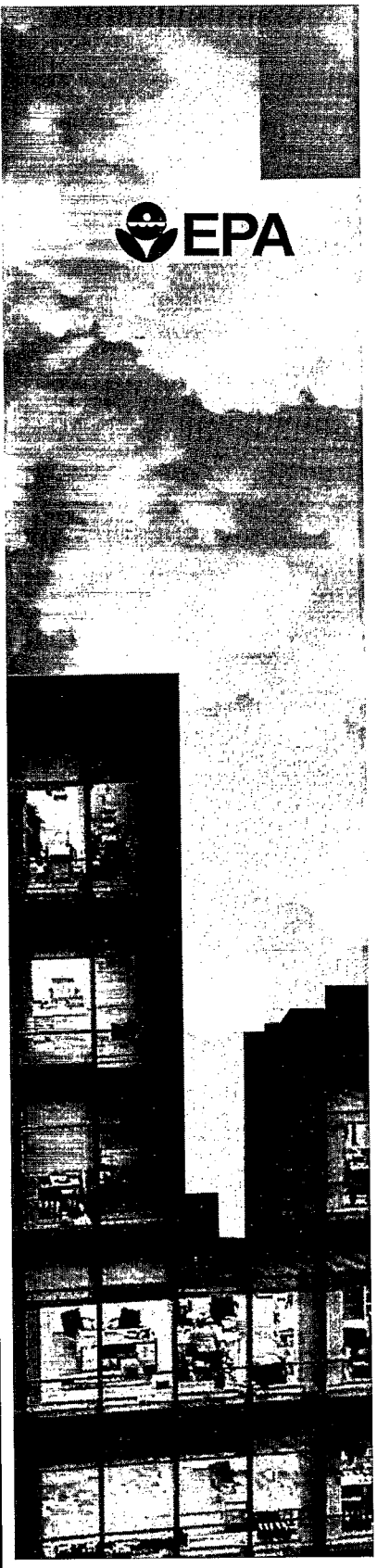
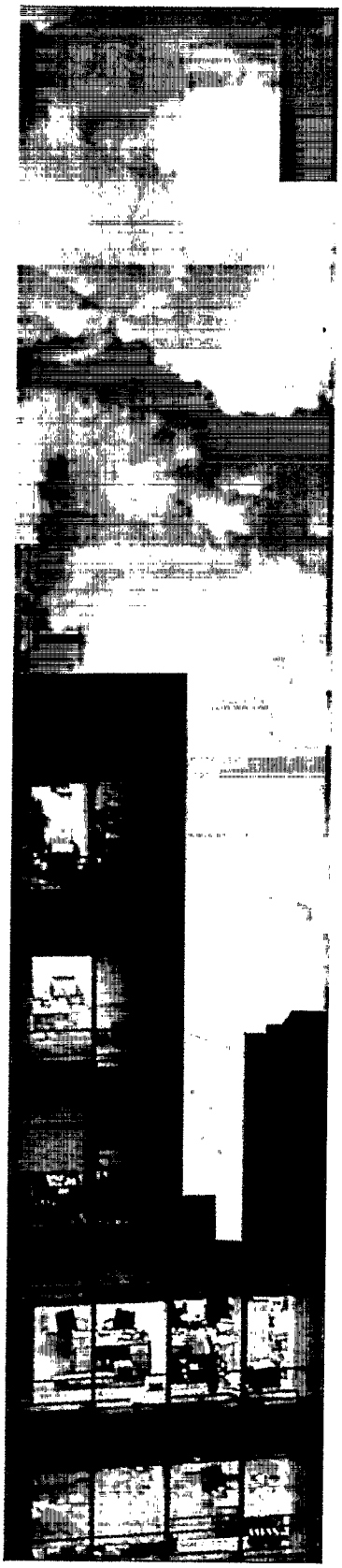


United States
Environmental Protection
Agency

Indoor Environments
Division (6604J)
Office of Air and Radiation

EPA-402-K-97-003
October 1997

An Office Building Occupant's Guide to Indoor Air Quality



A Summary of What You'll Learn Inside...

What You Can Do to Improve the Indoor Air in Your Office:

- Do not block air vents or grilles.
- Comply with the office and building smoking policy.
- Water and maintain office plants properly.
- Dispose of garbage promptly and properly.
- Store food properly.
- Avoid bringing products into the building that could release harmful or bothersome odors or contaminants.
- Notify your building or facility manager immediately if you suspect an indoor air quality problem.

If You Manage an Office:

- Maintain a good working relationship with building management on indoor environmental issues.
- Place office furniture and equipment with air circulation, temperature control, and pollutant removal functions of the heating, ventilating, and air conditioning (HVAC) system in mind.
- Coordinate with building management in instances when responsibilty for design, operation, and maintenance of the ventilation system is shared.
- Establish an effective smoking policy that protects nonsmokers from involuntary exposure to secondhand smoke.
- Avoid procedures and products that can cause indoor air quality problems.
- Integrate indoor air quality concerns into your purchasing decisions.
- Work with the building manager to ensure use of only necessary and appropriate pest control practices, and nonchemical methods where possible.
- Work with building management and the contractor before you remodel or renovate to identify ways of keeping building occupant exposure to pollutants to a minimum and to ensure that the air distribution system is not disrupted.
- Encourage building management to develop a preventive indoor air quality management program following guidance issued by EPA and the National Institute for Occupational Safety and Health (NIOSH).

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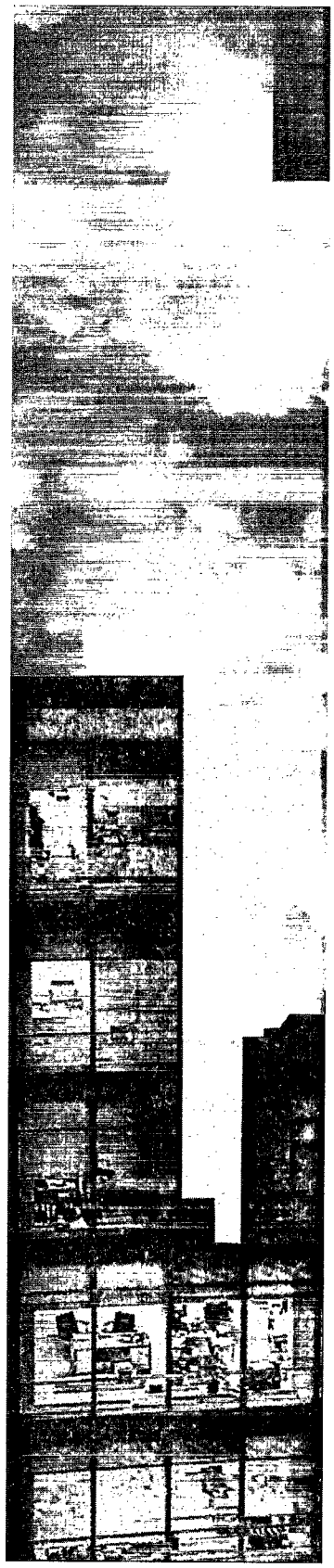
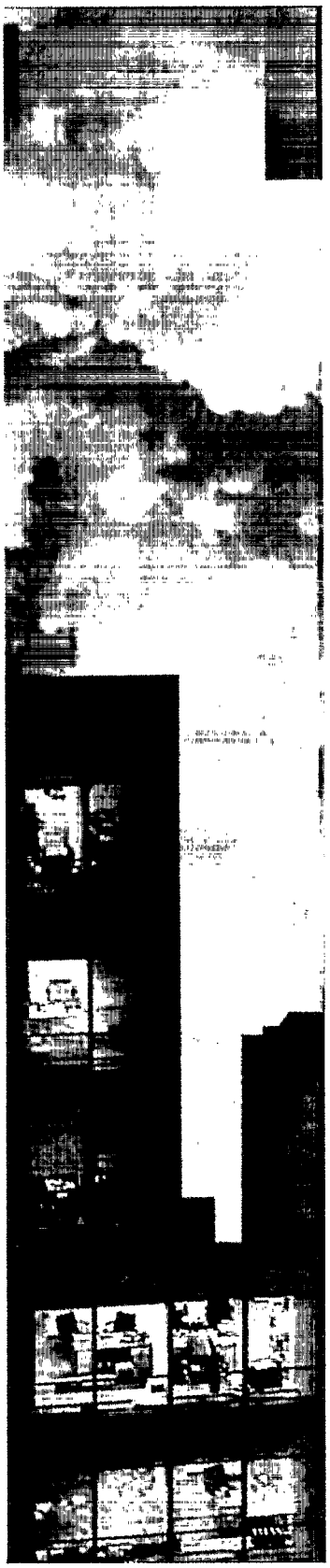




