



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

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# OUTLINE



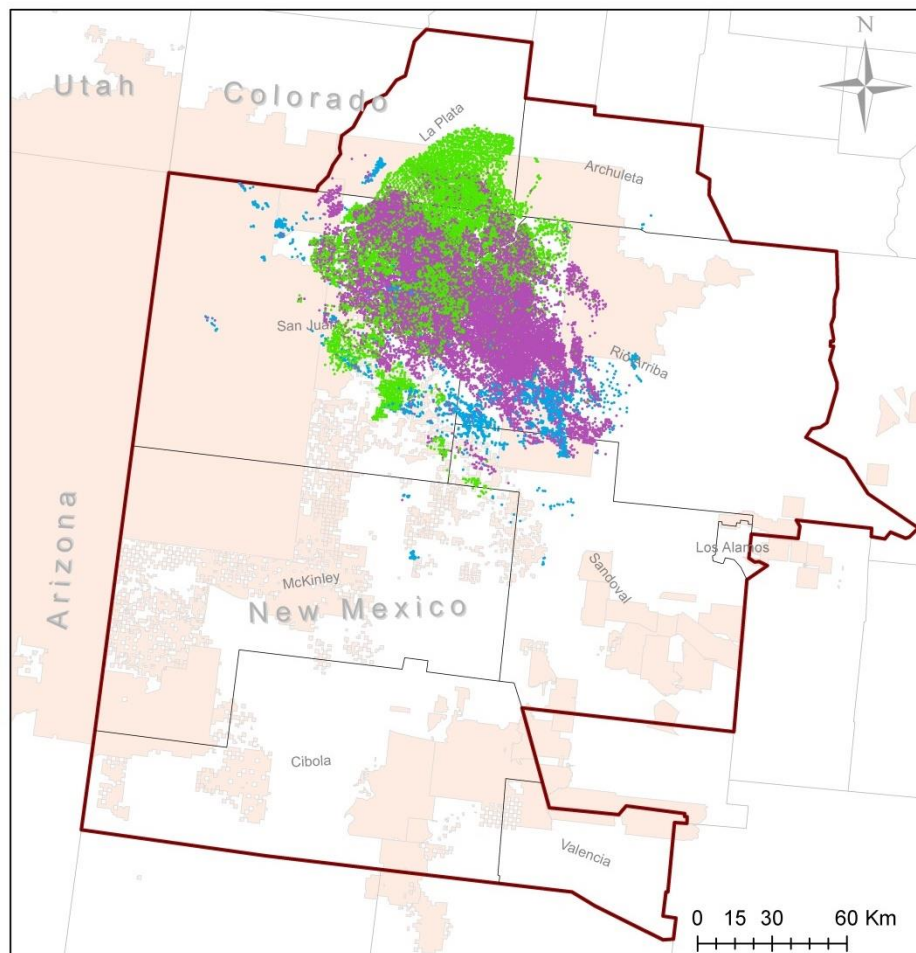
- Project overview
  - Basin maps: O&G well-site and midstream facility locations
- Inventory inputs
  - GHGRP subpart W
- Draft base year (2014) Greater San Juan inventory
- Draft future year (2028) emission inventory methodology



# 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<sub>x</sub>, VOC, CO, SO<sub>x</sub>, 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

