Policy

Our awareness about indoor air quality has increased in recent years. Energy conservation programs spawned by world oil shortages resulted in changes to building design and operation. Buildings have been sealed and ventilation rates reduced in an effort to prevent the infiltration of untempered outside air (hot, humid air in the summer and cold, dry air in the winter). These changes were made to reduce operating costs but have had a negative impact on indoor air quality.

Although control of airborne contaminants is the focus of these guidelines, ventilation, temperature, and humidity are also important. Their importance in productivity, comfort, and a sense of health and well-being should not be underestimated. It is also important to remember that factors such as noise, lighting, ergonomic stressors (work station and task design), and job- related psychological stressors can — individually and in combination — contribute to IAQ- related complaints. The greatest challenge posed by IAQ investigations is that the reported symptoms and health complaints are generally diverse and usually not suggestive of any particular medical diagnosis or readily associated with a causative agent. A typical spectrum of symptoms includes headaches, unusual fatigue, itching or burning eyes, skin irritation, nasal congestion, dry or irritated throats, and other respiratory irritations.

Typically, the workplace environment is implicated because workers report that their symptoms lessen or cease once they leave the workplace. In such cases, however, it is often difficult to prove a cause that would substantiate an OSHA violation. However, in some instances specific illnesses can be associated with identifiable exposures in the indoor environment and employers may be subject to an OSHA citation. Examples of such illnesses include Legionnaires disease, histoplasmosis, carbon monoxide poisoning, and certain allergic reactions associated with exposure to molds.

Sources of Indoor Air Pollution

Indoor air quality is affected by pollution from inside and outside of buildings and by poor ventilation. Human metabolic activity, smoking, structural components of the building, building contents, biological contamination, office and mechanical equipment, and outside air pollutants that enter the building—all are sources of indoor air pollution.

Inside Air Contaminants

Indoor sources of air pollutants due to chemicals can be attributed to building materials and products used in the building. Formaldehyde vapors can be emitted

from urea-formaldehyde foam insulation, particle board, plywood, and some glues and adhesives commonly used during construction. Other contaminants include fibrous glass, various organic solvents from glues and adhesives, and acetic acid used as a curing agent in silicone caulking.

Chemicals and emissions from equipment also contribute to indoor air pollution. These include, for example, methyl alcohol from spirit duplicators, butyl methacrylate from signature machines, ammonia and acetic acid from blueprint copiers, and ozone from photocopiers. Other inside contaminants includes:

- Improperly applied pesticides.
- Boiler additives such as N, N-diethyl ethanolamine.
- Improperly diluted cleaning agents such as rug shampoo.
- Tobacco smoke of all types (also commonly referred to as environmental tobacco smoke, ETS).
- Combustion gases from sources common to cafeterias and laboratories.
- Cross-contamination from poorly ventilated sources that leak into other air zones.

Indoor air problems due to biological pollutants often involve some type of microbiological contamination. Three conditions are necessary for microbial contamination to occur: high humidity (over 60 percent), appropriate temperatures and suitable growth media. Such contamination can result from water damage to carpets or furnishings or from standing water in ventilation system components. A respiratory problem known as hypersensitivity pneumonitis can result from bacteria, fungi, protozoa and microbiological products that may originate in ventilation system components.

Outside Air Contaminants

Pollutants from outside the building or office space can also contribute heavily to indoor air problems. Examples of these contaminants are motor vehicle exhaust, boiler gases and previously exhausted air. Major sources are improperly located exhaust and intake vents and periodic changes in wind conditions.

One of the most common contaminants from outside is carbon monoxide gas from basement parking garages, recirculated through the building ventilation system. Other outside contaminants include the by-products of construction or renovation, such as asphalt, solvents and dusts. Gasoline vapors can infiltrate the basement and sewage system and are usually caused by gasoline leaks from ruptured underground tanks at nearby service stations.

Inadequate Ventilation

Inadequate ventilation is a key factor associated with poor indoor air quality. Ventilation problems commonly encountered include:

- Insufficient outdoor air supplied to the office space.
- Poor air distribution and mixing, which causes stratification, draftiness and pressure differences between office spaces.
- Extremes of fluctuations in temperature and humidity (sometimes caused by poor air distribution).
- Air filtration problems caused by improper or inadequate maintenance to the building ventilation system.

In many cases, these ventilation problems have been created or exacerbated by energy conservation measures. Such measures include reducing or eliminating outdoor air; reducing infiltration and exfiltration; lowering thermostats in winter and raising them in summer; eliminating humidification or dehumidification systems; and early shutdown and late start-up of ventilation systems.

