

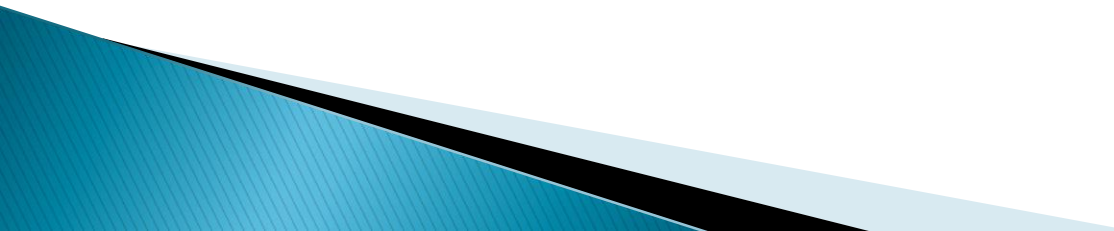


**Buildings and Human Habitation, Department of
Environmental Health September 2016, 4th Year**

Sick Building Syndrome and Indoor Air Quality (IAQ)




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Definitions of Sick Building Syndrome

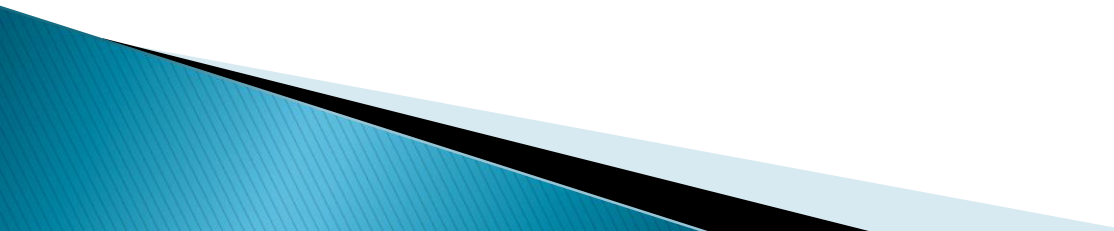
A syndrome is a collection of signs or symptoms of ill health. A building is a constructed enclosure with walls, a roof, doors and windows. A building is constructed to protect people and/ or objects from the outdoor climate.

Many people work, or have a home, in a building. A person with ill health is sick. Buildings cannot really have ill health, but the indoor environment enclosed space can have airborne contaminants that do cause ill health in the people who work, or live, in the building.




Sick Building Syndrome has been defined by World Health Organisation as “a collection of nonspecific symptoms including eye, nose and throat irritation, mental fatigue, headaches, nausea, dizziness and skin irritations, which seem to be linked with occupancy of certain workplaces.”

States that “Sick Building Syndrome refers to a group of non-specific symptoms with a temporal connection to a particular building, but with no specific or obvious cause.” Murphy (2006, p. 79)




Sick Building Syndrome are mostly minor, can vary with each episode of exposure and that there is no objective proof (such as would be shown in a blood test or by the finding of a particular substance on monitoring the air) available for Sick Building Syndrome.

Similarly Milica (2009. p. 80) describes Sick Building Syndrome as “an environmentally related condition with increased prevalence of non-specific symptoms among the population of certain buildings, often without clinical signs and objective measures of symptoms.



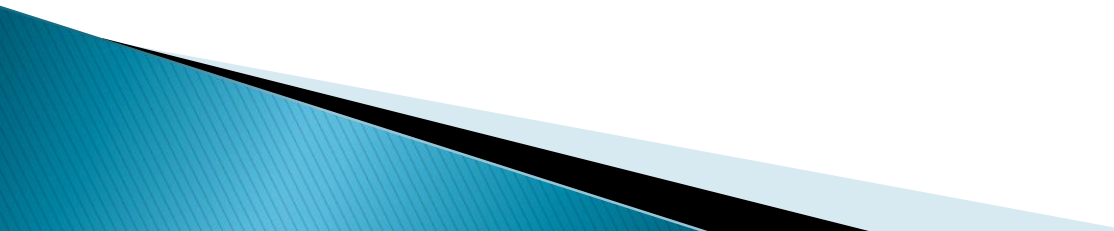
The Environmental Illness Resource (2010, p. 1) quotes the Environmental Protection Agency (EPA) as identifying Sick Building Syndrome being present if:

