

AIVC workshop at BRANZ



Wellington New Zealand

March 20 2018

Exposure due to cooking

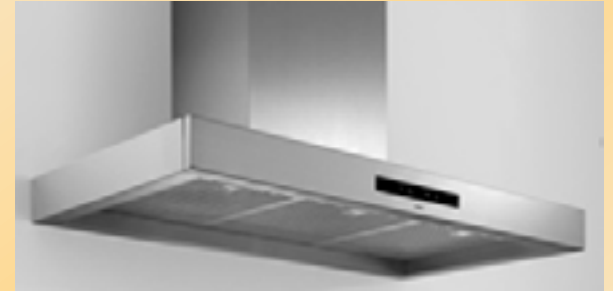


Willem de Gids



Wouter Borsboom

Piet Jacobs



Range hood efficiency ?

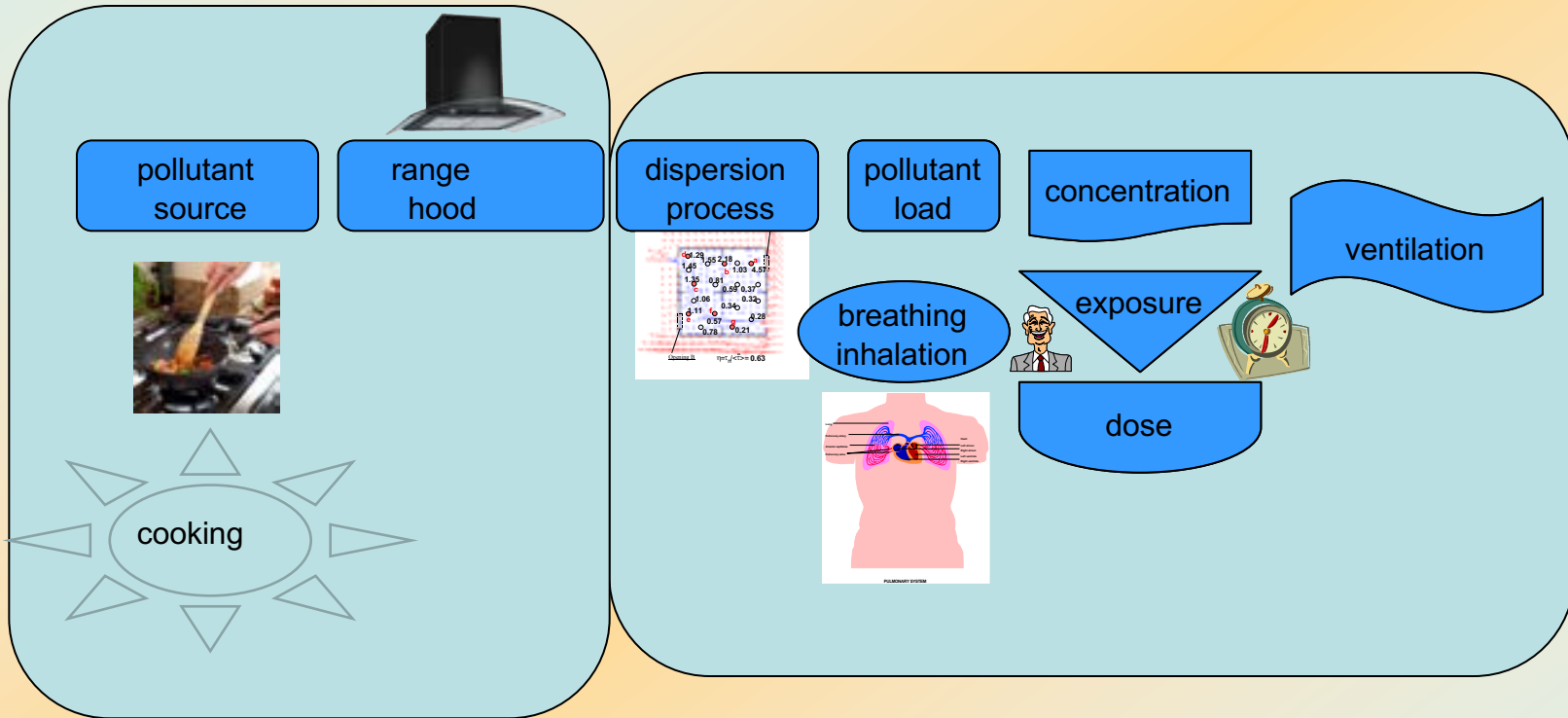
It is exposure that matters !