About This Booklet

This booklet is intended to help people who work in office buildings learn about the factors that contribute to indoor air quality and comfort problems and the roles of building managers and occupants in maintaining a good indoor environment. Because good indoor air quality depends on the actions of everyone in the building, a partnership between building management and occupants is the best way to maintain a healthy and productive work space.

Relationships and procedures between management and occupants will vary from building to building. Some buildings are occupied entirely by the employees of the building owner, and in most of these buildings, the responsibility for indoor air quality management may be handled by a central department or office. In other buildings, where one or more building occupants rent space under separate leases, building management may have limited control over the day-to-day activities in the leased space. Likewise, the occupants of such buildings may have little control over central building services such as heating and cooling, elevator services, housekeeping, and waste and pest management. For these reasons, occupants and management in leased space buildings will need to closely coordinate their indoor environmental management strategies.

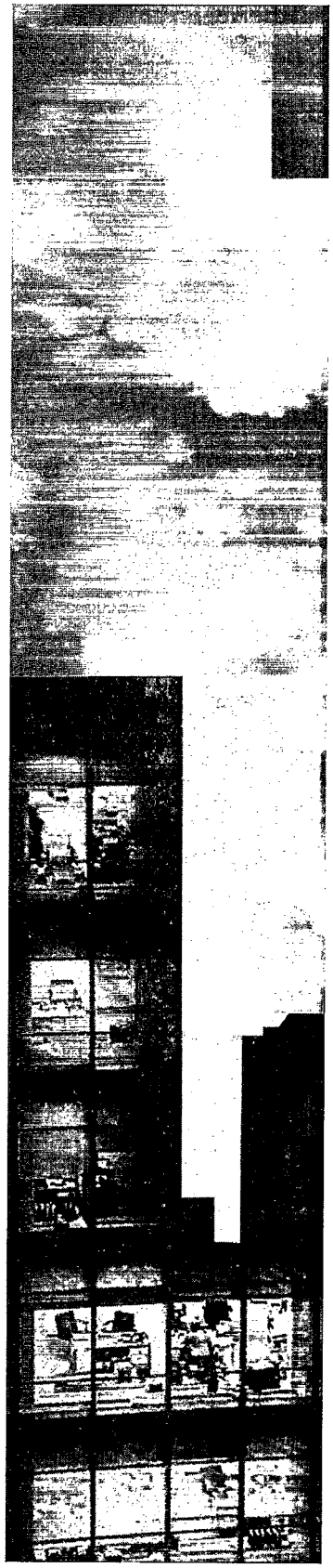
Why is Indoor Air Quality Important?

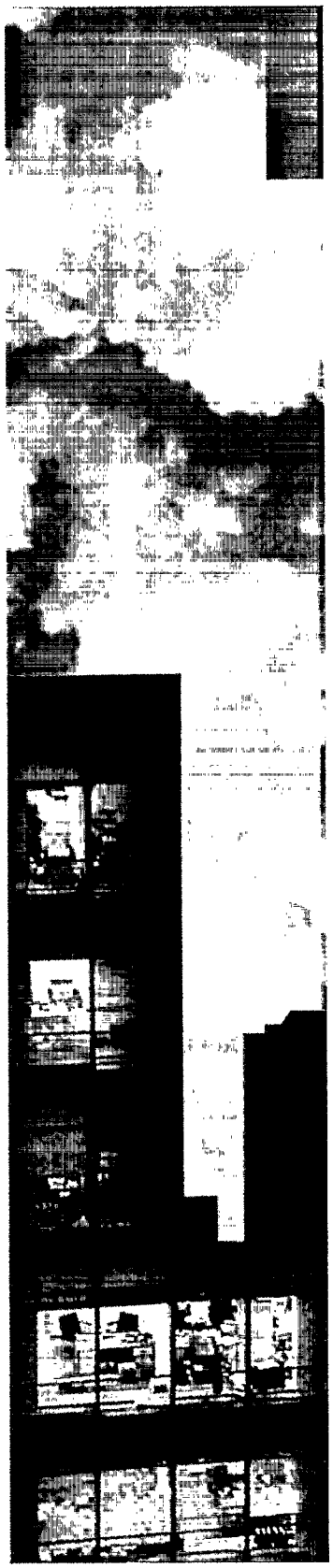
Indoor air quality is a major concern to businesses, building managers, tenants, and employees because it can impact the health, comfort, well being, and productivity of building occupants.

Most Americans spend up to 90% of their time indoors and many spend most of their working hours in an office environment. Studies conducted by the U.S. Environmental Protection Agency (EPA) and others show that indoor environments sometimes can have levels of pollutants that are actually higher than levels found outside.

Pollutants in our indoor environment can increase the risk of illness. Several studies by EPA, states, and independent scientific panels have consistently ranked indoor air pollution as an important environmental health problem. While most buildings do not have severe indoor air quality problems, even well-run buildings can sometimes experience episodes of poor indoor air quality.

A 1989 EPA Report to Congress concluded that improved indoor air quality can result in higher productivity and fewer lost work days. EPA estimates that poor indoor air may cost the nation tens of billions of dollars each year in lost productivity and medical care.





Factors that Contribute to Indoor Air Quality

Indoor air quality is not a simple, easily defined concept like a desk or a leaky faucet. It is a constantly changing interaction of complex factors that affect the types, levels, and importance of pollutants in indoor environments. These factors include: sources of pollutants or odors; design, maintenance and operation of building ventilation systems; moisture and humidity; and occupant perceptions and susceptibilities. In addition, there are many other factors that affect comfort or perception of indoor air quality.

