SHEPROS®

Safety, Heath & Environment Product Solutions

Solution for Outdoor Air Pollution (OAP)

MULTIPLE POLLUTION MASK

SHEPROS SDN. BHD.

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OUTDOOR AIR POLLUTION (OAP)

Outdoor air pollution is a major environmental health problem affecting everyone in developed and developing countries alike.

World Health Organization (WHO) estimates that some 80% of outdoor air pollution-related premature deaths were due to ischaemic heart disease and strokes, while 14% of deaths were due to chronic obstructive pulmonary disease or acute lower respiratory infections; and 6% of deaths were due to lung cancer.

Some deaths may be attributed to more than one risk factor at the same time. For example, both smoking and ambient air pollution affect lung cancer. Some lung cancer deaths could have been averted by improving ambient air quality, or by reducing tobacco smoking.

A 2013 assessment by WHO's International Agency for Research on Cancer (IARC) concluded that outdoor air pollution is carcinogenic to humans, with the particulate matter component of air pollution most closely associated with increased cancer incidence, especially cancer of the lung. An association also has been observed between outdoor air pollution and increase in cancer of the urinary tract/bladder.

Ambient (outdoor air pollution) in both cities and rural areas was estimated to cause 3.7 million premature deaths worldwide per year in 2012; this mortality is due to exposure to small particulate matter of 10 microns or less in diameter (PM_{10}), which cause cardiovascular and respiratory disease, and cancers.

People living in low- and middle-income countries disproportionately experience the burden of outdoor air pollution by 88% (of the 3.7 million premature deaths) occurring in low- and middle-income countries, and the greatest burden in the WHO Western Pacific and South-East Asia regions. The latest burden estimates reflect the very significant role air pollution plays in cardiovascular illness and premature deaths – much more so than was previously understood by scientists.

Most sources of outdoor air pollution are well beyond the control of individuals and demand action by cities, as well as national and international policymakers in sector like transport, energy waste management, buildings and agriculture.

MAJOR AIR POLLUTANTS AND THEIR EFFECTS

Poor outdoor air pollution can cause or contribute to the development of infections, lung cancer, and chronic lung diseases such as asthma. In addition, it can cause headaches, dry eyes, nasal congestion, nausea and fatigue. People who already have lung disease are at greater risk.

Asthma

Lung Cancer

Headaches

Dry Eyes

Nasal Congestion

Nausea

Outdoor air pollution comes from power plants, factories, cars, trucks, and buses. It also comes from off-road vehicles such as farm and construction equipment, and recreational vehicles. Individuals are directly responsible through their use of sources in their homes such as paints, consumer products and lawn mowers.

Below are the key air pollutants that pose health risks.

Particulate Matter

Definition and principal sources

PM affects more people than any other pollutant. The major components of PM are sulfate, nitrates, ammonia, sodium chloride, black carbon, mineral dust and water. It consists of a complex mixture of solid and liquid particles of organic and inorganic substances suspended in the air. The most health-damaging particles are those with a diameter of 10 microns or less, (≤ PM_{10}), which can penetrate and

lodge deep inside the lungs. Chronic exposure to particles contributes to the risk of developing cardiovascular and respiratory diseases, as well as of lung cancer.

Air quality measurements are typically reported in terms of daily or annual mean concentrations of PM_{10} particles per cubic meter of air volume (m^3). Routine air quality measurements typically describe such PM concentrations in terms of micrograms per cubic meter ($\mu g/m^3$). When sufficiently sensitive measurement tools are available, concentrations of fine particles ($PM_{2.5}$ or smaller), are also reported.

Health effects

There is a close, quantitative relationship between exposure to high concentrations of small particulates (PM_{10} and $PM_{2.5}$) and increased mortality or morbidity, both daily and over time. Conversely, when concentrations of small and fine particulates are reduced, related mortality will also go down – presuming other factors remain the same. This allows policymakers to project the population health improvements that could be expected if particulate air pollution is reduced.

