Health Impacts of Wood Smoke

Jan 15, 2019
CVRD CoW

We All Breathe

- High levels of pollutants in the air will expose the whole population.
- With a large exposed population the amount of disease related to air pollution will go up.
- AirBetter.org

- On days with worse air quality, more people die (out-of-hospital, >65 yrs.)
- In more polluted cities, people die earlier than in less polluted cities…
- …and, in the most polluted areas of cities, there is an increased risk of dying

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PM 2.5

- *Small combustion particles*

that reach deep in the

lungs

- *increase risk of*

hospitalization and death

from heart and lung

diseases

- *No "Safe" level of exposure*

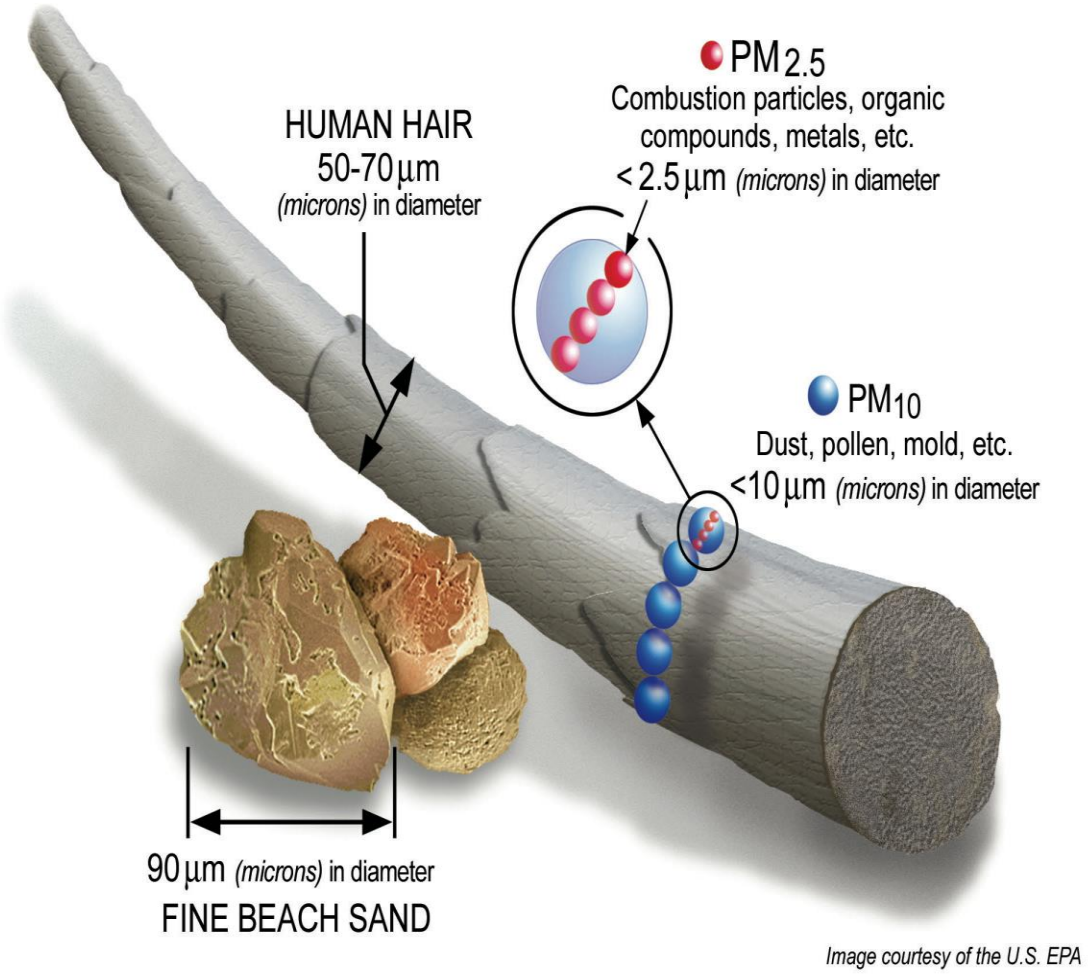

Image courtesy of the U.S. EPA

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The most prominent detrimental health effects of ambient PM2.5 air pollution for hospital admissions and mortality have been observed in the cardiovascular system

