

WRAP Oil and Gas Work Group

WRAP Oil and Gas Work Group (OGWG):

- Promote understanding of the role of oil and gas in regional and local air quality plans
- Address the data and analysis elements, topics, and issues related to air quality impacts from the oil and gas sector

Oil and Gas Work Group (OGWG) Formation:

- Members with applicable oil and gas expertise and geographic representation from WRAP member agencies (state, tribal, local, federal)
- Initial OGWG Call – November 15, 2016

Co-Chairs:

- Amanda Brimmer, Regional Air Quality Council (RAQC), Denver, CO
- Mark Jones, New Mexico Environment Department, Farmington, NM
- Darla Potter, Wyoming DEQ - Air Quality Division, Cheyenne, WY

WRAP OGWG: O&G EI WORK MIDTERM UPDATE

John Grant and Amnon Bar-Ilan; Ramboll

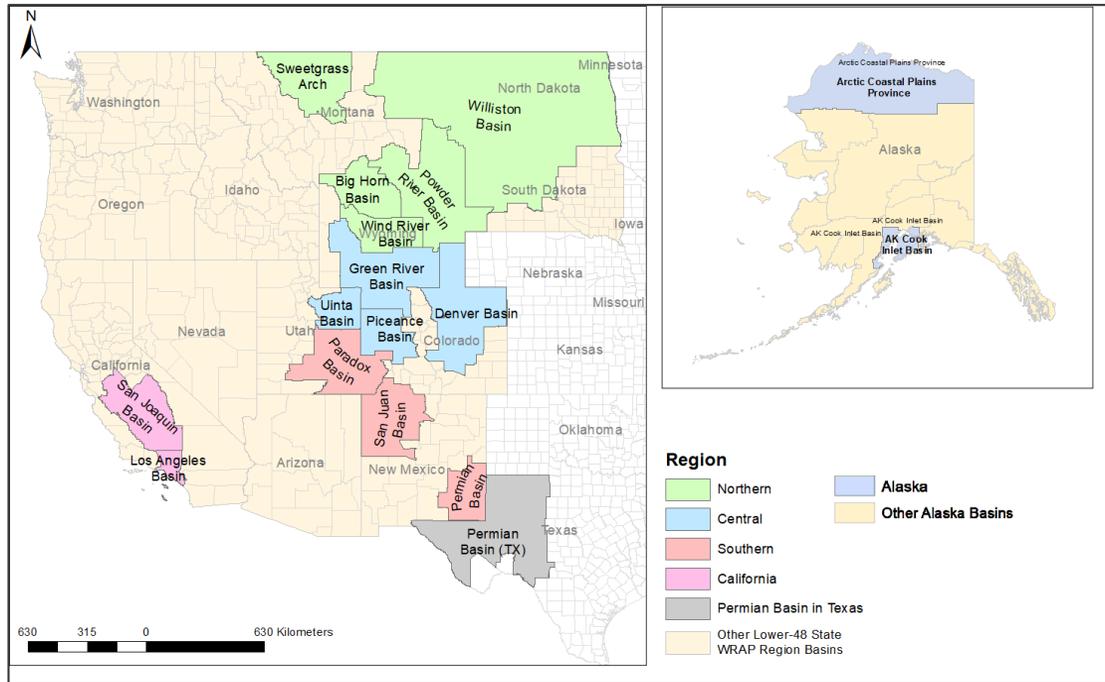
October 1, 2019

OUTLINE

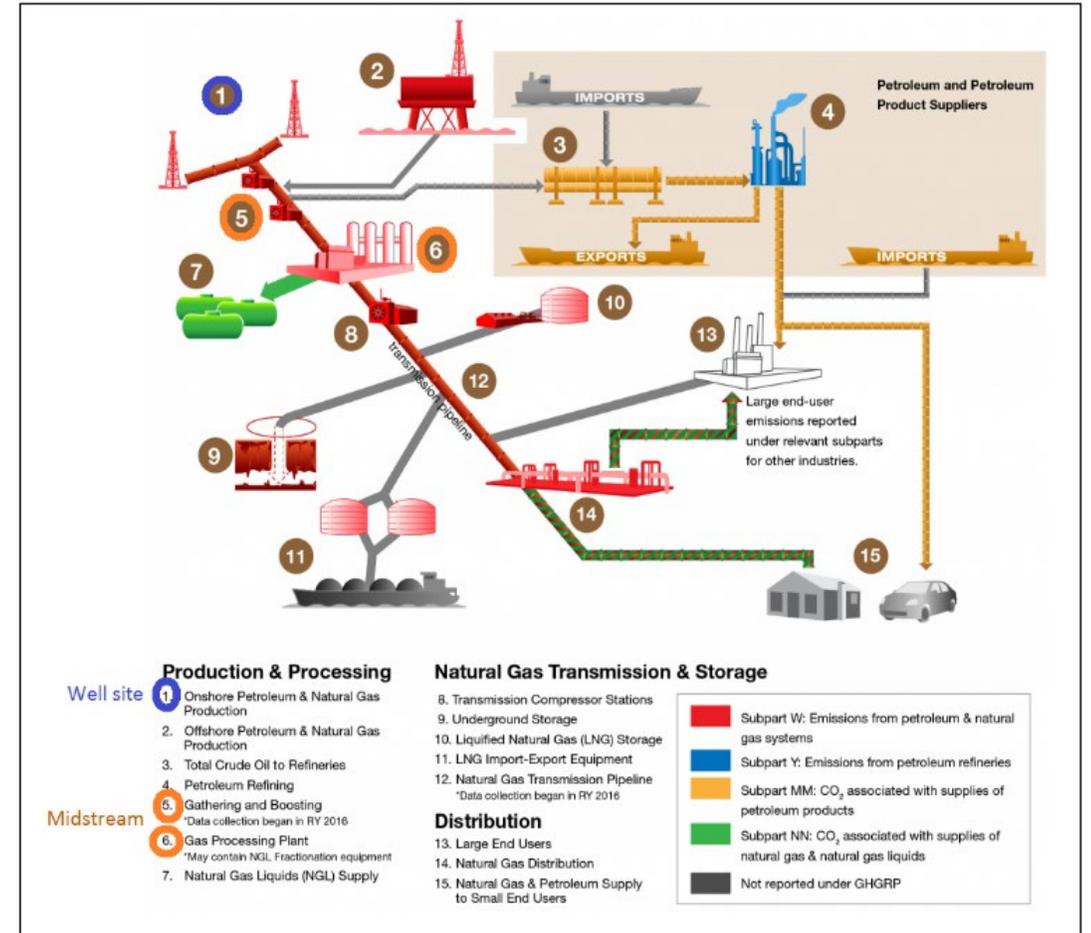
- Baseline inventory
 - Survey
- Future year inventory
 - O&G activity forecasts
 - NEPA considerations
 - Scenarios
- Regional Haze Additional Reasonable Foreseeable Controls
- Agency Program Review

