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Independent Regulatory Review Commission

Testimony for Control of VOC Emissions for Oil and Natural Gas Sources

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Thank you for the opportunity to speak to you today. My name is Arvind Ravikumar and I am an assistant professor of energy engineering at Harrisburg University. I run the sustainable energy development lab where we work on addressing methane emissions from the oil and gas industry through cost-effective technological solutions.

I want to commend the Department of Environmental Protection on their work to reduce methane and other emissions from oil and natural gas activity in the state. These steps are critical to ensure that we develop our resources sustainably and protect the health and well-being of all Pennsylvanians. However, the proposed rule is insufficient to mitigate air quality issues from oil and gas activity. Here, I want to address four specific ways in which the proposed rule can and must be strengthened. These recommendations are based on the latest scientific evidence collected by scientists in my group as well as several others in the country.

First, low producing wells should not be exempt from leak detection and repair regulations as research has shown significant methane emissions from marginal wells. Based on results from our recent work, we find that low producing wells emit 10 times more methane than high-producing wells relative to total natural gas production[1]. For example, low producing conventional well sites in the Marcellus showed a leakage rate of 11% while unconventional well sites only emitted about 0.1%. Furthermore, the large number of low-producing conventional wells – over 71,000 in Pennsylvania – mean that the total emissions from these wells are higher than the total emissions from the 8000+ high producing unconventional wells. Despite contributing less than 10% to total natural gas production in Pennsylvania, emissions from low-producing conventional wells were responsible for over half of all upstream emissions[2]. Therefore, exemptions for well sites with gas to oil ratio (GOR) less than 300 scfh per barrel of oil is not supported by the scientific evidence.

Second, the reduction in LDAR inspection frequency from quarterly to semiannually should NOT be based not on the fraction of leaking components as the proposed rule states. Several recent studies, including those in Pennsylvania, have shown that a majority of emissions come from a very small number of leaking components – these are called 'super-emitters'[3]. For example, only about 1% of total components were found emitting using EPA's Method-21 approach, and only about 0.2% were emitting

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[1] A.P. Ravikumar et al. (2020). Repeated leak detection and repair surveys reduce methane emissions over scale of years. *Environ. Res. Lett.* **15** 034029 LINK

[2] M. Omara et al. (2016). Methane Emissions from Conventional and Unconventional Natural Gas Production Sites in the Marcellus Shale Basin. *Environ. Sci. Tech.* **50** 2099 LINK

[3] A.R. Brandt et al. (2016). Methane Leaks from Natural Gas Systems Follow Extreme Distributions. *Environ. Sci. Technol.* **50** 12512. LINK

when using the typically used optical gas imaging or OGI cameras[4]. Even sites with high total emissions will likely have less than 2% of components leaking at any point – this means that every site will always be surveyed semiannually according to the proposed rule. Instead, reducing the LDAR inspection frequency should be based on total emissions which can be directly measured or estimated using emissions factors and other statistical approaches that account for super-emitters.

Third, episodic events like liquids unloadings, compressor blowdowns, and methane slip from compressor exhaust are some of the largest sources of methane and VOC emissions[5]. Any effort to reduce emissions should also require control of these sources using best available management practices. This is especially critical for compressor stations that are sometimes located near homes and community spaces like schools and parks.

Fourth and finally, I encourage the DEP to consider allowing the use of new technologies such as drones for LDAR applications after rigorous evaluation. Many recent scientific studies, including those in our group, have demonstrated the potential for these technologies to rapidly detect leaks in a variety of operating conditions[6]. In addition, they can also measure leak rates, allowing DEP to develop improved emissions estimates[7]. These alternatives to OGI are often mounted on mobile platforms such as trucks, drones, and planes and have the potential to cover large areas in a short time, and therefore significantly reduce the cost of LDAR regulations.

Citations to peer-reviewed scientific studies for all these recommendations will be made available as part of my written testimony and I would be happy to discuss any further questions that the board might have.

Thanks to the Environmental Quality Board for this opportunity to speak on this important issue.

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[4] A.P. Ravikumar et al. (2017). Designing better methane mitigation policies: the challenge of distributed small sources in the natural gas sector. Environ. Res. Lett. 12 044023. LINK

[5] D. Zimmerle et al. (2020). Methane Emissions from Gathering Compressor Stations in the U.S. Environ. Sci. Technol. 54 7552. LINK

[6] A.P. Ravikumar et al. (2020). Single-blind inter-comparison of methane detection technologies – results from the Stanford/EDF Mobile Monitoring Challenge. Elem. Sci. Anth. 7 37. LINK

[7] T.A. Fox et al. (2019). A review of close-range and screening technologies for mitigating fugitive methane emissions in upstream oil and gas. *Environ. Res. Lett.* 14 053002. LINK