

JRC Air Quality – The Major Challenges, London Dec. 9th – 10th, 2009

A quality assurance program for particles in Europe

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JRC **Outline**

- Scope of the project
- Measurement campaigns
- Measurement results
 - Reference value
 - Compliance with DQO
 - Correction factors
 - Uncertainties, Average Exposure Index for PM2.5
- Encountered problems
- Outlook



JRC **Scope of the project**

European Standards:

- EN 12341 (PM10)
- EN 14907 (PM2.5)

European Directive:

- 2008/50/EC


JRC **Scope of the project**

- provide information on the comparability of PM10 (PM2.5) measurements as implemented by the **NRLs** with JRC (ERLAP)
- provide information on the comparability of routine PM10 (PM2.5) measurements at **network monitoring stations** with JRC
- provide information about the state of **implementation and use of correction factors for automatic monitors** in the monitoring networks that are used in reporting under the Council Directive 2008/50/EC

JRC **Execution of the measurement campaigns**

- **JRC mobile laboratory**
 - Two sequential samplers for PM10, one for PM2.5, one for PM1 (24h avg.)
 - PM10 FDMS, OC/EC semi continuous, OPC, meteorological sensors
- **Equivalence-test in the field (2005/2006)**
 - Reference method (LVS) vs. candidate method (SEQ)
 - 3 locations in Italy and France, 41 days: successful
- **Measurement campaigns of 14 days each in 18 EU member states (2006 – 2009)**
 - During periods with moderate temperature
 - In urban background locations with NRL and local network

JRC **Countries visited during the PM QA/QC 2006 - 2009**

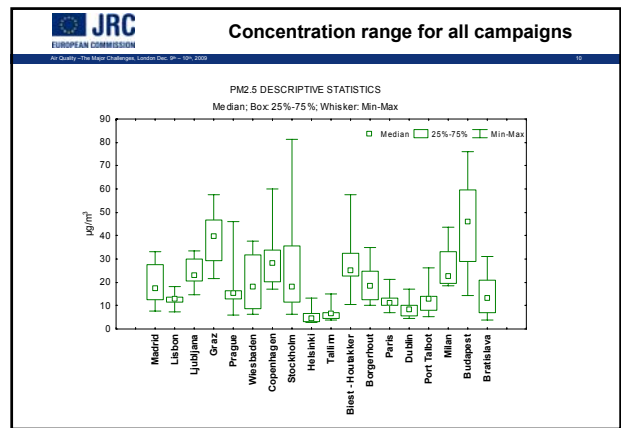
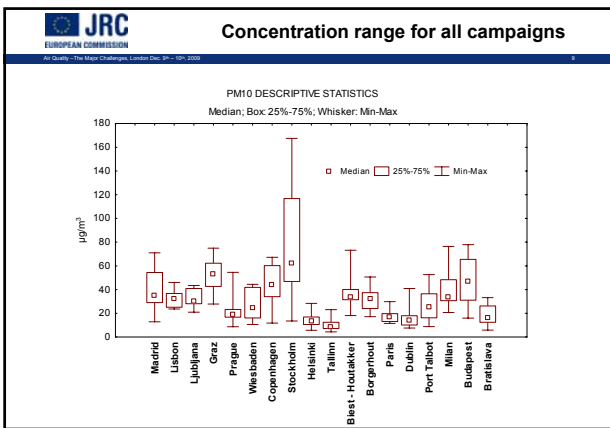


JRC Countries visited during the PM QA/QC 2006 - 2009
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Urban background Traffic

JRC Countries visited during the PM QA/QC 2006 - 2009
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Rural Industrial influence

