

DENVER METRO AND NORTH FRONT RANGE AREA: COMPLIANCE WITH FEDERAL OZONE STANDARDS

AWMA - ROCKY MOUNTAIN SECTION
OCTOBER 29, 2020

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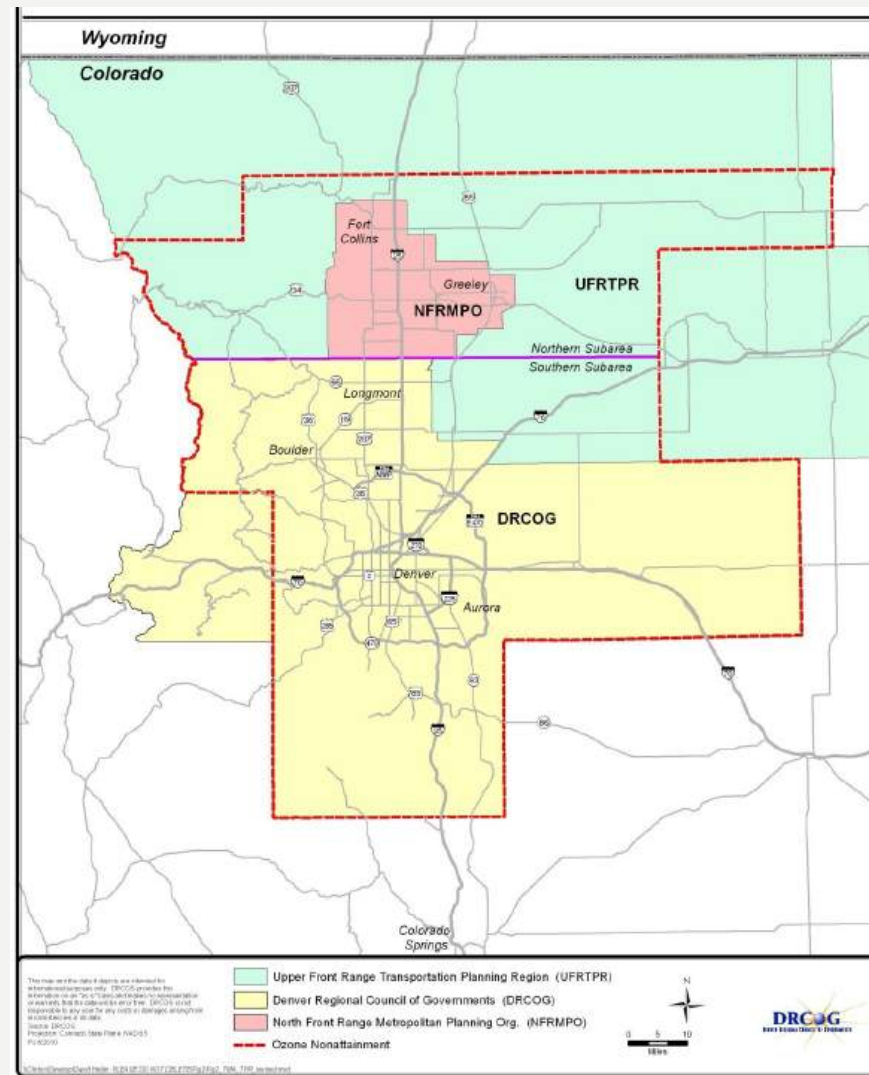


REGIONAL AIR QUALITY COUNCIL

Lead air quality planning agency for the Denver Metro/North Front Range

Primary responsibilities:

- Planning to meet federal air quality standards (SIPs) and state standards
- Conduct programs of public education and awareness
- Implement public/private projects to reduce emissions and improve air quality
- Represent and assist local governments in the air quality planning process





AIR QUALITY STANDARDS

Under the law, EPA sets standards at ambient levels “necessary to protect public health and welfare”

Does not require level of zero-risk

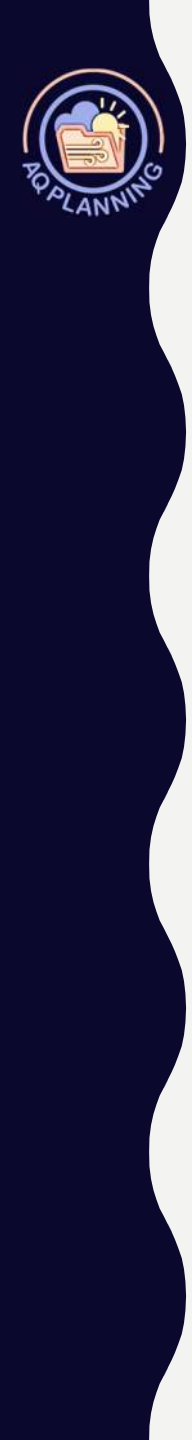
Based on extensive health studies

EPA must reevaluate standards every five years to ensure they continue to be adequately protective of human health based on current science

Standard setting involves judgment on the appropriate level of the standard

Under the federal Clean Air Act, cost cannot be considered in determining level of the standard

Standard is “attained” based on monitoring values within the nonattainment area



DENVER METRO/NORTH FRONT RANGE AQ STATUS

Fine Particulates (PM_{2.5})

Attaining

Nitrogen Dioxide (NO₂)

Attaining

Sulfur Dioxide (SO₂)

Attaining

Lead (Pb)

Attaining

Carbon Monoxide (CO)

Attained in 1996 – Maintenance Area

Coarse Particulates (PM₁₀)

Attained in 1993 – Maintenance Area

Ozone (O₃)

1979 1-hour standard: 125 ppb

Attained 1987 (Standard Revoked)

1997 8-hour standard: 84 ppb

Attained in 2009 (Standard Revoked)