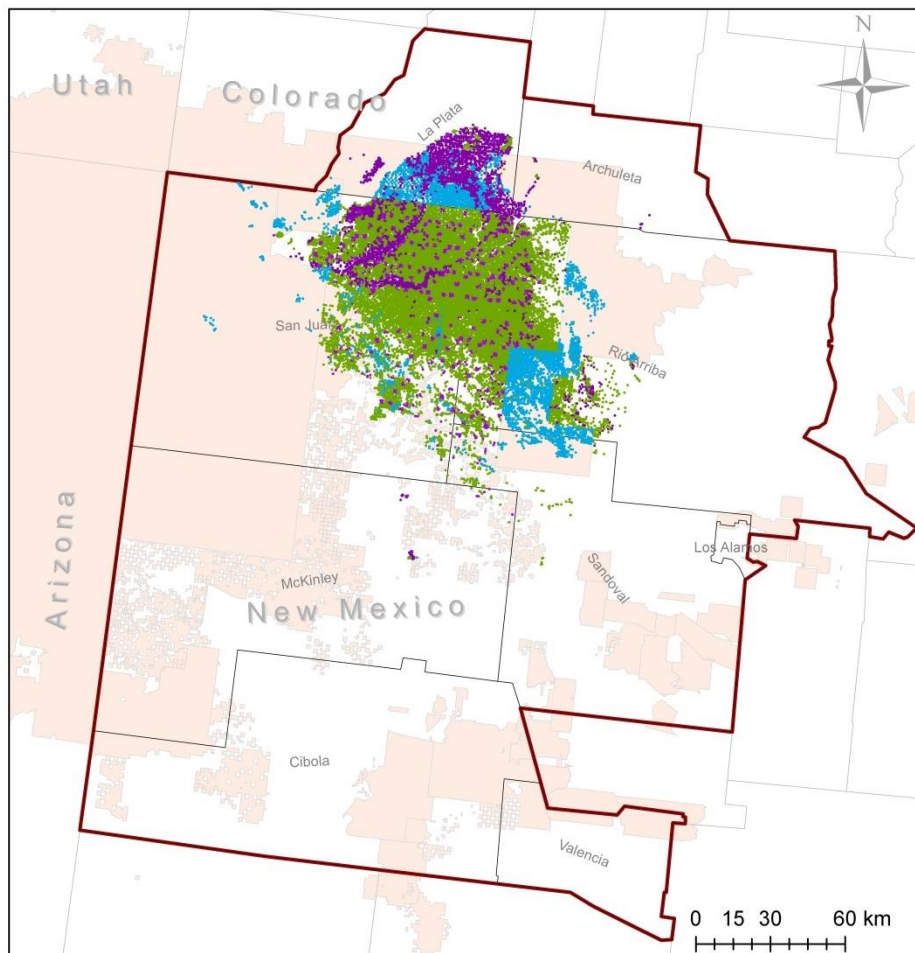
## Well Type

 Oil


 CBM

 Gas

# GREATER SAN JUAN BASIN: 2014 WELL LOCATIONS BY MINERAL OWNERSHIP



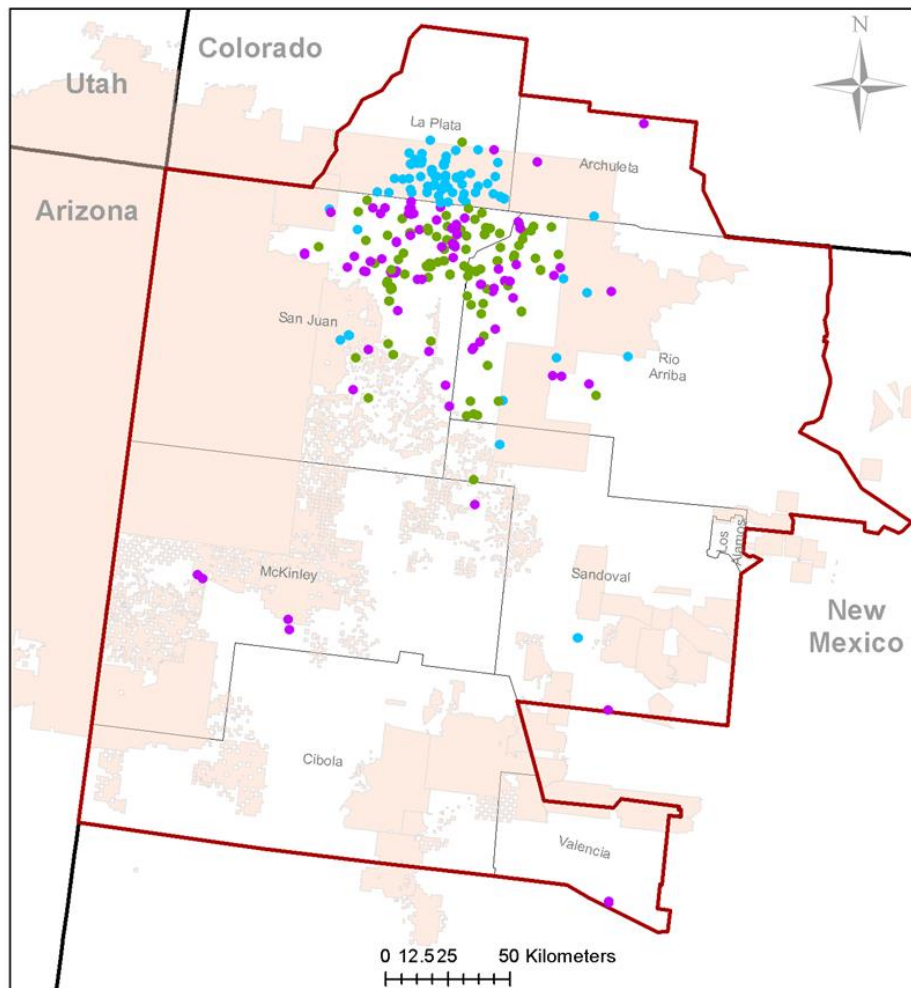
## Legend

-  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

- **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**



## Source

**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

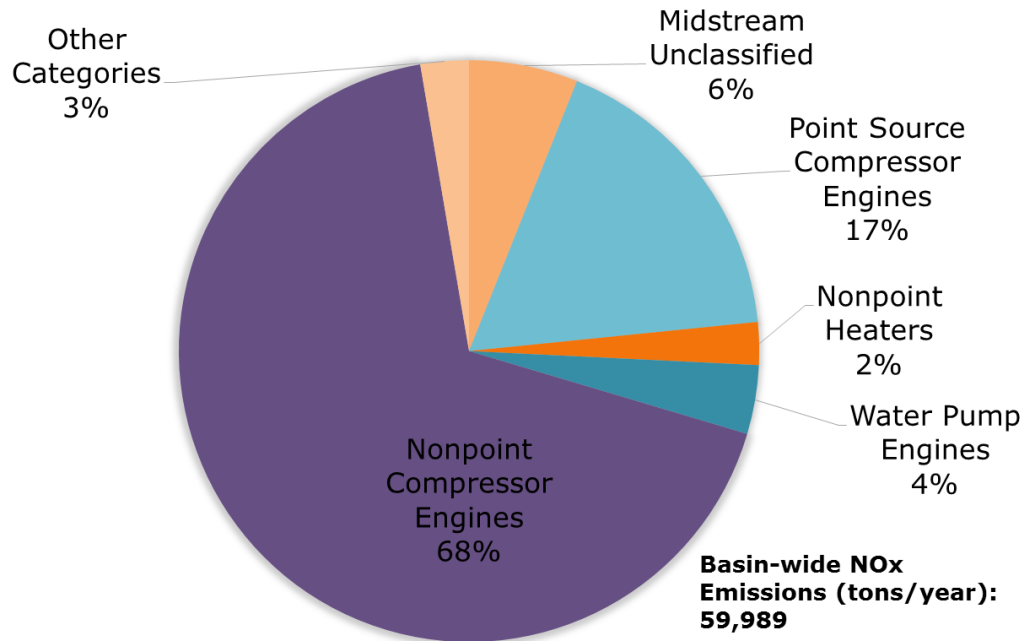


