

The background of the slide is a dark blue gradient. It features a silhouette of a person climbing a large rock formation. The person is positioned on the right side, with their body angled upwards and to the left. The rock formation is on the left and center, with a jagged peak. The overall scene suggests a challenge or a journey towards a goal.

Monitoring and Reporting Guidelines for Carbon Capture and Storage under the EU-ETS

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IEA CCS Webinar, 20.03.2008



Objectives of the EU-MRG

- Environmental integrity – “A ton is a ton”
- Consistency with national inventories under UNFCCC
- Market and stakeholder confidence
- Transparency
- EU-27 level playing field
- Accuracy at a level of a few percent uncertainty for each installation
- Cost-effectiveness for different sectors, technologies, installation sizes & ages



Capture

CO₂- Emissions = INPUT + potential emissions – OUTPUT

With:

- INPUT: CO₂ transferred from other installations
- Potential emissions: emissions production activities, capture activities which would happen without capture
- OUTPUT: CO₂ mass flow transferred to transport network
- Accuracy requirement: CO₂ transferred to or from the installation $\pm 2.5\%$, activities at installation depending on chosen tier for activities



Transport I

- Two approaches for emission determination:
 - A: Based on Input-output balance
 - B: Based on potential sources of emissions



Transport – Method A

- CO₂-Emissions =
$$\text{INPUT} + E_{\text{combustion}} + \text{OUTPUT}$$
- INPUT/OUTPUT: CO₂ transferred to /from the transport network
- $E_{\text{combustion}}$: Emissions from combustion activities, e.g. booster stations
- Accuracy requirements: $\pm 2.5\%$ for continuous emission measurement



Transport - Method B I

- Emissions CO₂ = $E_{\text{fugitive}} + E_{\text{venting}} + E_{\text{leakage incident}} + E_{\text{combustion}}$
 - E_{fugitive} : Fugitive emissions from transport network, calculated based on emission factors for categories of pipeline equipment, e.g. valves, seals, compressors
 - $E_{\text{venting}} + E_{\text{leakage incident}}$: Emissions from venting and leakage, to be determined by industry best practice
 - $E_{\text{combustion}}$: Emissions from combustion activities, e.g. booster stations
- Accuracy requirements: $\pm 7.5\%$ for overall approach



Transport - Method B II

- Pipeline integrity to be proven using temperature and pressure data
- Validation of Method B at least once annually through Method A data
 - Amounts transferred to/from transport network expected to be available for economic reasons
 - Use of lower tiers for Method A allowed



Injection & storage

Potential sources:

- Emissions from fuel use
- Vented and fugitive emissions from injection
- Vented and fugitive emission from enhanced hydrocarbon recovery
- Leakage from the storage complex



Emissions from Injection

- Combustion from injection: Determination according to provisions under Annex II of 2007MRGs
- Fugitive + vented from injection:
 - Vented emissions: Determination with continuous emission measurement according to revised MRG Annex XII
 - Fugitive emissions: Determination according to industry best practice



Emissions from Enhanced Hydrocarbon Recovery

Potential sources:

- Vents: Determination with continuous emission measurement according to revised MRG Annex XII
- Flares: Determination according to Annex II of the 2007MRGs



Leakage at CO₂ Storage Sites

- Leakage defined as in Directive on Geological Storage of CO₂
- Quantification only required, where CO₂ is released into the air (“emissions”) or into the watercolumn
 - -> Identification of such leakage under the Storage Directive “kickstarts” quantification of CO₂ emissions under the EU-ETS Directive / MRGs
 - -> Leakage is added as new source in the CO₂-monitoring plan of the storage site
 - -> Exclusion of leakage as source after corrective measures + emissions cannot be detected any longer



Leakage at CO₂ Storage Sites II

- Basic problem with quantification of emissions from leakage: Lack of experience with quantification of CO₂ released from storage sites into air or water column
- Uncertainty of quantification approaches can be considerably higher than average uncertainty of CO₂ monitoring in the existing EU ETS
 - > potentially endangering environmental integrity of the system in case of leakages with high emissions
- Approach to safeguard environmental integrity: Maximum uncertainty threshold required ($\pm 7.5\%$)



Uncertainty Supplement

What if maximum uncertainty threshold of 7.5% cannot be met?

-> "Uncertainty supplement approach": Amount of emissions reported is estimated in a way avoiding underestimation of emissions.

$$\text{CO2}_{\text{reported}} = \text{CO2}_{\text{quantified}} + \text{CO2}_{\text{uncertainty supplement}}$$

$$\text{CO2}_{\text{uncertainty supplement}} = \text{CO2}_{\text{measured}} * (\text{Uncertainty}_{\text{measurement}} - 0.075)$$



Scientific Panel I

Idea:

- Balance lack of industry level experience through experience at scientific level
 - Support harmonised implementation through one central contact point for advice
- > Set up scientific panel supporting implementation of CCS MRGs with regards to leakage quantification



Scientific Panel II

Tasks:

- Assess quantification approaches for emissions from leakage
- Collect and evaluate experiences with quantification of emissions from leakage
- Develop guidance from collected experiences
- Indicate need for further related research to Commission
- Support Member States with additional CCS related tasks like accreditation criteria for CCS verifiers



Scientific Panel III

- Panel to be combined with panel for the assessment of storage permit applications
- MS representatives allowed at Panel sessions
- Panel to draw on industry expertise, where necessary/possible
- Scientific panel not integrated into MRGs, but introduced through Directive for Geological Storage of CO₂
- Basic Terms of Reference for Scientific Panel developed, further development necessary



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Thank you for your attention!

***Members of the Association ASPEN
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