RATIONALE BEHIND CURRENT VENTILATION AIRFLOW RATES

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RATIONALE BEHIND CURRENT VENTILATION AIRFLOW RATES

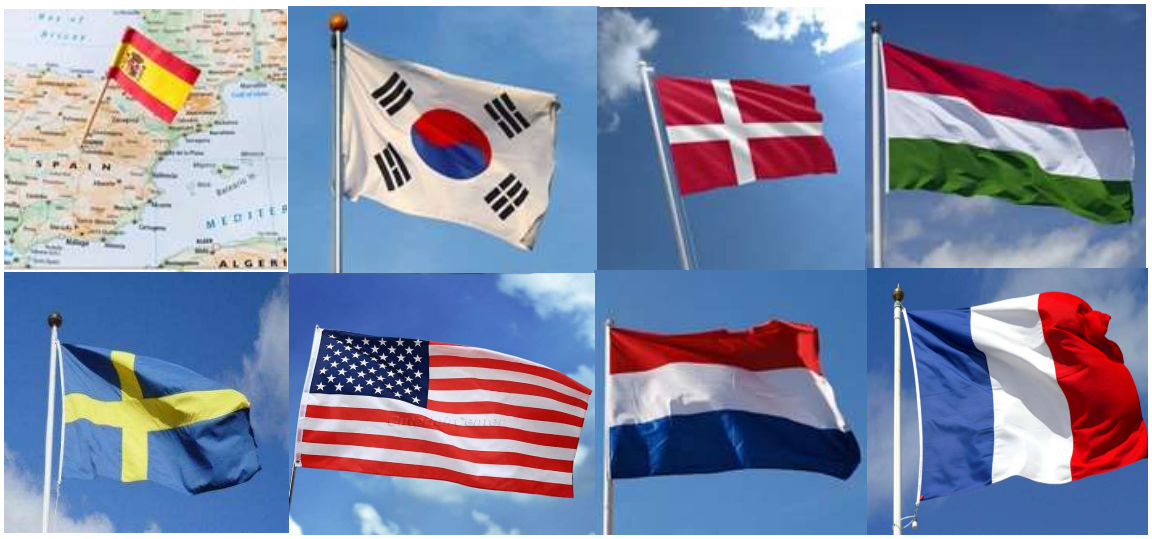
- International there are large differences in required ventilation flow
- Strong need to reduce energy demand control/zones ventilation
- Buildings become more airtight
- When we reduce flows is CO_2 the correct parameter ?

What were the reasons behind this ventilation levels ?

Which minimum level of flow is acceptable?

AIVC PROJECT WITH PARTICIPATING COUNTRIES:

- Denmark
- Hungary
- Netherlands
- UK
- France
- Sweden
- US
- South Korea
- Spain, etc.



More countries are welcome

PROCES

- Literature search
- Questionary: collection of data from different countries
- What are the differences, simularities
- Categorize the data, for instance climate conditions
- Recommendation based on latest research findings

STRATEGIES BEHIND STANDARDS AND REGULATIONS

Ventilate for :

- humans only
- activities of humans
- emissions
- heat removal
- moisture

- the most dominant pollutant
- all combinations:
  - humans
  - human activities
  - other emissions
- varying over time and place

FLOWRATE DISTRIBUTION (NL, 80 DWELLINGS)