## Well-site inventory and GHGRP Subpart W emission source categories

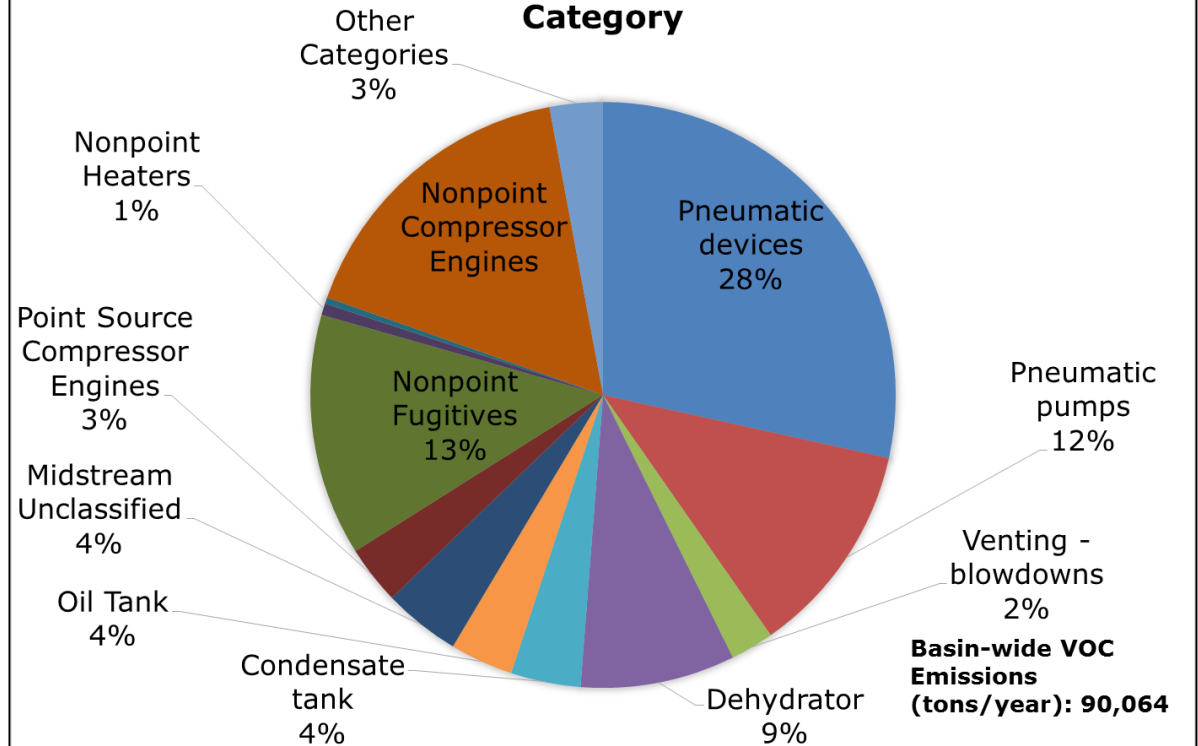
| Source Category               | Emission Inventory | GHGRP Subpart W | Source Category                   | Emission Inventory | GHGRP Subpart W |
|-------------------------------|--------------------|-----------------|-----------------------------------|--------------------|-----------------|
| Pneumatic 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