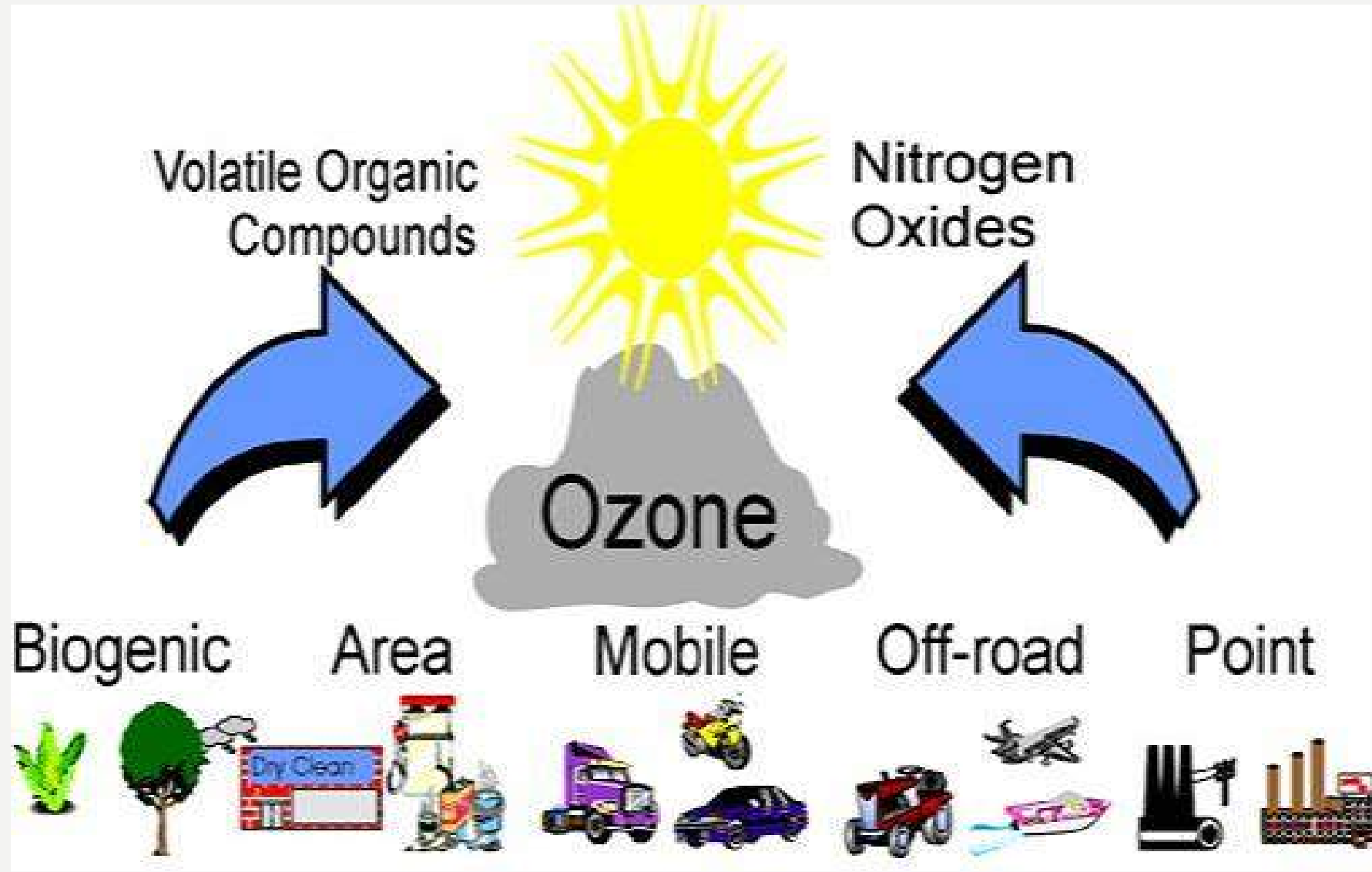
2008 8-hour standard: 75 ppb

Out of compliance ← **Serious SIP**

2015 8-hour standard: 70 ppb

Out of compliance

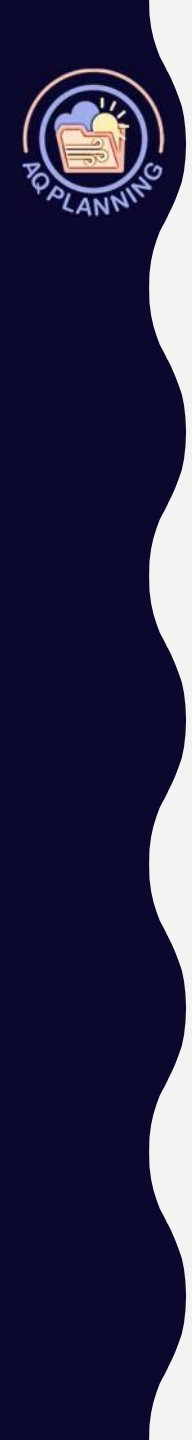
HOW OZONE IS FORMED



Source: www.montgomerycountymd.gov/DEP/Resources/Images/outreach/air/ozonformation.jpg

