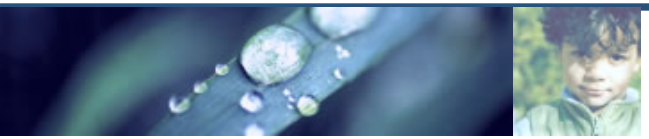


VOC Emission Testing

-

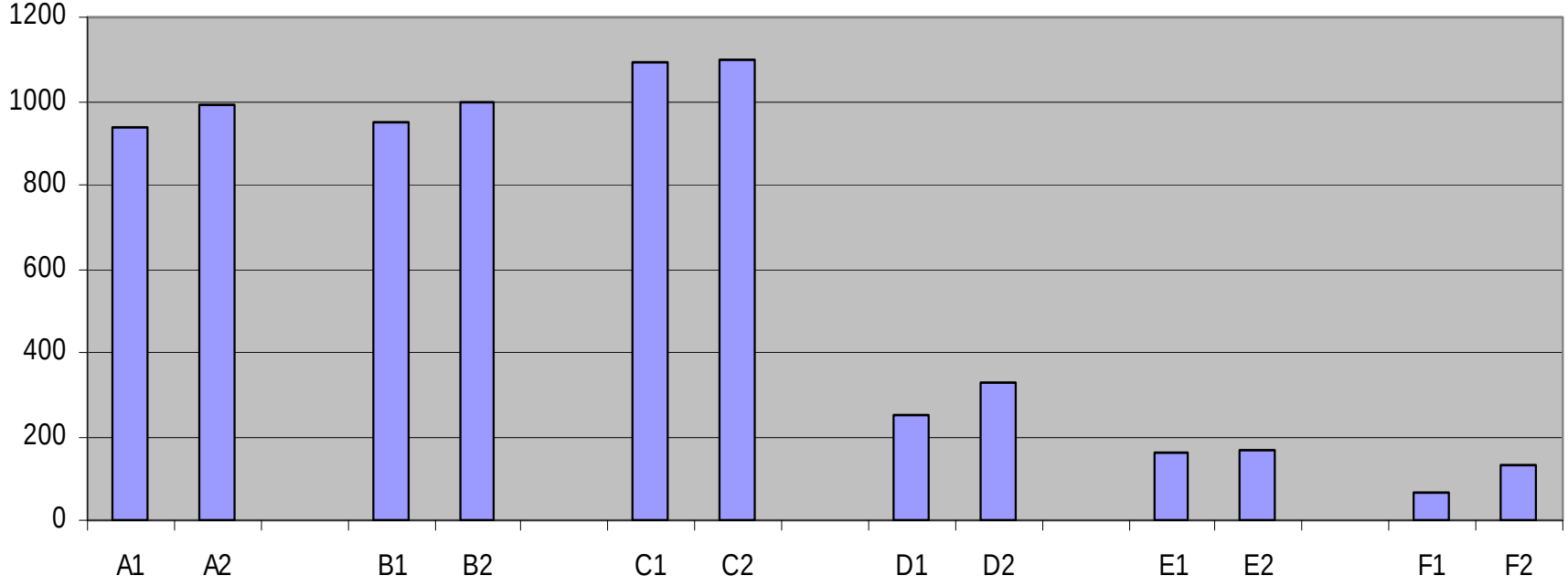
Some quality issues:

