issue in the industrial sector, where standards have been established to limit worker exposures to airborne contaminants. Only recently have we recognized poor indoor air quality as a broader public health problem that affects populations in office and institutional settings, in schools, and at home.

At the American Legion convention in Philadelphia, the sentinel event resulted in 182 cases of pneumonia and 29 deaths--caused by a previously unrecognized bacterium later dubbed *Legionella pneumophilia*.[1] The source of the bacterial exposure was ultimately determined to be the hotel's ventilation and humidification system. And so began the recognition of what now appears to be an epidemic of building-associated illness and disease.[2]

The scope of the indoor air quality problem is large, in terms of both the size of the population potentially at risk and the prevalence of symptoms and disease. Most Americans spend considerable portions of every day indoors. During much of the day, virtually all children ages 6 and older in the United States are in school, and younger children are increasingly in out-of-home day care. More than 50% of adult workers in North America and Western Europe are employed in "white collar" office settings.[2]
In this article, we describe the health problems caused by poor indoor air quality and how attention to the design, construction, maintenance, and repair of buildings can prevent further exposure and related disease.

Health Problems Associated With Polluted Indoor Air

Poor indoor air quality can cause or contribute to the development of chronic diseases such as asthma, multiple chemical sensitivity, and hypersensitivity pneumonitis.[2-4] In addition, it can cause a broader array of temporary conditions and symptoms such as headache, dry eyes, nasal congestion, nausea, and fatigue--which, when they meet the clinical definition as discussed below, are referred to as "sick building syndrome."

People who already have certain medical conditions such as asthma, allergies, and connective tissue disorders or are immunosuppressed by medications such as steroids or chemotherapeutic agents are at even greater risk than the general population.

Asthma. In the last two decades, a time when poor indoor air quality has been increasingly recognized as a potential health hazard, asthma has been increasing in prevalence and severity--both nationwide and internationally.[5] Indeed, identified risk factors for asthma include many indoor air contaminants such as house dust mites, cockroach allergens, molds, fungi, and environmental tobacco smoke.[5] Other factors likely to cause or aggravate asthma include dust; irritant gases and vapors emitted from indoor furnishings or entrained (pulled in) from outside air; and more specific contaminants such as isocyanate-containing urethanes used for floor refinishing, in wood varnishes, and in paints.

The increasing prevalence of asthma is particularly noticeable and troublesome among children and young adults. Data from the National Health Interview Survey show startling increases in self-reported asthma between 1980 and 1994.[6] The estimated average annual rate per 1000 potation for the total sampled rose from 30.7 in 1980 to 53.8 in 1993-1994. Rate increases were similar for males and females, for whites and African Americans, and for different age groups. Rates of physician office visits with asthma as the principal diagnosis increased overall from 21.4 per 1000 population in 1975 to 39.0 in 1995.

Rates of asthma-related hospital admissions have also increased, although not as dramatically as prevalence.[6] U.S. data from the National Hospital Discharge Survey for 1979-1994 reveal an overall increase in estimated average rates of hospitalization with asthma as the principal diagnosis. A rate of 17.6 per 10,000 population was observed in 1979-1980; the 1993-1994 rate was 18.1 per 10,000 population. Rates varied by age and gender. Among whites and those age 35 or older, rates actually decreased slightly. For African Americans and age groups younger than 35 years, rates increased. Data from the Underlying Cause of Death dataset for the time period 1960 to 1995 show a steady decline in death rates from asthma from 1960 through 1978, with an increasing trend thereafter--from 8.2 per million in 1975-1978 to 17.9 per million in 1993-1995.[6]

Sick building syndrome

In sick building syndrome, symptoms are variable and may involve multiple systems of the body. Objective physical and laboratory findings may be limited. Characteristic, however, is the resolution of symptoms upon leaving the building and recurrence with reentry. Recognition of the problem by both medical and management personnel and identification of the source(s) of exposure often take considerable time. And multiple factors are usually operative. Common health complaints observed by investigators from the National Institute for Occupational Safety and Health in their evaluation of 529 buildings were "eye irritation, dry throat, headache, fatigue, sinus congestion, skin irritation, shortness of breath, cough, dizziness, nausea, sneezing, and nose irritation."[7]

