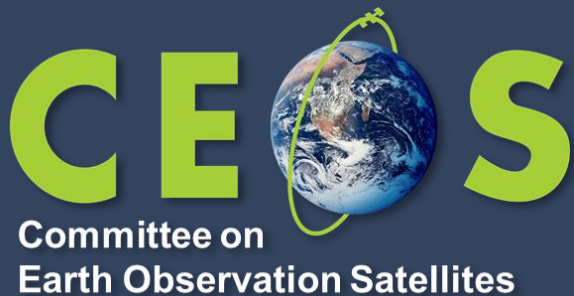


# CEOS SIT-40

## *Best Practices for Remote Sensing-based Estimates of Facility-scale Methane Emissions*

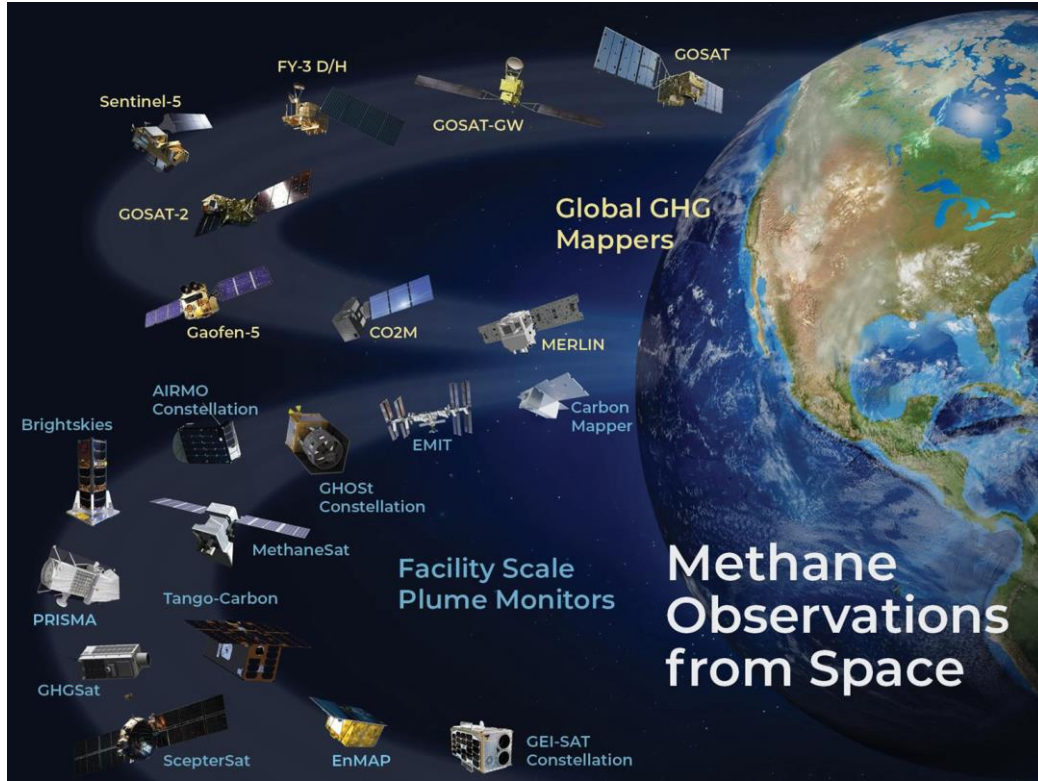
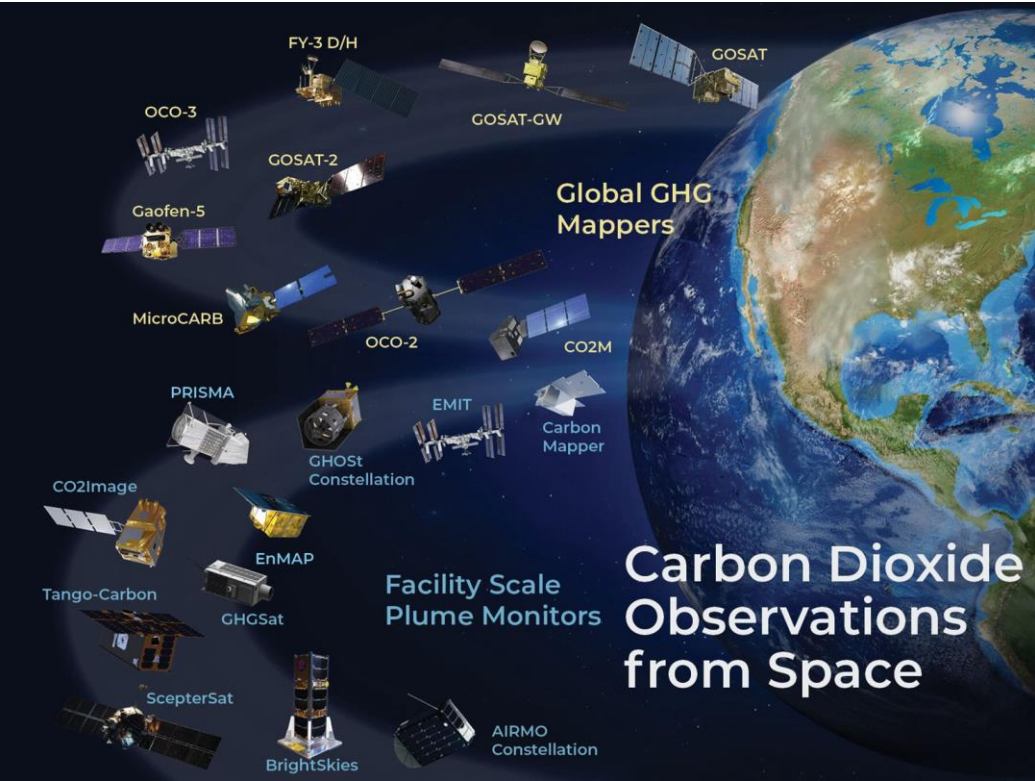


