



BRITISH
COLUMBIA Ministry of Environment

Air Quality: causes and solutions

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Thompson and Okanagan Regions

Objectives

- What is it?
- Where does it come from?
- How bad is it?
- Is it getting worse?
- What can we do about it?

The Air Pollution “System”

Sources → Dispersion → Receptors

- Receptors are human lungs, but there could be others.
- Dispersion is dependent on processes in the atmosphere, which are dependent on topography and weather.
- Sources --- where it comes from: point, area, mobile. Emission inventories.

Dispersion

(getting from here to there)

- Where it goes and how fast depends on the atmosphere.
- The PBL, mixed layer, or bit we live in.
- The box model of the lower atmosphere.
What is an inversion anyway?
- The Schwartzhoff model.

Implications of topography

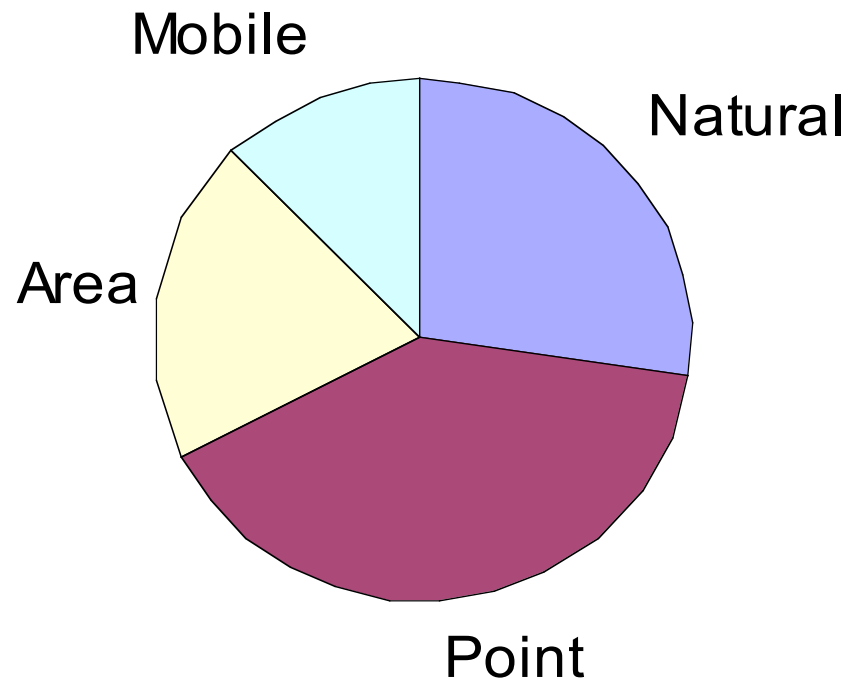
- Small box due to narrow valleys
- Cool valleys – low lid
- Lots of Calm periods, especially during winter and fall season
- All leads to poor dispersion (dilution) and high local (nearby) concentrations.

Emission inventories

- An estimate of how much of a particular pollutant is emitted.
- This is a black art --- lots of uncertainties
- How accurate do we need it?
- As an example...

Example Emission Inventory

PM₁₀ sources outside Lower Fraser



The Effect of Scale

- All the above can be considered at many scales, from airshed to local.
- Airshed scale would be something like a large industrial plant with a few large stacks.
- Local scale would be something like a person misusing a woodstove.

Which Pollutants?

