

EU-China Dialogue and Cooperation on ETS-related Policies and Measures 中欧碳市场政策对话与合作项目

TtT Intensive Phase (Day 3): Uncertainty Assessment



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What is the relevance of measurement uncertainty?

- **All measurements have an associated uncertainty:**
 - Uncertainty quantifies the level of doubt in the accuracy/precision of a measurement
 - It is typically expressed in terms of a standard deviation or confidence interval (that indicates the reliability of the measurement)
 - **BUT uncertainty is not indicative of error in a measurement**
- General supply of goods often relies on fit for purpose measurements/measurement uncertainties to ensure correct amounts and specifications:
 - To ensure fair billing for materials/fuels received
 - To ensure fit for purpose goods, e.g. the required thickness of a component may require use of a micromanometer rather than a ruler
- Even atomic masses are expressed to different decimal places/significant figures (often in the same periodic table) reflecting different levels of uncertainty in their determination
 - Even small differences, e.g. Carbon = 12.01 compared to 12.011, can result in big differences if they are multiplied in calculations with large numbers
- **Understanding of measurement uncertainties are important to an ETS to provide confidence that:**

tonnes monitored and reported = tonnes emitted

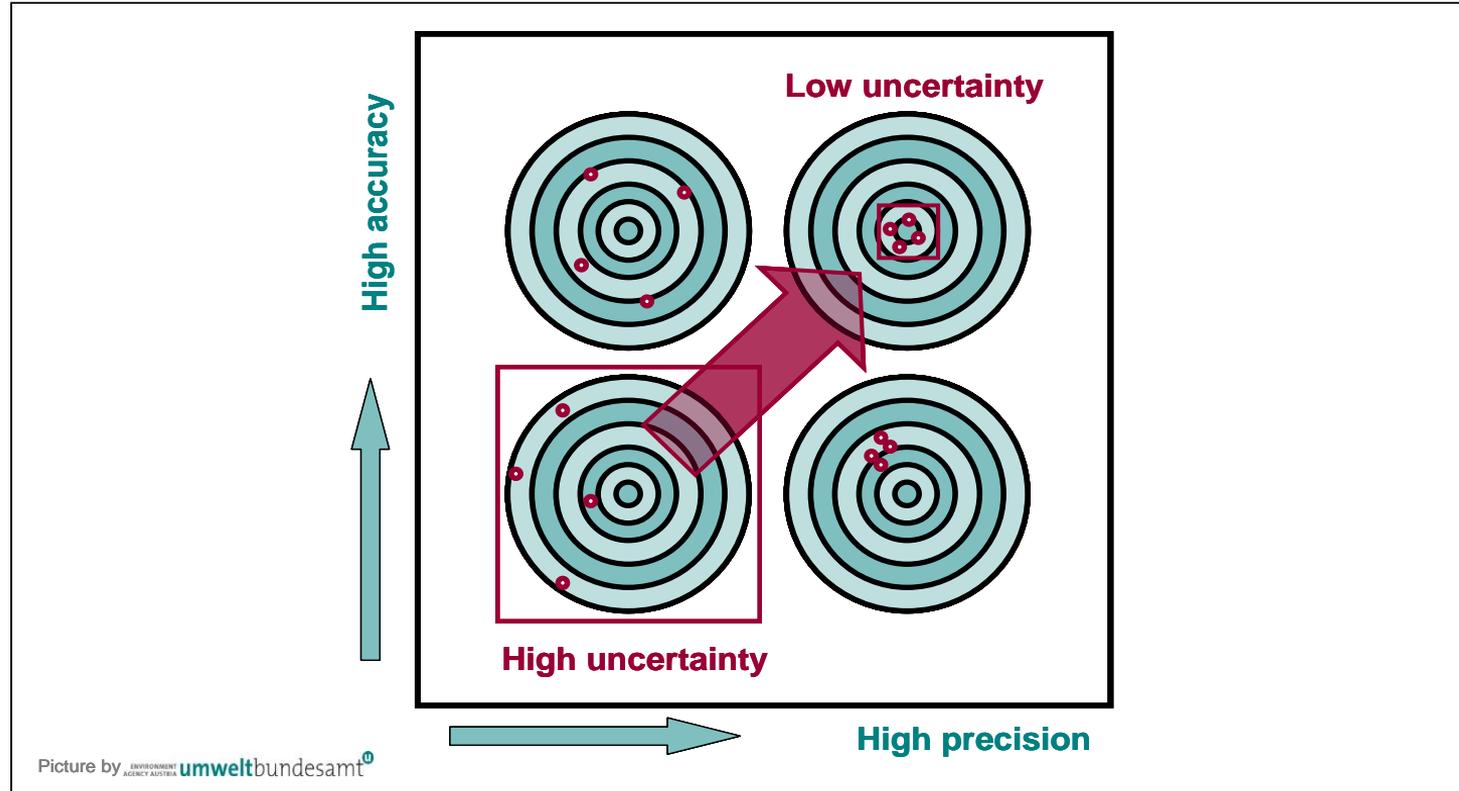
Relevant definitions/understandings

MRR Article 3(6) states: *'uncertainty'* means a parameter, associated with the result of the determination of a quantity, that characterises the dispersion of the values that could reasonably be attributed to the particular quantity, including the effects of systematic as well as of random factors, expressed in per cent, and describes a confidence interval around the mean value comprising 95 % of inferred values taking into account any asymmetry of the distribution of values

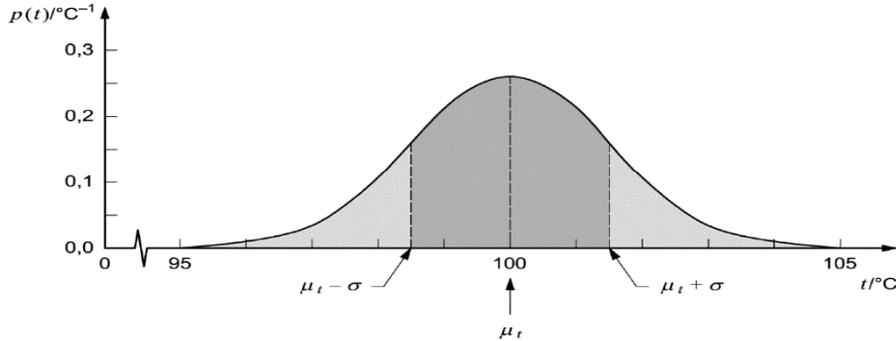
MRR Article 3(16) states: *'accuracy'* means the closeness of agreement between the result of a measurement and the true value of a particular quantity or a reference value determined empirically using internationally accepted and traceable calibration materials and standard methods taking into account both random and systematic factors

Precision is a term used to describe the closeness of results of measurements of the same measured quantity under the same conditions. It is often quantified as the standard deviation of values around an average value

What is measurement uncertainty?



Graphical representation of uncertainty (two examples)

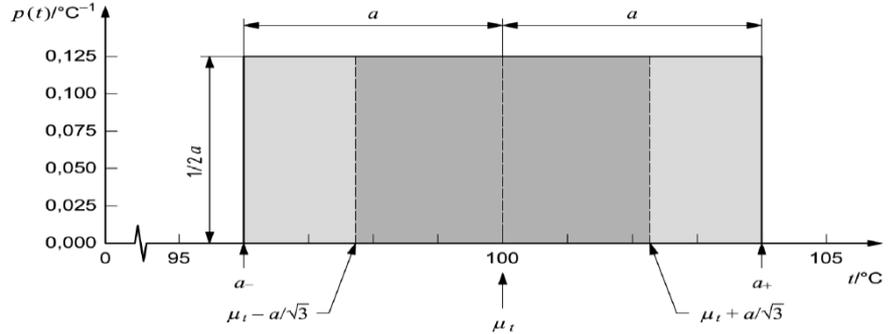


Standard uncertainty

u (standard deviation)

