EUROPEAN COMMISSION
DIRECTORATE-GENERAL
CLIMATE ACTION
Directorate C - Climate strategy, governance, and emissions from non-trading sectors
CLIMA.C.2 - Governance & Effort Sharing

EU ETS Monitoring and Reporting –
Training on Operator's Sampling Plans

M&R Training Event Webinar of 20th June 2017

This document comprises training material for competent authorities and verifiers for the checking of uncertainty assessments according to Commission Regulation (EU) No. 601/2012 of 21 June 2012 on the monitoring and reporting of greenhouse gas (GHG) emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council (the MRR)[1].

[1] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:181:0030:0104:EN:PDF

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1. LEGAL BACKGROUND

Article 33(1) MRR requires the operator to submit to the CA a sampling plan for each fuel and material where calculation factors are determined by analyses. This has to be in the form of a written procedure containing information on the following elements:

- Methodologies for the preparation of samples
- Responsibilities
- Locations
- Frequencies
- Quantities
- Methodology for the storage and transport of samples

This legal framework is supported by the following guidance documents:

- Guidance Document 5
  https://ec.europa.eu/clima/sites/clima/files/ets/monitoring/docs/gd5_sampling_analysis_en.pdf
- Guidance Document 5a
  https://ec.europa.eu/clima/sites/clima/files/ets/monitoring/docs/ex_5a_sampling_plan_en.pdf
- FAQs regarding Monitoring and Reporting
  https://ec.europa.eu/clima/sites/clima/files/ets/monitoring/docs/faq_mmr_en.pdf

2. OBJECTIVE

Experience and feedback from discussions in the EU ETS MRVA Support Technical Working Group (TWG) and the EU ETS Compliance Forum M&R Task Force had shown that the sampling plan is an area where Member States (MS) and CAs would most welcome training.

The M&R training event webinar of 20th June 2017 aimed to provide training for representatives from the EU ETS Competent Authorities (CAs) (and, by cascade, other stakeholders including verifiers) with focus on the role of sampling plans required in accordance with Commission Regulation (EU) No 601/2012 (the Monitoring & Reporting Regulation). The importance of sampling plans will be emphasised, in particular as a tool in support of an effective and efficient monitoring methodology.

Furthermore, this training event aimed to provide a better understanding of:

- The MRVA requirements concerning sampling (plans)
- The fundamentals and statistical principles of source stream sampling
- What a “representative” sample means
- The importance of describing the sampling, handling and storage over the whole trail from drawing a sample up until its analysis
- Available standards for sampling of common source streams
- Experience and common practices in Member States with Competent Authorities and verifiers checking of sampling plans
- Role and responsibilities of verifiers regarding operator sampling plans

An additional objective for this training event was that it should allow for further cascade to other MS and verifier audiences based on the case studies and this document.

3. PROGRAMME OF THE TRAINING ON 20TH JUNE 2017

Sampling and analysis in the MRR

- Tiers for calculation factors
- Provisions in Articles 32 to 35
- Use of (non-)accredited laboratories, demonstration of equivalence
- Reasons for derogation

Sampling requirments / Content of sampling plans

- Introduction to relevant terminology and parameters
- Sampling techniques and statistical considerations
- What is a “representative sample” (role of data quality and uncertainty)
- Available standards for common source streams
- Trail from sampling to analysis (handling, storage,…)
- Demonstration of the example in Guidance Document 5a

Checking compliance of sampling plans – CA perspective

- Required documents and evidence for approving MPs
- What should the CA look for in sampling plans? Best practices on how to check sampling plans
- Availability of documents / limitations
- Required time effort and expertise

Role of the verifier

- Legal requirements in the AVR
- Competence requirements and relevant standards (e.g. EN ISO 14065)
- What should a verifier look for in sampling plans? Best practices on how to check sampling plans
- Availability of documents / limitations
- Required time effort and expertise

Presentation:
Sampling and analysis in the MRR

by Christian Heller

- Tiers for calculation factors
- Provisions in Articles 32 to 35
- Use of (non-)accredited laboratories, demonstration of equivalence
- Reasons for derogation

M&R Training
Sampling Plans

Christian HELLER

Compliance Forum M&R Training Event Webinar
Brussels, 20 June 2017

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Agenda

Time	Session	Who
13:00 – 13:15	Opening, welcome and agenda	DG CLIMA
13:15 – 13:45	Introduction to sampling and analysis in the MRR	Christian Heller
13:45 – 14:45	Requirements for sampling plans	Christian Heller
14:45 – 15:00	*Tea break*	
15:00 – 15:30	Checking compliance of sampling plans	Presenters from CAs (DE, IE, UK)
15:30 – 16:00	Role of the verifier	Machtelt Oudenes / Lucy Candlin
16:00 – 16:15	Concluding remarks and next steps	DG CLIMA / consultants
16:15 – 16:30	Close of the meeting	DG CLIMA

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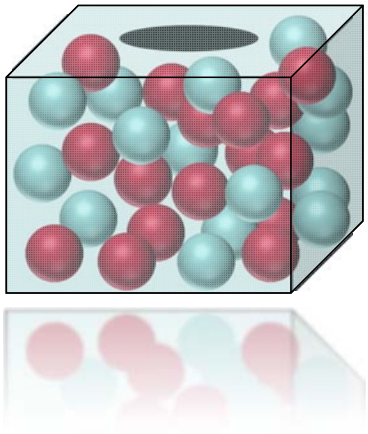
Introduction to sampling
What is it about?



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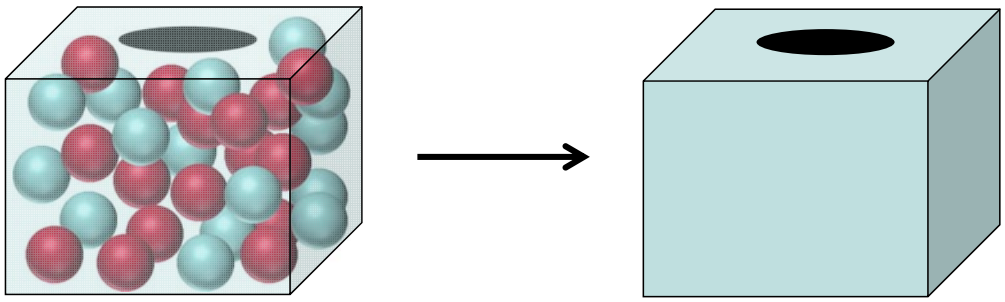
Let's assume a box with red and green balls in it



But you cannot see what really is inside

Claim: There is exactly the same number of red and green balls in the box

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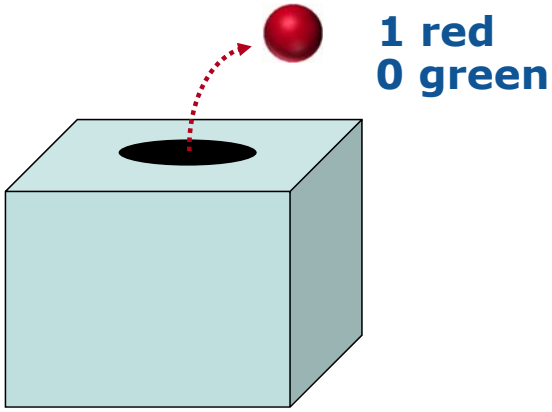
You pick out just 1 single ball



So is the claim false?

You would probably say 1 ball is not "representative", wouldn´t you?

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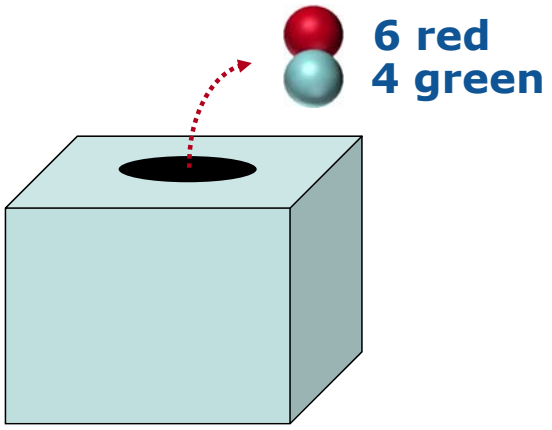
What if you drew 10 balls?



Would that raise any suspicion?

Conversely, would a 50%/50% result after 10 balls have made you trust the claim?

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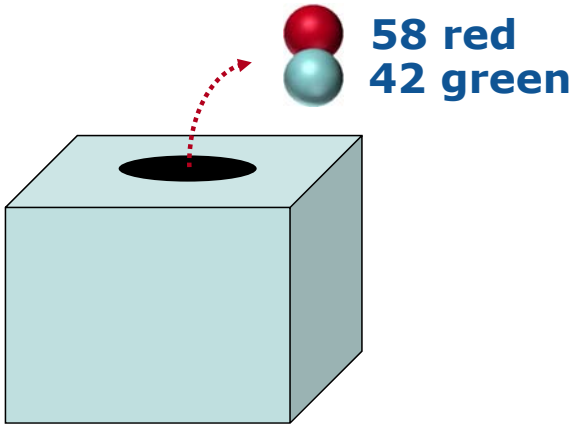
What if you drew 100 balls?



Would that raise any suspicion?

Conversely, would a 50%/50% result after 100 balls have made you trust the claim?

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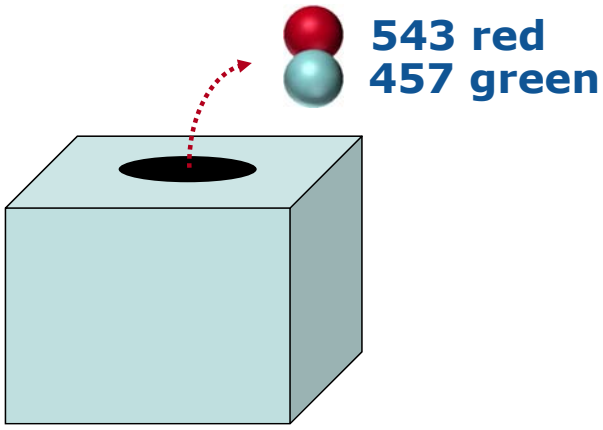
What if you drew 1 000 balls?



Does that raise any suspicion?

Conversely, would a 50%/50% result after 1 000 balls have made you trust the claim?

