

22 September 2014

Haze and Health Effects

Singapore can experience haze from time to time. This is more likely in the months of May to October as a result of very dry weather conditions in the region intensifying the effects of the fires in Indonesia and the prevailing Southwest Monsoon winds blowing the smoke from the fires in Singapore's direction. However as it can be seen recently, haze can happen in Singapore even outside the period of May to October.



1. What is Haze?

Haze is an aggregation in the atmosphere of very fine, widely dispersed, solid or liquid particles, or both, in relatively dry air, giving the air an opalescent appearance.



2. Adverse effects of haze on health

Haze contains dust, smoke particles, and air pollutants such as sulphur dioxide, nitrogen dioxide, ozone, carbon monoxide and particulate matter. As a result of the small particulate size, these particles can go deep into the lungs, and in some cases, enter the bloodstream. PM_{2.5} particulate matters, being the smallest, can penetrate right into the small air sacs in our lungs when inhaled, thereby posing the highest health risk.

Short-term exposures to particles (hours or days) can aggravate lung disease, causing asthma attacks and acute bronchitis, and may also increase susceptibility to respiratory infections. In people with heart disease, short-term exposures can be linked to heart attacks and arrhythmias.

Long-term exposures have been associated with problems such as reduced lung function and the development of chronic bronchitis and even premature death.

The health effects can be further classified into local and systemic effects.

Local effects can result in eye, nose, and throat irritation. People with history of sinus problems or sensitive nose are more likely to develop nasal congestion, sore throat and coughing. There may be increase incidents of skin irritations as well for those with eczema or other skin conditions.

Systemic effects are more serious. These can range from respiratory conditions such asthma attacks and bronchitis to worsening of heart diseases such as heart attacks or heart failure. There have also been suggestions that long term exposure to air pollution may give rise to increase risk of cancer.

The health effects are more prominent in high risk groups. The following groups of people should minimise outdoor activities when the air quality is bad.

- Children as they are more vulnerable due to faster breathing rates and the fact that their lungs are still developing.
- Elderly as they are more prone to adverse health conditions because of past medical conditions.
- Patients with past medical problems such as:
 - Any respiratory conditions especially those with asthma, chronic obstructive lung diseases.
 - Any heart diseases especially those with coronary artery disease, congestive heart failure.
 - Any history of ear, nose and throat problems such as allergic nasal conditions or problem with sinusitis.
 - Chronic diseases such as diabetes as patients with diabetes are more prone to cardiac conditions.





3. How is the severity of haze determined?

Using a network of air monitoring systems located in different parts of Singapore, the air quality is measured, and reported as the PSI index. PSI stands for 'Pollutant Standards Index'. It is an index developed by the United States Environmental Protection Agency (USEPA) and is determined by the level of air pollutants such as sulphur dioxide, nitrogen dioxide, ozone, carbon monoxide and particulate matter called PM10 (particulate matter of 10 microns or smaller in size).

Another value PM_{2.5} measures the level of pollutants that are of particulate matter 2.5 microns or smaller in size. As a result of their very small particulate size, these pollutants can penetrate deeper into the lungs and enter the blood stream, resulting in greater adverse health conditions.

With effect from 1 April, National Environment Agency (NEA) of Singapore adopted a new reporting system which incorporated the 2 indices, PSI and PM_{2.5}. The revised PSI index will reflect a total of 6 pollutants, namely sulphur dioxide, nitrogen dioxide, carbon monoxide, ozone, PM₁₀ and PM_{2.5}.



4. What does the PSI Value mean?

New PSI Value	Air Quality Descriptor
0 - 50	Good
51 - 100	Moderate
101 - 200	Unhealthy
201 - 300	Very unhealthy
Above 300	Hazardous

5. PSI reporting system and how to make sense of it

The health impact of air pollution is related to concentration levels of pollutants, the duration of exposure, as well as the health status and level of activity of the individual.

During the haze episode, PM_{2.5} is the dominant pollutant NEA reports the air quality as a 3-hour PSI level, a 1-hour PM_{2.5} and a 24 hour PSI level.

The 3 hour PSI is calculated based on PM_{2.5} concentration averaged over 3 hours. 3-hour PSI level and 1-hour PM_{2.5} concentration level are more volatile than the 24 hour PSI level, as they average the pollutants level over a short period of time.

