Given that the workplace is where many people spend a great deal of time during the week, there is always a concern that the environment is conducive for allowing productivity as well as being a place that is free of conditions that would or could potentially lead to health issues.

This edition of Health and Safety News seeks to shed some light on the topic of indoor environmental quality. The information on the following pages comes directly from the NIOSH (The National Institute for Occupational Safety and Health) [http://www.cdc.gov/niosh/](http://www.cdc.gov/niosh/) and CDC (Centers for Disease Control and Prevention) [http://www.cdc.gov/niosh/topics/indoorenv/](http://www.cdc.gov/niosh/topics/indoorenv/) websites. Topics included in this month’s issue include general indoor environmental quality information, dampness and mold in buildings, building ventilation, construction and renovation, and chemicals and odors. To read further about information in blue type, simply click and select Open Hyperlink.

**INDOOR ENVIRONMENTAL QUALITY**

Indoor environmental quality (IEQ) refers to the quality of a building’s environment in relation to the health and wellbeing of those who occupy space within it. IEQ is determined by many factors, including lighting, air quality, and damp conditions. Workers are often concerned that they have symptoms or health conditions from exposures to contaminants in the buildings where they work. One reason for this concern is that their symptoms often get better when they are not in the building. While research has shown that some respiratory symptoms and illnesses can be associated with damp buildings, it is still unclear what measurements of indoor contaminants show that workers are at risk for disease. In most instances where a worker and his or her physician suspect that the building environment is causing a specific health condition, the information available from medical tests and tests of the environment is not sufficient to establish which contaminants...
are responsible. Despite uncertainty about what to measure and how to interpret what is measured, research shows that building-related symptoms are associated with building characteristics, including dampness, cleanliness, and ventilation characteristics.

Indoor environments are highly complex and building occupants may be exposed to a variety of contaminants (in the form of gases and particles) from office machines, cleaning products, construction activities, carpets and furnishings, perfumes, cigarette smoke, water-damaged building materials, microbial growth (fungal, mold, and bacterial), insects, and outdoor pollutants. Other factors such as indoor temperatures, relative humidity, and ventilation levels can also affect how individuals respond to the indoor environment.

Understanding the sources of indoor environmental contaminants and controlling them can often help prevent or resolve building-related worker symptoms. Practical guidance for improving and maintaining the indoor environment is available.

Workers who have persistent or worsening symptoms should seek medical evaluation to establish a diagnosis and obtain recommendations for treatment of their condition.

Dampness and Mold in Buildings

Images above were taken from http://www.cdc.gov/niosh/topics/indoorenv/mold.html

Dampness results from water incursion either from internal sources (e.g., leaking pipes) or external sources (e.g., rainwater). Dampness becomes a problem when various materials in buildings (e.g., rugs, walls, ceiling tiles) become wet for extended periods of time. Excessive moisture in the air (i.e., high relative humidity) that is not properly controlled with air conditioning can also lead to excessive dampness. Flooding causes dampness. Dampness is a problem in buildings because it provides the moisture that supports the growth of bacteria, fungi (i.e., mold), and insects.

In the presence of damp building materials the source of water incursion is often readily apparent (e.g., leaks in the roof or windows or a burst pipe). However, dampness problems can be less obvious when the affected materials and water source are hidden from view (e.g., wet insulation within a ceiling or wall; excessive moisture in the building foundation due to the slope of the surrounding land).

What is mold?

Mold is a fungal growth that forms and spreads on various kinds of damp or decaying organic matter. There are many different mold species that come in many different colors. Molds are sometimes referred
to as mildew. They are found both indoors and outdoors in all climates, during all seasons of the year. Outdoors, molds survive by using plants and decaying organic matter such as fallen leaves as a source of nutrition. Indoors, molds need moisture to grow as well as a carbon source from building materials or building contents.

Excess moisture is generally the cause of indoor mold growth. Molds reproduce by releasing tiny spores that float through the air until landing in other locations. When they settle on wet or moist surfaces, the spores can form new mold colonies. Moderate temperatures and available nutrient sources make most office buildings ideal for mold growth.

Recent media attention has increased public awareness and concern over exposure to molds in the workplace. While this may seem to be a new problem, exposure to molds has actually occurred throughout history. In fact, the types of molds found in office buildings are not rare or even unusual. It is important to understand that no indoor space is completely free from mold spores – not even a surgical operating room. Molds are everywhere, making our exposure to molds unavoidable, whether indoors or outdoors, at home or at work.

