



European Commission

# Inorganic gaseous pollutants proficiency testing scheme within EU Air Quality measurement programme

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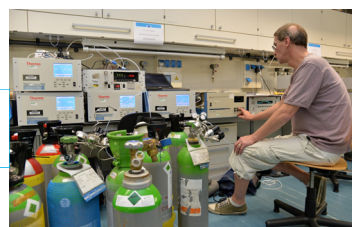
## INTRODUCTION

The European Commission's Joint Research Centre is operating the European Reference Laboratory for Air Pollution (ERLAP). ERLAP is supporting the development and validation of new assessment methods and the harmonised implementation of measurement requirements of current air quality legislation.

The Ambient Air Quality Directive (2008/50/EC) sets a framework for an harmonised assessment of air quality in Europe, requiring common methods and setting minimum data quality objectives and criteria. ERLAP organizes Proficiency Tests (PTs) to assess and improve the status of comparability of measurements between the National Reference Laboratories (NRLs) of each Member State of the European Union.



Pictures of PTs at ERLAP



## Proficiency Test

PT activity in ERLAP started in the early 90's with selected air pollutants, and is since several years being regularly carried out for the inorganic gaseous pollutants.

The objectives of these laboratory comparisons are to evaluate the repeatability and reproducibility of the measurements, to control the accuracy of the national reference standards for the measurements of sulphur dioxide (SO<sub>2</sub>), carbon monoxide (CO), ozone (O<sub>3</sub>) and oxides of nitrogen (NO/ NO<sub>2</sub>), through this to improve the comparability of the reference measurement methods used in the Member States.

Gas mixtures containing varying concentrations of SO<sub>2</sub>, CO, NO/NO<sub>2</sub> and O<sub>3</sub> are generated into a 20 m glass tube to which the participants connect their instrumentation. During the PT, which lasts usually 3-4 days, the participants measure with their automatic analysers calibrated versus their own travelling standards. All the European NRLs, joined in the AQUILA Network [2], are obliged to participate to the PTs, which are carried out in line with ISO/IEC 17043.

The results of PTs for inorganic gaseous pollutants which took place from 2003 to 2013 are here described and evaluated.

## EVALUATION

During the PTs, gas mixtures are prepared by dynamic dilution for SO<sub>2</sub>, CO, O<sub>3</sub>, NO and NO<sub>2</sub> at concentration levels from low to around European air quality limit and target values. The participants data are reported via a web-based interface to JRC.

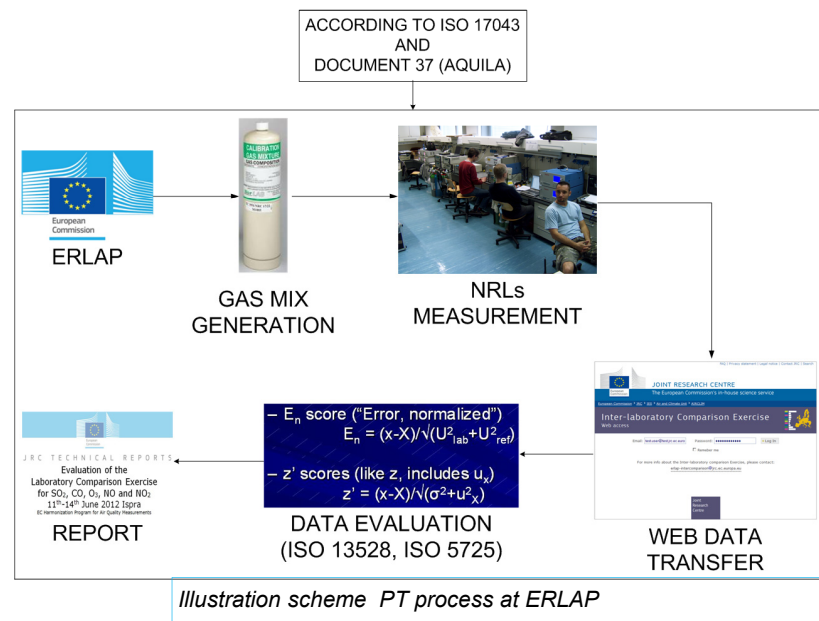


Illustration scheme PT process at ERLAP

All results submitted are evaluated through a series of statistical parameters: z'-score, En-number, robustness of assigned values (ISO 13528); repeatability, reproducibility and outliers with Grubb's test (ISO 5725).

## CONCLUSION

After more than 10 years of PTs the elevated level of expertise reached by the NRLs is confirmed by the high percentage of satisfactory z'-score results.