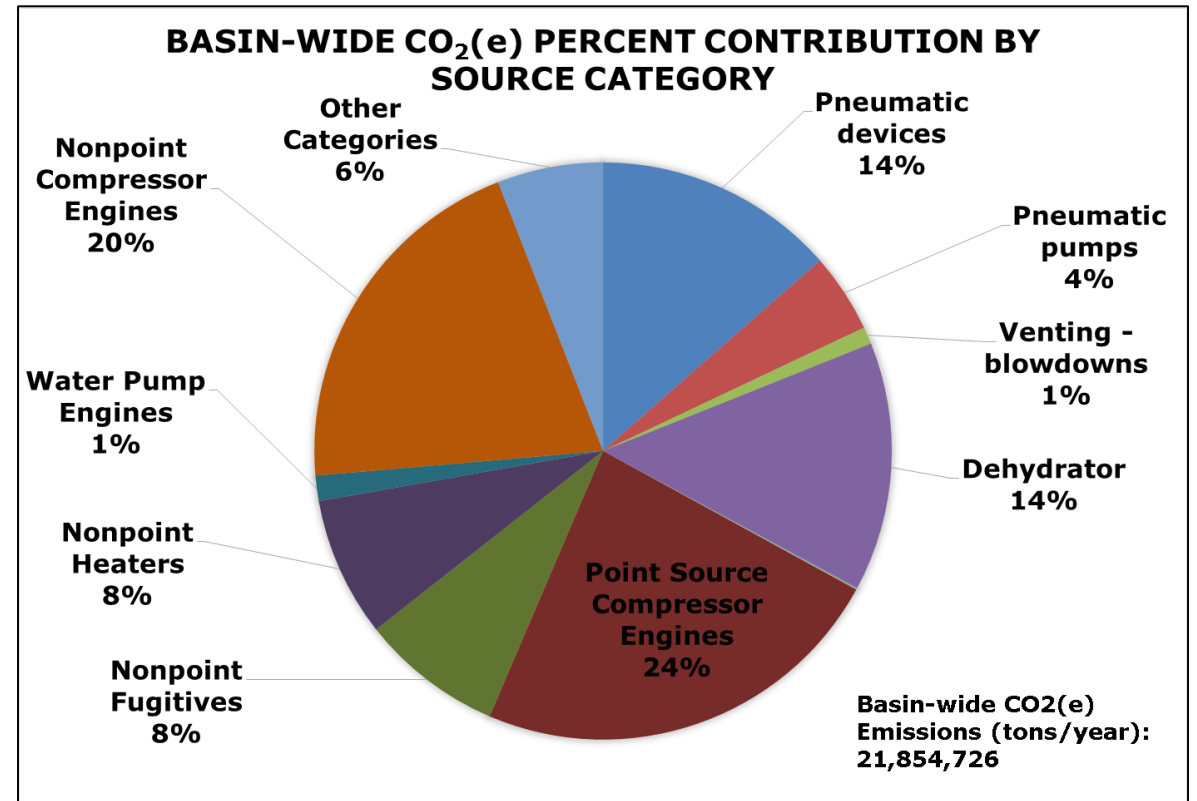


### Basin-wide VOC Percent Contribution by Source Category



# 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 <sub>2</sub> (e) <sup>1</sup> |
| 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                       |
| <b>Total</b>      | <b>59,989</b>         | <b>90,064</b> | <b>85,544</b> | <b>319</b> | <b>1,708</b> | <b>21,854,726</b>                |



# 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 |
|---|--|
| <b>Federal Regulations</b>  |  |
| 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  |  |
| <b>State Regulations</b>  |  |
| 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)<sup>1</sup>
- 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)

<sup>1</sup>Not yet published





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

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

| Area <sup>1</sup>    | Year | Spud Count | Active Well Count | Gas Production (BCF/yr) | Oil Production (Mbbl/yr) |
|----------------------|------|------------|-------------------|-------------------------|--------------------------|
| <b>Low Scenario</b>  |      |            |                   |                         |                          |
| 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                       |
| <b>High Scenario</b> |      |            |                   |                         |                          |
| 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                       |

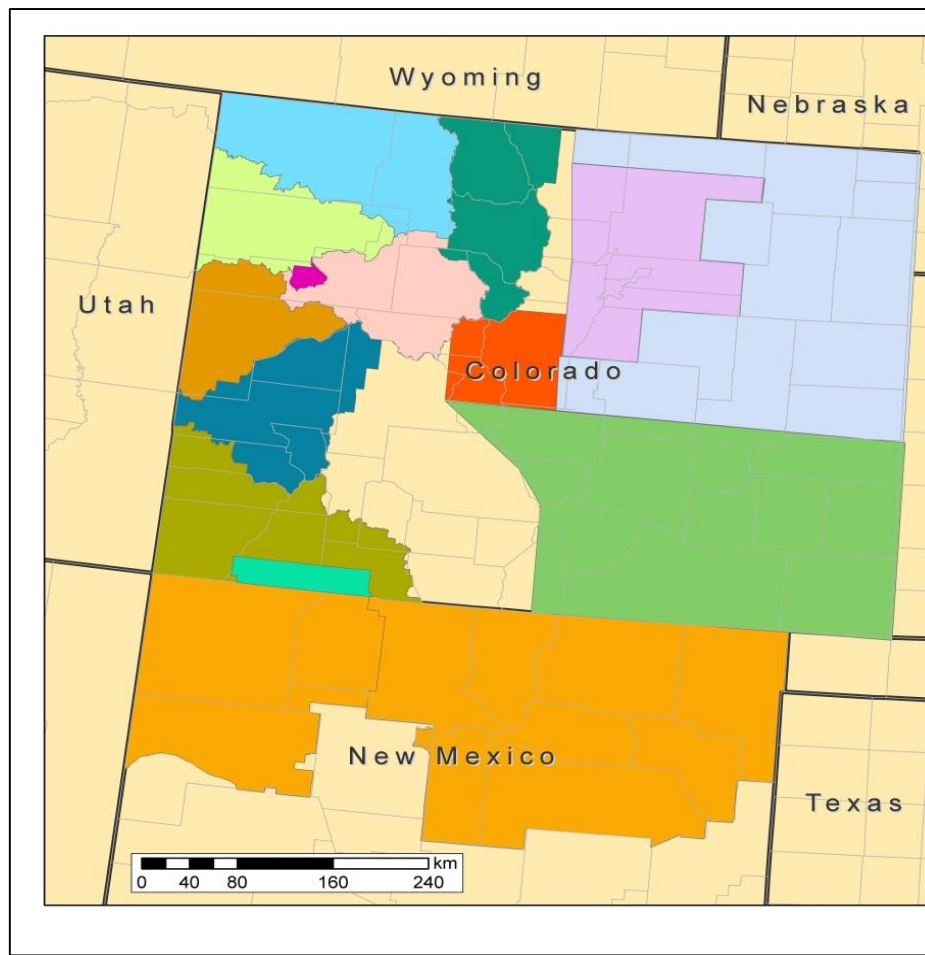
<sup>1</sup> O&G activity in the Farmington Field Office outside of the Mancos Shale conservatively assumed unchanged from base year