Reproducibility from lab to lab

Reinhard Oppl, Eurofins Product Testing

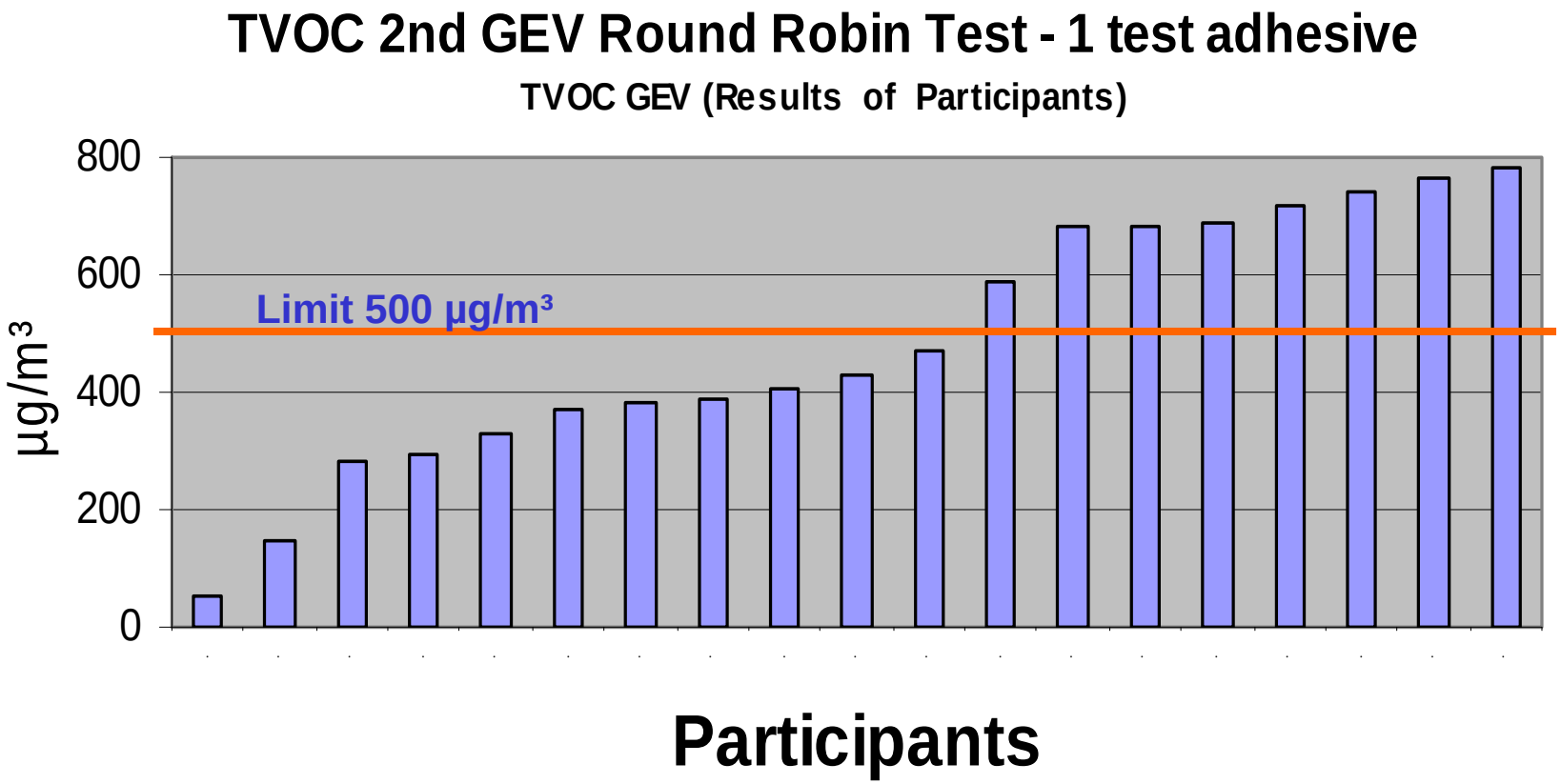
Within lab reproducibility

Typical TVOC reproducibility within one laboratory:
6 flooring samples in 2 test chambers each (µg/m³)



A - F: Different samples. 1, 2: Two test specimens taken from same sample.

