



**European Network on New Sensing Technologies for Air Pollution
Control and Environmental Sustainability - *EuNetAir*
COST Action TD1105**

INTERNATIONAL WG1-WG4 MEETING on

New Sensing Technologies and Methods for Air-Pollution Monitoring

European Environment Agency - EEA

Copenhagen, Denmark, 3 - 4 October 2013

Action Start date: 01/07/2012 - Action End date: 30/06/2016 - Year 2: 2013-2014 (*Ongoing Action*)

CO₂ SENSOR APPLICATIONS



Ingrid Bryntse

WG Leader in EuNetAir

SenseAir AB / Sweden



Background

Low-cost CO₂ sensor systems could have a large impact on the environment and economy in Europe

Main benefits are

- Reduced energy consumption
- Decreased events of death
- Fewer days at hospital intensive care
- Higher efficiency / yield for a particular application

■ The main CO₂ sensor applications are

1. Alarm

2. Process control

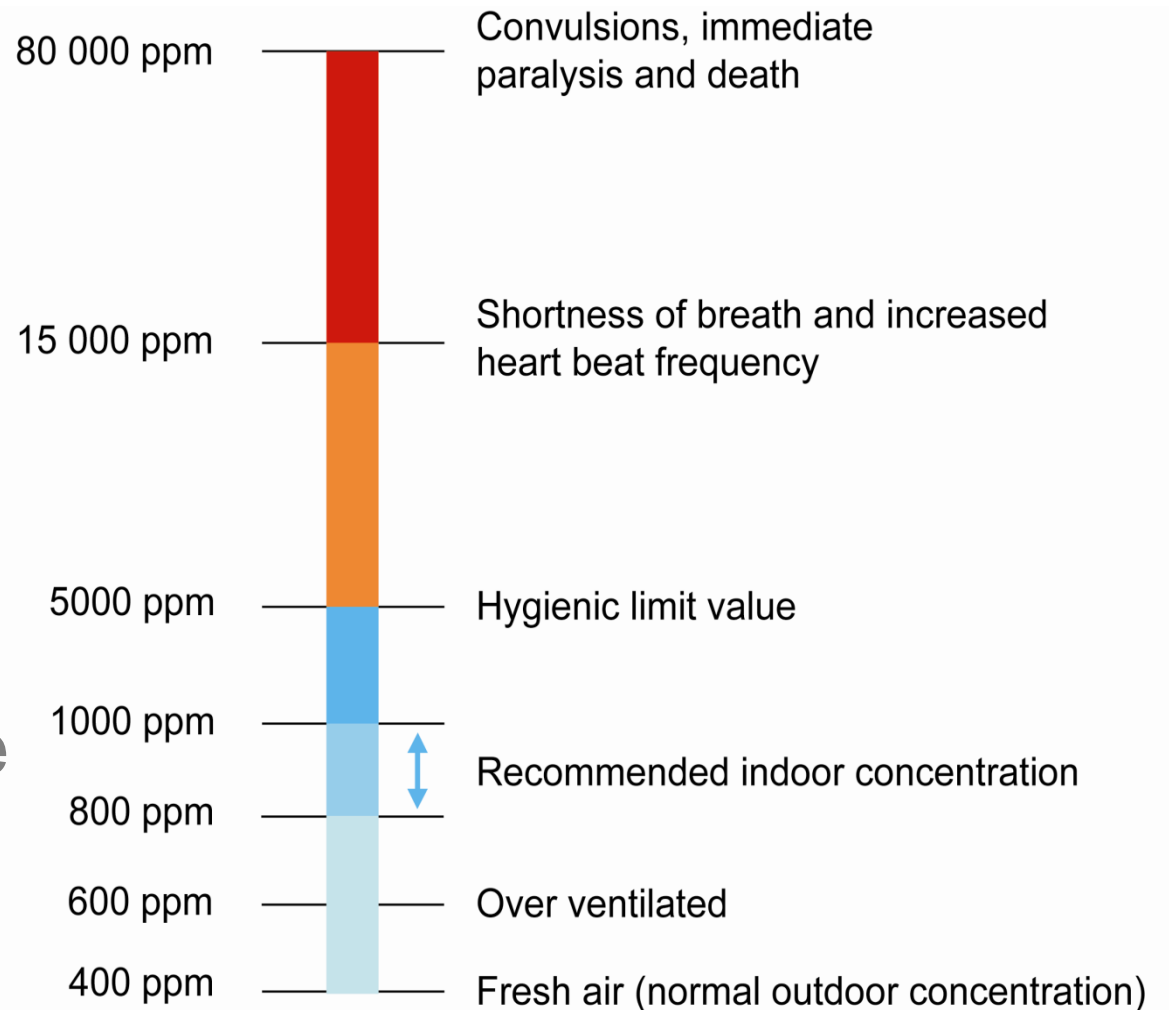
3. Ventilation

1 Alarm, CO₂ impact on health

CO₂ is neither harmless for us nor for the environment

High concentrations of CO₂ are fatal

CO₂ is difficult to notice because it is odorless and colourless



General Safety Alarm

- Environmental protection
- Healthy indoor & work environment
- 200 000 EU for hospitals saves





Beer and Soda

- Added CO₂ reduces the risk of bacteria in the drink
- CO₂ is used as propellant gas for beer and soda
- Every year people are harmed at restaurants due to CO₂ leakage

Beer and Soda

- Personal safety
- Saves life
- 200 000 EU hospital saves
- Reputation



Food Transportation and Storage

- Careful control of surrounding gases can slow down the ripening process
- CO₂ has an impact on decomposition and helps prevent pathogens





Food Transportation and Storage

- Higher efficiency
- Reduced loss in the supply chain
- Increased shelf life
- Enhanced flavours
- Improved product quality
