

Updates Under Consideration for the 2017 GHGI

Stakeholder Webinar
December 20 (and January 4)

OVERVIEW

- Background and process
- Production segment updates
- Processing segment updates
- Transmission and storage segment updates
- Providing comments

BACKGROUND AND PROCESS

- New data available
 - DrillingInfo
 - GHGRP
 - EDF series of studies
 - ARB
- EPA considering updates for Production, Processing, and Storage
- Memos
- Public review draft

PRODUCTION TOPICS

- Equipment Counts
- Liquids Unloading
- Tanks and Associated Gas Venting & Flaring
- Gathering & Boosting Episodic Events

PRODUCTION SEGMENT EQUIPMENT COUNTS

EQUIPMENT COUNTS: BACKGROUND

GHGRP Equipment Leaks Data

- For 2016 GHGI, EPA revised the AFs (equipment per well) using subpart W RY2014 data for equipment counts and well counts
 - Certain assumptions were applied (e.g. to distinguish between gas and oil)
- Starting in RY2015, GHGRP reporters also provide data on production type (gas or oil)

Well Counts

- Latest DrillingInfo dataset
 - Revisions for Texas
- EIA
- World Oil

EQUIPMENT COUNTS: RY2014 VS RY2015

Equipment Type	RY2014 Subpart W Count (Basis of 2016 GHGI)	RY2015 Subpart W Count
Wells		
Wells (NG)	223,192	307,737
Wells (Petro)	275,831	219,433
Separators		
Separators (NG)	149,912	210,836
Separators (Petro)	119,479	87,260
Heaters (NG)	48,460	63,523
Dehydrators (NG)	8,380	8,195
Meters/piping (NG)	256,340	263,870
Compressors (NG)	23,740	24,090
Heater-treaters (Petro)	34,902	51,364
Headers (Petro)	44,880	52,872

LIQUIDS UNLOADING

LIQUIDS UNLOADING IN 2016 GHGI

- Updates made in 2013 GHGI (1990-2011)
 - Based on API/ANGA survey
 - Respondents provided GHGRP data in advance of EPA publication
 - Data showed more widespread use of emissions control technologies and that duration of emissions from liquids unloading activities was shorter than had been assumed in the previous Inventory.
 - EPA used API/ANGA data to estimate activity data and emissions for 2010
 - EPA calculated from API/ANGA the % of wells that may conduct liquids unloadings. For 1990-2009, EPA applied an assumption that in 1990 no plunger or artificial lifts were in place. EPA then interpolated between 1990 and 2010 for each region.
- In GHGI Planned Improvements, noted intent to revisit calculations, with GHGRP data set
 - Data available from GHGRP for update
 - Options for development of 1990-2010 estimates

LIQUIDS UNLOADING ACTIVITY DATA

Data Source	Year	Total # Gas Wells	With Plunger Lifts		Without Plunger Lifts	
			# Wells Vented	% of Wells That Vented	# Wells Vented	% of Wells That Vented
Subpart W	2011		42,826		26,679	
	2012		34,136		25,262	
	2013		30,922		27,723	
	2014		26,859		23,068	
	2015	307,737	30,757	10.0%	20,886	6.8%
2016 GHGI	2014	456,140	22,477	4.9%	37,912	8.3%

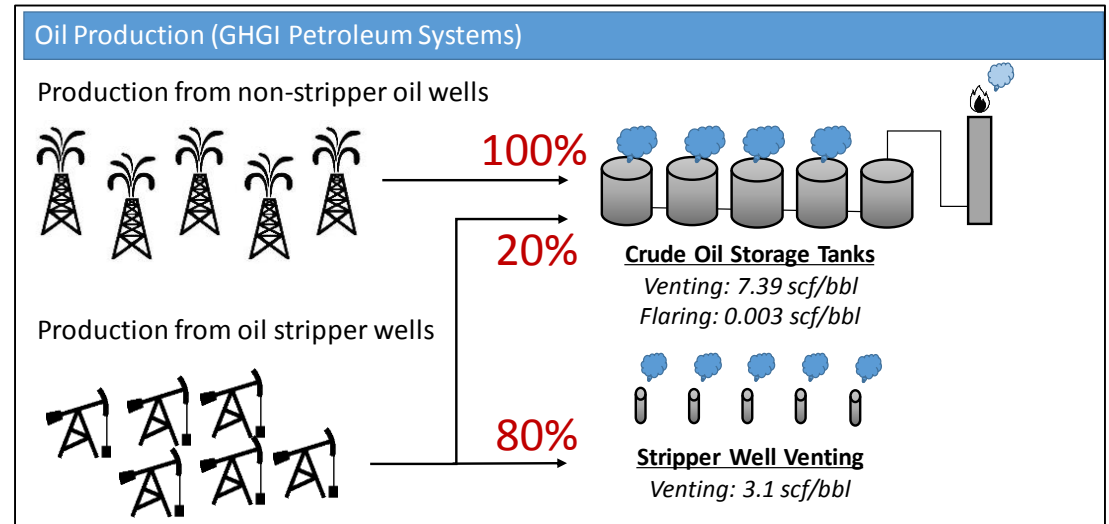
LIQUIDS UNLOADING EFs (scfy/well)

