



# **Petroleum and Natural Gas Systems in the Greenhouse Gas Reporting Program Onshore Production Segment**

U.S. Environmental Protection Agency  
Office of Atmospheric Programs, Climate Change Division

# Description of Onshore Production Segment



- In general, a “facility” for purposes of the GHGRP means all co-located emission sources that are commonly owned or operated.
- However, for Onshore Production, the “facility” includes all emissions associated with wells owned or operated by a single company (the permit holder) in a specific hydrocarbon producing basin (as defined by the geologic provinces published by the American Association of Petroleum Geologists).
- Onshore petroleum and natural gas production generally includes all equipment within a facility that is on a single well-pad or associated with a single well-pad.

# Emission Sources

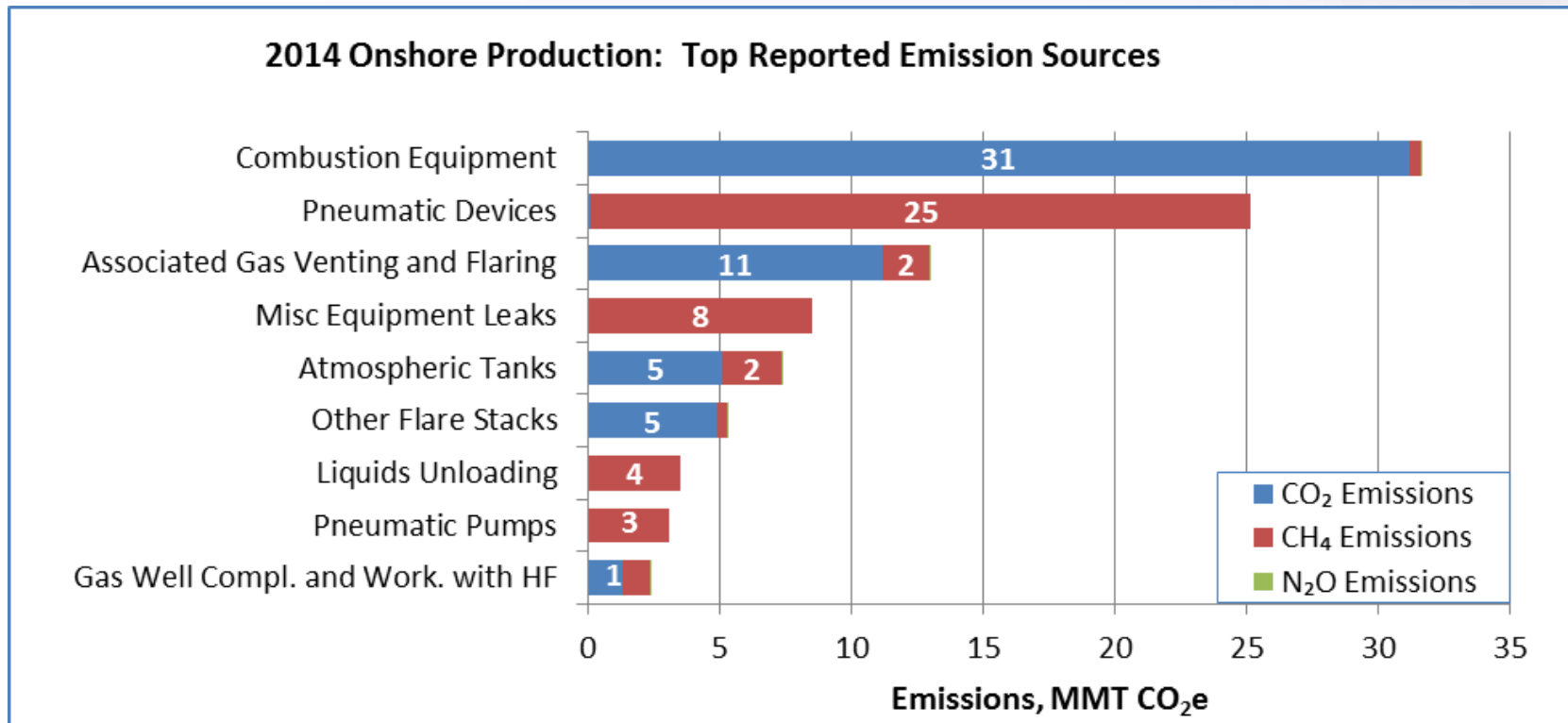


- Acid gas removal units
- Associated gas venting and flaring
- Atmospheric tanks
- Centrifugal compressors
- Combustion equipment
