

Air Quality in the Comox Valley

Comox Valley Airshed Roundtable Meeting

Sept 15, 2020

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Weight of Evidence: Wood Smoke Issue in CVRD

- BCCDC study - “Systematically identifying and prioritizing communities impacted by residential wood smoke in British Columbia, Canada” (S. Henderson 2016)
 - Courtenay 2nd highest WS impacted community in province
- Health Canada study - “wood smoke and heart attack” (2016)
 - High concentrations of wood smoke in Courtenay
 - Increased risk of heart attack during winter
- Ambient AQ data analysis (ongoing)
 - Analysis confirms that wood smoke sources are dominant during cold season (B.C. ENV 2017)
 - Exacerbated by POOR dispersion meteorology in the winter

Air Quality in B.C.:

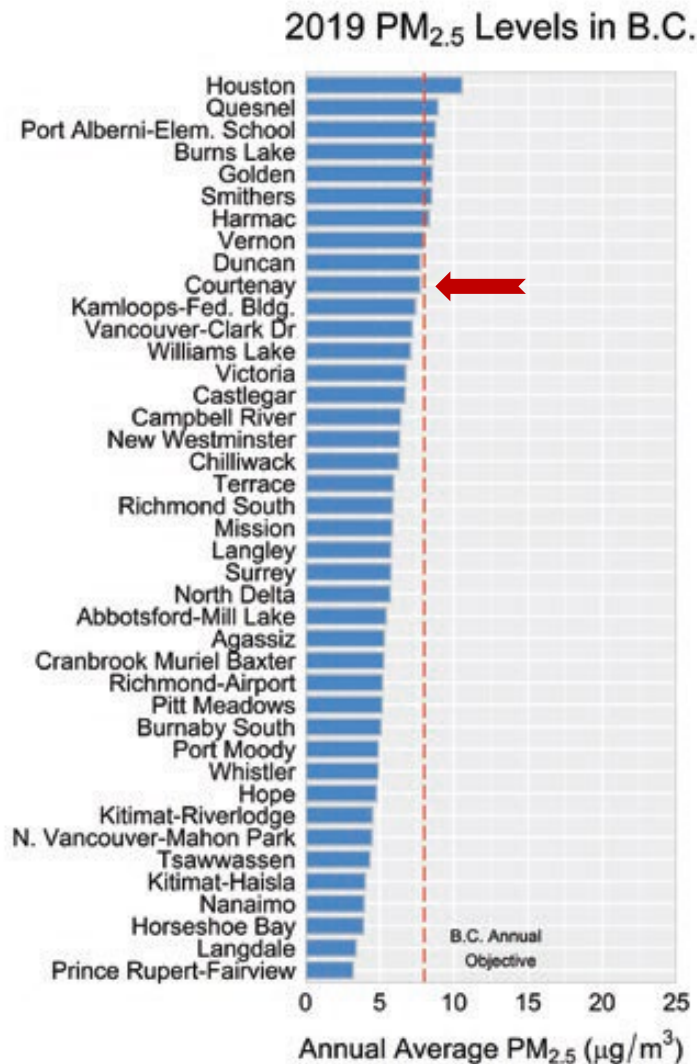
Air Zone Management for PM_{2.5}

Management Level	O ₃ (ppb)		PM _{2.5} – Annual (µg/m³)		PM _{2.5} - 24h (µg/m³)	
	2015	2020	2015	2020	2015	2020
Red	Actions for Achieving Air Zone CAAQS					
Threshold (CAAQS)	63	62	10	8.8	28	27
Orange	Actions for Preventing CAAQS Exceedance					
Threshold	56		6.4		19	
Yellow	Actions for Preventing Air Quality Deterioration					
Threshold	50		4		10	
Green	Actions for Keeping Clean Areas Clean					



Air Zone	Three-year Reporting Periods				
	2015-2017	2014-2016	2013-2015	2012-2014	2011-2013
Central Interior	Houston Vanderhoof (Valemount – based on 2 years of data)	Houston Vanderhoof	Smithers Vanderhoof	Smithers Vanderhoof	Smithers Vanderhoof
Coastal	Kitimat site	Kitimat sites	Kitimat sites	Kitimat sites ³	Kitimat Terrace
Georgia Strait	Courtenay	Courtenay Port Alberni	Courtenay Duncan Port Alberni	Courtenay Duncan	Courtenay Duncan
Lower Fraser Valley	Several sites	Several sites	Langley Abbotsford	Several sites	Several sites
Northeast	Fort St John	N/A	N/A	N/A	N/A
Northwest	N/A	N/A	N/A	N/A	N/A
Southern Interior	Several sites	Several sites	Several sites	Several sites	Castlegar Kamloops Vernon

While PM_{2.5} levels in Courtenay had relatively improved in 2019, still ranking among the highest in the province



What is Particulate Matter?

- Solid & liquid, various sizes & shapes, many chemicals
- Directly emitted or indirectly formed from gases
- Natural or human sources:
 - Fuel combustion, open burning, forest fires
 - Industries with crushing & grinding, construction
 - Roads, unpaved surfaces