Controlling indoor air quality involves integrating three main strategies. First, manage the sources of pollutants either by removing them from the building or isolating them from people through physical barriers, air pressure relationships, or by controlling the timing of their use. Second, dilute pollutants and remove them from the building through ventilation. Third, use filtration to clean the air of pollutants.

Management of Pollutant Sources, both Inside and Outside the Building

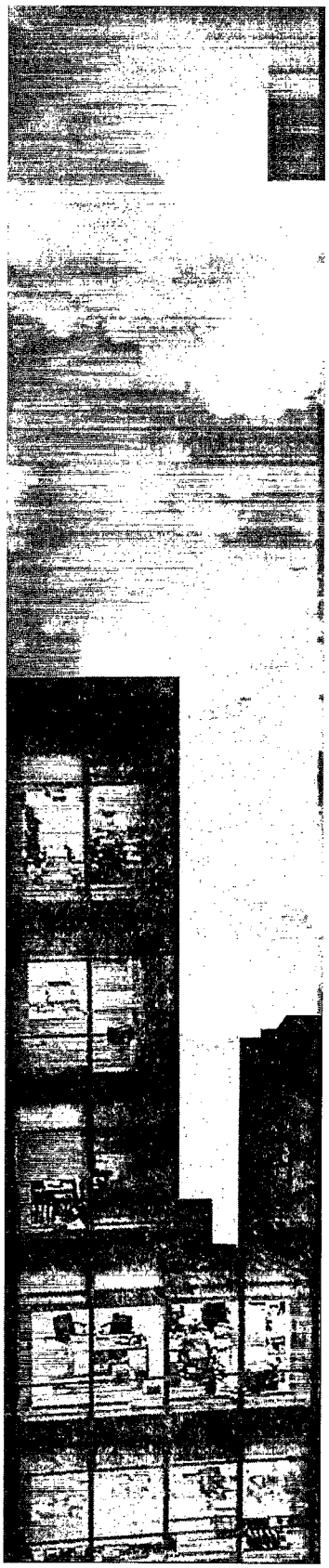
Pollutants can be generated by outdoor or indoor sources, including building maintenance activities, pest control, housekeeping, renovation or remodeling, new furnishings or finishes, and building occupant activities.

One important goal of an indoor air quality program is to minimize people's exposure to pollutants from these sources. Some of the key pollutant categories include:

- **Biological contaminants.** Excessive concentrations of bacteria, viruses, fungi (including molds), dust mite allergen, animal dander, and pollen may result from inadequate maintenance and housekeeping, water spills, inadequate humidity control, condensation, or may be brought into the building by occupants, infiltration, or ventilation air. Allergic responses to indoor biological pollutant exposures cause symptoms in allergic individuals and also play a key role in triggering asthma episodes for an estimated 15 million Americans.

- **Chemical pollutants.** Sources of chemical pollutants include tobacco smoke, emissions from products used in the building (e.g., office equipment; furniture, wall and floor coverings; and cleaning and consumer products) accidental spill of chemicals, and gases such as carbon monoxide and nitrogen dioxide, which are products of combustion.

• **Particles.** Particles are solid or liquid substances which are light enough to be suspended in the air, the largest of which may be visible in sunbeams streaming into a room. However, smaller particles that you cannot see are likely to be more harmful to health. Particles of dust, dirt, or other substances may be drawn into the building from outside and can also be produced by activities that occur in buildings, like sanding wood or drywall, printing, copying, operating equipment, and smoking.



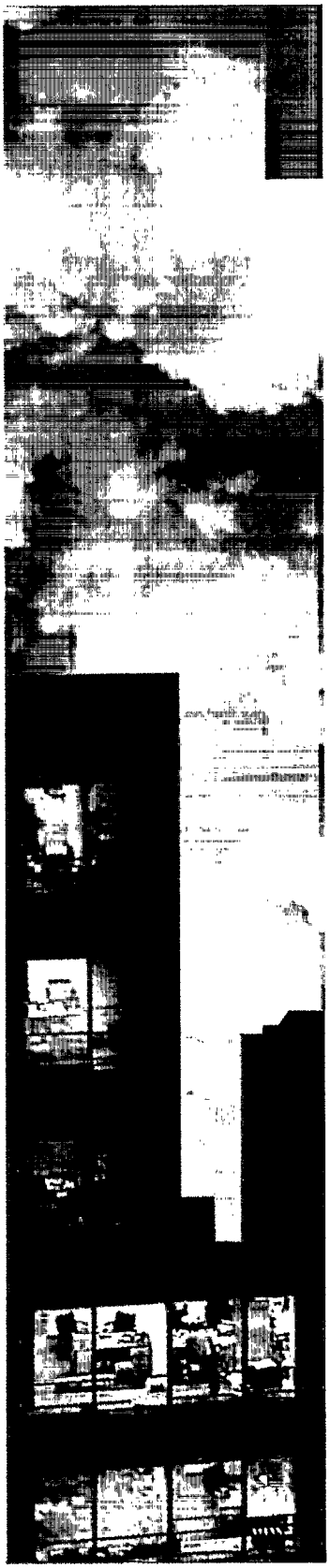
Type of Pollutant

Many different factors influence how indoor air pollutants impact occupants. Some pollutants, like radon, are of concern because exposure to high levels of the pollutant over long periods of time increases risk of serious, life threatening illnesses, such as lung cancer. Other contaminants, such as carbon monoxide at very high levels, can cause death within minutes. Some pollutants can cause both short and long term health problems. Prolonged exposure to environmental tobacco smoke can cause lung cancer, and short term exposures can result in irritation and significant respiratory problems for some people, particularly young children.

People can react very differently when exposed to the same contaminants at similar concentrations. For example, some people can develop severe allergic reactions to biological contaminants to which other people will not react. Similarly, exposure to very low levels of chemicals may be irritating to some people but not others. For people with asthma and other pre-existing conditions, exposure to irritants like environmental tobacco smoke or gases or particles from various indoor sources may cause more severe reactions than the same exposure would in others.

Moisture and Humidity

It is important to control moisture and relative humidity in occupied spaces. The presence of moisture and dirt can cause molds and other biological contaminants to thrive. Relative humidity levels that are too high can contribute to the growth and spread of unhealthy biological pollutants, as can failure to dry water-damaged materials promptly (usually within 24 hours) or to properly maintain equipment with water reservoirs or drain pans (e.g., humidifiers, refrigerators, and ventilation equipment). Humidity levels that are too low, however, may contribute to irritated mucous membranes, dry eyes, and sinus discomfort.



