

Institut universitaire romand de Santé au Travail

Institut für Arbeit und Gesundheit

Institute for Work and Health



Pour que santé et travail soient compatibles

Assessment of Particulate Exposure and Surface Characteristics in Association with Urinary Levels of Oxidative Stress Biomarkers

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Zürich, 13th-15th August 2007

Project : Hypotheses

External influences :

- UV rays
- Cigarette smoke
- Medication
- Alcohol
- Stress
- **PM**

Hypotheses :

- PM promote cellular oxidative stress
- Particulate surface characteristics play a key-role in the oxidative stress process

O₂
metabolism

produce

ROS

reduce

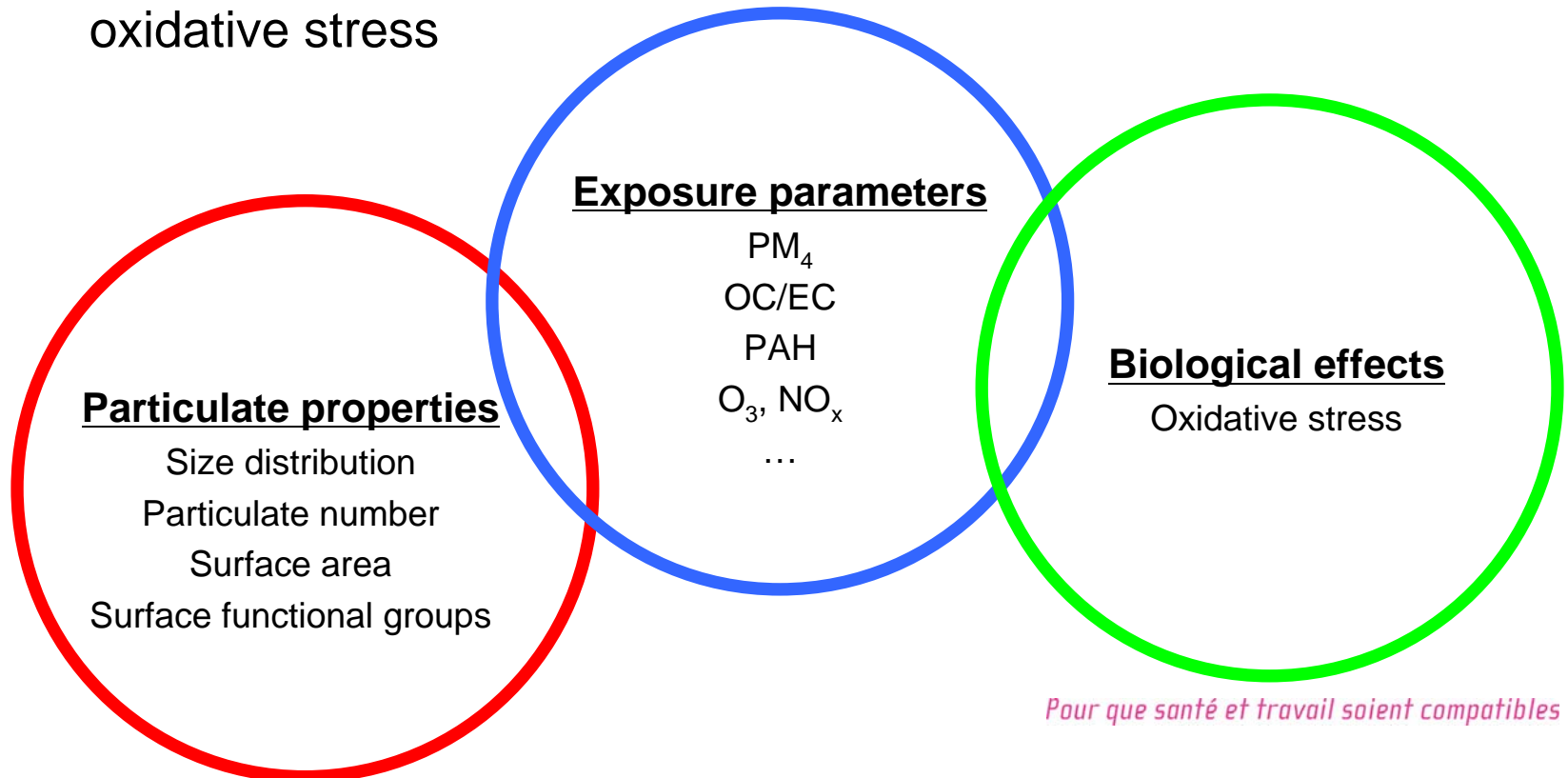
Defense
mechanism

increase

**Damages on DNA,
lipids, proteins**

Project : Objectives

- Assessment of exposure to fine/ultrafine particulate in occupational situations (Diesel exposed workers)
- Relate the exposure parameters to biological end-points for oxidative stress



