

Introduction to Ozone: The State Regulatory Response

Legislative Interim Committee on Ozone Air Quality

August 25, 2023

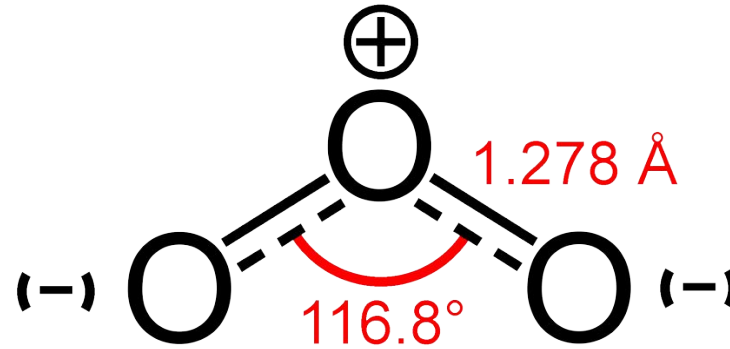
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Outline

- ▶ Introduction to ozone
- ▶ Ozone levels in Colorado's Front Range
- ▶ What are the biggest contributors to ozone formation?
- ▶ What has Colorado done to reduce ozone levels?
- ▶ What planning is in the works?

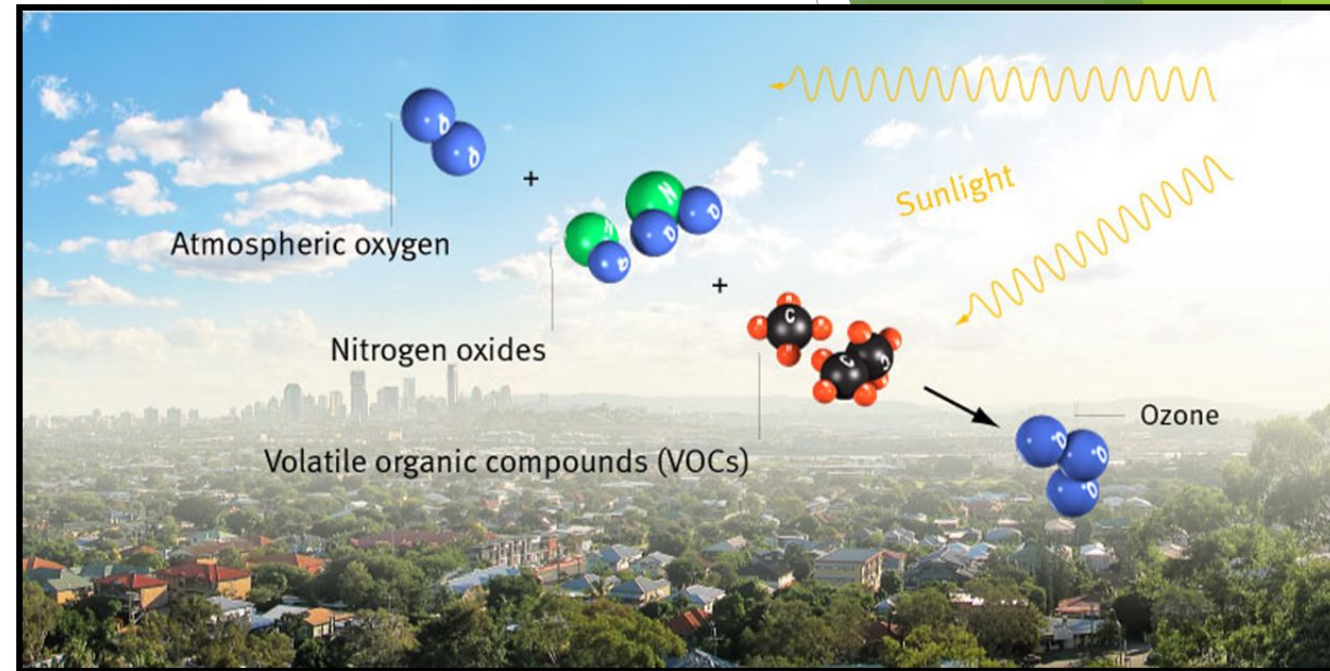


What is ozone? Why does it matter?

