

The AQUILA Network & Quality Assurance /Quality Control Programmes in Europe

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Institute for Environment and Sustainability

Air & Climate Unit



with contributions from Michel Gerboles,

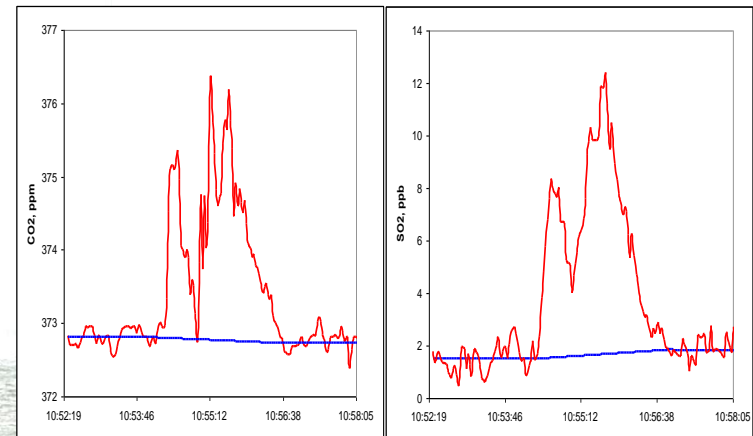
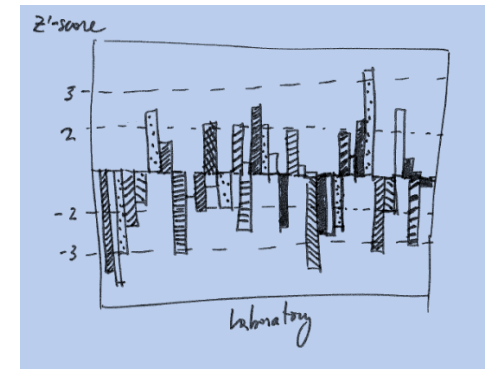
Pascual Perez Ballesta, Claudio Belis and Fritz Lagler

Structure of presentation

JRC/ERLAP & AQUILA QA/QC programmes

- JRC – ERLAP
- gaseous air pollutants
- particulate air pollutants

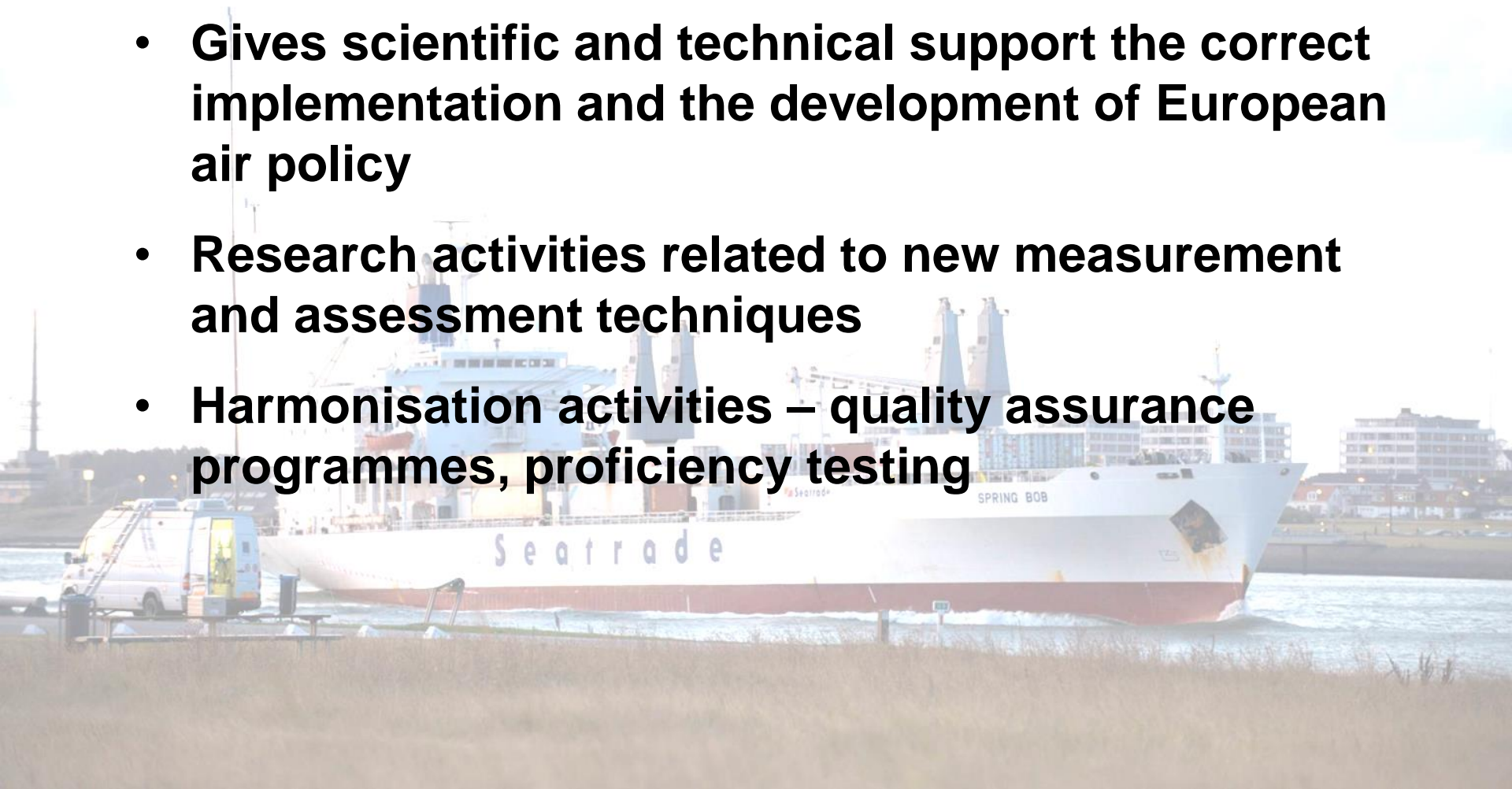
AQUILA & recent activities





JRC's European Reference Laboratory for Air Pollution

- **Gives scientific and technical support the correct implementation and the development of European air policy**
- **Research activities related to new measurement and assessment techniques**
- **Harmonisation activities – quality assurance programmes, proficiency testing**





Method development and improvement (sampling and analysis)

Diffusive sampling technique.

Sensor validation for monitoring.

Innovative system for sample preparation.

Development of methods for analysis and quantification.

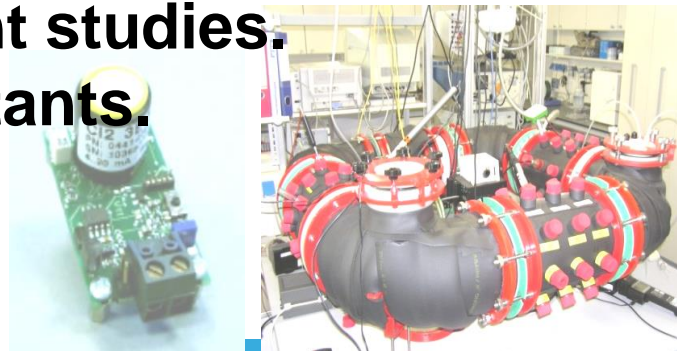
Field assessments

Remote measurements of ship emissions.