Data Source	Year	With Plunger Lifts	Without Plunger Lifts
Subpart W	2011	205,387	149,023
	2012	166,144	133,689
	2013	162,485	160,865
	2014	104,863	194,842
	2015	74,236	168,647
	Average		148,589
2016 GHGI	2014	200,791	260,030

TANKS AND ASSOCIATED GAS VENTING & FLARING

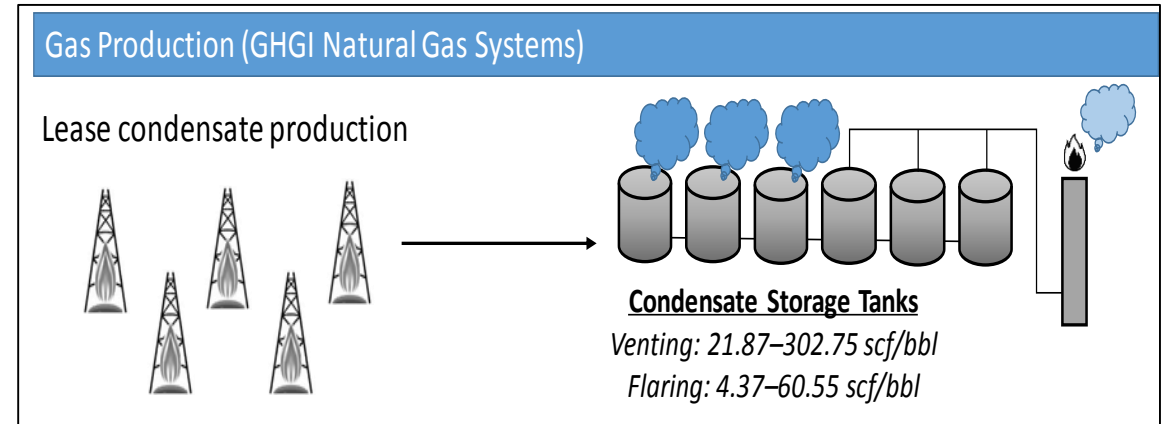
CURRENT GHGI: OIL WELLS

- Non-stripper wells: Apply tank EF (scf/bbl) to 100% of non-stripper well oil production
- Stripper wells: Production split between well venting and tanks using 80/20 split
 - Stripper well venting EF (scf/bbl) applied to 80%
 - Tank EF (scf/bbl) applied to 20%
- Tank EF includes malfunctioning dump valve emissions



CURRENT GHGI: GAS WELLS

- Apply tank EFs (scf/bbl) to 100% of condensate production
 - Apply uncontrolled tank EF to 50% of production
 - Apply controlled tank EF to 50% of production
- Tank EFs include malfunctioning dump valve emissions, for 2 regions



CURRENT GHGI: GATHERING & BOOSTING

- For certain sources, gathering and boosting is integrated with well pad activities in the production segment of Natural Gas Systems in GHGI
- A gathering and boosting station facility-level EF was implemented in 2016 GHGI
 - Based on Marchese study data
 - This EF includes tank emissions at gathering stations
- Updates under consideration ensure that production tanks methodology estimates emissions for well pad tanks only

AVAILABLE SUBPART W DATA

- Onshore oil and gas production includes all equipment “on a single well-pad or associated with a single well-pad”
- Tanks
 - Large tanks: ≥ 10 bbl/day
 - Small tanks: < 10 bbl/day (equivalent to stripper well definition)
- Associated Gas Venting & Flaring

TANKS: ACTIVITY COMPARISON

Parameter	Condensate Production	Oil Production
Throughput Basis Option		
2014 National Throughput (MMbbl)	277	2,998
Production (MMbbl) Reported for RY2015 Under Subpart W	277	2,160
Percent of National Reported Under Subpart W	100%*	72%*
Percent of Total Subpart W Production Reported Under Tanks	85%	62%
Tank Basis Option (well counts as key activity data)		
2015 National Well Count	440,496	607,559
Count of Wells Reported for RY2015 Under Subpart W	307,737	219,433
Percent of National Reported Under Subpart W	70%	36%
Percent of Total Subpart W Wells Reported Under Tanks	40%	71%

