

Health Hazards Associated with Indoor Air Pollution

Introduction

Health effects from indoor air pollutants may be experienced soon after exposure or, possibly, years later.

Immediate effects may show up after a single exposure or repeated exposures. These include irritation of the eyes, nose and throat, headaches, dizziness and fatigue. Such immediate effects are usually short-term and treatable. Sometimes the treatment is simply eliminating exposure to the source of the pollution, if it can be identified. Symptoms of some diseases, including asthma, hypersensitivity pneumonitis, and humidifier fever, may also show up soon after exposure to some indoor air pollutants.

The likelihood of immediate reactions to indoor air pollutants depends on several factors. Age and preexisting medical conditions are two important influences. In other cases, whether a person reacts to a pollutant depends on individual sensitivity, which varies tremendously from person to person. Some people can become sensitized to biological pollutants after repeated exposures, and it appears that some people can become sensitized to chemical pollutants as well.

Certain immediate effects are similar to those from colds or other viral diseases, so it is often difficult to determine if the symptoms are a result of exposure to indoor air pollution. For this reason, it is important to pay attention to the time and place the symptoms occur. If the symptoms fade or disappear when a person is away from the building and return when the person returns, an effort should be made to identify indoor air sources that may be the possible cause. Some effects may worsen from an inadequate supply of outdoor air or from the heating, cooling, or humidity conditions prevalent in the building.

Other health effects may appear either years after exposure has occurred or only after long or repeated periods of exposure. These effects, which include some respiratory diseases, heart disease, and cancer, can be severely debilitating or fatal. **It is prudent to improve the indoor air quality in the structure even if symptoms are not noticeable.**

While pollutants commonly found in indoor air are responsible for many harmful effects, there is considerable uncertainty about what concentrations or periods of exposure are necessary to produce specific health problems. People also react very differently to exposure to indoor air pollutants. Further research is needed to better understand which health effects result after exposure to the average pollutant concentrations found in buildings, and which result from the higher concentrations that occur for short periods of time.

Health Hazards of Mold Exposure

All molds have the potential to cause health effects. Molds produce allergens, irritants, and, in some cases, toxins that may cause reactions in humans. The types and severity of symptoms depend, in part, on the types of mold present, the extent of an individual's

exposure, the ages of the individuals, and their existing sensitivities or allergies. Specific reactions to mold growth can include the following:

Allergic Reactions: Inhaling or touching mold or mold spores may cause allergic reactions in sensitive individuals. Allergic reactions to mold are common – these reactions can be immediate or delayed. Allergic responses include hay fever-type symptoms, such as sneezing, runny nose, red eyes, and skin rash (dermatitis).

Mold spores and fragments can produce allergic reactions in sensitive individuals regardless of whether the mold is dead or alive. Repeated or single exposure to mold or mold spores may cause previously non-sensitive individuals to become sensitive. **Repeated exposure has the potential to increase sensitivity.**

Asthma: Molds can trigger asthma attacks in persons allergic (sensitized) to molds. The irritants produced by molds may also worsen asthma in non-allergic (non-sensitized) people.

Hypersensitivity Pneumonitis: Hypersensitivity pneumonitis may develop following either short-term (acute) or long-term (chronic) exposure to molds. The disease resembles bacterial pneumonia and is uncommon.

Irritant Effects: Mold exposure may cause irritation of the eyes, skin, nose, throat, and lungs, and sometimes can create a burning sensation in these areas.

Opportunistic Infections: People with weakened immune systems (i.e., immune-compromised or immune-suppressed individuals) may be more vulnerable to infections by molds (as well as more vulnerable than healthy persons to mold toxins). *Aspergillus fumigatus*, for example, has been known to infect the lungs of immune-compromised individuals. These individuals inhale the mold spores, which then start growing in their lungs. *Trichoderma* has also been known to infect immune-compromised children. Healthy individuals are usually not vulnerable to opportunistic infections from airborne mold exposure. However, molds can cause common skin diseases, such as athlete's foot, as well as other infections such as yeast infections.

A major concern with mold is that the mold can be hidden behind walls and deep in air ducts making it difficult to remove all the mold from the structure. Diligence should be exerted to remove and dispose of any porous materials that have been contaminated by mold. The replacement porous ductwork and the surrounding area should then be treated with QwikTreat® Porous Duct Sealant with Biocide to prevent reoccurrences. **Hard non-porous surfaces can be cleaned** with QwikTreat® MoldStop™ Hard Surface Disinfectant. Remember, QwikTreat MoldStop Hard Surface Cleaner is only for hard, non-porous surfaces, while QwikTreat Porous Duct Sealant is both a biocide and an air-duct sealant for porous surfaces, such as duct board, fiberboard and fiberglass insulation, but it should not be used over wet or moldy air ducts.

Currently, most health organizations consider exposure to *Stachybotrys* mold as a health hazard. Also, keep in mind that most responses leading to testing, investigations, and abatement of the *Stachybotrys* toxic mold are due directly to occupant complaints or documented detrimental health effects. *Stachybotrys* mold may evolve to a point where it is regarded with the same caution, response and liability concerns as those attributed to lead-base paint and asbestos. Health hazards and risks associated with concern to exposure to *Stachybotrys* are currently considered as short-term effects. Alternatively, exposure to radon gas in buildings is considered a long-term health risk and is not considered a short-term hazard.

