IEAGHG Information Paper 2018-IP25; Update of Technical Review: "2017-TR07 Reducing Emissions from Natural Gas Supply Chains"

Since the publication of IEAGHG's internal technical review on emissions in the natural gas supply chain (2017-TR7, http://ieaghg.org/publications/technical-reports/129-publications/new-reports-list/836-2017-tr7) significant advancements have been made in publications regarding the quantification of emissions. This IP aims to update members on current activities in this area.

Three reports were published in 2017, written by the Colorado School Mines and funded by RPSEA[i] and NETL:

1. Comparison of methane emission estimates from multiple measurement techniques at natural gas production pads;
2. Comparing facility-level methane emission rate estimates at natural gas gathering and boosting stations;
3. Gathering pipeline methane emissions in Fayetteville shale pipelines and scoping guidelines for future pipeline measurement campaigns.

These three papers have demonstrated that the discrepancy between top-down and bottom-up methane emissions estimates is being reduced which was highlighted as a major limitation IEAGHG's recent review, 2017-TR7. Top-down methods have been used to extrapolate to national emissions factors and the studies show that much more caution is needed in extrapolating such top-down data to become emissions factors.

1. Clay et al. (2017) ***"Comparison of methane emission estimates from multiple measurement techniques at natural gas production pads"***

   This study presents the results of a field campaign that estimated methane emissions at 268 gas production pads or facilities in Fayetteville basin. Three methane emission estimation methods were compared – namely, an onsite measurement and estimate and two mobile van based downwind methods (the dual tracer flux ratio method and the EPA Other Test Method 33a).

   These OTM (Other Test Method) or over-the-fence or downwind-based methane leak measurements are not necessarily accurate. Over the fence, or downwind-based methods, have been used to extrapolate to national emissions factors. OTM has been shown to be less reliable than Onsite or Tracer. The overall conclusion in the paper is "all three methods utilized here are in common use for determining emission rates from natural gas operations, this study indicates that further inter-comparison and characterization of these methods under field campaign and controlled conditions, is advisable".

2. Vaughn et al. (2017) **"Comparing facility-level methane emission rate estimates at natural gas gathering and boosting stations"**

   This study presents the results of a field campaign that estimated methane emissions at 36 unique gathering and boosting stations at the Fayetteville (~30% of the total in study area). Three methane emission estimation methods were compared either concurrently (same day, same time) or contemporaneously (both made during this field campaign) – an onsite measurement and estimate, dual tracer flux ratio method and spiral aircraft based downwind measurement. As in paper 1, the aircraft method is likely to overestimate emissions compared to onsite and tracer methods.

Overall the paper concluded that all four methods "showed emission rates greater than predicted by modeling software for dehydrators both with and without flash tanks, indicating the need for further empirical characterization of this source and validation of software used to predict methane emissions".

3. Zimmerle et al. (2017) **"Gathering pipeline methane emissions in Fayetteville shale pipelines and scoping guidelines for future pipeline measurement campaigns"**

   This study performed leak detection and measurement on 96 km of gathering pipeline (or ~2% in the study area), and the associated 56 pigging facilities and 39 block valves. The study found one underground leak accounting for 83% (4.0 kg CH_4/hr) of total measured emissions or about 1% of all methane emissions measured during a prior aircraft study of the same area.

   Emissions estimated by this study fall within the uncertainty range of emissions estimated using emission factors from EPA's 2015 Greenhouse Inventory and study activity estimates. The study provides both substantial insight into the mix of emission sources and guidance for future gathering pipeline studies, but since measurements were made in a single basin, the results are not sufficiently representative to provide methane emission factors at the regional or national level.

   Emission factors from recent NG distribution studies may not be appropriate for estimating emissions from gathering pipelines; it can lead to potential underestimation. Assuming the observations of this study hold for other basins, these data suggest future emissions studies should focus on detecting underground pipeline leaks and devote relatively fewer resources to characterizing above-ground auxiliary equipment.

Another paper of note since IEAGHG's technical review in 2017 is the EPA's 2016 greenhouse gas (GHG) data for Petroleum and Natural Gas Systems collected under the Greenhouse Gas Reporting Program (GHGRP):

https://www.epa.gov/sites/production/files/2017-09/documents/subpart_w_2016_industrial_profile.pdf

All emissions in the report reflect the most recent information reported to EPA as of 8/5/2017. The reported emissions exclude biogenic CO_2. 10 industry segments are incorporated in the report which includes natural gas transmission compression and transportation as well as LNG processes.

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[i] RPSEA (Research Partnership to Secure Energy for America) is a nonprofit corporation established in the State of Texas. RPSEA has operated as a robust research management consortium for over fourteen years. Over this period RPSEA has funded projects which have focused on imaging below complex geology, prediction of rock & fluid properties, produced water, specific regional studies and project management.