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October 2, 2023

Submitted via the Federal eRulemaking Portal at *www.regulations.gov*.

RE: Planetary Emissions Management, Inc. Comments on the Environmental Protection Agency's Greenhouse Gas Reporting Rule: Revisions and Confidentiality Determination for Petroleum and Natural Gas Systems. Docket Id. No. EPA–HQ–OAR–2023–0234

Dear Administrator Regan,

Planetary Emissions Management, Inc. ("PEM") is pleased to comment on the Environmental Protection Agency's ("EPA") Greenhouse Gas Reporting Rule: Revisions and Confidentiality Determination for Petroleum and Natural Gas Systems.

PEM creates tools and methods for direct measurement of greenhouse gases. Specifically, PEM integrates commercial analyzers that measure bulk greenhouse gases and experimental field systems to measure specific greenhouse gas isotopes, with the aim of more accurately measuring, and ultimately reducing greenhouse gas emissions. In support of its broader goal of reducing and preventing global warming, PEM designs and develops commercial systems that reduce costs, create new data, and support the deployment of more widespread greenhouse gas tracking technology. In addition to direct measurement, PEM is pioneering methods to transform directly measured greenhouse gas composition and atmospheric fluctuations ("flux") into new, unique, and verified financial greenhouse gas offsets and non-fungible tokens for sale to voluntary and compliance buyers worldwide. PEM hopes to use these financial tools to create the next generation of carbon exchanges, driven by more accurate data.

PEM applauds the EPA's proposed revisions to the requirements under 40 CFR Part 98, subpart W and respectfully submits the enclosed comments identifying how the EPA can leverage advanced emissions measurement technologies to meet those directives set forth under the Clean Air Act (CAA). As the preamble acknowledges, there is a need "to address potential gaps in the total CH_4 emissions reported per facility to subpart W."[1] While we support the EPA's efforts to address these gaps, further revisions are necessary to effectively fulfill CAA section 136(h)'s statutory mandate "to ensure that reporting of CH_4 emissions under subpart W (and corresponding waste emissions charges under CAA section 136) is based on empirical data, accurately reflects the total CH_4 emissions (and waste emissions) from applicable facilities, and allows owners and operators to submit empirical emissions data, in a manner prescribed by the Administrator . . . ."[2]

GHGRP and other inventory approaches have varying degrees of accuracy and are vulnerable to uncertainty in the "emission factors" used to calculate the GHG emission rates. Given these limitations, additional measurements of radiomethane are needed to reconcile differences amongst methods, to generate data at different times of the year, and to generate long-term data for monitoring the evolution of US oil and gas operations. The existing approach is not adequate to address the scope of and need for empirical data for CH_4 emissions.

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[1] https://www.regulations.gov/document/EPA-HQ-OAR-2023-0234-0001
[2] *Id*.

We recommend EPA Subpart W require a more accurate monitoring approach. We propose the adoption of a system of systems ("SoS") sensor architecture and an integrated sensor platform for the detection and quantification of directly measured CH_4 emissions. The SoS is designed to monitor net carbon flux at local-to-regional scales, produce automated reports, respond to remote commands and produce verified data. This approach, if adopted by EPA regulated oil and gas operations, could be employed at both onshore and offshore oil and gas production facilities. The goal of the empirical data and the SoS architecture is to ensure and demonstrate that CH_4 emissions are accurately measured and verifiable across reporting entities.

A key component of the SoS approach is identification and standardization of sensors and gases within the oil and gas operations area that may also be influenced by surrounding lands with variable magnitudes of flux and source apportionment. While the ratio of methane to ethane ratio (CH_4/C_2H_6), and the carbon 13 value ($\delta^{13}C$, ‰) for gas samples are currently utilized to differentiate fossil from contemporary CH_4, they may not be reliable across all sites and sampling conditions. In contrast, the radiomethane signature ($\Delta^{14}C$) can only be attributed to fossil CH_4, excepting for minor releases of radiomethane from pressurized water nuclear reactors. A plot of $\delta^{13}C$ vs $\Delta^{14}C$, clearly demonstrates the efficacy of this approach (see endnote 1), depicting a case study of CH_4 emissions measurement from a Canadian oil sands project.

