



WRAP Upstream Oil & Gas Emission Inventories: Background and Methodology

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Overview

- **Emission inventories – background**
- **O&G development in the Intermountain West**
- **History of O&G emission inventory development**
- **WRAP O&G emission inventories**
- **Technical methodology**
- **Results for an example basin**
- **Projections**

Emissions Inventories

- Emissions are what is regulated, not ambient air quality - through:
 - Limits on permitted sources and tracking of actual emissions
 - Strategies that address group or types of sources by specifying technology for operations (fuels, turnover of technology) or controls (specified emissions limits)
 - Fees for permitted sources allow regulators to recover costs to issue, inspect, and monitor impacts
 - Reporting and analysis of inventory data allows trend and compliance tracking
 - A heightened effort is required to build and understand a baseline historical period inventory for a modeling study
 - Modeling studies also require projections of future emissions to assess control programs and determine efficient emissions reduction strategies

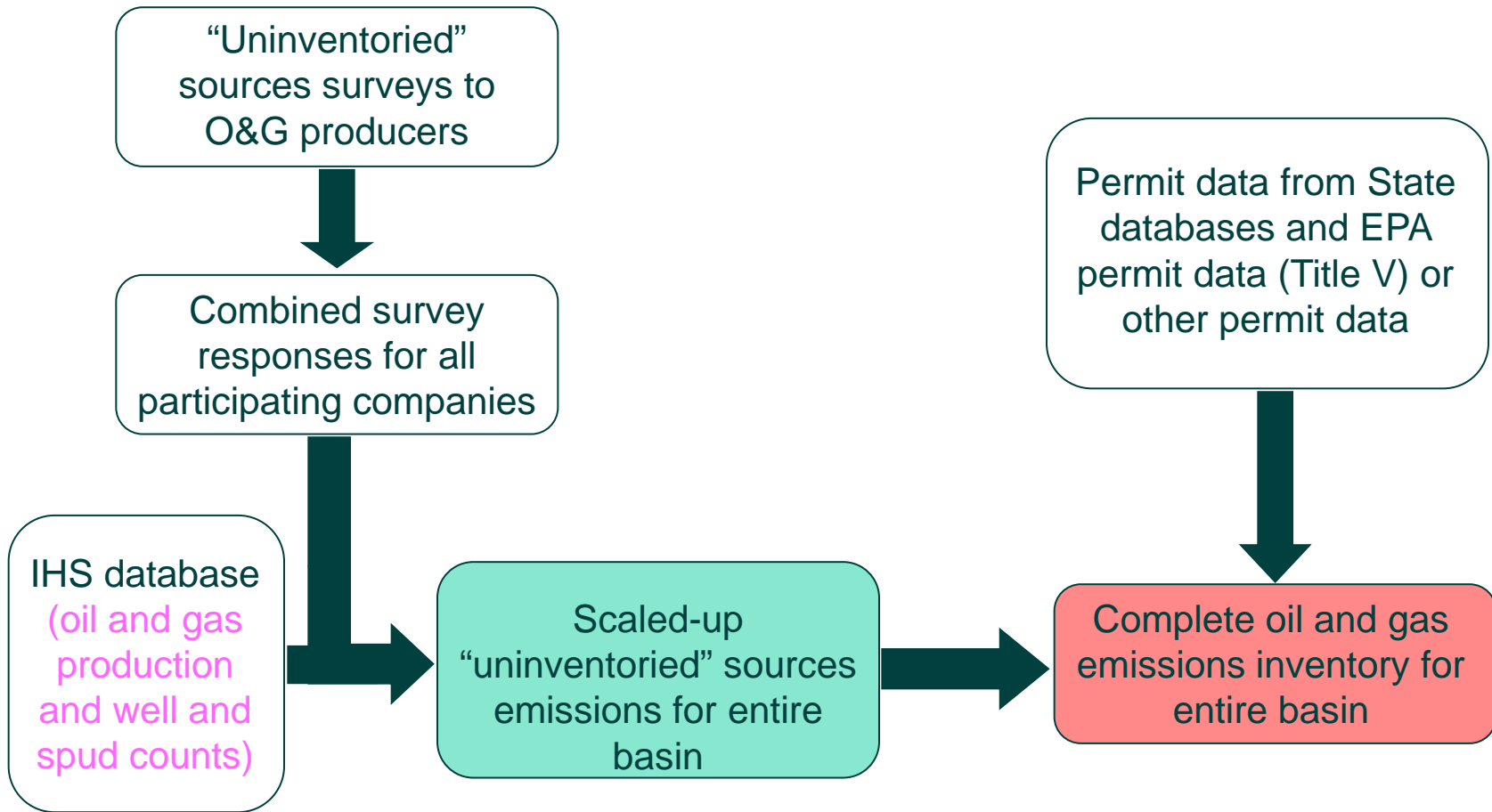
National Environmental Policy Act (NEPA)