Considerations

- For comparing range hoods as a product measuring capture efficiency satisfies
- For people finally the exposure to pollutants from cooking is more relevant
- The exposure of people
 - the hood efficiency but also the way people behave in front of the rangehood plays an important role

Pollutant process during cooking



range hood efficiency

human exposure

Manuals

**Energy
use**

Acoustics

**Mainte-
nance**

**Open
combustion**

**Visual
comfort**

**Cooker hoods
BASIC AIM:
Extraction of
pollutants**

**Under-
pressures**

Controls

Draught

Ergonomy

Aesthetics

**Fire
security**

Influencing factors on the hood efficiency

- Hood design
- Flowrate(s)
- Height above hob
- Adjacent cupboards
- Source strength
- Position of source
- Type of the source
- Heating source
Gas/ceramic/induction

There are several standards for measuring the efficiency;

- ASTM
- Draft CEN
- Swedish standard SS-EN 61591 A 11 includes interference

Several measurement methods

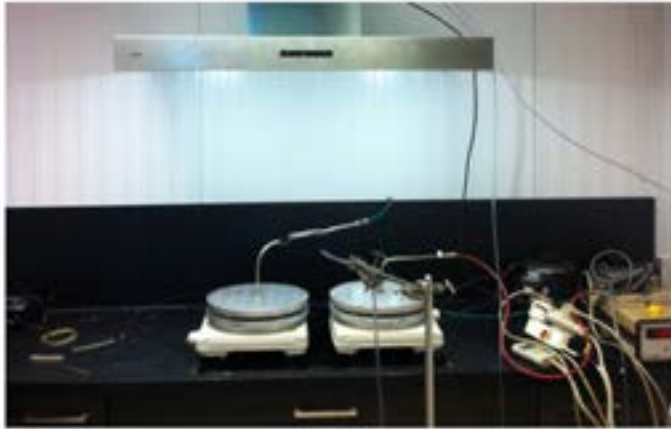


Figure 3. ASTM (2017) emitters on two electric heating (600-W) electric hot-plates. ¶

Reproduceability is a problem



Figure 2. Induction method with CO₂ injection in two stainless steel 24 cm stir-fry-pans in the front locations, the left pan is equipped with temperature sensors. ¶

Efficiency including interference

Air flow [m³/h]	With interference device	Without interference device
450	0.74	0.97
300	0.66, 0.67	0.89, 0.90
200	0.46, 0.49	0.95, 0.96