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Some looming questions…

- *How many balls would you want to draw?*
- *How close to / far off 50% does it have to be (not) to trust the claim?*
- *How would you draw the balls (samples)?*
- *..?*

Aim of this training webinar

- *Provide a better understanding of:*
  - The MRVA requirements concerning sampling (plans)
  - The fundamentals and statistical principles of source stream sampling
  - What a “representative” sample means
  - The importance of describing the sampling, handling and storage over the whole trail from drawing a sample up until its analysis
  - Available standards for sampling of some common source streams
- *Sharing experience and common practices of CAs and verifiers regarding operator sampling plans*
- *Provide stand-alone training material for (new) staff*

Legal background – M&R Regulation

- ***When do operators have to prepare sampling plans?***
  - When MRR makes **reference to Art. 32 to 35** (general tier 3) (main reason and focus of this training)
- ***Other occassions where sampling plans are relevant***
  - Tier 1 - **MRR Article 31(1)(e):** "values based on analyses carried out in the past, representative for the future"
  - Tiers referring to **industry best practice** (e.g. glass, non-carbonate carbon in clinker raw meal)
  - Tier 2b – **established proxies**

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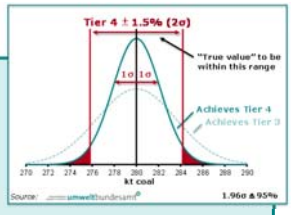
Calculation factors

- *Combustion emissions:* $Em = FQ \cdot NCV \cdot EF_{pre} \cdot (1 - BF) \cdot OF$
- *Process emissions:* $Em = AD \cdot EF \cdot CF$
- *Mass balance emissions:* $Em_{MB} = \sum_i \left(f \cdot AD_i \cdot CC_i \right)$



- *Tiers for activity data (e.g. fuel/material quanitity) → different levels of uncertainty*
- *Tiers for **calculation factors** → either*
  - *default values, or*
  - *values obtained by **sampling & analysis***

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Data quality levels - Tiers

Covered by training on 31 May 2016

Example: coal						
Parameter	**Tier 1**	**Tier 2**	**Tier 2a**	**Tier 2b**	**Tier 3**	**Tier 4**
FQ	± 7.5%	± 5.0%			± 2.5%	± 1.5%
NCV	Type I default values		Type II default values	Purchasing records	**Lab analysis**	
EF	Type I default values		Type II default values	Established proxies	**Lab analysis**	
OxF	OxF =1		Type II default values		**Lab analysis**	

Main focus of this training

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Article 32

- *Provides for a **hierarchy of standards***
  1. EN standards
  2. ISO standards
  3. National standards
  4. Draft standards, industry best practice guidelines or scientifically proven methodologies
- *Result of analysis only **valid for delivery period or batch** which samples represent*
- *Sets out rules for **online gas chromatographs/analysers***

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Article 33

- *A **sampling plan shall be submitted to the CA** in form of a written procedure containing the following information:*
  - *Methodologies for the preparation of samples*
  - *Responsibilities*
  - *Locations*
  - *Frequencies*
  - *Quantities*
  - *Methodology for the storage and transport of samples*
- *Derived samples have to be representative (for batch or delivery period) and free of bias*
- *Agreement required with the laboratory carrying out the analysis*
  - Sampling plan to be adapted if analysis shows higher heterogeneity

Article 34

- *Laboratories used to carry out analyses for the determination of calculation factors shall be accredited in accordance with **EN ISO/IEC 17025** for the **relevant analytical methods***
- *If laboratories not accredited are used the operator has to provide evidence that:*
  - Access of accredited laboratories would incur unreasonable costs or is technically not feasible
  - The laboratory meets requirements equivalent to EN ISO/IEC 17025 → demonstrating quality management and technical competence
  - Simplification for installation with low emissions: may use any laboratory that is technically competent → only demonstrate equivalence for quality assurance

➢ *Laboratories engaged need to be accredited or demonstrate equivalence*

Article 34

- *Equivalence* - ***Quality management***
  - E.g. if in conformity with EN ISO/IEC 9001, or other certified quality management systems that cover the laboratory
  - In the absence of such certified QM systems, the operator shall provide other appropriate evidence that the laboratory is capable of managing in a reliable manner its personnel, procedures, documents and tasks
- *Equivalence* - ***Technical competence***
  - Guidance Document 5 provides a non-exhaustive list of elements for checking equivalence (**https://ec.europa.eu/clima/policies/ets/monitoring_en#tab-0-1**)

Article 34

- *Simplification for* ***installations with low emissions***
  - may use any laboratory that is technically competent (able to generate technically valid results and provides evidence for quality assurance) and provides evidence for QA (Art. 34(3))
    - QA for calibration and test results (incl. regular participation in proficiency testing schemes, applying analytical methods to certified reference materials, or inter-comparison with an accredited laboratory)
  - In many cases not relevant because installations with low emissions often do not have to apply the highest tier

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Article 35

- ***Frequency of analysis***
- *General: Minimum frequencies as listed in **Annex VII** MRR to be applied*
- ***Reasons for derogation:***
  - A frequency based on analytical variation of results that is no more than **1/3 of the uncertainty** value of the corresponding activity data tier
  - Unreasonable costs

- *Frequencies of sampling must not be confused with frequencies of analyses*
- *Derogations from minimum frequencies possible → cost-efficiency*

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Annex VII – Minimum frequency

Fuel/material	Minimum Frequency of Analyses
Natural gas	At least weekly
Other gases, in particular synthesis gas and process gases such as refinery mixed gas, coke oven gas, blast-furnace gas, convertor gas	At least daily - using appropriate procedures at different parts of the day
Fuel oil (for example light, medium, heavy fuel oil, bitumen)	Every 20 000 tonnes and at least six times a year
Coal, coking coal, petroleum coke, peat	Every 20 000 tonnes and at least six times a year
Other fuels	Every 10 000 tonnes of fuel and at least four times a year
Untreated solid waste (pure fossil or mixed biomass fossil)	Every 5 000 tonnes and at least four times a year
Liquid waste, pre-treated solid waste	Every 10 000 tonnes and at least four times a year
Carbonate minerals (including limestone and dolomite)	Every 50 000 tonnes and at least four times a year
Clays and shales	Amounts of material corresponding to 50 000 tonnes of CO_2 and at least four times a year
Other materials (primary, intermediate and final product)	Depending on the type of material and the variation, amounts of material corresponding to 50 000 tonnes of CO_2 and at least four times a year

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Article 35 – Reasons for derogation

- ***The "1/3" rule:***
  - Example: category B inst. burning fuel oil
  - Activity data has to comply with tier 4 (u=1.5%)
  - Historical NCV: u=1%

$$n = \frac{u_i^2}{u_{\text{total}}^2} \qquad n = \frac{1.0\%^2}{0.5\%^2} = 4$$

  - **Result:** "1/3" rule allows for minimum frequency of analysis of 4 per year
  - Commission has published "Frequency of Analysis Tool" on its website

https://ec.europa.eu/clima/policies/ets/monitoring_en#tab-0-1

# of sample	NCV [GJ/t]
1	42.28
2	42.41
3	42.35
4	42.68
5	42.44
6	42.40
7	42.68
8	42.60
9	42.02
10	42.33
11	42.41
12	42.20
average	**42.40**
Uncertainty u_i	**1.00%**

- ***Unreasonable costs*** $C < P \cdot AEm \cdot IF$ IF...1% P...20€/t CO_2

Demonstrating compliance

- ***Art. 33(1):*** *Operator to submit a sampling plan*
- *Further relevant Articles to comply with in this regard:*
  - **Annex I(1)(2f):** Description of the procedure underpinning the sampling plan and procedure to revise appropriateness of the sampling plan
  - **Art. 14(2)(b)**: Operator to modify MP in case of changes to sampling & analyses (S&A) methods
  - **Art. 15(3)(i):** Significant change to MP if new S&A procedures are being introduced → CA approval required

Demonstrating compliance

- *If analytical results are obtained from the supplier, does the operator have to perform S&A as well?*
  - No, provided the supplier performs S&A in accordance with **Art. 32 to 35** and provides the operator with **sufficient evidence**
  - The **responsibility** for compliance with the MRR **remains with the operator,** who has the obligation to **exert control on this outsourced process** (Art. 58(3)(f) and 64)
- *What kind of information is considered **"sufficient evidence"**?*
  - Supplier needs to provide a **sampling plan complying with Art. 33**
  - Information about the applied **S&A standards**
  - Information about applied **QA/QC measures** (internal procedures, control measures, internal/external auditing results...)
  - ...

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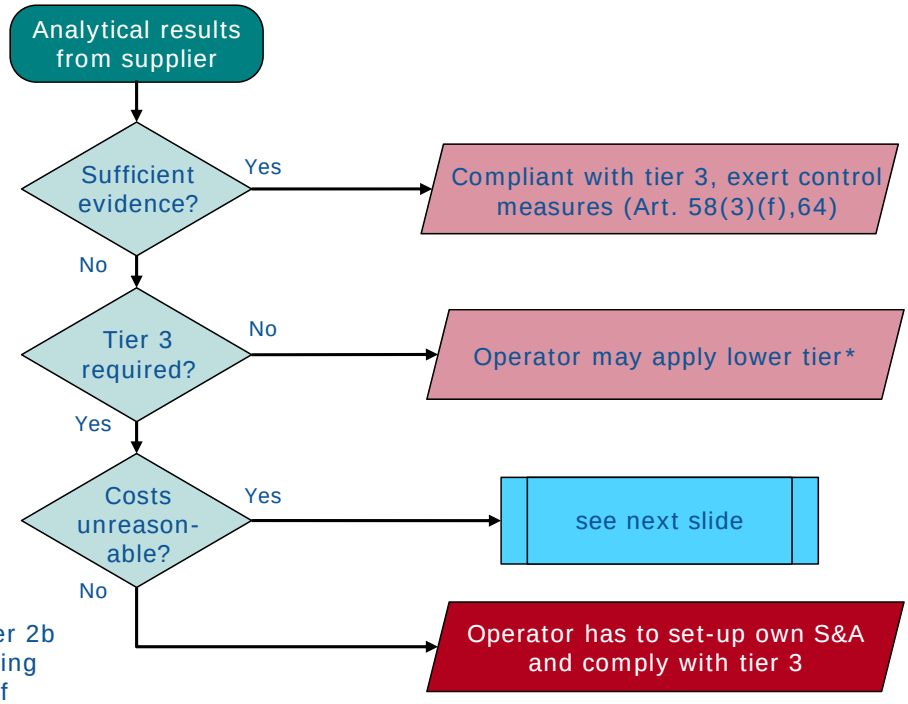
Demonstrating compliance

What if the supplier does not provide the operator with sufficient evidence for demonstrating compliance with Art. 32 to 35?