Design, Maintenance and Operation of Building Ventilation Systems

Maintaining good indoor air quality requires attention to the building's heating, ventilation, and air conditioning (HVAC) system; the design and layout of the space; and pollutant source management. HVAC systems include all of the equipment used to ventilate, heat, and cool the building; to move the air around the building (ductwork); and to filter and clean the air. These systems can have a significant impact on how pollutants are distributed and removed. HVAC systems can even act as sources of pollutants in some cases, such as when ventilation air filters become contaminated with dirt and/or moisture and when microbial growth results from stagnant water in drip pans or from uncontrolled moisture inside of air ducts. Because of the HVAC system's importance, good indoor air quality management includes attention to:

- **Ventilation system design.** The air delivery capacity of an HVAC system is based in part on the projected number of people and amount of equipment in a building. When areas in a building are used differently than their original purpose, the HVAC system may require modification to accommodate these changes. For example, if a storage area is converted into space occupied by people, the HVAC system may require alteration to deliver enough conditioned air to the space.

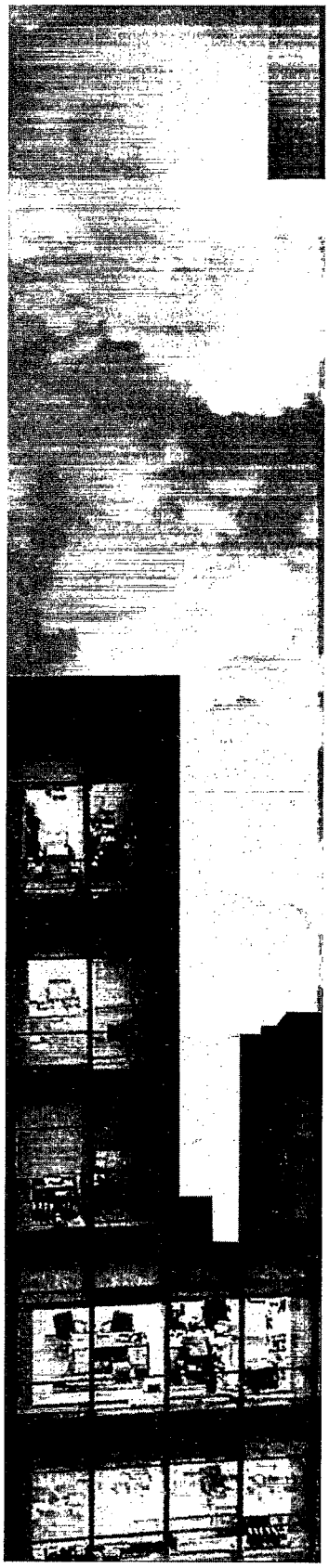
- **Outside air supply**. Adequate supply of outside air, typically delivered through the HVAC system, is necessary in any office environment to dilute pollutants that are released by equipment, building materials, furnishings, products, and people. Distribution of ventilation air to occupied spaces is essential for comfort.

- **Outdoor air quality**. When present, outdoor air pollutants such as carbon monoxide, pollen, and dust may affect indoor conditions when outside air is taken into the building's ventilation system. Properly installed and maintained filters can trap many of the particles in this outdoor supply air. Controlling gaseous or chemical pollutants may require more specialized filtration equipment.

- **Space planning.** The use and placement of furniture and equipment may affect the delivery of air to an occupied space. For instance, the placement of heat generating equipment, like a computer, directly under an HVAC control device such as a thermostat may cause the HVAC system to deliver too much cool air, because the thermostat senses that the area is too warm. Furniture or partitions that block supply or return air registers can affect IAQ as well, and need to be positioned with attention to air flow.

• **Equipment maintenance.** Diligent maintenance of HVAC equipment is essential for the adequate delivery and quality of building air. All well-run buildings have preventive maintenance programs that help ensure the proper functioning of HVAC systems.

• **Controlling other pollutant pathways.** Pollutants can spread throughout a building by moving through stairwells, elevator shafts, wall spaces, and utility chases. Special ventilation or other control measures may be needed for some sources.



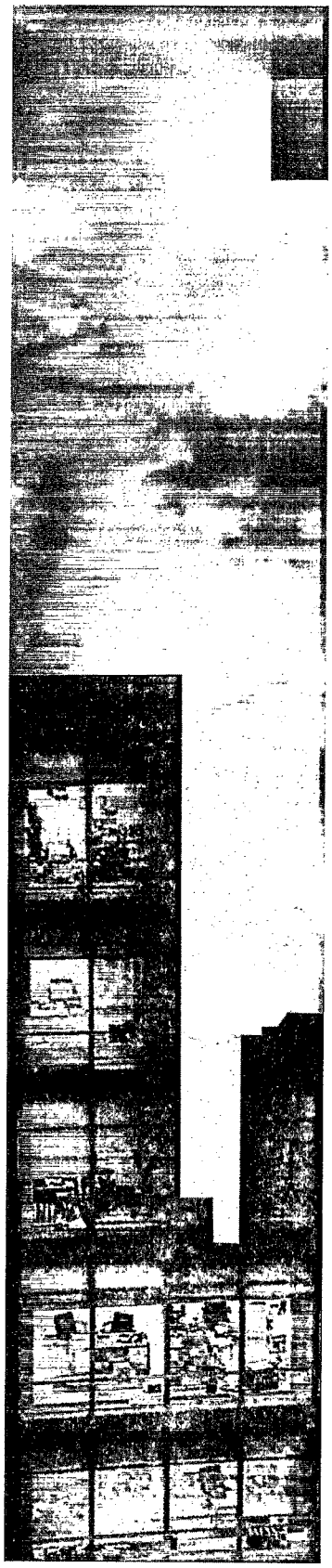
Factors that Affect Occupant Comfort and Productivity

Besides the factors that directly impact the levels of pollutants to which people are exposed, a number of environmental and personal factors can affect how people perceive air quality. Some of these factors affect both the levels of pollutants and perceptions of air quality.

- Odors
- Temperature — too hot or cold
- Air velocity and movement — too drafty or stuffy
- Heat or glare from sunlight
- Glare from ceiling lights, especially on monitor screens
- Furniture crowding
- Stress in the workplace or home
- Feelings about physical aspects of the workplace: location, work environment, availability of natural light, and the aesthetics of office design, such as color and style.
- Work space ergonomics, including height and location of computer, and adjustability of keyboards and desk chairs
- Noise and vibration levels
- Selection, location, and use of office equipment

Ask your supervisor or office manager who to talk with if you have a concern about any of these factors.

