

Indoor Air Pollution

Danger at Home

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Human exposure to pollutants within home exceeds the recommended limits set by the World Health Organisation (WHO). Unfortunately, indoor pollution has not been given much importance although most people spend as much as 80 – 90% of their time indoors. The health effects from indoor air pollutants may be experienced soon after exposure or, possibly, years later.

Introduction

Many of us spend the greater part of our lives indoors. The indoor environment of homes and offices is often more seriously polluted than the outdoor atmosphere. Thus, for many people, the risks to health may be greater due to indoor air pollution than the outdoor air. The major sources of indoor air pollution are those that release gases and particles into air, and inadequate ventilation makes the situation much worse.

The major factors that determine the quality of indoor air are:

- The nature of outdoor air quality around the building.
- The air exchange rate of the building (ventilation).
- The materials used in the construction of the building (presence of chemicals).
- The activities that go on inside the building (cleaning, cooking, heating etc.).
- Use of household chemicals.

Indoor Air and Your Health

In recent years, there have been an increasing number of complaints about the poor quality of indoor atmosphere from residents, and workers in offices and commercial buildings. The pollutants found in indoor air are responsible for many harmful

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health effects. The effects may show up immediately after a single exposure, and include irritation of eyes, nose and throat, headache, dizziness and fatigue. Such immediate effects are usually of short duration and treatable. Sometimes the treatment is simply eliminating the person's exposure to the source of pollution. Symptoms of some diseases such as asthma, hypersensitivity, pneumonitis and humidifier fever may appear soon after exposure to certain indoor air pollutants. Though most of these diseases can be treated, nevertheless, some pose serious risks.

Other health problems may appear either years after a single exposure had occurred or on repeated exposures. These effects, which include some respiratory diseases, heart diseases and cancer, can be severely debilitating or fatal. Further research is needed to better understand the health hazards caused by exposure to average pollutant concentrations found in homes and those by higher concentrations that occur during short periods of time.

Pollutant Sources

There are many sources of indoor air pollution in a home. Most homes have more than one source that contribute to indoor air problems. Many activities go on inside a home which include cleaning, cooking, heating by open or enclosed fires, smoking, etc. Some important indoor air pollutants are generated by burning of oil, gas, kerosene, wood and tobacco products or produced by building materials, furnishings, wet or damp carpets, household chemical products, air conditioners, dehumidifiers and outdoor sources such as radon and pesticides. Inadequate ventilation can increase indoor pollutant level because of insufficient air movement to dilute emissions from indoor sources and carry them out of home.

Radioactivity

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which homes are built. Radon is a product of radioactive decay process beginning with uranium-238 and thorium-232. Because of their longer half-lives (4.5 and 14 billion years respectively) they are present in trace quantities in many geological materials. Sometimes radon enters into the home through well water. Being a gas, radon escapes from construction material, penetrates through cracks in buildings and is released into the indoor atmosphere where it may be inhaled. The average indoor radon level is 1.3 pCi/l (pico curies per liter)

Volatile Organic Compounds (VOC)

There are many aliphatic and aromatic compounds contributing to VOC concentrations, with chloroform, acetone, chlorinated compounds and formaldehyde being predominant in many locations. Consumer products used in homes contribute other VOCs to the indoor atmosphere. For example, latex paints contain toluene, ethylbenzene, 2-propanol and butane. Many organic compounds are emitted from construction materials, furnishings and consumer products such as latex paints, cleaning agents, household solvents, detergents, waxes and varnishes.

Formaldehyde in construction materials such as particle boards, plywood and in urea formaldehyde foam insulation, leaks into air when the temperature rises. Combined with other contaminants it can cause headache, respiratory irritations, watery eyes, nausea, skin irritation and heart problems.

Indoor Combustion

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The emission quantity of these pollutants depends upon the type of fuel used, fuel / oxidant ratio and other combustion con-



ditions. Proper venting of exhaust gases reduces this problem.