# 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

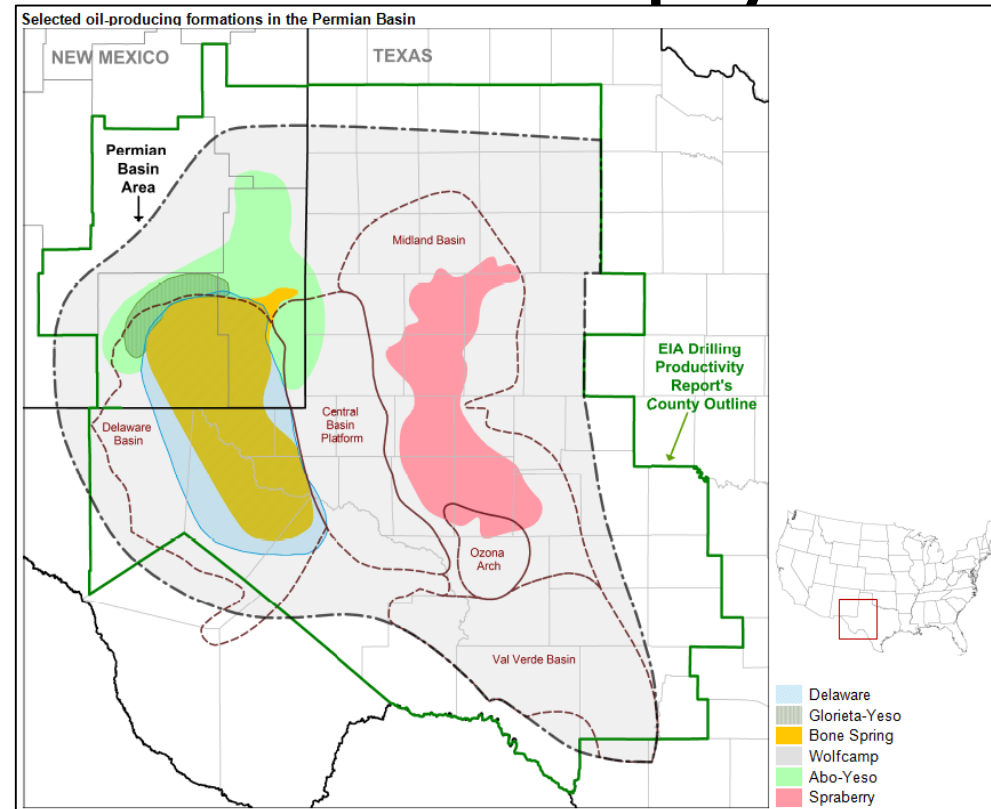


# DRAFT FUTURE YEAR ACTIVITY FORECASTS: EIA O&G SUPPLY MODULE REGIONS



# DRAFT FUTURE YEAR ACTIVITY FORECASTS: EIA SHALE REGIONS

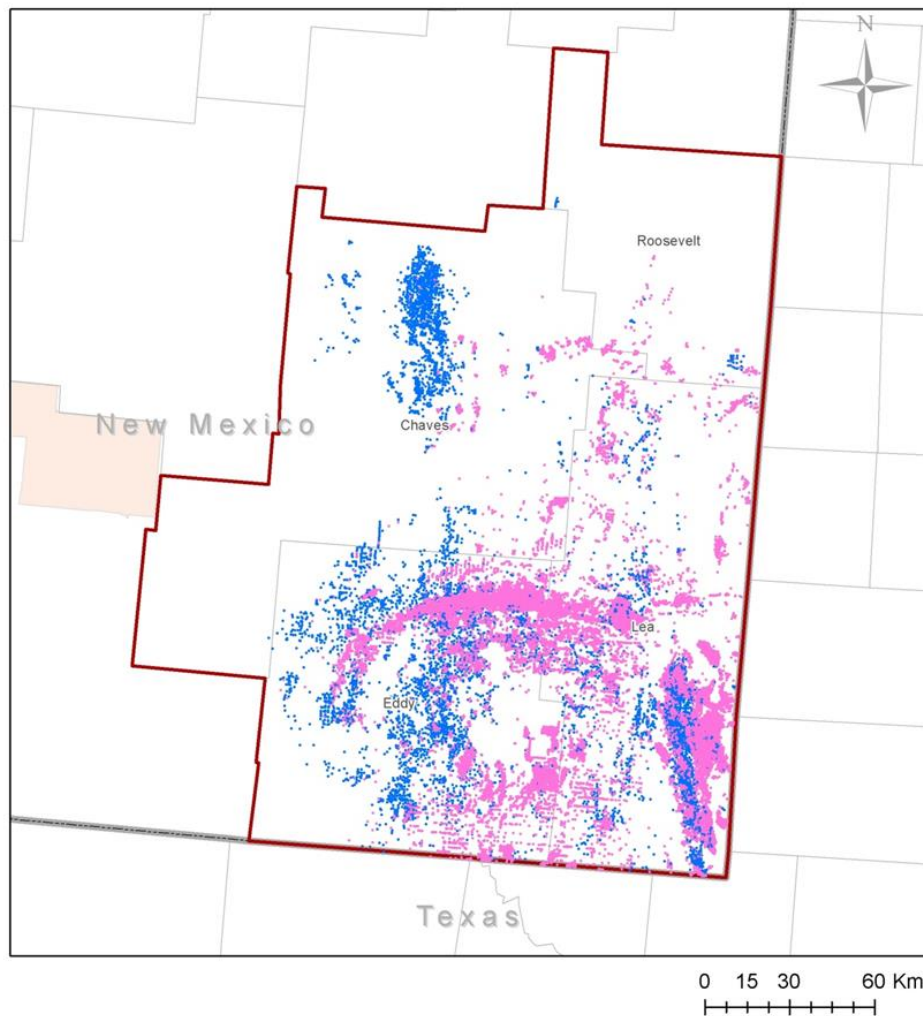
## Permian Basin oil plays





(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

