EUROPEAN COMMISSION
DIRECTORATE-GENERAL
CLIMATE ACTION
Directorate B – Carbon Markets & Clean Mobility
Unit B.2 – ETS (II): Implementation, Policy Support & ETS Registry

Guidance Document

The Monitoring and Reporting Regulation – General guidance for installations

MRR Guidance document No. 1,
Updated Version, final draft, 14 January 2025

This document is part of a series of documents provided by the Commission services for supporting the implementation of the "Monitoring and Reporting Regulation (the "MRR"). The version of the MRR developed for the use in the 4th phase of the EU ETS, i.e. Commission Implementing Regulation (EU) 2018/2066 has been revised in 2023 and 2024[1]. This guidance document takes into account those amendments.

The guidance represents the views of the Commission services at the time of publication. It is not legally binding.

This guidance document takes into account the discussions within meetings of the informal Technical Working Group on MRVA (Monitoring, Reporting, Verification and Accreditation) under the Working Group III (WGIII) of the Climate Change Committee (CCC), as well as written comments received from stakeholders and experts from Member States[2]. *This guidance document was endorsed by the representatives of the Member States at the meeting of the Technical Working Group MRVA on 16 January 2025.*

All guidance documents and templates can be downloaded from the documentation section of the Commission's website at the following address: **https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets/monitoring-reporting-and-verification-eu-ets-emissions_en** .

[1] Latest consolidated MRR: **http://data.europa.eu/eli/reg_impl/2018/2066/2024-07-01**, not yet containing the latest amendment by Commission Implementing Regulation (EU) 2024/2493 of 23 September 2024, **http://data.europa.eu/eli/reg_impl/2024/2493/oj**

[2] "Member States" in this document means all countries that apply the EU ETS, i.e. the 27 EU Member States plus the EFTA countries Norway, Iceland and Liechtenstein.

Version History

Date	Version status	Remarks
16 July 2012	published	Endorsed by CCC on 11 July 2012
27 November 2017	re-published	Minor updates taking into account general updates of the MRVA suite of guidance materials; Hyperlinks updated
10 February 2022	Re-published	Major revision: move from MRR 2012 to MRR 2018, including its revision in 2020, i.e. revision for use in the 4th phase of the EU ETS; FAQ included; guidance on RED II criteria included
20 February 2023	Re-published	Alignment of biomass-related sections with recently published GD 3; minor corrections.
14 January 2024	Re-published	Takes into account the amendments necessary for the 2023 review of the EU ETS Directive, i.e. by Commission Implementing Regulations (EU) 2023/2122 and 2024/2493.

TABLE OF CONTENTS

1 SUMMARY

Monitoring and reporting of emissions is a cornerstone of the EU ETS[3] (the European Union Emissions Trading System). Following the revisions of the EU ETS Directive, updated rules for monitoring and reporting have been laid down in the form of an EU Regulation (the Monitoring and Reporting Regulation, hereinafter the "MRR"). At the same time, a Regulation for verification of emissions and accreditation of verifiers (the "AVR") was established. In 2018, both Regulations were revised and republished. Further major revisions took place in 2020, 2023 and 2024. This guidance document gives guidance to the MRR in the version following the mentioned revisions.

This guidance document is part of a series of guidance documents and electronic templates provided by the Commission services to support the EU-wide harmonised implementation of the MRR. It gives an introduction to the EU ETS compliance system, the concepts used for monitoring and reporting of stationary installations, and then describes in more detail the requirements laid down in the MRR for the possible monitoring approaches. This guidance does not add to the mandatory requirements of the MRR, but it is aimed at assisting in more correct interpretation and facilitated implementation.

This guidance document represents the views of the Commission services at the time of publication. It is not legally binding.

Note that this document does not cover requirements for aircraft operators. Aircraft operators in search of guidance on monitoring and reporting in the EU ETS are invited to consult guidance document No. 2.

1.1 Where should I start reading?

This document has been developed to guide readers who are new to the EU ETS as well as those who are already familiar with the EU ETS. The latter group should in particular pay attention to sections which are marked with a *New!* sign[4] throughout the document (for a list of guiding symbols see section 2.2). Section 1.2 of this summary will serve as useful starting point.

Readers with little experience of the EU ETS and its MRV (Monitoring, Reporting and Verification) system should read in particular chapter 3 (about the EU ETS compliance cycle) and chapter 4 (concepts and approaches). All readers who need to monitor an installation and therefore have to develop (or update) a monitoring plan, are advised to check chapter 5 on monitoring plans. Depending on the monitoring approaches relevant for the installation to be monitored, chapters 6 (calculation-based approaches) and 8 (measurement-based approaches)

[3] For an explanation of acronyms and for references of legislative texts please see the annex of this document.

[4] In the original version of this document, the *New!* icon was used for highlighting elements that were new compared to the 2nd phase of the EU ETS. In this update, however, the symbol indicates changes made in 2023 and 2024, i.e. after the "Fit for 55" amendments of the EU ETTS Directive.

will give valuable insight into the details of MRR requirements for those approaches.

The MRR has put considerable emphasis on simplifying monitoring wherever this is possible for cost effectiveness reasons without compromising the robustness of the monitoring. Operators in search for such options are advised to look out for the "simplified!" icon.

Operators of installations with low emissions (for definition see section 4.4.2) should look for the "small" icon, and in particular to section 7.1. Finally, the MRR provides an option for Member States to employ standardised and simplified monitoring plan templates. This option is discussed in detail in section 7.2 of this document.

1.2 What is new in the updated MRR?

The MRR was revised to implement the amendment of the EU ETS Directive as part of the "Fit-For-55" package as part of the "European Green Deal". The new elements of the MRR cover the two amendments in 2023[5] and 2024[6]. The following main elements can be highlighted:

Installations for the incineration of municipal waste have been included in the EU ETS1, but only for monitoring, reporting and verification, without the obligation to surrender allowances for their emissions. More information for such MWI installations can be found in the FAQs section of this document (**section 12.18 and 12.19**).

- The relation as well as boundary issues and double counting between the EU ETS1 and the EU ETS2 have been added. For that purpose the reporting obligation for ETS1 installations in accordance with Annex Xa of the MRR has been introduced.
- The concept of zero-rating has been extended from biomass to other types of fuels (see section 6.3.5).
- The role of the Union Database (UDB) was strengthened under the updated RED II for simplifying the process of providing evidence for zero-rating.
- In the area of CCU (Carbon Capture and Utilisation and CCS (Carbon Capture and Storage), clarifications have been introduced. Furthermore, a framework for the transport of CO_2 by other means than pipelines has been provided.

In this guidance document, all MRR Article numbers refer to the "MRR 2018" (Regulation (EU) 2018/2066) including all its amendments up to the end of 2024.

[5] Commission Implementing Regulation (EU) 2023/2122 of 17 October 2023, http://data.europa.eu/eli/reg_impl/2023/2122/oj

[6] Commission Implementing Regulation (EU) 2024/2493 of 23 September 2024, http://data.europa.eu/eli/reg_impl/2024/2493/oj

2 INTRODUCTION

2.1 About this document

This document has been written to support the MRR (Monitoring and Reporting Regulation), by explaining its requirements in a non-legislative language. For some more specific technical issues, further guidance documents[7] are available. The set of guidance documents is further complemented by electronic templates[8] for information to be submitted by operators to the competent authority. However, it should always be remembered that only the Regulation is legally binding.

This document interprets the Regulation regarding requirements for installations. It builds on earlier guidance as well as best practice identified during earlier phases of the EU ETS. It also takes into account the valuable input from the task force on monitoring and reporting established under the EU ETS Compliance Forum, and from the informal Technical Working Group on Monitoring, Reporting, Verification and Accreditation (TWG on MRVA) of Member State experts established under Working Group 3 (WG III) of the Climate Change Committee (CCC).

2.2 How to use this document

Where article numbers are given in this document without further specification, they always refer to the MRR in its current version[9]. For acronyms, references to legislative texts and links to further important documents, please see the Annex.

This document applies to emissions starting from 2025 ([10]). A "*New!*" symbol (such as on the margin here) indicates where changes to requirements compared to the MRR before the amendments of 2023 and 2024 have taken place.

This symbol points to important hints for operators, verifiers and competent authorities.

This indicator is used where significant simplifications to the general requirements of the MRR are promoted.

The light bulb symbol is used where best practices are presented.

The small installation symbol is used to guide the reader to topics which are applicable for installations with low emissions.

The tools symbol tells the reader that other documents, templates or electronic tools are available from other sources.

[7] See section 2.3.

[8] Note that Member States may define their own templates, which must contain at least the same information as the Commission's templates.

[9] Implementing Regulation (EU) 2018/2066; The consolidated MRR can be found here: https://eur-lex.europa.eu/eli/reg/2018/2066

[10] Note that parts of the 2024 amendments apply already from 1 January 2024 or 1 July 2024, respectively.

The book symbol points to examples given for the topics discussed in the surrounding text.

2.3 Where to find further information

All guidance documents and templates provided by the Commission on the basis of the MRR and the AVR can be downloaded from the Commission's website at the following address:

https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets/monitoring-reporting-and-verification-eu-ets-emissions_en

The following **documents** are provided[11]:

- "Quick guides" as introduction to the guidance documents below. Separate documents are available for each audience:
  - Operators of stationary installations;
  - Aircraft operators;
  - Competent Authorities;
  - Verifiers;
  - National Accreditation Bodies.
- Guidance document No. 1 (this document): "The Monitoring and Reporting Regulation – General guidance for installations".
  - An exemplar simplified monitoring plan in accordance with Article 13 MRR.
- Guidance document No. 2: "The Monitoring and Reporting Regulation – General guidance for aircraft operators". This document outlines the principles and monitoring approaches of the MRR relevant for the aviation sector. It also includes guidance on the treatment of biomass in the aviation sector, making it a stand-alone guidance document for aircraft operators.
- Guidance document No. 3: "Biomass and other zero-rating in the EU ETS": This document discusses the application of sustainability criteria for biomass, as well as the requirements of Articles 38 and 39 of the MRR. This document is relevant for operators of installations and useful as background information for aircraft operators.
- Guidance document No. 4: "Guidance on Uncertainty Assessment". This document for installations gives information on assessing the uncertainty associated with the measurement equipment used, and thus helps the operator to determine whether he can comply with specific tier requirements.
  - Guidance document No. 4a: "Exemplar Uncertainty Assessment". This document contains further guidance and provides examples for carrying out uncertainty assessments and how to demonstrate compliance with tier requirements.
- Guidance document No. 5: "Guidance on sampling and analysis" (only for installations). This document deals with the criteria for the use of non-accredited

[11] This list reflects the status at the time of writing this updated guidance. Further documents may be added later.

laboratories, development of a sampling plan, and various other related issues concerning the monitoring of emissions in the EU ETS.

  - Guidance document No. 5a: “Exemplar Sampling Plan”. This document provides an example sampling plan for a stationary installation.
- Guidance document No. 6: “Data flow activities and control system”. This document discusses possibilities to describe data flow activities for monitoring in the EU ETS, the risk assessment as part of the control system, and examples of control activities.
  - Guidance document No. 6a: “Risk Assessment and control activities – examples”. This document gives further guidance and an example for a risk assessment.
- Guidance document No. 7: “Continuous Emissions Monitoring Systems (CEMS)”. This document gives information on the application of measurement-based approaches where GHG emissions are measured directly in the stack, and thus helps the operator to determine which type of equipment has to be used and whether he can comply with specific tier requirements.
- Guidance document No. 8: “EU ETS Inspection”: Targeted at competent authorities, this document outlines the role of the CA’s inspections for strengthening the MRVA system of the EU ETS.

The Commission furthermore provides the following **electronic templates**:

- Template No. 1: Monitoring plan for the emissions of stationary installations
- Template No. 2: Monitoring plan for the emissions of aircraft operators
- Template No. 4: Annual emissions report of stationary installations
- Template No. 5: Annual emissions report of aircraft operators
- Template No. 7: Improvement report of stationary installations
- Template No. 8: Improvement report of aircraft operators

There are furthermore the following **tools** available for operators:

- Unreasonable costs determination tool;
- Tool for the assessment of uncertainties;
- Frequency of Analysis Tool;
- Tool for operator risk assessment.

The following MRR **training material** is available for operators:

- Roadmap through M&R Guidance
- Uncertainty assessment
- Unreasonable costs
- Sampling plans
- Data gaps
- Round Robin Test
- Biomass

Besides these documents dedicated to the MRR, a separate set of **guidance documents on the AVR** is available under the same address. Furthermore, the Commission has provided guidance on the scope of the EU ETS which should be consulted to decide whether an installation or part thereof should be included

in the EU ETS. That guidance is available under https://ec.europa.eu/clima/system/files/2016-11/guidance_interpretation_en.pdf .

Monitoring for free allocation purposes:

For phase 4 of the EU ETS, the rules for determining the amount of allowances allocated for free pursuant to Article 10a of the EU ETS Directive also require the monitoring and reporting of installation data. Those rules build to some extent on the MRR, but other data sets are involved (such as sub-installation level activity data and "attributed emissions"), and the monitoring and reporting is dealt with separately[12]. Relevant guidance documents and templates are presented on the Commission's website:

https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets/free-allocation_en

In terms of monitoring, "Guidance on Monitoring and Reporting in Relation to the Free Allocation Rules (GD5)" is the most relevant, and "Verification of FAR Baseline Data Reports and validation of Monitoring Methodology Plans (GD4)" for verification of the relevant reports.

Guidance on the scope of the EU ETS for installations:

Guidance Document No. 0: Guidance on Interpretation of Annex I of the EU ETS Directive (excl. aviation and maritime activities): https://climate.ec.europa.eu/document/edc93136-82a0-482c-bf47-39ecaf13b318_en

Guidance material for EU ETS for shipping companies and the MRV Maritime Regulation[13] can be found on the Commission's website for the maritime transport sector: https://climate.ec.europa.eu/eu-action/transport/reducing-emissions-shipping-sector_en

All EU legislation is found on EUR-Lex: http://eur-lex.europa.eu/

The most important legislation is furthermore listed in the Annex of this document.

Also competent authorities in the **Member States** may provide useful guidance on their own websites. Operators of installations should in particular check if the competent authority provides workshops, FAQs, helpdesks etc.

[12] In addition to the monitoring plan under the MRR, a so-called MMP (Monitoring Methodology Plan) is required. Several other types of reports are relevant: A "Baseline Data Report" (BDR) every 5 years for the calculation of the free allocation, an annual "ALC" (Allocation Level Change) Report, and in case of new entrants, a "New Entrant Data report" – all of them are to be verified in accordance with the AVR.

[13] Regulation (EU) 2015/757 of the European Parliament and of the Council of 29 April 2015 on the monitoring, reporting and verification of carbon dioxide emissions from maritime transport, and amending Directive 2009/16/EC, http://data.europa.eu/eli/reg/2015/757/2024-01-01

3 THE EU ETS COMPLIANCE CYCLE

3.1 Importance of MRV in the EU ETS

Monitoring, reporting and verification (MRV) of emissions play a key role in the credibility of any emission trading system. Without MRV, compliance would lack transparency and be much more difficult to track, and enforcement compromised. This holds true also for the European Union Emission Trading System (EU ETS). It is the complete, consistent, accurate and transparent monitoring, reporting and verification system that creates trust in emission trading. Only in this way can it be ensured that operators meet their obligation to surrender sufficient allowances.

This observation is based on the twofold nature of the EU ETS: On the one hand it is a market-based instrument. It has allowed a significant market to evolve, in which market participants want to know the monetary value of the allowances they get allocated, they trade and they have to surrender. On the other hand it is an instrument for achieving an environmental benefit. But in contrast to other environmental legislation, the goal is not to be achieved by individuals, but the whole group of EU ETS participants having to achieve the goal jointly. This requires a considerable level of fairness between participants, ensured by a solid MRV system. The competent authorities' oversight activities contribute significantly to ensuring that the goal set by the cap is reached, meaning that the anticipated emission reductions are delivered in practice. It is therefore the responsibility of the competent authorities together with the accreditation bodies to protect the integrity of the EU ETS by supervising the well-functioning of the MRV system.

Both, carbon market participants and competent authorities want to have assurance that one tonne CO_2 equivalent emitted finds its equivalent of one tonne reported (for the purpose of one allowance to be surrendered). This principle has become known already from the early days of the EU ETS as the proverbial postulation: **"A tonne must be a tonne!"**

In order to ensure that this is achieved in a robust, transparent, verifiable and yet cost-effective way, the EU ETS Directive[14] provides a solid basis for a good monitoring, reporting and verification system. This is achieved by Articles 14 and 15 in connection with Annexes IV and V of the EU ETS Directive. Based on Article 14, the Commission has adopted the Monitoring and Reporting Regulation[15]" (MRR), which has been amended several times (and replaced by a new one in 2018) since its start of application on 1 January 2013.

However, it has always been recognised by the Commission as well as by Member States that a complex and technical legislation such as the MRR needs to be supported by further guidance, in order to ensure harmonised implementation throughout all Member States, and for paving the way to smooth compliance through pragmatic approaches wherever possible.

[14] Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC including all amendments.

[15] Commission Implementing Regulation (EU) 2018/2066 of 19 December 2018 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council and amending Commission Regulation (EU) No 601/2012.

Furthermore a Regulation for verification and accreditation of verifiers has been adopted (the Accreditation and Verification Regulation (AVR)[16], also revised for the 4th phase of the EU ETS), for which a separate series of guidance documents has been developed by the Commission.

3.2 Overview of the compliance cycle

The annual process of monitoring, reporting, verification of emissions, surrender of allowances, and the competent authority's procedure for accepting emission reports are often referred to as the "compliance cycle". Figure 1 shows the main elements of this cycle.

On the right side of the picture there is the "main cycle": The operator monitors the emissions throughout the year. After the end of the calendar year (within three months[17]) he must prepare the annual emissions report (AER), seek verification and submit the verified report to the competent authority (CA). The verified emissions must correlate with the surrender of allowances in the Registry system[18]. Here the principle "a tonne must be a tonne" translates into "a tonne must be an allowance", i.e. at this point the market value of the allowance is correlated with the costs of meeting the environmental goal of the EU ETS. Thereafter the monitoring goes on, as shown in the picture. More precisely, the monitoring continues without any stop at the end of the year.

The monitoring process needs a firm basis. Resulting data must be sufficiently robust for creating trust in the reliability of the ETS, including the fairness of the surrender obligation, and it must be consistent throughout the years. Therefore the operator must ensure that the monitoring methodology is documented in writing, and cannot be changed arbitrarily. In the case of the EU ETS, this written methodology is called the Monitoring Plan (MP) of the installation (see Figure 1). It is part of the permit[19], which every installation in the EU ETS must have for the emission of greenhouse gases.

The figure also shows that the monitoring plan, although very specific for an individual installation, must follow the requirements of the EU-wide applicable legislation, in particular the Monitoring and Reporting Regulation. As a result, the MRV system of the EU ETS is able to square the circle between strict EU-wide rules providing reliability and preventing arbitrary and undue simplifications, and allowing for sufficient flexibility for the circumstances of individual installations.

[16] Commission Implementing Regulation (EU) 2018/2067 of 19 December 2018 on the verification of data and on the accreditation of verifiers pursuant to Directive 2003/87/EC of the European Parliament and of the Council.

[17] According to national legislation, this period may be shorter, see footnote 22.

[18] For the purpose of simplification, the surrender of allowances has not been included in the picture. Similarly, the picture also ignores the processes of free allocation and trading of allowances.

[19] This permit pursuant to Article 4 of the EU ETS Directive is usually referred to as the GHG emission permit. Note that for simplifying administration, according to point (c) of Article 6(2), the monitoring plan may be treated separately from the permit when it comes to formal changes of the monitoring plan.

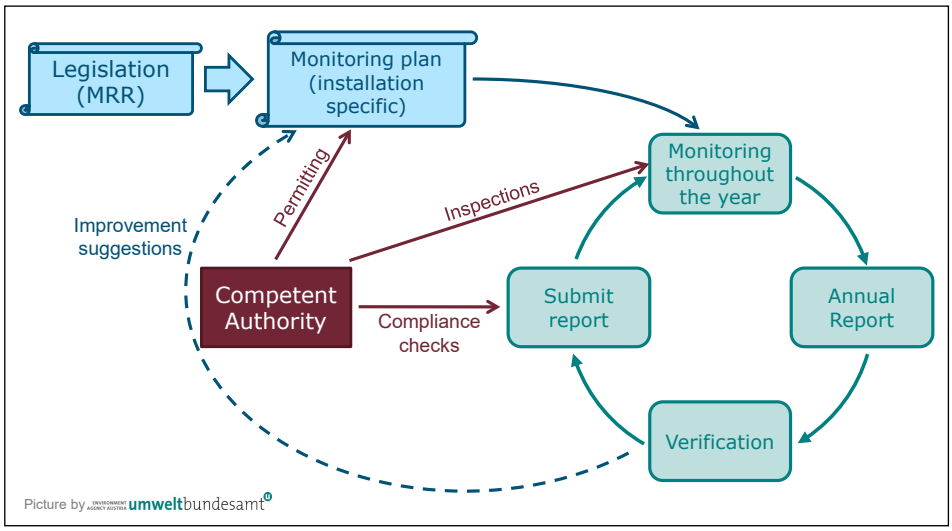

Figure 1: Principle of the EU ETS compliance cycle

Figure 1 also shows some key responsibilities of the competent authority. It has to supervise the compliance of the operators. As the first step, the CA has to approve every monitoring plan before it is applied. This means that the monitoring plans developed by the operator are checked for compliance with the MRR's requirements. Where the operator makes use of some simplified approaches allowed by the MRR, this must be justified by the operator, for example, based on the grounds of technical feasibility or unreasonable costs, where otherwise required higher tiers cannot be achieved.

Secondly, the CA may carry out inspections at installations, to gather assurance that the monitoring plan is well aligned to the reality of the installation. The CA may, for example, check if the installed meters are of the type laid down in the monitoring plan, whether required data is retained, and written procedures are followed as required.

Finally, it is the responsibility of the competent authority to carry out checks on the annual emission reports. This includes spot checks on the already verified reports, but also cross-checks with figures entered in the verified emissions table of the registry system and checking that sufficient allowances have been surrendered.

Moreover, the compliance cycle has a wider perspective. As Figure 1 shows, there is a second cycle. This is the regular review of the monitoring plan, for which the verification report may provide valuable input. Besides, the operator is required to continuously strive for further improving the monitoring methodology. Any inspections by the CA should also *inter alia* aim at identifying elements of the monitoring methodology which are not appropriate anymore, for example, after technical changes have been made to the installation.

3.3 The importance of the monitoring plan

From the previous section it becomes apparent that the approved monitoring plan (MP) is the most important document for every installation participating in the EU ETS. Like a recipe for a cook and like the management handbook for a certified quality management system, it serves as manual for the operator's tasks. Therefore, it should be written in a way that allows all, particularly new staff to immediately follow the instructions. It must also allow the CA to understand quickly the operator's monitoring activities. Finally, the MP is *the* guide for the verifier against which the operator's emission report is to be judged.

Typical elements of a monitoring plan include the following activities of the operator (applicability depends on the specific installation's circumstances):

- Data collection (metering data, invoices, production protocols, etc.);
- Sampling of materials and fuels;
- Laboratory analyses of fuels and materials;
- Maintenance and calibration of meters;
- Description of calculations and formulae to be used;
- Control activities (e.g. four eyes principle for data collection);
- Data archiving (including protection against manipulation);
- Regular identification of improvement possibilities.

Monitoring plans must be drafted carefully (→ chapter 5), so that administrative burden is minimised. Since the MP is to be approved by the competent authority, it goes without saying that changes of the MP are only allowed with the consent of the CA. The MRR reduces the administrative efforts here by allowing two approaches which should already be taken into account when drafting monitoring plans:

- Only changes which are "significant" need the approval by the CA (Article 15 of the MRR, see section 5.6 below).
- Monitoring activities which are not crucial in every detail, and which by their nature tend to be frequently amended as found necessary, may be put into "written procedures", which are mentioned and described briefly in the MP, but the detail of which are not considered part of the approved MP. The relationship between monitoring plan and written procedures is described in more detail in section 5.4.

Because of the importance of the monitoring plan, the Commission is also providing templates for monitoring plans. Some Member States might have provided customized templates based on the Commission's templates, other Member States use a dedicated (usually web-based) electronic reporting system (that must also meet at least stated Commission requirements). Before developing a monitoring plan, operators are therefore advised to check their competent authority's website or make direct contact with the CA for finding out the concrete requirements for submitting a monitoring plan. National legislation may also state specific requirements.

3.4 Milestones and deadlines

3.4.1 The annual compliance cycle

The EU ETS compliance cycle is built around the requirement that monitoring is always related to the calendar year[20], as shown in Table 1 and Figure 2. Operators have three months after the end of the year to finalise the emission reports and to get them verified by an accredited verifier in accordance with the AVR. Thereafter operators have to surrender the corresponding amount of allowances. Subject to national legislation, the competent authority may or shall perform (spot) checks on the reports received, and must determine a conservative estimate of the emissions, if the operator fails to submit an emissions report, or where a report has been submitted, but it is either not compliant with the MRR or not (positively) verified in accordance with the AVR (Article 70(1) of the MRR). When the CA detects any kind of errors in the submitted reports, corrections to the verified emissions figure may be a result. Note that for such corrections no deadline is given by EU legislation. However, there may be some requirement given in national legislation.

Table 1: Common timeline of the annual EU ETS compliance cycle for emissions in year N.

When?	Who?	What?
1 January N		Start of monitoring period
By 30 June N	CA	Allocation of allowances for free (if applicable) on the operator's account in the Union Registry
31 December N		End of monitoring period
by 31 March[21] N+1	Verifier	Finish verification and issue verification report to operator
By 31 March[22] N+1	Operator	Submit *verified* annual emissions report to CA
By 31 March N+1	Operator / Verifier[23]	Enter verified emissions figure in the verified emissions table of the Union Registry
By 30 April N+1	MS	Only for installation for the incineration of municipal waste: Submit the verified annual emissions report of each such installation to the Commission

[20] Article 3(12) of the MRR defines: '*reporting period' means a calendar year during which emissions have to be monitored and reported* […].

[21] Footnote 22 applies here as well. The deadline for verifiers is not laid down in the legislation but follows from the deadline for operators.

[22] According to Article 68(1), competent authorities may require operators or aircraft operators to submit the verified annual emission report earlier than by 31 March, but by 28 February at the earliest.

[23] This may be regulated differently in the Member States.

When?	Who?	What?
March – September[24] N+1	CA	Subject to national legislation, possible spot checks of submitted annual emissions reports. Require corrections by operator, if applicable. N.B. Subject to national legislation, there is no obligation for CAs to provide assistance or acceptance of operator reports either before or after 30 April).
By 30 June N+1	Operator	Submit report on possible improvements of the MP to the CA, if applicable[25]
By 30 September N+1	Operator	Surrender allowances (amount corresponding to verified annual emissions) in Union Registry
(No specified deadline)	CA	Carry out further checks on submitted annual emissions reports, where considered necessary or as may be required by national legislation; require changes of the emissions data and surrender of additional allowances, if applicable (in accordance with Member State legislation).

Figure 2 also suggests indicative timings for the verification process. Experience has shown that the availability of verifiers may be a bottleneck in some Member States, especially if the whole verification process is performed in the first three months of the year. However, several parts of the verification process can be performed well before the end of the reporting year. Therefore, the advice to the operator is to contract a verifier early in the reporting year, ideally soon after the previous report has been submitted in March. The verifier is then able to plan and perform much of the required work throughout the rest of the year, leaving only the final checks and the issuing of the verification report for the first quarter of the following year.

Finally, it has to be mentioned that further requirements apply which are not listed here. In particular, as discussed in section 5.6, the operator has to update the monitoring plan throughout the year where relevant, and the competent authority has to assess and approve it where relevant.

[24] Depending on Member States' legislation or administrative practice, CAs may continue checking the data after September N+1.

[25] There are two different types of improvement reports pursuant to Article 69 of the MRR. One is to be submitted in the year where a verifier reports improvement recommendations, and the other (which may be combined with the first, if applicable) every year for category C installations, every two years for category B, and every four years for category A installations. For categorisation, see section 4.4 of this document. The CA may set a different deadline, but no later than 30 September of that year.

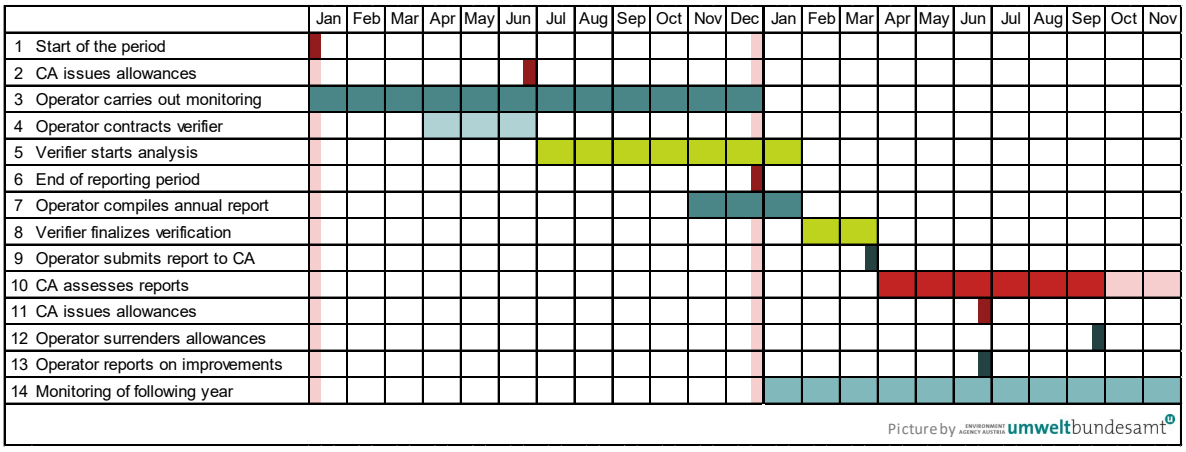

Figure 2: Example timeline for the EU ETS compliance cycle. Please see Table 1 for explanation of deadlines. Note in particular that subject to national legislation, the timeline may differ.

3.4.2 Preparing a new trading period

In order to make the compliance cycle work, the monitoring plans of all installations need to be approved by the competent authority before the start of the monitoring period. For new entrants to the EU ETS, the MP must be approved before the start of operations. For the start of the new trading period, some Member States may require that the monitoring plans of all installations be revised and adapted to the new requirements. Other MS only request an update of monitoring plans where this is necessary due to changes in the MRR.

Based on experience from previous ETS phases, such a general revision process may require several months and should be well prepared. For the purpose of providing additional guidance, a (legally non-binding) timeline is presented here. Relatively long timescales are assumed for an idealised timeline, as required for the most complex installations, as follows: Preparation of the monitoring plan by the operators can take up to several months, depending on the complexity of installations. However, for simple installations, the monitoring plan may be compiled within a few working days. In the same way, most MP updates for the fourth trading period will be small, and will require only few days.

Because the CAs also need a few weeks or months for assessing all submitted MPs (depending on current workload) and because operators then need some weeks for finally implementing the new approved MP, it can be envisaged that the CA should start early with workshops and other information for operators as considered appropriate. Operators in turn should prepare the new monitoring plans early enough for submission of MPs in time according to the deadline set by their competent authority, which should be at the latest by end of September[26]. An idealised example timeline for the start of a new trading period is shown in Table 2.

[26] Note that the concrete deadlines set by competent authorities in the Member States may differ from this assumption.

Table 2: Idealised model timeline for preparing the EU ETS compliance cycle for the start of a new trading period. Note that deadlines may significantly differ according to the Member States. Y is the year in which the new trading period starts (e.g. Y=2021 for the fourth trading period, or 2022 for changes regarding biomass issues).

When?	Who?	What?
May – Sept. Y-1	Operator	Check existing MP for required updates against MRR requirements, or develop new MP, as applicable
July – Sept. Y-1	Operator	Submit new or updated MP to CA, if relevant (deadline set by CA)
July – Dec. Y-1	CA	Check and approve MPs
Oct. – Dec. Y-1	Operator	Prepare for implementation of approved MP
1 January Y		Start of monitoring period using the approved MP based on the new MRR requirements

3.5 Roles and responsibilities

The different responsibilities of the operators, verifiers and competent authorities are shown in Figure 3, taking into account the activities mentioned in the previous sections. For the purpose of completeness, also the accreditation body is included. The picture clearly shows the high level of control which is efficiently built into the MRV system. The monitoring and reporting is the main responsibility of the operators (who are also responsible for hiring the verifier and for providing all relevant information to the verifier). The CA approves the monitoring plans, receives and checks the emission reports, is in charge of inspections and may make corrections to the verified emissions figure where errors are detected. Thus, the CA is in control over the final result. Finally, the verifier is ultimately answerable to the accreditation body[27]. Note that based on Article 66 of the AVR, Member States must also monitor the performance of their national accreditation bodies, thereby fully ensuring the integrity of the EU ETS system of MRV and accreditation.

[27] The AVR also allows in exceptional cases verifiers (if natural persons) to be certified and supervised by a national authority appointed by that Member State (in accordance with AVR Article 55).

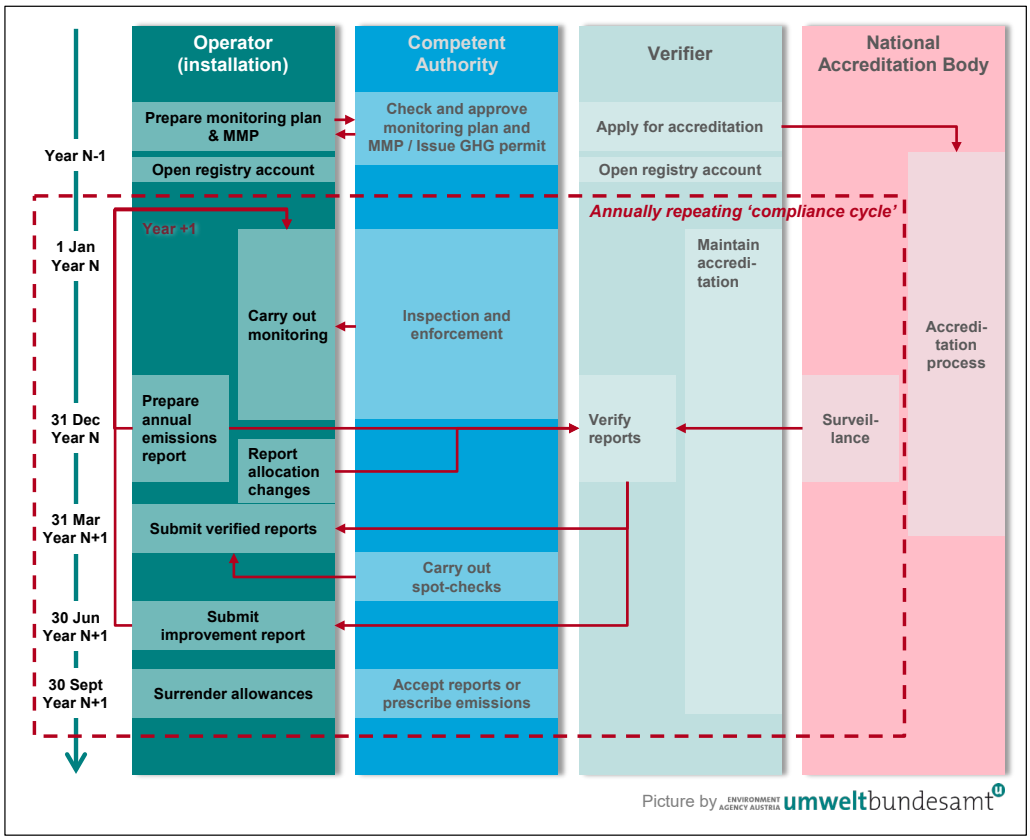

Figure 3: *Overview of responsibilities of the main actors in the EU ETS. Regarding "Accreditation body" see also footnote 27.*

4 CONCEPTS AND APPROACHES

This chapter is dedicated to explaining the most important terms and concepts needed for developing a monitoring plan.

4.1 Underlying principles

Articles 5 to 9 of the MRR outline the guiding principles which the operators have to follow when fulfilling their obligations. These are:

1. **Completeness** (Article 5): The completeness of emission sources and source streams is at the very core of the EU ETS monitoring principles. In order to ensure completeness of emissions monitored, the operator should take into account the following considerations:
   - Article 5 of the MRR requires that all process and combustion emissions from all emission sources and source streams (→ section 4.2) are to be included, which belong to activities listed in Annex I of the EU ETS Directive, or which are included in the EU ETS by "opt-in" (pursuant to Article 24 of the Directive, as e.g. some N_2O emitting activities during the second ETS phase).

New!

   - The 2024 amendment further clarifies the inclusion of all process and combustion emissions from associated activities within the boundaries of an installation as defined in point (e) of Article 3 of the EU ETS Directive.
   - Annex I of the EU ETS Directive states that *all* combustion activities of an installation are to be included in the EU ETS, if the capacity threshold of any of the other activities is exceeded. Due to the definition of "combustion" in the Directive[28], this includes process emissions from flue gas scrubbing in these cases, too.
   - Further specific points to be considered for each activity can be found in Annex IV of the MRR, under the heading "Scope" for each activity.
   - Article 20 requires emissions from regular operations as well as from abnormal events including start-up, shut-down and emergency situations to be included.
   - Emissions from mobile machinery used within the installation are generally excluded.
   - Operators should also be aware of the guidance[29] issued by the Commission regarding the interpretation of Annex I of the EU ETS Directive.
2. **Consistency and comparability** (Article 6(1)): Time series[30] of data need to be consistent throughout the years. Arbitrary changes of monitoring methodologies are prohibited. This is why the monitoring plan has to be approved by the competent authority, such as also significant changes to the MP. Because the same monitoring approaches are defined for all installations, from which

[28] Article 3(t) of the EU ETS Directive defines: "'Combustion' means any oxidation of fuels, regardless of the way in which the heat, electrical or mechanical energy produced by this process is used, and any other directly associated activities, including waste gas scrubbing".

[29] https://ec.europa.eu/clima/sites/clima/files/ets/docs/guidance_interpretation_en.pdf

[30] This does not imply a requirement to produce time series of data, but assumes that the operator, verifier or competent authority may use time series as a means of consistency checks.

they may choose using the tier system (→ see section 4.5), the data created is also comparable between installations.

