

# Investigation of Accuracy of Existing Methods for Stack Concentration Measurement and Support for New CEN/TC 264 Automatic Standards

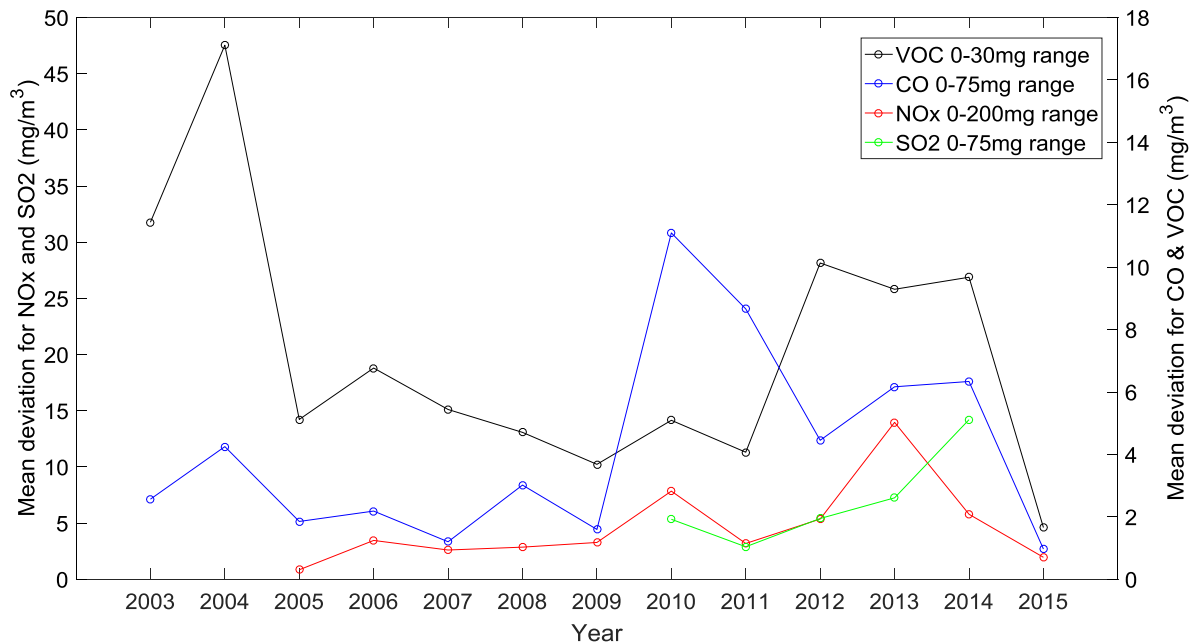
Marc Coleman

End of Project Workshop, 3<sup>rd</sup> May 2017, NPL, UK

# Aims of IMPRESS WP1

- The general aims of IMPRESS WP1 were 5-fold
  - Improve our understanding of the ‘real-world’ performance of the SRMs (CO, NO<sub>x</sub>, SO<sub>2</sub>, HCl, TVOC, dust)
    - SRMs validated in early 2000’s to support directives prior to Industrial Emissions Directive when emissions were higher
    - CEN/TC 264/N 2204 “assessment of current SRM to meet stricter limit values”
    - Utilising existing proficiency testing (PT) data to test the SRMs themselves
  - Gain greater acceptance for some exiting possible alternative techniques
    - Portable FTIR
  - Author new methods (protocols) for promulgation at CEN to provide QA/QC framework for alternative techniques
  - New stack simulator facilities (see talk at 11:10)
  - Work on future techniques (see talk at 11:25)