Project : Methodology

- Selection of an homogeneous group of workers exposed to fine/ultrafine particulate:
 - three bus depots (maintenance yards) (n = 40)
- Assessment of exposure to PM:
 - PM₄
 - OC/EC
 - Particulate size distribution
 - Particulate surface characterization

Project : Methodology

- Urine and blood samplings:

 - Control case → Monday morning before shift

 - Exposure case → Tuesday evening after shift

- Levels of oxidative stress biomarkers:

 - Damages on DNA → 8-hydroxy-2'-deoxyguanosine

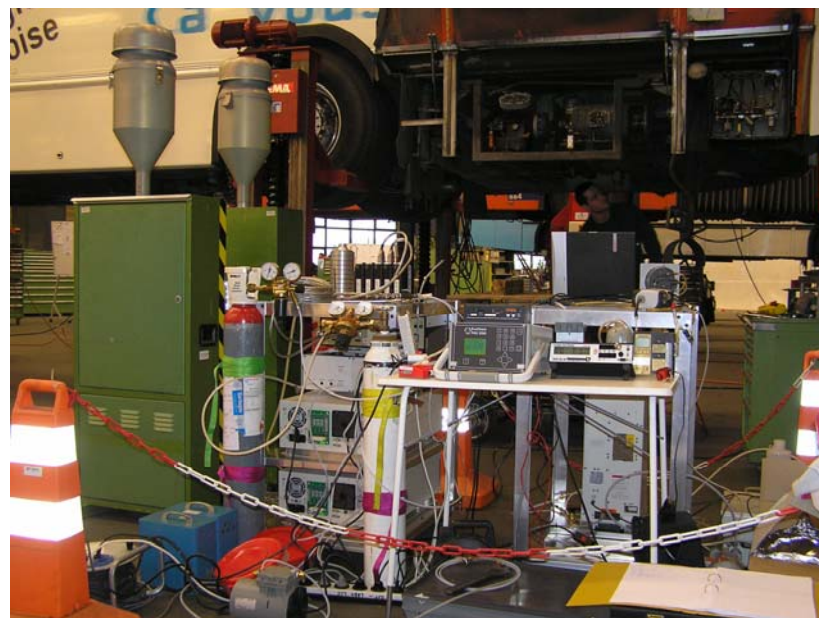
 - Damages on cell membranes → aldehydes

Project : Sampling campaign



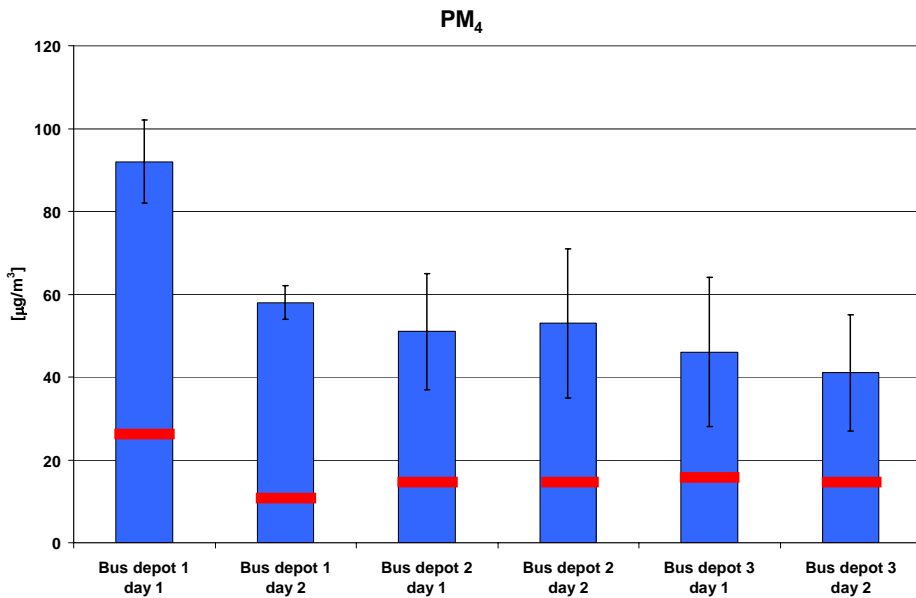
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Project : Sampling campaign