3. **Transparency** (Article 6(2)): All data collection, compilation and calculation must be made in a transparent way. This means that the data itself, the methods for obtaining and using them (in other words: the whole data flow) have to be documented transparently, and all relevant information has to be securely stored and retained allowing for sufficient access by authorised third parties. In particular, the verifier and the competent authority must be allowed access to this information.
   It is worth mentioning that transparency is in the own interest of the operator: It facilitates transfer of responsibilities between existing and new staff and reduces the likelihood of errors and omissions. In turn this reduces the risk of over-surrendering, or under-surrendering and penalties. Without transparency, the verification activities are more onerous and time-consuming. Furthermore Article 67 of the MRR specifies that relevant data is to be stored for 10 years. The minimum data to be retained is listed in Annex IX of the MRR.
4. **Accuracy** (Article 7): Operators have to take care that data is accurate, i.e. neither systematically nor knowingly inaccurate. Due diligence is required by operators, striving for the highest achievable accuracy. As the next point shows, "highest achievable" may be read as where it is technically feasible and "without incurring unreasonable costs".
5. **Integrity of the methodology and of the emissions report** (Article 8): This principle is at the very heart of any MRV system. The MRR mentions it explicitly and adds some elements that are needed for good monitoring:
   - The monitoring methodology and the data management must allow the verifier to achieve "reasonable assurance[31]" on the emissions report, i.e. the monitoring must be able to endure a quite intensive test;
   - Data shall be free from material[32] misstatements and avoid bias;
   - The data shall provide a credible and balanced account of an installation's emissions.
   - When looking for greater accuracy, operators may balance the benefit against additional costs. They shall aim for "highest achievable accuracy, unless this is technically not feasible or would lead to unreasonable costs".
6. **Continuous improvement** (Article 9): In addition to the requirement of Article 69, which requires the operator to submit regularly reports on improvement possibilities, e.g. for reaching higher tiers, this principle also is the foundation for the operator's duty of responding to the verifier's recommendations (see also Figure 1 on page 15).

[31] Article 3(18) of the AVR defines: "*'reasonable assurance' means a high but not absolute level of assurance, expressed positively in the verification opinion, as to whether the operator's or aircraft operator's report subject to verification is free from material misstatement.*" For more details on the definition this term, see guidance documents on the A&V guidance, in particular the AVR Explanatory Guidance (EGD I). Section 2.3 provides a link to those documents.

[32] See footnote 31.

4.2 Source streams, emission sources and related terms

Emission source: The MRR defines (Article 3(5)): "'emission source' means a separately identifiable part of an installation or a process within an installation, from which relevant greenhouse gases are emitted or, for aviation activities, an individual aircraft". Thus, an emission source can be considered either as a (physical) part of the installation, or rather a virtual construction which defines the system boundaries of a process which leads to emissions.

As will be outlined below, different monitoring methodologies may be applied as defined by the MRR. For these methodologies, two other concepts have been found useful for ensuring the completeness of the emissions monitored:

- Source streams; and
- measurement points.

Source streams[33]: This term refers to all the inputs and outputs which have to be monitored when using a calculation-based approach (→section 4.3). The wording is the result of the attempt to quickly express "fuel or material entering or leaving the installation, with a direct impact on emissions". In the simplest case it means the fuels "streaming" into the installation and forming a "source" of emissions. The same is true for raw materials which give rise to process emissions. In some cases, process emissions are calculated based on a product, such as burnt lime. In this case this product is the source stream. Furthermore, the term includes also mass streams going into and coming from the system boundaries of mass balances. This is justified by the fact that mass streams entering and leaving the installation are treated in principle by applying the same requirements[34] as for other source streams, as can be concluded from sections 4.3.1 and 4.3.2 below.

Measurement point (Article 3(43)) means "the emission source for which continuous emission measurement systems (CEMS) are used for emission measurement, or the cross-section of a pipeline system for which the CO_2 flow is determined using continuous measurement systems". Briefly, this is the position (e.g. in the waste gas duct) for which the measurement data are obtained (where the probing for a continuous measurement system takes place).

The following terms are only relevant for the description of the installation, which has to be included in the monitoring plan:

Emission points: The term is not defined explicitly by the MRR. However, it becomes clear when checking where the term is used by the MRR: Annex I, section 1 of the MRR requires under point (4)(b) that the monitoring plan contains:

---

[33] MRR Article 3(4): 'source stream' means any of the following:
(a) a specific fuel type, raw material or product giving rise to emissions of relevant greenhouse gases at one or more emission sources as a result of its consumption or production;
(b) in the case of a mass balance methodology in accordance with Article 25 of this Regulation, one of the following:
(i) a specific fuel type, raw material or product containing carbon;
(ii) CO_2 transferred in accordance with Article 49 of this Regulation;"

[34] The same requirements are valid for activity data, while other calculation factors (carbon content instead of emission factor) are used. However, as is shown in section 4.3.2, emission factor and carbon content can be calculated from each other. In terms of analytical chemistry, it is always the carbon content which is to be determined.

"a list of all relevant emission points during typical operation, and during restrictive and transition phases, including breakdown periods or commissioning phases, supplemented by a process diagram where requested by the competent authority". In other words, the description of the installation in the monitoring plan should list all emission points by describing the points where the greenhouse gases are actually released from the installation, including for fugitive emissions, if applicable.

Technical units: For completeness purposes, it is useful to mention that the term "technical unit" is used by the EU ETS Directive for referring to parts of the installation, in particular in the chapeau of Annex I of the Directive. The term is used for explaining the aggregation rule for determining whether an installation is to be included in the EU ETS or not[35]. Therefore it will help the competent authority to have a listing of those units. It can therefore be considered best practice to include such list in the MP as well.

4.3 Monitoring approaches

The MRR allows the operator to choose monitoring methodologies from a building block system based on different monitoring approaches. All types of combinations of these approaches are allowed, under the condition that the operator demonstrates that neither double counting nor data gaps in the emissions reporting will occur. The choice of methodology needs the approval of the CA, which is given usually implicitly as part of the monitoring plan approval.

The following methodologies are available:

1. Calculation-based approaches:
    a. Standard methodology (distinguishing combustion and process emissions);
    b. Mass balance;
2. Measurement-based approaches;
3. Methodology not based on tiers ("fall-back approach");
4. Combinations of approaches.

Note that the calculation-based approaches are also requiring measurements. However, the measurement here is usually applied to parameters such as the fuel consumption, which can be related to the emissions by calculation, while the measurement-based approach always includes measurement of the greenhouse gas itself. These approaches are briefly outlined below.

4.3.1 Standard methodology

The principle of this method is the calculation of emissions by means of activity data (e.g. amount of fuel or process input material consumed) times an emission factor (and further factors). Figure 4 illustrates this. Those further factors are the oxidation factor for combustion emissions and the conversion factor for process

[35] For more information, see guidance on the interpretation of Annex I of the EU ETS Directive, https://ec.europa.eu/clima/sites/clima/files/ets/docs/guidance_interpretation_en.pdf

emissions. Both are used for correcting the emissions numbers in case of incomplete chemical reactions.

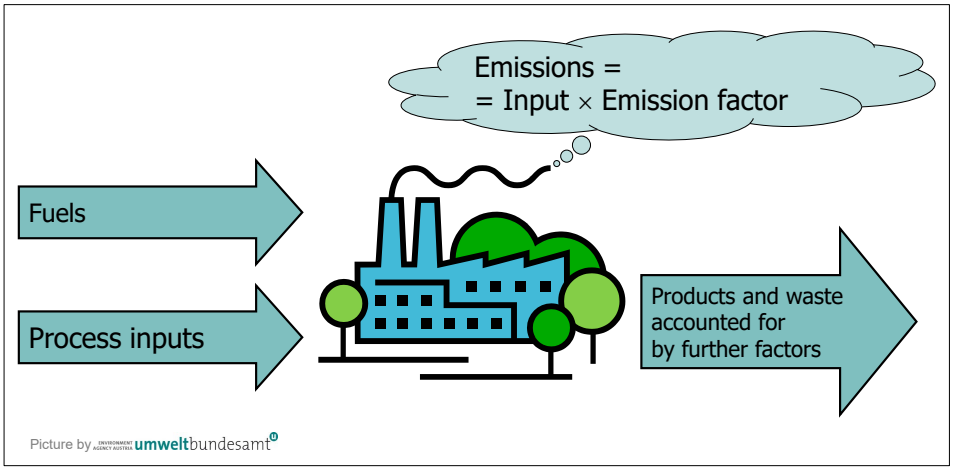

Figure 4: Principle of the standard methodology for calculating emissions

Under this methodology, the following formulae are applied for CO_2 emissions[36]:

1. Combustion emissions[37]:

$$Em = AD \cdot EF \cdot OF \quad (1)$$

Where:

Em ..... Emissions [t CO_2]

AD..... Activity data [TJ, t or Nm^3]

EF ..... Emission factor [t CO_2/TJ, t CO_2/t or t CO_2/Nm^3]

OF..... Oxidation factor [dimensionless]

Factors with units in tonnes are usually to be used for solids and liquids. Nm^3 are usually used for gaseous fuels. In order to achieve numbers of similar magnitude, values are usually given in [1000 Nm^3] in practice.

Activity data of fuels (including if fuels are used as process input) has to be expressed as net calorific value:

$$AD = FQ \cdot NCV \quad (2)$$

Where:

FQ..... Fuel quantity [t or Nm^3]

NCV .... Net Calorific Value [TJ/t or TJ/Nm^3]

[36] N_2O emissions are determined using measurement approaches, and for PFC special requirements are applicable. They are therefore not covered by this section.

[37] Article 3(11) of the MRR defines: *'combustion emissions' means greenhouse gas emissions occurring during the exothermic reaction of a fuel with oxygen;*

Under certain conditions (where the use of an emission factor expressed as t CO_2/TJ incurs unreasonable costs or where at least equivalent accuracy of the calculated emissions can be achieved) the CA may allow the operator to use an emission factor expressed as t CO_2/t fuel or t CO_2/Nm^3 (Article 36(2)). In that case, activity data is expressed as tonnes or Nm^3 fuel, instead using equation (2), and the NCV may be determined using a conservative estimate instead of using tiers, unless a defined tier is achievable without additional effort (Article 26(5)).

Simplified!

The EU ETS Directive allows that the emissions of biomass and certain other fuels may be "zero-rated", i.e. their emission factor may be set to zero (a precondition is the compliance with certain GHG savings or sustainability criteria, see sections 6.3.5 to 6.3.9. Zero rating may be applied to:

New!

- Biofuels, bioliquids and biomass fuels which fulfil the sustainability and the greenhouse gas emissions saving criteria of Article 29(2) to (7) and (10) of the Renewable Energies Directive (RED II)[38], or to which the RED II criteria do not apply (see section 6.3.7);
- Renewable Fuels of Non-Biological Origin (RFNBOs[39]) or Recycled Carbon Fuels (RCFs[40]) that comply with the greenhouse gas emissions saving criteria laid down in Article 29a of the RED II;
- Synthetic Low-Carbon Fuels (SLCFs)[41] if they meet the criterion given in Article 39a(4) of the MRR.

This "zero-rating" applies for accounting purposes only, while physically, still CO_2 is emitted from the installation. Therefore, and for transparency purposes, where zero-rating of biomass or the other mentioned fuels is applied, the emission factor must be determined from the preliminary emission factor and the zero-rated fraction of the fuel:

$$\boxed{EF = EF_{pre} \cdot (1 - ZF)} \qquad (3)$$

New!

Where:

EF ..... Emission factor;

EF_{pre}.... Preliminary emission factor (i.e. according to Article 3(36), "*assumed total emission factor of a fuel or material based on the carbon content of its biomass fraction and its fossil fraction before multiplying it by the fossil fraction to produce the emission factor*");

ZF Zero-rated fraction[42] [dimensionless].

Note: Equation (3) is valid because the emission factor of biomass, RFNBO, RCF or synthetic low-carbon fuel is zero (if they comply with the applicable sustainability or GHG savings criteria, see sections 6.3.5 to 6.3.9). For a mixed material this formula requires that the EF_{pre} is the weighted average value for the whole mixture.

[38] Directive (EU) 2018/2001

[39] As defined in Article 2, point (36) of the RED II.

[40] Defined in Article 2, point (35) of the RED II.

[41] Defined in MRR Article 3, point 23h: *'synthetic low-carbon fuels' means gaseous and liquid fuels, the energy content of which is derived from low-carbon hydrogen as defined in Article 2, point (13) of Directive (EU) 2024/1788 [Gas Market Directive], which meet the greenhouse gas emission reduction threshold of 70 % compared to the fossil fuel comparator […]"*

[42] The zero-rated fraction is composed of zero-rated biomass fraction, zero-rated RFNBO or RCF fraction, and zero-rated SLCF fraction.

Example: A mixed fuel contains fossil fuel, biomass for which evidence on meeting the RED criteria is available, and other biomass. In that case, "determining the zero-rated biomass fraction" means "determining the fraction of carbon in the mixture which is from biomass that complies with the RED II criteria". The total biomass can be determined e.g. by ^{14}C analysis. The part that complies with the RED criteria is determined by the availability of "proofs of Sustainability" (PoS) under a recognised certification scheme. The part of biomass which does not comply with those criteria has to be reported separately, but for emission calculation the above formula is correct if fossil and non-zero-rated fractions are added (both fractions are considered "as if they were fossil"). For reporting purposes, $FF + BF_{non\text{-}RED\ II} + BF_{zero\text{-}rated} = 1$, where *FF* is the fossil fraction, $BF_{non\text{-}REDII}$ the fraction of biomass carbon which is not complying with the RED II criteria (not zero-rated), and $BF_{zero\text{-}rated}$ the biomass fraction which is zero-rated. Section 12.17 contains an FAQ on how to report emissions from mixed fuels.

Therefore, the overall standard formula for combustion emissions is:

New!

$$Em = FQ \cdot NCV \cdot EF_{pre} \cdot (1 - ZF) \cdot OF \quad (4)$$

Note that for transparency, for each type of carbon fraction for which zero-rating is possible, the separate zero-rated and non-zero-rated fractions need to be determined and reported, where applicable. Section 6.3.12 gives more detailed information on these "memo items".

2. **Process emissions**[43] are calculated as:

$$Em = AD \cdot EF \cdot CF \quad (5)$$

Where:

Em ..... Emissions [t CO_2]

AD ..... Activity data [t or Nm^3]

EF ..... Emission factor [t CO_2/t or t CO_2/Nm^3]

CF ..... Conversion factor [dimensionless].

Note that in case of organic raw materials or fuels used as process input, equation (3) is to be applied for calculating the emission factor, if zero-rated fractions are relevant.

Note that the activity data may refer to either an input material (e.g. limestone or soda ash), or to the resulting output of the process, e.g. the cement clinker or burnt lime. In both cases activity data is used with positive values due to the direct correlation with the emission value. Annex II, section 4 of the MRR introduces for this purpose Method A (input based) and Method B (output based). Both methods are considered equivalent, i.e. the operator should choose the method which

[43] Article 3(31) of the MRR defines: *'process emissions' means greenhouse gas emissions other than combustion emissions occurring as a result of intentional and unintentional reactions between substances or their transformation, including the chemical or electrolytic reduction of metal ores, the thermal decomposition of substances, and the formation of substances for use as product or feedstock;*

leads to the more reliable data, is better applicable with his equipment, and avoids unreasonable costs.

The most common process emissions are from carbonate-based (inorganic) process materials. However, the MRR clearly requires the inclusion of organic carbon where relevant, in particular expressed in the sector-specific provisions of Annex IV sections 9 (Cement clinker), 10 (lime), 11 (glass) and 12 (ceramics)[44]. Section 4 of Annex II of the MRR 2018/2066 now contains clearer provisions on the treatment of organic and mixed carbon contained in process materials. These special rules are explained in section 6.3.13.

Further activity specific details are listed in Annex IV of the MRR. Note that in case of more complex processes, the mass balance will usually be the more suitable monitoring approach. Furthermore it is to be mentioned that N_2O process emissions always require a measurement-based approach[45]. PFC process emissions are determined using a calculation-based approach, which is discussed in section 6.4.

More details on the MRR's requirements for monitoring using the standard methodology are given in chapter 6.

4.3.2 Mass balance approach

Like the standard approach, the mass balance[46] approach is a calculation-based method for determining the emissions of an installation. The standard approach is straightforward to apply in cases where a fuel or material is directly related to the emissions. However, in cases such as integrated steelworks or sites of the chemical industry, it is often difficult to relate the emissions directly to individual input materials, because the products (and wastes) contain significant amounts of carbon (e.g. bulk organic chemicals, carbon black, etc.). Thus, it is not enough to account for the amount of non-emitted carbon by means of an oxidation factor or conversion factor. Instead, a complete balance of carbon entering and leaving the installation or a defined part[47] thereof is used (see Figure 5).

The following formula is applicable for mass balances:

$$Em_{MB} = \sum_i (f \cdot AD_i \cdot CC_i) \quad (6)$$

and

$$CC_i = CC_{i,pre} \cdot (1 - ZF) = CC_{i,pre} \cdot FF_i \quad (6a)$$

Where:

Em_{MB} ... Emissions from all source streams included in the mass balance [t CO_2]

[44] E.g. in Section 12, the MRR 2012 required "*Other carbonates and organic carbon in the raw material shall be taken into account, where relevant.*" The MRR rephrases the same point to "*Other carbonates and non-carbonate carbon in the raw material shall be taken into account, where they are relevant for emission calculation.*"

[45] As an exception, N_2O from temporary occurrences of unabated emissions are estimated based on calculation, see section 8.3.

[46] For clarity reasons this document uses the term "material balance" for determining activity data based on batch metering (see section 6.1.2), while "mass balance" is strictly used for the calculation approach discussed in this section and in Article 25.

[47] As will be shown in an example on page 32.

f..... factor for converting the molar mass of carbon to CO_2. The value of *f* is 3.664 t CO_2/t C (Article 25(1)).

i..... index for the material or fuel under consideration.

AD_i ..... Activity data (i.e. the mass in tonnes) of the material, fuel or CO_2 transferred under consideration. Ingoing materials or fuels are taken into account as positive, outgoing materials or fuels have negative activity data. Outgoing materials may e.g. be coke from coke ovens, carbon contained in steel produced, organic chemicals, carbon contained in materials produced by CCU and compliant with the delegated act pursuant to Article 12(3b) (see section 9.2). Products in which CO_2 is chemically bound, such as soda ash or urea, cannot be considered as outgoing materials, as the CO_2 bound has to be reported as emissions (see section 9.3). Mass streams to and from stock piles must be taken into account appropriately in order to give correct results for the calendar year.

CC_i ..... The carbon content of the component under consideration. Always dimensionless and positive.

$CC_{i,pre}$ .. the "preliminary carbon content", in analogy to the preliminary emission factor (for explanation see above, equation 3)

ZF ..... zero rated fraction (see above, equation 3)

FF_i ..... The fossil fraction (more precisely: the sum of all non-zero-rated fractions) of the component under consideration. Always dimensionless and positive.

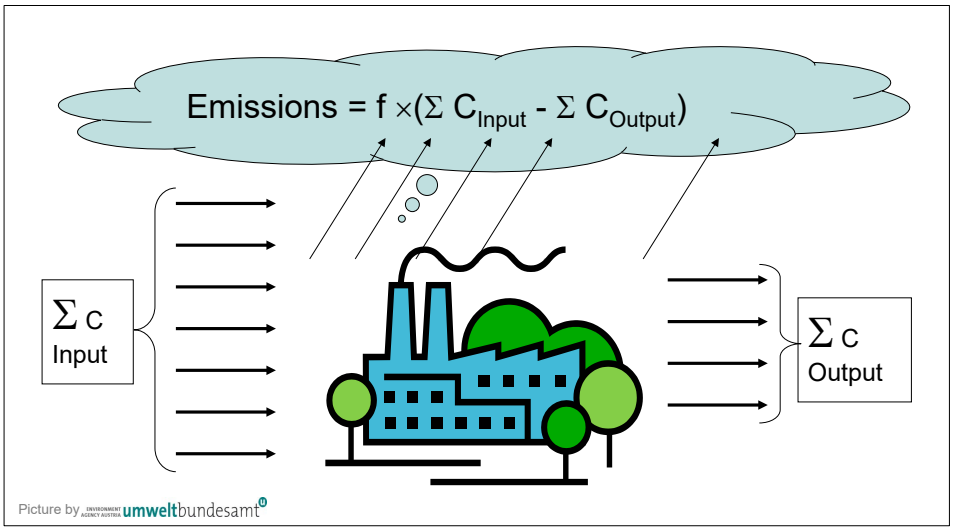

Figure 5: Principle of mass balance approaches

If the carbon content of a fuel is to be calculated from an emission factor expressed as t CO_2/TJ, the following equation is used:

$$CC_i = EF_i \cdot NCV_i / f \quad (7)$$

The same calculation can be carried out with the preliminary emission factor and preliminary carbon content, if relevant.

If the carbon content of a material or fuel is to be calculated from an emission factor expressed as t CO_2/t, the following equation is used:

$$\boxed{CC_i = EF_i \,/\, f} \qquad (8)$$

New!

For mass-balances with input materials or fuels containing zero-rated carbon and output materials containing carbon, the operator has to ensure that the emissions are not under-estimated. Therefore, the zero-rated fraction of carbon in the outgoing source streams must not be unduly low.[48] The operator must provide suitable evidence[49] to the competent authority that this condition is fulfilled.

The following remarks should be considered when setting up a monitoring plan using a mass balance:

- Emissions of carbon monoxide (CO) are not counted as outgoing source stream in the mass balance, but are considered as the molar equivalent of CO_2 emissions (Article 25(2)). This is easily accomplished by just not listing the CO as outgoing material.
- It is important to comply with the principle of completeness of the monitoring data, i.e. all input materials and fuels must be taken into account, if not monitored by an approach outside the mass balance. However, in some cases it may be difficult to determine smaller amounts of carbon precisely. In this situation the operator should explore whether the material may be considered a *de-minimis* source stream (see section 4.4.3). In particular, assuming the amount of carbon leaving the installation in slag or wastes as zero may be considered an applicable estimation method for such de-minimis source streams. This would be similar to assuming a conversion factor of 100% in case of the standard methodology.
  Also any zero-rated carbon amounts in the outputs may be considered de-minimis source streams.

More details on the MRR's requirements for monitoring using a mass balance methodology are given in chapter 6.

Note that it may be useful to combine the mass balance approach and the standard approach, as the following example shows:

In this installation, two clearly separable parts exist: A gas-fired CHP plant, and a non-integrated steel production (electric arc furnace process). In such a case it is useful to combine the calculation-based approaches:

- CHP plant: standard methodology; Source streams:
  - Natural gas (for simplicity it may be useful to include here all natural gas streams, including those belonging to the steel plant)
- Steel plant: Mass balance; Source streams:
  - Ingoing: scrap, pig iron, alloying components
  - Outgoing: products, slag

[48] Article 25(3) of the MRR: "… *The operator shall thereby provide evidence that the installation's total emissions are not systematically underestimated by the applied monitoring methodology and that the total mass of carbon corresponding to the zero-rated carbon fractions of the carbon contained in all relevant output materials, is not lower than the total mass of zero-rated fractions of the carbon contained in input materials and fuels.*"

[49] For such evidence it is not necessary to get formal proof from a scheme under Article 30 of the RED II.

4.3.3 Measurement-based approaches

In contrast to the calculation-based approaches, the greenhouse gases in the installation's off-gases are themselves the object of the measurement in the measurement-based approaches. This is difficult in installations with many emission points (stacks) or indeed impossible where fugitive emissions[50] have to be taken into account. On the other hand, the strength of the measurement-based methodologies is the independence of the number of different fuels and materials used (e.g. where many different waste types are combusted), and their independence of stoichiometric relationships (this is why N_2O emissions have to be monitored in this way).

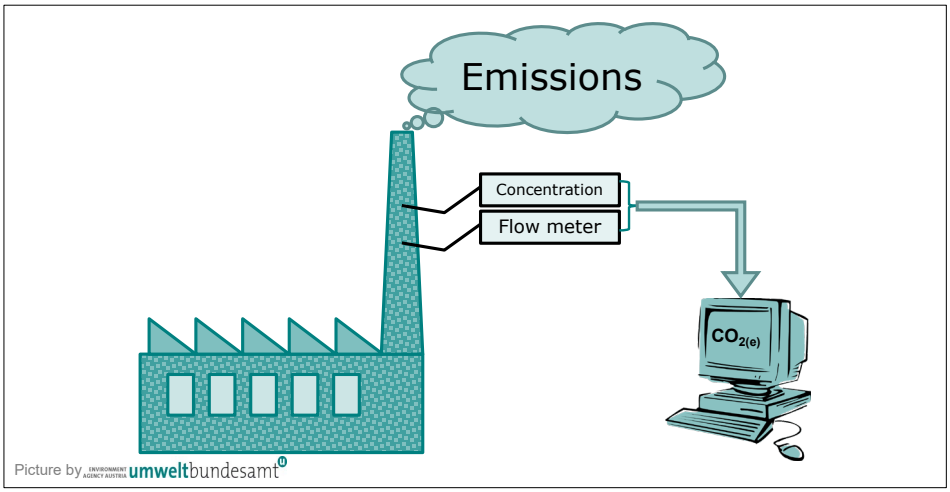

Figure 6: Schematic description of a continuous emission measurement system (CEMS).

The application of CEMS (Continuous Emission Measurement Systems[51]) always requires two elements:

- Measurement of the GHG concentration[52]; and
- Volumetric flow of the gas stream where the measurement takes place.

According to Article 43 of the MRR, the emissions are first to be determined for each hour[53] of measurement from the hourly average concentration and the hourly average flow rate. Thereafter all hourly values of the reporting year are summed up for the total emissions of that emission point. Where several emission

[50] Fugitive emissions are emissions which are not led through a duct, such as emissions from open furnaces, or leakages from pipeline systems.

[51] Article 3(40) of the MRR defines: *'continuous emission measurement' means a set of operations having the objective of determining the value of a quantity by means of periodic measurements, applying either measurements in the stack or extractive procedures with a measuring instrument located close to the stack, whilst excluding measurement methodologies based on the collection of individual samples from the stack.*

[52] This may need additional corrections, such as for moisture content.

[53] Pursuant to Article 44(1), operators shall use shorter periods than an hour, where this is possible without additional costs. This takes account of the fact that many measurement systems generate automatically half-hourly values due to other requirements than the MRR. In such case, the half-hourly values are used.

points are monitored (e.g. two separate stacks of a power plant), this data aggregation is done first for each source separately, before adding the emissions of all sources to result in the total emissions[54].

CO_2 stemming from biomass

It is difficult to continuously measure the biomass fraction of the emitted CO_2 with sufficient reliability. Therefore, the MRR's default approach is that emissions from biomass should be determined by a calculation-based approach, for subtracting them from the total emissions determined by measurement. However, there is more flexibility[55]. Article 43(4) allows:

- Calculation-based approaches;
- Methods that use radiocarbon analyses of samples taken from the flue gas by continuous sampling (e.g. according to EN ISO 13833). Note that formally this is a calculation-based approach in MRR terminology, as it does not rely on continuous measurement. The 2024 amendment introduced a minimum number of analyses to be carried out (every 50 000 tonnes of total CO_2, but at least once a month);
- The "balance method" (based on ISO 18466), which is an estimation method in MRR terminology;
- Other estimation methods published by the Commission[56].

New!

Further requirements for using CEMS are given in chapter 8 of this document.

4.3.4 Fall-back methodology

The MRR provides a very broad set of methodologies for monitoring, and tier level definitions which have been proven in recent years to be reasonably applicable in nearly all installations in the EU ETS. Nevertheless it is recognised that special circumstances may exist in installations under which applying the tier system is technically not feasible, or leads to unreasonable costs for the operator. Although there might be other reasonably precise methods of monitoring, these circumstances would render the operator non-compliant with the MRR.

In order to avoid such unwanted "pseudo-non-compliance", the MRR (Article 22) allows the operator to apply non-tier methodology (also known as "fall-back methodology"), if:

- a calculation-based approach using at least tier 1 for at least one major or minor source stream (→ see section 4.4.3), is not possible without incurring unreasonable costs; and
- a measurement-based approach for the correlated emission source using tier 1 is also not possible without incurring unreasonable costs.

[54] "Total" here means total of all emissions determined by CEMS. This does not exclude that further emissions from other parts of the installation are determined by calculation approaches.

[55] See guidance document No. 3 on biomass issues for further options to determine the biomass fraction.

[56] At the time of updating this guidance, no such methods have been published.

Note that this section is not applicable for de-minimis source streams (→ see section 4.4.3), because no-tier estimation methodologies are allowed for these anyway.

Where the above conditions are met, the operator may propose in the monitoring plan an alternative monitoring methodology, for which he can demonstrate that it allows achieving the required overall uncertainty level for the emissions of the total installation[57]. In other words: Instead complying with the uncertainty levels for individual source streams, one common uncertainty level for the emissions of the total installation is to be complied with. However, such individual monitoring approach has the drawback that it can't be easily compared with other approaches. Consequently, the operator must:

- every year carry out a full uncertainty assessment[58] for the installation's emissions and provide evidence that the required uncertainty level is met;
- submit the result together with the annual emissions report (including for verification); and
- provide a justification for using the fall-back methodology demonstrating unreasonable costs or technical infeasibility in the regular improvement reports (→ see section 5.7) pursuant to Article 69. If the conditions are not met anymore, the operator has to modify the monitoring plan and use a tier-based approach henceforth.

Note: Due to the increased administrative effort required for fall-back methodologies, operators are advised to carefully check whether a tier-based approach is still possible for all major and minor source streams or emission sources. In particular, operators should strive to use "standard" tier approaches for as many source streams and emission sources even if in the end a fall-back methodology is required for a limited part of the installation's emissions.

4.3.5 Combinations of approaches

Except where Annex IV requires specific methodologies to be applied for some activities, the MRR allows the operator to combine seamlessly the different approaches outlined above, on the condition that no data gaps and no double counting occur. Where different approaches would lead to similar tier levels, the operator may use other criteria for choosing the methodology, such as:

- Which methodology gives the more reliable results, i.e. where are the more robust measurement instruments used, fewer observations needed, etc.?
- Which method has the lower inherent risk? (→ section 5.5) I.e. which methodology is easier to control by a second data source, where are fewer possibilities to make errors or omissions?

[57] This overall uncertainty is less than 7.5% for category A installations, less than 5.0% for category B installations and less than 2.5% for category C installations. For categorisation of installations see section 4.4.

[58] ISO Guide to the Expression of Uncertainty in Measurement (JCGM 100:2008) is to be applied here. It is publicly accessible under https://www.bipm.org/en/committees/jc/jcgm/publications

As an example, the following fictitious installation might use all possible approaches simultaneously. It consists of the following elements:

- A coal-fired boiler: A measurement-based methodology is used (Note: if this were monitored using the standard approach, combustion emissions from coal and the associated process emissions from the use of limestone in the flue gas desulphurisation would have to be monitored separately).
- Production of iron & steel (electric arc furnace):
  - Natural gas used for heating: simplest approach is the standard methodology;
  - Steel making: A mass balance is used (Ingoing: scrap, pig iron, alloying components; Outgoing: products, slag).
- In addition, that installation operates a recycling plant (activity non-ferrous metal production and processing), where scrap stemming from electronic devices are burned in a rotary kiln. All scrap is treated as one (major) source stream. Due to the big heterogeneity of that material a fall-back methodology has to be used (the carbon content might e.g. be estimated from a combined heat and mass balance of this kiln).

4.4 Categorisation of installations, emission sources and source streams

It is a basic philosophy in the MRV system of the EU ETS, that the biggest emissions should be monitored most accurately, while less ambitious methods may be applied for smaller emissions. By this method, cost effectiveness is taken into account, and unreasonable financial and administrative burden is avoided where the benefit of more efforts would be only marginal.

4.4.1 Installation categories

For the purpose of identifying the required "ambition level" of monitoring (details will be given in section 5.2), the operator has to classify the installation according to the average annual emissions (Article 19(2)):

- Category A: Annual average emissions are equal to or less than 50 000 tonnes of $CO_{2(e)}$;
- Category B: Annual average emissions are more than 50 000 tonnes of $CO_{2(e)}$ and equal to or less than 500 000 tonnes of $CO_{2(e)}$;
- Category C: Annual average emissions are more than 500 000 tonnes of $CO_{2(e)}$.

The "annual average emissions" here mean the annual average *verified* emissions of the previous trading period. As for annual reporting, emissions from zero-rated[59] carbon are excluded, but contrary to annual reporting, CO_2 transferred

[59] *New!* This means that emissions are calculated taking into account all types of biomass and fuels which may be zero-rated, which comply with the applicable sustainability and GHG savings criteria. For further details see sections 6.3.5 to 6.3.10.

out of the installation[60], if any, is counted as emitted, in order to give a better indication of the size of the GHG amounts occurring at the installation.

Where the average annual verified emissions in the trading period immediately preceding the current trading period for the installation are not available or no longer representative for the used installation category, the operator shall use a conservative estimate (Article 19(5)). This is in particular the case where the installation boundaries change due to an extension of the scope of the EU ETS Directive.

Example: For the fourth EU ETS phase (starting in 2021), the operator determines the installation's category as follows:

- Average annual verified emissions in 2013-2020, excluding biomass, have been 349 000 tonnes $CO_{2(e)}$. The installation is category B and there was no transfer of CO_2.
- In 2023, the installation starts up an additional CHP plant, which is designed to emit around 200 000 t CO_2 per year. Therefore, the emissions of 349 000 tonnes $CO_{2(e)}$ are not representative anymore, and the operator has to make a conservative estimate of future emissions. The new estimate for the annual emissions is 549 000 t CO_2 per year, so the installation becomes category C. Consequently, the operator has to revise the monitoring plan (higher tiers may be required) and submit an updated MP to the competent authority for approval (see section 5.6).
- In 2025, the installation starts a pilot project for CO_2 capture and transfers on average 100 000 t CO_2 to an installation for the geological storage of CO_2. However, in this case the category of the installation does not change to B, because the transfer of CO_2 is not to be taken into account. However, due to the significant change of the installation's functioning, a revision of the MP is clearly needed.

New! Simplified!

The MRR 2018/2066 allows that an installation which exceeds one of the mentioned thresholds only once in six years does not have to change its categorisation. For example, a category A installation that emits 51 000 t CO_2 in one year only, does not have to change its category if the emissions were below 50 000 t CO_2 in the five preceding years. What is more important, this also means that the applicable minimum tiers do not change due to this one year of higher emissions, and the operator does not have to submit an updated monitoring plan for approval. Instead, the operator only has to provide evidence "*to the satisfaction of the competent authority that this threshold has not already been exceeded within the past five reporting periods and will not be exceeded again in subsequent reporting periods*" (2nd subparagraph of Article 19(2)). On the other hand, if the threshold is exceeded a second time within the next five years, the MP will have to be modified so as to comply with the more stringent conditions of the higher category.

[60] New! For e.g. a CO_2 transport infrastructure or storage site (see chapter 9) receiving 100 kt of CO_2, the installation would be categorised as B, as any further transfer of CO_2 is being disregarded for the purpose of determining the installation's category.

4.4.2 Installations with low emissions

Installations which on average emit less than 25 000 t $CO_{2(e)}$ per year can be classified as "installations with low emissions" in accordance with Article 47 of the MRR. For these, special simplifications of the MRV system are applicable in order to reduce administrative costs (see section 7.1).

As for other installation categories, the annual average emissions are to be determined as average annual *verified* emissions of the previous trading period, with exclusion of CO_2 stemming from zero-rated carbon (6.3.5) and before subtraction of transferred CO_2. Where those average emissions are not available or are no longer applicable because of changes in the installation's boundaries or changes to the operating conditions of the installation, a conservative estimate is to be used concerning the projected emissions for the next five years.

A special situation then arises if the installation's emissions exceed the threshold of 25 000 t CO_2 per year. In that case it is necessary to revise the monitoring plan and submit a new one to the CA, for which the simplifications for small installations are not applied any more. However, the wording of Article 47(8) allows that the operator may continue as an installation with low emissions provided that the operator can demonstrate to the competent authority that the 25 000 t CO_2 per year threshold has not been exceeded in the previous five years and will not be exceeded again (e.g. due to limitations in installation capacity). Thus, high emissions in one single year out of six years may be tolerable, but if the threshold is exceeded again in one of the following five years, that exception will not be applicable any more.

Example: An older and less efficient reserve boiler has to be used in only one year due to a longer maintenance shut-down of the main boiler. The emissions exceed the 25 000 t CO_2/year threshold in this one year, but the operator can easily demonstrate to the CA that after these maintenance works it will not happen again in the next 5 years.

4.4.3 Source streams

Within an installation, the greatest attention is and should be given to the bigger source streams. For minor source streams, lower tier requirements are applicable from the MRR (→section 5.2). The operator has to classify all source streams for which he uses calculation-based approaches. For this purpose, he must compare the emissions of the source stream with the "total of all monitored items".

The following steps have to be performed:

- Determine the "total of all monitored items", by adding up:
  - The emissions ($CO_{2(e)}$) of all source streams which are determined using the standard methodology (see section 4.3.1);
  - The *absolute values* of all CO_2 streams in a mass balance (i.e. the outgoing streams (e.g. carbon contained in steel products) are also counted as positive! See section 4.3.2); and
  - The emissions of CO_2 and $CO_{2(e)}$ of all emission sources which are determined using a measurement-based methodology (see section 4.3.3).

New!

- For this calculation, CO_2 from fossil sources as well as "non-sustainable[59] biomass" is taken into account.
- Transferred CO_2 is not subtracted from the total.

- Thereafter the operator should list all source streams (including those which form a part in a mass balance, given in absolute numbers) sorted in descending order.
- The operator may then select source streams which he wants to be classified "minor" or "de-minimis" source streams, in order to apply reduced monitoring requirements to them. For this purpose, the thresholds given below must be complied with.

The operator may select as **minor source streams**: source streams which *jointly* account for less than 5 000 tonnes of fossil CO_2 per year or to less than 10% of the "total of all monitored items", up to a total maximum contribution of 100 000 tonnes of fossil CO_2 per year, whichever is greater in terms of absolute value.

The operator may select as **de-minimis source streams**: source streams which *jointly* correspond to less than 1 000 tonnes of fossil CO_2 per year or to less than 2% of the "total of all monitored items", up to a total maximum contribution of 20 000 tonnes of fossil CO_2 per year, whichever is the highest in terms of absolute value. Note that the de-minimis source streams are no longer part of the minor source streams.

All other source streams are classified as **major source streams**.

Note: The MRR does not specify a reference time span for these classifications, such as the previous trading period in the case of installation categorisation. However, Article 14(1) requires the operator to regularly check *if the monitoring plan reflects the nature and functioning of the installation* and whether the monitoring methodology can be improved.

This check should be performed *at least* once per year (e.g. when the annual emission report has been compiled, as there it becomes evident if source streams have exceeded the relevant thresholds). Best practice is to have a procedure which connects such check to the regular performance of control activities such as monthly horizontal or vertical checks (see section 5.5). Furthermore the check should be automatically triggered by any change of the capacity or operations of the installation.

New!
Simplified!

The MRR 2018/2066 allows that an installation which exceeds one of the mentioned thresholds only once in six years does not have to change its categorisation. This means that the applicable minimum tiers do not change due to this one year of higher emissions, and the operator does not have to submit an updated monitoring plan for approval. However, the operator has to provide evidence "*to the satisfaction of the competent authority that this threshold has not already been exceeded within the past five reporting periods and will not be exceeded again in subsequent reporting periods" (2nd subparagraph of Article 19(3))*.

