MacPoll Zero Gas

Requirements from EN Air Quality Standards

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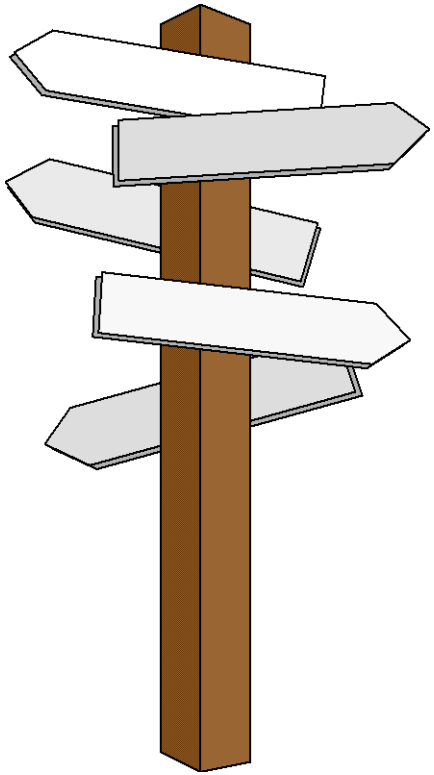
Overview of presentation



- *CEN/TC264 Air Quality*
- *Uses of zero gases*
- *Requirements for zero gases*
- *Current practice*
- *Conclusions*

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European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

CEN/TC 264 Air Quality

- ***http://www.cen.eu/cen/Sectors/TechnicalCommitteesWorkshops/CENTechnicalCommittees/Pages/TCStruc.aspx?param=6245&title=CEN/TC%20264***

CEN/TC 264 Air Quality

- ***Standardization of methods for air quality characterization of***
  - **Emissions into air**
  - ***Ambient air***
  - **Indoor air**
  - **Gases in and from the ground**
  - **Deposition**
  - **Measurement methods for air pollutants (particles, *gases*, odours, micro organisms)**
  - **Methods for the determination of the efficiency of gas cleaning systems.**

CEN/TC 264 Air Quality

- *Established in 1990*
- *Currently 27 active Working Groups and 1 Task Force*
- *Zero gases highly relevant for standards of TC 264*
  - **Most stringent requirements for measurements of gases in ambient air (low ppb concentration levels)**

Zero gas

Workshop June 2013

Applications of zero gases

- *CEN/TC 264 WG12*
  - Has produced 5 (draft) standards for measurement of gases (NOx, SO_2, O_3, CO, C_6H_6)
- *Each standards contains sections on*
  - Type approval of monitoring equipment
  - QA/QC of measurements (calibrations, checks)
- *For both zero gases are required*
  - For zero calibrations and checks
  - For dilution of high concentration calibration gas, span gas and test gases

Applications of zero gases

- *Zero gas may be from*
  - **Cylinders**
  - **Zero-air generators**
- *Quality of zero gases shall not adversely affect results of tests, checks and calibrations*
  - **Each standard contains purity requirements for zero gases**
- *Zero gases in the field shall be checked against independent standard gases*

Applications of zero gases

- *Zero gases are used by*
  - **Laboratories performing type-approval tests of monitoring equipment**
  - **Calibration laboratories of air quality monitoring networks**
  - **Field operators of air quality monitoring networks**
- *Under different environmental conditions*

Requirements for zero gases

- *Example: NOx*

Pollutant		*Concentration*
CO_2	≤	4,0 µmol/mol
O_3	≤	2,0 nmol/mol
NH_3	≤	1,0 nmol/mol
Water vapour	≤	150 µmol/mol
NO	≤	1,0 nmol/mol
NO_2	≤	1,0 nmol/mol

Type-approval testing of interferences

Pollutant		*Concentration*
CO_2	≤	400 µmol/mol
O_3	≤	2,0 nmol/mol
NH_3	≤	10 nmol/mol
Water vapour	≤	150 µmol/mol
NO	≤	1,0 nmol/mol
NO_2	≤	1,0 nmol/mol

Other type-approval tests

Requirements for zero gases

- *Preferably one zero gas for laboratory applications and one for field applications*
  - **Laboratory gas to be used as transfer standard for field checks**
- *Should combine all purity requirements !*
- *Should have levels of impurities certified !*

Requirements for lab gas

Requirement	Component(s)
≤ 1 nmol/mol	NH_3, NO, NO_2, SO2, xylenes, O_3, toluene
≤ 0,1 µg/m^3	Benzene
≤ 1 µg/m^3	Sum of interferents of benzene
≤ 0,5 nmol/mol	N_2O
≤ 0,1 µmol/mol	H_2S, CO
≤ 4,0 µmol/mol	CO_2
≤ 150 µmol/mol	H_2O

