

  
**Institute for**  
**HEART+LUNG Health**  
 Strong hearts. Clear thoughts. Full lives.

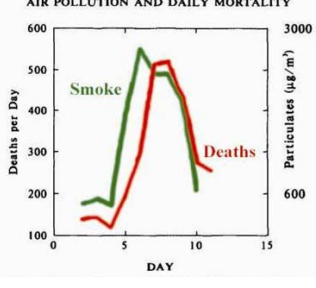
## Air pollution: How does it cause heart and lung disease?

Presented by: **Stephan van Eeden MD PhD**  
 Respirologist, Pacific Lung Health Centre, St Paul's Hospital  
 Investigator, Institute for Heart and Lung Health

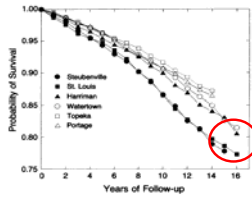
## London Fog (Smog) of 1952

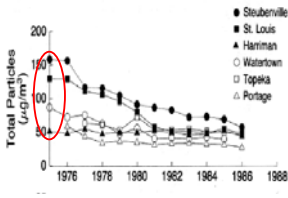
### AIR POLLUTION AND DAILY MORTALITY



## Effect of ambient air pollution on mortality




Dockery et al. *New Engl J Med*, 1993

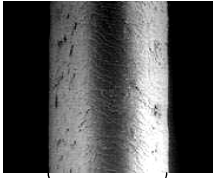


Laden et al *Am J Respir Crit Care Med*, 2006

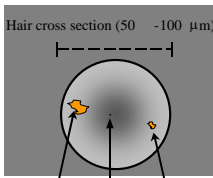
## Particulate matter deposition in lung tissues



## How small are these particles?

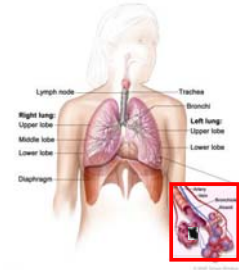


**Human Hair**  
(50-100 µm diameter)

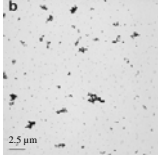


**PM10** (10 µm)  
**PM0.1** (0.1 µm)  
**PM2.5** (2.5 µm)

## Deposition of Particles into the lungs



**Particulate Matter:**  
 Carbon nucleus  
 Polycyclic aromatic hydrocarbons  
 Transition metals (iron, copper)  
 Biologic's (LPS etc)

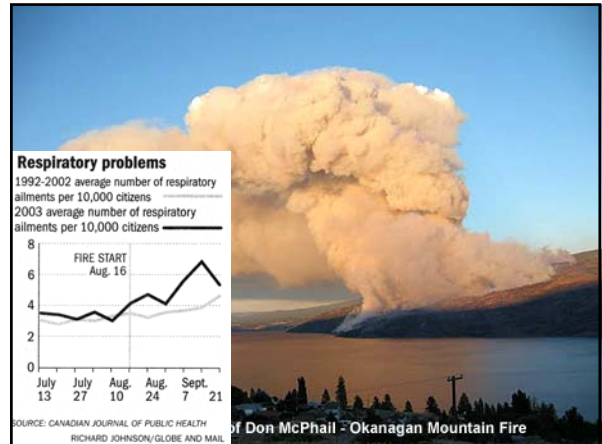


Nemmar A et al. *Circulation*, 2003

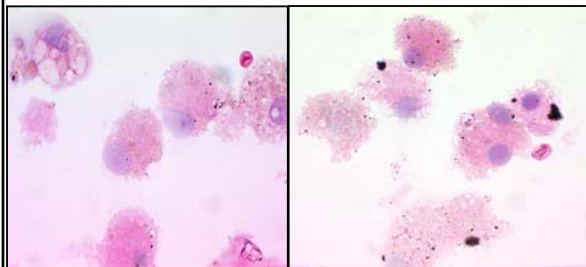
## Wildfires in BC in 2010



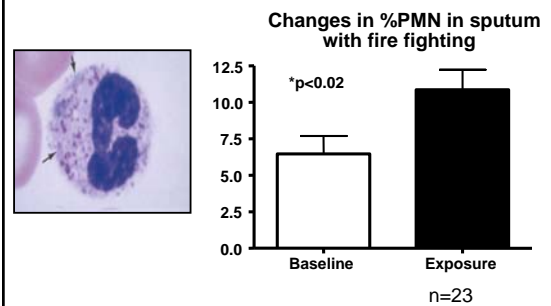
- 1600 fires over 330,000 hectare area
- Central interior hardest hit
- Williams Lake record PM2.5 levels 2010:
  - Hourly max 421ug/m3
  - 24 hour max 267ug/m3
- Smoke travel hundred's of kilometers



