

Mechanisms to ensure that data is internationally comparable

Air Quality Measurement Seminar

Monday 9th July 2007

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Background – what are we trying to do?

EU law – when are measurements acceptable?

Particles – a special mention

What are we trying to do?

or

I calibrate my analyser, what more is there?

Is my annual average NO_2 39 or 41 $\mu\text{g}/\text{m}^3$?

Have the measurements been nudged towards 39 $\mu\text{g}/\text{m}^3$?

Is my average ozone decreasing by 1 $\mu\text{g}/\text{m}^3$ per year?

Is the trend real or does the sample line need changing?

Are my PM_{10} concentrations higher than in Bloomsbury, or Birmingham, or Budapest?

Are we talking about the same sort of PM_{10} ?

What are we trying to do?

or

I calibrate my analyser, what more is there?

Many answers already exist:

Standardised methods

- or methods demonstrated to be equivalent

Traceable calibrations

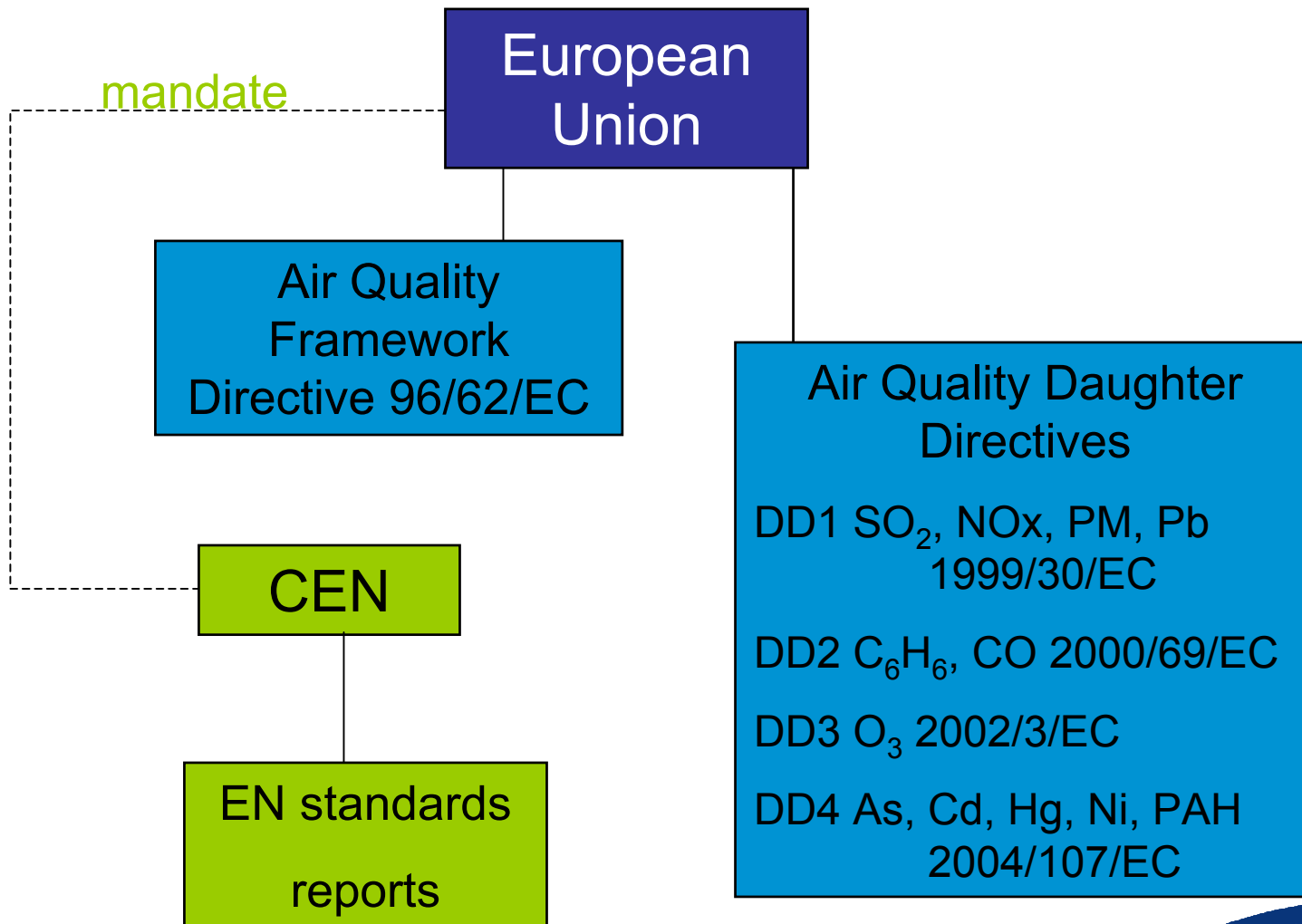
- linked by a chain to national and international standards

