



Monitoring, Reporting, and Verification of Methane Emissions from Coal Mining

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Global Methane Initiative



- Launched in 2004, the Global Methane Initiative (GMI) is an international public-private partnership that advances cost-effective, near-term methane (CH_4) reductions. This is achieved through technical support to deploy CH_4 -to-energy projects around the world.
- GMI partners with UNECE for increased impact. Information presented here is based on Best Practice Guidance GMI prepared for UNECE.
- GMI focuses on reducing barriers to the recovery and use of CH_4 as a clean energy source from 5 key sectors:

Oil & Gas Systems



Coal Mines



Wastewater



Agriculture

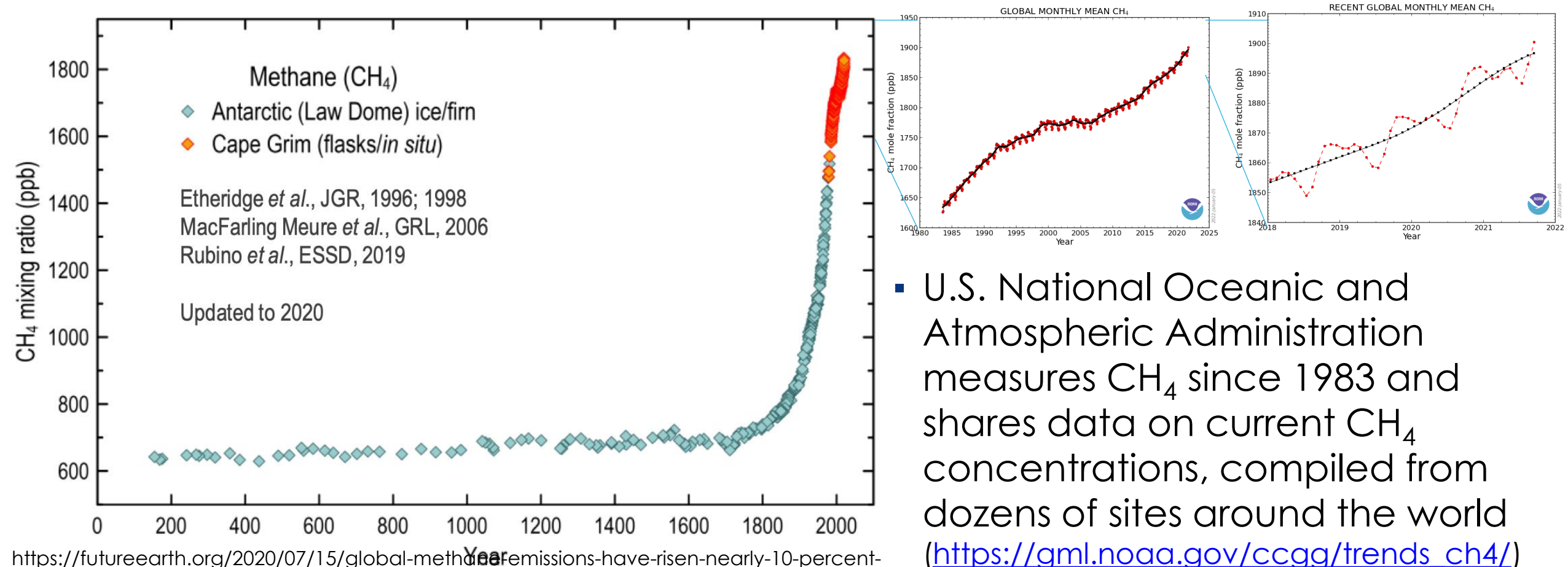


Municipal Solid Waste



How Do We Know CH₄ Concentrations are up?

- Data from historic ice core and air monitoring instruments reveal a consistent trend: global atmospheric methane (CH₄) ↑ sharply over past 2000 years.