Example: The source streams of the fictitious installation described in section 4.3.5 are classified using the approach outlined above. The result is shown in Table 3

Table 3: Categorisation of source streams of a fictitious installation.

Source stream / Emission source	CO_2 equivalent	Absolute value	% of total	Source stream category allowed
Coal fired boiler (CEMS)	400 000	400 000	71.6%	*(not a source stream, but an emission source)*
Natural gas	100 000	100 000	17.9%	major
Recycled material (fall-back)	50 000	50 000	8.9%	minor
Pig iron	5 000	5 000	0.9%	de-minimis
Alloying elements	2 000	2 000	0.4%	de-minimis
Iron scrap	1 000	1 000	0.2%	de-minimis
Steel products[61]	-1 000	1 000	0.2%	de-minimis

4.4.4 Emission sources

The MRR also provides for a categorisation of emissions sources for which a measurement-based methodology is applied (Article 19(4)). Similar to source streams in the previous section, the operator may classify **minor emission sources** where the emission source emits less than 5 000 tonnes of fossil CO_2 per year or less than 10% of the "total of all monitored items", up to a total maximum contribution of 100 000 tonnes of fossil CO_2 per year, whichever is the highest in terms of absolute value. All other emission sources are **major emission sources**.

Note: If the installation does not use CEMS, this categorisation can be omitted.

4.5 The tier system

As mentioned earlier, the EU ETS system for monitoring and reporting provides for a building block system of monitoring methodologies. Each parameter needed for the determination of emissions can be determined applying different "data quality levels". These "data quality levels" are called "tiers"[62]. The building block idea is illustrated by Figure 7, which shows the tiers which can be selected for determining the emissions from a fuel under the calculation-based methodologies. The descriptions of the different tiers (i.e. the requirements for complying with those tiers) are presented in more detail in chapter 6.

In general it can be said that tiers with lower numbers represent methods with lower requirements and being less accurate than higher tiers. Tiers of the same number (e.g. tier 2a and 2b) are considered equivalent.

[61] This is a product stream, i.e. contributing to the mass balance as output. Therefore the CO_2 equivalent is a negative number.

[62] Article 3(8) of the MRR defines: *'tier' means a set requirement used for determining activity data, calculation factors, annual emission and annual average hourly emission, and payload.*

Higher tiers are considered, in general, more difficult and costly to meet than lower ones (e.g. due to more expensive measurements applied). Therefore, lower tiers are usually required for smaller quantities of emissions, i.e. for minor and de-minimis source streams (see section 4.4.3) and for smaller installations (for categorisation see section 4.4.1). A cost effective approach is thus ensured.

Which tier an operator must select according to the requirements of the MRR is discussed in detail in section 5.2.

New!

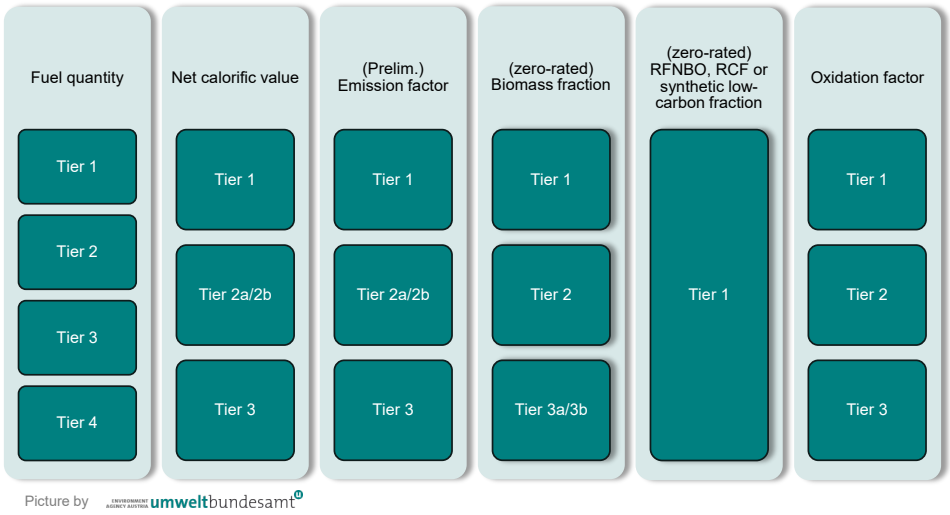

Figure 7: Illustration of the tier system for calculation-based approaches (combustion emissions).

4.6 Reasons for derogation

Simplified!

Cost effectiveness is an important concept for the MRR. It is generally possible for the operator to get permission from the competent authority to derogate from a specific requirement of the MRR (such as in particular the required tier level), if fully applying the requirement would lead to **unreasonable costs**. Therefore, a clear-cut definition for “unreasonable costs” is required. It is found in Article 18 of the MRR. As outlined in section 4.6.1 below, it is based on a cost/benefit analysis for the requirement under consideration.

Similar derogations may be applicable if a measure is **technically not feasible**. Technical feasibility is not a question of cost/benefit, but whether the operator is able to achieve a certain requirement at all. Article 17 of the MRR requires that an operator provides a justification where he claims something to be technically not feasible. This justification must demonstrate that the operator does not have the resources available to meet the specific requirement within the required time.

4.6.1 Unreasonable costs

When assessing whether costs for a specific measure are reasonable, the costs are to be compared with the benefit it would give. Costs are considered unreasonable where the costs exceed the benefit (Article 18).

Costs: It is up to the operator to provide a reasonable estimation of the costs involved. Only costs which are additional to those applicable for the alternative scenario should be taken into account. The MRR also requires that the equipment costs are to be assessed using a depreciation period appropriate for the economic lifetime of the equipment. Thus, the annual costs during the lifetime rather than the total equipment costs are to be used in the assessment.

Example: An old measuring instrument is found to not function properly any more, and is to be exchanged for a new one. The old instrument has allowed reaching an uncertainty of 3% corresponding to tier 2 (±5%) for activity data (for tier definitions see section 6.1.1). Because the operator would have to apply a higher tier anyway, he considers whether a better instrument would incur unreasonable costs. Instrument A costs 40 000 € and leads to an uncertainty of 2.8% (still tier 2), instrument B costs 70 000 €, but allows an uncertainty of 2.1% (tier 3, ±2.5%). Due to the rough environment in the installation, a depreciation period of 5 years is considered appropriate.

The costs to be taken into account for the assessment of unreasonable costs are 30 000 € (i.e. the difference between the two meters) divided by 5 years, i.e. 6 000 €. No cost for the working time should be considered, as the same workload is assumed to be necessary independent from the type of the meter to be installed. Also the same maintenance costs can be assumed as approximation.

New!

(CO_2 price and threshold)

Benefit: As the benefit of e.g. more precise metering is difficult to express in financial values, an assumption is to be made following the MRR. The benefit is considered to be proportionate to an amount of allowances in the order of magnitude of the reduced uncertainty. In order to make this estimation independent from daily price fluctuations, the MRR requires a constant allowance price of 80 € to be applied. For determining the assumed benefit, this allowance price is to be multiplied by an "improvement factor", which is the improvement of uncertainty multiplied by the average annual emissions caused by the respective source stream[63] over the three most recent years[64]. The improvement of uncertainty is the difference between the uncertainty currently achieved[65] and the uncertainty threshold of the tier which would be achieved after the improvement.

Where no direct improvement of the accuracy of emissions[66] data is achieved by an improvement, the improvement factor is always 1%. Article 18(3) lists some of such improvements, e.g. switching from default values to analyses, increasing

[63] Where one measuring instrument is used for several source streams, such as a weighbridge, the sum of emissions of all related source streams should be used.

[64] Only the fossil emissions are considered, which means all forms of zero-rated carbon are excluded. Transferred CO_2 is not subtracted. Where the average emissions of the most recent three years are not available or not applicable due to technical changes, a conservative estimate is to be used.

[65] Please note that the "real" uncertainty is meant here and not the uncertainty threshold of the tier.

[66] The MRR clarifies that any emissions data used for determining unreasonable costs have to take into account zero-rating where applicable.

the number of samples analysed, improving the data flow and control system, etc.

Please note the **minimum threshold** introduced by the MRR: Accumulated improvement costs below 4 000 € per year are always considered reasonable, without assessing the benefit. For installations with low emissions (→ section 4.4.2) this threshold is only 1 000 €.

Summarizing the above by means of a formula, the costs are considered reasonable, if:

$$C < P \cdot AEm \cdot (U_{curr} - U_{new\ tier}) \quad (9)$$

Where:

C ..... Costs [€/year]

P ..... specified allowance price = 80 € / t $CO_{2(e)}$

AEm .... Average emissions from related source stream(s) over the three most recent years [t $CO_{2(e)}$/year]

U_{curr} ..... Current uncertainty (not the tier) [%]

$U_{new\ tier}$. Uncertainty threshold of the new tier that can be reached [%]

Example: For the replacement of meters described above, the benefit of "improvement" for instrument A is zero, as it is a mere replacement maintaining the current tier. It cannot be unreasonable, as the installation cannot be operated without at least this instrument.

In case of instrument B, tier 3 (threshold uncertainty = 2.5 %) can be reached. Thus, the uncertainty improvement is $U_{curr} - U_{new\ tier}$ = 2.8% – 2.5% = 0.3%.

The average annual emissions are AEm = 120 000 t CO_2/year. Therefore, the assumed benefit is 0.003 ·120 000 ·80 € =28 800 €. This is higher than the assumed costs (see above). It is therefore not unreasonable to require instrument B to be installed.

Further guidance can be found in the training event material on "unreasonable costs" published on DG CLIMA's MRVA website (https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets/monitoring-reporting-and-verification-eu-ets-emissions_en). An Excel-based "unreasonable costs determination tool" can also be downloaded there.

4.7 Uncertainty

When somebody would like to ask the basic question about the quality of the MRV system of any emission trading system, he would probably ask: "How good is the data?" or rather "Can we trust the measurements which produce the emission data?" When determining the quality of measurements, international standards refer to the quantity of "uncertainty". This concept needs some explanation.

There are different terms frequently used in a similar way as uncertainty. However, these are not synonyms, but have their own defined meaning (see also illustration in Figure 8):

- **Accuracy**: This means closeness of agreement between a measured value and the true value of a quantity. If a measurement is accurate, the average of the measurement results is close to the "true" value (which may be e.g. the nominal value of a certified standard material[67]). If a measurement is not accurate, this can sometimes be due to a systematic error. Often this is can be overcome by calibrating and adjustment of instruments.
- **Precision**: This describes the closeness of results of measurements of the same measured quantity under the same conditions, i.e. the same thing is measured several times. It is often quantified as the standard deviation of the values around the average. It reflects the fact that all measurements include a random error, which can be reduced, but not completely eliminated.
- **Uncertainty**[68]: This term characterizes the range within which the true value is expected to lie with a specified level of confidence. It is the overarching concept which combines precision and assumed accuracy. As shown in Figure 8, measurements can be accurate, but imprecise, or vice versa. The ideal situation is precise and accurate.

If a laboratory assesses and optimizes its methods, it usually has an interest in distinguishing accuracy and precision, as this leads the way to identification of errors and mistakes. It can show such diverse reasons for errors such as the need for maintenance or calibration of instruments, or for better training of staff. However, the final user of the measurement result (in the case of the ETS, this is the operator and the competent authority) simply wants to know how big the interval is (measured average ± uncertainty), within which the true value is probably found.

In the EU ETS, only one value is given for the emissions in the annual emissions report. Only one value is entered in the verified emissions table of the registry. The operator can't surrender "N ± x%" allowances, but only the precise value N. It is therefore clear that it is in everybody's interest to quantify and reduce the uncertainty "x" as far as possible. This is the reason why monitoring plans must be approved by the competent authority, and why operators have to demonstrate compliance with specific tiers, which are related to permissible uncertainties.

More details on the definition of tiers are given in chapter 6. The uncertainty assessment which is to be added to the monitoring plan as supporting document (Article 12(1)) is discussed in section 5.3.

[67] Also a standard material, such as e.g. a copy of the kilogram prototype, disposes of an uncertainty due to the production process. Usually this uncertainty will be small compared to the uncertainties later down in its use.

[68] The MRR defines in Article 3(6): *'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*.

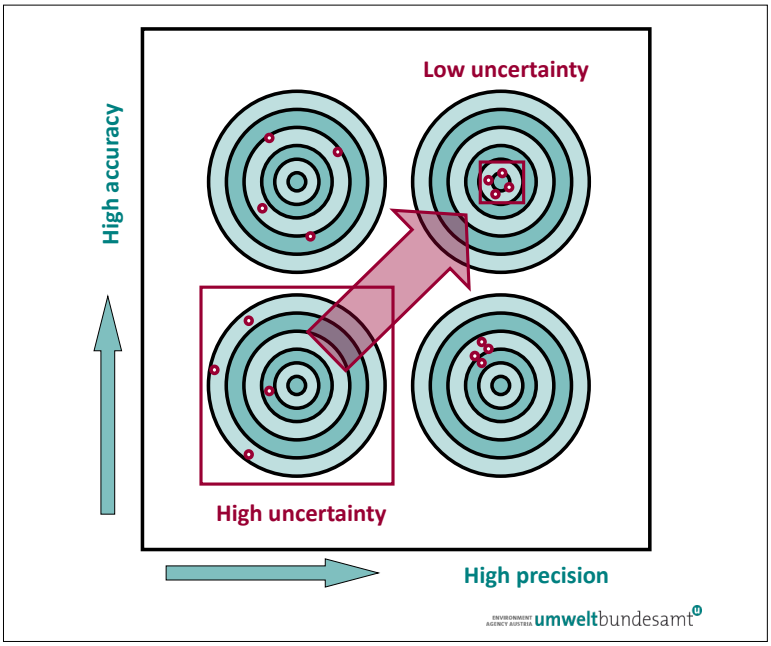

Figure 8: Illustration of the concepts accuracy, precision and uncertainty. The bull's eye represents the assumed true value, the "shots" represent measurement results.

Further guidance can be found on DG CLIMA's MRVA website (**https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets/monitoring-reporting-and-verification-eu-ets-emissions_en**):

- Guidance Document No. 4 ("Guidance on Uncertainty Assessment") and No. 4a ("Exemplar Uncertainty Assessment");
- Materials from training events on "uncertainty assessment";
- Excel-based "Tool for the assessment of uncertainties".

5 THE MONITORING PLAN

This chapter describes the way an operator can develop a monitoring plan from scratch. This will be the case for few installations only, i.e. for new installations. However, due to the transition from the MRR 601/2012 to the MRR 2018/2066, operators may have to revise the monitoring plans of their installations, in order to identify gaps or relevant improvement possibilities. Some Member States may request such reviews for *all* installations in their territory. Therefore this chapter is considered valuable for existing installations, too. Where significant changes compared to the "old" MRR 601/2012 have been introduced, this is highlighted in the text specifically with the usual "new" icons.

5.1 Developing a monitoring plan

When developing a monitoring plan, operators should follow some guiding principles:

- Knowing in detail the situation of their own installation, the operator should make the monitoring methodology as simple as possible. This is achieved by attempting to use the most reliable data sources, robust metering instruments, short data flows, and effective control procedures.
- Operators should imagine their annual emission report from verifier's perspective. What would a verifier ask about how the data has been compiled? How can the data flow be made transparent? Which controls prevent errors, misrepresentations, omissions?
- Because installations usually undergo technical changes over the years, monitoring plans must be considered living documents to a certain extent. In order to minimise administrative burden, operators should be careful which elements must be laid down in the monitoring plan itself, and what can be put into written procedures supplementing the MP.

Note: for installations with small emissions and some other "simple" installations, this chapter is only partly relevant. It is advisable to consult first chapter 7 of this document.

The following step-by-step approach might be considered helpful:

1. Define the installation's boundaries taking into account the provisions on the scope of each Annex I activity in the EU ETS Directive[69].
2. Determine the installation's category (→ see section 4.4.1) based on an estimate of the installation's annual GHG emissions. Where the boundaries of an incumbent installation are unchanged, the average verified annual emissions of the previous years can be used. In other situations, a conservative estimate is needed.

[69] See the Commission's guidance document on the interpretation of Annex I: https://ec.europa.eu/clima/sites/clima/files/ets/docs/guidance_interpretation_en.pdf

3. List all emission sources and source streams (→ for definitions see section 4.2) in order to decide on calculation or measurement-based approach. Classify the source streams as major, minor and de-minimis as well as the emission sources as major or minor, as appropriate.
4. Identify the tier requirements based on the installation category and the source stream/emission source category (see section 5.2).
5. List and assess potential sources of data:
    a. For calculation-based approaches, activity data (for detailed requirements see section 6.1):
        i. How can the amount of fuel or material be determined?
            - Are there instruments for continual metering, such as flow meters, weighing belts etc. which give direct results for the amount of material entering or leaving the process over time?
            - Or must the fuel or material quantity be based on batches purchased? In this case, how can the quantity on stock piles or in tanks at the end of the year be determined?
        ii. Are measuring instruments owned/controlled by the operator available?
            - If yes: What is their uncertainty level? Are they difficult to calibrate? Are they subject to legal metrological control[70]?
            - If no: Can measuring instruments be used, which are under the control of the fuel supplier? (This is often the case for gas meters, and for many cases where quantities are determined based on invoices.)

        iii. Estimate uncertainty associated with those instruments and determine the achievable tier associated. Note: For uncertainty assessment several simplifications are applicable, in particular if the measuring instrument is subject to national legal metrological control. For details see guidance document No. 4 (see section 2.3).

    b. Calculation factors (NCV, emission factor or carbon content, oxidation or conversion factor, (zero-rated) biomass fraction, (zero-rated) RFNBO and RCF fraction, (zero-rated) synthetic low-carbon fuel fraction): Depending on the required tiers (which are determined based on installation category and source stream category):
        i. Are default values applicable? If yes, are values available? (Annex VI of the MRR, publications of the competent authority, national inventory values)?
        ii. If the highest tiers are to be applied, or if no default values are applicable, chemical analyses have to be carried out for determining the missing calculation factors. In this case the operator must

[70] Some measuring instruments used for commercial transactions are subject to national legal metrological control. Special requirements (simplified approaches) are applicable to such instruments under the MRR. See guidance document No. 4 (for reference see section 2.3) for details.

- Decide on the laboratory to be used. If no accredited laboratory[71] is available, establish evidence on the equivalence to accreditation (see section 6.2.2);
- Select the appropriate analytical method (and applicable standard);
- Design a sampling plan (see guidance document No. 5 (for reference see section 2.3)).

iii. For source streams to be zero-rated, the operator has to decide what evidence is available to prove the compliance with the relevant sustainability and GHG savings criteria: Are RED II criteria (see section 6.3.5) applicable? Are Proofs of Sustainability (PoS) available from relevant certification schemes? Can the data be gathered from the Union Database (UDB)?[72]

c. For measurement-based approaches, if applicable:

i. Collect the necessary information (see section 8.1 and Guidance Document 7 for details on CEMS requirements) on the measurement instruments involved, in particular on the uncertainty levels achieved when carrying out the relevant Quality Assurance Level (QAL) tests;

ii. Check whether the placement of the probes allows for representative measurements;

iii. Select the method to determine the flue gas flow.

6. Can all required tiers be met for calculation-based approaches? If not, can a lower tier be met, if allowed in accordance with technical feasibility and unreasonable costs (→ section 4.6)?

7. If measurement-based approaches (CEMS, see section 8) can or have to be used[73], can the relevant tiers and other requirements (see section 8) be complied with?

8. If answers for points 6 and 7 are negative: Is there a way of using a fall-back methodology (see section 4.3.4)? A full uncertainty assessment for the installation is required in this case.

9. Next the operator should define all data flows (who takes which data from where, does what with the data, hands over the results to whom, etc.) from the measuring instruments or invoices to the final annual report. The design of a flow diagram will be helpful. More details on data flow activities are found in section 5.5.

10. With this overview of the data sources and data flows, the operator can carry out a risk analysis (see section 5.5). Thereby he will determine where in the system errors might occur most easily.

---

[71] „Accredited laboratory“ is used here as short form of “a laboratory which has been accredited pursuant to EN ISO/IEC 17025 for the analytical method required”.

[72] For more information please see section 6.3.5 to 6.3.10 and Guidance document No. 3.

[73] CEMS must be used for N_2O emissions, and may be used for CO_2 emissions. If the requirements for calculation-based methods for CO_2 cannot be reached, CEMS should be considered as equally valid alternative.

11. Using the risk analysis, the operator should:
    a. If applicable, decide whether CEMS or calculation-based approaches are more suitable;
    b. Assess which measuring instruments and data sources to use for activity data (see point 5.a above). In case of several possibilities, the one with the lowest uncertainty and lowest risk should be used;
    c. In all other cases which need decisions[74], decide based on the lowest associated risk; and
    d. Define control activities for mitigating the identified risks (see section 5.5).
12. It may be necessary to repeat some of the steps 5 to 11, before finally writing down the monitoring plan and the related procedures. In particular, the risk analysis will need update after having the control activities defined.
13. Then the operator will write the monitoring plan (using the templates provided by the Commission, an equivalent template by a Member State or a dedicated IT system provided by the Commission or a Member State), and the supporting documents required (Article 12(1)):
    a. Evidence that all the tiers noted in the monitoring plan are complied with (this requires an uncertainty assessment, which can be very simple in most cases, see section 5.3);
    b. The result of the final risk analysis (→section 5.5), showing that the defined control system is appropriately mitigating the identified risks;
    c. Further documents (such as installation description and diagram) may need to be attached;
    d. The written procedures referenced by the MP need to be developed, but do not need to be attached to the MP when submitting it to the CA (see section 5.4 on procedures).

The operator should make sure that all versions of the monitoring plan, the related documents and procedures are clearly identifiable, and that the most recent versions are always used by all staff involved. A good document management system is advisable from the beginning.

5.2 Selecting the correct tier

The system of defining the minimum required tiers is laid down in Article 26 for calculation-based approaches (i.e. for standard methodology and mass balances). **The overarching rule is that the operator should apply the highest tier defined for each parameter**. For major and minor source streams within Category B and C installations this is mandatory. For other source streams and smaller installations, the following set of rules defines the **exceptions from the rule**:

[74] E.g. where several departments could handle the data, choose the most suitable with the lowest number of error possibilities.

1. Instead of the highest tiers defined, category A installations are required to apply at least the tiers specified in Annex V of the MRR for major source streams.
2. Regardless of the installation category, the same tiers of Annex V are applicable for commercial standard fuels[75] with regard to calculation factors.
3. Where the operator demonstrates to the satisfaction of the competent authority, that applying the tiers required by the previous points leads to unreasonable costs (→ section 4.6) or is technically not feasible (→ section 4.6), the operator may apply to major source streams a tier which is
   - one tier lower in case of category C installations;
   - one or two tiers lower in case of category B and A installations;

   Tier 1 is always the lowest possible tier.
4. Where the tier levels required by the previous point are still technically not feasible or involving unreasonable costs, the CA may allow the operator to apply an even lower tier (with a minimum of tier 1) for a transitional period to be agreed with the CA, if the operator provides a suitable plan for necessary improvement within this period.

The above is applicable to major source streams. For **minor source streams**, lower tiers are allowed in general. The operator should select the highest tier that is technically feasible and not incurring unreasonable costs, with a minimum of tier 1. This means that the operator should first investigate which tier level is actually applied or can easily be applied. This tier is then laid down in the monitoring plan[76].

Operators are expected to apply tiers equal to or higher than 1 also for **de-minimis source streams** where this can be achieved "without additional effort" (i.e. without any notable costs). However, cases may exist where even tier 1 will involve significant or even unreasonable costs. For those cases the MRR allows that the operator applies a conservative[77] estimation method (this is a "no-tier method"). The operator should describe this method in the monitoring plan.

Special rules are applicable to **calculation factors** in some cases:

- For oxidation and conversion factors, the operator may apply in all types of installations tier 1 (i.e. setting the factor to a value of 100%)[78].

---

[75] Article 3(32) defines: *'commercial standard fuel' means the internationally standardised commercial fuels that exhibit a 95% confidence interval of not more than 1% for their specified calorific value, including gas oil, light fuel oil, gasoline, lamp oil, kerosene, ethane, propane, butane, jet kerosene (jet A1 or jet A), jet gasoline (jet B) and aviation gasoline (AvGas).*
Commercial standard fuels are considered easy to monitor. Therefore Article 31(4) allows the same treatment also for other fuels which exhibit similar constant composition: "*Upon application by the operator, the competent authority may allow that the net calorific value and emission factors of fuels are determined using the same tiers as required for commercial standard fuels provided that the operator submits, at least every three years, evidence that the 1 % interval for the specified calorific value has been met during the last three years*". The FAQ in section 12.9 gives further instructions how this rule can be applied.

[76] It is to be noted that the monitoring plan always has to reflect the tier actually applied, not the minimum one required. The general principle is that operators should attempt to improve their monitoring systems wherever possible.

[77] "Conservative" means that the method shall not lead to underestimation of the emissions.

[78] This is the "translation" of the MRR text of Article 26(4), which requires "the lowest tiers listed in Annex II, as a minimum".

- For some methodologies, the net calorific value (NCV) of fuels is not required for the calculation, but is to be reported for consistency reasons only. According to Article 26(5) this is the case for:
  - Fuels where the CA has allowed to use emission factors expressed as t CO_2 per tonne (or Nm^3) instead of t CO_2/TJ;
  - Fuels which are used as process input (if the emission factor is not expressed as per TJ);
  - Fuels which are part of a mass balance as described in section 4.3.2.

  In these cases the NCV may be determined by using conservative estimates instead of using tiers. However, the highest tier which does not involve additional efforts should be applied.

The full system of tier selection requirements for calculation-based approaches is summarized by Table 4.

Note: If not even tier 1 can be achieved for either activity data or a calculation factor of a major or minor source stream, the operator may consider applying a measurement-based approach (→ section 8). Where this also cannot even reach tier 1, a "fall-back methodology" (→ section 4.3.4) may be considered.

For measurement-based methodologies a similar hierarchy of approaches is laid down in Article 41: For major emission sources in category B and C installations, the highest tier is to be applied. For category A installations, tier 2 may be used (see section 2 of Annex VIII). Where the operator demonstrates unreasonable costs (→ section 4.6.1) or that such tier is technically not feasible, an even lower tier (minimum is tier 1) may be applied.

Again, if not even tier 1 is possible, the operator may have to use a fall-back methodology.

Important note: The monitoring plan always has to reflect the tier actually applied, not the minimum one required. The general principle is that operators should attempt to improve their monitoring systems wherever possible.

Table 4: Summary of tier requirements for calculation approaches. Note that this is only a brief overview. For detailed information the full text of this section should be consulted.

Installation category	**Source stream category**	**Tier required****	**Minimum tier** (if tier required technically not feasible or unreasonable costs)	**Absolute minimum tier** (if technically not feasible or unreasonable costs for transitional period of up to three years)	**If not at least tier 1 is possible**
Category C* (> 500kt)	Major	*highest tier in Annexes II & IV*	*highest tier in Annexes II & IV minus 1 (minimium tier 1)*	*tier 1*	*Fall-back approach*
	Minor	*highest tier in Annexes II & IV*	*tier 1*	*n.a.*	
	de-minimis	*conservative estimates unless tier is achievable without additional effort*			*n.a.*
Category B* (50kt < x ≤ 500kt)	Major	*highest tier in Annexes II & IV*	*highest tier in Annexes II & IV minus 2 (minimium tier 1)*	*tier 1*	*Fall-back approach*
	Minor	*highest tier in Annexes II & IV*	*tier 1*	*n.a.*	
	de-minimis	*conservative estimates unless tier is achievable without additional effort*			*n.a.*
Category A (≤ 50kt)	Major	*tier in Annex V*	*tier in Annex V minus 2 (normally tier 1)*	*tier 1*	*Fall-back approach*
	Minor	*tier in Annex V*	*tier 1*	*n.a.*	
	de-minimis	*conservative estimates unless tier is achievable without additional effort*			*n.a.*
Installation with low emissions (< 25kt)	Major	*tier 1 unless higher tier is achievable without additional effort*			*Fall-back approach*
	Minor	*tier 1 unless higher tier is achievable without additional effort*			
	de-minimis	*conservative estimates unless tier is achievable without additional effort*			*n.a.*

* for calculation factors (emission factor, net calorific value,..) of source streams that are commercial standard fuels the same tier requirements as for category A installations apply

** for oxidation and conversion factors the minimum requirement is to apply the lowest tier in Annexes II & IV (normally tier 1 = 100%)

Table 5: Summary of tier requirements for measurement-based approaches. Note that this is only a brief overview. For detailed information the full text of this section should be consulted.

Installation category	**Emission source category**	**Tier required**	**Minimum tier** (if tier required technically not feasible or unreasonable costs)	**If not at least tier 1 is possible**
Category C (> 500kt)	Major	*highest tier in Annex VIII*	*highest tier in Annex VIII minus 1 (minimium tier 1)*	*Fall-back approach*
	Minor	*highest tier in Annex VIII*	*tier 1*	
Category B (50kt < x ≤ 500kt)	Major	*highest tier in Annex VIII*	*highest tier in Annex VIII minus 2 (minimium tier 1)*	
	Minor	*highest tier in Annex VIII*	*tier 1*	
Category A (≤ 50kt)	Major	*tier 2*	*tier 1*	
	Minor	*tier 2*	*tier 1*	
Installation with low emissions (< 25kt)	Major	*tier 1 unless higher tier is achievable without additional effort (not applicable for N_2O)*		
	Minor			

5.3 Uncertainty assessment as supporting document

5.3.1 General requirements

As shown in section 6.1.1, the tiers for activity data are expressed using a specified "maximum permissible uncertainty over a reporting period". When submitting a new or updated monitoring plan, the operator must demonstrate the compliance of his monitoring methodology (in particular of the measuring instruments applied) with those uncertainty levels. Pursuant to Article 12(1), this is done by submitting an uncertainty assessment as supporting document together with the monitoring plan. (Note: installations with low emissions (→ section 4.4.2) are exempt from this requirement).

This supporting document should contain the following information:

- Evidence for compliance with uncertainty thresholds for activity data;
- Evidence for compliance with uncertainty required for calculation factors, if applicable[79];
- Evidence for compliance with uncertainty requirements for measurement-based methodologies, if applicable;

[79] This is applicable only where the sampling frequency for analyses is determined based on the rule of 1/3 of the activity data uncertainty (Article 35(2)). For more information see section 6.2.2.

- If a fall-back methodology is applied for at least part of the installation, an uncertainty assessment for the total emissions of the installation is to be presented.

It is advisable that the operator designs at the same time a pragmatic procedure for repeating this assessment regularly[80].

For activity data, the assessment shall cover (Article 28(2), by way of analogy also required by Article 29):

- the specified uncertainty of the applied measuring instruments,
- the uncertainty associated with the calibration, and
- any additional uncertainty connected to how the measuring instruments are used in practice.
- Furthermore the influence of the uncertainty related to determination of stocks at the start/end of the year are to be included, if relevant. They are relevant if:
  - fuel or material quantities are determined based on batch measurements rather than continual metering, i.e. mostly when invoices are used,
  - storage facilities are capable of containing at least 5% of the annually used quantity of the fuel or material considered; and
  - the installation is not an installation with low emissions (→ section 4.4.2).

5.3.2 Simplifications

As mentioned above in this section and in section 4.7, uncertainty encompasses several sources of uncertainty, in particular errors which are caused by a lack of precision (in principle this is the meter's uncertainty as specified by the manufacturer for use in an appropriate environment, and certain conditions for installation, such as length of straight piping before and after a flow meter) and a lack of accuracy (e.g. caused by aging or corrosion of the instrument, which may result in a drift). Therefore the MRR calls for the uncertainty assessment to take account of measuring instrument's uncertainty, as well as influence from calibration and all other possible influencing parameters. However, in practice such uncertainty assessment is very demanding, and exceeds the possibilities of many operators' resources. The MRR therefore provides for several pragmatic simplifications.

5.3.2.1 Simplification based on ETSG approach

For the second EU ETS phase, the so-called ETSG[81] guidance document proposed a simplified approach, which allowed the overall uncertainty for a source stream's activity data to be approximated by the uncertainty known for a specific type of instrument, under the condition that other sources of uncertainty are sufficiently mitigated. This is considered to be the case in particular if the instrument

[80] Such procedure is to be referenced in the monitoring plan in accordance with Annex I, section 1, point 1(c)(ii), and is needed for compliance with Articles 28(1), and 22, if applicable.

[81] ETS Support Group (a group of ETS experts under the umbrella of the IMPEL network, who have developed important guidance notes for the application of the MRG 2007)

is installed according to certain conditions. The ETSG note contains a list of instrument types and installation conditions which helps the user applying this approach.

The MRR has picked up the principle of this approach and allows the operator to use the "Maximum Permissible Error (MPE) *in service*"[82] specified for the instrument as overall uncertainty, provided that measuring instruments are installed in an environment appropriate for their use specifications. Where no information is available for the MPE in service, or where the operator can achieve better values than the default values, the uncertainty obtained by calibration may be used, multiplied by a conservative adjustment factor for taking into account the higher uncertainty when the instrument is "in service".

The information source for the MPE in service and the appropriate use specifications is not further specified by the MRR, leaving some room for flexibility. It may be assumed that the manufacturer's specifications, specifications from legal metrological control, but also guidance documents such as the Commission's guidance are suitable sources.

5.3.2.2 Relying on national legal metrological control

The second simplification allowed by the MRR, is even more simplifying in practice: Where the operator demonstrates to the satisfaction of the CA, that a measuring instrument is subject to national legal metrological control, the MPE (in service) allowed by the metrological control legislation may be taken as uncertainty, without providing further evidence[83].

5.3.2.3 Installations with low emissions

Article 47(4) and (5) exempt operators of installations with low emissions (→ section 4.4.2) completely from delivering an uncertainty assessment, where activity data is based on purchase records.

5.3.3 Further guidance

The topic of uncertainty assessment, and related topics such as default values for MPEs and use conditions of frequently used instrument types, are dealt with by guidance document No. 4 (for reference see section 2.3).

[82] The MPE in service is significantly higher than the MPE of the new instrument. The MPE in service is often expressed as a factor times the MPE of the new instrument.

[83] The philosophy behind this approach is that control is exerted here not by the CA responsible for the EU ETS, but by another authority which is in charge of the metrological control issues. Thus, double regulation is avoided and administration is reduced.

5.4 Procedures and the monitoring plan

The monitoring plan should ensure that the operator carries out all the monitoring activities consistently over the years, like according to a recipe book. In order to prevent incompleteness, or arbitrary changes by the operator, the competent authority's approval is required. However, there are always elements in the monitoring activities, which are less crucial, or which may change frequently.

The MRR provides a useful tool for such situations: Such monitoring activities may (or even shall) be put into "written procedures"[84], which are mentioned and described briefly in the MP, but are not considered part of the MP. These procedures are tightly linked to, but not part of the monitoring plan. They must be just described in the MP with such level of detail that the CA can understand the content of the procedure, and can reasonably assume that a full documentation of the procedure is maintained and implemented by the operator. The full text of the procedure would be delivered to the competent authority only upon request. The Operator shall also make procedures available for the purposes of verification (Article 12(2)). As a result, the operator has the full responsibility for the procedure. This gives him the flexibility to make amendments to the procedure whenever needed, without requiring update of the monitoring plan, as long as the procedure's content stays within the limitations of its description laid down in the monitoring plan.

The MRR contains several elements which are by default expected to be put into written procedures, such as:

- Managing responsibilities and competency of personnel;
- Data flow and control procedures (→ section 5.5);
- Quality assurance measures;
- Estimation method for substitution data where data gaps have been found;
- Regular review of the monitoring plan for its appropriateness (including uncertainty assessment where relevant);
- A sampling plan[85], if applicable (→ see section 6.2.2), and a procedure for revising the sampling plan, if relevant;
- Procedures for methods of analyses, if applicable;
- Procedure for demonstrating evidence for equivalence to EN ISO/IEC 17025 accreditation of laboratories, if relevant;
- Procedure for uncertainty assessment in case of fall-back methodologies (→ section 4.3.4) applied;
- Procedures for use of measurement-based methodologies, including for corroborating calculations and for subtracting biomass emissions, if relevant;

New!

[84] Article 11(1) 2nd sub-paragraph: "*The monitoring plan shall be supplemented by written procedures which the operator or aircraft operator establishes, documents, implements and maintains for activities under the monitoring plan, as appropriate*."

[85] Containing information on the methodologies for preparation of samples, including information on responsibilities, locations, frequencies and quantities and methodologies for the storage and transport of samples (Article 33).

- If relevant, procedures used for ensuring compliance of source streams with the relevant criteria for zero-rating[86];
- If relevant, procedures for the determination of the quantities of zero-rated biogas, RFNBO or RCF based on purchase records[87];
- If relevant, a procedure to determine the amount of CO_2 chemically bound permanently, and whether the product thereof complies with the delegated act pursuant to Article 12(3b) of the EU ETS Directive.

The MRR furthermore outlines how the procedure must be described in the monitoring plan. Note that for simple installations also the procedures will usually be very simple and straightforward. Where the procedure is very simple, it may be useful to use the procedure text immediately as "description" of the procedure as required for the monitoring plan.

Example for a procedure:

An operator might use different fractions of municipal or industrial waste as fuel. If every type of waste were to be considered as individual source stream, the operator would have to update the monitoring plan every time a new waste type is delivered. The competent authority would be required to issue an approval of the monitoring plan each time. Thus, such situation cannot be considered practical, in particular if the monitoring method is always the same (e.g. same balance used, same sampling and analyses methods applied).

Note: This example is without prejudice to other legal requirements regarding burning of waste, such as requirements under the Industrial Emissions Directive (IED, Directive 2010/75/EU). This example assumes that the different types of waste mentioned do not infringe any permit conditions or other legal requirements. The focus here lies purely on the EU ETS monitoring aspects.

Solution for monitoring: The operator uses a procedure for checking if the waste delivered fits into the boundaries of the defined source stream before applying the monitoring approach defined in the monitoring plan. The procedure could be outlined like this:

1. The shift personnel at the entrance gate is instructed to report every delivery of a waste material to the RSM (ETS Responsible Shift Manager)[88].
2. RSM checks if waste delivered complies with quality standard as defined by <procedure x.y.1>. That procedure defines that:
    a. only waste of certain waste catalogue numbers are permitted by the CA,
    b. only certain net calorific values, humidity and particle size can be used in the installation;
    c. in case of doubt, RSM will request the on-site laboratory to perform adequate analyses.
3. If the waste does not comply with <procedure x.y.1>, it has to be put on

[86] These criteria can be found in Articles 38(5), 39a(3) and 39(4) of the MRR. Guidance is given in sections 6.3.5 to 6.3.9

[87] For biogas see Article 39(4), for RFNBO or RCF see Article 39a(5).

