Indoor Air Pollution –
The ‘Unseen’ Devil

Smoke, dust, heat, sweat, pollution - something we encounter everyday going from one place to another. Many a times when we have bouts of cold, coughs, fever or some other illness we blame it on the dirty polluted air outside. We then confine ourselves inside the safe heaven of our homes - insulating ourselves from the polluted air outside. But are our homes really safe and unpolluted? Well not really!

Research has shown that the indoor environment can be as polluted as the outdoors. We spend considerable time inside our homes, offices, workplace etc. This exposes us to a range of dangerous pollutants, from most unlikely of sources that can cause serious health problems and illnesses.

How safe is your home?

Indoor air quality refers to the physical, chemical, and biological characteristics of air in the indoor environment within a residential / institutional building or a commercial facility.

Have you ever thought that the things we use to beautify our houses like furniture, carpets, drapes, floor tiles, paints etc., and other products like room deodorizers, toiletries, food containers can emit pollutants which are far more potent than the pollutants in the outdoor air. Due to several factors like, proximity to the source of pollution, higher levels of some pollutants, less dilution of enclosed air, and reduced air-exchange rates can be detrimental to health. The most susceptible groups are the young and the elderly who spend theirs greatest amount of time indoors.

Sources and Pollutants of Indoor air pollution

A number of sources that are the leading cause of indoor air pollution can be broadly classified into following categories:

1) **Off-gassing building materials.** Most of the building materials emit large amounts of toxic fumes and other pollutants like radon, heavy metals, Volatile Organic Compounds (VOCs) etc., that are a proven health hazard. Even the stones, used in masonry and aggregates for concrete, like granite may be a source of radon gas. Paints are sources of heavy metals and the carpets of some other VOCs.

2) **VOCs.** They are a variety of organic compounds that keep emanating from various household items like cleaning compounds, solvents, paints, cosmetics, fungicides, and other consumer products

   **Construction materials** are loaded with a variety of chemical compounds that are the major pollutant sources which includes:

   1. Materials containing binders like fiberglass insulation, chipboard, plywood, and particleboard
   2. Materials made from petrol-chemicals such as foam insulation, gaskets, furniture padding, carpet pads, softer plastics
   3. Paints and Coatings like oil based paints, stains, and solvents.
   4. PVC glues, vinyl adhesives, and related solvents.
like disinfectants, room deodorizers, shoe polish, aerosol sprays, cosmetics, carpet waxes etc. Pesticides are one of the most important VOC compounds commonly used to kill a variety of common household pests like rodents, insects, weeds, fungi etc. Some other types of VOCs are formaldehyde, tobacco smoke, chlorinated water supplies, benzene, toluene, styrene, naphthalene and chloroform emanated from dry-cleaned clothes.

**Radon – 222.** This Noble Gas, is produced in the decay of naturally occurring Uranium-238. The principal source of radon in buildings is natural radon gas in soil that tends to penetrate through sump pump wells, drains, cracks, utility access holes, and foundations. It can also diffuse through the basement walls and floors that are in contact with soil containing radioactive materials.

**Airborne Lead.** Paint is the chief source of lead pollution inside homes. Old houses and furniture that are coated with lead paint also contribute to indoor air pollution. Even the lead that remains outdoor in the soil near roads and highways tends to become airborne and carried inside homes. Art and craft materials like adhesives, dyes, thinners are an additional source of airborne lead.

**Asbestos and Mineral Fibers.** Are commonly used in a variety of building construction materials for insulation and as forcing agent in cement, brake-linings and plastics. It is also found in older homes, in pipes and furnace insulation materials, millboard, textured paints and other coating materials, and floor tiles. Any improper attempts to remove these materials can release asbestos fibers into the air in homes, endangering people living inside.

2) **Pollution from electro-mechanical equipment and appliances**
Organic particles are the major pollutants produced during the use of electrical gadgets like lights, buzzers, flashes, and beepers. These organic particles are actually the electro magnetic field generated by all electrical equipment including copying machines and electrostatic air cleaners.

3) **Biological sources (molds, mildew, spores, microbes, and pet dandruff)**
Biological contaminants are living organisms that include bacteria, viruses, mold, mildew, animal dander (flakes of dead skin from pets), dust mites and pollens. They may result from inadequate maintenance and housekeeping, water spills, and excessive humidity in a building. Dust Mites are one of the most highly allergic contaminants found indoors in house dust. Mold spores are the reproductive units of fungi that survive by decomposing and absorbing nutrients from food, or even wallpaper and carpeting.

4) **Combustion (Furnaces, Fireplaces, cigarettes, cooking)**
Any form of combustion whether smoking a cigarette or burning toast produces unhealthy byproducts like carbon monoxide, and nitrogen dioxide. In addition, depending on fuel type and additives used combustion may result in emissions of metals, sulfur oxides, or other particles. Many studies indicate that cooking gas ranges can raise indoor nitrogen dioxide concentrations above ambient levels.

