HEALTHIER WORKPLACES

Indoor Air Quality

Resources

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Indoor air pollution can cause negative health complications if you are exposed to poor air quality for extended periods of time. The below information and resources help you address air quality issues to improve your health and comfort.

Improving Indoor Air Quality at Work

Indoor air quality (IAQ) in the workplace is the subject of much attention these days, and for a good reason. The indoor environment's air quality can profoundly affect the health, comfort, and productivity of building occupants. Although serious health problems related to IAQ are rare, the perception of endangered health is increasingly common among building occupants.

The causes and consequences of poor IAQ are complex and not completely understood. Still, there are some basic factors that building owners, managers, employers, and occupants should know to address IAQ concerns.

What do we mean by "good" IAQ?

Most occupants barely notice when indoor air quality is "good," but most people will often recognize when the air is not good. IAQ is a problem when the air contains dust and objectionable odors, chemical contaminants, dampness or mold. Related to this are the physical characteristics of the air: the amount of air movement, its temperature and its humidity. General guidelines for achieving good IAQ include:

- Ventilation is in accordance with the current guidelines established in the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 62.1, Ventilation for Acceptable Indoor Air Quality.
- Comfort factors (i.e., temperature, humidity, air movement) in a range that is acceptable to most occupants, such as published in ASHRAE Standard 55, Thermal Environmental Conditions for Human Occupancy.
- Mechanical equipment and building surfaces are maintained in sanitary condition.
- Significant emission sources, such as large copy machines, are separated from occupied spaces and air intakes.
- Major sources of chemical or biological contamination are promptly identified and controlled.
- Occupied areas are regularly cleaned and good housekeeping practices are in place.
- Operations, maintenance, and construction activities are performed in a manner that minimizes occupant exposure to airborne contaminants.

Common complaints about IAQ

The most common complaint is related to temperature: the air is either too hot or too cold. The second most common complaint is about air movement: the air is either too drafty or too still. Other common comfort-related complaints involve humidity: the air is too dry or too muggy.

Some health-related complaints associated with poor air quality mimic those of the flu or a cold: headaches, sinus problems, congestion, dizziness, nausea, fatigue and irritation of the eyes, nose or throat. Such symptoms are often difficult to associate with the workplace. The indoor environment is usually not the suspected cause of occupant symptoms unless the symptoms are shared by a number of occupants, found to be unreasonably persistent or there is a distinct and suspect odor or other unusual quality to the air.

Some health-related complaints may be due to allergic reactions. Typical indoor allergens include dust mites, cat dander, and mold spores. When exposed to such allergens, 10 percent or more of the population may exhibit symptoms including sneezing, swollen airways or asthma-like attacks. Individuals with a building-related allergy will experience similar symptoms in other environments if the particular allergen is present in both places.

When are IAQ complaints most likely?

Factors associated with an increased likelihood of complaints include the installation of new furnishings, uncontrolled renovation activities, poor air circulation, and persistent moisture. Complaints may also increase when there is a stressful work environment, such as impending layoffs, a great deal of overtime, or an ongoing employee/employer conflict.

What can be done about IAQ Complaints

Occupant concerns should be taken seriously and responded to quickly. First, the following information should be gathered and verified, preferably through interviews with occupants and a visual inspection:

- What are the specific complaints?
- Where in the building are similar concerns about IAQ occurring?
- When does the problem occur?
- When and where did it first occur?
- Who is affected? Is it isolated, or over a large area?
- What health effects or discomfort are occupants experiencing?
- Do the health effects cease soon after leaving the building, or over the weekend?
- Have those affected seen a physician and, if so, what were the diagnoses (do not violate patient privacy)?
- Is there any environmental condition (e.g., weather) or activity (e.g., remodeling, use of the photocopier, spraying of pesticides) inside or outside the building associated with occurrence of the problem?
- Has the building engineer or HVAC contractor evaluated the area(s) and, if so, what were their conclusions?

Second, analyze the information. Determine if there is a time or space pattern to the complaints. Conduct a walk-through of the area to identify potential sources of contamination or unusual conditions. Also, consider whether the problem may be linked with an activity or condition inside or outside the building, or a malfunctioning HVAC system. In many cases, the source of the complaints may be readily apparent upon investigation, such as HVAC system air intakes next to an exhaust source or a loading dock, the recent addition of large photocopiers in a small room without proper ventilation system modification, an incorrectly set or broken thermostat, or recent remodeling issues.

It is important to communicate to occupants in a timely manner about what is being done to resolve the IAQ issue and any findings from the investigation.

Common sources of IAQ problems

Contaminants may originate from a variety of sources both inside and outside of a building, and may in-

clude airborne chemicals, bacteria, fungi, pollen and dust. Although they are not indoor pollutants, factors such as temperature, humidity, lighting, noise and personal and work-related stress can affect occupants' perceptions of indoor air quality.

Potential sources of contaminants in office buildings include dust; inadequate design or maintenance of heating, ventilation and air-conditioning (HVAC) systems; cleaning chemicals, which may contain irritant vapor and/or volatile organic compounds, or VOCs; pesticides; building materials; office equipment such as copy machines and printers; furnishings; occupant metabolic wastes (respiration and perspiration); fragrances/cosmetics; and tobacco smoke. Of course, virtually all of these are present to some degree in every building. They cause IAQ problems only when concentrations become excessive, usually as a result of being generated at a greater rate than they can be removed by the building's ventilation system.

Occupants may also unknowingly bring potential contaminant sources into the building on their clothing and their bodies, including dust, consumer products (cleaners, air fresheners, personal hygiene products, etc.) and allergenic particles from their homes, such as cat or dog dander. What occupants do may also affect IAQ, such as blocking air ventilation grills, overusing office chemical products and improperly storing food, which may lead to odors and vermin infestation.

Dusty surfaces, stagnant water, and damp materials provide a favorable environment for microbial growth. When odorous compounds resulting from microbial growth and other microbial particles become airborne, some building occupants may experience foul odors and symptoms including allergic reactions. One potential, but rare infection is caused by *Legionella* bacteria. Exposure to the *Legionella* bacteria can cause building-related illnesses (Legionnaire's disease and Pontiac fever) that can be diagnosed through medical tests.

Cigarette smoke contains fine particulate matter, carbon monoxide, formaldehyde, and thousands of other chemicals. Studies have shown that exposure to secondhand tobacco smoke may result in inner ear infections, asthma and lung cancer in nonsmokers. The U.S. EPA has listed tobacco smoke as a confirmed cancer-causing agent. With more restricted smoking regulations in public areas and workplaces, this exposure has decreased greatly. However, the increased use of electronic cigarettes indoors may contribute new sources of indoor air contaminants including nicotine, as well as flavor and fragrance additives.

Contaminants may also originate outside the building and enter via the outdoor air intakes or, when more air is removed by the HVAC system from the building than is supplied, creating a negative pressure in the building compared to outdoors. This pressure difference causes unconditioned air to flow into the building through any available gap. Contaminants can also be sent through a building—sometimes with disastrous consequences—from boilers, water heaters and other combustion sources that are not properly ventilated.

Why is ventilation important?

Poor IAQ may develop when not enough fresh air is introduced to reduce contaminant concentrations. The HVAC system must not only control contaminants, it must also provide a comfortable environment. The perception of still or stale air, odors, draftiness or errant temperature and humidity levels leads to discomfort. Discomfort, however subtle, can be the beginning of IAQ complaints. Many IAQ complaints originate with the HVAC system failing to meet occupants' comfort needs, either by not adequately controlling temperature and humidity levels or by not delivering outside air evenly to occupants.

Studies have shown that communicable diseases like the common cold, influenza and tuberculosis spread more efficiently in poorly ventilated buildings. Proper air filtration is also important. However, most of these kinds of illness are passed from person to person through the air or from contacting viruses or bacteria on surfaces, and thus are largely beyond the control of the building owners. Nevertheless, steps can be taken to limit the spread of serious communicable diseases, for example, including pandemics such as influenza ("flu") or COVID-19.