* e.g. for commercially traded fuels tier 2b allows to derive the NCV from purchasing records provided by the fuel supplier, if based on accepted standards

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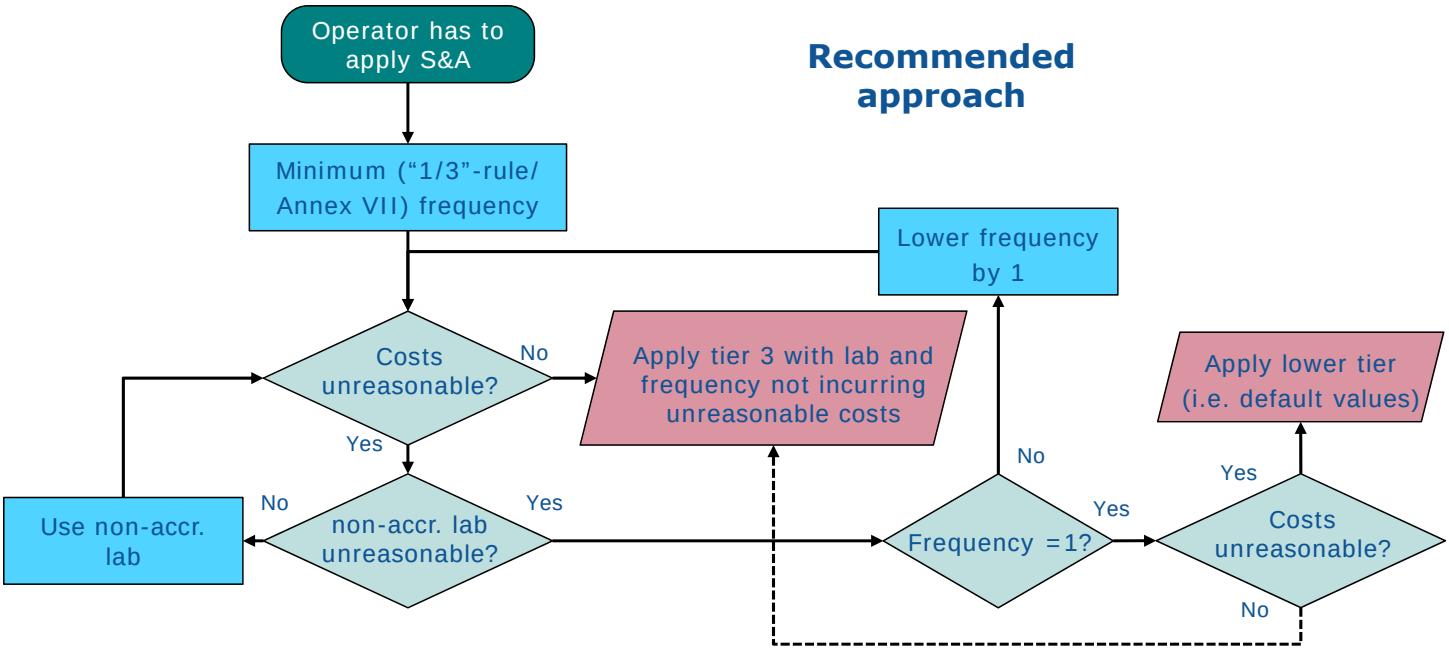
Demonstrating compliance operator

How to proceed if Articles 32 to 35 incur unreasonable costs?



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Demonstrating compliance

- *Can a sampling plan lead to unreasonable costs?*
  - In general, there is **no** sampling (& analysis) without a sampling plan; just like unreasonable costs do not provide for monitoring without an approved monitoring plan
  - BUT: costs associated with the sampling plan (establish, implement, maintain, review appropriateness…) can be taken into account → result can be e.g. lower frequency of analysis or lower tier to be applied, but not sampling without a sampling plan

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Demonstrating compliance

- *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 material".*
- *What information should the operator provide to demonstrate that results are still representative for the future?*

- *Historic sampling plan*
  - *since the analyses were done in the past, there may not have been a sampling plan compliant with Art. 33*
    → use best available data/information
- *Standards applied*
- *Historic analytical values (standard deviation,..)*
- *Where does the fuel/material arise from?*
- *What is the composition of the fuel/material?*
- *...*

Demonstrating compliance

- ***Established proxies**: Methods based on **empirical correlations** as determined at least once per year in accordance with the requirements applicable for laboratory analyses → rather complicated analyses are carried out once per year considered lower level than full analyses. The proxy correlations may be based on:*
  - **density measurement** of specific oils or gases, incl. those common to the refinery or steel industry, OR
  - **net calorific value** for specific coal types

- *Operator should provide information (at least upon request):*
  - *An appropriate sampling plan*
  - *A list of standards applied*
  - *Information about the correlation function*
  - *...*

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Demonstrating compliance

- *Tiers referring to „**Industry best practice**“*

> - *It may not be appropriate or possible to apply Articles 32 to 35 in full*
> - *However, CA may consider 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 that provides evidence for quality assurance measures and corrective actions, if needed, as referred to in Article 34(3)*
>   - *The operator should submit a sampling plan in accordance with Article 33*
>   - *The operator should determine the frequency of analysis in accordance with Article 35*

Questions?

Where to find more information?

Regulation No. 601/2012 (MRR)
http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1462274244220&uri=CELEX:02012R0601-20140730

Guidance Documents on European Commission's website
https://ec.europa.eu/clima/policies/ets/monitoring_en#tab-0-1
in particular Guidance Documents 5 and 5a

Presentation:
Sampling requirments /
Content of sampling plans

by Christian Heller

- Introduction to relevant terminology and parameters
- Sampling techniques and statistical considerations
- What is a “representative sample” (role of data quality and uncertainty)
- Available standards for common source streams
- Trail from sampling to analysis (handling, storage,…)
- Demonstration of the example in Guidance Document 5a

Sampling requirements

- *This section largely follows the general outline of CEN/TR 15310-1 on sampling of waste material*
- *Why? Waste comprises a large variety of (non-gaseous) fuels and materials*
- *Therefore, this technical report is considered as a good basis to describe the principles of sampling with the goal of preparing an appropriate sampling plan*

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Preparing a sampling plan

1. ***Specify objective***
   - e.g. to determine the annual average carbon content of the annual amount of coal consumed, or
   - to monitor & report emissions from coal in compliance with the MRR
2. ***Develop technical goals***
   - Define (sub-)population
   - Assess variability
   - Select sampling approach
   - Identify scale
   - Choose statistical approach
   - Choose reliability
3. ***Determine practical instructions***
   - Choose sampling pattern
   - Determine increment/sample size
   - Use of individual or composite sample
   - Determine required number of samples

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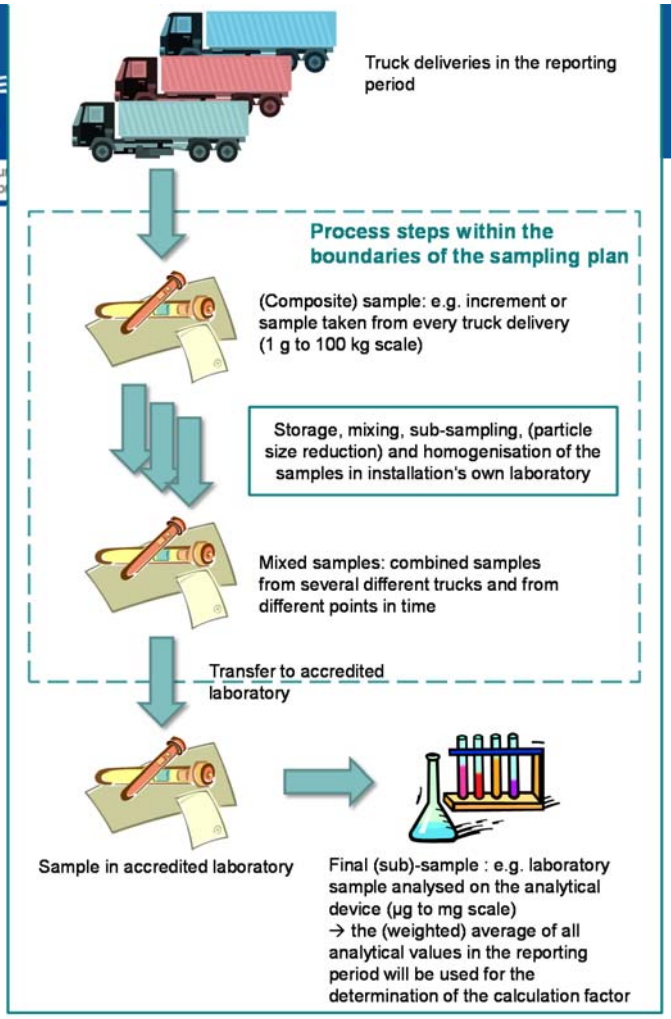
Sampling plan boundaries



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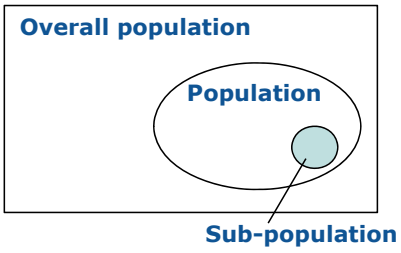
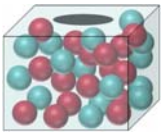
European Commission

Population



- *Statistical term for defining the total volume of material about which information is required through sampling*
- *Example:*
  - **Population:** Total amount of coal consumed over the year
  - **Sub-population ex. 1:** Amount of coal consumed in June
  - **Sub-population ex. 2:** One train delivery (batch) of coal
  - **Sub-population ex. 3**: Amount of coal in a stockpile accessible from the top inspection platform



Ball example:
Population: the whole box
Sub-population: (the top layers, if you are not allowed to mix)

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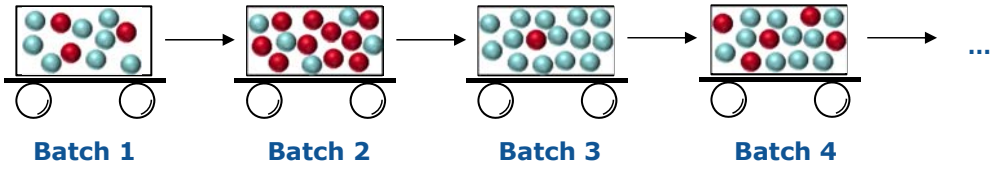
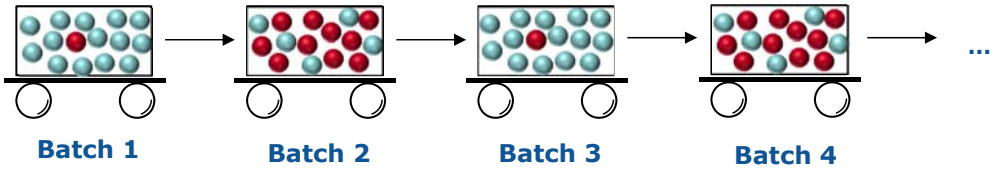
Temporal variability

Random



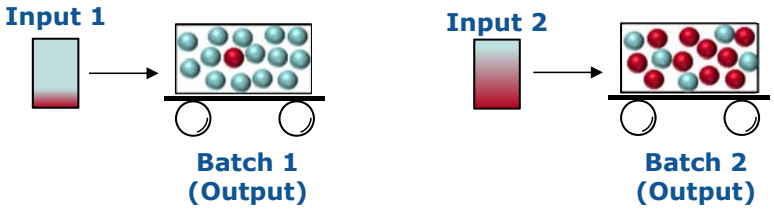
Cyclic

e.g. seasonal patterns



"Driven"

Caused by known factors, e.g. N_2O emissions with abatement system on/off



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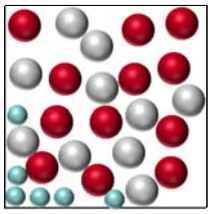
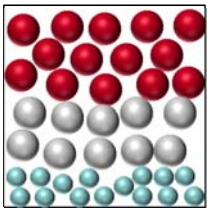
Spatial variability

- *Often referred to as "homogeneity" and "heterogeneity"*
- *Refers to the spatial distribution of the parameter of interest (e.g. carbon content, NCV, heavy metal concentration)*



Red balls evenly distributed

Green balls highly concentrated at left bottom corner



Balls distributed in "strata" (layers)