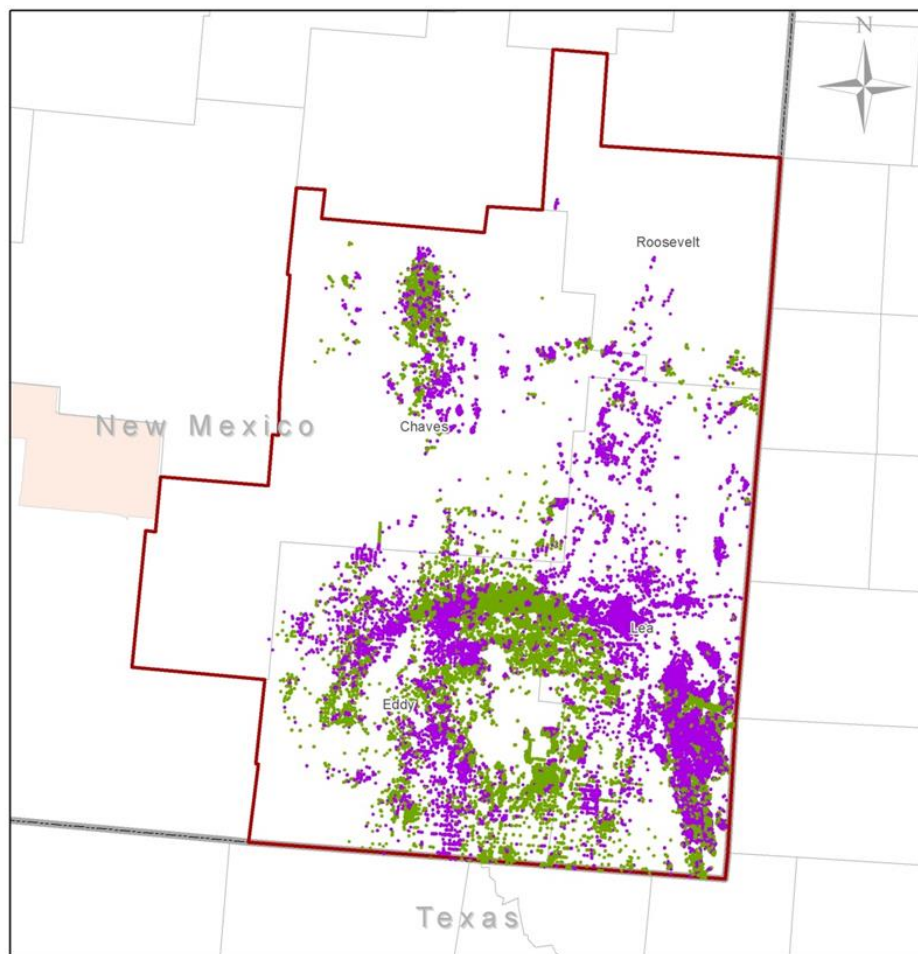
-  Permian Basin
-  Tribal Lands

## Well Type



-  Oil
-  Gas



# PERMIAN BASIN: 2014 WELL LOCATIONS BY MINERAL OWNERSHIP



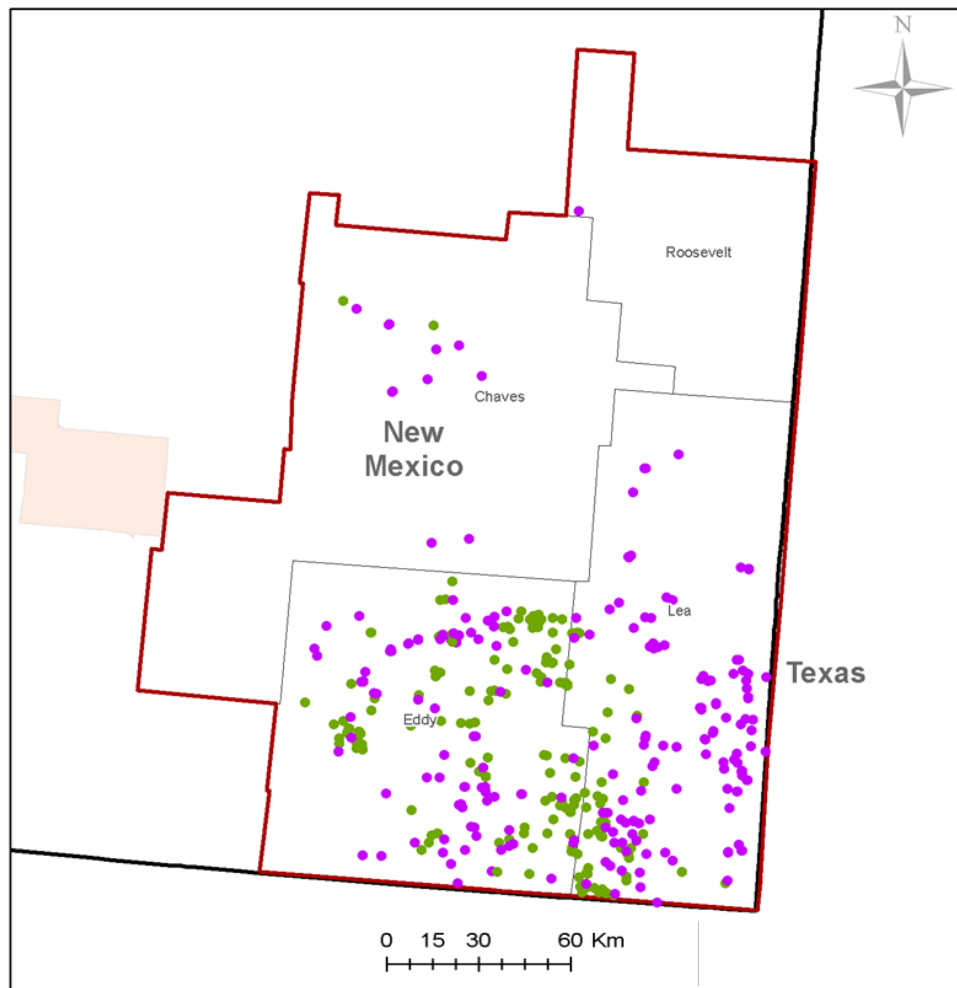
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## Mineral Ownership (2014 Wells)