[88] Note that not the name of responsible staff, but the name of the post is to be used, in order to avoid necessary updates whenever staff changes.

storage until the calculation factors have been determined. In this case this waste is put on a list of new materials, which will be notified to the CA every year in the first week of November.

4. Thereafter the waste can be used in the installation. The mass noted down on the delivery note, as well as the calculation factors are entered in the ETS data log, filename “E:\Raw data\SourceStreamData.xls”, sheet “WasteLog” by RSM.

<End of procedure>

Table 6 and Table 7 outline the necessary elements of information required to be put into the monitoring plan for each procedure (Article 12(2)) and give examples for procedures.

Table 6: Example related to the management of staff: Descriptions of a written procedure as required in the monitoring plan.

Item according to Article 12(2)	Possible content (examples)
Title of the procedure	ETS personnel management
Traceable and verifiable reference for identification of the procedure	ETS 01-P
Post or department responsible for implementing the procedure and the post or department responsible for the management of the related data (if different)	HSEQ deputy head of unit
Brief description of the procedure[89]	• Responsible person maintains a list of personnel involved in ETS data management • Responsible person holds at least one meeting per year with each involved person, at least 4 meetings with key staff as defined in the annex of the procedure; Aim: Identification of training needs • Responsible person manages internal and external training according to identified needs.
Location of relevant records and information	Hardcopy: HSEQ Office, shelf 27/9, Folder identified “ETS 01-P”. Electronically: “P:\ETS_MRV\manag\ETS_01-P.xls”
Name of the computerised system used, where applicable	N.A. (Normal network drives)
List of EN standards or other standards applied, where relevant	N.A.

[89] This description is required to be sufficiently clear to allow the operator, the competent authority and the verifier to understand the essential parameters and operations performed.

Table 7: QM-related example for a description of a written procedure in the monitoring plan. The installation of the example seems to be a rather complex one.

Item according to Article 12(2)	Possible content (examples)
Title of the procedure	QM for ETS instruments
Traceable and verifiable reference for identification of the procedure	QM 27-ETS
Post or department responsible for implementing the procedure and the post or department responsible for the management of the related data (if different)	Environmental officer / Business Unit 2
Brief description of the procedure	• Responsible person maintains a calendar of appropriate calibration and maintenance intervals for all instruments listed in table X.9 of the monitoring plan • Responsible person checks weekly which QM activities are required according to the calendar within the next 4 weeks. As appropriate, he reserves resources required for this tasks in the weekly meetings with the plant manager. • Responsible person orders external experts (calibration institutes) when required. • Responsible person ensures that QM tasks are carried out on the agreed dates. • Responsible person keeps records of the above QM activities. • Responsible person reports back to plant manager on corrective action required. • Corrective action is handled under procedure QM 28-ETS.
Location of relevant records and information	Hardcopy: Office HS3/27, shelf 3, Folder identified “QM 27-ETS -nnnn”. (nnnn=year) Electronically: “Z:\ETS_MRV\QM\calibr_log.pst”
Name of the computerised system used, where applicable	MS Outlook calendar, also used for storing documents as attachments chronologically
List of EN standards or other standards applied, where relevant	In the instrument list (document ETS-Instr-A1.xls) the applicable standards are listed. This document is made available to the CA and verifier upon request.

5.5 Data flow and control system

Monitoring of emissions data is more than just reading instruments or carrying out chemical analyses. It is of utmost importance to ensure that data are produced, collected, processed and stored in a controlled way. Therefore the operator must define instructions for "who takes data from where and does what with the data". These "data flow activities" (Article 58) form part of the monitoring plan (or are laid down in written procedures, where appropriate (see section 5.4). A data flow diagram is often a useful tool for analysing and/or setting up data flow procedures. Examples for data flow activities include reading from instruments, sending samples to the laboratory and receiving the results, aggregating data, calculating the emissions from various parameters, and storing all relevant information for later use.

As human beings (and often different information technology systems) are involved, mistakes in these activities can be expected. The MRR therefore requires the operator to establish an effective control system (Article 59). This consists of two elements:

- A risk assessment, and
- Control activities for mitigating the risks identified.

"Risk" is a parameter which takes into account both, the probability of an incident and its impact. In terms of emission monitoring, the risk refers to the probability of a misstatement (omission, misrepresentation or error) being made, and its impact in terms of annual emissions figure.

When the operator carries out a risk assessment, he analyses for each point in the data flow needed for the whole installation's emission monitoring, whether there would be a risk of misstatements. Usually this risk is expressed by qualitative parameters (low, medium, high) rather than by trying to assign exact figures. He furthermore assesses potential reasons for misstatements (such as paper copies being transported from one department to another, where delays may occur, or copy & paste errors may be introduced), and identifies which measures might reduce the found risks, e.g. sending data electronically and storing a paper copy in the first department; search for duplicates or data gaps in spreadsheets, control check by an independent person ("four eyes principle")…

Measures identified to reduce risks are implemented. The risk assessment is then re-evaluated with the new (reduced) risks, until the operator considers that the remaining risks are sufficiently low for being able to produce an annual emissions report which is free from material misstatement(s)[90].

The control activities are laid down in written procedures and referenced in the monitoring plan. The results of the risk assessment (taking into account the control activities) are submitted as supporting documentation to the competent authority when approval of the monitoring plan is requested by the operator.

[90] The operator should strive to produce "error-free" emission reports (Article 7: Operators "*shall exercise due diligence to ensure that the calculation and measurement of emissions exhibit the highest achievable accuracy*"). However, verification cannot produce 100% assurance. Instead, verification aims at providing a reasonable level of assurance that the report is free from material misstatements. For further information see the relevant guidance document on the A&V Regulation *(see section 2.3).*

Operators are required to establish and maintain written procedures related to control activities for at least (Article 59(3)):

(a) quality assurance of the measurement equipment;

(b) quality assurance of the information technology system used for data flow activities, including process control computer technology;

(c) segregation of duties in the data flow activities and control activities and management of necessary competencies;

(d) internal reviews and validation of data;

(e) corrections and corrective action;

(f) control of out-sourced processes;

(g) keeping records and documentation including the management of document versions.

Installations with low emissions: Article 47(3) exempts operators of installations with low emissions (→ section 4.4.2) from submitting a risk analysis when submitting the monitoring plan for approval by the competent authority. However, operators will still find it useful to carry out a risk assessment for their own purposes. It has the advantage of reducing the risk of under-reporting, under-surrender of allowances and consequential penalties, and also over-reporting and over-surrender.

Note that dedicated documents containing more detailed information on the data flow activities and control system (including risk analysis) has been published (GD No. 6 and 6a, tool for operators' risk assessment; for reference see section 2.3).

5.6 Keeping the monitoring plan up to date

The monitoring plan must always correspond to the current nature and functioning of the installation. Where the practical situation at the installation is modified, e.g. because technologies, processes, fuels, materials, measuring equipment, IT systems or organisation structures (i.e. staff assignments) are changed (where relevant for the monitoring of emissions), the monitoring methodology must be updated (Article 14)[91]. Depending on the nature of the changes, one of the following situations can occur:

[91] Article 14(2) lists a minimum of situations in which a monitoring plan update is mandatory: *"(a) new emissions occur due to new activities being carried out or due to the use of new fuels or materials not yet contained in the monitoring plan;*
(b) a change in the availability of data, due to the use of new types of measuring instrument, sampling methods or analysis methods, or for other reasons, leads to higher accuracy in the determination of emissions;
(c) data resulting from the monitoring methodology applied previously has been found to be incorrect;
(d) changing the monitoring plan improves the accuracy of the reported data, unless this is technically not feasible or incurs unreasonable costs;
(e) the monitoring plan is not in conformity with the requirements of this Regulation and the competent authority requests the operator or aircraft operator to modify it;
(f) it is necessary to respond to the suggestions for improvement of the monitoring plan contained in a verification report."

- If an element of the monitoring plan itself needs updating, one of the following situations can apply:
  - The change to the monitoring plan is a significant one. This situation is discussed in section 5.6.1. In case of doubt, the operator has to assume that the change is significant.
  - The change to the monitoring plan is not significant. The procedure described under 5.6.2 applies.
- An element of a written procedure is to be updated. If this doesn't affect the description of the procedure in the monitoring plan, the operator will carry out the update under his own responsibility without notification to the competent authority.

The same situations may occur as a consequence of the requirement to improve the monitoring methodology continuously (see section 5.7).

The MRR in Article 16(3) also defines the requirements for record keeping about any monitoring plan updates, such that a complete history of monitoring plan updates is maintained, which allows a fully transparent audit trail, including for the purposes of the verifier.

For this purpose it is considered best practice for the operator to make use of a "logbook", in which all non-significant changes to the monitoring plan and to procedures are recorded, as well as all versions of submitted and approved monitoring plans. This must be supplemented with a written procedure for regular assessment of whether the monitoring plan is up to date (Article 14(1) and point 1(c) of section 1 of Annex I).

Note: From 2021, a simplification[92] introduced in Article 19 helps to avoid a potentially large number of monitoring plan updates. In principle, every time an installation's emissions exceed the threshold for its classification (Category A, B, C or installation with low emissions), the operator would have to evaluate if all tiers applied still confirm with the requirement (see section 5.2). The same would apply to individual emission sources or source streams, if their emissions exceed the relevant threshold for their classification. The new simplification clauses in Article 19 now allow the operator to avoid such reclassification of the installation, emission source or source stream, if he provides evidence to the competent authority that the relevant threshold was not exceeded during the 5 years before the exceedance, and is unlikely to exceed it again.

Note: Any change of the monitoring plan under the MRR may have an impact on the "Monitoring Methodology Plan" (MMP) required by the Free Allocation Rules

[92] The simplification for installation classification is found in the 2nd subparagraph of Article 19(2): "*By way of derogation from Article 14(2), the competent authority may allow the operator not to modify the monitoring plan where, on the basis of verified emissions, the threshold for the classification of the installation referred to in the first subparagraph is exceeded, but the operator demonstrates to the satisfaction of the competent authority that this threshold has not already been exceeded within the past five reporting periods and will not be exceeded again in subsequent reporting periods.*" Similar wording is found in Article 19(3) for source streams and in Article 19(4) for emission sources.

(FAR) Regulation[93]. If the installation receives free allocation under the FAR, the operator is responsible to keep also the MMP up to date[94].

5.6.1 Significant modifications

Whenever a significant modification to the monitoring plan is necessary, the operator shall notify the update to the competent authority without undue delay. The competent authority then has to assess whether the change is indeed a significant one. Article 15(3) contains a (non-exhaustive) list of monitoring plan updates which are considered significant[95]. If the change is not significant, the procedure described under 5.6.2 applies. For significant changes, the competent authority thereafter carries out its normal process of approving monitoring plans[96].

The approval process may sometimes need longer than the physical change of the installation (e.g. where new source streams are introduced for monitoring). Furthermore the competent authority may find the operator's monitoring plan update incomplete or inappropriate and may require additional amendments of the monitoring plan. Thus, monitoring according to the old monitoring plan may be incomplete or lead to inaccurate results, while the operator is not sure whether the new monitoring plan will be approved as requested. The MRR provides for a pragmatic approach here:

According to Article 16(1), the operator shall immediately apply the new monitoring plan where he can reasonably assume that the updated monitoring plan will be approved as proposed. This may apply e.g. when an additional fuel is introduced, which will be monitored using the same tiers as comparable fuels in that

---

[93] Commission Delegated Regulation (EU) 2019/331, consolidated version: http://data.europa.eu/eli/reg_del/2019/331/2024-01-01

[94] See the guidance document No. 5 ("Guidance on Monitoring and Reporting in Relation to the Free Allocation Rules") of the guidance series on free allocation rules: https://ec.europa.eu/clima/sites/default/files/ets/allowances/docs/p4_gd5_mr_guidance_en.pdf

[95] Article 15(3):
3. Significant modifications to the monitoring plan of an installation include:
(a) changes to the category of the installation where such changes require a change to the monitoring methodology or lead to a change of the applicable materiality level pursuant to Article 23 of Implementing Regulation (EU) 2018/2067;
(b) notwithstanding Article 47(8), changes regarding whether the installation is considered an 'installation with low emissions';
(c) changes to emission sources;
(d) a change from calculation-based to measurement-based methodologies, or vice versa, or from a fall-back methodology to a tier-based methodology for determining emissions or vice versa;
(e)a change in the tier applied;
(f) the introduction of new source streams;
(g) a change in the categorisation of source streams – between major, minor or de-minimis source streams where such a change requires a change to the monitoring methodology;
(h) a change to the default value for a calculation factor, where the value is to be laid down in the monitoring plan;
(i) the introduction of new methods or changes to existing methods related to sampling, analysis or calibration, where this has a direct impact on the accuracy of emissions data;
(j) the implementation or adaption of a quantification methodology for emissions from leakage at storage sites.

[96] This process may differ between Member States. The usual procedure will include a completeness check for the information provided, a check for the appropriateness of the new monitoring plan in regard of the changed situation of the installation, and a check for compliance with the MRR. The competent authority may also reject the new monitoring plan or require further improvements. The competent authority may also come to the conclusion that the proposed changes are not significant ones.

installation. Where the new monitoring plan is not yet applicable, because the situation in the installation will change only after the approval of the monitoring plan by the competent authority, monitoring is to be carried out in accordance with the old monitoring plan until the new one is approved.

Where the operator is unsure whether the CA will approve the changes, he shall carry out monitoring in parallel using both the new and the updated monitoring plan (Article 16(1)). Upon receiving the approval of the competent authority, the operator shall use only the data obtained in accordance with the new monitoring plan as approved (Article 16(2)).

5.6.2 Non-significant modifications of the monitoring plan

While significant updates of the monitoring plan are to be notified without undue delay, the competent authority may allow the operator to delay the notification of non-significant updates in order to simplify the administrative process (Article 15(1)). Where this is the case and the operator can reasonably assume that changes to the monitoring plan are non-significant, they may be collected and submitted to the CA once a year (by 31 December), if the competent authority allows this approach.

The final decision on whether a change to the monitoring plan is significant is the responsibility of the competent authority. However, an operator can reasonably anticipate that decision in many cases:

- Where a change is comparable to one of the cases listed in Article 15(3), the change is significant;
- Where the impact of the proposed monitoring plan change on the overall monitoring methodology or on the risks for error is small, it may be non-significant;
- In case of doubt assume it is a significant change and follow section 5.6.1.

Non-significant changes do not need the approval of the competent authority. However, in order to provide for legal certainty, the competent authority must inform the operator without undue delay of its decision to consider changes non-significant where the operator has notified them as significant. Operators can be expected to appreciate if the competent authority acknowledges receipt of notifications in general.

5.7 The improvement principle

While the previous section has dealt with monitoring plan updates which are mandated as consequence of factual changes at the installation, the MRR also requires the operator to explore possibilities to improve the monitoring methodology when the installation itself is unchanged. For implementing this “improvement principle”, there are two requirements:

- Operators must take account of the recommendations included in the verification reports (Articles 9 and 69(4)), and
- Operators must check regularly on their own initiative, whether the monitoring methodology can be improved (Article 14(1) and Article 69(1)-(3)).

Operators must react to those findings on possible improvements by

- Sending an improvement report to the competent authority for approval,
- Updating the monitoring plan as appropriate (using the procedures outlined in sections 5.6.1 and 5.6.2), and
- Implementing the improvements, if relevant according to the time table proposed in the approved improvement report.

"Improvement report" has two different legal bases and deadlines. However, both reports may be combined if possible:

For the **improvement report pursuant to Article 69(1) on the operator's own initiative** (which may be combined with the one on verifier's findings – see next paragraph) the deadline is the 30 June. It has to be delivered:

New!

- Every 2 years for category C installations,
- every 3 years for category B installations, and
- every 5 years for category A installations.

The deadline of 30 June may be extended by the competent authority up to 30 September of the same year.

Where the operator can demonstrate that the reasons for unreasonable costs or for improvement measures being technically not feasible will remain valid for a longer period of time, the competent authority may extend the periods above to a maximum of 3, 4, or 5 years for category C, B, or A installations, respectively.

Simplified!

For the **improvement report responding to a verifier's recommendations (Article 69(4))**, the deadline is 30 June (or as late as 30 September, if the CA sets such later deadline) *of the year in which the verification report is issued*, irrespective whether an improvement report under Article 69(1) is also due this year. However, if the operator has already submitted an updated monitoring plan for approval, which addresses all the issues reported by the verifier, the improvement report pursuant to Article 69(4) may be omitted (see Article 69(5)).

Operators of installations with low emissions (→ section 4.4.2) have to take into consideration the verifier's recommendations in their monitoring, but are exempted from providing a corresponding improvement report to the competent authority (Article 47(3)).

The improvement reports pursuant to Article 69(1) have to contain in particular the following information:

- Improvements for achieving higher tiers, if the "required" tiers are not yet applied. "Required" here means "those tiers which are applicable if no unreasonable costs occur and if the tier is technically feasible"[97].
- If the operator applies a fall-back methodology (→ section 4.3.4), the report shall contain a justification as to why it is technically not feasible or would incur

[97] Those "required" tiers are:
(a) for calculation approaches (first sub-paragraph of Article 26(1)): the highest tiers defined in Annex II of the MRR for category B and C installations, and the tiers laid down in Annex V for category A installations and for calculation factors for commercial standard fuels;
(b) for measurement-based approaches (Article 41(1)): for each major emission source, the operator shall apply, at least the tiers listed in section 2 of Annex VIII in the case of a category A installation and in other cases, the highest tier listed in section 1 of Annex VIII.

unreasonable costs to apply at least tier 1 for one or more major or minor source streams. If this justification is not applicable any more, the operator has to report how at least tier 1 for those source streams is to be applied.

- The report should contain for each possible improvement either a description of the improvement and the related timetable, or evidence regarding technical non-feasibility or unreasonable costs, if applicable (→ section 4.6).

Note: The Commission has provided harmonised templates for improvement reports.

6 CALCULATION-BASED APPROACHES

This chapter gives further details which must be considered when applying calculation-based monitoring methodologies. The principles of the methodology have been outlined already in sections 4.3.1 (standard methodology) and 4.3.2 (mass balance). All calculation-based approaches have common elements which need to be defined in the monitoring plan. They will be discussed in this chapter as follows:

- For the monitoring of activity data, amounts of material or fuel need to be monitored, with tiers being defined according to the uncertainty of metering (→ section 6.1).
- Calculation factors have to be determined either as default values (section 6.2.1) or have to be determined by analyses (section 6.2.2)
- For calculation factors, a few specific requirements are found in the MRR. These are discussed in section 6.3.

6.1 Monitoring of activity data

6.1.1 Tier definitions

As discussed earlier, the tiers (→ section 4.5) for activity data of a source stream are defined using thresholds for a maximum uncertainty allowed for the determination of the quantity of fuel or material over a reporting period. Whether a tier is met, must be demonstrated by submitting an uncertainty assessment to the competent authority together with the monitoring plan, except it is an installation with low emissions (→ section 4.4.2). Elements of this uncertainty assessment have been discussed in section 5.3. For illustration, Table 8 shows the tier definitions for combustion of fuels. A full list of the tier definitions of the MRR is given in section 1 of Annex II of the MRR.

Table 8: Typical definitions of tiers for activity data based on uncertainty, given for the combustion of fuels as example.

Tier No.	Definition
1	Amount of fuel [t] or [Nm^3] over the reporting period[98] is determined with a maximum uncertainty of less than **± 7.5 %**.
2	Amount of fuel [t] or [Nm^3] over the reporting period is determined with a maximum uncertainty of less than **± 5.0 %**.
3	Amount of fuel [t] or [Nm^3] over the reporting period is determined with a maximum uncertainty of less than **± 2.5 %**.
4	Amount of fuel [t] or [Nm^3] over the reporting period is determined with a maximum uncertainty of less than **± 1.5 %**.

[98] Reporting period is the calendar year.

Note that the uncertainty is meant to refer to “all sources of uncertainty, including uncertainty of instruments, of calibration, environmental impacts”, unless some of the simplifications mentioned in section 5.3.2 are applicable. The impact of the determination of stock changes at the beginning and end of the period is to be included, if applicable.

6.1.2 Relevant elements of the monitoring plan

When developing the monitoring plan, the operator has to make several choices regarding the way activity data is determined. In the case of fuels, “activity data” includes the component of the net calorific value. However, the **quantity of material or fuel** is discussed here specifically, to which the calculation factors are related. For simplicity purpose, the term “activity data” is used here synonymous to “quantity of material or fuel”, and the net calorific value is discussed together with the other calculation factors in sections 6.2 and 6.3.2 below.

Continual vs. batch metering

In principle, there are two ways how the activity data can be determined (Article 27(1)):

(a) based on **continual metering** at the process which causes the emissions;

(b) based on aggregation of metering of quantities separately delivered (**batch metering**) taking into account relevant stock changes.

Continual metering: In case (a), the material or fuel is directly passing the measuring instrument before being fed to the GHG emitting process (or in some cases coming from there). This is the case for e.g. gas meters or belt weighers. Similarly, the metering may take place at the entrance to the installation, which is the more usual case for natural gas supplies. The quantity of the reporting period is read from the meter either as “value at the end of the period minus value at the beginning of the period” (this is usually the case for gas meters), or by summing up (integrating) many readings (e.g. every minute, hour or day) over the whole reporting period. The uncertainty assessment has to deal primarily with the uncertainty of this one instrument.

Note that cases may exist where part of the material entering the installation is not used within the installation, but exported to another installation or consumed within the installation for an activity which is not covered by the EU ETS. Although the latter situation will not occur as frequently as it did in the first two ETS phases[99], the metering of the amount of fuel or material exported must be taken into account in the uncertainty assessment, and thus must be done using meas-

[99] In particular, point 5 of Annex I to the EU ETS Directive is important: “*When the capacity threshold of any activity in this Annex is found to be exceeded in an installation, all units in which fuels are combusted, other than units for the incineration of hazardous or municipal waste, shall be included in the greenhouse gas emission permit.*” This sentence significantly reduced the number of occasions where part of the natural gas entering the installation is consumed in units considered not part of the GHG emissions permit. For more details, see the Commission’s guidance on the interpretation of Annex I.
(https://ec.europa.eu/clima/sites/clima/files/ets/docs/guidance_interpretation_en.pdf)

urement instruments which allow the total quantity used within the EU ETS installation to be determined with an overall uncertainty below the allowed threshold of the applicable tier.

Batch metering: In case (b), the material quantity is determined using a material balance (Article 27(2)):

$$Q = P - E + (S_{begin} - S_{end}) \quad (10)$$

Where:

Q ..... Quantity of fuel or material applied in the period

P ..... Purchased quantity

E ..... Exported quantity (e.g. fuel delivered to parts of the installation or other installations which are not included in the EU ETS)

S_{begin} .... Stock of the material or fuel at the beginning of the reporting year

S_{end} ..... Stock of the material or fuel at the end of the reporting year

This method is usually applied where invoices are used as the main data source for parameter *P*. The operator should pay special attention to clarifying whether exports[100] occur at the installation. Furthermore the operator has to include in the monitoring plan a description how the stocks are determined at the beginning and end of the reporting year. Some simplifications are allowed in this regard, which are discussed below within this section.

Method (b) is often applied where the operator does not dispose of measuring instruments of his own. Therefore the requirements for "instruments not under the operator's control" are usually applicable for the uncertainty assessment. However, the operator must take into account the uncertainties associated with the determination of the stock changes. Derogation is granted where the storage facilities are not capable of containing more than 5% of the annual used quantity of the fuel or material considered. In such case the uncertainty of stock changes may be omitted from the uncertainty assessment (Article 28(2)).

Note on stock determination:

The MRR (Article 27(2)) allows two simplifications to the determination of stocks at the beginning and end of the reporting year:

1. Where it is technically not feasible or would incur unreasonable costs to determine quantities in stock by direct measurement, the operator may use an estimation method. Such situations may e.g. occur in tanks for heavy fuel oil, where some solid fraction on top of the liquid oil prevents the exact metering of the surface level.

   Methods allowed by the MRR are:

   a. data from previous years correlated with output for the reporting period;

[100] Typical "exports" include the use of fuels for mobile machinery such as fork lifts, or where neighbouring installations are supplied with one common gas meter, while at least one of those installations does not fall within the scope of the EU ETS.

b. documented procedures and respective data in audited financial statements for the reporting period.

2. Theoretically, the stocks would have to be determined at midnight of the 31 December every year, which may not be possible in practice. Therefore, the MRR allows[101] choosing the next most appropriate day to separate a reporting year from the following one. Data must be reconciled accordingly to the calendar year required. The deviations involved for one or more source streams shall be clearly recorded, form the basis of a value representative for the calendar year, and be considered consistently in relation to the next year.

Operator's instruments vs. supplier's instruments

The MRR does not require every operator to equip the installation with measuring instruments at any cost. That would contradict the MRR's approach regarding cost effectiveness. Instead, instruments which are under the control of other parties (in particular fuel suppliers) may be used. In particular in the context of commercial transactions such as fuel purchase, it is often the case that the metering is done by only one of the trade partners. The other partner may assume that the uncertainty associated with the measurement is reasonably low, because such measurements are often governed by legal metrological control. Alternatively, requirements on quality assurance for instruments, including maintenance and calibration can be included in the purchase contracts. However, the operator must seek a confirmation on the uncertainty applicable for such meters in order to assess if the required tier can be met.

Thus, the operator may choose whether to use his own instruments or to rely on instruments used by the supplier. However, a slight preference is given by the MRR to the operator's own instruments: If the operator decides to use other instruments despite having his own instruments at his disposal, he has to provide evidence to the competent authority that the supplier's instruments allow compliance with at least the same tier, give more reliable results and are less prone to control risks than the methodology based on his own instruments. This evidence must be accompanied with a simplified uncertainty assessment.

In many cases this uncertainty assessment will be very short and simple. In particular, if the operator has no alternative instrument available under the operator's own control, the operator does not have to compare the tier applicable using his own instrument with the tier applicable to the supplier's instrument. For demonstrating the applicable tier for the supplier's instrument, suitable evidence should be added to the uncertainty assessment on the CA's request.

Furthermore, the control risk may be low where invoices are subject to an accounting department's controls[102].

In the case that invoices are used as primary data for determining the material or fuel quantity, the MRR requires the operator to demonstrate that the trade part-

[101] Under the condition that the exact time would be technically not feasible or would incur unreasonable costs the operator.

[102] Note that the existence of the accounting's controls does not automatically dispense the operator from including appropriate risk mitigation measures in the EU ETS related control system. The risk assessment according to Article 59(2) must include this risk as appropriate.

ners are independent. In principle, this should be considered a safeguard for ensuring that meaningful invoices exist. In many cases it will also be an indicator whether national legal metrological control is applicable.

Note that there is a “hybrid” possibility allowed by the MRR: The instrument is outside the control of the operator, but the reading for monitoring is done by the operator. In such a case the owner of the instrument is responsible for maintenance, calibration and adjustment of the instrument, and ultimately for the applicable uncertainty value, but the data on material quantity can be directly checked by the operator. Again, this is a situation frequently found for natural gas meters.

Information on further requirements regarding determination of activity data: Within this section 6.1, all the topics surrounding uncertainty, including maintenance, calibration and adjusting of measuring instruments have not been discussed. However, this is a very important topic which exceeds the scope of this guidance document. Reference is therefore made to section 5.3, and in particular 5.3.3, in which further information sources are listed.

6.2 Calculation factors – Principles

Besides the activity data, the “calculation factors” are important parts of any monitoring plan based on a calculation methodology. These factors are (as outlined in the context of the calculation formulae in section 4.3.1 and 4.3.2):

- In case of the standard methodology for combustion of fuels, or fuels used as process input: Emission factor, net calorific value, oxidation factor and biomass fraction;
- In case of the standard methodology for process emissions (in particular decomposition of carbonates): Emission factor and conversion factor;
- For mass balances: Carbon content, and if applicable: biomass fraction and net calorific value.

According to Article 30(1) of the MRR, these factors can be determined by one of the following principles:

a. As **default values** (→ Section 6.2.1); or

b. by **laboratory analyses** (→ section 6.2.2).

The applicable tier will determine which of these options is used. Lower tiers allow for default values, i.e. for values which are kept constant throughout the years, and updated only when more accurate data becomes available. The highest tier defined for each parameter in the MRR is usually the laboratory analysis, which is more demanding, but of course more accurate. The result of the analysis is valid for the very batch from which the sample has been taken, while a default value is usual an average or conservative value determined on the basis of big quantities of that material. E.g. emission factors for coal as used in national inventories might be applicable to a country-wide average of several coal types as used also in energy statistics, while the analysis will be valid for only one batch of one coal type.

Important note: In all cases the operator must ensure that activity data and all calculation factors are used consistently. I.e. where a fuel's quantity is determined in the wet state before entering the boiler, the calculation factors must also refer to the wet state. Where analyses are carried out in the laboratory from the dry sample, the moisture must be taken into account appropriately, for arriving at calculation factors applicable for the wet material.

Operators must also be careful not to mix up parameters of inconsistent units. Where the amount of fuel is determined per volume, also the NCV and/or emission factor must refer to volume rather than mass[103].

6.2.1 Default values

When an operator intends to use a default value for a calculation factor, the value of that factor must be documented in the monitoring plan. The only exception is where the default value or its information source changes on an annual basis. In principle, this is the case where the competent authority regularly updates and publishes the standard factors used in the national GHG inventory. In such cases, the monitoring plan should contain the reference to the place (webpage, official journal, etc.) where these values are published, instead of the value itself (Article 31(2)).

The applicable type of default values is determined by the applicable tier definition. Sections 2 to 4 of Annex II of the MRR give a general scheme for these definitions. The sector-specific monitoring methodologies in Annex IV further specify those tiers, or sometimes overrule the tier definitions with more specific ones. A complete listing of all tier definitions would significantly exceed the scope of this guidance. However, a simplified overview of tier definitions given by Annex II is presented in Table 9.

Table 9: Overview of the most important tier definitions for calculation factors, based on Annex II of the MRR. The following abbreviations are used: EF…Emission factor, NCV…net calorific value, OF…oxidation factor, CF…conversion factor, CC…carbon content, BF…biomass fraction. The tier definitions are further specified in the further text.

Source stream type	Factor	Tier	Tier definition
Combustion emissions	EF[104]	1	Type I default values
		2a	Type II default values
		2b	Established proxies (if applicable)
		3	Laboratory analyses or empirical correlations
Combustion emissions	OF	1	Default value OF=1
		2	Type II default values

[103] See section 4.3.1, in which conditions are mentioned under which the operator may use emission factors expressed as t CO_2/t fuel instead of t CO_2/TJ.

[104] According to section 2.1 of Annex II of the MRR, the tiers defined shall relate to the *preliminary* emission factor, where a biomass fraction is determined for a mixed fuel or material.

Source stream type	Factor	Tier	Tier definition
		3	Laboratory analyses
Combustion emissions and mass balance	NCV	1	Type I default values
		2a	Type II default values
		2b	Purchasing records (if applicable)
		3	Laboratory analyses
Combustion emissions, process emissions and mass balance	BF	1	Type I biomass fraction
		2	Type II biomass fraction
		3a	Laboratory analyses
		3b	Material balance of the production process *New!*
Combustion emissions, process emissions and mass balance	*New!* RF or SF[105]	1	Determined based on the mass balance pursuant to Article 30(1) of the RED
Process emissions (Method A: Input based)	EF	1	Type I default values
		2	Type II default values
		3	Laboratory analyses and stoichiometric values
Process emissions (Method B: Output based)	EF	1	Type I default values
		2	Type II default values
		3	Laboratory analyses & stoichiometric values
Process emissions (Methods A and B)	CF	1	Default value CF=1
		2	Laboratory analyses & stoichiometric values
Mass balance source stream	CC	1	Type I default values
		2a	Type II default values
		2b	Established proxies (if applicable)
		3	Laboratory analyses or empirical correlations or stoichiometric values for pure chemical substances

As can be seen from Table 9, the lowest tier usually applies an internationally applicable default value (IPCC standard factor or similar, as listed in Annex VI of the MRR). The second tier uses a national factor, which is in principle used for the national GHG inventory under the UNFCCC. However, further types of default values or proxy methods are allowed, which are deemed equivalent. The highest tier usually requires the factor to be determined by laboratory analyses.

The short descriptions of tier levels in Table 9 have to be read in full text as follows:

[105] RF…RFNBO or RCF factor; SF…Synthetic Low Carbon Fuel fraction

- **Type I default values**: Either standard factors listed in Annex VI (i.e. in principle IPCC values) or other constant values in accordance with point (e) of Article 31(1), i.e. analyses carried out in the past but still valid[106].
- **Type II default values**: Country specific emission factors in accordance with points (b), (c) and (d) of Article 31(1), i.e. values used for the national GHG inventory[107], more values published by the CA for more disaggregated fuel types, or other literature values which are agreed by the competent authority[108], or values guaranteed by the supplier[109].
- **Established proxies**: These are methods based on empirical correlations as determined at least once per year in accordance with the requirements applicable for laboratory analyses (see 6.2.2). However, these rather complicated analyses are only carried out once per year, therefore this tier is considered a lower level than full analyses. The proxy correlations may be based on
  - density measurement of specific oils or gases, including those common to the refinery or steel industries, or
  - net calorific value for specific coal types.
- **Purchasing records:** Only in case of commercially traded fuels, the net calorific value may be derived from the purchasing records provided by the fuel supplier, provided it has been derived based on accepted national or international standards.
- **Laboratory analyses**: In this case, the requirements discussed in section 6.2.2 below are fully applicable. This also includes the use of the 'established proxies', if applicable and where the uncertainty of the empirical correlation does not exceed 1/3 of the uncertainty value associated with the applicable tier for activity data. Furthermore, the competent authority may accept the use of the stoichiometric content of pure[110] chemical substances as meeting the tier that would otherwise require laboratory analyses.
- **Type I biomass fraction[111]**: One of the following methods is applied, which are considered equivalent:
  - Use of values published by the competent authority or by the Commission.
  - Use of values in accordance with Article 31(1), i.e. a "Type I/II default value".

---

[106] MRR Article 31(1)(e): "*values based on analyses carried out in the past, where the operator can demonstrate to the satisfaction of the competent authority that those values are representative for future batches of the same fuel or material*". This is a considerable simplification for operators, who do not have to carry out regular analyses as described in section 6.2.2.

[107] MRR Article 31(1)(b): "*standard factors used by the Member State for its national inventory submission to the Secretariat of the United Nations Framework Convention on Climate Change*".

[108] MRR Article 31(1)(c): "*literature values agreed with the competent authority, including standard factors published by the competent authority, which are compatible with factors referred to in point (b), but representative of more disaggregated sources of fuel streams*".

[109] New as of 2021, MRR Article 31(1)(d): "*values specified and guaranteed by the supplier of a fuel or material where the operator can demonstrate to the satisfaction of the competent authority that the carbon content exhibits a 95% confidence interval of not more than 1%*" – this is a similar approach as for "commercial standard fuels" defined in Article 3(32).

[110] The term *pure* is not defined in the MRR. It should however refer to best industry practices for identifying this state of purity of the substance, e.g. when sold on the market labelled as "purum".

[111] Note that it is not discussed here how to determine whether the relevant sustainability and GHG savings criteria are met (if applicable). A short overview is given in section 6.3.7. For biogas in natural gas grids see section 6.3.8. More information on the treatment of biomass issues in the EU ETS are given in guidance document No. 3 (for reference see section 2.3).

- **Type II biomass fraction**[111]:
  - Use of a value determined in accordance with the second subparagraph of Article 39(2), i.e. use an estimation method approved by the competent authority. A specific case is the use of a material balance, which is covered by tier 3b.
  - Use of a further estimation method based on guidelines published by the Commission, in accordance with the third subparagraph of Article 39(2). If the Commission considers publication of such guidelines in the future, they will be found or referenced in Guidance Document No. 3.
- **Material balance** for tier 3b of the biomass fraction: For fuels or materials originating from a production process with defined and traceable input streams, the operator may base such estimation on a material balance of fossil and biomass carbon entering and leaving the process. In particular, a proof in line with a mass balance system in accordance with Article 30(1) of the RED II counts as eligible for tier 3b. Such information is usually included in a PoS (see section 6.3.10 of this document, and GD 3).
- **Stoichiometrical values**: In principle these are allowed in the same way as other literature values, i.e. they have to be agreed with the competent authority and can therefore be considered "Type II default values". However, from 2021 onwards, under certain conditions (the substance must be pure, the use of that value would be conservative, and the otherwise required laboratory analyses would lead to unreasonable costs), the competent authority may approve that those values suffice to comply with the highest tier[112]. This in turn reduces the cases where operators would have to submit an improvement report, as the higher tier thereby has been achieved.

6.2.2 Laboratory analyses

Where the MRR refers to determination "in accordance with Article 32 to 35", this means that a parameter must be determined by (chemical) laboratory analyses. The MRR imposes relatively strict rules for such analyses, in order to ensure a high quality level of the results. In particular, the following points need consideration:

- The laboratory must demonstrate its competence. This is achieved by one of the following approaches:
  - An accreditation in accordance with EN ISO/IEC 17 025, where the analysis method required is within the accreditation scope; or
  - Demonstrating that the criteria listed in Article 34(3) are satisfied. This is considered reasonably equivalent to the requirements of EN ISO/IEC 17 025. Note that this approach is allowed only where use of an accredited laboratory is shown to be technically not feasible or involving unreasonable costs (→ section 4.6).

[112] Article 31(5): Upon application by the operator, the competent authority may accept that the stoichiometric carbon content of a pure chemical substance be considered as meeting a tier that would otherwise require analyses carried out in accordance with Articles 32 to 35, if the operator can demonstrate to the satisfaction of the competent authority that using analyses would lead to unreasonable costs and that using the stoichiometric value will not lead to under-estimation of the emissions.

- The way samples are taken from the material or fuel to be analysed is considered crucial for receiving *representative* results. Therefore, operators have to develop sampling plans in the form of written procedures (→ see section 5.4) and get them approved by the competent authority. Note that this applies also where the operator does not carry out the sampling himself, but treats it as an outsourced process.
- Analyses methods usually have to follow international or national standards. Preference is given to EN standards[113].

Note that laboratory analyses are usually related to the highest tiers for calculation factors. Therefore, these rather demanding requirements are rarely applicable to smaller installations. In particular operators of installations with low emissions (→ section 4.4.2) may use "any laboratory that is technically competent and able to generate technically valid results using the relevant analytical procedures, and provides evidence for quality assurance measures as referred to in Article 34(3)". In fact, the minimum requirements would be that the laboratory demonstrates that it is technically competent and "capable of managing its personnel, procedures, documents and tasks in a reliable manner", and that it demonstrates quality assurance measures for calibration and test results[114]. However, it is in the operator's interest to receive reliable results from the laboratory. Therefore operators should strive to comply with the requirements of Article 34 to the highest degree feasible.

