

## Memorandum

Date: August 22, 2018  
To: Melissa Weitz, Adam Eisele  
Climate Change Division, U.S. Environmental Protection Agency  
From: Karin Ritter, Manager, Regulatory and Scientific Affairs, American Petroleum Institute

**Re: Updates under consideration for the 2019 Inventory of U.S. Greenhouse Gas Emissions and Sinks: Natural Gas Systems and Petroleum Systems**

EPA's June 2018 memos outline updates to the national GHG inventory that EPA is considering for 2019. This memo provides API's review and comments on specific updates of interest to API members. These include the following:

1. Using GHGRP data to update emission estimates for gathering and boosting (G&B);
2. Using GHGRP data to develop emission estimates for oil well completions and workovers with hydraulic fracturing (HF);
3. Updates under consideration for LNG facilities; and
4. Updates under consideration for well-related activity data.

### 1. Gathering & Boosting Segment Updates

EPA is considering incorporating Subpart W data to update the national GHGI for Gathering and Boosting (G&B) stations and gathering pipelines. API has reviewed the proposed approach for scaling Subpart W data to the national level using data directly from the three top-emitting basins and scaling data for the remaining basins based on a ratio of reported gas throughput and DrillingInfo production for the basin. API supports the proposed scaling approach. However, API recognizes the lack of national data for the G&B segment and intends to continue to review Subpart W data as it becomes available.

EPA requested feedback on the level of detail for presenting emissions from G&B. API supports presenting the data at a basin level for the G&B station blowdown emissions (i.e., episodic event emissions), but separated into three categories (1) non-blowdown station emission sources, (2) blowdown station emissions, and (3) pipeline blowdown emissions. Blowdown emissions warrant separate reporting because these emissions are based on engineering estimates of the actual volumes emitted, while the majority of other emission sources for G&B stations are based on emission factors. Facility piping and pipeline venting are specific categories of blowdown vent stack emissions that should be attributed to the gathering pipelines and therefore should be separated from the other G&B station blowdown vents.

As an example, Table 1 illustrates the suggested level of detail. This is consistent with EPA's approach of scaling the emissions at a basin level.

**Table 1. Example Reporting for Gathering and Boosting CH<sub>4</sub> Emissions**

Segment Source	ktonnes CH <sub>4</sub>
<b>Gathering and Boosting Stations – non-Blowdown Emission Sources</b>	
	<b>API Comments</b>
430 – Permian Basin	These emissions would represent all G&B station emission sources except blowdown vent stacks.
220 – Gulf Coast Basin	
360 – Anadarko Basin	
All Other Basins	
<b>Gathering and Boosting Station - Blowdown Vent Stacks</b>	
430 – Permian Basin	API requests developing emissions from station blowdown activities separate from other G&B station emissions.
220 – Gulf Coast Basin	
360 – Anadarko Basin	
All Other Basins	
<b>Gathering and Boosting – Pipeline Leaks</b>	
Cast Iron gathering pipelines	API supports reporting GHGRP data for G&B pipeline leaks with no scale-up
Plastic/composite gathering pipelines	
Protected steel gathering pipelines	
Unprotected steel gathering pipelines	
<b>Gathering and Boosting Station – Pipeline Blowdowns</b>	
430 – Permian Basin	API requests showing the same level of detail for pipeline blowdowns as requested for station blowdowns if G&B facilities are to report blowdown events for facility piping or pipeline venting <sup>1</sup> .
220 – Gulf Coast Basin	
360 – Anadarko Basin	
All Other Basins	

For gathering pipelines, EPA compared gathering pipeline miles reported under Subpart W to the miles currently reported in the GHGI and to gathering pipeline miles used in a PHMSA proposed rule. The total gathering pipeline miles reported for Subpart W are larger than the other national data EPA is considering. API supports using the G&B pipeline mileage and emissions data reported under Subpart W for the GHGI with no scale-up since the Subpart W data appear to provide the most complete estimate of gathering pipeline emissions. API supports reporting emissions data for gathering pipelines based on source-specific emissions for each pipe material type, consistent with how data are reported under Subpart W. API does not support using the mileage estimate from the proposed PHMSA rule. However, API recommends comparing the

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<sup>1</sup> §98.233(i)(2) specifically references distribution pipeline in the definitions of facility piping and pipeline venting. However, 83 facilities reported non-zero blowdown emissions for one or both of these categories in 2016. EPA should clarify whether G&B pipeline facilities are to report blowdown emissions for these categories.

Subpart W data to PHMSA data once the rule is finalized and PHMSA begins collecting gathering pipeline mileage data.