Assessment of measurement uncertainty

- even the best measurements have uncertainty

+ organisations

The EU Ambient Air Directive Requirements



The Framework Directive

says there will be:

- limit values
- reference measurement methods
- data quality objectives (uncertainties)
- certification of equipment
- national reference laboratories
- accreditation
- intercomparisons (national & EU)

The Daughter Directives

- define limit values, alert thresholds, and upper and lower assessment thresholds, for all the pollutants
- provide data quality objectives (DQOs), eg. data capture and data accuracy (uncertainty): eg $\pm 15\%$ for NO_2 , $\pm 25\%$ for PM_{10}
- define the reference method principle

Delegated to CEN

- How is uncertainty calculated in practice? What is included? How is it justified?

Ad hoc group, CEN Report CR 14377 Jan 02

- How are reference methods to be implemented?
- What performance is required from instruments?
- What ongoing QA/QC is required?

Working Groups of CEN TC 264; EN standards

- How can instruments be approved; by whom?

CEN plus MCERTS, TUV etc

CEN standards eg EN 14211 for NO_x

Ambient air — Standard method for the measurement of the concentration of nitrogen dioxide and nitrogen monoxide by chemiluminescence

Luftqualität — Messverfahren zur Bestimmung der Konzentration von Stickstoffdioxid und Stickstoffmonoxid mit Chemilumineszenz

Qualité de l'air — Méthode normalisée pour la mesure de la concentration en dioxyde d'azote et en monoxyde d'azote par chimiluminescence

Each standard has the following components:

1. Methods and concentration range of application, including sampling requirements
2. Instrument performance characteristics required, and type approval tests to demonstrate compliance
3. Tests following installation at a specific site
4. On-going QA/QC procedures during use

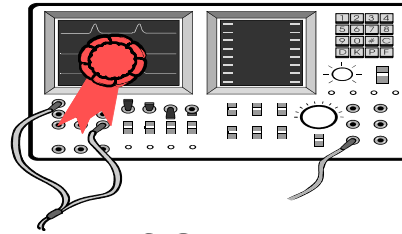
CEN QA/QC requirements

Sets of tests to ensure that the uncertainty of the measurements CONTINUE to meet the requirements, including checks of:

- linearity
- zero and span stability
- stability of site calibration gases
- manifold contamination