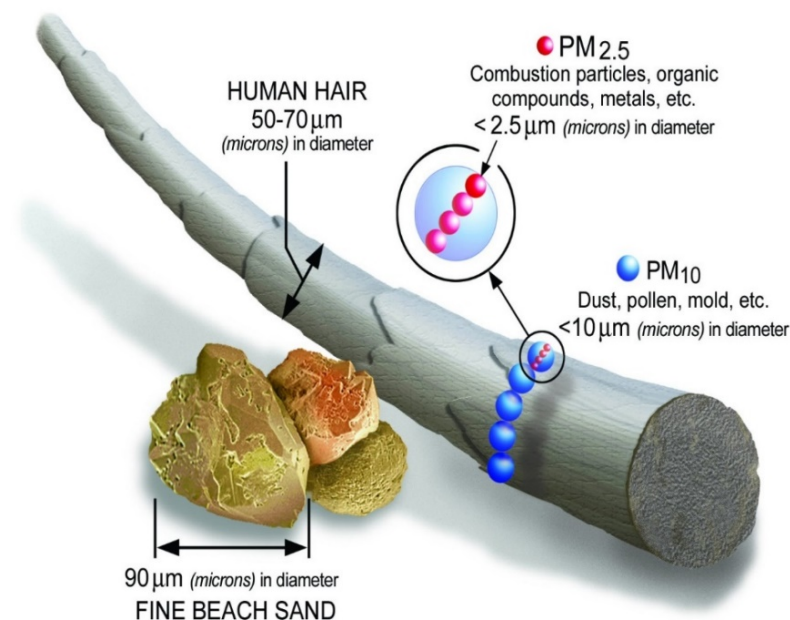
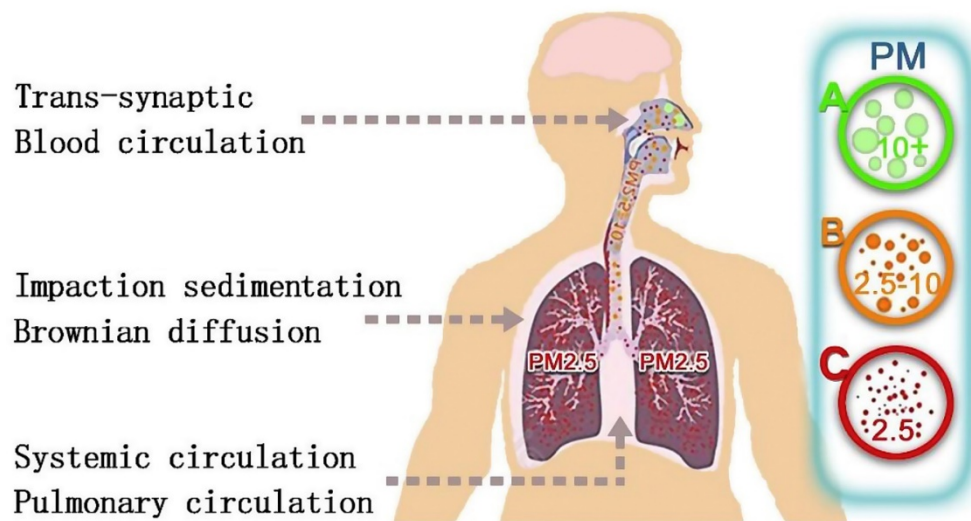


