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Using the Greenhouse Gas Reporting Program Data to Improve the National Greenhouse Gas Emissions Inventory for Petroleum and Natural Gas Systems

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Introduction

- API is analyzing publicly reported GHGRP data to use the results to provide recommendations to EPA for updating the GHGI methodology.
- The paper provides details of two recent areas in which API provided EPA with recommendations:
 - Comparison of different sources to refine the petroleum and natural gas well counts;
 - Demonstration of how the GHGRP measurement data could be used to derive updated methane emission factors for compressors in the natural gas processing segment of the industry.

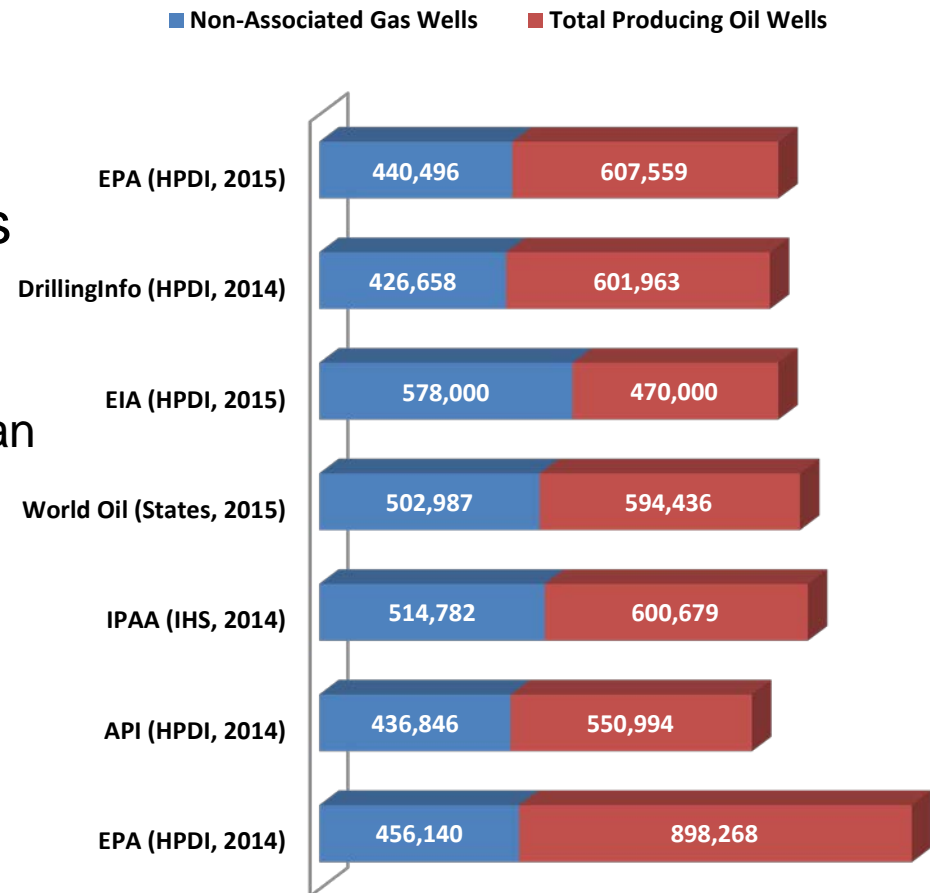
Well Counts in the GHG Inventory

- A number of Petroleum and Natural Gas emission sources in the GHGI rely on counts of producing wells as a key data input for emission calculations:
 - Used directly as the activity data input - fugitive emissions from wells;
 - Used to estimate the population of related equipment - number of pneumatic devices per well and well counts;
 - Used to calculate other inputs - dehydrator vent based on number of dehydrators per well, and the amount of throughput per dehydrator.