When should air testing be done?

Carbon dioxide (CO_2) testing is often performed during the early stages of an IAQ investigation because people exhale CO_2 and if there is not enough outdoor ("fresh") air in a space, the indoor levels of CO_2 will increase. Elevated CO_2 concentrations in a building reflect insufficient exchange of "fresh" outdoor air for "spent" interior air, allowing the accumulation of human-source odors, and possibly other contaminants. ASHRAE recommends that the indoor levels of CO_2 should be controlled to reduce occupant complaints of human-source body odors. When sufficient outdoor air is supplied in keeping with the ASHRAE recommended ventilation levels, the ventilation is generally considered to be adequate. If it is not possible to directly measure the rate of outdoor air supply, an industrial hygienist can measure the indoor and outdoor levels of CO_2 and estimate the adequacy of the ventilation. Note that the occupancy of an area affects the measured CO_2 concentration and it should be taken into consideration when interpreting results.

However, this approach does not work in all cases. If a particularly irritating or toxic contaminant is present, the problem can only be resolved through control of the contaminant at its source.

Testing for other contaminants (e.g., particulates, volatile organic compounds, microbes, formaldehyde, and pesticides) may provide valuable information but is recommended only if there is good reason to believe that a contaminant is present (a source has been identified or medical evaluation of occupants so indicates). Air testing for a broad spectrum of potential contaminants is generally unproductive. Carbon monoxide (CO) testing or continuous monitoring, on the other hand, is relatively inexpensive and is strongly recommended if there is any reason to question the proper venting of indoor combustion sources, such as furnaces or water heaters.

Some contaminants of IAQ concern are regulated and some are not. However, typical concentration levels of contaminants found in office workplaces are far below regulated exposure limits.

Usually the greatest value of air testing is in the comparison of the results from different locations within a building, indoors versus outdoors and at different times throughout the day. The data generated may yield information about the origin of the problem and possible solutions.

How IAQ problems can be prevented

Three fundamental measures will greatly reduce the likelihood of IAQ problems: good building and ventilation design, effective building maintenance (particularly of the HVAC system) and thoughtfully designed and executed renovation projects. Every building manager should develop a performance profile of the building ventilation system, including analyses of comfort, ventilation and sanitation. This is accomplished in two primary ways.

- Inspecting accessible areas of the system for obvious malfunction, bad design, or contamination
- Determining airflow, temperature, humidity, proper occupancy and air balance (pressure differentials) in representative areas (zones or rooms) of the building

The information developed may reveal problems with the building's HVAC system – that is, areas in which the system is clearly not performing on par with the remainder of the building. Beyond the initial system profile, it is crucial that the HVAC system be routinely inspected and maintained. Maintaining good IAQ in a building also requires careful managing of custodial, pest control, and building engineering or contractor maintenance activities.

Prior to initiating remodeling activities, discuss IAQ concerns with architects and contractors. Require that the materials and procedures used minimize airborne contaminants. Select materials and products that have been tested to ensure that they emit no detectable irritants or VOCs when possible. Where feasible, schedule work to minimize the impact on air quality (e.g., perform painting on weekends) and arrange for the ventilation system serving the area to be isolated from the remainder of the HVAC system. If walls are being added or moved in the project area or the number or distribution of occupants is to be greatly changed, have a mechanical engineer design modifications to the ventilation system to meet the new requirements.

What you can do to control indoor air contaminants

The best method to control indoor air contaminants depends on the source or sources causing the complaints. Source removal or control is generally the most cost-effective solution to the problem. For example, environmental tobacco smoke-related complaints have been eliminated in many municipalities by prohibiting smoking within buildings, or by isolating designated smoking areas and providing them with independent ventilation.

Modification of the ventilation system may also be an effective method of resolving IAQ complaints. Contaminants can be diluted with outdoor air, or contaminants such as radon can be managed by changing air pressure relationships between adjoining areas. Increasing the outdoor air supply to meet the criteria of ASHRAE 62.1 may require design and installation of additional heating, cooling, or dehumidification to prevent comfort or moisture-related problems. However, a well-designed and maintained HVAC system may be able to improve the work environment enough to pay for itself through improved occupant productivity.

Air cleaning may also be used to control indoor air contaminants, particularly when the contaminant source is outside the building. Typically, air cleaning is accomplished by installing higher efficiency air filters in existing HVAC systems. An upgrade in the efficiency of existing filters, if compatible with the HVAC system, can help improve IAQ.

During renovation activities, avoid running combustion appliances, such as propane heaters or fuel-fired generators indoors. Carbon monoxide exposure can be fatal.

Occupants can help improve IAQ by:

- promptly reporting unusual odors or discomfort

- being aware of weather conditions or other factors associated with periods when IAQ concerns appear
- using chemical formulations sparingly and only where dedicated ventilation is provided
- not taping off air supply diffusers (since it disrupts proper mixing and distribution of air)
- minimizing use of fragrances, scented cosmetics, and air-fresheners

When to seek outside help

If the problem persists even after you have identified and rectified obvious sources, you may want to seek outside assistance. You may also require outside help if the problem requires immediate attention and your resources are limited, or your preliminary investigation reveals little of significance and you don't know what to do next.

Sources of professional help include searching online (suggested keywords include "industrial hygiene" and "engineers-ventilation") or local, state, or federal agencies, such as local or state health departments. For a list of industrial hygiene consultants published semiannually, see AIHA's Consultants Listing or search for your state or local AIHA chapter. In certain cases, assistance from specialists in medicine, lighting, acoustic design, or psychology may be needed.

When evaluating consultants, pay particular attention to their professional background in terms of education, professional credentials, the reputation of their firm, and, most important, demonstrated success in resolving similar situations. Ask for references. Hiring someone to perform a poorly conceived study is worse than a waste of money and time; it may lead to erroneous conclusions and costly remedial efforts of little or no intrinsic worth. If a consultant proposes elaborate and expensive air monitoring without demonstrating to your satisfaction that the resulting data will be meaningful, look elsewhere for assistance.

Air quality in the home

The subject of indoor air pollution has received a great deal of attention in recent years. Although most of the concern originally focused on the workplace, more people are looking for answers to health and comfort problems occurring in their homes.

AIHA has produced this information to help homeowners, landlords, and tenants of residential dwellings to recognize and respond to indoor air quality problems. You can prevent or resolve many problems with common sense and a little knowledge of potential air pollutant sources and building systems. Indoor air quality problems may be due to more than one cause and those health problems may not necessarily be caused by the indoor environment. For these reasons, industrial hygienists and other environmental health scientists will continue to research these complex issues.

Good and Bad Indoor Air Quality

Americans spend the vast majority of their time indoors, especially in urban environments. As such, indoor air quality must be properly maintained to provide a safe and healthy living environment that minimizes discomfort and potential disease. It is sometimes easier to recognize "poor" indoor air quality than it is to define "good" indoor air quality (IAQ). A few examples that may suggest poor indoor air quality include:

- Stale ("stuffy") air
- Lingering disagreeable odors
- Occupants with eye, nose or throat irritation
- Mold or bacterial problems
- Relative humidity levels below 30% or over 60%
- Tobacco smoke
- Excessive dust or allergens, such as animal dander

- Good indoor air quality should not cause discomfort or health problems. You can be affected by many factors in the indoor environment to varying degrees. Your health and comfort can also be affected by factors other than air contaminants, such as food, drinking water, furniture and bedding, air temperature, humidity, lighting, stress, and more.

Other potential problems are not as obvious as those listed above and can only be detected with scientific testing equipment. These include:

- Carbon monoxide and other contaminants from appliances, fireplaces, vehicles
- Naturally occurring radon gas
- Pesticides (insecticides, herbicides, fungicides, and rodenticides)
- Asbestos from deteriorated building materials
- Dust containing lead and other heavy metals

Chemicals in the Home

Inventory all the commercial chemical products or chemically treated items in your home. You may be surprised to know how many common products contain toxic or irritating chemicals that can affect indoor air. For example, freshly dry-cleaned clothing may give off solvent vapors. Air out your freshly dry cleaned clothes in an unoccupied room.