ratio in %

76

74

50



no range hood

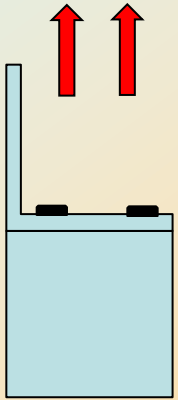


traditional range hood

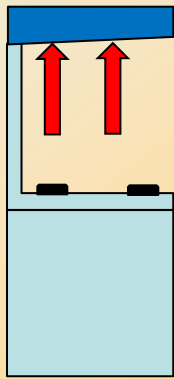
recent development



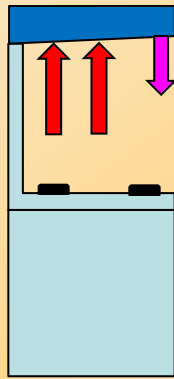
Type of cooking exhaust



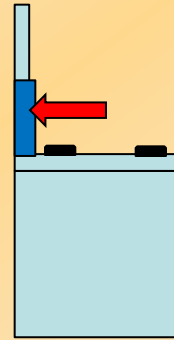
no range hood



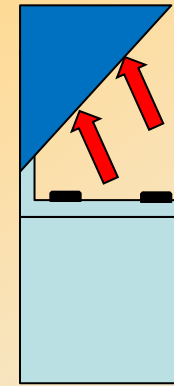
tradional



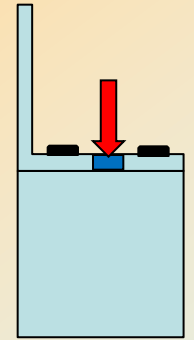
with supply



rear

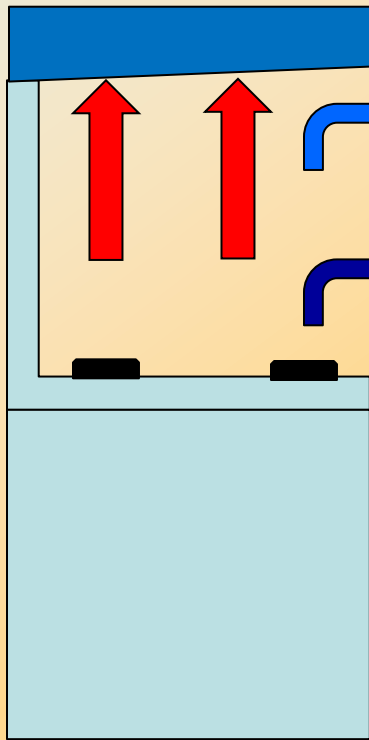


inclined



down

Interference/disturbance due to cooking increasing the exposure



- inefficient exhaust
- smelling
- body movements
- arm movements



Interference or disturbance effect is depending on exhaust type

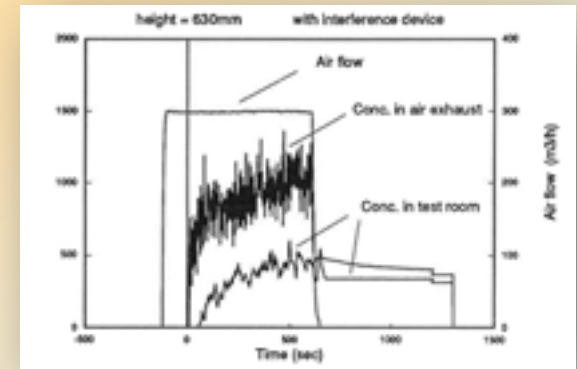
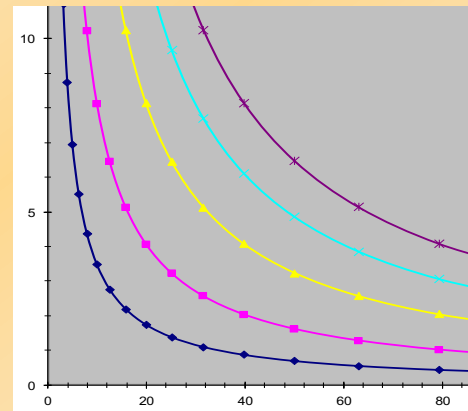
Role of ventilation in kitchen/living

