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# **COLLABORATIVE EXPERT REVIEW OF THE DENVER-JULESBURG BASIN OIL AND GAS EMISSION INVENTORY FOR OZONE NAAQS PLANNING IN NORTHERN COLORADO**

International Emission Inventory Conference - Oil and Gas Emissions Session

September 28, 2023 – 920 am





# OUTLINE

- Context and goals for emission inventory development project
- Collaboration and transparency
- Emission inventory development and results
- Key takeaways & general future recommendations
- Team effort acknowledgements:
  - Ramboll: John Grant, Amnon Bar-Ilan, Tejas Shah, Ralph Morris
  - State of Colorado Air Pollution Control Division: Dale Wells, Kira Shonkwiler, Kevin Briggs, Jessica Ferko, Garry Kaufman, Sara Heald
  - External Review Experts: Jana Milford and Clement Cros
  - RAQC: Mike Silverstein and Chris Laplante





# **CONTEXT AND GOALS**

# COLLABORATION & TRANSPARENCY





### **CONTEXT AND GOALS FOR EMISSION INVENTORY DEVELOPMENT**

- Severe Ozone Nonattainment classification for 2008 75 ppb NAAQS
- O&G EI work and NAAQS attainment demo modeling completed in 2022 for:
  - Severe 75 ppb plan

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- Moderate 70 ppb plan
- Errors in O&G EI led to withdrawal of parts of Severe plan
  - also, Moderate 70 ppb plan did not demonstrate attainment
- Work on EI, followed by re-modeling of 75 ppb attainment demonstration, done from Jan. through Sept. 2023
  - Modeling results for 75 ppb plan with revised O&G EI demonstrates attainment

#### 2008 Ozone Standard (75 ppb) Severe SIP Planning Milestones

	OZONE PLANNING NEXT STEPS		2023		2024				2025				2026			2027			
		1Q	2	Q 30	Q 4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q 4	Q	1Q 2	Q 3	RQ 4Q	1Q 2	Q 3Q	4Q
	2008 Ozone NAAQS - Severe Nonattainment Planning Milestones																		
1	Technical and SIP Preparation work for Severe 2008 NAAQS Classification																		
	O&G inventory revision and Colorado boundary conditions (January - April)																		
	Photochemical grid modeling for attainment design value (May - July)				_														
	Revise SIP by end of July for subsequent RAQC and AQCC consideration																		
2	RAQC and AQCC consideration and actions				+				-	Yc	u	ar	e	he	ere	е			
	Board consideration of revisions (July and/or August)																		
	Submit Board-approved documents to AQCC by August																		
	AQCC rulemaking hearings (August - December)																		
3	Consider / adopt additional Severe SIP contingency measures if required by <u>PROPOSED</u> EPA guidance																		
4	Submit Severe ozone SIP revision to EPA following legislative review																		
5	Monitor ozone to achieve attainment (by July 20, 2027)																		
	2024-26 fourth highest averages equal to or less than 75 ppb at each monitoring site																		

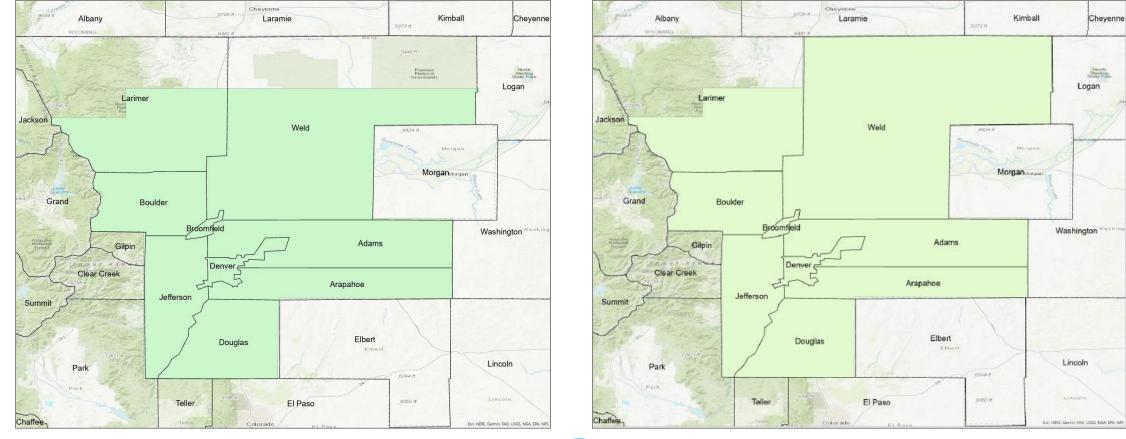


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# DENVER METRO/NORTH FRONT RANGE OZONE NAAQS NONATTAINMENT AREA BOUNDARIES