Petroleum solvent-based paints release solvent vapors during use and during brush cleaning. Use water- based paints whenever possible, but make sure they do not contain mercury. Use paints that are low or zero-emitting in volatile organic compounds (VOCs). Do not use paint stripping chemicals that contain methylene chloride, which is a potential cancer-causing agent.

Never store gasoline in the home. It is highly flammable and may release benzene, which may cause cancer, and other hydrocarbon vapors. Never use

gasoline as a cleaning solvent.

Pesticides should only be used when absolutely necessary. Even moth balls give off potentially hazardous substances in small amounts. Pesticides should be stored in the garage or away from inhabited areas. Hire a licensed pesticide applicator if you have a major pest problem. Check the pest control company's references, ask to see Safety Data Sheets for the products it uses and review the company's procedures to ensure that they address your concerns.

Be careful when disposing of unneeded chemicals. Many localities have household hazardous material disposal sites to drop off old paints, solvents, pesticides and other chemicals.

What You Can Do to Control Indoor Chemical Pollutants

A quick and cost-effective way to improve the quality of your air is to reduce your use of chemical materials indoors. Some best practices for managing your chemical inventory for good indoor air quality include:

- Find out what chemicals you have and reduce the unnecessary use of chemicals

- Do not bring home chemicals designed for use in the workplace
- Open your windows and/or use fans when using products that give off vapors
- Use household chemicals outside, if possible
- Provide adequate ventilation when removing paints or varnish using solvents or heat guns
- Have your home tested for asbestos and lead in paint prior to starting any renovations
- Do not disturb or remove asbestos-containing materials yourself; hire a licensed contractor
- Never sand or use a heat gun on lead-containing paints indoors
- Store toxic chemicals away from occupied areas and air conditioner closets
- Use non-chemical methods of pest control whenever possible.
- Properly dispose of any chemicals you do not need
- Do not use or limit use of air freshener devices and sprays

What if You Cannot Control the Source?

Ventilation and air cleaning devices can reduce exposure to air pollutants that cannot be eliminated by source control:

- To reduce carbon monoxide build-up and improve efficiency, provide outside air to the furnace
- For new construction, consider air-to-air heat exchangers to save energy while bringing in more outside air
- Use exhaust fans to vent kitchen and bathroom odors and moisture to the outside
- Use higher efficiency furnace or air conditioner air filters and change filters frequently
- Consult EPA publications and choose air cleaning devices carefully

A wide variety of "air cleaners" are now on the market. Before investing in such a device, carefully evaluate the manufacturer's claims and the limitations of the device. Many air cleaners work well controlling dust particles but do not control odors or vapors. Pay particular attention to the frequency and cost of replacement filters and ease of cleaning. A poorly maintained air cleaner can frequently make the air quality worse rather than better.

Testing Your Indoor Air Quality

No single air testing method is available to figure out the total quality of your home air. Air testing is often not worthwhile unless you know exactly what to test for. Discomfort or unusual odors are the best cues to use in judging indoor air quality in homes. Some pollutants, such as radon and carbon monoxide, are odorless, colorless and tasteless and can only be evaluated by testing. Carbon monoxide and radon test kits may be available through your local American Lung Association or your local hardware store.

If you have concerns about combustion product back-drafting, some contractors can help you test whether that is likely in your home. Carbon monoxide detecting alarms are also available for continuous monitoring.

Other air monitoring devices are available for formaldehyde and specific organic compounds. Use of some sampling devices requires scientific training and analysis by a qualified laboratory. Your local or state department of health can refer you to local sources for sampling device purchase and analysis.

If you are unable to resolve your IAQ problem by yourself, contact a reputable contractor or a professional industrial hygiene consultant for additional support. Make sure to check references and experience.

Beware of Scams

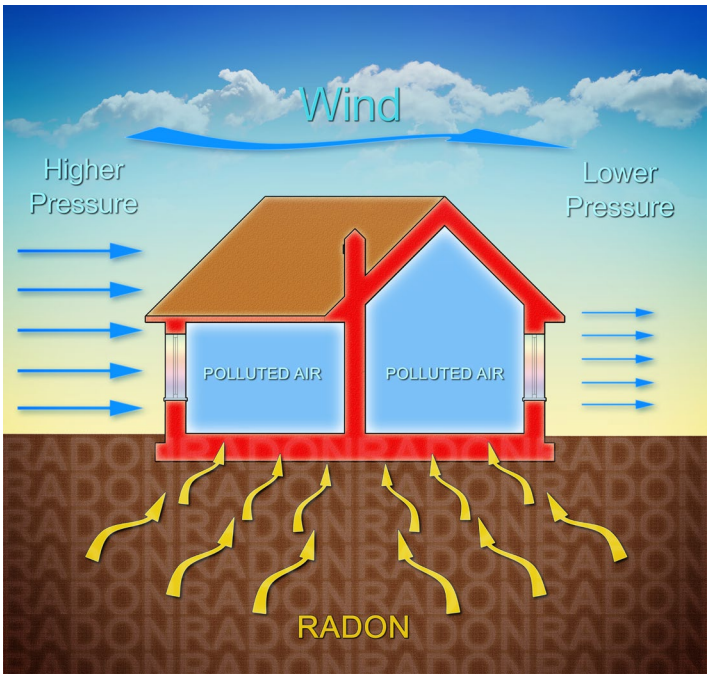
The field of indoor air quality investigation and remediation is relatively new. As a result, many opportunists have emerged to profit from your lack of knowledge and your desire for a healthy environment. An example is the ozone generator, which some companies promote as a "cure" for indoor formaldehyde and odors. Although the manufacturers claim that the units neutralize odors and chemical pollutants, they may produce ozone at levels above what is considered safe.

Can poor indoor air quality cause serious health problems?

Many indoor air quality problems only cause discomfort or irritation and do not result in serious health problems. Not everyone reacts in the same way to IAQ issues. Some people who experience symptoms find that they feel much better soon after leaving the area. Below are some examples of problems that you should be aware of because they can result in serious illness or death.

Carbon Monoxide

Carbon monoxide and other combustion byproducts can build up to hazardous or fatal levels in homes where insufficient outside air is provided to appliances that burn natural gas, propane, fuel oil or wood. This may include furnaces, space heaters, fireplaces, stoves, water heaters and clothing dryers. An adequate quantity of outside air should be provided to the furnace area to make up for the air that goes up the exhaust flue. Otherwise, combustion gases containing high amounts of carbon monoxide can "backdraft" down the flue. Combustion appliances should be inspected and cleaned periodically for proper combustion and venting. This is an instance of indoor air problems that can be created by "overtightening" a building for energy saving. Some outside air must be let into your home to replace exhausted air.



Radon Gas

Radon is one of the leading causes of lung cancer and is estimated to cause about 21,000 lung cancer deaths per year. Radon is a radioactive gas that comes from the natural decay of uranium that is found in nearly all soils. Radon enters the home through cracks in the foundation, porous concrete blocks, sump openings, unfinished basement floors and, in some areas, untreated well water. The United States Environmental Protection Agency (EPA) recommends that you have your home tested to see if radon reduction methods are needed. If a radon reduction device is needed, it should be installed by a professional so that it will not cause back-drafting of your furnace or other appliances. Refer to the EPA's A Citizen's Guide to Radon or EPA's Radon Resource page.