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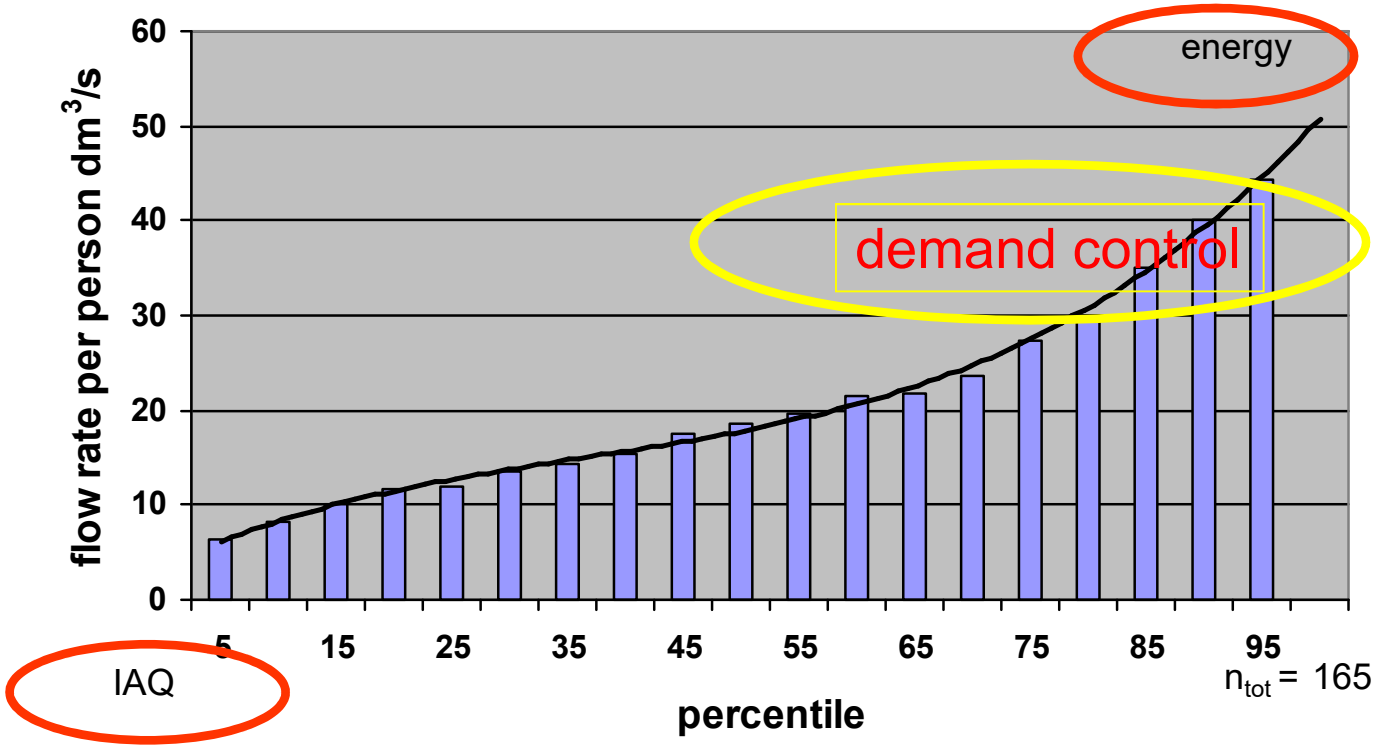
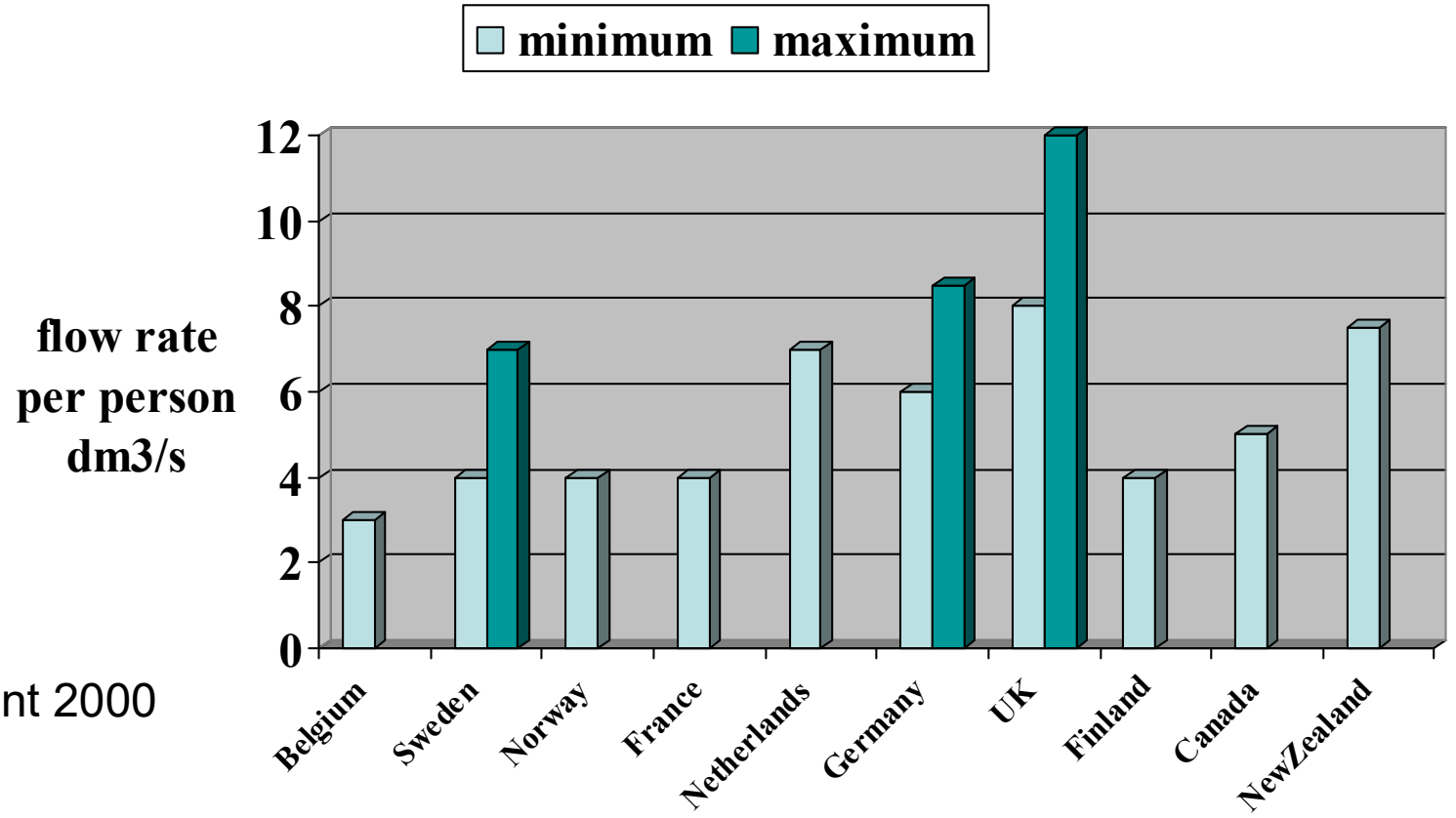
90% have a mean air flow rate over the heating season more than 8 dm3/s p.p.