Requirements for other zero gases

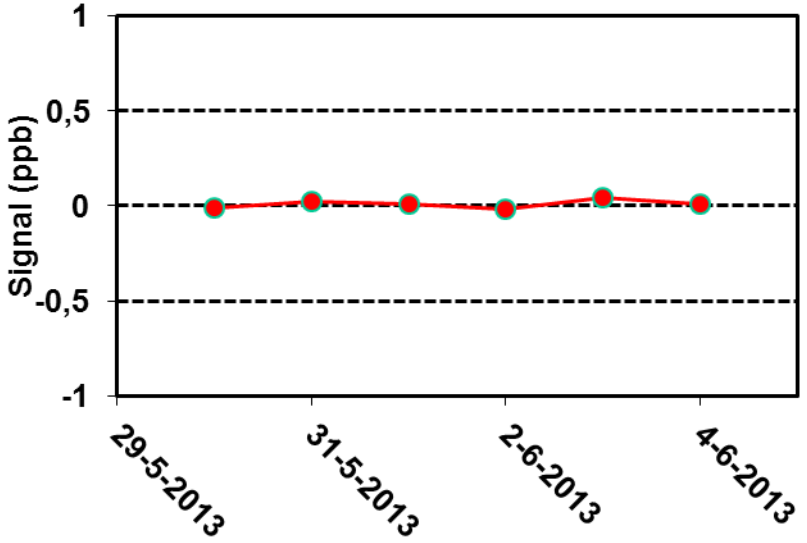
Requirement	Component(s)
≤ 1 nmol/mol	NO, NO_2, SO2, xylenes, O_3, toluene
≤ 10 nmol/mol	NH_3
≤ 0,1 µg/m^3	Benzene
≤ 10 µg/m^3	Sum of interferents of benzene
≤ 0,5 nmol/mol	N_2O
≤ 0,1 µmol/mol	H_2S, CO
≤ 400 µmol/mol	CO_2
≤ 150 µmol/mol	H_2O

Requirements for zero gases

- *2012 WG12 standards allow for use of monitors with different ranges (generally lower) when type approved*
  - **Requirements for zero gases should be scaled accordingly !**
- *CEN/TC 264 WG12 will produce a standard for measurement of ozone precursors*
  - **Need for stringent requirements for levels of interferents !**

Current practice

?



Current practice

- *Most networks and laboratories use zero-air generators*
  - **“Unlimited” supply of zero air**
  - **Substantial choice of manufacturers**
- *Quite different specifications*
  - **Sometimes qualitative**
  - **< 0,1 ppb, < 0,5 ppb, < 1 ppb for NOx, SO_2, CO, O_3**
  - **Sometimes information for other components (e.g., THC)**
  - **Sometimes information for H_2O**

Current practice

- *Zero air in cylinders with appropriate specifications are scarce*
  - **Mostly aimed at use as GC FID gas**
- *When levels are given, how are these measured ?*
  - **What equipment ?**
  - **How calibrated ?**
  - **Calibration standards with traceable compositions ?**

Current practice

- *Most networks and laboratories are unable to do (im)purity checks/ determinations*
  - **Other than below limit of detection of own equipment**
- *Rely on manufacturer's specifications*
  - **Supported by information on maintenance**
- *Attempt to find supporting evidence from inter-laboratory comparisons*

Conclusions

Conclusions

- *EU Standards for measurement of gaseous air pollutants contain stringent requirements for purities of zero gases*
- *Users rely on specifications of procucers of generators or cylinder zero gas*
- *If given, it is unclear how these specifications are determined*
- *Users have little or no means to determine qualities of zero gases themselves*

Conclusions

- *Need for (network of) institutes capable of testing/certifying zero gases at required specifications*
  - **Gas metrology laboratories ?**
  - **National Reference Laboratories for air quality monitoring ?**
  - **Common, harmonized methods and calibration standards ?**
- *Need for comparisons of zero gases*

Questions

- *Are such low levels of impurities measurable ?*
- *If so, by whom ?*
  - **Gas metrology laboratories ?**
  - **Producers ?**
  - **What should monitoring networks do ?**
- *If so, at what costs ?*
- *Will costs be balanced by benefits ?*
  - **Would require studies into effects of using “old” and “new” technology zero gases**

Thank you !