

Description and Capabilities of two new Stack Simulator Facilities: The Particulate Simulator at NPL and the Gas Simulator at VSL

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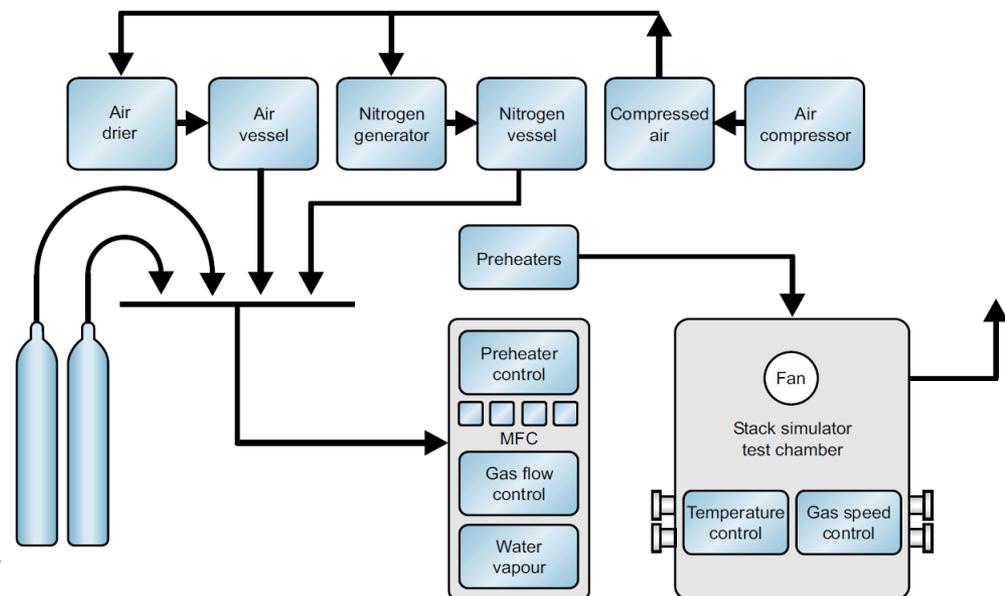
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Stack Simulators

- Currently only a handful in Europe
- Generally acknowledged as the best way to Proficiency Test (PT)
 - Gas bottles, solutions, foil shims, only test analytical proficiency not sampling proficiency
- Now routinely required in CEN standard validation for methods produced under Commission mandate
- Generally have controllability unlike a real stack
 - e.g. span a concentration range in even increments
 - Look at effect of H₂O inclusion / removal
- Needed for technique and method development
- Third party use

Previous Capability

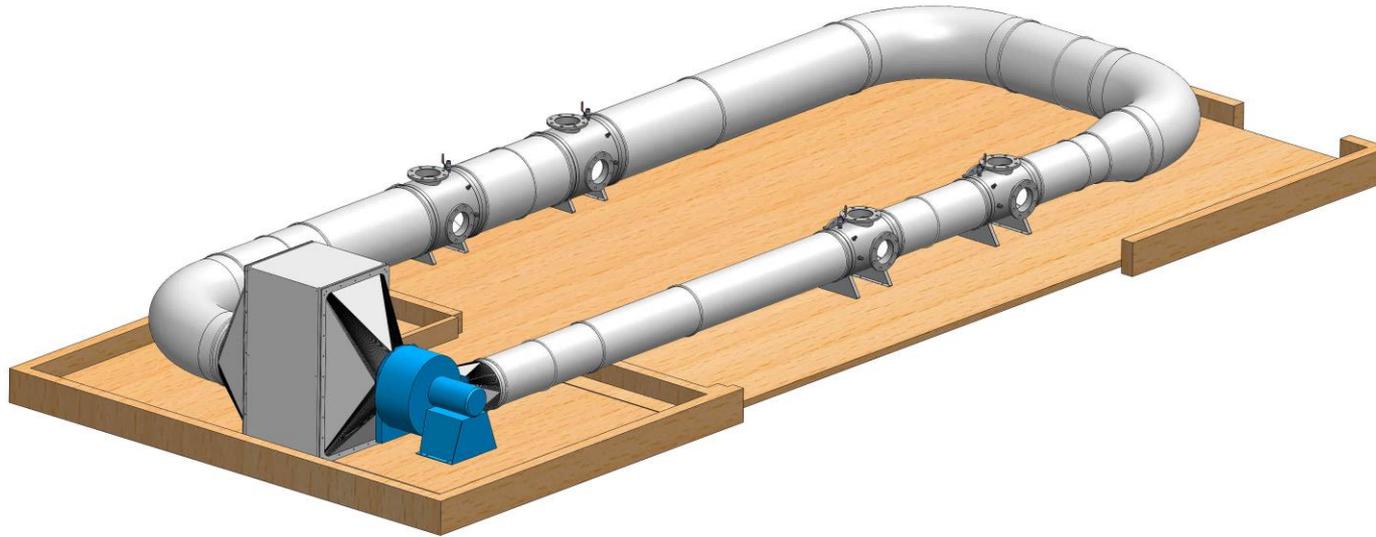
- Since the mid-2000's there has been a Gas Stack Simulator facility at NPL
- Can create hot (200C), wet (20%vol H₂O) gas matrices at realistic velocities (10m.s⁻¹)
- 5" BSP sampling ports allowing use of full sampling apparatus
- These specifications allow the testing of entire measuring systems and associated QA/QC methods
- It has been used for
 - Technique and method development: e.g. FTIR and CEN/TS 14793
 - CEN standard validation: CEN/TC 264/WG 3 HCl
 - ISO 17043 Proficiency Testing: CO, NO_x, SO₂, O₂, TVOC
 - Available to 3rd parties



Particulate (Dust)

- Sampling proficiency of European stack testing organisations largely unknown
- In UK proficiency testing (PT) based on foil shims (filter simulants) and NaCl solutions (probe washing simulants)
- These test half the measurement, i.e. weighing proficiency but not sampling proficiency
- If the 2016 NPL dust PT scheme the mean deviation of the participants from the washings reference value (6.5mg) was 2.6mg
 - EN 13284-1 requires a weighing uncertainty of 5% of ELV
 - 2.6mg is 52% of an ELV of 5mg.m⁻³
 - In a 60min run typically 1m³ is sampled from the stack
 - Hence, the emission equivalent is 2.6mg.m⁻³
 - For a ELV of 5mg.m⁻³ the IED maximum permissible uncertainty is 30% (1.5mg.m⁻³)
 - At a higher emitted concentrations such a deviation is much less an issue

Particulate Simulator Design



- Particle Simulator Facility
- 0.3m and 0.5m diameter sections
- $10\text{m}\cdot\text{s}^{-1}$ velocity at 0.5m section
- $1\mu\text{m}$ - $8\mu\text{m}$ particle size
- $10\text{'s mg}\cdot\text{m}^{-3}$ down to $<1\text{ mg}\cdot\text{m}^{-3}$ concentrations



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