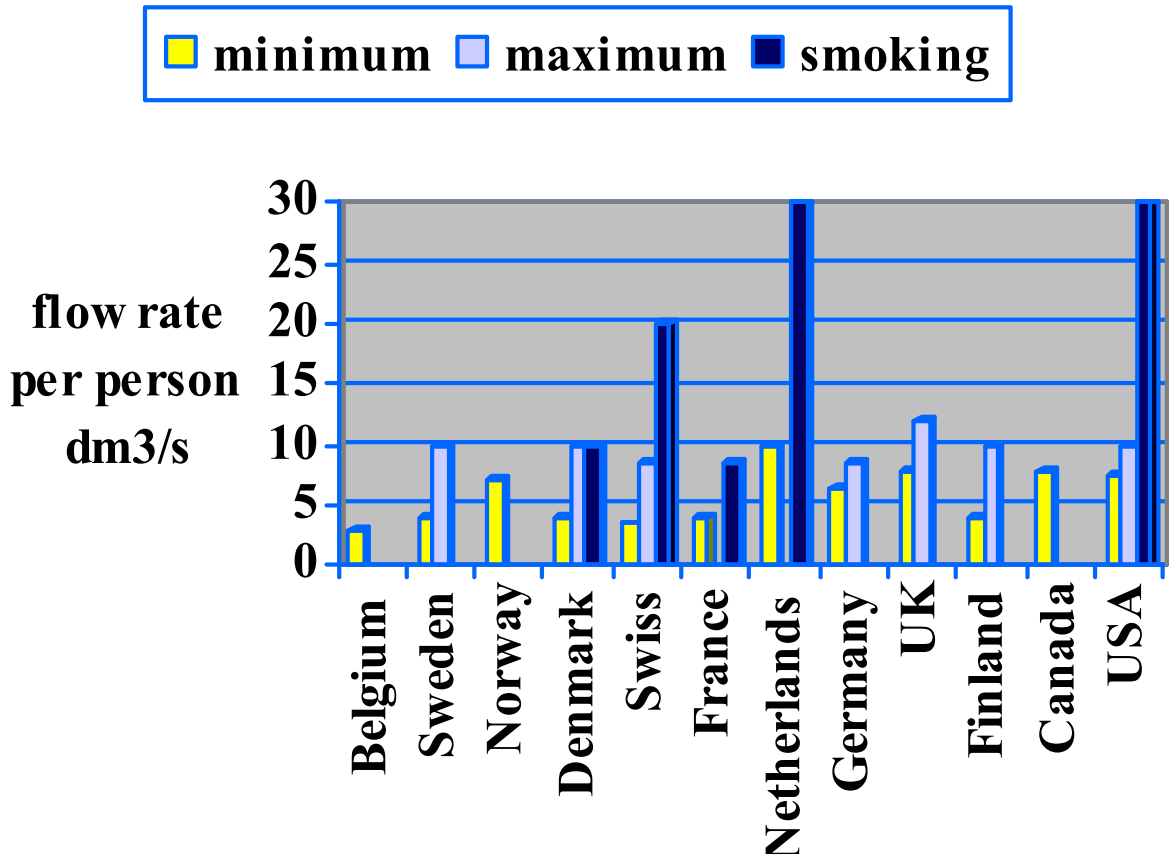
No person has a mean air flow rate over the heating season lower than 4.9 dm3/s

