

The principles of monitoring and reporting

Naomi Walker
EU ETS Advisor (MRV)
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General principles

Recipe for monitoring of emissions = monitoring plan

Ingredients:	Completeness (MRR Art. 5)
Method:	Consistency and comparability (MRR Art. 6)
Repeatable:	Transparency (MRR Art. 6) Accuracy (MRR Art. 7)
Reliable:	Integrity of methodology (MRR Art. 8)
Improving the recipe: Continuous improvement (MRR Art. 9)	



Overview

- ➔ Basic concepts
- ➔ Monitoring approaches
- ➔ Uncertainty and tiers system
- ➔ Data management and control system
- ➔ Improvement principle
- ➔ Simplifications for small emitters

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Basic concepts

➔ Emissions source

separately identifiable part of an installation or a process within an installation, from which relevant GHG are emitted

➔ Source stream

specific fuel type, raw material or product:

- *giving rise to emissions as a result of its consumption or production*
- *containing carbon and included in the a mass balance methodology*

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Basic concepts

➔ annual activity data

Data on the amount of fuels or materials consumed or produced by a process as relevant for the calculation-based monitoring methodology

➔ emission factor (t CO₂ / unit)

average emission rate of a greenhouse gas relative to the activity data of a source stream assuming complete oxidation for combustion and complete conversion for all other chemical reactions

➔ net calorific value (TJ/unit)

specific amount of energy released as heat when a fuel or material undergoes complete combustion with oxygen under standard conditions less the heat of vaporisation of any water formed

Monitoring approaches

➔ Calculation based approaches:

- *Standard methodology (distinguishing combustion and process emissions)*
- *Mass balance*

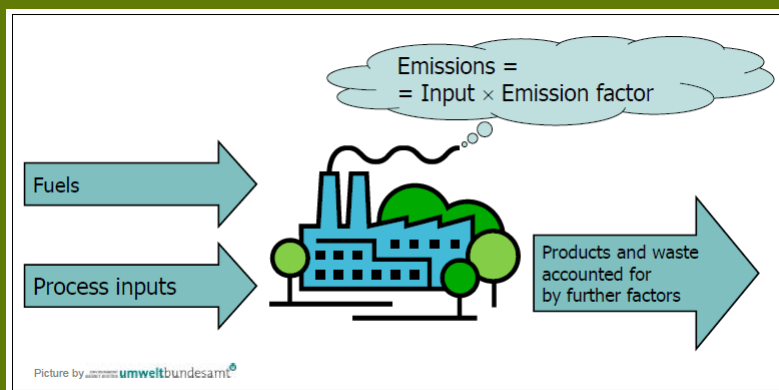
➔ Measurement based approaches

➔ Methodology not based on tiers (“fall-back approach”)

➔ Combinations of approaches

Calculation based approach (1)

Standard calculation methodology



Calculation based approach (2)

Standard calculation methodology

$$\text{Emissions}_{\text{combustion}} = \text{AD} * \text{EF} * \text{OF}$$

$$\text{AD} = \text{FQ} * \text{NCV}$$

$$\text{Emissions}_{\text{process}} = \text{AD} * \text{EF} * \text{CF}$$

Where

FQ.... Fuel Quantity

AD.... Activity data (TJ fuel or ton/nM³ input material)

NCV... Net Calorific Value (TJ)

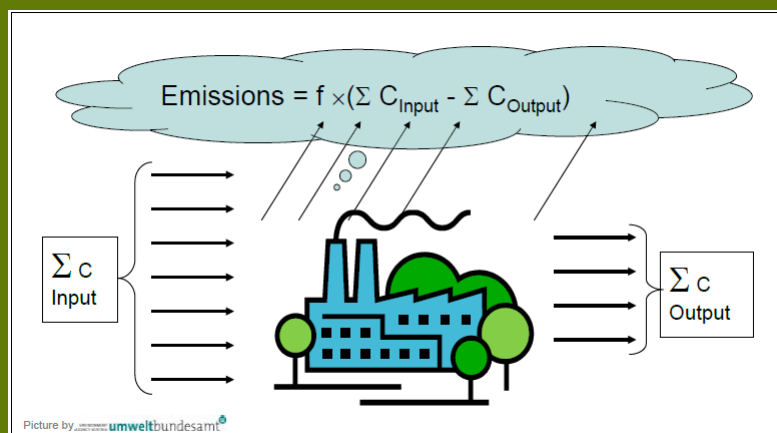
EF..... Emission factor (t CO₂/TJ or tCO₂/ton or t CO₂/nM³)

OF..... Oxidation Factor (-)

