



## Ground Air Pollution Health and Safety Guide

It's important for aircrew and other staff to be aware of air quality, the way it is measured, and how best to respond to differing levels of air pollution. This guide discusses how air pollution is monitored with the Air Quality Index, what are the potential adverse health effects, and how we should respond at differing levels to protect ourselves. Aircrew and other staff are advised to monitor air pollution when visiting at risk locations and take steps to minimise exposure. Most importantly this is avoiding outdoor activity as much as possible when the air pollution level is high.

Many ports are susceptible to high air pollution, especially in developing parts of the world with dense population. Transient events such as bush fires, back burning, or sand storms can lead to high air pollution. The recommendations given below should be followed when in a location where the air pollution is high.

### Background

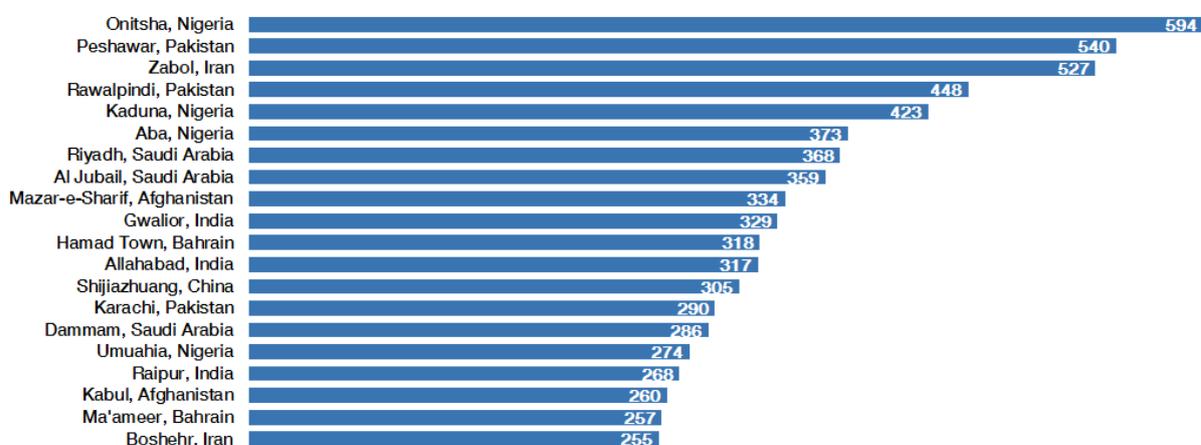
Air pollution is composed of chemicals and particles present in the air, which have the potential to cause harm to humans, animals and the environment. In general, the greater the concentration of pollutants the greater the risk of causing harm. Pollutants are by-products in the atmosphere from natural and man-made sources such as bushfires, back burning, dust storms, factory and vehicle emissions, and combustion heating.

The World Health Organization (WHO) estimates that air pollution has risen by 8% globally in the past five years. Most large cities in the developing world are breaching global air pollution guidelines, according to new data from the WHO. The latest urban air quality data, collected between 2011 and 2015, reveals that 98% of cities with over 100,000 inhabitants in low- and middle-income countries do not meet WHO air quality guidelines.

### The 20 most polluted cities in the world



PM10 particulate concentration, micrograms per cubic meter, annual mean



Source: World Health Organisation Urban Ambient Air Pollution database, 2016 update

Air pollution is made up of gases and particulate matter (PM). The common concerning gases found in air pollution are nitrogen dioxide, sulphur dioxide, ozone and carbon monoxide. PM consists of a mixture of solid and liquid particles suspended in the air. PM is described in terms of the mass concentration of particles with a diameter of less than 10  $\mu$  m (PM10), and a diameter of less than 2.5  $\mu$  m (PM2.5). The smaller particles (PM2.5) are able to move further into the respiratory tract towards the smaller airways and lungs themselves and so are associated with greater health risks. For this reason we tend to use the PM2.5 level as the measure for assessing the pollution level and associated precautions we should take. Air quality standards consist of an indicator PM10 or PM2.5 mass, an averaging time (e.g. 24-hours or 1-year), a mass concentration level in ambient air and, a statistical form (e.g. limit not to be exceeded more than once per year)