Reproducibility – 20 labs

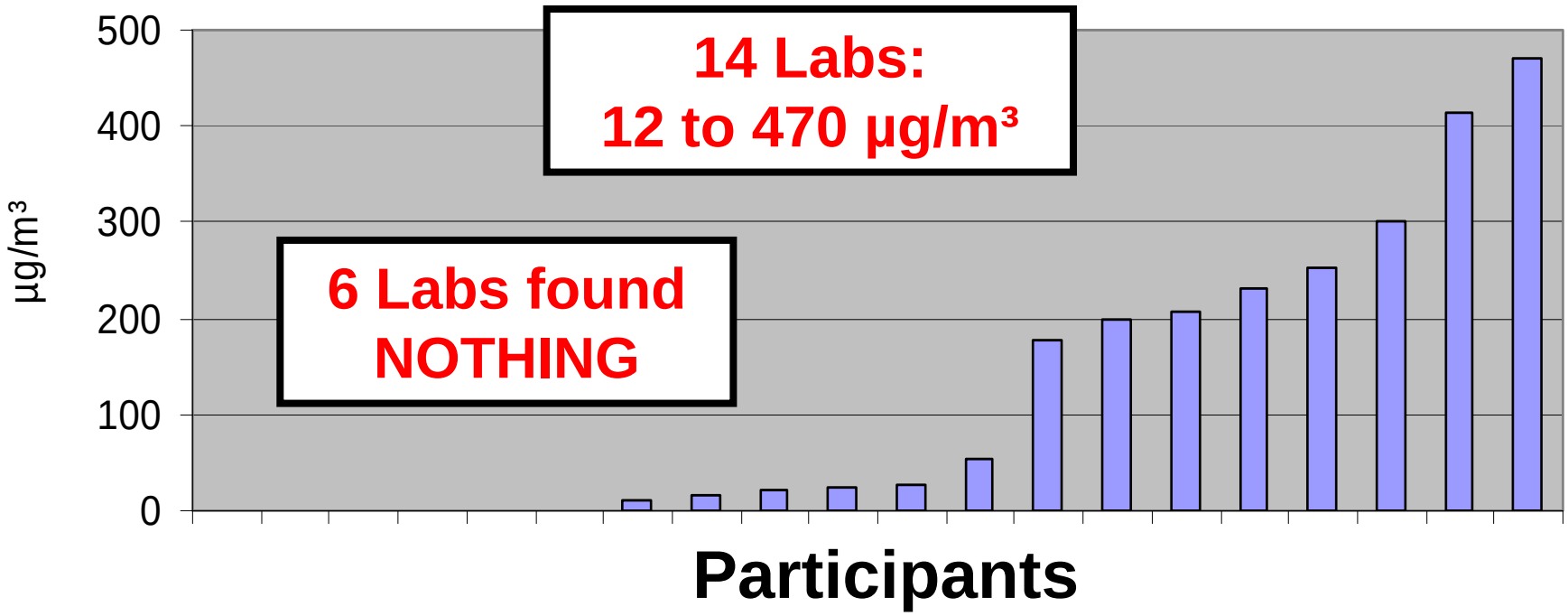


1 lab did not report a TVOC

Reproducibility – Single substances

2. GEV Round Robin Test

Ethylene glycol: 20 labs testing ONE adhesive



Status

- **Reproducibility of VOC test results:**
  - Variation ± 20 % (RSD) should be guaranteed
    within one lab (or better - but limited by material inhomogeneity)
  - But: Low concentration = higher uncertainty
    (weaker detector signal)
  - Variation ± 50% between different labs (RSD)
    Some improvement should be possible (=> ± 20-30 % for homogeneous material) - but this is **always limited by material inhomogeneity**
- **Other than VOC**
  - SVOC, VVOC, reactive compounds (e.g. formaldehyde)
    cannot be measured in a reliable manner with the VOC method,
    these require different analytical methods
- **Air concentration below 0.005 mg/m³**
  (for some compounds even already below 0.02 mg/m³)
  are not significant at all in many cases