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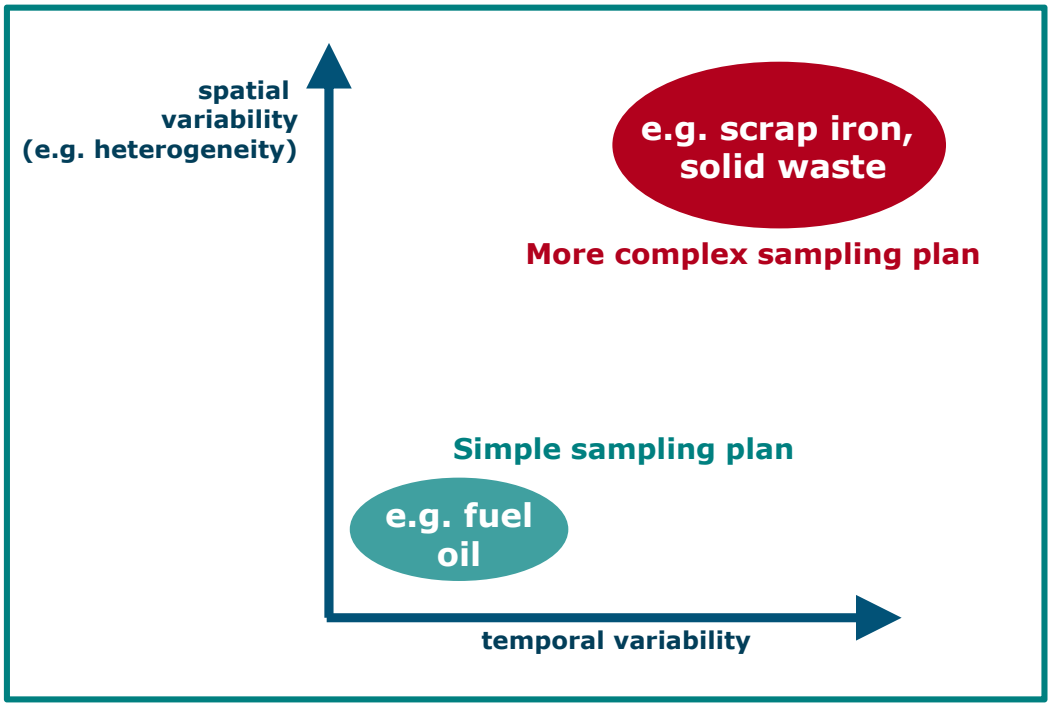
Variability



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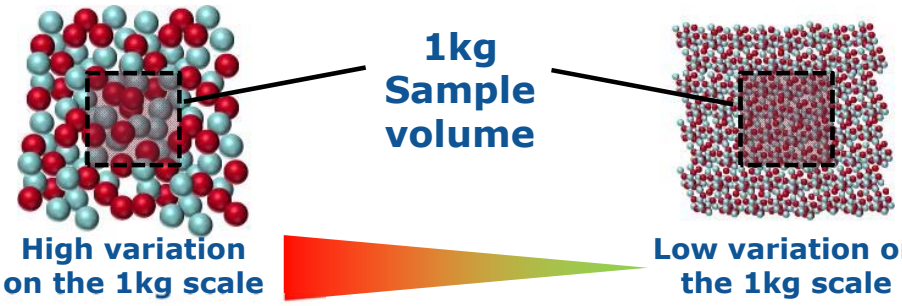
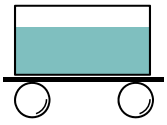
Scale

- *Defines the minimum quantity of material below which variations are judged to be unimportant*
- *Less important for liquids and gases (particles on molecular scale)*



e.g. scrap

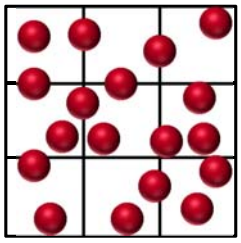
e.g. light fuel oil



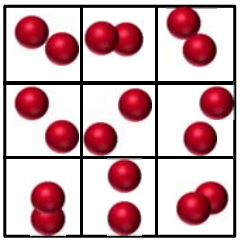
Climate Action

Sampling techniques (patterns)

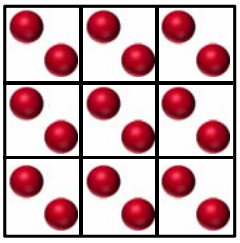
- ***Probabilistic*** *(statistical) sampling*



random

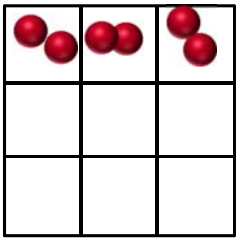


stratified random



systematic

- ***Judgemental*** *sampling*
  - Different from exclusively probabilistic sampling
  - e.g. statistical sampling but only within a pre-defined sub-population (e.g. stockpile where only certain parts are accessible)



Sampling techniques (patterns)

- *Suitable sampling pattern and equipment depends on*
  - Nature of the material (solid, liquid, gaseous...)
  - Parameter of interest
  - Location from which sample is taken (e.g. stockpile, conveyer, tank, pipeline...) and accessibility (e.g. closed or open storage tank...)
  - Scale and degree of heterogeneity
  - Sample size
  - ...

- ***Probabilistic sampling preferred*** *(free of bias), if possible*
  - *Judgemental sampling often chosen for pratical/cost-efficiency reasons, e.g. limited accessibility of the whole population*
- ***Appropriateness of sampling*** *pattern and equipment depends on various factors*

Errors

- ***Sampling error***
  - Due to the fact that only part of the whole population is sampled (variability)
- ***Analytical error***
  - Errors associated with the analytical method, incl. pre-treatment, extraction, analysis,..
- ***Other errors***
  - E.g. contamination of the sample during handling

Climate Action

"Representative" sample

- *When is a sample **representative**?*
  - Representative for what?
  - Results can only be representative in relation to the defined sub-population.

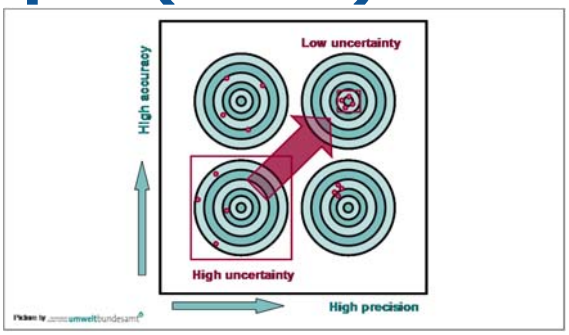
➢ *If only part of e.g. a stockpile is defined as sub-population from which samples are taken, samples can only be representative for this part of the stockpile, not for the whole stockpile*

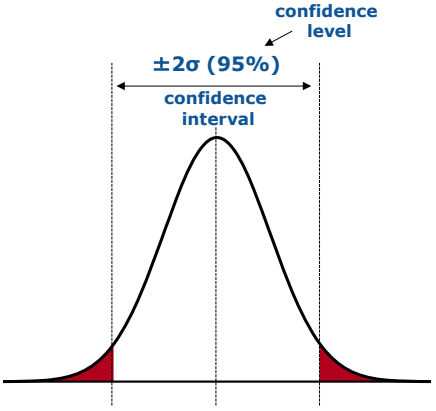
  - Depends on the required reliability, a collective term comprising the following three concepts:
    - Bias
    - Precision
    - Confidence

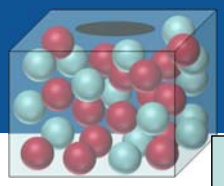
Climate Action

"Representative" sample (cnt'd)

- ***Bias*** *(or systematic error, or accuracy)*
  - Difference between test result and accepted reference value
  - Depends on sampling pattern, variability,..
- ***Precision***
  - Closeness of agreement between independent results (repeatability, reproducibility)
  - Depends on sampling technique, variability, distribution,...



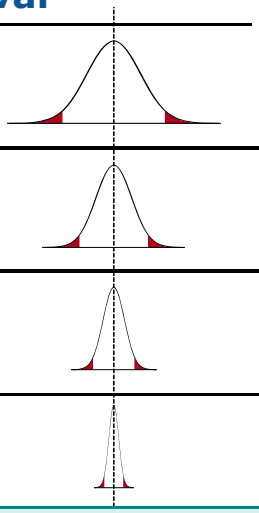




Precision & Confidence

When randomly drawing 10 balls from a box with 50% red balls, there is a 5% chance the sampled share of red is lower than 20% or higher than 80%.

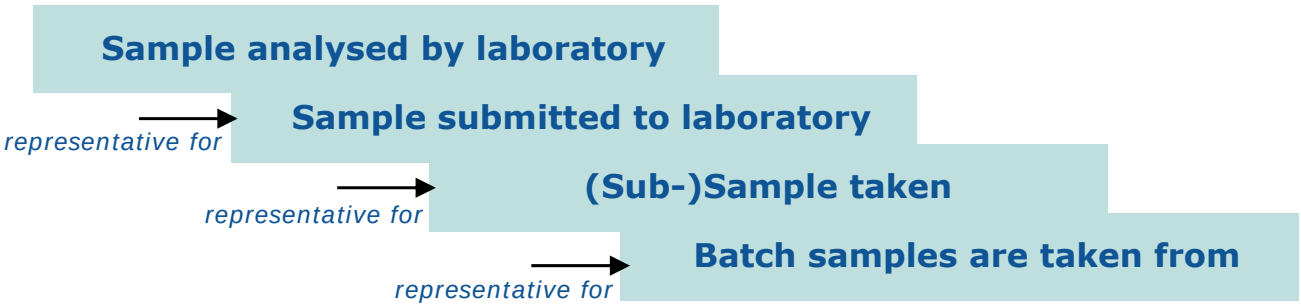
Number of balls drawn	95% confidence interval
10	[20%..80%]
100	[42%..58%]
1 000	[47%..53%]
1 000 000	[49.9%..50.1%]



➢ *Required reliability needs to be decided on first to know whether a sample is representative enough for the (sub-)population*

"Representative" trail

- *Integrity of the sample must be ensured throughout the whole S&A process (combination of increments/samples, sub-sampling, transport and storage, analytical clean-up/pre-treatment, etc.).*



- *Only if each step is fulfilled, representative values, i.e. valid weighted averages, can be obtained from the analyses*
- *Therefore, the sampling plan for obtaining representative samples should be prepared according to fuel or material specific standards*

Increment and (composite) sample

- ***Increment**: individual portion of material collected by a single operation of a sampling device (not individually analysed)*
- ***Sample:** if increment is analysed directly*
- ***Composite sample:** two or more increments mixed together*

Number of samples

$$n = \frac{u_i^2}{u_{\text{total}}^2}$$

Similar to the "1/3" rule

Number of increments/composite samples

Achieved uncertainty

Sampling error

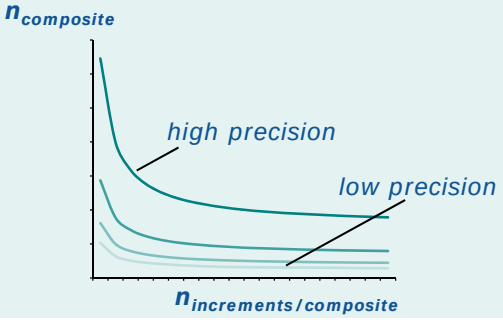
Analytical error

$$n_{\text{composite}} = 1{,}96^2 \cdot \frac{s_w^2 + s_b^2 + s_A^2}{n_{\text{increments/composite}}}$$