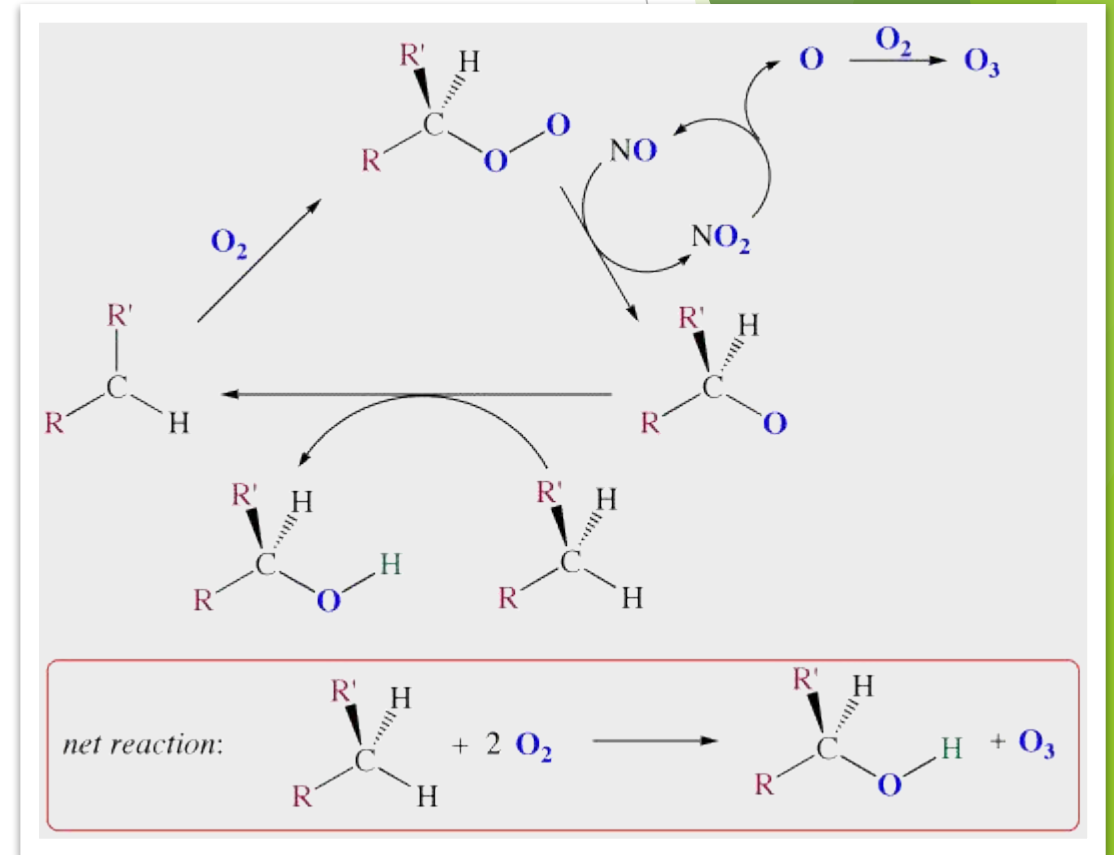
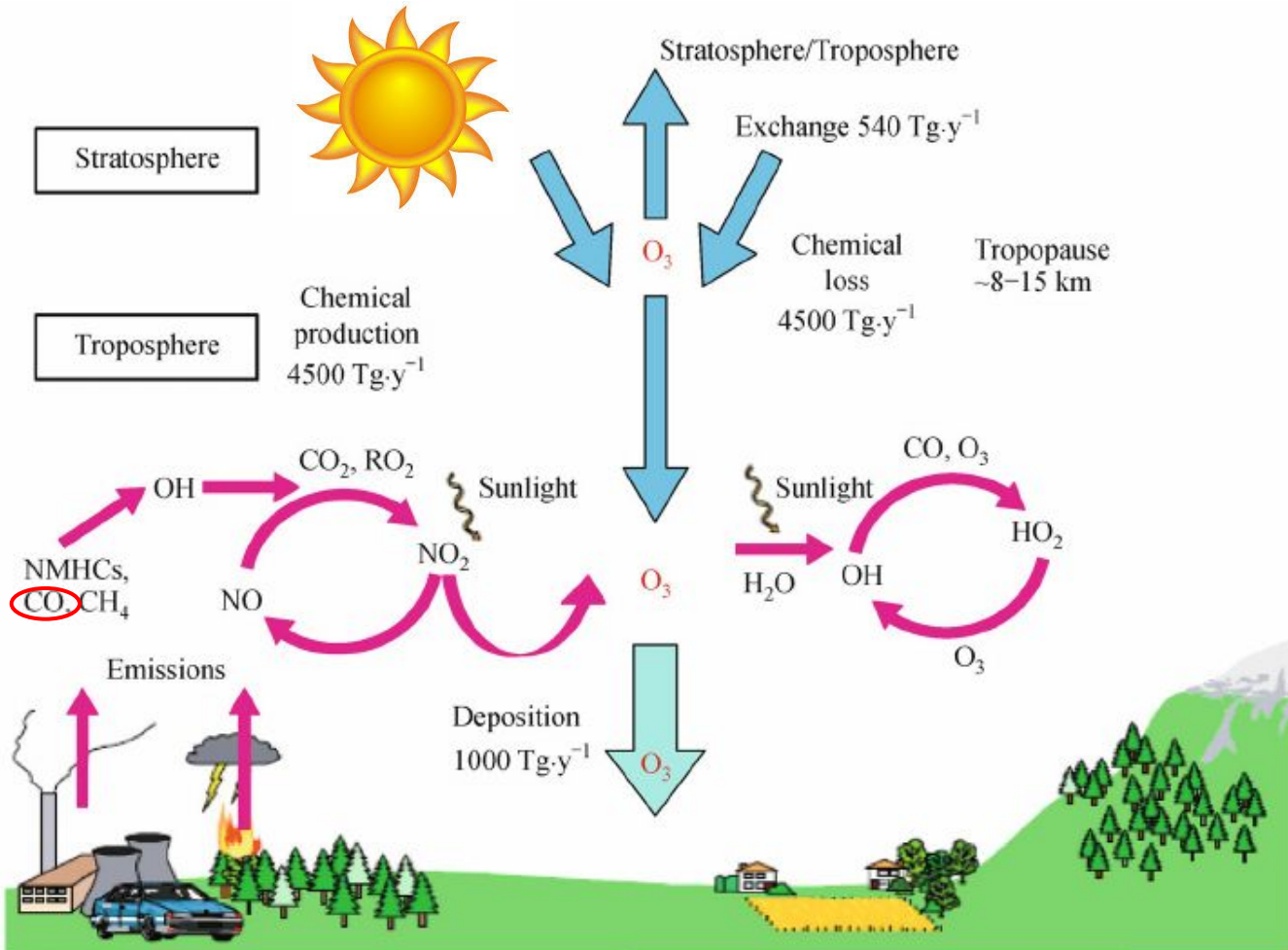
- ▶ Ozone (O₃) is a colorless gas that is odorless at relatively low concentrations.
- ▶ Ground-level ozone (bad) vs. stratospheric ozone (good)
- ▶ As an oxidant, ozone can be harmful to human health when inhaled.
 - ▶ Can cause respiratory irritation, aggravate respiratory conditions, reduce lung function, and has been linked to cardiovascular effects
- ▶ Formed through a complex chemical reaction in the atmosphere