One study of 4373 office workers from 42 different buildings found that the percentages with work-related symptoms ranged from 5% for chest tightness to 68% for lethargy.[8] Nasal congestion occurred in 47% of respondents, dry throat in 46%, and headache in 46%. The prevalence of symptoms varied somewhat with type of ventilation. Other investigators have reported similar symptom prevalence in epidemiologic studies of office workers, although Hoffman reported higher percentages of respiratory symptoms in both case and comparison groups of office workers in a study of building-related asthma in Colorado.[3,9,10]

Although not strictly comparable, data from the 1994 National Health Interview Survey show a much lower prevalence in the general population of symptoms similar to those of sick building syndrome or conditions likely to be associated with poor indoor air.[11] For example, "Headache, excluding migraine" was reported by 1.6% of respondents ages 25 to 44, compared with 46% in Burge's study of office workers.[8]

Multiple chemical sensitivity

Another "wake-up" call has been sounded by the emergence in the past two decades of a growing number of people with a disease known as multiple chemical sensitivity.[12] Originally described in the 1950s, multiple chemical sensitivity was viewed with skepticism by most medical practitioners until the 1980s and 1990s when it began to move into the mainstream of clinical practice.[13,14] The number of people in the United States with diagnosed multiple chemical sensitivity is unknown, but in a 1996 survey of 4000 adults in California carried out by the California Health Services Department, 6.3% of respondents reported a diagnosis of multiple chemical sensitivity. An additional 15.9% reported "chemical sensitivity" associated with multiple reactions, without a specific diagnosis of multiple chemical sensitivity.[15]

Onset of the disease, characterized by multisystem response to low-level chemical exposures commonly encountered in the ambient environment, often follows exposures incurred in association with indoor air quality problems. For some, the development of multiple chemical sensitivity is preceded by symptoms of sick building syndrome. For a subset of the group with sick building syndrome, symptoms become persistent even when the individual is out of the work environment. Such persistence of symptoms is an indicator of increased risk for the development of multiple chemical sensitivity. See above for the clinical definition of multiple chemical sensitivity.[16] Symptoms are similar to those seen in sick building syndrome.

While the physiology of multiple chemical sensitivity has not been clearly defined, it is generally believed that multiple chemical sensitivity occurs as a result of effects on the limbic system (part of the nervous system), the immune system, and the respiratory tract.[12,13] In some cases, psychological factors appear to be operative in terms of onset and severity of illness--both on individual and group levels. When the disease is work-related, it often occurs in long-term, dedicated, and hard-working employees.

The increasing importance of multiple chemical sensitivity as a public health problem is attested to by the fact that it has now been recognized by the American Lung Association/American Thoracic Society, the American Public Health Association, the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE), the American Conference of Governmental Industrial Hygienists (ACGIH), and the U.S. Environmental Protection Agency (EPA), and the media has begun to focus on the needs of people with this condition.

Hypersensitivity pneumonitis

Hypersensitivity pneumonitis was originally described in farm workers in association with exposure to thermophilic microorganisms in moldy hay.[17] Its appearance in association with indoor air in buildings and homes has been noted more recently. This condition can be caused by bacteria, fungi, and molds contaminating home humidifiers and building heating, ventilation, and air conditioning (HVAC) systems.[3] The illness is characterized by flu-like symptoms that include fever, chills, fatigue, cough, chest tightness, and shortness of breath. Antibodies to causal organisms may be measurable in the peripheral blood. The disease is usually reversible if exposure does not continue. Over time, however, permanent changes including pulmonary fibrosis may result.