"Toxic Mold" & *Stachybotrys chartarum*

![Image](http://www.cdc.gov/niosh/topics/indoorenv/mold.html)

Certain molds are toxigenic, meaning they can produce toxins (mycotoxins), but the molds themselves are not toxic, or poisonous. Hazards presented by molds that may produce mycotoxins, such as *Stachybotrys chartarum*, should be considered the same as other common molds which can grow in your house or workplace. Contradicting research results exist regarding whether toxigenic mold found indoors causes unique or rare health conditions such as bleeding in the lungs. Research is ongoing in this area.

Mold growing in buildings, whether it is *Stachybotrys chartarum* (*Stachybotrys atra*) or another mold, indicates that there is a problem with water or moisture. This is the first problem that needs to be addressed. For further information on *Stachybotrys chartarum*, go to the [CDC mold website](http://www.cdc.gov/niosh/topics/indoorenv/mold.html).

**Remediation of dampness and mold contamination**

First and foremost, determine the source of moisture and take appropriate measures to make repairs. Damp or wet building materials and furnishings as a result of leaks or flooding should be dried within 24 to 48 hours to prevent the growth of mold. Mold can be cleaned and removed from hard surfaces with detergent and water or a bleach solution of no more than 1 cup of bleach in 1 gallon of water. Never mix bleach with ammonia or other household cleaners. Mold in or under carpets typically requires that the
carpets be removed. Once mold starts to grow in insulation or wallboard, the only way to deal with the problem is removal and replacement. For complete remediation guidelines go to the New York City Department of Health and Hygiene's Guidelines on Assessment and Remediation of Fungi in Indoor Environments site.

I suspect mold in my workplace. How do I test for mold?

CDC does not recommend routine sampling for molds. Generally, it is not necessary to identify the species of mold growing in a building. Measurements of mold in air are not reliable or representative. If mold is seen or smelled, there is a potential health risk; therefore, no matter what type of mold is present, you should arrange for its removal. Furthermore, sampling for mold can be expensive, and standards for judging what is and what is not an acceptable or tolerable quantity of mold have not been established.

Symptoms related to dampness and mold

Health problems associated with excessive damp conditions and mold include:

- **ALLERGIES**

  Allergic responses like those to pollen or animal dander are the most common types of health problems related to mold. Typical symptoms include sneezing; irritation of the nose, mouth, or throat; nasal stuffiness and runny nose; and red, itchy or watery eyes. Inhaling or touching mold or mold spores can cause a person who was not previously allergic to mold to become allergic to mold. For people with known allergies, molds can trigger asthma symptoms such as shortness of breath, wheezing, or cough. Irritation can also occur in non-allergenic (non-sensitized) people. Additionally, scientific studies indicate that exposure to molds in the workplace can make pre-existing asthma worse. Recent NIOSH investigations document that some damp buildings are associated with developing new asthma.

- **HYPERSENSITIVITY PNEUMONITIS**

  Hypersensitivity pneumonitis (HP) is a kind of lung inflammation that occurs in persons who develop immune system sensitization (similar to an allergy) to inhaled organic dust. It can be mistaken for pneumonia, but it does not get better with antibiotics for infection.

  Symptoms of HP can vary. Some persons have shortness of breath, cough, muscle aches, chills, fever, night sweats, and profound fatigue. These symptoms usually first appear 2 to 9 hours after exposure and last for 1 to 3 days. Other affected persons have progressive shortness of breath and cough, as well as weight loss. Work-relatedness may only become apparent over long holidays if symptoms resolve and then recur on return to work. With continued exposure, the persistent lung
inflammation of both kinds of symptoms can lead to scarring and permanent damage. The slow progression of symptoms and the persistence of symptoms away from work may result in delayed recognition of work-related lung disease by both workers and physicians.

HP has been referred to as Bird breeder’s lung and Mushroom picker’s disease in specific occupations with a risk of HP from biological dusts. HP has been documented in workers in buildings with mold and bacteria contaminated air-conditioners (including spray-water cooling systems), and contaminated ductwork and filters. This lung disease has also occurred in workers who worked in water-damaged buildings with roof leaks, plumbing leaks, poorly draining condensation pans, and high indoor relative humidity.