Indoor Air Quality is a Shared Responsibility



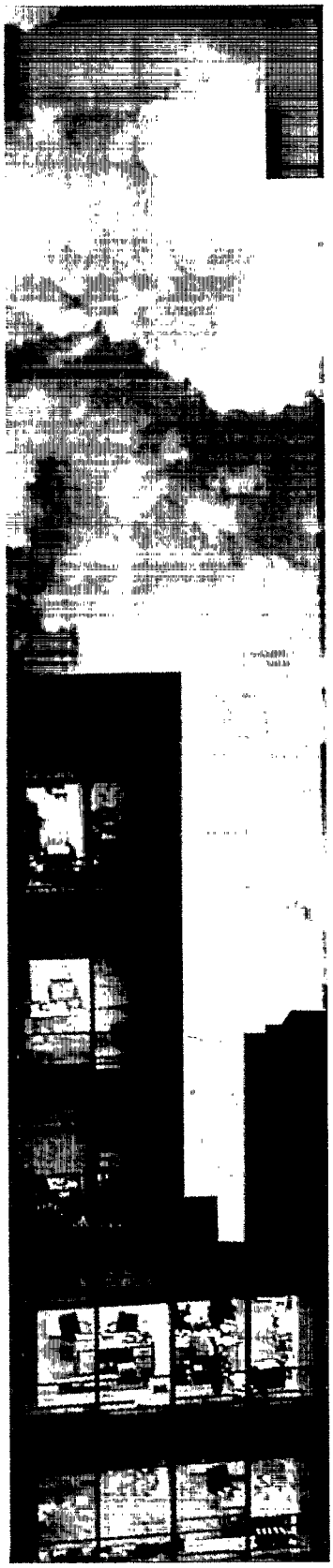
Some of the factors that contribute to poor indoor air quality may originate from inadequate HVAC design. Some may be solely in the control of the building management, such as maintenance of the HVAC system and the amount of outside air being mechanically brought into the building. Others are largely in the control of building tenants and occupants, such as materials used in renovations and products and furnishings brought into or used in the building by occupants. Some, like cleanliness and general housekeeping of the building, require the cooperation of both the building management as well as all of the individuals who work in the building. For these reasons, indoor air quality is a shared responsibility.

Good indoor air quality management practices can make a big difference. However, some factors, like reactions to indoor air contaminants among highly susceptible individuals, or the quality of the outside air, may not be within anyone's immediate control. It is also important to remember that any building, no matter how well operated, may experience periods of unacceptable indoor air quality due to equipment breakdown, inadequate maintenance, or in some cases, the actions of building occupants.

It is also important to keep in mind that many perceived indoor air quality problems are often comfort problems, such as temperature, humidity, or air movement in the space being too low or too high. In addition, many symptoms, such as headaches, can have causes that are not related to factors in the building.

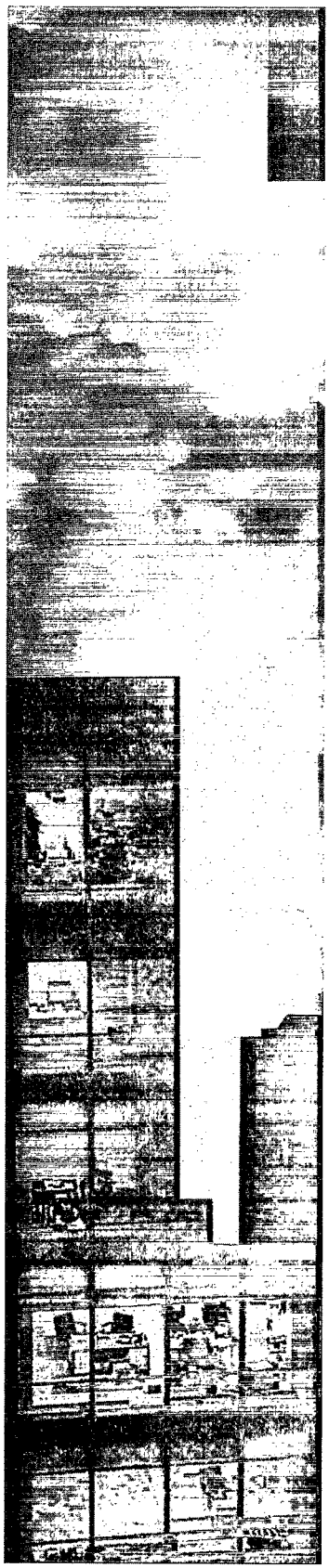
The Good News...

Even though the factors that affect the quality of the indoor environment are numerous, the good news is that most indoor environmental problems can be prevented or corrected easily and inexpensively through the application of common sense and vigilance on the part of everyone in the building. Success depends on cooperative actions taken by building management and occupants to improve and maintain indoor air quality. By becoming knowledgeable about indoor air quality, tenants and occupants are in a good position to help building managers maintain a comfortable and healthy building environment. Work with management any time you:



- Identify or suspect an indoor air problem
- Need cleaning and maintenance service
- Plan to install new office equipment
- Plan for renovations and/or remodeling with a professional interior designer and/or an architect
- Experience leaks, spills, or accidents

Things *Everyone* in the Building Can Do



All of the occupants of a building can have a great influence on indoor air quality. Everyday activities like heating food in a microwave and using the photocopier can generate odors and pollutants. By being aware of indoor air issues, occupants can help prevent problems. Here are some things you can do:

- **Do not block air vents or grilles**. Keep supply vents or return air grilles unblocked, so you won't unbalance the HVAC system or affect the ventilation of a neighboring office. Furniture, boxes or other materials near supply vents or return air grilles may also affect air flow. Follow your office's procedures to notify building management if your space is too hot, too cold, stuffy or drafty.

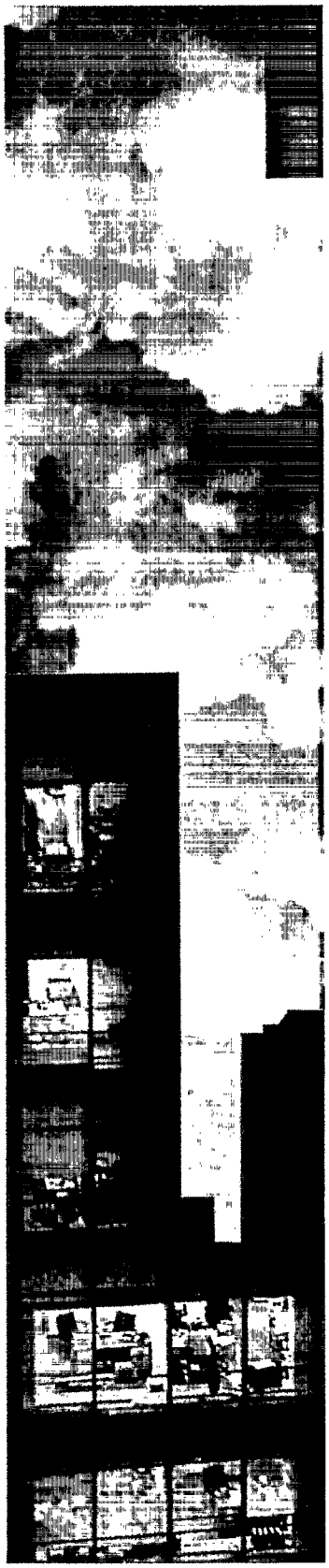
- **Comply with the office and building smoking policy.** Smoke in designated areas only.

- **Clean up all water spills promptly, water and maintain office plants properly and report water leaks right away**. Water creates a hospitable environment for the growth of micro-organisms such as molds or fungi. Some of these microbes, if they become airborne, can cause health problems.

- **Dispose of garbage promptly and properly**. Dispose of garbage in appropriate containers that are emptied daily to prevent odors and biological contamination.

- **Store food properly**. Food attracts pests. Some foods, if left unrefrigerated, can spoil and generate unpleasant odors. Never store perishable food products in your desk or on shelves. Refrigerators should be cleaned on a regular basis to prevent odors. Keep kitchens and dining areas clean and sanitize as necessary to prevent pests and maintain hygiene.