Syndrome being present if:

- 1 – Symptoms are temporally related to time spent in a particular building, or part of a building
 - 2 – Symptoms resolve when the individual is not in the building
 - 3 – Symptoms recur seasonally (heating, cooling)
 - 4 – Co-workers, peers have noted similar complaints.
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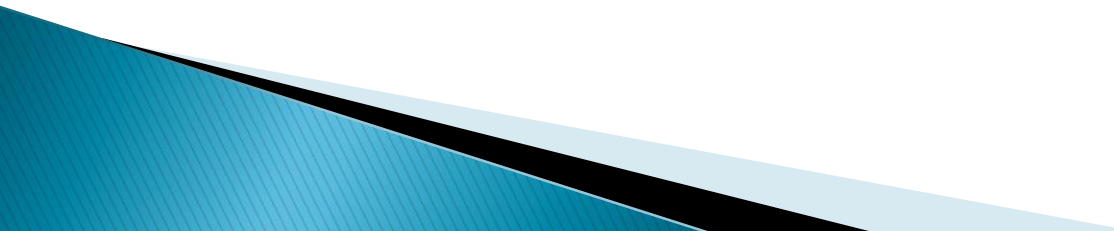
The Environmental Protection Agency (2010) states that the symptom complaints may come from employees throughout the whole building, one department, one room or one location. The cause of Sick Building Syndrome is thought to be the building and/or its services and/or equipment and/or products used in the building.

The symptoms of sick building syndrome are relieved within minutes to hours of leaving the building

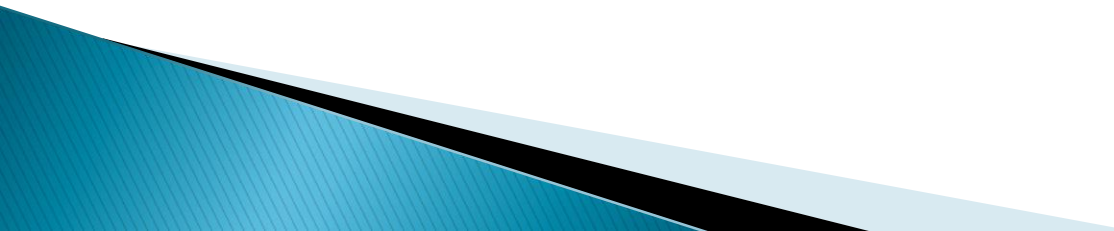


Sick building

Buildings can be either healthy or Sick, on May 2010 (The Straits Times), a study show that indoor polluted air kills 2 million Chinese youths yearly, half are below age five. This indoor pollution also causes respiratory and other conditions. dangerous indoor pollutants include formaldehyde, benzene, ammonia and radon, reported the Agence France-Presse news agency. Among the pollutants, formaldehyde posed the biggest threat,

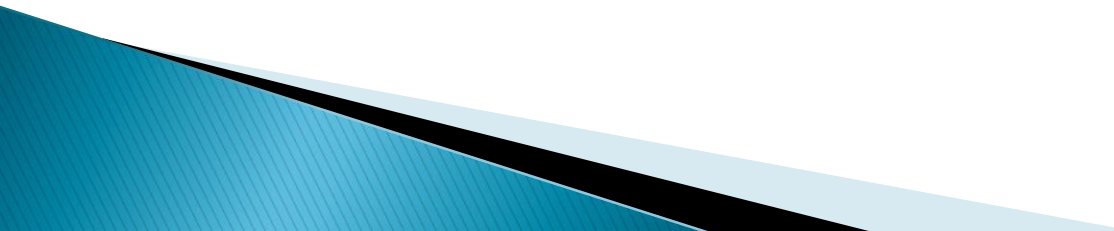


the study added that, the chemical is often found in building materials and new furniture in China and can be released slowly into indoor environments over the course of several years. The study said long-term exposure to such substances can cause a range of health problems including respiratory diseases, mental impairment and cancer, including leukemia, with young children, foetuses, pregnant women and the elderly at most risk