### Monitoring Pollution Levels

Pollution data readings are recorded in different units of measure, depending on the type of pollutant. In order to usefully compare pollutants, an Air Quality Index or AQI is used. AQI is expressed as a number, from 1 to 500 and beyond. The lower the number, the better the air quality. Below is a guide to a range of AQI values and the corresponding air quality description:

| Air Quality Description | Good | Moderate | Unhealthy for sensitive groups | Unhealthy | Very unhealthy | Hazardous |
|-------------------------|------|----------|--------------------------------|-----------|----------------|-----------|
| AQI                     | 0-50 | 51-100   | 101-150                        | 151-200   | 201-300        | 301-500   |

Aircrew and other staff travelling on business can check the AQI readings for the city of interest and make informed decisions about limiting their exposure to air pollution.

Air pollution changes within a day and over seasons and during environment events such as bushfires. Peak traffic times tend to be associated with higher air pollution in populated developing countries. Winter tends to be higher risk due to the use of heating.

### Understanding the Air Quality Index (AQI)

The AQI reported around the world can differ, owing to different local standards being used. Standards can vary by country, state or region. Reputable AQI sources should be used when seeking a reliable and meaningful AQI. Aircrew and other staff can monitor the AQI in most cities they visit (including their home base). This can be done via a range of websites and smartphone apps. Day to day monitoring of AQI can be done for most cities around the world via the Air Quality Index website.

The following sources for AQI are recommended:

[Air Quality Index Website](#)

[Chinese Government website](#)

[Air Quality Real time AQI- Android App](#)

[Global Air Quality Monitoring & Pollution Forecast PM2.5 AQI- iPhone App](#)

For Beijing we recommend also the [US Embassy in China website](#)

### What is a safe level of exposure in any short term period e.g. standard one day layover?

There is no evidence of a safe level of exposure or a threshold below which no adverse health effects occur. The WHO 2005 guideline limits are aimed to achieve the lowest concentrations of PM possible and have set guideline values at:

|  |   |
|--|---|
| <b>PM<sub>2.5</sub></b><br>25 µg/m <sup>3</sup> 24-hour mean | <b>PM<sub>10</sub></b><br>50 µg/m <sup>3</sup> 24-hour mean |
|--|---|

Exposure to fine particles from a one-day layover could be associated with short-term health effects such as eye, nose, throat and lung irritation. The main symptoms would be coughing, sneezing, runny nose or shortness of breath. Exposure to fine particles can also affect lung function and worsen medical conditions such as asthma and heart disease.

Aircrew generally do not fall into a higher risk group. Those that do have underlying chronic respiratory or cardiac disease should discuss management of air pollution with their doctor and their company's designated physician if available. With limited outdoor exposure when up line and good quality accommodation, it is unlikely that any aircrew will have significant short term health problems relating to air pollution.

### What is a safe level of exposure in the longer term?

There is no evidence of a safe level of exposure or a threshold below which no adverse health effects occur. Chronic exposure to particles contributes to the risk of developing cardiovascular and respiratory diseases such as bronchitis, COPD and lung cancer. This evidence is generally related to local residents with long term exposures.

For the intermittent traveller exposed to occasional air pollution to the level that aircrew are exposed, there is no evidence to suggest there is a risk of long term health effects. We recommend all staff take precautions to limit air pollution exposure to a level that is as low as reasonably achievable, the so called ALARA principle. We recommend this principle for other potential environmental hazards, such as cosmic radiation.

The WHO 2005 guideline limits are aimed to achieve the lowest concentrations of PM possible and have set guideline values at:

|   |  |
|---|--|
| <b>PM<sub>2.5</sub></b><br>10 µg/m <sup>3</sup> annual mean | <b>PM<sub>10</sub></b><br>20 µg/m <sup>3</sup> annual mean |
|---|--|

Example: for Beijing in 2016 the PM 2.5 level averaged 76.6 µg/m<sup>3</sup>.