7/31/2020

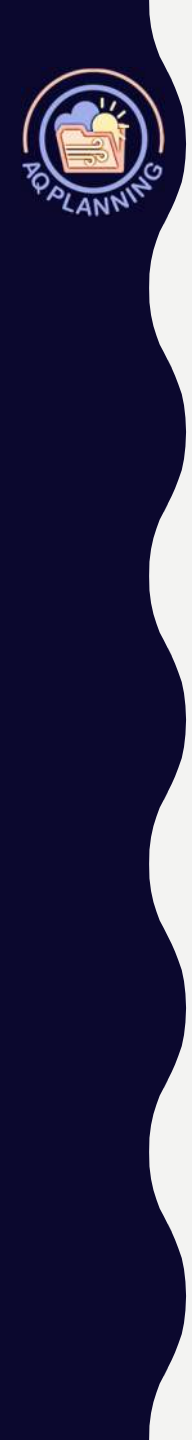
RAQC - Serious SIP Catch-up Session



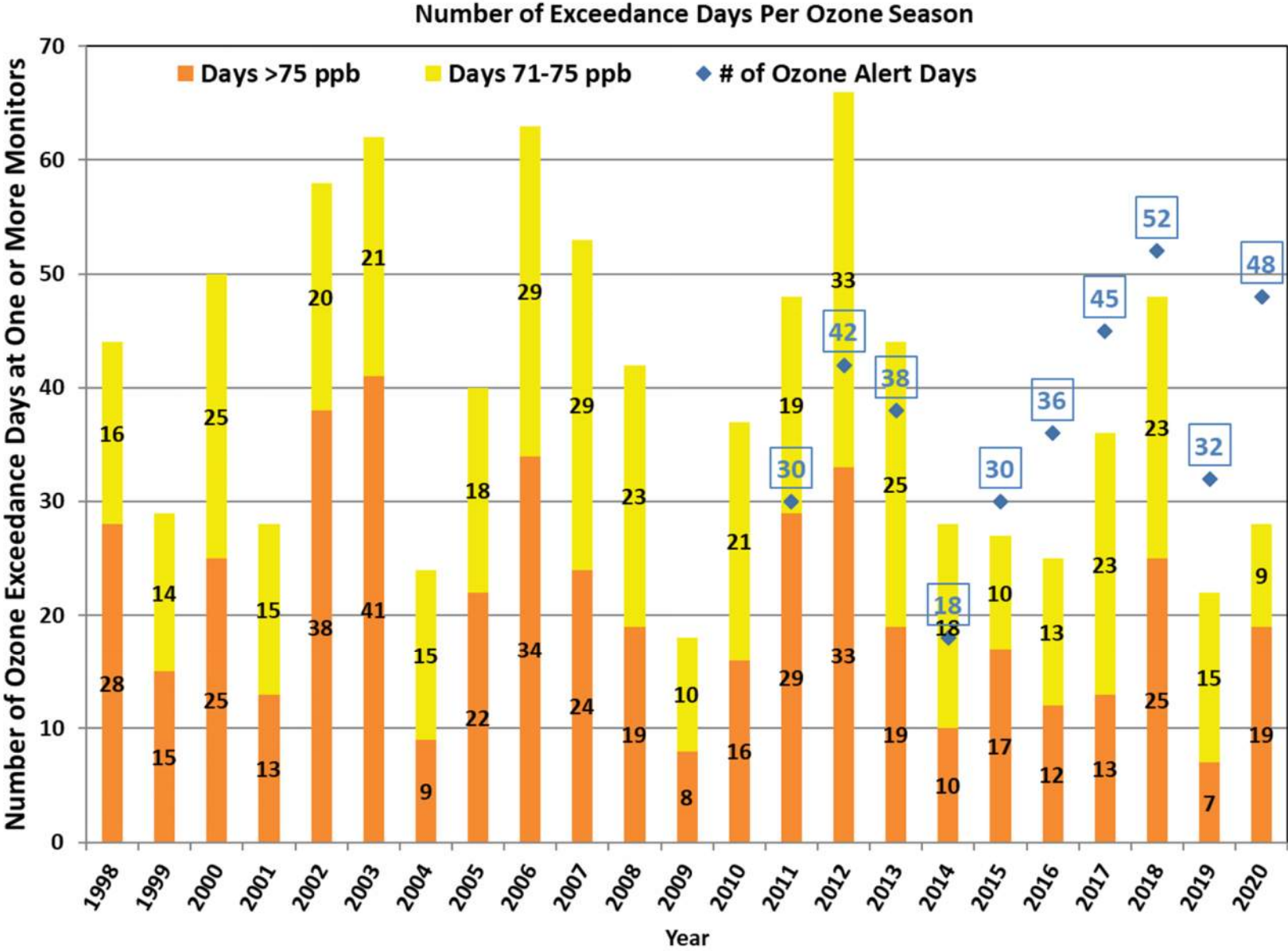
2020 OZONE SEASON TRACKING

As of 7/5/2020

Monitor	4th Max	4th Max	4th Max	2018-2020 Design Value
	2018	2019		
Chatfield State Park	83	78	64	75
NREL	80	75	68	74
Rocky Flats	81	72	69	74
Fort Collins - West	81	71	70	74
Highland	77	73	63	71
Boulder Reservoir	77	69	67	71
Welch	66	72	60	66
Greeley - Weld Tower	73	65	64	67
Rocky Mtn. Nat'l Park	74	65	63	67
Aurora East	72	66	63	67
CAMP	71	67	59	66
La Casa	72	65	60	66
Fort Collins - CSU	72	64	62	66
Welby	69	60	61	63
Blackhawk		69	64	67



TRENDS IN EXCEEDANCES OVER TIME



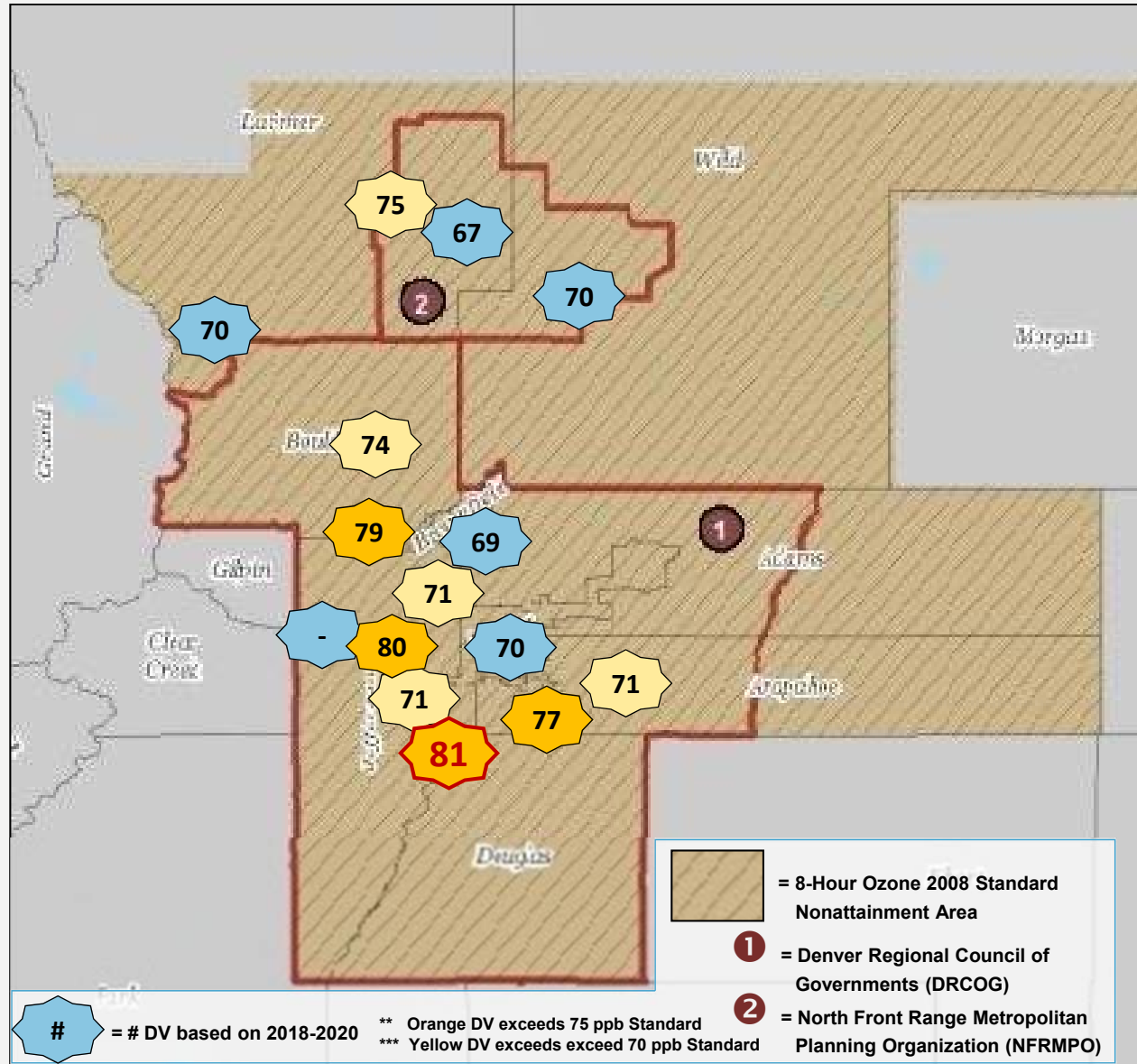
* Preliminary data - current as of 09/29/2020