Ozone (O₃) Formation

- ▶ Typically not emitted but secondarily formed
- ▶ Formed through interaction between ozone precursors (i.e. volatile organic compounds (VOCs) and nitrogen oxides (NO_x)) in presence of sunlight
- ▶ Emissions from motor vehicles, industry, oil and gas production, and consumer activities contribute to ozone formation
- ▶ Highest ground-level ozone concentrations usually occur in the summer on warm, dry and stagnant days



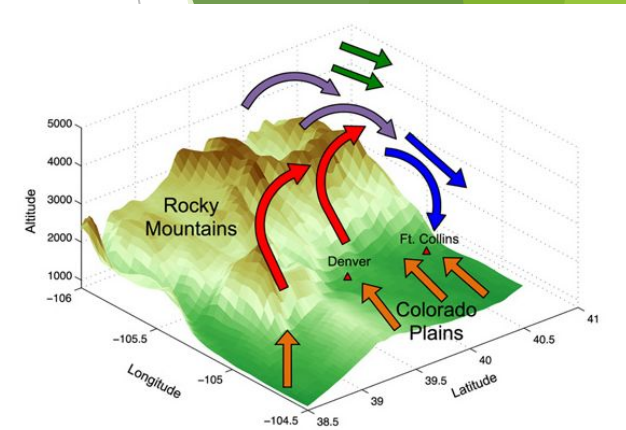
Ozone - How it's formed (A more complicated version)



<http://butane.chem.uiuc.edu/pshapley/genchem2/a12/2.html>

National Ambient Air Quality Standards (NAAQS)

- ▶ The NAAQS is based on 8-hour average ozone levels
- ▶ Compliance with the NAAQS is based on the 3 year average of the 4th maximum daily 8 hour average
- ▶ There are two NAAQS for ozone set by the Environmental Protection Agency
- ▶ Ozone concentrations vary significantly from year to year based on meteorology
- ▶ Because ozone forms from a photochemical reaction, ozone levels build up during the day and then decrease significantly during the night
- ▶ Afternoon rain showers or windy conditions significantly lower maximum ozone concentrations
- ▶ In the Denver area the highest ozone values occur along the foothills due to daytime upslope conditions



Under certain conditions, upslope flow (orange arrows) draws air from the plains, across the Colorado Front Range. This airflow sweeps pollutants from Denver upwind toward the foothills where they accumulate (red arrows) at higher elevations. This elevated flow (purple arrows) interacts with westerly winds (green arrows) and recirculates slightly north and back downward. The polluted air (blue arrows) can then mix downward over the Front Range. (Courtesy J. T. Sullivan, et al., 2016, Journal of Geophysical Research: Atmospheres)

Current Status: Denver Metro/North Front Range Nonattainment Area

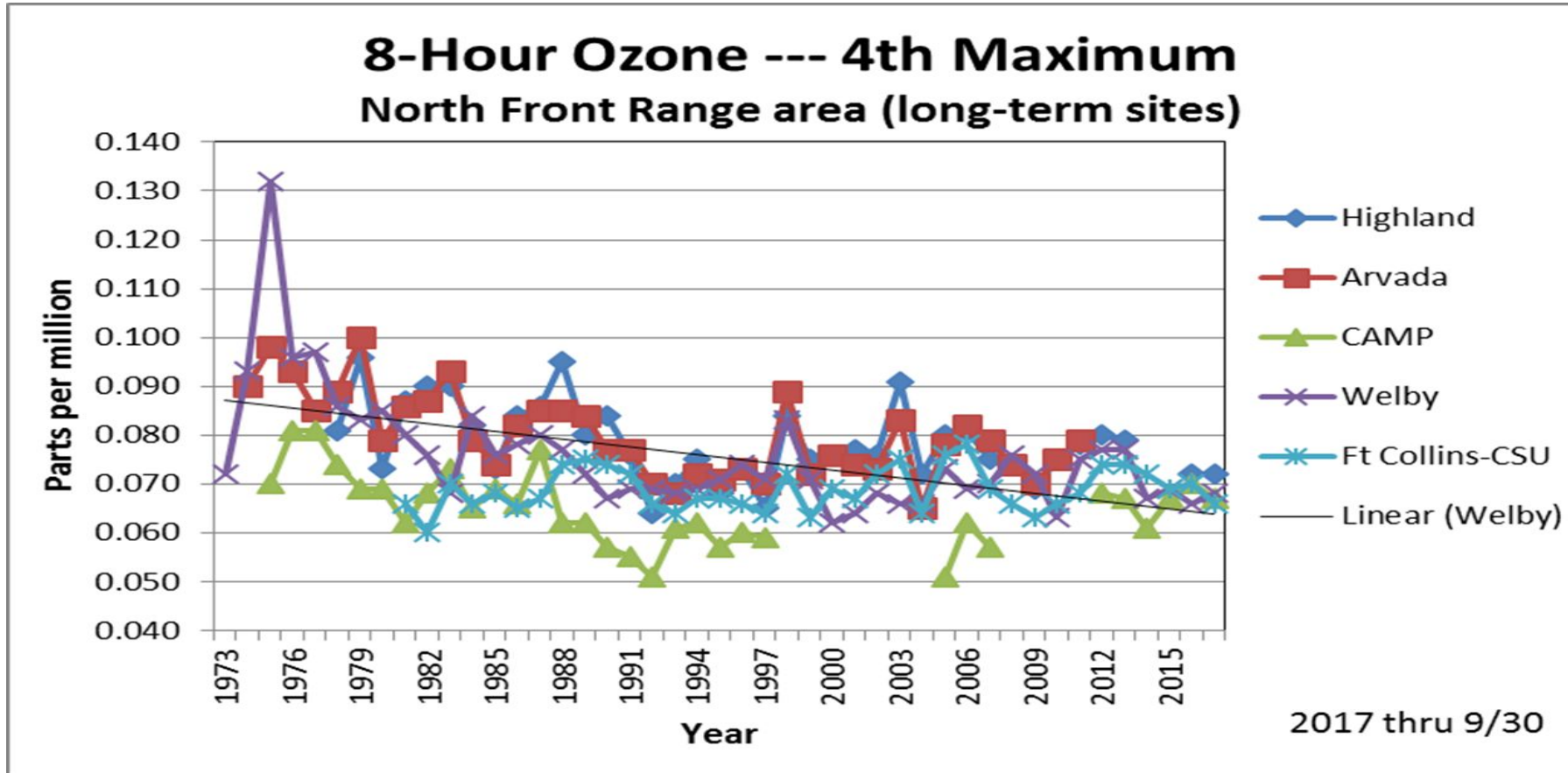
- ▶ Severe area for 75 ppb standard 2008 National Ambient Air Quality Standard (NAAQS)
- ▶ Moderate area for 70 ppb standard 2015 NAAQS
 - ▶ Area expected to be bumped up to Serious classification in late 2023, early 2024



