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By email

Mr. Leif Hockstad and Mr. Brian Cook
Environmental Protection Agency
Climate Change Division (6207J)
1200 Pennsylvania Ave., NW
Washington, DC 20460
hockstad.leif@epa.gov
cook.brian@epa.gov

Comments of America's Natural Gas Alliance

Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2009

Dear Mr. Hockstad:

America's Natural Gas Alliance (ANGA) appreciates the opportunity to submit these comments on the U.S. Environmental Protection Agency's (EPA) Draft Inventory of Greenhouse Gas Emissions and Sinks: 1990-2009 (Draft Inventory).

ANGA is an educational and advocacy organization formed by North America's leading independent natural gas exploration and production companies. Together, ANGA members produce about 40 percent of the total U.S. natural gas supply. ANGA is dedicated to increasing appreciation for the environmental, economic and national security benefits of clean, abundant, affordable and dependable North American natural gas.

ANGA supports the development of a national greenhouse gas inventory as a tool for tracking emission trends and providing scientists with accurate data. In order for an inventory to be useful, however, it must be based on robust data and analysis. ANGA is concerned that at least two elements of the EPA's Draft Inventory – revised emissions estimates from natural gas well cleanups and new emissions estimates from “unconventional” well completions and workovers – rely on fundamentally flawed data and analysis. Given the magnitude of the new emissions estimated from these sources – the Draft Inventory repeatedly highlights that they are the largest sources of emission increases in the inventory – we believe that EPA must provide a

more robust analytical justification. Failing to do so is counterproductive to EPA's mission to provide reasonable, scientifically sound information and could lead policymakers, scientists and others relying on the inventory to draw incorrect conclusions about greenhouse gas emissions from the natural gas sector and the greenhouse gas benefits of natural gas relative to other sources of energy.

To ensure the accuracy and credibility of the inventory, ANGA urges EPA to work collaboratively with industry and other stakeholders to develop a more robust methodology for estimating emissions from well cleanup and unconventional well completions and workovers before including new emissions estimates from these sources. ANGA urges EPA to respond to the critical issues we have identified below and provide more information on the data and assumptions that were not specifically identified in the Draft Inventory or its appendices.

EPA Has Dramatically Increased Emission Estimates from Natural Gas Field Production

Overall, the Draft Inventory shows that national greenhouse gas emissions have decreased from 2008 to 2009 by 6 percent (422.2 Teragrams carbon dioxide equivalent (Tg CO₂ Eq.)). This is due primarily to (1) the economic downturn and (2) fuel switching in the electricity generation sector in response to significant decreases in natural gas prices and increases in coal prices.

ANGA is pleased to see additional corroboration of the critical role that clean, abundant, affordable and dependable natural gas is playing in reducing the nation's greenhouse gas emissions. However, we are concerned about changes that have been made in calculating emissions from natural gas field production. The Draft Inventory contains new methodologies and assumptions for estimating emissions from natural gas field production that dramatically increase the emissions estimated from this sector. EPA's previous national inventory estimated 2008 emissions from natural gas field production at 14.1 Tg CO₂ Eq.¹ In the new Draft Inventory, estimated emissions in 2008 are 122.9 Tg CO₂ Eq, an increase of 108.8 Tg CO₂ Eq. To put this in perspective, the new draft estimate for natural gas field production is nearly 9 times higher than the previous estimate, more than double the previous estimate for all natural gas system emissions (which also includes processing, transmission and storage, and

¹ Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2008 (2010 Inventory), Table 3-37.

distribution) and on its own represents 1.5 percent of the 2011 draft national emissions inventory. No other emission source underwent such a striking adjustment.²

ANGA supports adjustments to the methodologies and assumptions used to estimate emissions in the national inventory, but only insofar as they are supported by new, robust data and reasonable methods of calculation. These requirements are heightened in the case of EPA's new estimates for natural gas field production, given the magnitude of the changes.

