





Annexes on MRV elements of the draft implementing act under Art. 35(7)

Expert group online meeting 16 October 2023



OVERVIEW

- Introduction to Monitoring and Reporting rules for embedded emissions
- Part 1: Monitoring rules for direct emissions of installations
 - Different monitoring approaches
 - Simplifications and flexibility
- Part 2: From installations to goods (Attribution of emissions to production processes and goods)
 - Including corrections for waste gases
 - Calculating embedded emissions
 - Monitoring of precursors
- Part 3: Further rules and special cases
 - Choosing most accurate data sources
 - Rules for monitoring heat flows
 - Monitoring of electricity
 - Attributing emissions in processes with several products
 - QA/QC measures
 - Reporting / Communication between producers and importers



STARTING POINT

- CBAM is intended to put the same carbon costs on imported products as would be incurred by installations in the EU under the EU ETS
- Consequently, coverage of emissions should be as similar as possible
- Monitoring, Reporting and Verification (MRV) rules should build on EU ETS experience
- Some flexibility is provided by allowing elements from 'eligible MRV systems' around the world
- The 'transitional phase' until including 2025 is designed as a learning phase
- This presentation / the draft implementing act only applies to the transitional phase

EMBEDDED EMISSIONS (CONCEPT)







GENERAL APPROACH: STEPS TO DETERMINE ACTUAL SPECIFIC EMBEDDED EMISSIONS (ANNEX III, A.2)

- **Step 1**: Define the installation's boundaries, production processes and production routes (production process is similar to the sub-installation in the EU ETS)
- Step 2: Perform monitoring:
 - Apply Annex III, section B to monitor *direct emissions* at installation level → like MRR*
 - Apply Annex III, section C to monitor flows of net *measurable heat* → like FAR^{**}
 - Apply Annex III, section D to monitor flows of *electricity* → like FAR
 - Apply Annex III, section E to monitoring *precursors* → new element
- Step 3: Attribute Emissions to production processes, then to goods (Section F) → like FAR
- Step 4: For complex goods, add embedded emissions of precursors (Section G) → new
- If the operator *cannot adequately determine the embedded emissions*, use **preliminary default values** made available by the Commission

*Monitoring and Reporting Regulation (Regulation (EU) 2018/2066) **Free Allocation Rules (Regulation (EU) 2019/331)





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Part 1 – direct emissions of installations





PRINCIPLES (ANNEX III, A.3)

- Completeness: Monitor "everything needed in accordance with this Annex"
- **Consistency and comparability**: selected data determination methods shall be laid down in a *monitoring methodology documentation*, and be kept up to date
- **Transparency**: to "enable the reproduction of the determination of emissions data by the operator's personnel as well as by independent third parties"
- **Accuracy**: apply due diligence to reach highest achievable accuracy. For *data gaps: apply conservative approach*
- **Integrity of methodology**: Enable reasonable assurance, avoid material misstatements, apply *optional measures to improve data quality* (Annex III, Section H)
- Cost effectiveness: Balance data quality against (unreasonable) costs
- Continuous improvement



DEFINITIONS (ANNEX III, A.1)

- Many well-known definitions from the EU ETS Directive, MRR*, AVR** and FAR***
- With some adaptations, in particular to avoid references to other EU legislation, for user-friendliness
- 'Production process' means the parts of an installation in which chemical or physical processes are carried out to produce goods under an aggregated goods category defined in Table 1 of Section 1 of Annex II, and its specified system boundaries regarding inputs, outputs and corresponding emissions
 → comparable, but not identical to 'Sub-installation' in EU ETS free allocation rules
- *'Production route'* means a specific technological option used in a production process to produce a good under an aggregated goods category;
 → different production routes can fall within the same production process.