OVERVIEW OF VENTILATION REQUIREMENTS AND GUIDELINES FOR DWELLINGS

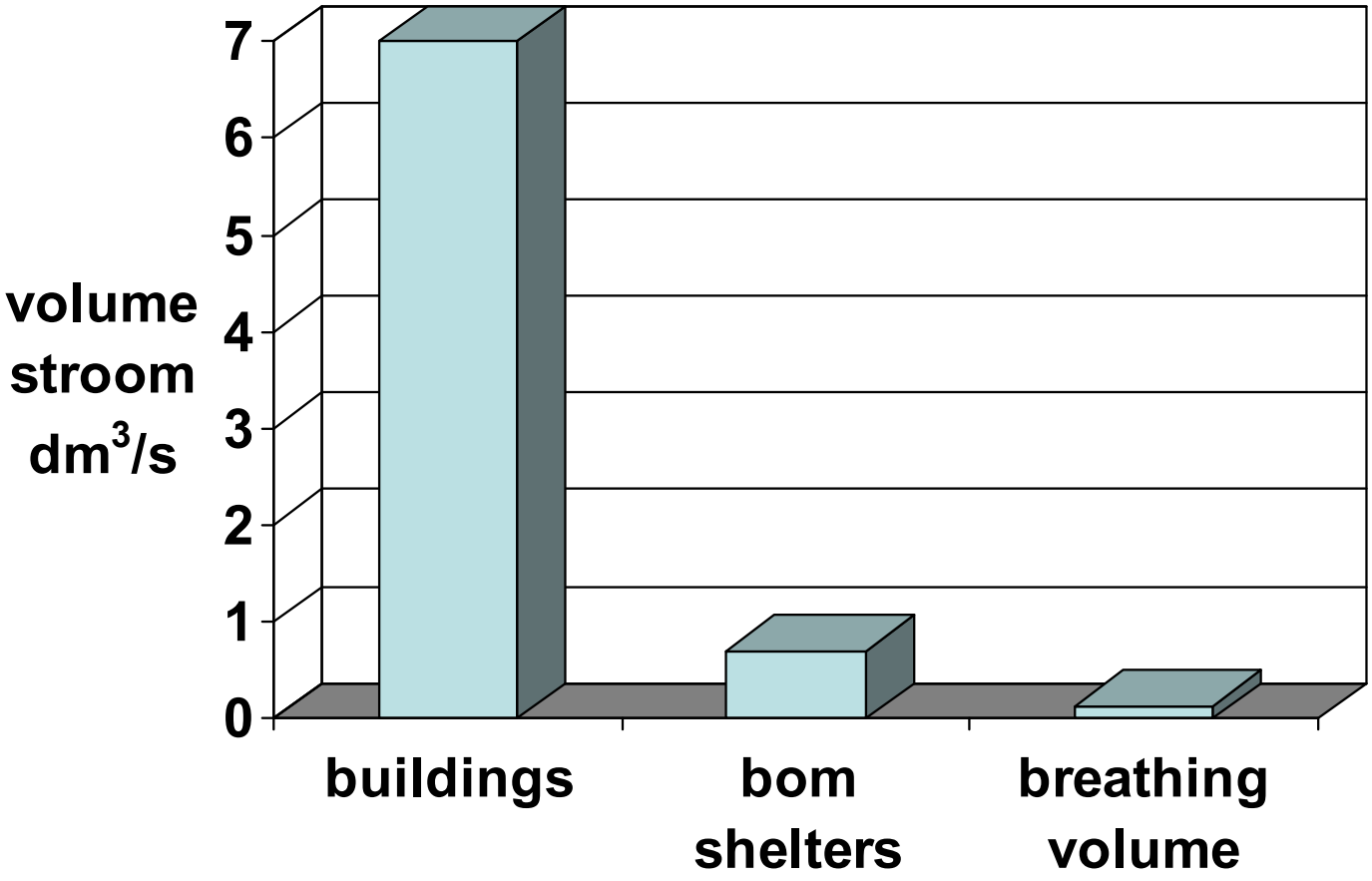


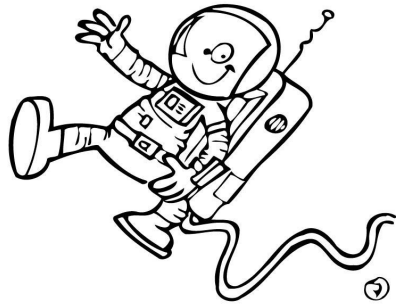
Tipvent 2000

OVERVIEW OF VENTILATION REQUIREMENTS AND GUIDELINES FOR OFFICES (TIPVENT 2000)

