

# CAUSES OF POOR INDOOR AIR QUALITY AND WHAT YOU CAN DO ABOUT IT

*Program on Employment and Disability*  
New York State School of Industrial  
and Labor Relations  
CORNELL UNIVERSITY

## What are the typical symptoms of poor indoor air quality?

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

There does not tend to be a rapid, acute onset of symptoms; rather, there are slow, subtle effects. The symptoms are often subjective, and other problems/stresses (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?

An indoor air quality problem (also called "sick building syndrome") consists of the complaints, symptoms, and illnesses believed to be related to contaminants concentrated within buildings. With over 52 million office workers in the United States, plus teachers and students in school buildings, health care professionals and patients in hospitals, residents in apartments, the homeowner, and many others, there is a large population potentially affected. In fact, indoor air is an issue which impacts on the health and productivity of the majority of all working adults and the vast majority of working women.

## What are the causes of poor indoor air quality?

- 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, offgases from new materials
- microorganismal contaminants, or,
- contaminants brought into the building from outside.

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 be a pristine pure environment, but rather that building occupants should not be subjected to air quality which is significantly worse than the air outside.

## How do you find out if your building has an indoor air quality problem?

*Gather information from the 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 building occupants. When collecting information about occupant complaints:

- review the records of complaints; if there are no existing records, begin the use of a complaint log
- interview the occupants, either directly or by the use of a

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questionnaire, or both. Avoid asking questions, particularly about health, which might be unnecessarily intrusive; such as about reproductive history or psychological problems.

- ask occupants to document their observations in an occupant diary.

### *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) 62-1989 recommends that office spaces have 20 cubic feet per minute (cfm)/person of outdoor air provided. Verify this with carbon dioxide measurements; outside there is about 300-350 ppm of carbon dioxide. Inside, the carbon dioxide should be less than 1000 ppm. 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 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.

### *Further monitoring (if needed)*

If the corrections to ventilation 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 or without identification of the bacteria and molds), measurement of particulates (with or without identification of particles and fibers), or chemical analysis for air contaminants (such as formaldehyde, ozone, pesticides, volatile solvents). And, as above, take outdoor measurements as well and compare indoor air with outdoor air. This additional monitoring is usually considerably more expensive than the measurements taken as described above. Consider whether the expense is justified; it may be far more cost-effective to remove the contaminant source than to pay for the testing. Consider whether this additional data will make a difference in the decision to fix or not 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 which are made to improve indoor air quality
- any remaining work which needs to be done and the schedule for its completion.

If the above described investigation

appears to indicate that an indoor quality problem exists, a qualified expert should be consulted to make appropriate recommendations for remediation; such an expert could include an industrial hygienist, ventilation engineer with IAQ experience, HVAC contractor with IAQ experience, safety risk manager with IAQ experience, or other similarly qualified consultant.

### **What can you do to correct poor indoor air quality problems?**

*If ventilation is inadequate*, increase the fresh air supply to meet the recommendations of Standard 62-1989 of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). 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 20 cfm/person of outdoor air. Check to make sure that air intakes and exhausts for each room are functioning. 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 or who have allergies, respiratory, cardiovascular, or other problems which 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. Consider increased ventilation or “baking off” for new materials or remodeled areas. “Baking-off” is a technique for speeding up the offgassing of new materials by heating the room, wing, or building (as appropriate) to about 80-85 fahrenheit for about 12 hours; then drop the air temperature as low as possible for the next 12 hours and ventilate during this cooling cycle. The heating/cooling cycles 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. Prevent vehicles from idling for long periods of time near air intakes. Separate a garage’s part of the ventilation system from that servicing the rest of the building.

*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. Have the condensation from air conditioners go to a floor 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; verify with appropriate air monitoring.

**What could be reasonable accommodation under the ADA for someone who needs better air quality (even after corrections are done)?**

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 an environmental illness still require some form of reasonable accommodation to be able to perform their job. The following are some options which could be considered:

1. Consider removing from a room any chemical challenges by stripping the room of any items which 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, etc.
2. Consider the use of an 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.

**Resources**

**ADA Regional Disability and Business Technical Assistance Center Hotline** - (800) 949-4232 (voice/TTY)

**The Equal Employment Opportunity Commission, 1801 L Street, N.W., Washington, DC 20507**, 800-669-4000 (Voice) to reach EEOC field offices; for publications call (800) 800-3302 or (800)-669-EEOC (voice/TTY).

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

**USEPA**, Indoor Air Division, Office of Air and Radiation, 401 M Street SW, Washington, DC 20460, (703) 308-8470.

**USDHHS - NIOSH**, Division of Surveillance, Hazard Evaluations and Field Studies, 4676 Columbia Parkway, Cincinnati, OH 45226, (513) 841-4428.

**Chemical Hazard Information Program**, Cornell University, School of Industrial and Labor Relations, 110 Pearl Street, 8th Floor, Buffalo, NY 14202-4111, (716) 842-1124.

**National Center for Environmental Health Strategies**, 1100 Rural Avenue, Voorhees, NJ 08043, (609) 429-5358.

**Human Ecology Action League**, P.O. Box 49126, Atlanta, GA 30359-1126, (404) 248-1898.

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This material was produced by the *Program on Employment and Disability*, School of Industrial and Labor Relations - Extension Division, Cornell University, and funded by a grant from the National Institute on Disability and Rehabilitation Research (grant #H133D10155). It has been reviewed for accuracy by the U.S. Equal Employment Opportunity Commission. 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 Equal Employment Opportunity Commission or the publisher. The Commission's interpretations of the ADA are reflected in its ADA regulations (29 CFR Part 1630), its Technical Assistance Manual for Title I of the Act and in various enforcement guidance.

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In addition to serving as a National Materials Development Project on the Employment Provisions of the Americans with Disabilities Act of 1990, the *Program on Employment and Disability* also serves as the training division of the Northeast Disability and Business Technical Assistance Center. This publication is one of a series edited by Susanne M. Bruyère, Ph.D., C.R.C., Director of the ILR Program on Employment and Disability at Cornell University.

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- ❖ Working Effectively with Persons who have Cognitive Disabilities
- ❖ Workplace Accommodations for Persons with Musculoskeletal Disorders
- ❖ Working Effectively with Employees who have Sustained a Brain Injury
- ❖ Employing and Accommodating Workers with Psychiatric Disabilities
- ❖ Employing and Accommodating Individuals with Histories of Alcohol and Drug Abuse
- ❖ Employment Considerations for People who have Diabetes
- ❖ Accommodating the Allergic Employee in the Workplace
- ❖ Causes of Poor Indoor Air Quality and What You Can Do About It
- ❖ Working Effectively with People with Learning Disabilities
- ❖ Working Effectively with Individuals who are HIV-Positive

These and other informational brochures can be accessed on the World Wide Web at:  
[www.ilr.cornell.edu/ped/ada](http://www.ilr.cornell.edu/ped/ada)

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