



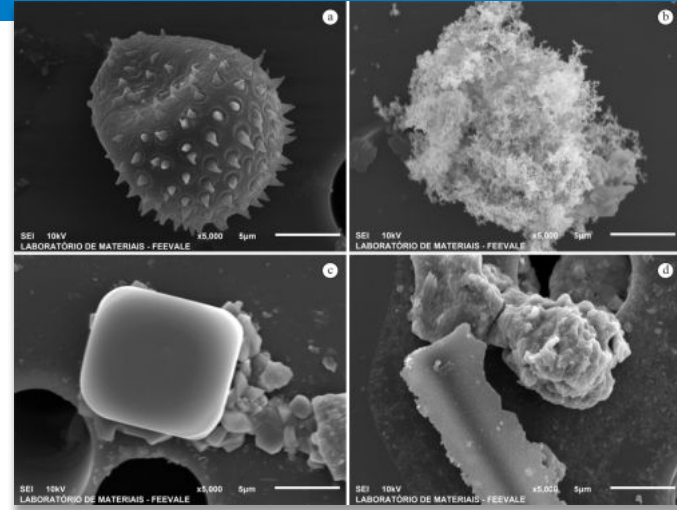
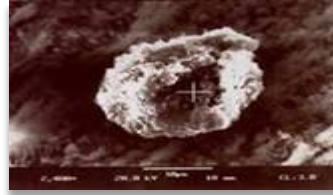
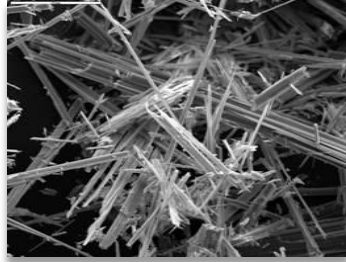
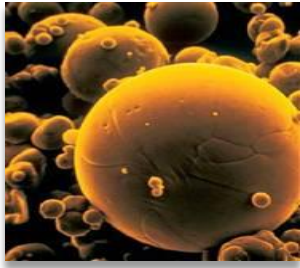
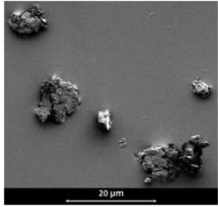
National Institute for Public Health  
and the Environment  
*Ministry of Health, Welfare and Sport*

## **Non-tailpipe emissions: brake dust**

Flemming R. Cassee, PhD ERT

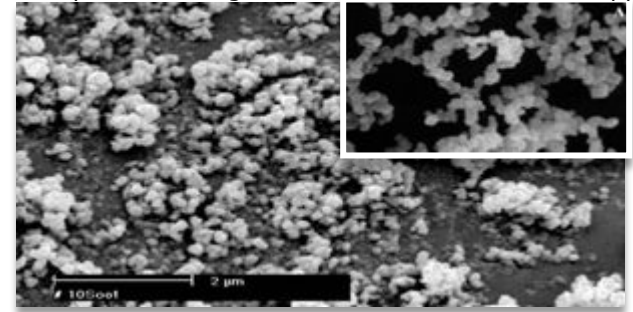
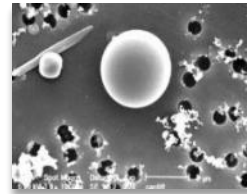
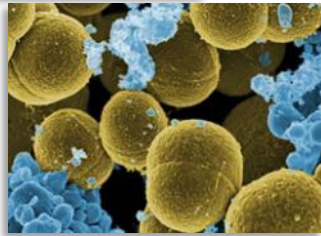
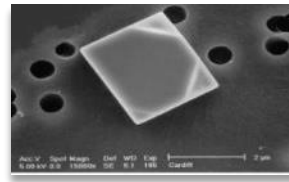
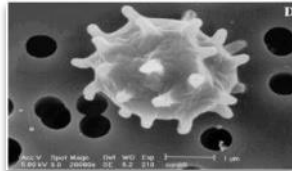
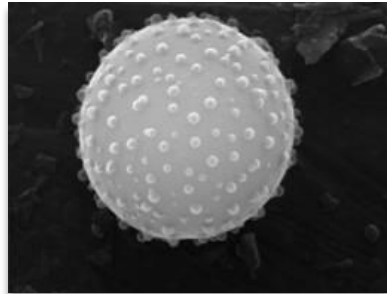


## What can be detected in air?



Alves et al., 2015

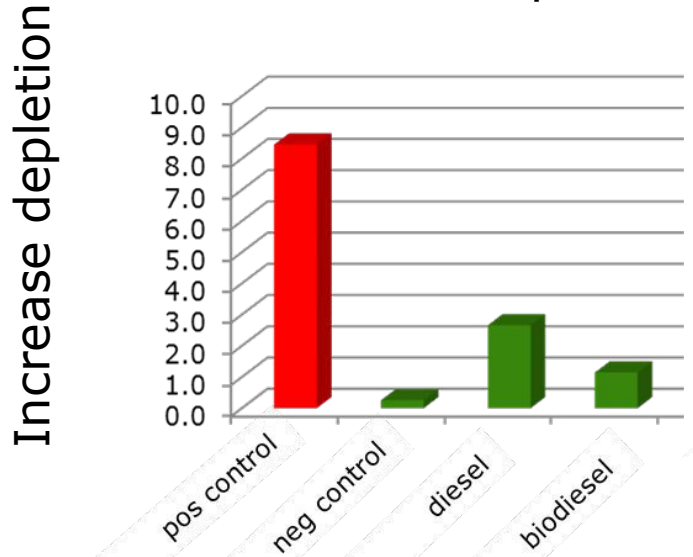
<http://dx.doi.org/10.1590/1519-6984.00113suppl>