HP is not contagious and is due to a person’s immune system reaction to inhaled microorganisms, whether dead or alive. It is possible for workers to have both dampness-related HP and asthma at the same time. Additionally, workplaces that have workers with HP may also have workers with building-related asthma.

- **ASTHMA**

Asthma is a form of lung disease in which the airways develop inflammation and bronchospasm (reversible narrowing) in response to sensitizing or irritating exposure. Affected individuals can experience episodes of shortness of breath, cough, chest tightness, and wheezing. These symptoms occur after exposure to nonspecific irritating substances in the air or after exposure to substances to which an individual is allergic. Medical testing typically reveals evidence of bronchial hyperresponsiveness such as an abnormal methacholine challenge test or reversible airways obstruction on spirometry (a test of lung function). It is important for affected individuals to have a comprehensive asthma treatment plan and regular follow-up with their physician. Early diagnosis and removal from the impacted damp office environment can cure asthma caused by workplace exposures.

In approximately 15% of asthmatics, the illness may have been caused, or made worse, by workplace exposures. Some occupational exposures are well known risks for asthma development (e.g., western red cedar; isocyanates). Indoor environment research has identified evidence of an association between damp buildings and asthma symptoms in individuals with pre-existing asthma. There is also new evidence of an association between damp buildings and new-onset asthma. In an individual with new-onset asthma or worsening of stable pre-existing asthma, measurements of lung function made several times a day at work and at home over several weeks may reveal a pattern of changing lung function that suggests a workplace cause.

For individuals with new-onset asthma or worsening of stable pre-existing asthma that is suspected to be related to the indoor environment, controlling or eliminating the sources of indoor contaminants, along with optimal medical treatment, may lead to symptoms of improvement or resolution.
What workers can do

When workers suspect their health problems are caused by exposure to building-related dampness or mold, workers should:

- Report concerns immediately to supervisors or those persons responsible for building maintenance.
- See your doctor for proper diagnosis and treatment.
- Ask your doctor whether you should be medically restricted from the affected environment.

What management and building owners can do

When health problems are believed to be caused by exposure to dampness or mold in the workplace, owners and managers should:

- Always respond when occupant health concerns are reported.
- Establish clear procedures for recording and responding to IEQ complaints to ensure an adequate and timely response.
  - Log all complaints or problem reports.
  - Collect information about each complaint.
  - Ensure confidentiality.
  - Determine a plan for response.
  - Identify appropriate resources for response.
  - Apply remedial action.
  - Provide feedback to building occupants regarding the complaint and response actions.
  - Follow-up to ensure that remedial action has been effective.

- Regularly inspect building areas for evidence of dampness; take prompt steps to identify and correct the causes of any dampness problems found.

- Conduct regularly scheduled heating, ventilating, and air-conditioning (HVAC) system inspections, and promptly correct any problems.

- Prevent high indoor humidity through the proper design and operation of HVAC systems.

- Dry any porous building materials that have become wet from leaks or flooding within 48 hours.

- Clean and repair or replace any building materials that are moisture-damaged or show evidence of visible mold growth. Follow remediation guidelines such as the Environmental Protection Agency’s (EPA) Mold Remediation in Schools and Commercial Buildings.

- Encourage occupants who have developed persistent or worsening respiratory symptoms while working in the building to see a health care provider.

- Follow health care provider recommendations for relocation of occupants diagnosed with building-related respiratory disease.

- Establish an indoor environmental quality (IEQ) team consisting of a coordinator and representatives of the building employees, employers, and building management who would
oversee implementation of an IEQ program. The [EPA Indoor Air Quality Tools for Schools](http://www.epa.gov/iaq/schools.html) can be used as a model for such a program.

### Building Ventilation

Building ventilation is the circulation of air throughout a building. The ventilation or the heating, ventilating, and air-conditioning (HVAC) system of a building supplies and removes air either naturally (windows) and/or mechanically to and from a space. HVAC systems consist of mechanical parts which should provide air to building occupants at a comfortable temperature and humidity that is free of harmful concentrations of air pollutants. Building ventilation is one important factor affecting the relationship between airborne transmission of respiratory infections and the health and productivity of workers.

**Why is the operation and maintenance of HVAC systems important?**

Improper operation and maintenance of HVAC systems is one of the most common problems that impact workplace indoor environmental quality (IEQ). HVAC systems include all of the equipment used to ventilate, heat, and cool the building; to move the air around the building (ductwork); and to filter and clean the air. These systems can have a significant impact on how pollutants are distributed and removed. Maintaining good IEQ requires constant attention to the building's HVAC system, which includes the design, layout and pollutant source management or air filtration.