GEOGRAPHICAL AND SECTOR SCOPE

- WESTAR-WRAP Region



- Exploration, Production, and Midstream



TEMPORAL SCOPE

2014 Base Year	Future Year 2023/2028
WRAP 2014 Base Year AQM	Continuation of Historical Trends Scenario to be used in WRAP Future Year Modeling and 2014-2016 Collaborative
Circa-2014 Baseline	Planning Scenarios: *Reduced Legacy Well Activity *Increased Horizontal Well Activity
WRAP Baseline AQM	
2014-2016 Collaborative	Regional Haze Additional Foreseeable Controls

BASELINE INVENTORY

- Basis
 - Utah Air Agencies Uinta Basin Emission Inventory
 - Greater San Juan and Permian Study 2014 Emission Inventory
 - Colorado non-tribal: CDPHE 2016 Emission Inventory
 - Southern Ute Indian Tribal 2017 Emission Inventory
 - IWDW 2014 Emission Inventory
 - EPA 2014 NEIv2
 - Williston Basin Casinghead Gas Revision
 - **Survey Updates**

SURVEY APPROACH

- Agency-centric approach
 - WRAP OGWG determined target sources: drill rigs, fracing engines, tanks, well-head engines, gas compositions
 - Two surveys compiled: (1) full survey and (2) controls-focused
 - By operator O&G activity data distributed to states so that they can determine which operators to survey
 - Agency determines which basins and which survey to focus on
 - Two-tiered distribution approach: (1) to agency for internal data review and (2) agency distributes survey to operators
- Baseline subject matter: Current practices and equipment that are critical to inventories
- Forecast subject matter: Controls-focused

SURVEY PARTICIPATION

- Broad participation across states and basins.
- Agency submissions:
 - Wyoming (2014 and 2017 operator inventories)
 - Utah (Uinta Basin engine data)
 - Montana (Gas compositions and wellsite inputs)
- 300+ gas composition files

State	Basin	No. of Returned Surveys	Percent of 2014 Basin-wide Activity Represented by Returned Surveys		
			Well Count	Oil Production	Gas Production
Montana	Big Horn	1	5%	0%	6%
	Central Montana Uplift	2	62%	5%	85%
	Powder River	1	23%	91%	90%
	Sweetgrass Arch	2	23%	19%	53%
	Williston	6	25%	64%	31%
New Mexico	Permian	4	66%	80%	86%
	San Juan	0	-	-	-
North Dakota	Williston	17	11%	25%	26%
Wyoming	Denver	1	18%	46%	52%
	Green River	4	46%	51%	53%
	Powder River	4	4%	34%	13%

SURVEY SAMPLES

Full Survey

A. Representative Drill Rig Data for Well Type and Spud Type Configuration 1

Spud Type	Horizontal
Well Type	Oil
Average Total Well Depth (ft)	

		EPA O&G Tool v2.1 Default Rig Data			Survey	
		<i>Note: EPA tool provides two rig configurations :- (1) Diesel-mechanical and (2) Diesel-electric (DE) powered drill rig. ONLY mechanical drill rig configuration defaults are presented below for a selected basin</i>				
		Engine 1	Engine 2	Engine 3	Engine 1	Engine 2
Representative Engine Configuration						
Engine Function		Draw Rig	Mud Pump	Generator		
Number of Engine per Rig (number/rig)		-	-	1.88		
Rated Horsepower (hp/engine)		-	-	2,206		
Hours of Operation (hours/spud)		-	-	507		
Percent of Engines Electrified (%)		0%	0%	0%		
Fuel Type		Diesel	Diesel	Diesel		
Fleet Control Data						
Percent of Engines by Tier Level	Uncontrolled	N/A	N/A	N/A		
	Tier 1	N/A	N/A	N/A		
	Tier 2	N/A	N/A	N/A		
	Tier 3	N/A	N/A	N/A		
	Tier 4	N/A	N/A	N/A		
Average Engine Turnover Frequency (years)		N/A	N/A	N/A		

SURVEY SAMPLES

Controls Focused

A. Representative Drill Rig Data for Well Type and Spud Type Configuration 1

Spud Type	
Well Type	
Average Total Well Depth (ft)	