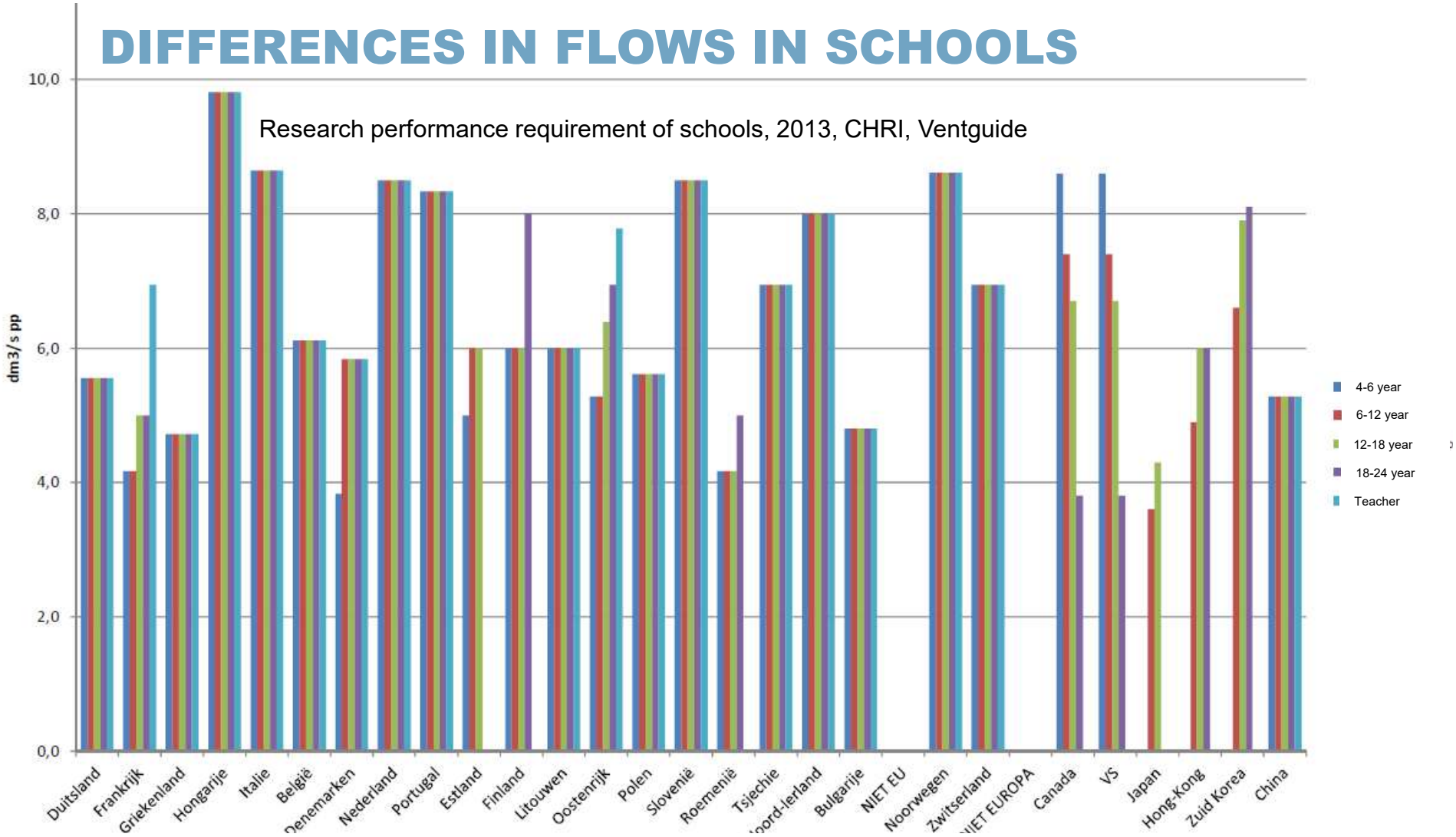


VENTILATION MINIMUM FOR PERSONS

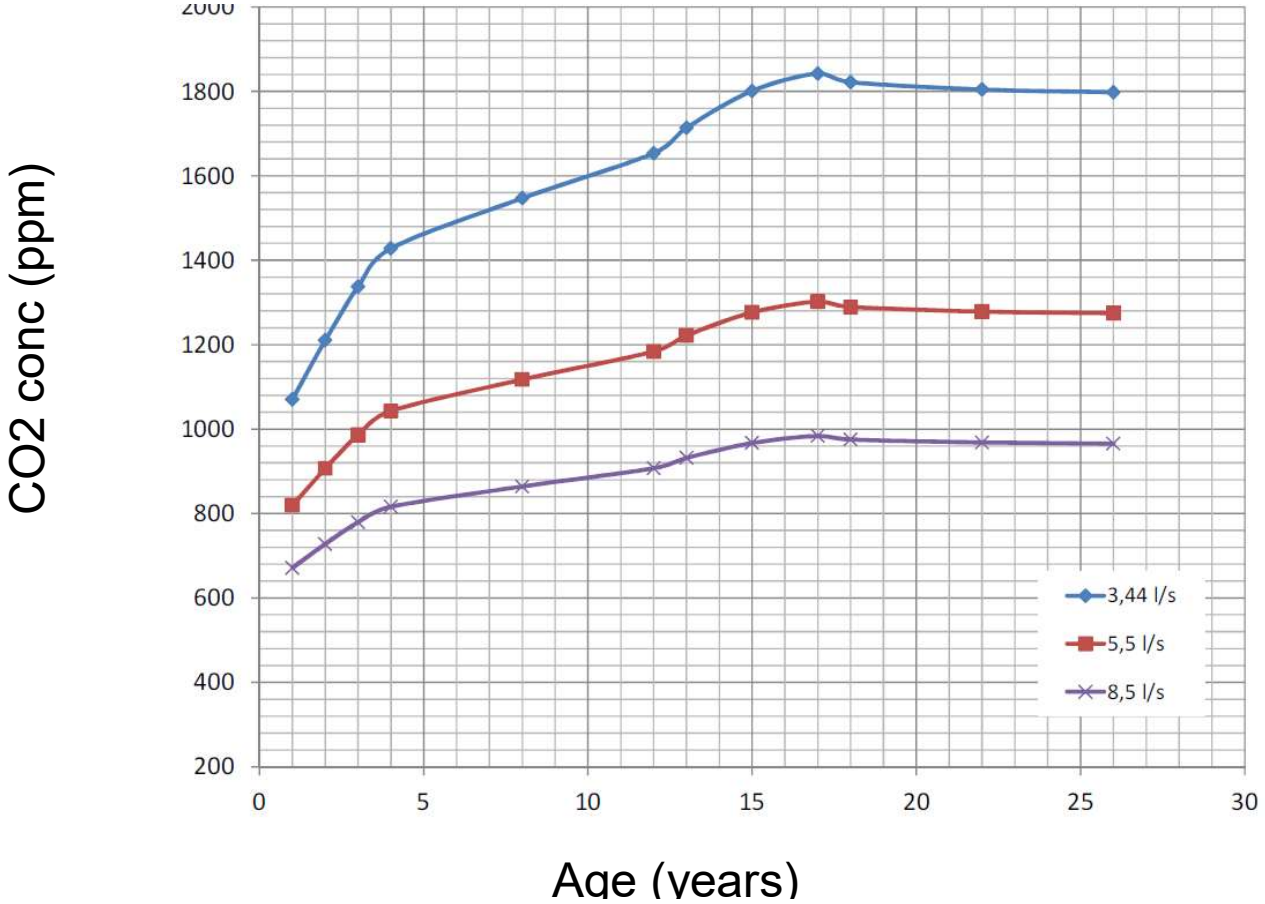


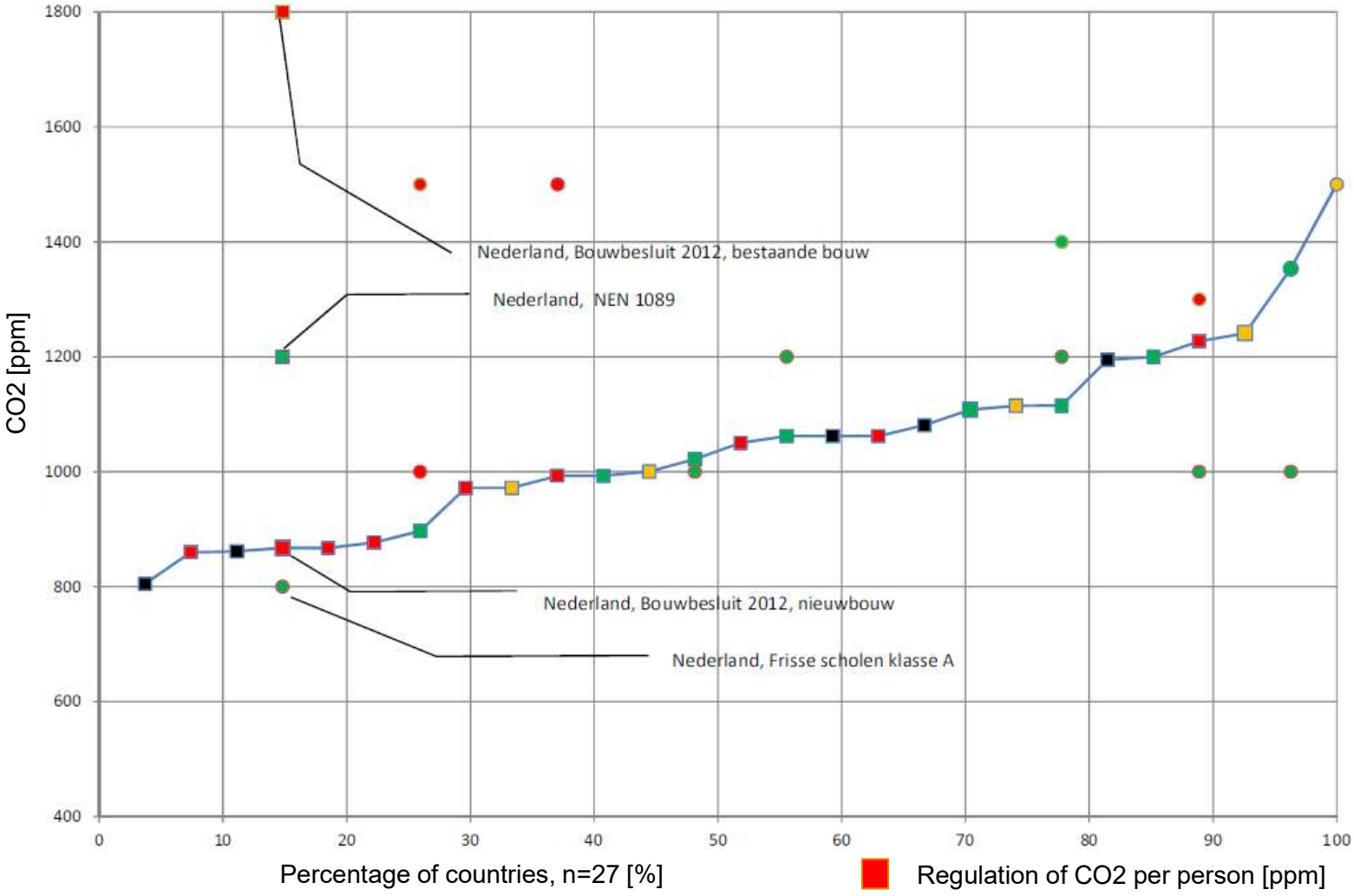


DIFFERENCES IN FLOWS IN SCHOOLS



CALCULATED CO2 CONC. AT DIFFERENT AGES




1800
1600
1400
1200
1000
800
600
400
CO2 [ppm]
0
10
20
30
40
50
60
70
80
90
100
Nederland, Bouwbesluit 2012, bestaande bouw