Air quality assessment.

Source apportionment studies.

Exposure to air pollutants.



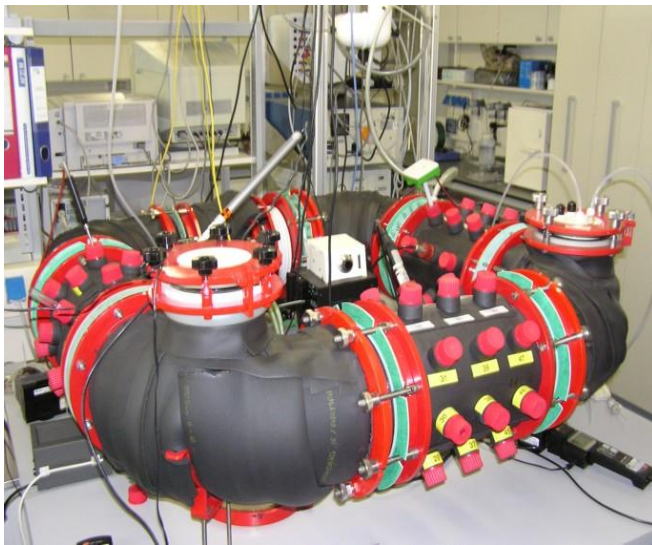
Testing & validation of micro-sensors for air pollution assessment



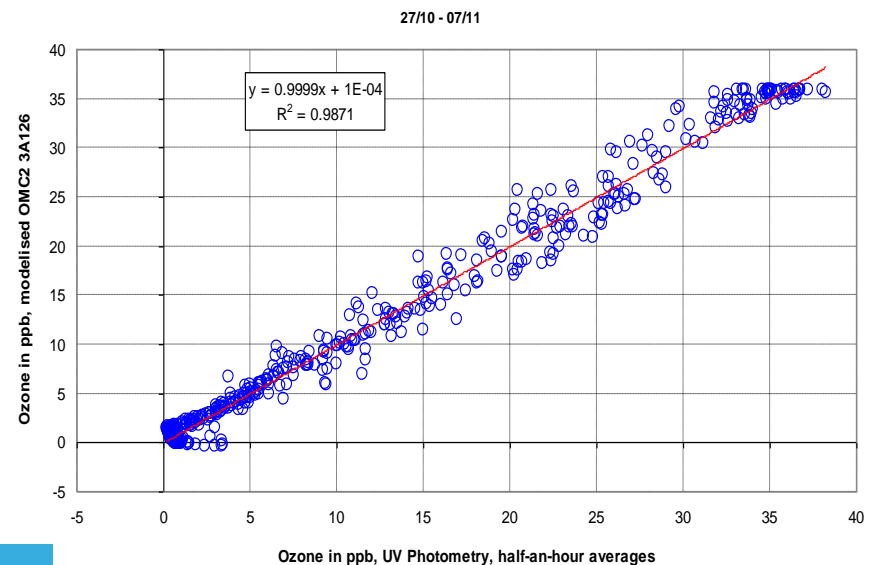
Field validation studies: obtaining results through modelling sensor response according to influencing parameters

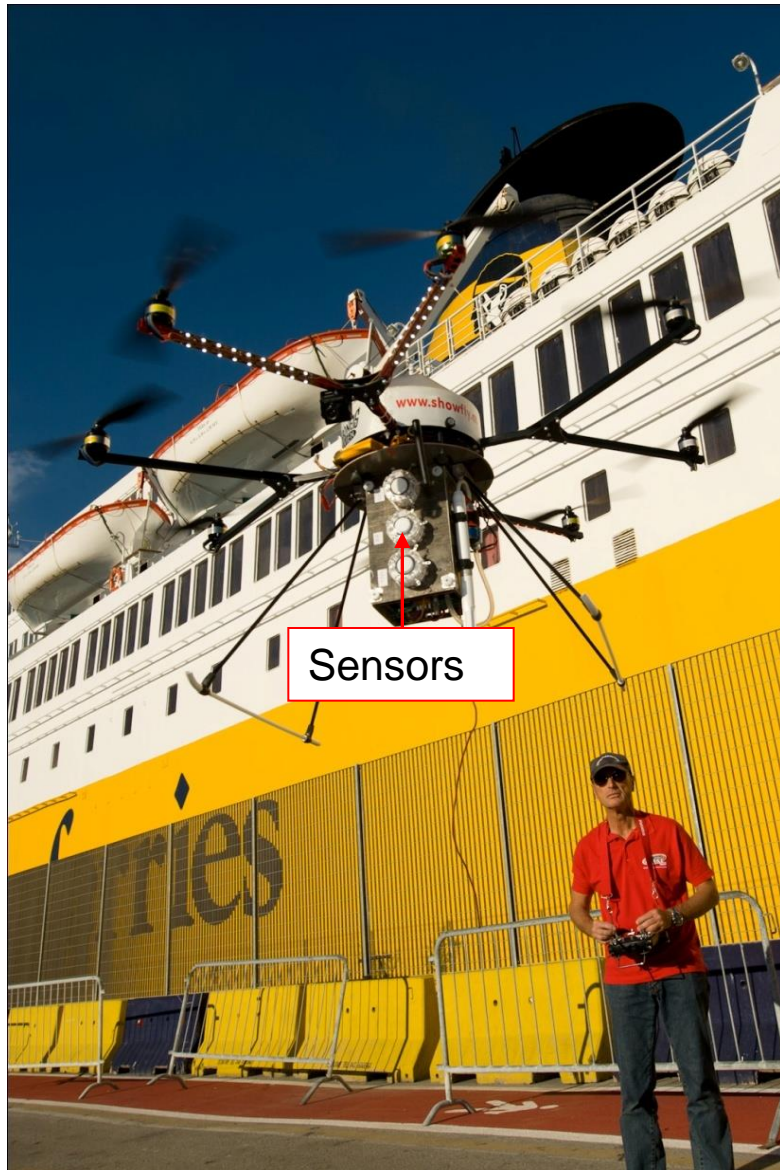


With “special treatment” some sensors can measure air quality (O_3 , NO_2) within data quality requirements of EU Directives.

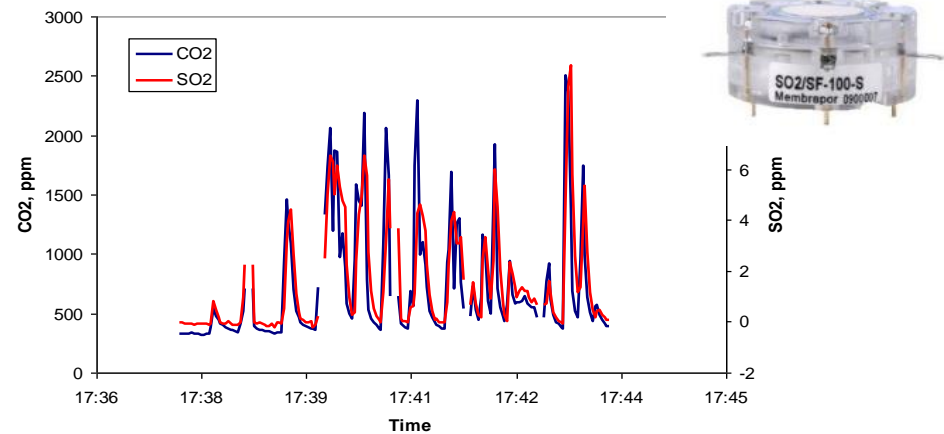


Laboratory testing at controlled wind/temperature/humidity conditions with varying air pollutant and interfering substances





Ship exhaust plume measurement from unmanned flying platform: verification of “ship fuel” directive on sulphur in marine fuel:



- Measurement of SO₂ and CO₂ concentrations: Calculation of S-content in fuel
- Validation of sensor results with canister sample & classical reference gas analyzers
- Difference < 8%.