-  Private/State
-  Federal


# PERMIAN BASIN: 2014 MIDSTREAM FACILITIES BY SURFACE OWNERSHIP



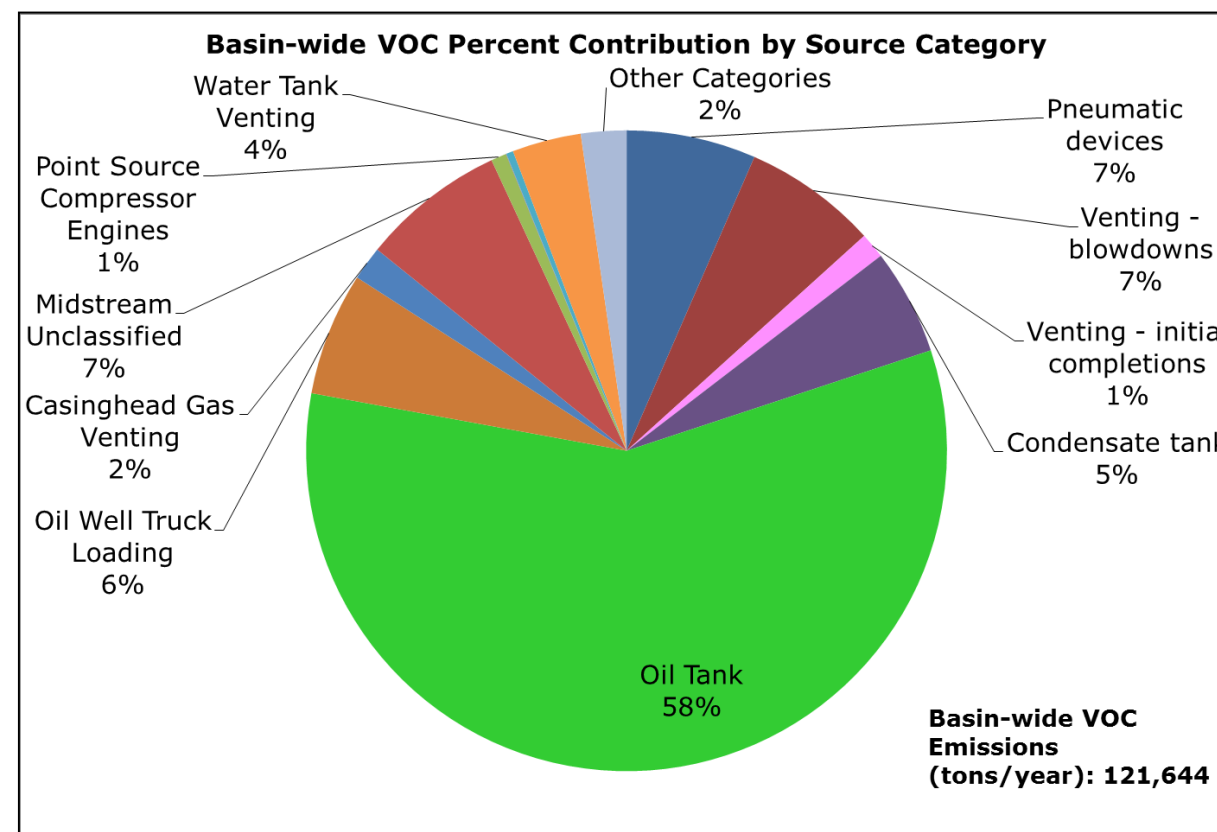
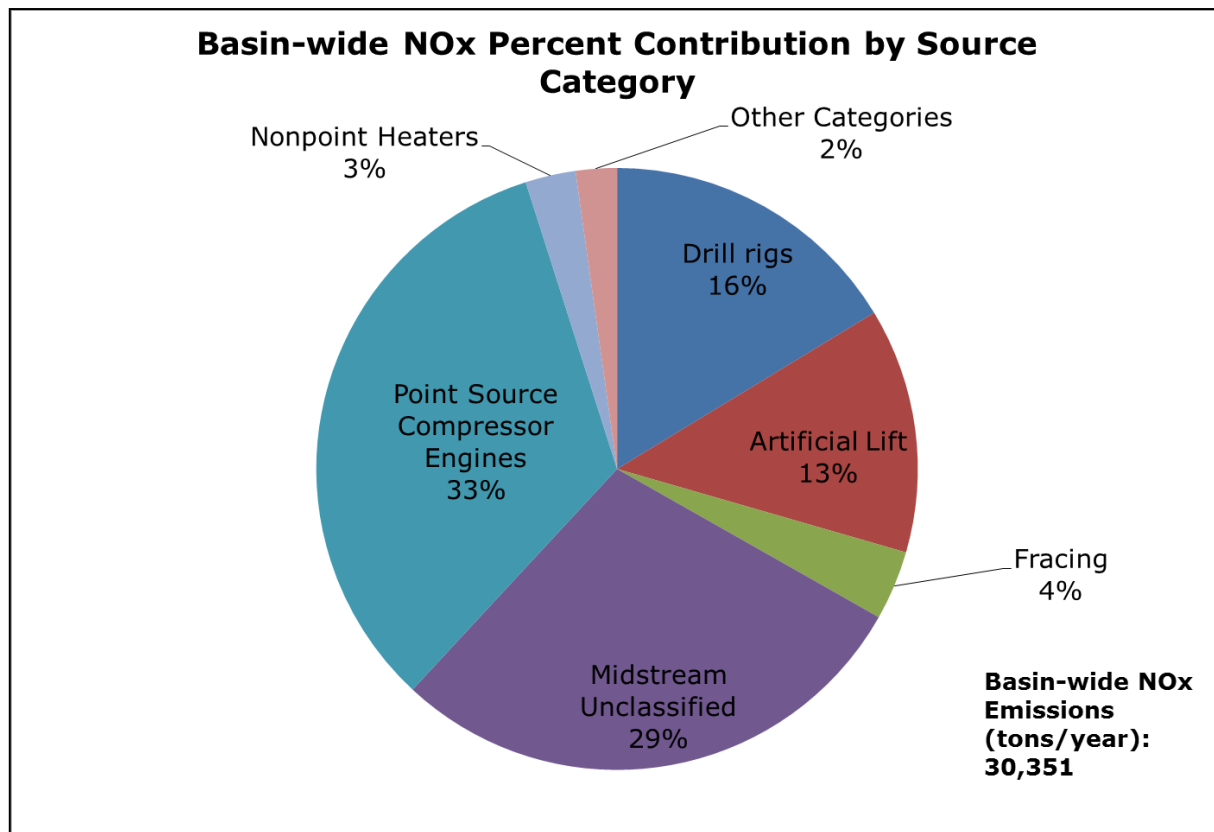
## Legend