- Reduced need for chemical spraying



2 Process control

- The concentration of CO₂ is tuned to give a higher efficiency in a process
- Corresponding sensor systems are specially developed for each application / surrounding

Chicken Farming

The fertilized eggs are placed in a chamber with controlled CO₂ concentration, depending on what stage of development the eggs are in



Chicken Farming

- Less staff
- Reduced losses
- More efficient process
- Slaughtering is faster, easier and more humane
- 16 000 European chicken farms could use this CO₂ application



Mushroom Farming

- The values of CO₂, temperature, and RH are individual for different mushroom types
- Accurate measurements and adjustments of the CO₂ concentration facilitate an optimal growth rate



Mushroom Farming

- 1 000 sites in Europe could use this application
- Less damage on the mushrooms
- Perfect shape
- Shorter growing period
- Higher profits



Greenhouse

For the growing plants it is important to have good control of ventilation, environment and CO₂ to give a maximum yield without risk of damage



Greenhouse

- Less damaged plants
- Shorter growing period
- Higher profits
- Yield increase with 8 – 10%





Incubator



Optimal cell growth condition requires perfect temperature, humidity and CO₂ concentration

Incubator

- Research studies with higher accuracy
- Stable growth control
- Efficient process



Capnometry

High accuracy CO₂ measurements facilitates individual treatments of various patients with different diagnosis





Capnometry

- Less hospital staff
- Less death events
- Shorter recovery time
- Safer treatments
- Individual-based treatments

Flue gas

- Energy optimisation in burners is essential to get as low operating costs as possible and at the same time benefit the environment in the best way