- NEPA requires federal agencies to consider the environmental impacts of their proposed actions and reasonable alternatives to those actions
- Federal agencies prepare an Environmental Impact Statement (EIS) or Environmental Assessment (EA) for oil and gas development on federal lands
- Vast majority of O&G NEPA actions are by U.S. Bureau of Land Management, a lesser number by the U.S. Forest Service
 - BLM administers all oil and gas federal mineral estate leasing in the U.S., regardless of surface ownership
 - Once development is authorized by the federal agency, stipulations may require specific practices that reduce air emissions; however, cumulative air impacts become the responsibility of the states, or the EPA regional office in the case of tribal lands

WRAP O&G Emission Inventories

- Regionally-consistent O&G inventory study across the Intermountain West
 - First inventory to cover all criteria pollutants (NO_x, VOC, SO_x, CO, PM)
- Historic scope of study includes 9 major basins for 2006/2009 baselines: San Juan (NM & CO), Denver-Julesburg (CO), Piceance (CO), Uinta (UT), Southwest Wyoming (WY), Wind River (WY), Powder River (WY), Williston (MT & ND), and Great Plains (MT) Basins
 - Need to update to 2014 baseline to reflect changes in operations
- Baseline inventories are used to develop midterm projections 5 to 7 years in the future

WRAP O&G Inventory Methodology Diagram



WRAP O&G Inventory Methodology

Scaled-up “uninventoried” sources emissions for entire basin

Basin	Percentage Ownership in older WRAP inventories		
	Gas	Liquid	Wells
D-J	63%	58%	50%
Piceance	84%	91%	75%
Uinta	82%	78%	71%
North San Juan	85%	93%	87%
South San Juan	82%	48%	67%
Wind River	97%	23%	54%
Southwest Wyoming	77%	64%	54%
Powder River	46%	24%	30%
Williston	30%	33%	20%

- Survey respondents in WRAP inventories do not represent all production in a basin
- Scale-up of survey data necessary to capture all activity

WRAP O&G Inventory Methodology

Permit data from State databases and EPA permit data (Title V) or other permit data

