



O&G EMISSIONS INVENTORY PROJECT: GREATER SAN JUAN AND PERMIAN BASIN

**John Grant, Rajashi Parikh,
Amnon Bar-Ilan
Ramboll Environ**

**Tom Moore, Mary Uhl
WESTAR & WRAP**

U.S. Bureau of Land Management



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OUTLINE



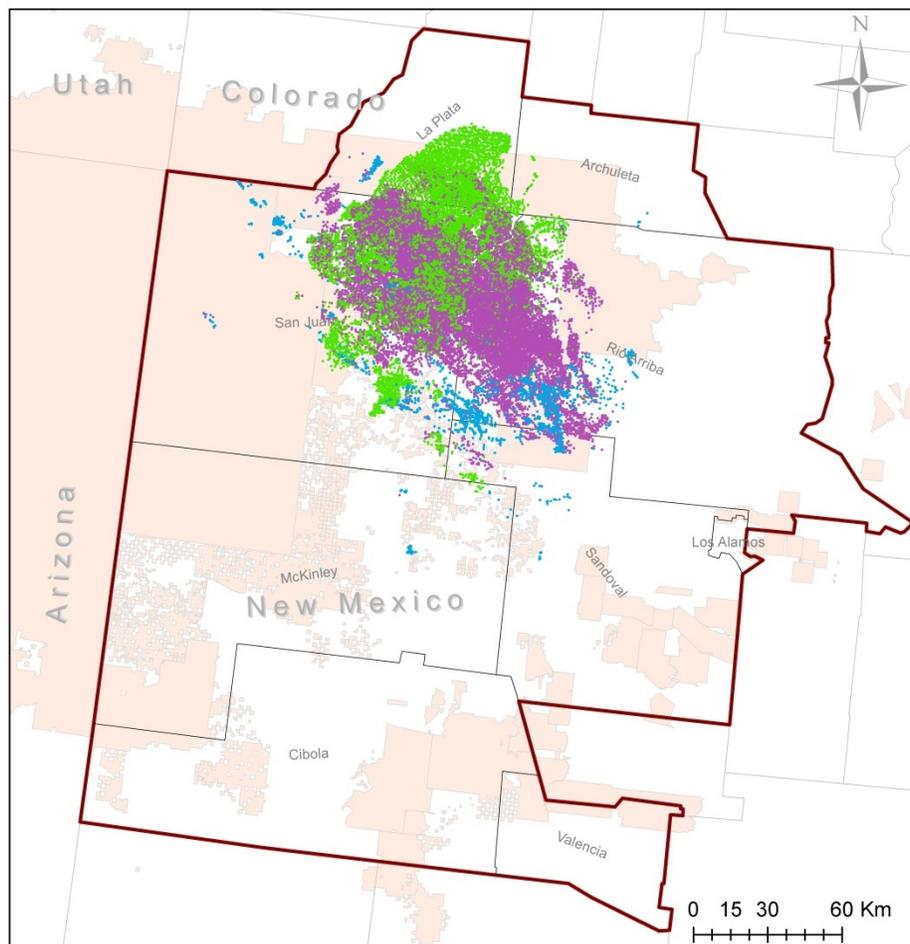
- Project overview
 - Basin maps: O&G well-site and midstream facility locations
- Inventory inputs
 - GHGRP subpart W
- Draft base year (2014) Greater San Juan inventory
- Draft future year (2028) emission inventory methodology



EMISSION INVENTORY OVERVIEW

- Objective: Develop O&G emission inventories
 - Base year 2014 and future year 2028
 - O&G Basins
 - Greater San Juan Basin in southern Colorado and northern New Mexico
 - Permian Basin (portion of the basin in New Mexico only)
- Emission Sources:
 - nonpoint (O&G well-sites)
 - point (midstream gas gathering and gas processing)
- Pollutants : NO_x, VOC, CO, SO_x, PM, GHGs
- Mineral ownership: Private/state fee, tribal, and federal

GREATER SAN JUAN BASIN: 2014 WELL LOCATIONS BY TYPE



Legend

 Greater San Juan Basin (consistent with GHGRP Subpart W definition)

 Tribal Lands

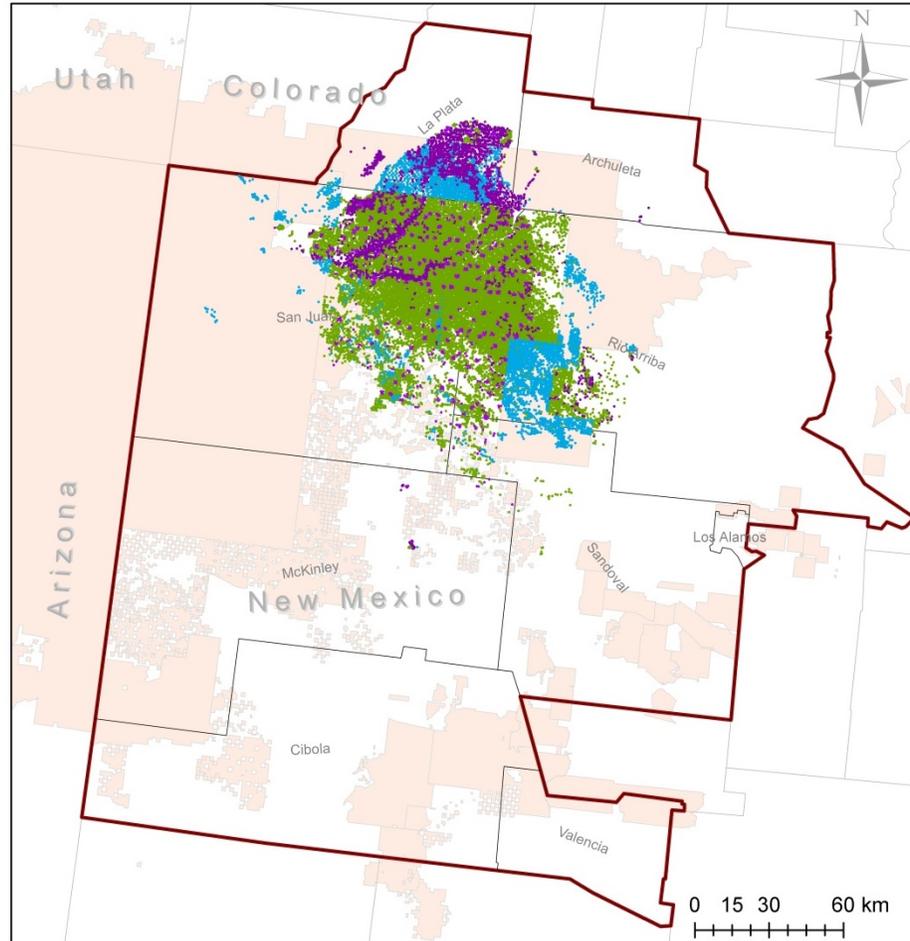
Well Type

 Oil

 CBM

 Gas

GREATER SAN JUAN BASIN: 2014 WELL LOCATIONS BY MINERAL OWNERSHIP



Legend

 Greater San Juan Basin (consistent with GHGRP Subpart W definition)