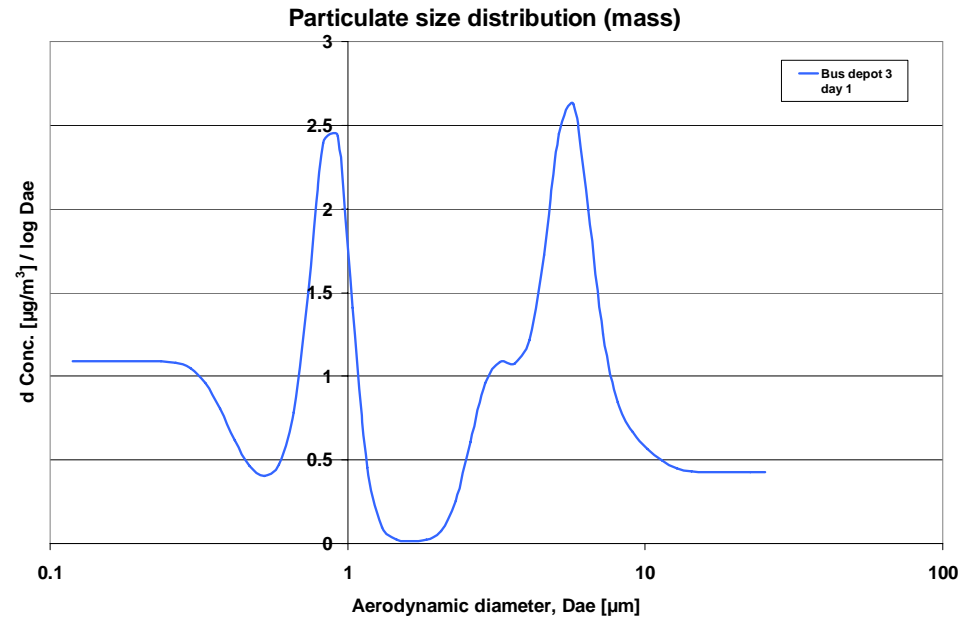


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Results : Exposure to PM

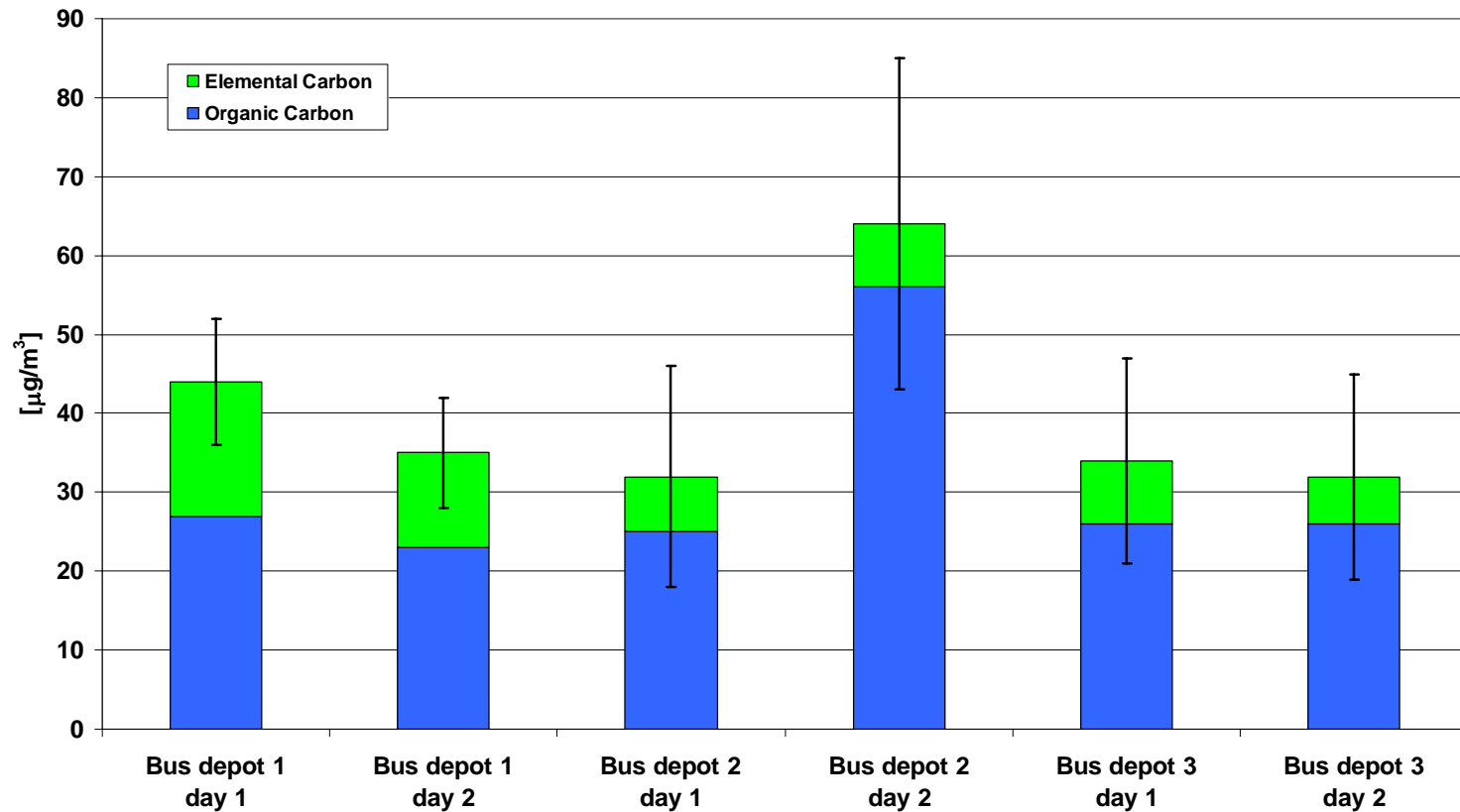


Official background measurements in the center of the same city

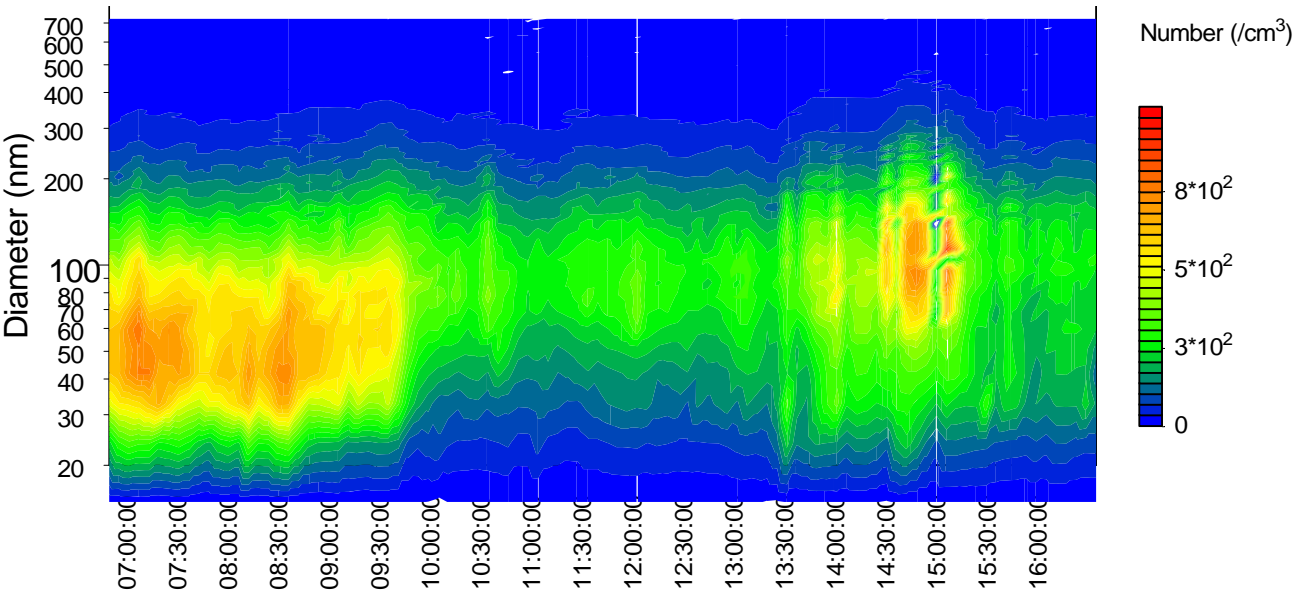


