INDEPENDENT PETROLEUM ASSOCIATION OF AMERICA

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Evaluation of EPA's Estimation of Methane Emissions From the Oil and Natural Gas Production Sector

In June 2017, the Environmental Protection Agency's (EPA) Office of Inspector General (OIG) announced that it intended to initiate a preliminary investigation regarding EPA's estimation of methane emissions from the oil and natural gas production sector. More precisely, it stated:

> The specific objectives for this evaluation are to determine: (1) how the EPA estimates methane emissions from the oil and natural gas production sector, including the extent to which the EPA has used the results of 2013 and 2014 emission studies conducted jointly by the Environmental Defense Fund and the University of Texas - Austin to estimate those emissions; and (2) whether concerns about technical or other problems with the Environmental Defense Fund and University of Texas - Austin studies were identified or brought to the EPA's attention, and how the EPA addressed and resolved any such concerns.

Some press coverage of this action suggests that it may be driven by a complaint filed by an extreme environmental advocacy group – NC WARN – that had earlier filed a complaint accusing David Allen, the lead investigator in the Environmental Defense Fund (EDF)/University of Texas – Austin (UT) methane emissions studies, of faulty work. OIG declined to pursue the NC WARN allegations in 2016, but it now has opened this investigation related to the same issues.

These comments are filed on behalf of the Independent Petroleum Association of America (IPAA). IPAA represents the thousands of independent oil and natural gas explorers and producers, as well as the service and supply industries that support their efforts, that develop American oil and natural gas. Independent producers drill about 90 percent of American oil and gas wells, produce 54 percent of American oil and produce 85 percent of American natural gas.

IPAA's member companies are significantly affected by the methane emissions and Volatile Organic Compound (VOC) regulations and Control Techniques Guidelines (CTG) that EPA has promulgated over the past several years. A key part of the debate over these regulations relates to their justification – justification that is based on EPA estimates of methane emissions. Throughout this debate, IPAA has been concerned that EPA has **overestimated** methane and VOC emissions. These overestimations then become critical to the justification of EPA's regulations; several estimation actions occurred at key times in the regulatory process when the

Obama Administration sought to move aggressively to expand federal regulation of oil and natural gas production.

More specifically, these comments will address several key points:

- Efforts by Keep It in the Ground environmental activists to portray natural gas development and use as adverse to the environment have been proven false.
- Emerging analyses of oil and natural gas production methane emissions call into question EPA's development of it methane emissions estimates.
- EPA failed in its creation of regulations to develop the necessary emissions information required by the Clean Air Act to properly regulate.
- EPA inappropriately recalculated its emission estimates to increase oil and natural gas production estimates to justify regulations created as part of the Obama Administration Climate Action Plan
- EPA used specious environmental activist studies to alter its proposed regulations without any analysis of the studies' validity.
- Recent studies are demonstrating that EPA revised estimates are overstating methane emissions and call into question the basis for the Obama Administration rush to impose regulations.
- Fundamental questions regarding the Obama Administration actions to complete unjustified regulations and manipulate emissions estimates are pertinent for an OIG review.

Consequently, IPAA believes that the EPA OIG needs to consider these issues in the context of its review of the EPA methane emissions process.

Some context to the nature of the methane emissions debate may help understand how it has evolved. Environmental activists have been attacking fossil energy for decades. Earlier, most of that attack challenged the use of coal but viewed natural gas (95 percent methane on average) as a positive alternative. However, that view changed when the development of shale gas demonstrated that natural gas was no longer a "bridge" fuel to the environmentalists' panacea of renewable energy. Consequently, environmentalists shifted their fossil energy attack to include arguing that unburned methane emissions from the natural gas value chain – production through processing through transportation through use – was worse than coal. The environmental activists embraced a series of specious studies on methane emissions to bolster this argument. When this approach failed, the attack shifted to explicit climate based allegations regarding the role of methane in the amalgamated greenhouse gas (GHG) emissions pool. Both of these issues need to be addressed.

Coal Versus Natural Gas

The natural gas versus coal arguments were characterized by assessments of whether natural gas methane emissions exceeded 3 percent of natural gas' total volume across the value chain. If higher, natural gas methane would have a greater GHG impact than combustion of coal. Two of the most visible proponents of the natural gas is worse than coal theme were Cornell University professors Robert Howarth and Anthony Ingraffea. Characteristic of their allegations were studies that postulated methane emissions from natural gas production in the range of 3.6 to 7.9

percent of production. Embraced by the radical environmental movement, these allegations were widely reported and used to oppose American natural gas development. But, they are wrong.

Following is a rundown of the most prominent scientific evidence showing that methane leakage rates from natural gas production are low and well below the threshold for natural gas to maintain its climate benefits.

- **Allen et al. (1.5 percent):** This landmark 2013 EDF/University of Texas study was the first to measure actual emissions, and it found emissions "nearly 50 times lower than previously estimated by the Environmental Protection Agency," confirming beyond a shadow of a doubt natural gas' climate benefits over coal. UT and EDF followed up with two more studies, which also found very low methane leakage rates. These studies concluded that methane emissions from the upstream portion of the supply chain are only 0.38 percent of production. That's about 10 percent lower than what they found in their 2013 study.
- **Littlefield et al. (1.65 percent):** This 2017 U.S. Department of Energy National Energy Technology Laboratory study used data from Zavala-Araiza et al. (see below) to synthesize emissions on a national scale. But even though the study finds low emissions, it is worth pointing out that it likely overestimates the leakage rate based to the fact that it extrapolates so-called "super-emitter" data from Zavala-Araiza et al. on a national scale. A recent NOAA study also reveals the "super-emitter" data Zavala-Araiza et al. relied on air measurements likely collected during episodic maintenance events, which skewed emissions higher than they typically would be.
- **Lyon et al (1.2 percent):** Using "top down" measurements from aircraft over the Barnett Shale in Texas, this 2015 EDF/University of Houston study found very low leakage rates, despite the fact that a limitation of "top down" studies is the fact that methane detected can come from other sources such as agriculture and natural seeps.
- **Marchese et al (1.6 percent):** This 2015 EDF/Colorado State University study took direct measurements from 114 gathering stations and 16 processing plants across 13 states. Using these measurements, along with EPA data from other segments of the natural gas supply chain, the study found an overall leakage rate that EDF's Mark Brownstein noted is a "well below what most scientists say is advantageous for the climate."
- **Peischl et al (1.1 percent):** This 2015 Colorado University-Boulder/NOAA study used "top-down" measurements from five flights from a NOAA research aircraft over areas that collectively represent half of the U.S.'s total shale gas production (Haynesville, Fayetteville and portions of Marcellus shale). The report goes notes: "[T]he regions investigated in this work represented over half of the U.S. shale gas production in 2013, and we find generally lower loss rates than those reported in earlier studies of regions that made smaller contributions to total production. Hence, the national average CH4 loss rate from shale gas production may be lower than values extrapolated from the earlier studies."
- **Zavala-Araiza et al. (1.5 percent):** This 2015 EDF study analyzes data from 12 previous EDF Barnett Shale papers and finds low methane emissions despite being, as the report puts it, "biased toward high-emitters." Notably, a recent NOAA study reveals the

"super-emitter" data Zavala-Araiza et al. relied on air measurements likely collected during episodic maintenance events, which skewed emissions higher than they typically would be. As a result, these "peak" emissions data were inappropriately used to calculate a normal emissions profile.

- **Zimmerle et al. (1.3 percent):** This 2015 EDF/Colorado State University study finds low overall natural gas system methane leakage rates based on 2,292 onsite measurements from transmission and storage facilities along with additional emissions data from 677 facilities and activity data from 922 facilities.