 Tribal Lands

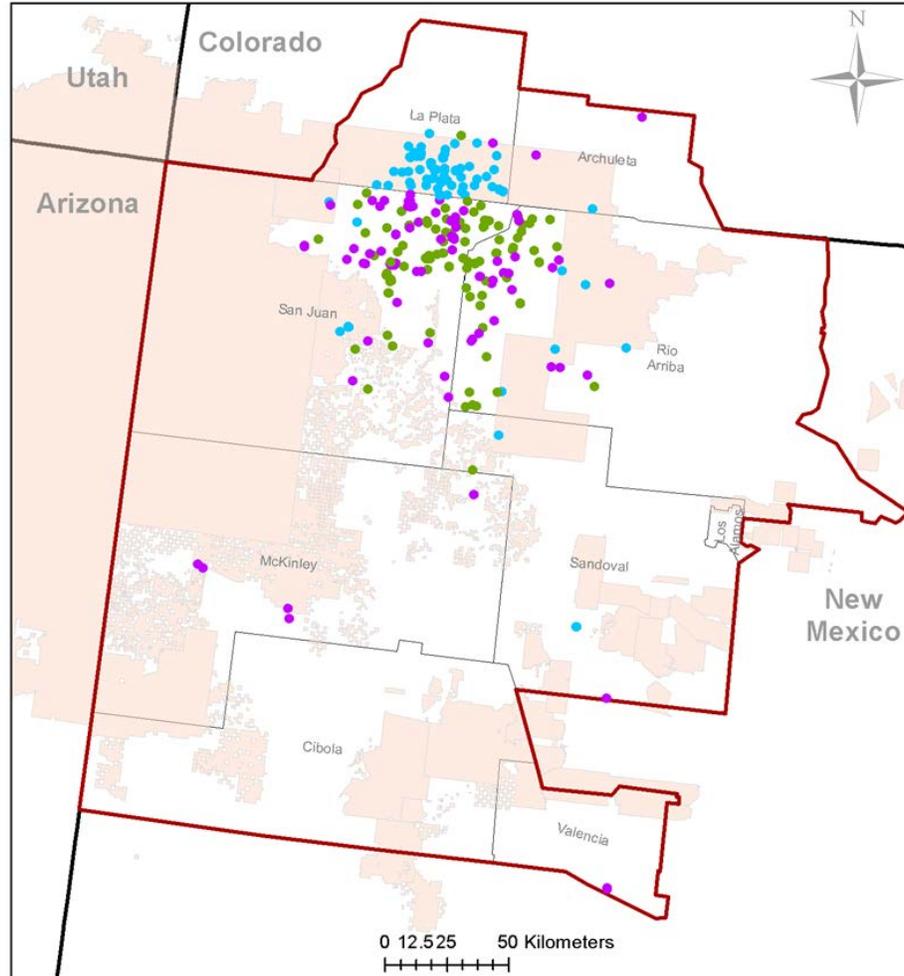
Mineral Ownership (2014 Wells)

 Private/State

 Tribal

 Federal

GREATER SAN JUAN BASIN: 2014 MIDSTREAM FACILITIES BY SURFACE OWNERSHIP



Legend

-  Greater San Juan Basin (consistent with GHGRP Subpart W definition)
-  Tribal Lands

Ownership

-  Federal
-  Private/State
-  Tribal



INVENTORY INPUTS



Input

Source

- **O&G activity data** by county, well type, and mineral designation
- **Point (midstream) source emissions** by facility
- **Greater San Juan well-site source input factors**
- **Permian Basin well-site source input factors**



IHS Enerdeq Database

Federal / State / Local / Tribal Agency Permit Databases

Operator survey, Subpart W GHGRP, EPA O&G Tool, CARMMS O&G Inventory

Literature Review, EPA O&G Tool

Greater San Juan and Permian Basin Input factor report is available at [https://www.wrapair2.org/pdf/2016-11y_Final%20GSJB-Permian%20EI%20Inputs%20Report%20\(11-09\).pdf](https://www.wrapair2.org/pdf/2016-11y_Final%20GSJB-Permian%20EI%20Inputs%20Report%20(11-09).pdf)



INVENTORY INPUTS: GHGRP SUBPART W

- **Segment applicable to well-site inputs development:** Onshore petroleum and natural gas production
 - **Reporting requirement:** Owners or operators of facilities that contain petroleum and natural gas systems and emit 25,000 metric tons or more of GHGs per year
- **Typical Input Data Available from Subpart W reporting:** population, emission factors for some sources and partial control information
- Subpart W data used to develop **Greater San Juan Basin input factors**
 - Operator provided Subpart W submissions as survey inputs for applicable source categories
 - Compiled data from publicly released data for companies that did not respond to survey
 - Facility Level Information on GreenHouse Gases Tool (FLIGHT) (<https://ghgdata.epa.gov/ghgp/main.do>)
 - Envirofacts (<https://www.epa.gov/enviro/greenhouse-gas-customized-search>)