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**Did You Know**

- According to U.S. Environmental Protection Agency (EPA) the indoor level of many pollutants may be 2-5 times, and occasionally more than 100 times, higher than outside levels. ([source: www.wherethetruthlies.org](http://www.wherethetruthlies.org))
- People spend as much as 90% of their time indoors. ([Source: http://www.epa.gov/iaq](http://www.epa.gov/iaq))
- In a 1996 study on deaths due to air pollution, revealed a total number of 373,000 deaths due to indoor air pollution and 70,000 deaths due to outdoor air pollution which implies an approx. 5 times higher incidence of deaths due to indoor air pollution ([source: www.panasia.org.sg](http://www.panasia.org.sg))
- Almost half a million children under the age of five die each year from indoor air pollution in India. ([Source: http://www.economictimes.com/040400/04indu04.htm](http://www.economictimes.com/040400/04indu04.htm))
- A study in Western Indian found a 50 per cent increase in stillbirths in women exposed to indoor smoke during pregnancy. ([source: http://wbln1018.worldbank.org](http://wbln1018.worldbank.org))
Environmental Tobacco Smoke (ETS). Is a complex mixture of gases, vapors, and particulate matter and is a major source of a large number of indoor contaminants. ETS contains more than 4,000 substances, more than 40 of which are known to cause cancer in humans or animals. In homes even the short-term concentrations of ETS can be fatal.

Carbon Monoxide. This poisonous gas sources out from unvented kerosene and gas space heaters; leaking chimneys and furnaces; wood stoves, and fireplaces.

Nitrogen dioxide (NO2) and Sulfur dioxide (SO2). Are another group of pollutants, whose primary source is tobacco smoke and combustion processes which involve biomass fuels (for cooking). According to a study conducted in New Delhi indoor nitrogen dioxide levels for households using natural gas and traditional fuels, were 3 to 5 times more than the outdoor levels.

5) Cleaning, and maintenance compounds
The household cleaning agents and maintenance compounds are also sources of hundreds of potentially harmful chemicals. These products release contaminants into air right away while other do so gradually over a period of time.

Formaldehyde. Is an important industrial chemical, added to medicines, cosmetics, toiletries, and some food containers as a preservative. The largest single use of formaldehyde is in producing urea and phenol resins, which are applied as adhesives in plywood and laminates. These wood products are widely used in homes and offices, as shelving, counters, floors, and wall covers. It is also used to improve fabrics. Wall-to-wall carpeting, often glued to the floor with adhesives, and draperies made of synthetic fibers is a continuous source of a variety of volatile chemicals. Plastic and fabric-covered room dividers can release VOCs as well. Office equipment like photocopying machines also emit a large number of pollutants.

Air Fresheners (or "Air Poisoners")?
“Air fresheners” are in continuous supply in our kitchens, bathrooms, and around the house to give us a clean and elegant feel. Thought to be an air quality-improving agent they invariably add a number of pollutants, in our household. Some of these pollutants may be designed to deaden our senses of smell, serving as propellants, and yet some others may be adding various kinds of toxic perfumes. Many of these ingredients cause irritation of nose and lungs, leading to serious problems for many people. A prominent constituent of these products is formaldehyde, one of the worst offenders of respiratory system. People suffering from ailments like lung infections, asthma are severely affected by these compounds.

Source: www.wherethetruthlies.org
# How these pollutants affect your health?

## Common Pollutants, Sources, Illnesses

<table>
<thead>
<tr>
<th>Home Products / Sources</th>
<th>Common Pollutants</th>
<th>Related Health Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobacco Smoke, Cleaning supplies</td>
<td>Ammonia, Benzopyrene</td>
<td>Eye/skin irritation, headaches, nose bleeding, sinus problems, asthma attacks, lung cancer</td>
</tr>
<tr>
<td>Paint, New Carpet, New drapes</td>
<td>Benzene, Chloroform, Xylene</td>
<td>Headaches, eye/skin irritation, fatigue, cancer, asthma attacks, dizziness</td>
</tr>
<tr>
<td>Gas burners, furnaces, wood stoves</td>
<td>Hydrocarbons, nitrogen dioxide, carbon monoxide</td>
<td>Headaches, eye/skin irritation, nausea, cardiovascular and pulmonary diseases</td>
</tr>
<tr>
<td>Paints, glues, furniture, wallpaper</td>
<td>Trichloroethylene, Xylene, airborne lead</td>
<td>Headaches, eye/skin irritation, fatigue, respiratory irritation, dizziness, nausea, loss of consciousness, anorexia</td>
</tr>
<tr>
<td>Carpet, clothing, dirt, paints, industrial processes, and human skin</td>
<td>Dust</td>
<td>Eye irritation, allergies, eye-ear, nose &amp; throat infections, asthma attacks, fatigue, depression</td>
</tr>
<tr>
<td>Every inhabited room harbors hundreds of thousands of dust mites. <em>(Typically 10,000 dust mites are found in an ounce of dust)</em></td>
<td>Dust Mites</td>
<td>Decaying dust mite waste materials are source of indoor allergies. Dust mites may be a factor in 50 to 80% of asthmatics[^3]</td>
</tr>
<tr>
<td>Pesticides misapplication</td>
<td>Organic vapor, dust</td>
<td>Headaches, dizziness, muscular weakness, nausea</td>
</tr>
<tr>
<td>Construction material like cement, brake linings, floor tiles, and plastics</td>
<td>Asbestos fibres</td>
<td>Asbestosis (irreversible lung scaring)[^4], lung cancer</td>
</tr>
<tr>
<td>Room deodorizers, shoe polish, aerosol sprays, cosmetics</td>
<td>Volatile organic compounds</td>
<td>Eye, nose and throat irritation, headaches, visual disorders, and memory impairment.</td>
</tr>
<tr>
<td>Alkaline environments including raw dairy, meat, poultry &amp; vegetables, open wounds</td>
<td>Biological contaminants like Aeromonas bacteria</td>
<td>Intestinal &amp; extra-intestinal infections including meningitis &amp; sepsis</td>
</tr>
<tr>
<td>Standing water, air conditioning ducts, moist areas in walls</td>
<td>Biological contaminants (eg legionella, molds)</td>
<td>Allergies, sinus headaches, irritability, fatigue, depression, legionellosis and Pontiac Fever.</td>
</tr>
<tr>
<td>Drains, cracks, soil gas penetration through sump pump wells</td>
<td>Radon gas</td>
<td>Lung cancer[^5]</td>
</tr>
<tr>
<td>Medicines, cosmetics, toiletries, food containers</td>
<td>Formaldehyde</td>
<td>Nasal cancer in animals, conjunctiva irritation, chest tightness, wheezing</td>
</tr>
<tr>
<td>Chemical reagents like chlorine bleach and detergents</td>
<td>Volatile organic compounds (VOCs)</td>
<td>Skin and eye irritation, anemia, liver damage, convulsions, possible coma</td>
</tr>
</tbody>
</table>