Results : Exposure to PM

Organic and Elemental Carbon

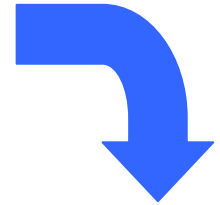
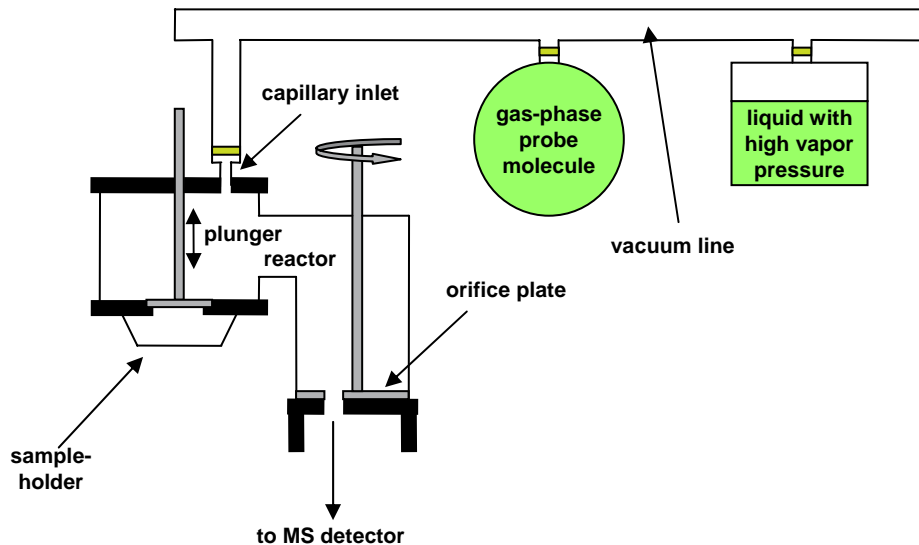
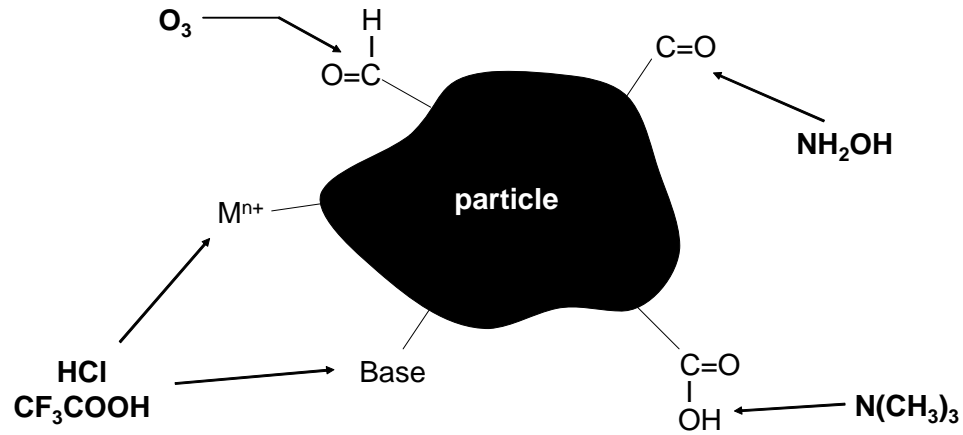


Results : Exposure to PM



	Number [#/cm ³]	Surface [μm ² /cm ³]
Bus depot 1 day 1	not available	not available
Bus depot 1 day 2	not available	not available
Bus depot 2 day 1	6500-15200	320-580
Bus depot 2 day 2	3300-13400	130-580
Bus depot 3 day 1	6600-54400	260-1250
Bus depot 3 day 2	5000-13200	190-410