Even the Intergovernmental Panel on Climate Change's (IPCC) — not exactly an industry or "climate denier" source — states in its latest climate assessment that numerous studies show methane leakage rates are very low,

> "While some studies estimate that around 5% of the produced gas escapes in the supply chain, other analyses estimate emissions as low as 1% (Stephenson et al., 2011; Howarth et al.,2011; Cathles et al., 2012). Central emission estimates of recent analyses are 2%–3% (+/-1%) of the gas produced, where the emissions from conventional and unconventional gas are comparable."

The IPCC also clarifies that even "[t]aking into account revised estimates for fugitive emissions, recent lifecycle assessments indicate that specific GHG emission are reduced by one half" as more power plants are powered by natural gas.

While more attention will be given to it later, even EPA's 2017 Greenhouse Gas Inventory (GHGI) shows production emissions levels at 1.2 percent. Despite numerous flaws — including extrapolation of emissions data from larger facilities onto smaller facilities, potentially incorrect assumptions about pneumatic controller emissions, and methodology based on flawed so-called "super-emitter" assumptions — EPA's latest methane emissions data show very low methane leakage rates.

Oil and Natural Gas Production Issues and the Climate Debate

The methane component of the GHGI is about 9-10 percent. Roughly one-third is related to oil and natural gas systems with approximately equal amounts for agriculture and landfills. Of the oil and natural gas systems component, about one-third is related to production operation – the 1.2 percent in the 2017 EPA GHGI report. Over the past 8 years, the determination of these emissions has been a key aspect of the regulatory agenda that has driven EPA's actions.

In 2009, environmentalists secured a consent decree compelling EPA to determine if it needed to revise New Source Performance Standards (NSPS) for oil and natural gas production facilities. EPA's actions in response to this consent decree raise questions that continue throughout the issue of methane emissions. When EPA develops a NSPS, the Clean Air Act (CAA) requires EPA to use "the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated". It creates four components that must be assessed and balanced – cost, nonair quality health and environmental impact, energy requirements and adequate demonstration. Inherent in assessing these components to determine the best system of emission reduction (BSER) is a high-quality understanding of emissions from the source category.

EPA did not choose to develop its own comprehensive source of emissions information – one that would understand differences in emissions from different types of formations, from different sized facilities. Rather, EPA used available information on emissions from a variety of public sources – data that was never developed for the purpose of regulation.

In the creation of EPA's NSPS – Subpart OOOO – EPA largely relied on requiring technologies that had been used as part of it voluntary Gas STAR program. While these technologies largely qualified as BSER, the scope of the NSPS included operations where those technologies were inappropriate in part because EPA had no data to understand the consequences of its actions. And, the fundamental question of whether EPA should have collected its own data was ignored.

In 2013 and 2014, EDF-UT studies led by David Allen presented information that should have alerted EPA to the need to develop a far more robust understanding of methane emissions as the Obama Administration moved to embrace its Climate Action Plan (CAP). A significant aspect of the Allen studies was that they collected data at the facility rather than interpolate it from offsite measurements. The studies revealed several key aspects of the methane emissions profile. First, the Allen studies confirmed that methane emissions from production operations were low. They were consistent with EPA's overall low estimates. Second, while the initial Allen study showed a larger component of emissions from pneumatic controllers, the later study showed that a small fraction of equipment components was producing 90 percent of emissions. This concept of "fat tails" is significant to designing a regulatory program. Additionally, because pneumatic controllers were included in the Subpart OOOO regulations, these emissions would decline as the new wells replaced the inevitably declining population of existing wells.

However, despite these studies presenting an emerging change to the perception of oil and natural gas production emissions, they occur in the midst of political events that influence future EPA decisions on methane emissions. After the Obama Administration announced its intent to create and implement its CAP, the vested interest of the Obama Administration related to targeting GHG emissions. Concurrently, the activist environmental lobby expanded its targeting of methane emitting facilities – most notable oil and natural gas facilities in their value chain.

An important aspect of this effort was the January 2015 Obama Administration announcement of the scope of its CAP for methane emissions. At its heart was a new goal to cut methane emissions from the oil and gas sector by 40 – 45 percent from 2012 levels by 2025. For the oil and natural gas production industry, the announcement identified several key initiatives. First, EPA indicated that it would "…issue a proposed rule in the summer of 2015 and a final rule will follow in 2016." It would "…consider a range of common-sense approaches that can reduce emissions from the sources discussed in the agency's Oil and Gas White Papers, including oil well completions, pneumatic pumps, and leaks from well sites, gathering and boosting stations, and compressor stations." Second, EPA would "…develop new guidelines to assist states in reducing ozone-forming pollutants from existing oil and gas systems in areas that do not meet the ozone health standard and in states in the Ozone Transport Region." Third, EPA would "… explore potential regulatory opportunities for applying remote sensing technologies and other innovations in measurement and monitoring technology to further improve the identification and quantification of emissions and improve the overall accuracy and transparency of reported data cost-effectively." Fourth, the Bureau of Land Management (BLM) would "…update decades-old standards to reduce wasteful venting, flaring, and leaks of natural gas, which is primarily methane, from oil and gas wells."

These initiatives theoretically hinged on the need to meet a specific 40-45 percent reduction target. For the oil and natural gas production segment of the industry, the Gas STAR program and the 2012 Subpart OOOO regulations were producing the targeted reduction without additional regulation. Data showed that – throughout the extensive expansion of American natural gas production resulting from shale gas development – emissions were falling. Ignoring the clear history of falling emissions with increased production, the Obama Administration concluded that expanded production would increase future emissions. While such an argument might have bearing in other industry segments, for oil and natural gas production the inherent decline that occurs in all wells means that maintaining and growing production requires new wells to replace old ones. Therefore, in the time window of 2012 to 2025, the pool of American production wells would be dominated by wells drilled with the new technologies. Consequently, justifying the expanded regulatory agenda required the Obama Administration to change emissions projections.

These issues were raised regularly with EPA and Obama Administration officials and the apparent result was an EPA recalculation of the GHGI. After releasing data that consistently show methane emissions plummeting as natural gas production soars, EPA upwardly revised methane emission data for natural gas and petroleum systems all the way back to 1990 in its final 2016 GHGI. These upward revisions came as the agency was trying to justify new regulations on methane – based on the idea that methane emissions from the oil and natural gas sector are "higher than previously thought."

EPA's revisionist data indicated methane emissions from natural gas systems declined just 0.68 percent since 2005 rather than 11 percent, as the 2015 GHGI indicated. The latest GHGI also shows a 29 percent increase in methane emissions from petroleum systems since 2005, just one year after agency data indicated a modest 8 percent increase since 2005. Overall, EPA's revision of data over a 23-year span resulted in a total of 773 million metric tons CO2 eq. of previously unreported natural gas and petroleum systems methane emissions that simply were not there a year before.

Sound a little sketchy? The American Petroleum Institute (API) certainly thought so, as it made the following comments:

> "At a time when EPA is looking to justify these costly new regulations on methane from the oil and gas industry," Kyle Isakower, API vice president of regulatory and economic policy, said, "they happen to issue these new methane inventory figures that not only increase the overall emissions estimates, but they also reduce or eliminate the downward trend that we've seen in previous inventories."
>
> Howard Feldman, API senior director of regulatory and scientific affairs, added, "We believe EPA is putting the public posturing right now above the science and data."

A close look at the methodology used by EPA confirms API's skepticism. In fact, the methods EPA used to calculate its new data were just as flawed as the timing of its release was suspicious.

Here are the facts on how EPA's new methods yielded a 27 percent upward revisions of methane emissions from natural gas and petroleum systems.

Fact # 1: EPA assumed emissions from smaller sources were the same as larger sources

For the first time, EPA incorporated new equation inputs collected from Subpart W of its greenhouse gas reporting program (GHGRP) into its GHGI estimates. This new data – which EPA deferred final reporting until late 2015 – includes the total number of emission sources at each reporting facility and the average estimated time each of the emission sources was operational at each reporting facility in each calendar year between 2011 and 2014.