Environmental Tobacco Smoke

Cigarette smoke, which contains carbon monoxide, formaldehyde and thousands of other chemicals,

can pose a serious problem in the home environment. Recent studies have shown that exposure to second-hand tobacco smoke may result in inner ear infections, asthma, and lung cancer in non-smokers. The EPA has listed environmental tobacco smoke as a confirmed cancer-causing agent. Indoor air quality can be greatly improved and health risks significantly reduced by preventing indoor smoking. The increased use of electronic cigarettes indoors may contribute new sources of indoor air contaminants including nicotine, flavor and fragrance additives.

Asbestos

Asbestos comprises a set of six naturally occurring silicate minerals that when inhaled over a period of time can cause lung cancer, mesothelioma, and asbestosis. Asbestos was widely used in a variety of products and building materials dating back more than 4,000 years but was most commonly used from the late 19th century through the 1970's. New building products are much less likely to contain asbestos but the material can still be found in some products sold today. In addition, many older homes still contain asbestos-containing materials such as pipe insulation, vinyl flooring materials, cementitious shingles and siding, wall and ceiling plasters, decorative wall and ceiling textures, roofing materials and more.

Homeowners should have their houses checked for asbestos by a professional prior to conducting renovations. Older homes may also have insulation that consists of a lightweight material called vermiculite, which is often contaminated with asbestos fibers. The EPA estimates that as many as 35 million homes may have this material in the attic or in wall cavities. Refer to EPA's Asbestos web page for additional information on asbestos, see link at end of this document. Another good source of information is the EPA's document "Protect your Family from asbestos-contaminated vermiculite insulation."

Legionnaires' Disease

Legionnaires' disease is a potentially fatal pneumonia caused most commonly by *Legionella* pneumophilia bacteria. The first recognized case of Legionnaires disease occurred in 1975 but the number of cases reported has increased in recent years and it is currently estimated that there are up to 18,000 cases of Legionnaires' disease reported each year in the United States. *Legionella* pneumophilia bacteria are ubiquitous in the aquatic environment and they can often be found in air conditioning systems, cooling towers, humidifiers, whirlpool spas, domestic water plumbing systems, misting systems and indoor fountains. Growth of *Legionella* bacteria can be controlled by proper maintenance and cleaning of the above sources. Refer to the Centers for Disease Control and Prevention (CDC) Legionnaires' disease web page for additional information.

How can building materials and furnishings affect indoor air quality?

A number of materials used in constructing, furnishing, and insulating a home contribute small, but sometimes noticeable amounts of dusts or irritating vapors.

Formaldehyde

Plywood, particle board and other pressed wood products are often held together with formaldehyde-based resins. Formaldehyde can cause eye, nose and throat irritation, and several federal agencies list it as a cancer-causing agent. Some people can become sensitized to formaldehyde and experience severe skin or respiratory symptoms. Federal standards require formaldehyde emission testing and labeling. Look for this labeling when you buy wood products.

Insulation

Insulation materials can affect indoor air quality. Urea-Formaldehyde Foam Insulation (UFFI) was used in the walls of many homes in the 1970s. UFFI is very rarely used today. This type of insulation resulted in significant levels of formaldehyde in some homes. Formaldehyde vapors from this source decrease with time, but sensitized people may react to low levels or decomposed UFFI dust. Exposed fiberglass insulation inside air ducts can release irritating fibers if it breaks down with age or water damage. Try to find glass fiber insulation with a plastic outer lining. Any kind of insulation can be a problem if it gets wet, since it can harbor molds and mildew.

Carpeting, Furnishings, and Housekeeping

Old carpets and some fabrics can harbor molds, dust mites, allergenic animal hair or dust, asbestos fibers and lead-containing dust. Dust mites typically live in areas where you sleep or sit for long periods of time. Dust mites and molds thrive when indoor humidity conditions exceed 60%. Proper housekeeping is essential to minimize the proliferation of dust and microorganisms indoors. Thorough vacuuming should be performed regularly at least once per week. Because the air filters on most household vacuum cleaners are not very efficient, microscopic particles can get into the air. A central vacuum system that discharges the filtered air outside the building or a portable vacuum cleaner equipped with high-efficiency particulate air (HEPA) filters should be used. Steam cleaning of carpets and fabric-upholstered furniture should be performed at least annually to reduce amounts of dirt and debris. If steam cleaning is performed, fans should be used to dry the carpet out within 24 to 48 hours or the wet carpet may support the growth of microorganisms. Do not shampoo carpets, as this causes the carpeting to become saturated with moisture.

New carpets, carpet backings and adhesives may release volatile organic compounds and other irritating vapors. Here are a few simple suggestions for preserving good indoor air quality:

- Contact the manufacturer and ask for any available health testing information
- Have the dealer unroll and air out the carpet before installation
- Try using nails instead of adhesives, if possible
- Provide plenty of fresh air to the space during installation and for a few days after installation

Fungi and Mold

There are thousands of types of fungi and molds and all of them are capable of causing allergic symptoms in sensitized persons. Many people are allergic to fungi and some types can cause disease or release toxins. Fungi are most likely to be found in damp areas of your home or with high humidity (greater than 60 percent) such as areas with improper drainage, porous foundation materials, improperly maintained humidifiers, dehumidifiers, or air conditioners. Leaks from roof systems, plumbing, and windows are also common causes of mold growth. A single flooding event can create a significant mold problem unless

it is immediately dried out within 24 to 48 hours. To avoid these problems do not allow water to form pools or wet spots inside or immediately outside your home. Thoroughly clean and disinfect or remove surfaces where molds have grown in the past. Humidifiers with a water reservoir can cause mold or bacterial contamination of indoor air, and should be cleaned thoroughly at least once a week. Empty and clean the water collection pans of refrigerators, dehumidifiers, and air conditioners frequently. Reduce the moisture that leads to mold growth by sealing and patching walls and floors either at the source or by using a dehumidifier, or both.

Testing for airborne mold spores is not usually necessary in order to identify a mold problem. Most mold problems can be identified by conducting a visual inspection; testing for moisture content is also helpful to identify areas that are prone to mold growth. If you can see mold then you have a mold problem, although many times the mold growth is hidden inside wall or ceiling cavities and the full extent of damage may not be apparent until mold remediation is performed. If you suspect you have a mold problem you should consult a professional mold inspector. If small amounts (less than ten square feet) of mold growth exists inside your home, it will be necessary to physically remove the mold from the surface it is growing on. Nonporous surfaces such as glass, metal, plastic and ceramic tiles can be cleaned using ordinary soap and water. Porous surfaces such as gypsum wallboard, carpeting and insulation cannot be cleaned and must be physically removed and discarded following industry guidelines for mold remediation while wearing appropriate protective equipment. Do not attempt to use bleach to kill mold. If the amount of mold is greater than ten square feet, a professional mold contractor should be used.

If your home suffers flood damage, clean and sanitize water-damaged furnishings and construction materials as soon as possible. Porous surfaces, such as carpets or fabrics, may not be as easy to clean as smooth or painted surfaces such as linoleum. Discard anything you cannot clean and dry, since even dry spores can continue to cause allergic symptoms.

What is carbon monoxide and why is it dangerous?

Carbon monoxide, or CO, is a colorless, odorless, toxic gas. It is produced by the incomplete combustion of solid, liquid, and gaseous fuels. Appliances fueled with gas, oil, kerosene or wood may produce CO. If such appliances are not installed, maintained, and used properly, CO may accumulate to dangerous and even deadly levels in cars, homes, or poorly ventilated areas.

Where does carbon monoxide (CO) come from?

Carbon monoxide is produced by devices that burn fuels. Therefore, any fuel-burning appliance in your home is a potential CO source. Electric heaters, water heaters and other electric appliances do not produce CO. Under normal circumstances, CO levels should not be detectable in the typical home or workplace.

When appliances are kept in good working condition, they produce little CO but improperly operating or improperly vented appliances can produce elevated—even fatal—CO concentrations. Likewise, using kerosene heaters or charcoal grills indoors, or running a car in a garage, can cause levels high enough to result in CO poisoning.