Nederland, NEN 1089
Nederland, Bouwbesluit 2012, nieuwbouw
Nederland, Frisse scholen klasse A
Percentage of countries, n=27 [%]
Regulation of CO2 per person [ppm]

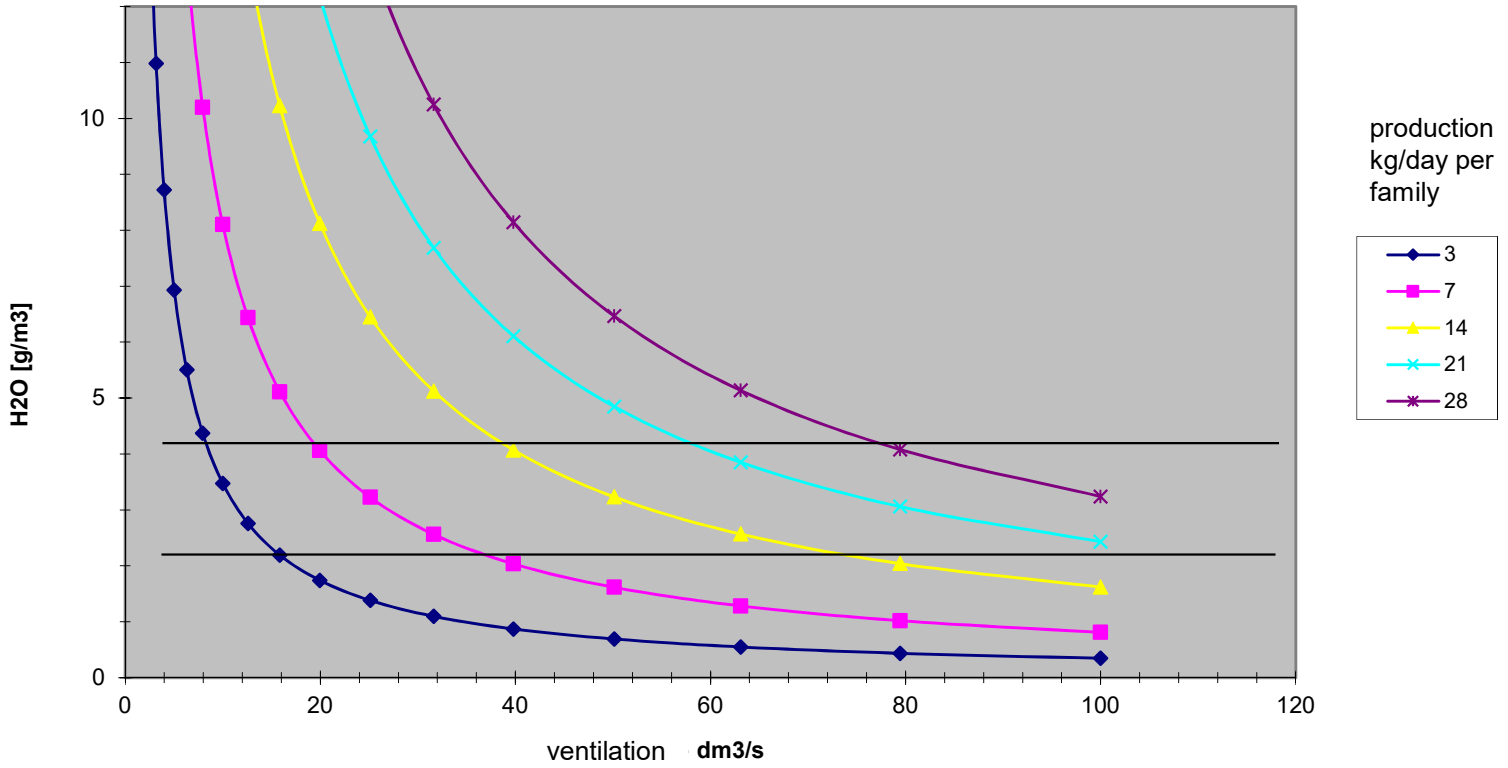
EFFECTS OF MOISTURE

- Comfort
  - Relative humidity
- Micro-organism
  - Health
- Material damage
    - Degradation
    - Decoulering