Resolving Well Counts Differences

- API noted, even prior to 2014, significant differences in the well counts used by EPA compared to other data sources of national oil and gas well counts.
 - All of the sources reviewed have lower total well count estimates than EPA (HPDI, 2014)
 - Main Differences with Oil wells
- EPA updated their approach with a recent revision to the DrillingInfo dataset (HPDI 2015)

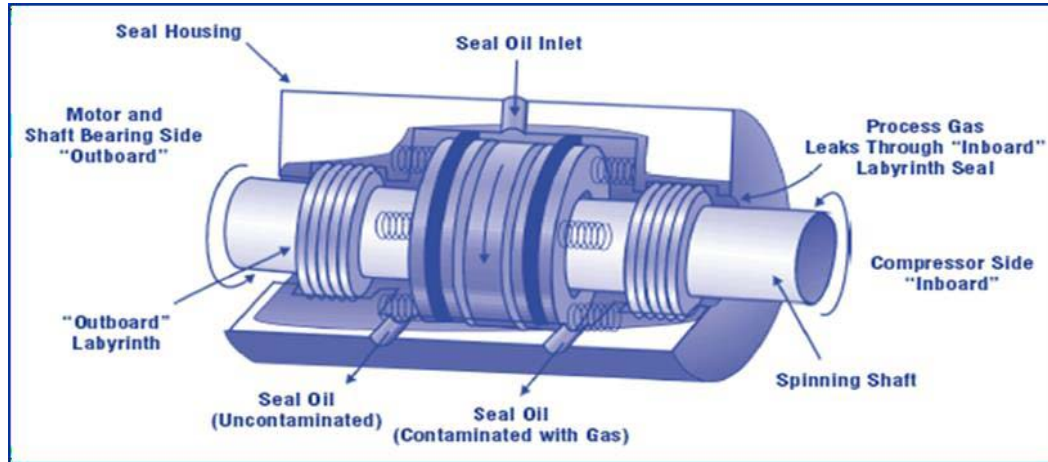
Comparison of Well Counts Estimates



GHGRP COMPRESSOR DATA FOR GAS PROCESSING FACILITIES

- Natural gas processing facilities with total GHG emissions > 25,000 metric tons of CO₂e emissions have been reporting GHG emissions to EPA since 2011.
- The GHGRP provides substantial information, including compressor counts and measured compressor component emissions that can be used to update data for EPA's national GHGI.
- The analysis presented here is based on data for three types of compressors:
 - Centrifugal compressors with either wet seals or dry seals,
 - Reciprocating compressors.

