How are Climate Change and Air Quality Linked?

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Outline

Brief review of climate change

Linkages between air quality and climate change

Common causes

Climate change impacts on air quality

Models uncertain
Heat and air pollution
Forest fires
Some mitigation measures can increase air pollution
Increase in pollen
Moisture and indoor moulds

Common solutions
What is climate change?

- Climate is the yearly and long-term pattern of temperature and precipitation.
- Climate “change” refers to unusual changes in climate believed to be caused by human activity increasing greenhouse gases.
Temperature in recent years
What causes climate change?

Human activities- Burning fossil fuels, habitat changes

Other causes:
- Earth tilt
- Earth orbit- ellipse or rounded
- Meteor hits/ large volcano activity
Climate change and air quality are linked

- They both are caused in part by burning fossil fuels
- Increasing temperatures can increase air pollution
- Greenhouse gases warm the planet. Some particles in the atmosphere can either warm or cool the planet

Greenhouse gases: CO₂, CH₄, H₂O, CFCs, N₂O
Air Pollution: SOx, NOx, VOCs, PM, CO, Toxics
Greenhouse gases warm the planet
Aerosols/particles can warm or cool

Sulphate, nitrate and organic carbon aerosols scatter energy back to space leading to cooling.

Soot (black carbon) aerosols absorb energy and radiate it into the atmosphere.

Aerosol-cloud interactions are the greatest uncertainty.
Increased temperatures
Changes in precipitation and wind patterns

SO2
NO2
VOCs
CO
Toxics

Mitigation:
Most measures go down air pollution
Biomass may go up air pollution

Wind patterns bring more hot days and smog
More pollen and mould
More forest fires

Burning fossil fuels

More air conditioners
Modeling future air quality is difficult

Modeling climate changes- fairly good

Predicted changes to temperature, precipitation, humidity, wind

ADD TO THIS

Impact of changes to emissions

Increasing uncertainty / modeling of future air pollution less accurate
Study shows heat and smog are killers

This study was conducted by a team of scientists from Toronto's public health department, the federal government and McMaster University in Hamilton. (Pengally, 2005)

It concluded that extreme heat was killing an average of 120 people a year in Toronto, 121 in Montreal, 41 in Ottawa and 37 in Windsor.

The air pollution that causes smog was found to be the cause of 822 deaths a year in Toronto, 818 in Montreal, 368 in Ottawa and 258 in Windsor.

The study predicted that heat-related deaths will double by 2050 and triple by 2080 because of global warming.

The scientists recommended the federal government introduce a national heat warning system such as Toronto's.

• Listen for Air Quality and Heat Alerts
• Keep cool.
• Take rests.
• Drink lots of water
• Check on elderly or frail who live alone
• Take advantage of air conditioning in public places
Climate change and forest fires

Key Factors:
- **Fuel** - loading, moisture, structure etc.
- **Ignition** - human and lightning
- **Weather** - $T^\circ$, precipitation, atmospheric moisture and wind; upper atmospheric conditions
- **Humans** - land use, fragmentation, fire management etc.

(Courtesy of Brigitte Leblon)
Residential Wood Burning in Canada

- Wood ranks as the fourth most popular home heating fuel in Canada, after gas, electricity and oil.

- About one in five single family dwellings is heated to some extent with wood; 2.2 million households report having a woodburning fireplace.

- About 60% of all wood heating appliances are wood stoves.

- Despite the performance and environmental advantages of advanced wood heating technologies, the older conventional models are more prevalent in Canadian homes.
Outdoor pollens and moulds

Increase in ambient CO2, temperature, moisture and growing season

- Increase in allergenic pollen production (Ragweed)
- Changes in distribution of moulds
  (2000 – 2003 Cryptococcus neoformans var. gattii outbreak in parks in Vancouver Island)
Indoor air quality and climate change considerations

Moisture issues

Changes in building design for energy efficiency
Changes in timing and intensity of rainfall
Building on flood plains

2005- Katrina Cough

Basement mould
Solutions are linked

Reducing the use of fossil fuels can reduce both greenhouse gases and air pollutants.

Energy efficiency actions always reduce both types of pollutants.

Use of biomass as a fuel source may reduce CO2 emissions, but may produce more air pollution than other options.

When selecting energy sources consideration should be given to both climate change and air quality. Emissions from total production cycle need to be assessed to determine best option.
There are several reasons to burn fewer fossil fuels

- Climate Change
- Air Quality
- Human Health

Summer 2005....

“No they left the money but they siphoned all our gas”