#### DMNFR 2008 Ozone NAA

#### DMNFR 2015 Ozone NAA







# **COLLABORATION & TRANSPARENCY**

- Analysis by experts from APCD for base year 2017 and projection year 2026 emissions, both revised from previous estimates, review of methods, inventories, and reports
- Comprehensive review and analysis by external experts
- Analysis and revised 2017 and 2026 modeling inventories' prep by Ramboll team
- Multiple virtual meetings of these experts to discuss and reach agreement on modeling inventories' data

#### Public forum materials and report:

- Public Forum: May 12, 2023 Oil & Gas Emission
  Inventory Results and Modeling Plans
- <u>Ramboll\_DMNFR\_NAA\_OilGas\_EI\_Report\_07Jul2023</u>
- Recommendations Memo in development: Potential Improvements to the Oil and Gas Emission Inventory for the DM/NFR Nonattainment Area

Methodology Outlin	e: Denver Metro/North Front Range Oil and Gas Emission Inventory
Ramboll US Corporati	on, May 10 2023
2017 Oil and Gas En	nissions Inventory Spreadsheets
Ramboll US Corporati	on, April 28, 2023
2026 Oil and Gas Er	nission Inventory Spreadsheets
Ramboll US Corporati	on, May 10, 2023
Severe Ozone SIP E RAQC staff	mission Inventory and Modeling Public Forum Presentation – May 12, 2023
Revised Oil & Gas E	mission Inventory Results Presentation – May 12, 2023
Ramboll US Corporati	on
Severe Ozone SIP M	odeling Plans Presentation – May 12,2023
Ramboll US Corporati	on
Modeling Forum Re Large file (231MB)	cording – May 12, 2023





EMISSION INVENTORY DEVELOPMENT & RESULTS

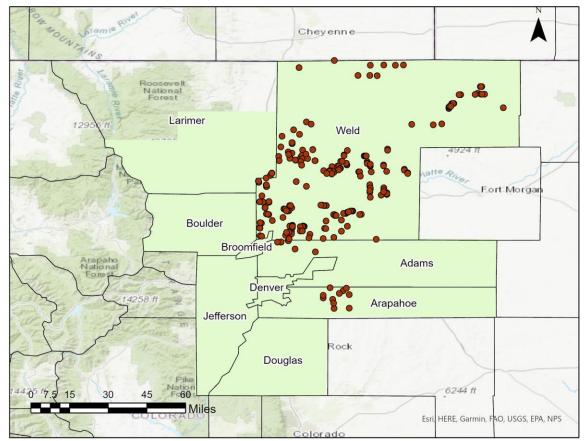




# **SCOPE**

- Geographical: DMNFR 2015 Nonattainment Area (NAA) and DMNFR 2008 NAA
- Pollutants: VOC and NOx
- Emission Sources
  - Nonpoint (wellsite): pre-production, production sources
  - Point (midstream): Gas gathering and boosting (compressor stations) and gas processing (gas processing plants, natural gas liquids processing plants)
- Temporal
  - 2017 historical year, 2026 future year
  - Average daily peak ozone season (May-Sep) emissions

#### DMNFR 2015 Ozone NAA









#### Basis

- Operator Survey
- Air Pollution Emissions Notice (APEN) Database (includes permitted wellsites and midstream facilities)
- Colorado Oil and Gas Commission Data (exploration phase and production phase activities)
- EPA 2016v2 Modeling Platform (mud degassing only)