Furthermore, it is important to note that the MRR in the activity-specific requirements of Annex IV allows the use of "industry best practice guidelines" for some lower tiers, where no default values are applicable. In such cases, where despite approval to apply a lower tier methodology analyses are still required, it may not be appropriate or possible to apply Articles 32 to 35 in full. However, the competent authority should deem the following as minimum requirements:

- Where the use of an accredited laboratory is technically not feasible or would lead to unreasonable costs, the operator may use any laboratory that is technically competent and able to generate technically valid results using the relevant analytical procedures, and provides evidence for quality assurance measures as referred to in Article 34(3).
- The operator shall submit a sampling plan in accordance with Article 33.
- The operator shall determine the analysis of frequency in accordance with Article 35.

More detailed guidance on topics related to laboratory analyses, sampling, frequency of analyses, equivalence to accreditation etc. are given in guidance document No. 5.

[113] For the use of standards, Article 32(1) defines the following hierarchy: *"The operator shall ensure that any analyses, sampling, calibrations and validations for the determination of calculation factors are carried out by applying methods based on corresponding EN standards.*
Where such standards are not available, the methods shall be based on suitable ISO standards or national standards. Where no applicable published standards exist, suitable draft standards, industry best practice guidelines or other scientifically proven methodologies shall be used, limiting sampling and measurement bias."

[114] Examples for such measures are given in Article 34(3), point (j): regular participation in proficiency testing schemes, applying analytical methods to certified reference materials, or inter-comparison with an accredited laboratory.

6.3 Calculation factors – specific requirements

In addition to the general approaches for determining calculation factors (default values / analyses) as discussed in section 6.2 and the general overview given in sections 4.3.1 and 4.3.2, some specific rules for each factor are laid down in the MRR. These are discussed below.

6.3.1 Emission factor

New!

Article 3(13) of the MRR defines: "*'emission factor' means the average emission rate of a greenhouse gas relative to the activity data of a source stream or a fuel stream assuming complete oxidation for combustion and complete conversion for all other chemical reactions*." Furthermore Article 3(36) is important for materials containing biomass or other zero-rated carbon: "*'preliminary emission factor' means the assumed total emission factor of a fuel or material based on its total carbon content before multiplying it by the fossil fraction to produce the emission factor*".

Important: According to section 2.1 of Annex II of the MRR, the tiers defined in the MRR shall relate to the *preliminary* emission factor, where a (zero-rated) biomass fraction, or RFNBO or RCF fraction or synthetic low-carbon fraction is determined for a fuel or material. I.e. tiers are applicable always to individual parameters.

The reporting of the preliminary emission factor is now mandatory for all source streams (i.e. also for 100% biomass source streams)[115], while it was required only for mixed biomass source streams during the third phase of the EU ETS.

As reflected by the definition, the emission factor is the stoichiometry-based factor which converts the (fossil) carbon content of a material into the equivalent mass of (fossil) CO_2 assumed to be emitted. Adjustment for incomplete reactions is handled via the oxidation or conversion factor. However, as mentioned in Article 37(1), sometimes national inventories do not use oxidation or conversion factors (i.e. those factors are set to 100%), but have the adjustment for incomplete reaction included in the emission factor. Where such factors are used as default values in accordance with Article 31(1)(b), operators should consult with the competent authority, if in case of doubt.

For combustion emissions, the emission factor is expressed in relation to the energy content (NCV) of the fuel rather than its mass or volume. However, under certain conditions (where the use of an emission factor expressed as t CO_2/TJ incurs unreasonable costs or where at least equivalent accuracy of the calculated emissions can be achieved) the competent authority may allow the operator to use an emission factor expressed as t CO_2/t fuel or t CO_2/Nm^3 (Article 36(2)).

Where the applicable tier requires the emission factor to be determined by analyses, the carbon content is to be analysed. Where a fuel or material contains

[115] This is not a large administrative burden, since pure biomass source streams are always de-minims source streams, so that a low tier may be applied. Most appropriate will be the use of default values for the dry biomass, corrected for the moisture content. The latter may be estimated or measured. More guidance is found in Guidance Document No. 3, which also contains some typical preliminary emission factors in an Annex.

organic as well as inorganic carbon[116], usually the total carbon content is to be determined. Note that inorganic carbon is always considered fossil.

For fuels, the NCV must also be determined (depending on the tier, this may require another analysis of the same sample).

If the emission factor of a fuel expressed as t CO_2/TJ is to be calculated from the carbon content, the following equation is used:

$$EF = CC \cdot f / NCV \quad (11)$$

If the emission factor of a material or fuel expressed as t CO_2/t is to be calculated from the carbon content, the following equation is used:

$$EF = CC \cdot f \quad (12)$$

The variable names are explained in sections 4.3.1 and 4.3.2.

6.3.2 Net calorific value (NCV)

Because activity data of fuels is to be reported as energy content (→ section 4.3.1), the NCV is an important parameter to be reported. This allows emission reports to be compared with energy statistics and national GHG inventories under the UNFCCC.

Note: Although the activity data of fuels is "NCV times the fuel quantity", the tier definitions for activity data refer to fuel quantity only, and the NCV is a separate parameter (calculation factor), for which individual tiers are applicable.

However, under certain conditions, the NCV is not indispensable for the emission calculation. This is the case:

- where emission factors of fuels are expressed as t CO_2/t fuel or t CO_2/Nm^3 (Article 36(2)[117]);
- where fuels are used as process inputs; and
- fuels being part of a mass balance.

In those cases, the NCV may be determined using a conservative estimate instead of using tiers (Article 26(5)).

6.3.3 Oxidation factor and conversion factors

The MRR defines the oxidation factor (OF) as the proportion of the fuel's total carbon content turned into CO_2 during the combustion process. Similarly, the conversion factor (CF) is defined as the proportion of the total carbon of the source stream released as CO_2 during the emission process. These two factors are used to account for incomplete reaction. Thus, if they are to be determined based on laboratory analyses, the factor would be determined as follows (oxidation factor):

$$OF = 1 - C_{ash} / C_{comb} \quad (13)$$

[116] E.g. paper contains organic carbon (cellulose fibres, resins etc) as well as inorganic carbon (carbonate fillers).

[117] This may be allowed by the competent authority if the use of an emission factor expressed as t CO_2/TJ would incur unreasonable costs, or where at least equivalent accuracy can be achieved with this method.

Where:

OF..... Oxidation factor [dimensionless]

C_{ash} ..... carbon contained in ash, soot and other non-oxidised forms of carbon (excluding carbon monoxide, which is considered as molar equivalent of CO_2 emissions)

C_{comb} ... (total) carbon combusted.

The two *C* variables are expressed as [tonnes C], i.e. quantity of material or fuel times the concentration of carbon in it. Therefore not only the carbon content of the ash has to be determined by analysis, but also the amount of ash must be determined for the period for which the oxidation factor is determined.

Further points to be considered in line with Article 37:

- Unlike for other parameters, for all categories of installations and source streams, tier 1 is the minimum applicable tier. This is equivalent to OF = 1 or CF = 1, i.e. reflects a conservative assumption in any event.
- Competent authorities are allowed to require an operator to use that tier 1. As outlined in section 6.3.1, this may be required because in some cases the effect of incomplete reaction has been included in the emission factor.
- Where several fuels are used in an installation and tier 3 (i.e. laboratory analyses) is required, the operator may choose one of two options:
  - Determination of one average oxidation factor for the whole combustion process, to be applied to all involved source streams, or
  - Attribution of the incomplete oxidation to one major source stream (i.e. using an OF < 1), and use OF = 1 for the other source streams.
- Where mixed fuels are used, the operator must provide evidence that an underestimation of emissions is avoided.

New!

- In the case of CO_2 emissions considered to be permanently chemically bound in a product, conversion factor means "*the ratio of CO_2 bound as carbon in a product during a process, to the total CO_2 contained as carbon in a product leaving the same process*".

6.3.4 Carbon content in case of mass balances

Due to the close relation between the emission factor in the standard methodology and the carbon content in case of the mass balance, the items discussed under section 6.3.1 (emission factor) apply as appropriate. In particular, analyses are applicable in the same way, and default values given in Annex VI of the MRR can be converted into default values for the carbon content by using the formulae given in section 4.3.2.

New!

6.3.5 Zero rating, zero-rated fuels and zero-rated carbon

While in earlier versions of the EU ETS' MRV framework the only case of zero-rating was sustainable biomass, the 2024 amendment of the MRR introduces a wider concept of zero-rating. As defined in point 23c of Article 3, zero-rating refers to the process by which the emission factor of a fuel or material is reduced to zero

if applicable criteria are complied with. This is a measure against double counting of emissions. Zero rating may be applied to:

- Biofuels, bioliquids and biomass fuels which fulfil the sustainability and the GHG savings criteria of the RED II;
- Renewable Fuels of Non-Biological Origin (RFNBOs) or Recycled Carbon Fuels (RCFs) that comply with the GHG savings criteria of the RED II;
- Synthetic Low-Carbon Fuels (SLCFs) if they meet the criterion given in Article 39a(4) of the MRR.

The MRR differentiates in all those cases between zero-rated and non–zero-rated carbon fractions. Although it is expected that operators will not willingly purchase or use such fuels that are not zero-rated, the possibility exists that the operator cannot provide the evidence necessary for zero-rating, or not in time for verification and submission of the annual emission report. For this purpose, the relevant templates must allow the possibility to report the non-zero-rated carbon, which improves transparency compared to simple reporting it under the category of “normal fossil fuel”.

For monitoring and reporting, the MRR expands the already existing approach for biomass: The general case assumes that the fuel monitored can contain a mixture of all possible fractions of fossil carbon, zero-rated and non-zero-rated biomass, RFNBO/RCF or SLCF (see Figure 9). In case of biomass this has been proven useful. However, RFNBO/RCFs and SLCFs are more likely to be purchased as neat fuels or as blended fuels with specified fractions. Where this is the case, it is expected that the relevant evidence for zero-rating will be available (e.g. from the “Union Database”), and the determination of the non-zero-rated fraction will not be necessary. This is reflected in the MRR requirements. Furthermore, the MRR distinguishes biomass and other zero-rated carbon by the fact that biomass can be determined by laboratory analyses (^{14}C method or sorting), while this is impossible for RFNBO, RCF and SLCF (the carbon contained therein can come from fossil or biomass, or even atmospheric CO_2). The different rules for the different types of fuels and materials are described separately in the following sections.

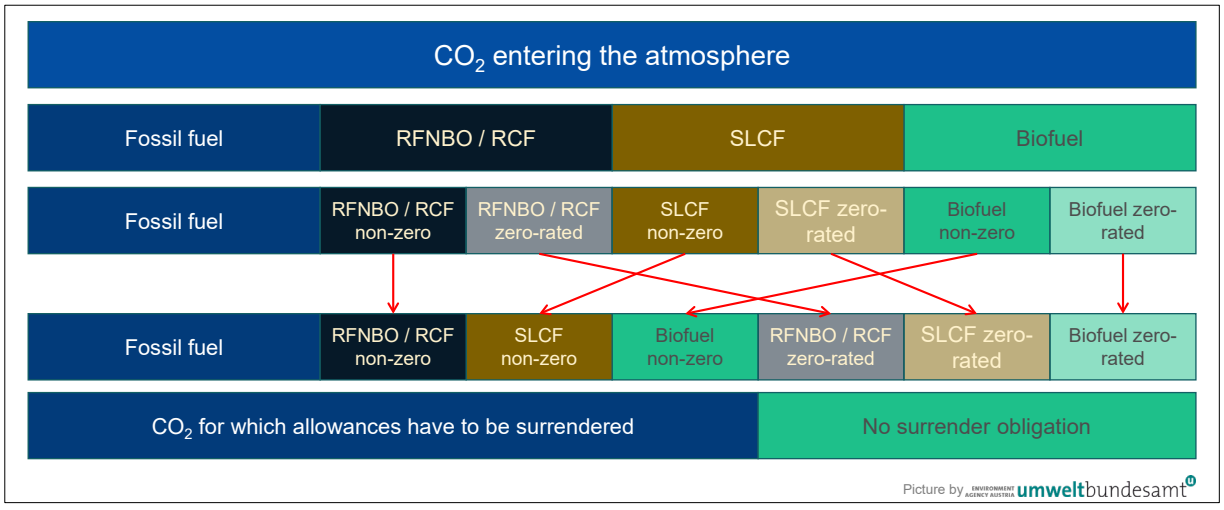

Figure 9: Overview of the possible fractions contained in a fuel.

6.3.6 Biomass fraction

In order for biomass used for combustion to be zero-rated (i.e. for applying an emission factor of zero), the biomass must satisfy the sustainability and GHG savings criteria defined by the RES Directive (Article 38(5) of the MRR).

An introduction to those criteria is given in section 6.3.7. A separate guidance document[118] is provided explaining topics relating to biomass and other zero-rating in detail.

The said guidance document No. 3 covers the following topics with regard to biomass:

- Criteria for zero-rating of biomass (i.e. whether it is allowed to set the emission factor to zero). From 2022[119], the new criteria of the RED II have to be applied. A particularly important new element for the EU ETS is that such criteria now apply not only to liquids, but also to gaseous and solid biomass.
- Determining the (total) biomass fraction as well as the zero-rated biomass fraction (Article 39), and guidelines for applicable estimation methods (Type II biomass fraction);
- Simplifications, in particular regarding determining activity data (Article 38(1) to (4));
- A list of biomass materials;
- Guidance on how to apply the purchase record-based approach to determining biogas in natural gas grids (see also section 6.3.8).

In principle, the distinction of "zero-rated" and other biomass is *not* new to the MRR. However, the new element introduced by the 2024 amendment is the improved clarity achieved by providing explicitly definitions and rules for determining those fractions:

According to the MRR, "biomass fraction means the ratio of carbon stemming from biomass to the total carbon content of a fuel or material, expressed as a fraction". The biomass fraction only needs to be determined for mixed fuels or materials that contain biomass. The applicable tiers for determining the biomass fraction can be found in Annex II Section 2.4 of the MRR.

The 2024 amendment of the MRR introduces an additional definition (point 38(b) of Article 3): "*'zero-rated biomass fraction' means the ratio of carbon stemming from biomass which complies with the criteria of Article 38(5) of this Regulation to the total carbon content of a fuel or material, expressed as a fraction*". The non-zero-rated fraction is given only implicitly as the difference between (total) biomass fraction and zero-rated biomass fraction.It is also indirectly determined: It is the biomass for which no evidence for meeting the "RED II criteria" is available. Those criteria are – as stated in Article 38(5) of the MRR – the sustainability and

[118] Guidance document No. 3. For reference see section 2.3.

[119] According to an amendment of the MRR (by Commission Implementing Regulation (EU) 2022/388 of 8 March 2022), a transition period until 31 December 2022 was introduced in a new Article 38(6) of the MRR: "*By way of derogation from paragraph 5, first subparagraph, Member States, or competent authorities as appropriate, may consider as fulfilled the sustainability and greenhouse gas emissions saving criteria referred to in that paragraph for biofuels, bioliquids and biomass fuels used for combustion from 1 January 2022 to 31 December 2022.*"

This MRR amendment means that effectively in many (or even all) Member States **the RED II criteria have to be applied by operators only from 1 January 2023**.

GHG savings criteria set out in Article 29(2) to (7) and (10) of the RED II. More details are discussed in section 6.3.5.

The determination of the biomass fraction follows usually one of the following approaches:

- The whole source stream is known to be of biological origin, and the biomass fraction is set to 100%;
- The biomass fraction of a mixed source stream is determined by a default value or analyses such as sorting or ^{14}C method;
- The biomass fraction is determined by using a certification scheme under the RED II, i.e. using mass balance in accordance with Article 30(1) of RED II. In this case, the zero-rated biomass fraction is determined, and the total biomass fraction is considered identical.

In the first two cases, the total biomass fraction may be higher than the zero-rated biomass fraction. The latter must therefore be determined separately (as mentioned in the third bullet point). Even if the operator purchases only biomass claimed to fully comply with the RED II criteria, the operator must be aware that situations may occur where the necessary evidence is missing. Therefore the monitoring plan must always take into account the possibility for some biomass to be non-zero-rated.

6.3.7 Applicability of RED II criteria to biomass

New!

As described in chapter 6.3.5 the 2024 amendment of the MRR introduces an explicit distinction between zero-rated and non-zero-rated carbon. This improvement is reflected in Article 38(5)[120]. It is the key linking Article between the MRR requirements and the RED II, and in particular how the sustainability and GHG

[120] Article 38(5) of the MRR:

"B*iofuels, bioliquids and biomass fuels shall fulfil the sustainability and the greenhouse gas emissions saving criteria laid down in paragraphs 2 to 7 and 10 of Article 29 of Directive (EU) 2018/2001 in order to be counted towards the zero-rated biomass fraction of a source stream.*

However, biofuels, bioliquids and biomass fuels produced from waste and residues, other than agricultural, aquaculture, fisheries and forestry residues are required to fulfil only the criteria laid down in Article 29(10) of Directive (EU) 2018/2001. This subparagraph shall also apply to waste and residues that are first processed into a product before being further processed into biofuels, bioliquids and biomass fuels.

Electricity, heating and cooling produced from municipal solid waste shall not be subject to the criteria laid down in Article 29(10) of Directive (EU) 2018/2001.

The criteria laid down in paragraphs 2 to 7 and 10 of Article 29 of Directive (EU) 2018/2001 shall apply irrespective of the geographical origin of the biomass.

Article 29(10) of Directive (EU) 2018/2001 shall apply to an installation as defined in Article 3(e) of Directive 2003/87/EC.

The compliance with the criteria laid down in paragraphs 2 to 7 and 10 of Article 29 of Directive (EU) 2018/2001 shall be assessed in accordance with Articles 30 and 31(1) of that Directive. The criteria may also be considered complied with if the operator provides evidence for a purchase of a quantity of biofuel, bioliquid or biogas connected to the cancellation of the respective quantity in the Union Database set up pursuant to Article 31a or a national database set up by the Member State in accordance with Article 31a(5) of that Directive. In case of subsequent non-compliance regarding the proof of sustainability of the quantities cancelled in the aforementioned databases, the competent authority shall correct the verified emissions accordingly.

Where the biomass used does not comply with this paragraph, its carbon content shall be considered as fossil carbon.

Where according to the first to sixth subparagraphs of this paragraph, the criteria laid down in paragraphs 2 to 7 and 10 of Article 29 of Directive (EU) 2018/2001 do not apply to biomass, the zero-rated biomass fraction equals its biomass fraction."

saving criteria of the RED II are to be applied in order to allow the emissions from biomass to be zero-rated. The following points are worth noting:

- As the RED II applies to renewable *energy*, the RED II criteria apply only to energy uses of biomass in the EU ETS. For avoiding confusion, the 2024 amendment of Article 38(5) does not continue the reference to biomass "*used for combustion*". However, a new sub-paragraph has been added stating explicitly that "*where … [the RED II criteria] do not apply to biomass, the zero-rated biomass fraction equals its biomass fraction.*"[121]
- As the RED II itself does not contain a definition of the term "installation", the MRR clarifies that the definition of "installation" of the EU ETS Directive applies[122].
- Not all the criteria given in Article 29 of the RED II apply. In particular:
  - The "land-related" sustainability criteria of Article 29(2) to (7) of the RED II apply;
  - The GHG saving criteria of Article 29(10) of the RED II apply;
  - The additional efficiency criteria for electricity production (Article 29(11) of the RED II) do *not* apply.

Some provisions contained in Article 29(1) of the RED II are copied into the MRR in order to clarify their applicability. In particular, this includes the simplification that for municipal solid waste the GHG saving criteria do not apply. Furthermore, the RED II criteria apply irrespective of the geographical origin of the biomass.

Figure 10 presents a "decision tree" to which an operator may adhere in order to determine which written procedures have to be included in the monitoring plan, and to determine the emission factor of biomass. The numbered steps in this picture mean the following:

1. The first step is to determine if the source stream consists exclusively of biomass, or whether it is mixed with a fossil fraction. In the latter case, the relevant analyses of the biomass fraction or the application of a reasonable default value is necessary (see section 6.2). The possibility to apply an emission factor of zero applies only to the biomass fraction of the source stream.
   If the biomass fraction should be determined based on proofs of sustainability from a certification scheme, please see section 4.3.2 of GD3.

[121] Some borderline cases exist where it may not be clear if a material is a fuel or a process input, such as pore-forming agents in the ceramic industry. Where the CO_2 emissions stem from a process which has a primary purpose other than the generation of heat, the competent authority may agree that the source stream is not acting as a fuel. Hence, such source streams serve non-energetic purposes and the sustainability criteria do therefore not apply.

[122] Article 3(e) of the EU ETS Directive: *'installation' means a stationary technical unit where one or more activities listed in Annex I are carried out and any other directly associated activities which have a technical connection with the activities carried out on that site and which could have an effect on emissions and pollution;*

New!

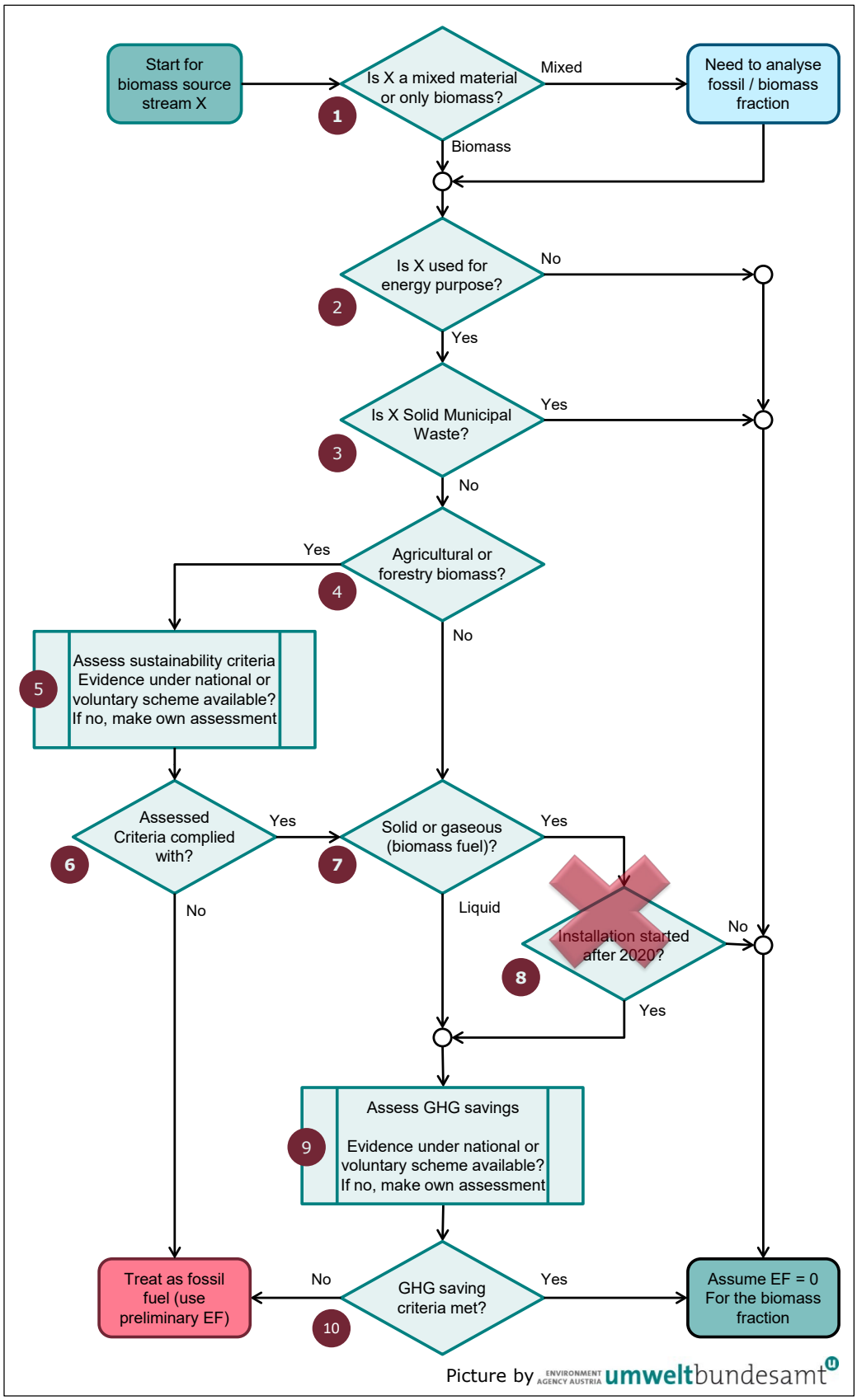

Figure 10: Decision tree for applying sustainability and GHG saving criteria of the RED II to the monitoring of EU ETS source streams.

If only a part of the source stream is biomass, the following steps apply only to that biomass fraction. However, if the necessary evidence for meeting the RED II criteria is available only for a part of that biomass fraction, three fractions have to be distinguished: one fossil, one biomass part that is treated like being fossil, and a biomass part which is zero-rated because it fulfils the RED II criteria.

2. Determine if the source stream is used for energy purposes. Only if this is the case, the following steps are needed.
3. If the source stream is municipal solid waste, no further criteria need to be taken into account. The biomass fraction may be zero-rated.
4. Determine if the source stream is any type of forest or agricultural biomass, or (produced from) "residues from agriculture, aquaculture, fisheries or forestry", as for such source streams the "land-related" sustainability criteria (Article 29(2) to (7) of RED II) apply[123]. For other residues or waste (including all kinds of industrial wastes, if containing biomass), only GHG savings criteria need to be complied with. For further discussion of the definition of "waste", please see section 3.4.6.4 of GD3.

   Note, however, that for biomass stemming from residues from animals, aquaculture and fisheries, Article 29 of the RED II does not list specific land-related sustainability criteria. There are also no default values found in Annexes V and VI of the RED II. Therefore, for such materials operators will have to determine only GHG savings based on the calculation methodologies outlined in those Annexes. Therefore, go to step 7.
5. Depending on step 4, the (land-related) sustainability criteria for the production of biofuels, bioliquids or biomass fuels are to be assessed.

   In short, the operator can rely on the certification of the used material/fuel under a national system or an (international) voluntary scheme recognised by the Commission or the installation's (or aircraft operator's administering) Member State.

   Competent authorities may require the operator to use a recognised scheme, where one is available. If no proof of sustainability under a certification is available to the operator, the operator would have to perform the assessment of the relevant criteria himself, and get the verifier's[124] confirmation, provided the national legislation and the competent authority allow this in the Member State where the biomass is used (in case of aircraft operators, the administering Member State). More details on steps 4 and 5 are given in sections 3.4.5 and 3.4.6 of GD3.
6. If the previous step shows that the relevant sustainability criteria are not complied with, then the operator has to treat the material as if it were fossil, i.e. the preliminary emission factor becomes the emission factor.

---

[123] Second subparagraph of Art. 38(5) MRR: "*However, biofuels, bioliquids and biomass fuels produced from waste and residues, other than agricultural, aquaculture, fisheries and forestry residues are required to fulfil only the criteria laid down in Article 29(10) of Directive (EU) 2018/2001. This subparagraph shall also apply to waste and residues that are first processed into a product before being further processed into biofuels, bioliquids and biomass fuels.*"

[124] Note that for compliance with RED II Article 30(3) (which is relevant pursuant to the 6th subparagraph of MRR Article 38(5)), operators have to "*arrange for an adequate standard of independent auditing of the information submitted, and to provide evidence that this has been done.*" The auditors engaged in this step are not necessarily the EU ETS verifiers. However, if the verifier has the relevant competence (as demonstrated by an accreditation or other means accepted by the MS), there is no obstacle for the EU ETS verifier to carry out the relevant audit. In any case, the result of the audit should be made available to the verifier.

7. If the source stream is liquid, the assessment of GHG savings is mandatory (i.e. the situation is like in the third phase of the EU ETS). Go to step 9.
8. For “biomass fuels”, i.e. solid or gaseous biomass, the GHG savings threshold depends on the starting date of the installation using them. However, the 2023 amendment of the RED II introduced this criterion also to installations starting operation[125] *before* 1 January 2021. Therefore, older installations (more exactly: installations which used biomass already before 2021) also have to carry out further assessment[126]. In the updated version of Figure 10, step 8 has therefore been indicated as deleted. This new need for assessment applies from the date the Member State implements the 2023 amendments of the RED II[127], at the latest from 21 May 2025.

New!

9. According to Article 29(10) of the RED II, required GHG savings have to be calculated in accordance with Article 31(1) of the RED II (more details are given in section 3.4.6.2 of Guidance Document No. 3). The required savings are:
    a. For the *production* of biofuels and bioliquids: at least 50% if produced in installations in operation before 5 October 2015, at least 60% for installations starting operation until 31 December 2020, and at least 65% for installations starting operation from 1 January 2021.
    b. For the production of electricity, heating and cooling from biomass fuels (i.e. for the *use* of solid or gaseous biomass): the thresholds given in Table 10 apply.
10. If the GHG savings are above the applicable threshold, the biomass can be zero-rated, otherwise it has to be treated as if it were fossil. With this step, the assessment is finished.

Note that when this “decision tree” results in no need to provide evidence with sustainability or GHG savings criteria, some Member States will still require a confirmation of the source stream’s nature providing of the fact that no RED II criteria apply. Member States may require such evidence to be issued by a certification scheme recognised by the Commission or the installation’s (or aircraft operator’s) Member State. Other Member States may require e.g. a formal declaration by the operator confirming the material type and that no RED II criteria apply to it.

[125] Article 29(10) of the RED is to be applied: "*An installation shall be considered to be in operation once the physical production of biofuels, biogas consumed in the transport sector and bioliquids, and the physical production of heating and cooling and electricity from biomass fuels has started*."

[126] See section 3.4.6.2 of GD3 for further information on the starting date.

[127] I.e. amendments made by Directive (EU) 2023/2413; http://data.europa.eu/eli/dir/2023/2413/oj

Table 10: Greenhouse gas savings required for installations using biomass fuels depending on their starting date[125]. The letter in brackets indicates the point in Article 29(10) of the RED II which defines this threshold.

Start date	Biomass fuels in general	Biomass fuels Installations >= 10 MW	Gaseous biomass fuels <=10MW[128]
after 20 November 2023	(d) 80%	–	–
between 1 January 2021 and 20 November 2023	–	(e) 70% until 31 December 2029; 80% from 1 January 2030	(f) 70% for first 15 years; 80% after 15 years operation
before 1 January 2021	–	(g) 80% after operation of 15 years; at earliest from 1 January 2026, at latest from 31 December 2029	(h) 80% after operation of 15 years, at earliest from 1 January 2026

New!

6.3.8 RFNBO or RCF fraction

For definitions the MRR refers to the RED II[129]:

- '*Renewable fuels of non-biological origin' [RFNBO] means liquid and gaseous fuels the energy content of which is derived from renewable sources other than biomass*".
- '*Recycled carbon fuels' [RCF] means liquid and gaseous fuels that are produced from liquid or solid waste streams of non-renewable origin which are not suitable for material recovery in accordance with Article 4 of Directive 2008/98/EC or from waste processing gas and exhaust gas of non-renewable origin which are produced as an unavoidable and unintentional consequence of the production process in industrial installations.*

As described in chapter 6.3.5 the 2024 amendment of the MRR introduced a distinction between zero-rated and non-zero-rated carbon. Article 39a(3) of the MRR specifies that the carbon content of RFNBO and RCF fuels used can be zero-rated if they fulfil the GHG savings criteria laid down in Article 29a of the REDII. More information can be found in section 6.3.10.

The ratio between to total carbon content of a fuel and the carbon stemming from RFNBO or RCF is the "RFNBO or RCF" fraction. If relevant evidence required for zero-rating is available, the same fraction can be used as the "zero-rated RFNBO or RCF fraction". However, if the evidence is not available for a certain batch of RFNBO or RCF, it is to be assigned to the "non-zero-rated RFNBO or RCF fraction" (which – like for the biomass fraction – is only indirectly defined).

[128] Column included only for completeness, but relevant for EU ETS installations only in exceptional cases (for activities where Annex I of the EU ETS Directive gives a threshold in terms of production volume but not as rated thermal input).

[129] As amended by Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023.

The sole method for determining the zero-rated RFNBO or RCF fraction is the mass balance based on Article 30(1) of the RED II (i.e. getting evidence via a RED II certification scheme, or from the Union Database). If the evidence for zero-rating is unavailable for a certain batch of fuel which was declared as RFNBO or RCF by the supplier, that batch must be considered as non-zero-rated RFNBO or RCF fraction, i.e. the emissions must be covered with allowances just like any fossil fuel. However, for transparency reasons it should be reported under the memo-items as discussed in section 6.3.12.

6.3.9 Synthetic low-carbon fraction

New!

Synthetic low-carbon fuels (SLCFs) are gaseous and liquid fuels with an energy content stemming from "low-carbon hydrogen"[130], i.e. they are similar to RFNBO/RCF, but produced from a different energy source. Their definition includes already the requirement to meet the GHG savings criteria, meaning that their greenhouse gas emissions have to be 70% lower than the emissions of a fossil fuel comparator. Therefore, theoretically no non-zero-rated SLCFs exist. Nevertheless the MRR distinguishes between zero-rated and non-zero-rated carbon also in the case of SLCFs, which is meant to cater for the situation where proof for the relevant certification cannot be provided by the operator. However, the relevant criterion for zero-rating of synthetic low-carbon fuels is different than for RFNBO/RCFs. In addition to the need to comply with the GHG savings in accordance with Article 29a of the RED II[131], an additional criterion is given in the MRR: The CO_2 used for producing the SLCF has to come for a source for which already allowances have been surrendered under the EU ETS, unless the CO_2 itself was zero-rated. This ensures that the SLCF comes from a source with a reliable MRV system in place and avoiding double counting.

Aside from the zero-rating criteria, the rules for determining the (zero-rated) SLCF fraction are the same as for determining the (zero-rated) RFNBO or RCF fraction, as discussed in section 6.3.8.

6.3.10 Evidence for meeting the criteria for zero-rating of RFNBO, RCF and SLCFs

The greenhouse gas emission savings of fuels have to be at least 70%[132,133] for compliance with the Greenhouse Gas Savings Criteria. In case of SLCFs an additional criterion os the avoidance of double counting (see 6.3.9). The calculation methodology for the GHG savings is laid out in Regulation (EU) 2023/1185. The calculation is usually performed by an economic operator certified under a "RED II certification scheme" (a national or (international) voluntary scheme in accordance with Article 30 of the RED II). The relevant evidence (called Proof of

[130] Defined in Article 2(11) of Directive (EU) 2024/1788: "*'low-carbon hydrogen' means hydrogen the energy content of which is derived from non-renewable sources, which meets the greenhouse gas emission reduction threshold of 70 % compared to the fossil fuel comparator for renewable fuels of non-biological origin set out in the methodology for assessing greenhouse gas emissions savings from renewable fuels of non-biological origin and from recycled carbon fuels, adopted pursuant to Article 29a(3) of Directive (EU) 2018/2001 [i.e. the RED II]*;"

[131] The RED II itself does not provide rules for SLCFs, but Directive (EU) 2024/1788 refers to the RED II calculation methodology for GHG savings, which is further detailed in Commission Delegated Regulation (EU) 2023/1185.

[132] For synthetic low-carbon fuels: Article 2 point 13 of Directive (EU) 2024/1788

[133] For RFNBO and RCF: Article 29a of Directive (EU) 2018/2001

Sustainability, PoS) should be transferred to the operator when purchasing such fuels. The best process for receiving the PoS is through the Union Database (UDB) in accordance with Article 31a of the RED II, or a Member State's national database linked to the UDB.

More guidance on providing evidence for zero-rating criteria can be found in MRR Guidance document No.3 as mentioned in section 6.3.6.

6.3.11 Special rules for zero-rated gases in natural gas grids

From 2022, operators may make use of a special approach to the accounting of biogas pursuant to Article 39(4). Where biogas is injected into natural gas grids and purchased by an EU ETS operator connected to the same gas grid, the said operator may report that purchased amount of biogas as consumed within his installation, even if the biogas is not physically delivered to the installation. This is done by determining and assigning a zero-rated biomass fraction to the total gas (natural gas plus biogas) based on the fraction of energy content of biogas in the total gas consumption and based on the mass balance in accordance with Article 30(1) of the RED II. Because laboratory analyses are excluded in this case, the MRR states that the assigned zero-rated biomass fraction should be considered identical to the (total) biomass fraction. This method is to be reported as tier 3b.

The preconditions for that approach are:

- The quantity of biogas used is determined from purchase records;
- The operator demonstrates to the satisfaction of the CA that there is no double counting of the same quantity of biogas. This can be done in particular by making use of a "biogas registry" system or similar database, which also ensures that there is no guarantee of origin disclosed to other users of biogas. This means that the guarantee of origin (if it has been generated at all) must be closely linked to the defined physical quantity of biogas and cannot be given ("disclosed") to another gas consumer;
- Producer and consumer of the biogas are connected to the same gas grid;
- The sustainability and GHG savings criteria laid down in the RED II are complied with.

The 2024 amendment of the MRR simplifies providing the relevant evidence: By allowing the use of evidence from the UDB (or a linked national database), the second and fourth bullet points above can be automatically complied with, since it covers the whole European gas grid with a single mass balance in accordance with Article 30 of the RED II, and prevents effectively a separate use of guarantees of origin. Further guidance to the application of these criteria are given in section 5.3 of Guidance Document No. 3 ("Biomass issues in the EU ETS").

Where RFNBO and RCF are injected into natural gas grids and purchased by an EU ETS operator connected to the same gas grid, the RFNBO and RCF fraction assumed to be identical to the zero-rated RFNBO and RCF fractions can be determined using the same approach using the UDB or a connected database of a Member State, as described for biofuels. However, in the case of H_2 blended into the natural gas grid, it is also necessary that the EU ETS operator physically

separates the hydrogen from the mixture of gases, as required under the relevant guidance under the RED II.[134]

6.3.12 Reporting of Memo-items

New!

In section 6.3.5, Figure 9 shows an overview of the fractions possibly contained in a fuel. In principle there are two main groups of fractions: those for which allowances have to be surrendered (fossil fraction, non-zero-rated fractions of biomass, RFNBO/RCF and SLCFs), and those that are zero-rated. However, for transparency, all fractions should be reported separately as so-called memo-items (i.e. without direct impact on the calculation of the emissions for which allowances are to be surrendered), although in many cases the total fraction of a type will be identical to the zero-rated fraction, and many fractions will be zero. The Commission's template for the annual emissions report provides a simple and user-friendly approach for this reporting.

Articles 24(1a) for combustion emissions, 24(2a) for process emissions, and Article 25(1a) define these memo-items. The logic sequence of how the individual fractions should be determined is given by Article 30(3). This article also clarifies that the different fractions only need to be determined where the respective fraction is relevant, and where the operator wants to make use of zero-rating. I.e. there is no obligation to zero-rate fuels. This may in particular reduce the administrative burden on operators who only occasionally use small quantities of such fuels.