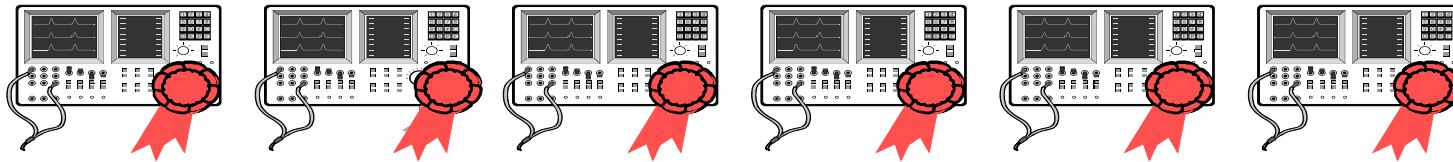
Accreditation

NPL

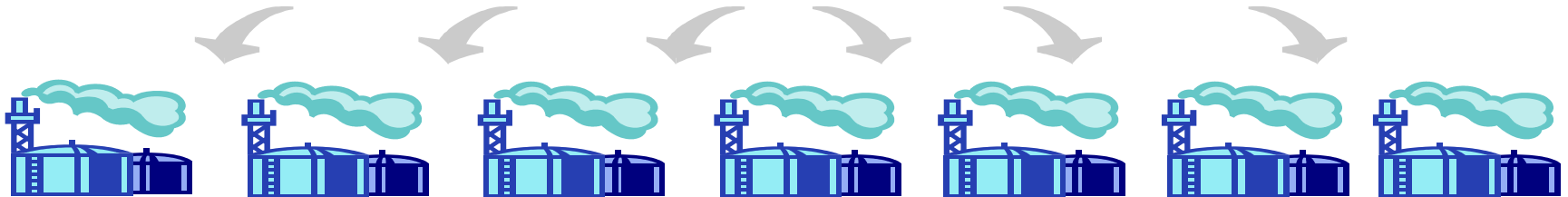


Research & Development of Standards
>5,000 calibrations pa

Since 1996
mostly accredited
to ISO 17025
(within ISO 9001)



~400 ISO 17025 (UKAS) Accredited Laboratories
>700,000 calibrations pa



Industry and Other Users
1,000,000,000s of traceable measurements pa


Accreditation

Quality system + non-technical assessment = ISO 9001 certification

- for an organisation

ISO 9001 + external expert assessment = ISO 17025 accreditation

- for specified calibrations and tests (formerly NAMAS)

 0478 Accredited to ISO/IEC 17025:2005	Schedule of Accreditation issued by United Kingdom Accreditation Service 21 - 47 High Street, Feltham, Middlesex, TW13 4UN, UK
	National Physical Laboratory Issue No: 042 Issue date: 15 May 2007
Calibration performed by the Organisation at the locations specified	

NPL's field accreditation

Measured Quantity Instrument or Gauge	Range	Best Measurement Capability Expressed as an Expanded Uncertainty ($k=2$)	Remarks	Location Code
INSTRUMENTS FOR AIR QUALITY MONITORING				
Analysers Calibration	NO _x 200 ppb to 2 ppm SO ₂ 150 ppb to 1 ppm O ₃ 30 ppb to 1 ppm CO 0.5 ppm to 45 ppm	4%	Two point (zero and span) calibration. An assessment of uncertainty due to analyser repeatability and linearity is also undertaken.	Customers' sites
Determination of on site standard concentration	NO _x 200 ppb to 2 ppm (NO and NO ₂) SO ₂ 150 ppb to 1 ppm CO 0.5 ppm to 45 ppm	4%		
NO ₂ molybdenum converter efficiency test	100 to 250 ppb NO ₂	1.5%	Reaction of NO with O ₃	
Sample system collection efficiency	NO ₂ 50 to 150 ppb SO ₂ 50 to 150 ppb O ₃ 50 to 150 ppb CO 6 to 12 ppm	1.5% absolute 1% absolute 1.5% absolute 1% absolute		
Analysers span noise test	Range as analyser calibration	2 ppb		
Analysers zero noise test	NO _x , NO, SO ₂ , O ₃ , CO	1 ppb		
Particulate analyser calibration	0 to 1 mg.m ⁻³	1.5%	Using 4 pre-weighed masses	
Particulate analyser flow rate test	1 slm to 10 slm 10 slm to 40 slm	1.5% 2%	Volumetric and mass flow	