Causal Factors

In 1989 the Director of NIOSH issued a report to Congress summarizing NIOSH's activities in the area of indoor air quality between 1971 and 1989.[7] He reported that 0.5% of the 1200 Health Hazard Evaluations performed between 1971 and 1978 were for indoor air quality problems, compared with 12% for the period 1978-1980, with the proportion increasing to 20% per year in 1988 and early 1989. Health Hazard Evaluations are usually requested by workers or employers and thus are not necessarily representative of all buildings. Nevertheless, the number of buildings evaluated was large at 529, anti included a variety of different building types. Government and business office buildings constituted 80% of the total evaluated; schools and colleges, 13%; and health care facilities, 7%.

NIOSH classified these building evaluations by the primary type of problem found:

Inadequate ventilation (53% of buildings examined). Causes of inadequate ventilation included not enough outdoor air, poor air distribution and mixing, air pressure differentials between offices, temperature and humidity extremes or unreasonable fluctuations or both, improper air filtration, and poor maintenance of ventilation systems.

Indoor air contaminants (15% of buildings examined). (See below for a summary of indoor sources of air contaminants.) The most common chemical culprits identified by NIOSH were volatile organic compounds (VOCs). These may be released (off-gas) from materials used in refinishing wood floors and trims; from chemicals used to dye draperies, upholstered furniture, and cloth coverings of cubicle partitions; from plywood used in interior construction or furniture; from carpets and carpet backings: from perfumes worn by building occupants; from cleaning agents used by custodial staff; from office equipment such as copiers: from office supplies such as certain processed paper, carbon paper, and carbonless paper; and from antimicrobial agents. In 4% of the buildings, it was the building materials themselves that provided the source of indoor air contamination.

In addition to those described by NIOSH, other pollutants associated with poor indoor air quality include dust and odors. Dust itself is an irritant. It can also absorb VOCs and deposit them on the skin or in the respiratory tract, thus increasing their toxicity. Dust can serve as a reservoir for house dust mites, an allergen for many people. Carpets cause problems not only as sources of VOCs but also as dust collectors.

Odors affect the comfort level of a those exposed, draw attention to the environment, and may lower the threshold for effects of other air pollutants and climate variations.[18] Odors stem from a myriad of sources including VOCs from perfumes, copiers, and furniture materials as well as tobacco smoke, cooking processes, and cleaning products.

Schools have their own particular sources of contaminants: chalk dust; fungi, bacteria, and viruses brought to the school environment by children and adults; and vapors and fumes from chemistry laboratories, wood-working shops, and art classes. School environments differ from adult work environments in that children have special habits that encourage the spread of infectious disease. For example, children are more likely to have unprotected coughs and sneezes, less likely to wash their hands, and more likely to share the "tools of the trade" such as pencils. Increasing the risk for adults in schools is their lack of resistance to viruses of childhood.

Outside air contamination (10% of buildings examined). Outdoor environmental pollutants may become part of the indoor air in buildings. These include, for example, pesticides, vehicular exhaust such as diesel exhaust from trucks at loading docks of commercial buildings, and tobacco smoke from smokers standing outside building entrances.

Microbial contamination (5% of buildings examined). Water damage and pooling of water as a result of improper drainage of HVAC systems provide reservoirs for the growth of molds and fungi that in turn cause skin, respiratory tract, and in some cases systemic illness and disease. For example, molds such as *Cladosporium*, *Penicillium*, and *Alternaria* are commonly found as contaminants of improperly designed or maintained ventilation and humidification systems and in water-damaged walls, ceilings, and carpeting.[19]

Unknown (13% of buildings examined). In 13% of cases, specific etiologic factors could not be identified by NIOSH.

Over the past 30 to 40 years, there has been an explosion in the number of chemicals produced and used in the manufacture of household and building products, including construction materials, interior refinishing materials, cleaning agents, furnishings, and office equipment and supplies. In addition, buildings and HVAC systems have deteriorated as a result of aging and inadequate maintenance or become obsolete as a result of technological advances. HVAC systems were redesigned in the 1970s to make them more energy efficient. The amount of fresh air being brought into buildings has been decreased in order to reduce the amount of energy needed to heat or cool it.