Required uncertainty

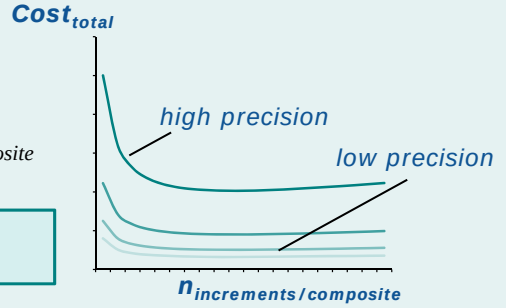
$CI_{95\%}$

Confidence interval (precision) e.g. @95%



Costs for sampling & analysis (simplified)

$$Cost_{\text{total}} = \left(Cost_{\text{per increment}} \cdot n_{increments/composite} + Cost_{\text{per analysis}}\right) \cdot n_{composite}$$



- *Lower costs for fewer analyses might be (partly) offset by increased costs for (sub-)sampling and verification costs*

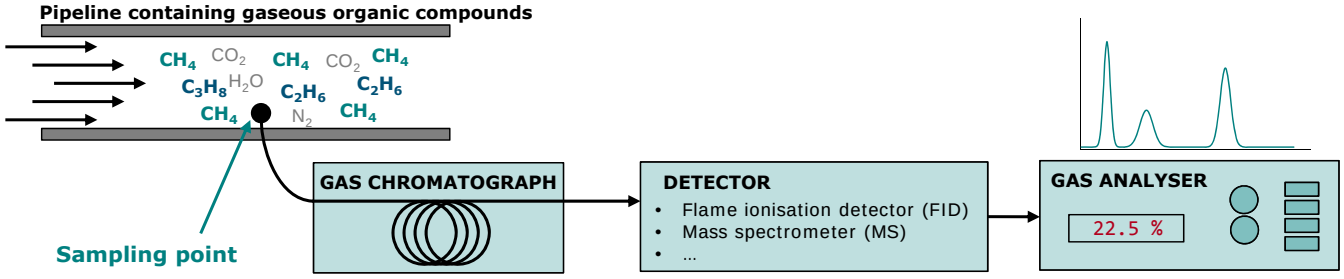
Climate Action

Steps after samples have been taken

- ***Storage and Handling*** *- Is the sample stable?*
  - At what conditions and for how long?
  - Volatile or hazardous compounds?
  - Light-sensitive?
  - Degradation?
  - Contamination
  - ...
- ***Transport*** *to laboratory*
  - Maintain appropriate storage conditions
  - Packaging
  - Sample labelling incl. health/safety information
  - ...
- ***Quality assurance / quality control***
  - Procedures in place to ensure correct sub-sampling, labelling, chain of custody documentation,..
  - Retained samples
  - ...

Climate Action

Online gas analysers



- *Relevant for gaseous fuel/material streams containing organic compounds that vary in composition*
- *Online gas analyers allows to determine the composition*
  - e.g. 95% CH_4, 2% C_2H_6, 2% CO_2, 1% N_2
- *Based on the composition NCV and EF can be determined*

Online gas analysers

How to demonstrate compliance?

- *Article 32(2):*
  - Operator must obtain approval from CA for online gas analysers
  - Minimum quality assurance: initial validation and annually repeated validations
- *Article 32(1): requires use of appropriate standards*
  (e.g . EN ISO 10723 - Natural gas - Performance evaluation for analytical systems)
- *It is recommended that:*
  - the operator meets the requirements of EN ISO 9001 (quality management) and
  - that calibration services and the suppliers of calibration gases are accredited in accordance with EN ISO/IEC 17025.
  - Also, where applicable, the initial and annually repeated validation of the instrument should be carried out by a laboratory accredited in accordance with EN ISO/IEC 17025.
- *Further information provided in FAQ 4.2 on Monitoring and Reporting (**https://ec.europa.eu/clima/policies/ets/monitoring_en#tab-0-1**)*

Online gas analysers

Is a sampling plan required for online gas analysers?

- *In principle, yes, because it will determine e.g. NCV and EF for tier 3 compliance (i.e. according to Article 32 to 35)*
- *However, sampling plan may be simple and look different from solid/liquid fuels because:*
  - Automatic sampling system involved
  - Sample will be analysed directly (no human hands involved → lower risk)
- *Recommended minimum information to be required*
  - Location
  - Responsibilities
  - Sampling/analyses frequency
  - Standard applied and related certificate of conformity (manufacturer)
  - Evidence that instrument has been installed appropriately by a competent person and sampling point is representative under normal operation conditions (flow, composition,..)
  - Results from initial validation (and annual validation, if applicable)
  - …

Guiding questions for sampling plans

- **Who** is responsible for each step?
- **Where** and **when** are samples taken?
- **How** are the samples taken?
- **Which** instruments are used, if relevant?
- How will the identity of the samples be ensured?
- How are the samples stored?
- How and when are increments combined?
- When are the samples analysed, are remaining samples stored after analysis, etc.?

Standards – General consideration

- *Appropriate standards should be as specific as possible with regard to the following aspects:*
  - **Constituents** (e.g. carbonates) or **parameter of interest** (e.g. NCV)
  - **Distribution** (spatial/temporal variability) of the constituent
  - **Matrix** and **environmental conditions**
  - **Chemical appearance** of the constituent (e.g. ionic, chemically bound,..)
  - ...

Standards for common source streams (non-exhaustive list)

Standard	Title
ISO 1213-2	Terms relating to sampling, testing and analysis
ISO 13909 - parts 1 to 8	Hard coal and coke
DIN 51750-1	Sampling of petroleum products; general information
DIN 51750-2	Sampling of liquid petroleum products
DIN 51750-3	Sampling of pasty and solid petroleum products
ISO 3170	Petroleum liquids - Manual sampling
ISO 3171	Petroleum liquids - Automatic pipeline sampling
EN ISO 10715	Natural gas - Sampling guidelines
EN ISO 6974 – parts 1 to 6	Natural gas - Determination of composition and associated uncertainty by gas chromatography

Standards for common source streams (non-exhaustive list)

Standard	Title
EN ISO 6975	Natural gas - Extended analysis - Gas-chromatographic method
EN ISO 6976	Natural gas - Calculation of calorific values, density, relative densi-ty and Wobbe index from composition
EN 16723-1	Natural gas and biomethane for use in transport and biomethane for injection in the natural gas network - Part 1: Specifications for biomethane for injection in the natural gas network
EN 14899	Characterization of waste – Sampling of waste materials – Frame-work for the preparation and application of a Sampling Plan
CEN/TR 15310 – parts 1 to 5	Characterization of waste – Sampling of waste materials (assists and supplements to EN 14899)
CEN/TS 16010	Plastics - Recycled plastics - Sampling procedures for testing plastics waste and recyclates
CEN/TS 16916	Materials obtained from End of Life Tyres - Determination of specific requirements for sampling and determination of moisture content using the oven-dry method
EN 14778	Solid biofuels - Sampling

Standards for common source streams (non-exhaustive list)

Standard	Title
EN 15442	Solid recovered fuels – Methods for sampling
EN 15443	Solid recovered fuels – Methods for the preparation of the laboratory sample
EN ISO 18135	Solid Biofuels - Sampling
CSN EN 16179	Sludge, treated biowaste and soil - Guidance for sample pretreatment
EN 932-1	Tests for general properties of aggregates - Part 1: Methods for sampling
EN ISO 14284	Steel and iron - Sampling and preparation of samples for the determination of chemical composition

Standards for common source streams (non-exhaustive list)

Do you have a list of
***further standards** to be added?*

Climate Action

Example sampling plan

- *Example provided in **Guidance Document 5a***
- *A category B installation burning **heavy fuel oil** delivered on trucks and stored in tanks on-site*
  - Approx. 24.000 t CO_2 per year (= **major source stream**)
  - Corresponding to ca. 7.700 t of heavy fuel oil and approx. 300 truck deliveries per year
  - Has to apply **tier 3** (laboratory analyses in accordance with Articles 32 to 35 of the MRR)
  - Annex VII of the MRR requires a frequency of analyses of **at least six times per year**

Climate Action

Sampling objectives: *Describe the objective(s) of the sampling, e.g. determination of net calorific value, emission factor, oxidation factor*
The determination of the (weighted average) net calorific value and the (weighted average) emission factor of the total amount of heavy fuel oil over the whole year for the purpose of determining the CO2 emissions stemming from its combustion.
Analysis required: *Describe what the laboratory is testing for, e.g. identify constituents to be tested.*
The net calorific value and the carbon content which is needed for calculating the emission factor[1]
Name of material or fuel: *Fill in the name of the source stream or mass stream, as used in the monitoring plan*
Heavy fuel oil
Characteristics of the source stream or mass stream: *Describe the relevant characteristics, such as its phase (gas, liquid or solid), if relevant common or maximum particle size of the fuel or material, density, viscosity, temperature, etc., if those properties are relevant for the sampling procedure*
Heavy fuel oil is a highly viscous fuel delivered by trucks exhibiting a density of about 0.8 t/m³ (at 70°C). Transfer requires heating to 70°C. In general, the amount of heavy fuel oil of one truck delivery is considered as very homogenous (see sampling approach below).
Source and origin of the material or fuel: *Describe the source and origin of the source stream or mass stream, e.g. is the source stream delivered continuously, in batches, produced on site, etc?*
Delivered in trucks in batches of approx. 25 t each
Heterogeneity of the material or fuel and causes of variability (spatial and in time): *Describe the heterogeneity of the material, both spatial and in time, and justify (e.g. origin of source stream, stability of manufacturing process).*
Very homogenous within one batch (truck load) and also between different batches

Sampling frequency: *Describe the sampling frequency (e.g. "every Monday morning", "every 3 hours", "once per truck load", "once every 200 tonnes",…)*
Once per truck load
Relevant standards: *Describe the relevant standards for the sampling methodology*
EN ISO 3170:2004 (Petroleum liquids - Manual sampling)
Define place and point of sampling: *Specify the place (e.g. the stockpile) and point of sampling (e.g. after delivery or after completion of a deposit). Please note that the sample should be as representative as possible*
The outlet of the heavy fuel oil tank of the truck (bottom of the tank). Increments are taken before and after transfer into the storage tank of the installation.
Equipment used for sampling: *Describe the equipment used for sampling*
• The outlet of the truck's heavy fuel oil tank (heated to 70°C) • Connecting pieces for transfer • Three sealable metal containers (approx. 5 litre capacity) • Heating jackets for containers and connecting pieces

Sampling approach: *Describe how the sample is taken, e.g. by probabilistic or judgmental approach*
From each truck load two increments are taken, one at the beginning and one at the end of the delivery process. Therefore two sampling containers are needed, plus one for the cleaning process (see alternative approach at the end of this paragraph for a simplified approach). 1. Before the start of transfer into the storage tank the outlet of the truck tank is connected to the first container via the connecting piece and heated to 70°C. 2. The outlet is opened slightly and approx. 3 litres are collected which will be discarded[1]; then the outlet is closed. 3. The first container is replaced by a clean and dry second container. 4. The outlet is reopened slightly again and approx. 3 litres are collected. 5. The container is sealed. 6. The container is labelled (Internal ID, Name of fuel, date and time, Name of sample collector, name of trade partner, truck license plate number) 7. After transfer of the fuel into the installation's storage tank, steps 3 to 7 are repeated for the second increment using the third container.

