

Air Quality and Outdoor Workers

We live in an ocean of air that we depend on in order to live. While air pollution is often invisible and can go unnoticed, it is a health hazard. Outdoor workers need to be especially aware of air pollution.

How Does Air Pollution Affect Health?

The Ontario Medical Association forecast 1,900 deaths, 9,800 hospital admissions, and 47 million illness days in Ontario for the year 2000 as a result of air pollution. In 2005 Health Canada projected that 5,900 Canadians would die from air pollution related conditions.

Over the past few decades, scientific understanding of the health effects from fine particulate and ozone air pollutants has increased dramatically. It is clear that ozone damages the cells lining the lung causing swelling, irritation and increasing their permeability. **Note: Ontario's environmental ozone standard was set in 1954 and does not reflect the current understanding of the hazards of ozone. New standards in British Columbia are much lower.**

Fine particulates congest the lungs and even pass through the lung into the blood stream to affect other organs. Chemicals can cling to particulate, which then acts as a carrier. Several health conditions are known to result from or be made worse by exposure to air pollution:

- *stroke*
- *asthma*
- *chronic obstructive pulmonary disease (COPD)*
- *heart attack*
- *lung infection*
- *lung cancer*
- *congestive heart failure*

In the days following an episode of poor air quality, the number of deaths and hospital admissions is significantly higher. This persists for 2-3 days following the episode. The longer and/or more intensive the exposure to air pollution is, the greater the risk of adverse health effects. The risk and duration of effect vary with the health of the individual.

The Ontario government has developed the **Air Quality Index (AQI)**, which provides a measure of pollution levels in the air as well as guidance on appropriate physical activity levels (PA) at various pollution levels. While the AQI is intended to help the general population adjust their activities according to the degree of air quality, it is also a useful tool for workers who work outdoors.

The Air Quality Index (AQI) can be accessed through various media (newspaper, radio, TV) or from the Ontario Ministry of the Environment (MOE) at www.airqualityontario.com or by calling 1-800-387-7768.



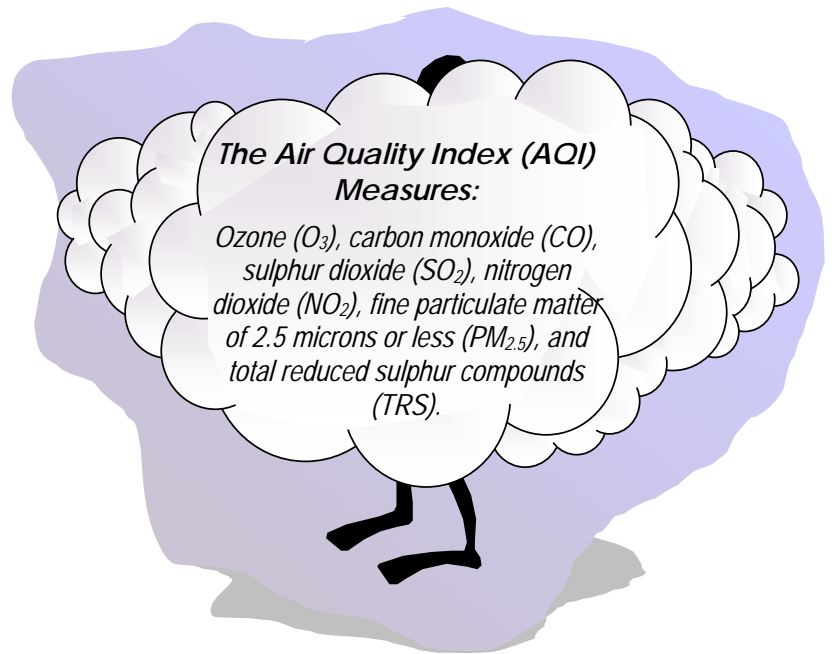
Some Symptoms of Overexposure

- ✓ *Coughing*
- ✓ *Dizziness*
- ✓ *Wheezing*
- ✓ *Nausea*
- ✓ *Headaches*
- ✓ *Feeling Weak*
- ✓ *Feeling Tired*

What is the AQI?

The Ontario Air Quality Index (AQI) is based on hourly measurements of air pollutants that are known to affect the health of humans and the environment. It is updated and reported at intervals throughout the day. The concentration of these pollutants is reported as an *index*. The AQI report does not give the actual measured concentration of any single pollutant or the combined pollutants in the air. It does tell us:

- ✓ *which of the six indexed pollutants is most elevated and what the index number is;*
- ✓ *how current the report is;*
- ✓ *whether the air quality is considered good, moderate or poor;*
- ✓ *guidance on reducing physical activity levels to limit the risk.*



Outdoor Workers are a High Risk Group

Outside workers have been identified as a group that is at higher risk from air pollution. They spend long periods of time outside doing strenuous activity, often with the added burden of diesel exhaust, traffic or other fumes. However, all workers who do moderate or heavy activity, and do not have the benefit of filtered air, have similar risks. Importantly, workers with underlying health problems are at even higher risk.

Populations at Risk include the elderly, diabetics, individuals with an existing heart/lung condition (asthma, COPD), irritant-sensitive individuals, and outdoor workers.

Workers may not feel the changes that are occurring in their lungs. Breathing tests (spirometry) on outside workers show decreased lung function that persists for several days following exposure. A significant association has been found between exposure to traffic and incidence of heart attack. It is believed that the cause is elevated air pollution (combined gasoline and diesel emissions). Research on diesel exhaust shows that it increases the risk of lung, kidney and ovarian cancer.