Serious Air Quality Hazards

Examples of IAQ problems that normally indicate a “Serious” hazard may exist include the following:

- Complaints of headaches, nausea, lethargy, and/or dizziness (especially if onset was sudden and/or severe) and carbon monoxide poisoning from combustion sources is suspected.
- Complaints of fever/chills and fatigue, or cough and shortness of breath (especially severe, or widespread complaints), other symptoms, or physician-diagnosed disease (e.g., Legionnaires’ Disease, histoplasmosis) consistent with exposure to airborne microorganisms.
- Wheezing or other indications, where chemicals are present, that might prompt or aggravate asthma in a worker.
- Complaints of significant mold growth within a building.

Control Strategies

Four control strategies can be implemented to reduce indoor air pollution: education and training; dilution ventilation; modifying processes and equipment; and air cleaning.

Education and Training

The employer should provide all employees with timely information on the health and physical hazards associated with products and materials. Employers are required by the OSHA Hazard Communication Standard, 29 CFR 1910.1200, to develop and implement a hazard communication program where any hazardous chemicals are known to be present and to which employees may be exposed. The required hazard communication program details information and training that employees must receive.

Dilution Ventilation

Ventilation systems are designed to supply sufficient oxygen for normal respiration, to dilute contaminants in occupied spaces, to remove contaminants emitted from work areas and to control odors. The American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) is a private standard setting organization that has developed specific ventilation standards that are often incorporated into building codes. Most ventilation systems meet the design standards set by state and local building codes.

The primary method of controlling air contaminants in most buildings is general ventilation. General dilution ventilation requires a clean air supply to dilute all the contaminants of concern and exhaust openings located near the contaminant source or work area.

Recirculation of exhausts can be avoided by locating the intake and outlet remotely. Reentry of exhaust air can be avoided by discharging exhaust above the roof away from openings and air intakes.

Modifying Processes & Equipment

Pollution emission rates may be reduced by modifying processes and equipment. Polluting substances that are part of the work process may simply be eliminated. Less toxic materials may be available to substitute for contaminating substances. Or the quantity of contaminating substances may be reduced.

Equipment may be subject to modification that would reduce contamination. Using equipment differently or installing barriers may also reduce emissions at their source.

Air Cleaning

This control strategy involves removing air contaminants before the air is recirculated. Filters and electronic air cleaners are common particle removal devices. Adsorption and absorption are removal techniques for pollutant gases. Air conditioning is primarily a comfort device, but some concentrations of pollen and other particulate matter are slightly reduced by air conditioning.

Evaluating Microbiological Contamination

Further investigation of a potentially serious hazard may be appropriate if all three of the following criteria are met:

- ***A Source:*** The building is significantly water damaged, contaminated with molds, or reservoirs of other microorganisms (e.g., Histoplasma, Legionella) exist.
- ***An Exposure Pathway:*** An exposure pathway is likely.
- ***Illness and Symptoms:*** A physician has diagnosed a building-related illness or building occupants are suffering from symptoms consistent with exposure to the potential source.

Evaluating the Source

A serious hazard can only be determined to exist if the workplace exhibits one of the potential sources of microbiological contamination listed in the attached Table.

Consideration should be made of the possible extent of contamination. Small areas of contamination (i.e., traces of mold on a wall or ceiling tile) may not necessarily warrant classification as a serious hazard (although it may be a superficial indicator of hidden problems), as opposed to a contaminated air plenum or an extensively water-damaged wall.

Normally, mold contamination is easily recognizable due to moldy odors and their unique visual characteristics. Other specialized sampling may be required if Legionella or any other pathogenic (disease-causing) microorganism is suspected.

Evaluating the Potential for an Exposure Pathway

Bioaerosol sampling has been used by many investigators to demonstrate the existence of exposure pathways. However, the numerous technical limitations and difficulties associated with this method make the sampling results extremely difficult to interpret. In general, bioaerosol sampling should not be performed, unless there are special circumstances that warrant this approach. You should qualitatively evaluate factors such as the magnitude and proximity of the contaminated materials and potential exposure pathways. See Table for potential sources and pathways for consideration.

Evaluating Illnesses and Symptoms

Examples of illnesses and symptoms consistent with exposure to molds and other microorganisms are indicated below. You must recognize that many of the listed symptoms are relatively common complaints and are not necessarily reflective of a workplace exposure or serious illness.

Physician-diagnosed illnesses associated with microbial contamination include:

- Allergic rhinitis or sinusitis.
- New-onset asthma.
- Hypersensitivity pneumonitis.
- Pneumonia.
- Fever/flu-like illness.
- Recurrent airborne infections.

Symptoms associated with microbial contamination include:

- Dry, irritated or sore throat.
- Wheezing.
- Difficulty breathing or shortness of breath.
- Chronic postnasal drip.
- Chronic cough.
- Continual throat clearing.
- Frontal headaches or facial pain that increases with bending over or straining.
- Eustachian tube dysfunction (ear pain).
- Altered hearing, smell and/or taste.
- Recurrent fevers or chills in addition to general malaise and muscle ache.