Image courtesy of the U.S. EPA

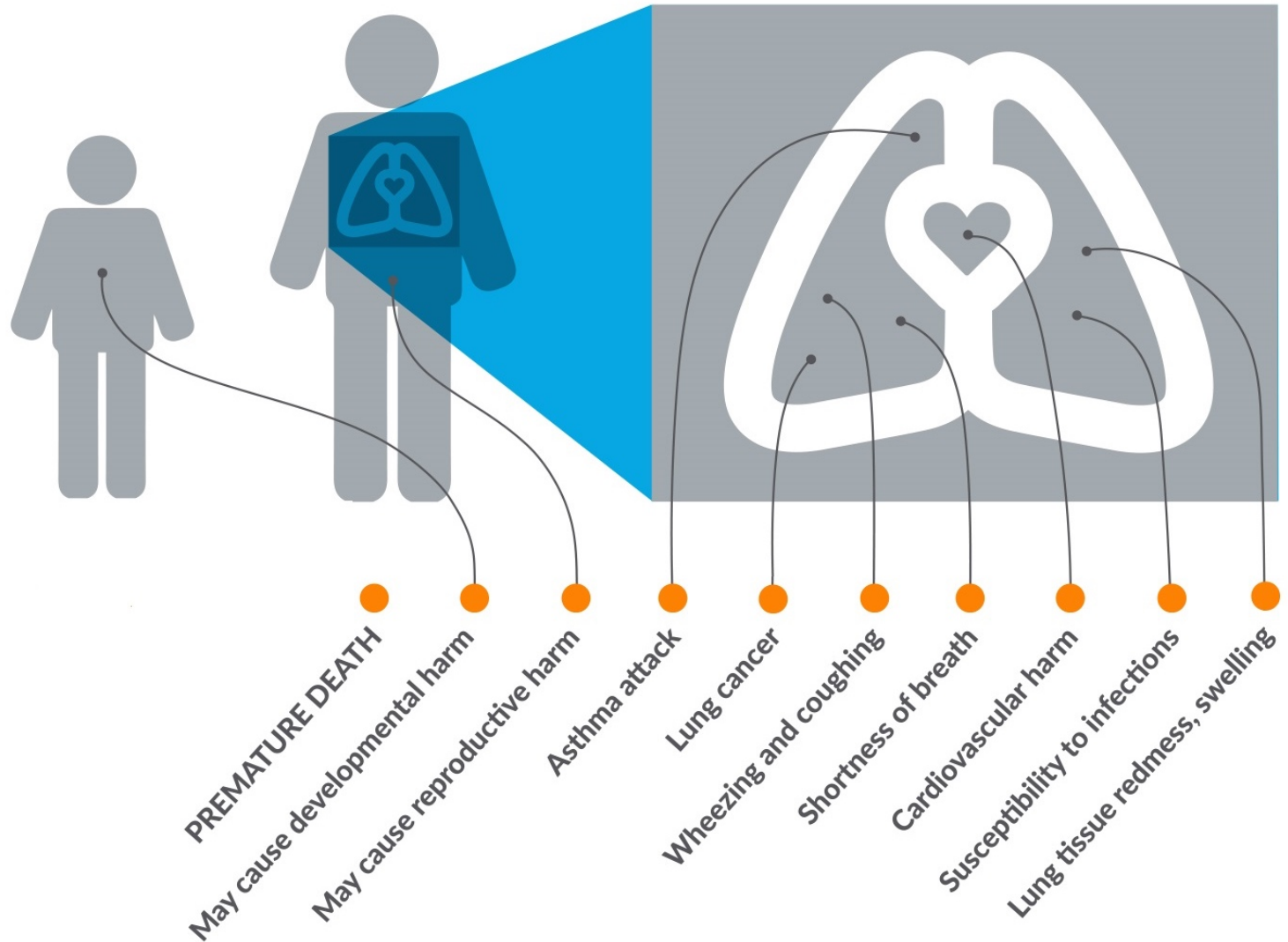
PM_{2.5} is of Primary Concern

- Local effect on the lining of airways that activates an inflammatory response
- Systemic impact:
 - Directly and indirectly into bloodstream
 - Inflammatory response
- Short-term exposure: increased hospitalizations and/or mortalities
- Long-term exposure: can lead to heart/lung diseases



T. Li et al. / Chronic Diseases and Translational Medicine 4 (2018) 176-186

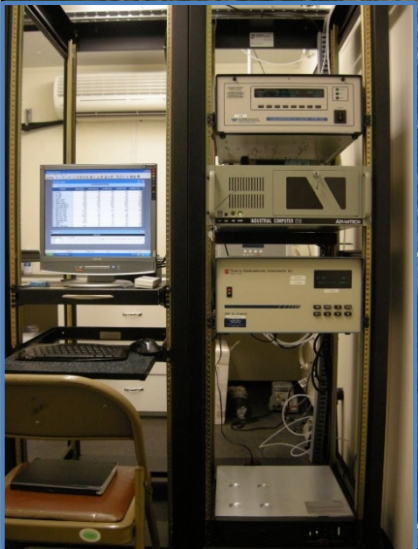
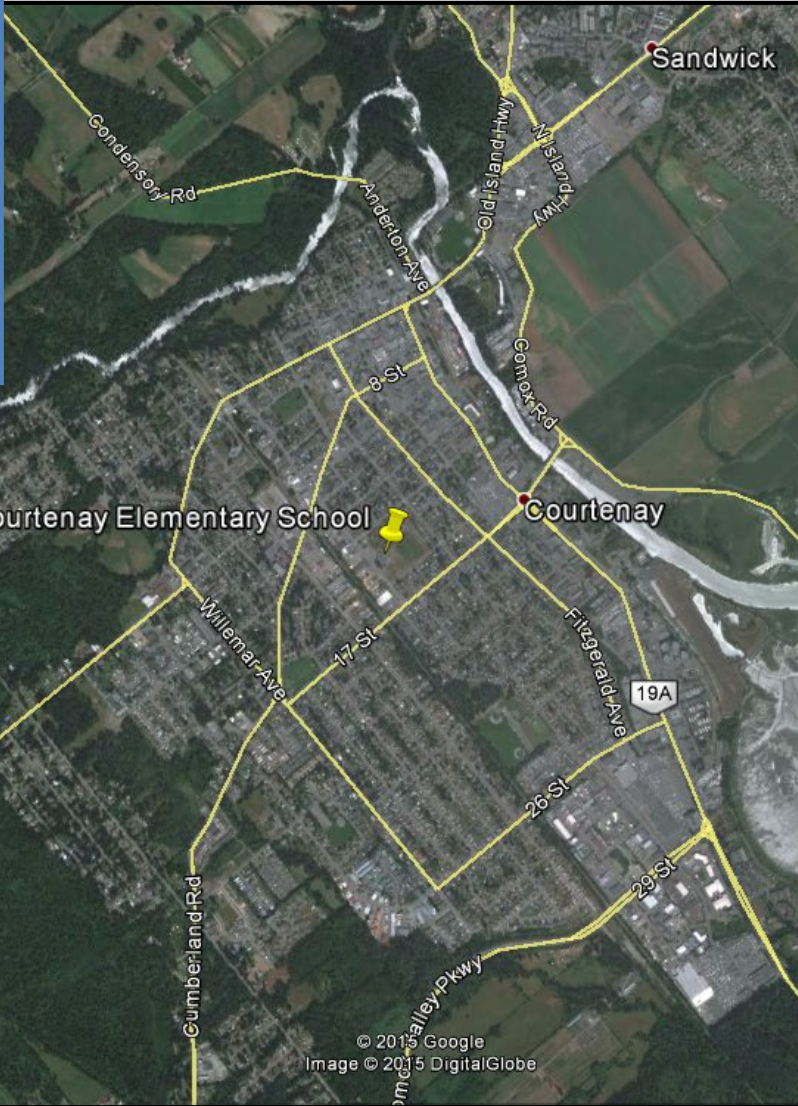
Health Risks from Particulate Matter



Air Quality Assessments in Comox Valley

- Monitoring station at Courtenay Elementary since June 2011
 - Continuous monitoring of:
 - Fine Particulate matter (PM_{2.5})
 - Ozone (O₃)
 - Nitrogen Oxides (NO & NO₂)
 - Meteorology
- } AQHI
- Special short-term (mobile) monitoring studies
 - Emissions inventory for the Comox Valley in March 2017

Air Quality Monitoring in Comox Valley



<https://www2.gov.bc.ca/gov/content/environment/air-land-water/air>

[AQHI](#)

[PM_{2.5}](#)

[PM_{2.5}\(24hr\)](#)

[PM₁₀](#)

[PM₁₀\(24hr\)](#)

[O₃](#)

[O₃\(8hr\)](#)

[NO₂](#)

[SO₂](#)