Nearly 95 percent of the increased emissions estimates for 2008 are attributable to two changes: (1) a new methodology for natural gas well cleanups accounts for 66 percent of new emissions and (2) the inclusion of emissions from unconventional wells (shale gas and coal bed methane) accounts for 28 percent.³ A close inspection of the record raises a number of issues for each of these changes that EPA must address before including them in the final Inventory.

Emissions from Natural Gas Well Cleanups

The majority of increased emissions from natural gas field production come from a change in the methodology for estimating emissions from natural gas well liquid unloading, also referred to as cleanups in the Draft Inventory. The new methodology contains a critical flaw in its failure to include emission reductions from the use of artificial lift systems, such as plunger lifts, and raises a number of other concerns.

Artificial lift systems provide substantial reductions in emissions from liquid unloading but it does not appear that EPA accounts for their use in the inventory. Generally, venting of gas during lift cycles is an old practice that has been largely replaced with methods that capture the gas. In addition to plunger lift systems – which can eliminate emissions entirely – there are a number of technologies used to reduce or eliminate venting from unloading, including but not limited to:

- Velocity string (install smaller diameter tubing to increase the velocity);
- Compression (reduce tubing pressure);

² According to the Draft Inventory, the adjustment in emissions for natural gas ranged between 46.5 and 119.7 percent for the years 1990-2008, with an average adjustment of 79.3 Tg CO₂ Eq. The second largest adjustment was to emissions from Non-Energy Uses of Fossil Fuels, which were adjusted by 2.1 percent (4.1 Tg CO₂ Eq.).

³ Draft Inventory, Annex 3 (Annex 3), Table A-127; 2010 Inventory, Table A-125.

- Pumps;
- Gaslift (added gas to boost flow above critical);
- Foaming (soap sticks, back side soap injection, cap string);
- Injection systems (inject water below packer); and
- Venting/Stop Clocking/Equalizing (temporary methods that are used in some cases).

The omission of emission reductions from the application of these practices results in a worst-case scenario approach that is not appropriate for an emissions inventory and dramatically overestimates the emissions from natural gas production. It is not enough to adjust the inventory by results from the Natural Gas STAR program since not all natural gas producers are Natural Gas STAR partners and not all Natural Gas Star partners report all emission reduction activities. In fact, artificial lift may be under-reported even among Natural Gas STAR Partners as it is part of producing a well and not looked at as an emissions reduction technology.

Emission reductions from artificial lift aside, the new methodology also raises concerns. EPA appears to have developed the methodology based on two sources.⁴ The first source, an EPA/Natural Gas STAR report “Lessons Learned: Installing Plunger Lift Systems in Natural Gas Wells”⁵, provides an equation for estimating the volume of gas vented during a blowdown:

$$V_v = (0.37 \times 10^{-6}) \times D^2 \times h \times P$$

where,

V_v	=	Vent volume (Mcf/blowdown)
D	=	casing diameter (inches)
h	=	well depth (feet)
P	=	shut-in pressure (psig)

As noted by El Paso Corporation in their comments on the Draft Inventory, EPA has not indicated whether the equation or the results were adjusted for the purposes of the Draft Inventory nor has EPA provided the data, or average characteristics, that it used in the

⁴ Annex 3, page A-150.

⁵ http://epa.gov/gasstar/documents/l1_plungerlift.pdf

equation. EPA states that it used its other source, production and permit data obtained from HPDI in October 2009, for at least part of the data to run the equation. HPDI supplied information on well depth, shut-in pressure, well counts and well production data. However, more detail on the data actually used, particularly the data used to calculate shut-in pressure (which is needed to ensure that EPA focused on low pressure wells where liquid unloading is more prevalent), is necessary to adequately evaluate the methodology and results.