INVENTORY INPUTS: GHGRP SUBPART W

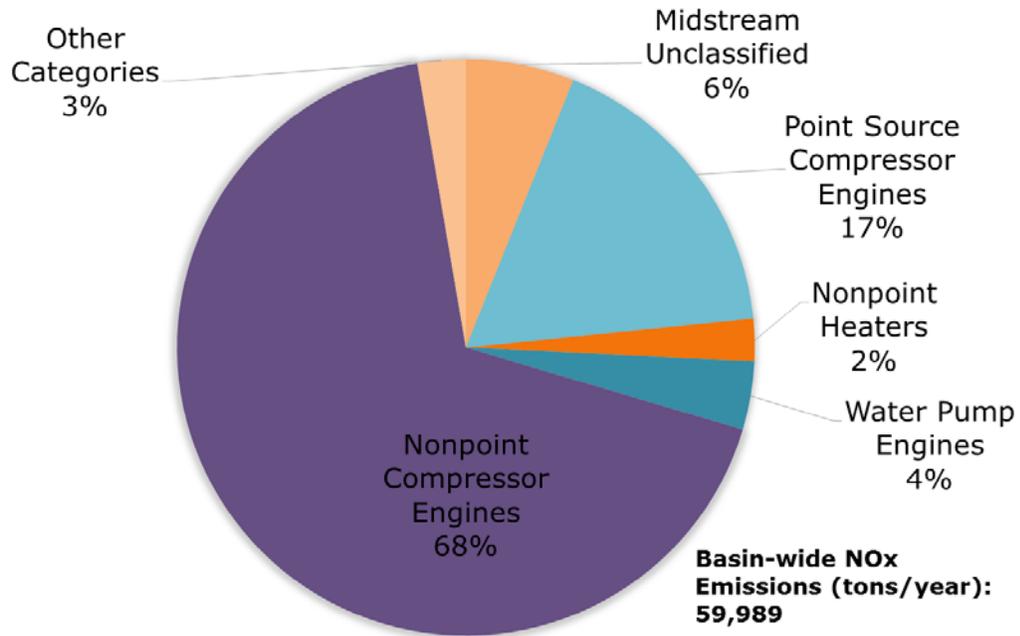


Well-site inventory and GHGRP Subpart W emission source categories

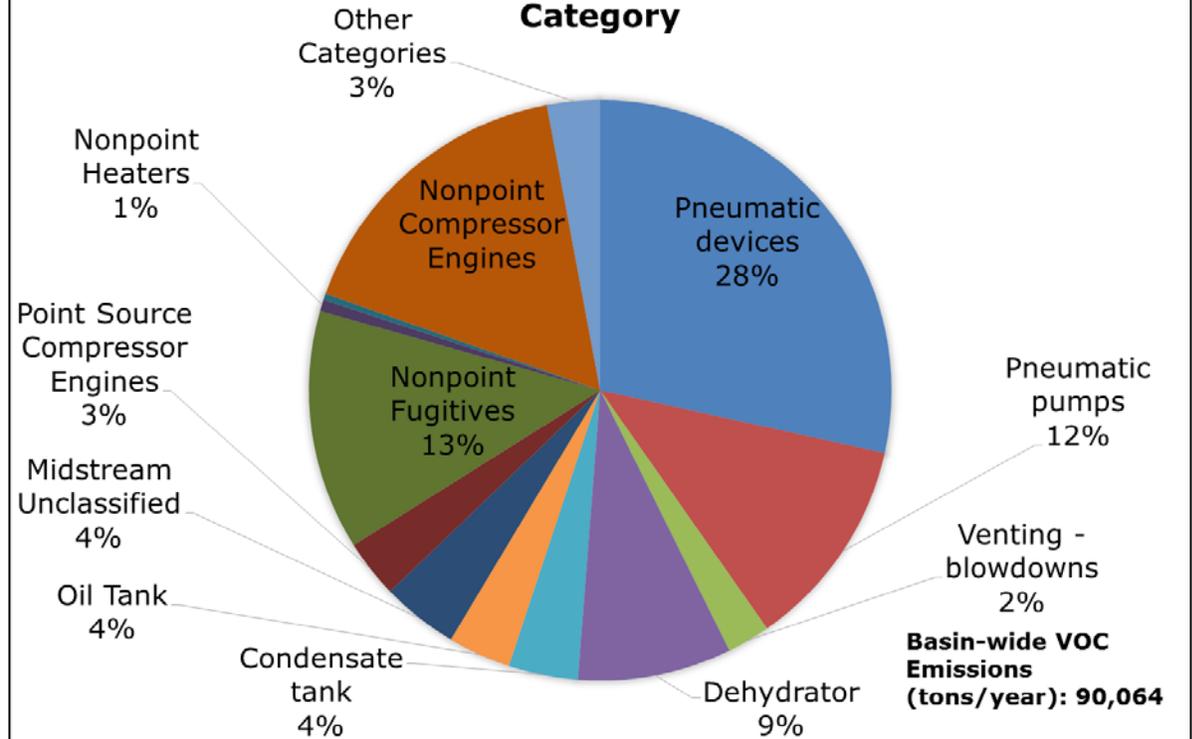
Source Category	Emission Inventory	GHGRP Subpart W	Source Category	Emission Inventory	GHGRP Subpart W
Pneumatic Devices	✓	✓	Hydraulic Fracturing Pumps	✓	✗
Gas-Actuated Pumps	✓	✓	Artificial Lift Engines	✓	✗
Dehydrators	✓	✓	Drilling Rigs	✓	✗
Liquids Unloading (Blowdowns)	✓	✓	Refracing	✓	✗
Well Completion Venting	✓	✓	Workover	✓	✗
Crude Oil Tanks	✓	✓	Water Pump	✓	✗
Condensate Tanks	✓	✓	Produced Water Tanks	✓	✗
Associated Gas Venting	✓	✓	Hydrocarbon Liquids Loading	✓	✗
Wellhead Compressor Engines	✓	✓	Injection Pump Blowdown	✗	✓
Lateral Compressor Engines	✓	✓	Hydrocarbon Liquids Dissolved CO2	✗	✓
Fugitive Emissions	✓	✓	Well Testing Venting and Flaring	✗	✓
Heaters	✓	✓	Acid Gas Removal Units	✗	✓

2014 EMISSIONS (DRAFT): GREATER SAN JUAN BASIN

Basin-wide NOx Percent Contribution by Source Category

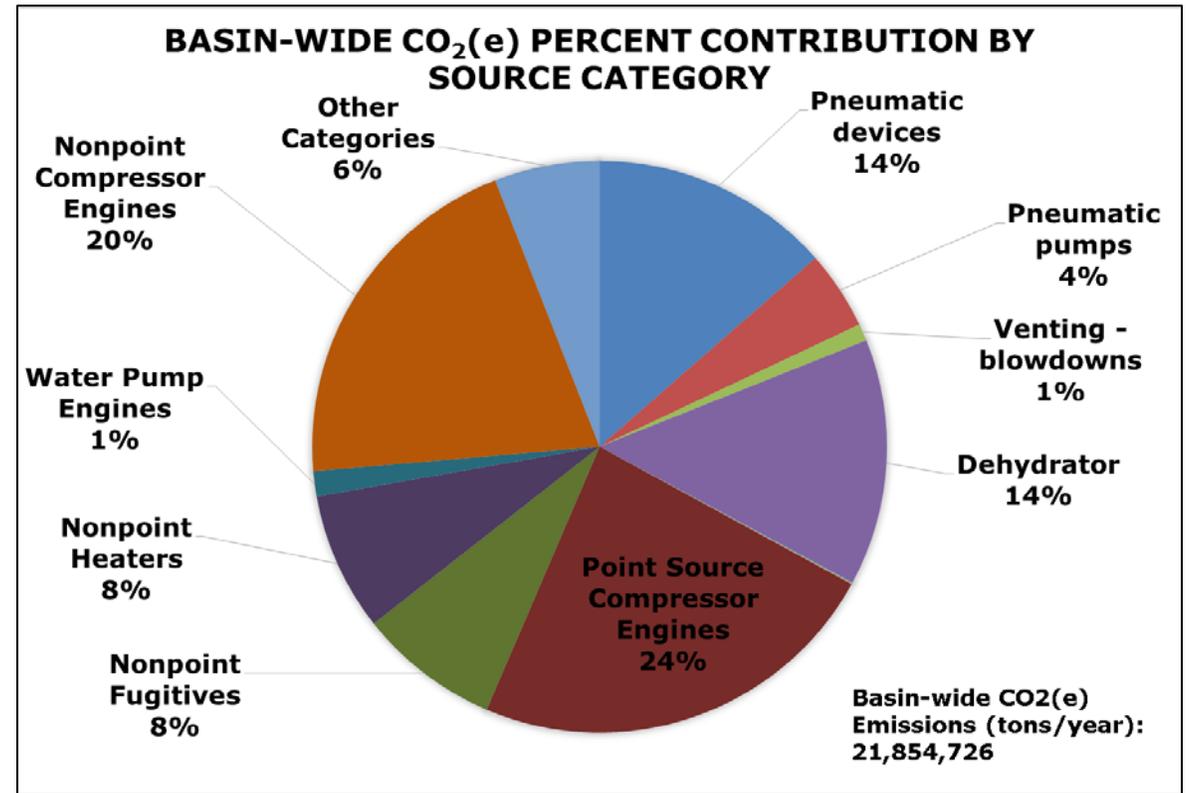


Basin-wide VOC Percent Contribution by Source Category



2014 EMISSIONS (DRAFT): GREATER SAN JUAN BASIN

- GHG emissions were not estimated for point source facilities for which process level emissions were unavailable
- Super-emitters were not included in emission inventory estimates