[TRS](#)

[All Station Data](#)

1 station selected

Courtenay Elementary School

As of: Monday 14 September 2020 2PM (PDT)

[Graphs](#) | [Download Data](#)

Hourly Averages:

- PM_{2.5}: **172** µg/m³
- NO: **0.5** ppb
- NO₂: **4.7** ppb. Objective: 100 ppb
- O₃: **25** ppb

Rolling Averages (24 or 8 hours)

- PM 2.5 (24h): **130.2** µg/m³.
Objective: 25 µg/m³
- NO (24h): **1.8** ppb
- NO₂ (24h): **4.6** ppb
- O₃ (8hr): **9.3** ppb. Objective: 63 ppb

Meteorological Data:

- Wind Direction: **91.7°**
- Wind Speed: **1.14** m/s
- Temperature: **16.4** °C

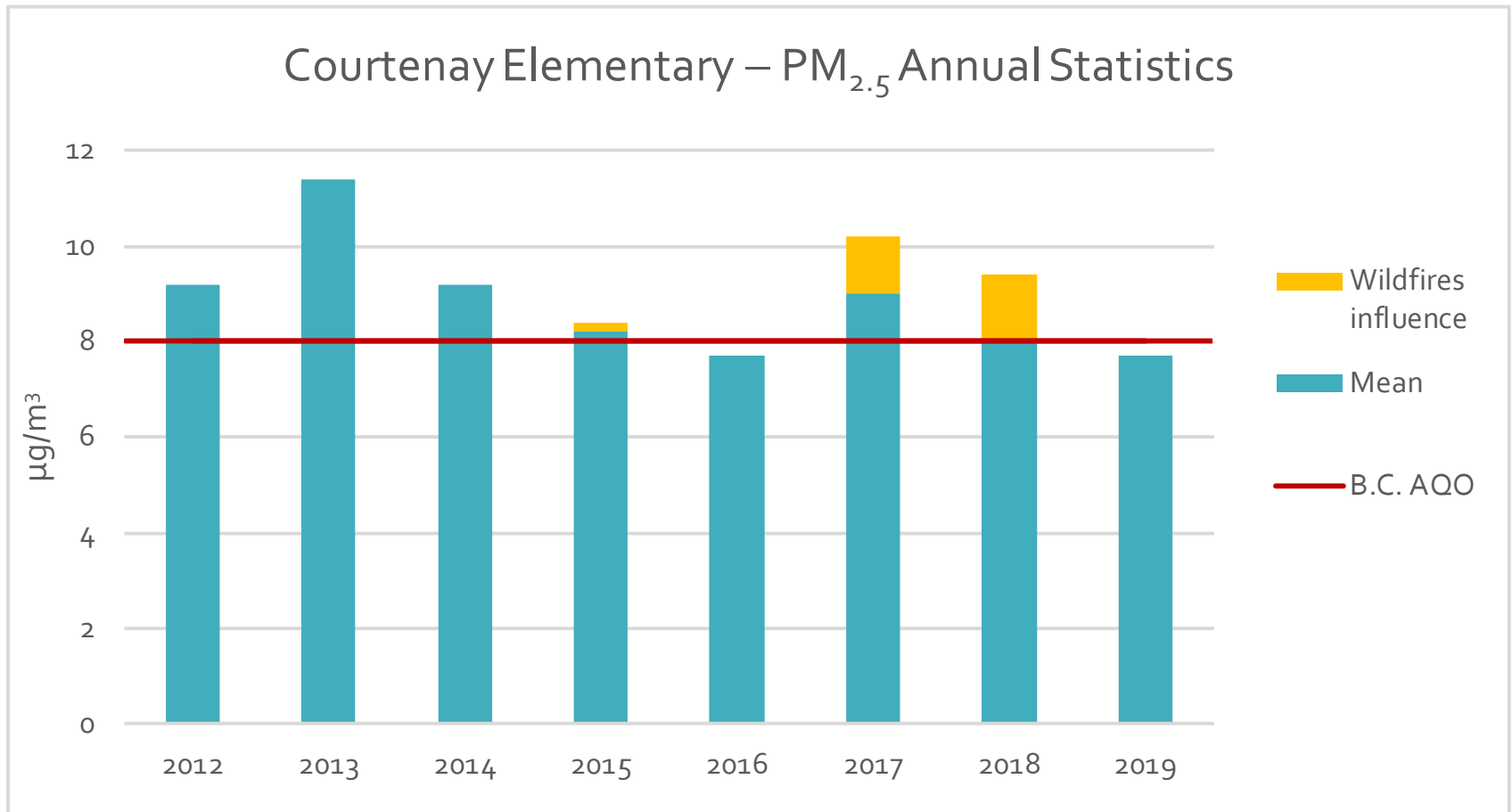


Provincial PM_{2.5} Management

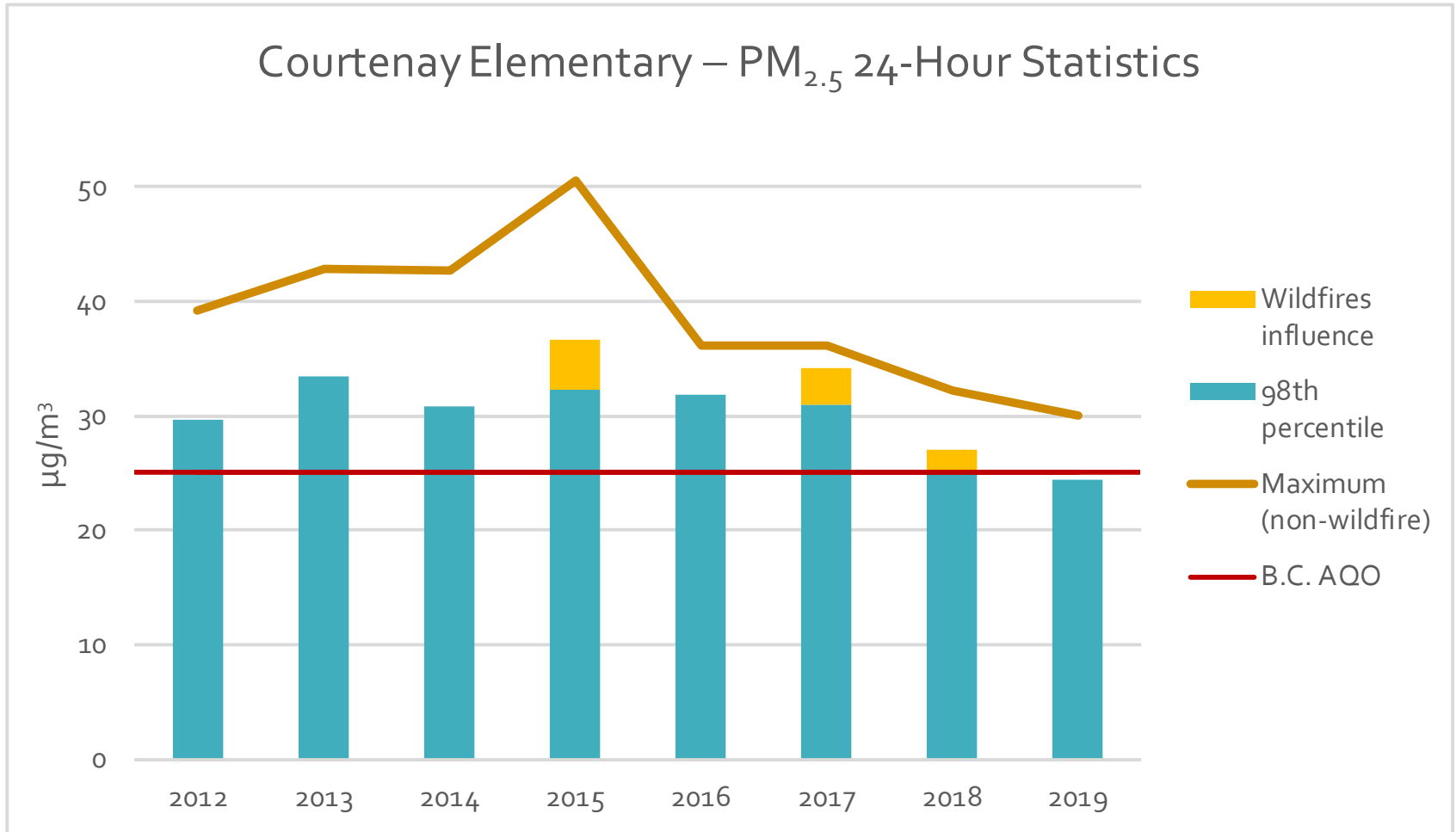
Averaging Period	BC AQOs	2020 CAAQS
24 hours	25 µg/m ³	27 µg/m ³
1 year	8 µg/m ³	8.8 µg/m ³

- For air quality management in an airshed with PM_{2.5} monitoring
 - One-year average below the annual AQO
 - 98th percentile of daily averages over a year below the 24-hr AQO
 - Minimal number of days in a year with average concentrations exceeding the 24-hr AQO
 - Advisories issued whenever the 24-hr running average exceeds the 24-hr AQO, and exceedance is expected to last for some time

