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**GAS INDUSTRY STUDY:
NEW EDF AND GAS INDUSTRY METHANE EMISSION STUDY IS NOT
REPRESENTATIVE OF US NATURAL GAS DEVELOPMENT, NOT THE PROMISED
DEFINITIVE STUDY**

The study, “Measurements of Methane Emissions at Natural Gas Production Sites in the United States” by David T. Allen and colleagues will be published in the Journal, *Proceedings of the National Academy of Sciences* at 3pm EST on Monday, September 16, 2013. The Environmental Defense Fund (EDF) together with many oil and gas companies funded and supported this research effort.

This new study of methane leakage appears fatally flawed. This important research bears directly on the powerful GHG/global warming effects of methane and thus the implications for regulation and continued widespread development of shale gas. But it has concluded that methane leakage at well sites, selected in time and location by industry participants, is so low as to be nearly trivial. This is a finding at odds with other researchers’ work that shows much higher rates.

Allen and colleagues conclude that upstream (at the well site) methane emissions from the natural gas industry amount to just 0.42% of gross annual domestic production of associated (oil wells) and non-associated (gas wells) natural gas.ⁱ However, the study - much like its widely-criticized predecessor, (EPA/GRI 1996)ⁱⁱ, which this study seems to closely follow – is based on a small sampling of hydraulically fractured wells which may not adequately represent national oil and gas activity and the variability within and across production basins. Furthermore, the fugitive losses reported by Allen and colleagues are 10 to 20 times lower than those calculated from more complete (field-level) measurements. Allen and colleagues do not address this large discrepancy or even reference these other studies.

Based on the study's text (supplemental information was not available at the time of this press release), we identified a number of methodological issues - including some of the same criticisms launched against the EPA/GRI study - that render this study incomplete and problematic in terms of it being representative of well site methane emissions in the real world:

1. **The study sites selected are not likely representative of typical gas development**

A very small sample size

The study measured emissions from just 489 gas wells and only 27 hydraulic fracturing events. These measurements represent just 0.11% of the total (conventional and unconventional) gas wells in the United States. EPA/GRI (1996) sampled a similarly small subset of the nation's wells (0.14%).

Non-random choice of sites

The study's results, much like those of the earlier EPA/GRI (1996) study, are based on evaluations of sites and times selected by the oil and gas industry rather than random and independent sampling of sites. Thus, this study must be viewed as a best-case scenario, based upon wells selected by industry, a party undoubtedly interested in a particular outcome (i.e. low methane loss from gas development).

As stated in the paper, **“The uncertainty estimate does not include factors such as uncertainty in national counts of wells or equipment and the issue of whether the companies that provided sampling sites are representative of the national population.”** Unfortunately, these are exactly the most important parameters on which to base a truly representative, nation-wide assessment. And it is exactly the many co-authors of the paper who are employed by the gas industry who should have been in best position to know well counts, the equipment deployed at each, and whether the very few wells sites they used in this paper were truly representative.

Type of gas wells sampled for flowback measurements is not clear and the results might say little about shale gas

Geological formation type has a significant impact on methane emissions during post-fracturing flowback. For example, industry data indicate **completion emissions from tight-sand and shale wells may be up to 10 times higher than those of coalbed methane or conventional wells** (Howarth, Santoro et al. 2011; Pétron, Frost et al. 2012; Karion, Sweeney et al. 2013). However, Allen and colleagues do not address this critical point and it is unclear whether the 27 wells sampled during flowback are shale, tight-sand, coalbed methane, or a combination of well types. Based on the wide range of non-captured or flared emissions reported, it does seem that both lower pressure wells (e.g. coalbed methane) and high pressure wells (e.g. shale) were included in the sampling, yet transparency of the distribution of the sampling across formation types is also omitted. If multiple formation types were indeed sampled, simply averaging all measurements, without weighting them for differences in formation type, biases the results.

2. **The study only takes upstream (at the well pad) emissions into account: it is not a complete life-cycle emissions study**

By design, only upstream (at the well pad) emissions were included in this study. Methane is also emitted as gas travels to consumers through compression, processing, storage, transmission, and distribution sectors (i.e. full lifecycle). Independent scientific research has indicated that these additional emissions are larger than previously thought (Peischl 2013; Phillips, Ackley et al. 2013). Presumably these other emission sources will be assessed in future papers, but **it must be clearly understood that emissions reported by Allen and colleagues in this paper reflect a very small subset of sources at a single stage of a multi-stage industrial process.**

3. **Ignoring conflicting results in the literature**

Methane emission estimates from Allen et al. are substantially lower than measurements taken by independent scientists. Other published emission studies and many more underway and presented at national scientific meetings have used techniques that measure field-level emissions and *do not require industry permission to sample* (See a **summary of all estimates to date at http://psehealthyenergy.org/data/PSE_ClimateImpactsSummaryUPDATED_12Sep20132.pdf**). The National Oceanic and Atmospheric Administration (NOAA) has been a very important player in this work, but other labs including many academic institutions have also pursued this line of research. **All of these studies report field-level emissions from natural gas production that are 10 to 20-fold higher than what Allen and colleagues estimate based on extrapolated data.** Some of these other studies combine upstream with some midstream emissions, so more study will be needed to identify contributions from each phase. Nevertheless, methane emissions of this magnitude for only upstream and some midstream components of the life-cycle should alarm anyone who cares about global climate change.