- EOR injection pumps
- EOR hydrocarbon liquid dissolved CO<sub>2</sub>
- Equipment leaks
- Flare stacks
- Liquids unloading
- Gas well completions and workovers with hydraulic fracturing (HF)
- Gas well completions and workovers without HF
- Pneumatic devices
- Pneumatic pumps
- Reciprocating compressors

# 2014 Onshore Production Emissions by Emission Source



- Reported emissions in onshore production totaled 103 MMT CO<sub>2</sub>e
- 523 facilities reported under this sector
- Methane emissions totaled 48 MMT CO<sub>2</sub>e and carbon dioxide emissions totaled 54 MMT CO<sub>2</sub>e



# Select Newly Reported Activity Data



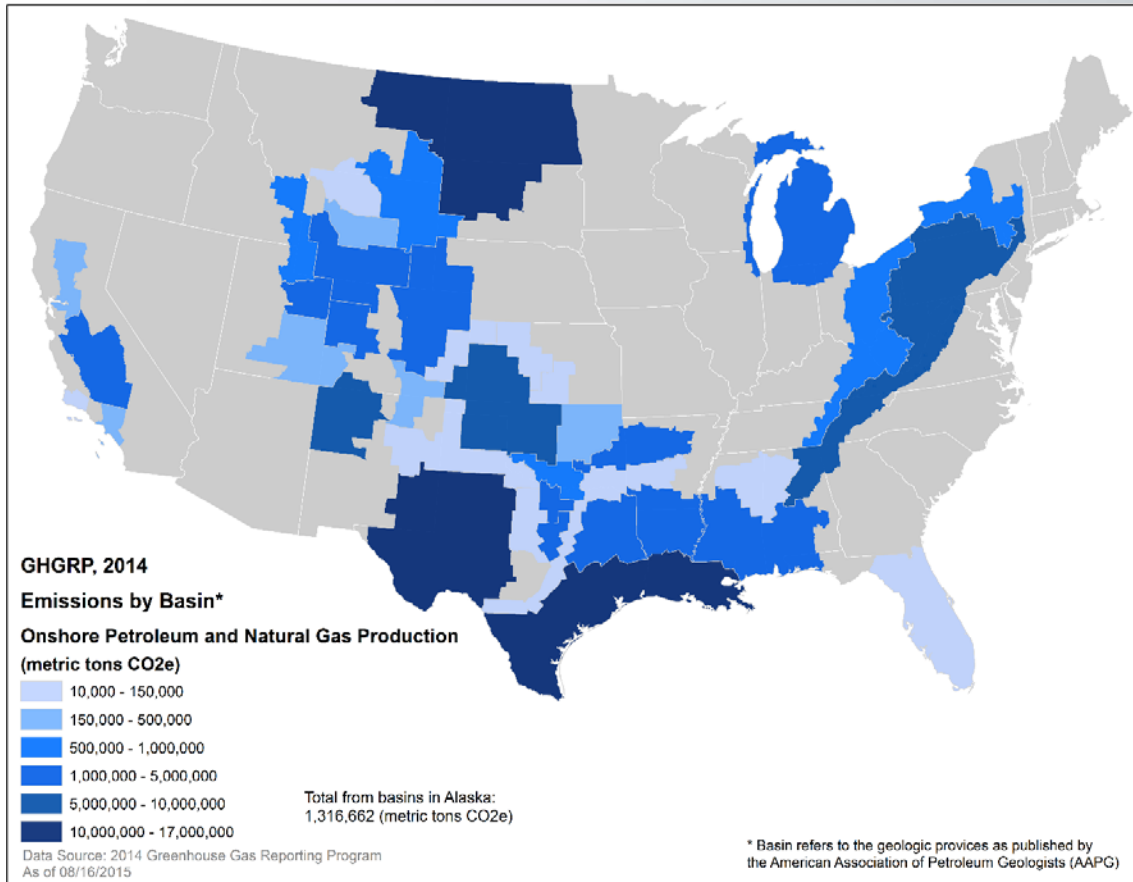
- Count of natural gas driven pneumatic pumps
- Count of pneumatic devices – low bleed, intermittent bleed, high bleed
- Count of each type of major equipment
- Flow rate of backflow during well completion/workover for each measured well
- Total number of days of backflow from all wells during completions/workovers
- Count of reciprocating/centrifugal compressors