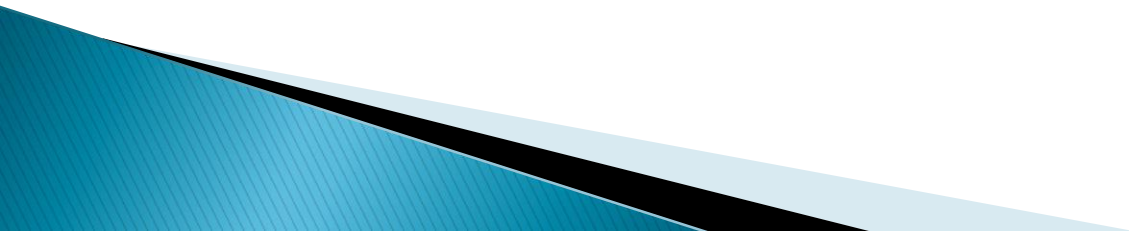


China's Ministry of Science and Technology has listed the management of indoor air pollution problems as one of the priority areas on which it would devote intensive research, reported the CNS. The ministry also announced in the study that households could now use a purifier developed by the CCDCP for removing formaldehyde from indoor air as it has been proven to produce results. The environmental bureau of Shijiazhuang, capital of northern China's Hebei province, recently advised its residents to be careful of materials used to design their houses as these might be the cause of their daily discomforts such as dizziness and fatigue.

China's massive economic expansion of the past three decades has made it one of the world's most polluted countries as environmental and health concerns are trampled on, amid an overriding focus on industrial growth. Countless cities are smothered in smog while hundreds of millions of citizens lack access to clean drinking water. 'Lung disease cases are growing by about 27 per cent a year in China because of deterioration in indoor environment, while about 80 per cent of leukemia cases are related to air problems,' said the study

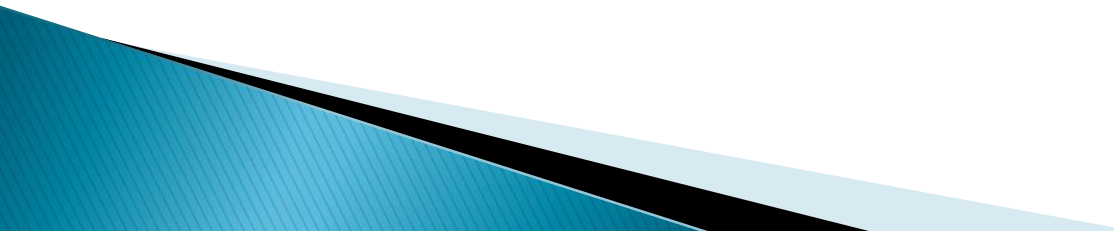


Partly to make indoor air cleaner, China will ban smoking in all indoor public places including offices and public transport.



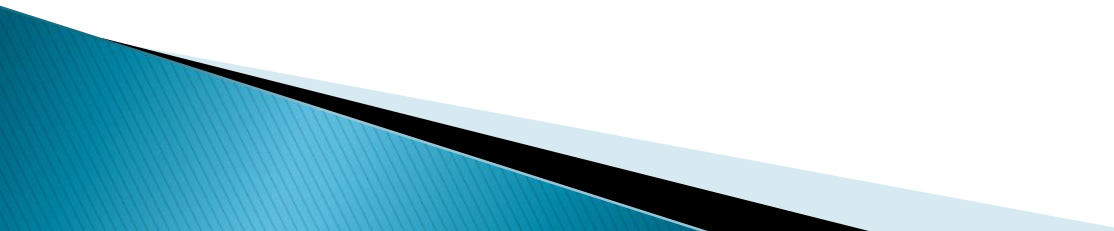
Indoor Air Quality in Building (IAQ)

A healthy indoor environment is one in which the surroundings contribute to productivity, comfort, and a sense of health and well-being. The indoor air is free from significant levels of odors, dust and contaminants and circulates to prevent stuffiness without creating drafts. Temperature and humidity are appropriate to the season and to the clothing and activity of the building occupants.