Small particulate pollution has health impacts even at very low concentrations – indeed no threshold has been identified below which no damage to health is observed. Therefore, the WHO 2005 guideline limits aimed to achieve the lowest concentrations of PM possible.

Guideline values

$PM_{2.5}$
10 $\mu g/m^3$ annual mean
25 $\mu g/m^3$ 24-hour mean
PM_{10}
20 $\mu g/m^3$ annual mean
50 $\mu g/m^3$ 24-hour mean

In addition to guideline values, the Air Quality Guidelines provide interim targets for concentrations of PM_{10} and $PM_{2.5}$ aimed at promoting a gradual shift from high to lower concentrations.

If these interim targets were to be achieved, significant reductions in risks for acute and chronic health effects from air pollution can be expected. Progress towards the guideline values, however, should be the ultimate objective.

The effects of PM on health occur at levels of exposure currently being experienced by many people, both in urban and rural areas and in developed and developing countries – although exposures in many fast-developing cities today are often far higher than in developed cities of comparable size.

"WHO Air Quality Guidelines" estimate that reducing annual average particulate matter (PM_{10}) concentrations from levels of 70 μg/m^3, common in many developing cities, to the WHO guideline level of 20 μg/m^3, could reduce air pollution-related deaths by around 15%. However, even in the European Union, where PM concentrations in many cities do comply with Guideline levels, it is estimated that average life expectancy is 8.6 months lower than it would otherwise be, due to PM exposures from human sources.

In developing countries, indoor exposure to pollutants from the household combustion of solid fuels on open fires or traditional stoves increases the risk of acute lower respiratory infections and associated mortality among young children; indoor air pollution from solid fuel use is also a major risk factor for cardiovascular disease, chronic obstructive pulmonary disease and lung cancer among adults.

Ozone (O_3)

Guideline values

O_3
100 μg/m^3 8-hour mean

The recommended limit in the 2005 Air Quality Guidelines was reduced from the previous level of 120 μg/m^3 in previous editions of the "WHO Air Quality Guidelines" based on recent conclusive associations between daily mortality and lower ozone concentrations.

Definition and principal sources

Ozone at ground level – not to be confused with the ozone layer in the upper atmosphere – is one of the major constituents of photochemical smog. It is formed by the reaction with sunlight (photochemical reaction) of pollutants such as nitrogen oxides (NO_x) from the vehicle and industry emissions and volatile organic compounds (VOCs) emitted by vehicles, solvents and industry. As a result, the highest levels of ozone pollution occur during periods of sunny weather.

Health effects

Excessive ozone in the air can have a marked effect on human health. It can cause breathing problems, trigger asthma, reduce lung function and cause lung diseases. In Europe, it is currently one of the air pollutants of most concern. Several European studies have reported that the daily mortality rises by 0.3% and that for heart diseases by 0.4%, per 10 μg/m^3 increase in ozone exposure.

Nitrogen Dioxide (NO_2)

Guideline values

NO_2
40 µg/m^3 annual mean
200 µg/m^3 1-hour mean

The current WHO guideline value of 40 µg/ m^3 (annual mean) was set to protect the public from the health effects of gaseous.

Definition and principal sources

As an air pollutant, NO_2 has several correlated activities.

- At short-term concentrations exceeding 200 µg/m^3, it is a toxic gas which causes significant inflammation of the airways.
- NO_2 is the main source of nitrate aerosols, which form an important fraction of $PM_{2.5}$ and, in the presence of ultraviolet light, of ozone.

The major sources of anthropogenic emissions of NO_2 are combustion processes (heating, power generation, and engines in vehicles and ships).

Health effects

Epidemiological studies have shown that symptoms of bronchitis in asthmatic children increase in association with long-term exposure to NO_2. Reduced lung function growth is also linked to NO_2 at concentrations currently measured (or observed) in cities of Europe and North America.