Effect of PM2.5

- Local effect on the lining of airways that activates an inflammatory response.
- Systemic impact:
  - Directly and indirectly into bloodstream
  - inflammatory response.
- Immune cell types are stressed and activated, altering their ability to function normally.

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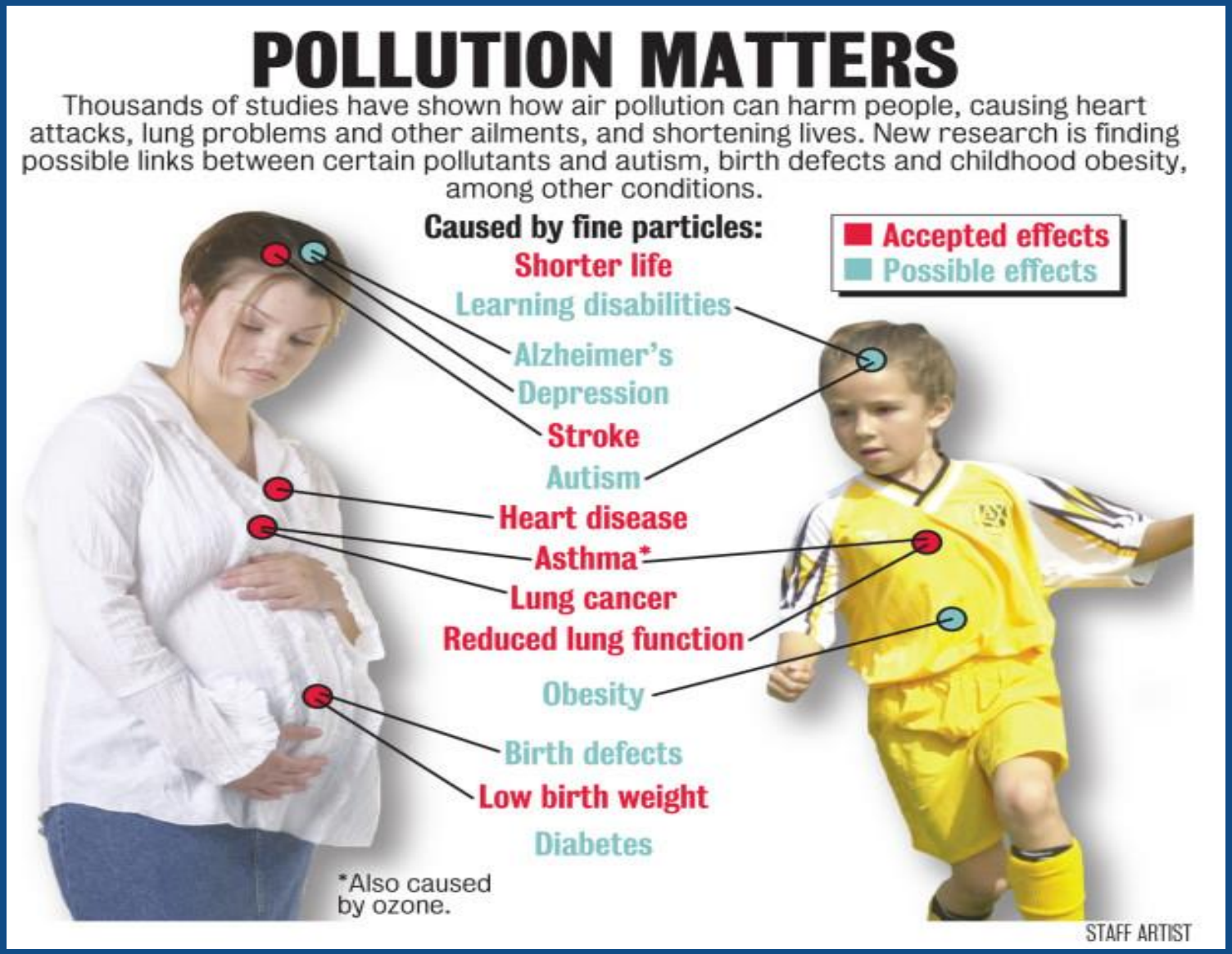