Kitchen/living normally almost perfect mixed air

But in the vicinity of the hob is it not the average concentration

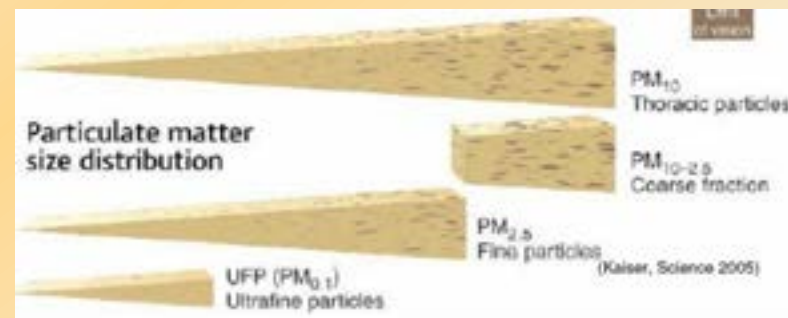
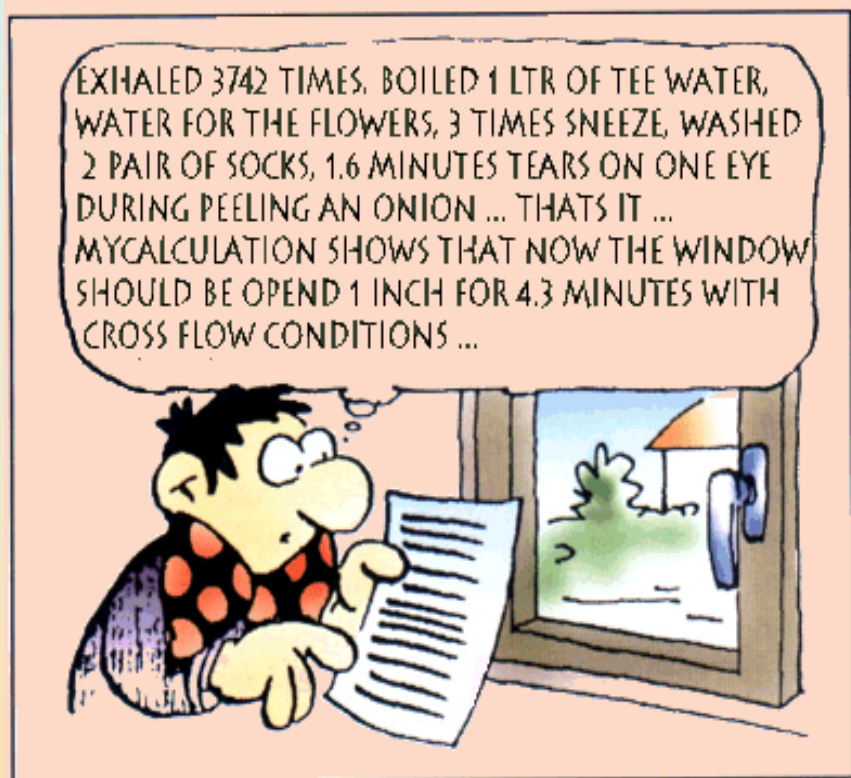
Exposure during

- Cooking
- Period after



The exposure is the integration over time of the concentration during cooking and after cooking

What do users know about ventilation and exposure?