JRC - AQUILA harmonisation activities

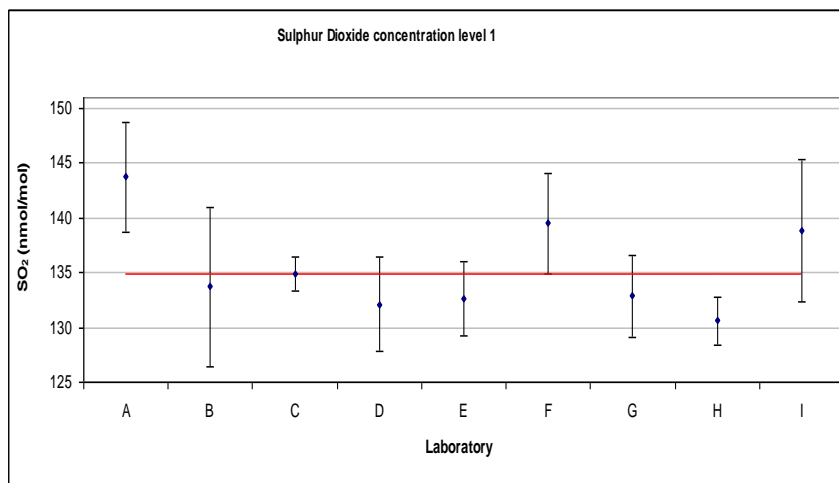
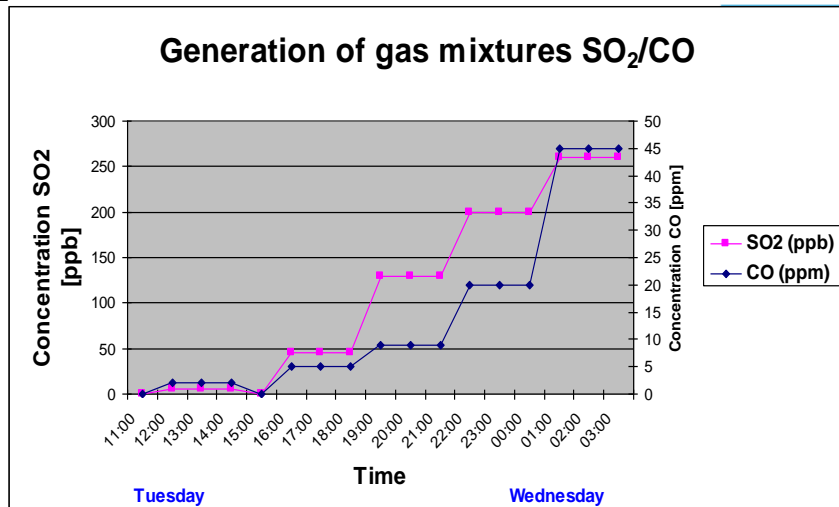
- **Intercomparison exercises for NO₂ since early 90s**
- **Regular intercomparison exercises for NO_x, O₃, SO₂, CO**
- **VOC round robin tests (gas cylinder)**
- **BTX intercomparisons**
- **AQUILA (EUSAAR/ACTRIS) EC/OC intercomparison**
- **1st metal intercomparison**
- **1st PAH intercomparison**
- **Unique PM₁₀ & PM_{2.5} QA/QC programme**

Intercomparison inorganic gaseous compounds



European
Commission

E.g. SO₂



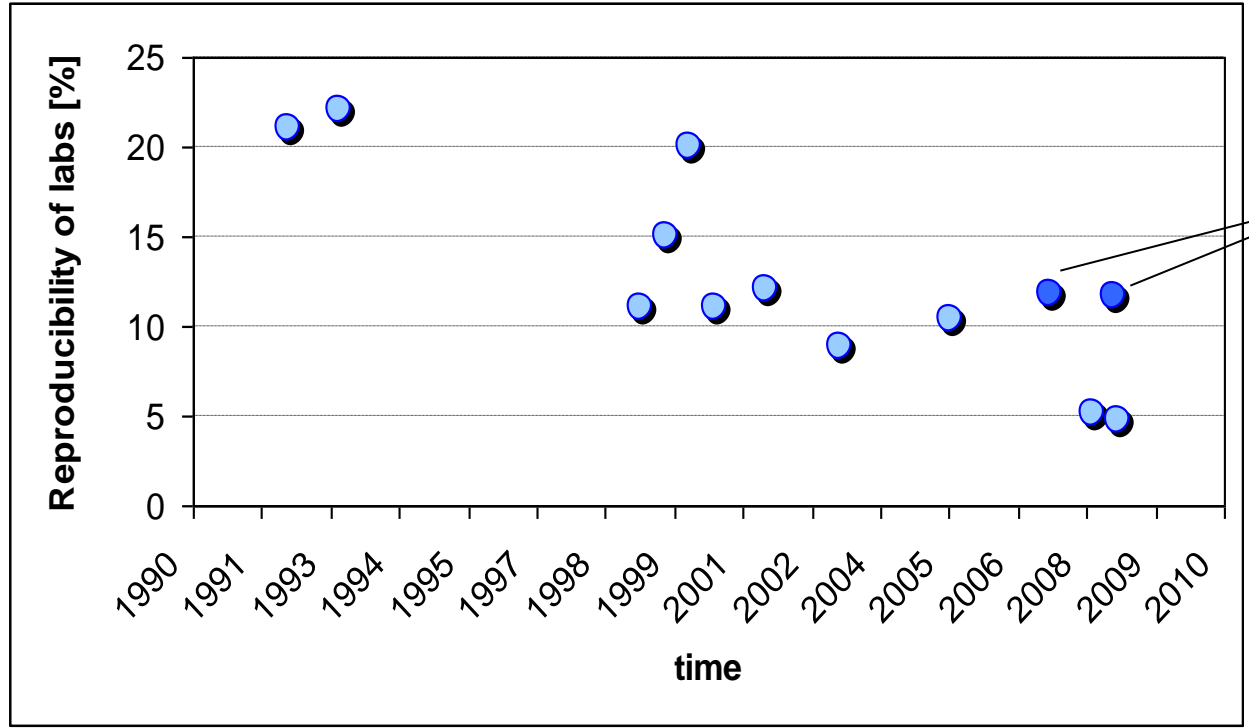
In collaboration with WHO CC at UBA (D)