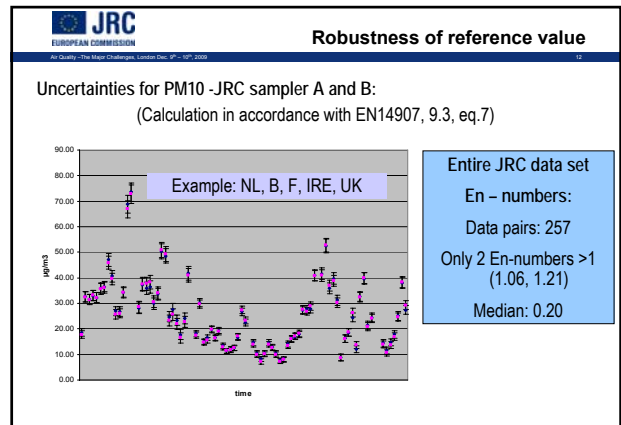


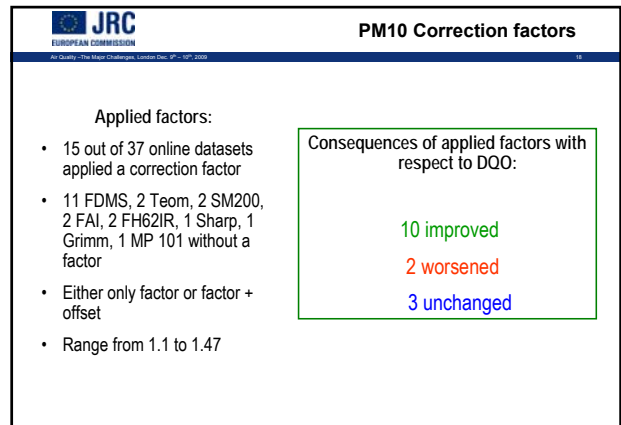
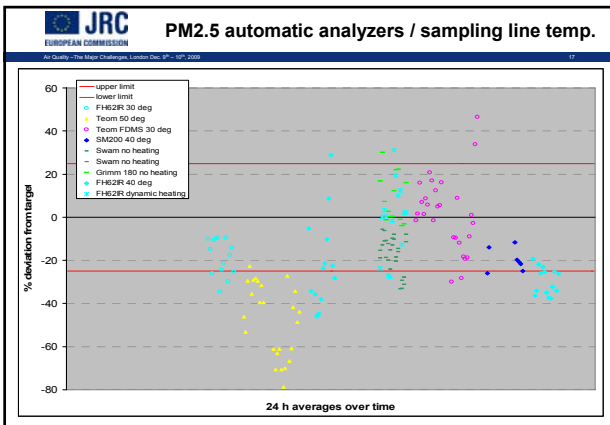
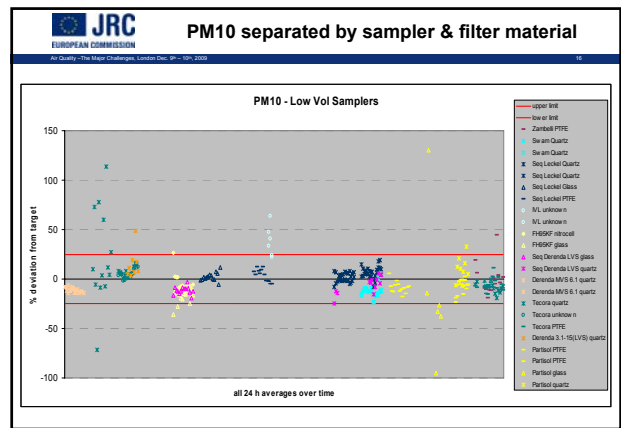
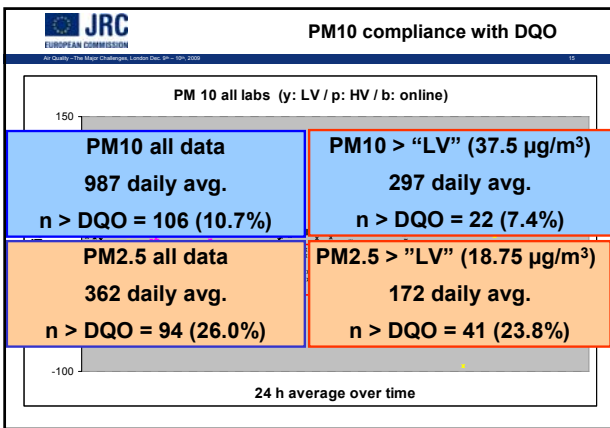
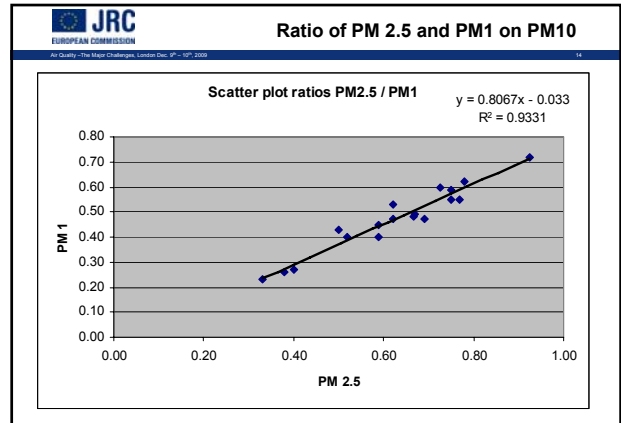
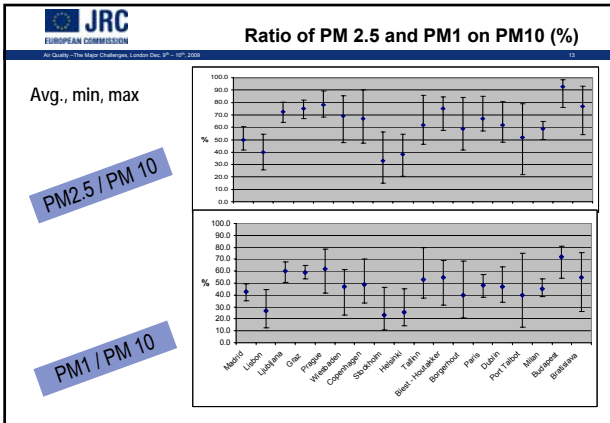
JRC Robustness of reference value
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PM10 Reference value:
 Average of both JRC SEQ samplers

