



# Causes of Poor Indoor Air Quality and What You Can Do About It

## What Are The Typical Symptoms Of Poor Indoor Air Quality?

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- irritations of eyes, nose, and throat
- dry mucous membranes and skin
- erythema (reddening or flushing of the skin); rashes
- mental fatigue, headache, and sleepiness
- airway infections, cough
- hoarseness, wheezing
- nausea, dizziness
- unspecific hypersensitivity reactions

Exposure to poor air quality may not result in a rapid, acute onset of symptoms; instead, there may be slow, subtle effects. The symptoms are often subjective, and other problems or stressors (including heat stress) may aggravate the problem. Some individuals may be particularly sensitive. Since people exposed to poor indoor air quality frequently experience subjective symptoms, they are often viewed as over-emotional or simply complainers – so it is important to place this problem on a scientific basis so as to be able to take a more constructive, problem solving approach.

## What Is Poor Indoor Air Quality?

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Science has shown that the quality of air within buildings is, at times, worse than the quality of outdoor air. Indoor air quality problems, believed to be related to contaminants concentrated within buildings, can cause symptoms and illnesses among people who spend time therein. When one considers the number of workers in offices, banks, school buildings, restaurants, hotels, hospitals, and health care institutions in the United States, it is not surprising to learn that indoor air quality impacts the health and productivity of the majority of working adults and the vast majority of working women. Moreover, when one includes time at home as well as at work, people spend approximately 90 percent of their time indoors.

## What Are The Causes Of Poor Indoor Air Quality?

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- inadequate fresh air supply and/or poor ventilation system maintenance
- pollutants given off by building or furnishing materials
- pollutants from processes occurring within the building, including cleaning products, office machines, pesticides, and off gases from new materials
- microorganisms or other biological contaminants, or,
- contaminants brought into the building from outside; some examples are exhausts from sanitary stacks, boiler stacks, natural gas vents, or flues.

When building ventilation is inadequate, the resulting low air exchange rate is such that there is insufficient fresh air brought into the building to dilute or flush out contaminants and they can become concentrated within the building. Improving indoor air quality does not mean that the indoor air must become pristine and pure, but rather that building oc-

cupants should not be subjected to air quality that is significantly worse than the air outside, especially if the occupant does not experience his/her health problem when exposed to outside air (and so long as the outside air is reasonably acceptable by USEPA or other health standards).

## How Do You Find Out If Your Building Has An Indoor Air Quality Problem?

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Gather information from building occupants. When investigating complaints of indoor air quality, it is important to determine the nature of the complaints and extent of the problem. This can be accomplished by surveying the people who work, live in, and visit the building. When collecting information:

- review the records of complaints; if there are no existing records, create a complaint log
- interview the occupants, either directly, by the use of a questionnaire, or both (obtaining medical advice and/or actual diagnoses of health conditions would be ideal), if possible and with the necessary privacy protection; however, the typically subjective nature of IAQ symptoms may make occupants' reports the only information available
- avoid asking questions that might be unnecessarily intrusive (for example, health or medical questions concerning reproductive history or psychological problems)
- ask occupants to document their observations in an occupant diary so as to observe trends or intermittent problems

Check out the ventilation system. Find out if there is enough fresh air being brought into the building. The American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) 62.1-2007 recommends that office spaces have 5 cubic feet per minute (cfm) per person of outdoor air provided.

There are similar recommendations for schools and other building types and usages. Verify this with carbon dioxide measurements during times of occupancy; the CO<sub>2</sub> level inside the building is usually higher than that outside the building since people exhale CO<sub>2</sub>. This makes CO<sub>2</sub> a useful surrogate measure of air turnover. Outside there is about 300-500 ppm of carbon dioxide (this is the composition of the Earth's atmosphere). Inside, the carbon dioxide should be no more than 700 ppm higher than the outside air concentration.

Examine the intakes and exhausts for contamination and cross contamination; verify this with carbon monoxide or other measurements as appropriate. For any monitoring performed, measure the same items in the outdoor air for comparison purposes. Be careful in the choice of method used so as to obtain a low enough detection limit as to be able to compare indoor air with outdoor air. Check out the heating, ventilation, and air conditioning system's performance and maintenance. Walk through the building and look for signs of leaks and water damage. Check the chemical usage in the building and look for potential sources of air contaminants. Make any corrections necessary as a result of these examinations and then re-survey the building inhabitants to see if conditions have improved and if any problems remain.

