

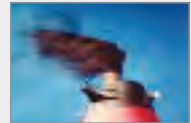
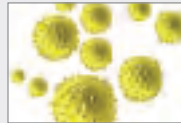
# Air Pollution And Its Sources

- ▶ A reference guide to major indoor air pollutants in the home.
- ▶ Type of solutions to air pollution and bacteria/germ elimination.



# Air Pollution & Its Sources

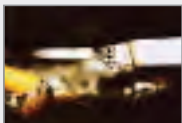
Pollutants in the air are caused by natural events (like bushfires and windstorms) or human activities (including industrial processes or driving motor vehicles). Examples of pollutants include gases, chemicals and airborne particles (such as dust and pollen).



Airborne contaminants vary from country to country, depending on a range of factors including population, industry, climate and the types of fuels burned. The main sources of air pollution in Malaysia are motor vehicles, power stations, industrial fuel burning and processes, domestic fuel burning, burning of municipal and industrial waste. The main pollutants include:

- Carbon monoxide
- Nitrogen dioxide
- Ozone
- Particulates (minute particles suspended in the air)
- Sulphur dioxide

Most of the time we are not aware that our home indoor air quality may just be as bad as outdoor air pollution. Indoor pollutants include:



- Cigarette smoke
- Chemical odours from freshly applied paint, glues or solvents
- Animal fur or dander
- Moulds
- Dust

All these pollutants contribute to "Unhealthy Air" and are potential health hazards to everyone in general and especially so to babies, children, the elderly and those with respiratory health problems.

# Potential Health Hazards of Air Pollution

**Short-term exposure:** watery eyes, coughing and wheezing, worsen heart and lung illnesses including asthma and other respiratory diseases such as emphysema, contribute to stress on the cardiovascular system, lessen the lung's ability to exhale air, and damage lungs even after minor irritation disappears.

**Long-term exposure:** permanent health effects, like rapidly aging the lungs, decreasing lung capacity and function, causing diseases like asthma, bronchitis emphysema, and cancer and shortening life span.

Every day, the average adult breathes over 3,000 gallons of air. Children and infants are at greater risk from air pollution than adults for many reasons. Children tend to breathe more rapidly and inhale more pollutants per pound of body weight. As babies' and children bodies, lungs and immune systems are still developing they are more prone to air pollution's ill effects.

## Reference Guide To Major Indoor Air Pollutants In The Home

Pollutants	Tobacco Smoke	Biological Contaminants	Carbon Monoxide (CO)	Nitrogen Dioxide (NO2)
<b>Source</b>	<ul style="list-style-type: none"> <li>• Cigarette</li> <li>• Pipe and cigar smoking</li> </ul>	<ul style="list-style-type: none"> <li>• Wet or moist walls, ceilings, carpets and furniture</li> <li>• Bedding</li> <li>• Household pets</li> </ul>	<ul style="list-style-type: none"> <li>• Leaking from gas stoves</li> <li>• Automobile exhaust</li> <li>• Environmental tobacco smoke</li> </ul>	<ul style="list-style-type: none"> <li>• Unvented gas stoves</li> </ul>
<b>Health Effects</b>	<ul style="list-style-type: none"> <li>• Eye, nose, and throat irritation</li> <li>• Headaches</li> <li>• Lung cancer</li> <li>• May contribute to heart disease</li> <li>• Specifically for children, increased risk of lower respiratory tract infection, such as bronchitis and pneumonia, and ear infections</li> <li>• Build-up of fluid in the middle ear</li> <li>• Increased severity and frequency of asthma episodes</li> <li>• Decreased lung function</li> </ul>	<ul style="list-style-type: none"> <li>• Eye, nose, and throat irritation</li> <li>• Shortness of breathe</li> <li>• Dizziness</li> <li>• Lethargy</li> <li>• Fever</li> <li>• Digestive problems</li> <li>• Can cause asthma; influenza and other infectious diseases</li> </ul>	<ul style="list-style-type: none"> <li>• At low concentrations, fatigue in healthy people and chest pain in people with heart disease</li> <li>• At higher concentrations, impaired vision and coordination; headaches; dizziness; confusion; nausea</li> <li>• Can cause flu-like symptoms that clear up after leaving home</li> <li>• Fatal at very high concentrations</li> </ul>	<ul style="list-style-type: none"> <li>• Eye, nose and throat irritation.</li> <li>• May cause impaired lung function and</li> <li>• Increased respiratory infections in young children</li> </ul>

