

Revisions Under Consideration for the 2018 GHGI Uncertainty Estimates

Stakeholder Webinar

August 24, 2017

Overview

- Background, methodology, and preliminary results
- Request for stakeholder feedback
- Summary of feedback received
- Next steps

Background, Methodology, and Preliminary Results

Background

- Prior uncertainty analysis done in 2010 for 2011 GHGI
 - Uncertainty for most EFs and AFs based on EPA/GRI study and expert judgment
- Since 2010
 - Changes in GHGI methodology and data sources
 - Changes in industry practices and equipment
 - Availability of new data
- New draft uncertainty analysis with 2017 GHGI data
- Updated approach would be included in 2018 GHGI

Methodology

- Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories (2006)
- **Goal 1:** Develop 95% confidence bounds around average EF and AF for each source category
- **Goal 2:** Improve/strengthen uncertainty analysis methods and data used

Methodology (cont.)

- **Step 1:** Identified top sources that cover at least 75% of gross emissions in natural gas and petroleum systems for year 2015, based on 2017 GHGI
 - Natural Gas – top 14 sources cover 77% of emissions
 - Petroleum – top 5 sources cover 79% of emissions

Methodology (cont.)

Top 14 Natural Gas Systems CH₄ Emission Sources in the 2017 GHGI

Emission Source (segment)	Year 2015 Gross Emissions (MMT CO ₂ Eq.)	% of Source Category Emissions
G&B stations (production)	49.2	27%
Pneumatic controllers (production)	25.5	14%
Station total fugitives (transmission)	14.3	8%
Engine combustion (transmission)	6.3	3%
Engine combustion (production)	6.3	3%
Engine combustion (processing)	5.8	3%
Liquids unloading (production)	5.2	3%
G&B episodic events (production)	4.9	3%
Pipeline venting (transmission and storage)	4.6	3%
G&B pipeline leaks (production)	4.0	2%
Station venting (transmission)	3.8	2%
Shallow water offshore platforms (production)	3.1	2%
Chemical injection pump venting (production)	3.0	2%
Separator fugitives (production)	2.9	2%
Subtotal, Top Sources	139.1	77%
Natural Gas Systems Total	181.1	100%

Top 5 Petroleum Systems CH₄ Emission Sources in the 2017 GHGI

Emission Source (segment)	Year 2015 Gross Emissions (MMT CO ₂ Eq.)	% of Source Category Emissions
Pneumatic controllers (production)	18.6	48%
Shallow water offshore platforms (production)	4.2	11%
Associated gas venting and flaring (production)	3.7	9%
Engine combustion (production)	2.3	6%
Oil tanks (production)	2.0	5%
Subtotal, Top Sources	30.8	79%
Petroleum Systems Total	39.0	100%

Methodology (cont.)

- **Step 2:** Examined all underlying data sources used in estimating average EF and AF for each top-source category
- **Step 3:** Characterized the probability density function (PDF) for each applicable parameter via
 - Bootstrapping analysis of GHGRP Subpart W data
 - Using estimates from published studies, e.g., Marchese et al. (2015), Zimmerle et al. (2015), EPA/GRI (1996), etc.
 - Applying expert judgment, per IPCC guidance
- **Step 4:** Estimated 95% confidence intervals around the mean emission estimate for each of the top sources using Monte Carlo simulation

Results

Analysis	Natural Gas Systems		Petroleum Systems	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
2011 Analysis	-19%	+30%	-24%	+149%
2018 Draft Update	-36%	+67%	-63%	+102%

- Wider bounds for natural systems in 2018 GHGI analysis
- Larger lower bound but smaller upper bound for petroleum systems in 2018 draft update

Requests for Stakeholder Feedback

Requests for Stakeholder Feedback

1. Appropriateness of performing a detailed uncertainty analysis for “top” sources that cover a specified percent (e.g., 75%), and applying the same confidence interval to the remaining sources
2. Availability of additional information and data to characterize uncertainty parameters
3. How to compare uncertainty ranges from different studies and measurement/calculation approaches

Requests for Stakeholder Feedback

5. Additional steps that could be taken to improve characterization of the PDFs for data sources for which:
 - a. Sample sizes are small
 - b. The sampling methodology was biased (e.g., not nationally representative)
 - c. Only certain statistical parameters (e.g., mean and std. dev) were available
6. Approaches to improve characterization of extreme distributions
7. Appropriateness of default uncertainty bounds
8. How improved uncertainty results can be used to target improvements in the GHGI