Common sources of CO include the following wood or gas fueled appliances:

- Room heaters
- Furnaces
- Charcoal grills
- Cooking ranges
- Water heaters
- Automobiles run in closed garages
- Fireplaces
- Portable generators
- Wood burning stoves

Who is at risk of CO poisoning?

Anyone in a space shared with a device capable of generating CO should be considered at risk of CO poisoning. CO exposures especially affect unborn babies, infants and people with anemia or a history of heart disease. Breathing low levels of the chemical can cause fatigue and increase chest pain in people with chronic heart disease.

In 1989 there were about 220 deaths from CO poisoning associated with gas-fired appliances, about 30 CO deaths associated with solid-fueled appliances (including charcoal grills) and about 45 CO deaths associated with liquid-fueled heaters.

Each year, nearly 5,000 people in the United States are treated in hospital emergency rooms for CO poisoning; however, this number is believed to be an underestimate of CO poisoning because many people with CO symptoms mistake the symptoms for the flu or are misdiagnosed.

Why is CO known as the silent, cold-weather killer?

Carbon monoxide poisoning can kill without warning, as your family sleeps.

Because CO gas has no warning properties, even at toxic or life-threatening levels, it is considered a silent killer. And since so many deaths occur as the result of defective or poorly operated home heating devices, CO has been termed the "silent, cold weather killer."

Although not always experienced, the initial symptoms of CO are similar to the flu, but without the fever. They include:

- Dizziness
- Fatigue
- Headache
- Nausea
- Irregular breathing

It is critical to note that death from CO poisoning can result with some or all of these symptoms never being experienced, in which case the overexposed victim simply "falls asleep" and never regains consciousness.

Who can I contact for more information?

AIHA: For additional information or expert referrals on the topic of carbon monoxide, its toxic effects, and related matters, contact the American Industrial Hygiene Association (AIHA) at (703) 849-8888.

AIHA represents a professional organization of engineers and scientists knowledgeable of the hazards of indoor air pollutants.

CPSC: The U.S. Consumer Product Safety Commission serves the public with respect to the safety of consumer products that both potentially generate CO as well as detect it. Call CPSC's hotline at (800) 638-2772 or CPSC's TTY (for the hearing impaired) at (800) 638-8270.

USEPA: General information about in-home air quality, including carbon monoxide, may be obtained from the U.S. Environmental Protection Agency (USEPA). Call (800) 438-4318.

UL: Information about Underwriters' Laboratory can be obtained from their corporate headquarters. Call (847) 272-8800, or write to UL Corporate Headquarters, 333 Pfingsten Road, Northbrook, IL 60062-2096.

Fire Departments: It may be useful to contact your local fire department at their nonemergency telephone number to find out what their response will be to a CO alarm in a residence. Your local fire department may also offer free home fire safety inspections that would include checks of potentially CO-generating equipment.

Utility Company: You may also wish to contact your local utility company (gas or electric). Some utilities provide free in-home inspections and additional brochures on the topic of CO safety; some may even provide financial assistance with the purchase of selected CO monitors.

Additional Reading

For an in-depth discussion of the toxic effects of carbon monoxide, read chapter 8, "Carbon Monoxide," of the book Indoor Air Pollution -- A Health Perspective, edited by Jonathan Samet and John Spengler. It was published in 1991 by the Johns Hopkins University Press, 701 West 40th Street, Baltimore, MD 21211-2190.

How can I prevent CO poisoning?

Dangerous levels of CO can be prevented by proper appliance maintenance, installation, and use. Timely inspections of potentially CO-producing equipment, and the use of CO toxic level concentration alarms, are also key to avoiding a CO fatality.

To avoid CO poisoning, follow these tips.

Installation

- Proper installation is critical to the safe operation of combustion appliances. All new appliances have installation instructions that should be followed exactly. Local building codes should be followed as well.
- Appliances designed to be vented should be vented properly, according to manufacturers' instructions.
- Adequate combustion air should be provided to ensure complete combustion.
- All combustion appliances should be installed by professionals.

Maintenance

- A qualified service technician should perform preventive maintenance on homes with central and

room heating appliances (including water heaters and gas dryers) annually. The technician should look at the electrical and mechanical components of appliances, such as thermostat controls and automatic safety devices.

- Chimneys and flues should be kept free of blockages, corrosion, and loose connections.
- Individual appliances should be serviced regularly.
- Kerosene and gas space heaters (vented or unvented) should be cleaned and inspected to ensure proper operation.

Appliance Use

- Follow manufacturers' directions for safe operation.
- Make sure the room where an unvented gas or kerosene space heater is used is well-ventilated. Doors leading to another room should be open to allow added ventilation.
- Never use an unvented combustion heater overnight or in a room where you are sleeping.
- Never use charcoal grills inside a home, tent, camper, or unventilated garage.
- Don't leave vehicles running in an enclosed garage, even to "warm up" a car on a cold morning.

Inspections

In addition to professional preventive maintenance on a potentially CO-producing appliance, timely inspections should be performed by the homeowner to identify signs of possible CO problems. Look for the following conditions, and if detected, have a professional service technician fully examine the unit for safety and continued use.

- Rusting or water streaking on vent/chimney
- Loose or missing furnace panel
- Sooting on internal or attic spaces
- Loose or disconnected vent/chimney connections
- Debris or soot falling from chimney, fireplace, or appliance
- Loose masonry on chimney

In addition, there are signs that might indicate improper appliance operation which include:

- Decreasing hot water supply
- Furnace unable to heat house or runs constantly
- Sooting, especially on appliances
- Unfamiliar or burning odor
- Increased condensation inside windows

Alarms

Next to prevention of the production of toxic CO gas, the best defense against this deadly killer is a CO alarm. These relatively new devices can detect toxic concentration of CO in the air, sound an alarm, and thereby save lives.

How do CO alarms work?

A CO detector sounds an alarm because it detects an elevated level of CO in the household. Different brands of detectors are designed with different options and features. Some are made to sound an alarm at persistent, low levels of CO while others will sound an alarm only at life-threatening levels. Some detectors are more sensitive than others and will detect an alarm sooner than other varieties of alarms. Some CO detectors may produce alarms at a low level even though the level may not be immediately dangerous.

Underwriters' Laboratory (UL) Listed CO detectors manufactured after October 1995, are required to have information on product packaging that clearly states the sensitivity level of the detector. Carefully read the product packaging of the CO detector you purchase, and understand what an alarm signal indicates.

Where should the detector be installed?

CO gas distributes evenly and fairly quickly throughout the house; therefore, a CO detector should be installed in sleeping portions of the house, but outside individual bedrooms, in order to alert all occupants who are sleeping in that part of the house.

A UL-Listed CO detector will sound an alarm before dangerous levels of CO accumulate. CO indicator cards and other devices are also intended to detect elevated levels of CO, but these devices are not equipped with an audible alarm and cannot wake room occupants at night, when most CO poisonings occur.

Do not place the detector within five feet of household chemicals as they may damage the unit or cause false alarms. Wall or ceiling installations are acceptable locations for mounting CO detectors, but always read and follow the manufacturer's instructions when installing a CO detector. If your detector is wired directly into your home's electrical system, you should test it monthly. If your unit operates off of a battery, test the detector weekly and replace the battery at least once a year.

Responding to CO alarms

A CO detector alarm indicates elevated levels of CO in the home. Never ignore the alarm or otherwise silence it unless a qualified individual has examined the affected area and deemed it safe.

If your alarm sounds, immediately open windows and doors for ventilation. If anyone in the home is experiencing symptoms of CO poisoning (headache, dizziness, or other flu-like symptoms) immediately evacuate the house and call the fire department. If no one is experiencing these symptoms, continue to ventilate, turn off fuel-burning appliances, and call a qualified technician to inspect your heating system and appliances, as soon as possible. Because you have provided ventilation, the CO buildup may have dissipated by the time help responds and your problem may appear to be temporarily solved. Do not operate any fuel-burning appliances until you have clearly identified the source of the problem.

