

and safety considerations, produces little CO<sub>2</sub> and has lower air emissions. Selecting any of these mechanisms to reduce carbon dioxide will also greatly reduce the emission of air pollutants.

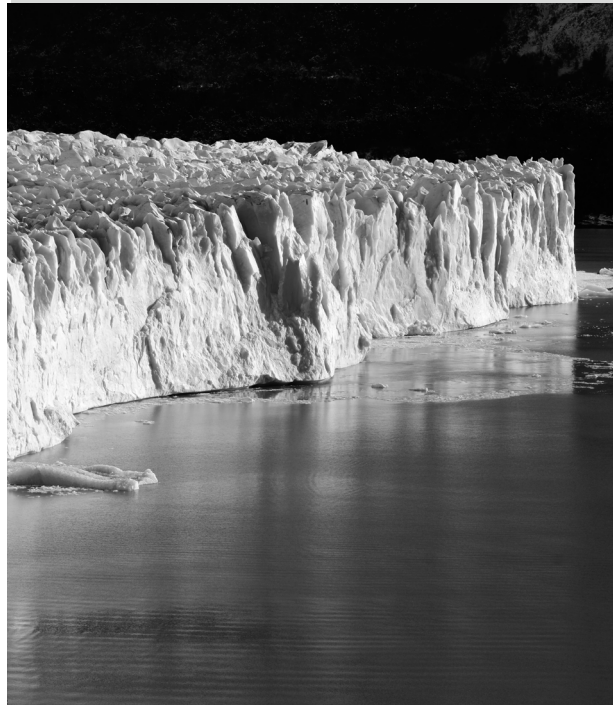
In contrast, traditional actions to reduce air pollutants have used “end of pipe” technology, or selection of low sulphur fuels to reduce SO<sub>x</sub> emissions. However, these actions do not reduce emissions of greenhouse gases.

Any new directions for reducing either air pollutants or greenhouse gases must take all emissions into account so as to reduce both types. Measures to combat climate change, will also positively impact air quality, either directly by reducing air pollutant emissions or indirectly by reducing the negative impact of climate change on air quality.

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## CLIMATE CHANGE, AIR QUALITY & RESPIRATORY HEALTH

What you need to know



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The Intergovernmental Panel on Climate Change report released on February 2, 2007 indicated virtual scientific certainty that the climate is changing at a rate faster than has been experienced for all years that humans have records, and that the cause of this rapid change is human activity.

### HUMAN CONTRIBUTIONS TO CLIMATE CHANGE

The principle human cause of climate change is the burning of fossil fuels - coal, oil, gas, diesel, etc. A second leading cause is intensive agriculture, which releases methane into the atmosphere. The principle greenhouse gas produced from fossil fuels is carbon dioxide, but methane is also released. These gases rise in the atmosphere and when located in the upper atmosphere they act like a blanket, preventing the sun's heat that has already reached the earth from dissipating to outer space.

Climate change will increase average global temperatures. Increased temperatures result in a faster movement of water through the water cycle, and warmer air can hold more water vapour. The result of this is that the increased temperature is also related to unusual precipitation and wind patterns. Thus climate change and weather are linked.

### FOSSIL FUELS ALSO RELEASE AIR POLLUTANTS

Burning fossil fuels also releases air pollutants- sulphur oxides (SO<sub>x</sub>), nitrogen oxides (NO<sub>x</sub>),

volatile organic compounds (VOCs; there are many), carbon monoxide (CO), and other toxic compounds. SO<sub>x</sub> and NO<sub>x</sub> react in the atmosphere to produce particulate matter. NO<sub>x</sub> and some VOCs react in the atmosphere to produce ground-level ozone. Particles and ozone together make smog, which can travel long distances on the prevailing winds, or can be clamped close to the ground during a weather inversion (often little wind). Thus air pollution and weather are also linked.

All of these air pollutants can cause serious health effects. Health effects are best understood for particulate matter smaller than 2.5 mg/m<sup>3</sup> and ground-level ozone. There is no safe level of exposure to either of these substances. Increased levels of exposure may cause congestion, difficulty breathing, asthma attacks and occasionally death. PM<sub>2.5</sub> is associated with an increase in heart attacks. Long-term exposure to PM<sub>2.5</sub> is associated with low birth weight and reduced lung development in children. Health risks are higher in vulnerable populations - the very young, the elderly, those with preexisting respiratory (such as asthma or COPD) or cardiovascular disease, or those exercising or doing strenuous work in locations with elevated air pollution.