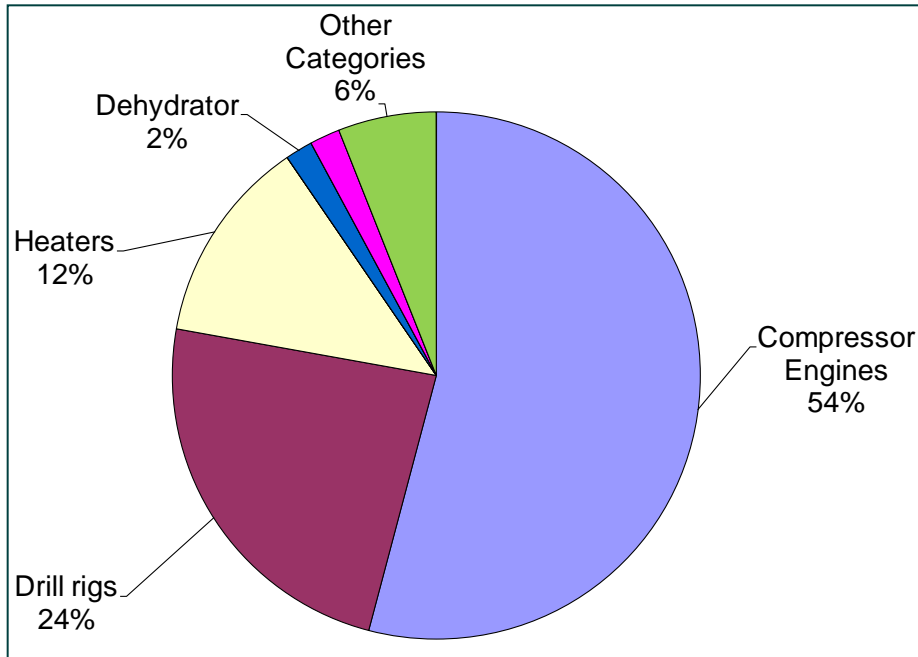
State	Emissions Thresholds (tons/yr)
New Mexico	Notice of Intent Required for Facilities with Emissions > 10tpy Criteria Pollutants; Permits Required for Facilities > 25 tpy
Colorado	Permits Required for All Sources with Emissions > 2 tpy Criteria Pollutants
Utah	Permits Required for All Sources with Potential to Emit (PTE) > 100 tpy
Wyoming	Combustion Sources: All Compressor Engines Require Permit; Oil and Gas Process Sources : Variable Depending on Development Region but Not Less than 6 tpy VOC Emissions in Most Areas (Some Sources Require Permits at Any Emissions Levels in JPAD Area or CDA)
Montana	Permits Required for All Sources with Potential to Emit (PTE) > 25 tpy;
North Dakota	Permits Required for All Sources with Potential to Emit (PTE) > 100 tpy

- Wide variation among states in permitting/reporting thresholds

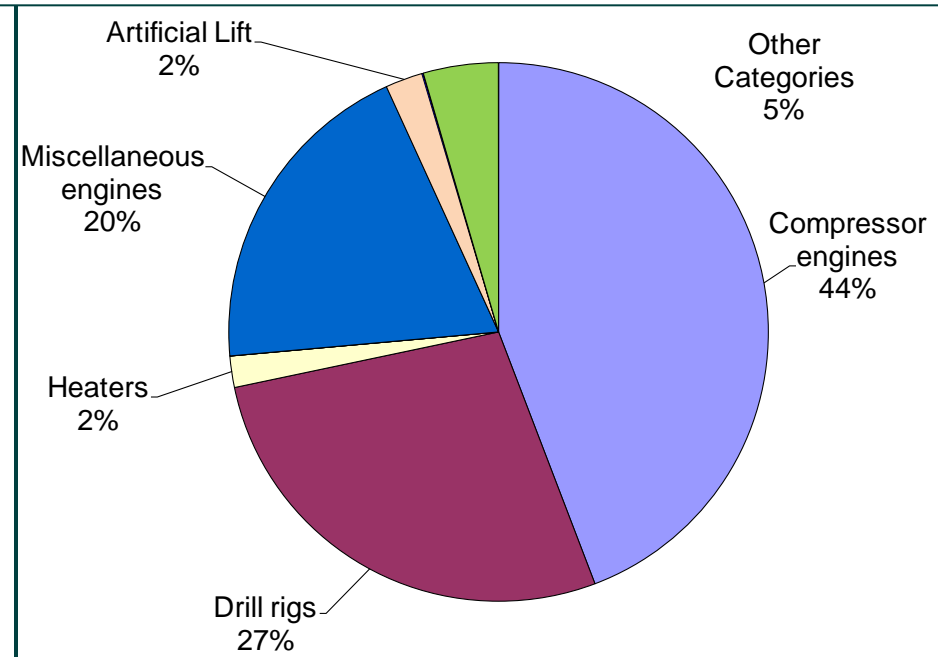
WRAP O&G Inventories – Source Categories