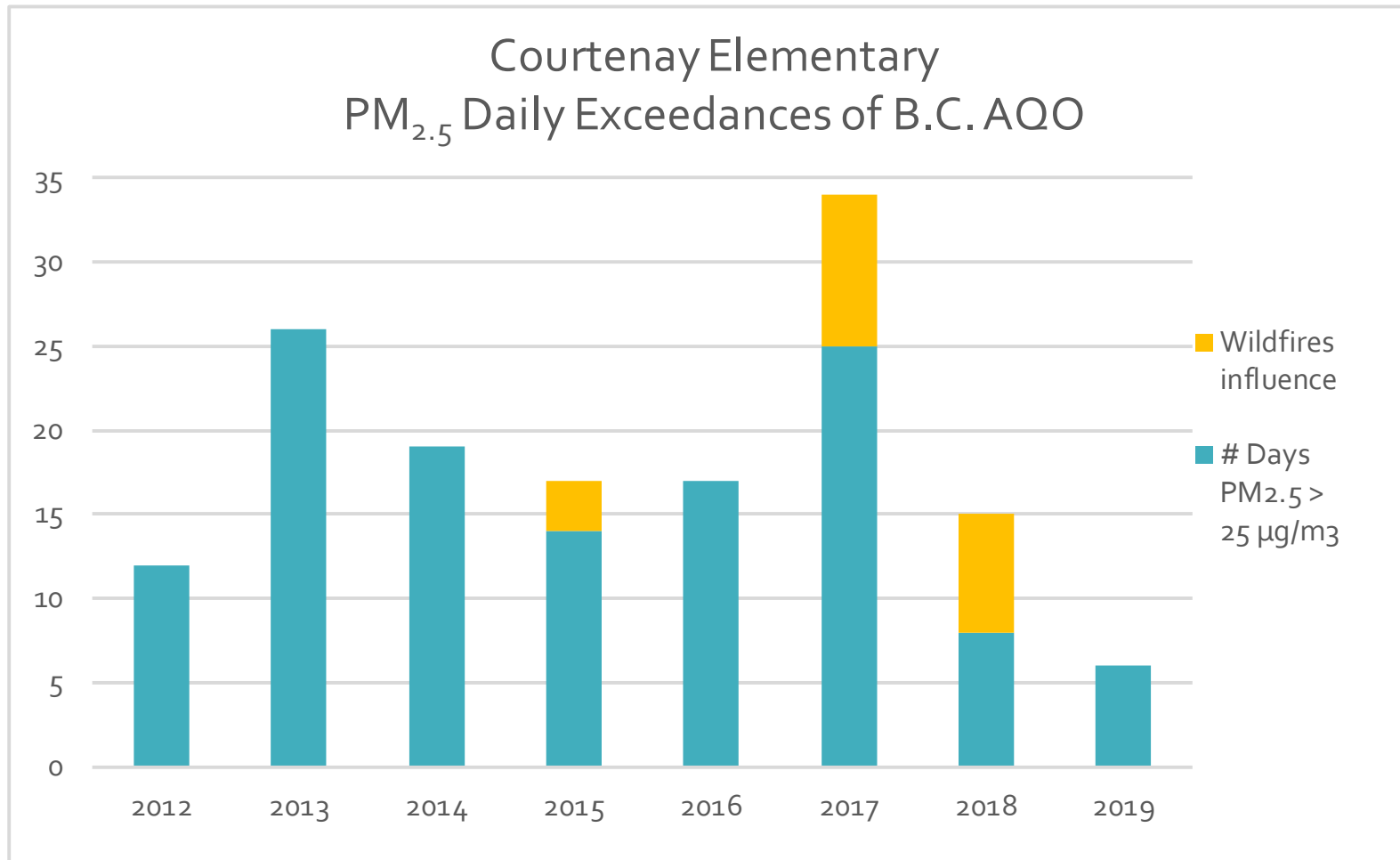
Stationary Monitoring Key Findings



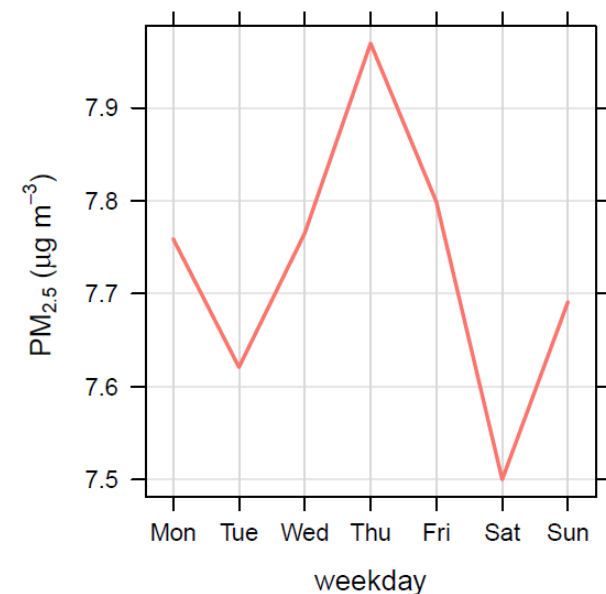
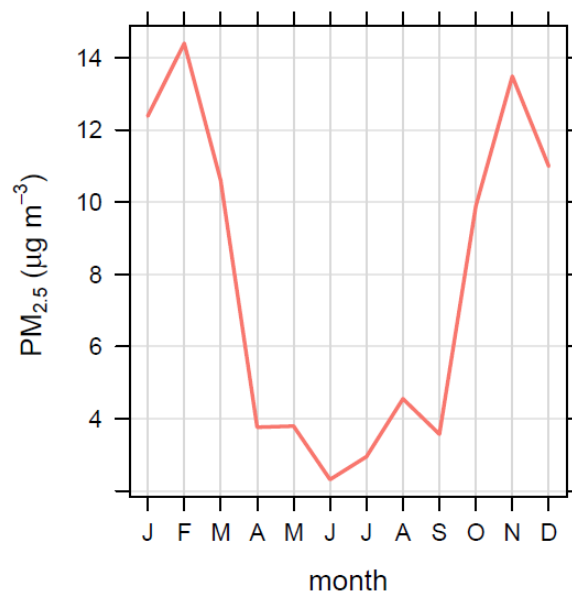
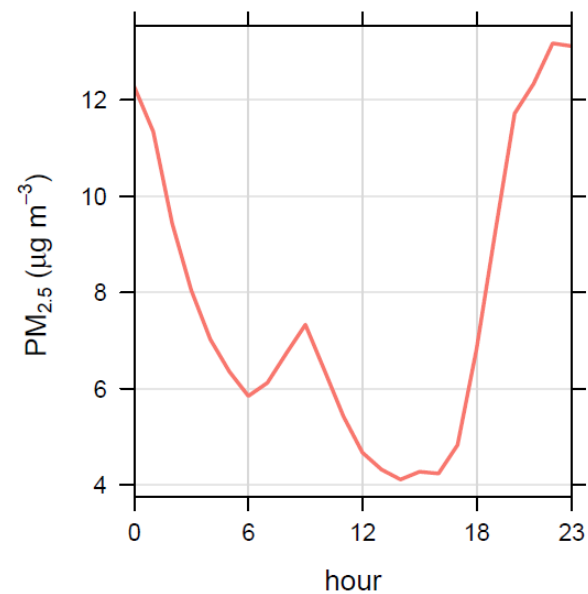
Key Findings from Stationary Monitoring