Given the variable high levels of air pollution in some ports around the world, aircrew are advised to follow the recommendations listed below to minimise exposure. Assuming crew follow these precautions and considering the limited exposure to the outdoors in these ports, aircrew are not considered to be at a significant risk of long term health problems.

## How do we effectively advise aircrew of the risks?

Aircrew and other staff travelling to ports with high levels of air pollution should be made aware of the risks involved and the steps to minimise these risks. This includes preparation prior to travel and actions when in the high pollution location.

### Pre-flight preparation

- 1) Aircrew awareness and access to up to date health information on the topic.
- 2) Know your destination details, weather pattern and AQI data via checking the AQI website or Smartphone App
- 3) Specifically for China, check the Chinese Embassy Website for further guidance
- 4) See your doctor to discuss vaccines, medications and managing situations such as acute irritation of eyes, nose, throat or airways. Relevant vaccines that are recommended for all of us include the annual influenza vaccine. Other vaccines that may be recommended for higher risk people include the pneumococcus vaccine. Medications that are relevant include any airway or lung medication. For example, people with asthma should maintain an up to date asthma plan, including management of acute asthma symptoms. People who suffer asthma and other airways limitation diseases should carry the inhaler and other medication on them at all times, especially in high pollution areas. Eye and nose irritation can be helped by drops and sprays, and aircrew should discuss the different options with an Aviation Medical Examiner. Saline nasal spray and lubricating eye drops are safe in aircrew.

### In a high air pollution country

- 1) Grade outdoor activity and exposures based on the **Health Protection Guidance column** from the below table
- 2) In the event of experiencing heart or lung related symptoms:
  - a. Follow your treating doctor Action Plan if you have one, for example, asthma action plan
  - b. Seek medical attention promptly for assessment.
  - c. Notify your manager

## AQI PM2.5 monitoring and recommendations

Aircrew operating to locations with high air pollution should be aware of the various levels of air pollution as measured by the AQI index. It is recommended that the AQI for the duration of the layover be monitored via the websites and phone apps as listed above.

**Table I Guidance on how to respond to the various AQI levels (PM2.5)**

| <b>Air Quality Index (AQI)</b>                     | <b>PM2.5 Health Effects Statement</b>  | <b>PM 2.5 Health Protection Guidance</b>  |
|--|--|---|
| <b>Good</b><br>(0-50)                              | PM2.5 air pollution poses little or no risk.   | None  |
| <b>Moderate</b><br>(51-100)                        | Unusually sensitive individuals may experience respiratory symptoms.   | Unusually sensitive people should consider reducing prolonged or heavy exertion.  |
| <b>Unhealthy for Sensitive Groups</b><br>(101-150) | Increasing likelihood of respiratory symptoms in sensitive individuals, aggravation of heart or lung disease and premature mortality in persons with cardiopulmonary disease and the elderly.        | People with heart or lung disease, older adults, and children should reduce prolonged or heavy exertion.  |
| <b>Unhealthy</b><br>(151-200)                      | Increased aggravation of heart or lung disease and premature mortality in persons with cardiopulmonary disease and the elderly; increased respiratory effects in general population.                 | People with heart or lung disease, older adults, and children should avoid prolonged or heavy exertion; everyone else should reduce prolonged or heavy exertion.        |
| <b>Very Unhealthy</b><br>(201-300)                 | Significant aggravation of heart or lung disease and premature mortality in persons with cardiopulmonary disease and the elderly; significant increase in respiratory effects in general population. | People with heart or lung disease, older adults, and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.      |
| <b>Hazardous</b><br>(301-500)                      | Serious aggravation of heart or lung disease and premature mortality in persons with cardiopulmonary disease and the elderly; serious risk of respiratory effects in general population.             | Everyone should avoid all physical activity outdoors; people with heart or lung disease, older adults, and children should remain indoors and keep activity levels low. |

It is recommended that all staff use the AQI reading and the table guidance above to sensibly pace outdoor activities. It is recommended that activities be mainly restricted to indoors when the AQI PM2.5 level is 150 or above.