Pollutants	Organic Gases (VOC)	Formaldehyde	Pesticides	Asbestos
<b>Source</b>	<ul style="list-style-type: none"> <li>Household products including: paints, paint strippers, and other solvents</li> <li>Wood preservatives</li> <li>Aerosol sprays</li> <li>Cleaners and disinfectants</li> <li>Moth repellents and air fresheners</li> <li>Stored fuels and automotive products</li> <li>Hobby supplies</li> <li>Dry-cleaned clothing</li> </ul>	<ul style="list-style-type: none"> <li>Pressed wood products (hardwood plywood wall paneling, particleboard, fiberboard) and furniture made with these pressed wood products.</li> <li>Urea-formaldehyde foam insulation (UFFI).</li> <li>Combustion sources and environmental tobacco smoke.</li> <li>Durable press drapes, other textiles and glues.</li> </ul>	<ul style="list-style-type: none"> <li>Products used to kill household pests (insecticides, termiticides, and disinfectants).</li> <li>Also, products used on lawns and gardens that drift or are tracked inside the house.</li> </ul>	<ul style="list-style-type: none"> <li>Deteriorating, damaged, or disturbed insulation, fireproofing, acoustical materials, and floor tiles.</li> </ul>
<b>Health Effects</b>	<ul style="list-style-type: none"> <li>Eye, nose and throat irritation</li> <li>Headaches</li> <li>Loss of coordination</li> <li>Nausea</li> <li>Damage to liver, kidney, and central nervous system.</li> <li>Some organic gases can cause cancer in animals; some are suspected or known to cause cancer in human.</li> </ul>	<ul style="list-style-type: none"> <li>Eye, nose, and throat irritation wheezing and coughing</li> <li>Fatigue</li> <li>Skin rash</li> <li>Severe allergic reactions</li> <li>May cause cancer</li> <li>May also cause other effects listed under "organic gases."</li> </ul>	<ul style="list-style-type: none"> <li>Irritation to eye, nose, and throat</li> <li>Damage to central nervous system and kidney</li> <li>Increased risk of cancer.</li> </ul>	<ul style="list-style-type: none"> <li>No immediate symptoms, but long-term risk of chest and abdominal cancers and lung disease.</li> <li>Smokers are at higher risk of developing asbestos-induced lung cancer.</li> </ul>

**Disclaimer:**

*The pollutants listed in this guide have been shown to cause the health effects mentioned. However, it is not necessarily true that the effects noted occur at the pollutant concentration levels typically found in the home. In many cases, our understanding of the pollutants and their health effects is too limited to determine the levels at which the listed effects could occur.*

# Micro-Organisms Found In Homes

(source:www.healthyenvironment.net/airborne.htm)

There are an enormous number of different microorganisms that share home environments with us. Microorganisms colonize indoor surfaces, especially those which contain a suitable substrate and enough moisture, and some of them may eventually become airborne.

For most microorganisms water is a natural surrounding which supports their growth and multiplication, while the air is considered to be hostile environment owing to the desiccation, oxygen concentration and radiation. However, **in humid and warm climates the microorganisms can thrive even in the air.** Many microorganisms can be found either free floating or more often attached to dust particles or water droplets.

Infectious microorganisms belong to the group of viruses, bacteria or fungi.

**Viruses** among the airborne viruses the major concern for the human population are those causing measles, chickenpox, mums, common cold and influenza. The survival of viruses in the air depends on the relative humidity, temperature and type of viral coating (Cox, 1995).