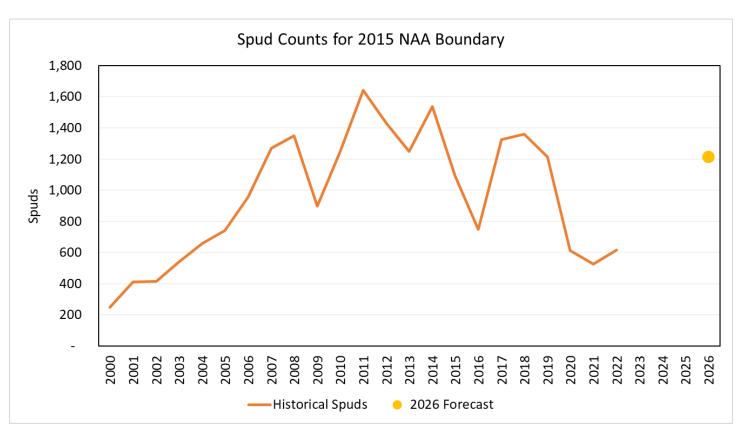
# HISTORICAL YEAR EMISSION INVENTORY DEVELOPMENT

- Started from CDPHE's previous inventory data and calculation methodology
- Developed new emission calculators
- Pre-production emissions are based on survey average emissions per spud and COGCC spud activity. Survey operator fleet included electric drill rigs.
- Production emissions sources are based on operator survey data. For operators that did not submit a survey we leveraged operator survey data and CDPHE permitting data to estimate emissions.



# FUTURE YEAR EMISSION INVENTORY DEVELOPMENT

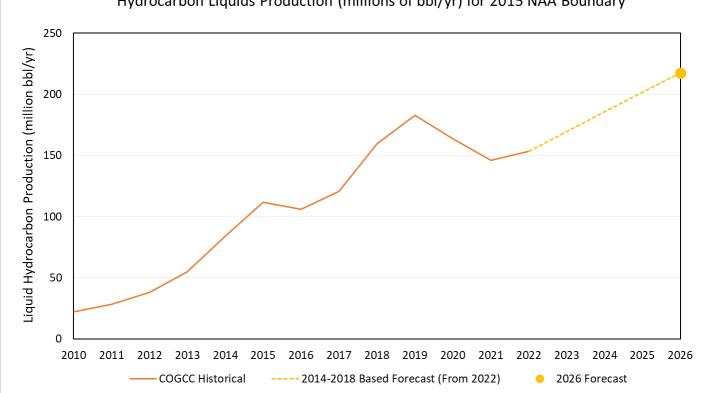
- Overall Activity Projections: Spuds (pre-production phase) and liquid hydrocarbon (production phase).
- Existing (as of 2017) Production Sites: Declined production-related (e.g., liquid hydrocarbon tanks, truck loadout) and held constant facilityrelated (e.g., process heaters, well-pad engines, fugitive components) emissions
- New (2018+) Production Sites: Assumed conformance to highly controlled 2017 configurations including multiple stages of separation
- Explicit on-the-books regulation-based adjustments accounted for pneumatic devices, but not other source categories





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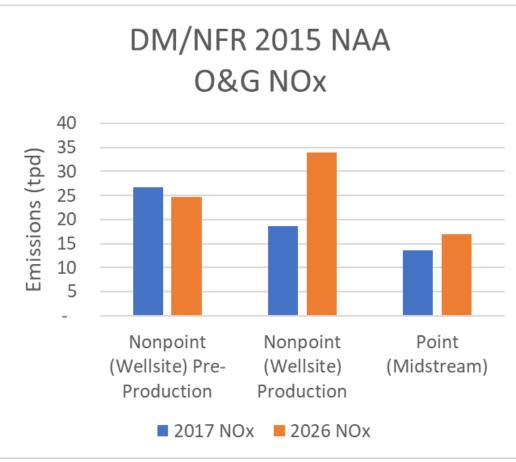






# DM/NFR 2015 NAA NOX EMISSIONS

- Five emission categories comprise >95% of NOx emissions:
  - Pre-Production: Fracturing engines, drill rigs
  - Production: Well-pad internal combustion engines, process heaters
  - Midstream: Point internal combustion engines
- Major changes from 2017 to 2026
  - Pre-Production: Small decrease in spud count from 2017 to 2026
  - Production: Existing well-pad engine and process heater emissions conservatively held constant. Rules affecting well-pad engines emissions post-2017 were not included