There are a variety of pollutants and sources of pollutants in a building such as:

- carbon dioxide and carbon monoxide
- tobacco smoke
- molds and bacteria
- cleaning products
- copy machines and printers
- pesticides
- vehicle exhaust
HVAC systems alone can act as sources of pollutants. If these systems are not appropriately maintained, ventilation air filters can become saturated leading to potential microbial growth and odor concerns. Microbial growth can also result from stagnant water in drain pans or from uncontrolled moisture inside of air ducts and cooling coils.

Image was taken from [http://www.cdc.gov/niosh/topics/indoorenv/buildingventilation.html](http://www.cdc.gov/niosh/topics/indoorenv/buildingventilation.html)

**HVAC management for better IEQ**

**Ventilation System Design**

The amount of air required to be delivered to a given space by an HVAC system is based primarily on the number of people occupying the space, the type and amount of equipment, and the overall size of the space. Proper distribution of ventilation air throughout all occupied spaces is essential. When areas in a building are used differently than their original purpose, the HVAC system may require modification to accommodate these changes. For example, if a storage area is converted into space occupied by people, the HVAC system may require alteration (balancing) to deliver enough conditioned air to the space.

**Outdoor Air Supply**

Adequate supply of outdoor air, typically delivered through the HVAC system, is necessary in any office environment to dilute pollutants that are released by equipment, building materials, furnishings, products, and people. Carbon dioxide (CO2) is a normal constituent of exhaled breath; thus, CO2 will also increase during building occupancy. CO2 levels are routinely collected in air quality studies because they can indicate whether a sufficient quantity of outdoor air is being introduced to an occupied space for acceptable odor control. The American National Standards Institute (ANSI) and the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) develop consensus standards and guidelines for HVAC systems. ASHRAE notes in an appendix to standard ANSI/ASHRAE 62.1-2010: *Ventilation for Acceptable Indoor Air Quality* that indoor CO2 concentrations no greater than 700 ppm above outdoor CO2 concentrations will satisfy a substantial majority (about 80%) of visitors with regard to odor from sedentary building occupants (body odor). This would typically correspond to indoor concentrations below 1200 ppm since outdoor CO2 concentrations usually range between 375 to 500 ppm. However, CO2 is not an effective indicator of ventilation adequacy if the ventilated area is not occupied at its usual occupant density at the time the CO2 is measured. Elevated CO2 concentrations suggest that other indoor contaminants may also be increased. If CO2 concentrations are elevated, the amount of outdoor air introduced into the ventilated space may need to be increased.

ASHRAE guidelines provide specific details on ventilation for acceptable IEQ. A ventilation system expert can help meet ASHRAE ventilation guidelines in the building. ANSI/ASHRAE 62.1-2010 recommends outdoor air supply rates that take into account people-related sources as well as building-related sources. For office spaces, conference rooms, and reception areas, 5 cubic feet per minute of
outside air per person (cfm/person) is recommended for people-related sources, and an additional 0.06 cfm for every square foot (cfm/ft²) of occupied space is recommended to account for building-related sources. In elementary and high school classrooms, 10 cfm/person plus 0.12 cfm/ft² of outdoor air is suggested. To find rates for other indoor spaces, refer to Table 6-1 also found in ANSI/ASHRAE 62.1-2010.

Outdoor Air Quality

When present, outdoor air pollutants such as carbon monoxide, pollen, and dust may affect indoor conditions when outdoor air is taken into the building’s ventilation system. It is important to properly install and maintain HVAC system filters, which can trap many particles. Controlling gaseous or chemical pollutants may require more specialized filtration equipment and sometimes relocation of the outdoor air intakes.

Equipment Maintenance

Diligent maintenance of HVAC system equipment is essential for the adequate delivery and quality of building air. All well-run buildings have preventive maintenance programs that help ensure the proper functioning of HVAC systems.

What workers can do

When workers suspect their health problems are caused by poor ventilation in their work areas, workers should:

- Report concerns immediately to supervisors or those persons responsible for building maintenance.
- See their doctor for proper diagnosis and treatment.