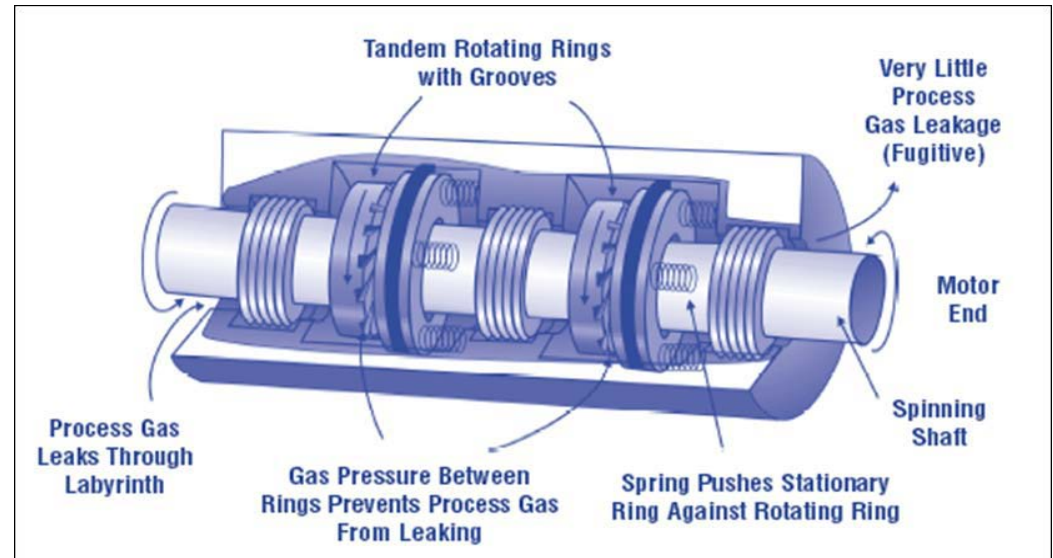
Centrifugal Compressors



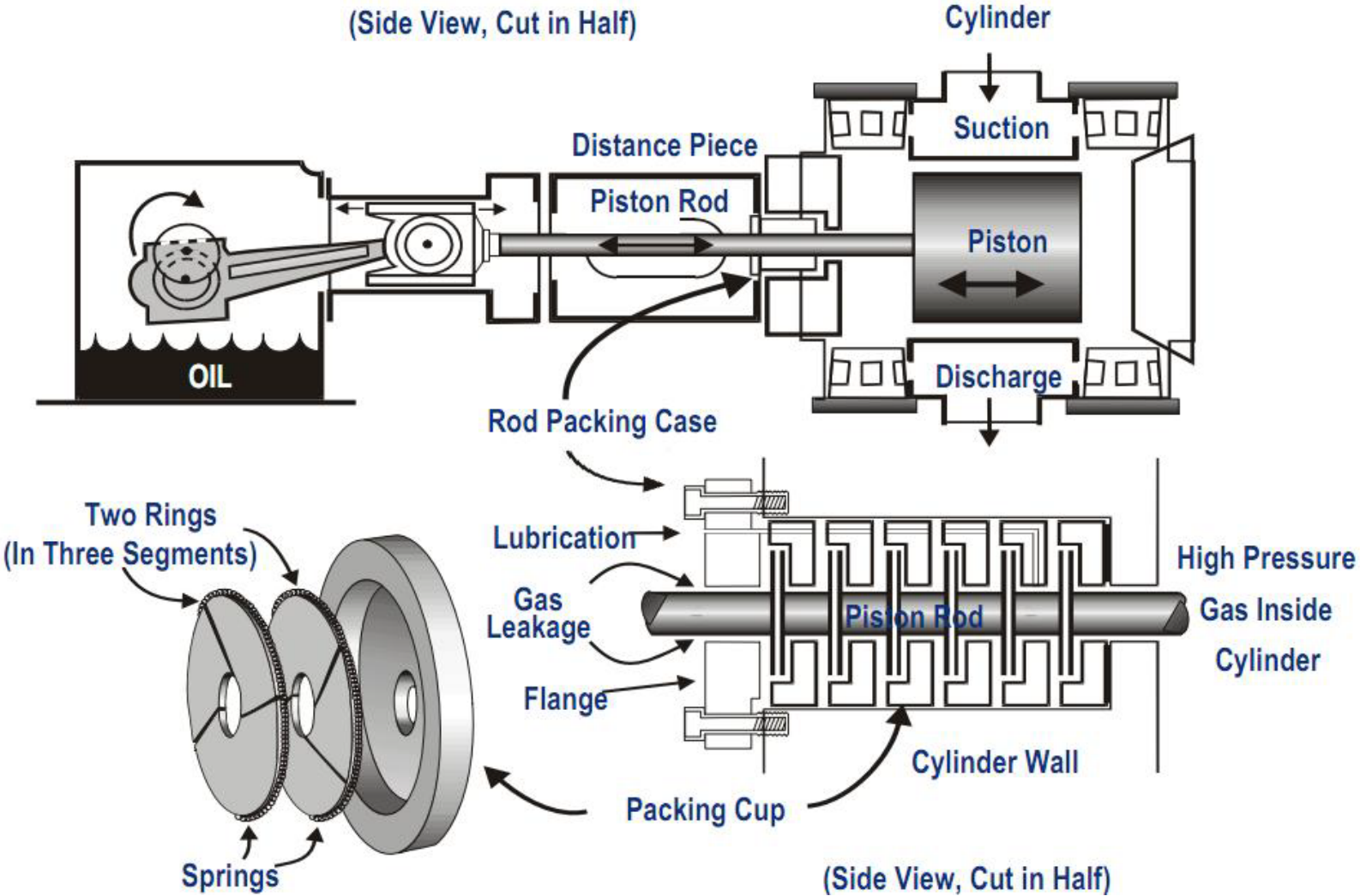
Wet seal compressor



Dry seal compressor



Reciprocating Compressors



GHGRP compressor component measurements for gas processing facilities

Compressor Type	Compressor Component	Compressor Operating Mode
Wet Seal Centrifugal Compressors	Blowdown valve	Operating
	Wet seal oil degassing vents	Operating
	Isolation valve	Non-operating, depressurized
Dry Seal Centrifugal Compressors	Blowdown valve	Operating
	Isolation valve	Non-operating, depressurized
Reciprocating Compressors	Blowdown valve	Operating
	Rod packing	Operating
	Blowdown valve	Stand-by pressurized