2014 Greater San Juan Basin emissions by mineral ownership:

Mineral Ownership	Emissions (tons/year)					
	NOx	VOC	CO	SOx	PM	CO ₂ (e) ¹
Tribal	14,049	12,471	13,029	65	359	4,718,641
Private/State	17,095	17,121	20,326	188	473	5,627,585
Federal	28,845	60,472	52,189	66	876	11,508,499
Total	59,989	90,064	85,544	319	1,708	21,854,726



FUTURE YEAR INVENTORY DEVELOPMENT: OVERVIEW

- 2028 future year for both Greater San Juan and Permian Basins
- Forecasts will be developed by well type and source category at the basin or sub-basin level
- Forecast will account for:
 - O&G activity change from base year 2014 to future year 2028
 - On-the-books regulatory controls effects on emissions in 2028



FUTURE YEAR INVENTORY DEVELOPMENT: CONTROLS

Regulations for which Control Scalars <u>WILL</u> be developed	Regulations for which Control Scalars <u>WILL NOT</u> be developed
Federal Regulations	
NSPS 0000 – O&G Phase I	NESHAP Subpart HH (dehydrators)
NSPS 0000a – O&G Phase II	Tribal MNSR
NSPS JJJJ – Spark-ignited engines	Subpart KKKK (turbines)
Farmington RMP Conditions of Approval Standards for Gas Compressors	Point Source Process Heater/Boiler MACT, NSPS
Federal Tier Standards for off-road diesel engines	
BLM Methane Rule	
State Regulations	
Colorado Regulation 7	None



FUTURE YEAR INVENTORY DEVELOPMENT: ACTIVITY FORECASTS (GREATER SAN JUAN BASIN)

- O&G activity growth will be based on forecasts from the US Bureau of Land Management (BLM) study, Colorado Air Resource Management Modeling Study 2.0 (CARMMS)¹
- O&G activity forecasts available from CARMMS by subarea:
 - Mancos Shale
 - Southern Ute Indian Tribe (SUIT) Shale Supplemental Environmental Impact Study (SEIS)
 - Tres Rios Field Office (TRFO)
 - Farmington Field Office (FFO)

¹Not yet published



FUTURE YEAR INVENTORY DEVELOPMENT: ACTIVITY FORECASTS (GREATER SAN JUAN BASIN)

CARMMS O&G activity forecasts for 2015, 2023, and 2025:

Area ¹	Year	Spud Count	Active Well Count	Gas Production (BCF/yr)	Oil Production (Mbbbl/yr)
Low Scenario					
Mancos Shale	2015	0	0	0	0
	2023	173	1,166	245	21,114
	2025	173	1,513	283	23,950
SUIT (SEIS)	2015	0	0	0	0
	2023	20	104	49	94
	2025	48	200	102	211
TRFO	2015	68	3,498	339	135
	2023	33	3,831	260	66
	2025	33	3,897	247	59
High Scenario					
Mancos Shale	2015	0	0	0	0
	2023	347	2,333	489	42,228
	2025	347	3,026	566	47,901
SUIT (SEIS)	2015	0	0	0	0
	2023	40	208	99	187
	2025	96	400	204	423
TRFO	2015	68	3,498	339	135
	2023	82	4,224	323	79
	2025	82	4,389	322	72

¹ O&G activity in the Farmington Field Office outside of the Mancos Shale conservatively assumed unchanged from base year

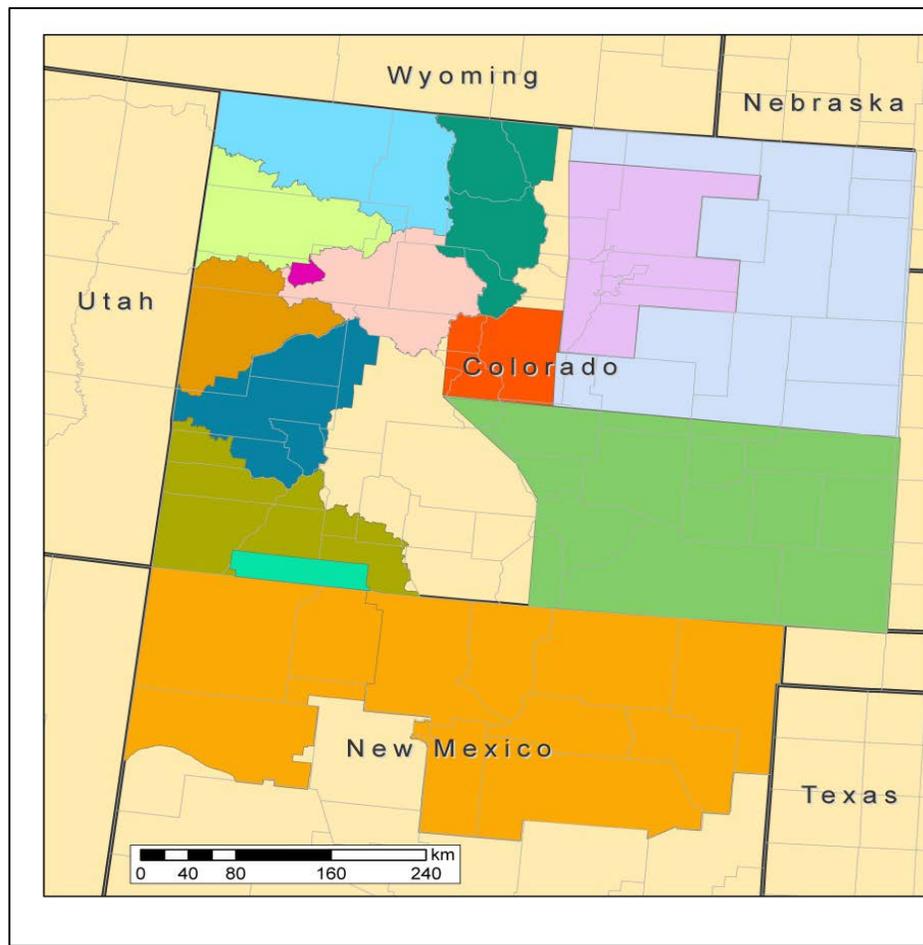


END

Report & other project materials available at:
<http://www.wrapair2.org/SanJuanPermian.aspx>