- **Notify your building or facility manager immediately if you suspect an IAQ problem.** This helps management determine the cause of the problem quickly so that a timely solution can be reached.



What the Office Manager/Tenant Can Do

In leased space, the office manager or other person responsible for office policies and/or relations with the property owner is often in a position to directly and significantly impact indoor air quality in the space. For some businesses, responsibility for dealing with air quality issues may involve more than one person. The office manager should follow the business's internal procedures in dealing with the building management. Some of the things this person can do to improve indoor air quality include:

- **Maintain a good working relationship with building management on indoor environmental issues.** Cooperative efforts are the best way to solve many indoor air quality problems. Follow your internal guidelines to ensure that building facility management is informed of, and involved in, all indoor air quality issues. Be as knowledgeable as possible when dealing with building management on indoor air issues.

- **Place office furniture, partitions, and equipment with air circulation, temperature control, and pollutant removal functions of the HVAC system in mind.** Make sure air supply vents and return grilles are not blocked by furniture or equipment. Computers and other heat-producing equipment placed near or under an HVAC sensor device system can trigger cooling, even if the actual temperature for occupants is cool. Place such equipment away from HVAC sensors to avoid this kind of situation.

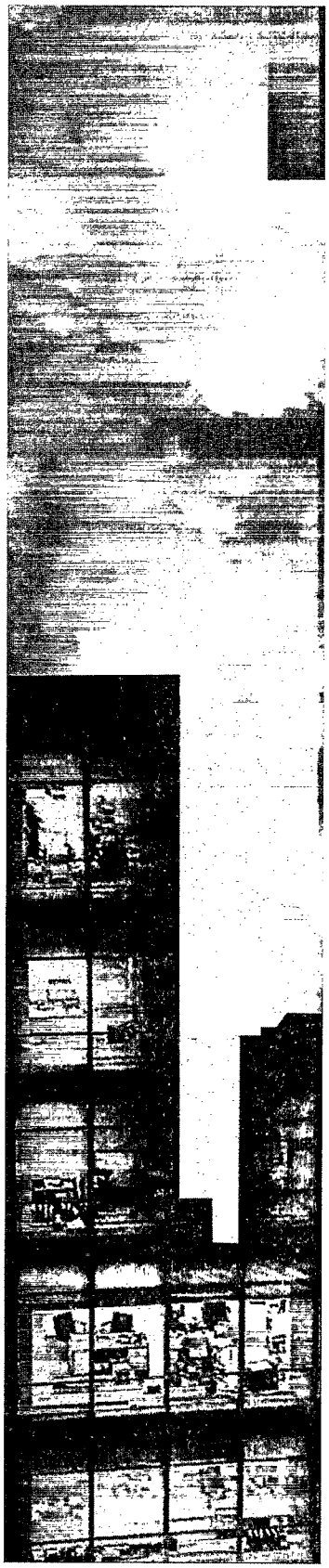
- **Coordinate with building management in instances when responsibility for design, operation, and maintenance of the HVAC system is shared.** Sometimes the portion of the HVAC system servicing a leased space is the responsibility of the tenant. In such cases, work closely with building management to ensure that all parts of the building are receiving optimal service from the system. Ensure that filters in window air conditioners and perimeter heating and cooling units are changed frequently.

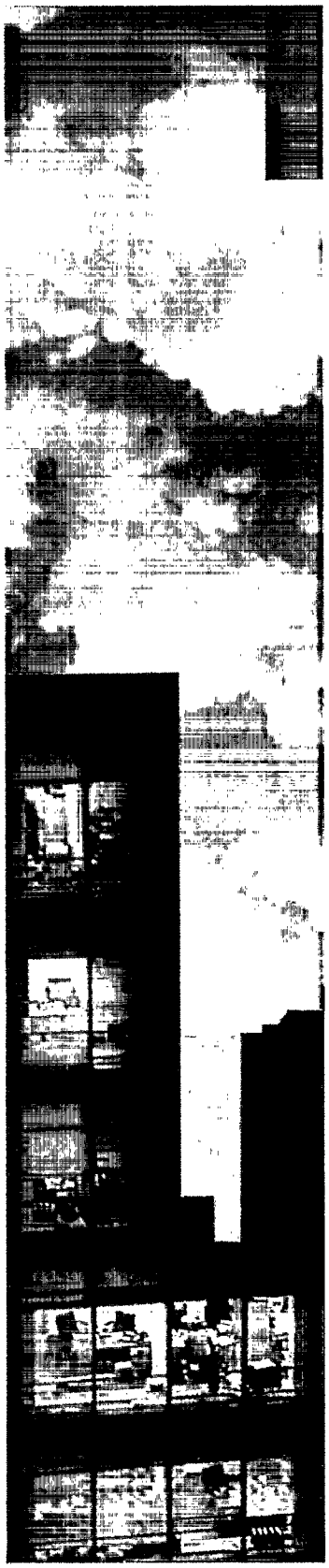
- **Establish an effective smoking policy.** Most of us today are aware of the health risks of smoking, not only to smokers, but to those who are exposed to secondhand smoke. In addition, environmental tobacco smoke in a building can increase costs for maintaining the ventilation system and for cleaning and replacing smoke-soiled furnishings and materials. Establish a smoke-free policy in the space under your control or work with building management to design properly ventilated smoking rooms that don't allow smoke to circulate through the central ventilation system or to adjoining spaces.

• **Avoid procedures and products that can cause problems.** Many common products used in offices, like solvents, adhesives, cleaners, and pesticides can give off pollutants and odors, as can office equipment such as copiers, printers, and fax machines. If any of these items are used in the office environment, adequate and sometimes separate ventilation should be provided. If your organization engages in activities that may generate pollutants, such as photographic or printing processes, exhaust ventilation will be especially important. Pollutants and odors (which may or may not indicate a health concern) generated in your space may not only bother those in the immediate area, but may enter the building ventilation system and cause problems for other tenants in other parts of the building.

• **Integrate indoor air quality concerns into your purchasing decisions.** Take steps to reduce exposures to contaminants from cleaning products, and from new furnishings and building materials, when odors and chemical emissions are usually highest. Ask the designers, suppliers, and manufacturers to provide information on chemical emissions from products and any potential associated respiratory hazards. While emissions information may not yet be available for many products, many product manufacturers are starting to do emissions testing. The more consumers request such information, the sooner it will become widely available.

• **Work with the building owner or manager to ensure use of only necessary and appropriate pest control practices, and non-chemical methods where possible.** Pesticides can contribute to poor indoor air quality and can cause serious health effects when used improperly. Unacceptable levels of pest activity and damage should be prevented by the most economical means and with the least possible hazard to people, property, and the environment. For example, if roaches are a problem, seal their entry points and properly store and dispose of food as part of a long term control strategy. If a chemical pesticide is selected, it should be used in strict accordance with label directions. To reduce airborne exposure to pesticides, consider using baits to kill pests instead of spraying. Work with building management to select the most appropriate pesticide to achieve your purpose, and do not purchase or use more than needed.