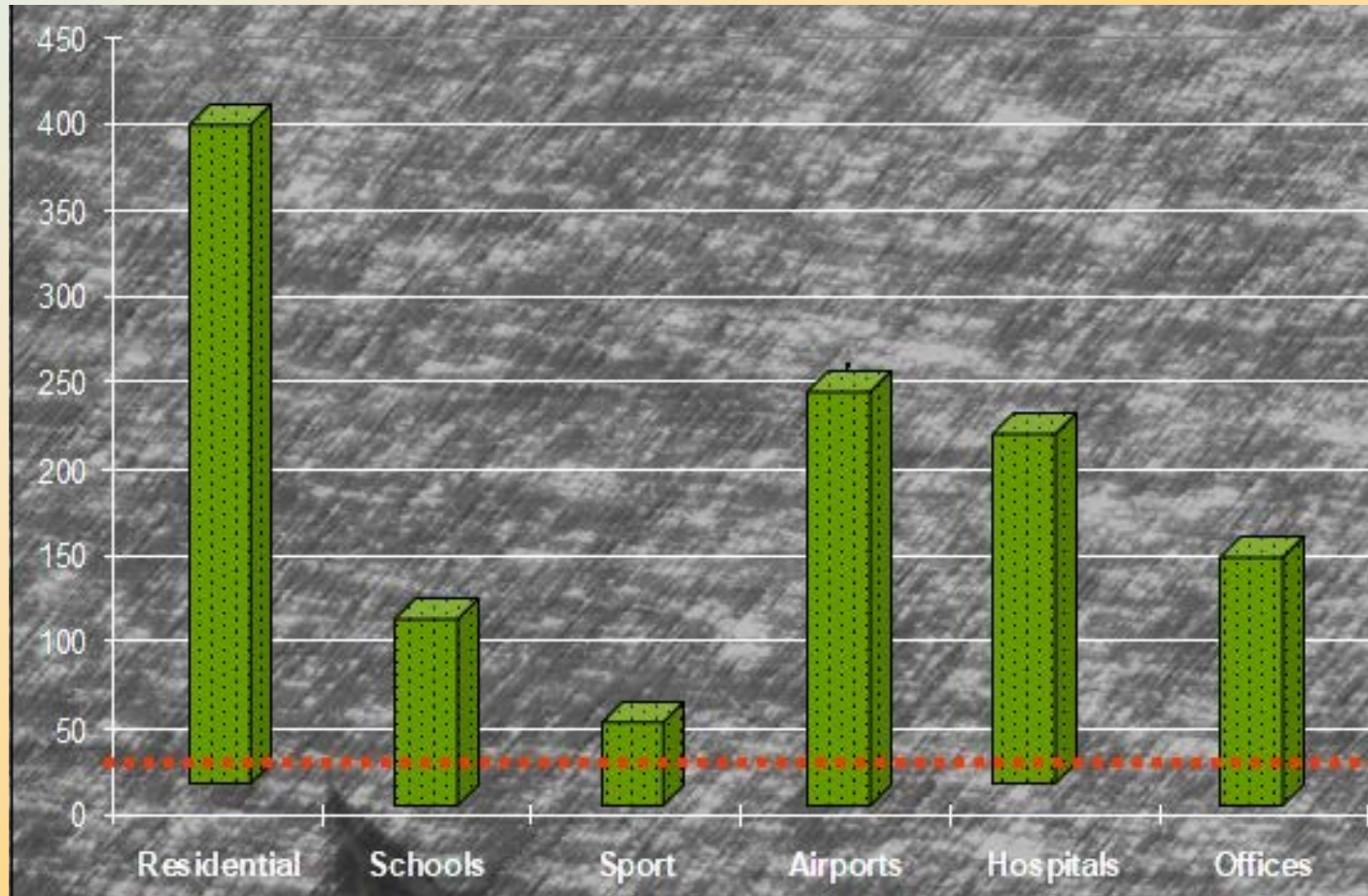
The only thing they really no is:

switch off the range hood because of the noise

The exposure to fine dust during cooking

- TNO has carried out long term exposure study on persons due to cooking
- The focus was on particle fine dust PM_{2.5}
- Three different exhaust strategies
 - No range hood
 - Standard range hood
 - Inclined Range hood
- Two different extract rates
 - low
 - high

