



# Measurement Uncertainty

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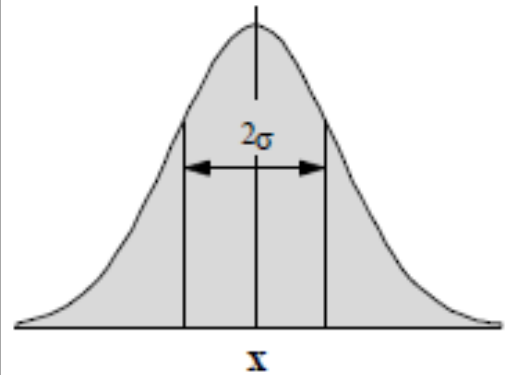


# Measurement Uncertainty

“A parameter associated with the result of a measurement, that characterises the dispersion of the values that could be reasonably attributed to the measurand”

From: Quantifying Uncertainty in Analytical Measurement (QUAM:2000.P1)

# Measurement Uncertainty

Normal distribution		
Form	Use when:	Uncertainty
	<ul style="list-style-type: none"> <li>An estimate is made from repeated observations of a randomly varying process.</li> <li>An uncertainty is given in the form of a standard deviation <math>s</math>, a relative standard deviation <math>s/\bar{x}</math>, or a coefficient of variance CV% without specifying the distribution.</li> <li>An uncertainty is given in the form of a 95% (or other) confidence interval <math>x \pm c</math> without specifying the distribution.</li> </ul>	$u(x) = s$  $u(x) = s$ $u(x) = x \cdot (s / \bar{x})$ $u(x) = \frac{CV\%}{100} \cdot x$  $u(x) = c / 2$ (for $c$ at 95%) $u(x) = c / 3$ (for $c$ at 99.7%)

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# Measurement Uncertainty

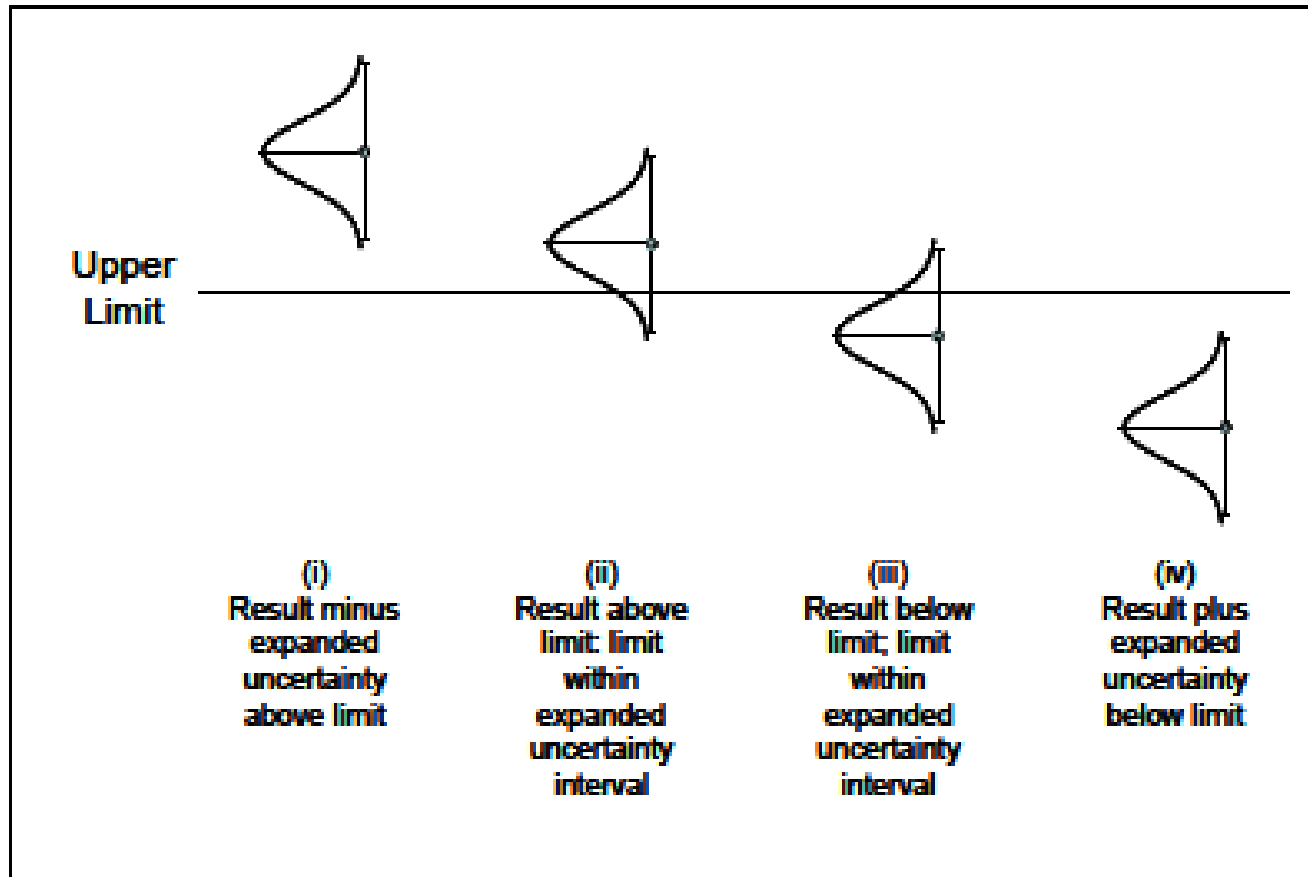
- Sources and Approaches:
  - Laboratory
    - Type A approach: statistical analysis of a series of observations (experimental data) expressed as standard deviations.
    - Type B approach: uses other means to evaluate (literature, experience, certificates, specifications, etc) expressed as standard deviations.

# Measurement Uncertainty

- Cadmium in Water
  - Result: 2.13 mg/L
  - With Uncertainty ( $U_e$ ):  $2.13 \pm 0.96$  mg/L
  - $U_e$  is calculated using the combined standard uncertainty ( $U_c$ )

# Measurement Uncertainty

Figure 1 Assessment of Compliance with an Upper Limit



# References

- Ellison SLR, Ramey MH (eds.) (2007) EURACHEM/CITAC Guide “Measurement uncertainty arising from sampling: A guide to methods and approaches”. Eurachem, First Edition.
- Ellison SLR, Roeslein M, Williams A (eds.) (2000) EURACHEM/CITAC Guide “Quantifying uncertainty in analytical measurement”. Eurachem, Second Edition.
- Ellison SLR, Williams A (eds.) (2007) EURACHEM/CITAC Guide “Use of uncertainty information in compliance assessment”. Eurachem, First Edition.
- Hammonds JS, Hoffman FO, Martel, SM (1994) “An introductory guide to uncertainty analysis in environmental and health risk assessment”. ES/ER/TM-35/R1
- Ramsey MH, Thompson M (2007) “Uncertainty from sampling, in the context of fitness for purpose”. Accred Qual Assur 12:503-513

# Questions



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