Intercomparisons

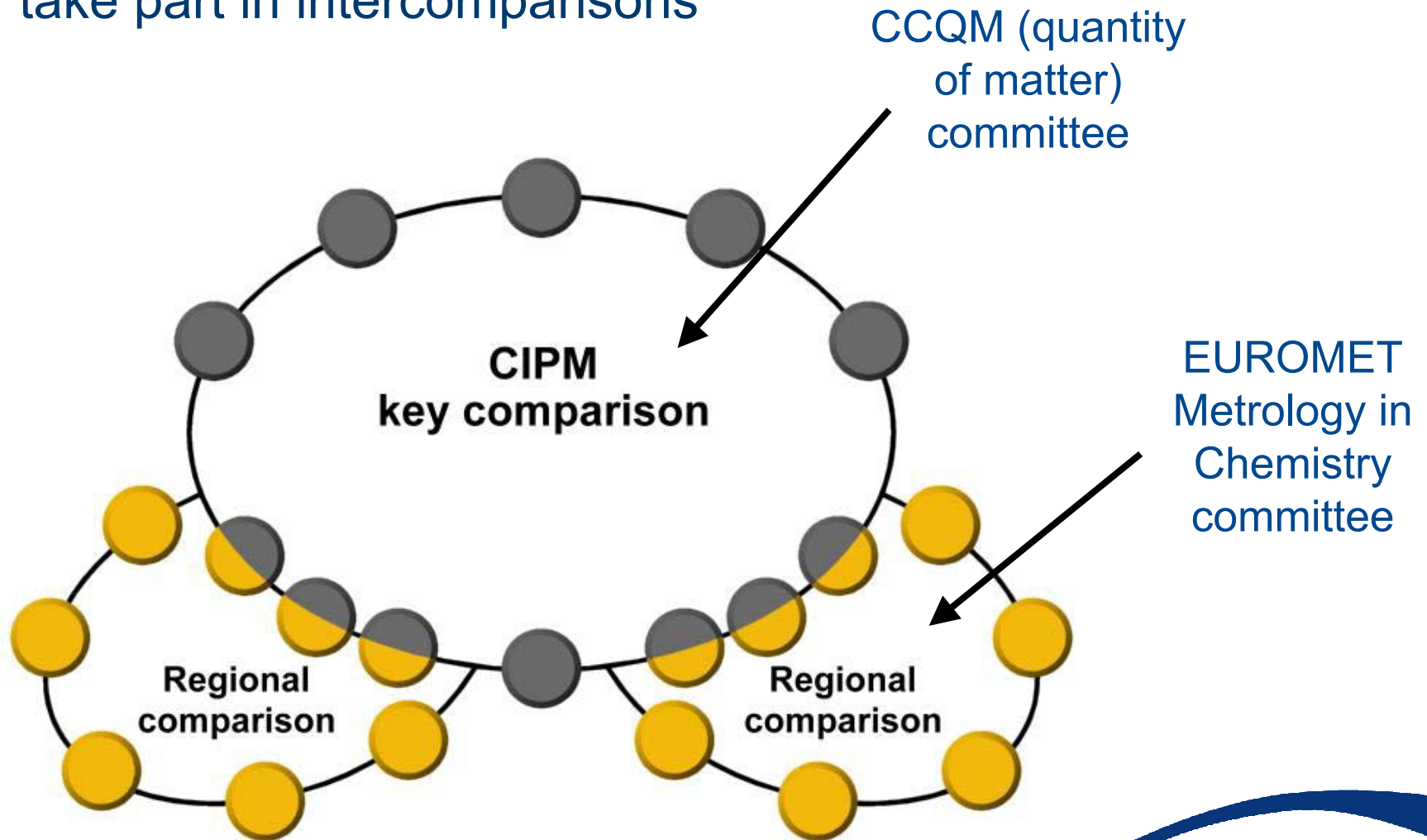
There are 2 distinct types for AQ-related measurements:

National Measurement Institutes - NPL in the UK
Compared through CCQM (global), EUROMET (European)