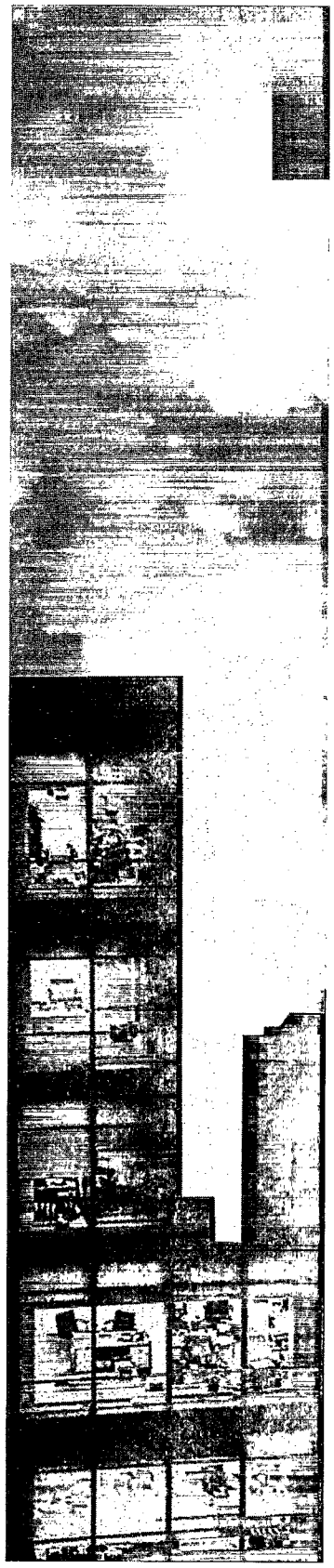


- **Work with building management and contractors before you conduct remodeling or renovation activities to identify ways of keeping exposure to pollutants to a minimum.**

Properly isolating the area to be remodeled or renovated from other spaces and the HVAC systems, and scheduling these activities for evenings and weekends if possible, can go a long way toward minimizing potential occupant problems. If the renovation work is contracted through you, ensure that the architect or interior designer and contractor are made aware, in advance, of the practices and procedures to be used during construction activities. If possible, try to arrange for plastic wrappings to be removed from partitions, carpet rolls, and other new materials before they are brought into the space. Ask to have the materials aired out in a clean, dry location outside the building for a few days before installation. This can significantly reduce chemical emissions and odors inside the building.

- **Encourage building management to obtain and use the joint EPA/NIOSH guidance document entitled: *Building Air Quality: A Guide for Building Owners and Facility Managers.*** EPA and the National Institute for Occupational Safety and Health (NIOSH) have published comprehensive guidance for building owners and managers to help them prevent and solve indoor air quality problems. Ensuring that your building management is knowledgeable about and committed to management of indoor air quality issues is an essential first step in preventing and fixing indoor air problems.

What Building Facility Managers Can Do to Promote Good Indoor Air Quality



As an occupant of an office building, understanding the role of the building management in maintaining a healthy and comfortable indoor environment is an important step in understanding how you can fit into the picture. EPA and NIOSH recommend that every building manager obtain and use the *Building Air Quality* guidance (see page 18) to:

- **Designate an Indoor Air Quality Representative, who serves as the contact for indoor environment issues.** The IAQ representative should be accountable for the quality of the indoor environment and should have the authority, knowledge, and training to oversee or carry out the following steps in a good indoor air quality management plan:

- **Assess the current condition of the indoor air in the building by:**
  — identifying and reviewing records pertaining to the HVAC design and operation
  — developing an indoor air profile of the building, identifying potential pollutant sources, if feasible

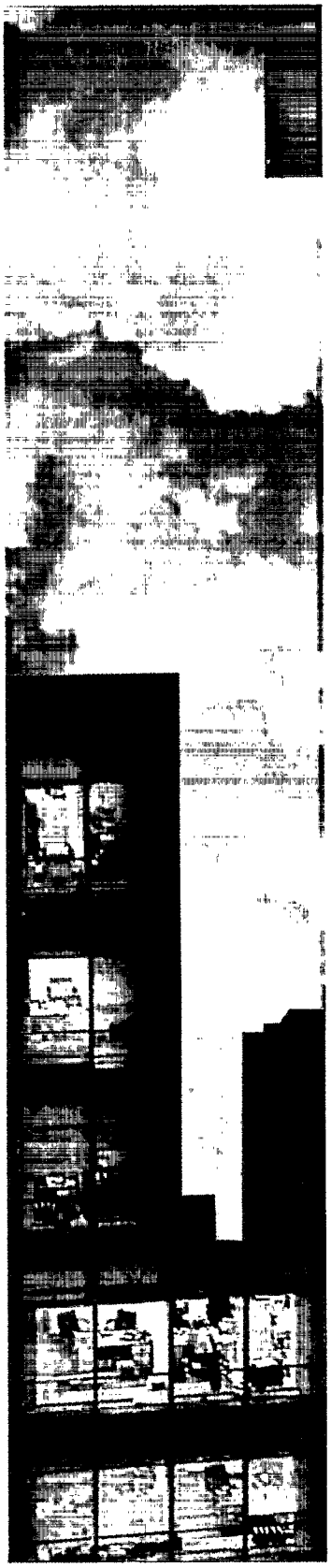
- **Address any existing and potential indoor air quality problems.**

- **Educate building staff about indoor air quality management by:**
  — providing training opportunities
  — establishing clear pollutant source management policies

- **Operate and maintain the building and ventilation system for good indoor air by:**
  — establishing or reinforcing standard operating and maintenance procedures
  — responding quickly to leaks, floods, and other accidents that occur in buildings to prevent indoor air quality problems from developing

- **Manage potential pollutant sources such as:**
  — smoking
  — remodeling and renovation materials and furnishings
  — housekeeping and pest control products
  — exhaust fumes from loading docks or garages

- **Communicate with tenants and occupants about their roles in maintaining good indoor air quality.**



- **Establish clear procedures for responding to indoor air-related complaints.**

- **Keep a record of reported health complaints to aid in solving indoor air-related problems.** This will help improve the chances of correctly diagnosing and then fixing problems, especially if a pattern in complaints can be detected.