**Paul Green, NPL/UKSA  
& wider GHG team  
Agenda Item #2.2  
SIT-40  
Fukuoka, Japan  
8-10 April, 2025**

- ❖ The Global Methane Pledge (now signed by 155 countries) seeks to reduce methane emissions by 30% between 2020 and 2030
- ❖ Fugitive emissions / high emitters (emissions  $t > 100$  kg / hr) represent a substantial fraction of fossil and waste emissions
- ❖ Public and New Space observations of  $\text{CO}_2$  and  $\text{CH}_4$  are increasingly being used to identify high emitters to improve production efficiency of drilling, support regulation, and are likely needed for a functioning reporting obligations and carbon market
- ❖ Currently there are 3 missions dedicated to facility scale emissions monitoring, with another 10 expected in few years – in addition to the products generated from public data.
- ❖ We need a set of “common” practices for reporting VVUQ and QA for facility scale emissions so that producers of these data know what is expected by the community and (new) users know how the data should be generated and reported so that it can be trusted



# Growing constellation of GHG concentrations observations from the global to the facility scale



These are now being used to derive carbon dioxide and methane emission (flux) estimates on a range of spatial and temporal scales

## EU agrees law to curb methane emissions from fossil fuel industry

Rules would require firms to report emissions, find and fix leaks, and limit wasteful venting and flaring



Flares burn off hydrocarbons such as methane at an oil and gas facility. Methane has more than 80 times the heating power of CO<sub>2</sub> over a 20-year timespan. Photograph: David Goldman/AP

[https://oeil.secure.europarl.europa.eu/oeil/popups/ficheprocedure.do?reference=2021/0423\(COD\)&l=en](https://oeil.secure.europarl.europa.eu/oeil/popups/ficheprocedure.do?reference=2021/0423(COD)&l=en)



The screenshot shows the top navigation bar of the EPA website. On the left is the EPA logo and the text "United States Environmental Protection Agency". On the right is a search bar with the text "Search EPA.gov" and a magnifying glass icon. Below the search bar is a dark blue navigation menu with the following items: "Environmental Topics", "Laws & Regulations", "Report a Violation", and "About EPA", each followed by a downward-pointing chevron.

### Controlling Air Pollution from the Oil and Natural Gas Operations

[CONTACT US](#)

[Oil and Natural Gas Air Standards Home](#)

[Basic Information](#)

[Actions and Notices](#)

[Implementation](#)

## EPA's Final Rule for Oil and Natural Gas Operations Will Sharply Reduce Methane and Other Harmful Pollution.

December 2, 2023 -- EPA has issued a final rule that will sharply reduce emissions of methane and other harmful air pollution from oil and natural gas operations — including, for the first time, from existing sources nationwide. The final action includes New Source Performance Standards to reduce methane and smog-forming volatile organic compounds from new, modified and reconstructed sources. It also includes Emissions Guidelines, which set procedures for states to follow as they develop plans to limit methane from existing sources. Oil and natural gas operations are the largest industrial source of methane pollution in the U.S.