National Reference Laboratories – NPL and AEAT in the UK

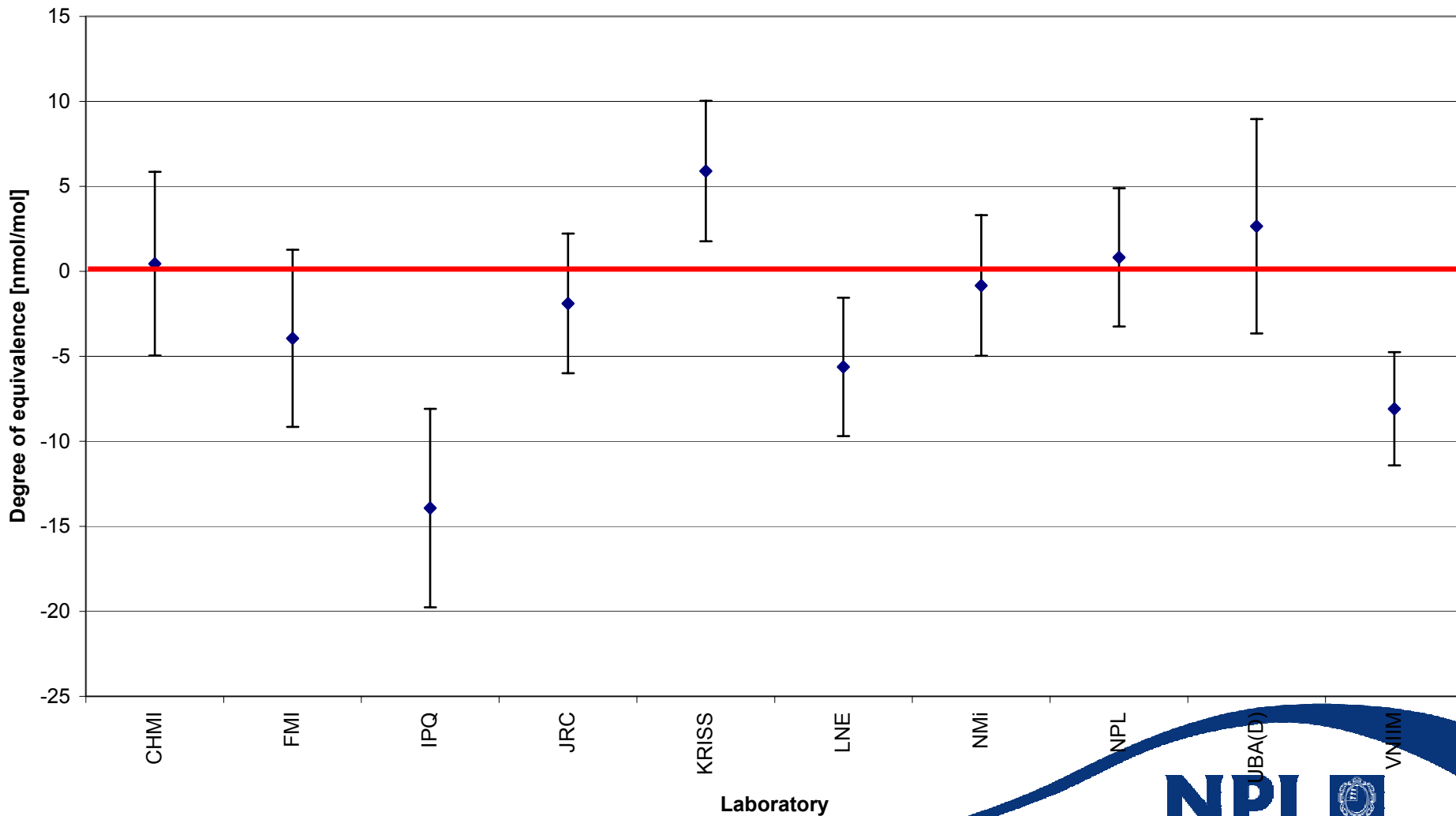
EU comparisons organised by Joint Research Centre at Ispra

Even National Measurement Labs
are not taken seriously unless they
take part in intercomparisons



CCQM example – SO₂ at 280 ppb (2005-6)

CCQM-K26b SO₂ - Degrees of Equivalence of Individual Laboratories



The role of AQUILA – Network of European Air Quality Reference Laboratories

Secretariat JRC Ispra

to enhance monitoring methods, and harmonise QA/QC

to provide expert advice to the Commission

to provide advice to new NRLs and others (eg EEA, WHO)