There is enough light to illuminate work surfaces without creating glare and noise levels do not interfere with activities. Sanitation, drinking water, fire protection, and other factors affecting health and safety are well planned and properly managed.

The definition of good indoor air quality includes:

1. introduction and distribution of adequate ventilation air
 2. control of airborne contaminants
 3. maintenance of acceptable temperature and relative humidity
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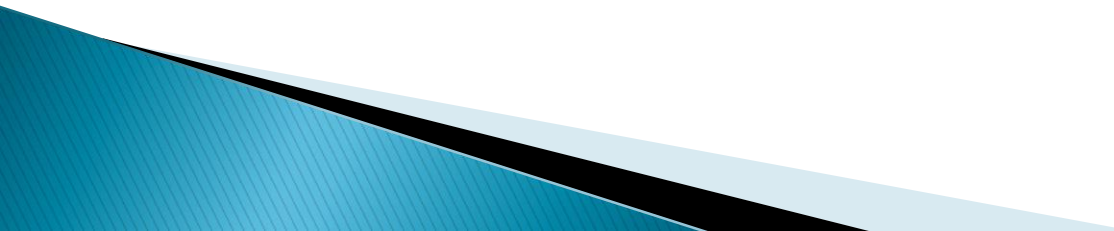
Failure to respond promptly and effectively to IAQ problems can have consequences such as:

- 1– Increasing health problems such as cough, eye irritation, headache, and allergic reactions, and, in some rare cases, resulting in life-threatening conditions (e.g., Legionnaire's disease, carbon monoxide poisoning)
 - 2– Reducing productivity due to discomfort or increased absenteeism
 - 3– Accelerating deterioration of furnishings and equipment
 - 4– Straining relations between landlords and tenants, employers and employees
- 

5– Creating negative publicity that could put rental properties at a competitive disadvantage.

6– Opening potential liability problems (Note: Insurance policies tend to exclude pollution-related claims).

Public and commercial buildings can present a wide range of IAQ problems. The variety of unique features in their design and usage (e.g., apartment buildings, hospitals, schools, shopping malls) make a wide range of IAQ problems possible. In apartment buildings, for example, each residential unit can produce cooking odors and the operation of kitchen exhaust fans.

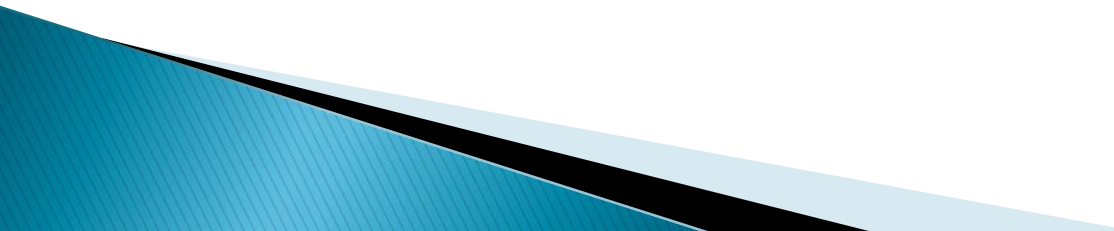


Factors Affecting Indoor Air Quality

Indoor air quality is a constantly changing interaction of a complex set of factors. Four of the most important elements involved in the development of indoor air quality problems are:

1 – **A source of odors or contaminants;** there is a source of contamination or discomfort indoors, outdoors, or within the mechanical systems of the building.