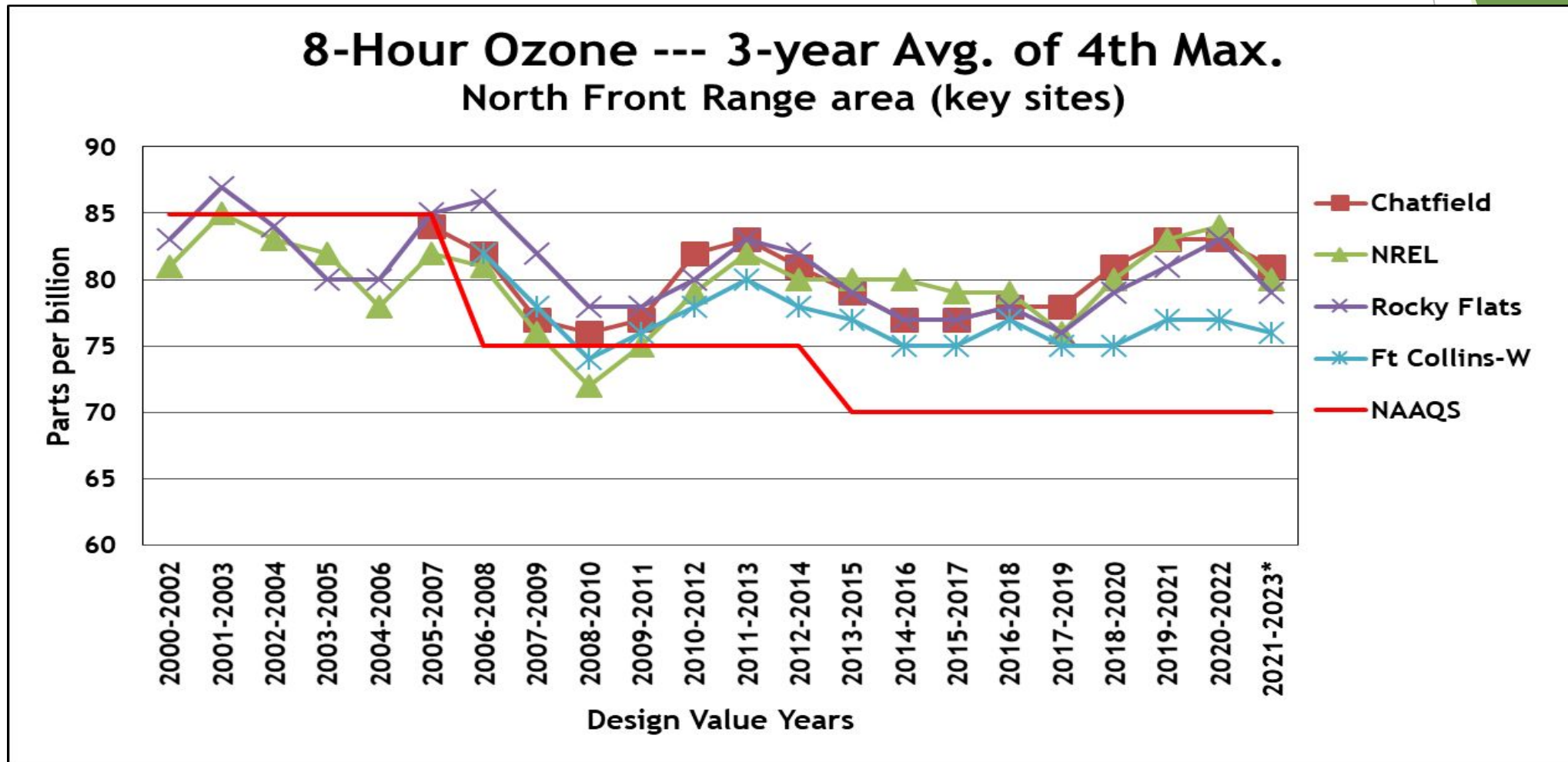
State Implementation Plan Process

- ▶ Required for all areas that are in nonattainment (i.e. not achieving the NAAQS)
- ▶ Allows for local and regional planning and federal enforceability
- ▶ Not the only tool in our toolbox
- ▶ Attaining the NAAQS is important, but every part per billion reduction matters
- ▶ AQCC is scheduled to hold a hearing on the 2008 NAAQS Severe SIP in December 2023
- ▶ APCD and the RAQC have started working on the 2015 NAAQS Serious SIP and expect to bring a proposal forward to the AQCC in 2025