DRAFT FUTURE YEAR ACTIVITY FORECASTS: CARMMS SUB-AREAS

Colorado Field Office (FO) Planning Areas



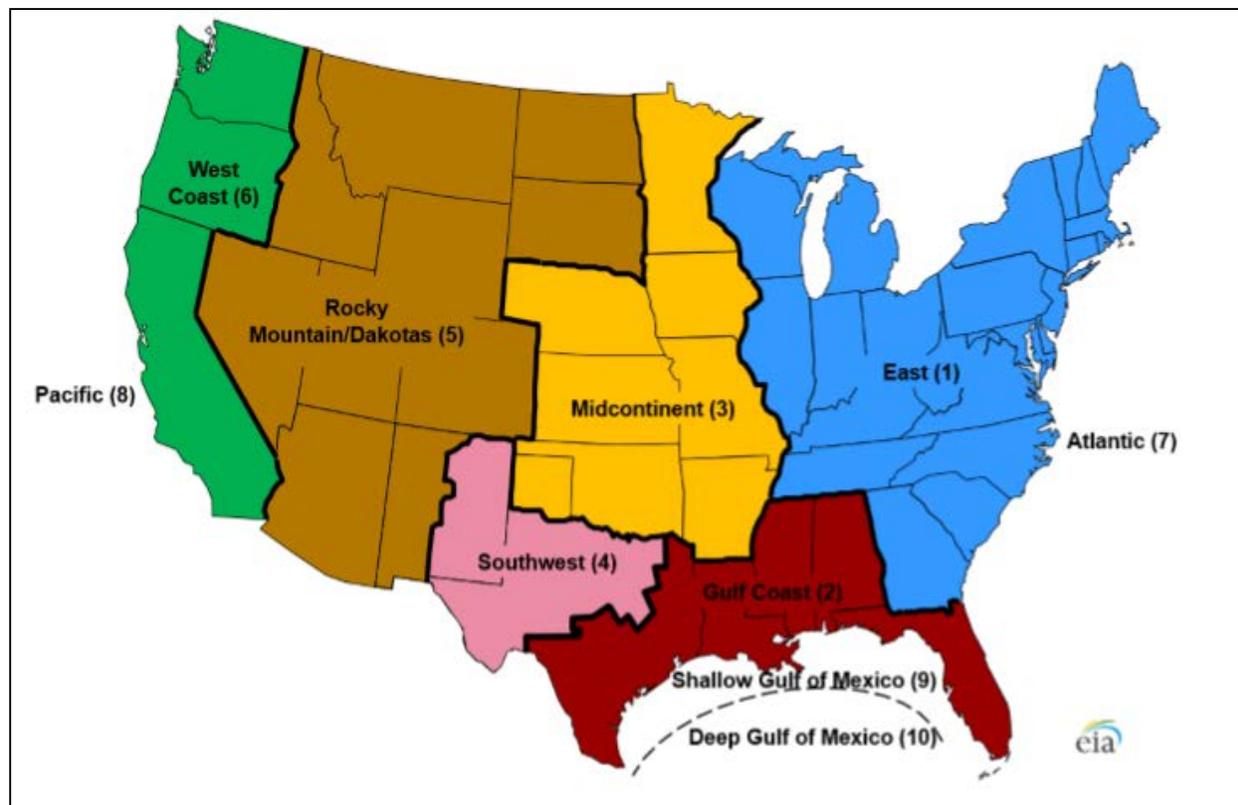
Source Regions

- Colorado River Valley FO except Roan Plateau
- Grand Junction FO
- Kremmling FO
- Little Snake FO
- Roan Plateau
- Tres Rios FO
- Uncompahgre FO
- White River FO
- Farmington FO
- RGFO_Area_1_O3_NAA
- RGFO_Area_2_South_Park
- RGFO_Area_3_North
- RGFO_Area_4_South
- Southern Ute (SUIT modeling boundary)

Mancos Shale (not shown) intersects the TRFO and FFO areas

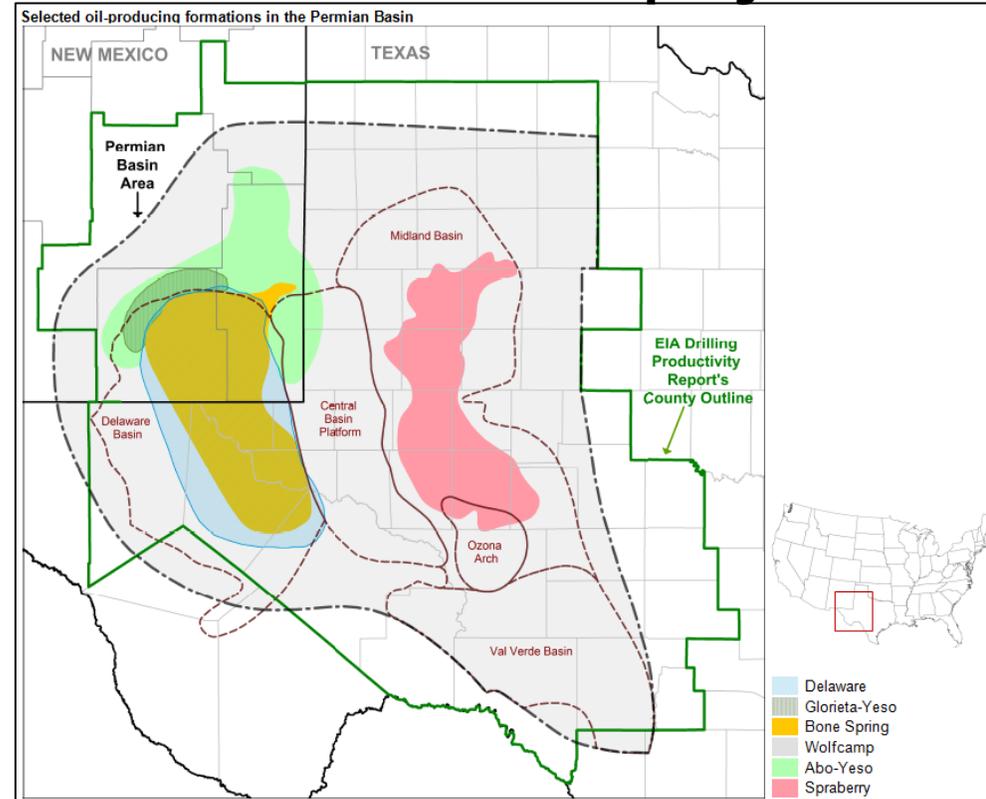
Source: CARMMS report, not yet published