Thus, there is less fresh air available to dilute indoor air contaminants.
Maintenance and custodial practices have also changed over time, with more work performed during regular working hours instead of nights and weekends. The result is that building occupants are exposed during normal working hours to vapors from cleaning and polishing agents and dust generated by dusting, sweeping, and vacuuming.

Relating Clinical Findings to Indoor Air Quality

Knowledge of specific etiologic factors is not necessary for symptomatic treatment of ill patients. However, cure and prevention do require knowledge of causal factors. In the case of health problems related to indoor air quality, alteration of the environment or protection of the patient from it are necessary components of the treatment plan.

The first step in proper medical treatment of indoor air-related illness is to suspect the diagnosis. Sick individuals may present with a variety of symptoms. These are often the same as symptoms seen with other commonly occurring illnesses, such as the flu, common cold, and non-building-related rhinitis, sinusitis, and asthma. For this reason and because objective medical findings are often scanty diagnosis depends to a large extent on history--both medical and exposure histories. This approach is no different from that applied to other medical conditions, except that the exposure history critical to diagnosis is often more difficult to come by. Reasons include lack of specific training of health care providers and, in some cases, unwillingness on the part of employers to provide the necessary information.

For the health care provider faced with a patient with suspected indoor-air-related health problems, it is important to bear in mind that measured levels of contaminants in buildings may be misleading. Measured levels may vary over time or from one part of a building or another; thus a given measurement may reflect a "best case" scenario that is not representative of usual exposures. For the most part, exposure limits established by Federal or state law apply to the industrial sector. Levels of contaminants lower than those allowed by the Occupational Safety and Health Administration (OSHA) and state regulatory agencies can cause problems. More recently, OSHA, the EPA, and the American Society of Heating, Refrigeration, and Air Conditioning Engineers have turned attention to the development of standards that apply to indoor air in the nonindustrial sector.

Also, effects of individual air quality problems in a building may be additive. For example, particulate matter can adsorb VOCs. Excess heat can add to the central nervous system effects of VOCs, enhancing such symptoms as fatigue and headache.

There appears to be an interaction between chemosensory neuroreceptors in the body and thermosensory neuroreceptors, so that cooler temperatures are associated with less chemical sensitivity.[18]

Finally, certain building occupants are likely to he particularly vulnerable to airborne contaminants. For example, individuals taking steroids or chemotherapeutic drugs are at increased risk for serious infection from molds and fungi growing in water-damaged walls or carpeting.

Fixing The Problem

Having recognized the problem, how do health care providers working together with employers and those responsible for designing, building, and maintaining buildings fix or prevent it? Several professional disciplines must be involved, including industrial hygienists to examine airborne contaminants, microbiologists when mold or fungal contamination is in question, engineers to examine the design and operation of the HVAC system, and physicians experienced in occupational and environmental medicine. Additionally, the aid of a psychologist with experience in building-related problems is often essential to ultimate resolution of the problem and a return to "business as usual." Psychological consultation may be needed on both an organizational and an individual level.

If an indoor air quality problem does develop in a building, it should receive prompt attention from those responsible for fixing it--which may include management personnel, building owners, or building managers. The longer recognition and correction of the problem takes, the greater the likelihood that symptoms will become chronic. Although the symptoms on their surface may seem trivial, together or alone they are enough to interfere with normal productivity and cause resentment directed at employers for real or perceived inattention to the problem, resulting in distrust and an "us-them" situation. The latter may be more difficult to resolve than the original indoor air quality problem.

Prevention strategies

The principal factors causally related to poor indoor air quality have been identified by NIOSH and others, as have solutions.[7,18] Interventions range from preconstruction intervention to "after-the-fact" legal strategies.

Building design and construction

Before a building is constructed or renovated, architects responsible for building design, engineers responsible for such things as HVAC system design and operation, and building contractors responsible for actual construction must work together. This formal communication will facilitate rational planning that takes into account factors that will affect air quality once construction is completed.