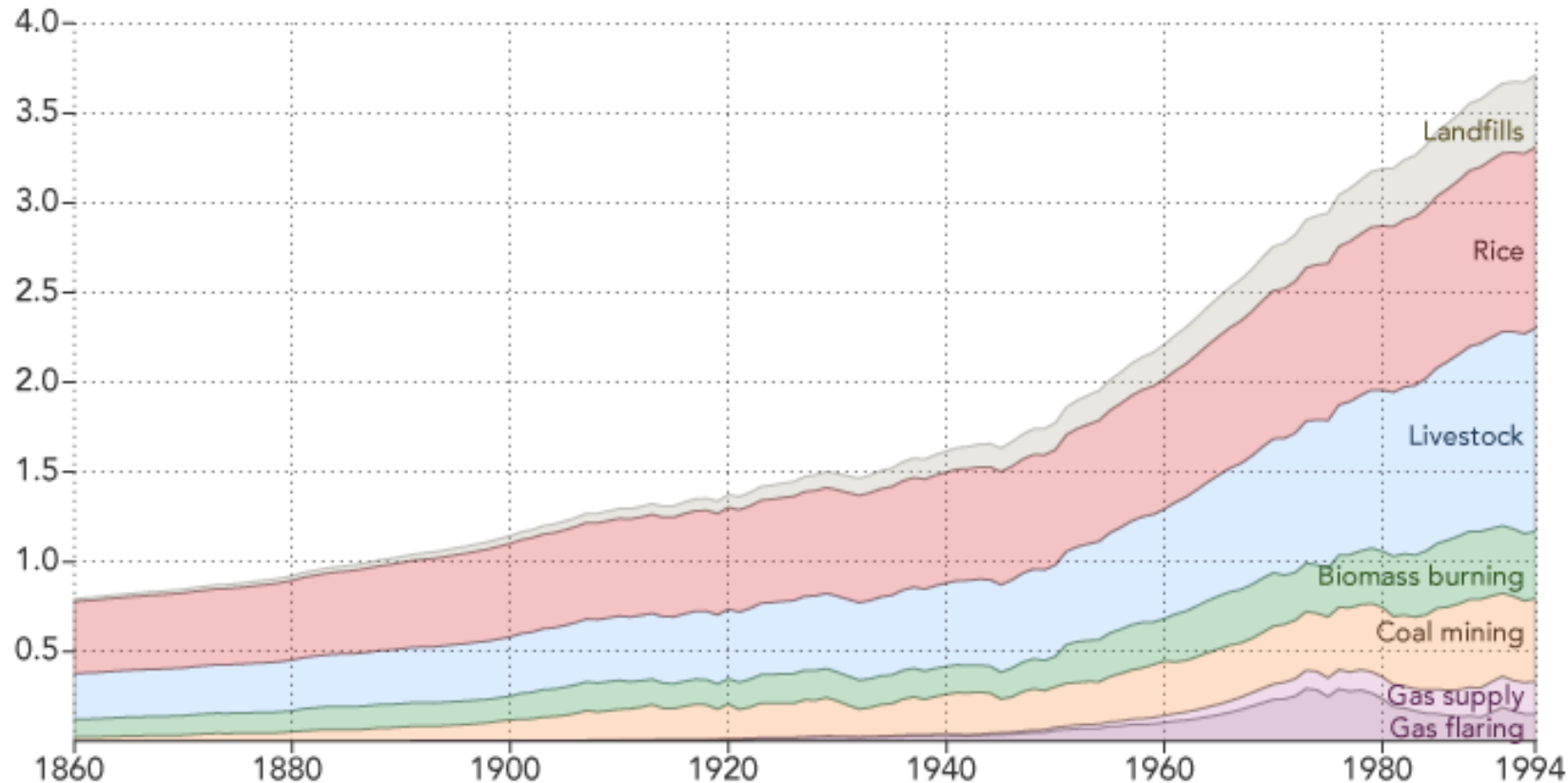


- U.S. National Oceanic and Atmospheric Administration measures CH₄ since 1983 and shares data on current CH₄ concentrations, compiled from dozens of sites around the world (https://gml.noaa.gov/ccgg/trends_ch4/)

CH₄ Emissions & Coal Mining

- Reconstructed historic emissions (chart source: NASA Earth Observatory, ORNL data)