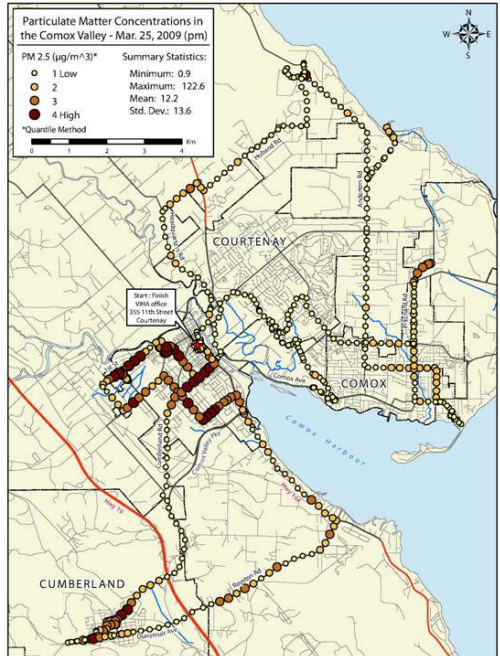
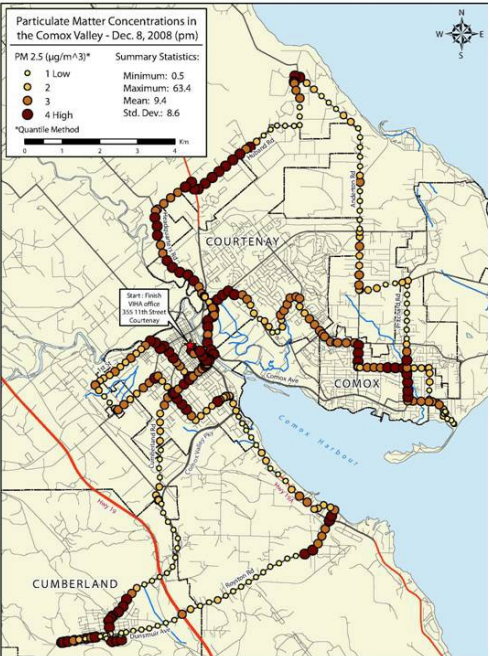


Key Findings from Stationary Monitoring



Key Findings from Stationary Monitoring Courtenay Elementary - 2019 Data



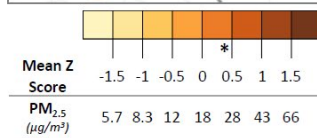
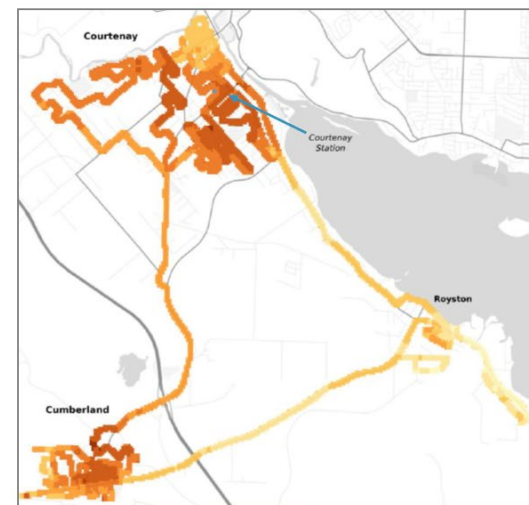


2008-2009 UVIC/VIHA Study

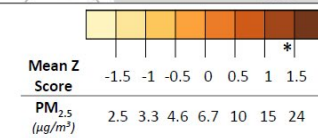
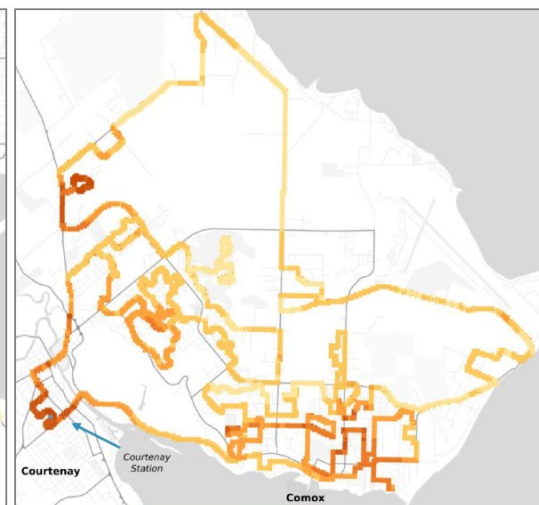
- Studies examined PM_{2.5} spatial variability across communities
- Widespread issue, “hotspots” with consistently higher levels
- PM_{2.5} during late winter largely from wood smoke
- Influence of traffic emissions

