

# Health impact of Fairbanks Air Quality

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**BIG DATA**  
**vs**  
**our experience**

# Why do we get ill?

## Big Data tells us:

- Genes: 20%
- Environment: 80%

# Environmental exposure:

- Excess sun exposure turns young skin old
- Eating grease makes young arteries old
- Excess noise makes young ears deaf
- But one of your biggest exposure is:

# Breathing

- You eat 3-4x in 24 hours; you breathe every 5 seconds.
- If the food was not safe, you could go a month without eating. How long can you live without breathing?
- You breathe: 5-10 liters a minute at rest; 100-150 liters/minute during exercise.
- 10,000 liters/day reach alveoli of lungs.



**SMOKING KILLS**

# Lung is a filter

- 10 micron particles removed in upper airway.
- 2.5-10 microns: trachea, bronchi, bronchioles
- <2.5 micron reach alveoli (“PM 2.5”)
- <0.1 micron pass through cell membranes
- Particles carry chemicals that dissolve in alveolar moisture (Think Lipton teabag).

**Where does most of PM 2.5  
come from in Fairbanks?**



# Major source:



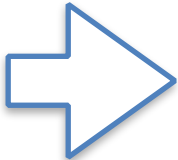
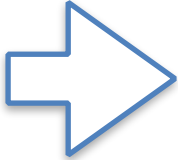
# Wood smoke is toxic because

- Incomplete combustion produces huge numbers of particles carrying chemicals

# What are these chemicals?

- formaldehyde
- dioxin
- toluene
- lead and other heavy metals
- Polycyclic aromatic hydrocarbons (PAH)
- 100s more proven toxins in woodsmoke

# Where do these chemicals go?

- airway 
- blood 
- cells (brain, organs, placenta)

# What do these chemicals do?

- Carcinogens
- DNA damagers
- Clot provokers
- Inflammation provokers
- cytotoxins (eg neurotoxins)