Joint
Research
Centre





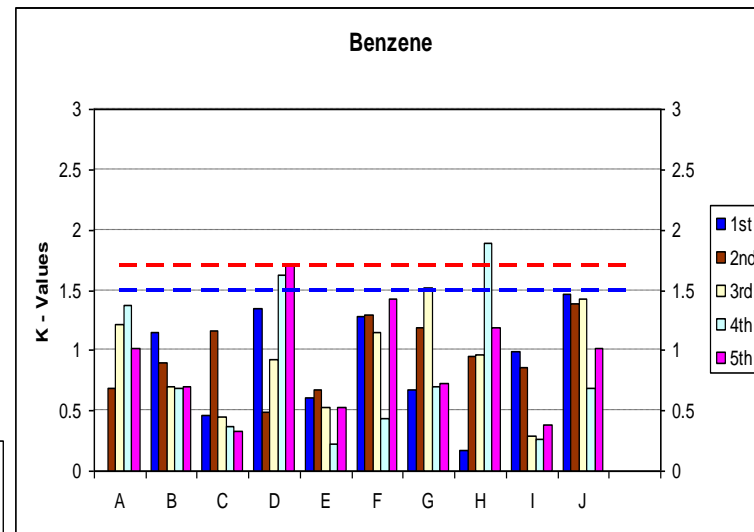
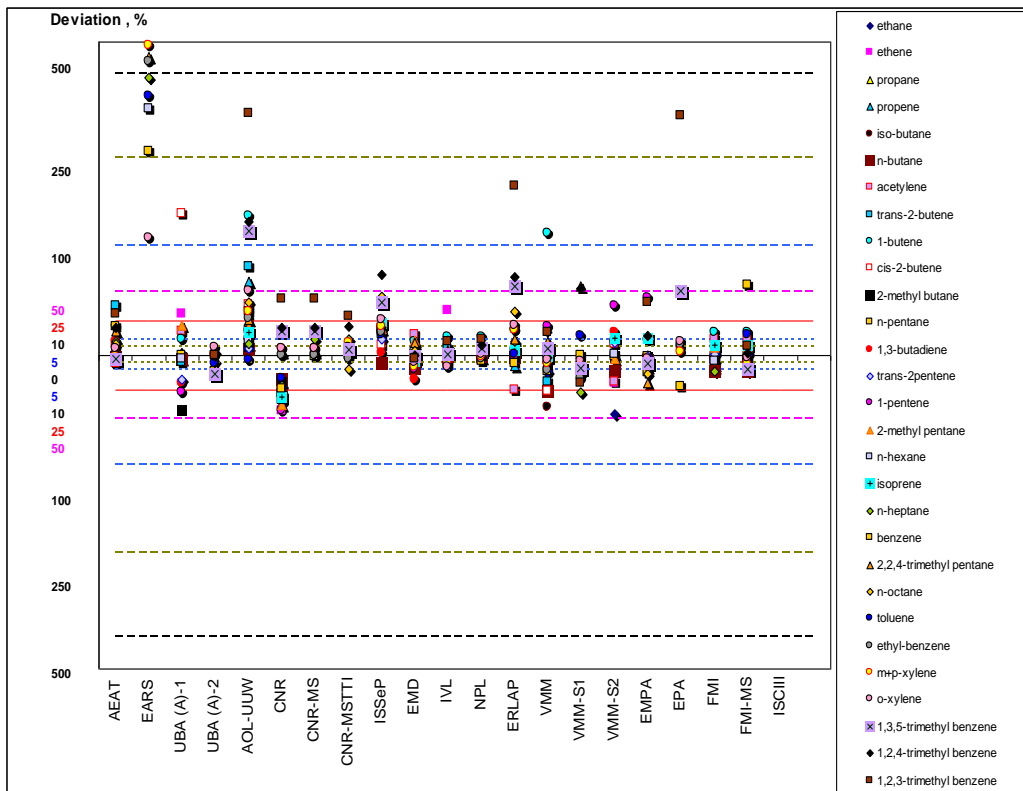
Example NO₂



High proportion of new members

Average reproducibility of participating national reference laboratories for NO₂ measurements

Intercomparison exercises *organic* gaseous compounds










**Example intercomparison
BTX - generated on ERLAP
bench**

**Example VOC round robin
test – circulating special gas
cylinders**

1st metals intercomparison



<p>S₁, liquid CRM, Calibration bias Repeatability/ reproducibility</p>	<p>S₂, digested dust CRM  ↓ JRC</p>	<p>S₃, dust CRM, 10 mg Digestion (dust matrix) Calibration bias</p>	<p>S₄, digested filter, 117 ng/m³  ↓ JRC</p>	<p>S₅, filter, 55 ng/m³ Digestion (filter matrix), DQO Repeatability/ reproducibility</p>
				

1st metals intercomparison




S4/S5/S6 PM10 filters

DIGESTION AND ANALYTICAL METHODS

Digestion

- Microwave, HNO₃, H₂O₂ (EN 14902)
- Hot plate with concentrated HF then Microwave, HNO₃, H₂O₂ (1 lab)
- Soxhlet extraction (1)
- High pressure digestion (1)

