6560-50-P

ENVIRONMENTAL PROTECTION AGENCY

[EPA-HQ-OAR-2024-0350; FRL 12138-01-OAR]

Use of Advanced and Emerging Technologies for Quantification of Annual Facility Methane Emissions Under the Greenhouse Gas Reporting Program

AGENCY: Environmental Protection Agency (EPA)

ACTION: Notice; request for information (RFI).

SUMMARY: The EPA invites public comment on the potential for expanded use of advanced and emerging technologies for methane emissions quantification in EPA's Greenhouse Gas Reporting Program (GHGRP). These technologies are an important part of EPA's GHGRP, including under the recently finalized amendments for Petroleum and Natural Gas Systems. EPA intends to use the feedback received in response to this RFI to consider whether it is appropriate to undertake further rulemaking addressing the use of advanced measurement technologies in the GHGRP for petroleum and natural gas systems and municipal solid waste (MSW) landfills, beyond the current role provided in existing rules for these technologies.

DATES: Comments must be received on or before **[INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**.

ADDRESSES: Submit your comments, identified by Docket ID No. EPA-HQ-OAR-2024-0350, to the Federal Portal: https://www.regulations.gov. Follow online instructions for submitting comments. Once submitted, comments cannot be edited or withdrawn. Do not submit electronically any information you consider to be Confidential Business Information (CBI). EPA

may publish any comment received to its public docket, submitted, or sent via email. For additional submission methods, the full EPA public comment policy, information about CBI, and general guidance on making effective comments, please visit https://www.epa.gov/dockets/commenting-epa-dockets.

FOR FURTHER INFORMATION CONTACT: Vasco Roma, Environmental Protection Agency, Office of Air and Radiation, Office of Atmospheric Protection, Climate Change Division; telephone number: 202-564-1662; email address: Roma.Vasco@epa.gov.

SUPPLEMENTARY INFORMATION:

I. Background

Technologies with the ability to detect and measure atmospheric methane have been advancing significantly over the last few decades. These technologies are an important part of EPA programs, including the recently finalized 40 CFR part 98 Subpart W (Subpart W) amendments, which allow for the use of advanced measurement technologies to help quantify methane emissions from Petroleum and Natural Gas Systems sources, such as emissions from other large release events and flares under the GHGRP.[1] Similarly, the oil and natural gas New Source Performance Standards and Emission Guidelines at 40 CFR part 60 Subparts OOOOb and OOOOc ("NSPS OOOOb/EG OOOOc") published in March 2024 allow for the use of advanced measurement technologies to identify the presence of Super Emitter Events and for detecting fugitive emissions.[2] In addition, the rules provide a pathway for demonstrating that new

[1] Final Greenhouse Gas Reporting Rule: Revisions and Confidentiality Determinations for Petroleum and Natural Gas Systems, 89 FR 42062 (May 2024).
[2] Final Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review, 89 FR 16820 (March 2024).

technologies meet the performance requirements established in the NSPS/EG rules. As a result, regulated entities are able to leverage advanced measurement technologies that are already available to detect methane emissions rapidly with accuracy, as well as to incorporate new technologies that are emerging in this rapidly evolving field.

Following requests for comment in the notice of the 2023 proposed rulemaking for Subpart W,[3] the EPA received numerous comments requesting that the use of advanced measurement technologies be allowed to quantify emissions from other sources beyond other large release events in Subpart W. In response to these comments, EPA reviewed remote sensing and in situ advanced measurement approaches (including both intermittent and continuous monitoring approaches) that utilize information from satellite, aerial, drone, vehicle, and stationary platforms to detect and/or quantify methane emissions from oil and gas operations for their potential use in Subpart W reporting. As a result of this review and in response to comments on the proposed Subpart W rule, in May 2024, EPA finalized additional options within Subpart W to use advanced measurement technologies to measure data that are inputs to emission calculations for flares and well completions and workovers, in addition to the proposed use of advanced measurement technologies to quantify emissions from other large release events and/or estimate the duration of such events.

As EPA acknowledged in the final Subpart W rule, advanced measurement technologies are developing rapidly and are particularly well-suited for detecting and quantifying large and discrete emissions events, such as other large release events. Based on EPA's assessment of the strengths and limitations of advanced measurement technologies at the time of finalizing the

[3] Proposed Greenhouse Gas Reporting Rule: Revisions and Confidentiality Determinations for Petroleum and Natural Gas Systems, 88 FR 50282 (August 2023).