What management and building owners can do

When workers suspect their health problems are caused by exposures from ventilation in their work environment, owners and managers should:

- Always respond when occupant health concerns are reported.
- Establish clear procedures for recording and responding to IEQ complaints to ensure an adequate and timely response.
  - Log all complaints or problem reports.
  - Collect information about each complaint.
  - Ensure confidentiality.
  - Determine a plan for response.
  - Identify appropriate resources for response.
  - Apply remedial action.
  - Provide feedback to building occupants regarding the complaint and response actions.
  - Follow-up to ensure that remedial action has been effective.
- Regularly clean or replace HVAC system filters -

Use the most efficient filters possible while still maintaining the ability to supply adequate air flow to the spaces. Ensure that filters are installed in the correct orientation relative to airflow,
that they are the appropriate size, and that they are seated in the filter rack properly. Take precautions to minimize air flowing around the filters instead of through them.

- Regularly inspect outdoor air intakes -

Open all outdoor air intakes that are closed. Adjust or repair those that are not working properly. Regardless of the air flow required for heating and cooling, the minimum outdoor air flow recommended by ASHRAE should always be provided to each space.

- Regularly inspect office building exhaust fans to make sure all are working properly -

Dysfunctional exhaust fans can result in suboptimal pressure differences throughout the building and can create or exacerbate IEQ problems.

- Use less conservative cycle times for the HVAC system -

Start the HVAC system earlier in the morning before workers arrive to reduce temperature fluctuations and control humidity levels. Simply providing a more thermally comfortable working environment may reduce the number of IEQ complaints.

- Never store paints, cleaners, or other chemicals in HVAC equipment rooms -

Odors and potentially harmful vapor contaminants can easily be circulated throughout the entire space being supplied by an HVAC system.

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**Maintaining Indoor Environmental Quality (IEQ) during Construction and Renovation**

Construction and renovation projects in office settings can adversely affect building occupants by the release of airborne particulates, biological contaminants, and gases. Careful planning for IEQ and the prevention of exposure during these activities is essential.

![Image](http://www.cdc.gov/niosh/topics/indoorenv/ConstructionIEQ.html)

**Particulates**

Particulate material such as dusts and fibers are likely to be produced during construction and renovation activities. Sources include drywall, plaster, concrete, soil, wood, masonry, flooring, roofing, and ductwork. Non toxic dusts are irritants and can exacerbate lung conditions such as asthma and chronic obstructive lung disease.
Materials that contain fibers such as fiberglass composite materials or insulation can irritate the skin, eyes and respiratory tract when disbursed in the air and/or inhaled. Toxic dusts containing asbestos, polychlorinated biphenyls (PCBs) or lead can cause serious long-term health effects.

For all construction and renovation dusts, a plan to minimize exposure should be implemented. Appropriate containment should be in place to prevent disbursement into occupied areas. Certified and licensed contractors are required to conduct renovation.

**Biological Materials**

Chronic dampness from water intrusion leads to increased bacteria, mold and other microbes in a building environment. Microbial-contaminated materials require special precautions prior to demolition to prevent biological dusts from dispersing in the occupied space. Another example of biological contamination is an accumulation of bird or rodent droppings. In both cases, uncontrolled disturbances could spread potentially allergenic or infectious dust to occupied building areas. It is therefore important to implement appropriate engineering controls and decontamination techniques to minimize all occupant exposure.

**Volatile Organic Compounds (VOCs)**

Some building materials release gases called VOCs. Common VOC sources include:

- Caulks, sealants, and coatings
- Adhesives
- Paints, varnishes and/or stains
- Wall coverings
- Cleaning agents
- Fuels and combustion products
- Carpeting
- Vinyl flooring
- Fabric materials & furnishings

Image was taken from [http://www.cdc.gov/niosh/topics/indoorenv/ConstructionIEQ.html](http://www.cdc.gov/niosh/topics/indoorenv/ConstructionIEQ.html)
Occupants with VOC exposure often report disagreeable odors, exacerbation of asthma, irritation to the eyes, nose and throat, headaches and drowsiness. Health symptoms associated with VOC exposure can be minimized by choosing low VOC emitting products.

What workers can do

When workers suspect their health problems are caused by construction and renovation exposures in their work areas, workers should:

- Report concerns immediately to supervisors or those persons responsible for building maintenance.
- See your doctor for proper diagnosis and treatment.