### Use of Face Masks

IATA does not advocate for or against any particular respirator mask, but advises aircrew and other staff to make their own informed decision whether to use them. To assist in mitigating exposure to air pollution when on duty/layover, Personal Protective Equipment (PPE) in the form of breathing protection masks have been made available by some airlines. The masks designed to provide a P2 (USA N95) level of respiratory protection to the wearer should meet the home State standards.

The P2 respirator mask has a filter which is protective against mechanically or thermally generated dust particles. The P2 mask has a 10 times protection factor when applied appropriately to the face for dust particles. The P2 mask filters at least 94% of airborne particles. The P2 dust mask is not effective for chemicals or toxic gases such as sulphur dioxide, organic vapours from paint fumes, thinners or glue; acid fumes; or gases such as carbon monoxide from petrol engines.

The filtration efficiency of the respirator will decrease in the presence of oily mists, sweating and water saturating the pores of the mask.

In most instances aircrew are not likely to gain much benefit from wearing a mask. Masks only protect against particulate matter and not gas. Masks become less effective when wet with sweating. Avoiding outdoor activity is preferred during times of high air pollution. The hotel gymnasium would be preferred at these times. If masks are worn as part of a strategy to reduce air pollution exposure, it is important to wear them correctly. Appendix I on the following page illustrates correct use of a P2/N95 respirator mask.

### Resources

1. Ambient Air Quality and Health Website WHO: <http://www.who.int/mediacentre/factsheets/fs313/en/>
2. WHO Health Effects of particulate Matter
3. Embassy of the United States, U.s Embassy Beijing Air Quality Monitor Website <http://beijing.usembassy-china.org.cn/070109air.html>
4. Hime et al. *Review of the health impacts of emission sources, types and levels of particulate matter air pollution in ambient air in NSW*. Woolcock Institute of Medical Research, Centre for Air Quality and Health Research and Evaluation (CAR)
5. Australian advice on managing air pollution: <http://www.environment.nsw.gov.au/aqms/aqi.htm>
6. Further information from the Australian Government: <http://www.npi.gov.au/resource/particulate-matter-pm10-and-pm25>

Note: Other guidelines and resources related to health and safety of passengers and crew at [www.iata.org/health](http://www.iata.org/health)

## Appendix I Guidance on correct use of face masks (P2 or N95)

The following steps should be followed in wearing a face mask:

- 1) Wash your hands before putting on the mask
- 2) Hold the mask in your hand and place it firmly over your nose, mouth and chin
- 3) Press the 'nose bridge sealer' along the upper edge gently against the bridge of your nose so that the mask fits nicely on your face
- 4) Select a P2 or N95 mask that fits you well.
- 5) First, stretch and position the lower band under your ears. Then, stretch and position the top band high at the back of your head
- 6) Perform a fit check by breathing in and out. While breathing out, check for air leakage around your face.



For higher risk activities a fit test should be completed to ensure the mask will be effective. If the seal around the face and mouth is poor, the mask is much less effective (men should be clean shaven to get a good seal).

Note that face masks can be hot and uncomfortable to wear. They can make it harder for you to breathe normally. Anyone with a pre-existing heart or lung condition should seek medical advice before using face masks. As previously mentioned, the P2 face mask does not filter out gases such as carbon monoxide. Note that P2 masks are generally recommended for about 1 hour of continuous wearing. They can be worn intermittently also, although good hygiene practices are important.

Overall, it is not expected that crew will need to participate in higher risk outdoor activities. It is better to stay indoors, away from high air pollution or smoke. In general, face masks are only required when prolonged working outdoors is unavoidable.