The **24 hour PSI** tracks PM_{2.5}, as a separate pollutant, together with the other 5 pollutants. It reflects the total exposure of an individual to PM_{2.5} level and provides good correlation of health effects. In view of this, the health advisory in Singapore takes reference from the 24-hour PSI as scientific and epidemiological studies on the health effects of particulate matter have been based on this duration of exposure. During haze episodes, NEA also provides an air quality forecast for the next 24 hours based on all relevant factors, including weather conditions, in determining this forward projection.

You can use the 3-hour PSI level or 1-hour PM_{2.5} level to make adjustment to your daily activities. For example, if the 3-hour PSI is high, you may wish to postpone strenuous outdoor activities such as jogging.



You can better plan your activities with the new simplified PSI index.

PSI level	Healthy Persons	Elderly, pregnant women, children	Persons with chronic lung disease, heart disease, or stroke
Good (0-50)	Normal Activities	Normal Activities	Normal Activities
Moderate (51-100)	Normal Activities	Normal activities	Normal activities
Unhealthy (101-200)	Reduce prolonged** or strenuous*** outdoor physical exertion	Minimise prolonged** or strenuous outdoor physical exertion	Avoid prolonged or strenuous outdoor physical exertion Reduce prolonged or heavy outdoor exertion if outdoor activity is unavoidable If outdoor activity is unavoidable, wear an N95 mask.^^
Very Unhealthy (201-300)	Avoid prolonged** or strenuous*** outdoor physical exertion Wear N95 mask if prolonged** and strenuous*** outdoor activity is unavoidable	Minimise outdoor activity If prolonged** outdoor activity is unavoidable, for adults, use an N95 mask.^^	Avoid outdoor activity If outdoor activity is unavoidable, wear an N95 mask.^^
Hazardous (> 300)	Minimise outdoor activities Wear N95 mask if outdoor activity is unavoidable	Avoid outdoor activity If outdoor activity is unavoidable, for adults, use an N95 mask.^^	Avoid outdoor activity If outdoor activity is unavoidable, wear an N95 mask.^^

Note: The advisory issued each day by NEA on forecast haze levels will be based on the PSI. However, if PM2.5 levels warrant a higher-level advisory, a higher-level advisory will be issued.

** Prolonged = continuous exposure for several hours

*** Strenuous = involving a lot of energy or effort



6. When is a N95 mask needed?

Healthy people should minimise outdoor activities when the PSI is greater than 200. Individuals in the higher risk groups should minimise outdoor activities when the PSI is greater than 101.

The 24-hr PSI level is in the 'Unhealthy' range when it exceeds 101. Individuals with existing heart or respiratory ailments or those who are more susceptible to smoke haze are advised to wear a respiratory mask such as N95 masks (designed to keep out fine particulate matter) when they go outdoors.



It is important to note that the use of N95 mask does increase the effort in breathing and may cause discomfort, tiredness or headache. As some elderly people, people with chronic lung disease, heart disease or stroke, and women in the 2nd and 3rd trimesters of pregnancy may already have reduced lung volumes or breathing issues, they should stop using a N95 mask if they feel uncomfortable. They should consult their doctor as to whether they can use the N95 mask. In addition, women in the 2nd and 3rd trimesters of pregnancy should not use the N95 mask for more than a short duration each time.

N95 masks are not certified for use in children, so it is best for them to remain indoors as much as possible. People with respiratory diseases should consult their doctors on the use of respirator masks if they intend to use them.

Surgical masks and paper masks do not provide adequate protection from the haze particles. Any individuals who experience any symptoms relating to irritation of the eye, nose and throat or any chest symptoms such as difficulty breathing or chest pain should consult their doctors.

7. Types of masks suitable for protection against the haze

N95 respirator masks are recommended for the protection against the haze. There are different brands and types of N95 masks in the market with the same functionality. Some models available in Singapore can be seen on the following page.



Some models of different masks available

N95 masks provide good protection against the haze as they are at least 95% efficient against fine particles that are about 0.1 – 0.3 microns. It is even more efficient (99.5% efficient) against particles that are 0.75 microns and larger.