Sampling pattern: *Define how the sample is taken, e.g. in the case of random sampling describe how inaccessible parts of the population are dealt with; define how a probabilistic approach is implemented, and/or how decisions are made for a judgmental approach*
Judgemental sampling: The heavy fuel oil tank on the truck is sealed and only accessible through the tank outlet.
Sample composition: *Describe whether each increment (amount of material obtained through one single sample action) is analysed individually, or combined with other increments to form a composite sample*
Two increments are taken (before and after transfer). Those increments are mixed to form a single sample (one sample for each truck)
Number of increments to be collected: *Describe the number of increments that make up a sample*
See above

Increment and sample size: *Describe the size of one increment (the amount of material that is obtained through one single sampling action). The increment size should accommodate all particle sizes present. Describe the minimum sample size. The minimum sample size must take into account the level of heterogeneity of individual particles, to ensure representativeness of the sample.*
Increment size: approx. 3 litres Sample size: Mixing of the two increments using precisely 50 g each. Composite sample size: Mixing of samples using precisely 2 g each from approx. 50 trucks. Therefore, composite samples are representative for approx. 2 months, resulting in a minimum of six samples to be analysed. Retained samples (at least 100 g each) are stored for at least 5 years in the “sample archive room”, i.e. a well-vented, dark room in the basement of the laboratory building. Temperature is kept between 18 and 25°C.
Sample reduction or sub sampling (if applicable): *If the overall sample is too large for transport to a laboratory, a sub-sample should be prepared in such a way that the integrity of the sample is protected. If relevant, describe this procedure and justify the representativeness of the final sample*
Composite sample size: Mixing of samples using precisely 2 g each from approx. 50 trucks. Retained samples are stored for at least 5 years
Justification of representativeness: *Give a justification that the chosen approach leads to a representative sample. Take into account the source stream or mass stream information and characteristics of the population (i.e. the amount of fuel or material represented by the sample)*
The amount of heavy fuel oil contained on one truck is considered to be very homogenous due to the permanent heating of the truck tank to 70°C and the resulting convection. Still, to take into account any gradients within the tank increments are taken before and after the transfer into the storage tank. The two increments are combined 1:1(wt) to form a sample which is considered to be representative for this one truck delivery. The composite samples (representative for approx. 50 trucks) are mixed again in equal quantities assuming that each truck delivery is about the same amount of heavy fuel oil.[1]
Access, health and safety: *Identify access problems or restrictions that may affect the sampling programme. Identify health and safety precautions.*
In accordance with MSDS (Material Safety Data Sheet)

Packaging: *Briefly describe the size, shape and material of the containers used, taking into account the risk of adsorption/absorption/reaction*
Increments/Samples: 5 litres sealable containers Composite samples/Retained samples: 250 mL sealable bottles
Sample coding methodology: *Describe how samples are coded. All sample containers should be marked with a unique identifier that is recognized by sampler and laboratory*
Internal ID (prefixes for types of samples: IS (increment/sample), CS (composite sample), RS (retained sample)), name of fuel, date and time, Name of responsible person
Preservation: *Justify how samples are packed and transported in such a way that the conditions at the time of sampling are preserved*
No special preservation required (see storage conditions)
Storage: *Describe how the sample is stored on site and in the laboratory*
In tightly closed containers/bottles stored in a well-vented, dark room in the basement of the laboratory building. Temperature is kept between 18 and 25°C.
Transport: *Describe relevant conditions during storage; Describe or refer to a chain of custody form that should be completed and sent with each sample*
Labelled bottles are transferred accompanied by material information sheets.
Data storage system: *Briefly describe the location and functioning of the data storage system and the information it contains, such as sample date, sample code, stockpile reference number, product type, specific location, size, etc.*
Excel file “Heavy Fuel Oil S&A.xlsx” stored under “P:\\ETS\S&A\”. Type of information: ID, sampled on, sampled by, delivery ID, stored at (location),..

Company: *Fill in the name of the laboratory responsible for analyses of the sample*
AccrACME Lab Inc.
EN ISO/IEC 17025 Accreditation: *Justify to what extent the scope of accreditation of the laboratory covers analysis of samples described in this sampling plan. If the laboratory is not accredited, please refer to the provided evidence that it meets the relevant criteria of Article 34(3).*
lab is accredited to EN ISO/IEC 17025
Contact details: *Fill in contact details of the analytical laboratory*
Mr John Doe John.doe@AccrACME.com B-1049 Brussels/Belgium
Analyses carried out: *Describe the properties to be analysed (e.g. net calorific value, emission factor, oxidation factor, carbon content)*
Net calorific value, carbon content for the calculation of the emission factor
Standards used: *Describe the relevant standards used for each parameter analysed*
EN ISO XYZ006 and 007

Questions?

Where to find more information?

Regulation No. 601/2012 (MRR)
http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1462274244220&uri=CELEX:02012R0601-20140730

Guidance Documents on European Commission's website
https://ec.europa.eu/clima/policies/ets/monitoring_en#tab-0-1
in particular Guidance Documents 5 and 5a

Presentation:

CA checking compliance of sampling plans

by Member States Representatives

- Required documents and evidence for approving MPs
- What should the CA look for in sampling plans? Best practices on how to check sampling plans
- Availability of documents / limitations
- Required time effort and expertise

Checking Compliance of Sampling Plans- CA Perspective. 20 June 2017

Annette Prendergast
Environmental Protection Agency Ireland
a.prendergast@epa.ie

Approach

- Where calculation factors are determined by analysis the Operator is required to submit a detailed sample plan for each fuel/material as part of the Monitoring Plan.
- If a standard method is directly applied this may be submitted as additional information. Site specific information on responsibilities, sample location, frequency, storage and transport, analysis etc. is included in the sample plan.
- In addition the Operator is required to give a brief description of the procedure covering essential parameters and operations performed, detail who is responsible and list the EN or other standards applied.
- The Operator is required to briefly describe the procedure for revising the appropriateness of the sample plan and responsibilities.

Approach

- To-date sample plan approvals have not required external expertise.
- Time and effort depends on:
  - the quality of the information received,
  - the degree of heterogeneity of the fuel/material,
  - whether standard methods are available,
  - whether the samples are taken by , in-house personnel non accredited (51%), third party accredited sampling (or in partnership with accredited lab) by national or international fuel supplier (19%), non accredited third party sampling (5%) continuous third party gas analysers (25%).
  - Samples already been taken for other reasons. Process samples taken for quality control, fuel sampling for fiscal purposes..

Checks

- Sample plans are checked, during MP approval, for compliance with the requirements of Article 33 MRR and COM Guidance. (sample preparation, methodology, responsibilities, locations, frequencies quantities, storage and transport).
- Operator must demonstrate that samples are representative for the relevant batch and sampling methods are based on standard methods/ industry best practice.
  - Detailed description of sample methodology to capture process variability
  - Description of variability in fuel/material suppliers
  - Follow up discussion with Operator
  - Consistent with in house quality sampling for raw materials and products and standard method requirements.
- Demonstrate agreement of laboratory (e.g. signed agreement of sample plan) and mechanism to adapt elements of sample plan where required.

Checks

- A follow up site visit by ETS experts may be undertaken to, review results, interview relevant personnel to confirm that the agreed procedure is applied, witness the sampling process and the data flow and control process, view training records.
- Detailed review of analysis data during AEM review has highlighted issues with sample plans and a requirement to revise the sample plan.
  - Time series analysis comparing values through out the year and between years.
  - Comparison with other similar installations.

Difficulties and limitations

- For international fuel suppliers where samples are taken by a third party the agreed standard method may not always be applied. Operators are required to maintain records on site confirming that third party samples are taken in accordance with the agreed sample plan and standard method.
- Process gas samples may be prohibited from air transport due to safety concerns. An in-house accredited laboratory was set up to analyse fuel gases.
- Reactive materials that absorb CO2 need to be stored appropriately in tightly sealed containers and the time between sampling and analysis should be minimised to protect sample integrity.
- A comprehensive list of standard sampling methods should be made available in the Guidance Document.
- An example sample plan should be made available for online gas analysers.

Umwelt Bundesamt

DEHSt
Deutsche Emissionshandelsstelle

Compliance Forum – Training event of sampling plans 20th June 2017

Checking the compliance of a sampling plan

Christian Schneider

Section E 2.1 – Energy Industries

Umwelt Bundesamt

DEHSt
Deutsche Emissionshandelsstelle

Minimum requirements/typical examples

- Content of sampling plans of two solid source streams from power plants (related to minimum requirements of Annex 2 - german guideline about reporting and monitoring)

fuel	parameters	sampling			relevant standard
		method	place/point	frequency	
hard coal	NCV, carbon content	automatic sampling	in front of coal bunker, prior to combustion	continuous; daily amount: < 10.000 t; automatic sample preparation for daily sub-sample	DIN 51701
SRF (solid recovered fuels)	NCV, carbon content, biomass content	manual sampling	truck	discontinuous, every truck delivery: 25 t (4 increments of 5 l), manual sample preparation, collective sample (250 t) and mixing sample (1.000 t)	referring to BGS* RAL-GZ 724 * Association for supporting and standardise of quality ensured SRF

- High efficiency and small time effort for checking sampling plans if sampling method is related to acceptable standards or well approved industrial procedures (formal check).

Umwelt Bundesamt DEHSt Deutsche Emissionshandelsstelle

Status: Most of the sampling plans prepared at beginning of the third trading period.

Possible ways to get more precise answers:

1. Risk based request for information (DEHSt concept)
- Check internal process instructions
- Check documentation of quality assurance
- Check raw data of (all) parameters

2. Inspections (DEHSt concept)
- Following the whole sampling process and check documentation
- Check data transfer from raw data to data of emissions report on site

3. Verification
- Feedback about non-compliance relating to sampling and sample preparation

Umwelt Bundesamt DEHSt Deutsche Emissionshandelsstelle

Advanced questions for spot tests

Automatic sampling

- Availability of automatic sampling system? Alternative method?
- E.g. DIN 51701-4, 6.4.2, operation: daily function test (documentation?)
- E.g. DIN 51701-4, 6.4.3, operation: validation (documentation?)
- Responsibility? Regular education of staff members? Documentation?
- Plausibility check e.g. with data from invoices?
- …

Manual sampling

- Theory and practice? Compliance to standard (sampling plan)?
- Responsibility? Regular education of staff members? Documentation?
- Optimized or failure sampling and sample preparation?
- …

Some results from 2016

- No documentation of „missing“ samples in emission reports (availability of automatic sampling < 100 % or deviation of sampling frequency)
- Described sampling method in monitoring plan and used sampling method are totally different
- Sampling frequency/mass insufficient
- Non-compliant sample preparation of an accredited laboratory

Umwelt Bundesamt DEHSt Deutsche Emissionshandelsstelle

Thank you for your attention!