Sulfur Dioxide (SO_2)

Guideline values

SO_2
20 µg/m^3 24-hour mean
500 µg/m^3 10-minute mean

A SO_2 concentration of 500 µg/m^3 should not be exceeded over average periods of 10 minutes duration. Studies indicate that a proportion of people with asthma experience change in pulmonary function and respiratory symptoms after periods of exposure to SO_2 as short as 10 minutes.

The (2005) revision of the 24-hour guideline for SO_2 concentrations from 125 to 20 µg/ m^3 was based on the following considerations.

- Health effects are now known to be associated with much lower levels of SO_2 than previously believed.
- A greater degree of protection is needed.
- Although the causality of the effects of low concentrations of SO_2 is still uncertain, reducing SO_2 concentrations is likely to decrease exposure to co-pollutants.

Definition and principal sources

SO_2 is a colorless gas with a sharp odor. It is produced from the burning of fossil fuels (coal and oil) and the smelting of mineral ores that contain sulfur. The main anthropogenic source of SO_2 is the burning of sulfur-containing fossil fuels for domestic heating, power generation and motor vehicles.

Health effects

SO_2 can affect the respiratory system and the functions of the lungs, and causes irritation of the eyes. Inflammation of the respiratory tract causes coughing, mucus secretion, aggravation of asthma and chronic bronchitis and makes people more prone to infections of the respiratory tract. Hospital admissions for cardiac disease and mortality increase on days with higher SO_2 levels. When SO_2 combines with water, it forms sulfuric acid; this is the main component of acid rain which is a cause of deforestation.

Airborne Microorganisms

Airborne Microorganisms are abundant in the atmosphere, where they often represent a major portion of the organic aerosols. Potential pathogens of plants and livestock are commonly dispersed through the atmosphere, and airborne bacteria can have important effects on human health as pathogens or triggers of allergic asthma and seasonal allergies. Despite their importance, the diversity and biogeography of airborne microorganisms remain poorly understood.

Here we consider:

- some important respiratory diseases of humans
- the roles of airborne spores in crop diseases
- the methods used to monitor spore populations in the air

During a sneeze, millions of tiny droplets of water and mucus are expelled at about 200 miles per hour (100 meters per second). The droplets initially are about 10-100 micrometers diameter, but they dry rapidly to droplet nuclei of 1-4 micrometers, containing virus particles or bacteria. This is a major means of transmission of several diseases of humans, shown in the table below.

Some important diseases of humans transmitted from person to person by inhaled airborne particles:

Virus Diseases **(virus type in brackets)**	**Bacterial Diseases** **(bacterial name in brackets)**
Chickenpox *(Varicella)*	Whooping cough *(Bordetella pertussis)*
Flu *(Influenza)*	Meningitis *(Neisseria species)*
Measles *(Rubeola)*	Diphtheria *(Corynebacterium diphtheriae)*
German measles *(Rubella)*	Pneumonia *(Mycoplasma pneumoniae, Streptococcus species)*
Mumps *(Mumps)*	Tuberculosis *(Mycobacterium tuberculosis)*
Smallpox *(Variola)*	

Several other diseases, below, are acquired by inhaling particles from environmental sources, not directly from an infected person.