Global Anthropogenic Methane Emissions (millions of metric tons)



- Atmospheric concentrations of CH₄ are well known but determining sector sources of emissions is harder.
- Top-down approaches:
 - Satellite and aircraft observations, modeling, atm. measurements
- Bottom-up approaches:
 - Facility measurements, national and regional inventories (IPCC Tier 2 and 3)

National Approaches to Accounting Coal Mining Emissions (IPCC Tier Approach as Stated)

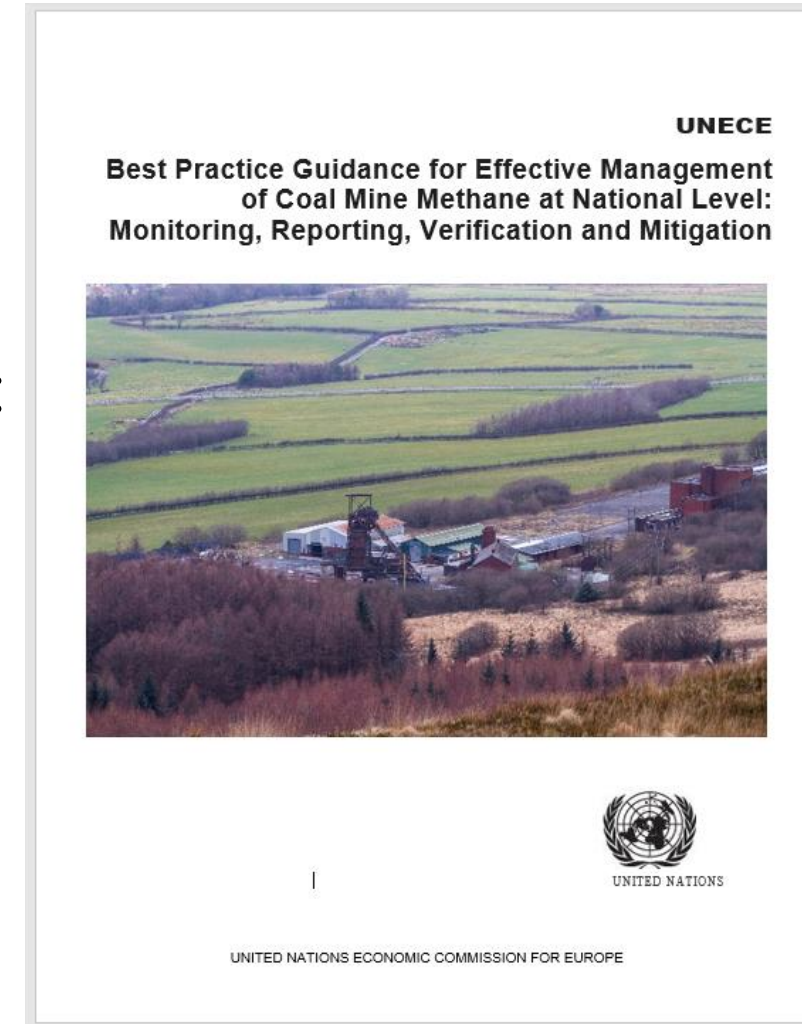
Type of emissions from coal mining	United States	China	Russia	Australia
Working underground coal mines	Tier 3	Tier 2	Tier 2	Tier 3
Abandoned underground coal mines	Tier 3	Tier 1	“Not a source”	Tier 2/Tier 3 mix
Surface coal mines	Tier 2	Tier 1	Tier 1	Tier 2/Tier 3 mix
Post-mining emissions	Tier 2	Tier 2	Tier 1	Tier 2

Source: National Inventory Reports submitted to UNFCCC; China: National Communication and Biennial Update Report submitted to UNFCCC

Tier 1	Default IPCC emissions factors (EF x Activity Data = Emissions)	First-order approach; highest level of uncertainty
Tier 2	Country-specific or basin-specific emission factors	More detailed than Tier 1; lower uncertainty
Tier 3	Facility-level measurements, detailed modeling, or specific emission factors	Detailed activity data; data at highest resolution; lowest uncertainty