EPA O&G Tool defaults not displayed in the table below because spud type has not been selected

		EPA O&G Tool v2.1 Default Rig Data			Survey	
		Engine 1	Engine 2	Engine 3	Engine 1	Engine 2
		<i>Note: EPA tool provides two rig configurations :- (1) Diesel-mechanical and (2) Diesel-electric (DE) powered drill rig. ONLY mechanical drill rig configuration defaults are presented below for a selected basin</i>				
Fleet Control Data						
Percent of Engines Electrified (%)		N/A	N/A	N/A		
Percent of Engines by Tier Level	Uncontrolled	N/A	N/A	N/A		
	Tier 1	N/A	N/A	N/A		
	Tier 2	N/A	N/A	N/A		
	Tier 3	N/A	N/A	N/A		
	Tier 4	N/A	N/A	N/A		
Average Engine Turnover Frequency (years)		N/A	N/A	N/A		

SURVEY-BASED BASELINE IMPROVEMENTS

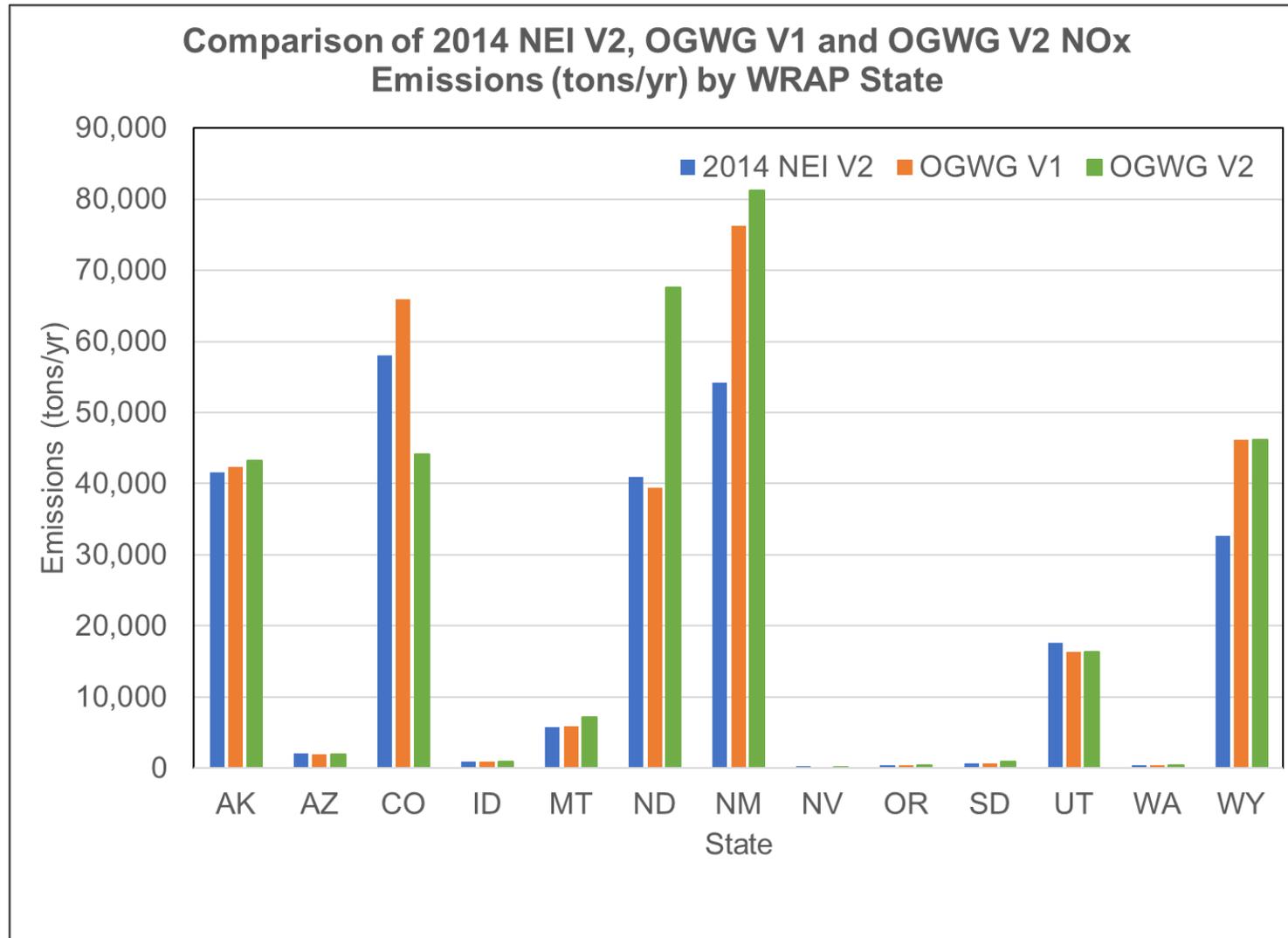
Major Findings

- Hydraulic fracturing engines:
Increased engine power
- Drill rigs: lower drilling times
- Tanks: more controls