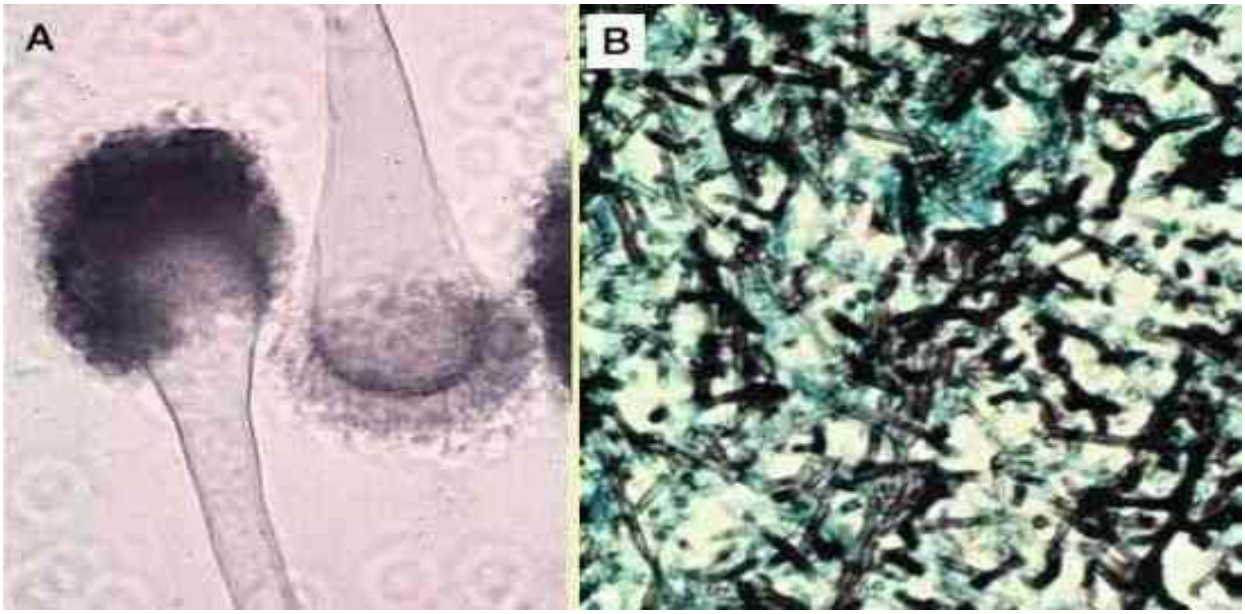
Disease	**Source**
Psittacosis *(Chlamydia psittaci)*	Dried, powdery droppings from infected birds (parrots, pigeons, etc.).
Legionnaire's disease *(Legionella pneumophila)*	Droplets from air-conditioning systems, water storage tanks, etc., where the bacterium grows.
Acute allergic alveolitis *(various fungal and actinomycete spores)*	Fungal or actinomycete spores from decomposing organic matter (composts, grain stores, hay, etc.)
Aspergillosis *(Aspergillus fumigatus, A. flavus, A. niger)*	Fungal spores inhaled from decomposing organic matter.
Histoplasmosis *(Histoplasma capsulatum)*	Spores of the fungus, in old, weathered bat or bird droppings.
Coccidioidomycosis *(Coccidioides immitis)*	Spores in air-blown dust in desert regions (Central, South and North America) where the fungus grows in the soil.

Psittacosis is a serious disease acquired by handling birds or by inhaling dust from bird faeces. It is caused by the bacterium *Chlamydia psittaci*, an obligate intracellular parasite. After entering the respiratory tract, the cells are transported to the liver and spleen, multiply there and then invade the lungs, causing inflammation, haemorrhage and pneumonia.

Legionnaire's disease is a fairly common form of pneumonia in older or immunocompromised people. It is seldom transmitted directly from person to person. The bacterium is an aquatic rod-shaped species with a temperature optimum of about 36^{o}C, and is a common inhabitant of warm-water systems in buildings. Infection occurs when people inhale aerosol droplets containing the bacteria.

Extrinsic allergic alveolitis is a serious hypersensitive response, usually associated with repeated exposure to airborne spores in the work environment. A classic example is the condition termed farmer's lung, caused by exposure to spores of thermophilic actinomycetes.

Aspergillosis, **Histoplasmosis** and **Coccidioidomycosis** are examples of serious fungal infections of humans, initiated by spores deposited in the alveoli. They can be life-threatening diseases of immunocompromised people, when the fungi disseminate from the lungs to major organs of the body. However, in all cases the infection of humans is incidental to the fungus, playing no part in its normal biology. These are fungi that grow naturally as decomposer organisms in the soil, bird faeces or other organic substrates.