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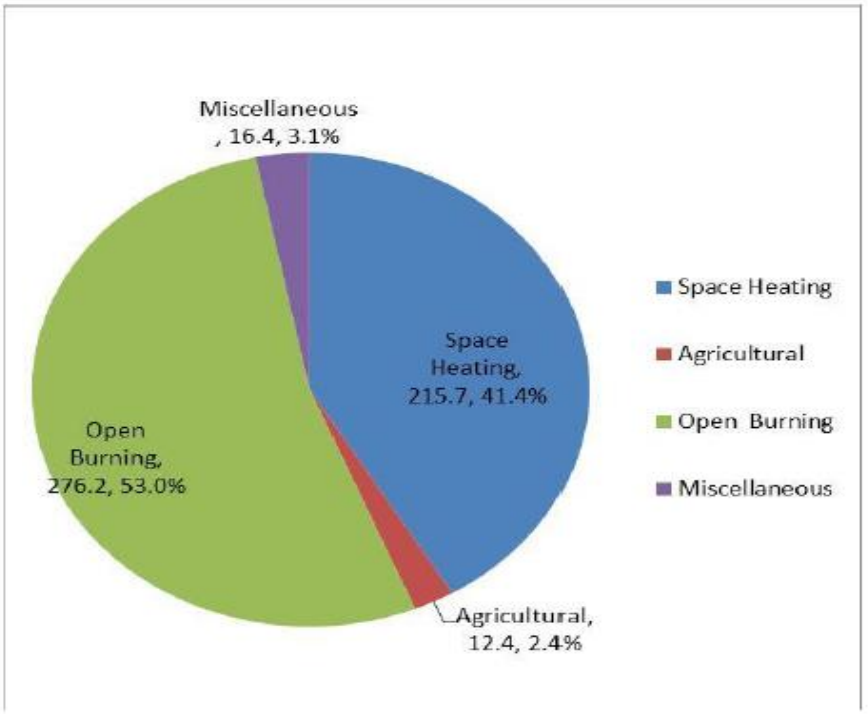
Biomass Burning

- An important source of air pollution globally and locally.
- Multiple potential sources.
- In CV 98.6 % of space heating PM2.5 is from wood burning.

Particulate Matter Emissions Inventory for the Comox Valley 2015 Base Year; RWDI AIR Inc, 2017



$PM_{2.5}$ Emissions from Area Sources in the CVRD, tonnes

Table 44: Particulate Matter Emissions from Space Heating Sources by Fuel Type

Emission Source		2015 Emissions (tonnes per year)		
		TPM	PM_{10}	$PM_{2.5}$
Space Heating	Natural Gas - Residential	1.2	1.2	1.2
	Natural Gas - Commercial/Industrial	1.0	1.0	1.0
	Propane	0.2	0.2	0.2
	Wood	225.6	213.0	212.8
	Heating Oil	0.5	0.5	0.5
	Space Heating Total	***228.5***	***215.9***	***215.7***

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Wood Smoke and Tobacco Smoke share many of the same harmful substances

Wood Smoke
Chemical Composition

⊗Indicates a chemical present in both wood smoke and tobacco smoke
Indicates a hazardous chemical for which ATSDR has prepared a toxicological profile
Indicates a chemical classified as a carcinogen by the US government
●Indicates a chemical that is one of the Top 20 CERCLA priority hazardous substances
[1-275] Indicates position on the CERCLA priority hazardous substances list