# Stack Simulator PT Schemes – Mean Deviation



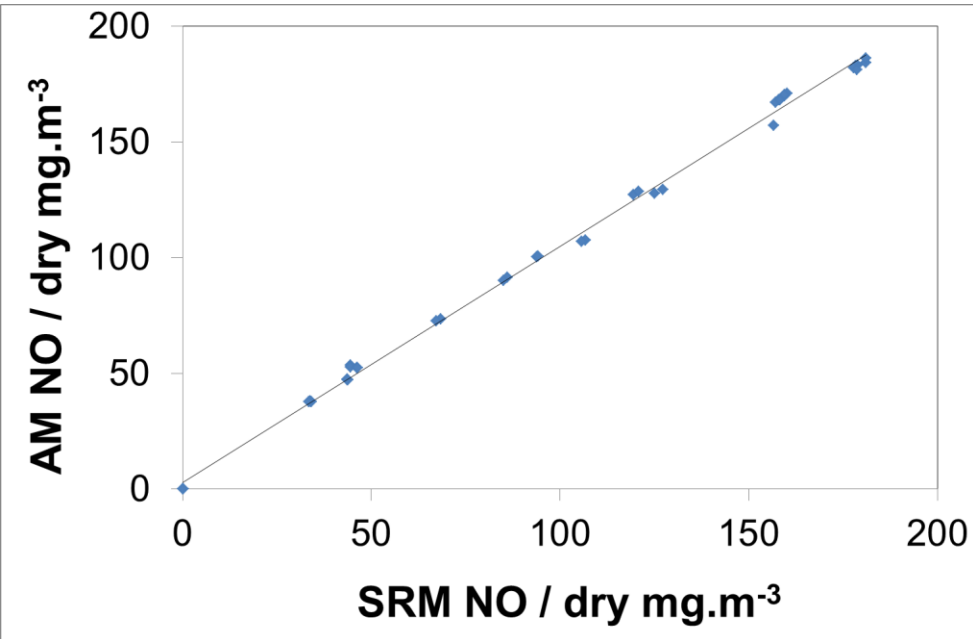
- Pooled German and UK data
- Start by asking if existing ELVs can be enforced?
- The mean deviation gives a measure of 'real-world' SRM capability
- UK data starts in 2010
- No obvious change in NOx or VOC (CO not measured in Germany)
- CO generally meets SRM uncert. requirements
- Not the case for NOx in latter years or TVOC in most years if UK requirement applied
- For SO<sub>2</sub> UK measurements dominated by NDIR+TGN M21, German measurements by wet chemistry+EN 14791
- Signs that NDIR+TGN M21 capability improving?
- Next need to look at capability for all species at lower levels

Species	IED ELV for WI / mg.m <sup>-3</sup>	SRM U <sub>95</sub> requirement / mg.m <sup>-3</sup>
NOx	200	20 (EN 14792)
SO <sub>2</sub>	50	10 (EN 14791)
CO	50	3 (EN 15058)
TVOC	10	1.5 (TGN M2 – UK only) Could be 3 elsewhere

# Gaining Greater Acceptance of Alternative Technique

- This was the second overall aim of WP1 (the 3<sup>rd</sup> aim relating too associated QA/QC methods which are inextricably linked)
- Here portable FTIR was targeted as
  - It is relatively well developed with a number of type approved models
  - It can measure a broad range of key pollutants in addition to H<sub>2</sub>O
  - It has already seen some use in the UK and Baltic region
- The SRMs are passed into, or referred to, in member state legislation
- However, there is a mechanism whereby it is possible to use an alternative technique + method
  - CEN/TS 14793 provides equivalency testing procedure
  - A national regulator has the authority to accept that an alternative technique + method are equivalent to the SRM if they accept the equivalency data
  - The alternative technique + method may then be used in place of the SRM

# Testing NO Equivalence



Verification tests	Value obtained	Critical value	Conclusion
<b>Non-systematic deviation</b>			
Validation of the test	1.00	$\geq 0.97$	Y
Slope	1.026	$\geq 0.963$ & $\leq 1.037$	Y
Intercept	2.37	$\geq -3.58$ & $\leq 3.58$	Y
<b>Repeatability</b>			
Standard uncertainty of the SRM	1.5	$\leq 3.6$	Y
Standard uncertainty of the AM	2.3	$\leq 3.6$	Y

# Equivalence Acceptance

- Equivalence was also shown for CO, SO<sub>2</sub>, HCl and H<sub>2</sub>O
  - Exception was for NO at concentrations >200mg.m<sup>-3</sup>
- This work was carried out jointly with the Environment Agency
  - FTIR + TGN M22 now accepted as equivalent in the UK

# Impact at CEN / ISO

- CEN/TC 264 Air Quality are responsible for emissions standards
  - WG16 'Emission monitoring reference methods'
    - Led promulgation of method for SO<sub>2</sub> by portable optical techniques
    - Published by CEN January 2017 (CEN/TS 17021)
    - Validation of CEN/TS 14793 equivalency statistics
  - WG36 'FTIR for emissions monitoring' – Convenor
    - Promulgation of FTIR method
    - TC264 Consultation about to be launched
  - WG9 'Quality assurance of emissions monitoring' – Convenor
    - Updated EN 14181 (calibration of permanently installed systems)
  - WG23 'Emission flow rate' – Co-convenor
    - Authored CEN Technical Report on implementation of flow SRM (EN 16911-1)
- ISO/TC 146/SC 1 are the ISO equivalent to CEN/TC 264
  - WG31 'Speciated VOCs by FTIR'
    - Request from Japanese convenor to co-author with USA expert clause on post measurement QA/QC of spectra