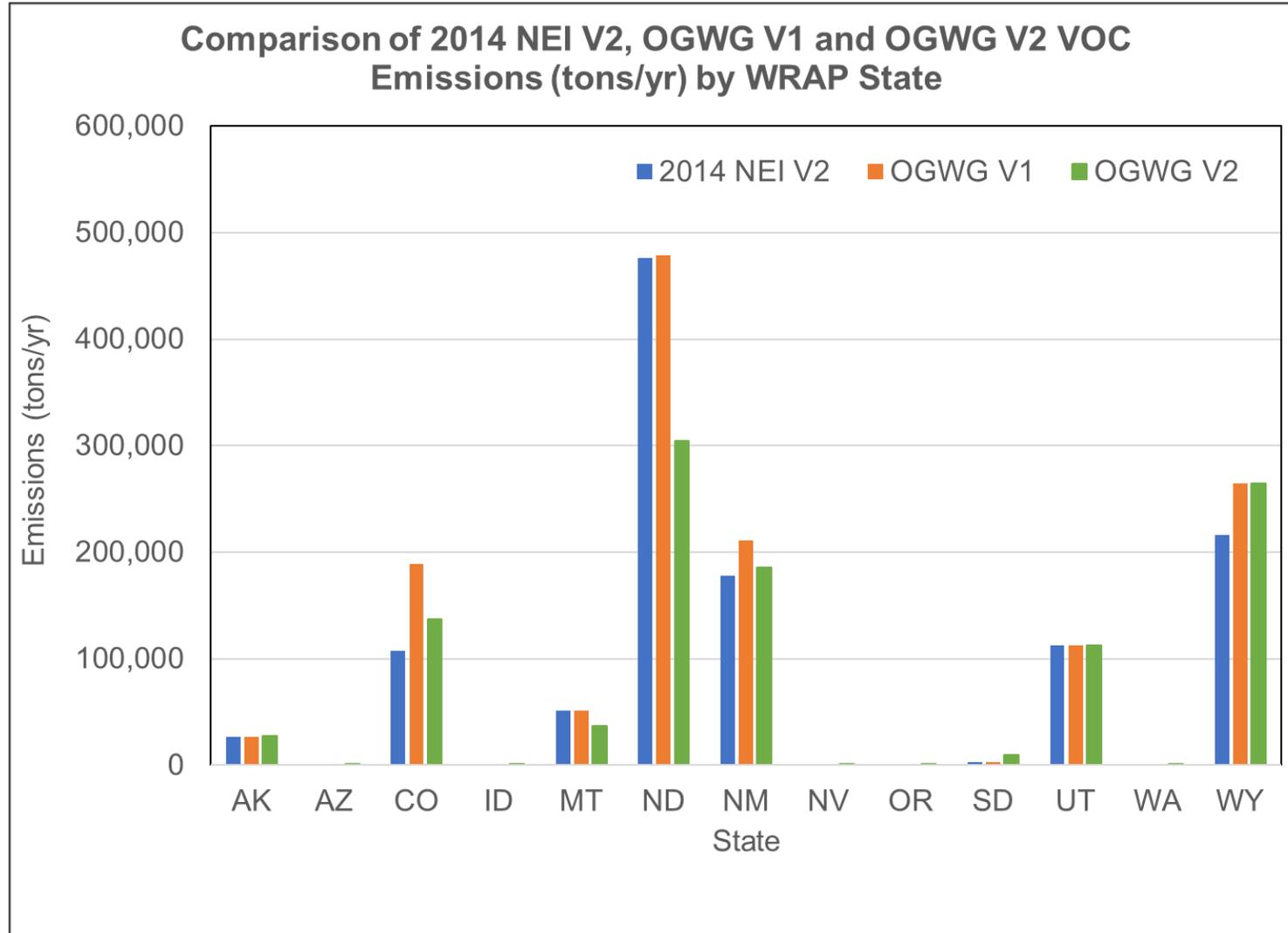
Basin	Emissions (tons/year)	
	NOx	VOC
Hydraulic Fracturing Engin	23,096	1,933
Artificial Lift Engines	13,977	3,186
Generator Engines	2,833	334
Nonpoint Compressor Eng	2,025	31
Drill Rigs	-17,812	-789
Oil Tanks	858	-326,939
Condensate Tanks	18	537
Total Change	24,995	-321,708
Percent Change	8%	-24%

Basin	Emissions (tons/year)	
	NOx	VOC
Williston , ND	19,108	-280,542
Permian , NM	4,900	-25,719
Sweetgrass , MT	1,789	600
Williston , MT	-1,036	-16,169
Powder River , MT	-1	5
Central Montana Uplift , M	226	116
Big Horn , MT	9	0
Total Change	24,995	-321,708
Percent Change	8%	-24%

2014 NOX EMISSIONS COMPARISON



2014 NOX EMISSIONS COMPARISON



O&G ACTIVITY FORECASTS

- Estimate future annual emissions based on O&G activity changes and controls
- Guiding principles
 - Basin specific
 - Distinguish between legacy and new production, to the extent feasible
 - Near term annual forecast preferred (2023)
- **Forecasts are uncertain** – goal is to use the most technically robust forecast methodology feasible
 - Failure rates impact emission rates. Infeasible to estimate/apply failure rates to the forecast.
- Forecast methodology accounts for emission sources that are tracked and regulated
- Forecast Scenarios
 - Continuation of historical trends scenario: status quo persists
 - Low and High Scenario
 - Reduced Legacy Well Activity
 - Increased Horizontal Well Activity

- Forecasts based on **historical trends** for basins with the greatest activity and emissions: these basins represent 98.6% of gas production, 99.6% of oil production, 99.5% of spuds, and 97.6% of active well count in the WRAP region in 2014
- O&G activity in other basins assumed unchanged from 2014

FORECAST METHODS

- Each SCC is assigned to the activity parameter most closely associated with its emissions (e.g., drill rigs to spuds, oil tanks to oil production)
- By source category control factor scalars to be developed based on on-the-books and on-the-way controls and survey responses