- **Large Point Sources**
(Gas plants, compressor stations)
- **Drill Rigs**
- **Wellhead Compressor Engines**
- **CBM Pump Engines**
- **Heaters**
- **Pneumatic Devices**
- **Condensate and Oil Tanks**
- **Dehydrators**
- **Completion Venting**
- **Fracing Engines**
- **Lateral compressor engines**
- **Workover Rigs**
- **Salt-Water Disposal Engines**
- **Artificial Lift Engines**
(Pumpjacks)
- **Vapor Recovery Units (VRU's)**
- **Miscellaneous or Exempt Engines**
- **Flaring**
- **Fugitive Emissions**
- **Well Blowdowns**
- **Truck Loading**
- **Amine Units (acid gas removal)**
- **Water Tanks**

Results – Example NOx Emissions Breakdown By Source Category



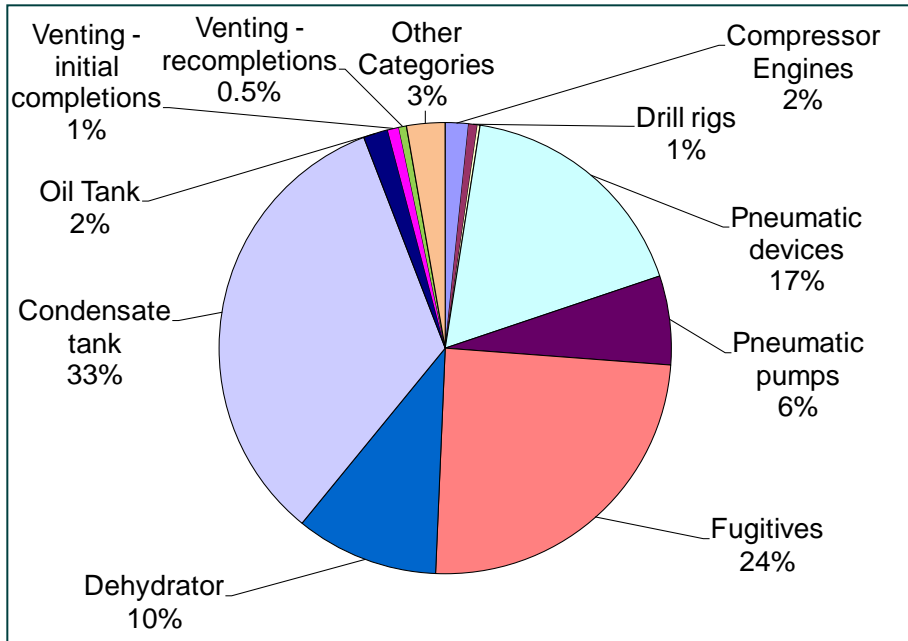
Southwest Wyoming Basin



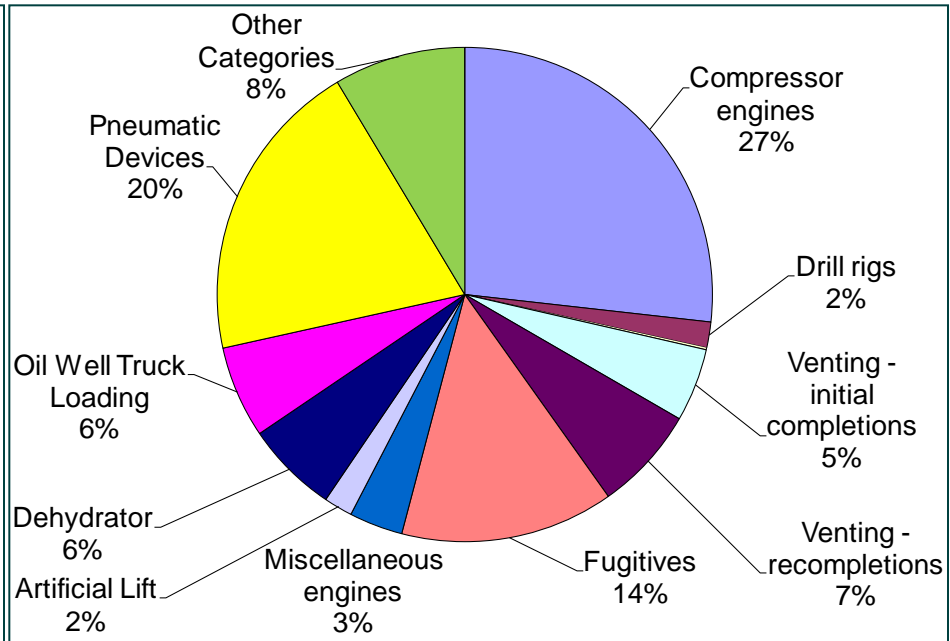
Powder River Basin

NOx emissions primarily comprised of compressor engines (central and wellhead) and drill rigs for basins in which active drilling was occurring

Results – Example VOC Emissions Breakdown By Source Category



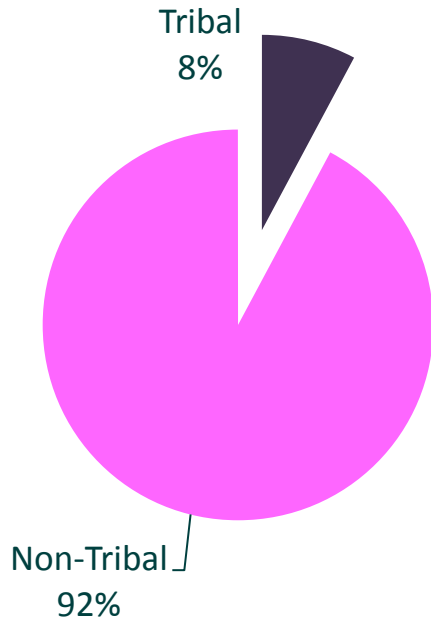
Southwest Wyoming Basin



Powder River Basin

VOC emissions sources vary significantly from basin to basin – tank flashing, dehydration and pneumatic devices are consistently large source categories in most basins, but for CBM dominant basins other categories are significant