Memo-items for combustion emissions

For each source streams that are combusted and for fuels used as process input the operator shall calculate additionally the following memo-items:

- Total preliminary emissions calculated as:

$$Em_{pre(total)} = AD \cdot EF_{pre} \cdot OF$$

Where

$Em_{pre\ (total)}$ ..... Total preliminary emissions [t CO_2], i.e. the emissions assuming the absence of any zero-rating

AD..... Activity data [TJ, t or Nm^3]

EF_{pre}..... Preliminary emission factor [t CO_2/TJ, t CO_2/t, or tCO_2/Nm^3]

OF..... Oxidation factor [dimensionless]

- The biomass emissions calculated as:

$$Em_{bio} = Em_{pre(total)} \cdot BF$$

Where

Em_{bio} ..... Biomass emissions [t CO_2]

BF..... Biomass fraction [dimensionless]

[134] Page 8 of Guidance on the targets for the consumption of renewable fuels of non-biological origin in the industry and transport sectors laid down in Articles 22a, 22b and 25 of Directive (EU) 2018/2001 on the promotion of energy from renewable sources, as amended by Directive (EU) 2023/2413, C(2024) 5042 of 2.9.2024, https://energy.ec.europa.eu/document/download/0c574279-b71d-4aa0-9403-daf9ea5a8491_en?filename=C_2024_5042_1_EN_ACT_part1_v8.pdf

- Zero-rated biomass emissions calculated as:

$$Em_{zr,bio} = Em_{pre(total)} \cdot BF_{zr}$$

Where

$Em_{zr,bio}$ ..... zero-rated biomass emissions [t CO_2]

BF_{zr} ..... zero-rated biomass fraction [dimensionless]

- Emissions from RFNBO, RCF or SLCFs calculated as:

$$Em_{R+S} = Em_{pre(total)} \cdot (RF + SF)$$

Where

Em_{R+S} ..... Emissions from RFNBO or RCF and SLCF [t CO_2]

RF ..... RFNBO or RCF fraction [dimensionless]

SF ..... SLCF fraction [dimensionless]

- Emissions from zero-rated RFNBO, RCF or synthetic low-carbon fuels calculated as:

$$Em_{zr,R+S} = Em_{pre(total)} \cdot (RF_{zr} + SF_{zr})$$

Where

$Em_{zr,R+S}$ ..... Emissions from zero-rated RFNBO or RCF and synthetic low-carbon fuels [t CO_2]

RF_{zr} ..... zero-rated RFNBO or RCF fraction [dimensionless]

SF_{zr} ..... zero-rated SLCF fraction [dimensionless]

Note:

Equation (3) in section 4.3.1 uses one total zero-rated fraction ZF. Using the above, this means that

$$ZF = BF_{zr} + RF_{zr} + SF_{zr}$$

And the total emissions (of one source stream) for which allowances are to be surrendered is then

$$Em_{surr} = AD \cdot EF_{pre} \cdot OF \cdot (1 - ZF)$$

Memo-items for process emissions and mass balances

For process emissions similar memo-items as for combustion emissions are to be calculated. However, only biomass is relevant, not RFNBO/RCF and SLCF, which are defined only for energetic use. For mass balances, RFNBO/RCF and SLCF are to be taken into account if relevant for energy purposes.

6.3.13 Special rules for mixed process materials

Most CO_2 process emissions stem from inorganic carbon, mostly carbonates. However, in some cases elemental carbon (graphite) or even organic carbon can be contained in materials that lead to process emissions. A prominent example is the use of urea for flue gas cleaning ($deNO_x$). As footnotes 37 and 43 clarify, “process emissions” are basically all emissions which are not combustion emissions. For pragmatic reasons, even if it is an oxidation which leads to the CO_2

emissions in those non-carbonate cases, the MRR allows emissions from such materials to be monitored as process emissions. The detailed requirements are given in Annex II section 4 of the MRR. They apply to all process materials leading to CO_2 emissions, i.e.

- Inorganic carbon (Carbonates, elemental carbon);
- Organic carbon (e.g. urea) and biomass;
- Mixtures thereof.

Section 4 of Annex II of the MRR allows the following approaches:

- Input-based (Method A): Due to the fact that emissions are in a stoichiometric relation to the carbon content of the input materials, this approach is allowed for all process input materials;
- Output-based (Method B): This is allowed only if all the emissions stem from the decomposition of carbonates.

In case of mixed materials where more than one type of carbon is to be analysed, e.g. a clay that contains carbonates as well as an organic fraction, the MRR allows two general approaches:

- The total carbon contained in the input material may be determined, giving a mixed (preliminary) emission factor (if applicable, the biomass fraction is to be determined, too), or
- The source stream may be split formally into two streams for reporting purposes, so that one stream serves for the reporting of emissions from the inorganic carbon and the other for the emissions from the organic carbon.

Any applicable conversion factor must be determined using an approach consistent with the approach chosen for the emission factor.

Except for the above, in principle all rules mentioned in section 6.2 apply to process materials and their calculation factors. There is only one exception: NCV has to be reported only "if relevant". The MRR clarifies "*NCV is considered not relevant for de-minimis source streams or where the material is not itself combustible without other fuels being added. If in doubt, the operator shall seek confirmation by the competent authority on whether NCV has to be monitored and reported.*"

6.4 PFC emissions

Section 8 of Annex IV of the MRR describes the determination of PFC (Perfluorocarbon) emissions. PFC emissions are currently only covered by the ETS for the activity "production of primary aluminium or alumina"[135]. The gases to be monitored are CF_4 and C_2F_6 Emissions from anode effects as well as fugitive emissions are to be included. PFC emissions not related to anode effects shall be calculated based on estimation methods.

[135] In practice, the production of alumina from Bauxit does not lead to PFC emissions. Therefore only rules for production of primary aluminium are available in the MRR.

The MRR specifies that "the most recent version of the guidance mentioned under Tier 3 of section 4.4.2.4 of the 2006 IPCC Guidelines shall be used." That guidance is the "Aluminium sector greenhouse gas protocol" published by the International Aluminium Institute (IAI)[136]. This uses a calculation-based approach which significantly deviates from the calculation-based approach outlined in section 4.3.1. Two different methods are allowed by the MRR: The "slope method" and the "overvoltage method". Which method is to be applied depends on the installation's process control equipment.

While the MRR describes the principle requirements and calculation formulae, other details on the applicable methods should be taken from the guidance mentioned above. Note that the IAI guidance is not applicable for CO_2 emissions from primary aluminium production and from anode production. Instead the MRR's usual calculation methods are to be used.

For calculating $CO_{2(e)}$ emissions from CF_4 and C_2F_6 emissions, the operator shall use the following formula:

$$Em = Em(CF_4) \cdot GWP_{CF_4} + Em(C_2F_6) \cdot GWP_{C_2F_6} \quad (14)$$

Where

Em ..... *emissions expressed as* t $CO_{2(e)}$

Em(CF_4) ..... emissions of CF_4 in tonnes

Em(C_2F_6) ..... emissions of C_2F_6 in tonnes

GWP ..... Global warming potential as listed in MRR Annex VI section 3 Table 6.

[136] Download at http://www.world-aluminium.org/media/filer_public/2013/01/15/fl0000127.pdf

7 SIMPLIFIED APPROACHES

7.1 Installations with low emissions

For the definition of installations with low emissions, see section 4.4.2. For those installations, several simplifications are found in Article 47 of the MRR. These are:

- The installation may use a simplified monitoring plan (where a Member State has provided an appropriate template), see section 7.2.
- The operator may apply as a minimum tier 1 for activity data and calculation factors for all source streams, unless higher accuracy is achievable without additional effort for the operator (i.e. no justifications regarding unreasonable costs are required).
- The operator is not required to submit the supporting documents mentioned in Article 12(1) when submitting a monitoring plan for approval, i.e. there is no requirement for submitting:
  - evidence that the required tiers are met (uncertainty assessment, see section 5.3), and
  - a risk assessment as part of the control system.
- The operator is exempted from reporting on improvements reacting on recommendations by the verifier.
- The operator may determine the amount of fuel or material by using available and documented purchasing records and estimated stock changes, without providing an uncertainty assessment.
- He is also exempted from including the uncertainty of determined stocks at the beginning and end of the reporting year in the uncertainty assessment.
- If the operator uses analyses by a non-accredited laboratory, simplified evidence regarding the competence of the laboratory[137] is needed.

All other requirements for installations are to be respected. However, because an installation with low emissions may apply lower tiers, the overall monitoring requirements are usually relatively easy to meet.

7.2 Other “simple” installations

The MRR aims to avoid unreasonable or disproportionate costs for installations, wherever possible. The concept of “installations with low emissions” has been found useful, but not enough, as there are many installations participating in the EU ETS which are rather simple to monitor, but which could not make use of some of the simplifications offered to installations with low emissions.

Before we discuss further elements of the MRR, we must ask how a monitoring plan can be simplified in general, i.e. how can the administrative burden for operators (of “simple” installations) be reduced? In principle, there are three areas

[137] The operator may use “any laboratory that is technically competent and able to generate technically valid results using the relevant analytical procedures, and provides evidence for quality assurance measures as referred to in Article 34(3)”. See section 6.2.2 for further details.

which have to be covered in the monitoring plan (assuming that "simple" installations always use a calculation-based methodology for monitoring):

- Monitoring of activity data,
- Determination of calculation factors, and
- Organisational issues, including data flow and control procedures.

When analysing the MRR's possibilities for simplification, it turns out that its requirements are largely proportionate anyway. I.e. if an installation is really simple, the monitoring is also simple to perform. For monitoring of activity data, the most obvious simplification is the use of invoices. For calculation factors, only the highest tiers require more effort due to the laboratory analyses to be performed, while smaller emitters are usually entitled to use default values. The only remaining area for simplification are the "organisational" issues (of which many require written procedures). This is exactly where Article 13 of the MRR comes in.

The MRR provides a flexible approach to allow simplifications where deemed appropriate by the competent authority. Article 13(1) of the MRR gives Member States the possibility to allow operators to use standardised or simplified monitoring plans, for which the Member States may publish templates based on the templates and guidelines published by the Commission. That Article mentions in particular the possibility that such templates include (standardised) descriptions of data flow and control procedures (→ section 5.5).

Dedicated templates may solve two issues: Firstly, the minimum content of monitoring plans, found in Annex I of the MRR as well as in the electronic templates for monitoring plans provided by the Commission, aims at avoiding gaps in the monitoring plans of complex installations. Fully responding to these needs may result in unnecessary burden for operators of small or simple installations.

Secondly, there may be elements of monitoring plans which apply to many installations in a similar way. It would be a considerable simplification for operators if there were standardised texts available which they may use where appropriate, rather than developing everything themselves. An additional efficiency improvement, in the process of approving monitoring plans, results where the competent authorities themselves would disseminate information on text blocks which are deemed appropriate in standard situations.

7.2.1 Practical approach to simplifications

Bearing in mind the nature and functioning of the monitoring plan templates provided by the Commission, it seems most practical for Member States who want to make use of Article 13 to provide modified versions of the Commission's original monitoring plan template. Those modified templates can be adapted to the needs of simple installations in particular by two elements:

- Hiding sheets or sections of the template[138] which are not relevant;

[138] Note that the original template does not hide full sections due to transparency considerations. Sections which are not relevant due to other data inputs are made automatically grey by the original template, but are not hidden.

- Inserting standard text blocks in the template, for example for standard data sources (national GHG inventory etc) or default values, simple data flow and control procedures.

Such approach would also support those operators which can use only parts of the simplified or standardised monitoring plan templates.

Note that the simplifications made in the templates must be appropriate for the types of installations for which these templates are developed. The Commission has published an exemplar simplified monitoring plan on its MRVA website (**https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets/monitoring-reporting-and-verification-eu-ets-emissions_en**).

7.2.2 Determining the scope for simplified approaches

The central tool for determining the appropriateness of simplifications is the risk assessment[139]. Competent authorities may allow any use of a standardised and simplified approach in the monitoring plan only where this does not lead to an undue risk of misstatements in the emission report. Because each installation is different, it does not seem appropriate to define one single way of broad simplification to a wide range of installations. Instead the MRR offers flexibility to competent authorities, but requires that any simplification be justifiable based on a simplified risk assessment.

It is acknowledged that a detailed risk assessment may be a disproportionate effort for a competent authority. Therefore this guidance provides some indicators based on which competent authorities may decide whether simplifications can be allowed. It is proposed to classify installations into one of the three following groups:

1. Installation types which are considered too complex for allowing simplifications under Article 13 (→ indicators given in section 7.2.2.1),
2. Installations which are considered eligible for simplified or standardised monitoring plans under Article 13 (→ section 7.2.2.2), and
3. Installations where an assessment of the individual situation is required.

In the third case, competent authorities are encouraged to make use of the second sub-paragraph of Article 13(2), i.e. that it should be the operator who performs a risk assessment for his installation. In this particular case it may be most appropriate to apply only some of the simplifications offered in standardised monitoring plan templates.

[139] Article 13(2): "*Before the approval of any simplified monitoring plan, as referred to in paragraph 1, the competent authority shall carry out a simplified risk assessment as to whether the proposed control activities and procedures for control activities are commensurate with the inherent risks and control risks identified, and justify the use of such a simplified monitoring plan.*
Member States may require the operator or aircraft operator to carry out the risk assessment pursuant to the previous sub-paragraph itself, where appropriate."

7.2.2.1 Installations with potentially high risks

The following types of installations are considered too complex for allowing simplified MPs:

- Installations applying measurement-based approaches (CEMS),
- Installations carrying out activities where PFC or N_2O are included in Annex I of the EU ETS Directive,
- Installations for capture, transport and geological storage of CO_2, as included in Annex I of the EU ETS Directive,
- Installations applying a fall-back methodology in accordance with Article 22 of the MRR,
- Category C installations which apply other source streams than commercial standard fuels[140],
- Category B or C installations which have at least one major source stream for which instruments are used which are not subject to national legal metrological control,
- Installations which have to use laboratory analyses in accordance with Articles 32 to 35,
- Installations which have more than three major source streams to monitor, or which apply several different monitoring methodologies (e.g. batch metering as well as some continual measurements for activity data, several different sampling plans, etc.)

7.2.2.2 Installations eligible for simplified monitoring plans

The following types of installations are considered generally eligible for allowing simplified MPs:

- Installations of category A and B which have only natural gas as source stream,
- installations which use only commercial standard fuels[141] without process emissions,
- installations which
  - can use exclusively invoices for monitoring activity data,
  - use exclusively default values for calculation factors, and
  - which use a limited number[142] of source streams with fossil carbon;
- Installations with low emissions, if
  - only minor and de-minims source streams are not monitored using invoices and default values,
  - the installation does not use CEMS or fall-back approaches, and
  - the installation does not carry out PFC or N_2O emitting activities or capture, transport or geological storage of CO_2.

[140] CAs may consider treating fuels in the same way if they have been accepted eligible for using the same tiers as commercial standard fuels in line with Article 31(4) of the MRR, see Footnote 75.

[141] See also Footnote 140.

[142] As guidance, the CA should perform an individual assessment where the number of source streams exceeds 10.

- Installations emitting fossil CO_2 only from minor and de-minimis source streams.

This list includes also all installations which comply with the above criteria, but have to monitor one or more biomass source streams in addition. In other words, biomass source streams do not affect the eligibility for simplified approaches, as the following example shows.

- Assuming an installation of category A or B which has only natural gas as source stream, and uses in addition various types of solid[143] biomass. This could be e.g. a biomass plant for district heating, which uses natural gas for covering peak load periods.
- If ignoring the biomass, it complies with the first criterion presented above. It is therefore also eligible for simplified approaches as a whole.

The Commission has published an example of a simplified monitoring plan in accordance with Article 13 MRR. It can be found under **https://ec.europa.eu/clima/system/files/2017-01/simplified_monitoring_plan_exemple_en.pdf**.

[143] Note that from 2022 the installation would have to provide evidence for the sustainability and GHG savings of the biomass consumed. Depending on the source of biomass (in particular the distance it has to be transported), this may require additional efforts by the operator, and the example may turn out to be not eligible for a simplified monitoring plan.

8 CEMS

8.1 General requirements

In addition to what has been outlined in section 4.3.3 about measurement-based methodologies, further points are to be taken into account:

- CEMS are put on equal footing with calculation-based approaches, i.e. it is not necessary to demonstrate to the CA that using a CEMS achieves greater accuracy than the calculation approach *using the most accurate tier* approach. However, minimum tier (→ see section 5.2) requirements have been defined implying uncertainty levels comparable to those of calculation approaches are applicable. Thus, the operator must demonstrate to the CA that those tiers can be met with the CEMS proposed. Table 11 gives an overview on defined tiers for measurement-based approaches.
- The measurement-based emissions must be corroborated using a calculation-based approach. However, no specific tiers are required for this calculation.

New!

  Due to the non-stoichiometric nature of N_2O emissions from nitric acid production, no corroborating calculation is required for those emissions. This is also true for greenhouse gases in general if they are transferred to a CO_2 transport infrastructure or storage site.
- Carbon monoxide (CO) emitted to the atmosphere shall be treated as the molar equivalent amount of CO_2 (Article 43(1)).
- Concentration measurements may be difficult in gas streams of very high CO_2 concentrations. This is in particular important for measurement of CO_2 transferred between installations for the capture, pipeline systems for the transport and installations for geological storage of CO_2. In such cases CO_2 concentrations may be determined indirectly, by determining the concentration of all other constituents of the gas and subtracting them from the total (Equation 3 in Annex VIII of the MRR).
- Flue gas flow may be determined either by direct measurement, or by a mass balance[144] using only parameters which are easier to measure, namely input material flows, input airflow and concentration of O_2 and other gases which need to be measured also for other purposes.
- The operator must ensure that the measurement equipment is suitable for the environment in which it is to be used, and regularly maintained and calibrated. Nevertheless the operator must be aware that equipment may fail once in a while. Therefore Article 45 outlines how data from missing hours are to be conservatively replaced. The operator has to make provisions for such data substitution when developing the monitoring plan[145].

[144] Article 43(5) allows the use of "*a suitable material balance, taking into account all significant parameters on the input side, including for CO_2 emissions at least input material loads, input airflow and process efficiency andon the output side including at least the product output and the concentration of oxygen (O_2), sulphur dioxide (SO_2) and nitrogen oxides (NO_x)*".

[145] In accordance with point (4)(a)(ii) of section 1 of Annex I of the MRR, the monitoring plan must contain: "*the method for determining whether valid hours or shorter reference periods for each parameter can be calculated, and for substitution of missing data in accordance with Article 45*".

- Operators must apply EN 14181 (“Stationary source emissions – Quality assurance of automated measuring systems”) for quality assurance. This standard requires several activities:
  - QAL 1: Testing whether the CEMS is meeting the specified requirements. For this purpose EN ISO 14956 (“Air quality. Evaluation of the suitability of a measurement procedure by comparison with a required uncertainty measurement”) is to be used.
  - QAL 2: Calibration and validation of the CEM;
  - QAL 3: Ongoing quality assurance during operation;
  - AST: Annual surveillance test
  - According to the standard, QAL 2 and AST are to be performed by accredited laboratories, QAL 3 is performed by the operator. Competence of the personnel carrying out the tests must be ensured.
  - This standard does not cover quality assurance of any data collection or processing system (i.e. IT systems). For those the operator has to ensure appropriate quality assurance by separate means.
- Another standard to be applied is EN 15259 (“Air quality – Measurement of stationary source emissions – Requirements for measurement sections and sites and for the measurement objective, plan and report”)
- Standard to be applied for measurements of the flue gas flow is EN ISO 16911-2 (“Stationary source emissions – Manual and automatic determination of velocity and volume flow rate in ducts”)
- All other methods applied in the context of the measurement-based approach should be based also on EN standards. Where such standards are not available, the methods shall be based on suitable ISO standards, standards published by the Commission or national standards. Where no applicable published standards exist, suitable draft standards, industry best practice guidelines or other scientifically proven methodologies shall be used, limiting sampling and measurement bias.
  The operator shall consider all relevant aspects of the continuous measurement system, including the location of the equipment, calibration, measurement, quality assurance and quality control.
- The operator shall ensure that laboratories carrying out measurements, calibrations and relevant equipment assessments for continuous emission measurement systems (CEMS) shall be accredited in accordance with EN ISO/IEC 17025 for the relevant analytical methods or calibration activities. Where the laboratory does not have such accreditation, the operator shall ensure that equivalent requirements of Article 34(2) and (3) are met.

Table 11: Tiers defined for CEMS (see section 1 of Annex VIII of the MRR), expressed using the maximum permissible uncertainties for the annual average hourly emissions.

	Tier 1	Tier 2	Tier 3	Tier 4
CO_2 emission sources	± 10%	± 7.5%	± 5%	± 2.5%
N_2O emission sources	± 10%	± 7.5%	± 5%	N.A.
CO_2 transfer	± 10%	± 7.5%	± 5%	± 2.5%
N_2O transfer New!	± 10%	± 7.5%	± 5%	N.A.

New!

For determining biomass CO_2, the MRR as well as its 2024 amendment allows some flexibility. Article 43(4) allows not only calculation-based approaches, but also

- Methods that use radiocarbon analyses of samples taken from the flue gas by continuous sampling. For this purpose, EN ISO 13833 "Stationary source emissions – Determination of the ratio of biomass (biogenic) and fossil-derived carbon 23 dioxide – Radiocarbon sampling and determination" is to be applied;
- The "balance method" (based on ISO 18466 "Stationary source emissions – Determination of the biogenic fraction in CO_2 in stack gas using the balance method").

If the methods used involve continuous sampling from the flue gas stream, EN 15259 ("Air quality – Measurement of stationary source emissions – Requirements for measurement sections and sites and for the measurement objective, plan and report" is to be applied. As a new element, the 2024 amendment provides a minimum number of analyses to be carried out (for every 50 000 tonnes of total CO_2, but at least once a month).

New!

8.2 Zero-rating in case of CEMS

8.2.1 Biomass

The (total) biomass fraction can be determined following the rules presented in chapter 8.1. For determining the *zero-rated* biomass fraction, the total biomass fraction can be considered as zero-rated, if one of the following conditions is met (Article 43(4a)):

- The sustainability and GHG emissions savings crtieria do not apply[146]. In particular this means that the biomass fraction of municipal waste is outomatically zero-rated, provided there is evidence that it is indeed municipal waste[147].

[146] See decision tree in section 6.3.7.

[147] For guidance on what is municipal waste, see Guidance Document No.0 on Annex I of the EU ETS Directive, referenced in section 2.3.

- 100% of the biomass fraction of the used fuel or material fulfil the applicable GHG savings and sustainability criteria. For example, this is always true for biogas monitored according Article 39(4).

If neither condition is met, the zero-rated biomass fraction – as potentially different from the (total) biomass fraction – has to be determined using a calculation-based approach. The zero-rated biomass fraction is to be subtracted from the total emissions measured using CEMS in order to result in the emissions for which allowances are to be surrendered.

When the biomass fraction is determined by continuous flue gas sampling and the installation uses natural gas from the grid, for which the approach using purchase records in accordance with Article 39(4) is to be applied (see section 6.3.11), double counting of biomass or an underestimation of biomass are possible. For mitigating this possible issue, it is necessary for the operator to determine the physical CO_2 amount of the biogas received from the grid using laboratory analyses as discussed in section 6.2.2 and deduct the respective CO_2 amount from the zero-rated CO_2 as above[148].

8.2.2 RFNBO, RCF or SLCF

New!

When the measurement-based approach is applied for emission sources where zero-rated RFNBO, RCF or SLCFs are used, the total emissions shall be reduced by the emissions from the zero-rated fraction of these fuels. In accordance with Article 43(4c) those emissions must be determined using the calculation-based approach as described section 6.3.8 and 6.3.9. This is necessary because these fuels cannot be chemically or physically distinguished from "normal" fossil fuels.[149]

8.3 N_2O emissions

Section 16 of Annex IV of the MRR deals with determining N_2O emissions from certain chemical production processes, which are covered by Annex I of the EU ETS Directive (production of nitric acid, adipic acid, glyoxal and glyoxylic acid), or which may be unilaterally included pursuant to Article 24 of the Directive (production of caprolactam). N_2O emitted from the activity "combustion of fuel" is not covered. N_2O emissions usually have to be determined using a measurement-based approach.

---

[148] MRR Article 43(4b): "*The operator may deduct from the total emissions of the emission source the emissions from zero-rated biomass determined in accordance with paragraph 4a of this Article.*

Where the method proposed by the operator for the determination of the zero-rated biomass fraction involves continuous sampling from the flue gas stream and the installation consumes natural gas from the grid, the operator shall determine the physical CO_2 amount of the biogas used in accordance with Articles 32 to 35 of this Regulation and deduct the respective CO_2 amount from the zero-rated CO_2 determined in accordance with paragraph 4a of this Article."

[149] MRR Article 43(4c): "*Where the operator uses zero-rated RFNBOs, RCFs or synthetic low-carbon fuels in a process for which the measurement-based methodology is applied, the operator may deduct from the total emissions the emissions from zero-rated RFNBOs, RCFs or synthetic low-carbon fuels.*

The emissions from zero-rated RFNBOs, RCFs or synthetic low-carbon fuels shall be determined using a calculation-based approach in accordance with Articles 24 to 39a of this Regulation. They shall equal the activity data of the relevant fuel multiplied by the preliminary emission factor and the zero-rated RFNBO or RCF fraction or the zero-rated synthetic low-carbon fraction."

In addition to the points mentioned under sections 4.3.3 and 8.1, the following specific points should be noted:

- In subsection B.3 of section 16 of Annex IV specific requirements for determining the flue gas flow are given. Where needed, the oxygen concentration must be measured in accordance with subsection B.4.
- Subsection B.5 specifies requirements for *calculation* of N_2O emissions in case of specific periods of unabated N_2O emissions (e.g. when the abatement system fails) and where measurement is technically not feasible.

For calculating $CO_{2(e)}$ emissions from N_2O emissions, the operator shall use the following formula:

$$Em = Em(N_2O) \cdot GWP_{N_2O} \quad (15)$$

Where

Em .....*emissions expressed as* t $CO_{2(e)}$

Em(N_2O) .....emissions of N_2O in tonnes

GWP_{N2O} .....Global warming potential of N_2O as listed in MRR Annex VI section 3 Table 6.

8.4 Transferred N_2O

The MRR 2018/2066 contains also specific rules for treatment of N_2O that is transferred to another installation (Article 50). The pre-condition for subtracting the N_2O from the transferring installation's reported emissions is that the N_2O is received by an installation that monitors and reports emissions under the MRR. The latter installation has to treat the N_2O as if it were generated within the receiving installation itself (i.e. monitor it by CEMS and report it).

If the N_2O is not used within the receiving installation, or where there is no evidence that the N_2O is destroyed by relevant abatement equipment, i.e. where the N_2O is sold and emitted later outside the installation, it shall be accounted for as emission of the installation where it originates.

8.5 Inherent CO_2

While "transferred CO_2" in the MRR means "more or less pure CO_2" (the CCS Directive[150] requires the CO_2 stream to "consist overwhelmingly" of CO_2), the term "inherent CO_2" in the MRR (Article 48) refers to CO_2 which results from an Annex I activity[151] and is typically contained in a gas which is considered a fuel,

[150] Directive 2009/31/EC: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02009L0031-20120217

[151] Or an activity included in the EU ETS pursuant to Article 24 of the EU ETS Directive ("opt-in").

such as waste gases from a blast furnace or from some parts of oil refineries, or a process input (such as synthesis gas).

New!

However, where CO_2 is used as a raw material, it qualifies as a source stream and hence as 'inherent CO_2' as well when transferred to another installation to produce an RFNBO/RCF or a product where CO_2 is permanently chemically bound (see section 9.2)

In order to ensure a consistent reporting of both receiving and transmitting installation, the following approaches are applicable:

- Where an EU ETS installation uses a source stream which contains inherent CO_2, the emission factor (or in case of mass balances, the carbon content) takes into account the inherent CO_2 (i.e. the CO_2 forms a part of the source stream, and the inherent CO_2 counts as emitted by the installation which indeed receives and thereafter emits the CO_2).
- The EU ETS installation which transfers the CO_2 to the other installation, subtracts the CO_2 from its emissions. Usually this is done using a mass balance. The inherent CO_2 is simply treated in the same way as any other carbon in that outgoing source stream. An exception is applicable where the inherent CO_2 is transferred to a non-ETS installation: In this case the inherent CO_2 has to be counted as emission from the ETS installation which transfers the CO_2.
- The operator of the installation transferring the CO_2 has to make sure, that the chosen monitoring methodology does not systematically underestimate the total emissions of the installation when the zero-rated biomass, RFNBO, RCF or SLCF fraction of the inherent CO_2 is determined.

New!

Regarding monitoring the point of transfer, the same approach as for transferred CO_2 is applicable, i.e. operators may choose whether the measurement is carried out by the transferring or receiving installation (Article 48(3), see section 9.1).

9 CARBON CAPTURE, STORAGE (CCS) AND UTILISATION (CCU)

New!

9.1 Definitions of transferred CO_2 and CO_2 transport infrastructure for CCS

Transferred CO_2

Where CO_2 (usually almost pure[152] for transport, but this applies also to flue gases transferred to a capture installation) not originating from zero-rated carbon is not emitted, but transferred out of an installation, it may be subtracted from that installation's emissions only if the receiving installation is one of the following (Article 49(1)):

- a capture installation for the purpose of transport and long-term geological storage in a storage site permitted under Directive 2009/31/EC;
- a CO_2 transport infrastructure (see below) with the purpose of long-term geological storage in a storage site permitted under Directive 2009/31/EC;
- a storage site permitted under Directive 2009/31/EC for the purpose of long-term geological storage.

The transfer of CO_2 may take place between any installations listed in Article 49(1), including from a capture installation to another capture installation, or from a transport to another transport installation.

In all other cases, the CO_2 transferred out of the installation counts as emission of the originating installation (unless it qualifies as a raw material and therefore 'inherent CO_2', see section 8.5).

New!

CO_2 transport and transport infrastructure

CO_2 transport refers to the transfer of CO_2 for geological storage in a storage site. This process resorts to a CO_2 transport infrastructure[153], which consists of a network of pipelines, as well as other infrastructure for other transport modes for the transport of CO_2 (in particular via ships, trains or trucks), including necessary harbour facilities and storage.

9.2 Definition of CCU and "permanently chemically bound in a product"

New!

In contrast to CO_2 being stored underground as in the case of CCS, Carbon Capture and Utilisation (CCU) comprises a wide range of applications where CO_2 is captured and used in products, either physically or chemically bound. The latter involves some sort of chemical reaction to store the carbon in products which can vary considerably in terms of the permanence of the carbon being stored before being released again. Products such as carbonates have the potential to fixate

[152] In contrast to "inherent CO_2" (see 8.5) which is part of a source stream and therefore only one of several consitutents of a gas flow, "transferred CO_2" is usually "overwhelmingly" composed of CO_2.

[153] MRR Article 2(63): "*'CO_2 transport infrastructure' means an infrastructure as defined in Article 3(29) of Regulation (EU) 2024/1735*". That Regulation defines: "*'CO_2 transport infrastructure' means the network of pipelines, including associated booster stations, for the transport of CO_2 to the storage site, as well as any ships, road or rail transport modes, including liquefaction devices and temporary storage facilities if needed, for the transport of CO_2 to the harbour facilities and storage site;*"

the CO_2 for long time periods of several centuries, whereas the usual lifetime of fuels or polymers, e.g. produced via the reaction with hydrogen, usually exhibit lifetimes of only months to years.

The EU ETS Directive and the MRR currently only allow the deduction of CO_2 that is *permanently chemically bound in a product and does not enter the atmosphere under normal use including its end of life*[154]. In order for CO_2 to be considered as permanently chemically bound in a product, a delegated act pursuant to Article 12(3b) of the EU ETS Directive[155] defines the following criteria:

- The chemical bond between the CO_2 and the product was achieved though an active and controlled utilisation process, which allows the determination of the exact amount of CO_2 equivalent bound in the product during and solely from the utilisation process, i.e. excluding carbon present in the material before or naturally absorbed from the atmosphere or other sources after the utilisation process.
- The CO_2 must remain bound to the product throughout its usage and any activity taking place after the product's end of life, for at least several centuries, without being released to the atmosphere. This excludes products subjected to high temperature combustion at any stage of their life cycle.

This provision does not cover any other product that is not produced via the intermediate formation of CO_2 (i.e. qualifying as emissions as defined in Article 3(b) of the EU ETS Directive) and the subsequent binding of that CO_2, even if the result is the same type of product. This would include e.g. bulk organic chemicals, polymers produced via 'conventional' production routes, carbon resulting from pyrolysis, etc. where there is no intermediate CO_2 formed.

Against those principles, the delegated act lists in its Annex the following products as eligible for deducting emissions for "permanent CCU":

- carbonated aggregates used unbound or bound in mineral based construction products;
- carbonated constituents of cement, lime, or other hydraulic binders used in construction products;
- carbonated concrete, including precast blocks, pavers or aerated concrete;
- carbonated bricks, tiles, or other masonry units.

In all other cases, the CO_2 cannot be considered permanently chemically bound and not be deducted from the emissions of an installation.

Note: The source alkaline materials for carbonation are not specified nor limited by the regulation. Examples include bauxite residues, ashes, burnt lime or clinker, etc.

[154] Article 12(3b) of the EU ETS Directive.

[155] Commission Delegated Regulation (EU) 2024/2620 of 30 July 2024 supplementing Directive 2003/87/EC of the European Parliament and of the Council as regards the requirements for considering that greenhouse gases have become permanently chemically bound in a product, http://data.europa.eu/eli/reg_del/2024/2620/oj

9.3 Special provisions to avoid double counting of CCU products

The revised definition of 'emissions' set out in Article 3(b) of the EU ETS Directive has led to changes in the MRR concerning the monitoring rules for certain sectors, most notably soda ash[156] and the sugar[157] industry. This amendment requires that all the CO_2 released from sources has to be reported as emissions, even if not released into the atmosphere, except where the CO_2 is bound in a product that meets the definitions described above for "permanently chemically bound". These emissions are therefore essentially calculated on the basis of the amount of products produced by the EU ETS installation during the calendar year. This approach could lead to double counting of emissions across EU ETS installations, where the product does not meet those definitions, but is consumed in another installation which again would report the emissions.

An example for this would be soda ash production and consumption in two separate installations: The producer which has to report the amount of the intermediate CO_2 formed during the soda ash production process which is then bound in the soda ash (but not "permanently" bound!) as emitted. The soda ash is then sold to an EU ETS installation (such as a glass producer or another process using soda ash as an input, e.g. for flue gas scrubbing). Following the direct emitter principle, the latter would have to report the emissions resulting from the soda ash decomposition happening during the glass production. This would lead to double reporting. In order to avoid such double counting, Annex II, section 4 of the MRR allows the consumer of such products (soda ash, urea, etc.) to rate process emissions from those materials as zero, provided the operator provides evidence for meeting all the following conditions:

- The material used (i.e. the soda ash in the example) does not meet the definitions of RFNBOs or RCFs or synthetic low-carbon fuels;
- The material was produced in another EU ETS installation;
- CO_2 was chemically bound to produce the material;
- the installation that emitted the CO_2 included this CO_2 in its annual emissions report as not zero-rated[158];
- The material does not meet the specification of a product that is listed in the delegated act under Article 12(3b)[155].

[156] As sodium bicarbonate is not included in the delegated act under Article 12(3b) either, the CO_2 used during this production process has to be counted as emitted as well.

[157] See FAQ on the monitoring in this case in section 12.20.

[158] Providing evidence on the inclusion of the emissions in the producer's AER could be part of a bilateral purchase contract between the producer and the consumer. Where there are intermediary traders, and the consumer is still able to provide evidence on which EU ETS installation produced the material, it can be difficult to access the producer's AER. In such cases, the consumer may assume the corresponding emissions to be included in the AER, as the producer would otherwise be not in compliance with the MRR. Since this provision applies as of 1 January 2025, only amounts produced as of this date are relevant for the above provision.

9.4 Monitoring rules for CCS and CCU

The rules for monitoring CCS (section 9.4.1) and CCU (section 9.4.4) including for CO_2 transport are discussed in the following sub-sections based on the illustration in

Figure 12.

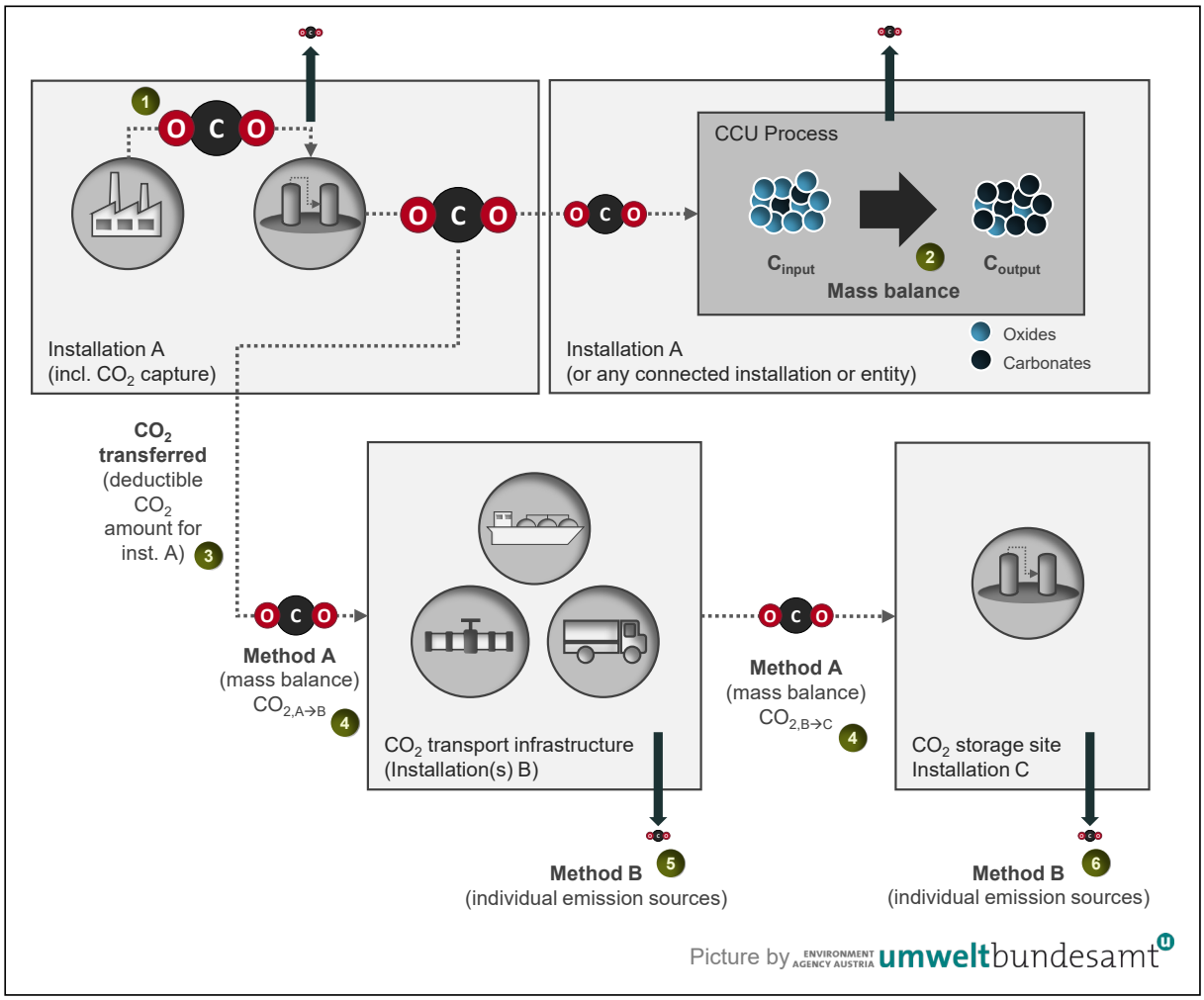

Figure 11. Illustration of the monitoring rules for CCS and CCU

9.4.1 Monitoring of the capture process

In order to make the calculation consistent in the case of a "CCS chain" (i.e. several installations together performing the capture, transport and geological storage of CO_2), the receiving installation has to add that CO_2 to its emissions (see sections 21 to 23 of Annex IV of the MRR), before it may again subtract the amount transferred to the next installation or to the storage site. Thus, CCS installations are monitored using a form of mass balance approach, where some of the CO_2 entering or leaving the installation (i.e. at the transfer points) is monitored.