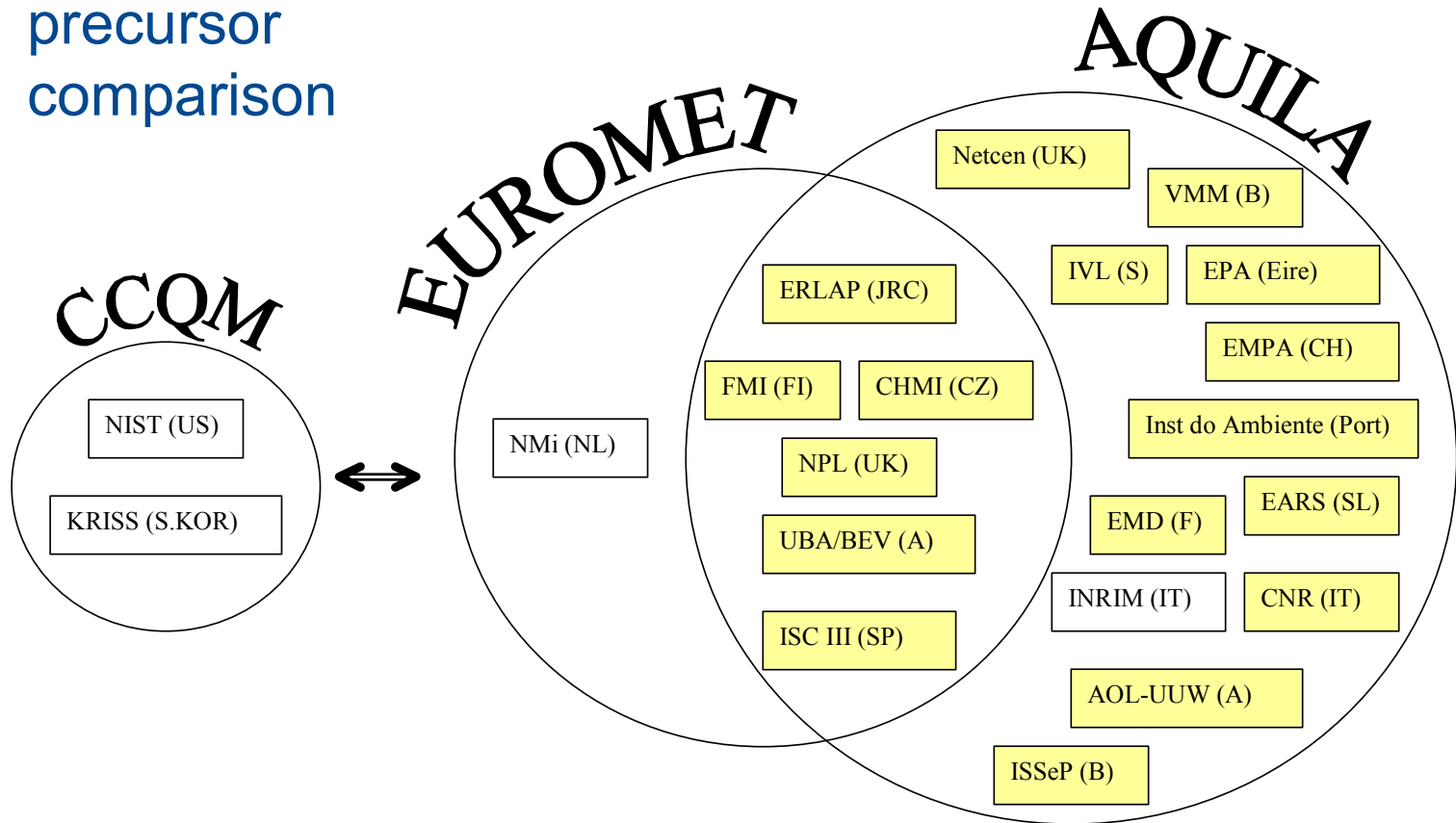
to provide technical liaison with Competent Authorities (eg Defra)