¹ 8-hr Ozone NAAQS decreased from 75 ppb to 70 ppb in October 2015

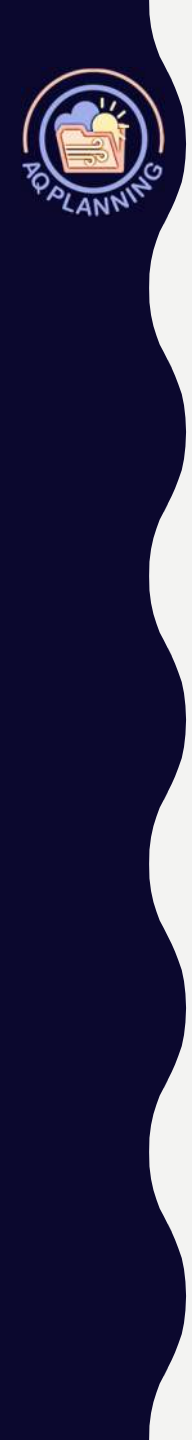
² Data for Number of Action Alert Days prior to 2011 not readily available



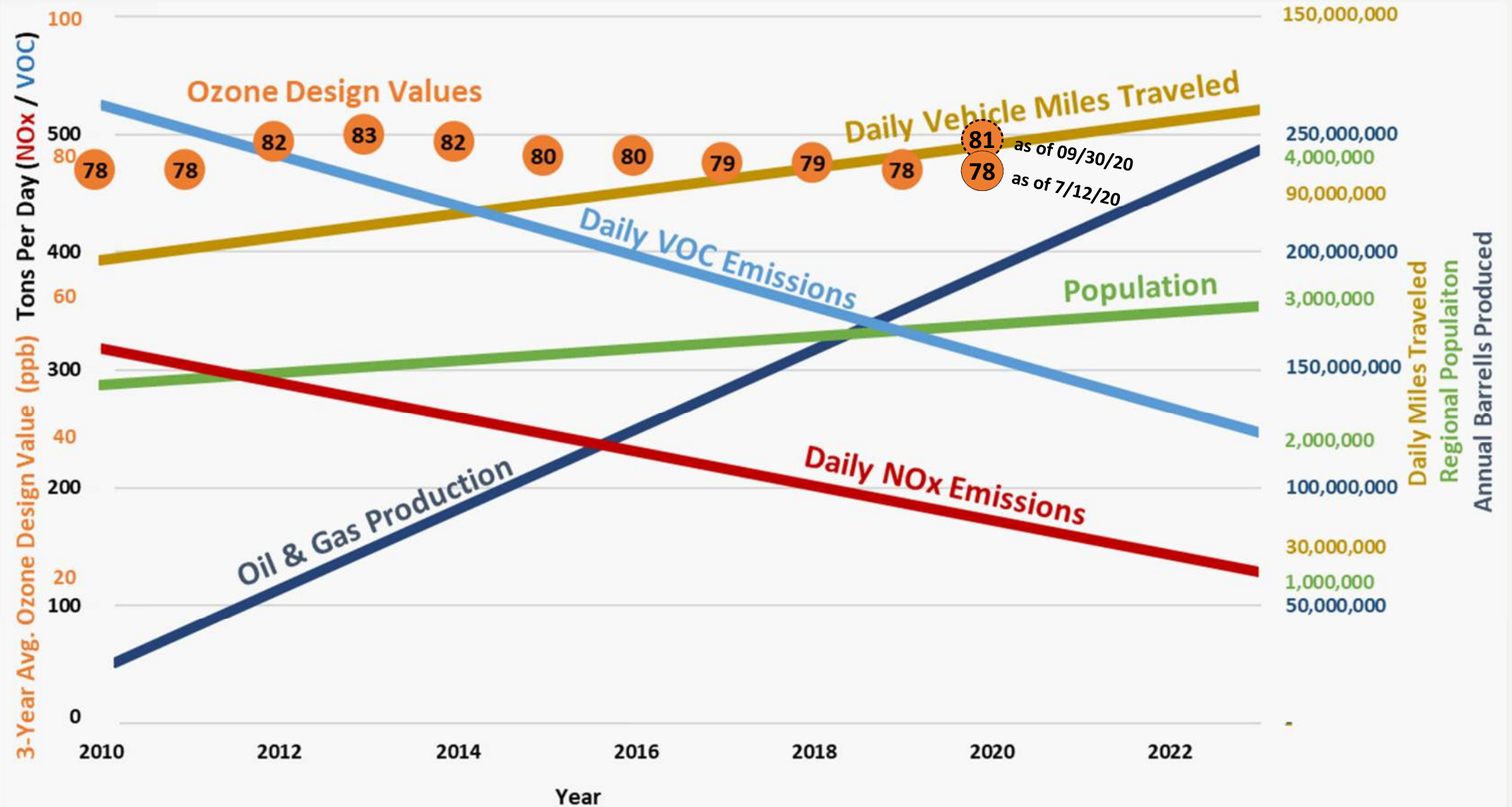
OZONE VALUES THROUGH SEPTEMBER 2020

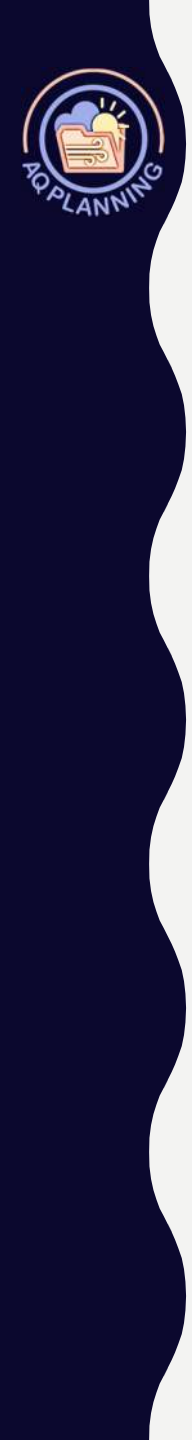


Monitor	2020 4 th High	2018-2020 DV
Chatfield State Park	83	81
NREL	87	80
Rocky Flats	84	79
Fort Collins - West	75	75
Highland	83	77
Boulder Reservoir	76	74
Welch	77	71
Greeley - Weld Tower	72	70
Rocky Mtn. Nat'l Park	72	70
Aurora East	77	71
CAMP	74	70
La Casa	78	71
Fort Collins – CSU	67	67
Welby	78	69
Blackhawk ¹	75	-