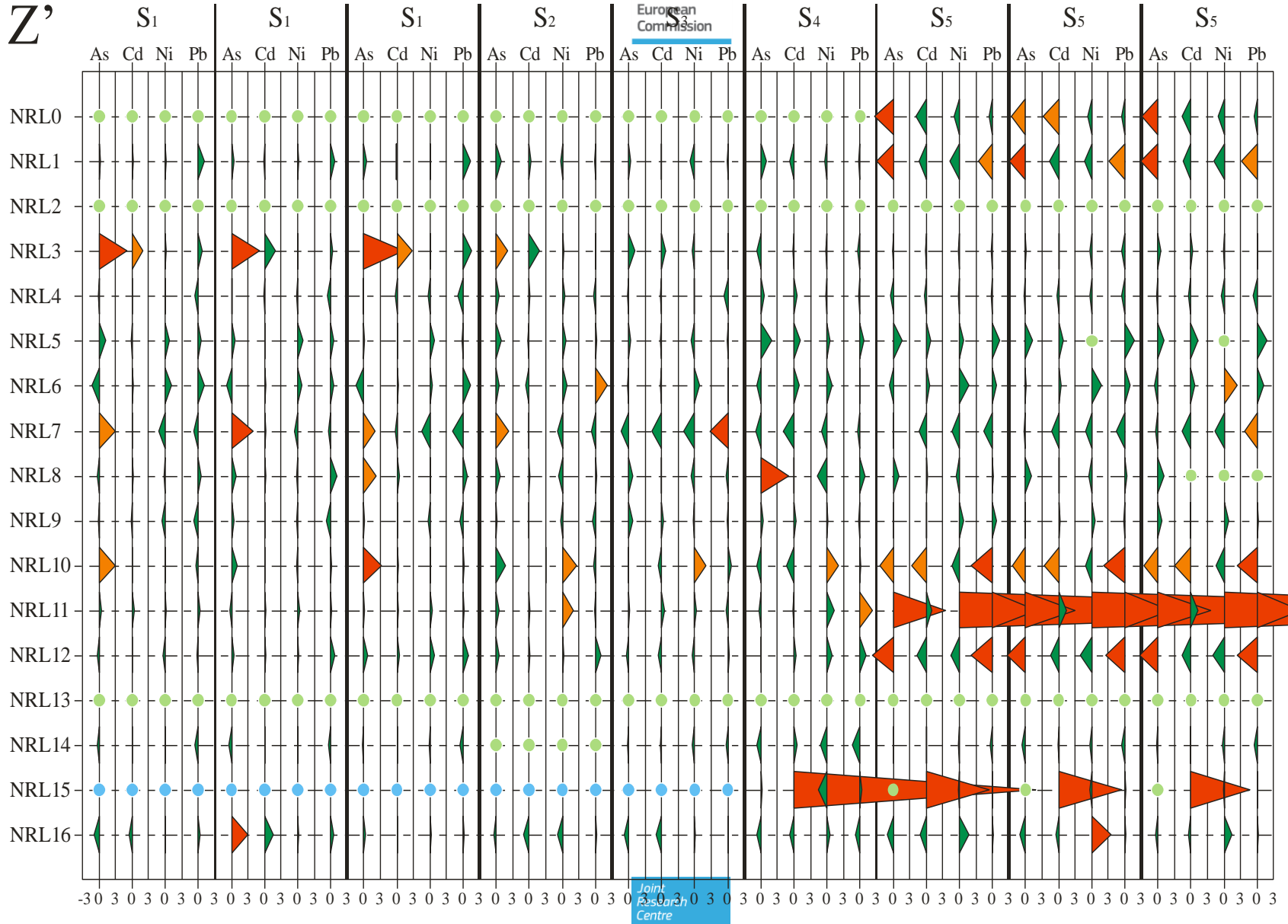
Analysis

- 
- ICP-MS (11)
 - GF-AAS (5)
 - ICP-OES (1 for Cd, Pb, Ni)
 - Voltammetry (1)
 - WD and ED-XRF (1)

1st metals intercomparison



Z'



Repeatability, Reproducibility for S₅

	All results		Outliers discarded	
	r	R	r	R
As	31%	183%	19%	46%
Cd	15%	181%	9%	54%
Ni	66%	620%	7%	68%
Pb	7%	98%	6%	41%