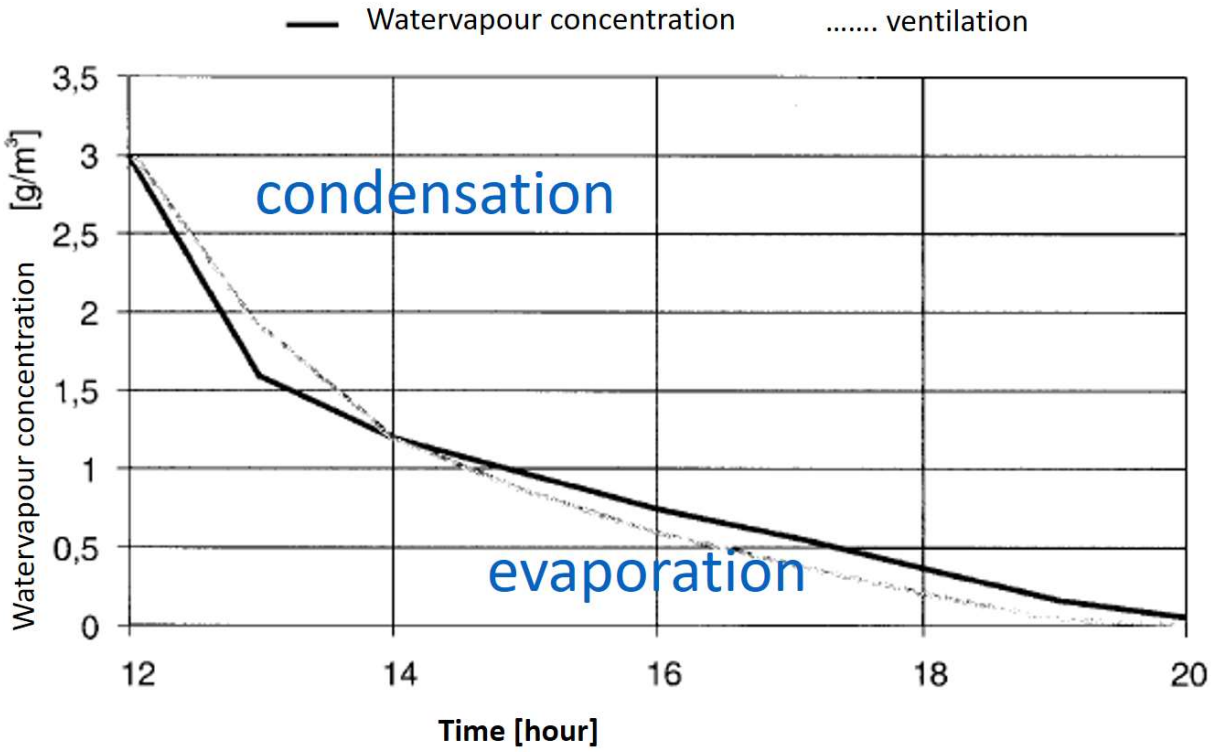
MOISTURE PRODUCTION

Acitivity	Average moisture production
Breathing/transpiration	Light activiy 30-60 g/h/person Average activity 120-200 g/h/person Heavy activiy 200-300 g/h/pers
Pet	10-15 g/h
Cooking (depending on hood- efficiency)	600-1500 g/h
Washing dishes	500-1000 g/h
Showering	2500-3000 g/h
Bathing	750 g/h
Wash drying (4,5 kg) tumble dryer	50-200 g/h
Wash drying (4,5 kg) wet	100-500 g/h
Plants	5-20 g/h
Kitchen Geyser kitchen use	25 g/h
Kitchen for showering	100g/h
Acquarium	4-15 g/h
Average family (cooking, plants, showering, etc)	7- 8 kg/day