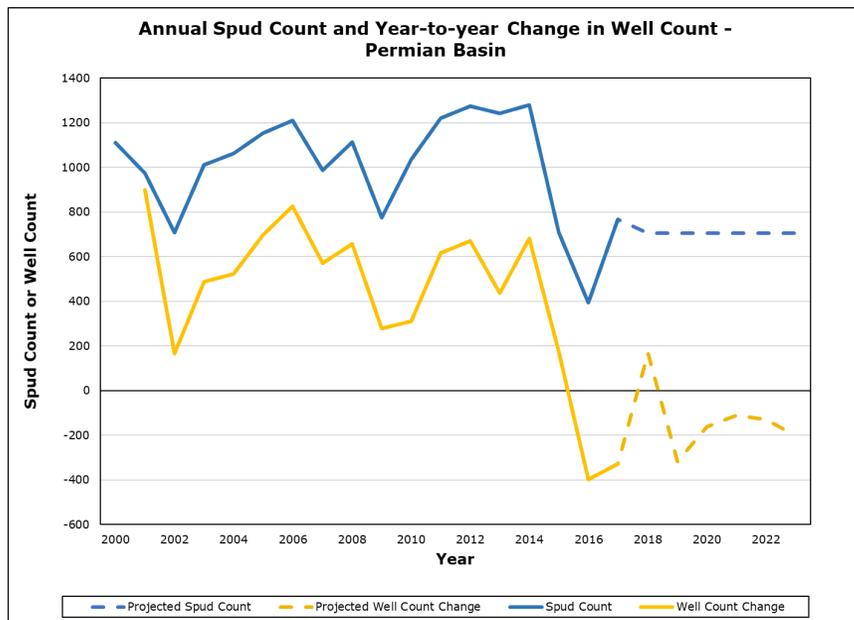
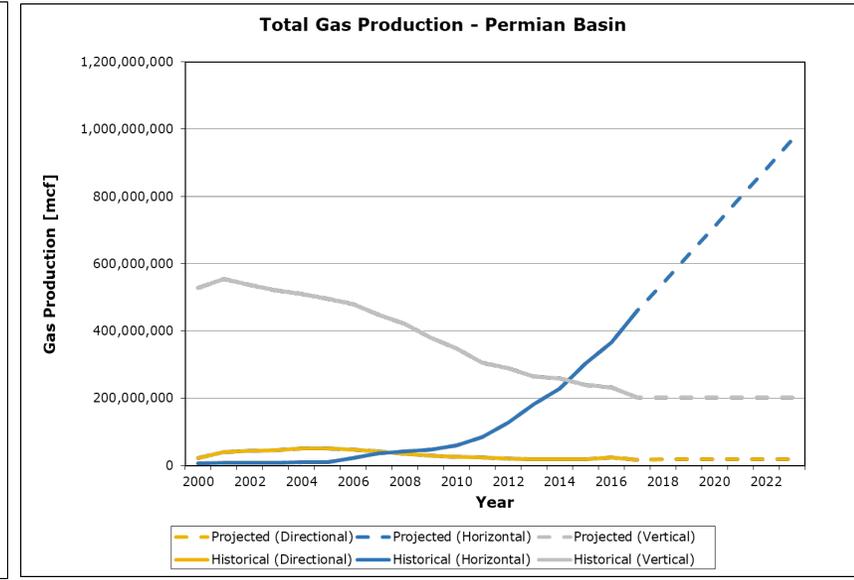
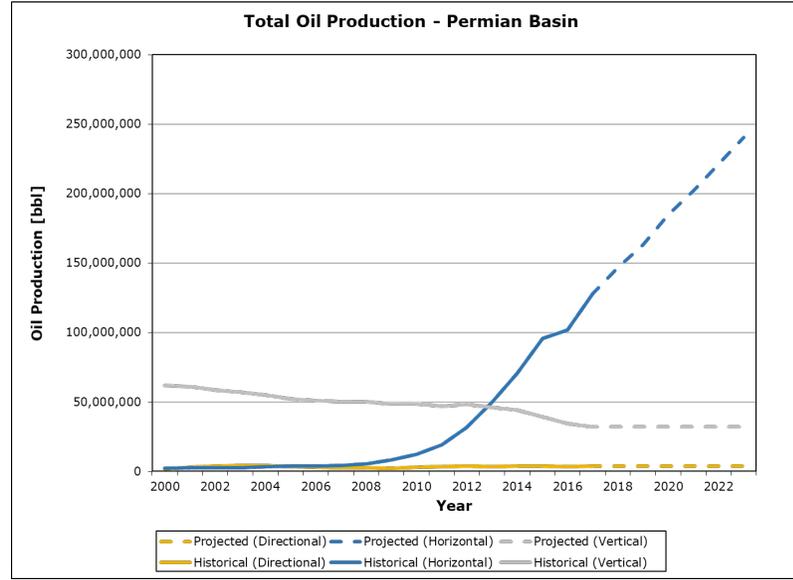
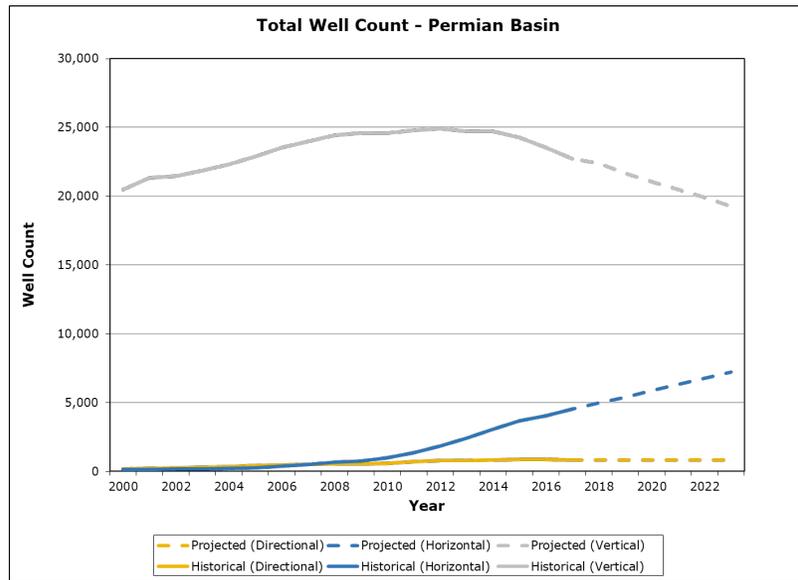
$$E_{2028,scc,pol} = E_{2014,scc,pol} \times GDF_{scc} \times CF_{scc,pol}$$