Methane is a climate "super pollutant" that is more potent than carbon dioxide and is responsible for approximately one third of current warming resulting from human activities. Rapid, sharp cuts in methane can generate near-immediate climate benefits and are a crucial addition to cutting carbon dioxide in slowing the rate of warming of Earth's atmosphere.

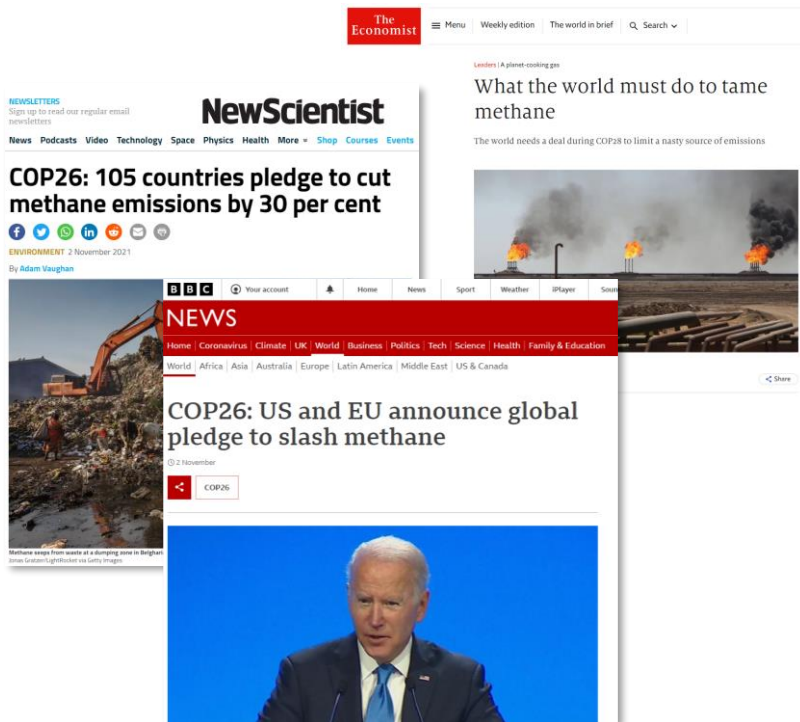
#### Regulatory Documents

- [Final Rule and Regulatory Text \(pdf\)](#) (5.9 MB)
- [Regulatory Impact Analysis \(pdf\)](#) (3.3 MB)
  - [Supplementary Material for the Regulatory Impact Analysis: Report on the Social Cost of Greenhouse Gases \(pdf\)](#) (8.8 MB)

<https://www.epa.gov/controlling-air-pollution-oil-and-natural-gas-operations/epas-final-rule-oil-and-natural-gas>



# Corporate emissions and climate risk reporting



Compulsory emissions & climate risk reporting for listed companies in US and UK, together with voluntary schemes to maintain market competitiveness aligned with customer climate expectations