The design and location of the HVAC system is critically important to the well-being of a building. Careful attention should be paid to location of air intake units and their relationship to sources of pollution. For example, rooftop units may pull into the HVAC system pigeon and other bird droppings as part of the outside "fresh" air brought into the building, increasing the risk for psittacosis infection in building occupants. Intake units located near parking lots, loading docks, or busy highways increase the likelihood of drawing into the building vehicular exhaust, carbon monoxide, VOCs, and particulates.

Decisions must also be made with regard to amount of fresh air intake and the handling of return air. At present, the recommended minimum amount of fresh air supply for buildings is 15 cubic feet per minute (cfm) per person in a sedentary, nonsmoking environment, with a recommended range of 15 cfm/person to 20 cfm/person.[18] Meeting this standard does not necessarily insure adequate air quality, however. Ventilation requirements are determined by a variety of factors. These include the number of occupants in a given space, climate variables, and the concentration of airborne chemicals and other pollutants. Some data suggest that increasing ventilation rates above a baseline of 10 liters per second per person does not result in substantial reduction in complaints of indoor air quality-related symptoms.[22] On the other hand, if baseline rates of fresh air intake are below 10 liters per second per person, increases in ventilation rate are associated with reduction in building occupants' symptoms. Recirculated indoor air is handled by structural ductwork or through a space (plenum) above a dropped ceiling, with ducted air return being the generally preferred alternative by those knowledgeable in HVAC system design and operation. Careful consideration should be given to whether the ductwork is to be insulated and if so, with what. For example, insulating ducts with fibrous glass material has been associated with indoor contamination with microscopic fibers, resulting in dermatitis and upper respiratory tract irritation among exposed occupants. Design specifications for HVAC systems should include attention to factors that will minimize moisture accumulation, which creates a breeding ground for microorganisms.

Provision must be made for reasonable and consistent control of both temperature and relative humidity. Extremes of either have adverse effects on building occupants, both directly and indirectly. Warm humid air encourages the growth of microorganisms, including house dust mites. Air that is too dry may cause dry, itchy skin and eye and upper respiratory tract irritation. Excessive variability in temperature is uncomfortable and distracting for building occupants.

Careful attention to roof and window design and construction is needed to minimize moisture accumulation on the roof and leakage around and glare from windows. The building envelope should be constructed so that there is slight positive pressure inside the building. Upholstered interior furnishings and carpeting should be kept to a minimum because of their role as dust collectors and VOC emitters. Attention should be given to devices to facilitate removal of dirt and other residue from shoes prior to building entry (metal grates, for example). Proper landscaping will allow drainage of moisture away from the base of the building and minimize the likelihood of water damage and secondary pest and mold/fungal infestation and the need for pesticide treatment later.[18]

Before the building is occupied, there should be a "test drive" of the HVAC system so that defects can be corrected before rather than after the fact of indoor air quality problems. In addition, sufficient time should be allowed for off-gassing from construction and painting/refinishing materials before employees are allowed back into the building or work area. If work is being done close to building occupants, these occupants should be removed from the building or work areas should be rigorously isolated to protect occupants.

Building maintenance

Essential to a healthy indoor environment is a proactive and rigorous operations and maintenance program.

Maintenance and custodial work must be performed after normal work hours except in the event of an emergency. Careful and planned maintenance will keep the need for emergency repairs to a minimum. If emergency repair work is needed, it must be performed with appropriate isolation of the work area.

The HVAC system must be well maintained--inspected and cleaned on a prescheduled and periodic basis and repaired as needed. If maintenance is inadequate, problems that may arise again include growth and dissemination of microbial agents from water reservoirs or water-damaged areas as well as the dissemination of irritant dust through supply air from the HVAC system.

Dust must be carefully removed from horizontal surfaces, and vacuuming of carpets done with efficient filters and in a manner least likely to stir up dust. Cleaning agents should be chosen not only with cost in mind but also with consideration of the potential toxic effects.