$E_{2028,scc,pol}$ = 2028 future year emissions by SCC and pollutant

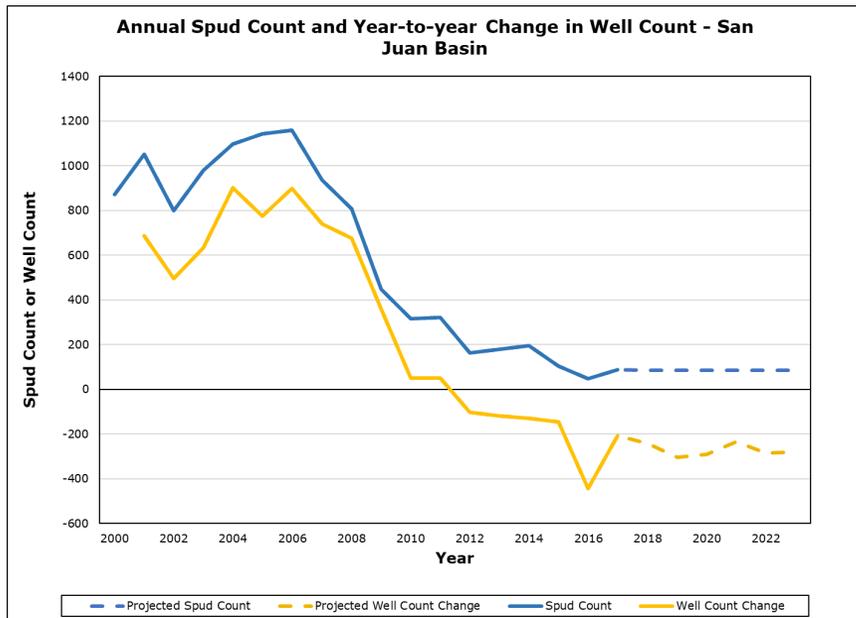
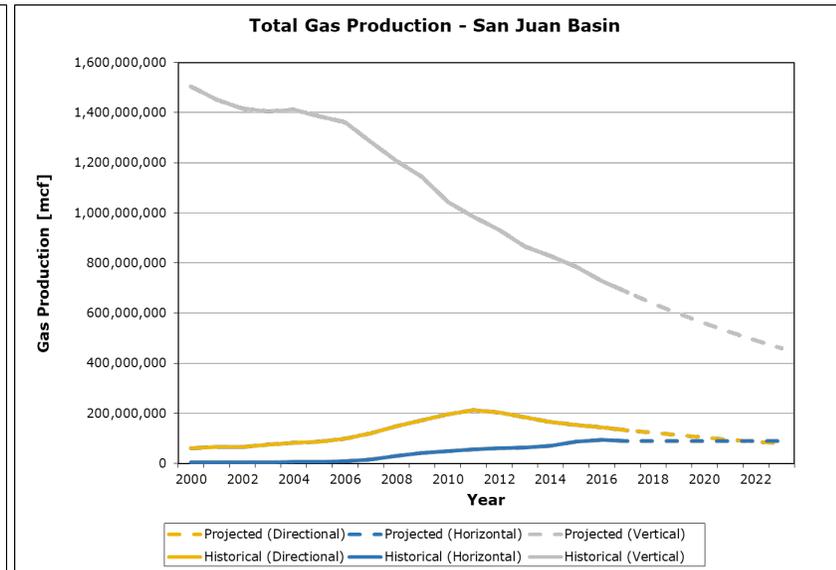
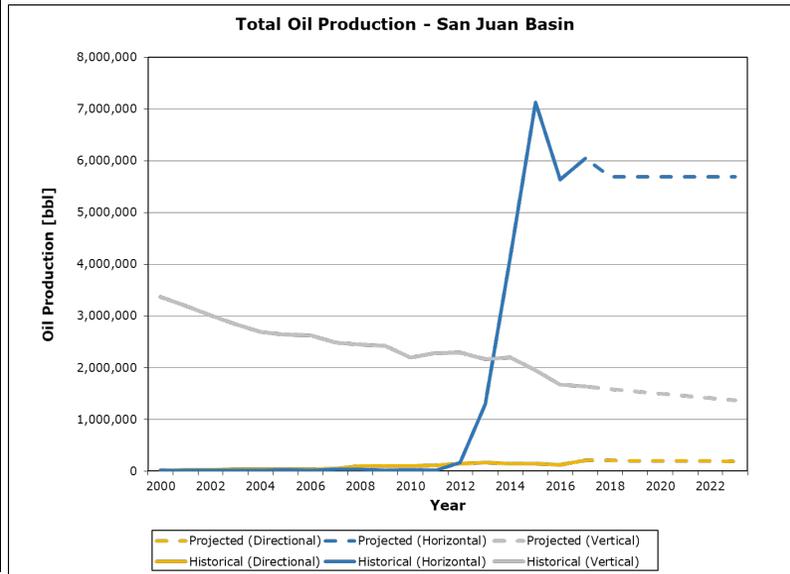
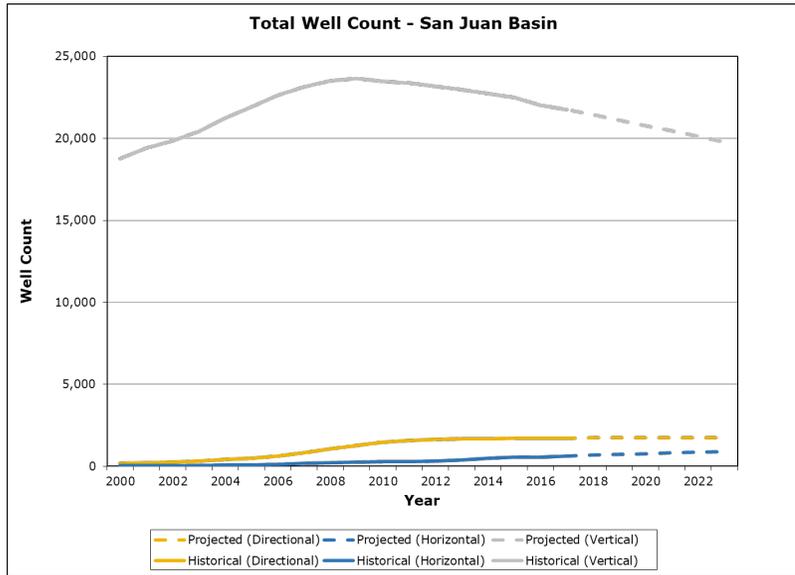
$E_{2014,scc,pol}$ = 2014 base year emissions by SCC and pollutant