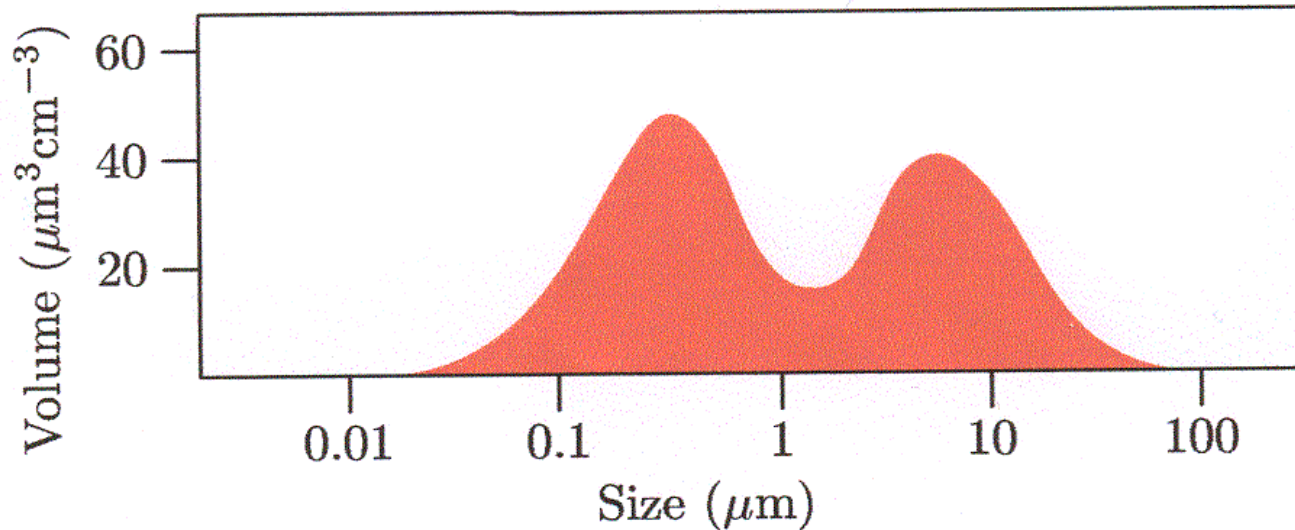
- Particulate Matter
- Ozone

Note that there are a lot of “missing” pollutants like NO_x, SO_x, VOCs etc.

Particulate Matter

- Particles that are small enough that they remain suspended in the atmosphere for periods of hours to days.

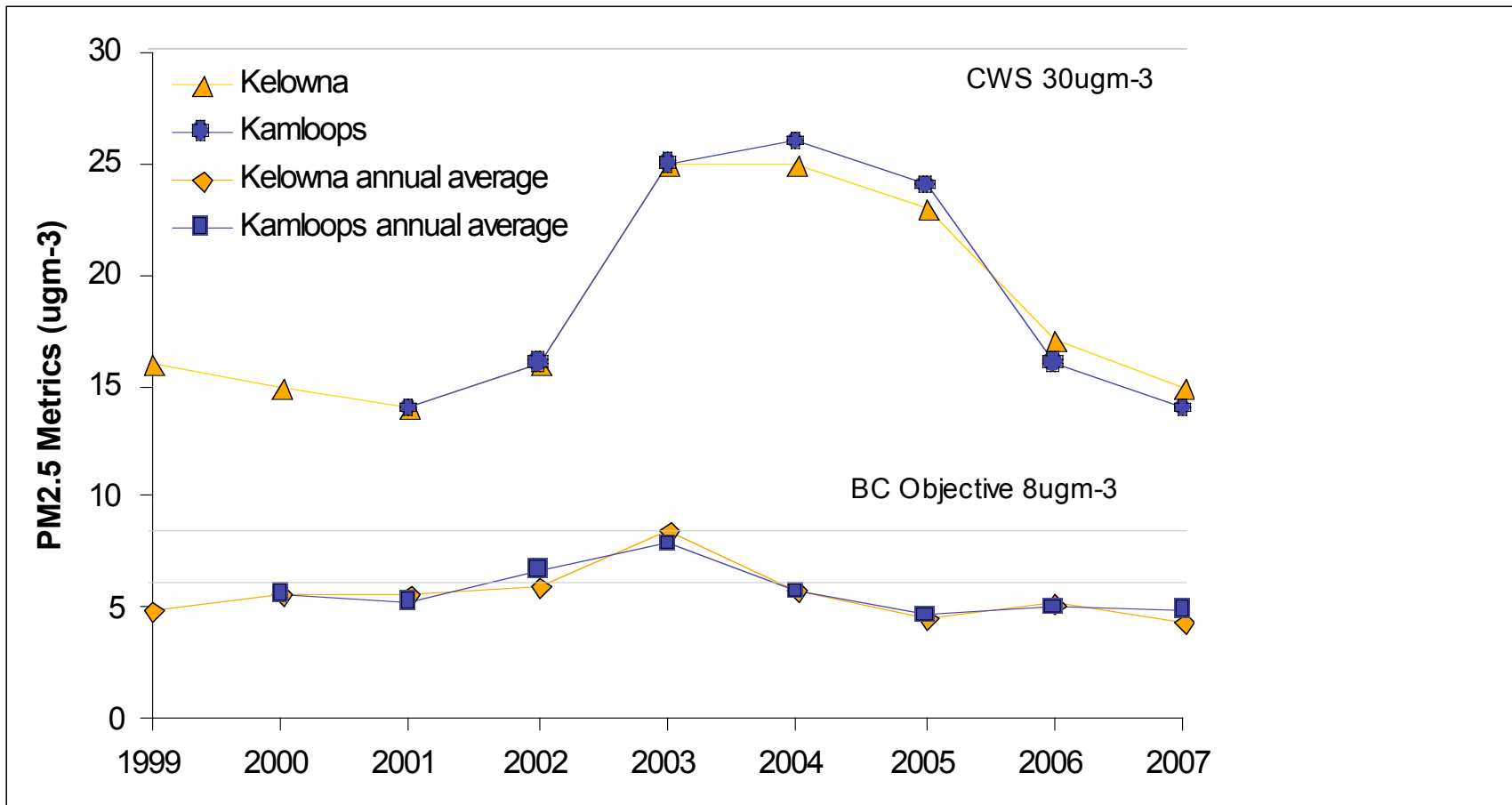
Particulate matter is **two** pollutants