Building occupants

Building occupants themselves have an important role to play in maintaining clean air. Building occupants should keep work areas tidy so that it is easier for them to be cleaned by custodial staff. A no smoking policy is imperative. Smoking outside but near the building should be prohibited because tobacco smoke can be drawn into the building envelope. Wearing of perfumes to work should be minimized. Cooking should be restricted to limited and well ventilated areas.

Legal strategies

While the common sense approach to the problem of poor indoor air quality is to do things right in the first place, another way of increasing the likelihood that preventive steps will be taken and that identified problems will be swiftly and effective remediated is to resort to legal strategies as a "court of last resort."

Potential tenants of commercial or residential properties might insert into the lease a clause that requires clean indoor air, with specification of minimum standards to be met and penalties for failure to comply or respond promptly in the event of an accident. Buildings have been declared "products" in some courts of law, so product liability laws may apply.[23] Determination of negligence on the part of responsible parties in such areas as building and HVAC design, building and HVAC construction or renovation, and building and HVAC maintenance and cleaning may provide leverage for correction of a problem, particularly if it has created a health risk or resulted in injury. If corrective action is not taken, legal action against those responsible may serve to prevent reoccurrence of similar problems in the future.

Summary

Health effects of poor indoor air quality are becoming increasingly important as a public health problem. At-risk populations include virtually all age, occupational, and socioeconomic groups in the United States. It is a problem that affects all members of society, and health care professionals alone can not fix it.

Fortunately, indoor air quality-related illness is preventable. The principal causes have been identified. Strategies for resolution and prevention have been developed. Although often expensive in the short term, their implementation is likely to be cost-effective in the long run. But that will require political and financial commitment and action from a variety of forces, Education of all potentially affected parties is critical.

The problem of poor indoor air quality and its related health effects is not going away. It will only increase as time goes on if action is not taken today. The best defense in this case is truly a good offense.

Clinical Definition of Multiple Chemical Sensitivity [16]

* Symptoms are reproducible upon exposure.
* The condition is chronic.
* Symptoms occur following low-level exposure.
* Removal of precipitating exposures results in resolution or improvement in symptoms.
* The condition is acquired.
* There is an acute inciting event, followed by a chronic component.
* There are no accepted objective tests to adequately explain the symptoms.

Indoor Sources of Air Pollution

Chemical emitters

Dust and dust reservoirs

Water reservoirs Water-damaged walls or interior furnishings

Microbial reservoirs in heating, ventilation, and air conditioning (HVAC) systems

Insulation materials in HVAC ductwork

Odor emitters

Plants

Building occupants (perfumes, perfumed soaps and deodorants, hair spray, viral infections, tobacco smoke)

Communications: A Critical Link In The Management of IAQ

As with other illnesses, problems associated with poor indoor air vary in severity and chronicity. For the individual, symptoms can range from mild and sporadic to severe and chronic. Within organizations, a few individuals can be affected or whole facilities can be crippled. In each case, concern and fear may drive an urgent search for the "smoking gun," the environmental exposure that is the cause of the problem: however, in this urgency, important interpersonal factors are often overlooked. Dysfunctional organizational communications can transform manageable symptoms into severe and chronic conditions.

All buildings are likely to have some problems with air quality. Balancing temperature, light, ventilation, and cleanliness, particularly in large and tight buildings, is a complex task. Especially during seasonal changes, systems may become out of balance. Within the dynamic environment of a building, the conclusion that a serious air quality problem exists is usually slow to develop, initially, employees experience symptoms that they interpret as non-occupational medical problems--such as colds or allergies. Over time, staff share their experiences and come to attribute many problems--those related and unrelated to air quality--to the ill health of the building. Stress and anxiety add to this mix, in turn exacerbating or creating symptoms similar to those of sick building syndrome--fatigue, headaches, nausea, and other nonspecific somatic and psychological symptoms.