* Monitoring and Reporting Regulation (Regulation (EU) 2018/2066) ** Accreditation and Verification Regulation (Regulation (EU) 2018/2067) ***Free Allocation Rules (Regulation (EU) 2019/331)



MONITORING OF DIRECT EMISSIONS AT INSTALLATION LEVEL (ANNEX III, SECTION B)

- B.1 Completeness
- B.2 Choice of monitoring approach
- B.3 Formulae and parameters for calculationbased approach
 - Standard method & Mass balance
 - Zero-rating of biomass
 - Relevant parameters
- B.4 Requirements for activity data
- B.5 requirements for calculation factors
 - Methods (standard factors, correlations, laboratory analyses)
 - Requirements for laboratories, sampling

- B.6 Measurement-based approach
 - Methods and calculation
 - Quality requirements
 - Corroborating calculation
- B.7 Monitoring of PFC emissions
- B.8 CO₂ transfers between installations
- B.9 Sector-specific requirements
 - Combustion: Special rules for flue gas cleaning, flares
 - Cement clinker production (CKD factor,...)
 - Nitric acid production N₂O



DIRECT EMISSIONS – MONITORING APPROACHES



Standard methodology

 $Em_{i} = AD_{i} \cdot EF_{i} \cdot OF_{i}$ $AD_{i} = FQ_{i} \cdot NCV_{i}$ $EF_{i} = EF_{pre,i} \cdot (1 - BF_{i})$

- *Em*_{*i*}...Emissions [t CO₂] caused by fuel *i*
- EF_i...Emission factor [t CO₂ / TJ] of fuel i
- *AD_i*...Activity data [TJ] of fuel *i*
- FQ_{i} ... Fuel quantity consumed [t or m³] of fuel i
- NCV_i... Net Calorific value (lower heating value) [TJ/t or [TJ/m³] of fuel i
- *OF_i*...Oxidation factor (dimensionless) of fuel *i*
- EF_{pre,i}... preliminary emission factor of fuel *i* (i.e. emission factor assuming the total fuel is fossil)
- BF_i... Biomass Fraction (dimensionless) of fuel i



Mass balance

 $Em_{k} = f \cdot AD_{k} \cdot CC_{k}$ $CC_{k} = EF_{k} \cdot NCV_{k}/f$

- *AD_k*...Activity data [t] of material *k*; for outputs, *AD_k* is negative
- f...ratio of molar mass of CO₂ to C: f = 3.664 t CO₂/t C
- *CC_k...carbon* content of material *k* (dimensionless and positive)



CEMS (continuous emissions monitoring systems)

$$Em = \sum_{h} (c_h \cdot \dot{V}_h)$$

- *h* ...hour (or other interval)
- *c_h*...hourly average concentration
- \dot{V}_h ...hourly flue gas flow

To be summed up over the whole reporting period

Notes:

- Special approach for PFCs (Annex III, section B.7) not shown here
- "Fall-back approach" like in MRR is not included replaced by wider flexibility rules



MONITORING OF DIRECT EMISSIONS – DETAILS (ANNEX III)

- B.4 Requirements for activity data: Copied MRR rules on
 - Continual vs. batch-wise monitoring; Formula for taking into account stock changes
 - Instruments under operator's control vs. other instruments
 - Requirements for measuring systems (i.e. uncertainty, but without tiers)
 - B.4.4: for orientation purposes, uncertainty should be between 1,5% (>500 000 t CO₂) and 7,5% (< 10 000 t CO₂)
- B.5 requirements for calculation factors
 - Standard factors Type I (e.g. in Annex VIII = MRR Annex VI and GD3*), and Type II, slightly modified from MRR
 - Correlations (for industrial gases, coal types, etc.) as in MRR
 - Laboratory analyses
 - Requirements for laboratories simplified
 - Accreditation of laboratories and representative sampling plan given as "recommended improvements"
- Zero-rating of biomass CO₂ (B.3.3):
 - MRR approach copied, i.e. GHG savings and sustainability criteria of RED II** applicable
 - It is assumed that certification schemes (recognised by the Commission) can operate world-wide. However, experience needs to be gathered



OTHER MONITORING OF DIRECT EMISSIONS

- Until 31 December 2024, the level of embedded emissions may be calculated using one of the following methods, if they lead to similar coverage and accuracy of emissions data:
 - 1. Methods used under eligible monitoring, reporting and verification systems.
 - 2. Other methods, with any of the following applicable monitoring rules:
 - a. a carbon pricing scheme where the installation is located, or
 - b. an emission monitoring scheme at the installation which can include verification by an accredited verifier, or
 - c compulsory emission monitoring schemes.
- 'eligible monitoring, reporting and verification (MRV) system' means the rules established by the jurisdiction in which the installation is located, for monitoring, reporting and verification for the purpose of a mandatory carbon pricing scheme, or the monitoring, reporting and verification rules governing a greenhouse gas emission reduction project carried out in the relevant installation, or compulsory emission monitoring schemes.