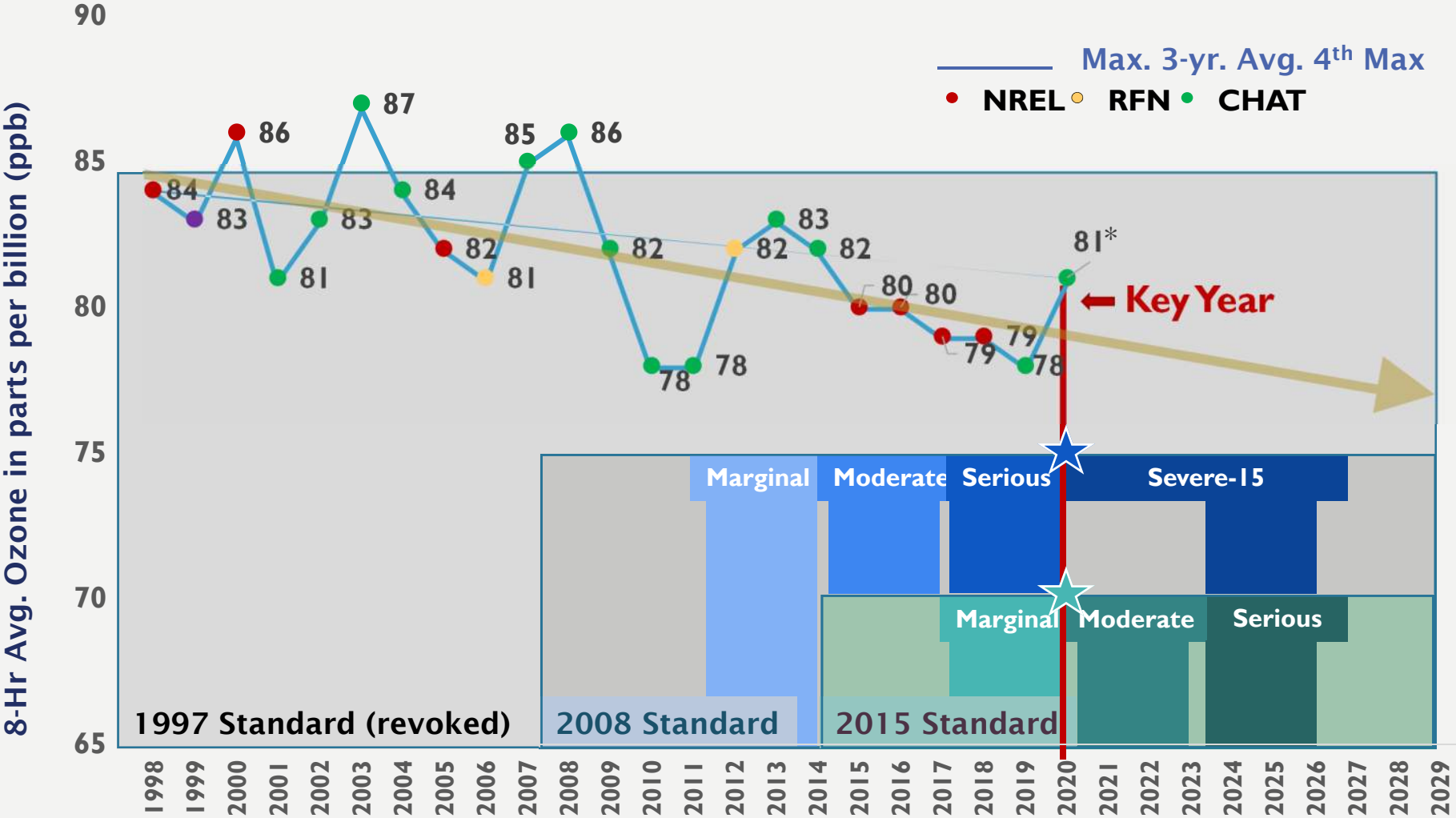
REGIONAL TRENDS (2010-2023)



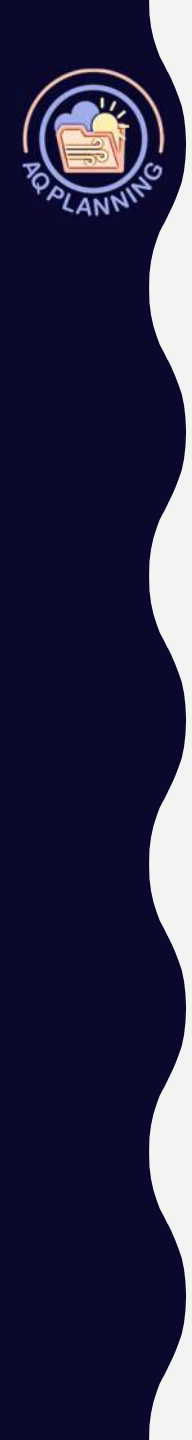


8-HOUR OZONE TRENDS AND FEDERAL STANDARDS

3-Year Design Values in the Denver Metro/North Front Range



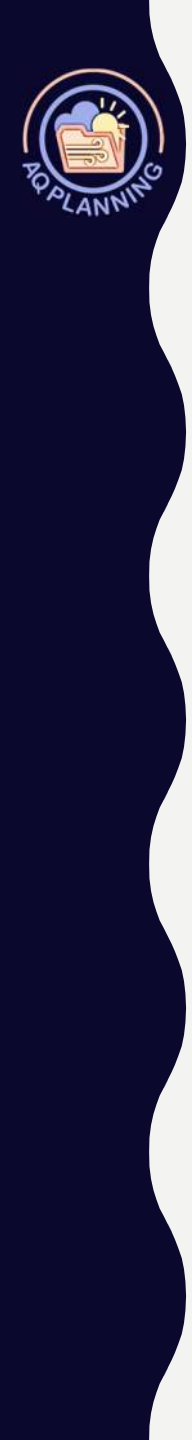
8-Hour Ozone Standard: Based on a three-year average of the annual forth-highest daily 8-hour maximum ozone concentration.
*Current as of 7/19/20.



NAAQS DESIGNATIONS & PLANNING PROCESS

EPA is required by the Clean Air Act to re-evaluate each NAAQS every 5 year and propose revisions if deemed necessary

Action	After NAAQS Promulgation
States submit area designation recommendations	1 year
EPA proposes nonattainment area rules/guidance	1 year
Final designations and classifications	2 years
States submit interstate and transport SIPs	3 years
States submit attainment plans	5-6 years
Nonattainment area attainment dates	5-24 years
Nonattainment Classification	Years to Attain
Marginal	3 years
Moderate	6 years
Serious	9 years
Severe (15 or 17)	15 or 17 years
Extreme	22 years



OZONE PLANNING TIMELINE – BOTH STANDARDS

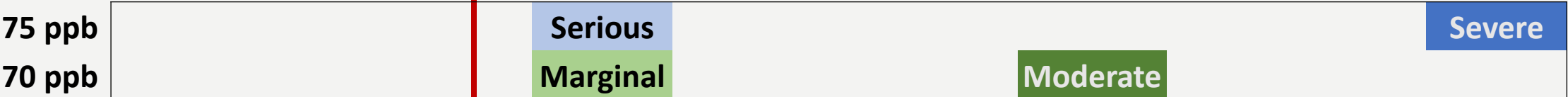
Attainment Years



SIP Due



Attainment Deadline



Reclassification



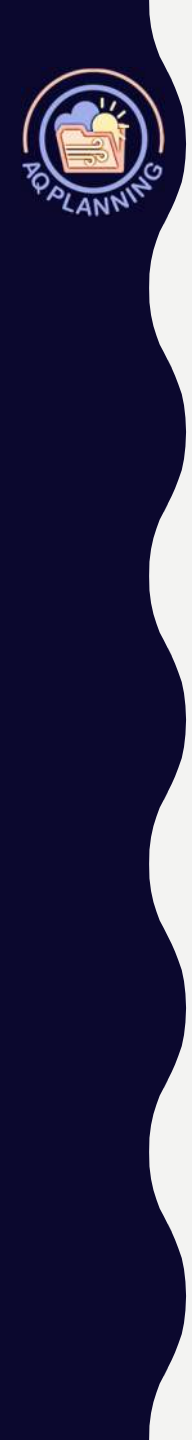
2018 2019 2020 2021 2022 2023 2024 2025 2026 2027