CF..... Conversion Factor (-)

Calculation based approach (3)

Mass Balance Methodology



Complete balance of carbon containing materials



Calculation based approach (4)

Mass Balance Methodology

Emissions = Carbon in – Carbon Out

$$\text{Emissions} = \sum_i f * AD_i * CC_i$$

Where

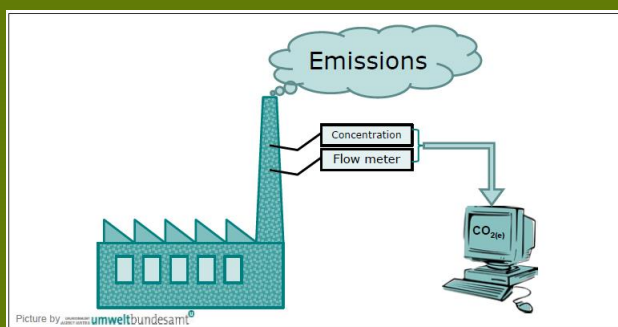
f = 3.664 t CO₂/ t C (constant value, mol.weights)

AD = activity data in ton (outgoing material is negative)

CC = carbon content in ton C /ton material



Measurement based approach (1)



CO₂ concentration: application of CEMS
(continuous emission measurement system)

Flue gas flow: measurement or calculation



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Measurement based approach (2)

MRR requirements

- aggregate hourly averages to yearly emissions
- corroborating calculation to check measurement
- apply EN 14181 for quality assurance CEMS
 - testing and calculating uncertainty
 - calibration procedures
 - quality assurance
 - annual surveillance test
- Procedures for missing data



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Measurement based approach (3)

- Not often used in practice
- Examples :
 - N₂O emissions: (e.g. nitric acid)
 - catalytic crackers refineries
 - waste gas incineration
- Equipment is relatively expensive
- Difficult to reach uncertainty thresholds
- Flue gas measurement can be difficult



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Fall – Back approach (1)

Conditions

- the tier system is technically not feasible or leads to unreasonable costs
- operators propose an alternative methodology
 - Not based on calculation or measurement
 - For selected source streams or emissions sources

MRR requirements

- uncertainty assessment each year and meet thresholds
- provide a justification demonstrating unreasonable costs or technical infeasibility
- improvement principle: regular report whether fall back can be improved



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Fall back approach (2)

- Fall Back not often used in practice
- Examples :
 - fugitive carbon emissions in mass balance
 - incineration : ventilation air with hydrocarbons
- yearly full uncertainty assessment can be burdensome on operators
- improvement principle: regular report whether fall back can be improved (achieve at least tier 1)

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Annex IV MRR : Specific monitoring rules for all ETS sectors

- Combustion
- Refining of Mineral Oil
- Production of coke
- Metal ore roasting and sintering
- Production of pig iron and steel
- Production or processing of ferrous and non-ferrous metals
- Production or processing of primary aluminium (CO₂ and PFC)
- Production of cement clinker
- Production of lime or calcination of dolomite or magnesite
- Manufacture of glass, glass fibre, or mineral wool insulation material
- Manufacture of ceramic products
- Production of gypsum
- Pulp and paper production
- Production of carbon black
- N₂O emissions from nitric acid, adipic acid, glyoxal, glyoxylic acid production
- Production of bulk organic chemicals
- Production of hydrogen and synthesis gas
- Production of soda ash and sodium bicarbonate
- Production of ammonia
- CO₂ emissions from CCS

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Annex IV : Specific monitoring rules for all ETS sectors

For each activity

- Scope
- Specific monitoring rules

Example:

- Scope of combustion
include at least : boilers, burners, turbines, heaters, furnaces, incinerators, kilns, ovens, dryers, engines, flares, scrubbers (process emissions) and any other equipment or machinery that uses fuel, excluding equipment or machinery with combustion engines that are used for transportation purposes (...)
- Specific monitoring rules for combustion
Flares: by way of derogation (...) tier 1 and 2b for the emission factor are defined as (..)