Christian Schneider

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Umwelt Bundesamt | DEHSt Deutsche Emissionshandelsstelle

Sampling plans

Environment Agency (England) approach
20 June 2017

Resources

- All Environment Agency technical officers are trained through a mixture of on the job training and mentoring
- All work is peer reviewed: 4 eyes principle
- No fixed time allocated to reviewing sampling plans
- Use MRR GD5a sampling plan exemplar as a checklist: no special tools

What do we check?

- Use experience to sense check information
- Does it contain information set out in GD5a
  - Quality of information, not the format that matters
- What is the fuel/material?
- How will the sample be taken?
- Who will take the sample?
- How often will the sample be taken?
- What will it be tested for?
  - Is there a standard/accepted methodology?

Environment Agency

Problems/limitations

- There is insufficient information about how the samples are physically taken
  - How the operator ensures representativeness
  - Composite vs single sample
- Sampling plans contain links to other quality documents rather than a bespoke document
  - Particularly affects large and complex installations such as oil refineries and steel works
  - Hard to get all of the information that you need
- Vagueness around standards that are applied (Article 32)

Environment Agency

Examples of good sampling plans

Environment Agency

Example of a cement works: sampling plan embedded in normal control procedures

VERSION 10 - QUALITY MANAGER / LAB SUPERVISOR Updates for additional fuels

Plant : Cement Works **Date of Release :** December 2016 **Applicable from : December 2016**

Control of Incoming Materials

Material	Sampling Location	Sample Type	Sampling Frequency	Alternative Sampling Frequency*	Sample Amount	Who Samples	Type of Analysis	Who carries-out the Analysis	Action Taken based on Analysis	Information Required by	Data Storage	Further action required / comments
Limestone from tertiary stockpile	Limestone sample tower / feed	Spot	Annual / prior to stock take	N/A	10 - 20kg	Quarry PO / lab PO	Density	Lab PO or Analysts	None - data for stock takes	Production Manager	EUETS density log sheet	SOP updated for annual stock checks. Annual analysis
Dry ROS PFA for raw mix	Rail off-loading point	Grab samples forming monthly composite	Every train	N/A	~2 kg	Rail team (rail delivery)	XRF - Ca and Mg, TOC	Suitable 17025 lab.	EUETS Permit Requirement	Environmental Coordinator, Optimisation Manager, Quality Manager, Finance Dept	CTC / EUETS Spreadsheet	External labs used Khights Energy Services and Ceram All external analysis updated in CTC
Gypsum	n/a	n/a	n/a	n/a	n/a	n/a	Quality test reports fropm British Gypsum	supplier	Review data as supplied. Contact supplier if any queries	Quality Manager / Operations Manager / Lab Supervisor / Chemist	CTC	-
Gypsum	Gypsum shed - inherent stability of pile allows sampling	Grab sample	Annual / prior to stock take	N/A	5 kg - 10kg	Lab PO	Density	Lab PO	None - data for stock takes	Operations Manager	EUETS density log sheet	-
Raw Coal or Petcoke (By Source)	Train or road vehicle	Grab sample to BS ISO 18283	Per train or bi-monthly when by road	N/A	As per BS ISO 18283	As arranged by supplier	CV & TOC to 17025 accreditation	TES Bretby or Knight Energy Services or other suitably certified body	EU ETS Permit requirement	Environmental Coordinator, Optimisation Manager, Quality Manager, Finance Dept	Data provided by supplier - EUETS file	

Environment Agency

Example of a cement works using GD5a: one sampling plan per material tested

1. General information
Operator name
Cement Limited
Installation ID
GB-EA-ETCO2-00XX
Title of sampling plan
TITLE: Sampling and Analysing Clinker for EU-ETS
Reference of procedure
EMS WI 020

2. Responsibilities
Sampling plan completed by
MR Jones / Dr Smith
Post or department responsible for sampling data
Quality department
Post or department responsible for sampling
Quality department
Laboratory responsible for analysis
Ceram
Other parties
N/a

4. Specifications of source stream or mass stream
Name of material or fuel
Clinker
Characteristics of the source stream or mass stream
Solid
Source of origin of the material
Continual process
Heterogeneity of the material or fuel and causes of variability (spatial and in time)
Material is generally homogeneous being created through the combination of continuous feeds of chalk and raw meal at defined ratio. Variability may be caused by changes to relative proportions of fuels

5. Sampling methodology
Sampling frequency
Daily
Relevant standards
Internal procedure followed. EMS WI 020 Sampling and Analysing Clinker for EU-ETS
Define place and point of sampling
Clinker cooler sample point
Equipment used for sampling
Long scoop, open at top and covering full width of sampling chute
Sampling approach
Probabilistic
Samples taken through drop flow method in vertical chute
10kg. Minimal sample size 3kg. Sample scoop is used repeatingly to obtain required increment.
Sample reduction and sub sampling (if required)
Each 10kg sample is reduced to 500g through use of riffle box and then added to monthly

Justification of representativeness
50 kg of material sampled from 25,000 tonnes of material
Access, health and safety
Access is controlled through traffic light system to enter area. Sample point access via steps with handrails. Sample scoop operates in complete containment, fully supported with no requirement for manual handling. Hot material delivered into bucket through chute and then removed from area by trained operating wearing correct PPE
6. Procedures for packaging, preservation, storage and transport
Packaging
Samples are taken using metal buckets. Once cooled they are stored in sealed plastic containers. For shipping purposes they are transferred to sealed plastic bags and shipped in a sealed plastic container.
Sample coding methodology
Samples are labelled as "EUETS Clinker" with the relevant week number
Preservation
Sample bags and containers preserve the sample in the state taken. No moisture ingress nor interaction with other materials is possible
Storage
Samples are stored in sealed plastic containers before sending to the external test house. Once sent, the duplicate sample is stored in a sealed plastic bag. All samples stored in cool, dry laboratory.
Transport
Transported in sealed plastic bags within sealed plastic containers. Each samples is sent with the appropriate sample booking in sheet supplied by the external test house, details of the required tests and a copy of the relevant purchase order number.
Data storage system
Analysis records retained as hard copies in EUETS Files and electronically in Laboratory Analysis File
7. Analytical laboratory
Company
Ceram
ISO17025 Accreditation
Ceram - UKAS Testing Accreditation 0013 / Accredited to 17025

Example of a glass manufacturer

FILE TOOLS VIEW glass Sampling Plan V2 [Compatibility Mode] - Word

Glass

EU ETS Sampling and Analysis Plan for Bulk Raw Materials

1 Purpose of Document

The European Union Emissions Trading Scheme (EUETS) requires that participating companies account for the CO_2 emitted from their process plants. Sources of CO_2 emissions that must be monitored include those from the decomposition of carbonates. Current EUETS regulations require that participating companies prepare and submit a monitoring plan detailing how they will measure their CO_2 emissions to the level of accuracy specified in the regulations. This document describes the procedures employed to obtain truly representative samples of carbonaceous raw materials (limestone and soda ash). The document also contains the recent analyses used to demonstrate the homogeneity of the material and determine an appropriate sampling frequency.

2 Supplier-Provided Samples

In general the supplier of the material is better placed to obtain a representative sample of the material due to the ease of access (samples are delivered to glass works in sealed tankers greatly hampering any sampling procedure).

The sampling requirements of EUETS participants have been discussed with all the suppliers to the British Glass raw materials club and many of them have been subject to an external audit.
The procedures adopted by raw materials suppliers follow the principles of BS 5309-1:1976 "Methods for sampling chemical products" and involve:

2.1 Collection of a Bulk Sample

A bulk sample is obtained incrementally from a suitable sampling point generally located at entry to the relevant bunker or at a convenient transfer stage. Samples are taken in such a fashion as to ensure that the full width of the product stream is traversed. Samples are taken over the course of a working day then aggregated to weekly or monthly composites to suit customer requirements. Composite samples are thoroughly mixed and reduced in size to approximately 1 kg by a process of repeated coning and quartering. The reduced sample is placed in a clean container, labelled with the date and the material's sample identity. The reduced sample is then transferred to the plant laboratory for further size reduction and packaging for onward dispatch to the accredited analytical laboratory.

2.2 Reduction to an Analytical Sample

A representative analytical sample of approximately 100g is obtained from the bulk sample by a process of repeated riffling. The sample is placed in a new sealable plastic sample bag appropriately labelled to include: the company and site, the material ID and the sampling date. The sample is then sent by a postal service to an ISO: 17025 accredited laboratory for analysis.

3 In-house Sampling Procedures

In-house sampling of materials is performed in those cases where a supplier does not have suitable on-site arrangements to produce a representative sample or in cases of disputes. The in-house sampling procedure involves:

3.1 Collection of a Bulk Sample

A bulk sample is obtained incrementally from a sampling point located at entry to the relevant bunker. Samples are taken from incoming deliveries at regular intervals over the course of a calendar month. Samples are taken manually using a scoop traversing the full width of the product stream. At the completion of the sampling period (month end) the bulk sample is thoroughly mixed and reduced in size to approximately 1 kg by a process of repeated coning and quartering. The reduced sample is placed in a clean container, labelled with the date and the material's sample identity. The reduced sample is then transferred to the plant laboratory for further size reduction and packaging for onward dispatch to the accredited analytical laboratory.