## Did You Know?

Did you know that one square centimeter of your skin has an average of 100,000 bacteria on it?  
(Measure a square centimeter on your skin and try to picture that many bacterial)

**Bacteria** are microscopic organisms that found in the water, on solid surfaces, and in air. Most of them are not harmful to men. However, there is a group of bacteria that are causative agents of many diseases in humans (tuberculosis, typhoid fever, plague, anthrax, etc). There are also bacteria that are not pathogenic but may cause allergies. Some of them produce volatile organic compounds (VOC) that contribute to the musty odor in homes and cars.

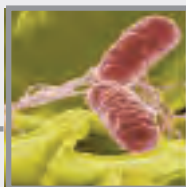
**Moulds** are microorganisms that live everywhere, especially in humid and warm environments. Mould spores are easily detached and made airborne by air flow, vacuuming, walking on a carpet or sitting on a couch. They produce and release millions of spores which are small enough to stay airborne threatening to invade the human respiratory system. There is scientific proof of a direct correlation between presence of mould spores and wheezing and asthma. The mould *Strachybotris atra* found in home environments on high cellulose materials has been linked to a fatal pulmonary disorder in young infants.

**Dust Mites** live in carpets, mattresses, pillows, stuffed toys and upholstered furniture, polluting the air in your home or office. A typical used mattress may have up to 1 million mites. They feed on human skin scales and need a moist and warm climate. Their fecal droppings are the main allergen in asthmatics. If you have pets, the likelihood that your home is contaminated with Dust Mites is even greater.

# Some Common Bacteria In the Home



**E. coli**  
(*Escherichia coli*)



**Salmonellosis**



**Staphylococcus aureus**

Bacteria	E. coli ( <i>Escherichia coli</i> )	Salmonellosis	Staphylococcus aureus
<b>What Is it?</b>	<ul style="list-style-type: none"> <li>A common type of bacteria that normally lives inside your intestines, where it helps your body break down and digest the food you eat.</li> <li>Unfortunately, when the E. coli moves from your intestines, where it's needed, and finds its way into other parts of your body (where it is not supposed to be), you can get sick.</li> </ul>	<ul style="list-style-type: none"> <li>A type of bacteria that cause an infection of the gastrointestinal system in humans.</li> <li>The disease is usually limited to the intestinal tract, but the salmonella organisms can spread to other parts of the body, such as blood or bone.</li> </ul>	<ul style="list-style-type: none"> <li>Staph bacteria can live harmlessly on many skin surfaces, especially around the nose, mouth, genitals, and rectum.</li> <li>But when the skin is punctured or broken for any reason, staph bacteria can enter the wound and cause an infection.</li> </ul>
<b>Source</b>	<ul style="list-style-type: none"> <li>Contaminated ground beef, meat that's not cooked all the way through.</li> <li>Vegetables washed in contaminated water.</li> <li>Non pasteurized juices.</li> </ul>	<ul style="list-style-type: none"> <li>Foods contaminated with animal feces.</li> </ul>	<ul style="list-style-type: none"> <li>About 20% to 30% of healthy people carry staph bacteria in their noses at various times, without getting sick. And most of us begin to have staph growing harmlessly on our bodies before we are 1 week old.</li> </ul>
<b>Health Effects / Symptoms</b>	<ul style="list-style-type: none"> <li>Fever</li> <li>Vomit</li> <li>Diarrhea</li> <li>Chills</li> <li>Bad cramping</li> <li>Belly pain</li> </ul>	<ul style="list-style-type: none"> <li>Nausea</li> <li>Vomiting</li> <li>Abdominal cramps</li> <li>Diarrhea (sometimes bloody)</li> <li>Fever</li> <li>Headache</li> <li>Typhoid fever</li> </ul>	<ul style="list-style-type: none"> <li>Folliculitis</li> <li>Boils</li> <li>Scalded skin syndrome</li> <li>Impetigo (skin infection)</li> <li>Toxic shock syndrome</li> <li>Cellulitis</li> <li>Other types of infections</li> </ul>

# Type of Solutions to Air Pollution & Bacteria/Germ Elimination

You can reduce your family's exposure to air pollutants and, at the same time, fight pollution itself. Even small changes can make a big difference.