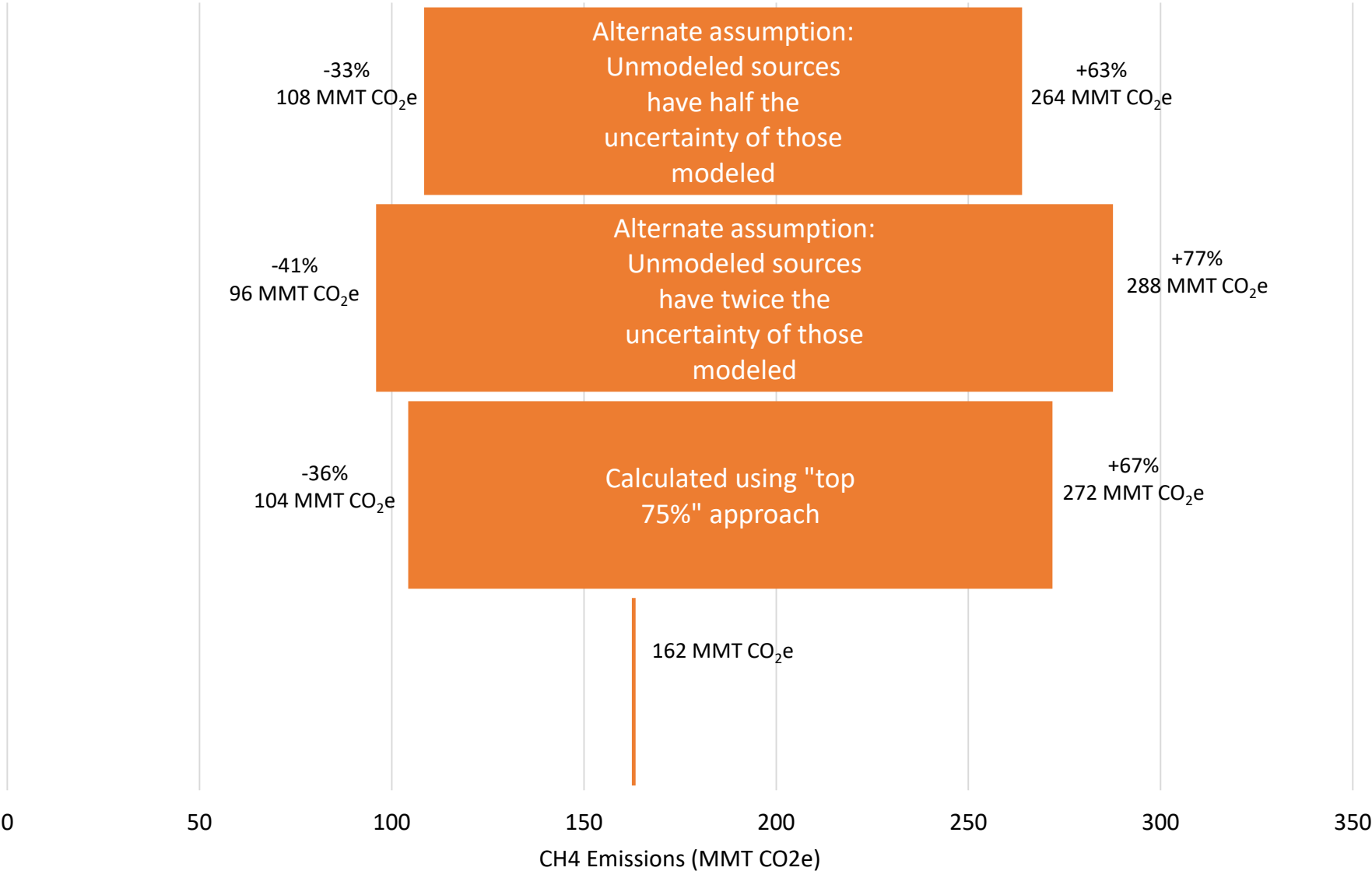
Summary of Stakeholder Feedback

Next Steps

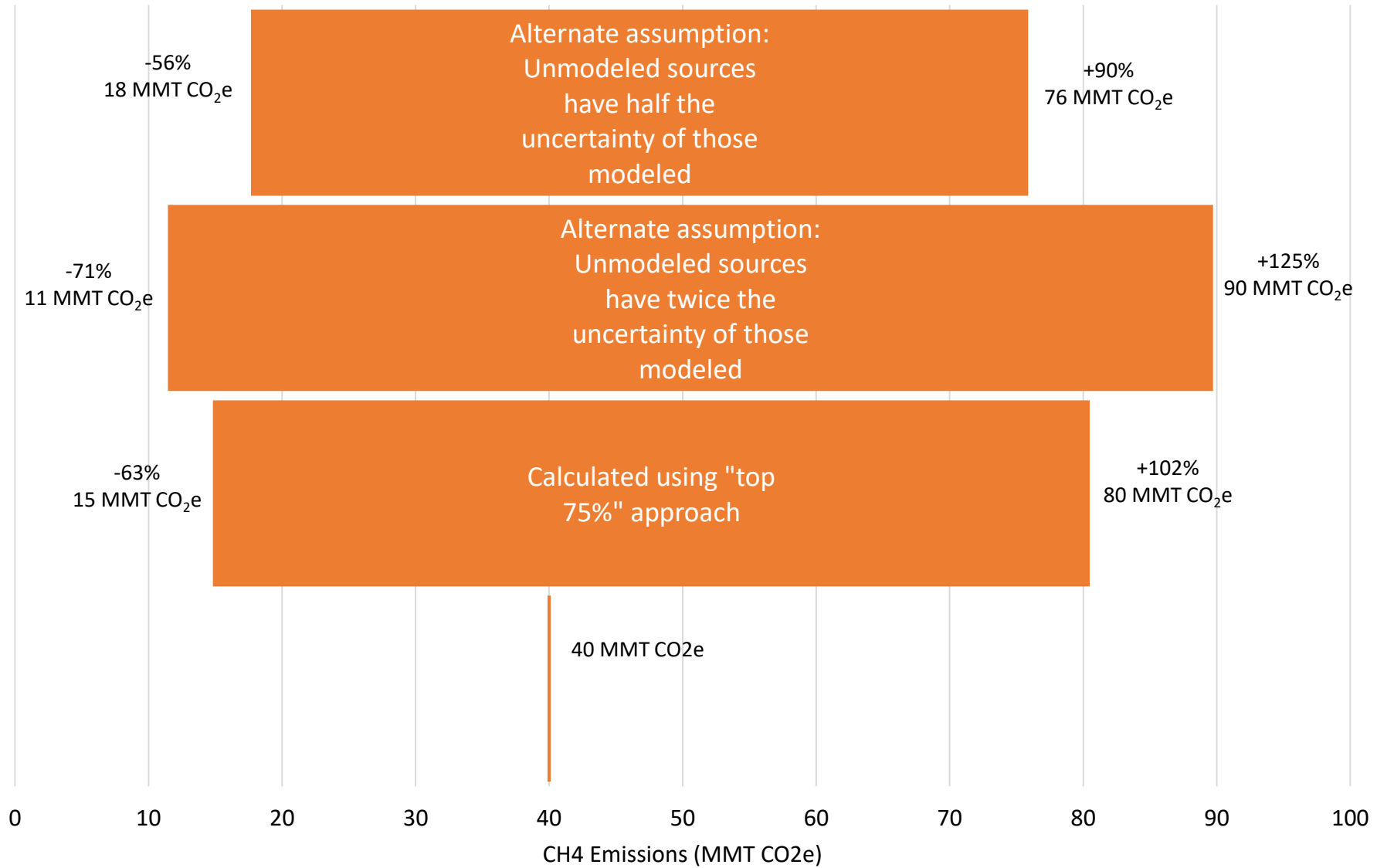
Next Steps

- In the 2018 GHGI report, EPA will discuss the potential for different or higher uncertainties across the time series based on the methods and assumptions used for emission factor and activity data development, e.g., interpolation. |
- Explore computation of heavy tail statistic to assess whether certain PDFs should be revised.
- Consider stakeholder feedback on uncertainty approach sensitivity analysis – see following slides.

Natural Gas Systems Uncertainty Approach Sensitivity Analysis



Petroleum Systems Uncertainty Approach Sensitivity Analysis



Petroleum Systems Draft Update Results

Emission Source		Mean Year 2015 Emissions (MT CO2 Eq.)	2.5% Lower Bound of Mean Year 2015 Emissions (MT CO2 Eq.)		97.5% Upper Bound of Mean Year 2015 Emissions (MT CO2 Eq.)	
			Value	%	Value	%
Pneumatic Controllers (Production)	High-bleed Pneumatic Controllers	2,126,086	635,320	-70%	4,175,097	96%
	Intermittent-bleed Pneumatic Controllers	15,887,354	7,674,488	-52%	26,842,275	69%
	Low-bleed Pneumatic Controllers	619,806	79,695	-87%	1,436,872	132%