It is essential to understand that smaller facilities do not report to the GHGRP. But, that did not keep EPA from simply assuming that these much smaller facilities have similar emissions rates as larger ones. So, EPA basically extrapolated data from large facilities reported on subpart W of the GHGRP onto smaller facilities for which it did not have solid data. This is obviously not a sound method to calculate emissions, resulting in a significant overestimation of emissions.

A memo released by EPA explaining its use of subpart W of the GHGRP even notes that the data are not appropriate for estimating comprehensive national-level emissions:

> "… As discussed in the introduction to this memorandum, subpart W provides substantial new data on oil and gas GHG-emitting activities in the U.S., but does not represent total national-level emissions due to the reporting threshold…"

This method is all-the-more significant considering these smaller facilities account for 70 percent of producing wells nationwide, according to EPA:

> "Subpart W reports reflect activities at facilities exceeding the emission threshold. While EPA estimates that subpart W reporting covers the majority of national oil and gas production, the reporting facilities represent approximately 30% of producing wells in the U.S., located within large facilities that exceed the emissions threshold for reporting."
>
> "In its analysis for this memo, the EPA developed activity estimates using an assumption that the subpart W data set also represents 32% of other national equipment counts (in other words, that the ratio of each type of equipment-per-wellhead is the same for nonreporting wells as it is for reporting wells) in the onshore production segment."

So, EPA assumed that smaller facilities – which account for more than two-thirds of national equipment counts – have a similar emissions profile to larger facilities. This is simply not the case.

For instance, this method of scaling emissions reported by larger facilities onto smaller facilities that do not report to the GHGRP has resulted methane emissions from pneumatic controllers to more than double in the 2016 GHGI compared to the 2015 GHGI for both natural gas and petroleum systems.

The italicized text in the chart below, taken from EPA's memo on its revised methodology, shows what EPA reported for natural gas system pneumatic controllers in 2015, while the bolded text shows the upward revisions for 2016.

Table 3-53: CH_4 Emissions from Pneumatic Controllers (MMT CO_2 Eq.)

Source	1990	2005	2010	2013	2014
All	**13.9**	**27.0**	**31.2**	**31.5**	**27.6**
High bleed	+	12.1	10.9	4.8	3.3
Low bleed	8.4	0.6	1.1	0.6	1.0
Intermittent bleed	5.5	14.3	19.2	26.0	23.3
Previous-All	*13.4*	*20.2*	*16.2*	*13.5*	*NA*

+ Does not exceed 0.05 MMT CO_2 Eq.
NA – Not applicable
Note: Values in *italics* are from the previous Inventory.

The chart below shows similar revisions for petroleum systems.

Table 3-42: CH_4 Emissions from Pneumatic Controllers (MMT CO_2 Eq.)

Source	1990	2005	2010	2013	2014
All	**19.0**	**30.2**	**33.2**	**37.7**	**39.2**
High bleed	17.8	17.5	12.6	5.5	4.7
Low bleed	1.2	1.8	2.0	1.4	1.2
Intermittent bleed	+	10.9	18.6	30.9	33.3
Previous-All	*12.2*	*10.1*	*10.8*	*11.9*	*NA*
Previous-High bleed	*9.5*	*7.8*	*8.4*	*9.2*	*NA*
Previous-Low bleed	*2.8*	*2.3*	*2.4*	*2.7*	*NA*

+ Does not exceed 0.05 MMT CO_2 Eq.
NA – Not applicable
Note: Values in *italics* are from the previous Inventory.

But a recent Oklahoma Independent Petroleum Association study refutes the argument that pneumatic controllers can be considered equally across all wells sites, large or small. The study found that smaller well site pneumatic controllers have significantly lower emissions, bolstering the fact that EPA is improperly scaling up emissions for small facilities.

EPA acknowledged that its method of extrapolating data from larger facilities onto smaller facilities is the primary driver of its upward methane emission data, which are driven by production-related emissions for both oil and natural gas.

> "… due to the activity data revision alone, production segment emissions greatly increase compared to previous estimates."

Fact #2: Gathering and boosting station data miscategorized, inflated

One of the more eye-popping revisions from EPA's 2016 GHG Inventory is the category of methane emissions from natural gas field production, which more than doubled from previous estimates for the years 2011 through 2014.

This chart shows what EPA reported in its 2015 inventory:

Table 3-44: CH_4 Emissions from Natural Gas Systems (MMT CO_2 Eq.)[a]

Stage	1990	2005	2009	2010	2011	2012	2013
Field Production	59.5	75.5	62.0	56.5	51.3	49.7	47.0
Processing	21.3	16.4	19.2	17.9	21.3	22.3	22.7
Transmission and Storage	58.6	49.1	52.7	51.6	53.9	51.8	54.4
Distribution	39.8	35.4	34.1	33.5	32.9	30.7	33.3
Total	**179.1**	**176.3**	**168.0**	**159.6**	**159.3**	**154.4**	**157.4**

Note: Emissions values are presented in CO_2 equivalent mass units using IPCC AR4 GWP values.
[a] These values represent CH_4 emitted to the atmosphere. CH_4 that is captured, flared, or otherwise controlled (and not emitted to the atmosphere) has been calculated and removed from emission totals.
Note: Totals may not sum due to independent rounding.

And this chart shows the drastic revisions for 2016:

Table 3-46: CH_4 Emissions from Natural Gas Systems (MMT CO_2 Eq.)[a]

Stage	1990	2005	2010	2011	2012	2013	2014
Field Production	83.4	108.1	108.3	108.8	111.1	110.7	109.0
Processing	21.3	16.4	17.9	21.3	22.3	22.6	24.0
Transmission and Storage	58.6	30.7	27.5	28.8	27.9	30.8	32.1
Distribution	43.5	22.1	12.5	11.2	11.4	11.5	11.1
Total	206.8	177.3	166.2	170.1	172.6	175.6	176.1

[a] These values represent CH_4 emitted to the atmosphere. CH_4 that is captured, flared, or otherwise controlled (and not emitted to the atmosphere) has been calculated and removed from emission totals.
Note: Totals may not sum due to independent rounding.

Inclusion of projected emissions from gathering and boosting stations — which clearly are not production activities – appears to be the biggest reason for the spike in field production emissions, which now account for 62 percent of total methane emissions from natural gas systems, according to EPA.

It is also noteworthy that, although gathering and boosting emissions were *apparently* included in previous GHG inventory's natural gas production totals, they were not listed in a separate table until the latest inventory, as the following table from the 2016 GHG Inventory shows.

Table 3-54: CH_4 Emissions from Gathering and Boosting (MMT CO_2 Eq.)

Source	1990	2005	2010	2013	2014
Gathering and Boosting Stations	23.9	27.7	35.8	43.3	46.6

Though there is no frame of reference, considering EPA did not separately list gathering and boosting emissions in previous inventories, it is clear that emissions from these sources spiked dramatically considering *total* 2013 field production methane emissions were 47 mmt CO2 eq. in the 2015 GHG Inventory and 2013 gathering and boosting methane emissions *alone* are 43.3 mmt CO2 eq. in the 2016 GHG Inventory.

The upward revisions are also more than a little suspect, considering gathering and boosting emissions were not included in GHGRP reporting used for the 2016 GHGI (they have been added this year and will be reported for the first time in 2017). That said, in the absence of actual emissions data, EPA appears to have made the above estimates based largely on a pair of EDF

studies (Marchese et al. and Mitchell et al.), according to a memo on EPA's revised methodology, as well as the following excerpt from the 2015 GHG Inventory:

> "Relevant ongoing studies are collecting new information related to natural gas system emissions (e.g. Environmental Defense Fund (EDF) study series data on natural gas systems, including new measurements on gathering and boosting, processing, transmission and storage, and distribution)."