New Report: Best Practices in Monitoring, Reporting Verification of CH₄ Emissions from Coal Mining

- Coal mines release ~10% of global anthropogenic CH₄ emissions
- National programs for monitoring, reporting, and verification (MRV) can provide robust data that support mitigation and national inventories through:
 - **Monitoring** emissions, such as through direct measurements at facilities following adequate methodologies
 - **Reporting** emissions data in a way that is easy to access and using a reporting platform that eases documentation & data management
 - **Verification** of reported data & calculations as well as facilitating an independent check
- Report is available on [UNECE](#) and [GMI](#) webpages



The Role of National Monitoring, Reporting & Verification in CH₄ Management

- National MRV programs support national inventories, but also:
 - Help understand emissions to design impactful policies, mechanisms & incentives
 - Track mitigation action & impact
 - Understand sector mitigation options, such as for ventilation air methane (VAM), which comprises 70-80% of CMM and is low-concentration
- If MRV programs include data that are based on facility-level measurements, such program can support development, planning and tracking of mitigation projects. Specifically, such MRV programs can:
 - Establish a clear baseline of CH₄ availability
 - Form an understanding of the variation in CH₄ flows & concentrations
 - Provide developer confidence in gas availability over time.



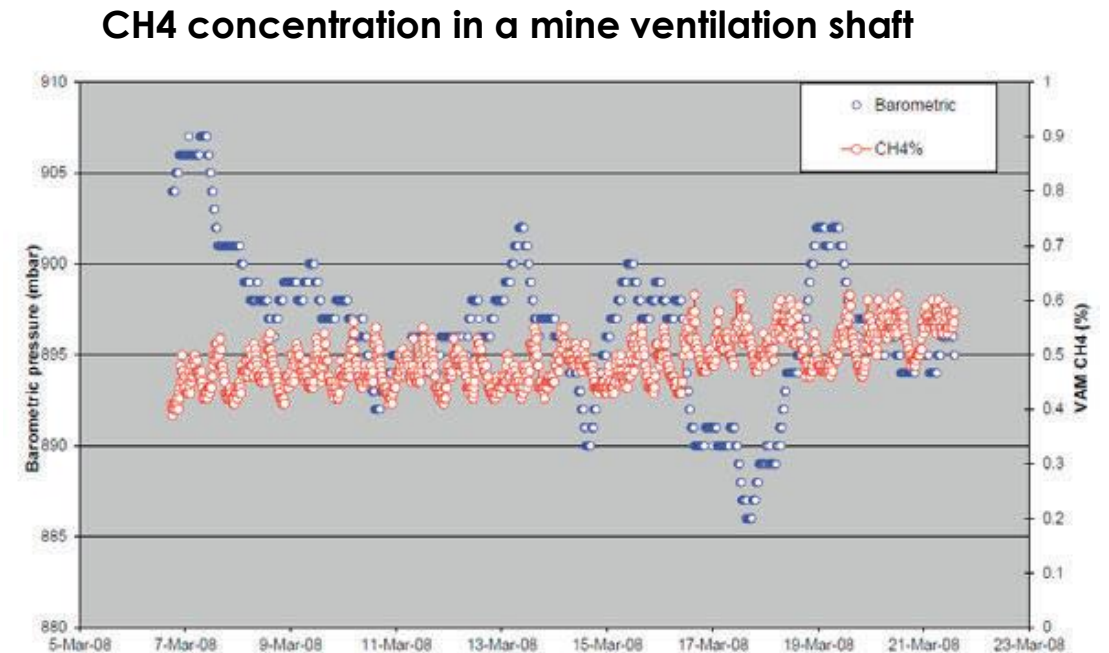
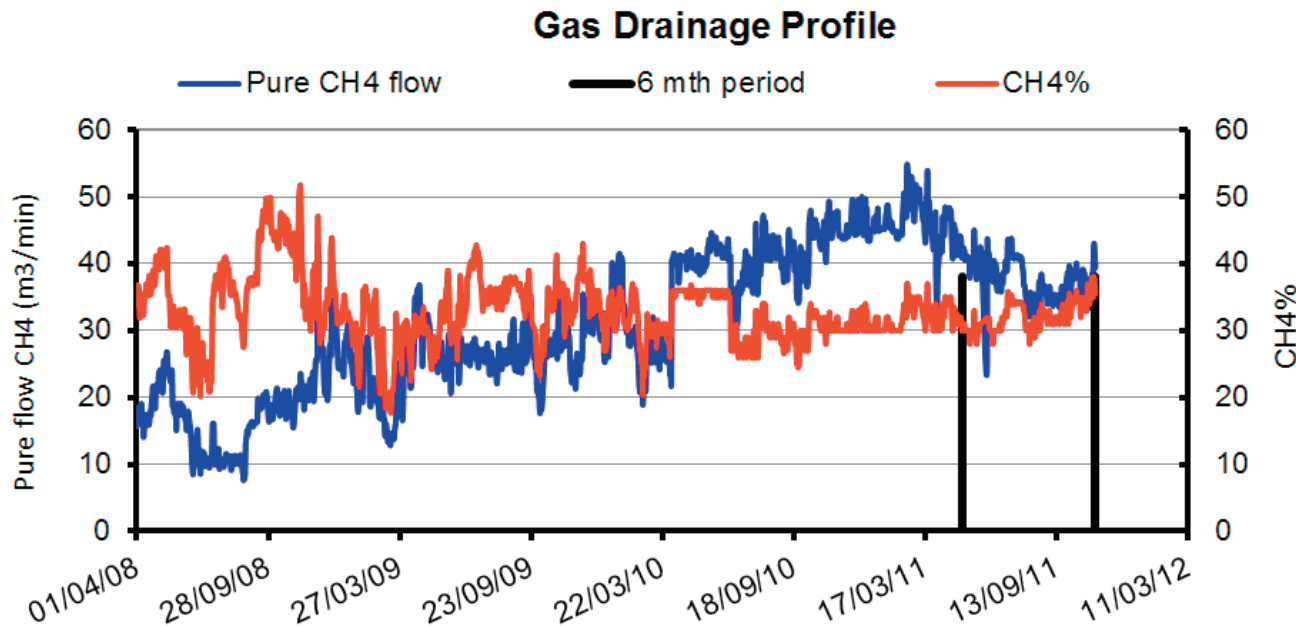
Monitoring Best Practice for Mitigation of CH₄ Sources in Coal Mines