Aspergillus fumigatus. (A) Typical sporing heads of the fungus in laboratory culture. Spores are produced from phialides that arise from the upper part of a club-shaped swelling (vesicle) of an erect hypha (the sporangiophore). (B) Microscopic section of lung tissue, stained to show hyphae of Aspergillus in an air sac. Such a ball of hyphae growing saprotrophically in the lung is termed an aspergilloma.

The human respiratory tract as an air-sampling device

The respiratory tract is highly effective in trapping airborne particles, with sometimes serious consequences for health. The mechanisms involved depend on particle size.

1. Large particles (about 10 micrometers) have sufficient mass to impact onto surfaces, even at low air speeds. They break free from the air as it flows around obstacles. During normal breathing, the airflow in the nose and trachea is about 100 cm per second - sufficient for pollen grains and larger fungal spores (Alternaria, etc.) to be retained on the mucosa, where they can cause typical hay fever symptoms like rhinitis and asthma.

2. Smaller particles do not impact at these air speeds, and the air speed decreases as the respiratory system branches further down. So all the particles of 5 micrometers or less are carried deep into the lungs. There they can settle out by sedimentation in the brief periods when the air is calm between successive breaths. Particles of 2-4 micrometers are optimal for alveolar deposition, and this range includes the spores of many Aspergillus and Penicillium species.

   This is how some of the serious fungal infections of humans are initiated - Aspergillomas, Histoplasmosis, Coccidioidomycosis, etc.

3. Even smaller particles, such as the spores of Actinomycetes (about 1 micrometer) are less efficient at being deposited in the alveoli, but repeated exposure to spore clouds by agricultural workers can lead to sensitisation and extrinsic allergic alveolitis (Farmer's lung, etc.)

4. Very small particles, less than about 0.5 micrometers, do not impact but are moved by diffusion (Brownian motion) which brings them randomly into contact with surfaces in the lungs. This is true of the fine dusts that cause many occupational diseases.

MULTIPLE POLLUTION MASK

Activating Oxidizing Protection Aids Products

Multiple Pollution Mask is a unique product for use in air purification. It is made with a disposable activated oxidizing filter that is sealed inside a comfortable lightweight frame.

The Multiple Pollution Mask was designed to effectively seal in the activated oxidizing filter. This filter does not replace industrial strength respirators and is not meant for extreme occupational exposure, but for most everyday tasks. This mask is more than sufficient to filter common indoor and outdoor air pollution. The Multiple Pollution Mask was shown to be comparable to a standard N95 mask in the filtration of particles 1.0 microns in size and larger. This face mask trapped 99-100% of particles in that size range.

TECHNOLOGY:

The Multiple Pollution Mask adopted all proven non-woven materials to meet the bio-compatibility and user safety aspects. In the middle of the non-woven fabric is a fabric powered with the activated oxidizing filter. The activated oxidizing fabric works with inner layers of filtration material to trap these indoor and outdoor pollutants such as air pathogens, particles, smog, dust, diesel fumes, formaldehyde and VOCs. It also does not support bacterial and fungal growth.
The Multiple Pollution Mask employs two of the state-of-the-art proven methods of gas contaminant control: sorption and oxidation. It begins operation by both adsorbing and absorbing molecules. Then, with the activated oxidizing filter, proceeds to chemically destroy the collected contaminants. This chemical oxidation is termed as Controlled Oxidation because of its containment in the fabric form; and because it does not involve high temperatures or burning, unlike combustible oxidation methods.

The product design fully benchmarked and achieved against the users expectation encountered against N95, vast improvement and specification altered or upgraded towards the user's expectation according to Bacterial Filtration Efficiency (BFE) within the ASTM F2101 standard and the Differential Pressure (Delta P) to determine the air exchange differential (breathability) of porous material.