FLEXIBILITY AND SIMPLIFICATIONS (1)

- CBAM rules should be robust and ensure the environmental integrity of the CBAM
- Complete ETS requirements would be perceived as excessively demanding
- ETS requirements could not be enforced anyway, as there is no Monitoring Plan (MP) approval and Annual Emission Report (AER) acceptance by competent authorities
- Like in the early days of the EU ETS, flexibility should be provided to use monitoring systems already available at the installations, e.g. for process control
- Where carbon pricing systems or GHG reporting requirements already exist, those should be used to the extent possible
- The principles of "unreasonable costs" and "technical feasibility" have been copied from the MRR as means to limit the operators' efforts



FLEXIBILITY AND SIMPLIFICATIONS (2)

- **No tier system** is introduced. The improvement principle is framed by two definitions:
- 'Minimum requirements' means monitoring approaches using the minimum efforts allowed for determining data in order to result in emission data acceptable for the purpose of Regulation (EU) 2023/956;
- '*Recommended improvements*' means monitoring approaches which are proven means to ensure that data are more accurate or less prone to mistakes than by mere application of minimum requirements, and which may be chosen on a voluntary basis;
- QA/QC ("Data flow and control activities" in the MRR) is optional (Annex III, Section H)
- Verification is also mentioned as voluntary measure / recommended improvement



FLEXIBILITY AND SIMPLIFICATIONS (3)

Reporting period: Annex III, Section A.2 clarifies:

- Default reporting period is the calendar year
- In the case that "eligible MRV systems" are relevant at the installation, the system's reporting period may be used, if at least longer than 3 months
- Alternative: Use of the fiscal year, provided it provides better data quality than the calendar year

System boundaries of production processes

→ Potentially biggest simplification (see next part of the presentation)





ANY QUESTIONS, COMMENTS ON THIS PART?





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Part 2: From installations to goods (Attribution of emissions)





APPROACH TO DIVIDING INSTALLATIONS INTO PRODUCTION PROCESSES (ANNEX III, A.5)

- **Default case**: "Aggregated goods category" corresponds to one production process (FAR: one benchmark one sub-installation)
- Voluntarily, operator can split production processes further
 - for different production routes (e.g. blast furnace / EAF)
 - For more precise differentiation of products (e.g. if needed for an eligible MRV system)
- **Simplification**: where precursors are produced in the same installation and no precursors are sold, several production processes (one value chain) can be covered by a single "bubble approach"
- For the transitional period, the bubble approach is explicitly allowed for iron & steel, aluminium and fertilizers
- Note: There are no "fall-back sub-installations"!
 - Non-measurable heat and process emissions are included in production processes \rightarrow no monitoring rules

EXAMPLE – OVERVIEW

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EXAMPLE – SIMPLIFIED APPROACH ("BUBBLE")



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LIST OF AGGREGATED GOODS CATEGORIES (ANNEX II, SECTION 1)

- Aim is to have a limited number of goods categories and production processes which can be sufficiently simple in terms of terminology and legal requirements
- Groups of CN codes, sometimes expressed different than in CBAM Regulation Annex I, e.g.:

Fertilizer	
2808 00 00 – Nitric acid; sulphonitric acids	Nitric acid
3102 10 – Urea, whether or not in aqueous solution	Urea
2814 – Ammonia, anhydrous or in aqueous solution	Ammonia
2834 21 00 – Nitrates of potassium	
3102 – Mineral or chemical fertilisers, nitrogenous – <u>except 3102 10 (Urea)</u>	
 3105 – Mineral or chemical fertilisers containing two or three of the fertilising elements nitrogen, phosphorus and potassium; other fertilisers Except: 3105 60 00 – Mineral or chemical fertilisers containing the two fertilising elements phosphorus and potassium 	Mixed fertilizers