Though EPA's extrapolation of GHGRP data collected from large facilities onto smaller facilities is far from sound, it is far better methodology than extrapolating the results from a pair of EDF studies to estimate national emissions for gathering lines and boosting stations in the absence of solid data.

Fact #3: EPA upwardly revised emissions based, in part, on EDF studies that showed low emission rates

Then EPA Administrator Gina McCarthy stated that EPA, at least in part, relied on data compiled by the EDF studies to drive its methane emission revisions and regulatory policies.

> "… Over the past year, EPA's Greenhouse Gas Reporting Program, along with studies from groups like the Environmental Defense Fund and industry and researchers at Colorado State University, Carnegie Mellon, the University of Texas, Washington State University, and others have provided significant new data on methane emitted by existing operations in the oil and gas sector.
>
> "The new data show that methane emissions are substantially higher than we previously understood. So, it's time to take a closer look at regulating existing sources of methane emissions."

Morning Consult also recently reported,

> "McCarthy cited the EDF-coordinated series of studies as a motivating factor on Tuesday at a Christian Science Monitor Breakfast event.
>
> 'It really gave us a signal that we need to do more,' McCarthy said. 'There clearly are opportunities here for further reductions. The information request is really a requirement for oil and gas companies to do specific testing that will allow us to understand the emissions better.'"

EDF has been pushing rhetoric that methane emissions are "higher than previously estimated" and "a big problem" for months. But EDF's mantra does not change the most important fact: its own studies have found low methane leakage rates between 1.2 and 1.9 percent, which is well below the 3.2 percent of production rate EDF and the scientific community agree is the benchmark for natural gas retaining its environmental benefits.

As Alex Trembath of the environmental group, The Breakthrough Institute, recently explained, data on methane emissions show "that methane leakage is a minor factor determining the benefit of a coal-to-gas transition and that methane leakage levels are well within acceptable ranges."

It was not that long ago that EDF touted one of its reports finding low leakage rates as "good news":

> "This is good news in that it shows emissions can be controlled," said Eric Pooley, EDF senior vice president, referring to a 2013 EDF study that found low leakage rates. "... Industry can get it right."

But EDF suddenly changed its tune, pushing claims that regulations were absolutely necessary based on estimates being higher than previously believed.

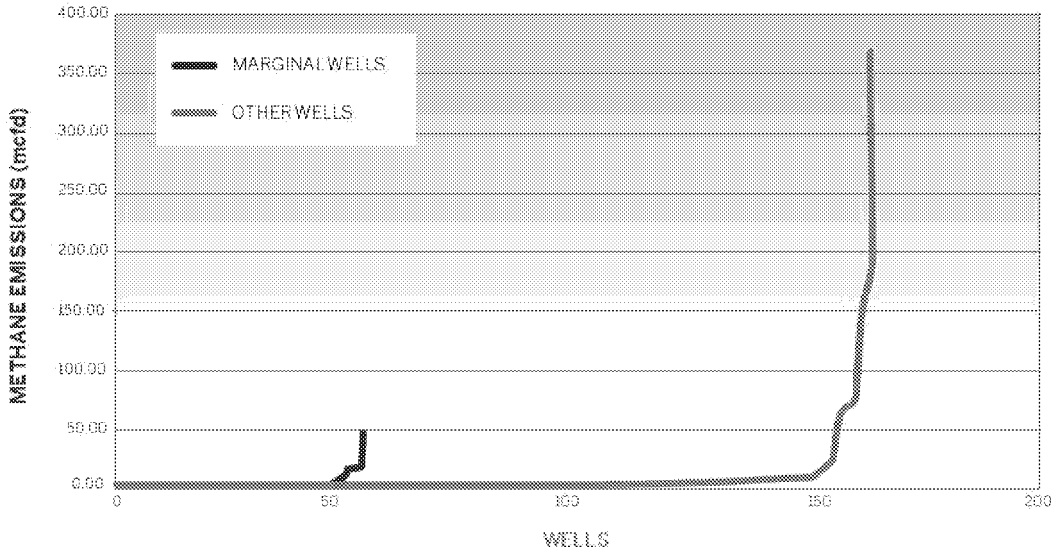
While these revisions to the GHGI were being created to apparently substantiate the need for higher methane emissions from the oil and natural gas production industry, EPA's actions related to its proposed Subpart OOOOa NSPS are more troubling because they create clear regulatory consequences. At the heart of this action is EPA's use of a highly specious EDF report on emissions from low producing oil and natural gas wells.

When EPA proposed Subpart OOOOa, it included an exclusion for low producing oil wells (less than 15 barrels/day) and natural gas wells (less than 90 mcfd) from its fugitive emissions program. This exclusion was significant because the costs of the EPA fugitive emissions program are large. While it may be a cost that can be absorbed for a well producing 5,000 mcfd, as new, large hydraulically fractured natural gas wells can, the cost it imposes on the average low producing natural gas well – wells that produce about 22 mcfd – is not sustainable. However, when the regulation was finalized, EPA removed the low producing well exclusion. The consequence of this change is three-fold. First, it creates a lifetime burden on the well that will make it uneconomic far sooner in its lifetime. Second, because the NSPS applies to new and modified sources, the refracturing of a well brings it under the NSPS requirements. As a result, the regulation inhibits refracturing of small wells because the costly fugitive emissions program would then apply. Third, most low producing wells are operated by small businesses and many are wells that were purchased from larger companies that sold the wells to capitalize other projects. The fugitive emissions requirements will make the operating costs too high to justify their purchase resulting in the loss of this U.S. production.

When EPA sought comments on the Subpart OOOOa proposal, industry stakeholders supported the exclusion that EPA proposed. However, when Subpart OOOOa was finalized, EPA had deleted the low producing well exclusion. EPA indicated that it removed the exclusion based on an EDF study presenting low producing wells as "super-emitters". The EDF study was purposely created to distort the role of low producing wells regarding methane emissions.

Initially, it is important to understand that the EDF study used data from a number of different studies to create its arguments. All of the underlying studies generated their data by driving vehicles with samplers downwind of production sites, hunting for methane plumes. None of them used samples taken on the production site. This creates two issues. First, it measures everything emitted at the site – fugitive emissions and permitted vents. Second, the data are collected over minutes – maybe over an hour – but not over a day. The data in the study are presented as if they were daily emissions but the studies merely scale up hourly estimates. Consequently, an emission that might occur for several hours, but not the full day, would be overstated.

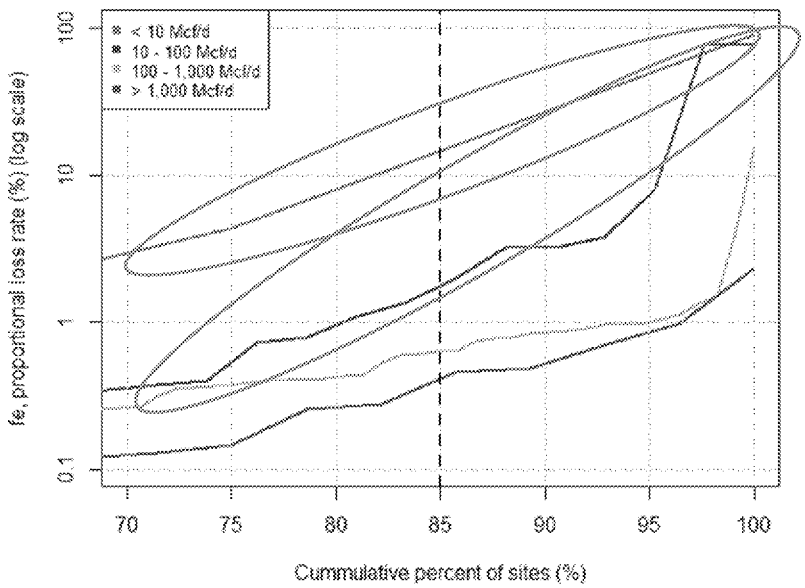
Before turning further to describe the submitted study, it is useful to look at the same data using a direct graph of emissions. In this graph, marginal wells are those with production volumes of 90 mcfd or less.