The equation only provides the volume vented for each blowdown. To complete the inventory, EPA needs to know how many wells required cleanups (W_c) and how many blowdowns are required annually at those wells (BD_a) so that:

$$U.S. \text{ Methane Emissions from Cleanups} = W_c * BD_a * V_v * 0.788^6$$

The documentation for the inventory does not indicate what data were used to estimate W_c or BD_a . While the HPDI data would have provided the total number of wells, it is unlikely that HPDI's production data would have provided information on which wells perform cleanups and the number of blowdowns performed each year at those wells.

EPA has recently estimated these two variables. Appendix B of the Technical Support Document (TSD) developed in support of Subpart W of the Mandatory Greenhouse Gas Reporting Rule uses data from a 1992 survey conducted by the Gas Research Institute (GRI) to estimate that 41.3 percent of conventional wells require cleanups. The 1992 survey was of 25 well sites.

To determine the average number of blowdowns at each well, the TSD uses a simple average of 31 blowdowns per well based on publicly available data from two Natural Gas STAR partners:

1. BP recovered 4 Bcf of emissions using plunger lifts with automation to optimize plunger cycles on 2,200 wells in the San Juan basin.⁷ Using the

⁶ The total volume of natural gas must be adjusted to differentiate methane from other gases. EPA assumes that 78.8 percent of vented gas is methane. Annex 3, A-151.

equation for blowdown emissions, EPA determined that 51 blowdowns per well would be required to match the reported 4 Bcf of emissions.

2. ExxonMobil reported it recovered 12 MMcf using plunger lifts on 19 wells in Big Piney.⁸ EPA used the blowdown emissions equation to estimate about 11 blowdowns per well to match the 12 MMcf of emissions.

ANGA asks EPA to clarify whether it used these same assumptions – 41.3 percent of conventional wells require liquid unloading and these wells require 31 blowdowns annually – for the Draft Inventory. If the Agency did not use these assumptions, we ask that it supply this information so that stakeholders can provide comment. If the Agency did use the TSD assumptions, then ANGA notes that the blowdown estimate is based on two isolated data points and does not appear to account for well-specific variables, such as differences in well depth (shallow wells such as those in the San Juan Basin require more blowdowns than deep wells), that drive the number of necessary blowdowns. If EPA has developed additional assumptions for determining the number of blowdowns, including well-specific data, it should disclose them and provide an opportunity for comment.

To address these issues, ANGA supports the alternative approach detailed in El Paso Corporation's comments that begins with estimating emissions per event using approaches similar to those proposed in the Mandatory Reporting Rule and then applying the emissions estimate to wells that (a) use cleanups and (b) do not use artificial lift of any kind. As discussed in the next section, the emissions should also be adjusted for reasonable estimates on the amount of gas that is flared instead of vented.

⁷ EPA, *Natural Gas STAR Partner Update: Spring 2004*. <http://epa.gov/gasstar/documents/partner-updates/spring2004.pdf>.

⁸ EPA, *Installing Plunger Lift Systems in Gas Wells: Lessons Learned from Natural Gas STAR Partners*. October, 2003. http://epa.gov/gasstar/documents/ll_plungerlift.pdf.

Emissions from Unconventional Well Completions and Workovers

For the first time, EPA is differentiating the emissions from “conventional” and “unconventional” natural gas wells.⁹ The result is two new categories of emissions in the Draft Inventory: unconventional gas well completions and unconventional gas well workovers. The addition of these two categories accounts for 28 percent of the increase in estimated 2008 emissions from natural gas field production over last year's inventory.

As EPA explains in the Draft Inventory:

Unlike conventional completions and workovers, the high pressure venting of gas in order to expel the large volumes of liquid used to fracture the well formation, results in a large emission of natural gas. The Draft Inventory tracks activity data for unconventional well counts (which were assumed to be completed by hydraulic fracture for the purposes of this analysis) in each region. This activity data were used along with a newly developed emission factor to estimate emissions from these sources.