Indoor air contaminants can originate within the building or be drawn in from outdoors. If contaminant sources are not controlled, IAQ problems can arise, even if the HVAC system is properly designed and well-maintained. It may be helpful to think of air pollutant sources as fitting into one of the categories that follow

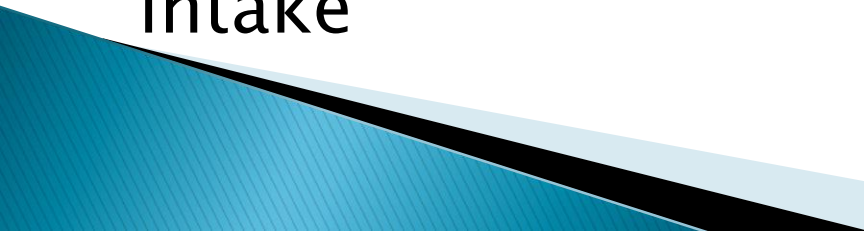


Sources Outside Building

Contaminated outdoor air

- 1– pollen, dust, fungal spores
- 2– industrial pollutants
- 3– general vehicle exhaust

Emissions from nearby sources

- 1– exhaust from vehicles on nearby roads or in parking lots, or garages
 - 2– re-entrained (drawn back into the building) exhaust from the building itself or from neighbouring buildings
 - 3– unsanitary debris near the outdoor air intake
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Soil gas

- 1– radon
- 2– leakage from underground fuel tanks
- 3– contaminants from previous uses of the site (e.g., landfills)
- 4– pesticides

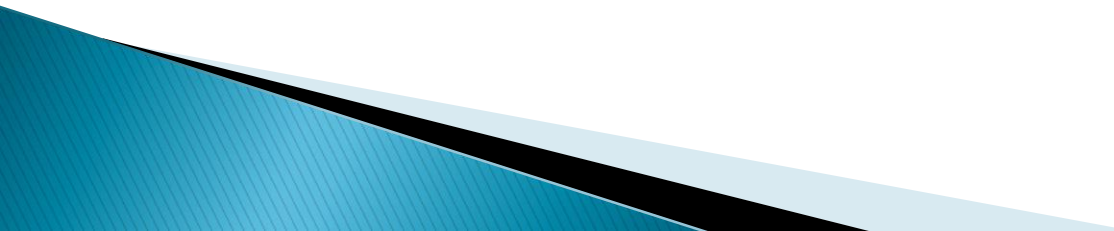
Moisture or standing water promoting excess microbial growth

- 1– rooftops after rainfall
 - 2– Crawlspace
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Equipment HVAC system

- 1– dust or dirt in ductwork or other components
- 2– microbiological growth in drip pans, humidifiers, ductwork, coils
- 3– improper use of biocides, sealants, and/or cleaning compounds
- 4– improper venting of combustion products
- 5– refrigerant leakage

Non-HVAC equipment

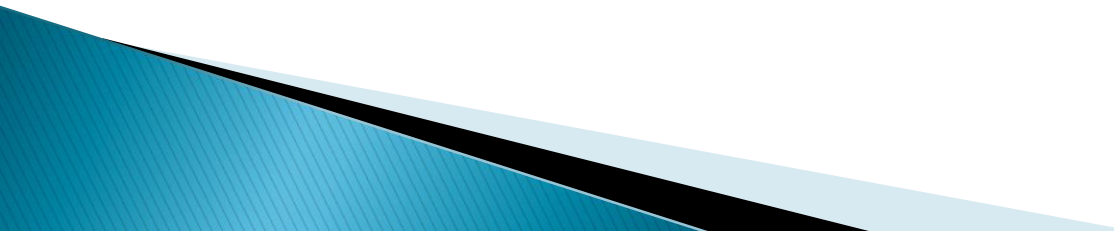
- 1– emissions from office equipment (volatile organic compounds, ozone)
 - 2– supplies (solvents, toners, ammonia)
 - 3– emissions from shops, labs, cleaning processes
 - 4– elevator motors and other mechanical systems
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Human Activities