Subpart W rule, however, EPA limited the use of these technologies in annual GHG reporting to certain specific roles identified in the final rule.[4] EPA has also sought comment on how methane monitoring technologies might enhance emission estimates for other industrial sectors covered under the GHGRP, specifically for MSW landfills under 40 CFR part 98 Subpart HH (Subpart HH). In a May 2023 notice of proposed rulemaking, EPA requested examples of methane data collected from available monitoring methodologies and how such data might be incorporated into quantifying annual emissions.[5] Although the EPA did not take final action to incorporate advanced measurement technologies in the April 2024 final rule for the reasons described therein,[6] including information in comments received noting limitations in existing technologies, EPA has continued to review ways to incorporate the use of advanced measurement technologies into the emissions reporting for MSW landfills for GHGRP reporting purposes under Subpart HH.

Based on these reviews, EPA recognizes that advanced measurement technologies, and their use for annual quantification of methane emissions, are evolving rapidly. EPA is committed to transparent and continual improvements to its programs to ensure reporting is accurate and complete. There are four key considerations associated with expanding the use of advanced

[4] Final Greenhouse Gas Reporting Rule: Revisions and Confidentiality Determinations for Petroleum and Natural Gas Systems, 89 FR 42062 (May 2024).
[5] Proposed Revisions and Confidentiality Determinations for Data Elements Under the Greenhouse Gas Reporting Rule, 88 FR 32852 (May 2023).
[6] Final Revisions and Confidentiality Determinations for Data Elements Under the Greenhouse Gas Reporting Rule, 89 FR 31802 (April 2024).

measurement technologies to quantify annual methane emissions[77] under the GHGRP in a robust, transparent, accurate, standardized, and verifiable way:

(1) How to translate the measurement data provided by different types of advanced measurement technologies (e.g., methane plume images, satellite retrievals of column methane mixing ratios, ambient methane concentrations) into total tons of methane emissions.

(2) How to extrapolate methane emissions from discrete and intermittent observations into total methane emissions throughout the year (with a specific level of accuracy) and attribute these emissions to a specific equipment type, process, or facility.

(3) How to identify, attribute, and quantify methane emission events that are below a technology's detection limit, in order to estimate total equipment-, process-, or facility-level emissions throughout the year.

(4) How to set detection, quantification, attribution, verification, and uncertainty criteria and/or protocols for different types of advanced measurement technologies to ensure implementation into the GHGRP in a manner that is applicable to different infrastructures and environmental conditions across the U.S. (e.g., topographies, climates, facility types and layouts).

As technologies continue to rapidly advance to meet these needs, EPA is issuing this RFI to the public to obtain information about currently available advanced and emerging methane measurement technologies, and how these technologies could be used to quantify annual

[7] Current GHGRP reporting requires quantification of methane emissions at the equipment-, process-, or facility-level. For example, under Subpart W emissions are quantified and reported for specific equipment types, such as pneumatic controllers. For Subpart HH, emissions are quantified and reported at the facility-scale, which includes the total surface area of the landfill, or for specific processes such as landfill gas collection and control systems.

methane emissions from the oil and gas and MSW landfill industry segments at the equipment-, process-, or facility-level for GHGRP reporting purposes. The following questions are aimed to address the key considerations outlined above and have been organized into the following categories: quantification, attribution, and implementation.

EPA believes that standards or protocols could help ensure the use of advanced measurement technologies to quantify annual methane emissions is implemented in a transparent and standardized manner. Furthermore, EPA anticipates that annual quantification approaches may be specific to an emission source, facility type, or type of technology. Therefore, a potential standard or protocol might be specific to a type of methane source (e.g., hydrocarbon liquid storage tanks, landfill working face) and a specific measurement approach (e.g., drone, aircraft, vehicle-based, or multi-platform based). For example, for a specific type of source, a potential standard or protocol might include a detection limit below a certain methane emissions rate threshold, a sampling frequency and duration (e.g., 1 overpass weekly) to ensure representative sampling of operating activities throughout the reporting year, the inclusion of specific ancillary data (e.g., wind speed and direction), and the use of a transparent and peer-reviewed methodology (e.g., inverse analysis, statistical sampling) to quantify the annual total methane emissions to within a specified level of accuracy (e.g., 90%). To the extent that information provided in response to the questions below are specific to a particular emissions source, facility type, or technology type, please indicate the applicability in the comments provided.