# Identified community appetite with international buy-in

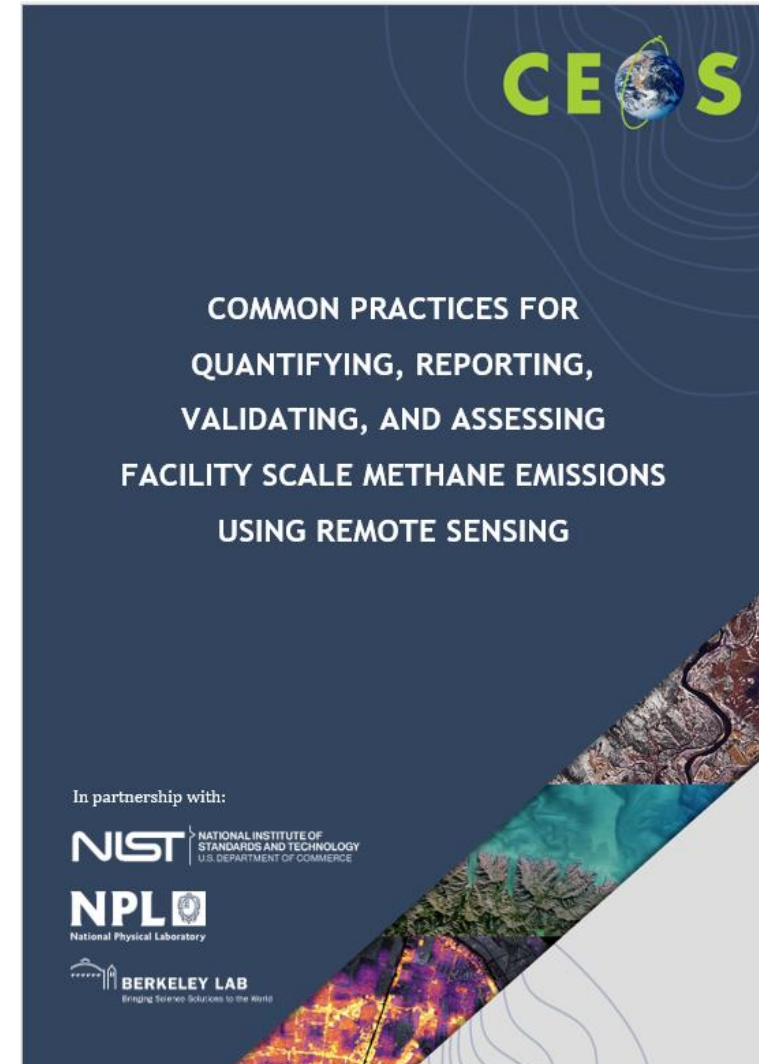


- ❖ COP28 - UKSA-hosted event on the UAE-Space Agency Space Sustainability stand within the first ever COP 'Space Pavilion'
- ❖ Monitoring Methane from Space: Towards an Internationally Recognised Standard
- ❖ NPL hosted a UKSA-sponsored methane reporting standards workshop Feb 2024