DRAFT FUTURE YEAR ACTIVITY FORECASTS: EIA O&G SUPPLY MODULE REGIONS



DRAFT FUTURE YEAR ACTIVITY FORECASTS: EIA SHALE REGIONS

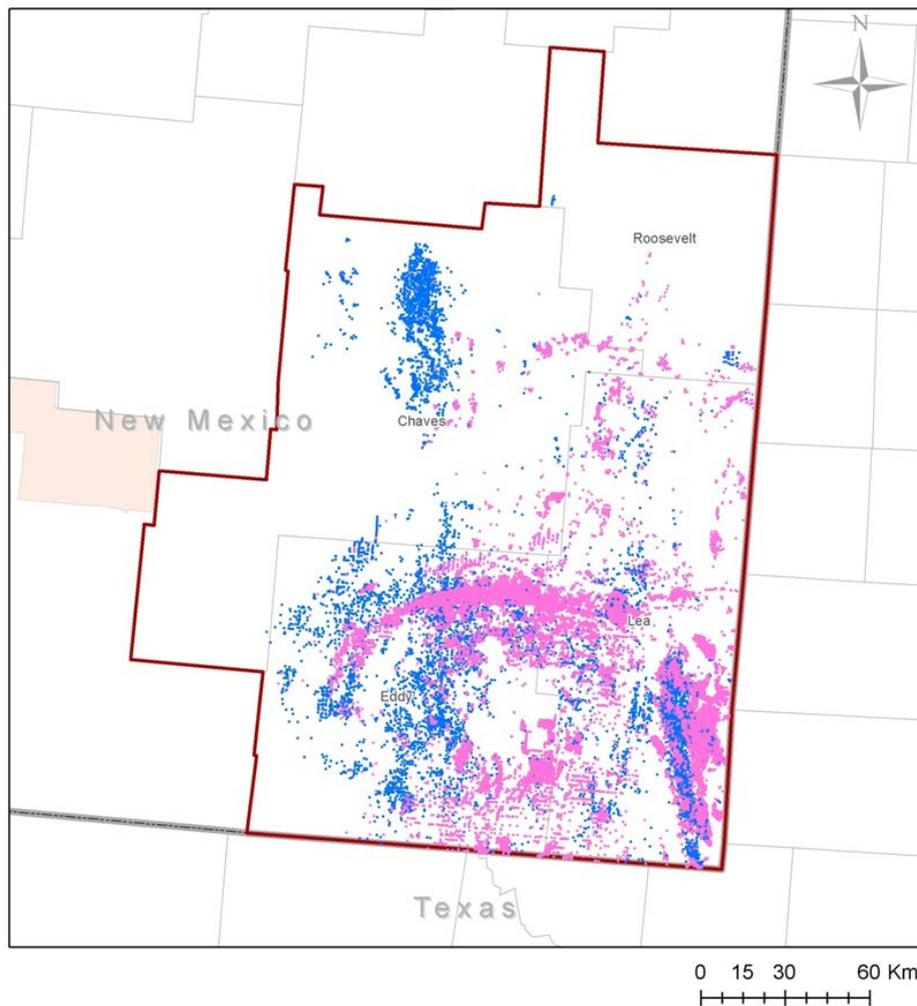
Permian Basin oil plays



(note: Permian Basin forecasts will be developed for New Mexico only, Texas is not part of this study)

