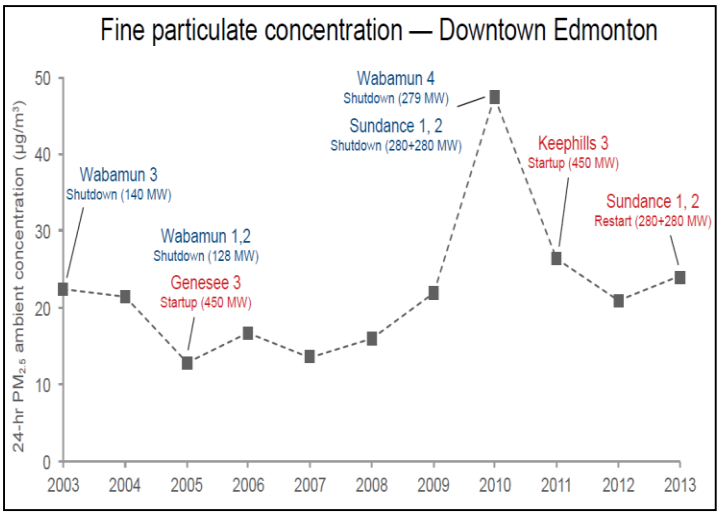
Canadian Association of Physicians for the Environment

Backgrounder

Alberta Coal Plants, Air Quality & Human Health

Reliance on Coal Plants in Alberta

- Alberta burns more nearly twice as much coal as the rests of provinces in Canada combined.
- Alberta generated 68 per cent of its electricity from coal in 2014.
- Alberta saw a 14 per cent increase in coal capacity from 2002 to 2012.
- Alberta has six coal plants with 18 individual generators.
- Each generator has a generating capacity ranging from 150 megawatts (**MW**) to 495 MW for a combined capacity of over 6,200 MW (Pembina, 2013).



- This graph illustrates how maximum 24-hour air levels of PM2.5 in Edmonton have fluctuated relative to the shut-down and start-up of coal-fired power plants in Alberta.

Common Air Pollutants & Alberta's Coal Plants

- Coal plants are a major source of the common air pollutants that harm human health.
- They are a particularly important source of sulphur dioxide (**SO_2**), nitrogen dioxide **(NO_2**), fine particulate matter (**PM2.5**) and **ozone.**
- In 2011, Alberta's coal plants emitted:
  - 33 per cent of the SO_2 emitted in the province or 114,511 tonnes;
  - 10 per cent of the nitrogen oxides (NO_x) emitted or 71,507 tonnes; and
  - 6 per cent of the PM2.5 that is directly emitted or 1,782 tonnes (Pembina, 2013).
- **SO_2** is a gas that can be transformed into sulphates in the air and add to air levels of PM2.5.
- **NO_X** includes two gaseous air pollutants: nitric oxide (**NO**) and **NO_2**. NO_x can be transformed into nitrates in the air and add to air levels of PM2.5.
- **PM2.5** are solid or liquid particles that are suspended in the air. They are tiny particles with a diameter of 2.5 micrometres or less that can be inhaled deep in to the lungs and absorbed into the blood stream. They can be composed of metal fumes, organic chemicals, smoke, acid mist and pollen. PM2.5 can be directly

emitted from combustion sources such as coal plants and diesel fuelled trucks or formed in the air from pollutants such as SO_2 and NO_x.

- **Ground level ozone** is a secondary air pollutant that is produced in the air from a reaction between NO_x and volatile organic compounds (**VOCs**) in the presence of sunlight.

Health Impacts Linked to these Common Air Pollutants

SO_2:

- Short exposures to high levels can irritate the eyes and aggravate respiratory diseases such as asthma and chronic obstructive pulmonary disease (**COPD**) (Alberta Health Services, 2012).
- Evidence suggests that low level exposures contribute to cardiovascular and respiratory deaths, disease and hospital admissions (WHO 2013; Sunyer J et al. 2003; Fung KY et al. 2005).
- Low level exposures during pregnancy have been linked to premature births and low birth weights (Yorifuji T et al. 2015; Dugandzic R et al. 2006; Lin et al. 2004).

NO_2:

- Short- and long-term exposures can increase the risk of premature deaths and diseases, particularly respiratory diseases (WHO 2013).
- Exposure can irritate the lungs and particularly among those with pre-existing respiratory conditions such as asthma and COPD.
- Edmonton studies have found that high levels of NO_2 are linked to increases in emergency visits for stroke, pediatric asthma visits, and cardiac and respiratory disease (Chen L et al. 2014; Villeneuve PJ et al. 2007; Stieb DM et al. 2009).
- Studies from other jurisdictions have documented links to deaths from respiratory disease among children, stroked, and premature deaths (Saldiva PHN et al. 1994; Maheswaran R et al. 2005; Crouse DL et al. 2015).

Photo: Kozielczyk, Thinkstock 1

PM2.5:

- Short- and long-term exposures have been clearly and consistently linked to increases in premature deaths and disease, particularly for cardiovascular effects (WHO, 2013).
- Multiple studies have shown that there is no safe level of exposure (Pope CA et al. 2002; Schwartz J et al. 2002).
- PM2.5 has been classified as a carcinogen, particularly for lung cancer, by the International Agency for Research on Cancer (IARC) and the World Health Organization (WHO) (Loomis D et al. 2013; WHO 2013).
- Long-term exposures may also have an adverse impact on birth outcomes, developmental and cognitive function, rates of childhood respiratory disease, and on those with diabetes (WHO, 2013).