3M-8210
Most common model in the market



3M-1860
Commonly used in healthcare institutions



3M-8110S
(Similar to 3M-8210 but for smaller faces)



3M-1860S
(Similar to 3M-1860 but for smaller faces)



Dräger Piccola FFP3
Cone-shaped mask for better fit



Kimberly-Clark 46727
Pouch-style, large breathing chamber for added comfort



MOH 24-hour Haze Hotline: 1800-333-9999
www.moh.gov.sg/haze

(Picture adapted from www.moh.gov.sg/haze)

Instructions for wearing and removal of the N95 mask are as shown below

Wearing and Removing Your N95 RESPIRATOR Correctly

(Cone Mask)

WEARING THE RESPIRATOR



- Step 1:** Select the correct respirator size which you were fitted.
Step 2: Place your palm through the loops of your respirator and cup it over your face.



- Step 1:** Position the respirator to cover the nose and chin.
Step 2: With one hand holding the respirator, use the other hand to place the first strap onto the crown of the head (above the ears), then place the second strap onto the back of the neck.



- Step 1:** Using two fingers of both hands, press down the metal piece according to the contour of your nose bridge.

NEVER PINCH THE METAL PIECE!

POSITIVE PRESSURE FIT CHECK



- Step 1:** With both hands over the respirator, exhale strongly to check for leakage around it.
Step 2: Leakage is evident when your hair moves during the strong exhale. If wearing glasses, fogging of the glasses indicate leakage.
Step 3: If air leak is noted, adjust respirator, straps, and nose piece before testing again.

REMOVING THE RESPIRATOR



- Step 1:** With both hands, slowly lift the bottom strap from around your neck up and over your head.
Step 2: Lift off the top strap. Do not touch the respirator.

RESPIRATOR IN CORRECT POSITION*



Alternatively, you can watch the instructional video [here](#)



8. Advice on reuse of N95 masks

N95 masks can be reused as long as it is not soiled or distorted in shape. However, there should be no sharing of masks strictly. Mask should also be changed when they become moist.

When not fitted on the face, one should ensure there is proper storage of the mask to avoid contamination e.g. to keep it in a zip lock bag. The mask should also not be left dangling around the neck as it will increase contamination of the inside surface of the mask.

9. Advice to special patient groups

- Children's N95 masks are not available, so how can we protect children from the adverse effects of haze?
 - N95 masks are not designed for children because a proper fit cannot be achieved on children and the N95 mask may not provide full protection.
 - Limit duration of outdoor activities when PSI > 100.
 - Stay indoors when PSI > 200 (very unhealthy).

- For asthmatic patients, how do they prepare themselves further?
 - Take their preventive meds regularly. Ensure their asthma is well controlled.
 - Ensure they have their rescue medications at hand.
 - Annual flu vaccine.
 - Limit duration of outdoor activities when PSI > 100.
 - Stay indoors when PSI > 200 (very unhealthy).
 - When wearing N95 mask, discontinue use if having difficulty breathing.

- What should I do if my eyes get watery and itchy as a result of haze?
 - Avoid rubbing.
 - Saline wash, commercial eye baths, warm towel compress.
 - When all fails, consult a doctor if not better. Anti-histamines and anti-allergic eye drops may be prescribed.

- General advice on what we can do in this period.
 - Stay healthy: adequate sleep, adequate hydration.
 - Get you annual flu vaccine updated.
 - For those with chronic illness, take your medications regularly.
 - Limit duration of outdoor activities when PSI > 100. Wear N95 mask when outdoors.
 - N95 mask increases the effort of breathing. So even if they need to go outdoors, they should not wear N95 masks for a long period.
 - Stay indoors when PSI > 200 (very unhealthy).



Tips to minimise the effects of haze on health

- Reduce outdoor activities.
- Avoid smoking.
- Drink at least 2 litres of water a day.
- Frequently wash hands and face after outdoor activities.
- Keep indoor environment clean.
- If you are suffering from asthma or heart disease, make sure you have adequate supply of medicine.
- Take your medicine regularly.
- See your doctor immediately if your condition worsens.

Source: Health Ministry



Should you require further information or clarification, please contact our Corporate Services Team or Account Managers at 6311 1333 for assistance.

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