-  Permian Basin
-  Tribal Lands

## Ownership

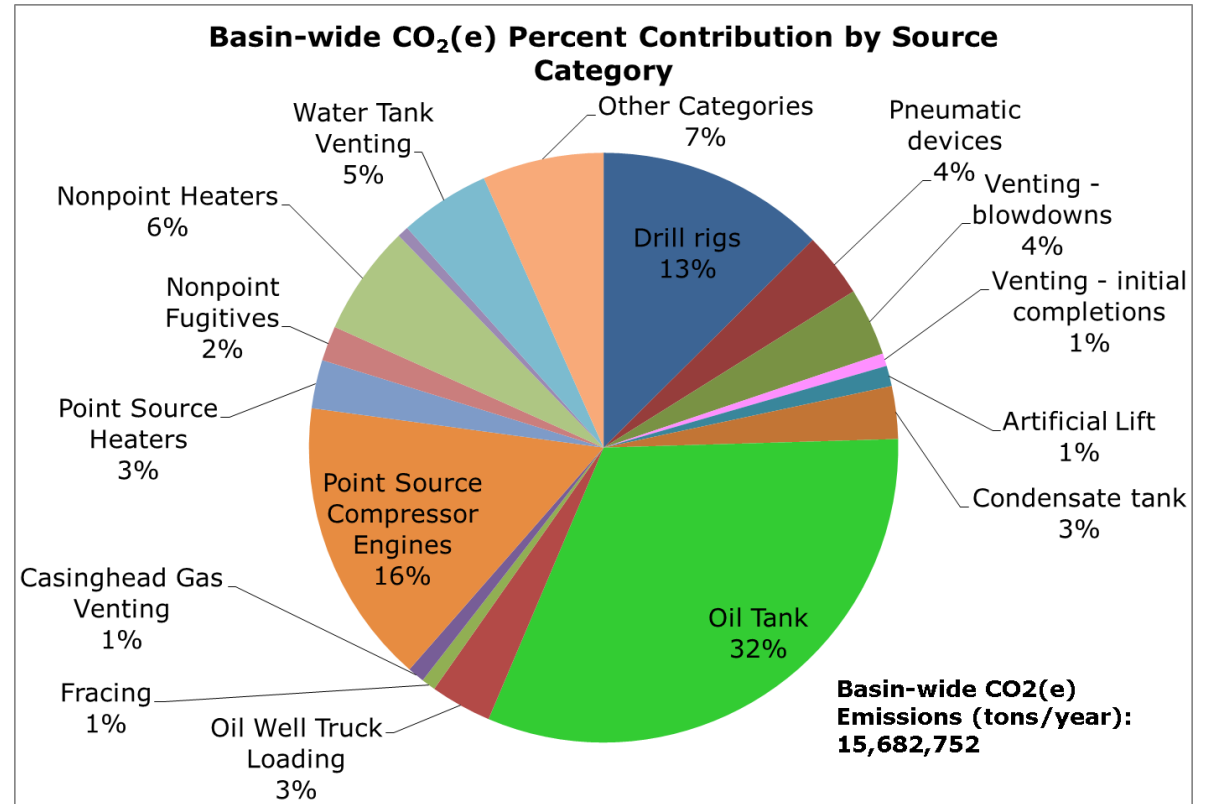
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-  Private/State

# 2014 EMISSIONS (DRAFT): PERMIAN BASIN



# 2014 EMISSIONS (DRAFT): GREATER SAN JUAN BASIN

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## 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 <sub>2</sub> (e) <sup>1</sup> [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                                    |
| <b>Total</b>      | <b>30,351</b>   | <b>121,644</b>  | <b>25,819</b>  | <b>12,393</b>   | <b>537</b>     | <b>15,682,752</b>                            |



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