# Examples of Reported Activity Counts: 2011-2014



Industry Segment	Source Type	2011 Count	2012 Count	2013 Count	2014 Count
Onshore Production	Reporting Facilities	456	502	503	523
	Pneumatic Devices	574,057	628,890	707,974	785,113
	Pneumatic Pumps	64,490	77,538	77,355	79,881
	Wells	375,445	406,262	425,125	499,023
	Atmospheric Tanks	184,203	223,447	219,632	275,532
	Centrifugal Compressors	156	139	105	69
	Reciprocating Compressors	14,107	18,129	20,156	23,318

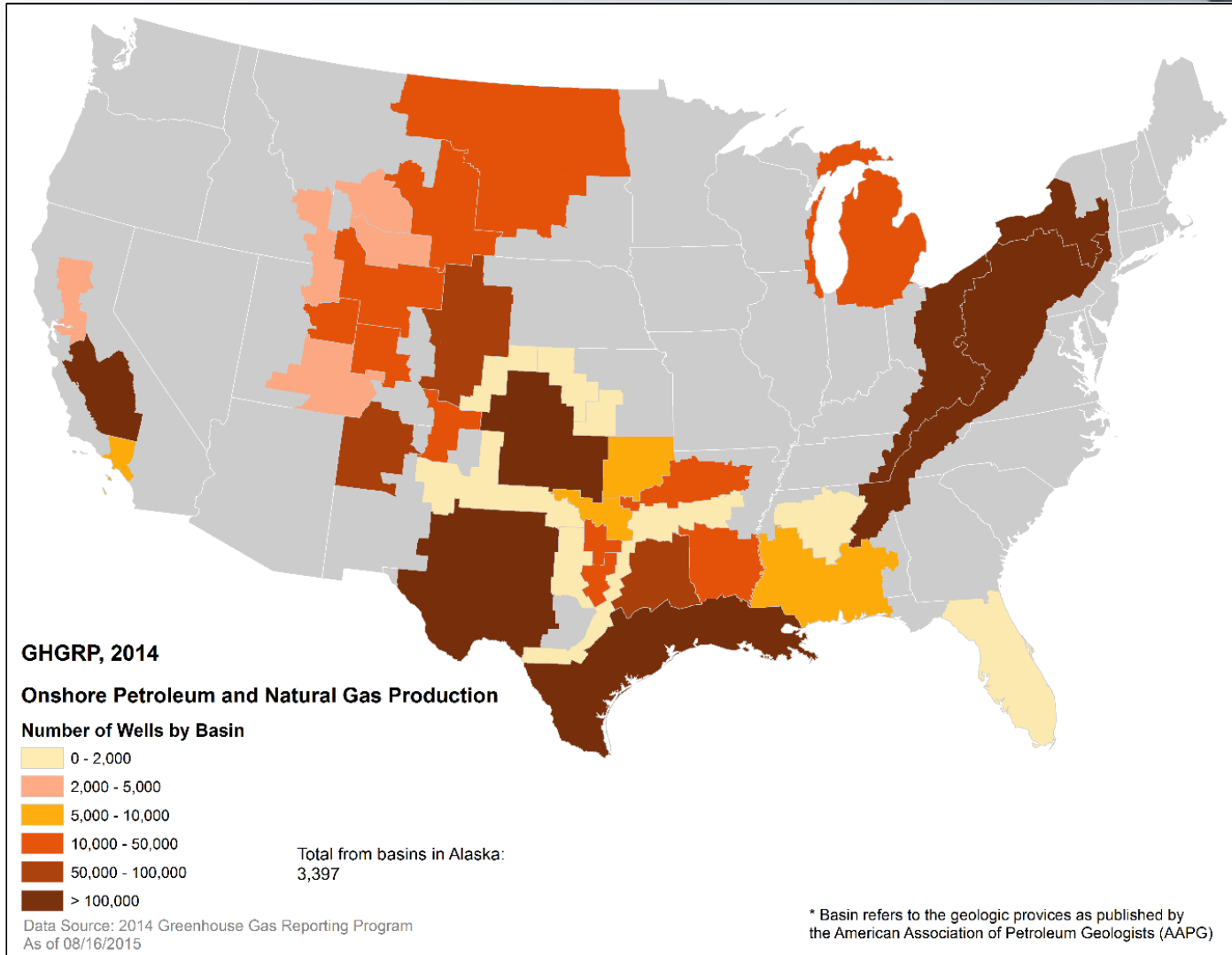
# 2014 Onshore Production Basin Emissions