	Isolation valve	Non-operating, depressurized

GHGRP Data for Centrifugal Compressors

		RY2015 Data	RY2014 Data	RY2013 Data
Total Compressors		478	461	460
Compressors with Wet Seals		264	275	277
Measurements reported	# wet seal gas emissions ≥ 0	124	156	144
	# dry and wet seal isolation valve emissions ≥ 0	24	90	81
	# dry and wet seal blowdown valve emissions ≥ 0	112	226	201

- Ratio of wet seal compressors declined from 60% in 2013 to 55% in 2015
- About 50% of wet seal compressors reported measured emissions
- About 25-40% of blowdown valves for all centrifugal compressors reported measured emissions

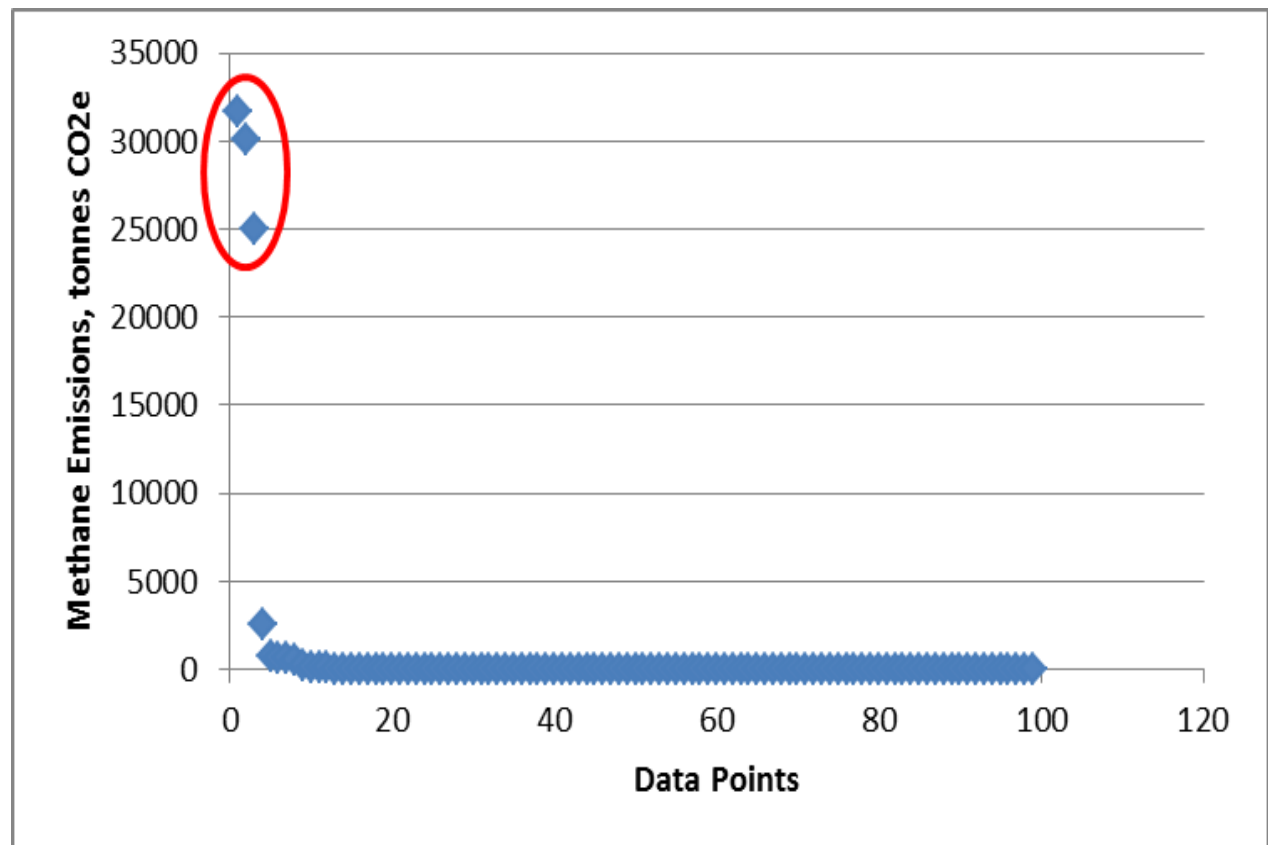
GHGRP Data for Reciprocating Compressors

