



## Indoor Air Quality



Most people know that outdoor air pollution can damage their health, but did you know that indoor air pollution can also have significant health effects? Studies indicate that indoor levels of pollutants may be two to five times, and occasionally more than 100 times, higher than outdoor levels. On average, we spend about 90 percent of our time indoors. Indoor pollution is estimated to cause thousands of cancer deaths and hundreds of thousands of respiratory health problems each year.

Concerns with indoor air quality have increased since energy conservation measures were instituted in office buildings during the 1970s, minimizing the infiltration of outside air and contributing to the buildup of indoor air contaminants. Complaints about indoor air quality range from simple complaints such as the air smelling odd to more complex, where the air quality causes illness and lost work time. Indoor air quality complaints stem from a variety of sources, causes, and individual sensitivities.

Indoor air quality problems can be caused by ventilation system deficiencies, overcrowding, tobacco smoke, microbiological contamination, outside air pollutants, and off gassing from materials in the office and mechanical equipment. Related problems also may include comfort problems due to improper temperature and relative humidity conditions, poor lighting, and unacceptable noise levels, as well as adverse ergonomic conditions, and job-related stressors.

Investigations of indoor air quality often fail to identify any harmful levels of specific toxic substances. Often, employee complaints result from items such as cigarette smoke, odors, low-level contaminants, poor air circulation, thermal gradients, humidity, job pressures, lighting, work-station design, or noise. Note that, despite the reference to investigations, the Environmental Protection Agency does not regulate indoor air quality, and OSHA only covers specific areas

The range of investigations of indoor air quality problems encompasses complaints from one or two employees to episodes where entire facilities are shut down and evacuated until the events are investigated and problems corrected. Complaints are often of a subjective, nonspecific nature and are associated with periods of occupancy. These symptoms often disappear when the employee leaves the workplace. They include headache, dizziness, nausea, fatigue, lack of concentration, and eye, nose, and throat irritation.



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In approximately 500 indoor air quality investigations in the last decade, the National Institute for Occupational Safety and Health (NIOSH) found that the primary sources of indoor air quality problems are:

- Inadequate ventilation – 52%
- Contamination from inside the building – 16%
- Contamination from outside the building – 10%
- Microbial contamination – 5%
- Contamination from building fabric – 4%
- Unknown sources – 13%

The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) recommends ventilation rates for indoor environments of 5 cubic feet per minute (CFM) of outdoor air per person. This standard has been incorporated into the building codes of many cities and states. The 62-1989 standard recommends a minimum of 15 CFM of outdoor air per person for offices (reception areas) and 20 CFM per person for general office space with a moderate amount of smoking.

### Health effects

Immediate effects may show up after a single exposure or repeated exposures. These include irritation of the eyes, nose, and throat, headaches, dizziness, and fatigue. These effects are usually short-term and treatable. Sometimes, the treatment is simply eliminating the person's exposure to the source of the pollution, if it can be identified.

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

Other health effects may show up either years after exposure has occurred or only after long or repeated periods of exposure. These effects (which include some respiratory diseases, heart disease, and cancer) can be severely debilitating or fatal. Thus, it is prudent to improve indoor air quality even if symptoms are not noticeable.



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## Improving indoor air quality

There are three basic strategies to improve indoor air quality:

- Source control,
- Improved ventilation, and
- Air cleaners.

### Source control

Usually, the most effective way to improve indoor air quality is to eliminate individual sources of pollution or to reduce their emissions. In many cases, source control is also a more cost-efficient approach to protecting indoor air quality than increasing ventilation because increasing ventilation can increase energy costs.

When possible, use local exhaust ventilation and enclosure to capture and remove contaminants generated by specific processes. Room air in which contaminants are generated should be discharged directly outdoors rather than re-circulated.

### Improved ventilation

Most heating and cooling systems do not mechanically bring fresh air into the building. Opening windows and doors, operating window fans, or running a window air conditioner with the vent control open increases the outdoor ventilation rate.

Increase ventilation during short-term activities that can generate high levels of pollutants such as painting, paint stripping, or engaging in maintenance activities such as welding, soldering, or sanding. You might also choose to do some of these activities outdoors, if you can and if weather permits.

### Air cleaners

Air cleaners range from relatively inexpensive table-top models to sophisticated and expensive systems. Some air cleaners are highly effective at particle removal, while others, including most table-top models, are much less so. Air cleaners are generally not designed to remove gaseous pollutants.

The effectiveness of an air cleaner depends on how well it collects pollutants from indoor air and how much air it draws through the cleaning or filtering element. A very efficient collector with a low air-circulation rate will not be effective, nor will a cleaner with a high air-circulation rate but a less efficient collector.

Another important factor is the strength of the pollutant source. Table-top air cleaners may not remove satisfactory amounts of pollutants from strong nearby sources. People with a sensitivity to particular sources may find that air cleaners are helpful only in conjunction with concerted efforts to remove the source