TODAY ►

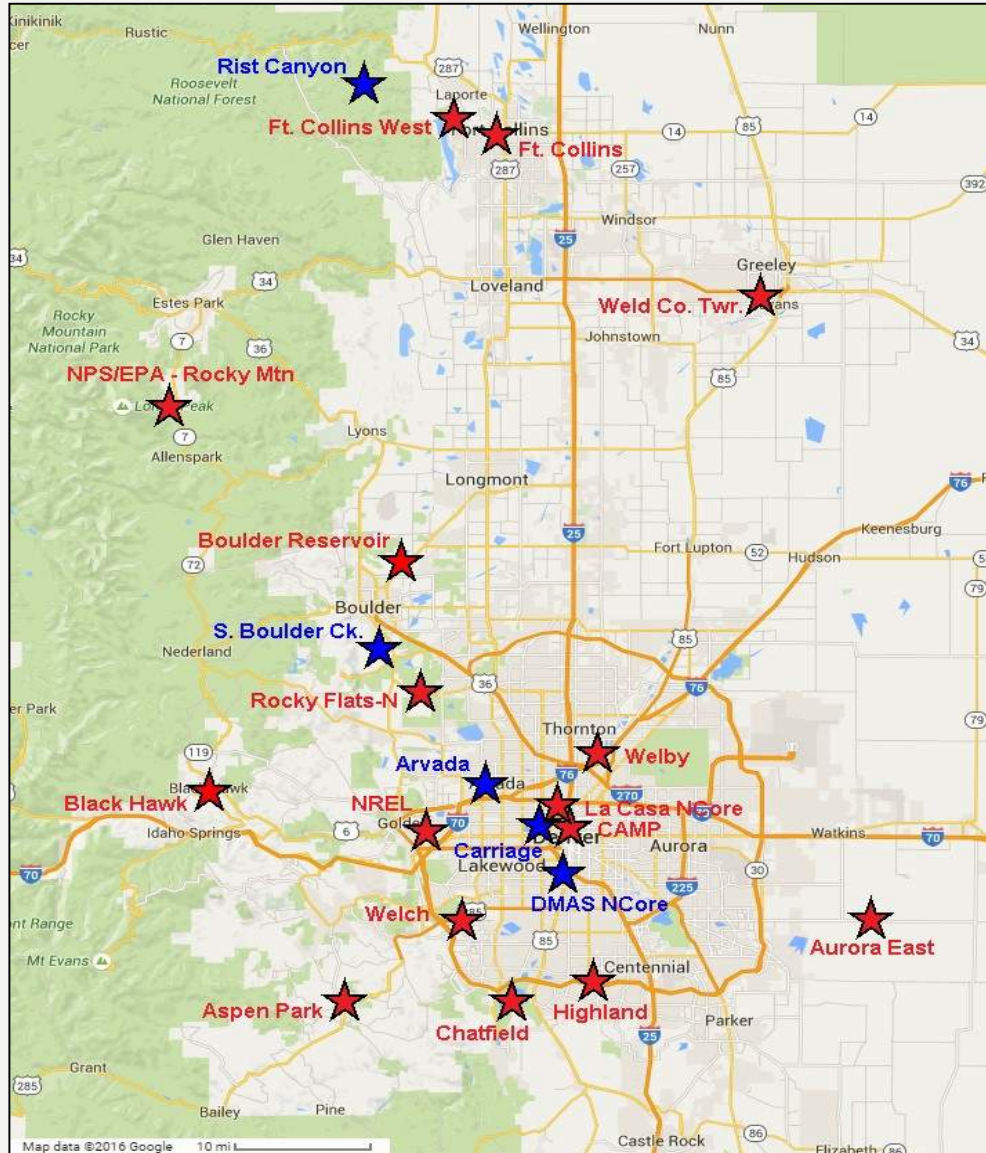


MODERATE VS. SERIOUS AREA SIP REQUIREMENTS

	Moderate	Serious
Photochemical Modeling	2017 Future Year	2020 Future Year
Reasonable Further Progress (RFP)	15% ↓ VOC 2012-2017	+9% ↓ VOC or NO _x 2018-2020
Reasonably Available Control Technology (RACT SIP)	Major Source = 100 tpy (NO _x or VOC)	Major Source = 50 tpy (NO _x or VOC)
Reasonably Available Control Measures	✓	✓
Inspection/Maintenance Program	Basic	Enhanced
New Source Review (NSR SIP) Emission offset ratio for VOC/NO _x	1.15:1	1.2:1
Contingency Measures 3% reduction in VOC and/or NO _x	✓	✓
Motor Vehicle Emissions Budgets	✓ (set at 2017 levels)	✓ (set at 2020 levels)
Clean Fuel-Fleet Programs	n/a	✓ new
Transportation Control	n/a	✓ new



OZONE MONITORING: NETWORK

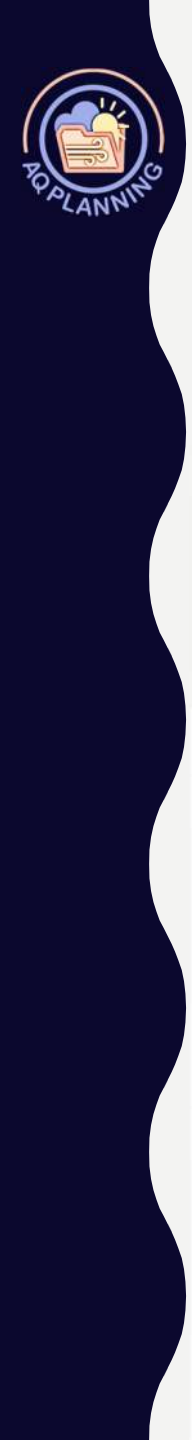


Denver Metro/North Front Range:

