"Tek" Newsletter

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Quarterly Newsletter

Factors that Affect Indoor Air Quality

Concerns about health hazards posed by exposure to environmental pollutants, both in the workplace and at home, should be considered by everyone. Health effects attributable to Indoor Air Quality (IAQ) have prompted regulatory action such as prohibition of smoking in most indoor workplaces. Concerns for health effects from sidestream tobacco smoke and other chemical and biological indoor air pollutants such as formaldehyde, pesticides, endotoxins (toxins in bacteria), and mycotoxins (toxins produced by fungus) categorically range from acute irritant to carnicogen.

Poor ventilation has been attributed to many IAQ problems. According to OSHA air contaminants and other air quality factors can act to present a risk of impairment to employees working in non-industrial work environments if adequate outside air is not provided.

Indoor air quality problems can occur in all types of buildings; in newly constructed, renovated, or remodeled homes and buildings, and in older homes and buildings. Older buildings that have not been adequately maintained may have problems with bioaerosols if parts of the building have been allowed to become reservoirs for microbial growth. Regardless of the age of the building; however, chemical and biological contaminants can build up to levels that can cause adverse health effects. Reported cases of illness include irritation of the eyes, nose, and throat, dry mucous membranes and skin, mental fatigue and headache; respiratory infections and cough; hoarseness of voice and wheezing; nausea, dizziness, loss of balance, numbness in extremities and face, and lethargy. These conditions are not easily traced to a specific substance and often result from a combination of contaminants. Symptoms most related to microbial exposure result in itchy, congested, or runny nose, watery eyes; and sometimes include wheezing, tight chest, or flu-like symptoms. Overlapping symptoms from chemical and microbial agents are eye, nose, and throat irritation. Typically, where microorganisms are allowed to grow, a moldy smell develops. This smell is often associated with volatile organic chemicals (VOCs) released during microbial growth on environmental substrates. VOCs, which may originate from bacteria, mold spores, particulate matter, and numerous chemicals, are generally found in very small quantities that are not considered to be harmful to indoor air quality.

Poor indoor air quality can lead to the transmission of disease cause by obligate pathogens (microbes that require a living host) such as influenza, colds, and measles, which are common in overcrowded and inadequately ventilated environments. Indoor transmission of disease caused by opportunistic microorganisms usually affects

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compromised individuals (those with existing conditions such as pulmonary disease or immunodeficiency) making them more susceptible to infection. Legionaires' disease, pulmonary tract infections, asthma, and allergic reactions fall into this category. Studies by the Environmental Protection Agency (EPA) indicate that when indoor air quality is a legitimate concern it is most frequently linked to biocontaminants.

Chemically sensitive individuals have demonstrated irritability from natural gas fumes, allergy from dust from forced air ventilation systems, paint fumes, dry cleaning chemicals, and carpet shampoos. Intolerance to highly scented products such as toilet deodorants, strong perfumes, and air fresheners (especially pine-scented one) has proven to be particularly troublesome. Individuals with pulmonary disease, such as asthma, are more susceptible than others to these indoor air contaminants and may experience coughing and wheezing at low levels of exposure.

Over the years, new carpet installations have occasionally been attributed to indoor air quality concerns and dermal sensitization complaints. Many of these complaints suggested that 4-PC (4-phenylcyclohexene); a trace by-product of styrene butadiene latex production, (and the compound generally associated with new carpet odor) may have contributed to these problems. These complaints were exasperated by one study that emerged claiming that carpet emissions could be shown to produce respiratory and neurotoxic effects in mice (Anderson, 1993). By now everyone knows that Anderson laboratories work was later examined by the scientific community and dismissed as lacking credibility; however, these studies prompted several other major studies of animal toxicity associated with new carpet. In one study for dermal sensitization potential, a high concentration of 4-PC sufficient enough to have evoked an allergic response (if the chemical possessed any potential for evoking a response) was applied to Hartley guinea pigs. The sensitivity response of these animals to these exposures were reported to be totally negative. In another study for dermal stability carpet was topically applied to the skin of New Zealand White Rabbits. This test categorized carpet as "negligible" on the Irritation Index. No wonder! Carpet is made from the same innocuous materials found in clothing, everyday fabrics, food and drink containers, and medical implements.

In an acute inhalation study where rats were exposed to the maximum achievable airborne concentration levels of 4-PC of 60 parts per million (ppm) no adverse effects were observed. Based on clinical analysis of the test specimens blood, urine, mucous membranes, condition of fur, behavior pattern, and nervous system it was determined that it is highly unlikely that any toxic endpoint could be evoked in either animal or human, as a result of single or repetitive exposures to airborne 4-PC vapor.

Perhaps the most comprehensive study to date on the possibility for adverse health effects associated with new carpet occurred in 1995 at Cornell University. After extensive review of all scientific and medical literature available, including studies on skin irritation, acute and chronic inhalation toxicity, and neurotoxicity, researchers here determined that carpet presents no risk to human health.

The potential 4-PC exposure range for human populations has been estimated to be in the low parts-per billion range' not exceeding 100 ppb (the odor threshold of 4-PC is reported to be in the range of 1 ppb). 4-PC in the range of 100 ppb is approximately 1,000 fold lower than that shown to be toxicologically inactive in rats. According to scientific studies that conformed to the requirements of Good Laboratory Practices in effect at modern toxicological test facilities designed to yield quantitative information, the toxicity of 4-PC emissions has been characterized as unremarkable. Other scientific studies have demonstrated that new carpet emissions dissipate very quickly, usually within 72 hours after installation. Compared with other building materials and furnishings carpet has also proven to be one of the lowest VOC emitting items commonly used in the home and workplace. However, in an effort to reduce the perception of a problem that might be associated with new carpet odor the carpet industry reduced the level of 4-PC used in latex by more than 70% over the past few years.

It is important to remember that carpet is only a part of the total floor covering system that includes cushion or adhesive, which are also sources of emissions. The Carpet and Rug Institute's IAQ testing program minimizes the potential for emissions from new carpet installations by covering carpet, cushion, and floor covering adhesives. Look for the CRI IAQ Green Label to insure low-level VOC emissions from these products.