GDF_{scc} = O&G activity growth/decline factor (i.e., the ratio of 2023 to 2014 O&G activity) by SCC

$CF_{scc,pol}$ = control factor scalar (ratio of emissions control in future year 2028 to emissions control in future year 2014) by SCC and pollutant



CONTINUATION OF CURRENT TRENDS
PERMIAN (NM) EXAMPLE:
STRONG RECENT GROWTH



CONTINUATION OF CURRENT TRENDS
**GREATER SAN JUAN BASIN:
 STRONG LEGACY
 PRODUCTION**

NEPA & CAA CONSIDERATIONS

- National Environmental Policy Act (NEPA) purpose
 - Examine impacts for several possible future drilling and production outcomes (however unlikely) – the recommended choice is a federal agency decision.
- Clean Air Act (CAA) planning needs
 - Utilize a specific firm projected level of emissions for one or more future scenarios, and evaluate modeled air quality projection concentrations in comparison to attainment of current air quality standards, nonattainment status design values, and for goal-setting such as Regional Haze reasonable progress goals.
- NEPA provides a decision matrix for FLMs and CAA processes provide an objective analysis result to evaluate state-EPA-local-tribal setting of future goals for air quality.
- Did not use NEPA inventory/activity in the WRAP per above considerations and desire for consistent forecast methodology across the region

ADDITIONAL REASONABLE CONTROLS

- Provide menu of potential emission controls with emission reduction percentage from uncontrolled/existing, cost effectiveness, and other metrics relevant to 4-factors analysis
 - Focus: Categories with substantial NO_x emissions (e.g, midstream engines, wellhead compressor engines, artificial lift engines, flares, heaters, drill rigs, fracing engines)
 - Agencies select control measures and prevalence to apply in their jurisdiction
 - Agency selected controls will be applied in SMOKE for air quality modeling of Additional Reasonable Controls
- Considerations:
 - Source definition: point/permitted source or nonpoint source
 - Implementation challenges/uncertainty
- Work with PMT and WRAP OGWG will determine future direction for this task

Four statutory factors [40 CFR 51.308(f)(2)(i)] relevant to inventory analyses

- Cost of compliance
- Time necessary for compliance
- Energy and non-air quality impacts of compliance
- Remaining useful life of any potentially affected major/minor stationary source or group of sources

AGENCY PROGRAM REVIEW

- Emphasis will be on describing state programs
- Starting point
 - [OGWG Road Map: Phase I Report Appendix A](#) (On-the-Books Regulations Tables)
- Scope
 - To include elements similar to previous 2013 program review <https://www.wrapair2.org/Analysis.aspx>
 - Write-up on individual state programs will be leaner than 2013 program review
 - Focus will be on comparison of elements across programs (e.g., side-by-side tables)
- Schedule
 - Early Nov: draft report/memo
 - Early Dec: final report/memo
 - Complete work by end of 2019
 - More details during next WRAP OGWG meeting in early-October

TIMELINE

- Baseline Planning Inventory (including new CO emissions and casinghead gas update)
 - Sep 16: SMOKE-ready emission inventory inputs
- Continuation of Historical Trends Future year 2028 Emission Inventory + Report
 - Sep 20: Draft for WRAP OGWG Member Review
 - Oct 1: Member Review Comments Due
 - Oct 8: Final inventory, report, and SMOKE-ready emission inventory inputs
- Mid-November: All scenarios Draft Final Report (inclusive of all scenarios), spreadsheets
- Additional Reasonable Controls: Complete work in 2019
- Program Review: Complete work in 2019