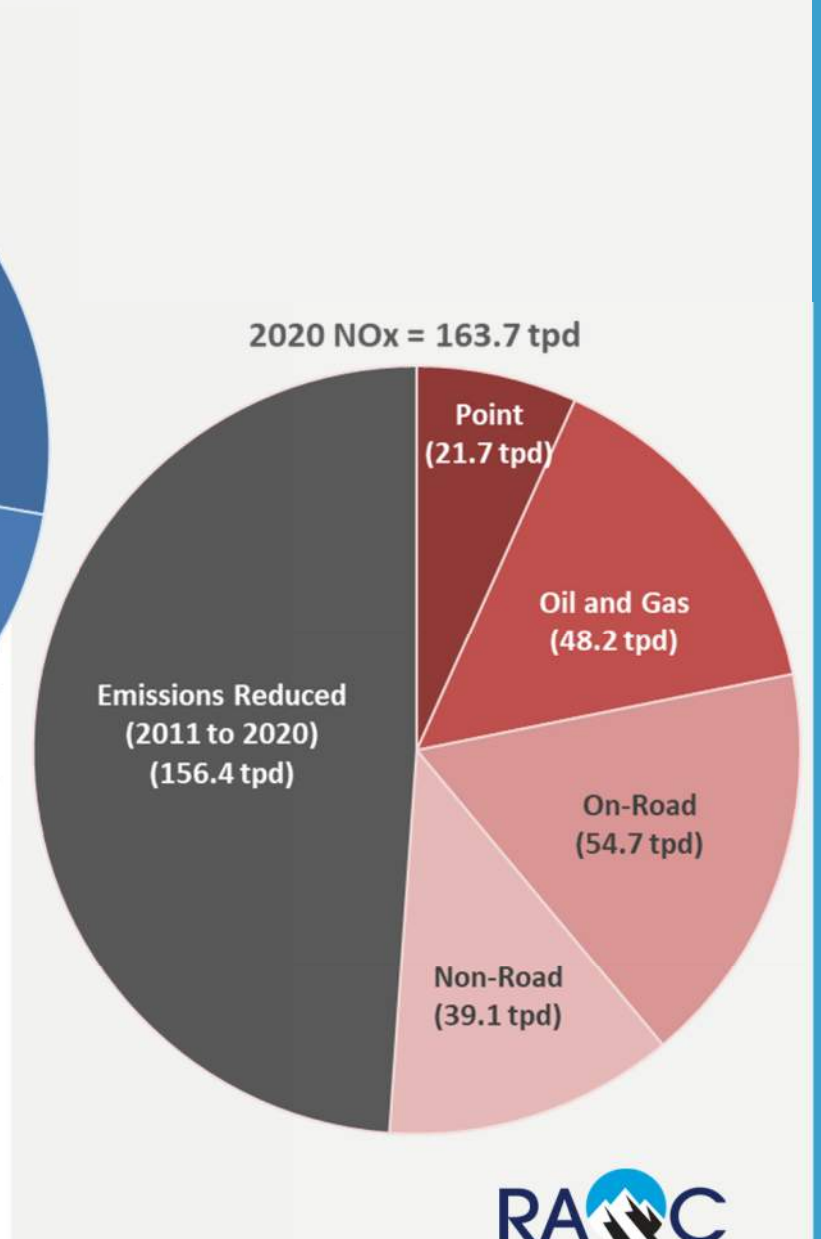
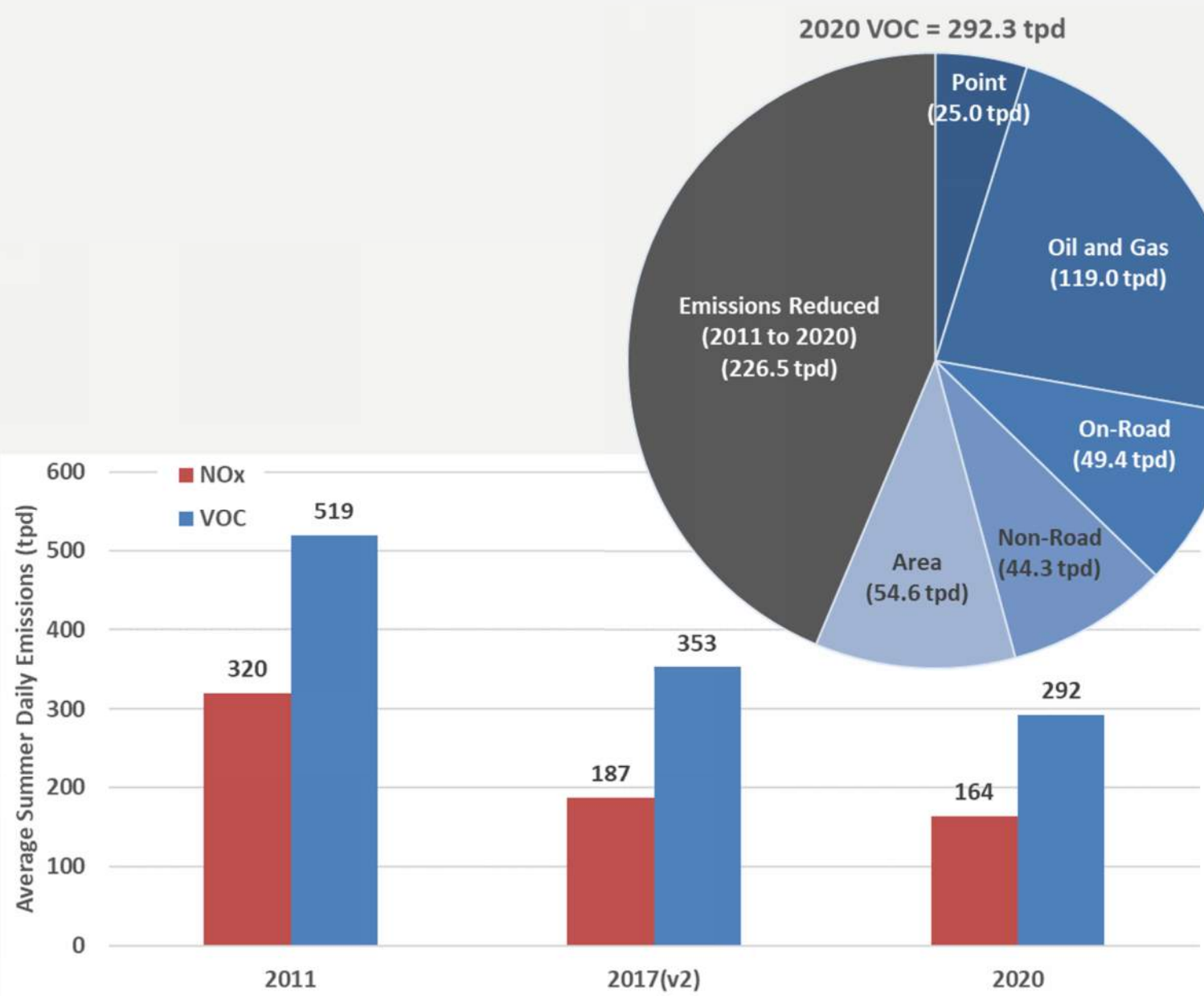
- 15 stations operated by the Colorado Air Pollution Control Division (APCD)
- 2 stations in Rocky Mountain National Park
 - 1 operated by the National Park Service (NPS)
 - 1 operated by the U.S. Environmental Protection Agency (EPA)