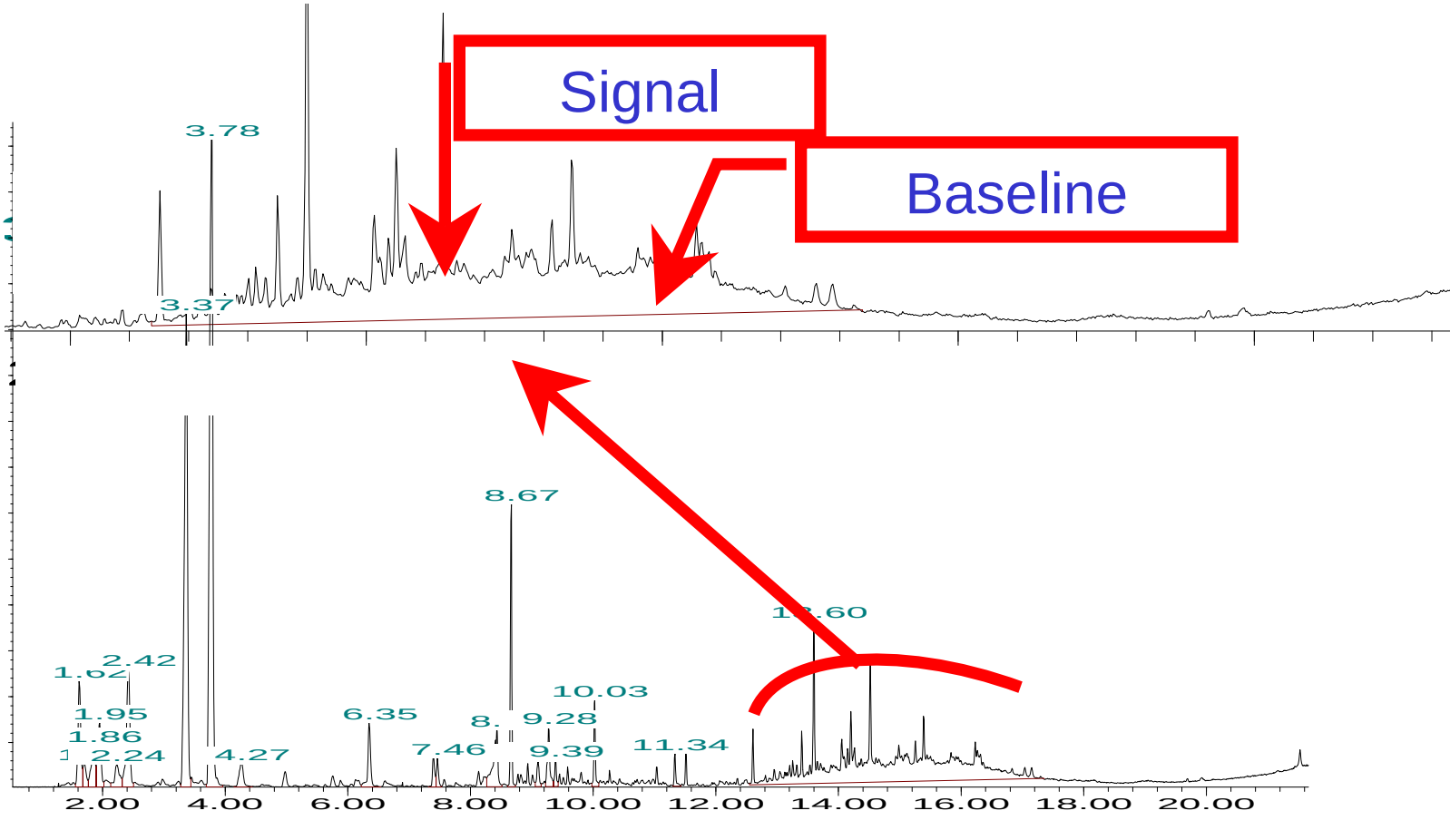
Starting point

- **Tested product**
  - **Inhomogeneous emissions over surface or over batches**
  - **This cannot be changed**
    - can only partly be levelled out by using larger chamber in case of known higher inhomogeneity over surface
- **Gas chromatographic analysis** (see slide 9)
  - **Time corresponds with identity, to be confirmed by MS**
  - **Height corresponds with mass of substance**
  - **Different VOC give different signal per mg ("response factor RF")**
    - Day in - day out calibration with toluene, high sequence
    - Calibration of other VOC than toluene: With its "relative response factor RRF" - relative to toluene - e.g. RRF 1.25 means toluene result is corrected by division with 1.25
    - The RRF values are pretty stable and must NOT be checked daily, can even be re-applied later on stored old data