Personal activities

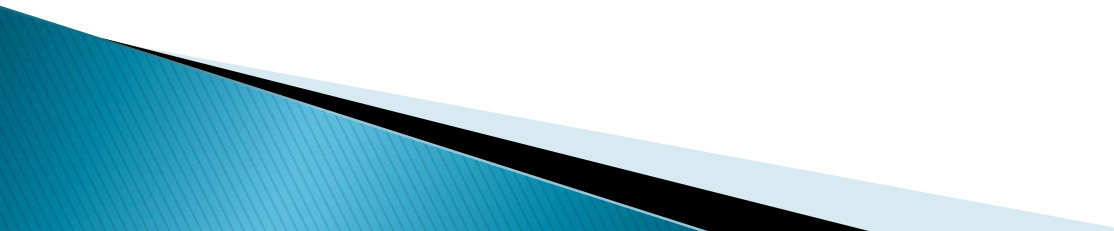
- 1– smoking
- 2– cooking
- 3– body odors
- 4– cosmetic odors

2– A problem with the design or operation of the HVAC system; the HVAC system is not able to control existing air contaminants and ensure thermal comfort (temperature and humidity conditions that are comfortable for most occupants).



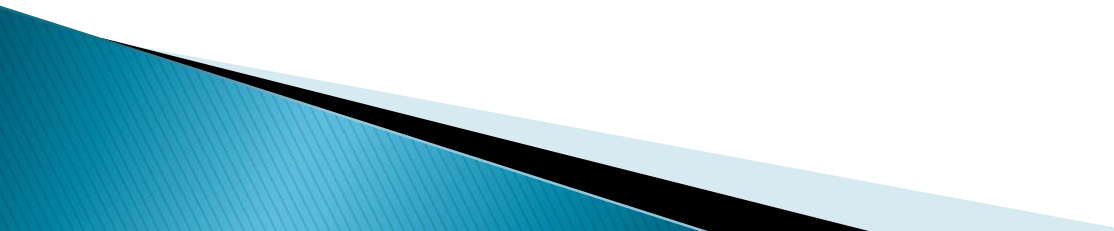
The HVAC system includes all heating, cooling, and ventilation equipment serving a building: furnaces or boilers, chillers, cooling towers, air handling units, exhaust fans, ductwork, filters, steam (or heating water) piping.

A properly designed and functioning HVAC system should:

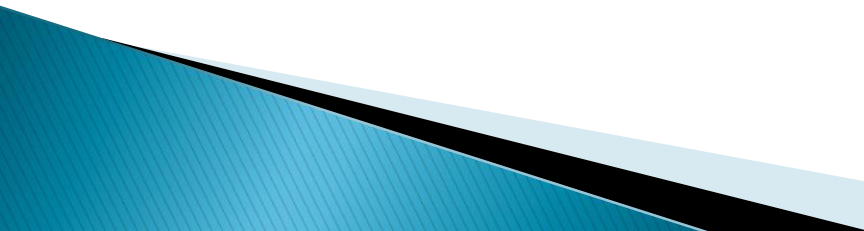
- 1– provides thermal comfort
 - 2– distributes adequate amounts of outdoor air to meet ventilation needs of all building occupants
 - 3– isolates and removes odors and contaminants through pressure control, filtration, and exhaust fans
- 

The HVAC system is generally the predominant pathway and driving force for air movement in buildings. However, all of a building's components (walls, ceilings, floors, penetrations, HVAC equipment, and occupants) interact to affect the distribution of contaminants.

3– A pathway between the source and the location of the complaint; one or more pollutant pathways connect the pollutant source to the occupants and a driving force exists to move pollutants along the pathway(s).