Ozone:

- Exposure has been clearly and consistently linked to increases in premature deaths with no apparent safe level of exposure. (Bell ML et al. 2006; Ostro BD et al. 2006).
- It produces acute and chronic damage to the respiratory system and increases the reactivity, permeability and inflammation of the airways (Jerrett M et al. 2009).
- Ozone has been clearly associated with increases in hospital admissions for respiratory diseases and increases in respiratory infections, especially among young children (Friedman MS et al. 2001; Thurston, GD et al. 1997; Stieb DM et al. 1996; Moore K et al., 2008)
- Exposures may also aggravate cardiovascular disease, increasing heart attacks and arrythmias (Ruidavets JB et al. 2005; Rich DQ et al. 2006)
- Long-term exposure to ozone appears to: increase deaths from respiratory and cardio-respiratory effects; increase asthma incidence, asthma severity, and hospital care for asthma; and negatively affect lung function growth (WHO, 2013).

Health Impacts Linked to Alberta's Coal Plants

- Using the Illness Cost of Air Pollution (**ICAP**) model, the Canadian Medical Association estimated that, in 2008, air pollution from all sources in Alberta gave rise to approximately 173 premature deaths, 894 hospital admissions, and 8,600 emergency rooms visits in the Province. These health impacts were valued at approximately $549 million per year (CMA, 2008).
- Using the ICAP model, with estimates of the impact of coal plants on air quality in Alberta, it was estimated that, in 2008, air pollution from Alberta's coal plants gave rise to approximately:
  - 100 premature deaths from long-term exposures;
  - 80 hospital admissions for respiratory and cardiovascular ailments from short-term exposures;
  - 700 emergency room visits; and
  - 4,800 asthma symptom days from short-term exposures (Pembina, 2013).
- The ICAP model valued these health-related impacts at **$300 million per year** (Pembina, 2013).
- These health impacts and costs greatly underestimate the true health impacts and costs as they reflect only those health impacts that have been clearly and consistently linked to ozone and PM2.5 and those health impacts where data can be easily collected.

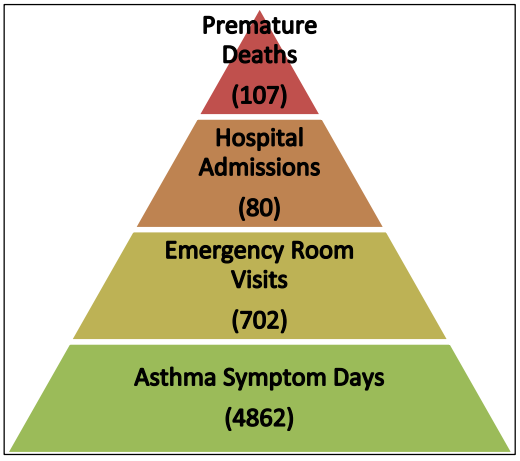
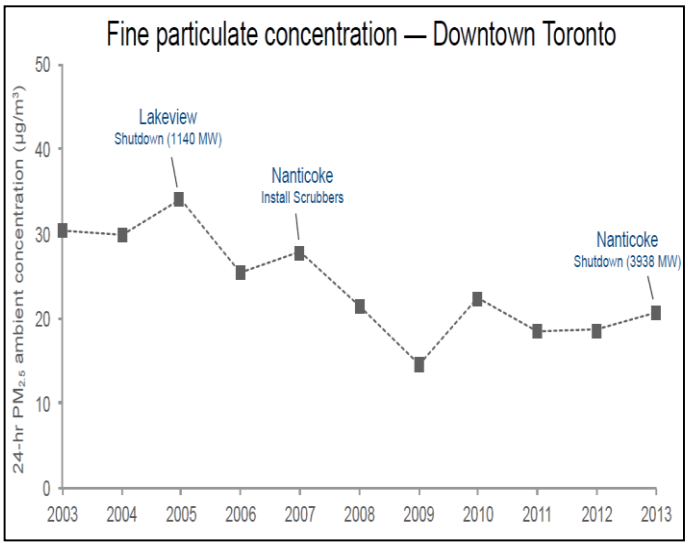


Figure 1 Air Pollution Health Impacts from Alberta Coal Plants, 2008

Health Benefits Linked to Ontario Coal Plant Phase-out

- Toronto Public Health has concluded that the phase-out of coal plants in Ontario, and other policies, have contributed to significant health benefits for the residents in Toronto (TPH, 2014).

- Between 2000 and 2010, air pollution-related premature deaths and hospitalizations in Toronto decreased by 23% and 41% respectively despite significant increases in population.
- Air pollution-related premature deaths in Toronto decreased from 1,700 in the year 2000 to 1,300 in 2010, while air pollution-related hospital admissions decreased from 6,000 in the year 2000 to 3,550 in 2010 (TPH, 2014).
- Toronto Pubic Health attributes the decreased health impacts directly to reductions in air levels of PM2.5, SO_2, NO_2, and carbon monoxide (**CO**).
- In Toronto, between 2000-2011, annual air levels of:
  - PM2.5 decreased by 30% from about 9 to 6.5 $\mu g/m^3$;
  - SO_2 decreased by 79% from about 4.2 to 1.0 ppb;
  - NO_2 decreased by 36% from about 25 to 16 ppb; and
  - CO decreased by 78% from about 0.8 ppm to 0.12 ppm.
  - Ozone increased by 10% from about 20 ppb to 22 ppb during this same period (TPH, 2014).



- This graph illustrates how maximum 24-hour air levels of PM2.5 in Toronto have decreased relative to the closure of the Lakeview and Nanticoke coal-fired power plants which were upwind of Toronto.

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For more information, see [CAPE Website](#).