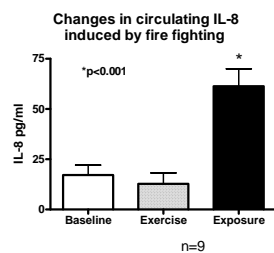
## Macrophages with particles



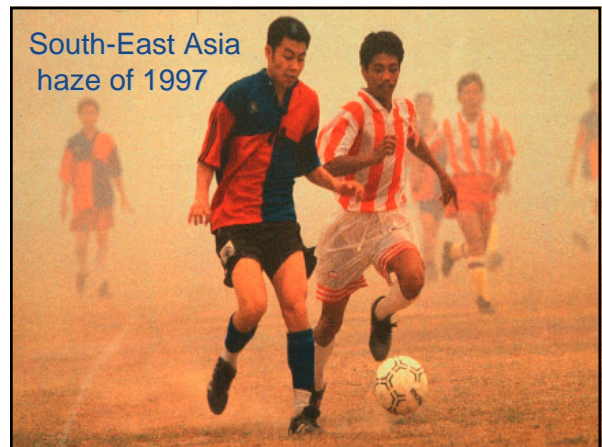
## Lung Inflammation causes by woodsmoke

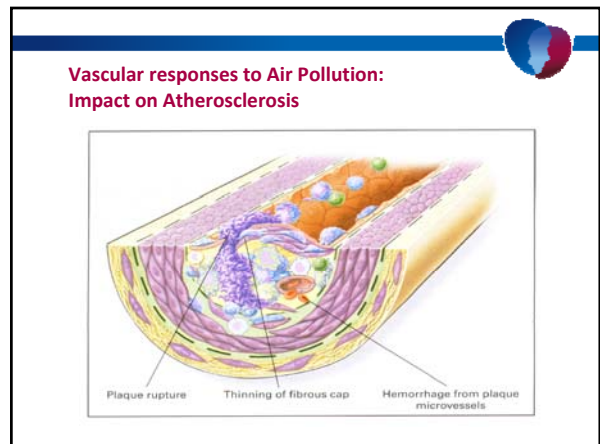
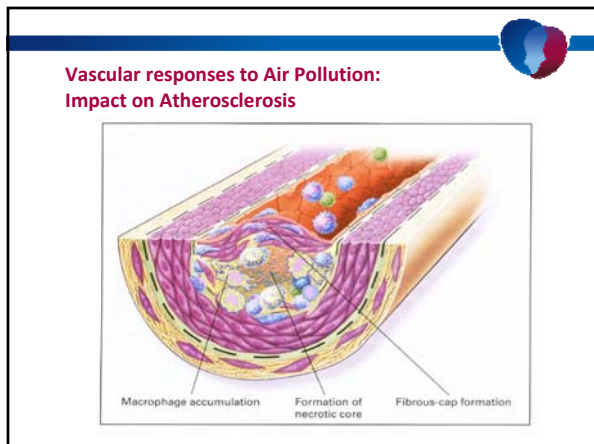
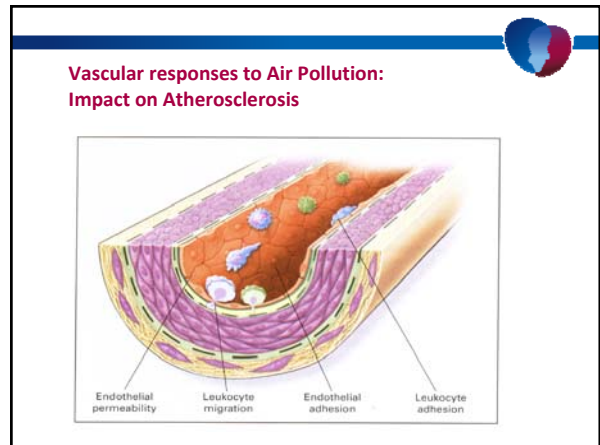
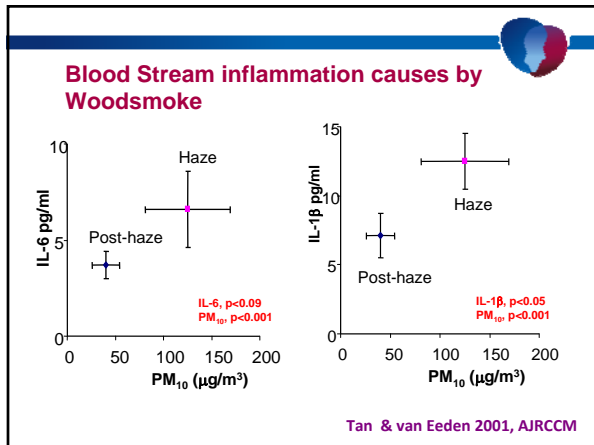
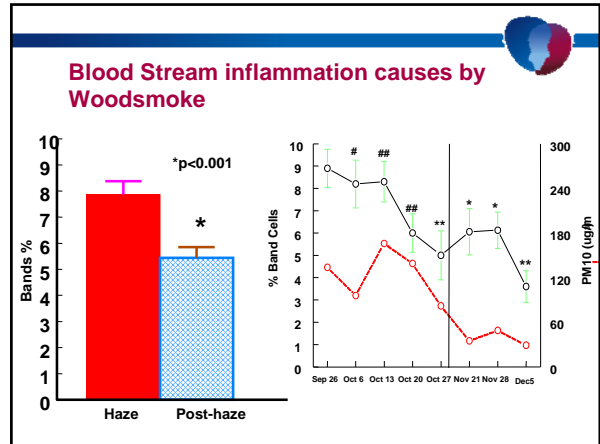
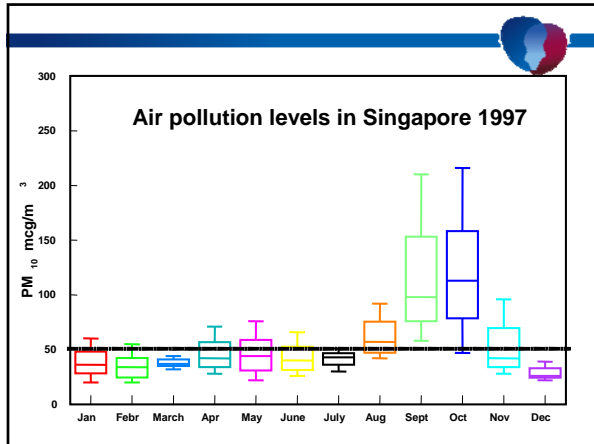