DELIVERABLES

- Available on WRAP OGWG webpage: <https://www.wrapair2.org/OGWG.aspx>
- OGWG Baseline Year Alaska and Intermountain Region Emissions Inventory revised final deliverables – Sept. 2019
 - The [Revised Final Report](#) and [Inventory Spreadsheet](#) were completed in mid-Sept. and posted on Sept. 23, 2019. These files completely replace the previously posted July 2019 report and spreadsheet, while the [gas profile](#) information posted in July is unchanged. The July report and spreadsheet files have been removed to avoid confusion. The Revised Final Report includes updates from the July postings to include the: 1) Colorado O&G emissions based on new inventories provided by Colorado Department of Public Health and Environment and Southern Ute Indian Tribe and 2) Williston Basin casinghead gas emission inventory to correct emissions that were biased low based on EPA O&G Tool inputs.
- OGWG Emissions Survey for State Air Agencies and O&G Operators
 - [Complete survey](#) (January 2019)
 - [Fleet turnover and controls-focused survey](#) (January 2019)
- Comments due on Draft Future Year Inventory Report on Oct 1.

WRAP Oil and Gas Work Group

Call Schedule:

- OGWG Calls - 2nd Tuesday, every other month @ noon MT
 - Upcoming - October 8, 2019 & December 10, 2019
- OGWG Project Management Team (PMT) Calls - as needed / bi-weekly
 - Smaller group for contractor coordination and feedback

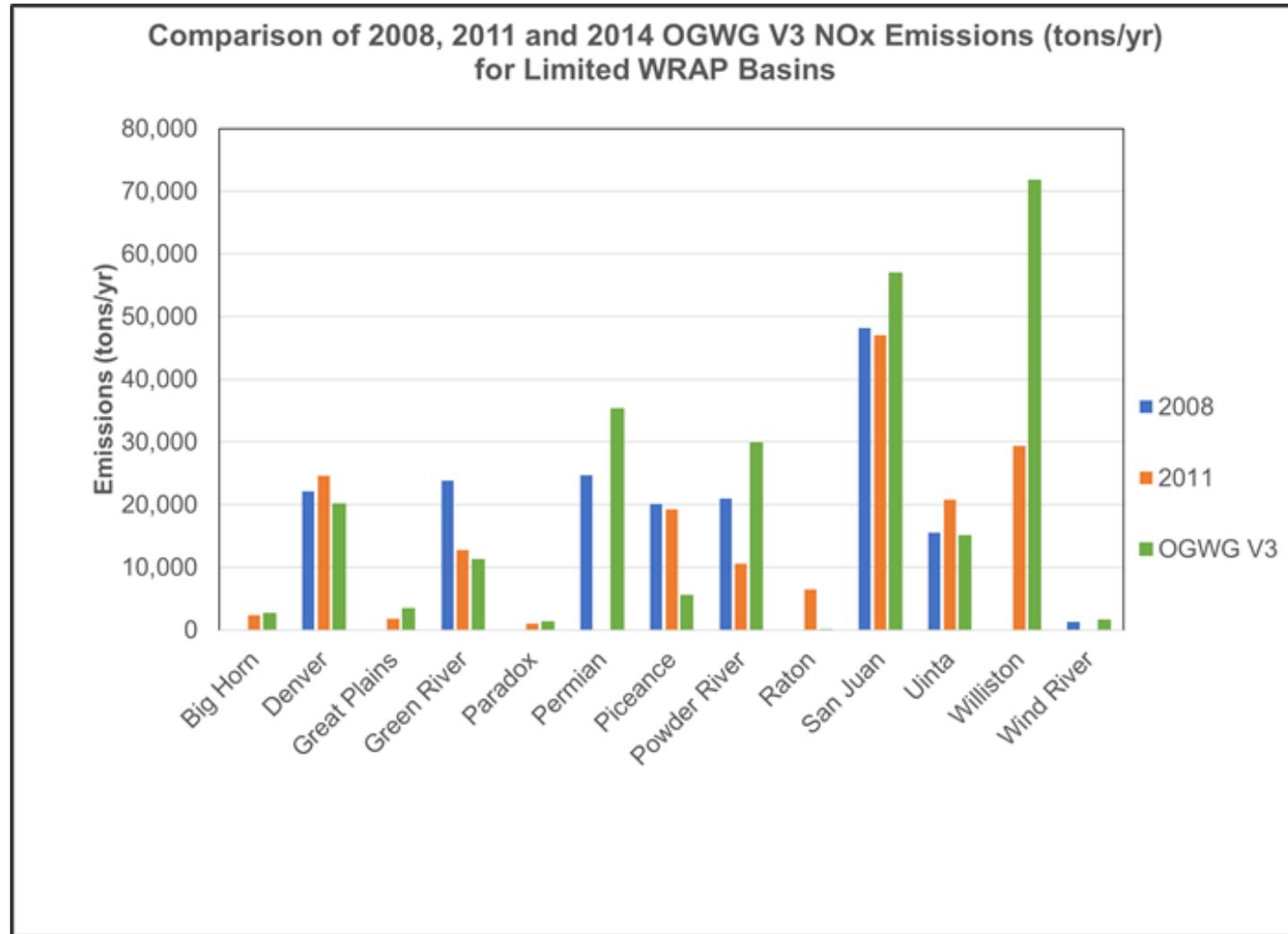
Website:

- <https://www.wrapair2.org/OGWG.aspx>

Contacts:

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- Tom Moore tmoore@westar.org

NOX EMISSIONS FROM 2008 TO CIRCA-2014



VOC EMISSIONS FROM 2008 TO CIRCA-2014