*Comparison of 2015 GHGRP and 2014 (most recent available) national data on throughput

THROUGHPUT-BASED OPTION EFs (scf/bbl)

Tank Category	Condensate Tank Throughput			Oil Tank Throughput		
	Subpart W - Large Tanks	Subpart W - Small Tanks	GHGI (a)	Subpart W - Large Tanks	Subpart W - Small Tanks	GHGI
Tanks with Flaring	0.28	0.34	4.4 or 60.6	0.35	0.09	7.39
Tanks with VRU	0.21	n/a		0.47	n/a	
Tanks without Controls	8.73	n/a	21.9 or 302.8	7.9	n/a	
Tanks without Flares	n/a	24.8		n/a	2.3	
Malfunctioning Dump Valves	0.02	n/a	-- (a)	0.15	n/a	
ALL TANKS	1.8	16.6	56.3	2.0	1.7	

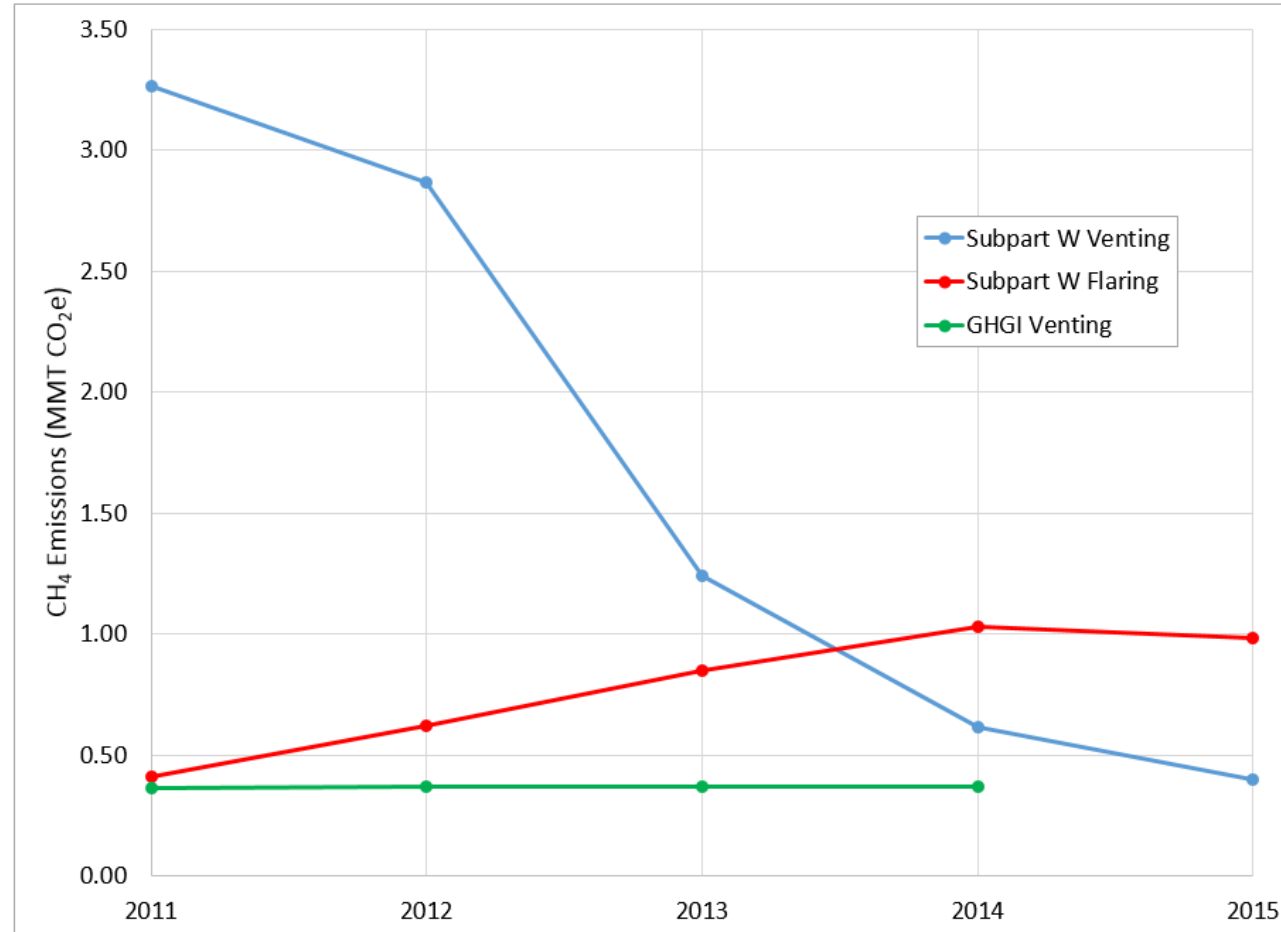
a) Larger GHGI EFs include malfunctioning dump valve emissions for 2 NEMS regions