Long Term Ozone Trend

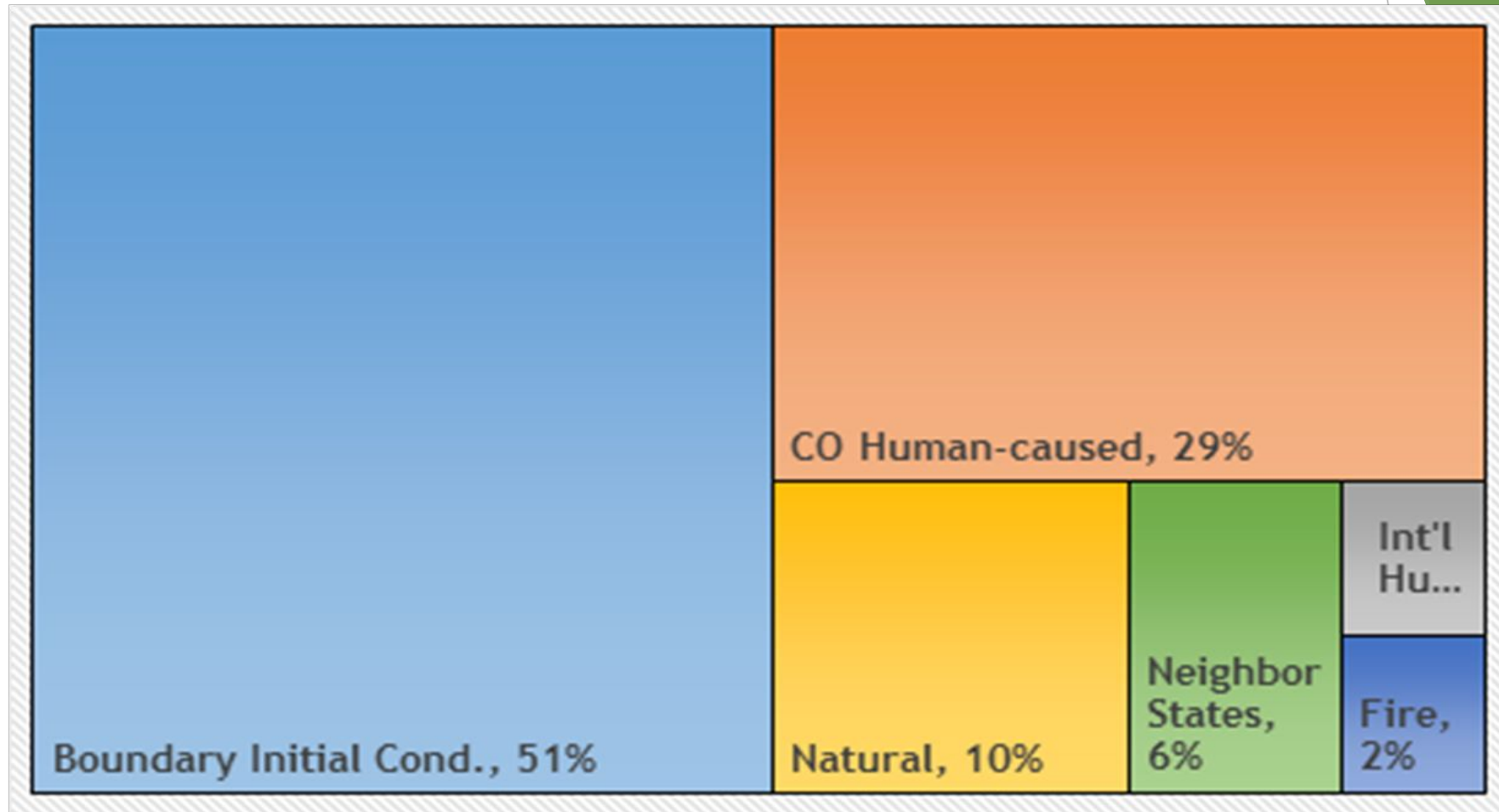


Ozone Trends (2000 - 2023) at Priority Monitors

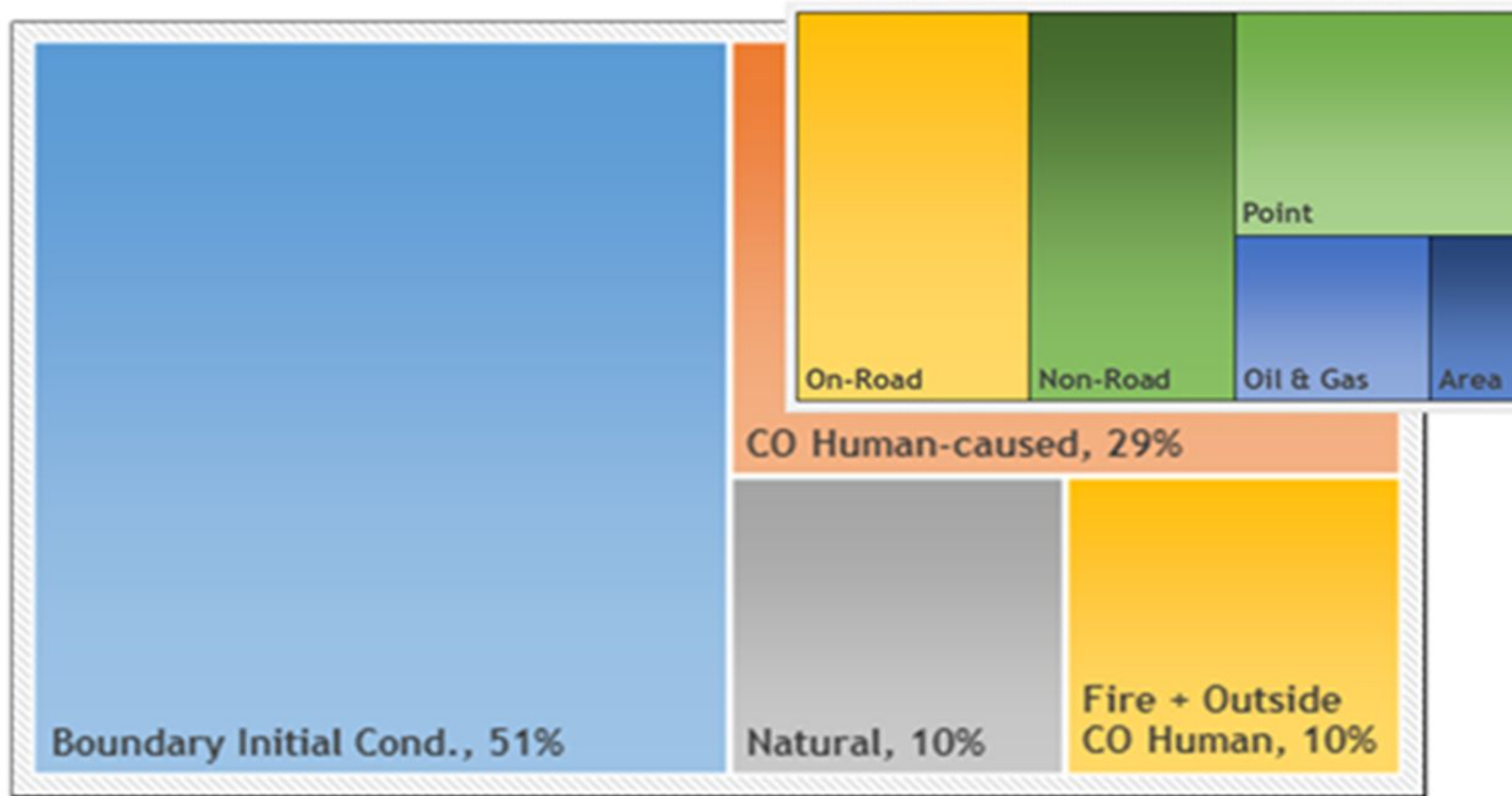