1st PAH intercomparison



Summer F21

T = 22.8 C

HR = 63 %

O₃ = 70 ppb

PM₁₀ = 24.3 µg/m³

PM_{2.5} = 16.7 µg/m³

Volume (m³) = 1590

Period 27-28/8/2009

Winter F30

T = 7.28 C

HR = 87 %

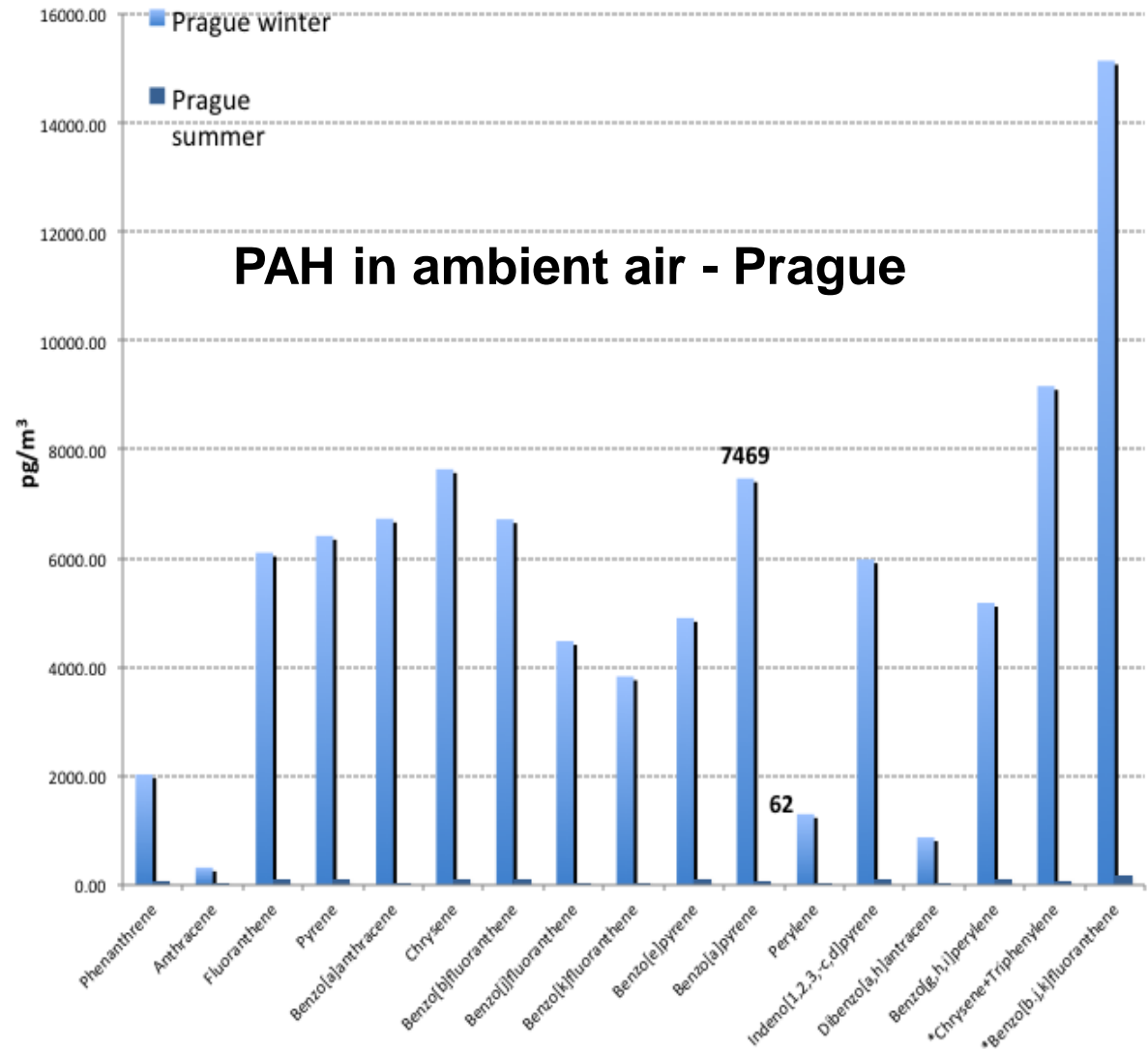
O₃ = 5 ppb

PM₁₀ = 89

Pm_{2.5} = 64

Volume (m³) = 1708

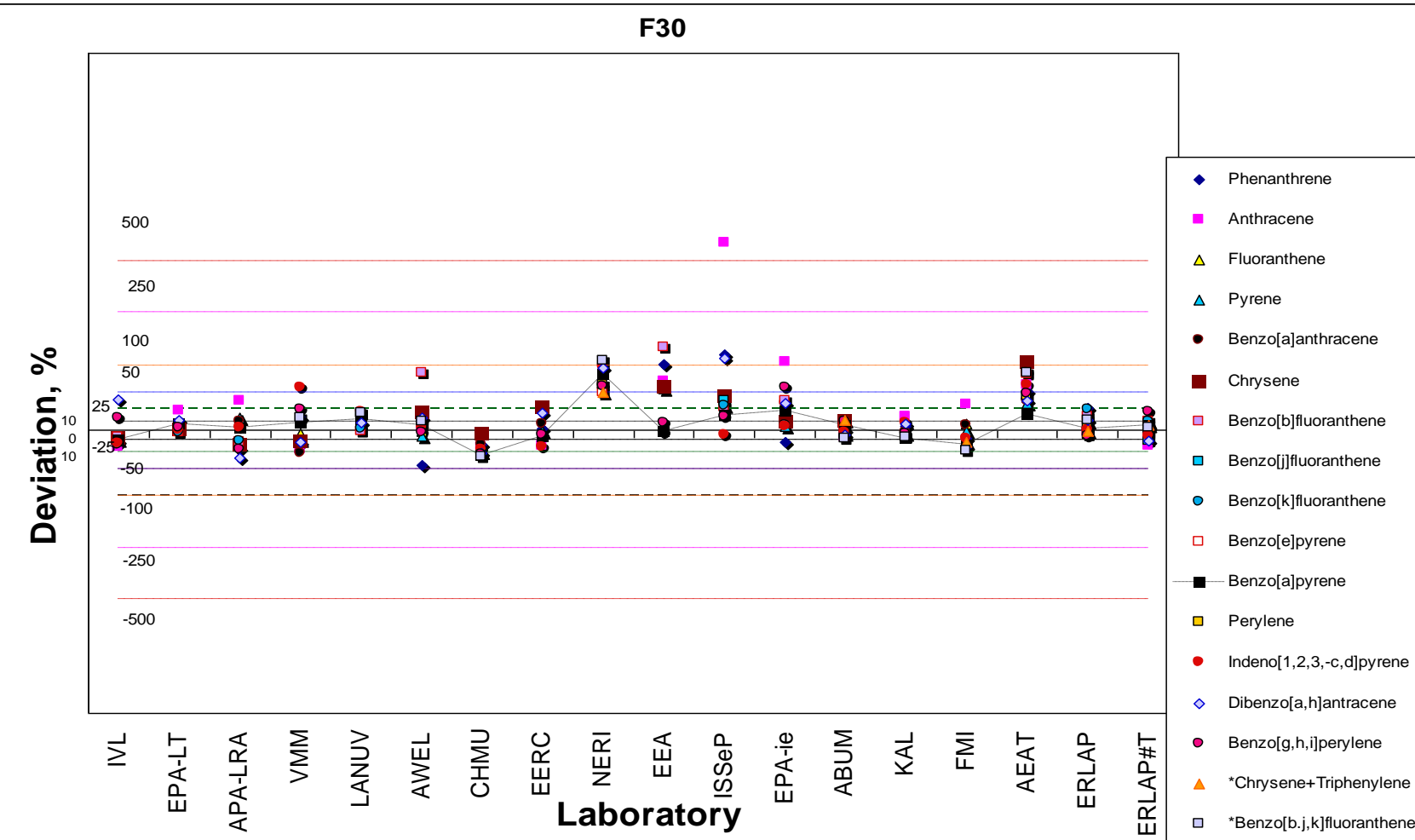
Period 21-22/11/2009



1st PAH intercomparison



PRAGUE WINTER 16 PAH=79.14 ng/m³, 7.47 ng/m³ of BaP, Sampled Volume= 49.9 m³

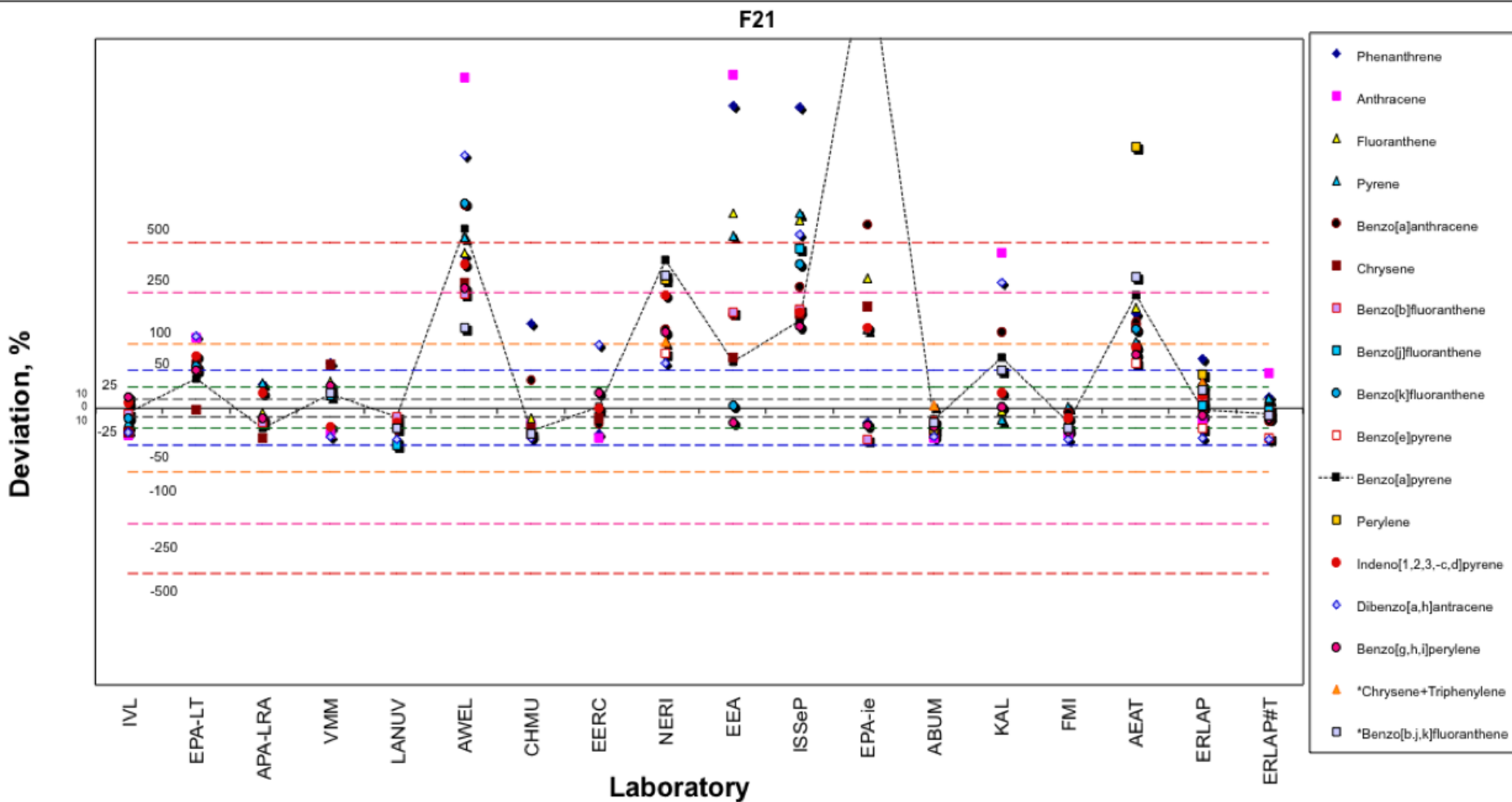


T= 7.3 ° C, HR= 87 %, O₃= 5 ppb, PM10 = 89µg/m³, PM2.5 = 64 µg/m³

1st PAH intercomparison

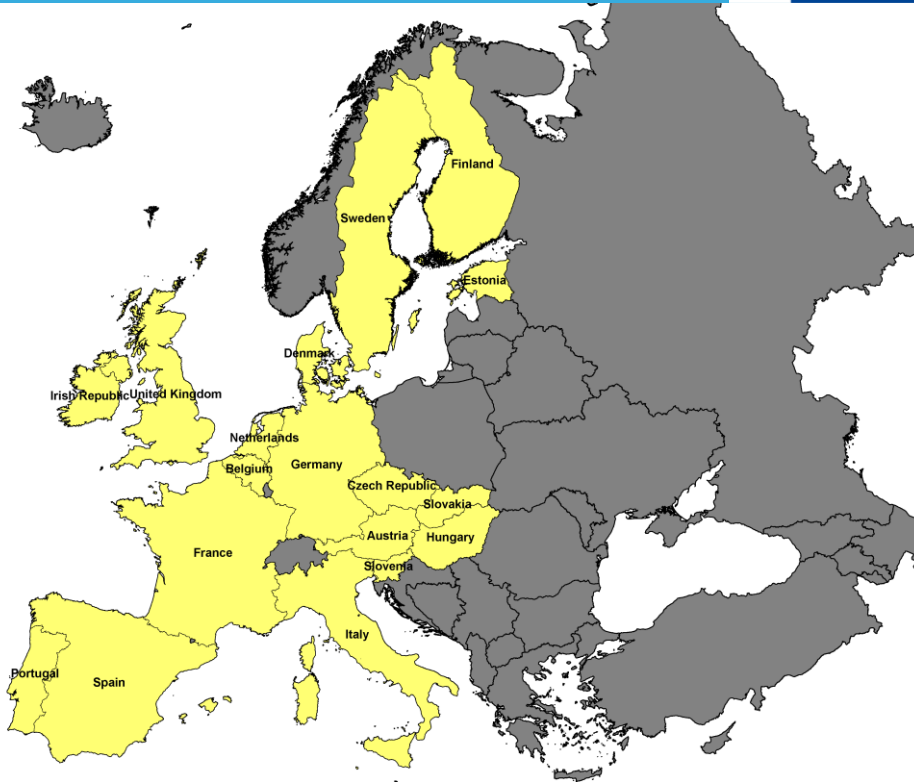


PRAGUE SUMMER 16 PAH= 1.15 ng/m³, 62 pg/m³ of BaP , Sampled Volume= 46.5 m³



T= 22.8 ° C, HR= 63 %, O₃= 63 ppb, PM10 = 24 µg/m³, PM2.5 = 17 µg/m³