South San Juan Basin – 2006 NOx Emissions Contribution by Designation



Basin-wide NOx Emissions (tons/yr)- 42,075

Tribal NOx Emissions (tons/yr) - 3,287

Permitted Emissions - 1,341

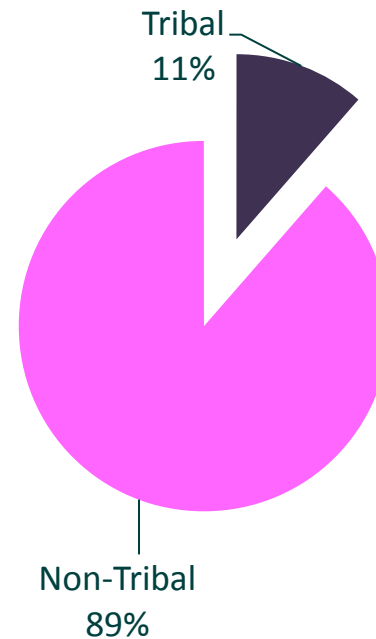
Non-permitted Emissions - 1,946

Non-Tribal NOx Emissions (tons/yr) - 38,788

Permitted Emissions - 11,054

Non-permitted Emissions - 27,734

South San Juan Basin – 2006 VOC Emissions Contribution by Designation



Basin-wide VOC Emissions (tons/yr)- 60,697

Tribal VOC Emissions (tons/yr) - 6,923

Permitted Emissions - 427

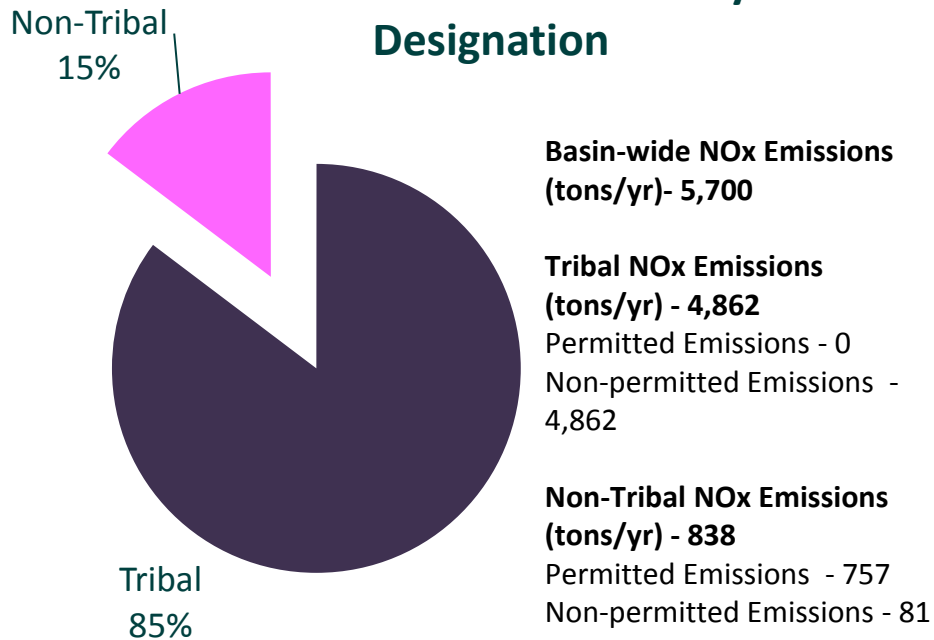
Non-permitted Emissions - 6,496

Non-Tribal VOC Emissions (tons/yr) - 53,774

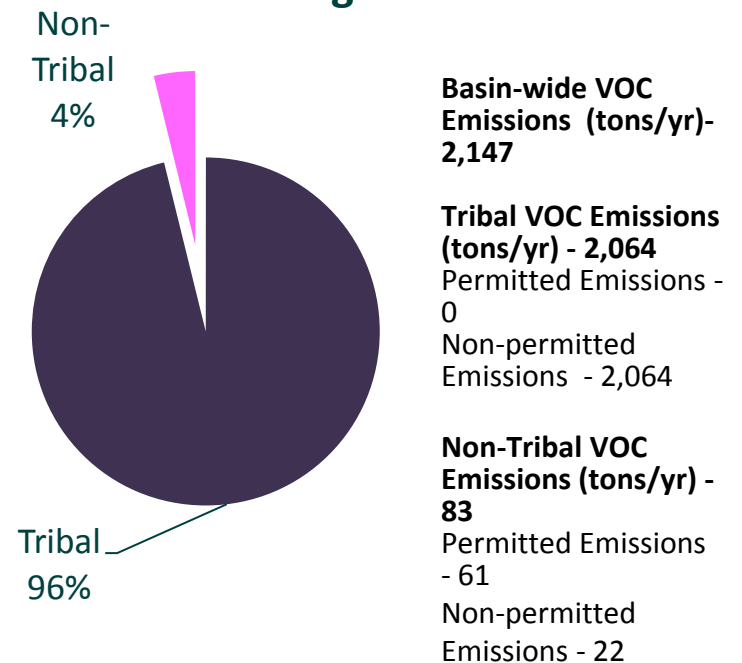
Permitted Emissions - 4,969

Non-permitted Emissions - 48,805