Typical occurrences

- Calibration reports
- Manufacturer's specifications
- Combined uncertainties



Standard uncertainty

$$u = \frac{a}{\sqrt{3}}$$

Typical occurrences

- Maximum permissible errors
- Tolerances
- Reference book values

EU ETS MRR call for uncertainty analyses

- **MRR Article 12(1) requires that in support of the monitoring plan installation operators submit evidence of compliance with relevant uncertainty thresholds:**
 - **Evidence of compliance with uncertainty thresholds for activity data**
 - **Evidence of compliance with uncertainty required for calculation factors, if applicable**
 - **Evidence for compliance with uncertainty requirements for measurement-based methodologies (CEMS), if applicable**
 - **If a fall-back methodology is applied, an uncertainty assessment for the total emissions of the installation**

Reminder of tier definitions for activity data based on uncertainty

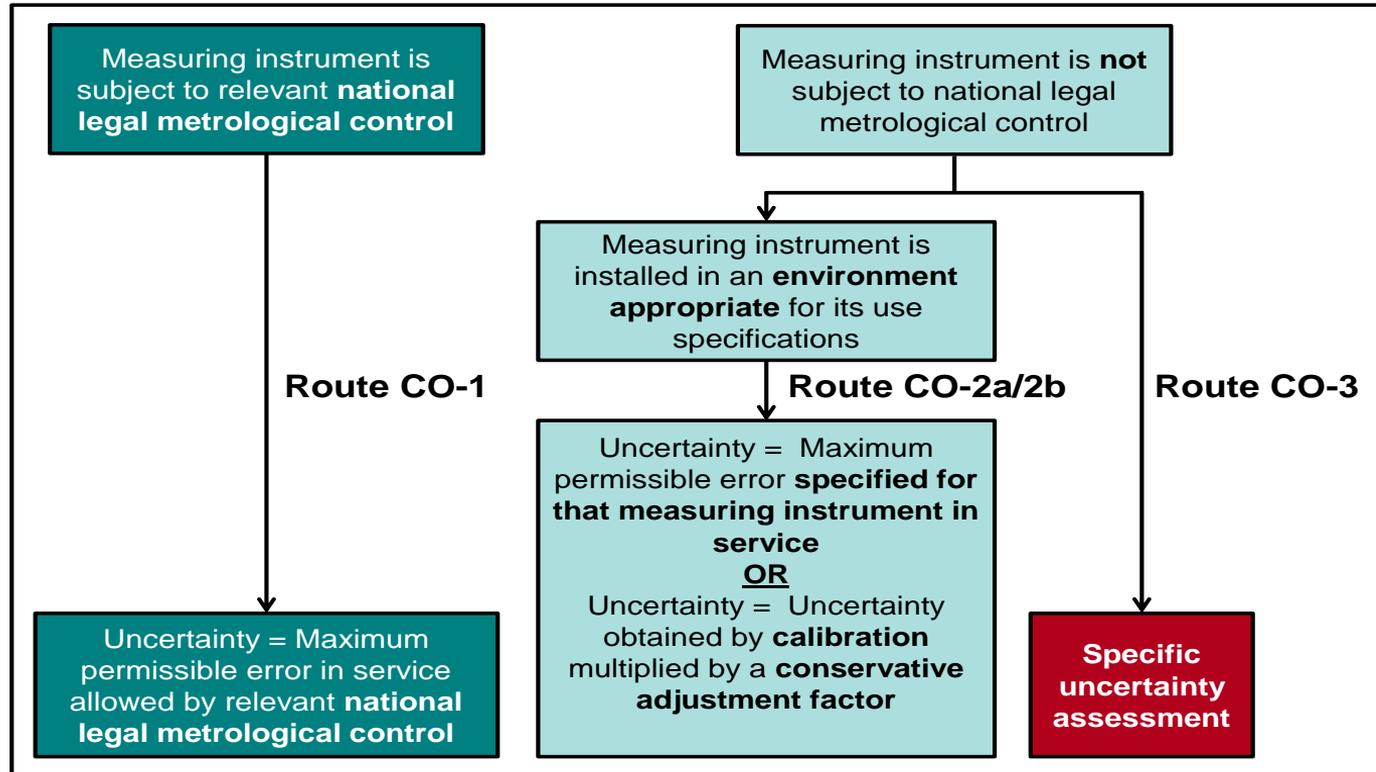
For example, for the combustion of fuels:

Tier	Definition
1	Amount of fuel [t] or [Nm ³] over the reporting period is determined with a maximum uncertainty of ± 7.5 %
2	Amount of fuel [t] or [Nm ³] over the reporting period is determined with a maximum uncertainty of ± 5.0 %
3	Amount of fuel [t] or [Nm ³] over the reporting period is determined with a maximum uncertainty of ± 2.5 %
4	Amount of fuel [t] or [Nm ³] over the reporting period is determined with a maximum uncertainty of ± 1.5 %

EU ETS requirements for demonstrating compliance with tier uncertainty thresholds (1)

- EU ETS operators must demonstrate that the uncertainty threshold of a required tier is met by submitting an uncertainty assessment to the competent authority in support of the monitoring plan
- The uncertainty assessments must also be made available to the verifier in support of verification
- The MRR requires assessments to take account of the specified uncertainty of the measurement instrument(s), the uncertainty associated with calibration, and any additional uncertainty connected with how the instrument is used in practice and environmental impacts
- However, the MRR also recognises that an uncertainty assessment can be infinitely long: It is always possible to consider more sources of uncertainty, including uncertainties in the uncertainties
- There is a need for pragmatism and focus on the most relevant aspects: The MRR puts forward three general approaches in the interests of pragmatism (see next slide)

EU ETS requirements for demonstrating compliance with tier uncertainty thresholds (2)

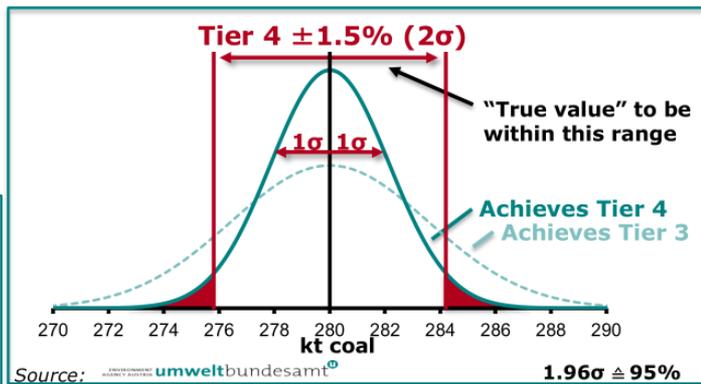


Uncertainty – What it means

Example: A category C installation consumes **280 kt coal**

- **Tier 4** is required for the determination of the fuel quantity
(**Uncertainty: $\pm 1.5\%$**)

➤ This means that the measurement system needs to provide results that allow the "true value" to be within **280 ± 4.2 kt ($\pm 1.5\%$) at the 95% (2σ) confidence level.**



Further Information on uncertainty assessment

European Commission Publications:

EU ETS Monitoring and Reporting Regulation, Guidance Document No.4 – Guidance on Uncertainty Assessment:

https://climate.ec.europa.eu/document/download/873cfdb7-4039-4170-b3bb-49e1800ac320_en?filename=policy_ets_monitoring_gd4_guidance_uncertainty_en.pdf

Monitoring and Reporting Training Event on Uncertainty Assessment:

https://climate.ec.europa.eu/document/download/3fd6939a-c3df-478e-9c12-c28d60a47d9e_en?filename=uncertainty_assessment_en.pdf

Tool for Uncertainty Assessments

https://climate.ec.europa.eu/document/download/ce893b04-9ef1-4bb2-8df9-996fa5368a4d_en?filename=tool_uncertainty_en.xls

Thank you for your attention!