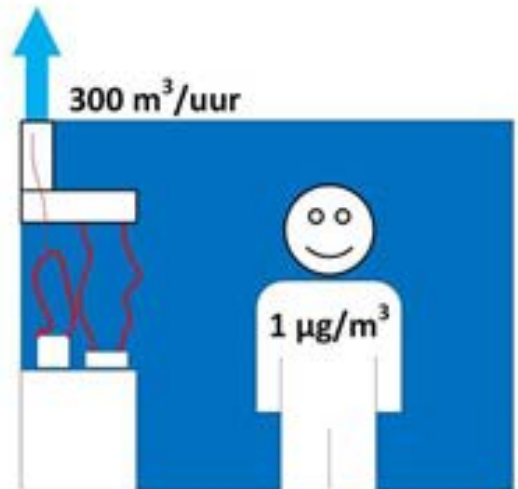
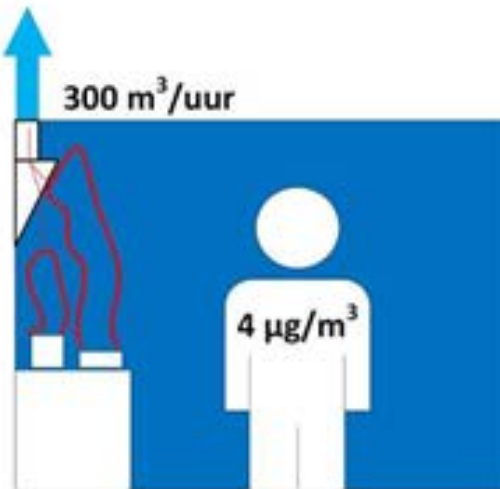
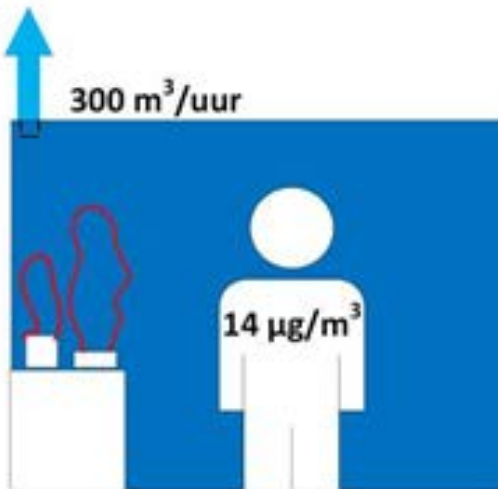
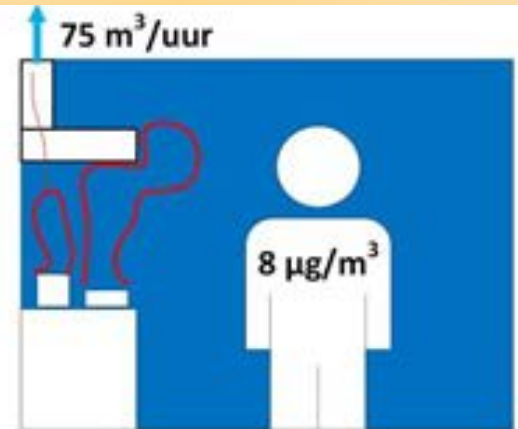
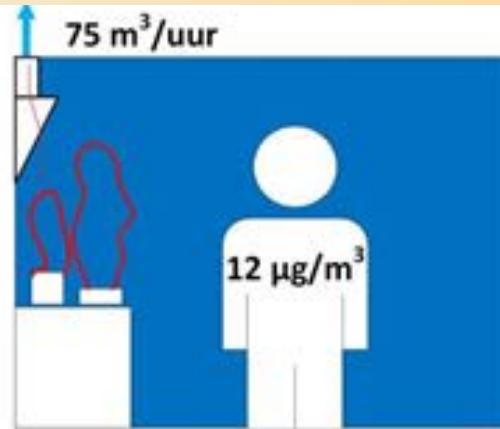
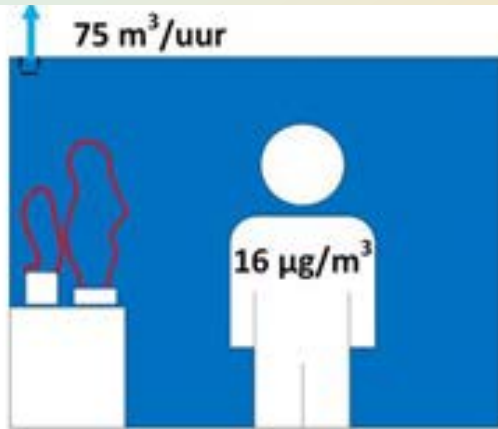
Concentration of PM2.5 types of Buildings



The exposure study

- Cooking a full Dutch meal for 2,2 persons causes an emission of 35 mg PM_{2,5}
- Dutch people: a meal is cooked on average 5 times a week
- Cooking 10 minute emission constant emission rate of 41,6 µg/s
- An open kitchen/living with a volume of 96 m³
- Dilution flow of 28 dm³/s for the kitchen/living

Results of exposure study



How to come from efficiency to exposure

Several possibilities :

- Adding a correction approach in the existing efficiency measurement standards on range hoods ?
- Composing a new standard ?
 - with a procedure to derive exposure from efficiency measurements
- Defining a kind of labelling systems for users to compare the different systems



Closing Remarks

- Hood efficiency measurements exists in several,, but very different standards
- TNO study shows that exposure is very important
- The challenge is now:
 - how to reach valuable information for users
 - will it be in Standards or a labelling system
- A proposal for a CEN standard is in the preparation phase
- This presentation was to stimulate the audience to consider exposure in stead of only hood efficiency



Thank you for
your attention