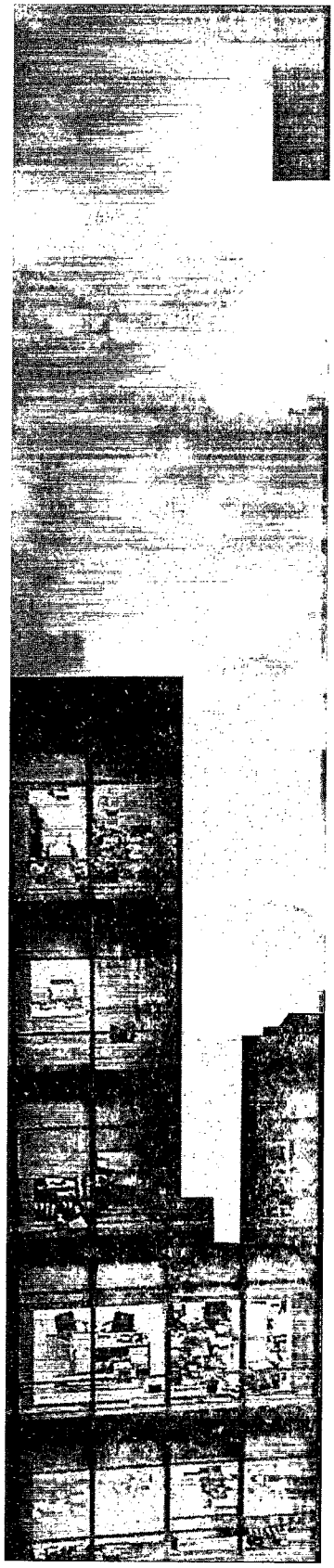
If You Think Your Building Has an Indoor Air Quality Problem...

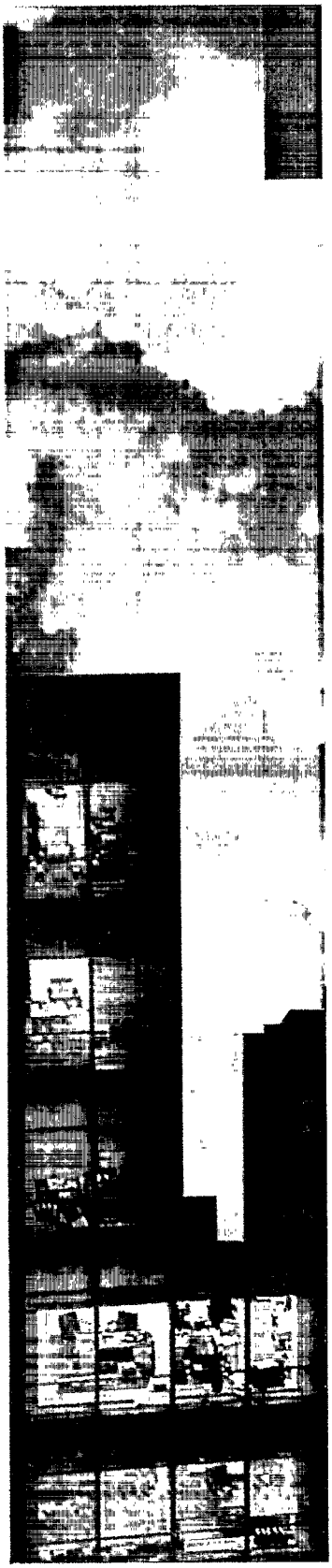
If you or others at your office are experiencing health or comfort problems that you suspect may be caused by indoor pollution, you can:

- **Inform the building management of your concerns through your usual and proper channels.**

- **Talk with your doctor or other health care provider, and report your problems to the company physician, nurse, or health and safety officer.** Ask that person if you should call your state or local health department to discuss your symptoms and possible causes.

- **Cooperate with management during any indoor air quality investigation** to aid the sometimes difficult process of identifying and solving problems.





For More Information...

There are many sources of additional information on indoor air quality in offices, homes, and schools and what people can do to ensure that their indoor environment is a healthy one. To obtain a list of available publications, contact EPA's:

Indoor Air Quality Information Clearinghouse
800 438-4318
P.O. Box 37133
Washington, DC 20013-7133
202 484-1307
FAX 202 484-1510
e-mail: iaqinfo@aol.com

Visit EPA's Indoor Air Quality Home Page on the World Wide Web:

www.epa.gov/iaq/

Building Air Quality: A Guide for Building Owners and Facility Managers
is available from:

Superintendent of Documents
PO Box 371954
Pittsburgh, PA 15250-7954
Order #: S/N 055-000-00390-4; Price $24.

US EPA Regional Indoor Air Contacts

US EPA Region 1
JFK Federal Building (ATO)
Boston, MA 02203-2211
Phone (617) 565-3232
Fax (617) 565-4940

US EPA Region 2, (AWM-RAD)
290 Broadway, 28th Floor
New York, NY 10007-1866
Phone (212) 637-4005
Fax (212) 637-4942

US EPA Region 3
(3AT32)
841 Chestnut Building
Philadelphia, PA 19107
Phone (215) 566-2083
Fax (215) 566-2134

US EPA Region 4
100 Alabama Street, SW
Atlanta, GA 30303-3104
Phone (404) 562-9143
Fax (404) 562-9095

US EPA Region 5
Mail Code (AE-17J)
77 West Jackson Blvd.
Chicago, IL 60604-3590
Phone (312) 886-6053
Fax (312) 353-8289

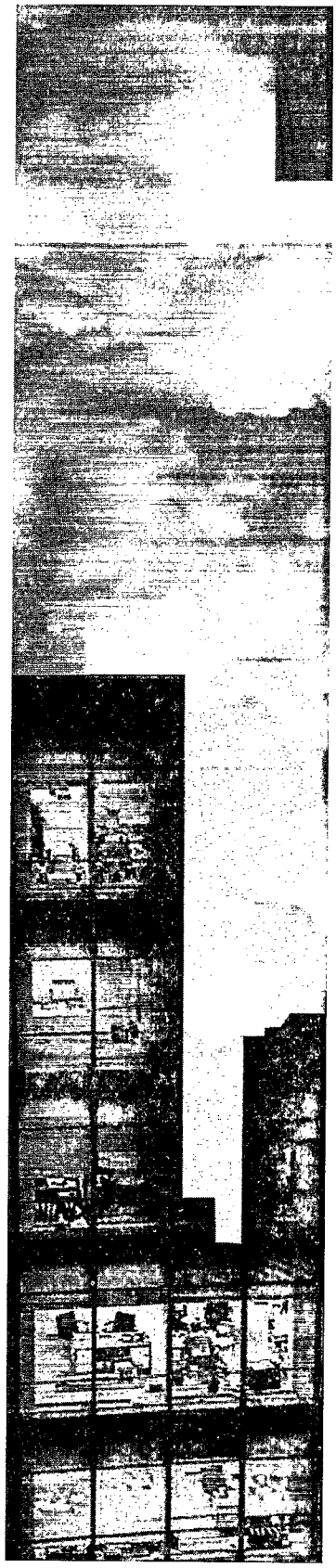
US EPA Region 6
1445 Ross Ave.(6PD-T))
Dallas, TX 75202-2733
Phone (214) 665-7547
Fax (214) 665-6762

US EPA Region 7
726 Minnesota Ave.
Kansas City, KS 66101
Phone (913) 551-7604
Fax (913) 551-7065

US EPA Region 8
(P2-TX)
999 18th Street, Suite 500
Denver, CO 80202-2466
Phone (303) 312-6024
Fax (303) 312-6044

US EPA Region 9, (Air-6)
75 Hawthorne Street
San Francisco, CA 94105
Phone (415) 744-1132
Fax (415) 744-1073

US EPA Region 10
(OAQ-107)
1200 Sixth Avenue
Seattle, WA 98101
Phone (206) 553-2589
Fax (206) 553-0110



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