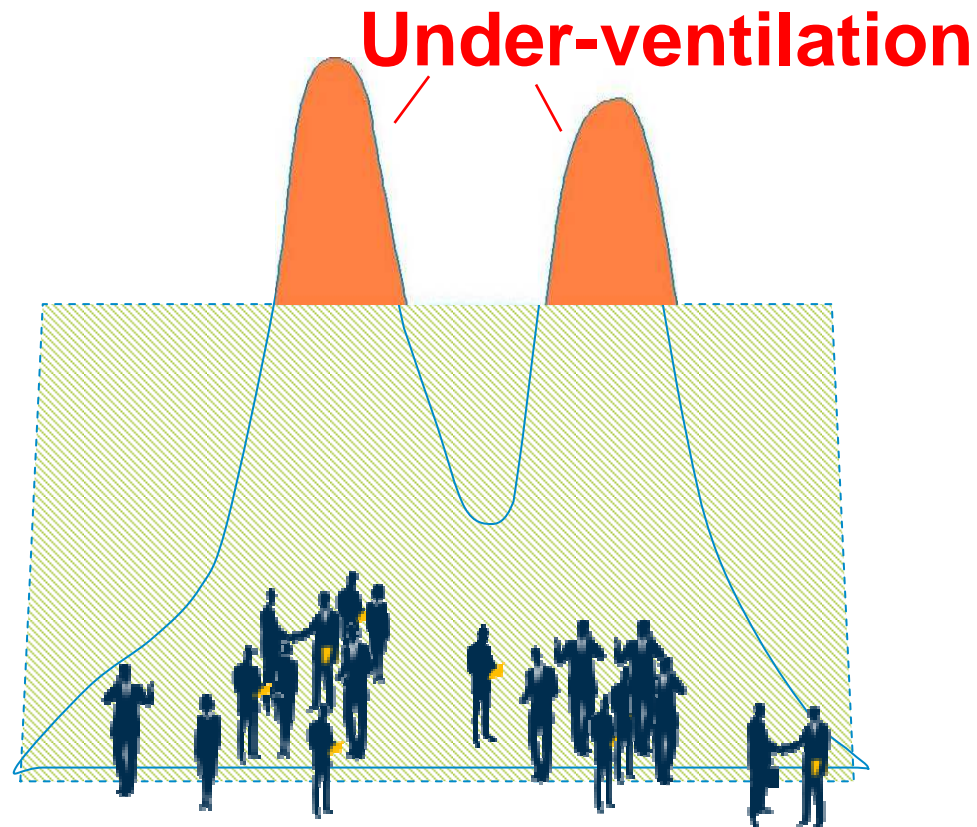
Flue gas

- Optimised combustion
- Less dangerous exhaust
- Energy & money savings
- Easier to control combustion of various fuels, such as waste or garbage
- 1 500 sites in EU could improve their flue gas control