*2023 to date

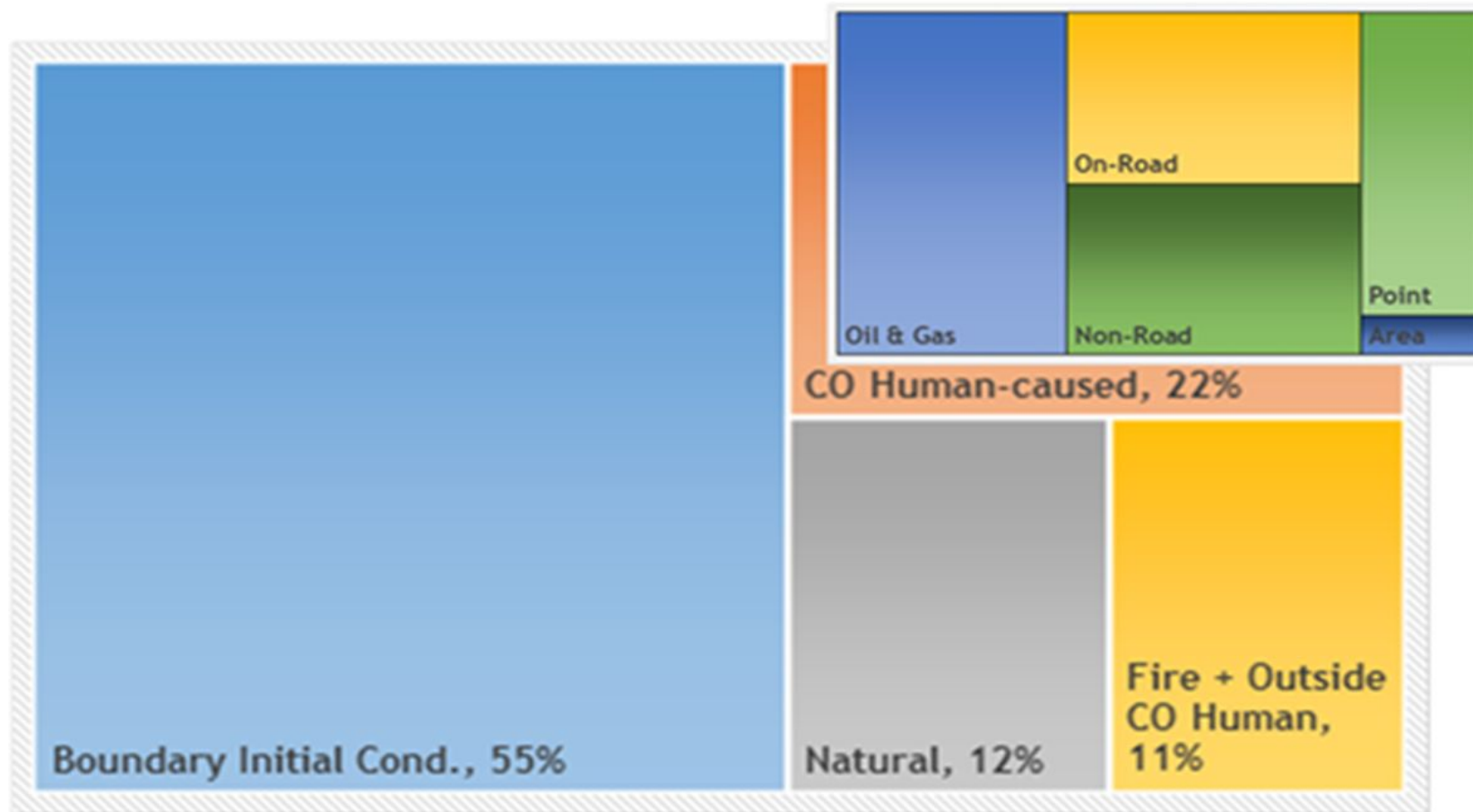
Average Contribution Across Monitors



National Renewable Energy Lab (NREL)