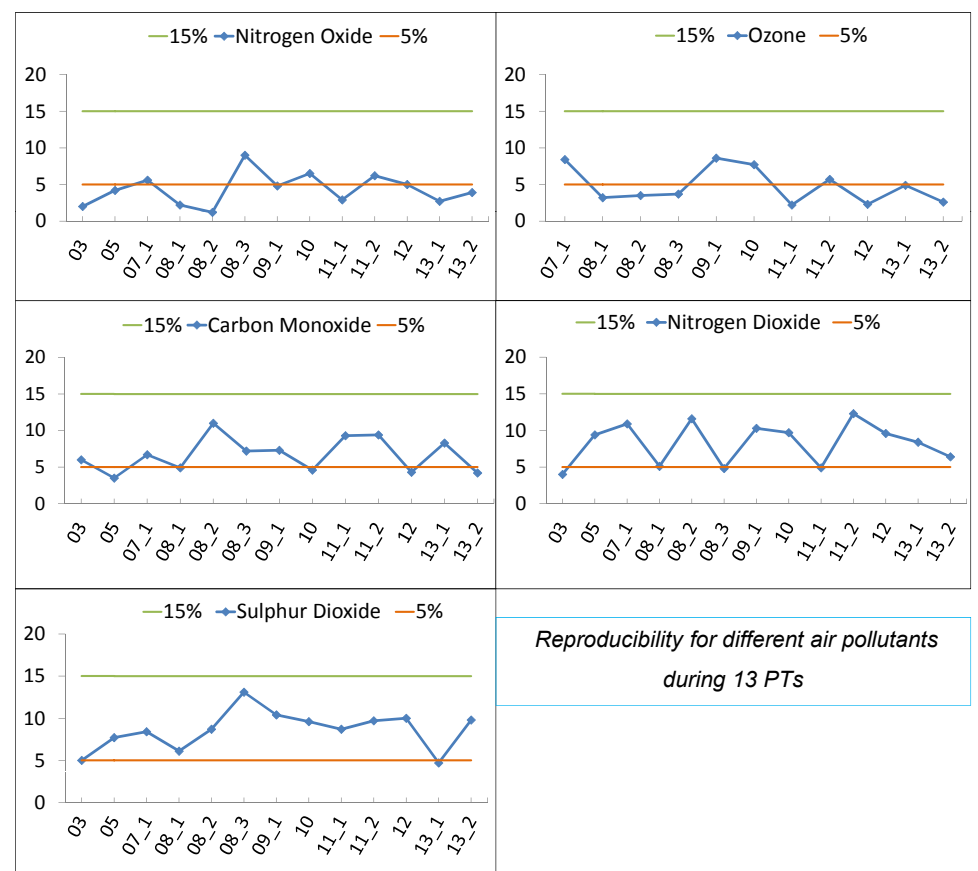
PTs	z'-score		
	Satisfactory (%)	Questionable (%)	Unsatisfactory (%)
April/03	94.2	5.8	0.0
June/05	94.7	2.3	3.0
June/07	97.8	1.9	0.3
April/08	93.8	2.1	4.1
October	92.9	4.2	2.9
October	97.0	3.0	0.0
October/09	98.2	1.8	0.0
June/10	97.0	3.0	0.0
September/11	99.4	0.3	0.3
October/11	98.7	1.3	0.0
June/12	100.0	0.0	0.0
September/13	100.0	0.0	0.0
October/13	99.3	0.7	0.0

z'-score results of 13 PTs at ERLAP

$$z' = \frac{x_i - X}{\sqrt{\sigma_p^2 + U_x^2}}$$

|z'| ≤ 2 satisfactory  
2 < |z'| ≤ 3 questionable  
|z'| > 3 unsatisfactory

All the reproducibility at limit values obtained during the PTs are compared to the maximum permitted uncertainty for calibration requested by the EN methods (EN 14211, EN 14212, EN 14626 and EN 14625) and the Data Quality Objective for measurement results requested by the Ambient Air Quality Directive.



Reproducibility for different air pollutants during 13 PTs

For the inorganic gaseous pollutants the measuring performance is respecting the limits imposed by the Ambient Air Quality Directive.

Due to the "easy" laboratory conditions in which the PTs are carried out and the high expertise of the participants the results show a successful performance for NO and O<sub>3</sub>. For NO<sub>2</sub>, SO<sub>2</sub> and CO the results do not show a stable trend and leave opportunities for discussion and improvement.

## References:

- [1] 2008/50/EC – Directive of the European Parliament and of the Council on ambient air quality and cleaner air for Europe
- [2] AQUILA Network: <http://ies.jrc.ec.europa.eu/aquila-homepage.html>

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