Comments of Environmental Defense Fund at EPA's Public Listening Sessions on Upcoming Oil and Natural Gas Methane Rulemaking

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Good afternoon, my name is David Lyon and I am a Senior Scientist at Environmental Defense Fund, where I have worked since 2012 researching methane emissions from the oil and gas industry. I have a Ph.D. in Environmental Dynamics from the University of Arkansas and performed my doctoral research on the characterization and mitigation of oil and gas methane emissions. EDF urges EPA to propose and adopt protective standards for new and existing sources across the oil and natural gas sector that reflect the best available science and achieve substantial emission reductions of the powerful greenhouse gas methane and co-emitted pollutants. Today, I will discuss the latest science on methane emissions from the oil and gas sector. My EDF colleagues Edwin LaMair and Rosalie Winn will later discuss EPA's opportunity to tackle this challenge and policy recommendations.

Ten years ago, EDF launched a series of research studies to quantify methane emissions from the United States oil and gas supply chain with diverse, measurement-based methodologies. Our collaborative work with over 140 experts from academia, industry, and government has resulted in more than 40 peer-reviewed papers. Alvarez et al., a 2018 paper, synthesized previous studies to estimate that national oil and gas supply chain emissions were 13 million metric tons methane in 2015, equivalent to 2.3% of natural gas production and approximately 70% higher than estimated by EPA's most recent Greenhouse Gas Inventory.[1] Numerous studies have confirmed that bottom-up approaches like the EPA inventory greatly underestimate emissions, primarily because these traditional methods are based on assumptions rather than measurements and fail to account for large emissions caused by malfunctions and other abnormal conditions.[2]

Recent research by EDF and others has identified several characteristics of oil and gas industry methane emissions. First, emissions occur across the value chain from well to end use, including the transmission and storage, processing, and local distribution sectors, but in the U.S., emissions are most concentrated in the production and gathering segments, such as well pads, tank batteries, and compressor stations. Second, all facility types have a skewed distribution in which the top 5 to 10% highest emitting sites are responsible for about half the total emissions; however, the identity of these sites can change with time and is difficult to predict. Third, low production, marginal wells have lower average absolute emissions than high production wells, but much higher loss rates as a percentage of gas production, and due to their great numbers

[1] Alvarez et al., *Assessment of Methane Emissions from the U.S. Oil and Gas Supply Chain*, Science (2018), https://science.sciencemag.org/content/361/6398/186.
[2] *See, e.g.*, Rutherford et al., *Closing the gap: Explaining persistent underestimation by US oil and natural gas production-segment methane inventories*, Earth ArXiv (2021), https://eartharxiv.org/repository/view/1793/.

contribute a substantial fraction of total emissions. Fourth, emissions can almost always be mitigated once detected, sometimes with a simple repair to stop a leak, other times by implementing operational and/or equipment changes that improves a site's efficiency.

Since late 2019, I have been the science lead on EDF's Permian Methane Analysis Project, which uses several peer-reviewed measurement approaches to quantify oil and gas methane emissions in the Permian Basin, then posts the emissions data on the public website PermianMAP.org to facilitate mitigation. Several papers by EDF and collaborating scientists have revealed insights about the Permian Basin and I would encourage EPA to consider these as the agency develops protective national standards. Zhang et al., a 2020 paper, estimates the basin loss rate is 3.7% of gas production, substantially higher than the national average.[3] Lyon et al. 2021 found a similar loss rate of 3.3% in the core production area of the Delaware sub-Basin in March 2020 using aircraft and tower-based measurements; the paper reports that the loss rate temporarily dropped to 1.9% in April 2020 when oil price crashed due but recovered to pre-crash levels by summer 2020.[4] Robertson et al., a 2020 paper, determined that New Mexico Permian well pad emissions were 5 to 9 times higher than EPA estimates.[5] Complex well pads with tanks or compressors, including many with marginal production, had about 20 times higher average emissions than simple pads with only a wellhead. In addition to quantifying methane emissions, we performed a series of helicopter-based infrared camera surveys to determine that around 5% of flares are unlit and venting gas. Finally, Cusworth et al. 2021, used an aerial remote sensing approach to quantify over 1,100 large methane sources in the Permian.[6] In support of previous research, they find that both the gathering sector and flares are large sources of emissions; additionally, they assess the intermittency of large sources and find on average large sources are emitting 26% of the time.

Our scientific understanding of oil and gas methane emissions has expanded greatly over the last decade and can inform effective regulations for reducing emissions. First, emissions can occur across the supply chain so regulations must have comprehensive coverage. Marginal well pads can have high methane emissions and should be included within programs such as leak detection and repair. Second, due to the skewed distribution of emission rates, the speed of detecting and stopping large emission sources is most critical for reducing total emissions. Third, since large emissions can be episodic, after a screening approach finds a high emitting site, follow-up surveys must not only look for ongoing leaks, but equipment and operational issues that could trigger high emission events such as an undersized tank control system. Finally, regulations should be based on the best available science and incorporate flexible, performance-based approaches that incentivize the continued development and use of advanced technologies

[3] Zhang et al., *Quantifying methane emissions from the largest oil-producing basin in the United States from space*, Sci. Advances (2020), https://advances.sciencemag.org/content/6/17/eaaz5120/tab-pdf
[4] Lyon et al., *Concurrent variation in oil and gas methane emissions and oil price during the COVID-19 pandemic*, Atmos. Chem. Phys. (2021), https://acp.copernicus.org/articles/21/6605/2021/
[5] Robertson et al., *New Mexico Permian Basin Measured Well Pad Methane Emissions Are a Factor of 5–9 Times Higher Than U.S. EPA Estimates*, Envtl. Sci. Tech. (2020), https://pubs.acs.org/doi/abs/10.1021/acs.est.0c02927
[6] Cusworth et al., *Intermittency of Large Methane Emitters in the Permian Basin*, Envtl. Sci. Tech. Letters (2021), https://pubs.acs.org/doi/abs/10.1021/acs.estlett.1c00173

for detecting and reducing emissions. We thank EPA for considering our views and again urge the agency to issues standards that are comprehensive and protective.