- ❖ Representation from CEOS member, commercial suppliers and academia
- ❖ NIST-sponsored workshop for L0-L4 common practise – Jan 2024





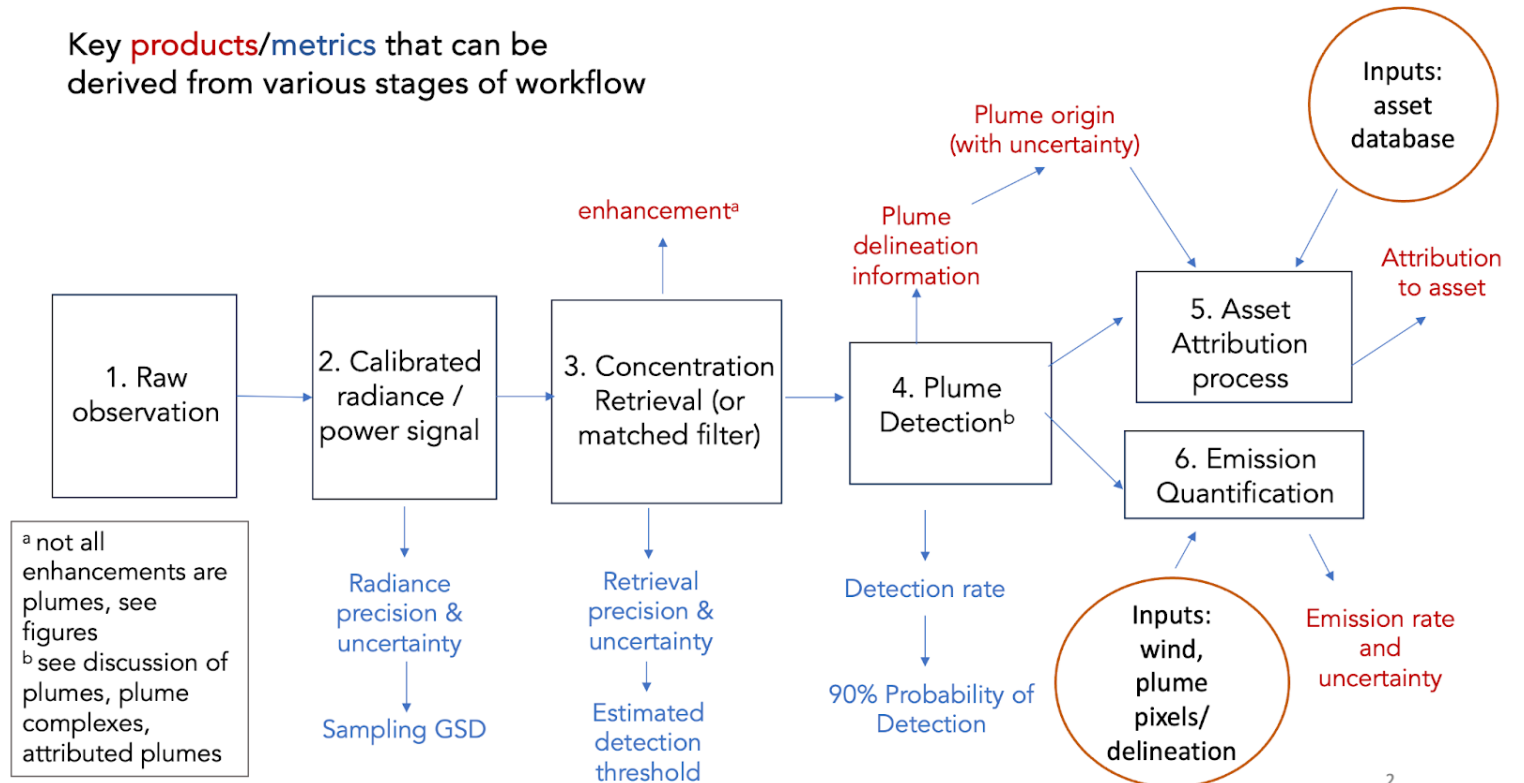
- ❖ Common practices intended users are
  - producers of these data (to know what is expected by the community)
  - users of these data (to understand how it should be generated and know how to use)
  