- Particles less than 10 micrometres get past your nose.
- Particles less than 2.5 micrometres get all the way into your lungs
- Particulate matter is made up of two broad groups of particles, the larger ones derived from rock and clay, and finer ones derived from chemical reactions
- For our purposes we can call them dust and smoke
- Current evidence is that smaller (smoke) is more harmful than larger (dust) particulate.

How do we report PM levels

- A calculation that says something about the higher levels: hours above a certain level, an exceedance frequency, the 98th percentile, the 4th highest daily maximum of the 8 hour forward running average, etc.
- An exposure above a threshold, similar to the idea of a dosage. Problem is that there is no clear threshold for PM. Examples are: total exposure, Vedal increments, CWS exposure above the Reference Health Level (RHL)
- We use the same methods to set objectives and standards. In BC we are using both a system based on objectives and the new Canada Wide Standards system using upper percentiles.



So is PM a problem?

- We are well below the CWS level for $\text{PM}_{2.5}$, and below BC objectives
- $\text{PM}_{2.5}$ is not increasing.

But....

- “Keeping Clean Areas Clean” and “Continuous Improvement” means we have to hold or reduce levels. Potential economic effects.
- There is no “safe” level of $PM_{2.5}$
- This does not include the most serious local scale effects.
- Sources of $PM_{2.5}$ are increasing.

Strategies?

