

# API/ANGA

---

## Information on Gas Well Liquids Unloading

EPA Stakeholder Workshop  
September 13-14, 2012  
Washington D.C.

# Gas Well Liquids Unloading

- 2009 National GHG Inventory increased the emission estimate by 24 times
  - From 185,569 tonnes CH<sub>4</sub> total to 4,554,417 tonnes CH<sub>4</sub>
  - EPA indicated revisions result from analysis of a new database of well production and well properties
- Gas well clean ups (i.e., liquids unloading) accounts for 51% of total CH<sub>4</sub> emissions from the natural gas production sector in EPA's national GHG inventory
  - Increase from 6% of CH<sub>4</sub> emissions that liquids unloading represented in the 2008 inventory

# Gas Well Liquids Unloading

- **EPA's assumptions:**
  - 41.3% conventional wells require unloading (180,811 wells vented for liquids unloading – 2009 inventory)
  - 150,000 plunger lifts are in service (31% gas wells)
  - Average well is vented to atmosphere 38.73 times/yr
  - Average casing diameter is 5 inches
  - Well is vented for 3 hours per vent
- **The ANGA/API survey gathered activity and emissions related information for gas well liquids unloading to examine EPA's assumptions and estimated emissions for this source**

# API/ANGA Survey Data Collected

- Geographic area represented;
- Time period
  - Data were annualized
- # gas wells represented by the information provided;
- # gas wells with plunger lift installed;
- # gas wells with other artificial lift;
- Total gas well vents;
- # wells with and without plunger lifts that vent;
- Count of gas well vents for time period with and without plunger lifts;
- Average venting time for wells with and without plunger lifts;
- Average daily production of venting gas wells (Mcf/day);
- Average depth of venting wells (feet);
- Average casing diameter);
- Average tubing diameter of wells with plunger lift;
- Average surface pressure.

# API/ANGA High Level Data Summary

<b>Survey High Level Data Summary</b>		
Gas wells with plunger lifts (59,648 in sample)	21,500	wells (36.0%)
Gas wells with artificial lift (54,660 in sample)	7,329	wells (13.4%)
Gas Wells Vented to the atmosphere for Liquids Unloading (49,124 in sample)	6,462	wells (13.2%)
# Vents per vented well	145.1	vents/ vented well
Total gas well vents represented by the data sets	937,663	vents
<b>National Well Characterization</b>		
National # of wells from 2010 Inventory	484,795	wells
Calculated national # wells with plunger lift	174,743	wells
Calculated national # wells without plunger lift	310,052	wells
Calculated national # wells with artificial lift (subset of wells without plunger lift)	65,003	wells
Methane mole percentage from EPA 2010 national inventory	78.8%	

# API/ANGA Mid Level Data Summary

## Mid Level Data Summary

Total number of wells with plunger lift (42,681 in sample)	11,518	wells
Total number of wells without plunger lift (42,681 in sample)	31,163	wells
Number of plunger equipped wells that vent (42,681 in sample)	2,426	wells (21.1%)
Number of non-plunger equipped wells that vent (42,681 in sample)	2,901	wells (9.3%)
Total annual volume gas vented for venting wells	1,719,843,596	scf gas/year
Calculated volume vented gas per venting well	322,854	scfy gas/well
Calculated methane volume vented per venting well	254,409	scfy CH4/well

# Calculated National Data

## Calculated National Well Data

Calculated national # wells with plunger lift that vent for unloading	36,806	wells
Calculated national # wells without plunger lift that vent for unloading	28,863	wells

## National Emission Calculations

Total gas venting for liquids unloading volume (scaled for national wells)	21,201,410,618	scf gas/yr
Total methane venting for liquids unloading (scaled for national wells)	16,706,711,567	scf CH <sub>4</sub> /yr
Total liquid unloading vented methane (scaled for national wells)	319,664	metric tons CH <sub>4</sub> /yr

## Comparison to 2010 National Inventory Liquids Unloading

2010 National Inventory CH <sub>4</sub> emissions from Liquids Unloading	4,501,465	metric tons CH <sub>4</sub> /yr
% difference between survey and national data	-92.9%	

# Survey Comparison to EPA Assumptions

Detailed Survey Data		Survey Data		EPA Assumptions	
Total national # of wells that vent for liquids unloading		65,669	wells	179,391	wells
Average number of vents/venting well	per venting plunger well	343.72	vents/well	38.7	vents/well
	per venting non-plunger well	32.57	vents/well		
Average time per vent	plunger equipped wells	0.11	hour	3	Hours
	non-plunger equipped wells	1.90	hours		
Average depth	plunger equipped wells	4,370	feet	6,000	Feet
	non-plunger equipped wells	5,433	feet		
Average tubing diameter - plunger equipped wells		2.15	inches	2	inches
Average casing diameter - non-plunger equipped wells		4.57	inches	5	inches
Average production rate	plunger equipped wells	104.3	Mcf/d gas		
	non-plunger equipped wells	45.9	Mcf/d gas		
Average pressure	plunger equipped wells	91.0	psig	100 psig sales line pressure (200-1000 psig shut-in pressure)	
	non-plunger equipped wells	110.8	psig		
Calculated methane volume venting per venting wells		254,409 scf CH <sub>4</sub> /well		1,316,750 scf CH <sub>4</sub> /well	

# Conclusions

- Overall, the change in emission factors based on data collected from the ANGA/API survey reduces estimated emissions for this source by 93% from the emissions reported in EPA's 2010 national GHG inventory.
  - This is a factor of 14 times lower than EPA's reported emissions.
- When compared to EPA's assumptions used to derive the national GHG emission estimates for liquids unloading:
  - the API/ANGA survey data indicated a lower percent of gas wells that vent for liquids unloading and a much shorter vent duration.
  - The difference in these two parameters from EPA's assumptions more than offsets the higher number of vents/venting-well observed from the survey data.