ABSOLUTE HUMIDITY VERSUS VENTILATION

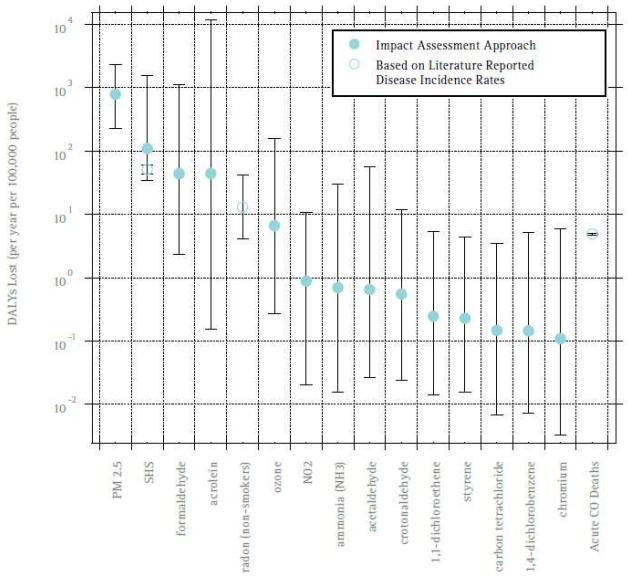


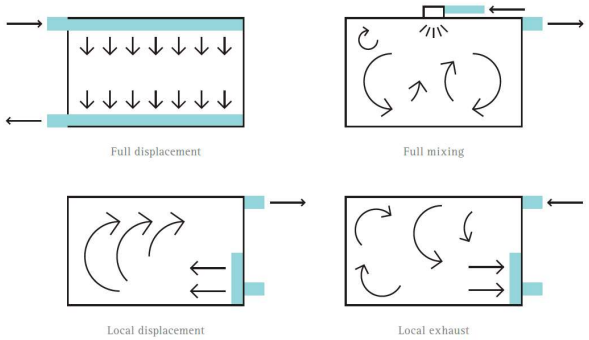
EXPERIMENT MOISTURE PRODUCTION



Production was 1 kg/h
stopped at 12
Flow rate: 14 dm3/s

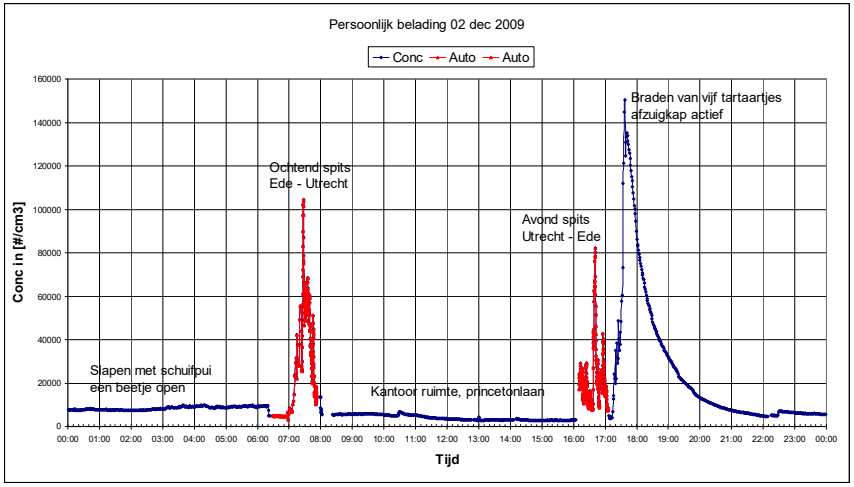
RESEARCH IN PROGRESS: TECHNOTE 68





Rationale behind current ventilation airflow rates

RESEARCH IN PROGRESS: PM2,5 EXPOSURE



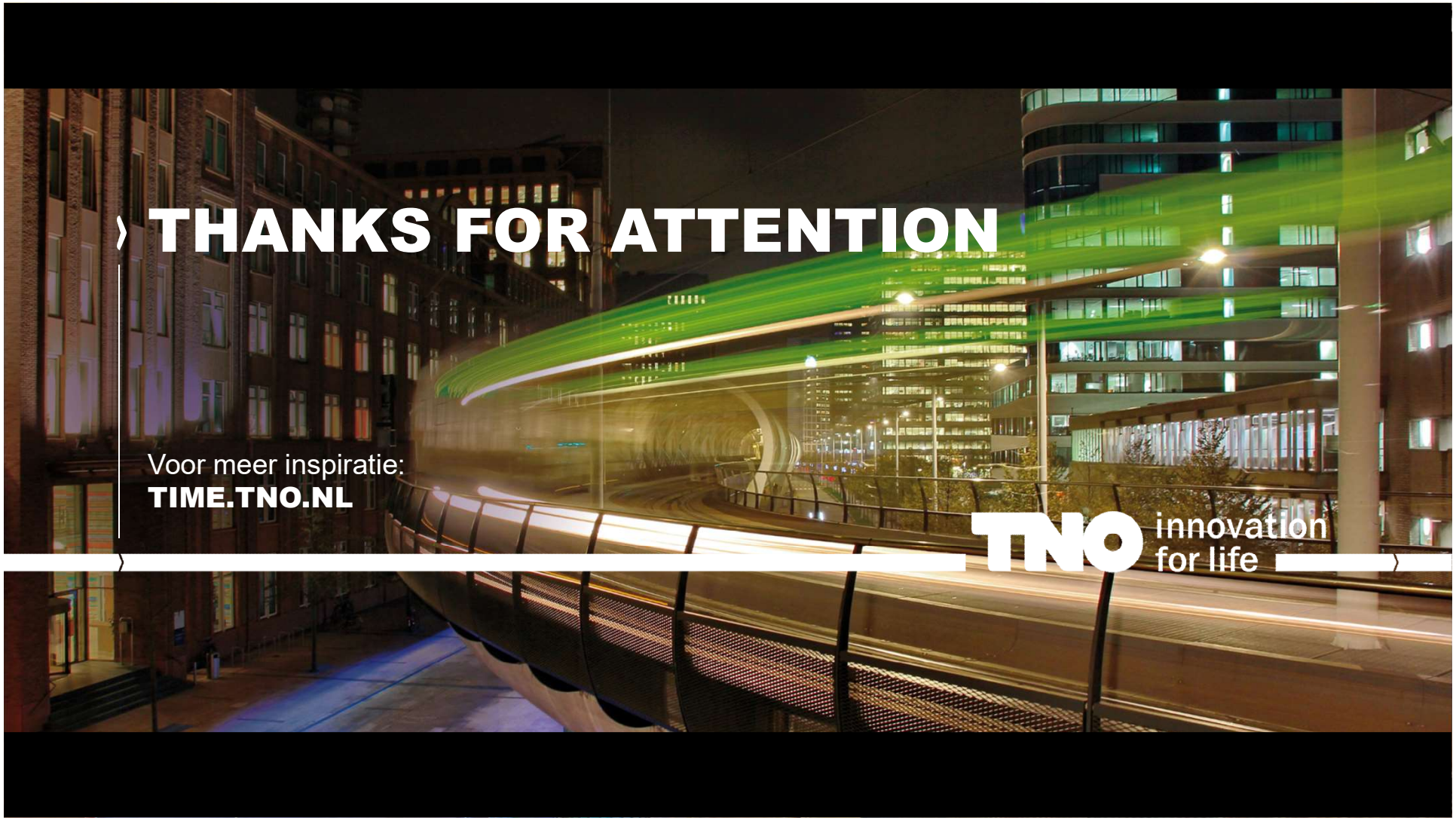
new publication coming soon

Rationale behind current ventilation airflow rates

CONCLUSIONS

- The difference in ventilation requirements in different countries is remarkable
- A factor 4 difference is found between countries
- Almost all requirements are based on odour nuisance of bio-effluents, while CO2 is used as marker or is based on humidity

- Challenge:
  - Understanding of the background of current standards and regulations,
  - Which exposure is acceptable for each of the relevant contaminants?
  - Reduction of generation of pollutants, source control of pollutants.


THANKS FOR ATTENTION
Voor meer inspiratie:
TIME.TNO.NL
TNO innovation for life