- Emissions in onshore production are reported by basin
- The map to the left shows reported emissions aggregated for all onshore production facilities by basin
- The basins with highest reported emissions were:
  - Williston Basin (16.4 MMT CO<sub>2</sub>e)
  - Gulf Coast Basin (15.6 MMT CO<sub>2</sub>e)
  - Permian Basin (10.9 MMT CO<sub>2</sub>e)
  - Anadarko Basin (9.4 MMT CO<sub>2</sub>e)
  - San Juan Basin (7.3 MMT CO<sub>2</sub>e)

*Note: For the onshore production segment, the “facility” includes all emissions associated with wells owned or operated by a single company in a specific hydrocarbon producing basin. A basin refers to a geologic region where sediment infilling has occurred. The GHG Reporting Program definition of basin refers to the geologic provinces as published by the American Association of Petroleum Geologists (AAPG).*

# 2014 Onshore Production Basin Well Counts

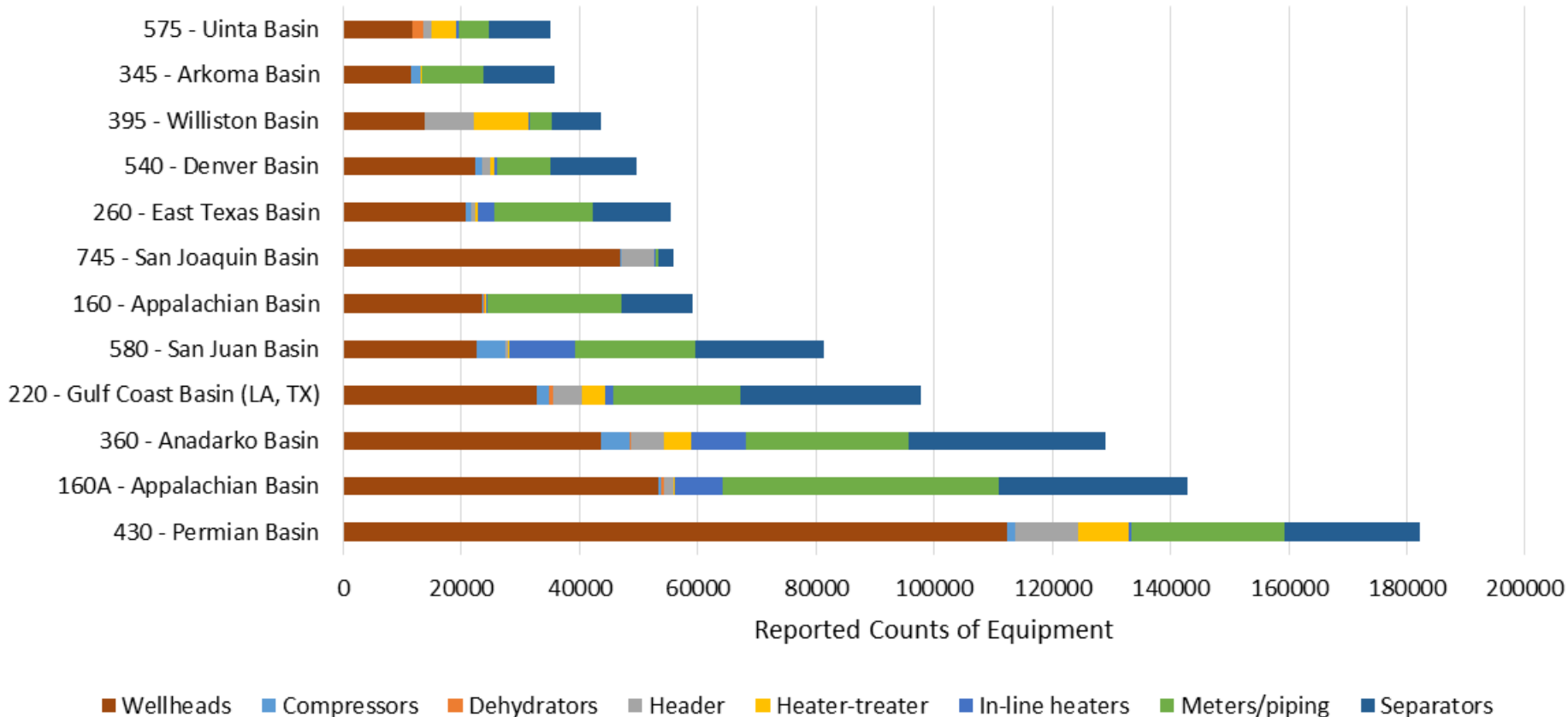




# Onshore Production Reported Equipment Counts per Basin



RY14 Equipment Counts



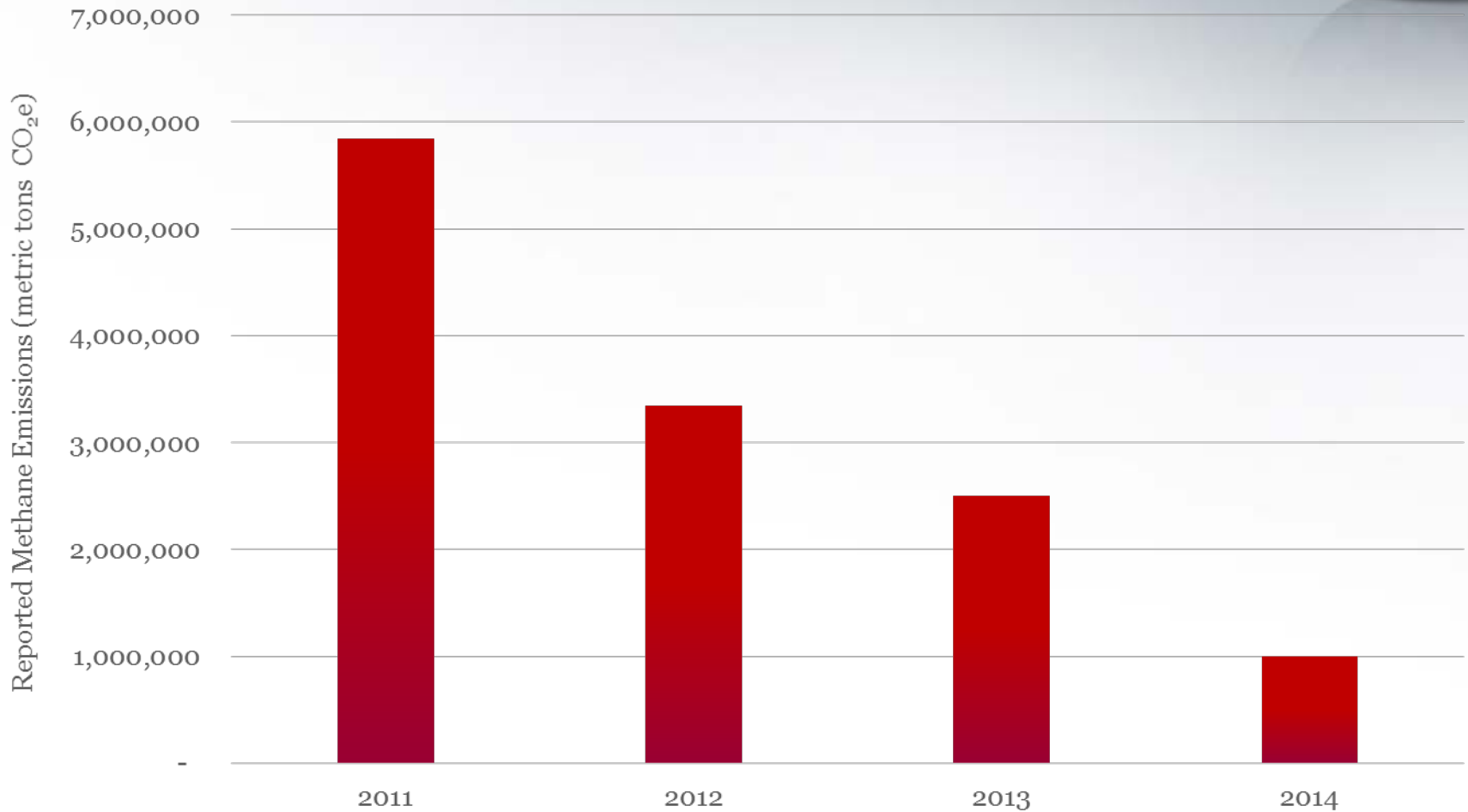
# Gas Well Completions and Workovers with Hydraulic Fracturing



- 183 onshore production facilities reported emissions from gas well completions and workovers with hydraulic fracturing, which totaled 2.3 MMT CO<sub>2</sub>e
- GHGRP calculation methods allow facilities to measure or estimate the backflow rate in order to report emissions using an engineering calculation, or the backflow vent or flare volume may be measured directly

