

Health Impact of Fugitive Emissions and Road Dusts

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Context:

Health Impacts of Air Pollution

- Health risks from ambient air pollution exposure has emerged as major health issue
- Numerous epidemiological studies found significant association between air pollution and health effects
 - Health Canada attributes approximately 6,000 deaths in Canada's largest cities every year due to exposure to air pollution (Health Canada, 2004).

Hamilton Context: Health Impacts of Air Pollution

- “A Public Health Assessment of Mortality and Hospital Admissions Attributable to Air Pollution in Hamilton”, completed for CAH by Talar Sahsuvaroglu and Mike Jerrett (2003)
 - (Also forthcoming in *Journal of Toxicology and Environmental Health*)

Hamilton Context:

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- Currently, Hamilton exceeds government objectives by about 20 days per year, and has some of highest ambient air pollution in Canada (Sahsuvaroglu & Jerrett, 2003)
 - Results from combination of pollution from outside region, industrial emissions, transportation sources, and local meteorology and topology

Hamilton Context:

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- Mortality & morbidity counts, based on 1997 Hamilton ‘total’ pollution values:
 - 96 – 217 premature deaths / year
 - 139 - 352 respiratory admissions / year
 - 479 – 1120 CV admissions / year
- “Conservative” estimates

(From: Sahsuvaroglu & Jerrett, 2003)

Hamilton Context: Health Impacts of Air Pollution 4

- Attributed to PM_{10} :
 - 14 - 43 premature deaths / year
 - 27 - 83 respiratory admissions / year
 - 49 - 157 CV admissions / year

(From: Sahsuvaroglu & Jerrett, 2003)

What is Particulate Matter?

- Fine particulates are 10 micrometers or less in diameter (PM_{10})
- Largest sources of PM_{10} are diesel vehicles (trucks and buses), gasoline vehicles & other combustion sources, bulk shipping terminals/work yards, and road dust, particularly from track-out.
- Not all PM_{10} created equal and includes:
 - Very small particulates of about 0.1 to 0.2 micrometers in diameter.
 - $PM_{2.5}$ to PM_{10} (i.e., sea salt spray or road dust)
 - $PM_{2.5}$ can remain suspended for long periods

Health Impacts: General

- Fine particulates at current levels can pose a greater danger to our health than the better-known kinds of air pollution, such as smog, sulphur dioxide, and carbon monoxide.
- Short-term exposure to fine particulates is associated with (Vedal 1995):
 - Increased deaths from lung and heart disease;
 - Increased lung and heart disease;
 - Increased hospitalizations for treatment;
 - Amplification of existing respiratory health conditions

Health Impacts: PM₁₀

- Particulates in the coarse fraction of PM₁₀ can lodge in the upper respiratory area and may cause severe irritation
 - Especially pronounced in infants, the elderly, and those with pre-existing conditions such as asthma or other respiratory health tissues.
- PM₁₀ may also be linked to some respiratory cancers.

Health Impacts: PM_{2.5}

- Can penetrate deep into lungs, damaging epithelial cells and may pass into the bloodstream
- Trigger for respiratory illnesses
 - Asthma, bronchitis, pneumonia and emphysema
 - Connection between asthma and fine particulates: Over 1.2 million Canadians suffer from asthma, and asthma is the most common cause of medical emergencies in children.
- Senior citizens, infants and people who already have lung, asthmatic or heart problems are most at risk, but healthy younger adults and children can also be affected.

Health Impacts: PM_{2.5}

- A number of potentially harmful substances have been found in PM_{2.5}:
 - Sulphates (from sulphur dioxide emissions): acidic in nature and may react directly with lung tissues;
 - Elemental carbon (i.e., from wood and engine combustion) can pick up cancer-causing chemicals like benzo(a)pyrene;
 - Other organic carbon compounds identified in exhaust from vehicles, combustion processes;
 - Toxic trace metals (i.e., lead, cadmium and nickel) more concentrated in PM_{2.5} than in bigger particulates.

Health Impacts: PM_{2.5}

- Lung cancer linked to:
 - Known carcinogen: Benzo(a)pyrene
 - Suspected carcinogen: cadmium
- Lead and Benzo(a)pyrene also linked (either recognized or suspected) to cancer, endocrine disruption, developmental, immunotoxic and neurotoxic issues

Health Impacts: Conclusions

- Health effects attributable to air pollution are:
 - Important
 - Sensitive
 - Not always transparent
- Road dust:
 - Spatially variable
 - Controllable

Questions?