to coordinate inter-comparison exercises

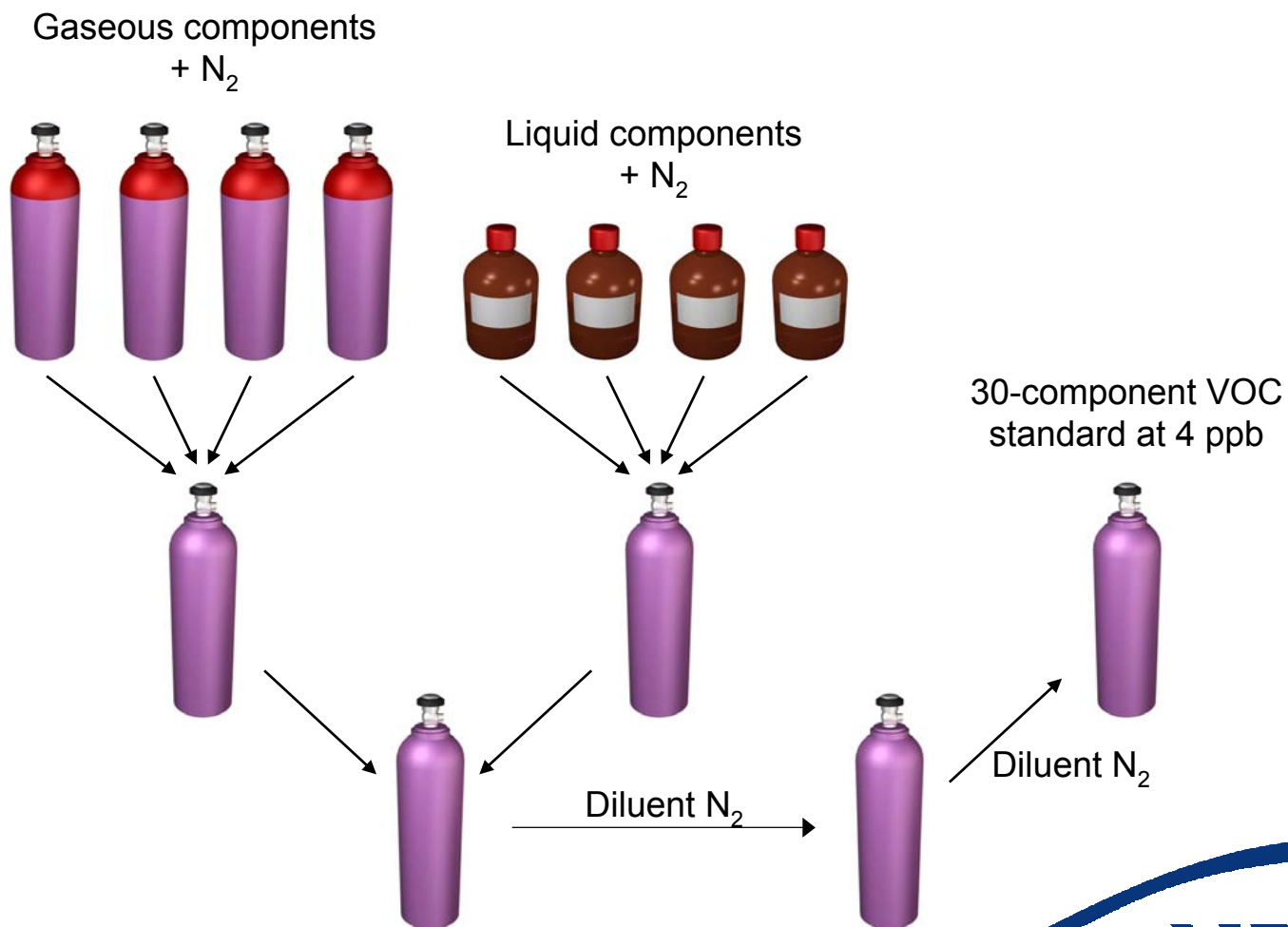
to collate data relevant to CEN standards