- ❖ Overall structure
  - Motivation, remit and timeliness
  - Common practise for L0 to L4
  - Validation current art
  - Quality assessment framework
  
- ❖ Integrates efforts across multiple agencies



# Workflow Common Practise



- ❖ At a high level, all practitioners use the same sequence of steps in their workflows
- ❖ The details of implementation vary, increasingly later in the process (from concentration/enhancement to emissions estimates)
- ❖ Later plume detection, delineation and emission quantification steps require a human in the loop



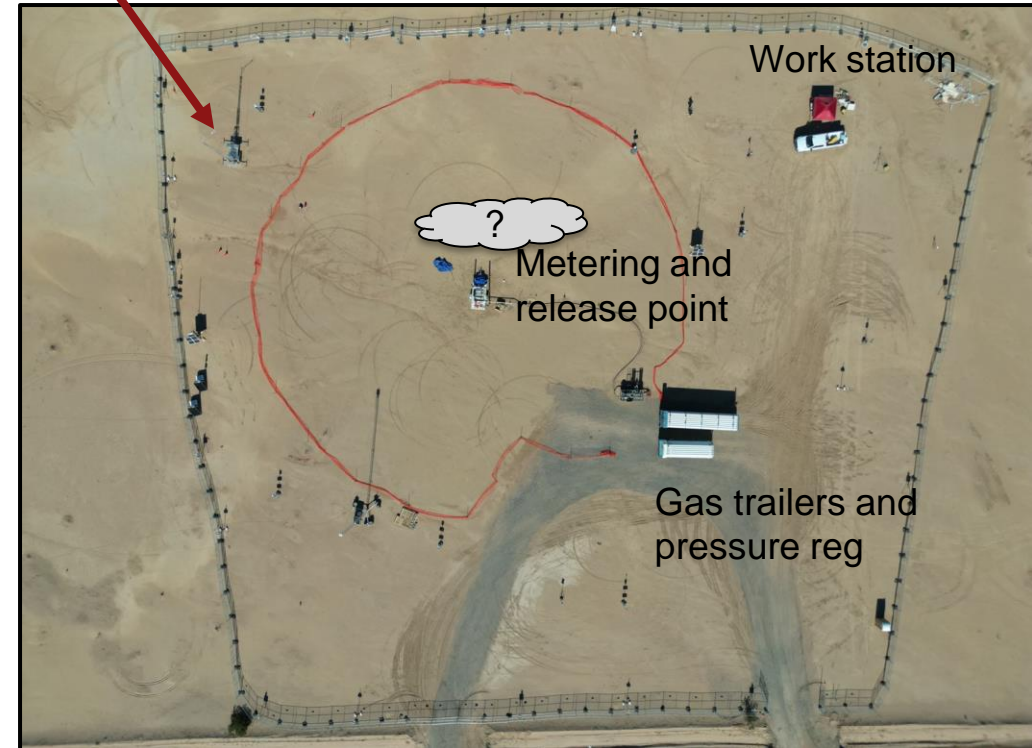


# State of Practice for Validation – controlled release

- ❖ First-of-a-kind controlled and blind\* testing of super emitter quantification and satellite detection
- ❖ Tests teams' detection and quantification ability



10 m ultrasonic winds and meteorological station

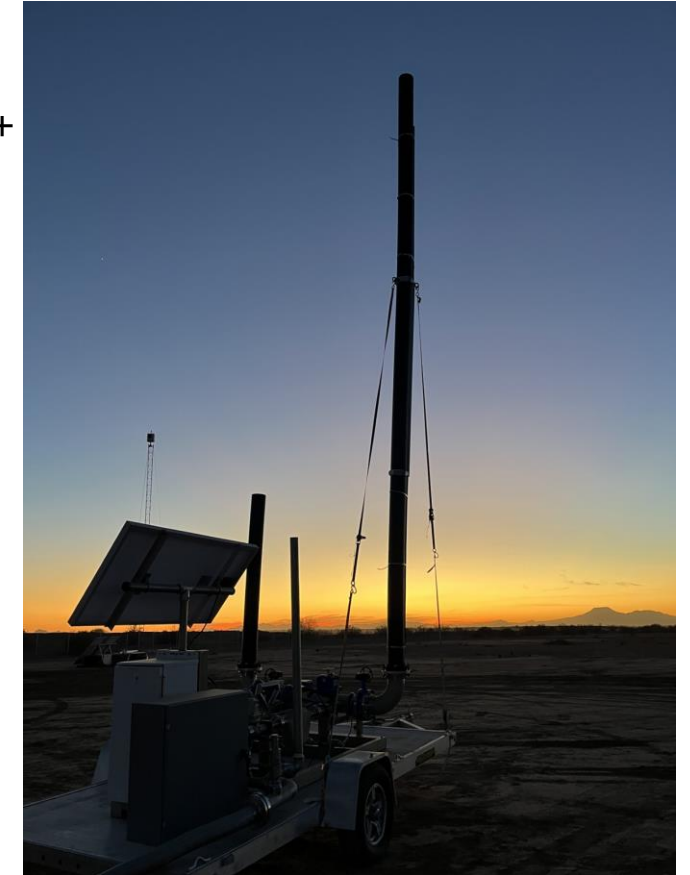


Credit: A Brandt Stanford [tinyurl.com/stanford-methane](https://tinyurl.com/stanford-methane)  
\*Participants know location but not [on/off] or volume flow rate. Coriolis flow metering for leaks between 3 kg/h and 1500 kg/h

# Large-scale controlled methane release 2024 -2025



- ❖ Independent testing of space-based methane detection needed, including several new satellite programs launched last year
- ❖ Cooperative and single-blind controlled release tests, building on 5+ years of satellite, airplane and ground sensor tests
- ❖ Expanded participation to 12+ methane satellite platforms and 15 analysis teams
- ❖ Remotely controlled gas flow enables higher sample sizes and better characterization of methane detection and quantification performance plus improved local meteorological measurements
- ❖ Current activity
  - ~150 release (10-1500 kg/h) cooperative stage being analysed
  - First single-blind stage “Phase 1” is ongoing in Q1 2025, data to be unblinded on May 1
  - Subsequent phases to follow with alternate testing configurations



Credit: A Brandt Stanford E  
Sherwin LBL & E. Kort UMich

# Quality Assessment framework



- ❖ Quality Assessment framework aligned with that developed within EDAP / CSDA for consistency across GHGs and other ECVs

Data Provider Documentation Review		
Product Information	Metrology	Product Generation
Product Details	Metrological Traceability Documentation	Atmospheric Column Retrieval Algorithm
Availability & Accessibility	Uncertainty Characterization	Geometric Processing
Product Format, Flags & Metadata	Ancillary Data	Mission Specific Processing
User Documentation		