Tobacco Smoking

Tobacco smoke contains a complex mixture of over 4000 compounds, more than 40 of which are known to cause cancer, and as many are strong irritants. Tobacco smoking is a source of VOCs including polyaromatic hydrocarbons (PAH), organic bases like nicotine, aldehydes, ketones, organic acids and respirable particulate matter. Smoking inside home is a cause for large amounts of indoor pollutants. Natural or mechanical ventilation techniques do not remove them from the air as quickly as they build up.

Cigarette smoking is another source of formaldehyde. The directly inhaled air drawn through a cigarette may contain formaldehyde concentrations more than 400 times the level of concentration in the indoor atmosphere.

Tobacco smoking is responsible for approximately 3000 lung cancer deaths every year in non-smoking adults and causes respiratory infections in hundreds of thousands of children.

Biological Contaminants

Biological contaminants include pollens, bacteria, mildew, fungal spores, etc. There are many sources of these pollutants. Pollens originated from plants, and viruses and bacteria are transmitted by people and animals. Biological contaminants cause allergic diseases, pneumonitis, and some types of asthma. By controlling the relative humidity level (30-50 %) in a home, the growth of some of these sources of biological pollutants can be minimized.

Preventive Measures

Preventive measures for indoor air pollution in homes, apartments and offices involve eliminating or controlling the sources of pollution, increasing ventilation and installing air-cleaning devices.

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Indoor Air Pollutants

Pollutants	Sources	Health Effects
Radon	Construction materials from geological sources	Lung cancer
Formaldehyde	Particle boards, plywood, urea formaldehyde foams, tobacco smoking, furniture etc.	Headache, respiratory irritations, nausea, skin irritation, watery eyes, and heart problems
Other VOCs (Toluene, 2-propanol, phenols, aldehydes, ketones, esters, etc.)	Paints, solvents, wood preservatives, aerosol sprays, varnishes, cleansers, air fresheners, etc.	ENT irritations, headache; some organic compounds can cause cancer.
CO ₂ , CO, NO _x , SO _x and HC	Combustion of fuels (kerosene heaters, gas stoves, leaking chimneys, tobacco smoking etc.)	Fatigue, dizziness, confusion, nausea like symptoms that disappear once out of the house
Particulate matter (suspended and respirable) and PAH	Tobacco smoking and combustion of fuels	Burning sensation of eyes and nose, bronchitis asthma, cancer, reduced lung functions
Pesticides	Moth repellants, insecticides and other pesticides, termiticides, disinfectants.	Eye, nose, throat irritation, damage to central nervous system, kidneys; risk of cancer
Biological pollutants (pollens, viruses, bacteria, etc.)	Wet or moist walls, ceiling, carpets, poorly maintained humidifiers, air conditioners and house hold pets.	ENT irritation, allergy, shortness of breath, humidifier fever and other infectious disease.
Lead	Lead based paints, contaminated soil and water.	Affects all systems within the body, central nervous system and kidney

- Carefully choose building and furnishing materials (free from formaldehyde).
- Ensure effective ventilation in all the areas of the building (good air-exchange rate).



- Install and use exhaust fans in kitchens and bathrooms.
- Don't smoke at home or permit others to do so.
- Use pesticides in recommended amounts with proper dilution.
- Get air conditioners cleaned regularly.
- Ensure cleanliness in the entire house especially in kitchens and bathrooms.
- Get evaporation trays in dehumidifiers, air conditioners and refrigerators cleaned regularly.
- In gas stoves, a prescient yellow tipped flame is generally an indicator of maladjustment and increased pollutant emissions. Adjust the burner so that the flame tip is blue.
- Keep exposure to products containing methylene chloride (paint stripper, adhesive remover) and benzene to a minimum.
- Use high quality plywood in furnitures.

Some of the common indoor air pollutants, their sources and health effects are listed in the table.

Conclusion

Indoor air pollution is one of the major problems that we have to solve since we spend a large part of our life indoors. We should take all necessary precautions to eliminate or minimize the harmful effects of indoor air pollution.

Suggested Reading

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