A fatal flaw in the study by Allen and colleagues is that they make no attempt to discuss these conflicting results, nor do they even reference these other studies as relevant evidence to uncertainty. How might one explain this huge discrepancy in measured emissions?

Possible explanation #1 for discrepancy: industry well selection

While it is possible that the gas industry can produce gas with relatively low associated emissions at the well site, this is likely not now the norm nationally, regionally, or even within a single production play. It is in the interest of industry to select lower emitting wells for sampling. Studies carried out by NOAA and other independent researchers which report significantly higher rates of emissions rely on atmospheric measurements and chemical analysis of atmospheric samples to assess emissions across the entirety of a production field rather than a small subset of selected wells. As such, these studies are more likely to reflect accurately real-world emissions from the industry as a whole.

Possible explanation #2 for discrepancy: the effect of oversight

This paper suggests that when industry knows that they are being carefully watched they are motivated to, and capable of, substantially reducing fugitive methane emissions at the well site. However, in the real world, not every well has oversight by scientists and engineers of the caliber of Allen and colleagues during all of their work. In fact, many state oil and gas regulatory agencies in the United States have too few inspectors to monitor the large numbers of wells and regulatory oversight is, thus, greatly limited (<http://goo.gl/VK4nzf>). In the real world, gas production operators may not take all precautions necessary to limit fugitive methane loss; field-level measurements capture the emissions from wells owned by these operators as well as exemplary wells.

The results of this study fall within the range of upstream methane emissions reported in the controversial EPA/GRI 1996 study: 0.38% (± 0.17) of gross U.S. production. One can't help but notice other similarities between the studies: e.g. relative sample size, sampling methods. The EPA/GRI study has been widely criticized for limited data and unrepresentative sampling (Howarth et al. 2011; EPA 2010; OIG 2013). Given the politically charged environment around unconventional natural gas development, we must question whether this study is simply an attempt to manipulate science and reverse the political discussions of fugitive methane emissions. A confirmation of high rates of fugitive methane losses as is concluded in all of the field-level studies to date (again, these were omitted from the Allen et al. paper) would discredit the "clean natural gas" narrative. It is likely that a higher methane emission rate would necessitate more regulatory oversight of the oil and gas industry and this study may be an industry maneuver to counter that possibility.

Anthony Ingraffea, PhD, the Dwight C. Baum Professor of Engineering at Cornell University said:

“I am pleased to see the plea for actual measurements of methane emissions we made in our 2011 paper taken seriously by EDF, other academics, industry and government agencies like NOAA. This first in a series of papers from one measurement project is a useful start to answering a technical question that should have been answered before a national energy policy involving "all of the above" was promulgated: how much methane is being emitted? The paper also raises questions about the validity of measurements supplied by industry. Moreover, it does not address the more important science and policy questions that will ensue after that technical question is finally answered: what is the climate changing effect of any amount of methane emission, and over what period of years are we willing to risk extending the fossil fuel era in the face of the answer to that science question?”

Seth B. Shonkoff, PhD, MPH, executive director, Physicians, Scientists, & Engineers for Healthy Energy (PSE) and environmental researcher, University of California, Berkeley, said:

“Policy-makers and society in general are in great need of robust scientific measurements of methane emissions from modern gas development. It is

disappointing that Allen and colleagues seem to have failed to employ basic scientific rules including transparent criteria for the selection of study sites to measure, sufficient sample sizes, and the attempt to place their results in the context of other scientific studies to date. This study falls short in its attempt to help answer questions about methane emissions from modern gas development beyond the small number of gas industry-selected wells where measures were taken.”

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ⁱ Allen et al (2013) calculate national emission intensity for the gas production sector using U.S. gross gas production from both gas and oil wells, yet their comparison with EPA (2013) emissions in Table 2 does not include methane emission from the petroleum sector. It is unclear from the text of Allen et al. (2013) whether the authors sampled only gas wells or both gas and oil wells. If emissions reported reflect only gas wells (non-associated natural gas production), then the calculation of emission intensity should not include associated production from oil wells. Adjusting for this error yields a higher loss rate in the production sector (0.62%).

ⁱⁱ The EPA/GRI (1996) report, from which this new study appears to borrow freely, has been criticized for limited data and unrepresentative sampling (Howarth et al 2011; OIG 2012). The EPA (2010) itself has stated that, "...the [1996] study estimate of emissions factors are not representative of industry operations because the estimates were based on limited . . . field data and hence not representative of the entire country. Therefore, this method for estimation of the emissions is not is not considered to be appropriate . . ."