This process is magnified and accelerated in organizations in which staff members do not see managers as resources and are uncomfortable approaching them with concerns. When employee-manager communications are poor, managers may face concerns about air quality that have already become urgent and adversarial by the time they are formally communicated.

In an adversarial environment, complaints about air quality are likely to be minimized or denied by management, increasing staff members' frustration and, in turn, heightening the focus on air quality and the safety of the environment. Over time, the perception that a danger exists will increase employees' anxiety, exacerbating medical symptoms both related and unrelated to air quality. In fact, it is not: entirely relevant whether there are toxins in the environment. Even in cases in which air quality testing indicates levels of airborne contaminants that are below permissible exposure limits established by regulatory agencies, employees may continue to have symptoms. Frustrated managers are then likely to listen to industrial hygienists who say that the environment is safe and, subtly or not so subtly, ignore the ongoing fears of the staff ("It's all in their heads").

Employees can be caught in a bind; if they feel loyal to or dependent on the organization and don't want to leave, they will be working for a boss who apparently won't listen in an environment that feels hazardous. This creates chronic stress, which can have significant and long-lasting effects on emotional and physical health.[20] As resistance and immune functioning is lowered, susceptibility increases to a variety of medical anti psychological conditions, including multiple chemical sensitivity.
A healthier climate. Poor morale can exacerbate air quality problems, and air quality problems can exacerbate poor morale. Patients in sick buildings have been found to present greater distrust of authority, defensiveness, anxiety, and confusion than nonsymptomatic workers, although the two groups do not differ in their performance on psychological inventories.[21] Within organizations, problems with distrust of authority and labor-management tensions will often be found to predate the advent of environmental problems. It is not useful to blame a particular party because employees and employers often share responsibility for communication problems. But it is useful to examine how these complex bio-psycho-social environments can be effectively managed from both individual and organizational points of view.

How can employees and organizations break the complex cycle of dysfunctional communication?

Listen to one another.

Indoor air quality problems, particularly when they are chronic and intractable, are often accompanied by a fracturing of staff opinions. Commonly heard explanations include: "It is only in people's minds, and they are just scaring each other." "There are minor irritants in the air that are innocuous, and people are overreacting." "There must be a dangerous toxin present. Our health and lives are in danger."

Multiple chemical sensitivities and sick building syndrome are complex issues that are often reduced to ideological and political positions that are not constructive to their resolution. It is important for employees, managers, and consultants to listen to and trust each others' perceptions; conclusions should follow a thorough airing of all points of view and a reconciliation of all of the data.

Talk openly.

Particularly if the air quality problem has a long history, staff will need a forum to vent emotional frustrations and to come to a shared understanding of how the situation evolved. These conversations can take time and energy but are far less costly than their alternative, the continued evolution of chronic and intractable sick building syndrome.

Gain consensus.

Just as the elephant in the proverbial story was taken for a rope, a hose, a leaf, and a tree trunk by blind observers who could reach only part of the animal, all involved parties—administrators, occupational health consultants, industrial hygienists, and employees--may initially be limited in their ability to "see the whole elephant." It is essential that employees and managers develop a common picture of the history and current state of the problem, including both scientific facts and emotional perceptions. These understandings need to cut across union-management and staff-administration lines, and it is critical that they are separated out from other employment issues. Unless a consensus is developed, management of the air quality problem is in danger of being fragmented and polarization between factions is likely. The various perspectives need to be reconciled in a management plan that does not just focus on indoor air quality but takes into account the whole complex bio-psycho-social environment of the organization.

Preventing Indoor Air Quality-Related Illness

Attention to air quality in design and construction of new and renovated buildings, including selection of building and furnishing materials;

Avoiding premature occupancy or reentry;

An ongoing operations and maintenance program;

Adequate and properly timed housecleaning, using non-toxic cleaning materials;

Attention to manufacturers' labels and Material Safety Data Sheets in selecting materials and training staff;

Rapid response to suspected problems;

Education and training of health care providers, the public, and responsible parties;

Use of legal strategies for prevention.

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