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Presentation:
Role of the verifier

by Machtelt Oudenes & Lucy Candlin

- Legal requirements in the AVR
- Competence requirements and relevant standards (e.g. EN ISO 14065)
- What should a verifier look for in sampling plans? Best practices on how to check sampling plans
- Availability of documents / limitations
- Required time effort and expertise

Role of verifier on sampling plans Legal requirements and competence

Machtelt Oudenes (SQ Consult)

MR Training Event webinar
20 June 2017

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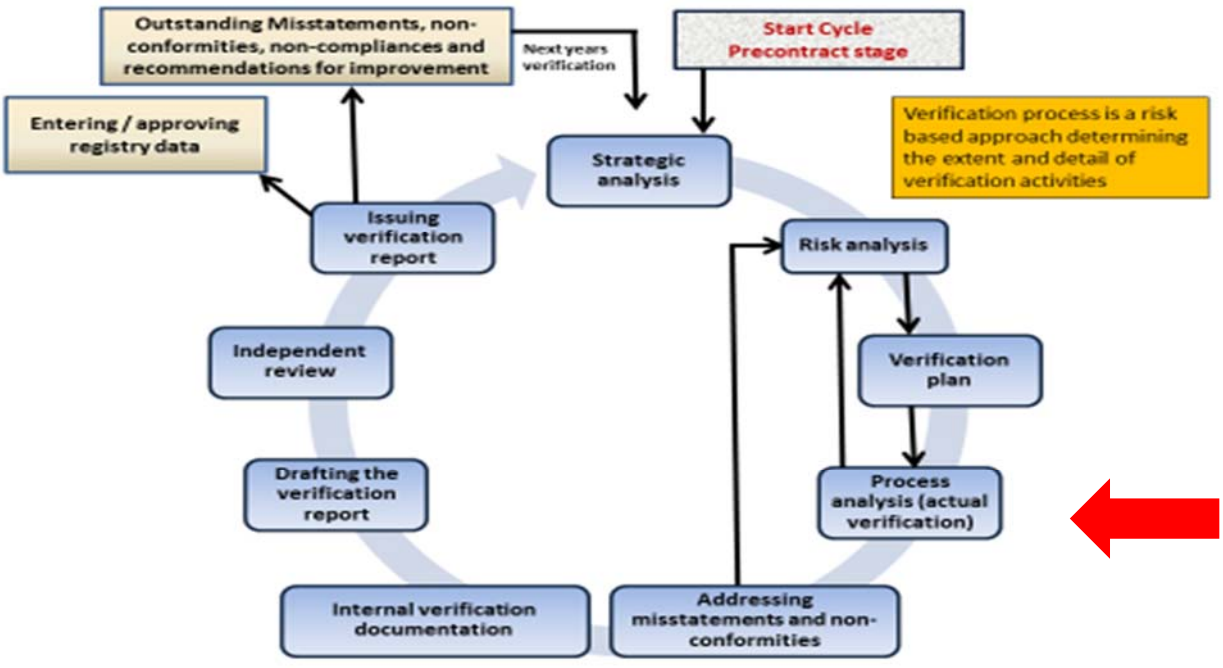
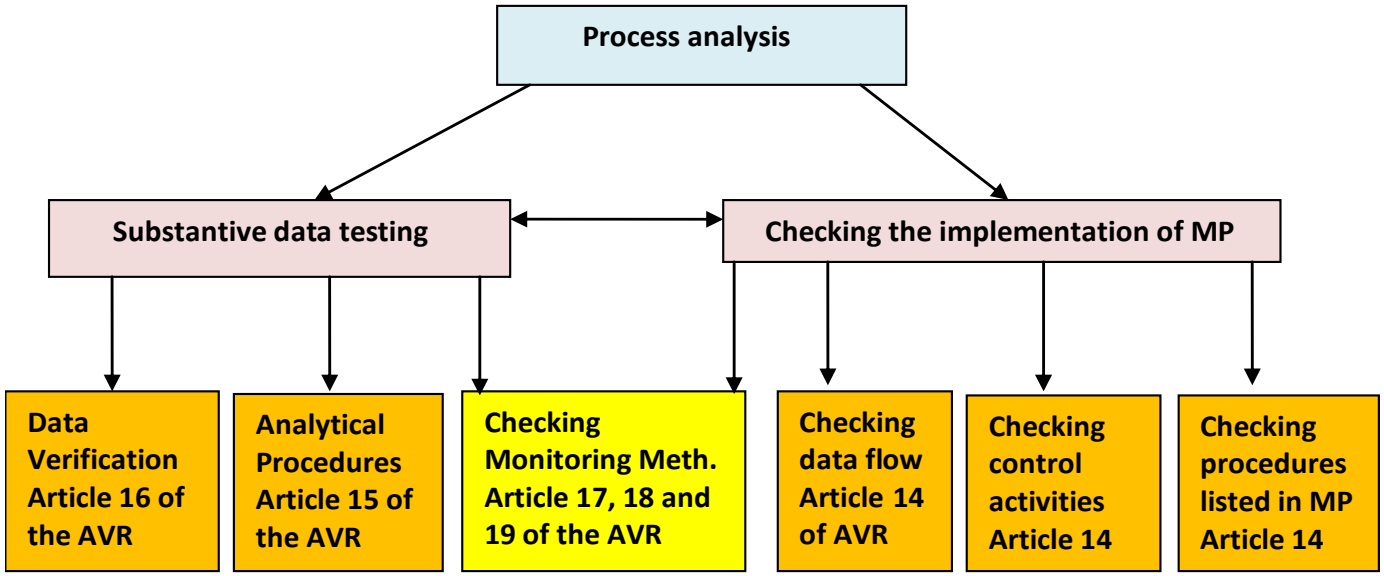
Checking the operator's sampling plan is part of the process analysis



Legal requirements on process analysis (Art. 14 – 19 AVR)



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Checking the implementation of the monitoring methodology involves:

- *Correct application of the monitoring methodology listed in the MP approved by CA (Article 17 (1) AVR)*
- *Correct application and implementation of the sampling plan as approved by the CA (Article 17(2) AVR)*
- *Checking specific elements of the monitoring methodology where relevant:*
  - Uncertainty assessment (Art 19), missing data (Art 18)
  - Transfer of CO_2 for CCS purposes (Art 17(3))
  - Capacity Changes (Art 17 (4))

KGN II.3 on process analysis and Q 4.11 FAQ explain the details

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Role verifier concerning sampling plan

- *Checking completeness, effectiveness and appropriateness sampling plan: e.g. representativeness samples*
- *Checking whether sampling is carried out consistently in accordance with approved sampling plan*
- *Checking significant changes in sampling plan and approval of these changes by CA*
- *Checking central reference document/table if relevant*
- *Checking documentation, implementation, maintenance and effectiveness of procedures underlying the sampling plan*
- *Checking competence personnel carrying out the sampling*
- *Checking documentation and responsibilities in sampling*

Competence verifier

- *Article 37 AVR: Competence of EU ETS auditor*
  - Knowledge of relevant legislation and guidance: relevant articles MRR, GD 5, sampling plan template etc.
  - Knowledge and experience of data and information auditing
  - Ability to carry out verification activities: e.g. checking implementation MP, operator's sampling plan
  - Knowledge of and experience in sector specific technical monitoring and reporting aspects
- *Article 36 (4) (5) AVR: Requirements verification team*
  - Understanding of individual role in verification
  - Ability to communicate effectively in language
  - Technical competence and understanding to assess the sector and installation specific MR aspects for at least one member of team
- *Art 35 AVR requires verifiers to establish competence process to ensure competence of relevant personnel*

Examples of technical competence

- *Ability to assess representatives and appropriateness of samples*
- *Ability to check preparation of samples*
- *Ability to understand sampling approach*
- *Knowledge of sampling standards*
- *Ability to check documentation, implementation, maintenance and effectiveness of procedures*

If EU ETS (lead) auditors do not have the expertise to assess specific elements of the sampling plan, they can hire a technical expert

KGN II.7 on competence provides some information and examples

Further contact on supporting the revision of MRVA regulations:

Commission:

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M&R Training
Sampling Plans –
the verifier's perspective

Lucy CANDLIN, Planet & Prosperity Ltd

Compliance Forum M&R Training Event Webinar
Brussels, 20 June 2017

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Sampling plans……

- *The 'recipe book' for getting it right!*
- *What needs to be right? –*
  - Calculation factors
  - Representative of the fuel/material consumed
- *How does everyone know what right looks like & how to get there?*
  - Everyone know their role(s) and how tasks fit together?
  - Methods are reproduceable *(ie done the same way by different people)*
  - Plan is transparent? Up to date? Being implemented?
- *Can calculation factors be verified?*
  - Is there an appropriate audit trail?

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Sampling Plan Checklist

Why….

What…

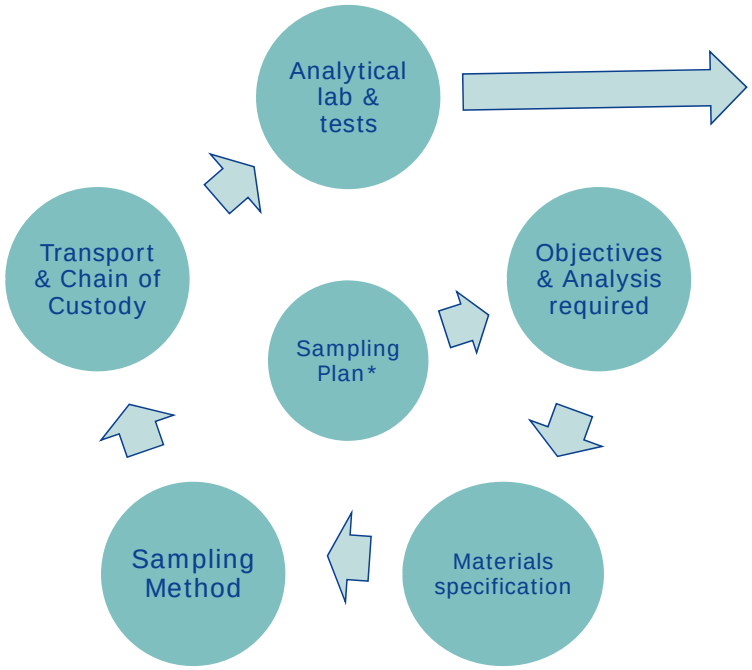
Who….

When..

Where.

Which.

How….



Input for determination of representative calculation factors

Results records & spreadsheets for manipulation to produce factor to be verified

* *Related to factors for each relevant material/ fuel*

Checking sampling:

- Pattern, approach & frequency in accordance with Plan
  - *Frequency meets minimum / 1/3rd rule for uncertainty*
- Sampling methodology reasonable & applied
  - *Including increments & sub-sample(s) prepared for lab*
- Operators trained & understand quality requirements
- Impact of any identified problems with sampling &/or analysis
- Changes to schedule &/or plan that need approval
- Review & update of plan elements agreed with lab
- All analytical results included in factor calculation
- Supporting procedures implemented & effective

Checking accredited lab :

a) **External –**
- Current certificate & schedule – scope
- Accredited tests match monitoring plan
- Contract is in place

b) **Internal –** *As for external plus -*
- Latest NAB Assessment Report
- Control & maintenance of analytical equipment & calibration gases etc
- Control & update of sampling schedule
- Updates of lab procedures
- Views on –
  - quality of samples submitted & sample bias
  - issues with sampling equipment
  - issues at the operational level

Checking non-accredited lab (Int/Ext) :

- Current ISO9001 certificate
  - If not certified, evaluate system in place for consistency & review any 'certification' process applied for validity
- Procedures for –
  - Management, training & competence review of staff, including PT testing
  - Selection & control of samples, analytical standards & test methods etc
  - Preparation of lab samples from 'sample' supplied by site
  - Determination of uncertainty of results
  - Control, maintenance & calibration of equipment & reference materials
  - Document control (standards, methods, software, results etc)
  - QA/QC - internal audit & review, inter-comparison testing, etc

Checking non-accredited lab (Int/Ext) :

- Appropriate lab 'environment' to facilitate quality results
- QA/QC/Information security control of IT systems for data management & results recording
- Formal contracts specifying approaches, tests & outcomes agreed with client
- Evidence of implementation of procedures specified in approved MP

Challenges for verifiers

- *Lack of transparency*
- *'Distributed' sampling system*
- *Rigidity of format (eg standardising exemplar)*
- *Non-accredited labs*
- *Adequate time allocated*

Sampling plans……

- ✓ *Transparency & completeness*
- ✓ *Succession planning*
- ✓ *Quicker verification*
  - ✓ More so if lab is ISO17025 accredited

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Thank you….

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