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Uncertainty and the tiers system

Relevant questions when monitoring emissions for ETS

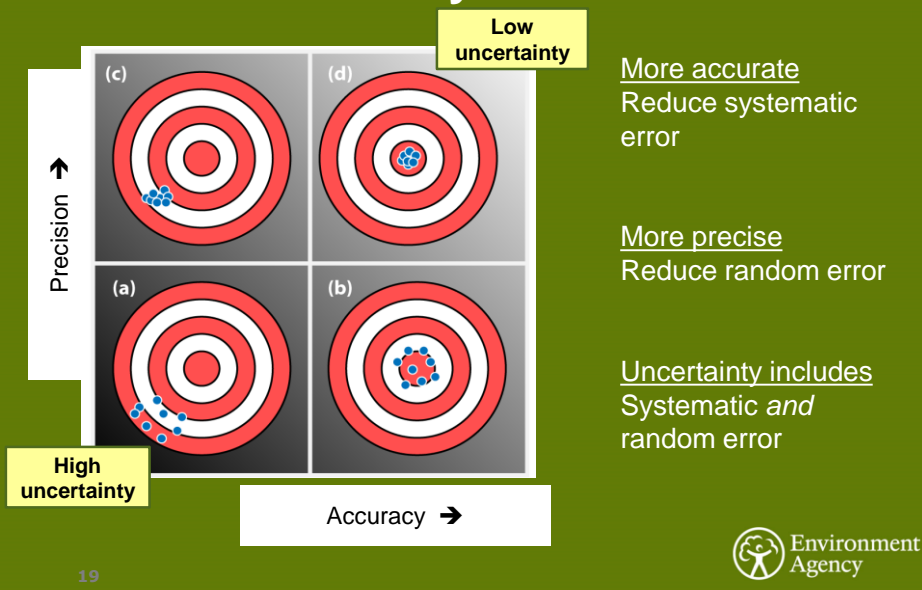
- How good is the measurement data?
- Is the measurement system adequate?
- Equal treatment: is my competitor doing the same effort to deliver reliable data?
- Is each ton CO₂ emitted also a ton reported CO₂ ?

MRR requirements

- Tiers system and uncertainty thresholds for tiers

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What is uncertainty?



Categorisation of installations

Category A

Annual emissions $\leq 50\,000$ ton of CO₂(e)

Category B

Annual emissions $> 50\,000$ ton and
 $\leq 500\,000$ ton of CO₂(e)

Category C

Annual emissions $> 500\,000$ ton of CO₂(e)

Installation with low emissions

Annual emissions $< 25\,000$ ton of CO₂(e)

Categorisation of source streams

De-minimis source streams

- jointly correspond to
 - less than 1 000 tonnes of fossil CO₂ or
 - less than 2% of total : maximum contribution of 20 000 tonnes of fossil CO₂

Minor source streams

- jointly correspond to
 - less than 5 000 tonnes of fossil CO₂ or
 - less than 10% of total : maximum contribution of 100 000 tonnes of fossil CO₂

Major source streams

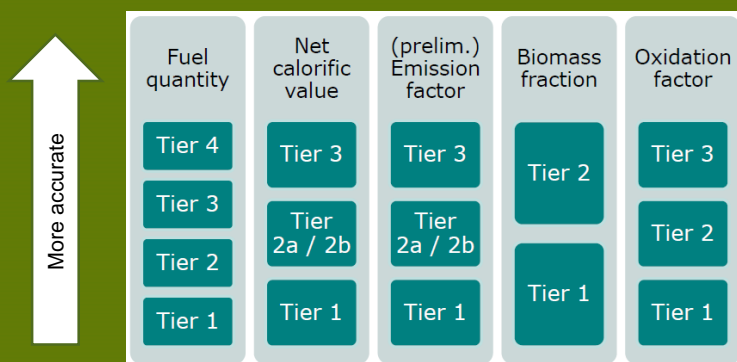
- Not minor and not de-minimis



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The tiers system

- Each parameter determined by "data quality levels"

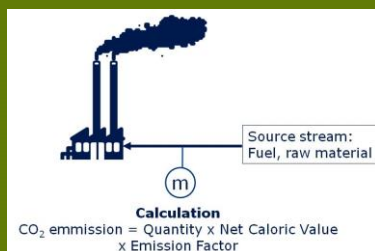


- The higher the tier, the lower the required uncertainty
- Cost effective approach: lower tiers usually required for smaller quantities of emissions and for smaller installations



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Uncertainty thresholds



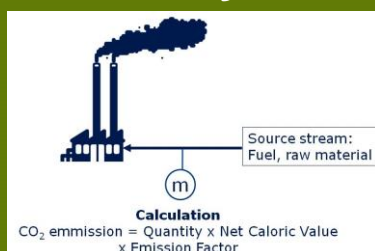
Standard calculation methodology
 Measurement of fuel quantity

Tier	Maximum uncertainty to report quantity of fuel (t or m3)
1	7,5%
2	5,0 %
3	2,5 %
4	1,5 %



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Uncertainty thresholds



Standard calculation methodology
 Determination of calculation factors
 -Net Calorific Value
 -Emission Factor

Tier	Example thresholds combustion
1	Type I Default values (from MRR)
2a	Type II Default values (GHG Inventory)
2b	Established proxy-value
3	Laboratory analysis: table minimum frequencies.