This graph is consistent with information from other studies showing that a small portion of wells have an emission profile for some reason with high emissions and most wells have really low emissions. Importantly, it also clearly shows that marginal wells – low producing wells in the context of the regulation – have far smaller emissions. But, since this graph is using the same data as the study, it could also be overstating emissions because of scaling short term emissions to a daily amount.

With this background, turning to the presentation of the same material in the study demonstrates how it was manipulated.

Below is the graphic used to present the data. It would suggest that the worst emitting operations – the "super-emitters" – are the smallest wells (the orange line and the blue line, circled in green). Having directly plotted this data, the obvious issue is how such a result can occur.



It is a busy and confusing graph – it's intended to be. The study uses data analysis tricks to create the appearance that marginal wells are "super-emitters".

First, it shows emissions as a percentage of production rather than actual emissions. Thus, one mcf emitted out of ten mcf produced is 10 percent, but 50 mcf emitted out of 1000 mcf produced is 5 percent. As a result, it skews the perception of the data to imply that low producing wells are large emitters when they are not.

Second, its production volumes are really sales volumes, not the amount extracted from the wellhead. Consequently, a "proportional loss rate" of 50 percent would be the calculated loss divided by the volume sold. If the percentage of loss were calculated based on extracted volumes, the 50 percent "proportional loss rate" would drop to 33 percent because the loss would be added to the sales volume to obtain the extracted volume.

Third, it only shows data from the 70th percentile of information. This excludes all of the virtually zero emissions that dominate the data.

Fourth, it uses a logarithmic scale to present the data. One of the reasons to use logarithmic scales is to flatten curves to make them look more like straight lines.

These observations can be made without conducting an intense investigation of the study. The manipulations are obviously intended to contort data to create a specific result. Yet, with all the investigative power at EPA, with all of the research work EPA has conducted, EPA took this contrived study at face value to make its determination to remove the low producing well exclusion in the Subpart OOOOa regulations.

Since these actions occurred, more recently published data are beginning to demonstrate that EPA's actions during 2015 and 2016 are misdirected.

A new EPA study released in May 2017 indicates the agency may be greatly exaggerating oil and natural gas system methane emissions. It was primarily funded by an EPA Regional Applied Research Effort (RARE) internal project grant issued during the Obama Administration.

By using a combination of extractive air sampling and remote optical gas imaging (OGI) tools to analyze 80 pneumatic control systems across eight well pads, the study found oil and gas methane emissions in Utah's Uinta Basin are "significantly lower" than previously thought.

In fact, EPA researchers found methane emissions from intermittent bleed devices were 97 percent lower than the standard emission factor for intermittent pneumatic control devices EPA uses for estimates in its GHGI. The researchers wrote,

> "The average IPC emission rate estimate of 0.32 scf/h was significantly lower than the GHG Inventory IPC emission factor of 13.5 scf/h per device."

This is relevant on a national scale considering the EPA's latest inventory reported 45 percent of oil and gas system methane emissions in 2015 were attributable to pneumatic controllers. The researchers acknowledge the significance of this finding by noting pneumatic devices are the "most significant sources of CH4 in ONG production field operations."

This report must be considered in the context of the faulty methodology issues described above involving the assumptions to calculate national oil and gas production segment pneumatic device counts described previously where EPA started extrapolating leakage rate data from larger

facilities that report to the GHGRP onto these smaller wells under the false assumption that smaller wells have similar equipment counts and emission profiles.

Since the purpose of the study was to "improve information on a variety of factors affecting well pad PC emission characterization," hopefully, the new data will be used by EPA to improve its methodology for calculating pneumatic controller emissions. As Western Energy Alliance's Ryan Streams said,

> "The Uinta Basin pneumatic controller study is the latest in a series that have consistently demonstrated emissions from this type of equipment are much lower than previous EPA estimates. We're pleased to see research supporting what industry has been suggesting for some time now.
>
> "We're hopeful that EPA will take this study along with the growing body of scientific evidence as an opportunity to revisit its emission factors for pneumatic controllers."

The EPA study also finds that emissions of volatile organic compounds (VOCs) are lower than previously believed, further confirming a 2016 report also found that VOC emissions were about half of previous estimates.

Additionally, in May 2017, a new peer-reviewed National Oceanic & Atmospheric Administration (NOAA) study also suggests emission estimates reported in a series of studies used to justify federal methane regulations may have been significantly exaggerated.

Those earlier studies garnered considerable media coverage based on conclusions that methane emissions from shale gas development were 50 percent higher than EPA estimates, due to so-called "super-emitters." But the new NOAA study finds that such research relied on air measurements likely collected during episodic maintenance events, which skewed emissions higher than they typically would be. As a result, these "peak" emissions data were inappropriately used to calculate a normal emissions profile.

This conclusion is based on the fact that aircraft measurements such as the ones taken for the earlier studies are typically collected around noon in order to get the best readings, according to the NOAA paper. This happens to be roughly the same time emissions from routine maintenance operations typically conducted in the late morning — such as manual liquids unloading — are at their maximum levels in the atmosphere, leading to anomalous emissions.

As the orange-tinted columns in the following chart from the NOAA study illustrate, these episodic emissions are substantial – and certainly not reflective of typical emissions. The orange column near the center of the chart shows actual emission leakage rate data collected during the study, while the orange column on the right shows those leakage rates when emissions from manual liquid unloading events are subtracted.

Table 1: Study area West-East comparison of natural gas (NG) infrastructure, CH_4 emissions, production normalized emission rates (PNER), and manual liquid unloading (MLU) events (active during the downwind transects). Ranges indicate 1σ uncertainty.

	Gas production [a] [MCF/d]	Active well count [a]	Gathering station count [a]	Transmission station count [a]	NG CH_4 emissions [b] [t CH_4/hr]	PNER [c] [%]	Active MLU events [d]	MLU CH_4 emissions [e] [t CH_4/hr]	PNER excl. MLU CH_4 emissions [f] [%]
West	1.6×10^6	3,520	84	1	21.5	1.7–2.0	15.8	7.0–10.6	0.8–1.4
East	0.8×10^6	1,910	41	8	5.7	0.8–1.5	2.6	1.1–1.7	0.5–1.2
W–E ratio	2.0	1.8	2.0	0.1	3.8	**1.3–2.3**	6.2	6.2	**1.1–1.5**

Notes: [a] Data from ref[23]; [b] Study area top-down CH_4 emission estimates (Figure 3, panel b, mean values) minus study area bottom-up non-NG sources CH_4 emission estimates (SI section 7, mean values); [c] October 1 and 2, 2015 range of mean values; [d] Industry study partner reported data (October 1 and 2, 2015 averages); [e] Based on [d] and range of bottom-up MLU emission rate estimates (see SI section 9); [f] PNER assuming no CH_4 emissions from MLU events (October 1 and 2, 2015 range of mean values).

The NOAA researchers — who in addition to taking state-of-the-art air measurements, also had full site access and emissions data from 90-plus percent of the operators in the Fayetteville region for the purpose of this study — were able to conclude,

> "Operator reported hourly activity data show that midday episodic emissions from manual liquid unloadings (a routine operation in this basin and elsewhere) could explain ~1/3 of the total emissions detected midday by the aircraft and ~2/3 of the West-East difference in emissions."