 Not necessarily the same grouping as the one that will be used for the default values – those may be more disaggregated



PRODUCTION PROCESSES AND PRODUCTION ROUTES (ANNEX II, SECTION 2)

- This section gives special provisions for some production processes, and for each production route the relevant precursors
- Few aggregated goods categories have more than one production route:
 - Pig Iron: Blast furnace / smelting reduction
 - Crude Steel: Basic oxygen steel making / Electric arc furnace Note: High-alloy steels included in same process
 - Unwrought aluminium: Primary smelting / secondary production
- Some aggregated goods categories can be precursors of their own category, if more complex products are produced from simpler products of the same category (e.g. steel sheets → steel profiles)



PRODUCTION ROUTES AND AGGREGATED GOODS CATEGORIES (1) (SIMPLIFIED)





PRODUCTION ROUTES AND AGGREGATED GOODS CATEGORIES (2) (SIMPLIFIED)



CALCULATION OF ATTRIBUTED EMISSIONS (ANNEX III, SECTION F.1)







ATTRIBUTED DIRECT EMISSIONS (F.1, CONTINUED)

- *DirEm**: Direct emissions without
 - Emissions from (separate) measurable heat used
 - Waste gases not fully consumed in the process
- *Em_{H,import}*: Emissions corresponding to heat imports
- $Em_{H,export}$: Emissions corresponding to heat exports $Em_{H,import} = Q_{import} \cdot EF_{heat}$

Q... heat flow (TJ) *EF*...emission factor (t CO₂/TJ)

Details on heat in Annex III, section C (see next part of the presentation)

Waste gases (WG) are treated like in the FAR:

• $WG_{corr,import} = V_{WG,import} \cdot NCV_{WG} \cdot EF_{NG}$

 V_{WG} ...Volume of WG, EF_{NG} ...Emission factor of natural gas

• $WG_{corr,export} = V_{WG,export} \cdot NCV_{WG} \cdot EF_{NG} \cdot Corr_{\eta}$

 $Corr_{\eta} = 0,667$... Correction factor for converting to electricity production efficiency of natural gas

Em_{el,produced}: Details on emissions corresponding to produced electricity in Annex III, section D (see next part of the presentation)



ATTRIBUTED EMISSIONS (F.1, CONTINUED)

• Attributed indirect emissions of the production process:

 $AttrEm_{indir} = Em_{el,cons}$

- Further details in Annex III, Section D (see next part of the presentation)
- From **attributed emissions** of the production process to **specific embedded emissions** of the (simple) good, i.e. t CO₂e per t good:

$$SEE_{g,Dir} = \frac{AttrEm_{g,Dir}}{AL_g}$$
 and $SEE_{g,Indir} = \frac{AttrEm_{g,Indir}}{AL_g}$

- SEE ... specific embedded emissions
- *AL_g*... Activity level of good *g* (amount of the goods g produced in the reporting period in that installation, in line with section F.2, i.e. referring to the whole aggregated goods category)



EMBEDDED EMISSIONS OF COMPLEX GOODS (1)

Calculation of embedded emissions

(Annex III, section G) Formulae can be used both for direct and indirect emissions:

$$SEE_g = \frac{AttrEm_g + EE_{InpMat}}{AL_g}$$

and $EE_{InpMat} = \sum_{i=1}^{n} M_i \cdot SEE_i$

Where

- *EE*_{*InpMat*} ... Embedded direct or indirect emissions of all precursors consumed
- *M_i* ... Mass of precursor *i* used in the production process yielding good *g*
- *i* ... index for the precursor

• For comparability purposes, calculate values per tonne (complex) good:

 $m_i = M_i / AL_g$ and $ae_g = AttrEm_g / AL_g$ Where

- *ae_g* ... attributed emissions of good g before adding precursors' embedded emissions, per tonne of *g* produced
- *m_i* ... Mass of precursor *i* used in the production, per tonne of good *g* produced
- Values *ae_g*, *m_i* and *SEE_i* could be specified as default values for filling data gaps of operators (*possibly only for the definitive phase, under discussion*):

$$SEE_g = ae_g + \sum_{i=1}^n (m_i \cdot SEE_i)$$



EMBEDDED EMISSIONS OF COMPLEX GOODS (2)

Monitoring of precursors (Annex III, section E)

- Collect data for each relevant precursor, separately for each supplier
- If self-produced, see rules on defining production process boundaries
- Data to be collected:
 - SEE_i, M_i,
 - country of origin, installation identification,
 - production route, additional parameters,
 - applicable reporting period, etc.
- Ideally the same template is used as the one for communication from the operator to the importers (Annex IV)



$AttrEm_{dir} = DirEm^* + Em_{H,import} - Em_{H,export} + WG_{corr,import} - WG_{corr,export} - Em_{el,produced}$



and
$$EE_{InpMat} = \sum_{i=1}^{n} M_i \cdot SEE_i$$

ANY QUESTIONS, COMMENTS ON THIS PART?

CBAM embedded emissions 30





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Part 3 – Further rules and special cases





APPROACH FOR CHOOSING THE MOST ACCURATE DATA SOURCE (ANNEX III, A.4)

- Like in FAR Annex VII, there is a need to select data sources beyond what is given in the MRR, i.e. beyond installation-level direct emissions. This may in some cases be difficult. Rules are therefore needed which guide the selection of data sources.
- The principles are expressed without reference to the EU ETS' provisions on "approved monitoring plans" or tier levels:
 - Monitoring methods described in the Annex are preferred over eligible MRV systems (but the latter are allowed subject to the conditions in the main text)
 - Next best are indirect methods (correlations). Last resort are preliminary default values
 - ISO/EN standards to be applied, or draft standards/national standards, or industry best practice / scientifically proven methods
 - Measurement instruments / laboratory analyses under operator's own control are preferred
 - Lowest uncertainty preferred
 - Accredited laboratories preferred



APPROACH FOR CHOOSING THE MOST ACCURATE DATA SOURCE (ANNEX III, A.4, CONTINUED)

- Best available data sources that appear highest in the ranking should be selected, and where lowest inherent risk in the data flow
- Besides the *primary data source*, a second "*corroborating data source*" should be defined, if possible, for the purpose of internal controls and plausibility checking
- At least once a year, a check for possible improvements should be carried out
- Unreasonable costs and technical feasibility (similar to MRR) are reasons for allowing the next lower level. Definitions included in section A.4



HEAT FLOWS (ANNEX III, C)

- Determination of heat flows (C.1):
 - Measurement needs metering of flow, temperature, pressure, saturation (steam)
 - Net heat flows (i.e. heat in returned medium needs to be subtracted)
 - Proxy calculations (calculation from fuel input and efficiency, use of a reference efficiency,...)
- Fuel mix emission factor (C.2):
 - C.2.1: Non-CHP: Simple case using NCV and EF of each fuel used
 - C.2.2: CHP (cogeneration of heat and power): Approach of FAR is followed, using a formula from the Energy Efficiency Directive; The calculation requires reference efficiencies for the separate production of heat and electricity. These reference values are compiled as Annex IX into the implementing act (Copy from Commission Delegated Regulation (EU) 2015/2402).
 - C.2.3: Imported heat:
 - If the heat-producing installation is known and performs monitoring \rightarrow Use Sections C.2.1 or C.2.2 as appropriate
 - Otherwise use standard value "based on the standard emission factor of the fuel most commonly used in the country and industrial sector, assuming a boiler efficiency of 90%."
 → Reason: there is no "heat benchmark" available outside the EU ETS
- Heat recovered from electricity-driven processes and from nitric acid production shall not be accounted (Annex III, section F.1)
- Emission factor of waste gases *consumed*: Substitute by the EF from natural gas (Annex III, section F.1)