TANK-BASED OPTION EFs (scf/tank)

Tank Category	Condensate Tanks		Oil Tanks	
	Subpart W EF - Large Tanks	Subpart W EF - Small Tanks	Subpart W EF - Large Tanks	Subpart W EF - Small Tanks
Tanks with Flaring	2,242	393	3,755	197
Tanks with VRU	1,774	n/a	10,854	n/a
Tanks without Controls	33,201	n/a	51,192	n/a
Tanks without Flares	n/a	10,951	n/a	4,236
Average for all Tanks	11,915	9,242	20,739	3,253

Category	Condensate Production	Oil Production
Malfunctioning Dump Valves (<i>scf/separator</i>)	21,175	154,874

ASSOCIATED GAS: SUBPART W VS GHGI



ASSOCIATED GAS

Subpart W Activity Factor Development

- Determine number of wells applicable to associated gas venting and flaring

Year	Total Oil Wells	Total # Venting & Flaring Wells	% of Total that Vent or Flare
2015	219,433	25,739	12%

ASSOCIATED GAS

Subpart W Activity Factor Development

- Determine number of associated gas wells that vent and flare

Year	Total # Venting & Flaring Wells	Associated Gas Venting		Associated Gas Flaring	
		# Venting Wells	% of Total that Vent	# Flaring Wells	% of Total that Flare
2011	14,491	8,863	61%	5,628	39%
2012	15,813	8,554	54%	7,259	46%
2013	15,860	6,980	44%	8,880	56%
2014	19,453	7,264	37%	12,189	63%
2015	25,739	4,286	17%	21,453	83%

ASSOCIATED GAS

Subpart W Emission Factors

- Subpart W EFs are much higher than GHGI EF (which is only applicable to stripper wells)

Year	Subpart W Venting EF (mscfy/well)	Subpart W Flaring EF (mscfy/well)	GHGI Venting EF (mscfy/well)
2011	765	151	2.35
2012	696	178	
2013	369	198	
2014	176	176	
2015	193	95	

GATHERING AND BOOSTING EPISODIC EVENT EMISSIONS

- Blowdown data were specifically excluded from Marchese et al. data used to develop station-level EF
- Marchese developed a separate emissions estimate specific to episodic events
 - Blowdowns of pressurized equipment, compressor engine starts utilizing gas-pneumatic starters, pig launch and receive operations
- Marchese EF = 37 MT CH₄/station
- Considering update to apply Marchese EF and/or review RY2016 subpart W data when available for updates

PRODUCTION-KEY REQUESTS FOR STAKEHOLDER FEEDBACK (1 OF 2)

Tanks

- The EPA seeks feedback on the throughput-based or tank-based subpart W EF and AF data options, and on how to best estimate emissions over the GHGI time series.
- Subpart W only includes reporting of malfunctioning dump valves from large tanks. The EPA seeks stakeholder feedback on whether small tanks are more or less likely to have malfunctioning dump valves.
- Recent studies have observed (but not quantified) very high emissions from tanks. GHGRP data is showing lower, not higher emissions than the GHGI. The EPA is seeking stakeholder feedback on this apparent discrepancy.

PRODUCTION-KEY REQUESTS FOR STAKEHOLDER FEEDBACK (2 of 2)

Associated Gas Venting and Flaring

- The EPA seeks stakeholder input on approaches for scaling subpart W data for associated gas venting and flaring to national representation for use in the GHGI.
- The EPA seeks stakeholder input on approaches for populating the GHGI time series using subpart W data for associated gas venting and flaring.

Equipment Counts

- The EPA seeks stakeholder input on the latest DrillingInfo data set.
- The EPA seeks feedback on whether and how to distinguish between stripper and non-stripper oil wells in applying the subpart W data.