- IPCC does not define any Tier approach as best practice.
- For mitigation purposes, an approach may be deemed “best practice” if it provides the most accurate accounting of emissions and establishes a reliable baseline for mitigation projects.
- Project developers typically do not accept data based on IPCC Tier 1 and Tier 2 methodologies to investigate, plan, develop, and finance mine CH₄ mitigation projects.



Monitoring & Variability of CH₄ Emissions in Coal Mines

- Flow of CH₄ at a source can **vary within the day** & often – **hourly**
 - Depends on pace of coal production, geology, ventilation velocities, barometric pressure



Source: UNECE, 2021. Best Practices in Monitoring, Reporting, Verification of CH₄ Emissions from Coal Mining

- Accuracy of measurement → frequency of measurement ← cost vs. benefit

Monitoring Best Practice for Mitigation of CH₄ Sources in Coal Mines

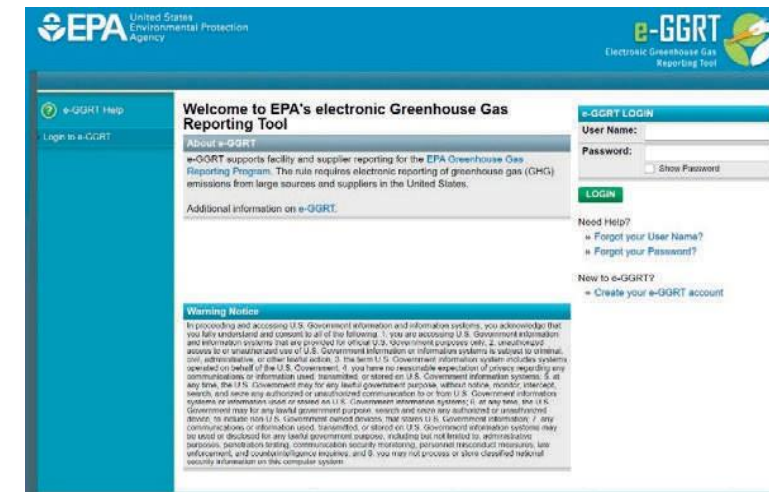


Mine Methane Source	Best Available Monitoring Approach from the Perspective of Mitigation Action	Examples of Countries where Approach is Included in MRV Methodology/Inventory
Working underground coal mines (ventilation and drainage)	Calculation based on data from Continuous Emissions Monitoring System (CEMS)	Australia (along with periodic measurements) United States (along with periodic measurements)
Abandoned underground mines	Regional decline curves using vent flow measurements, starting from gas flow at closure and mine status (sealed/ vented/flooded), allowing for flooding rate	Australia, United Kingdom, United States
Surface mines	Emission factor applied to coal production at the regional or mine-specific level and validated with local seam gas content measurements	Australia, United States, Germany
Post-mining	Emission factor established through residual gas content of coal after leaving the mine, applied to coal production that shows emissions during storage, processing and transport	Australia, United States

Reporting & Verification in Coal Sector MRV



- If a country of setting up an MRV program, in addition to sound **monitoring** approaches, reporting systems and verification are needed to deliver quality data.
- **Reporting** considerations:
 - Balance the burden to reporters and the level of detail sufficient for mitigation?
 - Do facilities have the technical capacity to correctly monitor, measure and report data?
 - Is the cost of requirements commensurate with the benefits derived from the reported data?
 - Is adequate reporting system in place?
- **Verification** considerations:
 - Ensure individual measurements are consistent, complete, and in alignment with protocols and equipment standards & procedures
 - Ensure results are calculated accurately and checked for consistency, against time series and algorithmic checks
 - Enable independent verification, if possible.



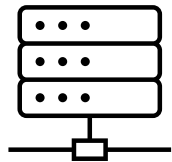
In Summary...



- Inherent variability of CH₄ emissions from coal mines has implication for estimating methane production by coal mines.



- Tier 3 (e.g., mine-level measurements) approach is best suited to facilitate planning, development, and financing of mine CH₄ projects.



- Estimation of emissions from different sources of mine CH₄ is not equally detailed. Monitoring of CH₄ emissions at working underground coal mines is often the most detailed, particularly, when there is capacity to use Continuous Emissions Monitoring Data (CEMS).



- Reporting and verification are important components of national MRV programs.

- Considerations for countries developing robust MRV programs for mitigation:
 - Adjust to the **policy framework** for the MRV, such as legislative, regulatory & administrative
 - Recognize and define roles for relevant **stakeholders**
 - Understand the **specific sources of sector emissions** (sub-sources) & their monitoring options
 - Assess **feasibility of direct measurements** at facility level (preferred approach) for sub-sources for monitoring
 - Determine the **target sub-sources** (e.g., working, abandoned or surface mines)
 - Prioritize by establishing **reporting thresholds** (e.g., facility type or size, emission size)
 - Develop the **program structure** (reporting frequency, platform, recordkeeping, publication)
- National MRV systems can provide reliable data for mitigation
- In principle, national data should be compatible with international reporting efforts, such as UNFCCC.

Thank you for your attention!



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- GMI is an international partnership of 45 countries & hundreds of private sector & multilateral partners focused on reducing methane emissions across five key sectors: oil & gas, coal mining, landfills, agriculture (manure), wastewater.
- Uniquely qualified with tools, resources & expertise to enable countries to reduce methane quickly & cost-effectively
- US EPA provides cross-sector technical expertise & serves as secretariat

<https://www.globalmethane.org/>

Appendix: Global Methane Budget