> "[E]pisodic sources can substantially impact midday methane emissions and aircraft may detect daily peak emissions rather than daily averages that are generally employed in emissions inventories."

The motivation of the NOAA study — the first in a series of research planned in the Fayetteville region — was to better characterize "top down" emission collection techniques in aircrafts with "bottom up" facility-level methods in an effort to reconcile the two methods by combining the two approaches.

"Top down" studies typically yield higher emissions than "bottom up" studies, and – as a result – critics have suggested bottom-up studies underestimate emissions. But as the NOAA study notes, not only did those studies assume that the higher emissions detected using the "top-down" method were from episodic and other peak emissions events, they also inappropriately used statistical models to extrapolate these measurements as if they were typical emissions on a 24-hour-a-day, 365-day-a-year basis.

As the NOAA study explains,

> "We offer a different explanation by showing that manually-triggered, episodic releases of NG can represent a large fraction (~1/3 in this case) of total midday CH4 emissions. This explanation is based on average emission rates of the specific episodic releases (MLU) rather than statistical fat tails. Thus, a valid comparison of aircraft estimates with annualized inventories needs to establish the representativeness of midday activity data for annualized emissions… Episodic

releases, rather than atmospheric variability, may also explain substantial day-to-day variability."

The fact that there was a substantial difference in emissions from the first day to the final day of the two-day sampling process of the study also supports the researchers' topline conclusion,

> "The 22% emission difference between both days further emphasizes that episodic sources can substantially impact midday methane emissions and that aircraft may detect daily peak emissions rather than daily averages that are generally employed in emissions inventories. While the aircraft approach is valid, quantitative and independent, our study sheds new light on the interpretation of previous basin scale aircraft studies, and provides an improved mechanistic understanding of oil and gas related methane emissions."

These recent studies generate some specific issues that bear on the OIG assessment of EPA's actions regarding methane emissions estimates, particularly when those estimates become instrumental in rulemaking actions that have profound consequences for American oil and natural gas production.

First, developing emissions estimates is different between those for general understanding purposes such as the GHGI and those for regulations. Crafting an inventory will never be precise and it can err without consequences. However, in developing an NSPS or other regulatory programs, including a CTG, the CAA imposes a greater responsibility on EPA. That responsibility is substantive because the consequences are significant. For example, the BSER determination requires balancing multiple factors. Therefore, EPA should bear the burden of acquiring data consistent with that responsibility. However, with regard to the development of methane regulations for oil and natural gas production facilities, it did not.

Second, in looking through the past several years, EPA begins its estimating process using mid-1990s data that were never taken for the purpose of regulation. The EDF-UT studies show that the pattern for emissions is based on a few sources with "fat-tails" and calls into question the underlying data assumptions. The two recently released reports by EPA and NOAA that were funded with federal money show that prior studies were overestimating emissions. Yet, despite knowing that better emissions estimates must be developed, EPA moved forward on regulations without acquiring the necessary information, without meeting its fundamental BSER responsibilities. Worse, it relied on specious analyses from environmental activists – pressing for an agenda to undermine American oil and natural gas production. It took these actions knowing that it was initiating studies to address the fundamental issues. It took theses actions without a compelling legal reason to do so. Even the consent decree that created the 2012 Subpart OOOO regulations did not mandate that EPA act; it mandated that EPA had to determine if it needed to act.

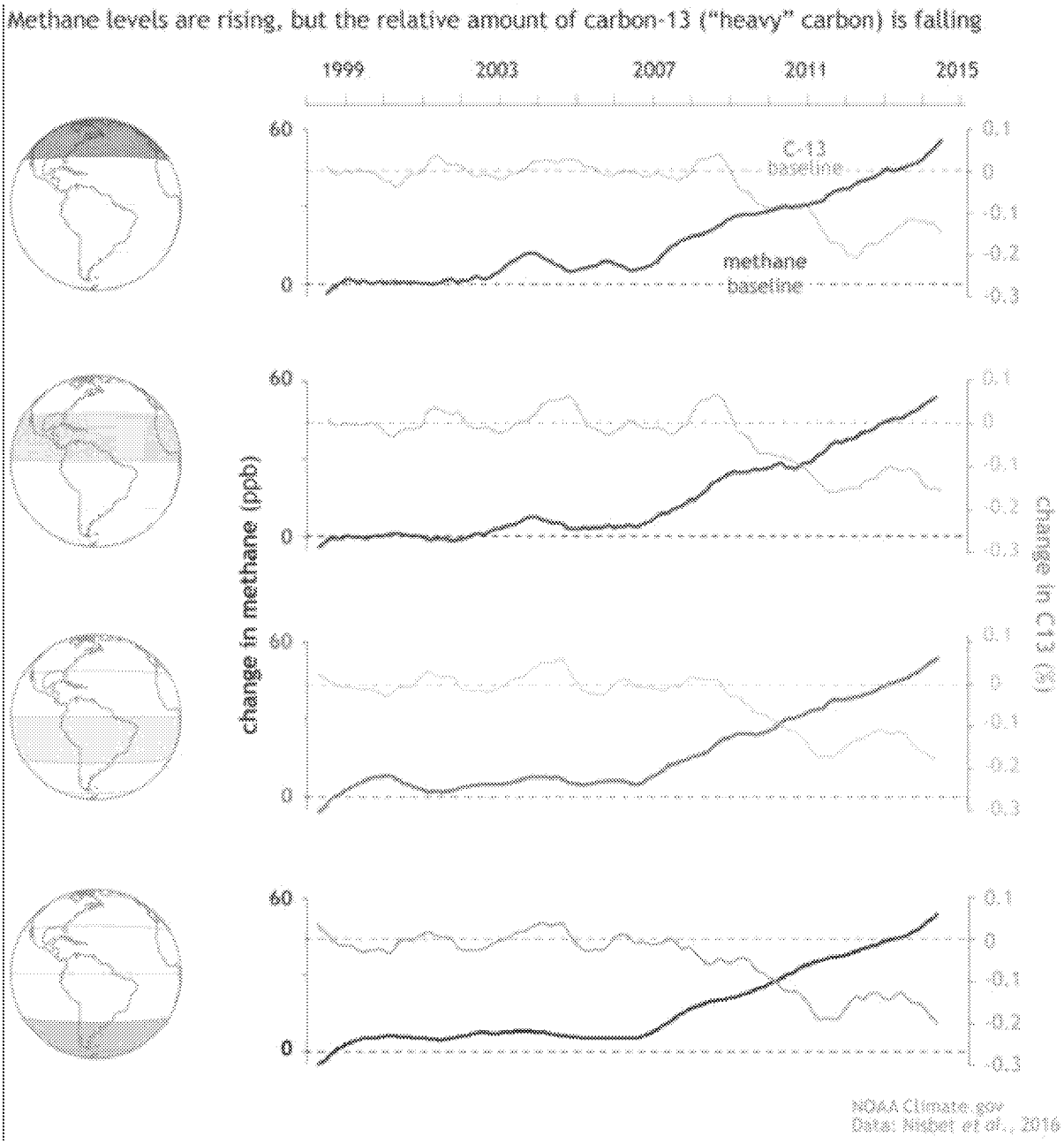
Third, the issue of political rather than scientific decisions generating regulations must be confronted. The timeline for EPA's regulations follow the Obama Administration Climate Action Plan, not EPA's schedule to improve its methane emissions data. This pell-mell action to produce a federal regulatory structure based on the Keep It in the Ground environmentalist agenda calls into question EPA's ability to rationally act. For example, during the rush to complete Subpart OOOOa to assure it was in place prior to the end of the Obama Administration, EPA repeatedly indicated to industry stakeholders that if it chose to regulate methane emissions, its actions did not compel it to act under CAA Section 111(d) to regulate

existing sources. Yet, as soon as Subpart OOOOa was finalized, EPA announced it intended to initiate an Information Collection Request (ICR) to begin the process of creating a nationwide existing source regulation despite the Obama Administration's creation of both an EPA created CTG and a BLM existing source regulation. This action was widely recognized as a temporary action to deter demands by the Keep It in the Ground environmentalists for an immediate action to replicate the Section OOOO and Section OOOOa regulations as nationwide existing source requirements using Section 111(d). Moreover, this demand had support within the Obama Administration despite the reality that it ignored all of the logical actions that EPA needed to take for rulemaking.