ELECTRICITY (ANNEX III, D)

- D.1: Monitoring of electricity quantities:
 - Net data; Real power, not apparent power
- D.2: Emission factor of electricity:
 - D.2.3 Imported from grid (most common case):
 - Use the average emission factor of the country of origin electricity grid based on data from the IEA provided by the Commission; or
 - any other emission factor of the country of origin electricity grid based on publicly available data in the country of origin representing either the average or the CO₂ emission factor as defined in Section 1 of Annex IV of Regulation (EU) 2023/956 in the country of origin.
 - Option to use actual emission factor for auto-produced electricity or received via power purchase agreement still under discussion (monitoring rules for non-CHP (Annex III, D.2.1) or for CHP (Annex III, D.2.2) would apply as appropriate)
- Special case: Indirect emissions in hydrogen production may be assumed automatically to be zero, if certification as renewable fuel of non-biological origin (RFNBO)* regarding the renewable energy under RED II is provided (Annex II, section 2.6)

* Under Commission Delegated Regulation (EU) .../... of 10.2.2023 supplementing Directive (EU) 2018/2001 of the European Parliament and of the Council by establishing a Union methodology setting out detailed rules for the production of renewable liquid and gaseous transport fuels of non-biological origin



MONITORING NEEDED FOR ATTRIBUTED EMISSIONS (ANNEX III, SECTION F)

- Rules follow FAR approaches
- F.2 Monitoring rules for activity levels
 - Activity levels = sum of tonnes saleable goods produced, without scrap, waste, residues
 - Avoid double counting: In value chains, only the very final product counts, in particular if a production process is defined using a "bubble approach"
- F.3 Rules necessary for attributing emissions to production processes
 - What to do if not all fuel and material streams have measurement instruments, estimation, reconciliation
 - F.3.2: Need to track which goods are produced (by CN code) in order to ensure validity of monitoring of activity levels
- F.4 Further rules for direct emissions: Need to monitor also source streams and heat exchanged between production processes, not only at installation level
- F.5 Further rules for measurable heat: Attributing heat losses proportionally to production processes



ATTRIBUTION OF EMISSIONS IN PROCESSES WITH MORE THAN ONE PRODUCT

- Annex III, F.3.1, point 2(b) states (like FAR): "... emissions shall be attributed based on the mass or volume of individual goods produced or estimates based on the ratio of free reaction enthalpies of the chemical reactions involved or based on another suitable distribution key that is corroborated by a sound scientific methodology."
- Example: Hydrogen Annex II, 2.6
 - Here free reaction enthalpies don't work \rightarrow proposed to use a molar ratio as basis
 - In water electrolysis, reward if oxygen is utilised instead of emitted \rightarrow Hydrogen gets less embedded emissions
 - In Chlor-Alkali electrolysis split energy consumption / emissions equally (according to molar ratio) to Hydrogen (H₂), Chlorine (Cl₂) and caustic soda (NaOH)
 - Similar in Chlorate production H₂, Cl₂ and sodium chlorate (NaClO₃)



OPTIONAL MEASURES TO INCREASE DATA QUALITY (ANNEX III, SECTION H)

- This section reflects Article 11 of the FAR, which is a summary of Articles 58 to 66 MRR
- Need for a rudimentary risk analysis and control system
- Ensure calibration and maintenance of measurement instruments, horizontal and vertical data checks, etc.
- Carry out internal reviews
- *Recommended improvement*: voluntary verification



REPORTING – ANNEX III, SECTION I & ANNEX IV

- In lieu of an annual emissions report, there is only the need to "compile a communication" that can be used to inform the importer of the relevant emissions data required for the CBAM report
- This shall be done within 3 months after the end of the *reporting period*
- It is *recommended* to use the template provided by the Commission
- (Not mentioned in the implementing act, but best practice: If voluntary verification is used, its results should be communicated to the importers, too)
- The minimum content of the template is outlined in Annex IV
 - Minimum requirements
 - Optional information (recommended improvement)
 - Sector-specific parameters (e.g. clinker content of cement)
 - ightarrow Basis for the Excel template



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