Aren't there lots of problems with alarms?

For various reasons, there have been some problems in the past with the use of CO alarms. Some problems were due to the alarms themselves, others to ambient air pollution or improper use of the alarms.

Avoid placing a CO detector directly on top of or directly across from fuel-burning appliances. These appliances will emit some CO when initially turned on.

Underwriters' Laboratory responded to early concerns about nuisance alarms by revising their standard governing CO detectors (UL 2034). New UL-listed CO detectors available October 1995 were required to meet the revised standard in order to bear the UL mark. These detectors will ignore low levels of CO for a much longer period and will be equipped with reset buttons to help confirm life-threatening CO problems.

If you experience nuisance alarms, have a qualified technician come to your home as soon as practically possible and carefully inspect for sources of CO from all fuel-burning appliances, including gas ranges, gas stoves and fireplaces. As stated previously, never ignore or otherwise silence the alarm.

How Do I Select an IAQ Consultant?

This information was developed to help you find a professional who can competently investigate and resolve indoor air quality (IAQ) problems. It is targeted to building owners, facility managers, and commercial building tenants, environmental health and safety (EHS) coordinators, and others who are responsible for indoor air quality in the workplace. Although this brochure was written for commercial buildings, some of these concepts can be applied to homes and residential buildings.

Introduction

Indoor air quality problems have been around for centuries, but our scientific understanding of the indoor environment is just beginning. Because of this, the knowledge and skills of individuals providing indoor environmental quality services vary tremendously. There are no federal regulations covering professional indoor air services (except where it involves asbestos, lead or radon). Some professional organizations, such as the American Board of Industrial Hygiene (ABIH), offer certifications that address indoor environmental quality, but these are not required by federal regulations. There are some local regulatory requirements regarding IEQ-specific education, training, or credentials. So if you have a suspected indoor air quality problem that you cannot readily understand and remedy, it can be difficult to decide where to turn. This guide was written to help you:

- Investigate the problem in-house
- Recognize when you need outside help
- Decide what expertise is required to resolve your indoor air problem
- Select a consultant, if necessary
- Fit the scope and approach of indoor air services to your needs
- Solve the problem

Investigating the Problem In-House

Many IAQ problems can be detected and corrected by you or your building maintenance personnel. This section was designed to give you an overview of such IAQ problems. Also, the National Institute for Occupational Safety and Health (NIOSH) and the Environmental Protection Agency (EPA) have developed Building Air Quality, a comprehensive guide for building owners and facility managers (see the additional resources section at the end of this booklet).

A typical IAQ investigation involves the following steps:

- Determine who is affected, and when and where they are affected
- Inventory potential sources of environmental agents that may be related to indoor air quality problems
- Look for locations and sources of moisture intrusion or water damage
- Investigate heating, ventilating and air conditioning (HVAC) system problems and air movement pathways

Determine the Scope of the Problem

One key element in resolving problems is reviewing complaints and obtaining firsthand information from occupants. Occupants' experiences and observations may go a long way toward improving your understanding of the problem. Questions you pose should address symptoms reported, how many people have problems or concerns, where are they located, when problems appear and general occupant observations about the indoor environment. Persons reporting specific medical problems should be encouraged to see a physician. Complaints may reflect individual medical conditions, work stress, office politics or other factors unrelated to air quality, but add to the overall perception of poor air quality and require investigation.

Inventory sources of airborne dusts, chemicals and allergens

Many sources of indoor pollutants are readily observable during an inspection in and around the building and their possible relation to the complaints should be noted. Inspect the general cleanliness of the area. A thorough cleaning of the surfaces, carpets and furnishings may alleviate occupant discomfort related to airborne dusts, fibers and allergens.

Consider the outdoor air as a possible source. Pollen and mold can aggravate allergies and result in air quality complaints. Vehicle traffic near HVAC system air intakes can add carbon monoxide and other contaminants to the indoor air. Workplace activities involving even small amounts of chemicals can lead to occupant discomfort if the area is not properly ventilated. Use your organization's hazard communication program as a starting point to list chemicals occupants use and don't forget to consider outside contractors' activities, such as cleaning crews, roofers and construction contractors.

Examine sources of moisture intrusion or water damage

Moisture intrusion can promote growth of mold (fungi) and bacteria. Bacteria are rarely a problem unless there is a constant or pooled water source. Unusual types or high concentrations of fungi may be related to a significant portion of occupant symptoms, especially among persons with allergies. Sometimes you may not be able to see the impact of moisture on the building. It can be hidden by floors, walls and ceilings, and may require professional assistance and highly specialized testing to locate the problem.

Look for common HVAC problems

The HVAC system should be reviewed with the personnel responsible for its upkeep. Look for excessive debris or visible mold growth, pooled water and malfunctioning components. HVAC systems may affect air movement between rooms, and can direct air contaminants through various pathways.

Recognizing When You Need Outside Help

After you have done all of the above with no apparent success, it is time to seek outside help. As a general rule, you should seriously consider calling a professional indoor air quality consultant if any of the following statements is true:

- In-house efforts have not solved the problem — If occupant reports of building-related symptoms or discomfort continue, the problem has not been resolved.
- The problem is too serious to delay response — If there is suspected Legionnaires' disease or known contamination with polychlorinated biphenyls (PCBs), asbestos or lead, you will need outside resources. In addition, if workplace health complaints are widespread and persistent, the situation must be resolved in a rapid and professional manner.
- There is mistrust between occupants and the employer or building management — Indoor air quality concerns can escalate to the point where independent investigation is needed to develop a credible indoor air diagnosis and recommendations.
- Litigation or workers' compensation claims are likely — When problems are not addressed and resolved early, minor occupant discomfort may become more serious. Increasing numbers of occupants are willing to file workers' compensation claims or initiate other legal actions if IAQ problems persist. Retain an expert as early as possible if litigation is likely to occur.
- There is a need for specialized equipment or expertise — One example of such a case would be if the initial investigation produced a hypothesis that the cause of discomfort was a potentially harmful chemical agent. Verification might require special air sampling media and equipment as well as people qualified to collect, analyze and interpret such samples correctly.

Solving the Problem

Once you have chosen your consultant, it is up to you to make sure the occupants are kept informed of progress on the problem and involved in the process. Occupant involvement enhances credibility and helps to ensure success. Accurately communicate the indoor air survey timetable and status. Communicating the limitations of current knowledge will help establish realistic expectations. Many consultants are experienced in this aspect of the project and can help you develop credible information for distribution.

How can the various professions help with indoor air problems?

Indoor air quality consultants vary in their training and experience. For example, a consultant may be trained in architecture, heating and ventilation, medicine, engineering, microbiology, toxicology, ergonomics, environmental and occupational health or industrial hygiene. The ideal consultant has a basic understanding of all of the above, with a specialized knowledge in the particular issues present in your workplace. The following discussion describes several types of professionals and how they can help.

Industrial Hygienists

Most industrial hygienists have college degrees in engineering or the natural sciences, such as biology, chemistry, biochemistry or microbiology. This is supplemented by specialized training in industrial hygiene. The science of industrial hygiene is dedicated to anticipating, recognizing, evaluating and controlling the causes of occupational illness. Since industrial hygienists are trained to evaluate environments for factors that affect health and comfort, qualified industrial hygienists are key members in most indoor air quality investigations. In addition, because industrial hygienists have fundamental training in ventilation engineering, environmental health, toxicology and microbiology, they can assist

you in determining when the input of other professions would be helpful.

Mechanical Engineers and Contractors

Engineers are invaluable in understanding the intended design parameters of HVAC systems. Their input is essential when it comes to designing retrofits to existing HVAC systems to improve indoor air quality. Many mechanical contractors (non-engineers) are helpful in implementing changes to air-handling equipment, but may not have the mechanical engineering background required to design effective solutions.