- Drive only when necessary: walk, cycle, or use public transit instead. Arrange a car pool.
- Choose alternatives to solvent-containing products, such as water-based paint, and dispose of all chemicals with care. Solvents in household cleaners and in surface coatings like oil-based paints are a major source of VOC.

Pollutants	Tobacco Smoke	Biological Contaminants	Carbon Monoxide (CO)	Nitrogen Dioxide (NO2)
<b>Steps to reduce exposure</b>	<ul style="list-style-type: none"> <li>• Do not smoke in your home or permit others to do so.</li> <li>• Do not smoke if children are present, particularly infants and toddlers.</li> <li>• If smoking indoors cannot be avoided, increase ventilation in the area where smoking takes place. Open windows or use exhaust fans.</li> </ul>	<ul style="list-style-type: none"> <li>• Install and use fans vented to outdoors in kitchens and bathrooms.</li> <li>• Empty water trays in air conditioners, dehumidifiers, and refrigerators frequently.</li> <li>• Clean and dry or remove water-damaged carpets.</li> </ul>	<ul style="list-style-type: none"> <li>• Keep gas appliances properly adjusted.</li> <li>• Install and use an exhaust fan vented to outdoors over gas stoves.</li> <li>• Do not idle the car.</li> </ul>	<ul style="list-style-type: none"> <li>• See steps under carbon monoxide.</li> </ul>

Pollutants	Organic Gases	Formaldehyde	Pesticides	Asbestos
<b>Steps to reduce exposure</b>	<ul style="list-style-type: none"> <li>• Use household products according to manufacturer's directions.</li> <li>• Make sure you provide plenty of fresh air when using these products.</li> <li>• Throw away unused or little-used containers safely; buy in quantities that you will use soon.</li> <li>• Keep out of reach of children and pets.</li> <li>• Never mix household care products unless directed on the label.</li> </ul>	<ul style="list-style-type: none"> <li>• Use "exterior-grade" pressed wood products (lower-emitting because they contain phenol resins, not urea resins).</li> <li>• Use air conditioning and dehumidifiers to maintain moderate temperature and reduce humidity levels.</li> <li>• Increase ventilation, particularly after bringing new sources of formaldehyde into the home.</li> </ul>	<ul style="list-style-type: none"> <li>• Use strictly according to manufacturer's directions.</li> <li>• Increase ventilation when using indoors.</li> <li>• Take plants or pets outdoors when applying pesticides to them.</li> <li>• Use nonchemical methods of pest control where possible.</li> <li>• Do not store unneeded pesticides inside home; dispose of unwanted containers safely.</li> <li>• Store clothes with moth repellents in separately ventilated areas, if possible.</li> <li>• Keep indoor spaces clean, dry, and well ventilated to avoid pest and odor problems.</li> </ul>	<ul style="list-style-type: none"> <li>• It is best to leave undamaged asbestos material alone if it is not likely to be disturbed.</li> <li>• Use trained and qualified contractors for control measures that may disturb asbestos and for cleanup.</li> </ul>

Bacteria	E. coli (Escherichia coli)	Salmonellosis	Staphylococcus aureus
<b>Steps to reduce exposure</b>	<ul style="list-style-type: none"> <li>• Only eat meat that is well cooked on the inside. The meat should not look pink at all and any juices should be clear.</li> <li>• Don't swallow any lake, ocean, or pool water.</li> <li>• Always clean the kitchen counter when raw meat has been sitting on it. Never put anything on top of the space where the raw meat was unless you wash it thoroughly first. The E. coli from the meat surface can sit in the counter and rub off onto that spoon or tomato you put on top of it.</li> <li>• Finally, always wash your hands after you use the bathroom and before you eat. There is plenty of bacteria in your waste and if you don't wash your hands, you could transfer the bacteria to your sandwich and then to your mouth without even knowing it!</li> </ul>	<ul style="list-style-type: none"> <li>• Similar to steps to reduce exposure to E. coli.</li> <li>• Care should be taken with family pets- especially reptiles - to avoid contact with their faeces. Wash your hands thoroughly after handling an animal and ensure that no reptiles are permitted to come into contact with an infant. (Children, especially young infants, are the most likely candidates to become ill from salmonella ingestion, and may even need to be hospitalized.)</li> </ul>	<ul style="list-style-type: none"> <li>• Hand washing is the most important way to prevent Staph (and other) infections.</li> <li>• Keep areas of the skin that have been injured - cuts, scrapes, eczema, and rashes caused by allergic reactions or poison ivy - clean and covered, and use antibiotic ointments or other treatments that your doctor suggests.</li> </ul>