Usually these steps are enough, but sometimes further monitoring is needed. If the corrections to ventilation or contaminant sources do not fix the problem or if the ventilation system was adequate, it may become necessary to proceed further to better identify the specific contaminants and their possible sources, such as: microbial monitoring (with identification of the bacteria and molds), measurement of particulates (with identification of particles and fibers), or chemical analysis for air contaminants (such as formaldehyde, ozone, pesti-

cides, or volatile solvents). And, as above, take outdoor measurements as well and compare indoor air with outdoor air. Keep in mind that, as IAQ involves non-industrial workplaces, it is rare to find that the concentration of air contaminants violates OSHA regulations or other groups' recommendations intended to address the industrial environment.

Consider whether the expense of this additional monitoring is justified; it may be far more cost effective to remove the contaminant source than to pay for the testing. Consider whether these additional data will make a difference in the decision to fix or not to fix a potential problem. If you are going to fix it anyway, are the data needed to confirm that exposure happened or are the data a waste of the funds which could be used to fix the problem?

Keep building occupants informed. Building occupants should be kept informed during the entire process of investigation and mitigation, including:

- how the investigation is progressing, the types of information being gathered, and ways that they can help the process along
- the nature of the health problems being reported; this enables occupants to put their symptoms into perspective
- how long the investigation is expected to last
- any attempts that are made to improve indoor air quality
- any remaining work that needs to be done and the schedule for its completion.

If the above-described investigation indicates that an indoor quality problem exists, consult with a qualified expert who can make appropriate recommendations for remediation. Such an expert could include an industrial

hygienist, a ventilation engineer with IAQ experience, a HVAC contractor with IAQ experience, a safety risk manager with IAQ experience, or other similarly qualified consultant.

### **What Can You Do To Correct Poor Indoor Air Quality Problems?**

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If ventilation is inadequate, increase the fresh air supply to meet the recommendations of Standard 62.1 2007 of the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE). ASHRAE recommendations are well-respected industry standards and often incorporated into building codes and other regulations. This industry standard recommends ventilation needs in terms of the amount of cubic feet per minute per person of fresh air for rooms and buildings depending upon their usage. For office space, it recommends 5 cfm/person of outdoor air. Check to make sure that the air intakes and exhausts for each room are functioning. For some spaces, ASHRAE recommends minimum exhaust rates, as well. Ventilation adequacy can be verified by measuring the air concentration of carbon dioxide during occupancy.

If indoor sources are the problem, choose alternative products or eliminate the use of troublesome products. Schedule product usage or construction/remodeling for times when it will have the least impact on occupants; consider changing schedules or using flextime or time off for sensitive individuals such as those who are pregnant, those with allergies or those who have respiratory, cardiovascular, or other problems that the exposure could adversely affect. Provide better ventilation or local exhaust ventilation for specific contaminant sources. Ban smoking in the building or provide a smoking lounge with smoke vented to the outside away from any air intakes. Your state, county, or municipality may have smoking prohibitions for your building or work-

place. Purchase new materials or furnishings with low emissions (often these are “green” alternatives). New materials and furnishings could also be purchased in advance and stored where they can be allowed to offgas before being installed in their new locations. Consider increased ventilation or “baking off” for new materials or remodeled areas to speed up the offgassing process. Baking-off involves heating the room, wing, or building (as appropriate) to about 80-85 Fahrenheit for about 12 hours. The air temperature is decreased as low as possible for the next 12 hours while the room is ventilated. This process of heating and cooling can be repeated several times.

If outside sources are the problem, separate air intakes from exhausts or raise exhausts higher to prevent exhaust air from being drawn back inside. ASHRAE 62.1-2007 makes recommendations for minimum separation distances – see if your building meets these. Prevent vehicles from idling for long periods of time near air intakes; some states or cities have health or environmental regulations which forbid idling. Separate a garage’s part of the ventilation system from that servicing the rest of the building. Verify air pressure in the building relative to the outside; a building that is under negative pressure could cause drains, sanitary stacks, or exhaust vents to run backwards.

If biological contamination is the problem, make sure there is adequate cleaning and maintenance of air intakes, filters, and ductwork. Fix leaks, condensation, and standing water in the building or the ventilation system. Send the condensation from coils or air conditioners to a drain. Discard water damaged items and those with porous surfaces. Disinfect nonporous materials.

If building fabric is the problem, baking-off may help. Check insulation to verify its proper installation, and conduct air monitoring.



## **Reasonable Accommodation Under The ADA For Someone Who Needs Better Air Quality (Even After Corrections Are Done)**

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In striving to make the indoor environment not significantly different from the outdoor environment, the building air quality may reach the limit of what is feasible for a whole building performance approach. Despite the best efforts to improve ventilation and remove sources of contaminants, you may discover that the individuals who meet the definition of disability under the ADA due to, for example, very sensitive allergies, a suppressed immune system, or an environmental illness still require some form of reasonable accommodation to be able to perform their job.

