

# Example calculation for oxygen measurement uncertainty

1. Oxygen correction factor =

$$(21 - O_2 \% \text{ reference}) \div (21 - O_2 \% \text{ measured})$$

2. Uncertainty of oxygen correction =

$$\left( \frac{21 - O_2 \% \text{ reference}}{21 - O_2 \% \text{ measured} \times O_2 \% \text{ measured}} \right) \times \text{uncertainty of } O_2 \text{ measurement}$$

3. Uncertainty of oxygen factor (%) =

$$(\text{uncertainty of } O_2 \text{ correction} \div \text{oxygen correction factor}) \times 100$$

4. Overall measurement uncertainty ( $\mu$ ) (%) =

$$\sqrt{\mu \text{ of the determinand}^2 + \mu \text{ of the oxygen correction factor}^2}$$

The example calculation is based on a:

- reference oxygen of 11%
- measured oxygen of 13%
- $\mu$  of oxygen measurement of 0.5% (absolute value)
- $\mu$  of pollutant measured (for example, particulates) of 15%

1. Oxygen correction factor =  $(21 - 11) \div (21 - 13) = 1.25$

2.  $\mu$  of oxygen correction =  $(21 - 11) \div ((21 - 13) \times (21 - 13)) \times 0.5 = 0.0781$

3. Overall  $\mu$  for the oxygen correction (%) =  $(0.0781 \div 1.25) \times 100 = 6.25\%$

4. Overall uncertainty for the measurement =  $\sqrt{15^2 + 6.25^2} = 16.25\%$

The measurement uncertainties in this example are the expanded uncertainties at a 95% confidence interval.