What management and building owners can do

When workers suspect their health problems are caused by exposures from construction in their work environment, owners and managers should:

- Always respond when occupant health concerns are reported.
- Establish clear procedures for recording and responding to IEQ complaints to ensure an adequate and timely response.
  - Log all complaints or problem reports.
  - Collect information about each complaint.
  - Ensure confidentiality.
  - Determine a plan for response.
  - Identify appropriate resources for response.
  - Apply remedial action.
  - Provide feedback to building occupants regarding the complaint and response actions.
  - Follow-up to ensure that remedial action has been effective.

Before and during construction or renovation, management and building owners should do the following:

- Identify all key personnel including representatives from the building and the general contractor who are responsible for addressing construction or renovation-related activities and airborne contaminant control. Other personnel such as building staff, engineers, and subcontractors, should be involved as necessary.
- Assure that construction/renovation workers are equipped with any necessary personal protection equipment such as N95 respirators, gloves, eye wear, head gear, and steel-toed boots.
- Develop a plan describing anticipated work activities and their location, associated source contaminants, and areas potentially affected.
- Schedule construction or renovation work during periods of low building occupancy or when occupants are not in the building.
- Isolate construction work areas from occupied areas using appropriate containment barriers.
- Negatively pressurize construction work areas and/or positively pressurize occupied areas to prevent migration of air contaminants from work areas to occupied areas.
- Dusts, fibers and contaminants can be released and carried to other areas in a building by heating, ventilating, and air-conditioning (HVAC) systems during construction and renovation activities if
not properly contained. Consult HVAC professionals and engineers on how to modify HVAC operations to ensure isolation of construction work areas from occupied areas.

- Avoid storing construction materials and equipment in HVAC mechanical rooms.
- Maintain an adequate unoccupied buffer zone around the work areas to allow for construction or renovation traffic. If work is being done when occupants are still in the building, a buffer zone could require temporarily relocating occupants in the immediate vicinity of the work areas.

Chemicals and Odors

Chemicals and related odors can be sources of IEQ problems in buildings. Odors are organic or inorganic compounds and can be both pleasant and unpleasant. Some odors can be health hazards and some are not. While most chemical contaminants originate from within the building, chemicals can be drawn into a building from the outdoors as well.

Reducing exposure to chemicals in the workplace is a preventative action that can lead to improved outcomes for both worker health and to the environment.

Chemical Contaminant Sources

There are a variety of chemical contaminants found in a variety of sources. Volatile organic compounds (VOCs) are common chemical contaminants found in office and home environments and are a source of odors. VOCs are organic (containing carbon) chemicals that can easily evaporate into the air. Many products found in the office environment may have the potential to release VOCs. Examples include:

- Caulks, sealants, and coatings
- Adhesives
- Paints, varnishes and/or stains
- Wall coverings
- Cleaning agents

Image was taken from http://www.cdc.gov/niosh/topics/indoorenv/ChemicalsOdors.html

- Fuels and combustion products
- Carpeting
- Vinyl flooring
- Fabric materials & furnishings
- Air fresheners and other scented products
- Personal products of employees like perfume, shampoos, etc.

If these and other chemical contaminant sources are not controlled, indoor environmental quality problems can arise, even if the building’s ventilation system is properly designed and well maintained. Some examples of building related chemicals, odors, and their sources are listed below:

**Contaminated outdoor air**

- General air pollutants (oxides of sulfur and nitrogen, ozone, others)
- General vehicle exhaust (carbon monoxide, oxides of nitrogen)
- Exhaust from gasoline and/or diesel powered vehicles on nearby roads or in parking lots, or garages (carbon monoxide, oxides of nitrogen)
- Odors from dumpsters
- Exhaust from the neighboring buildings (VOCs and odors)
- Unsanitary debris near the building’s outdoor air intake (various odors)

Image was taken from http://www.cdc.gov/niosh/topics/indoorenv/ChemicalsOdors.html
Soil emissions

- Radon (odorless and not visible)
- Leakage from underground fuel tanks (gasoline or solvent odors)
- Contaminants from previous uses of the site (e.g., methane)
- Pesticides