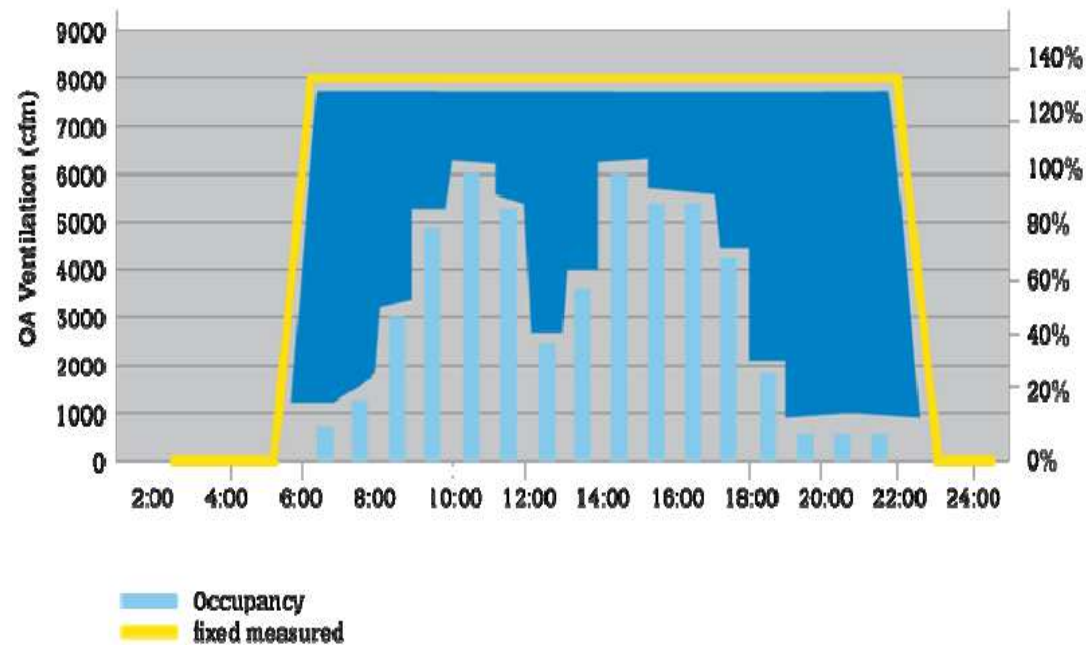
3 Ventilation

- Inadequate ventilation leads too a poor air quality causing health problems



3 Ventilation

- Over-ventilation results in higher energy usage and costs



Minor Ventilation Control

- Saves about 30% energy
- Positive environmental impact
- Healthy indoor environment
- 670 MEU/year (class rooms)



Cabin air

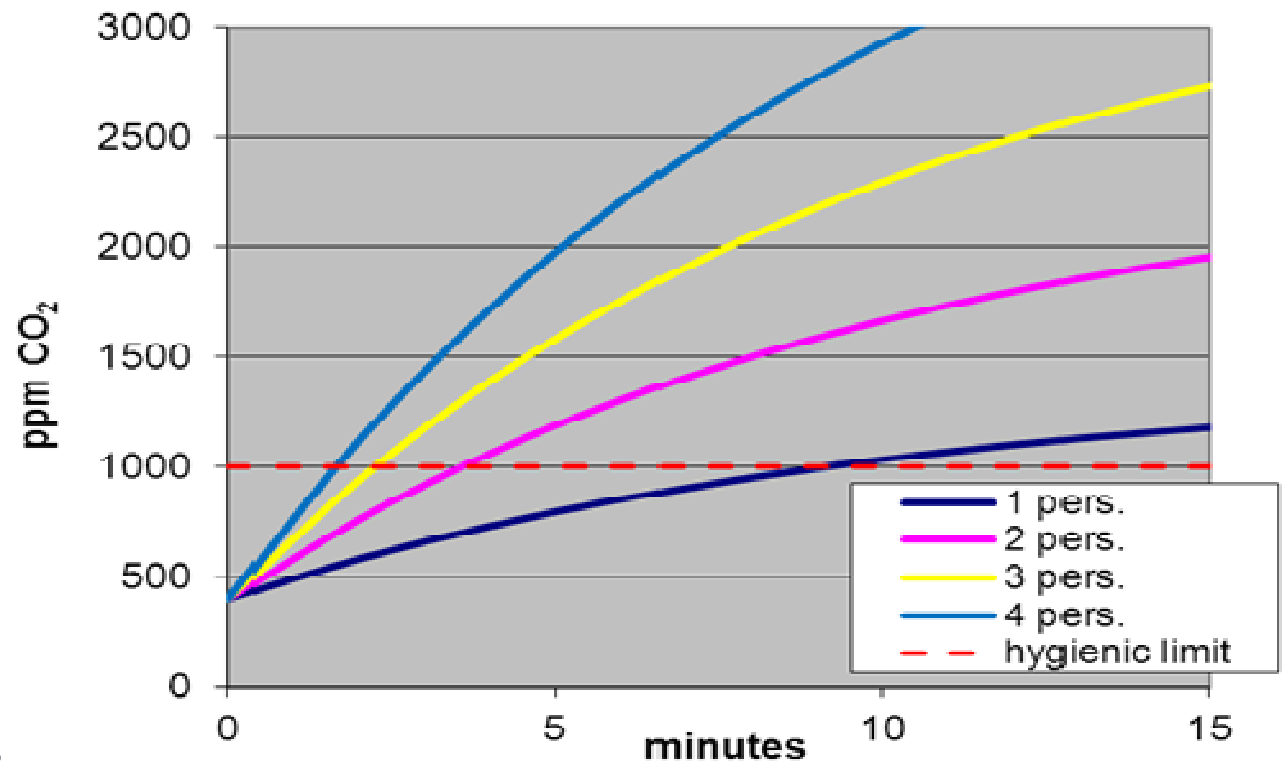


- People get tired by high CO₂ concentrations and therefore it can be a danger
- The CO₂ concentration level rises for every person in a cabin