# Summary

- Analysis of PT data has shown
  - NO<sub>x</sub> SRM measurement capability appears in excess of uncertainty requirements in recent years
  - VOC measurement capability has not met UK uncertainty requirements since inception
  - SO<sub>2</sub> performance shows an issue with NDIR approach
- FTIR has been demonstrated as equivalent in accordance with CEN/TS 14793 to the SRMs for CO, NO<sub>x</sub>, SO<sub>2</sub>, HCl and H<sub>2</sub>O
- There has been significant support at CEN in leading elaboration of methods for portable techniques as well as supporting an EN 14181 update and validating the equivalency statistics in EN 14793



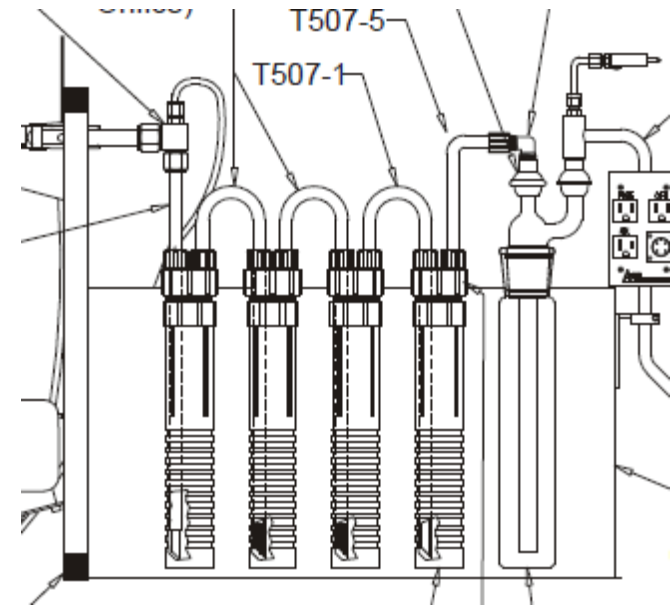
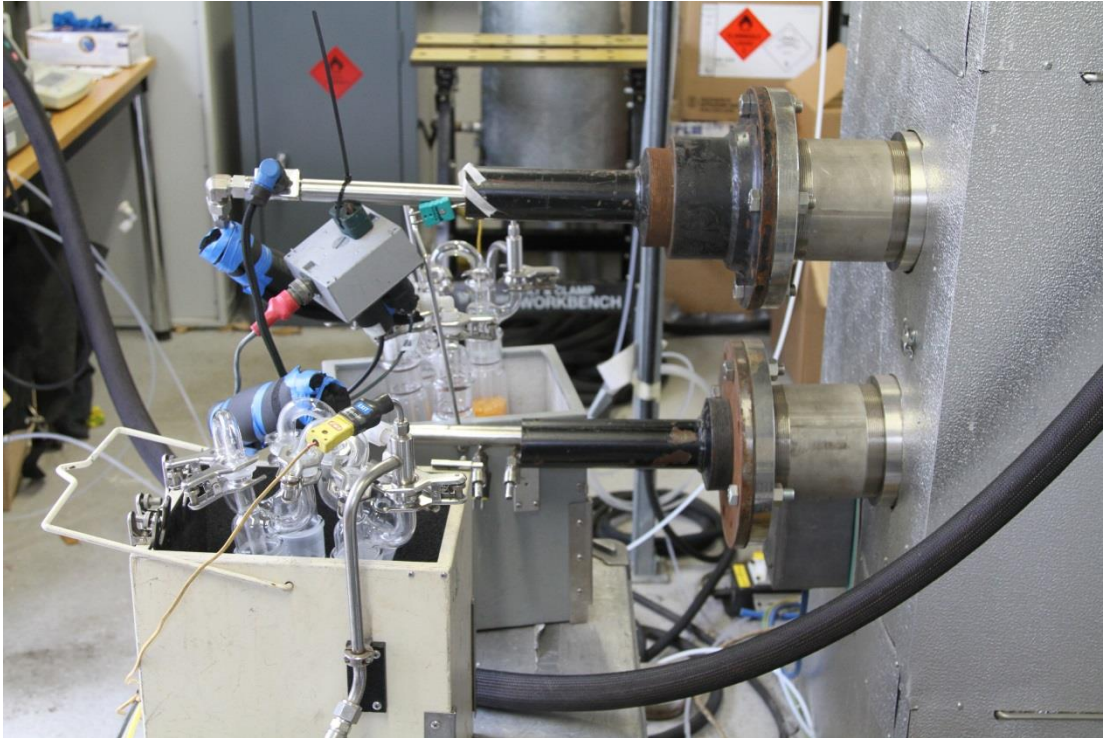


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# Parallel Impinger Sets and Probes



# Pooled German and UK Stack Simulator PT Data: e.g. SO<sub>2</sub>