Architects

Architects are in a position to understand how building design can affect indoor air quality. They are also responsible for specifying interior building finishes and building components that are part of the total IAQ equation. Look for an architect with formal training or experience in preventing indoor air quality problems.

Medical Professionals

Occupational physicians and occupational health nurses have specific training in aspects of the work environment, and can help IAQ investigators target potential sources of health complaints. An occupational physician should be consulted whenever a specific disease (such as Legionnaires' disease) is believed to be attributable to indoor air.

Other Professions

Building occupants often report nonspecific symptoms, such as headaches, eye discomfort or muscle aches. Although occupants may identify these symptoms as being related to building air quality, some of these reports may actually be associated with improper lighting, noise or poorly designed work stations. Many industrial hygienists have the expertise to assess and resolve most lighting, noise or ergonomic problems. If such problems require additional expertise, the IH can refer you to illumination engineers, acoustics specialists or professional ergonomists.

The Indoor Air Quality Team Approach

In larger indoor air quality assessments, it is important to form a team of professionals drawn from the appropriate disciplines. Through their professional training and broad practical experience, industrial hygienists are uniquely suited to the team approach. If lack of time or resources prohibits forming a team, an industrial hygienist with sufficient training and experience can provide the skills necessary to investigate and resolve most indoor air problems.

How to Find the Best Indoor Air Quality Consultant for Your Needs

It is far better to be prepared before an indoor air quality problem is reported. Proactive organizations develop an indoor air quality management plan that describes procedures for preventing indoor air problems and responding to problems as soon as they are recognized. As part of your organization's plan, you may want to include a short list of consultants competent in indoor air quality-related issues.

The following are suggested steps in the IAQ consultant screening process:

1. Verify that the consultant has appropriate training and project experience. Ask for references and contact clients to verify that the consultant has helped them solve their IAQ problem. Find out whether the most experienced personnel will be onsite or in direct contact with the site investigation staff. Many qualified IAQ consultants are self-employed or work for small firms.

2. Nationally recognized certifications or accreditations help to ensure that firms of varying size can produce results of similar quality. Not all accreditations, certifications or professional society memberships are equal. Be wary of contractors who may overstep the bounds of their expertise or who have a financial stake in the outcome of the investigation. For example, a duct cleaning contractor may have seen a lot of IAQ problems, but that does not qualify him or her to diagnose and remedy all IAQ problems. Be aware of applicable state or federal certification requirements if the work involves asbestos, lead or radon. In addition, some states have special requirements for persons involved in ventilation modifications in schools.
3. Define what you expect from the consultant you hire. Ask if the consultant can respond on short notice, if needed. It helps to define the scope of services up front; however, indoor environmental quality is rarely simple or predictable. Your proposed scope may be modified based on question-and-answer sessions with prospective consultants. No two buildings and no two indoor air quality problems are alike; thus the scope of the project may not be definable until more information is obtained through inspection and (if necessary) testing.
4. Solicit proposals and interview candidates if time permits. A telephone interview is usually sufficient. Ask the consultant for his or her general approach to resolving the problem. A general but systematic approach is usually more effective than relying on extensive air testing in the absence of complaints or observations indicating the value of such testing. Proposals should indicate the estimated consulting fees and expenses for the specified initial phase of the project. Pay attention to the project approach and ask questions if some of the scope items don't make sense to you. Find out how decisions for follow-up testing or remediation will be made.
5. Draw up a request for proposal (RFP) or contract specifications. This may take time, but it helps avoid surprises. The contract may specify the following:

The project scope, specifying activities to be included, such as air monitoring, occupant surveys or health assessments.

- The frequency of status reports and meetings
- The work product, such as drawings, reports, tables, back-up data
- Quality control procedures
- Project budget estimates and fee schedules
- A reasonable schedule agreeable to both parties (and consistent with sample analysis turnaround times)

Can Facemasks Prevent Disease?

Infectious diseases such as influenza (the flu) can be spread by several methods, including:

- Airborne droplets or sprays
- Hand-to-mouth/nose/eye contact
- Direct surface contact

Respiratory protection for reducing disease transmission

"Facemasks" are sometimes used in an attempt to prevent the spread of airborne diseases such as influenza (the flu). The below sections present information about the different types of facemasks and their uses and limitations, and you can access more resources to stop the spread of infectious diseases in the pandemic resources center.

- Combinations of these methods

Because recent evidence suggests that inhalation of microscopic airborne particles may also transmit some diseases, it has been suggested that masks might reduce disease transmission.

What Types of Masks are Available?

Two general types are available:

- Surgical masks (SM)
- Disposable N95 filtering facepiece respirators (FFR)

Some N95 FFR masks have been cleared by the Food and Drug Administration (FDA) for use by the general public in public health medical emergencies. However, no study has shown that a FFR or a SM alone will effectively reduce disease transmission when worn by people in the general public who may come into contact with sick people.

Current recommendations for the use of FFR or SM are based on what is known about how these devices perform in the workplace.

Surgical Masks (SM)

A surgical mask can:

- Protect patients from bacteria and other particles exhaled by healthcare workers
- Protect healthcare workers from contact with sprays or splashes that may contain infectious organisms

SMs are not designed to reduce the inhalation of small airborne particles that may contain infectious organisms.

Do not expect a SM to protect you from inhaling infectious organisms.

Disposable N95 Filtering Facepiece Respirators (FFR)

N95 FFRs are designed and tested to filter small particles from the air. This can reduce the number of infectious particles you inhale and might reduce your chance of infection.

Proper Fit Is Critical For Protection

N95 FFRs are designed to seal against your face to help reduce the amount of infectious particles that can enter your nose or mouth. When N95 FFRs are used in a workplace, particle concentrations inside the FFR are typically at least ten times lower than particle concentrations in the workplace air if the respirator fits the wearer. Workers receiving this level of protection have been trained in proper use of the FFR and have passed an individual fit-test.

Unfortunately, there may be little benefit from wearing an N95 FFR that has not been fit-tested on the wearer. Effective fit-tests may be difficult to obtain for members of the general public.

N95 FFRs Can Only Protect when Worn

The benefit of using any respirator, including a properly fitting N95 FFR, is quickly lost if it is not worn at all times the hazard is present. Most of the benefit of wearing a respirator is lost unless it is worn at least 90 percent of the time.

Infections and aerosols are invisible, so there is no indication when they are present. Also, some sick people may produce particles that can infect others before they show any symptoms themselves. Therefore, it is very easy to receive a significant exposure without knowing.

Even taking the respirator off to talk or eat in an area where infectious particles are present might allow enough exposure to cause infection. The only way to avoid this problem is to properly wear the respirator at all times the infectious aerosol might be in the air.

All of the respirator manufacturer's instructions for putting on and wearing the FFR must be followed.

Respirators Alone will not Prevent Disease Transmission

Some diseases may be transmitted via small aerosols that N95 FFRs can filter out. However, droplets or sprays, hand-to-mouth/nose/eye contact, and direct surface contact may also cause infection.

All routes of exposure must be avoided to the greatest extent possible to reduce your chance of getting sick.