# Oxidative potential– source specific particles

Vitamin C depletion in test tube

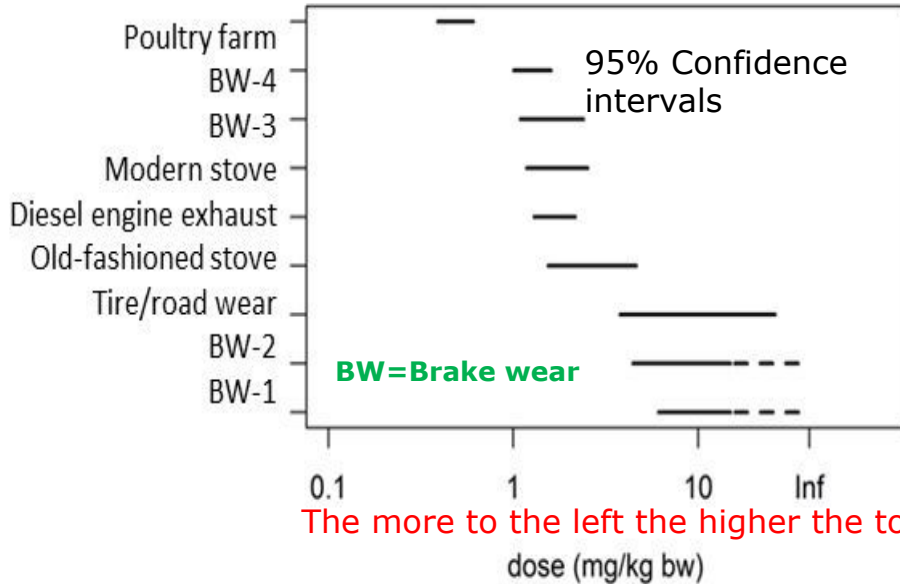


Brake wear more potent than diesel particles based on PM mass – role of Cu



# Ranking toxicity based on inflammation

Inflammatory cells



- Considerable variability in the toxic potency of brake wear particles.

Gerlofs-Nijland et al. 2019



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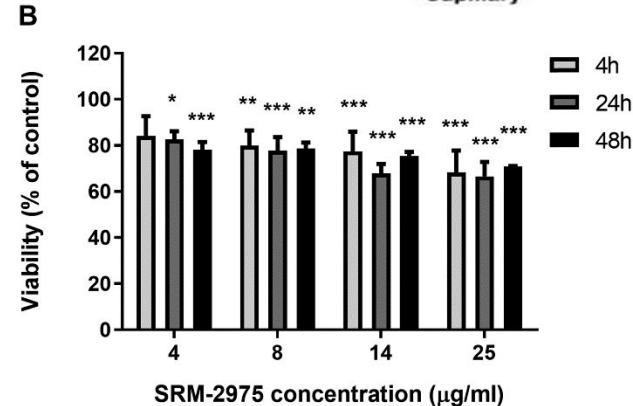
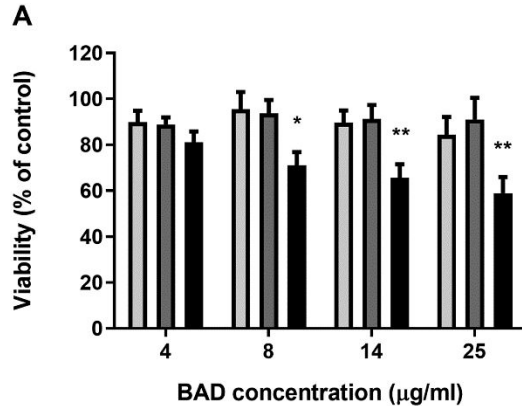
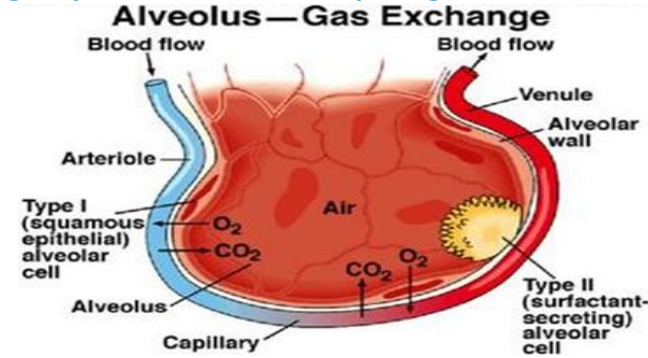




# Brake dust versus diesel exhaust particles

exposure exacerbates inflammation and compromises phagocytosis in macrophages

- Similar toxicological profiles in macrophages
- Metals more abundant in brake dust
- Conclusion: consider contributions of abrasion particles to traffic-related clinical health effects





# Messages

- Brake dust / non-tailpipe particles can be equally or more potent than tailpipe (diesel) particles
- Size has a large impact on adverse health effects
- However, this has to be put in perspective of exposure concentrations □ lower levels for dust on average, though hotspots can be identified