	Subtotal	18,633,247	8,389,503	-55%	32,454,244	74%
Shallow Water Oil Platforms (Production)		4,207,887	1,052,724	-75%	11,578,951	175%
Associated Gas Flaring & Venting (Production)	Associated Gas Flaring	2,642,647	1,180,379	-55%	4,430,285	68%
	Associated Gas Venting	1,062,962	79,843	-92%	2,623,880	147%
	Subtotal	3,705,610	1,260,222	-66%	7,054,166	90%
Oil Tanks (Production)	Large Oil Tanks with Flares	202,495	83,698	-59%	337,425	67%
	Large Oil Tanks with VRU	99,012	13,183	-87%	206,330	108%
	Large Oil Tanks without Controls	1,443,504	595,372	-59%	2,475,665	72%
	Small Oil Tanks with Flares	1,726	277	-84%	4,972	188%
	Small Oil Tanks without Controls	115,514	4,920	-96%	370,501	221%
	Large Oil Tank Separators with Malfunctioning Dump Valves	149,605	22,046	-85%	524,525	251%
	Subtotal	2,011,857	719,495	-64%	3,919,418	95%
Gas Engine Combustion (Production)		2,254,932	33,122	-99%	7,195,582	219%
Total for Sources Modeled in Uncertainty Assessment		30,813,532	11,455,066	-63%	62,202,361	+102%
Total for Sources Not Modeled in Uncertainty Assessment		9,062,042	3,368,854	-63%	18,293,274	+102%
Source Category Total		39,875,574	14,823,920	-63%	80,495,635	+102%