## Smoke Exposure Causes bloodstream inflammation



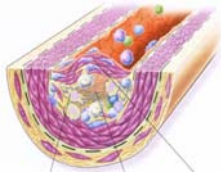
## South-East Asia haze of 1997



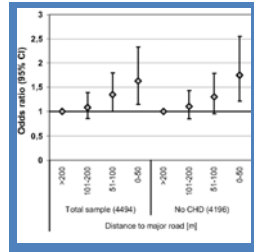




## Living near a heavy traffic route: Coronary Heart Disease



Coronary Plaque

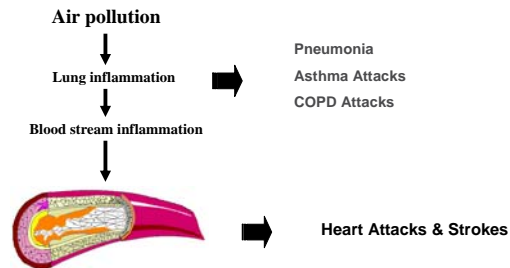


Hoffmann B et al., Circulation, 2007

## How does Air Pollution impact Heart and Lung disease?

- Hospital admission within days of episode of pollution (Schwartz et al 1994, Alberti et al 1998).
- Hospital admissions for lung infections (pneumonia), exacerbations of COPD & Asthma, and Heart Attacks, Heart failure and Strokes (Dockery et al 1993).
- Predominantly the very young & elderly (Schwartz J 1994)
- Impact correlates the best with particle levels (Bates DJ 1992)

## How air pollutants aggravate heart and lung disease



## Industry & Air Pollution



## American Lung Association : Lung Action Network

### Industry:

- 1) Industry such as coal-fired power plant, emit toxins such as arsenic, lead, formaldehyde, hydrogen chloride, mercury, and dioxins, just some of the more than 84 toxic emissions coming out of these plants.
- 2) They emit an estimated 386,000 tons of these toxic pollutants each year in the USA. Some of these toxins may cause cancer, birth defects, trigger asthma attacks, and cause heart attacks and strokes. Estimated to responsible for 17,000 death annually.
- 3) The Clean Air Act directed EPA to start getting these hazardous pollutants out of the air in 1990. This is an ongoing battle with industry.

<http://action.lungusa.org>

### Acknowledgements:

Jim Hogg  
David Walker  
Shizu Higashi  
Renaud Vincent  
Michael Brauer

Takeshi Terashima  
Hiroshi Mukae/Isshi  
Akira Ogami  
Takeshi Fujii  
Tats Suwa  
Kevin Quinlan  
Erin Tranfield  
Kaz Yatera  
Yuki Goto  
Eji Tamagawa  
Takashi Suda  
Nicola Bai  
John Swiston  
Grace Li



Breathing Clean Air Promotes Heart & Lung Health