II. Questions

1. Quantification of Annual Emission Rates

EPA is requesting information on issues related to the quantification of methane emissions using

currently available advanced measurement technologies, including: (1) detection and quantification of methane emission rates; (2) approaches for extrapolating observation-based methane emission rates to estimate annual total emissions; and (3) approaches for quantifying annual total methane emissions for sources that emit at rates below technology minimum detection thresholds. Detailed questions on each topic are listed below. Please provide detailed answers and citations to relevant resources.

a. Detection and Quantification of Atmospheric Methane Emission Events from Advanced Measurement Technologies

Advanced technologies for methane detection, such as instruments deployed on satellite, aircraft, or in the form of continuous monitors, can be used to detect methane emissions. These technologies do not directly quantify methane emission rates but require additional analytical tools and methods to transform the raw sensor measurements (e.g., change in light attenuation) into quantified methane emission rates (e.g., kg/hour) associated with each observation. Quantification approaches can include but are not limited to the inverse analysis of observed concentrations, the use of dispersion modeling, co-emitted tracer releases, or mass balance approaches. Based on the wide variety of detection and quantification approaches currently available, EPA requests comment on the following:

i. What advanced measurement technologies are currently available that can provide quantified methane emission rates using transparent, open-source, and standardized methodologies? What are the specific quantification approaches that have been used with these technologies, and how have these methodologies been demonstrated and validated? How can these technologies and

quantification methodologies be used to provide annual data in a consistent manner for each future year of GHGRP reporting? Are there specific detection and quantification approaches or methodologies that EPA should or should not consider?

ii. What performance metrics and threshold(s) related to quantification would be appropriate to apply to advanced measurement technologies for their incorporation into the GHGRP? For example, should EPA consider: thresholds for the methane detection limit (e.g., minimum emissions leak rate), thresholds for the probability of detection (e.g., rate of false positives or negative detections), specific levels of accuracy for quantification, specific measurement frequencies, or other? What would be a feasible approach for developing these thresholds and metrics?

iii. Should quantification approaches be limited to the use of specific methodologies (e.g., inverse analysis, mass balance) or specific approaches for using ancillary datasets (e.g., standardized interpolation of wind field products)?

iv. Are there ongoing efforts outside of EPA to develop standards or protocols for methane emissions detection and quantification from advanced measurement technologies that would address any of the questions raised in this RFI? If so, please specify which efforts and which question(s) can/will be answered and when these standards or protocols will be publicly available.

b. Extrapolating Quantified Methane Emission Rates to Calculate Annual Emissions for GHGRP Reporting Purposes

Different advanced measurement technologies provide data at different sampling frequencies (e.g., continuous to weekly) and durations (e.g., seconds to hours). Depending on the type of

technology and emissions source sampled, different approaches have been used to extrapolate observation-based methane emission rates to estimate total annual emissions for a specific region, facility, or site. These approaches often require additional information on the frequency and duration of the sampled emission events, information on the population of sampled emission sources, site-specific operational activities, or statistical analytical approaches. EPA seeks comment on the following:

i. What advanced measurement technologies are currently available that can provide annual total methane emission estimates for specific regions, facilities, processes, or equipment-level sources, that use transparent, open-source, and standardized methods? Are these technologies applicable across the entire U.S. and could they provide annual data in a consistent manner for each future year of GHGRP reporting? Are there specific annual extrapolation approaches or methodologies that EPA should or should not consider?

ii. What accuracy or uncertainty metrics would be appropriate for GHGRP reporting purposes? For example, what level of accuracy in reported annual methane emissions should advanced measurement technologies be required to meet? What sources of uncertainty are necessary to consider? Are there other specific quality assurance or quality control markers that should be considered to ensure that annual estimates represent the methane emissions from all operational activities throughout the reporting year, such as specific measurement frequencies or duration? What would be a feasible approach for developing these thresholds and metrics?

iii. To what extent should standards and protocols be specific to the type of methods and ancillary data used (e.g., statistical approaches), and to what extent should standards and protocols simultaneously consider the specific type of emission sources being sampled (e.g.,

large unintended vs. small routine emissions event)?

c. *Quantifying Annual Methane Emissions from Emissions Sources Below Detection Limits of Advanced Measurement Technologies*

Different advanced measurement technologies also have different detection thresholds (e.g., ~1 kg/hr to above 100 kg/hr), in part dependent on the distance of the instrument from the source (e.g., typically larger detection limit for instruments on satellites compared to aircraft), instrument type, and sampling strategy. In the current GHGRP, a significant number of sources emit methane at rates below these typical detection limits (e.g., a component leak will typically emit at rates significantly below 1 kg/hr). To account for methane emissions from these additional sources, various methodologies and statistical approaches have been developed to estimate total annual emissions to complement the data collected from advanced technology measurements. EPA seeks comment on the following:

i. What methodologies are currently available for integrating estimates of methane emissions for those sources emitting below technology detection thresholds in an open-source, transparent, and standardized way? Can these methodologies provide annual data in a consistent manner for each future year of GHGRP reporting? Are there specific approaches or methodologies that EPA should or should not consider?

ii. Should these quantification approaches be limited to the use of specific methodologies (e.g., Monte Carlo method) or specific ancillary datasets (e.g., the use of standardized infrastructure or operator data)?