<https://www.eia.gov/todayinenergy/detail.php?id=17031>

PERMIAN BASIN: 2014 WELL LOCATIONS BY TYPE



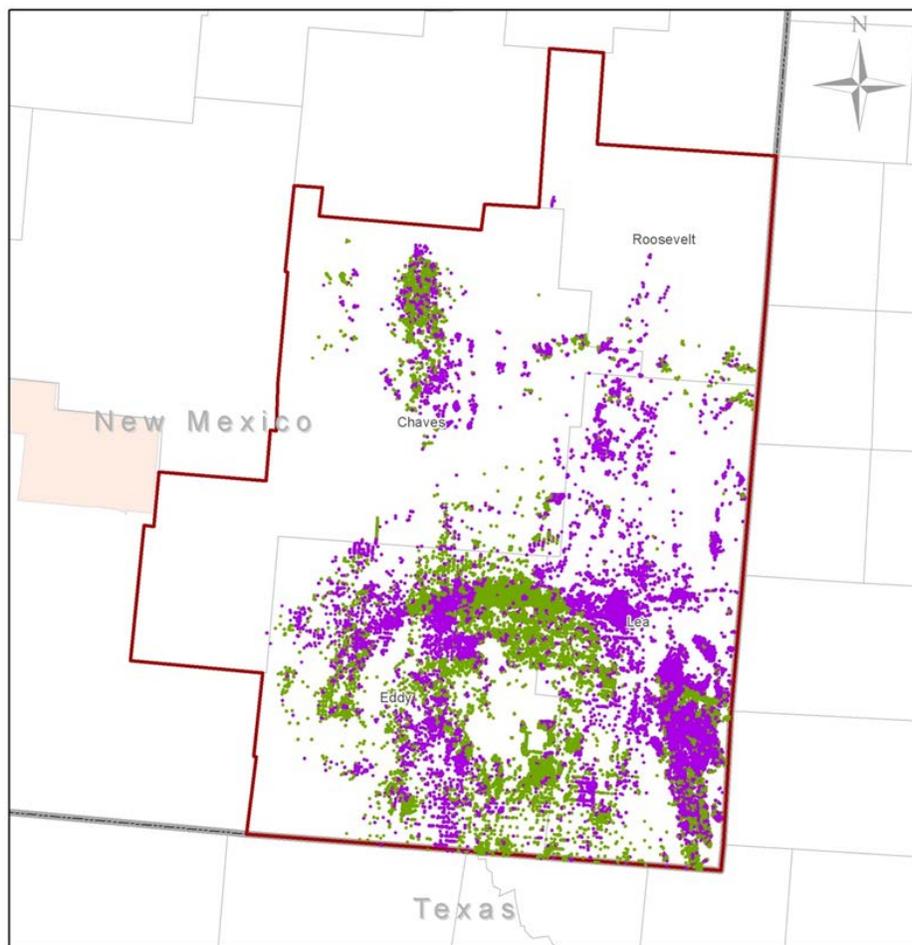
Legend

-  Permian Basin
-  Tribal Lands

Well Type

-  Oil
-  Gas

PERMIAN BASIN: 2014 WELL LOCATIONS BY MINERAL OWNERSHIP



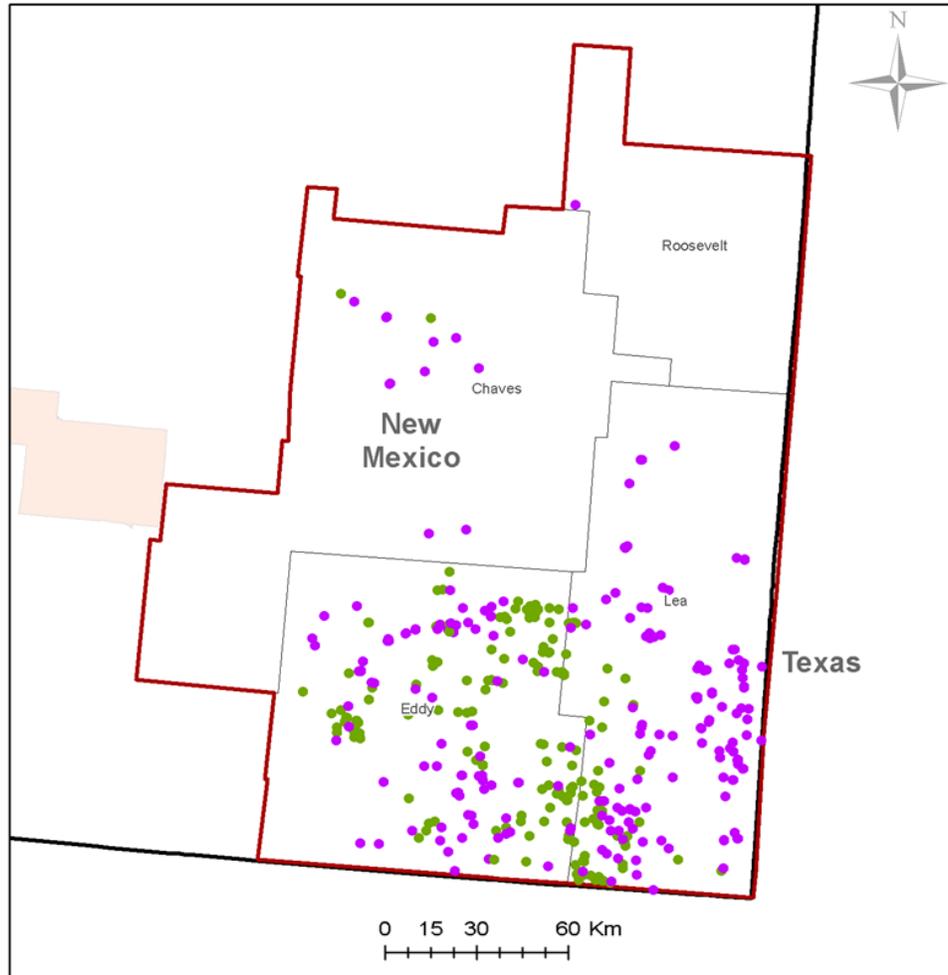
Legend

-  Permian Basin
-  Tribal Lands

Mineral Ownership (2014 Wells)

-  Private/State
-  Federal

PERMIAN BASIN: 2014 MIDSTREAM FACILITIES BY SURFACE OWNERSHIP



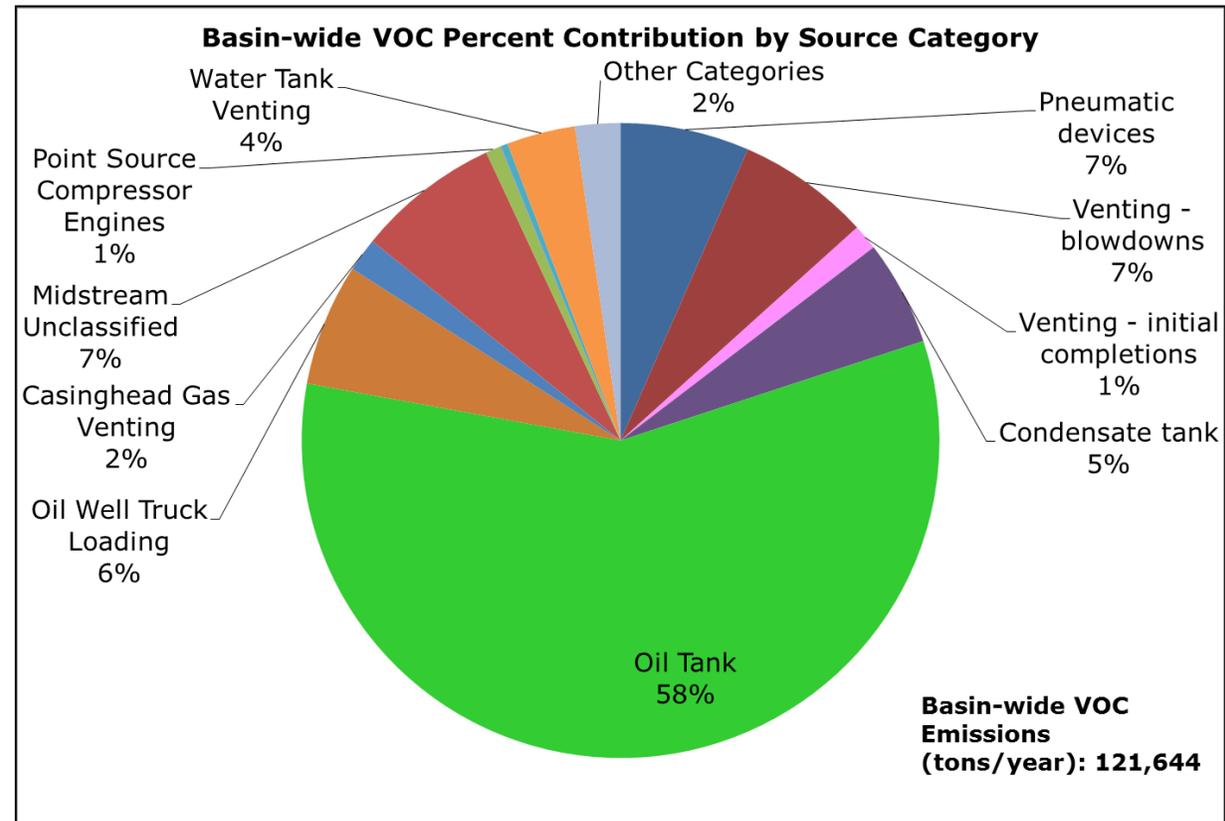
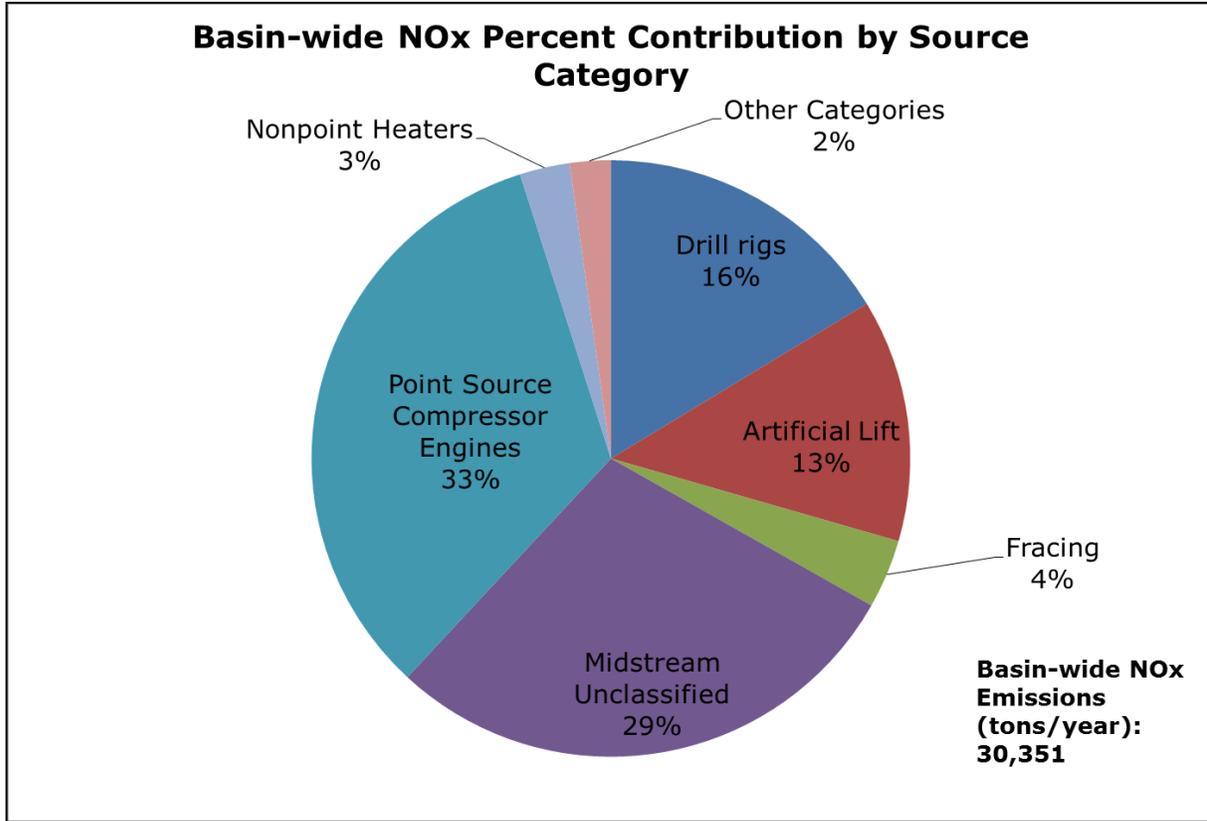
Legend