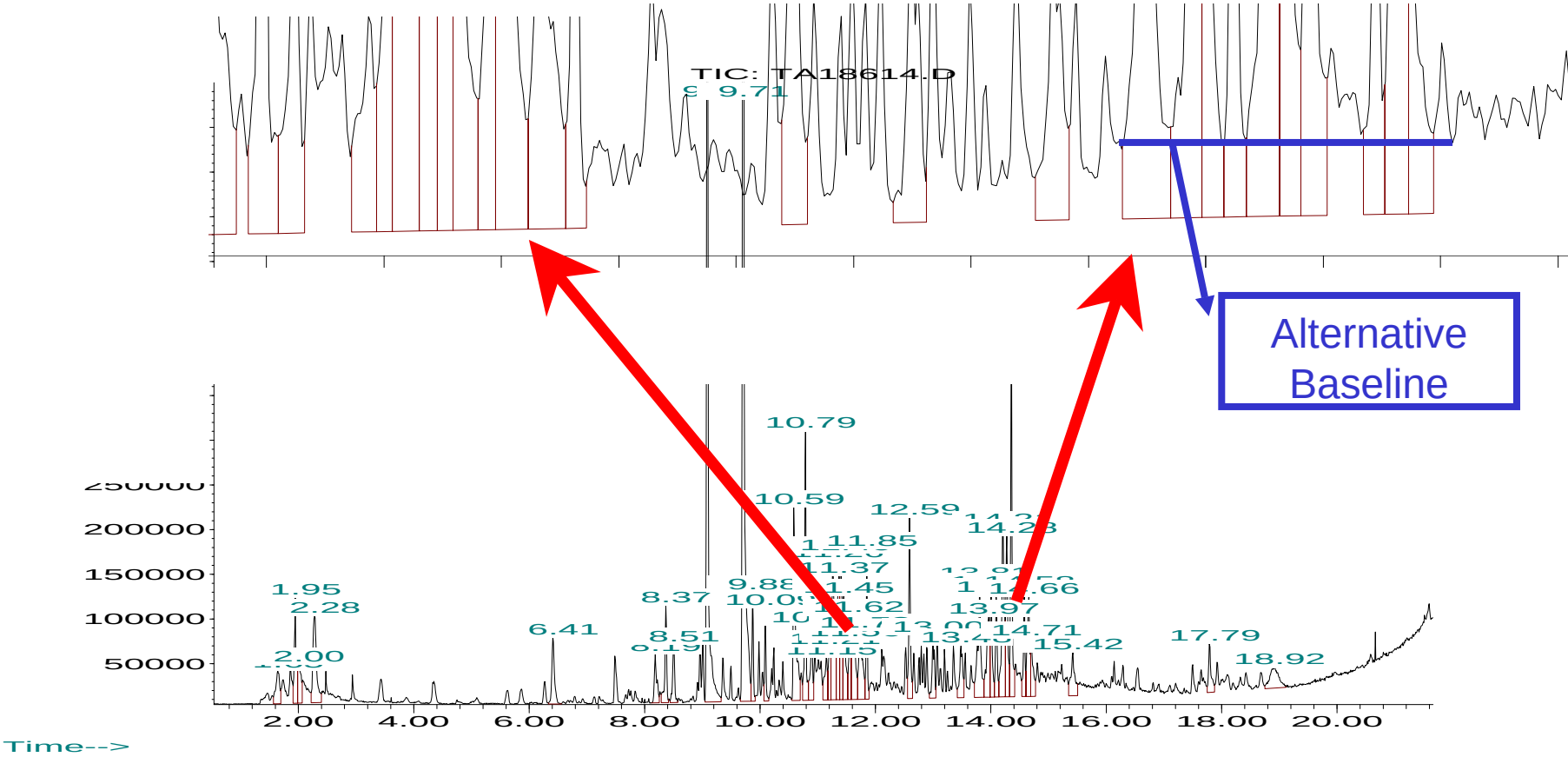
Key issues I (GC analysis)

- **Different separation of VOC mixture gives different chromatograms**
  - ISO 16000-6 allows use of different columns
  - Should be restricted to 100% non-polar column (see VOC definition)
- **Different detectors give different quantitative signal as toluene RF**
  - ISO 16000-6 allows use of different detectors (MS or FID)
  - Should be restricted to one detector only (MS)
- **Different calibration factors give different results**
  - ISO 16000-6 requires 2/3 of signal to be identified
    => differences per lab and its identification power. Better is:
  - Use only toluene equivalent, or
  - Use specific calibration for a list of target VOC,
    and toluene equivalent for all other substances
- **Different peak baselines give different quantification**
  - Harmonise interpretation procedures, see next slides

Identification and Quantification – different interpretation possible



Quantification in complex mixture – different interpretation possible



Key issues II (air sampling)

- **Air sampling from test chamber: 2x2 samples per result**
  - **Always apply and analyse <u>backup</u> sampling after front sampling, and report sum of both sampling tubes**
    - for identifying any breakthrough in case of high emissions
    - Otherwise: High risk of erroneous results
    - Discard whole test if >25% breakthrough
    - Backup tube <u>may be skipped if</u> low emissions are expected
  - **Always apply <u>parallel</u> double sampling, and report average of both samplings**
    - for identifying any error in sampling,
    - Otherwise: High risk of erroneous results
    - Discard whole test if >20% difference
    - 2 samplings after each other acceptable if only 1 sampling port is available

Key issues III (more air sampling)

- **Selection of adsorbent for VOC analysis**
  - **Different sorbent gives different**
    - adsorption capacity
    - desorption efficiency
    - selectivity during sampling and analysis
  - **Use only one sorbent: Tenax TA for VOC (as defined in ISO 16000-6)**
    - Plus: Harmonisation between labs
    - Minus: Not so good for VVOC, SVOC
- **Sampling time and duration**
  - When emissions are still in decay, slightly different sampling intervals may determine result
  - Define starting date / hour, then allow small intervals only

Testing with high reliability
will lead to less questions and doubts

=>

saves money compared to

uncertain tests

even if

high quality tests may be

more expensive

Validation of Test Method and of Quality Criteria for Test Houses are essential

Further reading:

R.Oppl: Reliability of emission testing,

Gefahrstoffe Reinhaltung der Luft 68(2008)3 pp 83-86

Free download:

http://product-testing.eurofins.com/
testing/chemical-safety/emission-into-indoor-air.aspx