Building emissions

Indoor

- Bioaerosols from water damage, microbial VOCs (VOCs from fungi)
- Emissions from office equipment (VOCs, ozone)
- Emissions from stored supplies (solvents, toners, ammonia, chlorine)
- Emissions from building carpet, furnishings, and other building components (VOCs including formaldehyde from glues, fabric treatments, stains and varnishes)
• Emissions from special use areas within the building such as laboratories, print shops, art rooms, smoking lounges, beauty salons, food preparation areas, and others (various chemicals and related odors)
• Emissions from indoor construction activities (VOCs from use of paint, caulk, adhesives, and other products)
• Elevator motors and other building mechanical systems (solvents and other chemicals)
• Plumbing problems (sewer odors, improper bathroom ventilation)
• Emissions from housekeeping / cleaning activities (ammonia, chlorine, and other cleaning agents such as detergent, dust residual from carpet shampoo, and disinfectants)
• Use of deodorizers and fragrances
• Emissions from pesticide use inside the building
• Accidental events such as spills inside the building
• Emissions from stored trash inside the building
• Fire damage inside the building (soot, polychlorinated biphenyls from electrical equipment, odors)

Outdoor

• Loading docks (vehicle exhausts, chemical spills)
• Emissions from pesticide use outside the building
• Emissions from outdoor construction activities (VOCs from roofing chemicals, and other products)
• Accidental events such as spills outside the building
• Fire damage outside the building

Emissions from building occupants

Potentially hazardous

• Smoking
• Cooking odors
• Cosmetic odors
• Increased levels of carbon dioxide

Unpleasant

• Body odor
Related Health Symptoms

While some chemicals found in the workplace may have little effect on workers’ health, others may cause health problems. The presence of odor can cause people to suspect exposures to be harmful to their health. However, with few exceptions, chemical concentrations observed in the office work environment generally fall well below the occupational standards or recommended exposure limits used for industrial settings. Additionally, the presence of odors in a building does not always mean that there is an overexposure to chemicals by these existing occupational exposure standards. Some chemicals have very low odor thresholds, which means you can smell them at very low levels.

The degree to which a chemical exposure can affect health depends on:

- how much of the chemical is present in the building / building air
- how often a person comes into contact with the chemical
- how harmful the chemical is to human health
- how sensitive a person is to the chemical

Common symptoms reported by occupants in the building environment include:

- Itchy, watery, or burning eyes
- Skin irritations or rashes
- Nose and throat irritation
- Nausea
- Headache
- Dizziness
- Fatigue

While chemical concentrations are typically observed at low levels, severe symptoms are possible under extreme conditions. Severe symptoms include kidney and liver damage, and damage to the central nervous system.

What workers can do

When workers suspect their health problems are caused by chemicals in their work areas, workers should:

- Report their concerns immediately to supervisors or those persons responsible for building safety and health or maintenance.
- If necessary, see their doctor or health care provider.
- Avoid the use of air fresheners and room deodorizers. These can cause eye, nose, and throat irritation.
- Properly store all foods and dispose of trash promptly to prevent odors.

What management and building owners can do

When workers suspect their health problems are caused by exposure to chemicals in their work environment, owners and managers should:

- Always respond when occupant health concerns are reported.
Establish clear procedures for recording and responding to IEQ complaints to ensure an adequate and timely response.
  o Log all complaints or problem reports.
  o Collect information about each complaint.
  o Ensure confidentiality.
  o Determine a plan for response.
  o Identify appropriate resources for response.
  o Apply remedial action.
  o Provide feedback to building occupants regarding the complaint and response actions.
  o Follow-up to ensure that remedial action has been effective.

Identify and repair all areas of water incursion.

Schedule building renovation projects after work hours or when the building is unoccupied.
  o Open windows or increase ventilation to dilute chemical odors.

Ask your product suppliers for information on chemical emissions and potential health hazards.

Choose products that emit low or no VOCs when choosing new or replacement carpets, flooring, office furniture, and paints.

Choose low VOC emitting cleaners.

Ensure that the manufacturer’s instructions for the use of all cleaning products are followed.
  o Dilute products to the recommended strength before using.
  o Prohibit mixing of cleaning products.

Properly store cleaning and maintenance chemicals with containers closed and tightly sealed.
  o Do not store chemical products in equipment rooms where they could contaminate the heating, ventilation, and air-conditioning (HVAC) system.

Provide proper ventilation and maintain the HVAC systems.

Apply pesticides only when the building is unoccupied. Follow the integrated pest management (IPM) system to prevent risks of exposure.
  o Further information for pest control can be found at the Environmental Protection Agency’s website.

You can learn more about potentially hazardous housekeeping or maintenance products by requesting a copy of the material safety data sheet (MSDS). The MSDS contains complete information about a product, including all safety precautions. Request a copy by calling the manufacturer’s number on the product.