The new emissions factor is based on two different PowerPoint presentations given at Natural Gas STAR technology transfer workshops. While the Draft Inventory does not provide details on how these presentations were used to develop emission factors, the TSD provides insights into how EPA has approached this problem in the past. The TSD uses four data points from the presentations to develop an estimate of emissions from completions. The first presentation, dated September 21, 2004 and given by EPA at a Producer's Technology Transfer Workshop sponsored by the American Petroleum Institute, ExxonMobil Production Company, and the U.S. EPA¹⁰, includes three of the data points:

⁹ These terms are not commonly used in industry. For clarity and consistency, EPA should use the same terminology it used in Subpart W – with and without hydraulic fracturing.

¹⁰ EPA, *Green Completions*. Natural Gas STAR Producer's Technology Transfer Workshop. September 21, 2004. Available at: <http://epa.gov/gasstar/workshops/techtransfer/2004/houston-02.html>.

- 1) The presentation cites an EIA estimate of 45 Bcf of methane emissions from completions and workovers in 2002. In the TSD, EPA uses API's Basic Petroleum Handbook to estimate that there were 5,188 conventional wells drilled in 2002 and 7,783 unconventional wells.¹¹ Using the default emissions factor from EPA's Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006 for the conventional wells (which EPA reports in the TSD is 49,570 scf/well-year), EPA concludes that conventional wells were responsible for 0.3 Bcf of the 45 Bcf of emissions from completions and workovers in 2002. EPA then divided the remaining 44.7 Bcf by the unconventional wells to arrive at a rounded estimate of 6,000 Mcf/completion.
- 2) The second data point in the same presentation was a Natural Gas STAR case study from Devon Energy showing that they implemented a reduced emission completion on 30 wells and captured an average of 11,900 Mcf. EPA rounded this estimate to 10,000 Mcf/completion.
- 3) The third data point in the same presentation was a case study of a project at three wells in a coal bed methane project. The project captured 2,000 Mcf or about 700 Mcf/completion in EPA's rounded estimate.
 - a. The final estimate is from a presentation at a 2007 Natural Gas STAR Producer's Technology Transfer Workshop¹²:
- 4) The presentation, by the Williams Companies, estimated the natural gas captured from a project to reduce methane emissions from completions at an unconventional natural gas project. EPA's rounded estimate of recovered gas was 20,000 Mcf/completion.

¹¹ This percentage of unconventional wells (60 percent) is nearly double EPA's 32 percent estimate used in its national emissions analysis, another inconsistency.

¹² EPA, *Reducing Methane Emissions During Completion Operations*. Natural Gas STAR Producer's Technology Transfer Workshop. September 11, 2007. Available at: http://epa.gov/gasstar/documents/workshops/glenwood-2007/04_recs.pdf.

The TSD took these four estimates and calculated a simple average $((6,000 + 10,000 + 700 + 20,000)/4)$ to arrive at an emissions estimate of 9,175 Mcf/completion for unconventional wells. EPA applied the same number to workovers.

According to Table A-120, which provides region specific emission estimates, the Draft Inventory uses emission factors ranging from 7,194 Mcf/completion to 8,630 Mcf/completion. While this suggests some modifications from the TSD that EPA should clarify, it appears that the Draft Inventory largely utilizes the same methodology and data points since two presentations are the only referenced sources.

This raises a number of concerns. Not only is the emission factor based on four data points with the high end nearly 30 times higher than the low end, a fatal flaw in itself, but none of these data points were purported to be representative estimates of emissions from completions or workovers. Rather, they are case studies from a voluntary EPA program aimed at reducing emissions and, as such, they are simply reporting the results of a handful projects in the field. They are not based on standardized and audited protocols. Moreover, case studies, by their nature, are typically based on the “cream-of-crop” projects. Since in this context, the best projects are the ones that reduce the greatest amount of emissions, using emission reductions from those case studies as the basis for a national inventory can lead to grossly inaccurate results.

The bottom line is that EPA has the methodology backwards: the Agency should evaluate the volumes that are emitted from non-green completion activities rather than rely on green completion volumes from a voluntary program that were never intended to provide inventory-grade information to the Agency.