## 2. Oil Well Completions and Workovers with Hydraulic Fracturing

EPA is proposing to use the Subpart W data for oil well completions and workovers with hydraulic fracturing to update the national GHGI emissions. EPA’s method for developing the oil well emission factors is the same approach that EPA uses for gas well completions and workovers with hydraulic fracturing, aside from the fact that EPA combines completion and workover emissions data for oil wells into an integrated emission factor. API’s analysis of the GHGRP data produces the same emission factors as EPA’s when the completion and workover emissions data are combined, with the exception of the CO<sub>2</sub> emission factor for Completions and Workovers with REC that flare. For this category, API’s analysis results in an emission factor that is about 8% higher than EPA’s (309.7 tonnes CO<sub>2</sub>/event compared to EPA’s factor of 287.1 tonnes CO<sub>2</sub>/event).

Table 2 provides a comparison of EPA’s combined emission factors for oil well completions and workovers with hydraulic fracturing to API’s emission factors for oil well completions with HF separate from oil well workovers with HF.

**Table 2. Comparison of Emission Factors for Oil Well Completions and Workovers with Hydraulic Fracturing**

Event Type	Control Category	EPA’s Proposed Updated EF		EF from API’s Analysis	
		Tonnes CH <sub>4</sub> /event	Tonnes CO <sub>2</sub> /event	Tonnes CH <sub>4</sub> /event	Tonnes CO <sub>2</sub> /event
<b>Completions</b>					
Non-REC	Vent	36.0	0.8	45.9	1.0
	Flare	1.1	248.8	1.2	252.3
REC	Vent	1.3	0.1	1.5	0.1
	Flare	2.6	287.1	2.7	314.3
<b>Workovers</b>					
Non-REC	Vent	36.0	0.8	4.6	0.2
	Flare	1.1	248.8	0.9	126.5
REC	Vent	1.3	0.1	0.05	0.001
	Flare	2.6	287.1	0.02	7.3

As shown in Table 2, there are distinct differences in the emission factors for oil well completions versus workovers which supports developing separate emission factors. In addition to separating oil well completions from workovers, a key difference between EPA’s oil well completion and workover approach and API’s analysis is due to data quality issues that were identified by API when analyzing the GHGRP data. API’s analysis eliminates 2 data sets that report emissions but do not report completion counts and 9 data sets that report flaring yet the reported CH<sub>4</sub> emissions are higher than the reported CO<sub>2</sub> emissions. EPA’s approach does not eliminate any of the data sets.

For gas wells with hydraulic fracturing, EPA develops completion emission factors separate from workover emission factors, which facilitates separate emissions reporting for the Exploration versus Production segments. For 2016, Subpart W provides emissions data for 267 oil well workovers with hydraulic fracturing, compared to 103 gas well workovers with hydraulic fracturing. API requests EPA develop separate emission factors for oil well completions and oil well workovers for consistency and to enable separate reporting of emissions from these respective activities in the Exploration and Production segments.

Table 3 compares EPA’s proposed 2016 emissions for oil well completions and workovers with hydraulic fracturing to the emissions resulting from API’s analysis.

**Table 3. Comparison of 2016 Emissions for Oil Well Completions and Workovers with Hydraulic Fracturing**

Event Type	Control Category	EPA’s Emission Estimates		Emission Estimates from API’s Analysis	
		Tonnes CH <sub>4</sub>	Tonnes CO <sub>2</sub>	Tonnes CH <sub>4</sub>	Tonnes CO <sub>2</sub>
<b>Completions</b>					
Non-REC	Vent	13,433	299	17,132	384
	Flare	1,779	402,295	1,864	408,075
REC	Vent	5,336	410	6,117	443
	Flare	16,493	1,821,184	17,253	1,993,772
<b>TOTAL Completions</b>		<b>37,040</b>	<b>2,224,188</b>	<b>42,366</b>	<b>2,402,674</b>
<b>Workovers</b>					
Non-REC	Vent	7,461	166	964	49
	Flare	104	23,437	81	11,892
REC	Vent	1,372	106	51	1
	Flare	1,372	151,451	8	3,840
<b>TOTAL Workovers</b>		<b>10,307</b>	<b>175,159</b>	<b>1,104</b>	<b>15,782</b>
<b>TOTAL Emissions from Completions and Workovers</b>		<b>47,348</b>	<b>2,399,347</b>	<b>47,470</b>	<b>2,418,456</b>

Overall, as shown in Table 3, the total emissions estimated by the EPA and API analyses are very similar for oil completions and workovers with hydraulic fracturing. However, applying the combined completion and workover emission factor to workover events overestimates those emissions and impacts the accuracy of the estimated emissions for the Exploration and Production segments of the GHGI.

