CISBO

Human exposure study

DUST & OZONE

Background

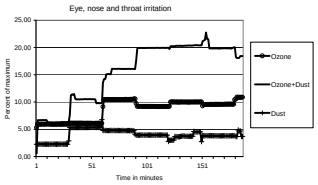
- Air borne particulate matter (e.g. dust) and ozone by themselves are known causes of some of the known indoor air quality problems.
- Furthermore, also reactive short-lived compounds resulting from reactions between ozone and dust have been suggested as a cause of indoor air quality complaints and objective health effects.

Aim of the study

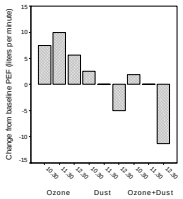
- The aim of the study is to provide information which may help to improve the quality of the life of persons exposed to indoor environments in Danish dwellings.
- The experiment will document if dust and ozone contribute to deterioration of indoor air quality and to the occurrence of symptoms and health effects.

Experiences from pilot study

Mucus membrane irritation



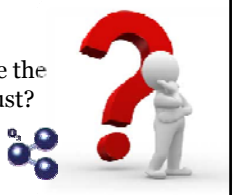
Lung function



8 subjects, 75 ug støv /m³ , 0,3 ppm O_3

Hypothesis

- Does house dust and ozone in concentrations frequently encountered in Danish dwellings etc. cause unwanted health effects either by the selves or in interaction?
- If so, does the ozone potentiate the expected irritative effects of dust?



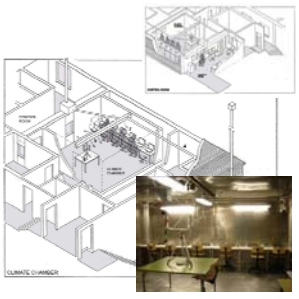
Design

The study type

- A human experiment conducted in a climate chamber under controlled exposure conditions.

The study design

- A controlled, randomized and balanced Latin square cross-over design using the participants as their own controls.



AARHUS UNIVERSITY

Exposure

7

- Possible exposures are clean air, dust alone, ozone alone and combined dust and ozone.

	Clean air	Ozone (O_3) 0.2 ppm	Dust (D) 100µg/m³	Dust + O_3 0.1 ppm	Dust + O_3 0.2 ppm	Dust + O_3 0.4 ppm
1	+	+	+		+	
2			+	+	+	+
3			+		+	+
4				+	+	+

AARHUS UNIVERSITY

Participants

8

- Number of participants 15-20 depending on the chosen exposure setup.
- Non-smoking atopic volunteers with normal lung function and normal bronchial reactivity.
- Participants will be exposed at rest for 3½ hour inside the chamber.

AARHUS UNIVERSITY

Health evaluation

9

- Selected subjective and objective health outcomes are measured at baseline and at follow-up at predefined time points.

- Measures includes:
  - Subjective symptoms
  - Respiratory outcomes (lung function, FENO, exhaled breath condensate, nasal lavages, nadar)
  - Blood samples (inflammation biomarkers)

AARHUS UNIVERSITY

Perspectives

10

- The study may bring basic information on underlying pathophysiological mechanisms involved in human responses to these pollutants and in their interactive effects.
- The study may help to identify priority irritants to be addressed in the future in research and in mitigation of air quality problems in existing Danish dwellings.

AARHUS UNIVERSITY

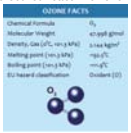
11

AARHUS UNIVERSITY

Ozone facts

12

- What is ozone
- **A Powerful Oxidant**
- Ozone is a very powerful oxidation agent. It is easily soluble in water and its ability to eliminate the microorganisms that form pollutants is very good. Once the problem is solved, the ozone dissolves - our method forces the ozone to react with the pollutants and break them down, after which any residual ozone returns to oxygen.
- **The Chemistry of Ozone Formation**
- Ozone can be produced photochemically with UV light or with electrical discharges (corona discharges) in an oxygen-filled atmosphere. Thanks to our own patented technique, our equipment uses the advantages of corona discharge to the maximum. Air or oxygen is channelled between two electrodes and then subjected to electronic discharges. The oxygen atoms are then partly atomized and form ozone when free oxygen molecules react with the oxygen molecules present.



- The electrons in the discharge supply energy to dissociate the atoms in the oxygen molecule:
- $O_2 + e^- \Rightarrow O_o + O_o$
- These free atoms react directly with each other or with oxygen molecules to form ozone:
- $O_2 + O_o \Rightarrow O_3$

AARHUS UNIVERSITY

Exposure

13

- The four exposures are clean air, dust alone, ozone alone and combined dust and ozone.
  - The levels are:
    - Clean air (<5µg/m³ $PM_{2.5}$)
    - 100µg/m³ ($PM_{2.5}$) Inert, inactivated dust
    - 100µg/m³ ($PM_{2.5}$) Inert, inactivated dust+ O_3 (0.2 PPM)
    - O_3 (conc. 0.2 PPM)
- Participants are exposed at rest for 3½ hour