

1. INTRODUCTION

- 1.1 Starting from June 1998, the Environmental Protection Department (EPD), in addition to the General Air Pollution Index (API), reports and forecasts also the Roadside API. It gives an indication of the level of air pollution which is present in the outdoor environment. Very high levels of air pollution can cause symptoms in persons with no underlying disease, but persons who have health problems may be affected at lesser levels. Any person who is sick and unfit to work should take sick leave. For those who need to work on days with high air pollution, they may indicate a wish to use respiratory protection.
- 1.2 This Guidance Note is to assist physicians to assess the medical fitness of their patients or clients in using respiratory protection.

2. THE AIR POLLUTION INDEX

- 2.1 The Air Pollution Index (API) is a simple way of describing air pollution levels to provide timely information about air pollution to the public and to enhance awareness. It serves also as an alert to the public before the onset of serious air pollution episodes and helps the general public, especially susceptible groups such as those with heart or respiratory illnesses, to consider taking precautionary measures when necessary.
- 2.2 The API converts the measured pollution levels to a value ranging from 0 to 500 by referencing to the breakpoint values set out in the Appendix 1. Similar to the practice in other places to ensure proper protection of the public health, the EPD determines the indices for the five major pollutants and reports the highest as the API of the day. The most important API number is 100, since it corresponds to the health related Air Quality Objectives established under the Air Pollution Control Ordinance. An API level in excess of 100 means that one or more air pollutants are in the unhealthy range on a given day. People with existing heart or respiratory illnesses will notice mild aggravation of their health conditions while some healthy individuals may also notice some discomfort.
- 2.3 Since June 1995, the EPD has been reporting the daily ambient, or general, API and making a forecast for the following day. This information is reported in newspapers, on the radio and on television. It is also available from the API Hotline at 28278541 and, starting from mid-1998, at the EPD's website at <http://www.info.gov.hk/epd/>. Please refer to the EPD's leaflet entitled "Air Pollution Index and You" for further information.
- 2.4 To serve the community better, the EPD reports also the roadside API from June 1998. The levels of air pollution at urban roadsides with fairly heavy to very heavy traffic in areas surrounded by tall buildings are represented. The roadside API provides information on the level of pollution very close to vehicle emission sources. It will, therefore, naturally be higher than the general API on a given day. For most people, the roadside API will be less relevant as they spend only a short period of time each day in busy roads or streets. The index is of more interest to outdoor workers who need to spend several hours continuously each day in busy streets.

- 2.5 Despite the rigorous control efforts to combat air pollution, there may still be several days each year that the air pollution is poorer because of the continual increase of diesel vehicle mileage. On days with calm and stable meteorological conditions (mostly in winter months and a few occasions in summer when tropical cyclones are approaching), the air pollution may be built up to unhealthy levels. The occurrence of such air pollution episodes is low: about 3-5 days a year but busy roadsides will see more days with the API higher than 100.

3. USE OF RESPIRATORS

- 3.1 To alleviate the possible adverse health effects on days with poor air pollution, those who have existing respiratory or cardiovascular diseases should reduce strenuous outdoor activity. However, this is not often practicable for some outdoor workers. These people may, therefore, wish to use protective respirators. However, they must seek advice from physicians if they find difficulties or have doubt on their fitness to use these devices. Physicians, inter alia, can help them by assessing and advising on their fitness to work outdoors and to wear protective respirators.
- 3.2 Due to the continual control efforts, it is unlikely that severe air pollution incidents will occur. The use of light and disposable respirators with lower breathing resistance should often be sufficient for providing protection on days with high particulate pollution. For other more sophisticated respirators, while effective in filtering both gaseous and particulate air pollutants, they are uncomfortable and increase the effort of breathing.

4. EFFECTS OF RESPIRATOR USE

- 4.1 Wearing a respirator results in increased resistance to breathing and prolongs the duration of both the inspiratory and expiratory phases of respiration. The pressure flow characteristics of respirators are such that the resistance to flow increases as the flow rate increases. High flow rates such as those demanded by heavy exertion may be difficult or impossible to achieve while wearing a respirator, even though breathing is little affected at rest or during mild exertion. Reductions in arterial blood oxygen tensions and elevations in arterial blood carbon dioxide levels have been observed in normal subjects exercising while wearing respirators.
- 4.2 Persons with airflow obstruction (such as those suffering from chronic obstructive airways disease) have decreased expiratory flow rates and thus require more expiratory time in each breathing cycle to achieve the same tidal volume. As the respiratory rate increases, the relative time for inspiration is decreased, requiring a higher inspiratory flow rate. Thus for people with airflow obstruction, the effect on maximal voluntary ventilation (MVV) of using a respirator may be much greater than for persons with normal respiratory function. Some subjects with moderate COAD may be asymptomatic during exertion but this is not an accurate reflection of gas exchange alterations [1].

- 4.3 The additional dead space associated with a respirator may cause carbon dioxide retention at high work rates, especially in persons with suppressed respiratory drive. Use of respirators in conditions of high heat and humidity may cause additional stress.
- 4.4 Some studies have shown elevated heart rates while using respirators and others have demonstrated significantly elevated systolic pressure and more moderately elevated diastolic pressure associated with respirator use, both at rest and during exercise [2].

5 MEDICAL ASSESSMENT

- 5.1 There are no simple or universal criteria which can be given in order to decide on fitness to use a respirator under actual working conditions. The examining physician must use his medical judgement based on the following:
- The nature of the work
 - The underlying pathology
 - The physiological effects of respirator use.
- 5.2 The combination of these factors (and particularly the interaction of underlying pathology and altered physiology) will allow the examining physician to decide whether the patient can perform the required duties and whether the use of a respirator will lead to an exacerbation of the underlying condition.
- 5.3 The main conditions which raise doubt about the ability of workers to use respirators are respiratory and cardiovascular disease. It is the respiratory and cardiovascular systems which are primarily affected by high API itself.
- (i) *Pulmonary Function*
- 5.4 A useful measure of pulmonary function is spirometry. The main causes of abnormal spirometry are obstructive and restrictive lung disorders. Those workers who have both Forced Vital Capacity (FVC) and Forced Expiratory Volume in 1 second (FEV_1) > 70% of that predicted for a person of the same sex, age, height and race (Appendix 2) and a ratio of FEV_1/FVC of > 65% will probably be able to tolerate the use of a respirator under moderate workloads [2].
- 5.5 Careful assessment of workers with asthma will be required. Factors to be taken into account include the severity and frequency of attacks and any triggering factors. Those with asthmatic attacks precipitated by non-specific factors or by exercise, cold air or stress are unlikely to be fit for respirator use.
- 5.6 Workers with past history of spontaneous pneumothorax may develop increased fluctuations in thoracic pressure while breathing with a respirator. The increased risk of barotrauma may be incompatible with the use of a respirator with relatively high resistance.