API’s review also identified 23 data sets with an inconsistency between the sub-basin category and the well types specified, but these data sets were not eliminated from the analysis. The completion and workover emissions are reported at a sub-basin level, which is the unique combination of wells within an individual county and subsurface completion in one or more of each of the following five formation types: Oil, high permeability gas, shale gas, coal seam, or other tight gas reservoir rock. In addition, for completions or workovers with hydraulic fracturing, the well type combination is reported (horizontal or vertical, gas well or oil well). Both API’s and EPA’s emission factor approach use the well type as specified with the well type combination, even if this conflicts with the reported sub-basin category.

API supports the use of GHGRP data to develop to emission factors specific to oil well completions and workovers with hydraulic fracturing using the same approach as applied to gas wells. However, it is imperative that EPA review the GHGRP data for obvious data errors and eliminate erroneous data sets from any analysis. API also recommends that the emission factors for this source category should be updated annually, for each calendar year, to reflect current dynamic trends in completion and workover practices with hydraulic fracturing.

### **3. Liquefied Natural Gas (LNG) Facility Updates**

The EPA memo on proposed updates to the GHGI notes the difference between the total emissions from LNG facilities in the 2018 GHGI and the 2016 Subpart W total emissions for CH<sub>4</sub> and CO<sub>2</sub>, along with the respective emission factors per station. EPA is considering improving the methodology by calculating LNG emission factors based on the Subpart W data and moving away from the current practice of using EFs from transmission and storage stations.

API supports the use of data collected under Subpart W for LNG storage and LNG import/export facilities as this information more accurately reflects the current state of LNG operations in the U.S. API also recommends that the emissions data for LNG operations be updated annually for each calendar year to reflect the current dynamic trends in this sector.

### **4. Well-Related Activity Data Updates**

#### **Well Drilling**

API's subscription to DrillingInfo does not enable the same data analyses that EPA uses. API is able to determine the count of wells drilled and resulted in a similar count of wells drilled (within ~8% of EPA's estimated count).

Overall, EPA's proposed approach seems reasonable for determining the number of wells drilled and splitting the count between oil and gas wells. As a means of a sensitivity analysis, API requests that EPA compare the results presented in the June memo (using a GOR cutoff value >100 Mscf/bbl), to an analysis of the split of wells drilled when using a gas-to-oil ratio (GOR) threshold of 6 Mscf/bbl.

#### **Heavy vs. Light Crude Oil**

EPA is proposing two approaches for splitting equipment between heavy crude and light crude.

1. Using equipment counts (e.g., separators) as reported in Table R.4 for equipment leaks as "Crude oil production equipment".
2. Use EIA data that provides oil production data by API gravity to split heavy crude and light crude wellheads. This approach would not facilitate splitting equipment other than wellheads between heavy and light crude oil.

API examined data on API gravity in DrillingInfo, but the information is too inconsistent to compare to the Subpart W data that EPA has summarized in their June 2018 memo. API

requests that EPA present the outcome of the two analyses under consideration to enable review of the impact they would have on the equipment counts for light versus heavy crude oil.

### Well Completions with Hydraulic Fracturing

API constructs a Quarterly Well Completion report based on information provided by IHS. The report provides counts of well completions by Oil, Gas, and Dry, and further classified as exploratory and development. However, the report does not indicate if wells are hydraulically fractured or not.

Currently, EPA assumes all horizontally drilled wells are hydraulically fractured (HF), but not all wells report the drilling direction. EPA is considering reviewing Subpart W sub-basin level data to determine if location and HF indication from Subpart W could be used to classify wells that do not report a drilling direction. API supports reviewing GHGRP data to supplement the information available from DrillingInfo.

EPA’s June 2018 memo provided a summary of well-related activity data used in the national inventory (Table 1 of EPA’s June, 2018 memo). The GHGI continues to rely on data from the 1996 GRI/EPA study for non-HF gas well completions, non-HF gas well workovers, and HF gas well workovers. Table 4 provides the basis for the completion and workover counts used in the GHGI, and compares the GHGI data to counts reported in the GHGRP for 2016.

**Table 4. Comparison of 2016 Gas Well Completions and Workovers Counts**

	2018 GHGI*			GHGRP**	
	Basis for GHGI Values	2015	2016	2015	2016
<b># of non-HF gas wells completions</b>	Scaled from 400 completions/yr in 1992	786	770	108	88
<b># of non-HF gas wells workovers</b>	Based on 4.35% of non-HF wells	7,549	7,315	18,031	14,957
<b># of HF gas wells workovers</b>	Based on an assumption that 1% of HF gas wells have workovers each year	2,521	2,487	184	103

\* Numbers estimated based on factors specified in Table 1 of EPA’s June 2018 Well Related Activities memo;

\*\* The numbers reported to the GHGRP, which represent about 50% of the national gas wells

For the three well-based activity data above, it appears the GHGI overestimates the number of non-HF gas well completions and HF gas well workovers, and underestimates the number of non-HF gas well workovers. API recommends that EPA use the GHGRP data to develop national counts of these well-related activities for the GHGI.