Stack flow measurement

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Stack emission measurements

- The Industrial Emissions Directive sets out emission limits for various species of pollutant.
- Operators are required to measure their stack emissions in order to ascertain whether they are meeting these requirements.
- In order to calculate the mass emissions from a stack two elements have to be measured:
  - Concentration of the pollutant
  - Flow rate out of the stack
Flow Measurement Standards

- ISO 10780:1994 *Stationary source emissions – Measurement of velocity and volume flowrate of gas streams in ducts*
  - Specified manual methods for determining velocity and volume flowrate using Pitot tubes

- EN ISO 16911:2013 *Stationary source emissions – Manual and automatic determination of velocity and volume flow rate in ducts*
  - Part 1: Manual reference method
  - Part 2: Automated measuring systems
Problems with ISO 10780

- Most instrumental methods for stack monitoring take continuous measurements of the concentration of the pollutants being emitted.
- Flow rate measurements under ISO 10780 are discontinuous which can lead to inconsistencies when propagating uncertainty in the calculations to determine annual emissions.
- The uncertainty levels in ISO 10780 were unsupported by published work.
- Limits specified on measurement conditions (e.g. minimum flow rate, minimum cross sectional area, etc.) can leave some measurements outside the scope of the standard so no uncertainty can be assigned.
EN ISO 16911:2013

- Written by Working Group 23 under Technical Committee 264, with NPL representation
- Describes a wider variety of methods including continuous emission monitoring systems (CEMS)
- Provides solutions for some of the problems in ISO 10780:
  - Adjustment factors for wall effects
  - Method for flow at low differential pressures
  - Range of quoted uncertainty values dependant on flow profile and measurement methodology
Work under IMPRESS

- Project is developing a new CFD model of stack flow.
- This will be used to better understand the flow measurement uncertainty under different stack conditions and sampling procedures.
- In addition, the impact of propagating the uncertainty associated with a periodic flow measurement to the annual mass emission uncertainty is being studied in order to provide a much needed industry guidance document.