The ADA defines an individual with a disability as someone with a physical or mental impairment that substantially limits a major life activity. Major life activities include actions such as caring for oneself, walking, talking, seeing, breathing, and working. In determining whether an impairment is substantially limiting, ameliorative measures such as medications are not considered. In other words, an employee who successfully controls the adverse effects of exposure to poor air quality through the use of medications could nevertheless qualify as disabled if the effects of that exposure in their unmitigated state substantially limit his or her breathing or other major life activity.

A reasonable accommodation is a modification or adjustment to a job, the work environment, or the way things usually are done that enables a qualified individual with a disability to enjoy an equal employment opportunity. Employers are not required to provide any accommodation if it would impose an undue hardship upon that employer's business. This determination of what constitutes an undue burden can vary from one employer to

the next, depending upon the size of the employer's business, its financial resources and other factors.

The following are some options that courts may consider reasonable:

- (1) Consider removing from a room any chemical challenges by stripping the room of any items that could be a problem, such as carpeting or pressed wood products, and provide a plain floor, a metal desk, minimal use of solvent based products, no air fresheners, no pesticides, no fragrances, etc.
- (2) Consider the use of a room-sized air cleaning unit having a carbon filter and high efficiency particulate air filter (HEPA) capable of removing the problem contaminants. Be sure the unit is large enough to handle the air volume needs for the size of the room.
- (3) Consider moving the person to a different work environment such as a different room, wing, or building that has not had recent remodeling or that uses a different HVAC system.

## Resources

ADA Disability and Business  
Technical Assistance Center Hotline  
800.949.4232

Equal Employment Opportunity Commission,  
131 M Street, NE, Washington, DC 20507  
800.669.4000 (voice); 800.669.6820 (TTY); or  
800.669.3362 (publications) or 800.669.3302  
(TTY)

Your local Department of Health at the state or  
county level.

USEPA, Indoor Air Division, Office of Air  
and Radiation, 1200 Pennsylvania Avenue,  
NW, Mail Code 6609 Washington, DC 20460  
202.343.9370  
<http://www.epa.gov>

EPA has a collection of useful publications,  
fact sheets, and tools that can be accessed at  
<http://www.epa.gov/iaq/pubs/index.html>

Indoor Air Quality Scientific Findings  
Resource Bank, an interagency project of the  
Lawrence Berkeley National Laboratory and  
the USEPA.  
<http://eetd.lbl.gov/ied/sfrb/>

USDHHS NIOSH, Division of Surveillance,  
Hazard Evaluations and Field Studies,  
395 E. Street, SW, Suite 9200, Patriots Plaza  
Building, Washington, DC 20201  
800.232.4636  
<http://www.cdc.gov/niosh>

Workplace Health and Safety Program,  
Cornell University, School of Industrial and  
Labor Relations  
237 Main St. – Suite 1200, Buffalo, NY 14203  
716.852.4191  
<http://www.ilr.cornell.edu/healthsafety/>

National Center for Environmental Health  
Strategies,  
1100 Rural Avenue, Voorhees, NJ 08043  
856.816.8820  
<http://www.ncehs.org/>

Human Ecology Action League,  
P.O. Box 509, Stockbridge, GA 30281  
770.389.4519  
<http://www.healnatl.org>

# Disclaimer

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The U.S. Equal Employment Opportunity Commission has reviewed it for accuracy. However, opinions about the Americans with Disabilities Act (ADA) expressed in this material are those of the author, and do not necessarily reflect the viewpoint of the Commission or the publisher. EEOC interpretations of the ADA are reflected in its ADA regulations (29 CFR Part 1630), Technical Assistance Manual for Title I of the Act, and Enforcement Guidance.

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The Equal Employment Opportunity Commission has issued enforcement guidance which provides additional clarification of various elements of the Title I provisions under the ADA. Copies of the guidance documents are available for viewing and downloading from the EEOC web site at:  
<http://www.eeoc.gov>

# About this brochure

This brochure is one of a series on human resources practices and workplace accommodations for persons with disabilities edited by Susanne M. Bruyère, Ph.D., CRC, Director, Employment and Disability Institute, Cornell University ILR School.

It was updated in 2010 by Nellie Brown, M.S., CIH, Statewide Director, Workplace Health and Safety Program, Cornell University ILR School, from her original, which she wrote in 1994 and first updated in 2002.

The full text of this brochure, and others in this series, can be found at [www.hrtps.org](http://www.hrtps.org). More information on accessibility and accommodation is available from the ADA National Network at 800.949.4232 (voice/ TTY), [www.adata.org](http://www.adata.org).

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