Liquids Unloading

- The EPA seeks stakeholder feedback on approaches for calculating liquids unloading emissions and activity using subpart W data.

GAS PROCESSING REVISIONS
UNDER CONSIDERATION FOR
THE 2017 GHGI

KEY BACKGROUND ON CURRENT METHODS

- Emission factors and activity data are based “Methane Emissions from the Natural Gas Industry” GRI/EPA 1996, with some exceptions.
 - Centrifugal compressor wet seal emission factors from “Methane’s Role in Promoting Sustainable Development in the Oil and Natural Gas Industry” – Proceedings of the 24th World Gas Conference. October 2009.
 - Centrifugal compressor dry seal emission factors from Gas STAR partner data. October 2006.
- Methane from flares not included in the estimation methodology.
- Gas STAR reported data used for reductions

NEW DATA AVAILABLE— MITCHELL ET AL. AND MARCHESE ET AL.

- Mitchell conducted plume measurements down wind of 16 gas plants in 2014.
 - Owned by 3 companies
 - Ranged from 2 to 972 MMscfd
- Marchese extrapolated the Mitchell et al. data to the national level, based upon a national inventory of gas plant sizes.

NEW DATA AVAILABLE-- GHGRP

- Annual data reporting since 2011.
- Includes over 450 processing plants ranging in size from 1 to 1800 MMscfd.
- Includes a majority of plants and throughput.
- Calculation requirements vary by source and include direct measurement, engineering calculations, and emission factors.
- Includes data for most of the source categories in the GHG Inventory
- Does not include methane from dry compressor seals, AGR vents or pneumatic devices.

COMPARISON OF AVAILABLE DATA SOURCES

(National estimates, MMTCO_{2e})

Emission Source	2016 GHGI	GHGRP Throughput Scale-up	GHGRP Plant Scale-up	Marchese Option
Non-compressor Fugitives	0.9	0.3	0.4*	12.7
Reciprocating Compressor	11.9	1.3	1.8*	
Centrifugal Compressors (wet seals)	6	0.4	0.5*	
Centrifugal Compressors (dry seals)	1.4	<0.1 (without seal emissions)*	<0.1 (without seal emissions)*	
AGR Vents	0.4			
Kimray Pumps and Dehydrator vents	1	0.3	0.4	
Pneumatic Devices	0.1			
Reciprocating and turbine Engine Exhaust	5.2	<0.1*	<0.1*	
Flares	0	0.4	0.5*	
Blowdowns and Venting	1.3	0.7	0.9*	

For certain sources, e.g., where GHGRP data are unavailable, EPA is considering retaining the current GHGI data

*These figures have been revised to reflect minor corrections to these values after the webinar.

APPROACHES UNDER CONSIDERATION FOR 2017 GHGI

GHGRP

- Scale GHGRP to a national level (plant or throughput basis)
 - GHGRP data years to include
 - Use 2015 GHGRP only
 - Use an average of 2011-2015 GHGRP
 - Use annual GHGRP data for 2011 to 2015
 - Supplement with GHGI factors for dry compressor seals, AGR, pneumatics, and potentially use GHGI exhaust factor
 - Interpolate between 1992 and 2011 or 2015 depending on how GHGRP data are included

Marchese

- Develop a plant-wide emission factor based on Marchese for
 - Use with plant populations 2014 and later years
 - Include Marchese estimate of missing sources
- Interpolate between 1992 - 2014 using plant population

PROCESSING-KEY REQUESTS FOR STAKEHOLDER FEEDBACK

- GHGRP versus Marchese data sets
- GHGRP data years for GHGRP approach
- Approaches for scaling current GHGRP emissions to the national level; throughput versus plant population for GHGRP approach
- Approaches for interpolating between 1992 and current emissions; throughput versus plant population
- For combustion exhaust sources, potential use of the existing GHGI emission factors (scf/HPhr) GHGRP activity factors (HPhr/mmscf)

ALISO CANYON

ALISO CANYON EMISSIONS ESTIMATE

- Estimate available from ARB
 - Calculated using data from multiple methods
- Separated estimate into 2015 and 2016 emissions
- Leak estimate for 2015 is 78,350 tons of methane
- Very minor other emissions occurring at the time of measurements
 - E.g. other minor equipment leaks
 - Preliminary estimate is that any double counting would be <1% of estimate
- Addition of this source increases storage well emissions from 0.4 MMT CO₂e to 2.3 MMT CO₂e for 2015

NEXT STEPS

- Posting of memos with additional details on updates under consideration
- Public review draft early 2017
- Final 2017 GHG Inventory April 2017