ALL CHEMICALS LISTED BELOW ARE REPORTED PRESENT IN WOOD SMOKE

⊗ [198]carbon monoxide, [66]methane, volatile organic compounds (C_2-C_7), *aldehydes*: ⊗ [245]formaldehyde, ⊗ [72]acrolein, propionaldehyde, butyraldehyde, ⊗acetaldehyde, furfural; substituted furans, ⊗ ●[6]benzene, *alkyl benzenes*: ⊗ [68]toluene, ⊗acetic acid, ⊗formic acid; ⊗nitrogen oxides (NO, NO_2), sulfur dioxide, methyl chloride, ⊗ [77]naphthalene, ⊗substituted naphthalenes, *oxygenated monoaromatics*: guaiacol (and derivatives), ⊗ [162]phenol (and derivatives), syringol (and derivatives), ⊗catechol (and derivatives); particulate organic carbon, oxygenated polycyclic aromatic hydrocarbons, ●[9]*polycyclic aromatic hydrocarbons*: ⊗ [270]fluorene, ⊗ [219]phenanthrene, ⊗anthracene, methylanthracenes, ⊗ [106]fluoranthene, ⊗ [249]pyrene, ⊗ [34]benzo(a)anthracene, ⊗ [117]chrysene, ⊗ ●[10 60 70]benzofluoranthenes, benzo(e)pyrene, ⊗ ●[8]benzo(a)pyrene, perylene, ⊗ [180]indeno(1,2,3-cd) pyrene, benzo(ghi)perylene, coronene, ⊗ dibenzo(a,h)pyrene, retene, ⊗ ●[16]dibenz(a,h)anthracene; *trace elements*: Sodium, Magnesium, [186]Aluminum, Silicon, Sulfur, [96]Chlorine, Potassium, Calcium, Titanium, [197]Vanadium, ⊗ Chromium, [138]Manganese, Iron, ⊗ [53]Nickel, Copper, [73]Zinc, Bromine, ⊗ ●[2]Lead; particulate elemental carbon, normal alkanes (C_{24}-C_{30}), cyclic di-and triterpenoids, dehydroabietic acid, isopimaric acid, lupenone, friedelin, chlorinated dioxins

Sources:

Larson TV and Koenig JQ. 1994. *Wood Smoke: Emissions and Noncancer Respiratory Effects.* Table 1, Chemical composition of wood smoke. *Annual Review of Public Health*, v.15, p.136-137.

US Surgeon General. 1989. *Reducing the Health Consequences of Smoking.* Tables 5-8, p.81-89.

US Department of Health and Human Services. Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profiles.

US Department of Health and Human Services. National Toxicology Program. *Report on Carcinogens.* Tenth. 2002.

US Department of Health and Human Services. Agency for Toxic Substances and Disease Registry (ATSDR). Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). List of Priority Hazardous Substances, 2001

Chemicals Found in Both Wood Smoke and Tobacco Smoke

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[245]	formaldehyde
[72]	acrolein
	acetaldehyde
[6] ●	benzene
[68]	toluene
	acetic acid
	formic acid
	nitrogen oxides (NO, NO_2)
[77]	naphthalene
	substituted naphthalenes
[162]	phenol
	catechol
[270]	fluorene
[219]	phenanthrene
	anthracene
[106]	fluoranthene
[249]	pyrene
[34]	benzo(a)anthracene
[117]	chrysene
[10 60 70] ●	benzofluoranthenes
[8] ●	benzo(a)pyrene
[180]	indeno(1,2,3-cd)pyrene
	dibenzo(a,h)pyrene
[16] ●	dibenz(a,h)anthracene
	chromium
[53]	nickel
[2] ●	lead

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“Biomass Burning as a Source of Ambient Fine Particulate Air Pollution and Acute Myocardial Infarction”