2. Attribution

EPA is requesting comment and information regarding attribution of quantified methane

emissions (from discrete events or annual totals) to specific GHGRP facilities, sites, or sources.

In addition to differences in temporal resolution, advanced measurement technologies have spatial resolutions that can range from kilometers (e.g., satellite) to site or individual equipment scales (e.g., ground-based sensors). There are different approaches for attributing observed events to a specific equipment type, process, or facility depending on the specific type of technology used and sampling distance from the emissions source. These approaches often require ancillary information such as infrastructure data, site operator data, or meteorological data such as wind speed and direction. EPA seeks comments on the following:

a. What methodologies are currently available that can attribute quantified methane emission events to specific equipment types (or additionally, specific regions, facilities, or processes) using transparent, open-source, and standardized methods? Are there specific attribution approaches or methodologies that EPA should or should not consider?

b. What accuracy or uncertainty metrics would be appropriate for GHGRP reporting purposes? For example, what level of confidence in the source attribution would be necessary for advanced measurement technologies to meet for GHGRP reporting purposes? What would be a feasible approach for developing these thresholds?

c. To what extent would standards and protocols need to be specific to the type of methods and ancillary data used (e.g., infrastructure datasets) or the type of emission source sampled (e.g., large unintended vs small routine emissions event)?

3. Implementation

EPA is requesting comment and information on issues related to the implementation of advanced measurement technologies into the GHGRP.

Implementation considerations include the need for quantifying annual total methane emissions from oil and gas and MSW landfill applicable sources across the U.S. in a transparent and standardized way, validation and verification of the reported data, and additional potential uses of advanced measurement technologies for the GHGRP. EPA also requests information on additional data that could be reported for the verification of methane emissions estimates produced using advanced measurement technologies.

a. Structure of Approaches or Protocols

i. What form would standard method(s) or protocol(s) need to take to ensure that advanced measurement technologies provide annual total, source-specific, methane emissions in a transparent and standardized way? For example,

(1) To what extent should standards and protocols be specific to the type of methods used (e.g., satellite, aircraft, ground-based)? In addition, would different standards or protocols be necessary for sampling approaches using single platform vs. multi-platform measurements? Could standard methods be developed to be technology agnostic?

(2) To what extent could standard method(s) be developed to be source agnostic? For example, would standards need to be specific to the type of equipment, process, or emission source sampled (e.g., tanks, flares, pneumatic devices, landfill working face), or could a set of standard(s) be developed to be more broadly applicable across different GHGRP industry segments (e.g., oil and gas operations and landfills)? Alternatively, would different standards be necessary for different types of methane emission events sampled (e.g., large unintended vs small routine emissions events)?

b. Verification and Validation of Annual Source-specific Methane Emission Quantification

Methods Using Advanced Measurement Technologies for GHGRP Reporting Purposes

i. Are there approaches currently available that could be used to verify that advanced measurement technologies meet specific standards (e.g., independent blind studies, deployment of calibration standards, other)?

ii. Technologies to environmental and site conditions that have been previously validated? For example, if an advanced measurement technology has been validated through blind control release testing during which wind speeds ranged from 0.5 to 10 m/s, should the technology be limited to measurements within this range of wind speeds? What form of validation could be used to demonstrate whether a technology is applicable across environmental conditions outside of their tested ranges?

iii. Are there specific types of operator- or facility-specific information that would be useful for improving or validating annual methane emissions quantification or source attribution from advanced measurement technologies?

c. Other Considerations Related to the Use of Advanced Measurement Technologies for GHGRP Reporting Purposes

i. What (if any) are the current barriers or limitations to using advanced measurement technologies beyond what is currently allowed under the GHGRP to quantify annual equipment-level methane emissions at scale in the U.S.?

ii. What are the cost considerations for implementing different advanced measurement technologies to quantify annual, equipment-, process-, or facility-level methane emissions for GHGRP reporting purposes? If available, costs should be provided in a manner that can be scaled up to different implementation approaches (e.g., cost per site, cost per area covered).

iii. How are factors such as measurement and analysis cost, complexity, or time burden relevant for determining whether advanced measurement technologies may be appropriate for annual GHGRP application?

iv. Other than methane emissions detection and quantification, and establishing the duration of emission events as permitted under Subpart W for Other Large Release Events, are there additional ways in which advanced measurement technologies could be used to support quantification and reporting of equipment-, process-, or facility-level methane emissions to the GHGRP (e.g., as a method to identify changes in operating conditions, to supplement specific reported data elements)?

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