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Selection of the applicable tier

Source stream	Category Installation		
	Category A	Category B	Category C
Major	Annex V (lower tiers)	Highest tiers	Highest tier
Major, but technically not feasible or unreasonable costs	up to 2 tiers lower	up to 2 tiers lower	1 tier lower
Major, but still technically not feasible or unreasonable costs; improvement plan (max. 3 year transition)	Minimum tier 1	Minimum tier 1	Minimum tier 1
Minor	highest tier technically feasible and without unreasonable costs (minimum tier 1)		
De-minimis	conservative estimation, unless a defined tier is achievable without additional effort		

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Data management and control

- ➔ Management system
- ➔ Identify what might go wrong and prevent it
- ➔ Risk assessments are useful for all operators; a requirement for some
- ➔ The quality and effectiveness of the risk assessment and control measures can influence verification activities
- ➔ Living documents – keep under review!

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Data management and control

➔ Inherent risk

- ➔ Susceptibility of material misstatements within the report
- ➔ Control activities to mitigate against the risk

➔ Control risk

- ➔ Susceptibility of material misstatements not being prevented or detected and corrected on a timely basis by the control system

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Data management and control system

Requirement MRR on data flow activities

Written procedure data flow should cover

- *identification primary data sources*
- *each step in data flow from primary data to report*
- *relevant processing steps*
- *electronic processing of data and storage*

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Data gaps

- ➔ Risk of a material misstatement through a data gap: missing, lost, corrupt, wrong
- ➔ Control procedures are required to identify where this may occur and how to avoid them and how to deal with them if they do occur
- ➔ Alternative data sources?
- ➔ Verifier must assess if there are any data gaps and the impact on materiality

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Data management and control system

Requirements MRR on control activities

Specific written procedures on

- *quality assurance of the measurement equipment*
- *quality assurance of the information technology system*
- *segregation of duties in the data flow activities*
- *internal reviews and validation of data*
- *corrections and corrective action*
- *control of out-sourced processes*
- *keeping records and documentation including the management of document versions*

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Improvement principle (1)

- ➡ Operators must take into account the recommendations included in the verification reports

- ➡ *by 30 June of the year in which the verification report is issued*

- ➡ Operators must check regularly on their own initiative, whether the monitoring methodology can be improved

- ➡ *by 30 June every year for category C installations*

- ➡ *by 30 June every two years for category B installations*

- ➡ *by 30 June every four years for category A installations*



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Improvement principle (2)

MRR requirements:

- ➡ Report on the proposed improvements to the CA for approval
- ➡ Update the monitoring plan as appropriate
- ➡ Implement the improvements according to the time table proposed in the approved improvement report



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Areas for improvement

- ➔ Risk assessment
- ➔ Development, documentation implementation and maintenance of data flow activities and control activities as well as the evaluation of the control system
- ➔ Development, documentation, implementation and maintenance procedures for
 - Ability of the operator to improve their monitoring:
 - achieve a higher tier,
 - reduce risk
 - enhance efficiency in monitoring and reporting

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Simplifications – installation with low emissions (1)

- ➔ The installation may use a simplified monitoring plan
- ➔ No justifications regarding unreasonable costs
- ➔ No requirement for submitting
 - ➔ *evidence that the required tiers are met (uncertainty assessment)*
 - ➔ *a risk assessment as part of the control system*
- ➔ Exempted from reporting on improvements reacting on findings by the verifier

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Simplifications – installation with low emissions (2)

- ➡ use purchasing records and estimated stock changes, without providing an uncertainty assessment
- ➡ if the operator uses analyses by a non-accredited laboratory, simplified evidence regarding the competence
- ➡ All other requirements for installations are to be respected
- ➡ Lower tiers: requirements are relatively easy to meet

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Emissions report

- ➡ 1 January to 31 December: monitoring
- ➡ 31 March at the latest: submit emissions report
 - ➡ Verified in accordance with the Accreditation and Verification Regulation i.e. by an accredited verifier
- ➡ Verification report
 - ➡ Opinion
 - ➡ Outstanding issues
 - ➡ Recommendations for improvement

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Useful information

1. General Guidance for installations
2. General Guidance for aircraft operators
3. Biomass issues
4. Uncertainty assessment
5. Sampling and analysis
6. Data flow activities and control system

http://ec.europa.eu/clima/policies/ets/monitoring/documentation_en.htm