The process starts with the capture of CO_2 (denoted by "1" in Figure 11) which would be emitted if no CCS activities were carried out. However, neither the captured part, nor the non-captured part of the CO_2 are directly impacting the reportable emissions. Instead, as the starting point, the installation has to consider all CO_2 indicated by "1" as emitted and can only deduct the amounts being transferred for CCS (denoted by "3" in Figure 11) or permanent CCU (denoted by "2" in Figure 11). An important derogation from that principle applies where part of the CO_2 stems from zero-rated carbon. In this case, the amount to be deducted from the emissions should be proportional to non-zero rated carbon fraction only. For example, if 60% of the installation's CO_2 emissions stem from fossil sources and 40% from zero-rated biomass and 100% are transferred for CCS, only 60% of the CO_2 captured can be deducted from installation A's emissions. Note that in the example the release of CO_2 and its capture take place in the same installation A. However, this can also be done in two separate installations, where the monitoring rules of Article 49 of the MRR are to be applied.

9.4.2 Monitoring of CO_2 transport

For CCS, the captured CO_2 can be transferred, as shown in the example in Figure 11, to a CO_2 transport infrastructure (installation B: pipeline, ships, trains, trucks, etc.). Such CO_2 transport infrastructure is also subject to the MRR. For monitoring those emissions transferred, which constitute the deductible amount "3", installation A has to apply Method A which will be described further below. Subsequently, those transferred amounts of CO_2 will also change "ownership"[159] from installation A to installation B, the CO_2 transport infrastructure, in terms of being liable for reporting the CO_2, if emitted, and for surrendering allowances accordingly.

The emissions from a CO_2 transport infrastructure (including its storage) are calculated as follows:

$$Emissions\ [t\ CO_2] = E_{vented,leaked,fugitive} + E_{transport\ infrastructure\ or\ storage\ site}$$

Where:

$E_{vented,\ leaked,\ fugitive}$ ... Emissions from venting, leakage and fugitive emissions

$E_{transport\ infrastructure\ or\ storage\ site}$ ..... Emissions from the transport infrastructure's own activity, meaning emissions not stemming from the transported CO_2 (i.e. the CO_2 captured and intended for storage). These emissions include all emissions from any functionally connected ancillary facilities, such as CO_2 intermediate storage, booster, liquefaction, gasification, purification stations or heaters. This means that emissions in particular from any fuels used for any of these processes will have to be monitored separately[160] by applying the general rules for either a calculation-based approach or a measurement-based approach.

[159] This means that any potential emission of the CO_2 (e.g. leakage) after this point will have to be included in the receiving installation's AER, i.e. the receiving installation will become liable.

[160] This only applies in all cases to stationary combustion units such as booster stations, gasification/liquefaction, etc. Emissions that are already covered by the EU ETS, e.g. internal combustion engines of large ships, do not have to be included here (no double counting). A special case arises for emissions that fall under ETS2. Those are included here until the pricing phase of the ETS2 starts in 2027.

Determination of GHG emissions from CO_2 transport infrastructure must be in accordance with section 22 of Annex IV, where 2 methods are described. The CO_2 transport infrastructure can monitor the emissions from transferred CO_2 ($E_{vented,leaked,fugitive}$) either via Method A, in the form of a mass balance between ingoing CO_2 and outgoing CO_2 (transferred to another transport infrastructure operator or to a storage site), denoted by "4" in Figure 11, or by Method B, i.e. monitoring all individual emission sources (denoted by "5" for the CO_2 transport infrastructure and by "6" for the CO_2 storage site in Figure 11), as explained in more detail below.

Method A:

This uses an overall mass balance of all input and output streams. Here the operator can either apply a measurement-based or a calculation-based approach.

$$E_{vented,leaked,fugitive} = \sum_i T_{IN,i} - \sum_i T_{OUT,i} - \Delta E_{in\ transit}$$

Where:

$T_{IN,i}$ ..... Amount of CO_2 transferred to the transport infrastructure at entry point i;

$T_{OUT,i}$ ..... Amount of CO_2 transferred out of the transport infrastructure at exit point i;

$\Delta E_{in\ transit}$ ..... CO_2 in transit, i.e. any amount of CO_2 transferred to the transport infrastructure at an entry point i, that is not transferred to another installation or CO_2 transport infrastructure in the same reporting period but by 31 January of the following year[161].

Measurement-based approach: For the relevant continuous measurement systems (CMS) the rules specified for CEMS (see section 8.1) apply *mutatis mutandis* (the word "emissions" has to be omitted from CEMS). In particular the provision of "indirect" CO_2 measurement[162] is applicable. The highest tier (tier 4) has to be used, unless unreasonable costs or technical infeasibility are demonstrated. As a special provision, it is important to clearly identify the transferring and receiving installations in annual emissions report, using the unique identifiers which are also used in the EU ETS registry system.

Calculation-based approach: Here the amounts of CO_2 transferred are determined like for any source stream that is part of a mass balance (see section 4.3.2), i.e. activity data multiplied with the carbon content. The activity data can be determined by appropriate measuring instruments such as flow meters designed for CO_2 flows, where CO_2 is transferred in gaseous form, or by weighbridges, where the CO_2 is transferred between installations e.g. in containers.

[161] Corresponding amounts shall not be taken into account for $T_{OUT,i}$ for the subsequent reporting period.

[162] I.e. determining the concentration of all other constituents of the gas and subtracting them from the total (Equation 3 in Annex VIII of the MRR).

The tiers to be applied are the same as for any other source stream of the installation, i.e. usually the highest tiers for the activity data[163] and the requirement for sampling & analysis of the CO_2 content in accordance with Articles 32 to 35.

General provision: For monitoring at the interface between installations, the operators need to agree whether the measurement is carried out by the transferring or receiving installation (both approaches are allowed, see Article 48(3)). In case the respective operators opt to install individual measurement systems at both sides of the transfer point, the reported quantity in their respective annual emission reports must be the arithmetical average of both values determined by the respective operators. If the deviation is higher than the uncertainty approved in the MP, a value with conservative adjustment is to be reported by the operators, which needs the approval by the competent authority.

CO_2 in transit ($E_{in\ transit,i}$): There can be cases where a quantity of CO_2 is captured and transferred to a CO_2 transport infrastructure in year Y but not geologically stored or transferred to another installation in the same year, i.e. the CO_2 is in transit (i.e. in intermediate storage). In such a case, Article 49(7) allows deduction of corresponding amounts from the emissions in year Y, provided that the amount has been stored by 31 Jan Y+1 [164]. Note that this provision is only relevant if Method A is applied, as any emission from CO_2 intermediately stored would be monitored under Method B directly anyway.

Article 49(7) furthermore requires the operator of the CO_2 transport infrastructure to compile annually an inventory of the CO_2 entering and leaving the CO_2 transport infrastructure and report separately any CO_2 in transit.

Method B:

Here, emission sources are monitored individually. Under this method, the emissions of any transferred CO_2 is not monitored via the mass balance, but by monitoring all relevant emissions sources from which the transferred CO_2 is vented, leaked or released as fugitive emissions (from seals, valves, measurement devices, etc.) applying the corresponding rules set out in sections 22 and 23 of Annex IV.

$$E_{vented,leaked,fugitive} = E_{vented} + E_{leakage\ events} + E_{fugitive}$$

Where

E_{vented} ..... Amount of vented emissions [t CO_2] from CO_2 transported in the transport infrastructure;

$E_{leakage\ events}$..... Amount of CO_2 [t CO_2] transported in the transport infrastructure, which is emitted as the result of the failure of one or more components of the transport infrastructure;

$E_{fugitive}$ ..... Amount of fugitive emissions [t CO_2] from CO_2 transported in the transport infrastructure, including from seals, valves, intermediate compressor stations and intermediate storage facilities;

[163] Annex II, table defines the tiers for determining the amount of CO2 transferred under Method A

[164] Amounts not stored by 31 January have to be reported as an emission in year N, and deducted as stored in year N+1, resulting in slightly higher emissions in year N and slightly lower emissions in year N-1.

Special provisions for both Methods: CO_2 stemming from any zero-rated fuels or materials: any re-emission of CO_2 that has been captured and fed into the CO_2 transport infrastructure, either through venting, leakage or as fugitive emissions, has to be reported as emissions as if they were from fossil origin. The same applies to any CO_2 stemming from non-EU ETS sources (including from direct air capture).As counterintuitive as this seems, this is consistent with the IPCC Guidelines for compiling national GHG inventories and acknowledges the fact that the system boundaries of zero-rating emissions (i.e. the RED compliance) ends with the point in the value chain where the carbon is converted into CO_2.

The MRR gives preference to Method B as it is expected to lead to an overall lower absolute uncertainty of the CO_2 emissions. However, the operator can apply Method A if he can demonstrate that Method A would lead to more reliable results with lower uncertainty of the overall emissions, using best available technology and knowledge at the time of the application for the greenhouse gas emissions permit and approval of the monitoring plan, without incurring unreasonable costs. In any case, Method A has to be applied to corroborate results obtained by Method B at least once per year, yet at any tier available. This is to ensure that no significant amounts having been vented, leaked or released as fugitive emissions go unnoticed.

9.4.3 Monitoring of CO_2 storage

The emissions of the geological storage site can be divided in three parts:

1. The emissions from the storage complex, i.e. leakage from the site as included in the monitoring plan which is part of the permit under the CCS Directive (Directive 2009/31/EC). Monitoring and quantification of those emissions have to be included in the monitoring plan of the EU ETS permit only in the event that such leakage has been detected. As these emissions are expected to exhibit very high uncertainty, the MRR provides for an exceptional rule to add a safety margin to the measured emissions, based on the corresponding uncertainty.
2. Vented and fugitive emissions from injection: These are emissions from the CO_2 intended to be stored underground. Monitoring rules are similar to respective rules for CO_2 transport infrastructures (Method B).
3. Emissions from ancillary facilities functionally connected to the storage complex, such as CO_2 intermediate storage, booster, liquefaction, gasification, purification stations or heaters. These are to be monitored like any other EU ETS installation.

These emissions are denoted as “6” in Figure 11. It is to be noted that storage sites can also be sites at which enhanced oilfield recovery (EOR) operations take place. Section 23 of Annex IV of the MRR contains rules for this case, too.

9.4.4 Monitoring for CCU

New!

In order to monitor the amounts of CO_2 that can be deducted for CCU (denoted by "2" in Figure 11), the operator has to determine the amount of non-zero-rated[165] CO_2 that is actually permanently chemically bound in a product listed in the delegated act pursuant to Article 12(3b) of the EU ETS Directive[155] (see section 9.2). This has to be done based on a mass balance[166] of the carbon (in the form of fuels or materials, or transferred CO_2) entering and leaving the CO_2 binding process.

It is not necessary that the binding process takes place in the installation where the CO_2 originates from. Where the binding process is carried out e.g. in another location[167], the monitoring boundaries would have to be extended to this process in order to allow for the measurement and verification of the CO_2 bound. As the amount of CO_2 that can be deducted is the amount of CO_2 bound in a product (and not the amount of CO_2 captured for CCU), it is not necessary to monitor for any losses or leaks from the transport or handling of the captured CO_2. When preparing the annual emissions report, the operator will have to demonstrate to the verifier (and, upon request, to the CA) that the product actually meets the specification set out in the delegated act. This could include product specifications (e.g. carbonate content, product meeting specification of a certain type of construction material), identifying appropriate PRODCOM codes[168] of the products, written confirmation by consumers that this product will be used for the construction of buildings, etc. This process will be simpler where the operator mixed the CCU product into construction materials (e.g. cement, ceramic products) already onsite and only sells this product on the market.

Example for monitoring CO_2 actually bound:

In order to illustrate that the relevant rules, it is assumed that the CCU process shown in Figure 11 is carried out in a cement installation, which captures CO_2 emitted form the rotary kiln and binds part of it with the burnt clinker to produce carbonated aggregates in a separate process onsite. To determine the actually bound amount of CO_2, the operator will have to monitor the amount of carbon going into this process, i.e. the amount of burnt clinker going into the process multiplied with its carbon content due to un-decomposed carbonates and the amount of carbon going out from this process, i.e. the amount of carbon aggregates produced multiplied with their carbon content. The difference be-

[165] Art. 49a(1): If a mixture of zero-rated and non-zero-rated CO_2 is used for the CCU process, the operator shall only subtract from the emissions of the installation the non-zero-rated fraction of the quantity of CO_2 permanently chemically bound in a product.

[166] Article 49a(2) subsequently allows to either include the corresponding amount of CO_2 as part of an actual mass balance pursuant to Article 25, or e.g. in the conversion factor as part of the standard methodology (e.g. included in the conversion factor of raw meal in the case of a cement producer, as described in the example).

[167] It could be another EU ETS installation or a non-EU ETS installation, adjacent or not. In case of transfer to another EU ETS installation, the responsibility for the CO_2 remains with the originating installation, unless it qualifies as a raw material and therefore 'inherent CO_2', see section 8.5.

[168] In particular PRODCOMs in the NACE sectors 2351 (cement), 2351 (lime), or 2320 and 2332 (ceramics), even more for those where the definition mentions the "construction" application explicitly.

tween the ingoing and the outgoing amounts of carbon equal the amount actually chemically bound and which can be deducted from the emissions.[169] The tiers to be applied to determine the activity data and the carbon content of these source streams going into and out of the CCU process are the same ones as for any source stream in this installation, i.e. usually the highest tiers set out in Annexes II and IV for this sector. The results can be presented either in the form of an explicit mass balance in accordance with Article 25 or included as part of the conversion factor of e.g. the raw meal.

When setting up the monitoring plan, the operator has to provide a detailed description of the methodology used to monitor the quantity of permanently chemically bound CO_2. This includes the following:

- The procedures for determining whether or not a product in which the CO_2 is chemically bound and monitored in accordance with Article 49a(1) meets the requirements for being “permanently” bound as set out in the delegated act[155] and the types of uses of those products;
- A description of the calculation methodology for determining the CO_2 amounts permanently chemically bound in accordance with Article 49a(2).

[169] As can be seen, such mass balance does not require a measurement of the actually emitted emissions by CEMS.

10 BOUNDARIES BETWEEN EU ETS AND ETS2

New!

A second Union-wide emission trading system (ETS2) for road transport, buildings and additional sectors is currently being introduced[170], to become fully operational in 2027. This will oblige fuel suppliers (the ETS2 *regulated entities*) to report annually the emissions related to the combustion of the fuels they release for consumption and surrender allowances correspondingly.

The ETS2 regulated entities are expected to pass on carbon costs to their consumers downstream. Where the end consumers are EU ETS (ETS1) participants (operators of installations, aircraft operators, shipping companies) such cost pass-through would constitute double counting or a double burden on them as they would have to bear both the ETS1 and ETS2 costs. This should be avoided. The following elements contained in the updated MRR are relevant for avoiding such double counting:

- Article 75v(2) obliges ETS1 operators (i.e. the operator of a stationary installation) to report, together with their annual emissions report, information on their fuel suppliers (whether they are an ETS2 regulated entity or not) and the annual amounts of fuels acquired from each entity and consumed in the ETS1 regulated activities (Annex Xa)[171] during the reporting period.
- Therefore, point 10 of Section 1 of Annex I introduces a new provision for the ETS1 operator to include in their MP a related description of a procedure on the calculation steps for the Annex Xa information. This will include calculation methods on:
  - How to attribute fuel amounts to each regulated entity from whom fuel has been acquired; and
  - Parameters such as 'fuel used for ETS1 activities during the reporting year', which requires to separate actual consumption from 'fuel put on stock' and 'fuel exported or used for non-ETS1 purposes (e.g. for on-site vehicles)'.

ETS1 operators have to add the description of that procedure to their MPs by 31 December 2026. However, as ETS2 regulated entities require historic data for the first time already by 30 April 2025, ETS1 operators will report the Annex Xa information for the first time already by 31 March 2025 (although verification is not required). Verified Annex Xa information will be submitted by ETS1 operators for the first time in the emission reports by 31 March 2026.

For cases where there is just one supplier and no fuels are put on stock (e.g. natural gas), reporting on Annex Xa requirements will be very simple for ETS1 operators. However, for any liquid and solid fuels, in particular if received from more than one supplier, this can be more demanding. The following example shows how the distinction between used fuel, exported fuel and fuel put on stock can be made in such case.

[170] For more information, please consult the Guidance Document 1 for EU ETS 2 (https://climate.ec.europa.eu/document/download/b5ccad58-6909-4a32-8a72-c73ab8d2a165_en?filename=policy_ets_ets2_gd_regulated_entities_en.pdf)

[171] Member States may require that operators make this information available to the regulated entity concerned earlier than 31 March of the reporting year.

Example for Annex Xa reporting:

The installation receives fuel from two different suppliers, consumes most of it and puts some quantities on stock, as shown in Figure 12.

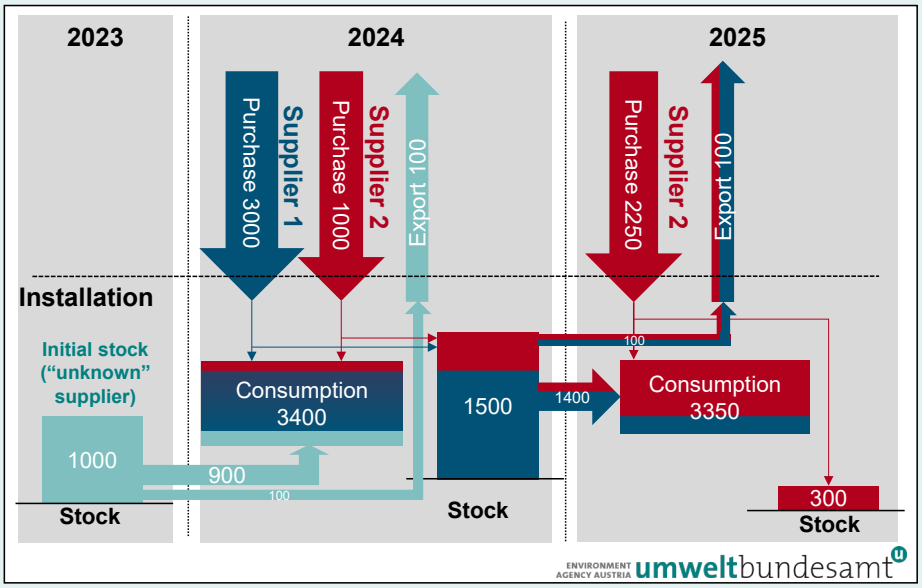

Figure 12: Example installation for Annex Xa reporting

Year 2023

The year 2023 represents the year before the historic emissions period of the ETS2 starts (i.e. reporting on 2024 emissions by 30 April 2025). At the end of 2023, the installation has 1 000 units of a specific fuel on stock (i.e. a source stream under ETS1 which corresponds to a fuel stream under ETS2). In order not to take into account any historic fuel amounts before ETS2 is even relevant, these 1 000 units should be attributed to the supplier "unknown" (or initial default).

Year 2024

In 2024, the year for which ETS2 entities will have to report their emissions in 2025, the installation purchases fuel from Supplier 1 and Supplier 2, amounting to a total purchase of 4 000 units of fuel (3 000 + 1 000, respectively). At the same time, 100 units of fuel are exported (e.g. used for non-ETS1 purposes such as mobile machinery, which is covered by the ETS2 scope), and 1 500 units of the purchase are put on stock.

The total consumption is calculated to equal 3 400 units of fuel (4 000 – 100 – 500), applying the following general calculation (see also equation (10) in section 6.1.2):

Consumption = Purchase – Export + Stock change

The ratio relative to the amounts purchased from each supplier in that year would be applied to the amounts put on stock and, consequently, to the consumed amounts as well as the amount exported, calculated as follows:

$$Ratio_{supplier\ x} = \frac{amount\ purchased_{supplier\ x}}{total\ amount\ purchased} \cdot 100\%$$

$$Amount_{export/consumption/stock} = Ratio_{supplier\ x} \cdot \text{Total } Amount_{export/consumption/stock}$$

For Supplier 1, this results in a ratio of 75% (3 000/4 000), while Supplier 2's ratio is 25% (1 000/4 000).

However, the consumption and the export follows the First-In-First-Out principle (FIFO). This means, that last year´s stock is used first and only subsequently the purchased fuels. For simplicity of calculation, a second rule is applied: The exported amount is deducted from the stock before the consumed amount. Following this logic, 100 units are exported from the 2023 stock. The remaining 900 units from the same stock are then consumed, followed by a consumption of 2 500 units (3 400 – 900) units from this year´s purchased fuel.

This means that the ETS1 installation can report to Supplier 1 that it has consumed 1 875 units (75% of 2 500 units) of the purchased fuel and to Supplier 2 that it has consumed 625 units (25% of 2 500 units) of the purchased fuel.

Furthermore **stocks** are **distinguished by year** for following the FIFO principle. It is assumed that these stocks, even though stored in the same facility, generally do not mix from an accounting perspective. As a result the 1 500 units from Supplier 1 and Supplier 2 are recorded as “stock from 2024”.

Year 2025

At the beginning of year 2025 the installation has 1 500 units on stock (1 125 from Supplier 1 and 375 from Supplier 2, according to the split ratio) from 2024. Furthermore, during this year 2 250 units of fuel are purchased only from Supplier 2. Again, 100 units are exported and there is a decrease in stock by 1 200 units to 300 units. Using the equations above the total fuel consumption equals 3 350 units of fuel (2 250 – 100 + 1200).

As in the year before the **First-In-First-Out (FIFO)** principle is applied for splitting the consumed and exported amounts by supplier and year, meaning that the oldest stock is used first. Following the second rule mentioned above, 100 units from the 2024 stock are exported first, followed by a consumption of the other 1 400 units (1 500 – 100). Those 1 400 units consumed from the 2024 stock need to be allocated to each supplier based on the 75% to 25% ratio determined for 2024. Applying this ratio, 1 050 units (75% of 1 400 units) of the 2024 stock consumed are from Supplier 1, while 350 (25% of 1 400 units) units are from Supplier 2.

Due to the consumption amounting to 3 350, the purchased fuels from Supplier 2 cover 1 950 (3 350 - 1 400) consumed units of fuel.

Hence the consumption from Supplier 1 consists of 1 050 units and for Supplier 2 consists of 2 300 units (350 + 1 950).

At the end of 2025, 300 units of fuel remain on stock, coming all from from Supplier 2 and are henceforth called the stock of 2025. This will be starting point for determining amounts consumed by supplier in subsequent years.

11 ANNEX I

11.1 Acronyms

AER .....Annual Emissions Report

AVR .....Accreditation and Verification Regulation (A&V Regulation)

CA .....Competent Authority

CCS .....Carbon Capture and [geological] Storage

CCU .....Carbon Capture and Utilisation

CEMS .....Continuous Emission Measurement System

ETSG .....ETS Support Group (a group of ETS experts under the umbrella of the IMPEL network, who have developed important guidance notes for the application of the MRG 2007)

EU ETS.....EU Emission Trading System

IMPEL .....European Union Network for the Implementation and Enforcement of Environmental Law (http://impel.eu)

MP .....Monitoring Plan

MPE .....Maximum Permissible Error (term usually used in national legal metrological control)

MRR.....Monitoring and Reporting Regulation (M&R Regulation)

MRV.....Monitoring, Reporting and Verification

MS .....Member State(s)

Permit .....GHG emissions permit

PoS .....Proof of Sustainability (issued under a certification scheme under the RED II)

RFNBO .....Renewable Fuel of Non-Biological Origin

RCF .....Recycled Carbon Fuel

SLCF.....Synthetic Low-Carbon Fuel

11.2 Legislative texts

EU ETS Directive: Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a system for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC, amended several times. Download of the consolidated version: http://data.europa.eu/eli/dir/2003/87/2024-03-01

MRR: Commission Implementing Regulation (EU) 2018/2066 of 19 December 2018 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council and amending Commission Regulation (EU) No. 601/2012. Download consolidated version: http://data.europa.eu/eli/reg_impl/2018/2066/2024-07-01 and 2024 amendment (not yet included in consolidated version): http://data.europa.eu/eli/reg_impl/2024/2493/oj

AVR: Commission Implementing Regulation (EU) 2018/2067 on the verification of data and on the accreditation of verifiers pursuant to Directive 2003/87/EC of the European Parliament and of the Council. Download of consolidated version: http://data.europa.eu/eli/reg_impl/2018/2067/2024-05-14

RED II: Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast). Download consolidated version under: http://data.europa.eu/eli/dir/2018/2001/2024-07-16

"Permanent CCU" delegated act: Commission Delegated Regulation (EU) 2024/2620 of 30 July 2024 supplementing Directive 2003/87/EC of the European Parliament and of the Council as regards the requirements for con-sidering that greenhouse gases have become permanently chemically bound in a product, http://data.europa.eu/eli/reg_del/2024/2620/oj

12 ANNEX II – FAQS

12.1 What type of costs are included in or excluded from the determination of unreasonable costs?

The last sentence of Article 18(1) of the MRR states that "*the competent authority shall consider costs unreasonable where the cost estimate exceeds the benefit.*" Besides the clarification that "*costs shall include an appropriate depreciation period based on the economic lifetime of the equipment*" there is no further definition of what kinds of costs are included or what kinds are excluded. In general, only those costs that are additional to a reference system should be taken into account, i.e. higher costs compared to existing equipment or costs of a more expensive (but more accurate or reliable) equipment less the costs of equipment that would have been purchased, i.e. without monitoring obligations under the EU ETS.

The following type of costs can be considered relevant:

- Investment costs: Those costs shall be based upon an appropriate depreciation period. Where appropriate, a suitable interest rate may be applied.
- Operating & Maintenance (O&M) costs: Those costs include costs for any outsourced calibration or maintenance. It should also include, for the sake of equal treatment, any internal labour costs related to O&M. Only those labour costs shall be taken into account for which the operator can demonstrate to the satisfaction of the competent authority that they can be clearly attributed to the improvement under consideration.
- Costs related to changes in operations: Those costs may occur e.g. if the installation of measurement equipment requires a temporary shutdown of operations. Again, only those costs shall be taken into account for which the operator can demonstrate to the satisfaction of the competent authority that they can be clearly attributed to the installation of the new equipment. If a shutdown was planned anyway, it shall not be taken into account.
- Any other costs: Those costs may include, e.g. costs of sampling, costs for additional analyses, etc.

In some cases some costs, e.g. costs related to maintenance shutdowns or instrument replacements may occur not every year. For such cases those costs should be summed up over the whole depreciation period and divided by the number of years of this depreciation period.

Example:
For assessing whether the acquisition of a measurement instrument incurs unreasonable costs, the operator wants to calculate the annual O&M costs. The depreciation period of this investment has been agreed to be 10 years. In the manufacturer's specification of the instrument it is specified that special maintenance is required every three years. Associated O&M costs are 3,000 € each. What are the annual costs of this special maintenance?
The operator determines the annual costs to be 900 €/year since this special maintenance will be necessary three times over the whole depreciation period resulting in 9,000 €. Dividing by the depreciation period of ten years provides the result. Alternatively, simply dividing those 3,000 € by three may also be an acceptable approach, where considered more appropriate, e.g. if the technical lifetime significantly deviates from the economic lifetime.

To determine whether costs can be considered unreasonable you could consider using the tool for unreasonable costs provided on DG CLIMA's homepage: https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets/monitoring-reporting-and-verification-eu-ets-emissions_en

12.2 Is it possible to apply a mass balance approach to activities, for which the MRR does not explicitly allow a mass balance approach?

No, the MRR does not allow a mass balance approach to be applied except for activities for which it is an explicitly stated option. In particular for combustion activities mass balance is only applicable if:

- The installation is a gas processing terminal (in this case Annex IV, section 1(B) allows use of a mass balance in accordance with Article 25);
- Another Annex I activity of the EU ETS Directive apart from the combustion activity is carried out and Annex IV of the MRR allows or requires the use of a mass balance in accordance with Article 25 for that specific activity; or
- The proposed mass-balance methodology is applied to de-minimis source streams only. In this case the mass balance would qualify as an allowed estimation method.

When the activity does not foresee monitoring using mass balance such an approach can in principle only be applied as a fall-back approach pursuant to Article 22. As a consequence, the operator has to check and report regularly in accordance with Article 69(1) and (3) whether the monitoring method can be improved, e.g. by installing measurement instruments. However, under specific circumstances the MRR also allows for a mass balance approach without explicitly mentioning it as such. Article 27(1), point (b) and Article 27(2), allow determination of activity data based on aggregation of metering of quantities according to the following formula (also see section 6.1.2):

$$Q = P - E + (S_{begin} - S_{end})$$

Where:

Q ..... Quantity of fuel or material applied in the period

P ..... Purchased quantity

E ..... Exported quantity (e.g. fuel delivered to parts of the installation or other installations which are not included in the EU ETS)

S_{begin} .... Stock of the material or fuel at the beginning of the year

S_{end} ..... Stock of the material or fuel at the end of the year

The application of this approach is possible if all parameters, i.e. for S_{begin}, S_{end}, P and E are referring to the same source stream.

Example 1:
An installation producing fine organic chemicals is using ethyl acetate as solvent for chemical reactions. Part of this solvent evaporates during the reaction and is combusted in an incinerator connected to the exhaust hood. The rest of the solvent is sold ("exported from the installation") containing only minor contaminants

with negligible impact on changing NCV or EF. In this case the amount of ethyl acetate burned in the incinerator is determined by level readings from the storage tanks, the purchased amounts and the amount sold. Therefore, this monitoring approach is fully in line with the requirements of Article 27(1) point (b).

Example 2:
An installation similar to example 1 is also using other solvents. Now a mixture of these solvents is exported from the installation. Mixing solvents impacts the NCV and EF. Due to this interdependency between the activity data and other calculation factors, the materials entering and leaving the installation cannot be considered *one* source stream. Therefore this fuel / material balance cannot be considered to be covered by Article 27(1) point (b). Hence, a mass balance monitoring approach can only be used here if the installation is approved to apply it as a fall-back monitoring methodology under Article 22 or all the solvents involved fall within the de-minimis threshold.

12.3 How to determine unreasonable costs when applying no-tier (fall-back) monitoring approaches for activity data?

General considerations

According to Article 22 of the MRR a no-tier (fall-back) monitoring approach can only be applied if "*applying at least tier 1 under the calculation-based methodology [..] and a measurement-based methodology [..] is technically not feasible or would incur unreasonable costs*".

Please note that the term "at least tier 1 under the calculation-based methodology" implies that a no-tier approach is already applied for one source stream if not at least tier 1 is applied for one single parameter, i.e. the activity data or any calculation factor, except for de-minimis source streams. Therefore, a fall-back methodology should only be applied to the specific part(s) of the calculation or measurement-based methodology that does not meet at least tier 1. E.g. to the extent possible, available default values should be used for calculations and the no-tier approach should be limited to the parameters where no such factors are available.

Example 1:
The amount of CO_2 emitted from a refinery gas source stream cannot be determined by applying tiers due to unreasonable costs. Due to the availability of default values for NCV and EF in Annex VI (compliant with tier 1) the operator should apply a no-tier approach only for activity data. Only where the operator can demonstrate to the satisfaction of the competent authority that the default values are not applicable (e.g. because they apply to another type of refinery gas composition), an estimation methodology for calculating directly the emissions by other means may be developed.

Activity data

For fall-back monitoring approaches for activity data it has to be assessed first if the methodology applied really constitutes a no-tier approach. It can be distinguished between:

(c) Activity data is determined in accordance with Article 27[172] (i.e. continuous metering or aggregation of metering of quantities) but the uncertainty related to the measurement is higher than the uncertainty allowed under tier 1, OR

(d) Activity data is not determined in accordance with Article 27. Note here that not complying with the requirements in this Article means that you don't comply with any tier. Therefore, any such methodology has to be considered as a fall-back approach and can only be applied if the application of at least tier 1 is not technically feasible or would incur unreasonable costs.

For (a) please be aware that an indirect measurement of activity data, e.g. by addition or subtraction of two or more fuel/material flows or batches can also be considered as complying with Article 27. For determination of the applied tier for such cases rules for error propagation must be applied (see Annex III of MRR GD4 on Uncertainty). If the uncertainty achieved complies at least with the relevant tier 1 requirements the determination of activity data is not a fall-back approach.

If assessment shows that the approach is actually a fall-back approach, it has to be demonstrated that applying at least tier 1 of a "conventional" tier approach is technically not feasible or would incur unreasonable costs. For the determination of the incurrence of unreasonable costs when applying at least tier 1 for activity data it has to be assessed whether the costs exceed the benefit. In order to calculate the benefit the difference between the uncertainty currently achieved and the uncertainty threshold of the tier must be used as the improvement factor. This approach is relevant regardless whether (a) or (b) is the reason for deviation because both have a direct impact on the accuracy of activity data. The improvement factor of 1% in Article 18(3) shall not apply here. Therefore, the uncertainty related to the determination of activity data currently achieved has to be assessed in any event and has to be used for calculating the improvement factor.

Note that the higher (the worse) the uncertainty achieved by a fall-back approach the more likely it is that the costs do not exceed the benefit, i.e. the more difficult it will be to demonstrate unreasonable costs. This is the case because the improvement factor feeding into the calculation will be higher. Improving the monitoring methodology of a fall-back approach in terms of reducing its associated uncertainty (e.g. by applying a better estimation method) may lead to a lower (better) uncertainty achieved. As a consequence, costs for meeting at least tier 1 (using measurement equipment to determine the activity data) may more likely be unreasonable after such improvement.

Example 2 (assessing whether the approach proposed is to be considered a fall-back):

[172] Article 27(1): "The operator shall determine the activity data of a source stream in one of the following ways:

(a) based on continual metering at the process which causes the emissions;

(b) based on aggregation of metering of quantities separately delivered taking into account relevant stock changes.

A fine organic chemical plant is burning contaminated organic solvents in an incinerator with a heat recovery boiler (see the example in section 12.2). Installing a measurement instrument for the solvent flow (minor source streams) would incur unreasonable costs. The operator proposes calculating the activity data by an energy balance taking into account the measurable heat (i.e. steam) produced and the energy input from natural gas used for auxiliary firing. This approach is clearly not complying with the requirements of Article 27 and should be considered as a fall-back approach. In this case the operator will have to demonstrate pursuant to Article 22 that the application of at least tier 1 is not technically feasible or would incur unreasonable costs.

Note: Pursuant to Article 22(b) the operator has to assess and quantify each year the uncertainties in accordance with the ISO guide to the expression of uncertainty in measurement (JCGM 100:2008), or another equivalent internationally accepted standard. Furthermore, the operator must demonstrate that the uncertainty for the total emissions of the installation is below 7.5% (the threshold for a category A installation under Article 22(c)). For calculating the uncertainty for the total emissions of the installation please consult “Example 9” of Guidance Document 4 on Uncertainty.

12.4 To what extent are the tier requirements for minor source streams different to those for major source streams?

In accordance with Article 26(1) the required tiers are:

- at least the tiers listed in Annex V for category A installations, or where a calculation factor of commercial standard fuels,
- the highest tier as defined in Annex II for all other cases.

Operators may deviate from applying those tiers where they are technically not feasible or would incur unreasonable costs (a tier one level lower than required for category C installations and up to two levels lower for category A and B installations, with a minimum of tier 1). Under certain conditions even lower tiers, with a minimum of tier 1, may be allowed by the Competent Authority.

Article 26(2) specifies for minor source streams that the highest tier which is technically feasible and does not incur unreasonable costs, with a minimum of tier 1, shall be applied. Therefore, also for minor source streams the use of a tier lower than the required tier is allowed only if the operator demonstrates to the satisfaction of the competent authority that the required tiers are technically not feasible or would incur in unreasonable cost. Please note that no reference is made here that there are any further derogations from paragraph 1. Therefore, for category A installations and commercial standard fuels tiers in Annex V are also to be considered as the required tiers for minor source streams.

As a consequence, the main difference between the tier requirements for major and for minor source streams is that there is no threshold or time limit when deviating from the tier requirement. In any event this is true if at least tier 1 is applied and applying the required tiers is technically not feasible or would incur unreasonable costs (see examples below).

Example 1: Category B or C installation, liquid fuel

	Tier required (highest tier in Annex II)	Minimum tier (technically not feasible or unreasonable costs)	Absolute minimum tier (transitional period to be agreed with the CA)
Major	**4**	**3 (for Cat. C)** **2 (for Cat. B)**	**1**
Minor	**4**	**1**	**n.a.**

Example 2: Category A installation, liquid fuel

	Tier required (Annex V)	Minimum tier (technically not feasible or unreasonable costs)	Absolute minimum tier (transitional period to be agreed with the CA)
Major	**2**	**1**	**n.a.**
Minor	**2**	**1**	**n.a.**

12.5 Is it possible to apply tier 2a for net calorific value (NCV) and tier 2b for emission factor (EF) or vice versa for the same fuel?

No, unless the EF is consistent with the use of NCV and the corresponding oxidation factor

Tier 2a and 2b are considered to be on the same accuracy level in the MRR, hence there is no preference to choose one or the other. Furthermore, there is no provision that the same tier, i.e. tier 2a or 2b or another tier, has to be applied for NCV and EF for the same fuel.

However, Article 24(1) states: "*Under the standard methodology, the operator shall calculate combustion emissions per source stream by multiplying the activity data related to the amount of fuel combusted, expressed as terajoules based on net calorific value (NCV), with the corresponding emission factor, expressed as tonnes CO_2 per terajoule (t CO_2/TJ) consistent with the use of NCV, and with the corresponding oxidation factor.*"

If the NCV or EF contradict this principle, this approach is not allowed. To avoid such inconsistency please contact your competent authority regarding background information on certain default values (e.g. values from the National Inventory used for tier 2a) or the IPCC Guidelines (tier 1).