PM_{2.5} Mobile Monitoring Studies in Comox Valley

2017 UBC Study

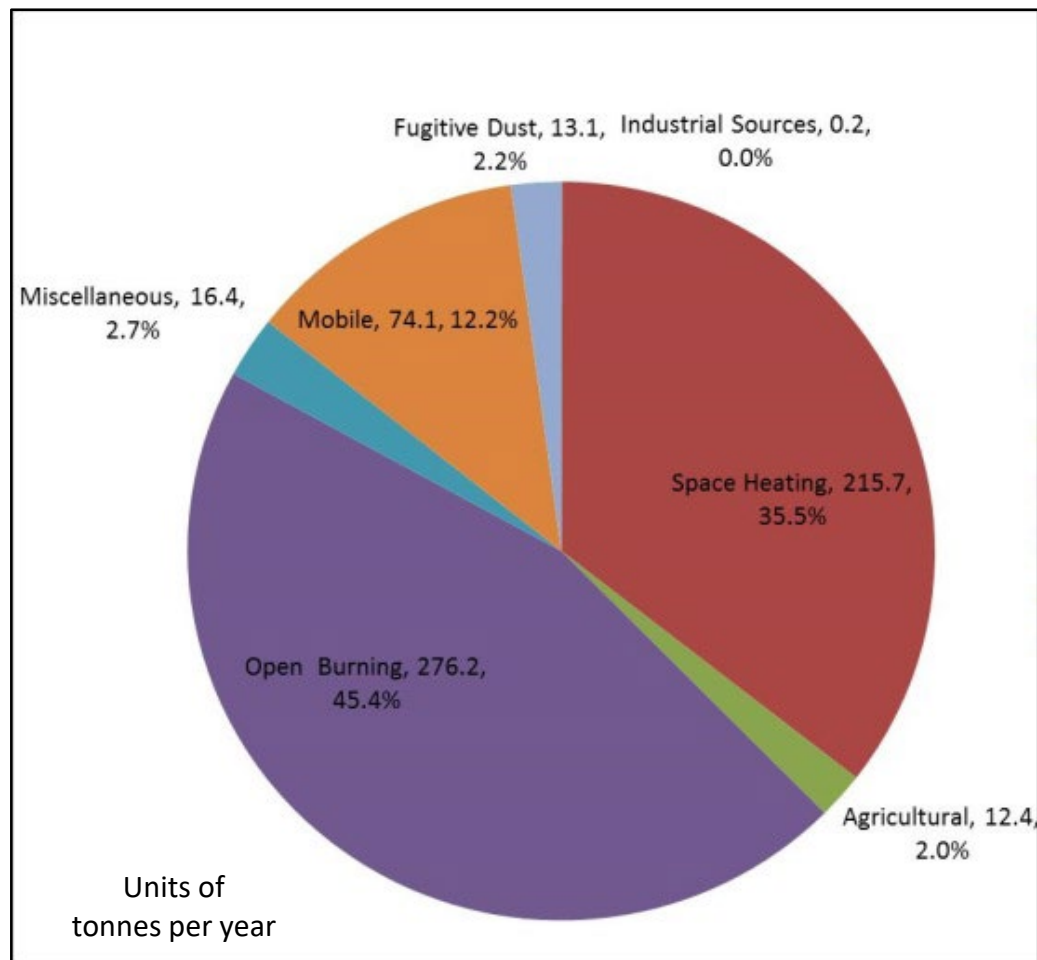


* Courtenay Station
Z = 0.44
PM_{2.5} = 27 µg/m³



* Courtenay Station
Z = 1.4
PM_{2.5} = 22 µg/m³

Comox Valley Emissions Inventory for PM_{2.5} 2015 Base Year



Emission Sources: Location and Timing

- Emission inventories: limitations of time & sources captured.
- Location of sources relative to population centers is an important consideration.
- Pollutants from back-yard burning, land-clearing and wood stoves are released right where people live and play → more likely to be inhaled.
- Burning with best practices and under good ventilation can significantly reduce smoke emissions & PM_{2.5} concentrations.

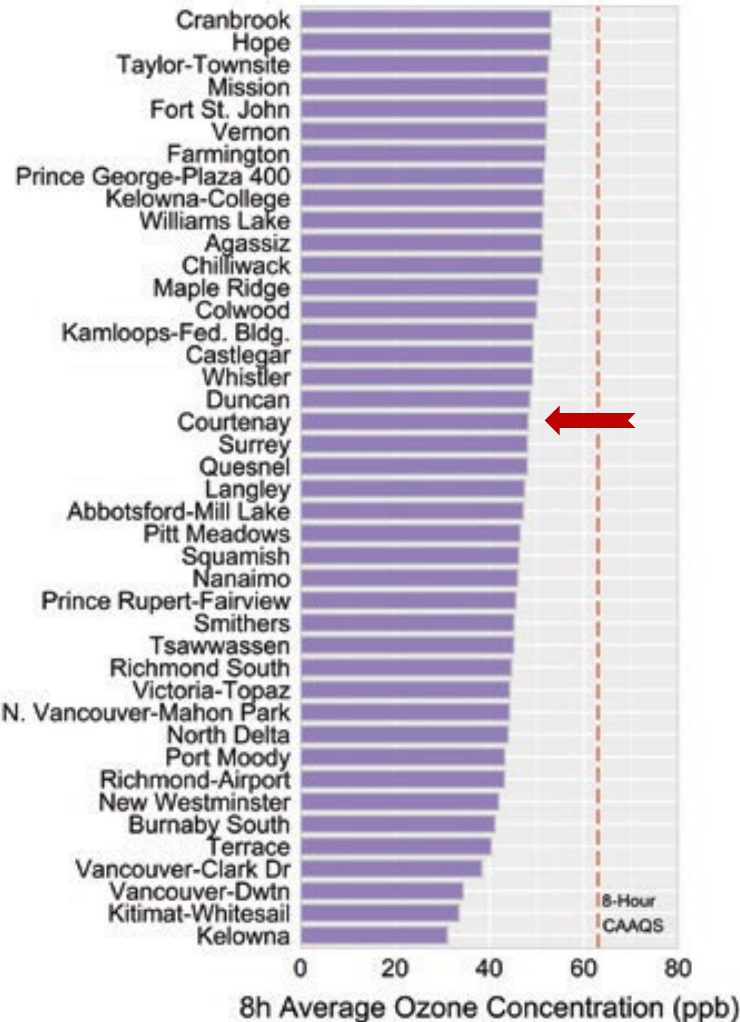
Key Messages

- Whereas ozone and nitrogen dioxide levels are overall acceptable, fine particulate matter remains a chronic issue in Comox Valley.
- PM_{2.5} concentrations are generally low during spring-summer, but are elevated during fall-winter: more wood smoke (residential heating, open burning) & less ventilation.
- Comox Valley has mostly exceeded national and provincial PM_{2.5} objectives since monitoring began in 2012, consistently in top 10 for worst AQ in BC.
- Analysis to-date indicates that residential heating and open burning are the main PM_{2.5} sources in the Comox Valley. Mobile sources also play a role during the colder months.
- There is a clear and urgent need to manage PM_{2.5} sources and improve air quality in the Comox Valley.

Thank You!

Questions?

2019 Ozone Levels in B.C.



2019 NO₂ Levels in B.C.