Cabin air

- Energy saving of 1300 MEU/year
- Healthy cabin air
- Driver safety

Cabin CO₂ concentration rate-of-rise
3m³ cabin @ 5 litre/sec fresh-air ventilation



Ice Arena

The CO₂ -value varies a lot in the stadium whether it is empty or at maximum capacity during a key match

- Energy saving
- Healthy indoor environment
- 4 MEU/year



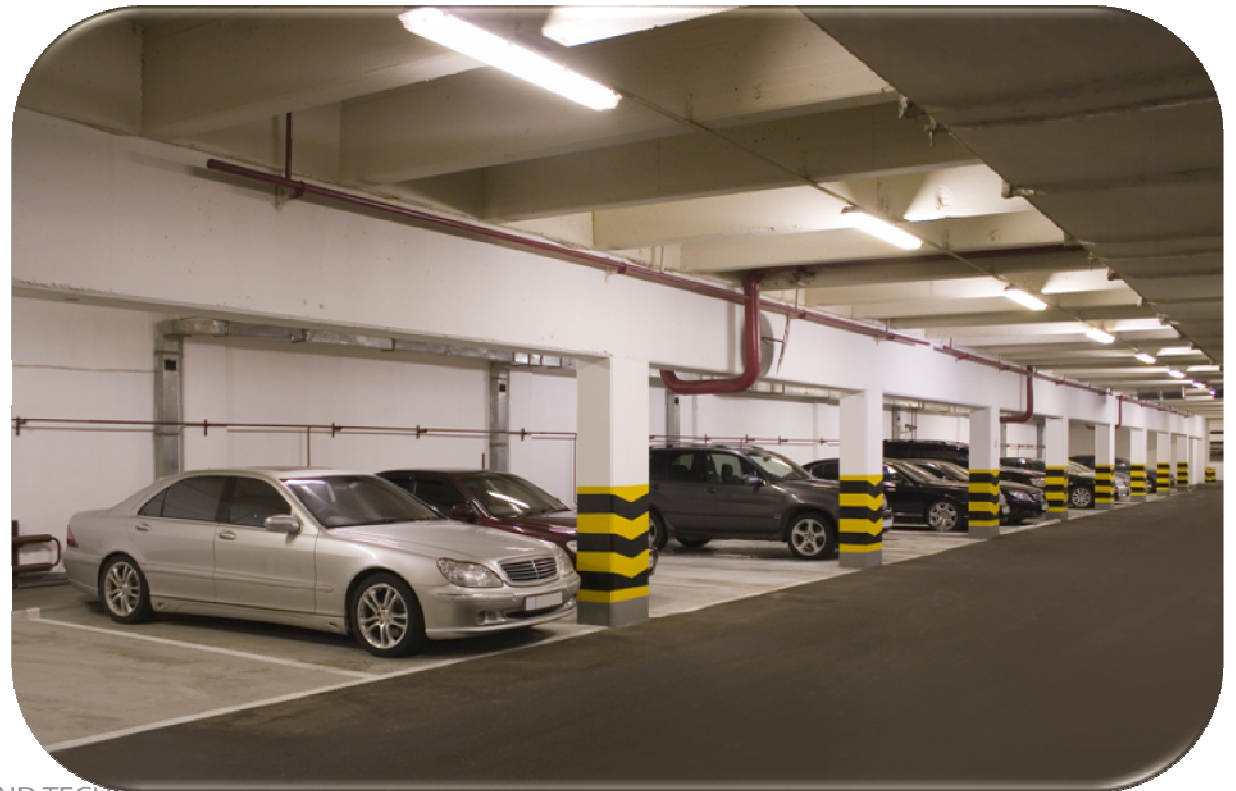


Garage and Tunnel

- A warm running modern engine with catalyst generates 140 X more CO₂ than CO
- CO₂ measurements and ventilation control in garage surroundings leads too fewer people suffering from either CO₂ or CO poisoning

Garage and Tunnel

- Environmental savings
- Reduced costs 12 kEU/year
- Public safety



Building Management System

Measures CO₂ (+ temp, RH) to determine the correct level of fresh air in a larger zone, to adjust the ventilation system