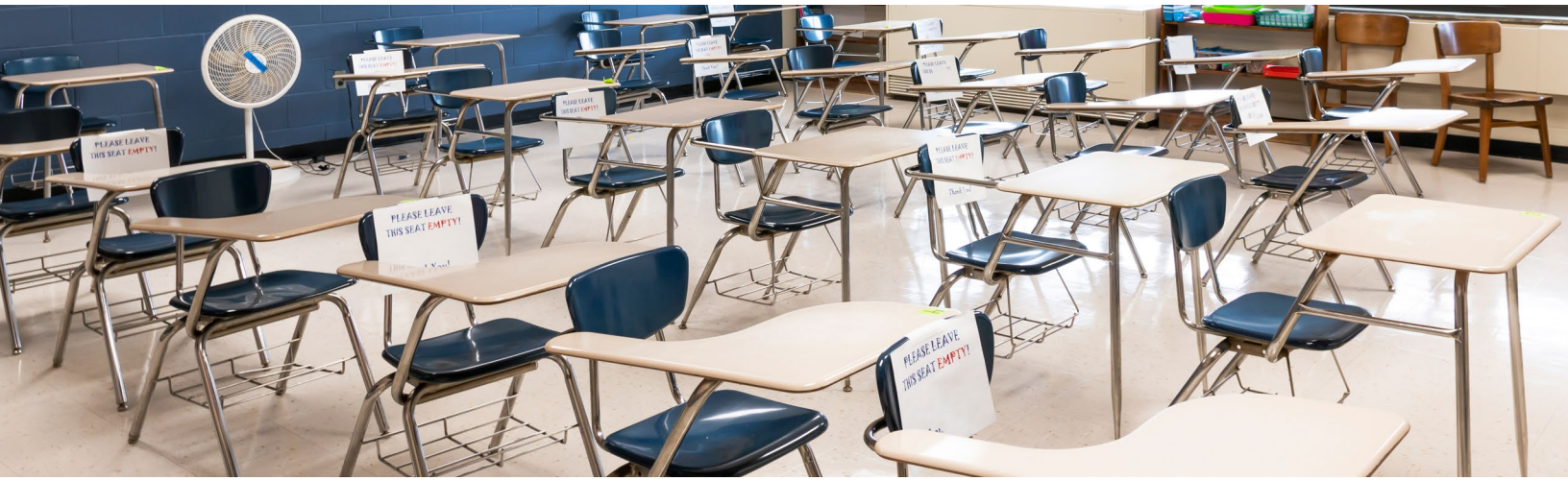
While wearing a properly fitted N95 FFR can reduce inhalation exposures, frequent hand washing with soap and water can help minimize transmission through other exposure routes.

An annual seasonal flu vaccination is the best way to reduce the chances that you will get seasonal flu.

Key Facts About Respirator Effectiveness

- A respirator that is not worn will not provide protection.
- Wearing a respirator the wrong way will result in ineffective protection.
- Wearing a respirator that fits properly all of the time provides the most effective protection.
- The protection a respirator provides is quickly lost when not worn at all times

See Healthierworkplaces.org for dozens of links to additional resources.



Healthy Air In Schools

How School Employees Can Protect Themselves From Health Risks

K-12 schools, colleges, universities, and other higher education institutions have grappled with how to keep faculty, staff, and students safe from transmitting viruses and illnesses like COVID-19, especially in classrooms and other shared spaces.

While many teachers and professors have introduced remote and distanced learning capabilities like all-virtual classes or rotating schedules to distance students, there are ongoing health risks for all school faculty that require them to take precautions when conducting in-person work.

Protecting Teachers, Faculty, and Students From Health and Safety Risks

There are many key questions that must be considered when exploring how to safely teach and conduct school business given the ongoing risks of illness, including:

- How can we protect the health and safety of students, faculty, and teachers?
- How do we assure students and their parents that we are doing all we can to prevent the spread of illness?
- What do we do if a student or staff member comes in contact with someone who has a positive or suspected case of COVID-19?
- What steps can teachers and professors take to disinfect and clean classrooms and shared spaces?

With these questions in mind, AIHA has created three guidance documents—which you will find in the below 'Resources' section under 'Support Documents'—to help K-12 school and college employees protect their well-being at work:

- Healthier Workplaces: Guidance for K-12 Schools Guidance Document, 2nd edition
- Healthier Workplaces: Guidance for Institutions of Higher Education Guidance Document, 2nd edition
- Healthier Workplaces: Guidance for Libraries

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All of the guidance documents borrow from the latest advice given by the Centers for Disease Control and Prevention (CDC) and expert advice from other leading health, government, and academic organizations.

The guidelines share actionable steps and recommendations to protect K-12 and college staff and students, including information on the following key areas:

How school employees can protect themselves and their students from health risks:

- Best practices for limiting the risk of COVID-19 or similar virus transmission in classrooms or other instruction and learning environments, including recommended room layouts, staggered schedules, and the avoidance of shared objects
- Enhanced cleaning practices for school facilities and college campuses, including how to disinfect classrooms, labs, and other shared spaces
- Recommended communications for students and parents to educate them on how to limit the risk of transmitting COVID-19
- How to perform a student wellness check, including temperature screening and visual signs to look for
- Self-monitoring practices and the necessary personal protective equipment for teachers, professors/lecturers, and students
- Ways to safely use college common spaces, like a library or cafeteria

Indoor Air Quality Resources for Healthy Schools

A top priority of the Biden-Harris Building Better School Infrastructure Action Plan is to improve the health of our schools, and AIHA is recognized as an EPA resource in the action plan and reference guide for better air quality in schools.

Considering that students, teachers and staff spend approximately one third of their day at school—and 90% of that time is spent indoors—indoor air quality should be a priority for all faculty and employees. Outdated heating, ventilation, and air conditioning systems can all present invisible hazards to students and teachers, as well as off-gassing of construction materials and interior furnishings.

To help school administrators and facilities managers understand these risks and improve the air quality in their buildings, please see the below "Resources by Type" that are marked "Healthy Schools" and visit our Indoor Air Quality hub for more information.

Students, teachers and staff spend approximately 90% of their time at school indoors. The checklist (on the next page) helps school facility managers improve indoor air quality and prevent the long- and short-term health effects that poor indoor air quality can have on students and staff.

HEALTHIER WORKPLACES

BE PART OF THE SOLUTION

Keeping Schools Healthy

Students, teachers and staff spend approximately one third of their day at school, 90% of it indoors. Building systems can directly impact the air of the indoor environment. In turn, the occupants are exposed to air that can have a direct impact on their health. Failure to improve poor indoor air quality may increase long- and short-term health effects for students and staff.

This checklist is for school facility managers who are dedicated to healthy and safe indoor air quality.

Create a detailed inventory of your school's mechanical systems: It's important to recognize that each school is its own separate unit. The controls used at one facility cannot be directly standardized to other schools. The specific mechanical systems will determine how to best implement controls in the individual school.

Identify an appropriate balance of efficiency across all the school's mechanical systems: The balance will depend on several factors, including: the type of facility, the age of the systems, and the density of occupants (e.g., students) inside the building.

Efficiently introduce outdoor air when feasible: Depending on the climate and outdoor humidity, it may not be feasible to introduce outdoor air into the building and classrooms and expect the system to function in an energy-efficient manner or function as it was designed and intended. The system should be evaluated, and system performance should be verified after outdoor air introduction to ensure proper system function and acceptable indoor climate conditions.

Improve system filtration to increase air exchange equivalents: This upgrade may require the system to work at a higher level than it did before the pandemic and can result in more effective air filtrations and exchanges.

Schedule regular system evaluations: Identifying an issue before it becomes a problem. Each facility needs a preliminary, individualized facility evaluation to identify the most appropriate control.

Schedule an IAQ building assessment with a third party OEHS consultant: Having facility health risk assessments performed to address identified issues before they result in human health impacts will be a long-term return on investment and a beneficial one when the health of the occupants is ultimately improved by healthy facility systems.

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For more information, see:
HealthierWorkplaces.org, **Commit2CARE.org**, and **consultantslisting.org**

WE ARE AIHA

This is what we do.

Every single day, we work to empower those who apply scientific knowledge to protect all workers from occupational hazards.

This is how we do it.

We are experts in what we do. We use our knowledge to better protect people and the environment.

We are supportive. We exist to serve Occupational Health and Safety professionals, and are constantly searching for new ways to do so.

We are inclusive. We know we are all stronger when knowledge is shared among people coming from diverse backgrounds and across our allied professions.

We are forward-looking. We are growing and evolving with the industry, always looking ahead.

This is why we do it.

Working together, we all share one goal:

A world where all workers are healthy and safe.

To find FAQs and learn more about occupational and environmental health and safety, please visit us at **aiha.org**.

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