### IMPACTS IN RESPECT TO RESPIRATORY HEALTH

Climate change will have many impacts. These include an increase in global average temperatures, changes in precipitation and weather patterns, droughts, forest fires, desertification

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or floods, changes in growing seasons and ability to grow crops, changes in food and water supply and safety, changes in the distribution of wildlife and plants, changes in the distribution of certain disease-causing agents, changes in ocean temperatures and current patterns, sea level rise, increased storm surges and salt water intrusion into fresh water reserves, loss of infrastructure, displaced populations of people, socio-economic challenges.

**Specifically with respect to respiratory health, the following impacts may occur:**

1. An increase in air pollution in certain regions, especially downwind of emission sources

With rising temperatures associated with climate change air pollution may increase as a result of increased use of air conditioners which will cause power plants to burn more fuel. In those regions that have air pollution associated with warm weather (i.e. locations that have warm wind directions coming from heavily industrialized areas) a greater number of hot days will also mean a greater number of days with elevated air pollution and associated deleterious impacts on health.

There have been an increasing number of instances where people have been exposed to the combination of unusually high temperatures and elevated air pollution. Days with these combined threats are likely to become more frequent as a result of climate change. High temperatures, especially over several days, and elevated air pollution,

have resulted in high mortality rates in some regions. For example, France in 2003; where thousands of deaths were attributable to air pollution and heat.

**2. An increase in forest fires in some re- gions, as a result of drier conditions**

Burning wood releases particulate matter, carbon monoxide, polyaromatic hydrocarbons (PAHs) and many other toxic chemicals, which not only make it difficult to breathe, but can cause heart attacks. Long term or repeated exposures can cause cancer.

**3. An increase in mould growth, and possibly a change in the types of moulds in regions affected by elevated levels of precipitation**

Changes in precipitation patterns will cause unusual floods and water intrusion in buildings not built to withstand heavy rains and winds. Moisture accumulation within buildings creates ideal conditions for mould growth. Exposure to mould is known to cause asthma in some individuals. Species of mould previously unusual in Canada have been found in some locations, such as British Columbia. Exposure to *Cryptococcus gattii* in certain forested areas has resulted in a low incidence of infection in people and other animals. Rarely, some people have fever, aches, and respiratory problems which can be severe.

**4. An increase in forest fires in some regions, as a result of drier conditions**

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hydrocarbons (PAHs) and many other toxic chemicals, which not only make it difficult to breathe, but can cause heart attacks. Long term or repeated exposures can cause cancer.

**5. An increase in certain types of plants and their pollen**

Increased levels of carbon dioxide in the atmosphere and increased temperatures have been shown to foster the growth of certain plants, such as ragweed, and result in increased pollen production. This will lead to an increase in the frequency and severity of asthma and allergy attacks.

**POSSIBLE NEGATIVE AIR QUALITY IMPACTS OF CERTAIN ACTIONS TO REDUCE GREENHOUSE GASSES**

As we take action to reduce our production of greenhouse gases, some reduction strategies may also cause greater air pollution, for example:

**1. Biomass burning**

Biomass such as wood and other plant material is considered to be “carbon neutral” when burned as an energy source because the plant absorbs approximately as much CO<sub>2</sub> while it grows as it releases when it is burned. However, many units that burn biomass, including even the best wood stoves, have insufficient controls to eliminate toxic air emissions. Thus policies recommending biomass burning as

strategy to reduce GHGs should not be supported until technology is advanced and regulations are in place to greatly reduce the air emissions.

2. Energy efficiency measures in buildings that only focus on insulation and draft reduction without proper ventilation.

Sufficient ventilation is essential to prevent mould growth and will assist with reduction in radon. Exposure to certain moulds is known to cause asthma in susceptible individuals. Radon is the leading cause of lung cancer in non-smokers. The Canadian guideline for radon in buildings has been reduced from 800 Bq/m<sup>3</sup> to 200 Bq/m<sup>3</sup>, thus triggering a need to test buildings and remediate if necessary.

**POSITIVE AIR QUALITY IMPACTS FROM ACTIONS TO REDUCE GREENHOUSE GASSES**

Unlike many of the air pollutants released when fossil fuels are burned, carbon dioxide cannot be easily removed using “end of pipe” technology such as scrubbers, bag houses, filters etc. Thus until new carbon capture technology is produced, the only way to reduce carbon dioxide emissions is to reduce the demand for energy through energy efficiency measures, burn fossil fuels more efficiently, or switch to other sources of power such as wind, solar, hydroelectric or tidal. Even nuclear power, with its other environmental