Building Management System

- Energy saving
- Reduced costs
- Higher in-door air quality
- 100 MEU/year
(sky scrapes)





Concluding remarks

- Today there are many cheap CO₂ sensors available on the market
- Efficient control systems have been developed for many different applications
- Normally an installation is fully paid after 1-2 years and could last >15 years



Example of installation

The Kremlin in Moscow has a CO₂ based ventilation system since 1995

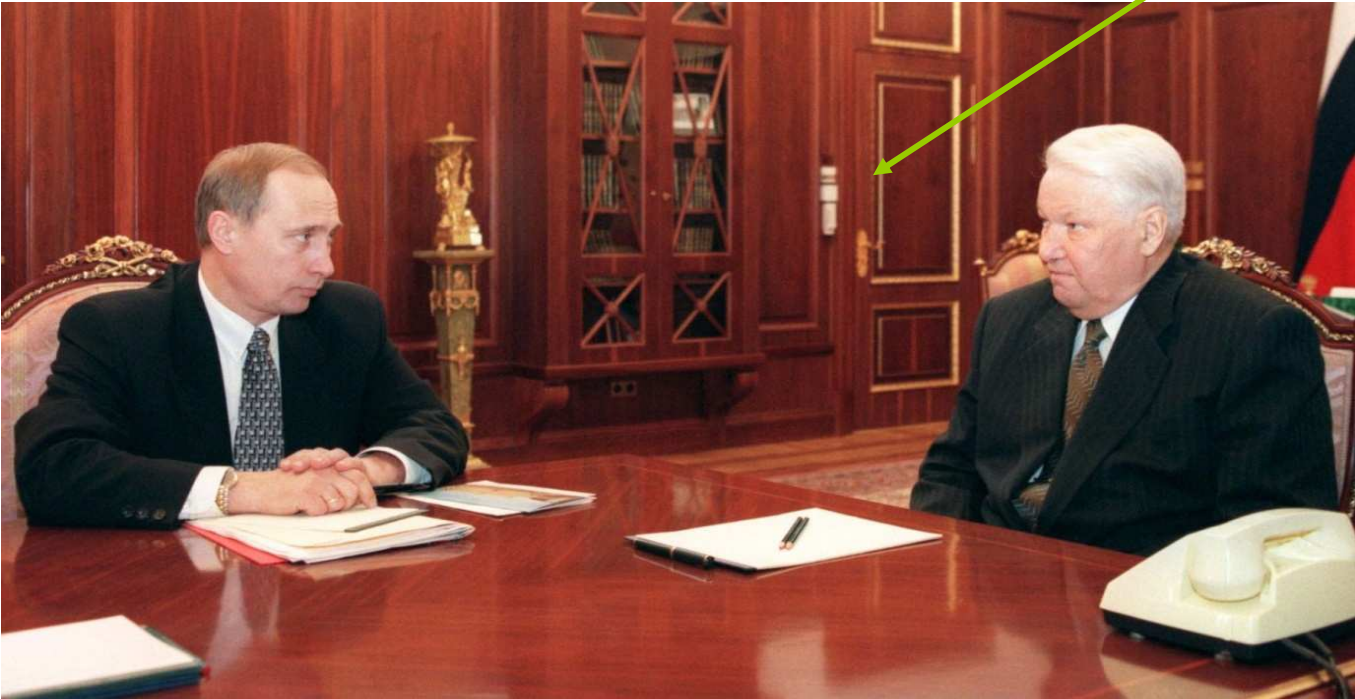


Photo from 2000



Photo from 2008



Recent photos,
found on
internet, 2013



In future?

Hopefully our European leaders will change construction rules or general legislation so that smart **CO₂ sensor systems** become **obligatory**:

- new industries, farms, plants
- pubs, schools, other buildings ...
- restoration of old buildings / plants



Conclusion

Cheap CO₂ sensor systems gives Europe a better out-door air quality!

And in addition:

- >2 billion EU saving / year for energy
- Avoiding ~200 events of death / year
- >140 million EU saving / year due to less hospital days
- ~8% yield increase for in-door farming applications



Thank you for your attention!