		R _Y 2015 Data	R _Y 2014 Data	R _Y 2013 Data
Total Compressors		2,662	2,642	2,648
Measurements reported	# measured blowdown valve emissions ≥ 0	430	1,600	1,175
	# measured isolation valve emissions ≥ 0	165	498	447
	# measured rod packing emissions ≥ 0	1,239	1,405	1,140

- The number of reciprocating compressors is constant through the period 2013-2015
- About 45% of compressors reported measured emissions for rod packing for the time series
- The number of compressors that reported emissions for blowdown and isolation valves ranges from 5% to 45%

GHGRP Potential Outliers Impact

- Scatter plot of 2014 measured data points for centrifugal compressors isolation valves identifies three potential outliers



GHGRP Potential Outliers Impact, continued

- Removing these three data points significantly changes the 2014 GHGRP analysis results for Isolation Valves

	Including Outliers	With Outliers Removed
# centrifugal compressors with measured isolation valve emissions ≥ 0	90	87
Total annual CH₄ emissions for centrifugal compressor isolation valves, tonnes CH₄	3,716	247
Tonnes CH₄/compressor	41.29	2.84
Mscfy CH₄/compressor	2,150	147.8

Comparison of Emission Factors

- The following slide provides a comparison between EPA's calculated 2016 GHGI (RY 2014) and EPA's revised 2017GHGI (RY 2015) emission factors, to the emission factors resulting from API's analysis of GHGRP data for compressors.
- Some key differences between EPA's and API's analysis:
 - EPA used all data reported to the GHGRP for RY2015,
 - API only used the GHGRP measured data and corrected for the percentage of compressors with controls.
- API recommends the emission factor be based on a three year average of the GHGRP data to dampen the impact of year-to-year variability.

Comparison of Derived Emission Factors

Centrifugal Compressors

Average annual CH ₄ emissions per compressor (tonnes CH ₄ /compressor)	2016 GHGI RY2014	2017 GHGI RY2015	API's Analysis of GHGRP Data (average 2013-2015)	API's Analysis using RY2015 GHGRP Data Only
Wet Seal Compressors	361	57	81	75
Dry Seal Compressors	177	30	36	30

Reciprocating Compressors

Average annual CH ₄ emissions per compressor (tonnes CH ₄ /compressor)	2016 GHGI RY2014	2017 GHGI RY2015	API's Analysis of GHGRP Data (average 2013-2015)	API's Analysis using RY2015 GHGRP Data Only
Average annual CH ₄ emissions per compressor (tonnes CH ₄ /compressor)	79	19	27	25

In Summary

- Properly accounting for the number of active producing oil and gas wells is key to robust estimate of emissions that are associated with the major equipment and components linked with the wells.
- The wealth of measurement data that is becoming available through the GHGRP is a good source for updating EFs - and keeping them updated - to ensure that the GHGI reflects current operations and practices.
- When updating the GHGI with data reported through the GHGRP it is essential that data be properly vetted to ensure the removal of erroneous values.

Thanks for your attention

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