Fort Collins West (FCW)



Total Ozone Precursor Emissions Inventory

Emissions Inventories (TPD)	2011		2017		2026	
	2008 Boundary		2008 Boundary		2008 Boundary	
	2011 VOC	2011 NOx	2017 VOC	2017 NOx	2026 VOC	2026 NOx
Area	60.6	--	79.1	0.1	79.9	0.1
Non-Road	58.2	75.9	44.3	41.7	47.4	34.6
Oil and Gas	279.7	41.4	164.7	54.9	90.4	68.4
Area	48.9	22.2	49.1	40.7	61.8	52.9
Condensate/Oil Tanks	216.0	1.1	106.1	1.4	15.4	0.2
Point	14.8	18.1	9.4	12.8	13.3	15.3
On-Road	93.7	142.1	48.1	57.4	27.0	21.7
Light-Duty Vehicles	90.0	102.5	46.7	45.5	26.3	14.6
Medium/Heavy-Duty Vehicles	3.7	39.6	1.3	11.9	0.7	7.1
Point (Non Oil and Gas)	26.6	60.7	21.5	24.2	21.5	19.6
EGU	0.7	39.7	0.3	8.4	0.3	4.7
Non-EGU	25.9	21.0	21.2	15.8	21.2	14.9
TOTAL	518.8	320.1	357.6	178.4	266.3	144.3

Reduction Strategies in Place or Coming Soon

VEHICLE-FOCUSED

- New emissions standards
- Inspection & Maintenance Program
- Gasoline & diesel fuel standards

INDUSTRY FOCUSED

- Utilities/power generation
- Oil & gas industry
- Major sources (large emitting sources)

ELECTRIFICATION

- Transportation focused (charging stations, fleets)
- Electricity from renewable sources

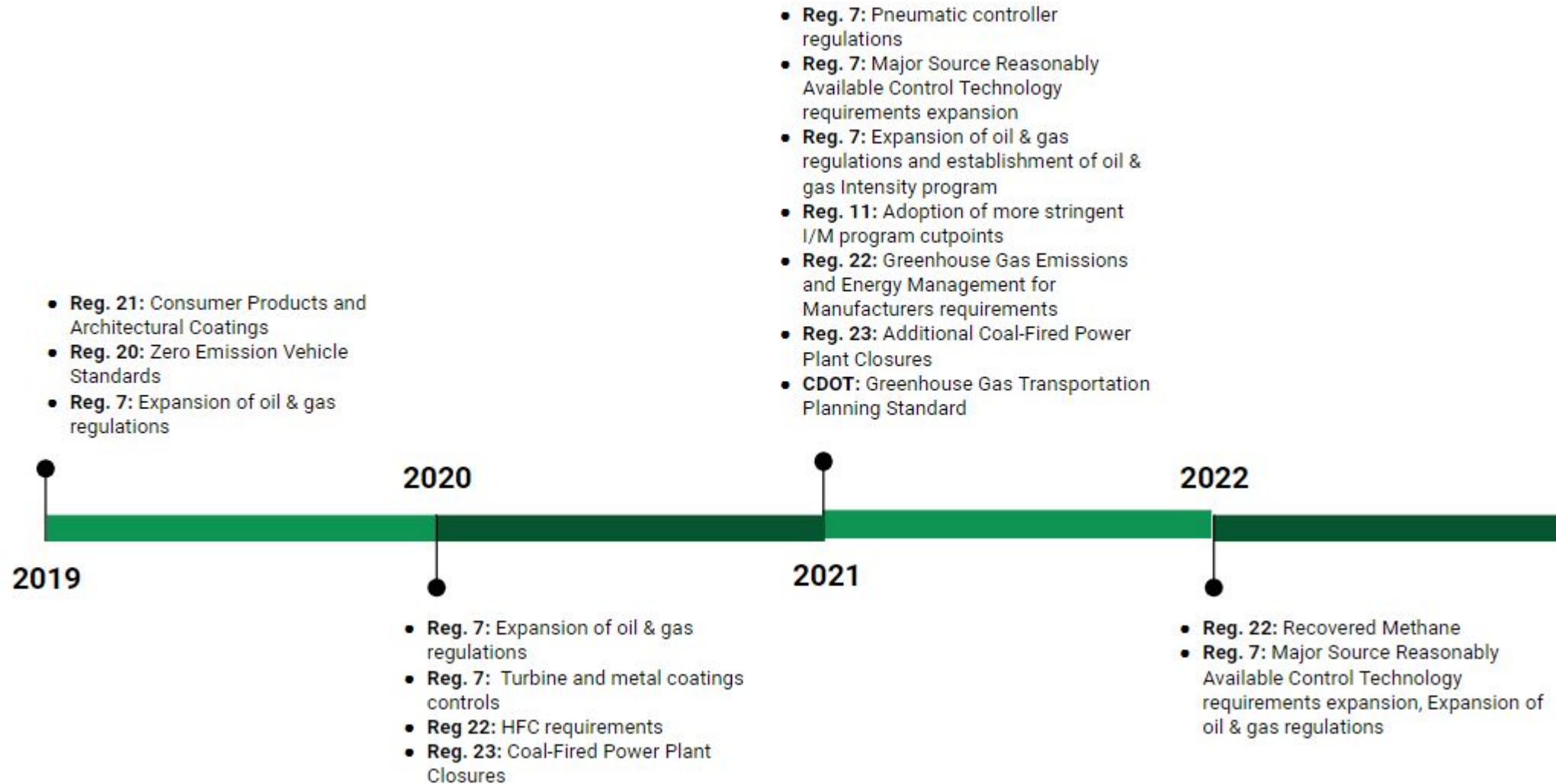
TOUGHER PERMITTING REQUIREMENTS

- More sources covered
- Tighter control requirements
- Emission increases are offset

