# Ongoing QA/QC for PM Monitoring

## Requirements from CEN/TC264 WG15 AMS Group


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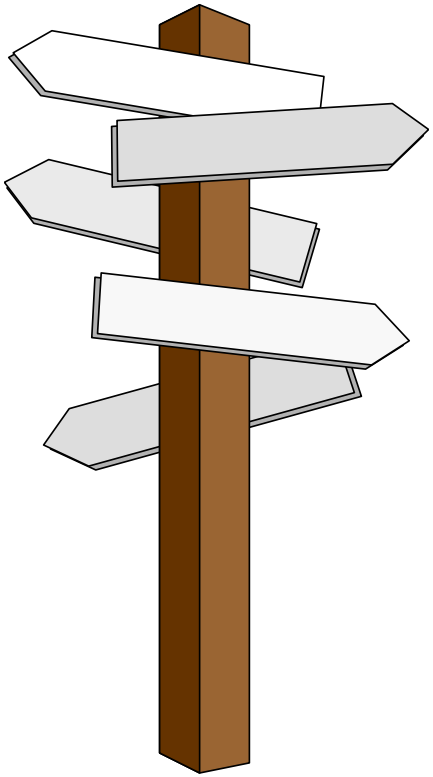
# Roadmap of presentation



- Introduction - context
- Premises
- Elements of ongoing QA/QC
- Summary

# Introduction

- *2008: CEN/TC264 WG15 proposes drafting a standard for automated continuous measurement systems (AMS) for PM*
  - **AMS needed to fulfill requirements of 2008/50/EC**
  - **As “equivalent” methods**
    - *Burden of proof of equivalence on networks*
  - **Lack of harmonized QA/QC**
  - **Lack of harmonized data treatment/validation**

# Introduction

- *Proposed standard*
  - **Type approval of AMS cf. EN 15267-1 and -2**
    - *Laboratory tests and field tests*
    - *Input from VDI 4203 part 3 and Guide to Demonstration of Equivalence (GDE)*
  - **Suitability evaluation by networks**
  - **Requirements for ongoing QA/QC**
  - **Requirements and recommendations for data treatment and validation**
    - *Input from Aquila*
  - ➔ **Comparable standards exist for AMS for gases**

# Premises

- *Equal requirements from GDE and new AMS standard*
  - **Field testing and evaluation of results**
- *Requirement from Commission for ongoing verification of equivalence in time and space !*
  - **Implications for ongoing QA/QC**
  - **Introduction of QA/QC section in GDE !**

➔ *Simultaneous revision of GDE and drafting of AMS Standard !*

# Progress

- *Revised GDE published in January 2010*
  - **http://ec.europa.eu/environment/air/quality/legislation/assessment.htm**
- *Working draft of AMS Standard ready for circulation in CEN/TC264*
- *Standard to be published (?) before revision of 2008/50/EC*

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# *Ongoing QA/QC for PM AMS*

# Ongoing QA/QC

- *Purpose*
  - **Ensure that uncertainties of measurement results are kept below stated limits during extended periods of operation in the field**
- *Elements*
  - **Checks, calibrations, maintenance**
    - *Minimum frequencies*
    - *Performance action criteria*
  - **Ongoing verification of suitability of AMS**

| ***Checks, calibration and maintenance*** | ***Section*** | ***Frequency*** | ***Lab / field*** | ***Action criteria*** |
|---|---|---|---|---|
| Checks of status values of operational parameters | 8.4.3 | Daily | L | See 8.4.3 |
| Checks of sensors for temperatures, pressure and/or humidity | 8.4.4 | Every 3 months | F | ± 2 K<br>± 1 kPa<br>± 5 %rh |
| Calibration of sensors for temperatures, pressure and/or humidity | 8.4.5 | Every year | L / F | |
| Check of the AMS flow rate(s) | 8.4.6 | Every 3 months | F | 4% |
| Calibration of the AMS flow rate(s) | 8.4.7 | Every year | L / F | |
| Leak check of the sampling system | 8.4.8 | Every year | L / F | 1% |
| Zero check of the AMS reading | 8.4.9 | Every year | L / F | 3 μg/m3 |
| Check of the AMS mass measuring system | 8.4.10 | As recommended by the manufacturer and after repair, but at least every year | L / F | 3% |
| Regular maintenance of components of the AMS | 8.5 | As required by the manufacturer | L / F | |

# Ongoing suitability verification

- *Ongoing comparisons with reference method*
  - **No metrological standards for PM**
  - **Limited “technical” QA/QC**
  - **Type approval and suitability evaluation tests cover a limited number of practical situations (compositions of PM; meteorology)**
  - ***AMS measurand always differs from that of reference method !***
  - ***New versions of the same type of AMS may behave differently !***

# Example RIVM

- *PM10 AMS: ß-attenuation monitors*
  - **Upto 2007: 2 types**
    - *Fixed heating*
    - *Flexible heating*
  - ➔ ***4 different equivalence "calibration equations" (also differences between urban and rural sites)!***
- *Currently*
  - **One type: one calibration !**

# *Examples EU (anon)*

- ***Technical improvements (?) to AMS have led to problems with continuity of equivalence***
  - **Shall be covered by requirements for type approval (design changes)**

# Ongoing suitability verification

- ***Minimum requirements***

| $W_{AMS}$ (%) | ≤10 | 10 - 15 | 15-20 | 20 - 25 |
|---|---|---|---|---|
| % of sites (nr ≥2) | 10 | 10 | 15 | 20 |
| Number of sites | 2 | 3 | 4 | 5 |

* The smaller of the two resulting numbers may be applied.

  - **Sites representative of conditions typical for network**
  - **Tests shall cover full year**
  - **Minimum 80 valid data pairs per site**

- ***Recommendations***
  - **One site from suitability test**
  - **Other sites change yearly**

# Ongoing suitability evaluation

- ***Results accumulated over 3-year period to be evaluated yearly***
  - **Using "GDE" uncertainty evaluation sub-procedure (paragraph 9.5.3.2 – 9.5.5)**
  - ➔ **When uncertainty in different category: change comparison regime accordingly**
  - ➔ **When uncertainty > 25%: corrective action, e.g., recalibration of AMS**

# Ongoing suitability evaluation

- *After 5 years: complete re-evaluation of uncertainty*
  - **Using all results collected**
  - **Using full “GDE” data evaluation procedure (paragraph 9.5 of GDE)**

# *Wrap up*

# Summary

- *New standard under development*
  - **Replaces equivalence demonstration for PM AMS by combination of**
    - *Type approval*
    - *Suitability evaluation*
  - **Adds requirements for ongoing QA/QC and data treatment**

# Summary

- ***However, still problems exist with implementation of the reference methods for PM !***
  - **Effects of filter types, brands, conditioning !**

# *Thank you !*