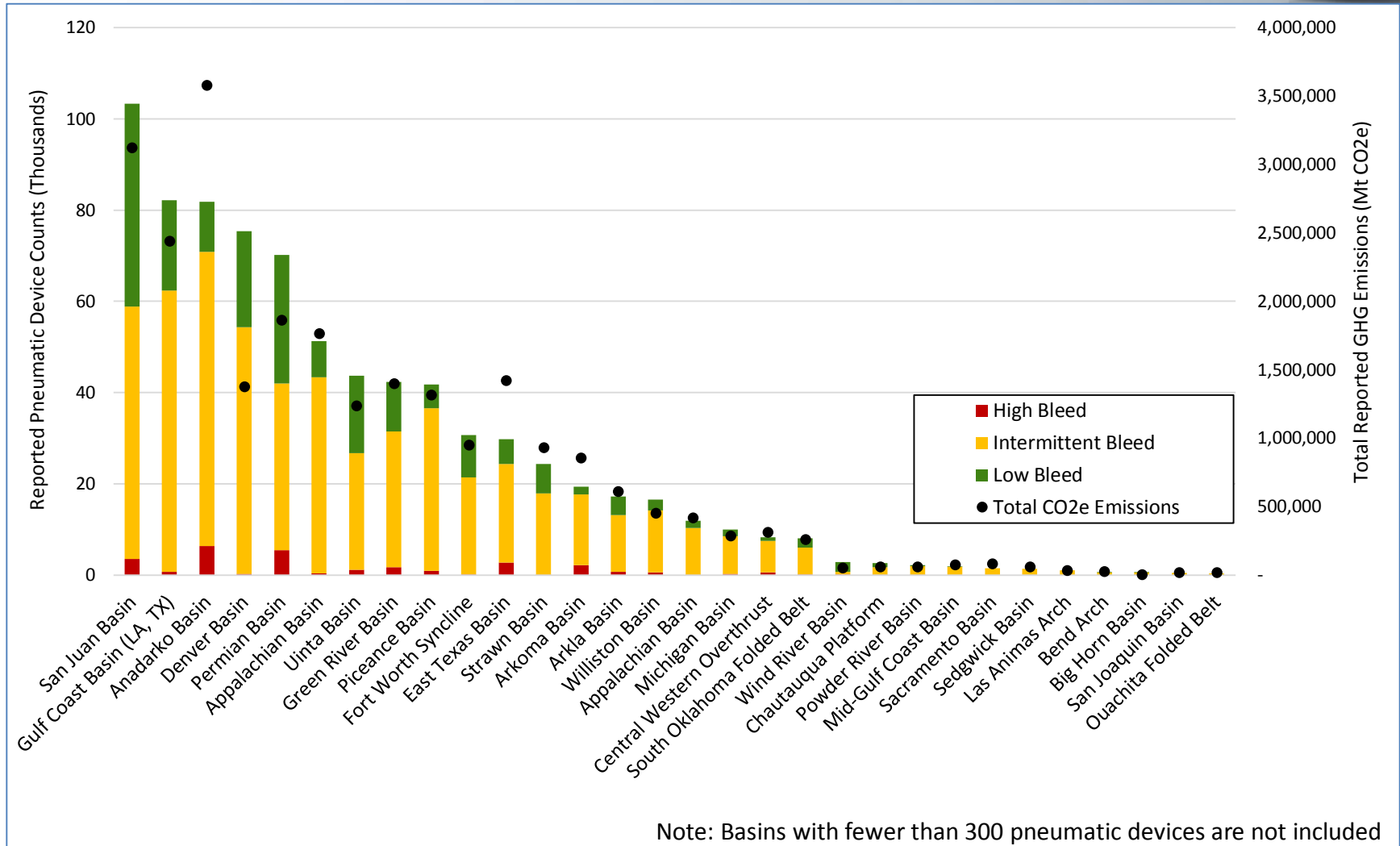
Activity	Total Number	Number of RECs	Reported Venting CO <sub>2</sub> Emissions (MT CO <sub>2</sub> e)	Reported Venting CH <sub>4</sub> Emissions (MT CO <sub>2</sub> e)	Reported Flaring CO <sub>2</sub> Emissions (MT CO <sub>2</sub> e)	Reported Flaring CH <sub>4</sub> Emissions (MT CO <sub>2</sub> e)	Total Reported Emissions (MT CO <sub>2</sub> e)
Gas Well Completions with Hydraulic Fracturing	7,139	4,928	6,533	902,202	1,230,755	177,903	2,145,152
Gas Well Workovers with Hydraulic Fracturing	445	138	133	83,612	83,563	4,100	171,427
<b>Total</b>	<b>7,584</b>	<b>5,066</b>	<b>6,666</b>	<b>985,813</b>	<b>1,314,318</b>	<b>182,003</b>	<b>2,316,580</b>

# Gas Well Completions and Workovers with Hydraulic Fracturing: 2011-2014 Reported CH<sub>4</sub> Emissions



# Onshore Production Pneumatic Devices

## 2014 Pneumatic Device Types by Basin & by Facility



Note: Basins with fewer than 300 pneumatic devices are not included

# Considerations for Future Reporting Years



- Select changes for 2015 reporting year:
  - Several changes to the measurement, calculation, and reporting procedures for gas well completions and workovers with hydraulic fracturing.
  - Several changes to emission calculation methodologies for atmospheric storage tanks.
- Select changes for 2016 reporting year:
  - Begin monitoring and reporting of completions and workovers of oil wells with hydraulic fracturing.
  - Report well identification numbers associated with each basin-level report.