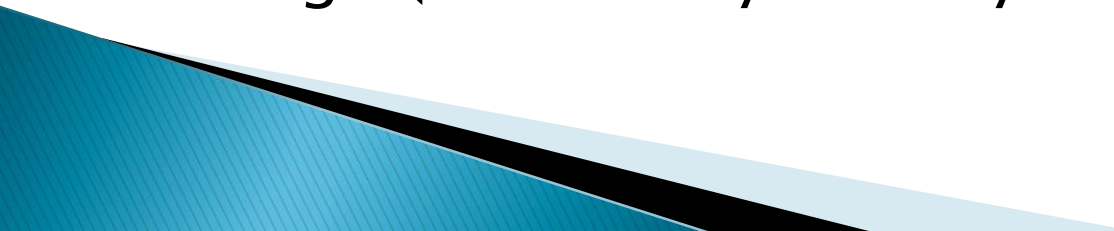


Airflow patterns in buildings result from the combined action of mechanical ventilation systems, human activity, and natural forces. Pressure differentials created by these forces move airborne contaminants from areas of relatively higher pressure to areas of relatively lower pressure can produce many patterns of contaminant distribution, including:

- 1 – local circulation in the room containing the pollutant source
 - 2 – Air movement into adjacent spaces that are under lower pressure (Note: Even if two rooms are both under positive pressure compared to the outdoors, one room is usually at a lower pressure than the other.)
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- 3– recirculation of air within the zone containing the pollutant source or in adjacent zones where return systems overlap
- 4– movement from lower to upper levels of the building
- 5– air movement into the building through either infiltration of outdoor air or re-entry of exhaust air


Air moves from areas of higher pressure to areas of lower pressure through any available openings. A small crack or hole can admit significant amounts of air if the pressure differentials are high enough (which may be very difficult to assess.)



4– The Building Occupants

The term “building occupants” is generally used in this document to describe people who spend extended time periods (e.g., a full workday) in the building. Clients and visitors are also occupants; they may have different tolerances and expectations from those who spend their entire workdays in the building, and are likely to be more sensitive to odors.

Groups that may be particularly susceptible to effects of indoor air contaminants include, but are not limited to:

- 1– allergic or asthmatic individuals
 - 2– people with respiratory disease
 - 3– people whose immune systems are suppressed due to chemotherapy, radiation therapy, disease, or other causes
 - 4– contact lens wearers
- 


Some other groups are particularly vulnerable to exposures of certain pollutants or pollutant mixtures. For example, people with heart disease may be more affected by exposure at lower levels of carbon monoxide than healthy individuals. Children exposed to environmental tobacco smoke have been shown to be at higher risk of respiratory illnesses and those exposed to nitrogen dioxide have been shown to be at higher risk from respiratory infections.

Because of varying sensitivity among people, one individual may react to a particular IAQ problem while surrounding occupants have no ill effects.



Types of illnesses systems and complaints contribute to poor IAQ

The effects of IAQ problems are often nonspecific symptoms rather than clearly defined illnesses. Symptoms commonly attributed to IAQ problems include:

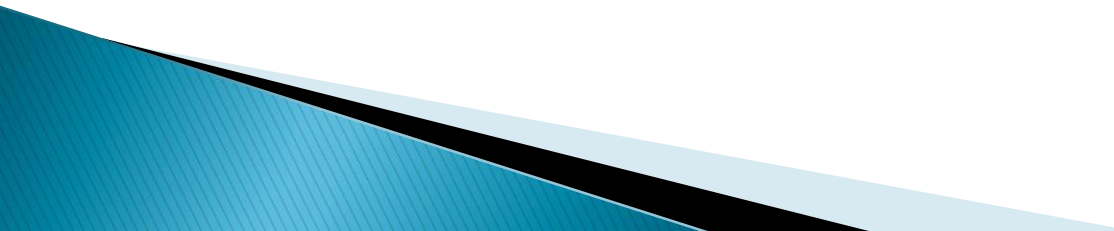
- 1– headache
 - 2– fatigue
 - 3– shortness of breath
 - 4– sinus congestion
 - 5– cough
 - 6– sneezing
 - 7– eye, nose, and throat irritation
 - 8– skin irritation
- 

9– dizziness

10– nausea

All of these symptoms, however, may also be caused by other factors, and are not necessarily due to air quality deficiencies. “Health” and “comfort” are used to describe a spectrum of physical sensations.

For example, when the air in a room is slightly too warm for a person’s activity level, that person may experience mild discomfort. If the temperature continues to rise, discomfort increases and symptoms such as fatigue, stuffiness, and headaches can appear.



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