Validation Summary
Atmospheric Column Validation Methodology
Atmospheric Column Validation Results
Geometric Validation Method
Geometric Validation Results

Key
Not Assessed
Not Assessable
Basic
Good
Excellent
Ideal
🔒 Not Public

Product Evaluation Matrix			
Data Provider Documentation Review			Validation Summary
Product Information	Metrology	Product Generation	
Product Details	Metrological Traceability Documentation	Emission Quantification Method	Emission Validation Methodology
Availability & Accessibility	Uncertainty Characterisation	Mission-Specific Processing	Emission Validation Results
Product Format, Flags & Metadata	Ancillary Data		
User Documentation			

Key
Not Assessed
Not Assessable
Basic
Good
Excellent
Ideal
🔒 Not Public

Column Enhancement

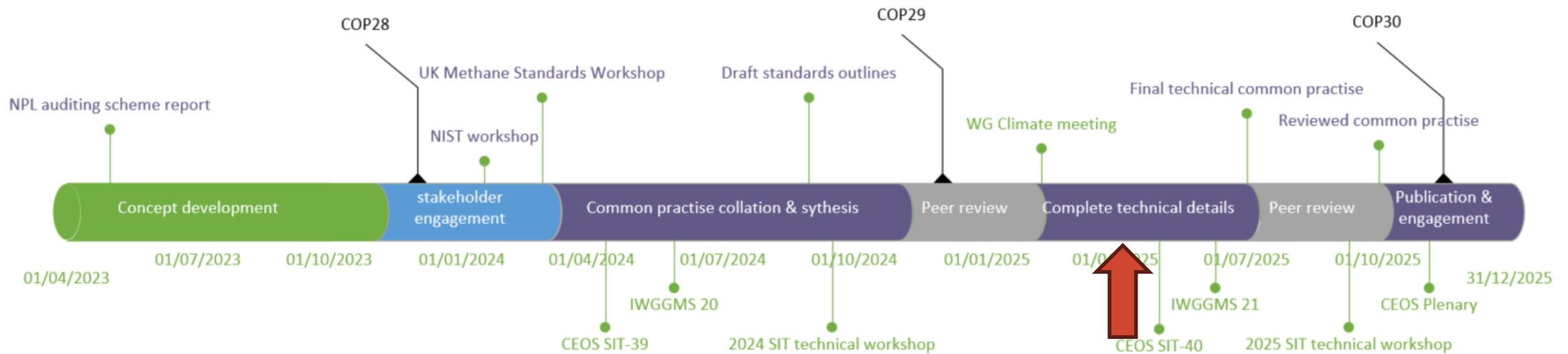
Emissions



# Progress and timeline



- ❖ 2024 – outline development & peer review
- ❖ 2025 – detailed completion, peer review & v1 finalisation for end 2025
  - ❖ v0.2 open for consultation Jan – Mar 2025,
  - ❖ now (in final stages of consolidation) to v0.3
  - ❖ V0.99 for final review June 2025 leading to static v1.0 July 2025.



- ❖ Public and New Space observations of CO<sub>2</sub> and CH<sub>4</sub> are increasingly being used to identify high emitters for regulation (in addition to science) and are likely needed for a functioning reporting obligations and carbon market
- ❖ Currently there are 3 dedicated to facility scale emissions monitoring, with another 10 expected in few years – in addition to the products generated from public data.
- ❖ We need define the common practices for reporting VVUQ and QA for facility scale emissions so that producers of these data know what is expected by the community and (new) users know how the data should be generated and reported so that it can be trusted

# Requests & Next Steps



- ❖ Continued support of effort to define best practices for quantifying and reporting emissions - in time this effort is handed off to an appropriate "operational" focused organization after agreement between vested parties
- ❖ Identified need to extend a Best Practices to Area Flux Mappers to better support the Global Stock Take and Global Methane Pledge as well as diffuse point sources and other sectors.
- ❖ Producer engagement is good, and recent input from UNEP IMEO but need to increase user engagement to ensure uptake – UN Climate & Clean Air Coalition (via short-lived climate pollutants initiative) & Global Methane Pledge – upcoming meeting between CCAC, GMP champions and best practices team to advance.
- ❖ Best practices actions added into the wider GHG TT roadmap