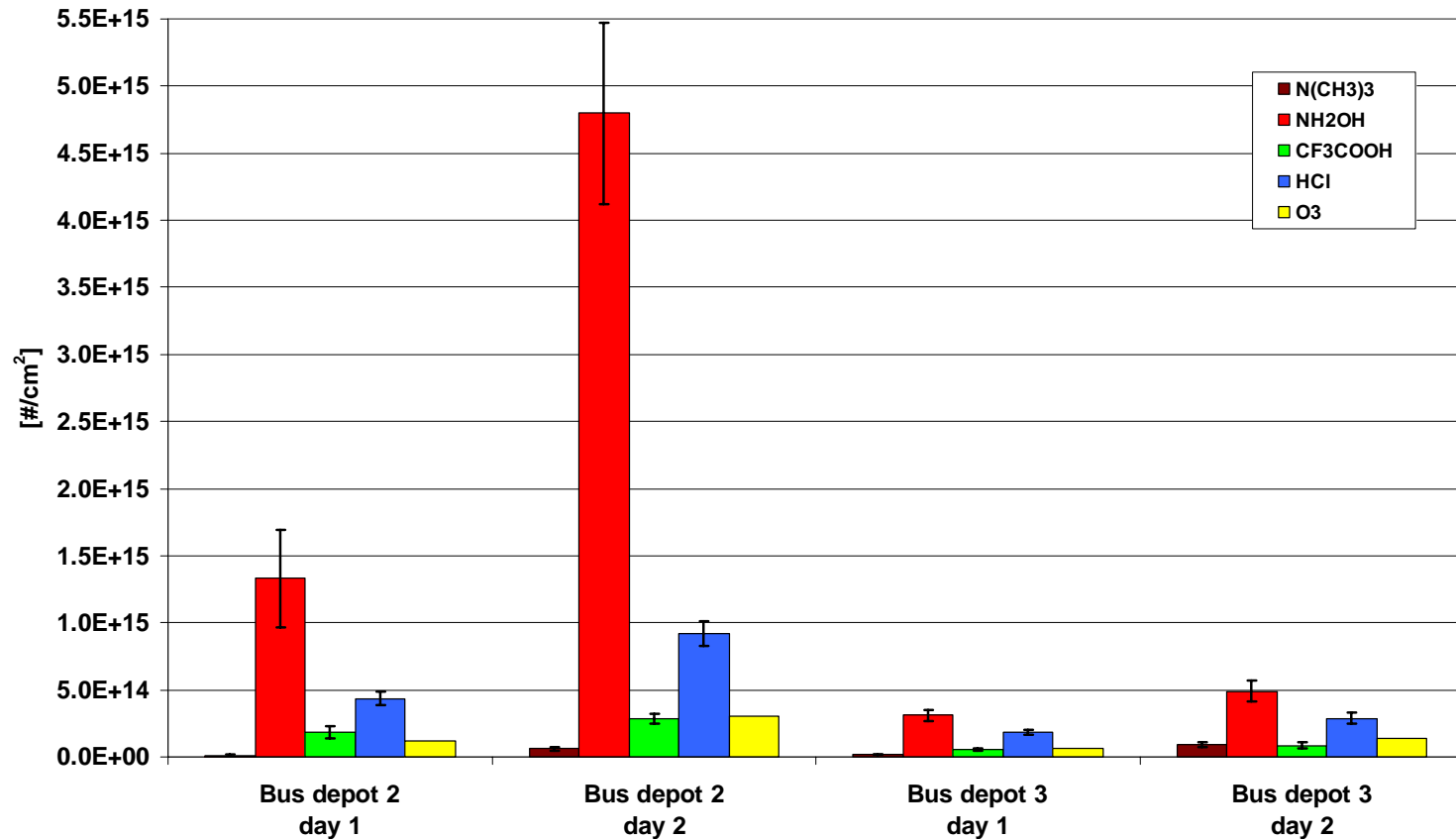
Results : Exposure to PM



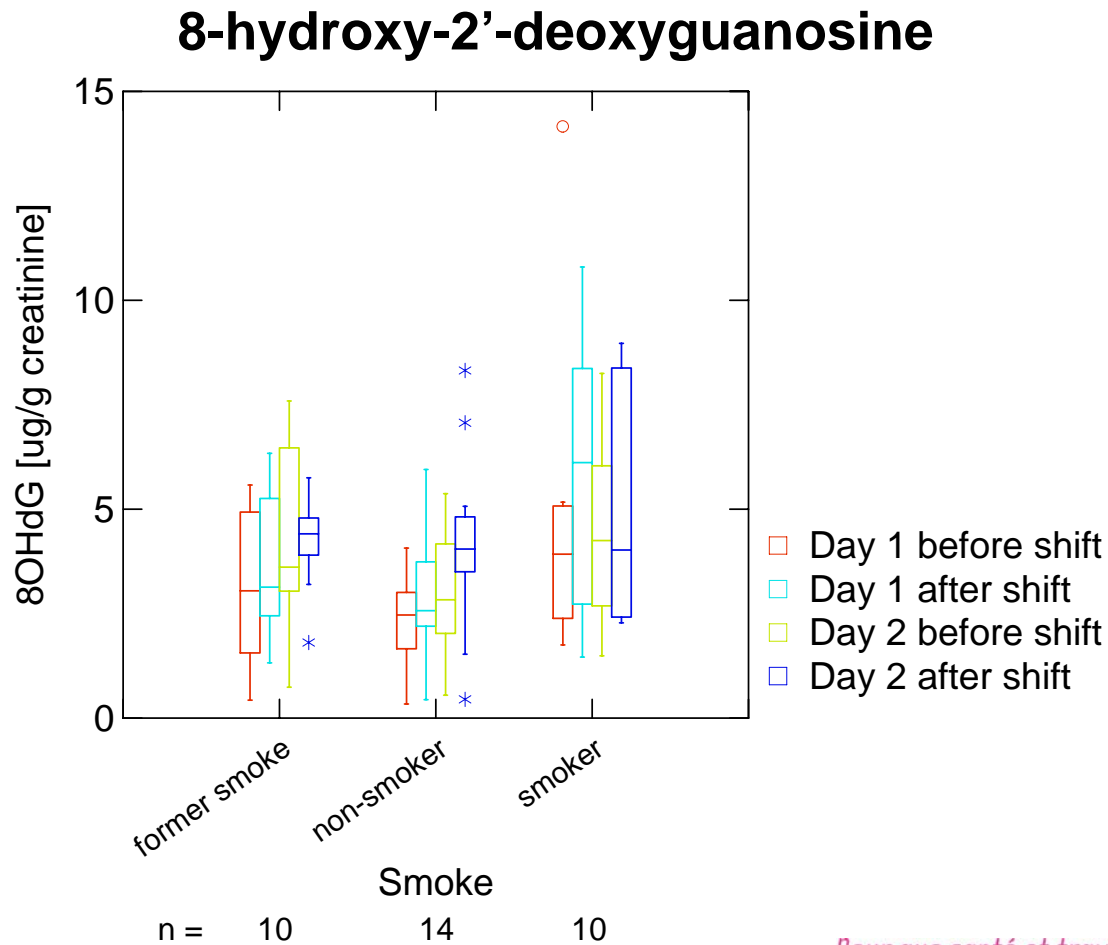
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Results : Exposure to PM