New Reports Point to Other Methane Sources

At the same time that the Obama Administration focused its attention on regulating oil and natural gas production operations as its principal methane emissions target, new reports are pointing toward other areas where the understanding of methane emissions suggest that those emissions have been underestimated. Following is a recent analysis by Energy In Depth (EID) that reviews these reports:

> Last year, EID highlighted the fact that several recent peer-reviewed studies have concluded microbial sources of methane such as wetlands, agriculture and rice paddies are responsible for the increase in global emissions since 2007 — not oil and natural gas production.
>
> And now, recent updates to the National Oceanic and Atmospheric Administration's (NOAA) website further debunks environmentalists' misguided claim that shale development is responsible for driving up global methane emissions. From Climate.gov,
>
> > "NOAA observations, analysis, and field research campaigns suggest the increase (in global methane emissions) is being driven by natural and agricultural emissions, not fossil fuels."
>
> This conclusion is based on the fact that NOAA research found the amount of methane carrying a rare isotope associated with oil and natural gas production — carbon-13 — has dropped "significantly" since 2007. As NOAA researchers Rebecca Lindsey and Michon Scott write,
>
> > "That drop casts doubt on one of the first explanations experts considered for the post-2007 rise: an increase in methane emitted from fossil fuels, including 'fugitive' methane gas escaping during oil and natural gas drilling. **Instead, the chemical fingerprints point toward agricultural and wetland emissions from the tropics**."
>
> As the following NOAA graphic illustrates, the amount of carbon-13 detected (lighter colored lines) started to fall in 2007 while overall methane levels (darker colored lines) increased in each of the four latitude zones NOAA collected air samples from.



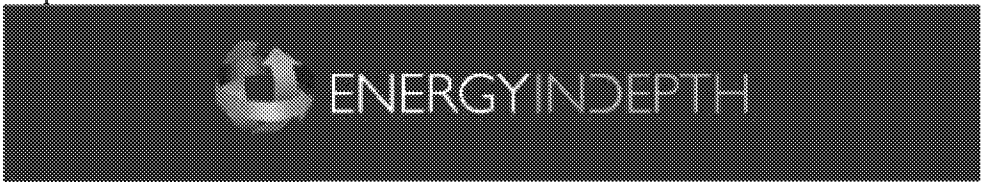
As Lindsey and Scott write, the data simply don't support the anti-fracking narrative that shale development has driven up global methane emissions, despite the fact that global emissions started to rise about the time the shale revolution started,

> "The post-2007 uptick in global methane levels roughly coincides with the rapid deployment of natural gas 'fracking' in the United States, making fugitive emissions a logical suspect. **But attempts to verify the connection have produced counter-intuitive results**, according to Stefan Schwietzke, a methane expert from the Cooperative Institute for Research in Environmental Sciences (a NOAA-University of Colorado Boulder partnership).

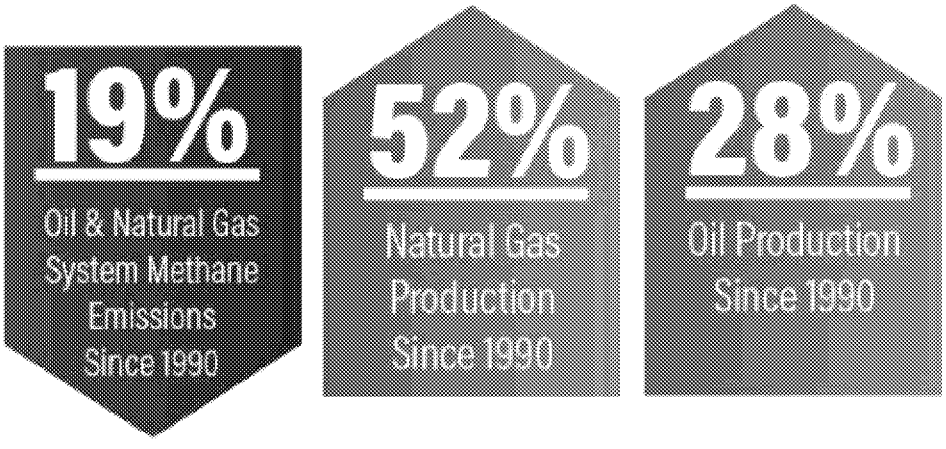
> "Schwietzke's research suggests that methane emissions from fossil fuels *are* higher than countries' self-reported inventories suggest, and they may even be increasing. And yet, he explained via email, methane derived from fossil fuels is enriched with carbon-13 — a rare, heavy isotope of carbon — and air samples show that the amount of carbon-13-flavored methane is dropping worldwide.
>
> "The drop seems to rule out fossil fuel emissions, wildfires, or biomass cook stoves as the reason for the post-2007 methane surge. All those sources of methane, to a greater or lesser extent, are enriched in carbon-13, not depleted."

Furthermore, as the above NOAA graphic illustrates, "Declines in the late 1990s through the mid-2000s are concentrated in the Northern Hemisphere. The leading hypothesis **is that industrialized countries, including the United States, got better control of 'fugitive' methane emissions, which escape during drilling and pumping of oil and natural gas**."

This conclusion is supported by the latest U.S. EPA Greenhouse Gas Inventory, which shows methane emissions from oil and natural gas systems have decreased 19 percent since 1990 (249 million metric tons to 202 mmt) at the same time natural gas production has increased 52 percent and oil production has increased 28 percent.

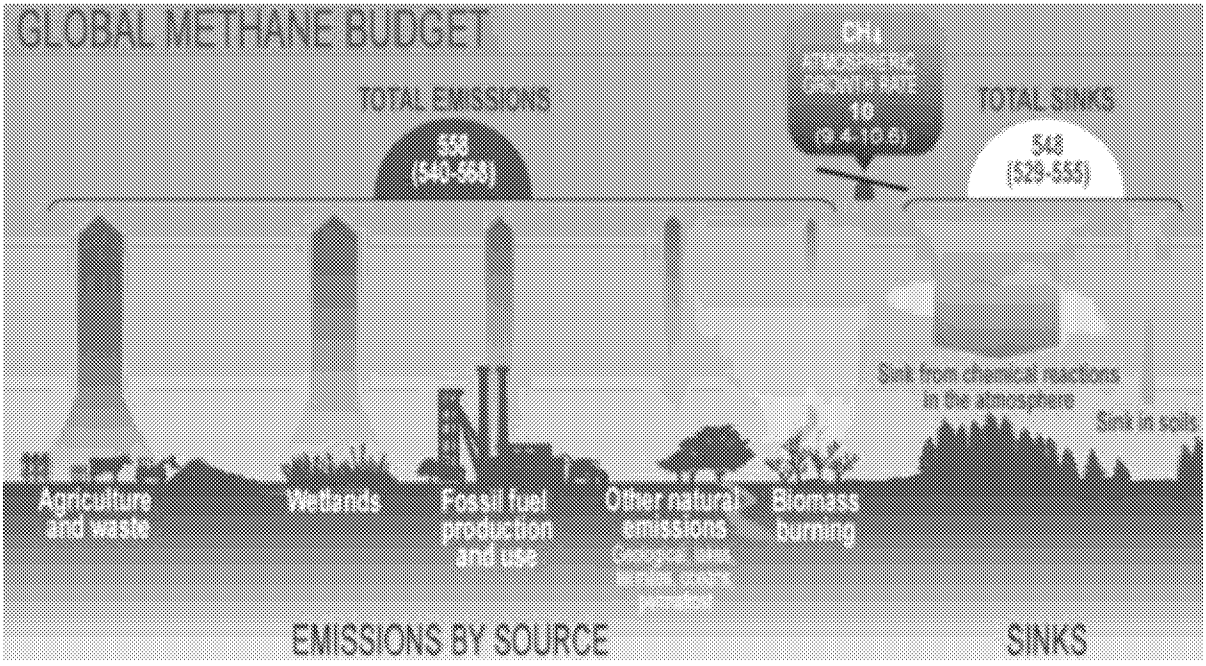


U.S. Oil & Natural Gas System Methane Emissions Declining as Production Skyrockets.