The singular significance of radiomethane in standardizing CH_4 derived oil and gas empirical data for operational and regulatory purposes requires that high-precision portable analyzers for radiomethane be installed at each site or group of sites of production and related operations, and anchored by a central reference laboratory such as maintained by the National Institute of Standards and Technology (NIST). An independent third-party for verification of empirical data is necessary to accurately document and verify methane emissions. The NIST for example, operating a central reference facility, would issue certification of radiomethane results via the cloud instantaneously and be reported by the SoS according to a Data Management System that releases information automatically as authorized, including traceability to the System of International Units (SI). Traceability to the SI ensures that all radiocarbon measurements from all locations are directly comparable. Because the Inflation Reduction Act's methane fee requires fees on excess methane emissions, regulated entities will want the most accurate documentation of emissions. Accuracy in documentation will ensure regulated entities avoid unnecessary fees.

An integrated sensor portfolio managed by the SoS could also be installed according to a phased approach. The SoS and sensor platform could be purchased or leased to accommodate the need for each operation (see endnote 2 for examples of configurations). For example, the rule's framework to account for gaps in CH_4 emissions reporting, could be immediately strengthened by engaging a third-party central reference facility, such as the NIST, in anticipation of radiomethane and radiocarbon *in situ* analyses. In the interim, adsorption of CH_4 on zeolite cartridges placed within a facility could be implemented immediately at sites followed by conversion CH_4 to $^{14}CO_2$ (e.g., Endnote 2). Concomitantly, reporting oil and gas production facilities could determine the optimal locations for sampling for radiomethane, updating and augmenting existing national databases followed by optional service agreements. Empirical data for diagnostic gases such as (CH_4/C_2H_6) would continue to be gathered by stationary and dynamic methods (e.g., grab samples, eddy covariance, spectroscopic methods) as measures to immediately address gaps in the GHGRP. As a cost-control measure, subscription monitoring, reporting and verification services for facilities could be offered at flat rates according to facility size. Turn-key sensor portfolios could also be leased or purchased with the SoS software. The key point is that radiomethane empirical data organizes facility emissions according to emission levels and provides a central framework for all related sensor methods.

While the SoS reporting architecture software is being tested in the field, the radiomethane analyzer and extraction protocols require further development. PEM is currently in a partnership with the NIST to develop a portable high precision radiocarbon analyzer. Additional funding will be needed to complete and test the benchtop system followed by initial production of analyzers for beta site testing. Thus, a phased approach could be developed that first deploys the SoS reporting on existing sensor results, followed by installation of the radiomethane analyzer. The SoS will also include collection of air in flasks or as trapped on solid adsorbents for radiomethane analysis by accelerator mass spectrometry.

The confluence of the EPAs agency infrastructure and rulemaking across the US and the infusion of funding specifically for increased empirical data for CH_4, offers an opportunity for game-changing sensor and model development that satisfies the contemplated revisions to the GHGRP, Part W, and results in much more accurate emissions measurement.

Thank you for the opportunity to comment on EPA's proposed revisions to the requirements under 40 CFR Part 98, subpart W.

Sincerely,

Bruno Marino, PhD
CEO, Founder & Executive Chairman, Chairman of the Board of Directors
Planetary Emissions Management, Inc.

endnote 1. Source: acp-22-2121-2022.pdf (copernicus.org)

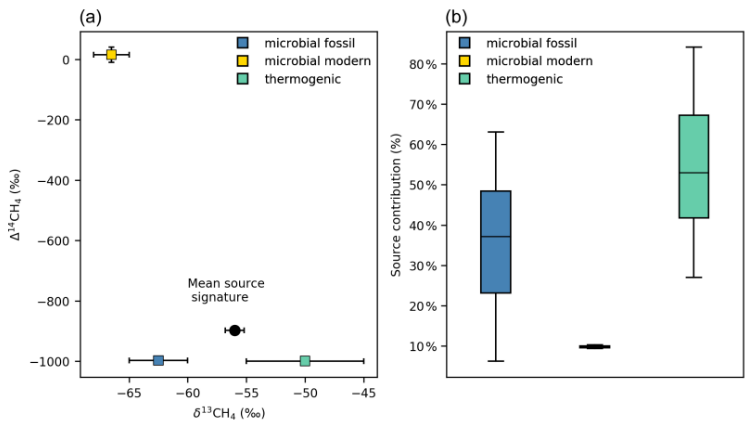
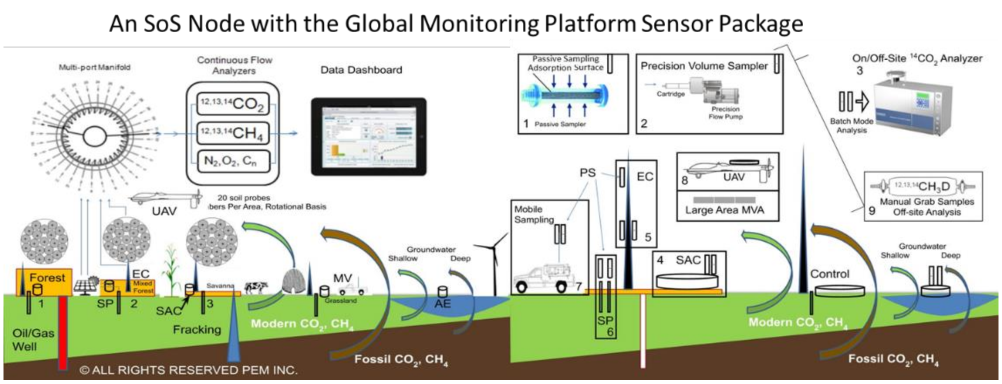