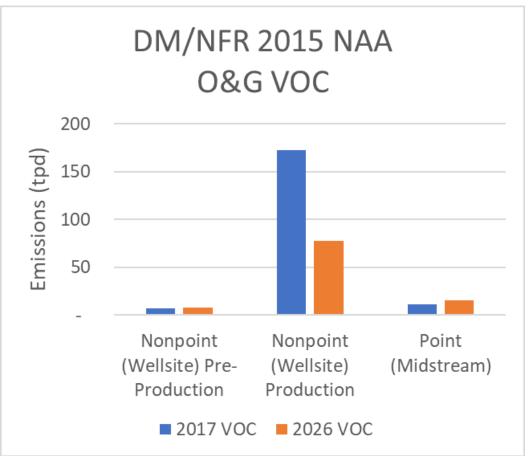






# DM/NFR 2015 NAA VOC EMISSIONS

- Largest VOC emissions contributors
  - Liquid Hydrocarbon Tanks (17-18%)
  - Pneumatic Devices (18%-19%)
- Major changes from 2017 to 2026
  - Steep decline in existing 2017 wellsite production phase emissions to 2026
  - Highly controlled hydrocarbon tank and pneumatic device emissions for new facilities







# **KEY TAKEAWAYS & GENERAL FUTURE RECOMMENDATIONS**





# **70 PPB ATTAINMENT PLANNING – BIG PICTURE IMPROVEMENTS**

#### Motivations to develop 2022-based modeling platform

- 2016 base year out of date
- Comply with EPA guidance
- Use a post-pandemic, more current year
  - Improved and more complete data for O&G and other emissions categories
  - Up-to-date / better understood basis to project attainment year activity and emissions
  - Account for O&G and other emission categories' control programs and source changes over past several years
- National 2022 emissions modeling platform in development to provide boundary and background inputs for Colorado and DM/NFR region air quality modeling
- Improve approaches and use current data to test control strategies

#### 2015 Ozone Standard (70 ppb) Serious SIP Planning Milestones

	OZONE PLANNING NEXT STEPS		2023	}		20	)24			202	5		2	026			202	7
		1Q .	2Q 3(	Q 4Q	10	20	3Q	4Q	1Q .	2Q 3	Q 40	2	1Q 20	3Q	4Q	1Q	2Q .	BQ 40
	2015 Ozone NAAQS - moving from Moderate into Serious Nonattainment Planning Milestones																	
1	Consider / adopt additional Moderate SIP contingency measures if required by <u>PROPOSED</u> EPA guidance																	
2	Technical Analysis and Modeling work for expected Serious 2015 NAAQS Re-Classification Inventory, Modeling, and Analysis Plan - new base year platform + contracting (October 23 - February 24) Inventory and met data preparation and evaluation (January - June) Attainment Modeling - 2026 design value, source attribution, control strategies (June 24 - February 25)																	
3	SIP Preparation work for expected Serious 2015 NAAQS Re-Classification EPA reclassifies area from Moderate to Serious for failing to attain on time (late 2024 / early 2025) Develop / analyze additional ozone-reducing control measures (Spring 2023 through Summer 2025) Develop Serious area ozone SIP (June 2024 through Fall 2025)																	
4	RAQC and AQCC consideration and actions Board consideration of revisions (May - August) Submit Board-approved documents to AQCC by August AQCC rulemaking hearings (August - December)																	
5	Submit Serious ozone SIP revision to EPA following legislative review																	
6	Monitor ozone to achieve attainment (by August 3, 2027) 2024-26 fourth highest averages equal to or less than 70 ppb at each monitoring site																	





# **GENERAL RECOMMENDATIONS FOR FUTURE DM/NFR NAA OIL AND GAS EMISSION INVENTORIES**

- Leverage available operator reported data from new Colorado Air Pollution Control Division reporting requirements
- Use refined operational data from the Energy and Carbon Management Commission
- Reevaluate control efficiency, rule penetration, and rule effectiveness assumptions for on-the-books rules
- Develop projection methods that account for recent and ongoing changes to operations, rules and regulations, and changes in energy supply
- Estimate emissions based on DMNFR NAA-specific data to the greatest degree possible









<u>Mission</u>: We collaborate to improve air quality and protect Colorado's health, environment, and economy through planning, policy development, and program implementation.
 <u>Vision</u>: Clean air provides us the opportunity to breathe easy.

# Bright ideas. Sustainable change.

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