12.6 What does "additional effort" mean in case of de-minimis source streams or for installations with low emissions?

When reading the MRR the term "additional effort" is encountered three times:

- Article 26(3): *For de-minimis source streams, the operator may determine activity data and each calculation factor by using conservative estimates instead of using tiers, unless a defined tier is achievable without additional effort.*
- Article 26(5): *Where the competent authority has allowed the use of emission factors expressed as t CO_2/t or t CO_2/Nm^3 for fuels, and for fuels used as process input or in mass balances in accordance with Article 25, the net calorific value may be monitored using a conservative estimate instead of using tiers, unless a defined tier is achievable without additional effort.*
- Article 47(6): *By way of derogation from Articles 26(1) and 41(1), the operator of an installation with low emissions may apply as a minimum tier 1 for the purposes of determining activity data and calculation factors for all source streams and for determining emissions by measurement-based methodologies, unless higher accuracy is achievable without additional effort for the operator, without providing evidence that applying higher tiers is technically not feasible or would incur unreasonable costs*.

In all three cases "additional effort" means effort in addition to monitoring systems or monitoring methodologies already in place. This usually refers to systems or methodologies already in place before considering improvements, or, where appropriate, if there were no EU ETS monitoring obligations. Therefore, it should not be considered to incur an additional effort to use available data for a second purpose (i.e. GHG emissions monitoring), including any associated administrative or bureaucratic effort (e.g. writing procedures or providing evidence).

Example 1:
An installation with low emissions is covered by the EU ETS from 2013 onwards because of its production of bulk organic chemicals. For quality assurance and for commercial purposes the installation is analysing (indirectly) the carbon content[173] of each source stream involved in the reaction in accordance with Articles 32 to 35, i.e. compliant with tier 3 for the determination of the carbon content. Although eligible to apply tier 1 under Article 47(6), compliance with tier 3 in effect requires no additional effort because it is already being met. The requirement to provide a sampling plan to the Competent Authority may be caused only by the EU ETS monitoring obligations, but it should not be considered to cause additional effort because it requires only to lay down in writing what is already done.

Example 2:
The customers of this same installation are now only requiring that the main compound of the product exhibits a purity of > 95 %. Due to the fluctuation of the

[173] *Explanation of the term "indirect analyses":* It is frequently found that the purity of substances must be regularly analysed before the input materials can be used for the process, or before the products can be sold. These are analyses which are done already without an EU ETS obligation. For this example we assume that the purity of the substances are analysed by a suitable method, e.g. HPLC. Furthermore also the nature of the main impurities are known. In many cases the impurities are predominantly water or other solvents. Thus, as soon as the purity and the type of substances are known, the carbon content can be determined by stoichiometry. This is what we refer to as "indirect analysis" in the example. A "direct" analysis would be an elementary analysis for determining the (total) carbon content. The "additional effort" here is the mere application of one additional stoichiometric calculation, which can be easily assumed negligible effort.

production process, the impurities are not constant and not identified for quality assurance. In this case, the analytical results cannot be considered to comply with the requirements of Articles 32 to 35. Full compliance would require a more demanding analytical method and should therefore be considered as requiring additional effort. As a consequence, the operator will not be required to apply tier 3 but to use available default values instead. However, note that the lower the purity the less appropriate it will be to assign this product to a certain material for which default values are available. If default values are not available, the operator will have to propose a fall-back approach demonstrating that improving his analytical method would otherwise incur unreasonable costs.

12.7 How to determine the oxidation factor by taking into account the carbon content of ashes?

The annual emissions are calculated by:

$$Emissions = FQ \cdot NCV \cdot EF \cdot OF$$

where:

FQ..... Quantity of fuel [t]

NCV .... Net calorific value [TJ/t]

EF ..... Emission factor [t CO_2/TJ]

OF..... Oxidation factor

There are two possible approaches to calculate those annual emissions:

(a) Emissions are calculated for each batch or delivery period the analytical value is representing. The total emissions are obtained by adding up all emissions calculated.

(b) Determine annual weighted averages for each calculation factor and calculate the annual emissions according to the formula above.

Where not all calculation factors represent the same batch or delivery period, method (a) will not be applicable. For this case the following example gives guidance on the calculation route (b).

Example:
An operator is burning lignite. Each analytical value for NCV and EF determined in accordance with Articles 32 to 35 is representative for each batch of lignite. Note that the EF will be calculated from the carbon content (CC) and the NCV (f=3.664[174]) according to:

$$\boxed{EF = CC \cdot f / NCV}$$

The OF is determined by analysis of the carbon content of the ash and by the amount of ash obtained upon combustion in accordance with Articles 32 to 35 as well. The oxidation factor will be obtained by:

[174] Article 36(3): "*For the conversion of the carbon content into the respective value of a CO_2 related emission factor or vice versa, the operator shall use the factor 3.664 t CO_2/t C.*"

$$OF = 1 - \frac{CC_{ash} \cdot Quantity_{ash}}{CC_{fuel} \cdot Quantity_{fuel}}$$

The batches of ash used for analysing their carbon content do not correspond necessarily with the fuel batches. Still, Annex VII requires to also analyse the OF at least six times per year. Therefore, the OF can be calculated as follows.

Batch	FQ [t]	NCV [GJ/t]	EF [t CO_2/TJ]	CC [t C/t]	FQ x CC [t C]
1	20,000.00	11.9	101.6	0.3300	6,600
2	22,000.00	12.1	101	0.3335	7,338
3	25,000.00	11.95	101.3	0.3304	8,260
4	21,000.00	12.06	101.8	0.3351	7,037
5	23,000.00	11.85	102.3	0.3309	7,610
6	24,000.00	11.9	101.5	0.3297	7,912
7	23,000.00	11.93	102.2	0.3328	7,654
8	24,000.00	11.91	101.6	0.3303	7,926
				Sum (=total amount of carbon in lignite)	**60,335**

Batch	Q_{ash} [t]	CC_{ash} [t C/t]	Q_{ash} x CC_{ash} [t C]
1	1,589	0.0207	32.9
2	1,900	0.0180	34.3
3	2,108	0.0193	40.7
4	1,573	0.0243	38.3
5	1,764	0.0203	35.8
6	2,073	0.0229	47.4
		Sum (=total amount of carbon in ash)	**229.4**

The weighted average annual NCV is calculated by:

$$NCV = \frac{\sum_i NCV_i \cdot FQ_i}{\sum FQ} = 11.95 \frac{GJ}{t}$$

The weighted average annual EF is calculated by:

$$EF = \frac{\sum_i EF_i \cdot NCV_i \cdot FQ_i}{\sum_i NCV_i \cdot FQ_i} = 101.66 \frac{tCO_2}{TJ}$$

The weighted average annual OF is calculated by:

$$OF = 1 - \frac{CC_{ash} \cdot Quantity_{ash}}{CC_{fuel} \cdot Quantity_{fuel}} = 1 - \frac{229.4}{60{,}335} = 99.62\,\%$$

The annual emissions are calculated by:

$$Emissions = 182{,}000 \cdot 11.95 / 1{,}000 \cdot 101.66 \cdot 99.62\% = 220{,}260\ tCO_2$$

In principle, this approach for determining OF is based on a mass balance, but not based on Article 25 of the MRR. Therefore, the quantity of ash is not considered a separate source stream and no dedicated uncertainty thresholds apply. However, as a result of analogy, operators should strive to apply an uncertainty level similar to the tier level which would be required, if the ash were a source stream of its own. It must be noted that in most cases such “ash source stream” would be a de-minimis source stream. The appropriate method for determining the ash amount, and therefore the associated uncertainty, will be taken from suitable standards. For sampling and analysing Articles 32 to 35 (requirements for analyses) apply.

Note that alternatively the oxidation factor can be determined using the carbon content of the ash and ash content of the fuel (AC_{fuel}, %) instead of determining the amount of ash. This alternative does not require the ash quantity to be measured, only the percentage ash content of the fuel and carbon content of the resultant ash.

$$OF = 1 - \frac{CC_{ash} \cdot AC_{fuel}}{CC_{fuel}}$$

The ash content of a fuel is commonly obtained by a loss on ignition method where the fuel is burned until no more mass loss is observed. However, for this method burning of the fuel is done under laboratory conditions which may lead to different results than the fuel combustion in the boiler (e.g. due to different particle sizes and morphology as well as different retention times). On the other hand, accurate measurement of ash quantity can be problematic if water is used to convey (and cool) the ash. Therefore, preference should be given to the method giving higher accuracy and the operator has to ensure that emissions are not underestimated.

12.8 How are emissions to be calculated if the emission factor (EF) and net calorific value (NCV) are based on analyses per batch?

The calculation is done according to the formula presented in section 12.7 above. Based on the figures used in the example in that section, the calculation of EF and NCV are done as follows. For simplicity reasons it is assumed that the oxidation factor is 1, i.e. any carbon contained in ashes is not deducted.

Batch	FQ [t]	NCV [GJ/t]	Energy input (FQ x NCV) [TJ]	EF [t CO_2/TJ]
1	20,000.00	11.90	238.00	101.6
2	22,000.00	12.10	266.20	101.0

3	25,000.00	11.95	298.75	101.3
4	21,000.00	12.06	253.26	101.8
5	23,000.00	11.85	272.55	102.3
6	24,000.00	11.90	285.60	101.5
7	23,000.00	11.93	274.39	102.2
8	24,000.00	11.91	285.84	101.6
Sum or weighted average	182,000.00	11.95	2,174.59	101.66

The weighted average annual NCV, and subsequently the weighted average annual EF, can be calculated by the following equations:

$$NCV = \frac{\sum_i NCV_i \cdot FQ_i}{\sum FQ} = \frac{20{,}000t \cdot 11.90\frac{GJ}{t} + 22{,}000t \cdot 12.10\frac{GJ}{t} + ...24{,}000t \cdot 11.91\frac{GJ}{t}}{182{,}000t} = 11.95\frac{GJ}{t}$$

$$EF = \frac{\sum_i EF_i \cdot NCV_i \cdot FQ_i}{\sum_i NCV_i \cdot FQ_i} = \frac{101.6\frac{t\,CO_2}{TJ} \cdot \frac{11.90\frac{GJ}{t}}{1{,}000} \cdot 20{,}000t + .. + 101.6\frac{t\,CO_2}{TJ} \cdot \frac{11.91\frac{GJ}{t}}{1{,}000} \cdot 24{,}000t}{2{,}174.59TJ} = 101.66\frac{t\,CO_2}{TJ}$$

12.9 Application of Article 31(4); clarification on how to apply the 1% rule

Article 31(4) states that "*upon application by the operator, the competent authority may allow that the net calorific value and emission factors of fuels are determined using the same tiers as required for commercial standard fuels provided that the operator submits, at least every three years, evidence that the 1 % interval for the specified calorific value has been met during the last three years.*"

An operator may now demonstrate to the competent authority that based on analyses in the past the NCV or EF of a specific fuel was determined to be within this 1% interval. This may be done by calculating twice the standard deviation (a 95% confidence interval) of those historic values and check whether it is lower than 1%. However, as Article 31(4) requires provision of evidence at least every three years, an operator will have to start sampling and analysing again for the following three years to demonstrate that the 1 % interval is not exceeded. Note that such homogeneous fuels may only require lower frequencies of analyses than listed in Annex VII due to application of the 1/3-rule or the incurrence of unreasonable costs.

The most common cases for application of this Article will be fuels or materials used by many operators, exhibiting such constant values for NCV or EF within one Member State or region. In some countries natural gas will meet such requirements and reliable historic analytical values will be available from e.g. network distribution owner data on a Member State or regional level. **Operators of category B and C installations will then be allowed as well to apply e.g. tier 2a by using values from the National Inventory instead of analysing themselves.**

It can be considered good practice by CAs to publish the relevant findings on the 1% interval and respective default values for common fuels or materials, such that all operators concerned can make use of Article 31(4) without making their own investigation. In particular for default values determined for their use in the National Inventory CAs may have a better knowledge about any regional deviations than a single operator.

12.10 Article 26(3): What does a conservative estimate mean in practice, what does it look like? Are there any generic figures that could be used, for example emissions from a typical diesel back-up generator?

Please see "GD 4a: Exemplar for Uncertainty Assessments" on DG CLIMA's homepage (see section 2.3), which describes inter alia an installation with low emissions using Diesel.

12.11 Does an operator of an installation with low emissions have to submit improvement reports?

Yes, but only under certain circumstances. Operators of installations with low emissions must submit an improvement report in accordance with Article 69(1) and in response to a verifier's report noting non-conformities. They also have to take into consideration the verifier's recommendations in their monitoring, but are exempted from having to provide a corresponding improvement report (under Article 69(4)) to the competent authority in this particular respect, as allowed by Article 47(3).

Articles 69(1) and (2) require all operators to submit an improvement report if the tiers required by Article 26(1) are not met. The MRR does not differentiate between low emitters and other categories with regard to use of highest tiers. However, Article 47(6)[175] exempts installations with low emissions from the requirements in Articles 26(1) and 41(1) and allows application of tier 1 as a minimum.

Therefore, operators of installations with low emissions must submit an improvement report:

- in response to verifier's findings of non-conformities (Article 69(4)), AND
- every five years (category A installation) if they are applying fall-back approaches (Article 69(3)). Under certain circumstances this period can be extended, but for category A it does not exceed 5 years (see section 5.7).

[175] Article 47(6): "*By way of derogation from Articles 26(1) and 41(1), the operator of an installation with low emissions may apply as a minimum tier 1 for the purposes of determining activity data and calculation factors for all source streams and for determining emissions by measurement-based methodologies, unless higher accuracy is achievable without additional effort for the operator, without providing evidence that applying higher tiers is technically not feasible or would incur unreasonable costs.*"

12.12 Does the determination of unreasonable costs require the use of a depreciation period? How is it determined and how should evidence be provided?

For the determination of unreasonable costs the second subparagraph of Article 18(1) requires that the operator "*shall include an appropriate depreciation period based on the economic lifetime of the equipment.*"

The economic lifetime is a term that is not defined in the MRR but refers to its meaning used in taxation laws. For a lot of assets (e.g. measuring instruments) national taxation laws or supplementing guidance (e.g. published by the respective Ministry of Finance) provide asset-specific depreciation periods for several economic sectors.

Nevertheless, those values are not legally binding for the EU ETS but may be considered as reference values. The operator's justification for proposing a different depreciation period may be taken into account, e.g. where a measuring instrument is used in a corrosive environment.

12.13 Do CO_2 emissions stemming from the purification of natural gas have to be monitored and reported?

They have to be monitored and reported only if the CO_2 is released in a combustion process by using either a standard combustion methodology or a mass balance methodology, where a calculation-based monitoring approach is applied or by using CEMS. This means that there is no monitoring and reporting requirement for CO_2 that is part of the imported raw natural gas but is at no point in the process fed into a combustion process. In the simplest case, CO_2 contained in any natural gas will be reported by including this CO_2 when determining the emission factor for applying it in a standard calculation method.

In upstream industries, the situation is slightly more complex: Natural gas usually requires several purification steps after extraction to meet the specifications of the gas network operator. Those purification steps are normally done in a gas processing terminal and involve e.g. gas separation from liquid organic compounds and water. If the CO_2 or H_2S (hydrogen sulphide) concentration (acid gas) exceeds the thresholds of the gas network operator's specification, a removal of those impurities is also required. This is most commonly achieved by separating those acidic gases from the main organic components in the natural gas by an amine treatment system. In subsequent steps the CO_2 and H_2S are separated from each other as well. H_2S will generally be converted into saleable products (e.g. to sulphur in a CLAUS unit)[176] and the gas flow containing very high CO_2 concentrations will be released to the air.

This gas flow containing CO_2 in high concentrations often also contains some VOC (volatile organic carbon) impurities and therefore cannot be released directly to the atmosphere without a thermal conversion of those VOCs. Because this

[176] Note: The H_2S enriched gas flow may still contain a significant concentration of CO_2. If this gas flow is also fed into a combustion unit (e.g. CLAUS unit), this CO_2 needs to be monitored and reported as well.

conversion is an oxidation of fuels this conversion qualifies as combustion within the meaning of Article 3(t) of the EU ETS Directive[177], and the off-gas is regarded a fuel. As a consequence, the CO_2 contained in this fuel is inherent CO_2 according to Article 48[178] and needs to be monitored and taken into account for the emission factor of this fuel.

It has to be noted that gas processing terminals are normally covered by the EU ETS due to their combustion activities > 20 MW (e.g. steam production for the purification process) and there is no special activity unlike for liquid fuel refineries. However, section 1 of Annex IV also provides the opportunity for combustion processes taking place in gas processing terminals to be monitored by a mass balance methodology in accordance with Article 25. In this case, the CO_2 emissions may simply be calculated as the difference between the amount of natural gas imported by the installation multiplied by the corresponding carbon content and amount of natural gas exported from the installation multiplied by the corresponding carbon content.

12.14 Do fuels stored in pressurised gas-bottles (e.g. propane, acetylene, etc.) and used for certain process steps within the installation have to be monitored and reported?

In principle, yes they have to be monitored regardless of whether the fuel is stored in tanks, in pressurised gas-bottles or is directly imported from an external fuel network (e.g. natural gas). It is only relevant in which technical unit those fuels are used and whether those units have a technical connection with the activities carried out on that site[179]. If those units are stationary and have a technical connection with the activities carried out (e.g. laboratory units), they have to be included in the greenhouse gas permit. Hence all fuels combusted in those units must be listed as source streams in the monitoring plan.

12.15 Do non-significant source streams (e.g. with single digit annual emissions) and mobile sources need to be covered by the Monitoring Plan?

Yes, all source streams need to be covered by the permit and the monitoring plan. There is no threshold laid down in the MRR with respect to the annual emissions stemming from each source stream.

---

[177] Article 3(t) of the EU ETS Directive: "*combustion means any oxidation of fuels, regardless of the way in which the heat, electrical or mechanical energy produced by this process is used, and any other directly associated activities, including waste gas scrubbing*".

[178] Article 48: "*Inherent CO_2 that is transferred into an installation, including that contained in natural gas, a waste gas (including blast furnace gas or coke oven gas) or in process inputs (including synthesis gas), shall be included in the emission factor for that source stream.*"

[179] Article 3(e) of the EU ETS Directive: "*installation means a stationary technical unit where one or more activities listed in Annex I are carried out and any other directly associated activities which have a technical connection with the activities carried out on that site and which could have an effect on emissions and pollution*".

In contrast to that, mobile sources are in general excluded. In section 2.3.1 of the "Guidance on Interpretation of Annex I of the EU ETS Directive (excl. aviation activities)"[180] it is clarified that "*Excluded from the EU ETS is "true" mobile machinery (trucks, forklifts, bulldozers...), i.e. machinery which has the purpose of being mobile at the moment of performing its tasks*." For instance, mobile flares have to be monitored and reported because is it not their purpose being mobile at the moment of performing its tasks. For further explanation please consult the abovementioned Annex I guidance.

For emissions from non-significant sources related to stationary units it may not be necessary to report emissions from individual emission sources, where these can be grouped into combined source streams (i.e. by fuel type).

Example 1: Natural gas is supplied to site via a main site gas meter; the gas is consumed by a number of emission sources including boilers, canteen equipment and laboratory units. In this case the emission sources can be grouped into one source stream and fuel consumption determined via the single gas meter.

Example 2: A number of emergency generators are fuelled by gas oil; the generators may only be used for very small periods and so annual emissions are low. Gas oil for the generators is taken from a storage tank which is used to supply fuel to a number of other emission sources at the installation. Fuel consumption for reporting purposes can therefore be based on deliveries and/or stock tank measurements for this source stream.

In the case of small emission sources which cannot be grouped as they use unique fuel streams then the monitoring approach should be appropriate to the scale of emissions. It is likely that very small sources will fall into the de-minimis category and therefore under the Monitoring and Reporting Regulation a no tier approach may be applied using a conservative estimation method.

Example 3: Small heating units supplied from propane cylinders; this is the only use of propane at the installation and represents a de-minimis source stream. Emissions are determined using a conservative estimation method based on the number of cylinders purchased each year.'

12.16 What is the difference between flares and post-combustion units?

Identifying relevant units correctly impacts the effort which is necessary to comply with the monitoring requirements in the MRR. Fuels combusted in post-combustion units, also often named incinerators, need to be monitored like all other fuels in combustion units whereas for flares less stringent requirements apply. Nevertheless, there is no clear legal definition of flares and post-combustion units, neither in the EU ETS Directive nor in the MRR.

However, the definition of safety flaring in Article 2(13) of the free allocation rules Regulation (2019/331) can be used as a suitable starting point for this distinction. In this Article safety flaring is defined as *"the combustion of pilot fuels and highly*

[180] https://ec.europa.eu/clima/sites/default/files/ets/docs/guidance_interpretation_en.pdf

fluctuating amounts of process or residual gases in a unit open to atmospheric disturbances which is explicitly required for safety reasons by relevant permits for the installation".

In other words, flaring can be considered as safety flaring if all three following conditions are met:

1. The flaring is required for safety reasons (in particular if required by a relevant permit), AND
2. The combustion takes place in a unit open to atmospheric disturbances (the combustion in other units is not covered), AND
3. The amounts and/or composition of process or residual gases are highly fluctuating.

This definition implies that the predictability of the combustion activity is a relevant parameter for the distinction. Flaring is often encountered for processes in which combustible gas flows are transported under high pressure through ducts for chemical reaction (e.g. production of polyethylene from pressurized ethylene gas) or purification (e.g. refineries).

However, the MRR does not distinguish between flaring and safety flaring. For flaring other than safety flaring often the criterion of high fluctuations is not met. Therefore, criteria 1 and 3 above can only serve as indicators but the focus of the assessment should be on criterion 2.

For further reading, please consult Guidance Document 8 accompanying the free allocation rules. This document can be downloaded from the following website: **https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets/free-allocation_en**

All other post-combustion processes not meeting the above-mentioned specifications can be considered as post-combustion units, in particular combustions not taking place in a unit open to atmospheric disturbances[181]. Post-combustion is often encountered in processes where the combustible gas is transported using a carrier gas (e.g. solvents for the production of fine organic chemicals, solvents in painting resins, etc.) in combustion units which are not open to atmospheric disturbances. Note that units equipped with a heat recovery steam generator are indicating that this unit is not open to atmospheric disturbances and are therefore to be considered as post-combustion units.

12.17 How to report emissions from mixed (fossil-biomass) materials

How should the fossil and biomass-related emissions of the following (hypothetical) mixed fuel be determined and reported? An installation produces mixed pellets before using them in a boiler that was formerly fired by coal.

The Installation uses the following raw materials for producing the pellets:

- Plastic waste (mostly polyethylene) – 25% of the total input by weight, fossil.

[181] Note that this also includes "shrouded flares", i.e. flares where combustion is "open to atmospheric disturbances" but a shroud is provided to hide the flame.

- Imported forest residues (small cut branches from hard wood) – 40% of input by weight. The operator receives these residues from a cheap source in a third country without evidence whether the land-related sustainability criteria are met. Therefore the operator has to consider them as non-sustainable biomass.
- Residues (bark) of locally harvested wood – 35% of input by weight; certified by a voluntary scheme, therefore counted as sustainable biomass and zero-rated.

The input materials have the following properties:

Raw material	Fossil or biomass?	Input to Mix	Moisture (water content)	C content (dry) t C / t fuel	NCV (dry) GJ / t
Polyethylene	fossil	25%	0%	86%	40.2
Hard wood residues	non-sust. biomass	40%	30%	50%	18
Wood wastes (bark)	sustainable biomass	35%	45%	46%	17

During processing to pellets, the mixture is dried such that the wood components contain only 8% water in the end (the polyethylene is assumed to remain completely dry). The operator calculates the properties of the components in the final pellets as follows:

Dried Mixture	Content in mix	Moisture	C content	NCV GJ / t	EF t CO_2 / TJ
Polyethylene	32.7%	0%	86.0%	40.2	78.4
Hard wood residues	39.9%	8%	46.0%	16.4	102.8
Wood wastes (bark)	27.4%	8%	42.3%	15.4	100.6

Note: For this calculation it is taken into account that the total mass decreases due to the drying. Therefore the relative quantities of the materials in the mix change. For calculating the NCV based on the moisture content, the following equation is used:

$$NCV = NCV_{dry} \cdot (1 - w) - \Delta H_v \cdot w$$

Where NCV_{dry} is the NCV of the absolute dry material, w is the water content (mass fraction) and $\Delta H_v = 2.4 GJ/t\ H_2O$ is the evaporation enthalpy of water.

Using the above individual components, the operator can calculate the emissions and energy input from 1000t of these pellets; The percentage in the total emissions can be used to calculate the carbon content percentage attributed to each component:

		Emissions t CO_2	Energy TJ	% of emissions = % of C content
Polyethylene	fossil	1030.4	13.1	48.4%
Hard wood residues	non-sustaina-ble Biomass	672.5	6.5	31.6%
Wood wastes (bark)	Sustainable Biomass	424.7	4.2	20.0%
Total		**2127.6**	**23.8**	**100%**

In the annual emission report the operator may choose to report these three components separately, which has the advantage of transparency and avoiding the need to calculate with different moisture contents. Instead, the operator may use directly emission factor and NCV of the moist (as received) biomass.

Alternatively, there is also the possibility to calculate weighted carbon content / emission factor and NCV from the final pellets (in particular useful if e.g. the operator also sells part of the pellets and wants to inform the customers of their properties).

From the above, the operator may calculate (using f = 3.664 t CO_2/tC):

- The weighted NCV = 23.8 GJ/t pellets
- Carbon content: CC = 2127.6 t / 1000 t / f = 58.1%
- Weighted emission factor EF = CC × f / NCV = 89.39 89.39 t CO_2 / TJ

Using these calculation factors and the percentages of the fossil and biomass fractions given in the previous table, the operator can fill the annual emissions report using one single source stream:

1	F1. Solid - Other solid fuels; Mixed plastic/Wood pellets			Combustion		CO2 fossil:	1.702,0	t CO2e
	Combustion: Solid fuels					*CO2 bio:*	*425,5*	*t CO2e*

		Tier	tier description	Unit		Value		error
iii.	AD:	3	± 2,5%	t			1.000,00	
iv.	(prelim) EF:	2a	Type II default values	tCO2/TJ			89,39	
v.	NCV:	2a	Type II default values	GJ/t			23,8	
vi.	OxF:	1	Default value OF=1	-		100,00%		
vii.	ConvF:							
viii.	CarbC:							
ix.	BioC:	2	Type II biomass fraction	-			20,00%	
x.	non-sust. BioC:	2	Type II biomass fraction	-			31,60%	

12.18 How do Installations for Municipal Waste Incineration have to monitor emissions?

New!

As of the start of 2024, installations for the incineration of municipal waste[182] exceeding 20 MW[183] are included in the EU ETS with an obligation for monitoring, reporting and verification only. With respect to the general monitoring rules, the MRR does not contain any special provisions for the monitoring of emissions from municipal waste incineration (MWI). In other words, the same requirements apply as for any e.g. natural gas or fuel oil that is combusted in this installation. This is similar to other sorts of waste that are already included in the EU ETS, such as waste combusted in cement plants or scrap material used in (non-)ferrous metal production. The tier requirements therefore only depend on the categories of the installation and the respecive source stream or emission source, respectively.

This means that MWI installations, like any other combustion installation, can monitor emissions either by a calculation-based or a measurement-based approach as follows:

- **Calculation-based approach** (see section 4.3.1): Here the municipal waste would constitute one or more source stream(s). For larger installations (category B and C) the NCV and EF would have to be determined via sampling and analysis (Tier 3). Some installations (or waste suppliers) may already perform such analyses anyway for analysing the content of other substances. In such cases, it will be mostly a matter of preparing the appropriate sampling plan and submit it to the CA as part of the MP approval. However, sampling municipal waste can be more costly than sampling common fossil fuels due to health and safety issues, and due to its very heterogeneous nature. If applicable, it is for the operator to demonstrate unreasonable costs or technical infeasibility to be allowed to use lower tiers. Category A installations may apply the tier 2a default values (consistent with the national GHG inventory) even without having to demonstrate unreasonable costs. In order to make appropriate tier 2a default values available, Member States should publish such on their website, potentially having to take into account that the smaller installations may use different sorts of municipal waste than the larger ones.
- **Measurement-based approach** (see section 8.1): For the monitoring obligations under the Industrial Emissions Directive (IED), most (if not all) MWI installations will already apply CEMS. However, while this will include monitoring the concentration of air pollutants (NO_x, SO_x, etc.), it may not include the concentration of CO_2 yet, and maybe also not the volumetric flow. In particular the latter can be quite costly. Furthermore, due to the higher fluctuations of the flue gas as compared to using standard fuels, finding appropriate CEMS instruments that allow compliance with the required tiers set out in Table 1 of Annex VIII can be more difficult. As in all other cases, the MRR requires to carry out the appropriate uncertainty assessment to demonstrate the uncertainty that can be achieved, but allows deviation from the required tiers where the operator can demonstrate unreasonable costs.

[182] As defined in Article 3 point (2b) of Directive 2008/98/EC

[183] For identification of those installations see Guidance Document 0 as referenced in section 2.3.

In contrast to the requirements for all other installations, MRR Article 68(4) requires competent authorities to submit annual emissions reports of MWI installations by 30 April each year to the Commission. This will apply for the first time by 30 April 2025 for reporting year 2024.

12.19 How do MWI installations have to determine the zero-rated biomass fraction?

New!

This is similar to the determination of the biomass fraction as for all other source streams (see section 6.3.6) and emission sources (see section 8.2). However, for municipal waste the RED II criteria do not apply and the opeartor would just have to demonstrate the waste is indeed municipal waste (e.g. according to the applicable waste codes). The biomass fraction can therefore be determined as follows, subject to the required tier:

- **Calculation-based approach:**
  - Tier 3 Sampling & Analysis, e.g. in accordance with EN 15440;
  - Tier 2: Propose an estimation method for CA approval (e.g. the “balance method” below);
  - Tier 1: Default values, such as published by the Member State (e.g. consistent with national GHG inventories), historic analyses which are still representative, etc.
- **Measurement-based approach**: Article 43(4) allows to subtract biomass emissions:
  - Based on source streams (see above), i.e using a calculation-based method;
  - “Continuous sampling” from the flue gas (not continuous measurement): EN ISO 13833 (“Stationary source emissions – Determination of the ratio of biomass (biogenic) and fossil-derived carbon dioxide – Radiocarbon sampling and determination”). The minimum frequency of analysys is every 50 000 tonnes of total CO_2, but at least once a month.
  - The “balance method”, which is an estimation method in MRR terminology (based on ISO 18466 “Stationary source emissions – Determination of the biogenic fraction in CO_2 in stack gas using the balance method”);
  - Estimation methods published by the Commission (not available yet).

12.20 How should sugar factory lime be monitored?

New!

In sugar factories, limestone is burnt for use in a purification process for the raw sugar solution resulting from the extraction of sugar beet, i.e. to remove proteins and other impurities from that sugar solution. The quick lime resulting from the burning process is added to the solution, whereafter the CO_2 from the burning process is also added to the process. While chemically this is similar to the production of PCC (precipitated calcium carbonate, a relatively pure calcium car-

bonate), this process results in “SFL” (Sugar Factory Lime), which contains significant impurities as result of the process for which it was used. In addition, this SFL is often of high moisture.

As a result of the updated rules on the definition of emissions and non-permanent CCU (see section 9.3), the process emissions from the calcination of limestone must now be monitored and reported. This would follow the general rules for monitoring process emissions (method A or B) in the lime sector (MRR Annex II, section 4 and Annex IV section 10; for guidance see this document section 4.3.1).

However, this general approach may be difficult for some installations, as usually there is no bespoke metering of the limestone or burnt lime quantity, or analysis for determining the conversion factor. In order to allow for the relevant CO_2 emissions to be determined despite the difficulties, an approach based on the quantity of SFL sold or otherwise exported from the installation may be considered. For that approach based on method B (output-based), the monitoring of the following is required:

- Determination of the quantity of SFL;
- Determination either of the CaO content of SFL, or determination of the water content and the quantity of impurities of the SFL, assuming that the rest of the SFL consists of CaO;
- Assumption of the conversion factor in the lime burning process to be conservatively 1.

12.21 How should the conservativeness of zero-rated emissions in mass balances be determined?

New!

Article 25(3) of the MRR requires that in the case of a mass balance approach and use of a zero-rated input, emissions must be conservative, i.e. the zero-rated amount of emissions must not be over-estimated, which in turn means that zero-rated carbon remaining in products or other output source streams must not be under-estimated. The following example should illustrate this situation:

In a blast furnace, 40% (in terms of carbon content) of coke are replaced by charcoal from a RED II certified biomass supplier. Hence, if no carbon remained in the pig iron, 40% of the emissions would be zero-rated. However, pig iron contains 4 to 5% of carbon. For being conservative, this carbon leaving the mass balance should be zero-rated *at least* to be 40% like the carbon in the inputs. This would qualify as an ‘estimation method’ as allowed for under Tier 2 for determination of the biomass fraction. For a more precise treatment, a ^{14}C analysis would be required (Tier 3a). In absence of such analysis, using the same fraction as for the inputs will be reasonable.

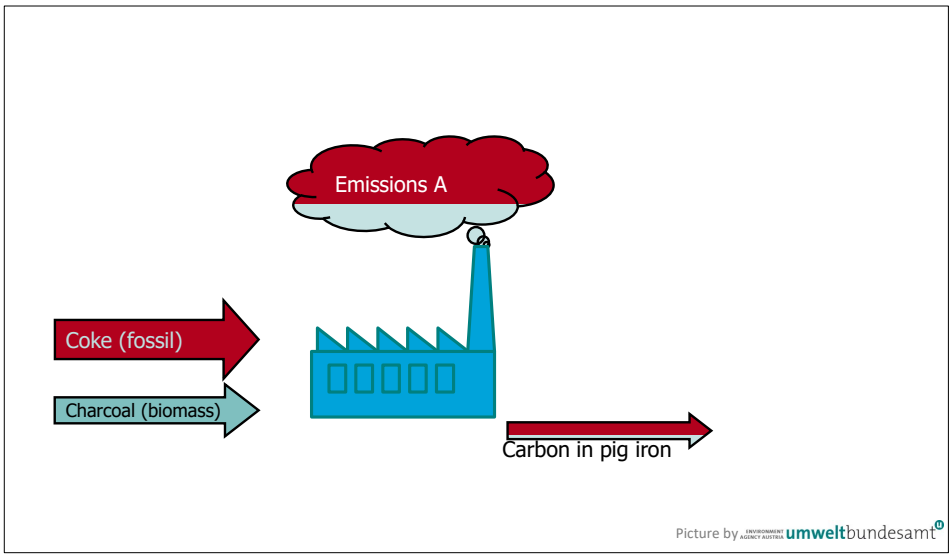

Figure 13: Simple example for mass balance with zero-rated carbon

In such fictitiously simple pig iron production (Figure 13), the calculation of the mass balance would work as follows:

$\text{Carbon input}_{total} = CC_{coke} \times M_{coke} + CC_{charcoal} \times M_{charcoal}$

$\text{Zero-rated fraction of input: } ZF_{input} = CC_{charcoal} \times M_{charcoal} \text{ / Carbon input}_{total}$

$\text{Carbon input}_{zero\text{-}rated} = \text{Carbon input}_{total} \times ZF_{input}$

$\text{Carbon Output}_{total} = CC_{pig\ iron} \times M_{pig\ iron}$

For determining conservative zero-rated emissions, the zero-rated fraction of output would be set identically to the zero-rated fraction of inputs. The result is then:

$\text{Carbon Output}_{zero\text{-}rated} = CC_{pig\ iron} \times M_{pig\ iron} \times ZF_{output}$

Which gives the resulting emissions:

$\text{Emissions}_{prelim.} = f \times (\text{Carbon input}_{total} - \text{Carbon output}_{total})$

$\text{Emissions}_{zero\text{-}rated.} = f \times (\text{Carbon input}_{zero\text{-}rated} - \text{Carbon output}_{zero\text{-}rated})$

If in this example waste gases are exported to an adjacent installation (Figure 14), these waste gases are another output source stream, containing inherent CO_2. However, they are in nature very similar to emissions. It seems appropriate to assign to them the same zero-rated fraction as to the emissions. This would also avoid the discussions whether the emissions of the CO_2 producing or receiving installation should be more conservative.

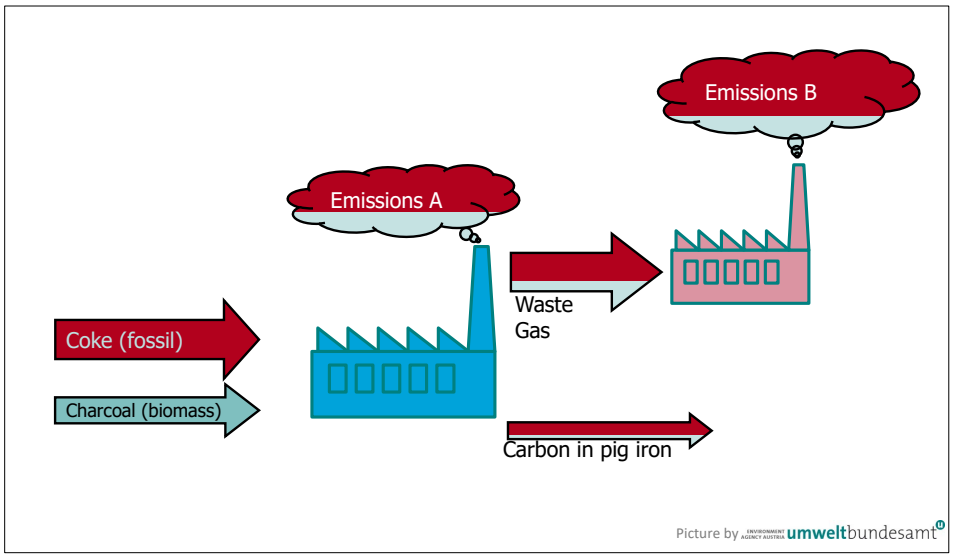

Figure 14: Simple example for mass balance with zero-rated carbon and export of waste gases to an installation B.

The emissions would now have to be calculated for installation A as follows:

$$\text{Carbon Output}_{total,A} = CC_{pig\ iron} \times M_{pig\ iron} + CC_{waste\ gas} \times M_{waste\ gas}$$

The zero-rated fraction would be the same as above.This gives the resulting emissions of installation A:

$$\text{Emissions}_{prelim.} = f \times (\text{Carbon input}_{total} - \text{Carbon output}_{total,A})$$

$$\text{Emissions}_{zero\text{-}rated.} = f \times (\text{Carbon input}_{zero\text{-}rated} - \text{Carbon output}_{total,A} \times ZF_{input})$$