MATERIAL AND STRUCRURE:

The Multiple Pollution Mask is designed in 3 layers:

- Layer 1 – Outer layer of SPUNBOND + MELTBLOW
- Layer 2 – Powered with Activated Oxidizing Filter
- Layer 3 – MELTBLOW
- Ear Band – Nylon and PP

PRODUCT CAPABILITIES:

- More than 99% of contact kill rate of germs – Staphylococcus Aureus ATCC 6538 (Challenge Test Studies).
- Achieved 99% of contact kill rate of germs within the airborne bacteria test in an actual living environment (Empirical Studies).
- BFE average rate up to 99%, but with the additional protection of Activated Oxidizing Filter, it has obviously further enhanced the product performance. Based on FDA scale relating breathing resistance to comfort, a differential pressure drop of 2.0-3.0 considered low. According to EN14683 international applied standard, Multiple Pollution Mask achieved the resistance ≤2.0.
- The particulate filtration rate is more than 95% efficiency.
- The Multiple Pollution Mask material is anti blood and water repellency.
- The Multiple Pollution Mask is meeting the *16 CFR part 1610 Standard for the flammability of Clothing Textile*, the material is subjected to 5 inches distance at 45 degree flame test and found more than 5 second to cause the ignition of the face, under the normal class 1 fabric standard, take longer than 4 second to burn is considered normal textile flammability.

- Eliminates odor.
- Self cleansing and overall fully protected against the cross contaminations.

ADVANTAGES:

- Three dimensional design for better face fitting
- Very lightweight and superb ventilation
- Vacuum packed to preserve the product performance before use
- Air sealed external packing for control storage and control disposal
- Protection aids for flu attacks and Asthma triggers
- Prevent volatile organic compounds allergy and respiratory infections
- Active usage time until the inner activated oxidizing filter, turn from brown to black color
- No harmful chemical applied
- Very affordable price and economical

APPLICATIONS:

Medical

- Emergency services
- Nursing Homes
- Oncology post treatment areas for patients
- Nurseries
- Doctors and Dentists
- Medical Laboratories
- Mortuary
- Clinics

Business

- Research laboratories
- Sterile processing
- Clean rooms
- Funeral Halls
- Travel agencies / Companies

Institutions

- Day care centers
- Schools
- Universities

Private

- In home – Protection aids
- Outside – Protection aids

NOTICE TO USERS:

- Disposable type and active exposure time up to the inner activated oxidizing filter, turn from brown to black color
- To store the used masks into the air sealed pack before reuse
- Do not wash the masks
- Do not destroy the inner vacuum pack prior to use
- Not effective against high concentration of harmful or toxic gases
- Stop using when felt irritated
- Once you discovered the broken vacuum pack, recommended not to use

STORAGE:

- Keep away from direct sunlight
- Stored below 50% humidity level and below 35 degree Celsius
- Retention period up to 5 years
- The material discoloration will not affect the Face Masks effectiveness

ADDITIONAL SUPPORT INFORMATION:

- Bio-compatibility – Safety with ISO19033 international test standard against Cytotoxicity, Irritation to primary skin and Skin Sensitization.
- Bacterial Filtration Efficiency – Test against the procedures complied to ASTM F2101 to determine the air exchange differential (Breathability) of porous material.
- EN14683- International Test Standard to determine the breathability (differential pressure with Delta P).
- 16 CFR Part 1610 – International Testing Standard for the flammability of Clothing Textiles.
- FDA ID CODE: 2030950 – FDA Testing Standard applies to Toxicity Test of Oral Dose and Skin Patch Test.
- All challenges, Empirical Testing and chemical analysis conducted at the accredited laboratory with recognized International Standard ISO/IEC 17025:2005 SAMM074 – Chemical Laboratory (Malaysia) SDN BHD (Field of Testing: Chemical and Microbiology).
- Non-Woven material for masks Tested in NELSON Laboratory. The Laboratory is FDA registered and third-party certified to ISO 17025 of laboratory quality management system.
- MSDS of substances used will be furnished with an international CAS number for verification and prepared according to 29 CFR 1910.1200 (Toxic and Hazardous Substances Standard).