PM QA/QC



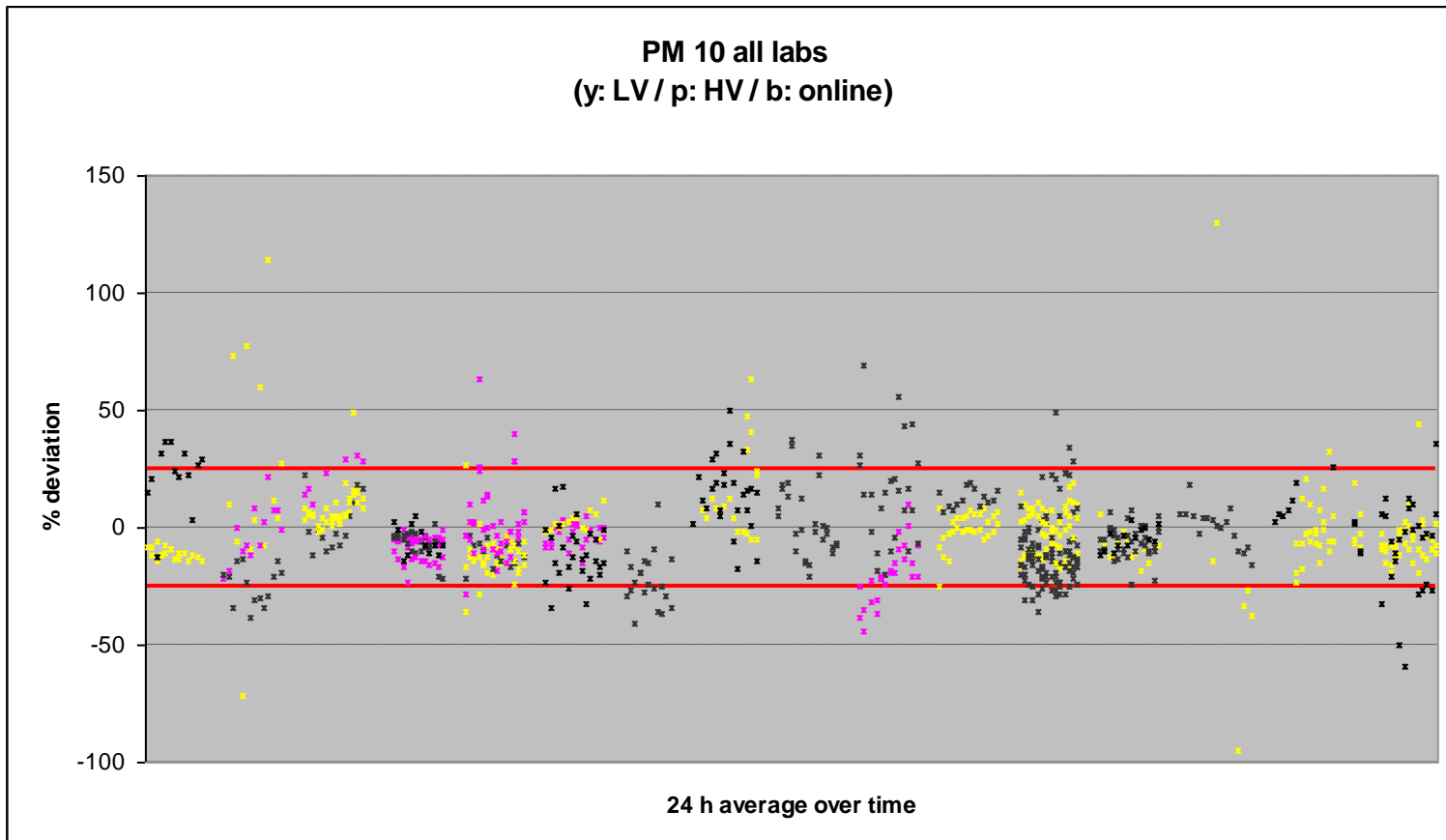
2006 – 2009: JRC mobile PM laboratory equipped with EN reference instrumentation carried out 17 parallel measurement campaigns



PM QA/QC



- Provide information on comparability of PM measurements (MS, reference, equivalent)
- Check performance of NRL & routine monitoring network
- Implementation and validity of correction factors
- Performance LV, HV, automatic instruments, info filter material and filter blanks, ...





JRC Inter-comparison for Receptor Models

Kick-off Workshop in Ispra (4th-5th November 2010)

Step 1

Survey of receptor models suitable for the purposes of the inter-comparison
Identification of the pollutants and metrics to test, according to the needs and to the most up-to-date technical developments.