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The EU ETS tier hierarchy (examples to illustrate)

- **Example 1: Solid fuel used for combustion or process input (e.g. in iron and steel)**

- (i) **Activity data:**

- Tier 1: Measurement uncertainty within $\pm 7.5\%$

- Tier 2: Measurement uncertainty within $\pm 5\%$

- Tier 3: Measurement uncertainty within $\pm 2.5\%$

- Tier 4: Measurement uncertainty within $\pm 1.5\%$

- (ii) **Calculation factors (e.g. emission factors):**

- Tier 1: Basic (general) default values

- Tier 2: Use of more specific default values

- Tier 3: Factors determined by actual sampling and analysis of the solid used by the installation

- **Example 2: Tiers for CEMS (CO₂ emission sources)**

- Tier 1: Maximum permissible uncertainty $\pm 10\%$

- Tier 2: Maximum permissible uncertainty $\pm 7.5\%$

- Tier 3: Maximum permissible uncertainty $\pm 5\%$

- Tier 4: Maximum permissible uncertainty $\pm 2.5\%$

[Further tier definitions for calculation-based methodologies are listed in MRR Annex II; and for CEMS in MRR Annex VIII]



MRR Article 35 (Frequencies for analyses) – for calculation factors

- Usually reliant on the operator applying at least the minimum tiers specified in MRR Annex VII
- However, the competent authority may allow the operator to use a different frequency where minimum frequencies are not available or where the operator demonstrates one of the following:
 - (a) based on historical data, including analytical values for the respective fuels or materials in the reporting period immediately preceding the current reporting period, any variation in the analytical values for the respective fuel or material **does not exceed 1/3 of the uncertainty value to which the operator has to adhere with regard to the activity data determination** of the relevant fuel or material;
 - (b) using the required frequency would incur unreasonable costs

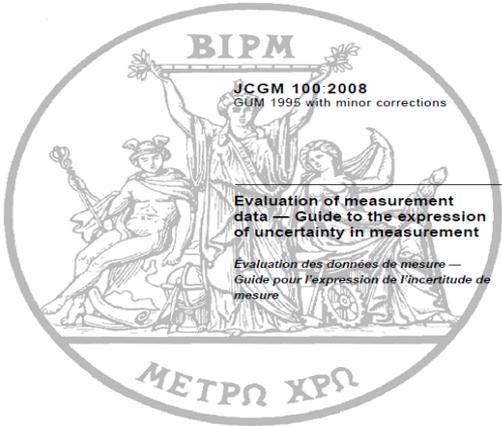
EU ETS MRR Article 22 (Methodology not based on tiers)

MRR Article 22 provides possibility to allow a *'no-tier/fall-back' approach* for selected source streams or emission sources, where **all** the following conditions are met:

- (a) applying at least Tier 1 for one or more source streams or emission sources is technically not feasible or would lead to unreasonable costs;
- (b) every year, the operator assesses and quantifies the uncertainties of all parameters used in the determination of the annual emissions in accordance with the **ISO guide to the expression of uncertainty in measurement (JCGM 100:2008)** or another equivalent internationally accepted standard, and includes the results in the annual emissions report;
- (c) the operator demonstrates **compliance with an overall uncertainty threshold for the emissions determination for the whole installation not exceeding: Category A: $\pm 7.5\%$; Category B: not exceeding $\pm 5\%$; Category C: $\pm 2.5\%$.**

The “GUM”

Guide to the expression of uncertainty in measurement (JCGM 100:2008)



JCGM 100:2008
GUM 1995 with minor corrections

Evaluation of measurement data — Guide to the expression of uncertainty in measurement

Evaluation des données de mesure — Guide pour l'expression de l'incertitude de mesure

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JCGM 100:2008

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