-  Permian Basin
-  Tribal Lands

Ownership

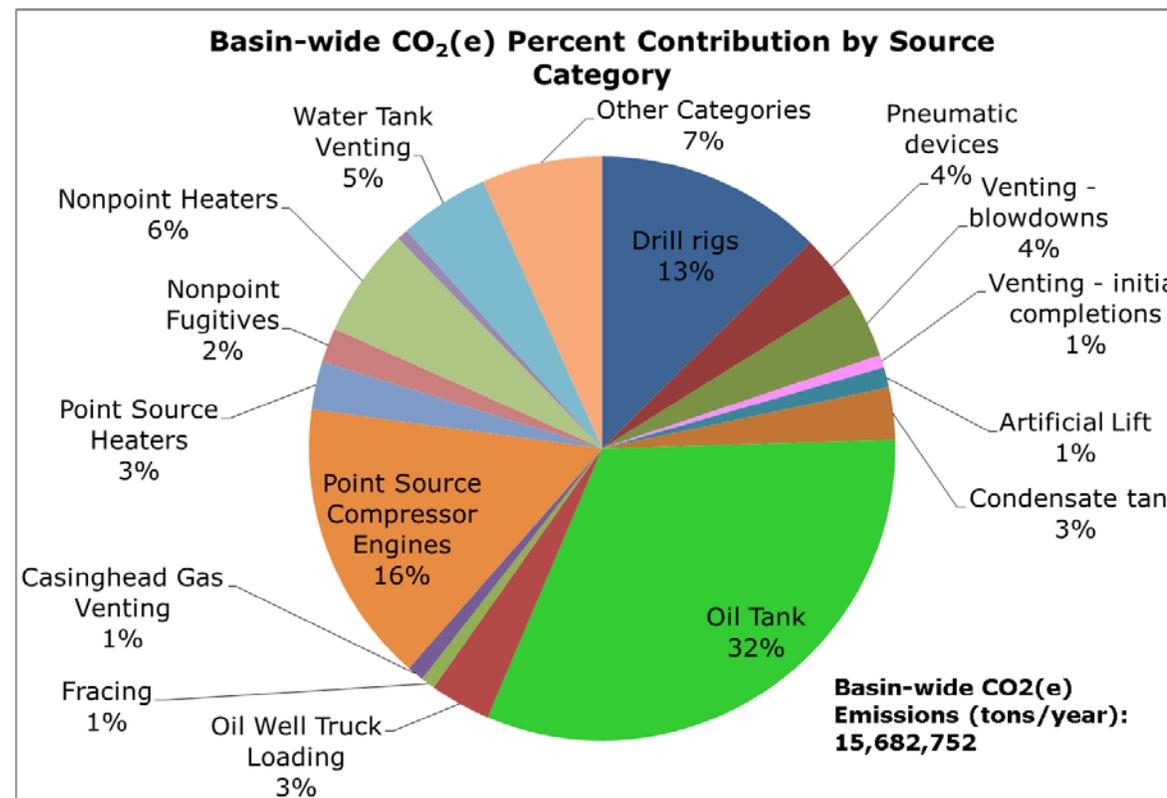
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2014 EMISSIONS (DRAFT): PERMIAN BASIN



2014 EMISSIONS (DRAFT): GREATER SAN JUAN BASIN

- GHG emissions were not estimated for point source facilities for which process level emissions were unavailable
- Super-emitters were not included in emission inventory estimates



2014 Greater San Juan Basin emissions by mineral ownership:

Mineral Ownership	NOx [tons/year]	VOC [tons/year]	CO [tons/year]	SOx [tons/year]	PM [tons/year]	CO ₂ (e) ¹ [tons/year]
Private/State	19,198	61,422	15,016	8,863	346	9,076,317
Federal	11,153	60,222	10,803	3,530	191	6,606,435
Total	30,351	121,644	25,819	12,393	537	15,682,752



FUTURE YEAR INVENTORY DEVELOPMENT: ACTIVITY FORECASTS (PERMIAN BASIN)

- O&G activity growth will be based on US Energy Information Association (EIA) Annual Energy Outlook (AEO) forecasts

2017 AEO O&G production estimates for 2014 and forecasts to 2023 and 2028

Region / Shale Play	Oil Production (million barrels per day)			Gas Production (trillion cubic feet per year)		
	2014	2023	2028	2014	2023	2028
Southwest Region-wide						
Southwest	1.74	2.68	2.69	3.56	2.89	3.15
Shale Plays in the Permian Basin (New Mexico)						
Avalon/Bone Springs	0.19	0.44	0.34	not available		
Wolfcamp	0.2	0.68	0.73			