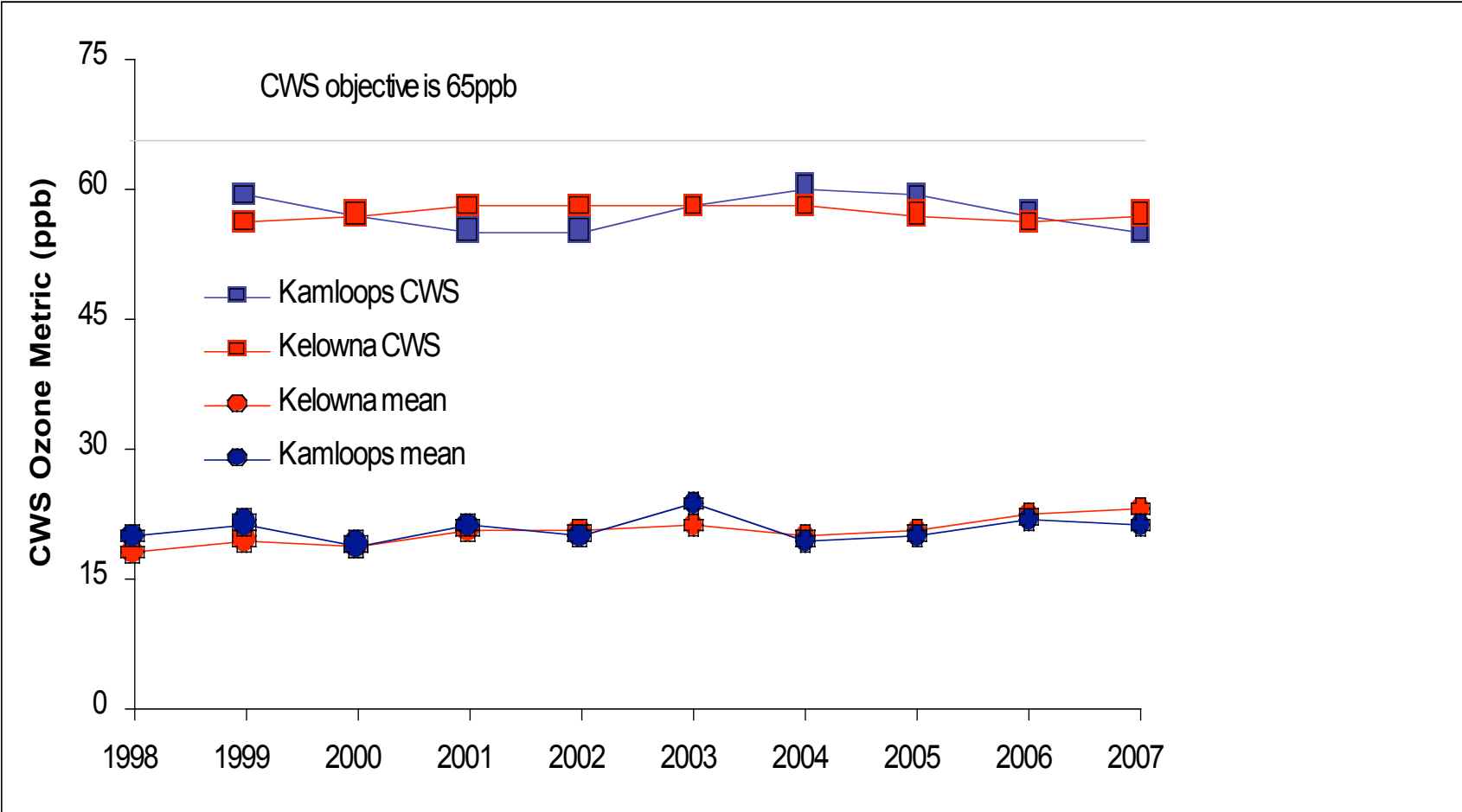
- Reduce emissions (e.g. Pulp Mill is halving their maximum emission of PM over next years, encourage small mills not to rely on open burning or primitive burners to dispose of wood waste, BACT on new sources).
- “Buffers”, assuming that there are no emissions from light and heavy industrial operations is not reasonable.
- Misuse of woodstoves, barrel burning garbage, and outdoor boilers should be eliminated or reduced.
- Anti-idling campaigns
- Chipping of orchard waste
- EDUCATION