Using the AQI to Reduce Your Risk

Air pollution is a health concern for all workers. Workers should know when and how they are exposed to ambient air pollution and how to minimize health risks. They can use the AQI as a tool to do this by:

- ✓ *taking note of whether they are among a **population at risk** or have other personal **health risk factors**;*
- ✓ *listening for **pollution levels** (AQI reports) and knowing what they mean;*
- ✓ *determining what **level of physical activity** is associated with their various occupational tasks (do this ahead of “bad air days” so that you do not risk high exposure);*
- ✓ *using AQI guidance on **appropriate physical activity** to plan their work;*
- ✓ ***monitoring** themselves for symptoms of acute overexposure.*

Determining Your Physical Activity Levels

The AQI provides some information on the concentration of pollutants and appropriate physical activity. However, to use this AQI guidance, workers must know what their physical activity level is. The guidance on appropriate **physical activity (PA)** that accompanies the AQI suggests choosing a suitable level (e.g. light, moderate and vigorous/strenuous or heavy) depending upon air pollution conditions and ones health condition. In order to use this guidance, each worker must have a sense of what the levels of physical activity mean. What is light activity? Moderate? **Heavy?** There are methods that workers can use to estimate their own physical activity levels:

- I. Perceived Exertion:** *How hard do you feel that you are working? There is a high correlation between perceived exertion and actual heart rate. Self-evaluation of exertion is a good indication of the true physical activity level.*
- II. Talk Test:** *A person engaged in a light physical activity should be able to sing while doing the activity. During moderate physical activity one should be able to carry on a normal conversation. If a person is unable to comfortably carry on a conversation then the activity is classed as heavy physical activity.*
- III. Metabolic Equivalent Task (MET) Level:** *A third way of measuring the intensity of physical activity is through metabolic equivalents (METs). That is, how much oxygen is used per kilogram of body weight in one minute. According to the MET system, light physical activity uses <3 METs, moderate activity 3-6 METs, and heavy activity >6 METs.*

A reference chart of occupational activities has been produced using the MET system. Workers can use it to approximate the physical activity level associated with their occupational tasks. Individual fitness and health conditions affect the amount of exertion that an activity requires. Physical activity is unique to each person.

| | RECREATIONAL ACTIVITIES | METs | OCCUPATIONAL ACTIVITIES | METs |
|----------|---------------------------------|------|------------------------------------|------|
| Light | Sitting | 1.0 | Directing | 2.0 |
| | Fishing (in boat & sitting) | 2.5 | Operating heavy equipment | 2.5 |
| Moderate | Walking | 3.0 | Welding | 3.0 |
| | Gardening | 4.0 | Custodial work | 3.5 |
| | Raking | 4.3 | Plumbing/Electric | 3.5 |
| | Golf (carrying clubs & walking) | 4.5 | Walking (briskly 3.5 mph) | 3.8 |
| | Cutting lawn with power mower | 5.5 | Painting | 5.0 |
| | Doubles tennis | 6.0 | Construction outside (remodeling) | 5.5 |
| Heavy | Jogging | 7.0 | Masonry | 7.0 |
| | Cycling | 8.0 | Carrying heavy loads (i.e. bricks) | 8.0 |
| | Football | 9.0 | Farming (baling hay) | 8.0 |
| | Soccer | 10.0 | Shoveling (digging ditches) | 8.5 |
| | Cycling > 20 mph | 16.0 | Cutting wood (manual & fast) | 17.0 |

A more complete list can be obtained from www.cdc.gov/nccdphp/dnpa/physical/pdf/PA_Intensity_table_2_1.pdf

Modifying Activity to Reduce Exposure

After determining what level of physical activity a worker's various tasks requires, the worker and supervisor can then devise a plan to minimize exposure to air pollution. Some workplace health and safety practices have been recommended:

- ✓ *Reschedule tasks to times when pollutants are lower. Elevated CO, NO₂ levels correspond to rush-hour traffic. Ozone is highest on hot days and usually peaks after mid-day. Ambient particulate levels do not show a pattern of concentration.*
- ✓ *Avoid locations where pollution is higher, such as near traffic, heavy equipment, dusty areas and other point sources of pollution on a job site. Actively reduce emissions on the job site (shut off engines when not in use and use the cleanest engines and exhaust technology available).*
- ✓ *Work in locations where air quality is better. Workplaces with properly filtered ventilation and air conditioning are recommended.*
- ✓ *Reducing levels of physical activity will reduce risk. This may be achieved through rotating shifts, intermittent rest periods, not engaging in highly strenuous activity and working in shadier, less-exposed areas.*

The American Conference of Governmental Industrial Hygienists (ACGIH) has different standards for occupational ozone that are based on the intensity of the work. For example, the 8-hour standard for light work is 0.10 parts per million (ppm) while the standard for heavy work is 0.05 ppm. **In other words, it is recognized that the heavier the work, the lower the exposure needs to be.**

Best practices for reducing physical activity, and thus exposure to pollution, are worker and workplace dependant. The various methods mentioned have not been fully studied for effectiveness either in comparison to each other or alone. However, they are the best recommendations available and are drawn from related exposure reduction practices across various disciplines.



Air pollution is a concern for workers. It has been shown to impair the health and functioning of healthy workers and is known to be a greater threat for those with underlying health conditions. Effects may not appear immediately, but short-term and long-term effects do occur. It is believed that the risk can be reduced if one monitors the AQI with personal health in mind, and then modifies both physical activity and work practices accordingly.



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**Bibliography available from
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