**What is a safe amount of these chemicals to inhale?**



**How many cigarettes is it  
safe for your kid to smoke?**

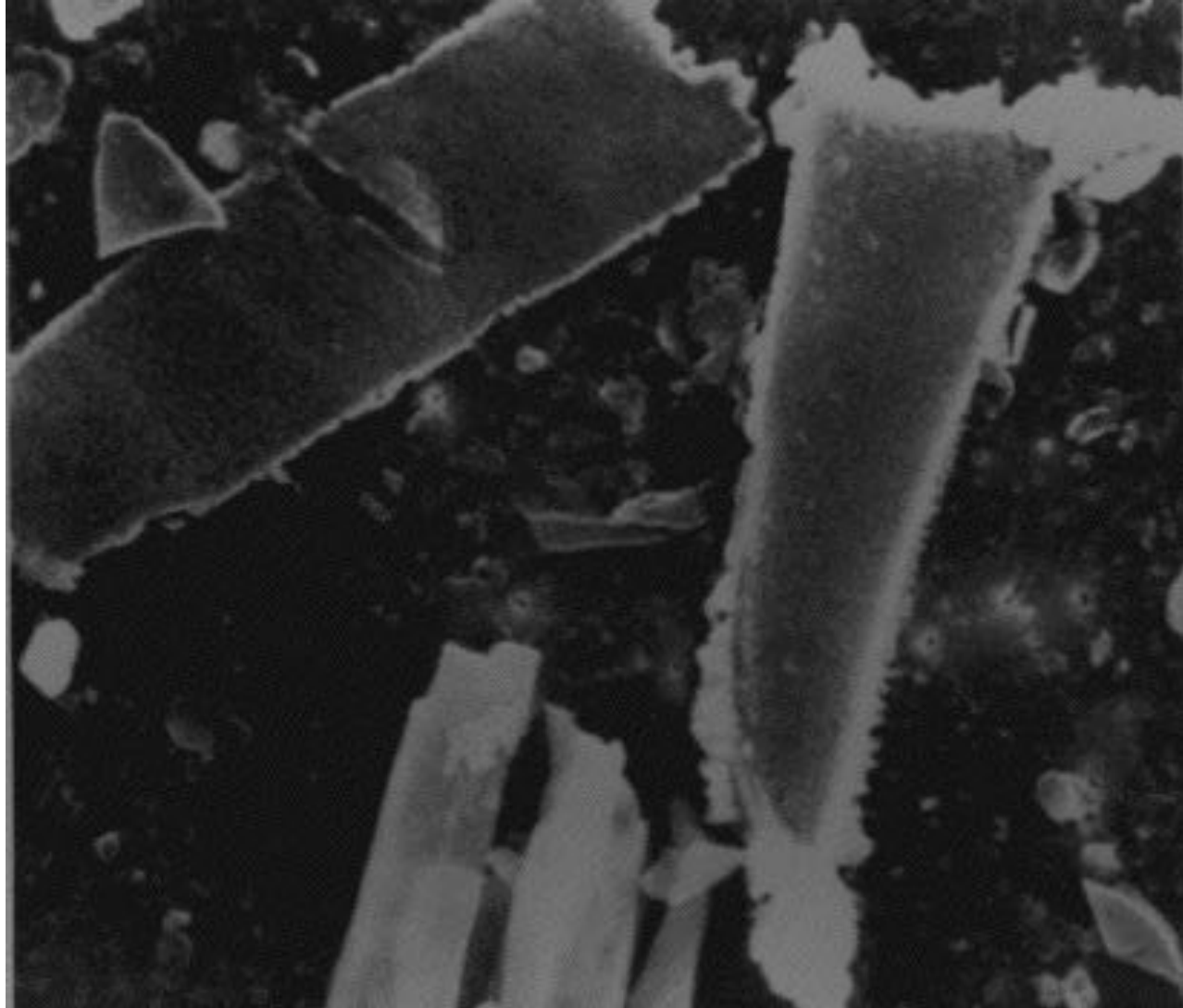


# Setting limits for PM 2.5

- USA (EPA): 35
- Australia:25
- WHO:25
- EU:20
  
- These are “regulatory limits” not “safety standards”!
- Levels of 5 are proven hazardous to health!

**At PM 2.5 levels of 35  
we inhale 100,000,000  
particles in 24 hours.**

# Particle shape matters



# Particle size matters

- surface area
- removal mechanisms
- cancer locations in smokers

# Particle composition matters

- Particle as a vehicle
- PM 2.5 is a dangerous vehicle
- wood smoke 12x potential of 2nd hand cigarette smoke to cause lung cancer

# What are the health hazards?

- Air pollution contributes to 4 of 5 leading causes of deaths:
- Heart attacks
- Strokes
- Cancer
- Respiratory illnesses

# How large is the health effect?

- In the US, the annual deaths due to:
- Air pollution: >100,000
- Breast cancer: 40,000
- Prostate cancer: 29,000
- gun-related deaths: 32,351
- motor vehicle deaths: 35,543

**Which deaths are most easily preventable?**



# PM2.5's Larger Health Impact

- DVT increases 70% for each 10 mcg increase in PM 2.5
- spikes in pollution cause BP to rise within 30 minutes
- heart rhythms become irregular (AF)
- Alzheimer's occurs earlier in life (a 10 mcg increase in long term PM 2.5 exposure increases cognitive aging 2 yrs)



**Many pregnant women in Fairbanks  
will spend several weeks of critical  
fetal development breathing air  
proven to be toxic to their baby**

# Toxins cross the placenta

increased miscarriage  
increase still births  
increased birth defects  
low birth weight

# childhood development

- 5 year old children whose mothers breathed  $>2.26$  nanograms/m<sup>3</sup> of PAH showed IQ loss of 5 points (fetal BBB not fully developed)
- The neurotoxins in wood smoke are particularly harmful for developing brains
- These children become adults with more health problems/costs

# Air pollution limits freedom to play

- In healthy kids, lung function will be impaired for a week after a brief spike in air pollution. Why?
- Exercise in polluted air will deliver 10-30 times more pollutants to the lungs.

# lung development

- Only 20% of alveoli are present at birth
- Children who grow up with air pollution are less likely to develop full lung capacity.

# What should we do?