Molds can produce toxic substances called mycotoxins. Some mycotoxins cling to the surface of mold spores; others may be found within spores. More than 200 mycotoxins have been identified from common molds, and many more remain to be identified. Some of the molds that are known to produce mycotoxins are commonly found in moisture-damaged buildings. Exposure pathways for mycotoxins can include inhalation, ingestion, or skin contact. Although some mycotoxins are well known to affect humans and have been shown to be responsible for human health effects, for many mycotoxins, little information is available. The information on the human health effects of inhalation exposure to mycotoxins (which is available) is typically derived from studies performed in the workplace. Information on ingestion exposure, for both humans and animals, is more abundant--a wide range of health effects has been reported following ingestion of moldy foods including liver damage, nervous system damage, and immunological effects.

Many symptoms and human health effects attributed to inhalation of mycotoxins have been reported, including: mucous membrane irritation, skin rash, nausea, immune system suppression, acute or chronic liver damage, acute or chronic central nervous system damage, endocrine effects, and cancer. More studies are needed to clarify the health effects related to most mycotoxins. However, it is clearly prudent to avoid exposure to molds and mycotoxins.

Some molds can produce several toxins, and some molds produce mycotoxins only under certain environmental conditions. The presence of mold in a building does not necessarily mean that mycotoxins are present or that they are present in large quantities.

Aflatoxin B₁ is perhaps the most well known and studied mycotoxin. It can be produced by the molds *Aspergillus flavus* and *Aspergillus parasiticus* and it is one of the most potent carcinogens known. Ingestion of aflatoxin B₁ can cause liver cancer. There is also some evidence that inhalation of aflatoxin B₁ may cause lung cancer. Aflatoxin B₁ has been found on contaminated grains, peanuts and other human and animal foodstuffs. However, ***Aspergillus flavus* and *Aspergillus parasiticus* are not commonly found on building materials or in indoor environments.**

Aspergillus versicolor and *Stachybotrys atra* (*chartarum*), are known to produce potent toxins under certain circumstances. *Stachybotrys* produces a mycotoxin that causes animal and human mycotoxicosis. This type of mold is thought to be a possible cause of the "sick building syndrome". In May 1997, *The Journal of the American Medical*

Association carried a news article titled “Floods carry potential for toxic mold disease”. Children’s exposure to air-borne *Stachybotrys* spores is thought to most likely cause pulmonary hemosiderosis (bleeding in the lungs). Please be aware that there is no threshold dangerous spore exposure level by the U.S. EPA or any other health administrations. There are ongoing new epidemiology studies being conducted. There is reference information related to a 1994 incident in Cleveland, Ohio, where 45 cases of pulmonary hemorrhage in young infants occurred. Sixteen of the infants died. In addition, many departments of health administration in states across the U.S., as well as the Center for Disease Control (CDC), list the following as symptoms associated with exposure to *Stachybotrys* mold spores:

- 1) Respiratory problems, such as wheezing, and difficulty in breathing
- 2) Nasal and sinus congestion
- 3) Eyes-burning, watery, reddened, blurry vision, light sensitivity
- 4) Dry, hacking cough
- 5) Sore throat
- 6) Nose and throat irritation
- 7) Shortness of breath
- 8) Chronic fatigue
- 9) Skin irritation
- 10) Central nervous system problems (constant headaches, memory problems, and mood changes)
- 11) Aches and pains
- 12) Possible fever
- 13) Diarrhea
- 14) Possible hemosiderosis
- 15) Immune suppression

Health Hazards of Microbial Volatile Organic Compounds (mVOCs)

Some compounds produced by molds are volatile and are released directly into the air. These are known as microbial volatile organic compounds (mVOCs). Because these compounds often have strong and/or unpleasant odors, they can be the source of odors associated with molds. Exposure to mVOCs from molds has been linked to symptoms

such as headaches, nasal irritation, dizziness, fatigue and nausea. Research on mVOCs is still in the early phase.

Health Hazards of Glucans (Fungal Cell Wall Components)
(also known as β -(1 3)-D-Glucans)

Glucans are small pieces of the cell walls of molds that may cause inflammatory lung and airway reactions. These glucans may affect the immune system when inhaled. Exposure to very high levels of glucans or dust mixtures, including glucans, may cause a flu-like illness known as Organic Dust Toxic Syndrome (ODTS). This illness has been primarily noted in agricultural and manufacturing settings.

Health Hazards of Spores

Mold spores are microscopic (2-10 μm) and are naturally present in both indoor and outdoor air. Molds reproduce by means of spores. Some molds have spores that are easily disturbed and waft into the air and settle repeatedly with each disturbance. Other molds have sticky spores that cling to surfaces and become dislodged by brushing against them or by other direct contact. Spores may continue to grow for years after they are produced. In addition, whether or not the spores are alive, the allergens in and on them may remain allergenic for years.

Health Hazards of Radon

Radon gas decays into radioactive particles that may become trapped in the lungs as a person breathes. As they break down further, these particles release small bursts of energy. This could damage lung tissue and lead to lung cancer over the course of one's lifetime. Not everyone exposed to elevated levels of radon will develop lung cancer, and the amount of time between exposure and the onset of the disease may be many years.

Like other environmental pollutants, there is some uncertainty about the magnitude of radon health risks. However, we know more about radon risks than risks from most other cancer-causing substances. This is because estimates of radon risks are based on studies of cancer in humans (underground miners, for example). Additional studies on more typical populations are under way. Smoking combined with radon is an especially serious health risk.

Children are reportedly at greater risk than adults of certain types of cancer from radiation, but there is currently no conclusive data on whether children are at greater risk than adults from radon.

An individual's chances of getting lung cancer from radon depend mostly on:

- The level of radon in a person's building
- The amount of time spent in a person's building
- Whether a person is a smoker or has ever smoked