Beyond these general concerns, the data points raise additional issues that are reviewed in detail in El Paso Corporation's comments. In addition to those comments, we note that even the data point that was not based on green completions (the EIA data used for the 6,000 Mcf/completion estimate) raises serious concerns. First, when backing out

emissions attributable to conventional well completions and workovers, the TSD uses the old emission factors for conventional wells and assumes the rest is attributable to unconventional wells. The TSD provides no support in the EIA data for this assumption, nor does EPA explain why it uses an old emissions factor that has been revised in the TSD.¹³ Based on the lack of data, a more reasonable approach would be to adjust based on the fraction of conventional wells – 40 percent. Making this adjustment, conventional wells would be responsible for 18 Bcf, leaving 27 Bcf to unconventional wells. The TSD then applies all remaining emissions to completions, instead of first adjusting for workovers (the 45 Bcf applies to completions and workovers, but the TSD emissions estimate is for completions only). For example, according to data in the TSD, there were 13,403 unconventional well completions and workovers in 2007 and of these, 31 percent were workovers. After this adjustment, 18.6 Bcf are attributable to unconventional well completions. Dividing that by the number of completed wells yields an average emission rate of approximately 2,350/Mcf per completion – substantially less than half the estimate in the TSD. This provides further support to the conclusion emissions from unconventional well completions and workovers have been significantly overestimated.

Moreover, the emissions estimates assume that all of the gas is vented and none of it is flared. In discussing the effects of the new emissions estimates on inventories, the TSD assumed that about half of the wells would flare their emissions. This assumption itself is suspect, since it is based on an oversimplification of state regulations and not on industry practice. But it appears that the Draft Inventory may compound this by not assuming any flaring for unconventional completions or workovers – if flaring reductions are included, they are not readily identifiable. Our experience indicates that, while the amount of flaring will vary depending on state regulations and specific operational characteristics of the well, in many U.S. fields sending gas to flare is relatively easy and preferred to venting strictly for safety reasons (this is particularly

¹³ This new factor in the TSD appears to be entirely attributable to a change in the assumption on flaring from 98 percent of completion emissions being flared to no emissions being flared, an assumption that is not supportable for reasons stated in these comments.

true for sour gas). Coupled with state regulations requiring flaring or emissions controls (e.g. in Louisiana and Wyoming), failing to adequately account for flaring in the inventory will lead to an inaccurate estimate of emissions from completions and workovers. Accordingly, we ask EPA to clarify its flaring assumptions and provide further opportunity for comment.

Finally, the Draft Inventory indicates that activity data were used, but does not specify the source or reference the data. The Draft Inventory also assumes that the emissions from completions and workovers are the same without providing an explanation on how these two different processes result in the same emissions. EPA should provide the activity data and an explanation of its assumption that emissions from completions and workovers are the same and provide an opportunity for stakeholder comment on this information.

Conclusion

ANGA understands EPA's desire to accurately estimate emissions from unconventional wells, but the operative word must be "accurately". Given the magnitude of the changes and their impact on the national inventory, the underlying data and assumptions must be rigorous and well supported. That is not the case for either natural gas well cleanups or unconventional well completions and workovers. We ask that EPA provide the additional information requested in these comments and the comments of other stakeholders and provide an opportunity for further comment. If the significant flaws in the new methodologies are not corrected, the resulting new emissions estimates will provide inaccurate information to those who rely on the national inventory for analysis and decisions, and undermine the purpose and credibility of the national inventory program. Accordingly, we ask that any new emissions estimates for natural gas cleanups and unconventional well completions and workovers be excluded from the inventory until more robust data and methodologies have been developed and subjected to public comment.

If you have any questions, please contact me at probertson@anga.us or (202) 789-2642.

Sincerely,

A handwritten signature in black ink that reads "Peter D. Robertson". The signature is written in a cursive style with a large, stylized initial "P".

Peter D. Robertson

Senior Vice President for Legislative
and Regulatory Affairs