Sources: 2017 EPA Greenhouse Gas Inventory and U.S. Energy Information Administration

Several recent studies (see below) also support the data presented in the following NOAA graphic showing agriculture and wetlands are a larger source of global methane than fossil fuel production and use.



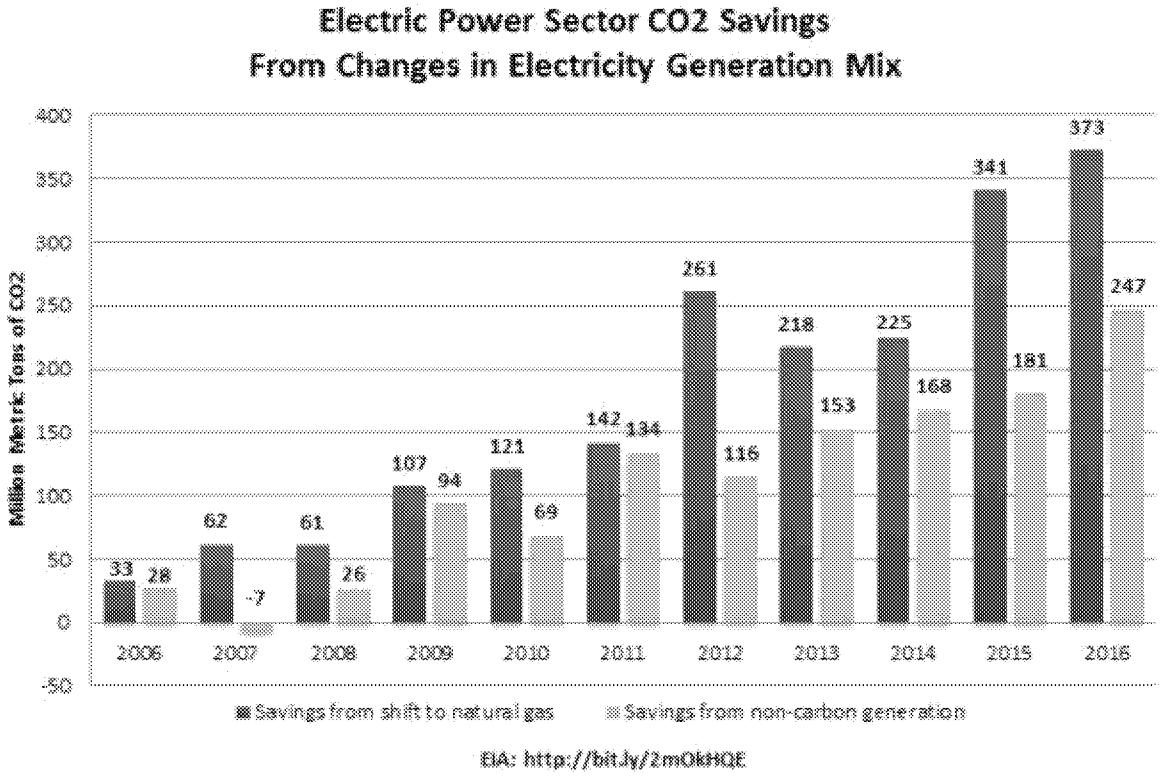
National Oceanic and Atmospheric Administration (NOAA) Study: This study found that microbial sources such as rice paddies and wetlands are the cause of the global increase in methane emissions. Lead author Stefan Schwietzke of NOAA at the University of Colorado Boulder also emphasized that fossil fuel development is "not responsible for the increase in total methane emissions observed since 2007."

Department of Earth Sciences at Royal Holloway, University of London Study: This study found the spike in global methane emissions since 2007 has been "largely driven" by tropical wetlands and agriculture. Using measurements made by NOAA's Cooperative Global Air Sampling Network in three locations (the Canadian Artic, the south Atlantic and South Africa), a combination of latitudinal analysis and isotopic data led researchers to determine a majority of the methane increase since 2007 has a biogenic signature, meaning it cannot be attributed to thermogenic methane from oil and gas development. The study further notes that the tropical wetlands are responsible for **as much as a quarter of global methane emissions**, and that significant weather events — such as La Nina in 2007 and 2008 — could explain a nearly 50 percent hike in methane emissions when compared to the last half decade.

NOAA and the National Institute of Water and Atmospheric Research in New Zealand (NIWAR) Study: This study also found increased global methane emissions are coming from wetlands and agriculture. On the increase in agriculture, the study itself notes that

India, China and South East Asia are likely emitting the highest amounts of methane: "India and China's dominance in livestock-emissions and S.E. Asian rice cultivation are consistent with the location of the source increase."

Furthermore, NOAA's statement that "carbon dioxide is the 800-pound gorilla" when it comes to global warming because "it's the most abundant of the long-lived greenhouse gases that human activities generate" is also worth emphasizing, considering the Energy Information Administration (EIA) credits 62 percent of the total 12 percent of U.S. CO2 reductions from 2005 levels to increased natural gas use.



All these facts considered, the science is clear: methane emissions from oil and natural gas development are not driving the global increase in emissions observed since 2007, and are actually declining as production remains near record levels. Furthermore, increased natural gas use is responsible for a vast majority of U.S reductions of carbon dioxide — the greenhouse gas NOAA considers the "800-pound gorilla" in the fight to combat climate change.

So why do environmentalists continue to make methane emissions from oil and natural gas systems — specifically costly regulations that would reduce global temperatures a mere 0.0047 degrees Celsius by the year 2100 — a focal point of the climate change debate?

It is becoming more and more evident that this campaign is driven more by politics and ideology than science.

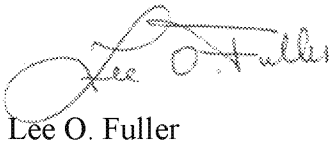
Conclusion

EPA's history of actions from 2009 through 2016 should be set against the results of recent data demonstrating that EPA was overestimating methane emissions from oil and natural gas production operations and their contribution to the overall GHG emissions. If EPA and other federal agencies were in the process of collecting methane emissions data that would help determine the validity of its estimating process, the issue of why EPA then acted so precipitously to regulate in the absence of that information needs to be assessed. Rather than the OIG evaluating EPA's methane emissions process, it should be turning its attention to whether EPA was capable of controlling the development of its regulatory program and meeting its responsibilities to make the technology decisions required under the CAA during the Obama Administration without inappropriate pressures on the agency.

IPAA appreciates the opportunity to provide information on the issue of methane emissions estimation with regard to oil and natural gas production facilities. Much of the information included in this letter can be viewed in more detail at the EID website, including analyses of specific reports and studies – some of which are linked in this letter. Launched by IPAA in 2009, EID is a research, education and public outreach campaign focused on getting the facts out about the promise and potential of responsibly developing America's onshore energy resource base – especially abundant sources of oil and natural gas from shale and other "tight" formations across the country.

If you have questions or need additional information, please contact me at lfuller@ipaa.org.

Sincerely,



Lee O. Fuller
Executive Vice President