# Facts & Figures: The Malaysian Environment

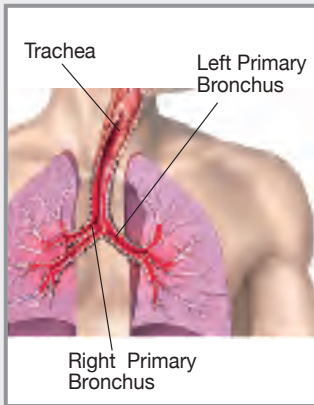
(Source: Sahabat Alam Malaysia - A to Z of the Malaysian Environment; [www.surfoerver.com/sam](http://www.surfoerver.com/sam))

The main sources of air pollution in Malaysia are motor vehicles, power stations, industrial fuel burning and processes, domestic fuel burning, burning of municipal and industrial waste.

In 1991, vehicle emissions contributed 75 percent of the total emissions into the air, an increase of 12 percent over 1987. Kuala Lumpur is now one of 15 Asian cities that have the greatest levels of pollution. The average reported suspended levels at 53 percent of monitoring stations far exceeded WHO standards. The five states with the largest number of air pollutants are Selangor, Perak, Federal Territory Kuala Lumpur, Penang and Johor. As urbanization and industrialization become more intensified, the situation will worsen unless due consideration is given to the incorporation of air pollution control measures in development planning.

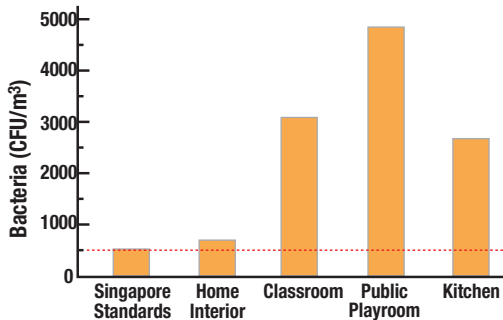


**Asthma** - it is estimated that 9 percent of the Malaysian population - about 1.54 million - suffers from asthma. Although it has not been scientifically proven, medical researchers have openly postulated the cause to be worsening environmental pollution that results in a higher level of irritants and allergens in the air. Contrary to popular belief, asthma is not exclusively a hereditary malady. It can be triggered by inhaling excessive smoke, dust, chemical and exhaust fumes, sawdust or spray paint. It is now believed that asthma is also brought about in the home environment due to indoor pollution such as dust mites, drapes and upholstery.



# Situation in Real World (Research Data and Survey)

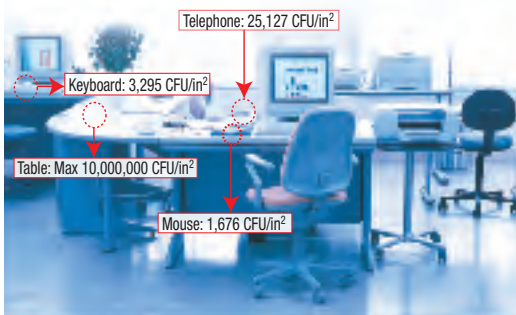
## Bacteria Attacks Kids



Yonsei Univ. Bioeng. Research Centre

## Bacteria in The Office

CNN News Report Feb 2004  
Arizona Univ. & Clorox Co.