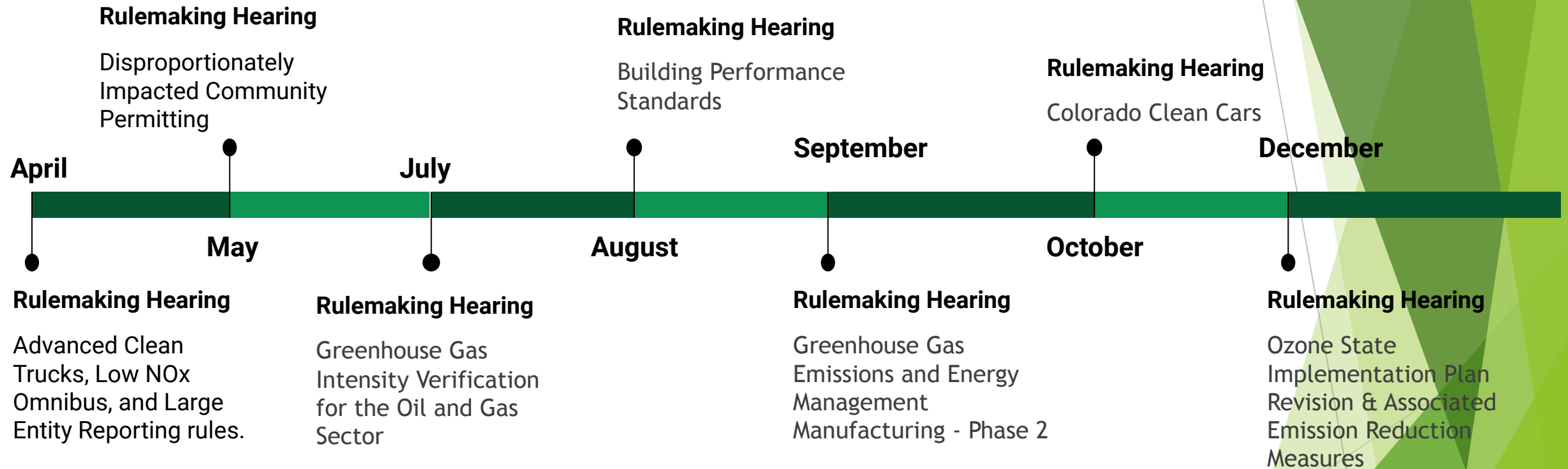
OTHER PROJECTS' COBENEFITS

- CDOT's Transportation GHG Rule (adopted 2021)
- AQCC's GEMM Rule (adopted 2021)
- AQCC's Regional Haze Rule (adopted 2021)
- AQCC's Oil & Gas Rule (adopted 2021)
- CEO's Building Efficiency Taskforce Recommendations/AQCC Rulemaking (2022)

AQCC Rulemakings: 2019 - 2022



AQCC Rulemakings: 2023



Governor's Directive to CDPHE and ECMC to Reduce NOx Emissions from the Oil and Gas Sector

- ▶ On March 16, 2023 Governor Polis directed ECMC and CDPHE to work together to develop and implement rules to achieve a 30% reduction of NOx from the oil and gas production sector in the non-attainment area during ozone season by 2025 and a 50% reduction by 2030
- ▶ ECMC and CDPHE have worked collaboratively developing a 2 step process to meet these directives
- ▶ Step 1, Rulemaking before the AQCC by the end of 2023 to achieve 2025 goal:
 - ▶ NOx reduction requirements for stationary engines
 - ▶ Rules limiting NOx emissions from oil and gas drilling and fracking operations
- ▶ Step 2, Stakeholder process in late 2023 and early 2024 to identify additional strategies to meet 2030 target with rulemaking(s) by end of 2024

Recent Legislation to Improve Air Quality

- ▶ SB19-181 - Oil and Gas Reform
- ▶ SB19-096 - Long Term Climate Change Data
- ▶ SB19-236 - Climate Change
- ▶ HB19-1261 - Climate Action Plan to Reduce Pollution
- ▶ SB20-204 - Air Quality Enterprise
- ▶ SB21-260 - Clean Transportation
- ▶ HB21-1266 - Environmental Justice Act
- ▶ HB21-1189 - Regulate Air Toxics
- ▶ HB22-1244- Public Protections from Air Toxics
- ▶ 2022 Air Quality Transformation Decision Item
- ▶ HB23-1294 - Pollution Protection Measures
- ▶ HB23-1161 - Environmental Standards for Appliances
- ▶ SB23-016 - Greenhouse Gas Emission Reduction Measures
- ▶ SB23-198 - Clean Energy Plans

Building Capacity at CDPHE to Address Air Quality Challenges

- ▶ 185 new FTE hired since April 2022 including many ozone related positions:
 - ▶ 30 new permit engineers and permit support staff
 - ▶ 8 new permit modelers
 - ▶ 20 new oil and gas program staff
 - ▶ 13 new air toxics and ozone precursor monitoring staff
 - ▶ 11 new regulatory development staff
 - ▶ 20 new compliance and enforcement staff
 - ▶ 7 new mobile sources program staff
 - ▶ 21 new technical services staff

Building Capacity at CDPHE to Address Air Quality Challenges

- ▶ New staff and resources are allowing us to transform how we do business
- ▶ More robust permitting including the most stringent minor source modeling program in the country
- ▶ Advanced technologies to measure pollutants
- ▶ Groundbreaking new regulatory strategies
- ▶ Comprehensive approach to air toxics
- ▶ Enhanced oversight of emission sources
- ▶ Data systems that both increase efficiency and greatly improve public transparency
- ▶ Enhanced Community Outreach
- ▶ Embedding Environmental Justice in all our programs

EPA-600/9-76-007a
June 1976

DENVER AIR POLLUTION STUDY - 1973
Proceedings of a Symposium
Volume I



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Thank you!

Questions?