North San Juan Basin – 2006 NOx Emissions Contribution by Designation



North San Juan Basin – 2006 VOC Emissions Contribution by Designation



Projections of Future Emissions – Background

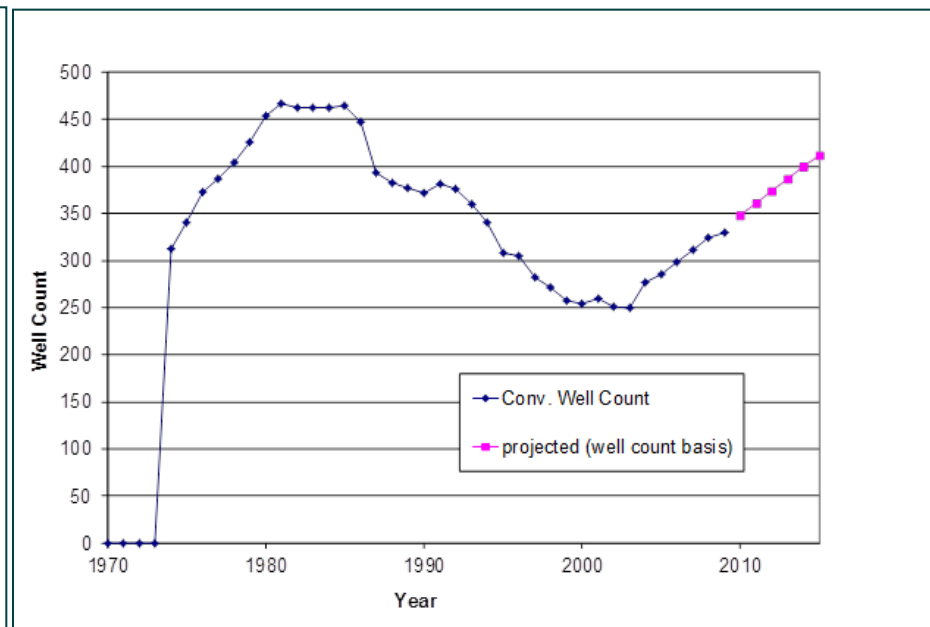
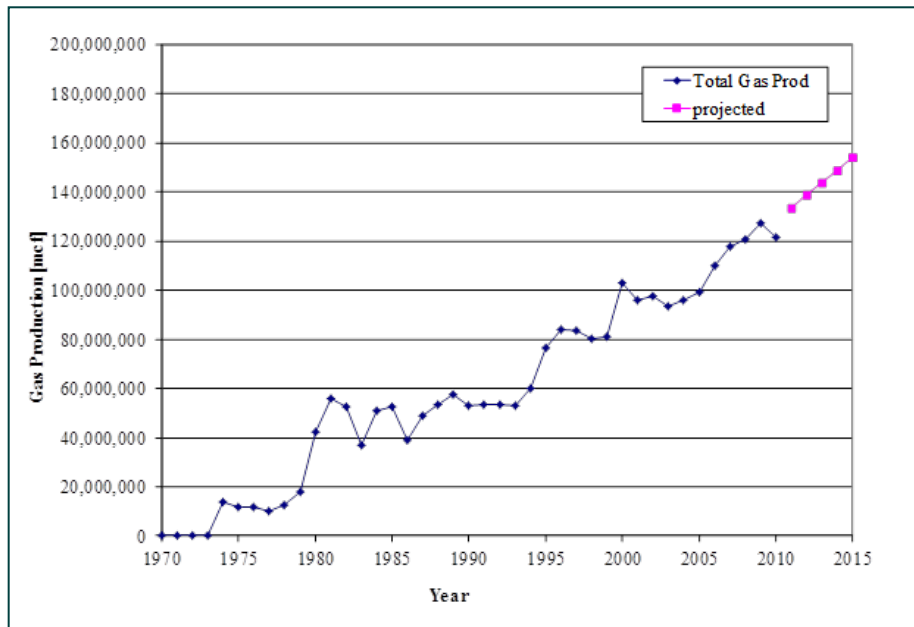
- Need
 - Air quality planning to correct potential violations of health and welfare standards
 - To prevent violations of standards and to reduce exposure
 - Account for state and federal regulations “on the books and on the way”
 - Effectively consider “known future” to estimate additional costs and benefits of additional control options
- Scope
 - Change across all source categories from baseline actual emissions into the future
 - Anthropogenic sources, including O&G operations, are affected by
 - Economic factors
 - Changes in technology
 - Emerging standards

Projections - Methodology

- No standardized methodology for conducting projections – each inventory study has used different approaches (RMPs, NEPA projects, regional inventories)
- WRAP inventories use a three-step approach:
 1. Activity scaling factors
 2. “Uncontrolled” projections
 3. State and federal regulatory control requirements
- Activity scaling requires input from operators on planned activities and/or analyzes trends and/or relies on industry studies
- State and federal regulatory control requirements complex

Projections - Methodology

- Operators queried for planned drilling activities
- Well decline data gathered to generate basin-average curves
- Production projections constructed from operator data/historic trends



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