Scott Weichenthal et al

Epidemiology:
http://journals.lww.com/epidem/Abstract/publishahead/Biomass_Burning_as_a_Source_of_Ambient_Fine.98888.aspx

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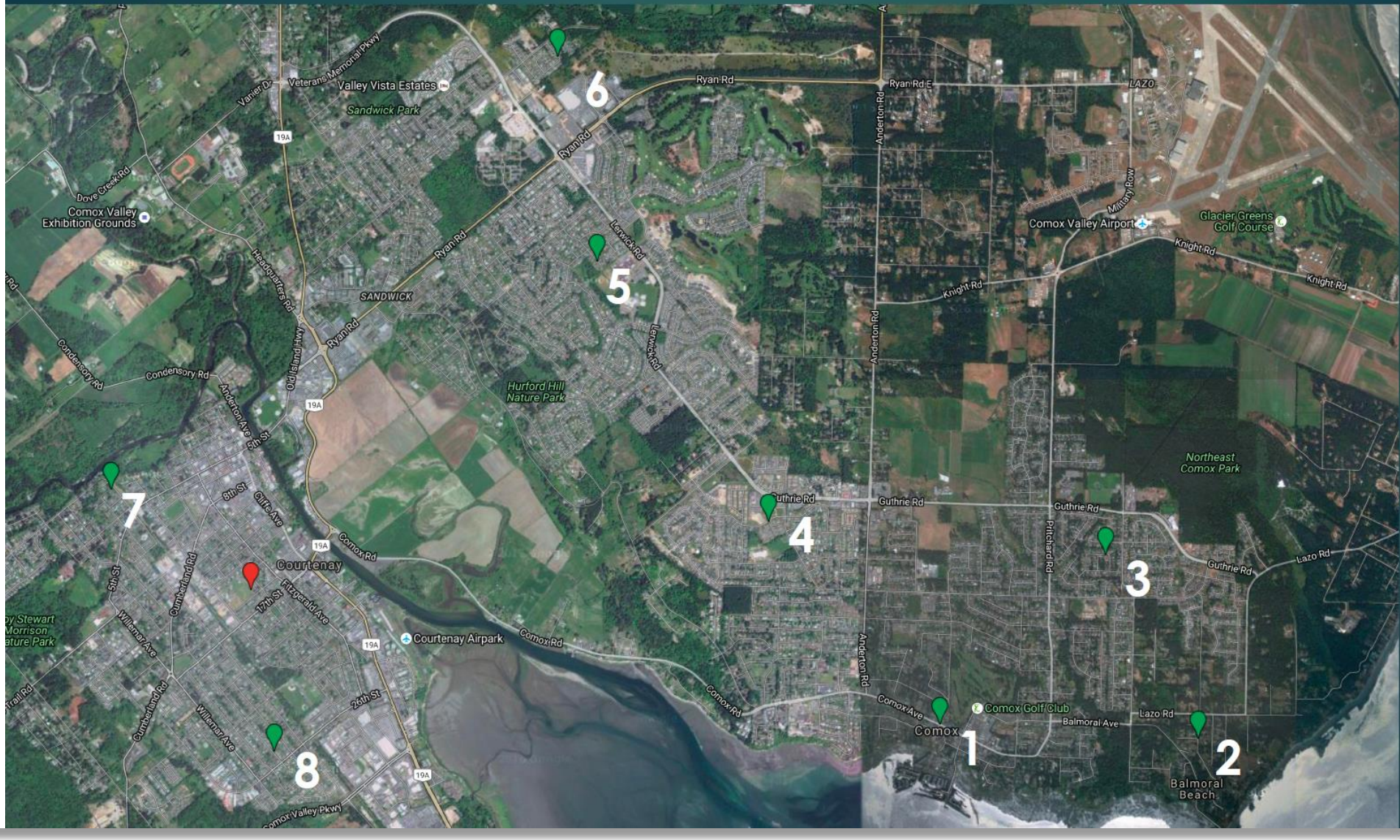
Study Summary