Revision of the methodologies for uncertainty estimation and expression

Definition of criteria for the assessment of model performance

Discussion about the feasibility of a Common Protocol for source apportionment (including quality assurance procedures, validation criteria and quality standards)

Step 2

Carry out an Inter-comparison between the involved research groups by applying the Harmonized Protocol and other widely accepted techniques to one or more common databases.

Evaluate the outputs according to quality criteria and assess the influence of critical variables

Check the influence of different scientific backgrounds/ approaches in source identification.

Use the results of this exercise to set up common standards for the interpretation of receptor model outputs and to draft a common protocol to be used for obligations under AQD.

Results of the European Intercomparison exercise for Receptor Models 2011-2012. Part I. **Report EUR 25727 EN**

3rd Workshop in Ispra (27th-28th February 2013)

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Network Members: 37 National Reference Laboratories from the 27 Member States & EFTA

Observers: Turkey, Croatia, Macedonia, Serbia

<http://ies.jrc.ec.europa.eu/aquila-homepage.html>

annette.borowiak@jrc.ec.europa.eu

AQUILA: Members



<http://ies.jrc.ec.europa.eu/aquila-project/members.html>

AQUILA Members - EU-27 & EFTA

Country	Institute	Contact	Website	Country	Institute	Contact	Website
Austria	Umweltbundesamt	Marina Froehlich	http://www.umweltbundesamt.at	Luxembourg	Adm. de l'Environnement	Serge Soleigna	http://www.admenviro.lu/public/index.html
	Obersteiermärkische Landesregierung	Walter Gabroysh	http://www.land-obersteiermark.gv.at/	Malta	Malta Environment & Planning Authority	Michael Nolle	http://www.mepa.org.mt/
Belgium	IRCEUCOLINE	Philippe Maetz	http://www.irceline.be	Poland	Chief Inspectorate for Environmental Protection		http://www.glos.gov.pl/
Bulgaria	Executive Environmental Agency	Milena Panayova	http://nfp-bp.ekonet.eu/info/eed/eng/index.html	Portugal	Instituto do Ambiente National R & D Institute for Environment Protection	João Mateus	http://www.ambiente.pt/
Czech Republic	Czech Hydrometeorological Institute	Jiri Novak	http://www.chmi.cz	Romania			http://www.iom.ro
Cyprus	Ministry of Labour and Social Insurance	Savvas Kleanthous	http://www.airquality.dl.mil.gov.cy/	Slovakia	Slovak Hydrometeorological Institute	Ladislav Ronchelli	http://www.chmi.sk/
Denmark	NERI	Claus Nordstrom	http://www.dma.dioforde_an.asp	Slovenia	Environmental Agency of the Republic of Slovenia	Tanja Bolte	http://www.arn.gov.si/
Estonia	Estonian Environmental Research Centre	Toivo Traut	http://www.kitab.ee	Spain	ISCIII	Saul Garcia Dos Santos	http://www.isciii.es/isciii/
Finland	FINI	Jari Walden	http://www.fini.fi	Sweden	MIL	Eva Bronstrom-Lunden	http://www.mil.se/
France	LCSQA-EMD	Francois Mathe	http://www.ansp-lcsqa.fr/		ITM	Hans Aarekoug	http://www.itm.se/sem/index.html
	LCSQA-NERIS	Olivier Favre	http://www.lcsqa.fr	The Netherlands	RIVM	Theo Hafkenscheid	http://www.rivm.nl/
	LCSQA-LNE	Tatjana Macek	http://www.lcsqa.fr	United Kingdom	ADAT	Brian Stacey	http://www.adat.co.uk/
Germany	LANUV NRW	Ulrich Pfeiffer	http://www.lanuv.nrw.de/		NPL	Paul Guiney	http://www.npl.co.uk/air/environment
	Umweltbundesamt	Klaus Wirtz	http://www.umweltbundesamt.de/	Norway	NEU	Kjersti Karlsen Toemkist	http://www.neu.no/
Greece	Ministry of Environment		http://www.mhenv.gr	Switzerland	EMPA	Robert Gehrig	http://www.empa.ch
Hungary	Hungarian Meteorological Service	Viktor Danyi	http://www.kvvm.hu/kvvm		BAFU		http://www.umwelt-schweiz.ch
Ireland	EPA	Barbara O'Leary	http://www.epa.ie	European Commission	DG Joint Research Centre	Annette Borovskak	http://ies.jrc.ec.europa.eu/
Italy	CNR	Rosanna Mabita	http://www.iaa.cnr.it		DG Environment	Andrej Koba	http://ec.europa.eu/environment/air
	ISPRA	María Belli	http://www.isprambiente.it				
Latvia	Latvian Hydrometeorological Agency		http://www.meteo.lv				
Lithuania	Environment Protection Agency	Jozas Nolle	http://www.epa.lt/				

and: associated members & observers



Article 3 (2008/50/EC): Responsibilities

For the implementation of this Directive, the Member States shall designate at the appropriate levels the competent authorities and bodies responsible for:

- Assessment of ambient air quality,
- Approval of measurement systems (methods, equipment, networks, laboratories),
- Ensuring accuracy of measurements,
- Analysis of assessment methods,
- Coordination on their territory of Community-wide quality assurance programmes organized by the Commission,
- Cooperation with other MS and the EC.

Where relevant competent bodies shall comply with Section C of Annex I:

QA/QC at national and EU level, traceability, accreditation according to EN/ ISO 17025



Role and tasks of National Reference Laboratories

Verifying and supporting the correct implementation of AQDs, by:

- **Implementing a quality system in the laboratory**
- **Approving measurement systems (instruments, laboratories, networks)**
- **Ensuring the traceability of the measurements at national level, by providing/certifying reference materials to networks**
- **Organizing intercomparisons/round robin tests at national level**
- **Participating in EC QA/QC programmes**
- **Exchanging information through the organisation of training sessions, workshops, conferences and guidance documents**

“AQUILA's role and the tasks of a NRL” has been approved by DG ENV's "Air Quality Committee" in 2009 (download of document 'roles & requirements' from ENV or AQUILA website).

AQUILA: structure



- **Steering committee: chair, vice-chair and co-chairs**
- **Election of chair and vice-chair (4 years)**
- **Co-chair: DG ENV, JRC-IES (4 years)**
- **Secretariat: JRC-IES**

Chair

**F. Mathe
EMD, FR**

Vice - chair

**J. Walden
FMI, FI**

Senior advisor

**P. Woods,
NPL, UK**

Co - chair

**D. Buzica
DG ENV**

Co - chair

**A. Borowiak
JRC**

AQUILA: meetings



1st meeting: December 2001



20th meeting: 22/23 April 2013



focussing on, e.g.:

- Accreditation of NRL's
- Common PM equivalence tests
- Development of CRM
- Training on measurement uncertainty
- PM_{2.5} measurement uncertainties
- *Review of EU policy*





Examples of AQUILA's activities:

PM QA/QC campaign (2006 - 2009)

VOC round robin test (2009)

Co-Organisation of conferences and workshops

JRC Intercomparison exercises in collaboration with
WHO and AQUILA

Production of documents/papers to topics of interest
(e.g. guidance on equivalence)

Contribution to implementation of AQ Directives (e.g.
uncertainty of PM_{2.5} measurements to evaluate AEI)

AQUILA recommendations to review of TSAP 2013

Thank you!