Figure 4. **(a)** δ^{13}C and Δ^{14}C signatures of potential CH_4 sources used to estimate source contribution using MixSIAR and mean $\delta^{13}CH_4$ and $\Delta^{14}CH_4$ source signatures of the samples associated with south trajectories derived from Keeling plots. **(b)** Boxplot of the estimated source contributions from microbial fossil CH_4 (tailings ponds), thermogenic CH_4 (surface mines and processing facilities), and microbial modern CH_4 (wetlands) for these samples. The line inside the boxes represents the median, boxes indicate the 25th and 75th percentiles, and whiskers show the 5th and 95th percentiles.

endnote 2: Source: Planetary Emissions Management Inc.



Left Panel: GMP overview of options for in-situ continuous flow monitoring for three well pads within the QUEST project environment designed to quantify fossil sources of CO2 and CH4 relative to modern sources. Detection of fossil fuel derived CO2 and fossil CH4 will indicate leakage of the injected CO2 gas and associated (e.g., fugitive) emissions of fossil CH4. A multi-port manifold will be used to switch between gas sources. Gas streams flowing from soil chambers (SC), and eddy covariance towers (EC) can be continuously measured for 12,13,14CO2 as well as N2, O2 and hydrocarbons (Cn). Measurements of 14CH4 requires separate collection of CH4 with intermittent analysis utilizing the bench top SCAR batch mode 14C analyzer. Placement of soil chambers have not been determined but can be modified to accommodate PEM measurement equipment and established well pad monitoring sites. Establishment of a control site or sites is required for comparative analysis of data sets representing QUEST and a non-injection environment. Data resulting from continuous flow analyses will be accessible in real time via a secure encrypted portal provided by PEM. The exact configuration of instrumentation and operation will be determined in the final deployment environment. Copyright PEM Inc. © 2023. All Rights Reserved.

Right Panel: Overview of options for discrete passive (1) and controlled-flow (e.g., specified flow rate and time of exposure) (2) sample collection using adsorbent cartridges for a generic well pad within the QUEST project environment. The cartridges, once exposed for specified periods of time, passively or actively, will be analyzed using AMS and the SCAR bench top ^{14}C analyzer (3). The cartridge exposures and subsequent analysis schedules are designed to quantify fossil sources of CO_2 and CH_4 relative to modern sources over large areas or in discrete locations where very small diffusive leakage is suspected. Detection of fossil fuel derived CO_2 and fossil CH_4 may indicate leakage of the injected CO_2 gas and associated (e.g., fugitive) emissions of fossil CH_4. Cartridges can be exposed passively or actively in the environment or inserted in-line within gas streams flowing from soil chambers (SC) (4) or eddy covariance towers (EC) (5). Grab samples in flasks (6) will also be obtained to explore complex isotopologues (e.g., $^{13,14}CH_3D$) and to establish performance of PEM and SCAR measurements relative to NOAA AMS characterized standards and to AMS analysis. Establishment of a control site or several selected sites is required for comparative analysis of data sets representing QUEST and a non-injection environment. Data resulting from cartridge analyses will be accessible as they are available via a secure encrypted portal provided by PEM. The exact configuration of cartridge sampling will be determined in the final deployment environment. Copyright PEM Inc. © 2023. All Rights Reserved.