Ozone

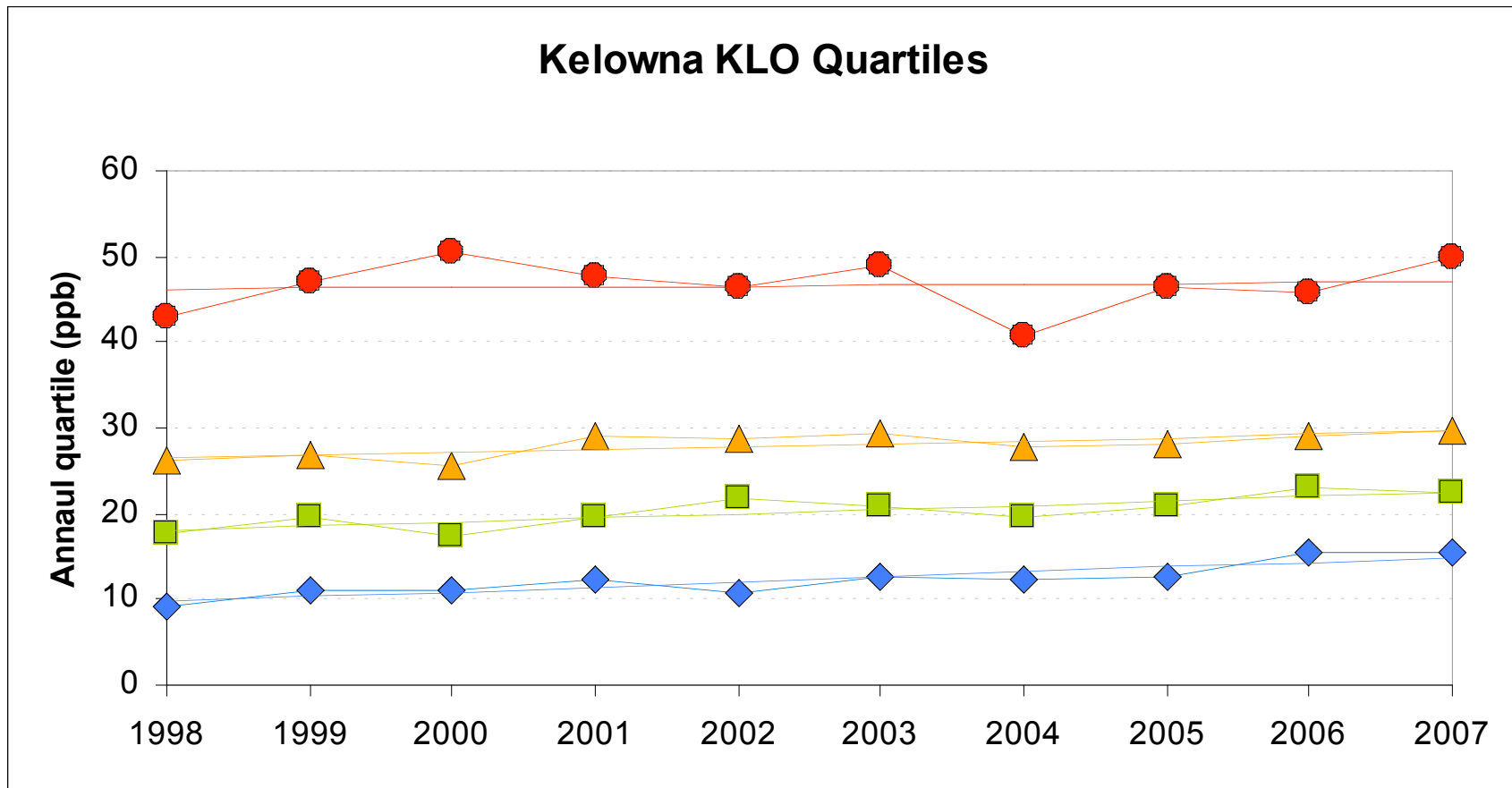
- Ozone is a gas, a special kind of oxygen molecule (O_3).
- Stratospheric ozone, the ozone layer, GOOD ozone.
- Tropospheric, ground level ozone, BAD ozone.
- Irritates the lungs, similar symptoms to $PM_{2.5}$.

Where does it come from?

- Formed when volatile organic compounds and oxides of nitrogen react with ultraviolet radiation (sunlight).
- These precursors can be both anthropogenic and natural, and can be transported great distances before ozone is produced.
- Stratospheric ozone can get to ground level in certain conditions.



Is it changing?



Can we control ozone levels?

- Probably not.
- May well become an issue as population increases.
- Research is underway to determine normal background levels in BC.

Emerging Issues

- Fuel switching (coal, used oil replacing natural gas)
- Visibility
- Fire guards, fuel reduction
- Beetle sanitation.