- Researchers from McGill and Health Canada compared pollution data from three cities in BC; Prince George, Kamloops and Courtenay/Comox, with hospital admissions for heart attacks between 2008-2015
- **Main Question**: Is biomass burning as a source of PM2.5 associated with heart attacks?
- This study utilized both the fixed AQ sites in each of the three communities plus multiple spatial monitoring sites to correlate both the PM2.5 and levoglucoscan (a biomarker for biomass burning).

Spatial Monitoring Sites in Courtenay/Comox



*Dr. Scott Weichenthal

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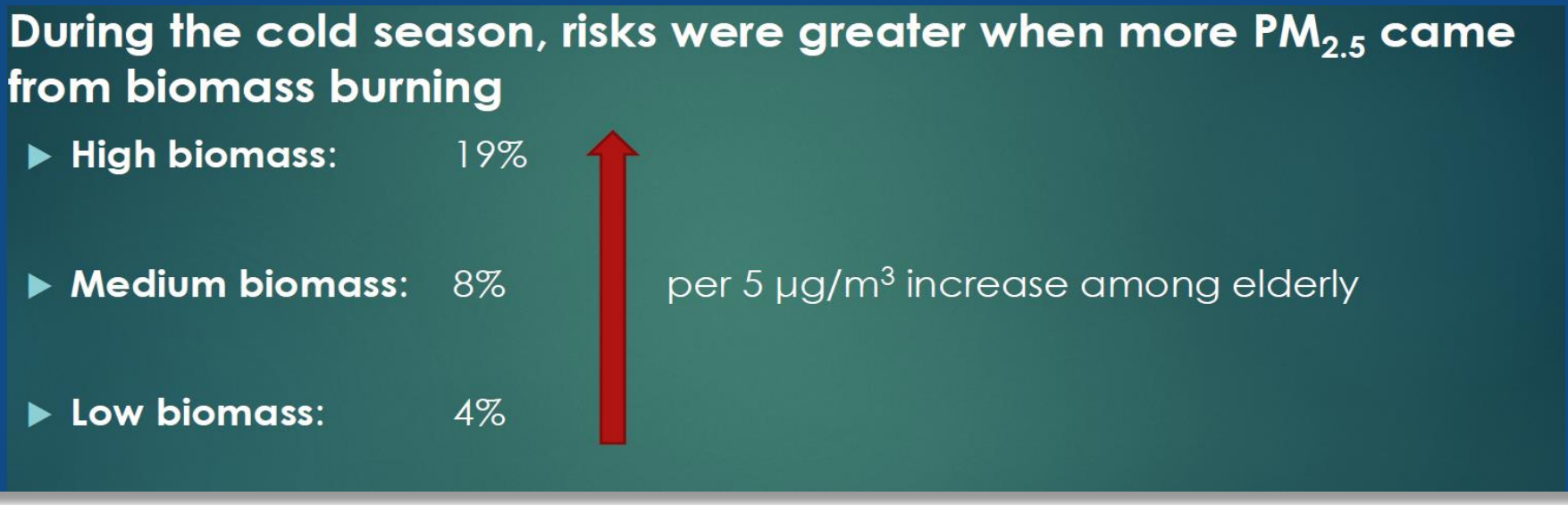
Findings

- Each 5 µg/m3 increase in 3-day mean PM2.5 was associated with a **6% increased risk of MI in the elderly (> 65 years)**
- The source of PM2.5 matters:



*Dr. Scott Weichenthal

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Summary

- There is no safe limit for air pollution.
- Any improvements in AQ will result in reduced health impacts.
- The lower the levels of PM $_{2.5}$, the better health of the population will be, especially cardiovascular and respiratory health, both long and short-term.
- We have options and technology to reduce particulate air pollution

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