## Bacteria and fungi in the hospital



### Bacteria CFU/m<sup>3</sup>

Outdoor: 160  
Patient's waiting room: 580  
Ward room: 120  
Intensive care unit: 80

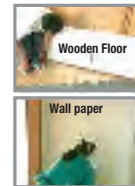
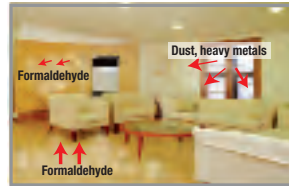
### Fungi CFU/m<sup>3</sup>

Outdoor: 100  
Patient's waiting room: 78  
Ward room: 52  
Intensive care unit: 20

*Korean Journal of Environmental Health 2003*

## Formaldehyde from hardwood, wall paneling and furniture....

→ Eye, nose and throat irritation; wheezing and coughing; fatigue, skin rash and severe allergic reaction.



## Biological pollutants (fungi, bacteria, virus)

from household pets, kitchen, wet or moist walls, ceilings, carpets  
→ Respiratory irritations, allergy irritation



### Biological pollutants (Malodor)

from decomposition of food, odor → Nausea, damage to nervous system

# Healthy Air Through Technology

Besides taking preventive actions to reduce your exposure to the various indoor air pollutants, there are many technologies available that aid the reduction of indoor air pollutants and elimination of bacteria & mould in the home.

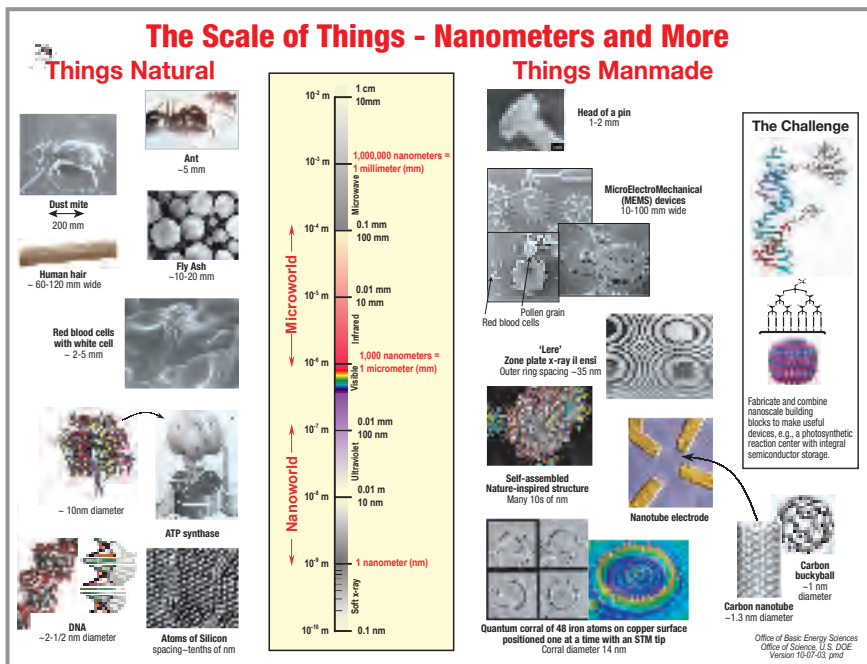
One of the latest air treatment methods is through Nanotechnology.

## What Is Nanotechnology?

“The art of manipulating materials on an atomic or molecular scale especially to build microscopic devices”

Merriam-Webster Dictionary, 1987

- **Devices with minimum features sizes less than 100 nanometers(nm) are considered to be products of nanotechnology.**



NanoSilver, NanoCarbon and NanoPhotocatalyst (Titanium Oxide) are some examples of nanotechnology products.

Category	Function	Applications
Nano-Photocatalyst	De-VOCs, Deodorise, Anti-bacterial	Air conditioner (pre-filter, de-odor filter)
Nano-Carbon	De-VOCs, Deodorise	Air conditioner (pre-filter, de-odor filter)
Nano-Silver	Anti-bacterial	Air conditioner (pre-filter, antibacterial filter)



99.9% bacteria free,  
no more worries

## NanoShield

- Effectively Inactivate & Eliminate Various Harmful  
Airborne Elements