Particulate surface characteristics

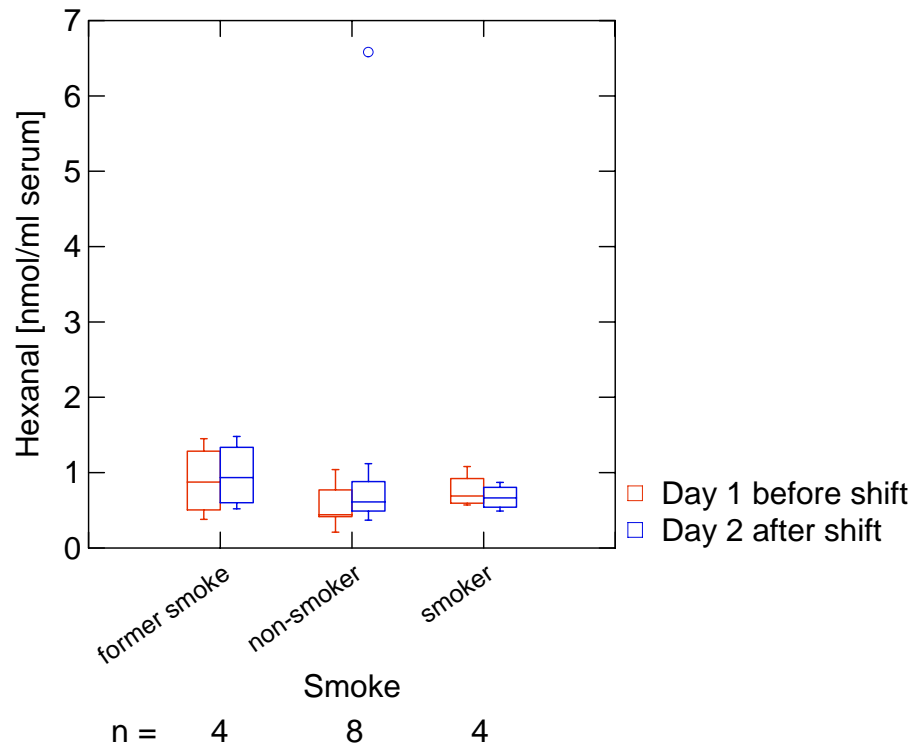


Results : Oxidative stress biomarkers

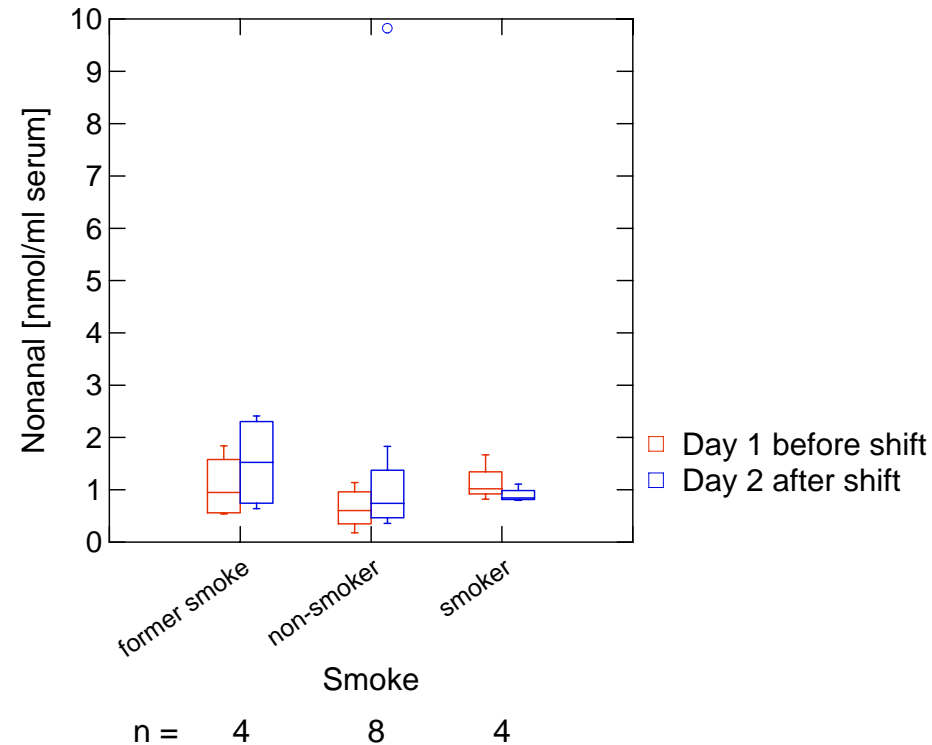


Results : Oxidative stress biomarkers

Hexanal



Nonanal



Conclusion

- Workers in the bus depots were exposed to rather low fine/ultrafine particulate concentrations (40-60 $\mu\text{g}/\text{m}^3$).
- Surface characteristics of sampled particles were different, depending on the bus depot. They were usually characterized by high carbonyl and low acidic sites content.
- Urinary levels of 8-hydroxy-2'-deoxyguanosine increased significantly for non-smokers during two consecutive days of shift.
- Serum levels of aldehydes did not change significantly during two consecutive days of shift.

Perspectives

Is there a correlation between urinary levels of 8-hydroxy-2'-deoxyguanosine for non-smokers and the following exposure parameters:

- PM_4 ?
- OC/EC ?
- Particulate number or surface ?
- Functional groups on the surface of the particles ?
- ... ?

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Thank you for your attention

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