Joint EUROMET/AQUILA comparison 2007

Ozone
precursor
comparison

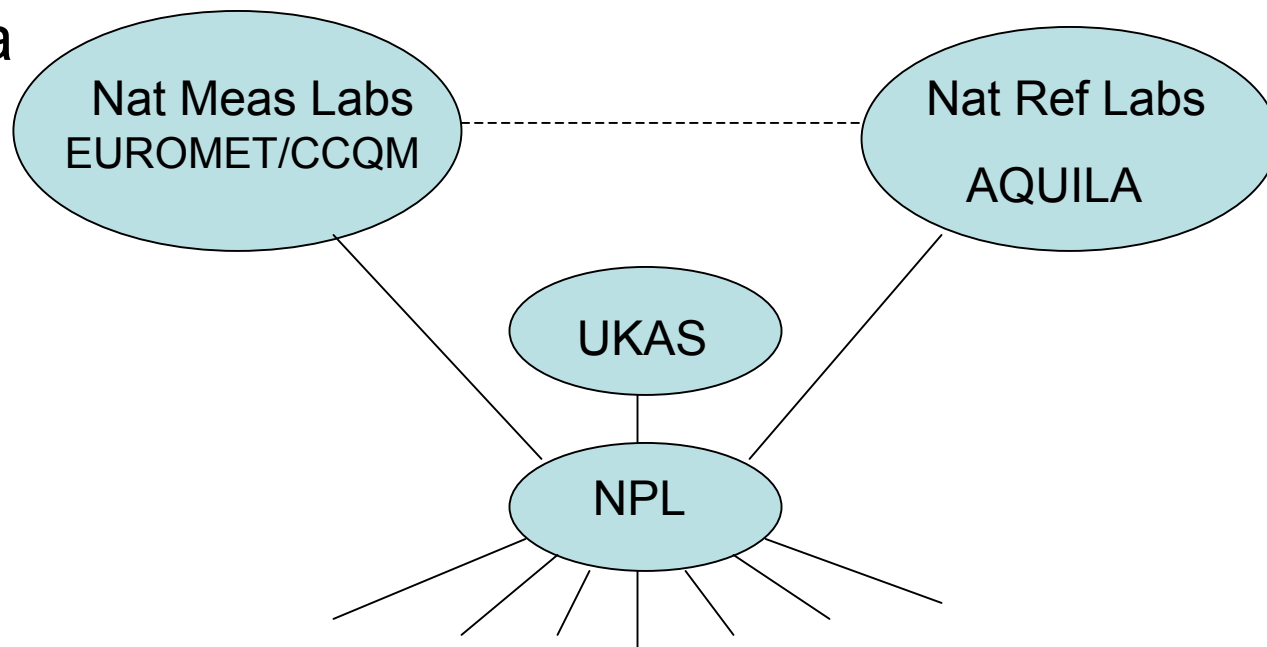


30 components, 1-10 ppb, in N₂ and real air



Summary so far:

There are many international rules and organisations whose job is to improve air quality data



Involvement of an accredited AQUILA member is necessary for data to be acceptable to the EU

It is also a simple way help ensure that data is as accurate and useful as possible

PM is different

The only CEN standards are for manual filter weighing:

EN 12341 for PM_{10} ; EN 14907 for $PM_{2.5}$

There are no CEN standards, performance requirements, or QA/QC for automatic methods like TEOM and BAM

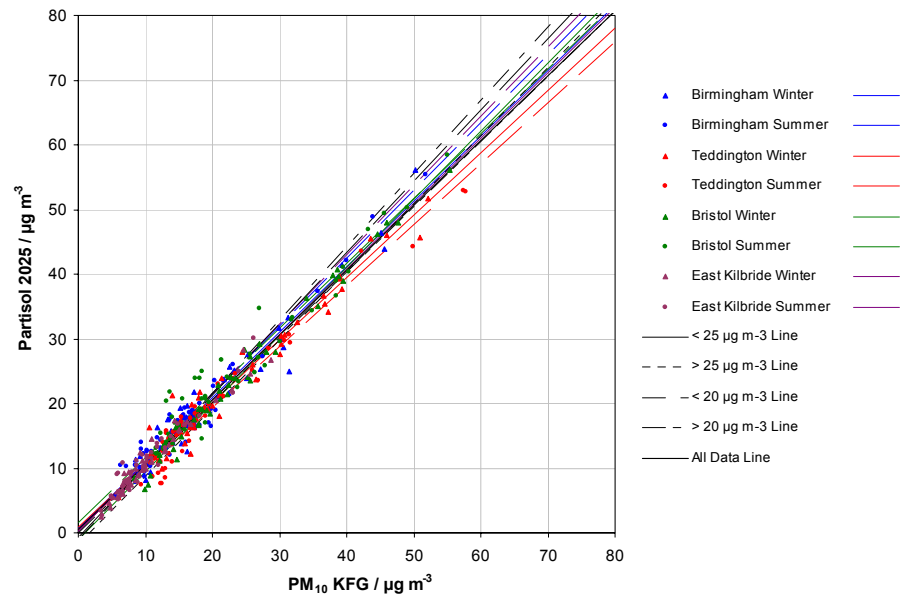
Main current document: Guidance for Equivalence

The position for PM

Demonstrations of Equivalence are in progress across Europe

EN 12341 (PM₁₀) is being revised by CEN

QA/QC procedures, and a mechanism for approval of automatic PM monitors, are just starting, also in CEN



Thank you