[^4]: [http://www.epa.gov/iaq/asbestos.html]
[^5]: [http://www.mwt.net/~roald/indoorair.html]
THE INDIAN SCENARIO

In developing countries like India, wood and other biomass fuels (wood, crop residues, dung cakes) are still the primary source of energy for the majority of people. Biomass fuels combined with open chulhas (stoves) and inadequate ventilation play havoc with lives of two major vulnerable groups: children and women. Wood emits 10mg of CO per cubic meter of air -- cooking gas emits only 2.8mg -- during a typical cooking session. In 1991, The World Bank rated indoor air pollution in developing countries as one of the four most critical global environmental problems. Although there are many hundreds of separate chemical agents that have been identified in the smoke from biofuels, the four most serious pollutants are particulates, carbon monoxide (CO), polycyclic organic matter and formaldehyde. These pollutants are responsible for more respiratory illnesses and decreased pulmonary functions than that from kerosene and cooking gas. The six major categories of ill-health that can be attributed to indoor air pollution are:

- Acute respiratory infections in young children
- Adverse outcomes of pregnancy (low birth-weight, stillbirth, and neonatal death)
- Lung cancer
- Chronic lung ailments (bronchitis or asthma) and associated heart disorders
- Diseases of the eye
- Increase in the severity of coronary heart disease.

Apart from these four major illnesses, indoor air pollution is also associated with blindness and changes in immune system. 18 percent of blindness in India is attributed to the use of biomass fuels. Estimates from a study carried out in India by American scientists, indicate that some 400-550 thousand premature deaths can be attributed annually to the use of biomass fuels in population groups using biomass fuels. Further, it is also estimated that a total of 4-6% of the Indian national burden of disease is from indoor air pollution.

What we can do?
The indoor concentration of pollutants can be reduced by:

- Keeping the area in and around your house, office clean and well ventilated to keep away pests.
- Refrain from using chemical pesticides indoors.
- Improving ventilation in the cooking area, using clean fuels, and better stoves, which require less fuel and generate less smoke.
- Avoid using chemical cleaning agents, instead use neem oil for cleaning floors.
- Replace room fresheners or deodorizers with baking soda which is a good absorbent of odors in the refrigerators and elsewhere.
- Grow plants in and around your living space since plants are effective in removing toxic vapors and keeping the premises fresh.

(For further information on alternatives to toxins in home, refer to our Factsheet "Toxics Free Home")

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6 Edited by Pachauri, R.K. and Sridharan, P.V.; Looking back to think ahead – GREEN India 2047;1998; TERI.
7 Ibid.
8 http://wbln1018.worldbank.org
9 National burden of disease in India from indoor air pollution in the Proceedings of the National Academy of Sciences of the United States of America (PNAS 2000 97:13286-13293)
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5. Ramakrishna, Jamuna; Durgaprasad M.B; Smith, Kirk. R; Cooking in India: The Impact of improved stoves on indoor air quality; 1989
10. Edited by Hester, R.E. and Harrison, R.M.; Volatile Organic Compounds in the Atmosphere; 1995; The Royal Society of Chemistry
11. Down to Earth; Feb 29, 2000, Dec 15, 2000
13. www.lungusa.org
15. www cpsc.gov/cpscp pub/pubs/455.html
17. http://core.ecu.edu/phys/spraguem/environment/pollution/control.html
20. www.indoorairpollution.com

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