Between sampler u:
 Median: 0.50

Measurement site	Between sampler uncertainty "u _{seq} " in µg/m ³
Madrid	0.62
Lisbon	0.64
Ljubljana	0.06
Graz	0.99
Prague	0.09
Wiesbaden	0.54
Copenhagen	4.08
Stockholm	7.44
Helsinki	1.73
Tallinn	0.30
Biest - Houtakker	0.36
Bergerhout	0.72
Paris	0.14
Dublin	0.15
Port Talbot	0.33
Milan	0.09
Budapest	0.94
Bratislava	0.45





JRC **PM10 uncertainties**

- 12 laboratories (number might still increase) out of 37 laboratories (incl. JRC) expressed uncertainties
- Calculation of E_n -number (ISO/ICE guide 43-1):
 - 500 data pairs (24 h avg.) calculated
 - For 191 data pairs (38.2%) $E_n > 1$

JRC **PM10 uncertainties**

- Calculation of uncertainty at the 24 h limit value using the template from the "Guide to the demonstration of equivalence"
- Only datasets with $n \geq 10$ and $R^2 > 0.9$ accepted
- Only campaigns with min. 20% of data >50% of "LV" taken into account (applying "Equivalence Guide Criteria")

Type of analyzer	total datasets	exceeding u at LV	%
Low Vol	16	1	6.3%
High Vol	9	2	22.2%
Automatic	23	13	56.5%
Sum	48	16	33.3%

JRC **PM2.5 "Average Exposure Index"**

- PM2.5 uncertainty vs. "Reduction target":

JRC - PM2.5 concentrations $8.5 < PM < 13 \mu\text{g}/\text{m}^3$

Legend: ■ reduction target - ● Concentr. + U in $\mu\text{g}/\text{m}^3$

JRC **Encountered problems**

PM10 / PM2.5 data expressed at standard conditions

- 7 laboratories (PM10) and 3 laboratories (PM2.5) expressed data at conditions different from ambient
- The applied standard conditions were:
 - 1013 hPa / 0 deg. C
 - 1013 hPa / 20 deg. C
 - 1013 hPa / 25 deg. C

JRC **Encountered problems**

Field blanks (JRC data only)

- EN14907: "...if the blank masses differ by a mass more than 40 μg for LVS the reason shall be investigated."
- Out of 110 field blanks 62 (56%) differed more than 40 μg
- Worst case Budapest and Bratislava with ca. 300 μg !!!
- Max. influence on mass concentration:
 - PM10: 49.6 % (Bratislava)
 - PM2.5: 62.1 % (Bratislava)

JRC **Encountered problems**

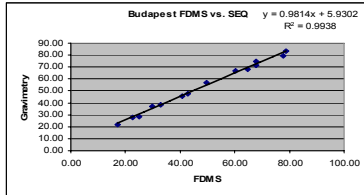
- Investigations (HU and SK):
 - "Mass gain" can be linked to boxes but not to "batch no."
 - It was not possible to "clean" a field blank from the mass gained flushing it for 24 h with "particle free air"
 - ➔ NO "CLEANING EFFECT" DURING SAMPLING !
 - Exposing a field blank inside a storage tube or outside on the Leckel SEQ (in the pre-chamber of the balance room) showed both no change in mass

• Investigations (HU and SK):

• Heating a "loaded" field blank to 30 deg. C for 24 h removed most of the gained mass

• Confirmed by comparison to FDMS

p.e. HU: Field blank counts for 5.8 µg/m³):



• Some data sets have a **bad correlation** with reference value (worst case: $R^2 = 0.02$)

• **Automatic analyzers: Many variables** to produce a measurement result (e.g. sampling temperature/correction factor, many brands of sampling heads,...). Hence it is **difficult to check the influence of a single variable**.

- Evaluation of OC/EC data and possible comparisons to participating laboratories
- Evaluation of OPC data (where available)
- Chemical speciation in selected cases
- Final report

Thanks to the ERLAP team

the NRLs & local Networks

and your attention!