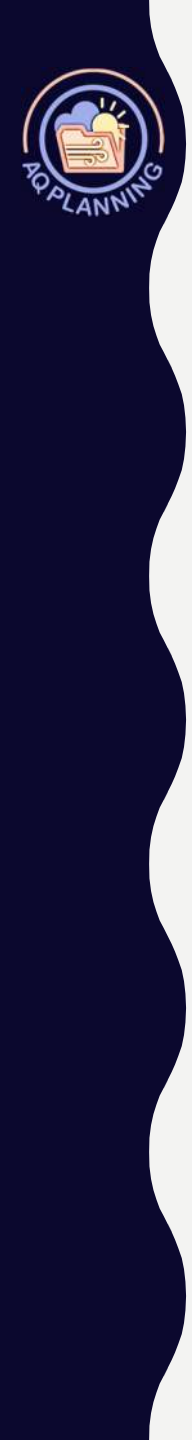
Red = Current sites in operation in 2019

Blue = Sites since 2006 that are no longer in operation



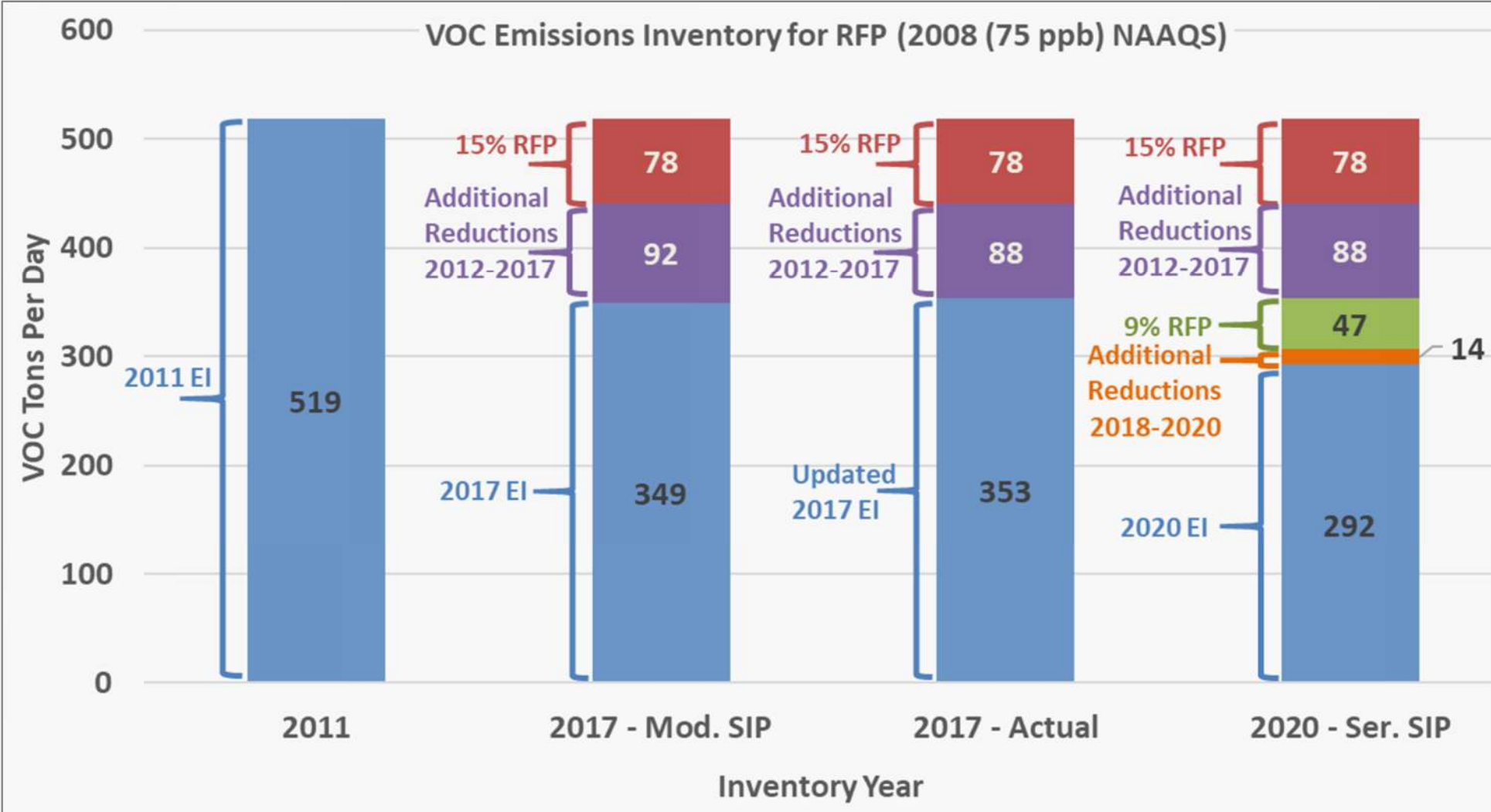
REDUCTIONS FROM BASE YEAR INVENTORY



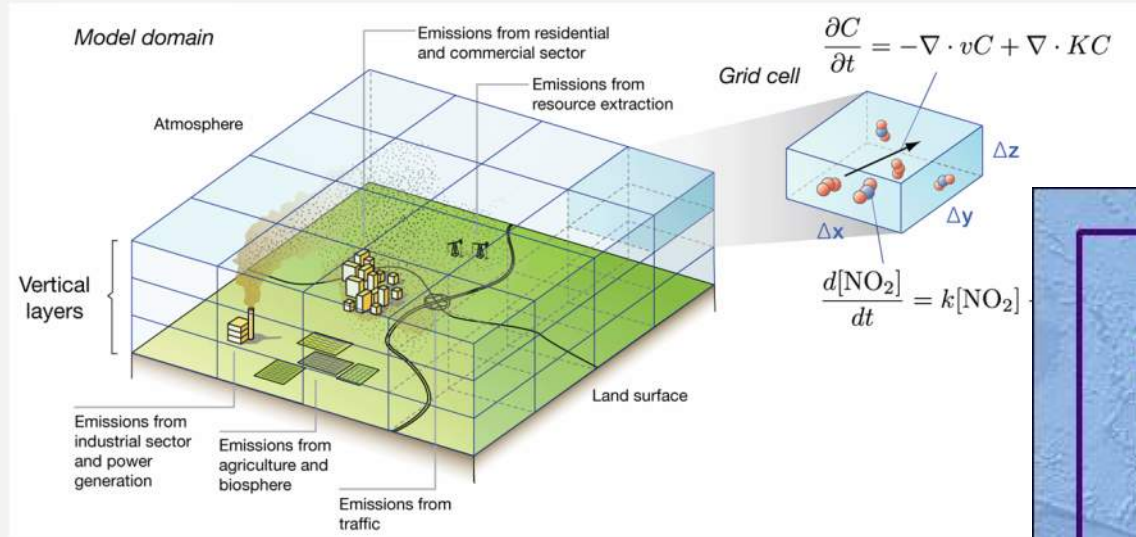


REASONABLE FURTHER PROGRESS (RFP)

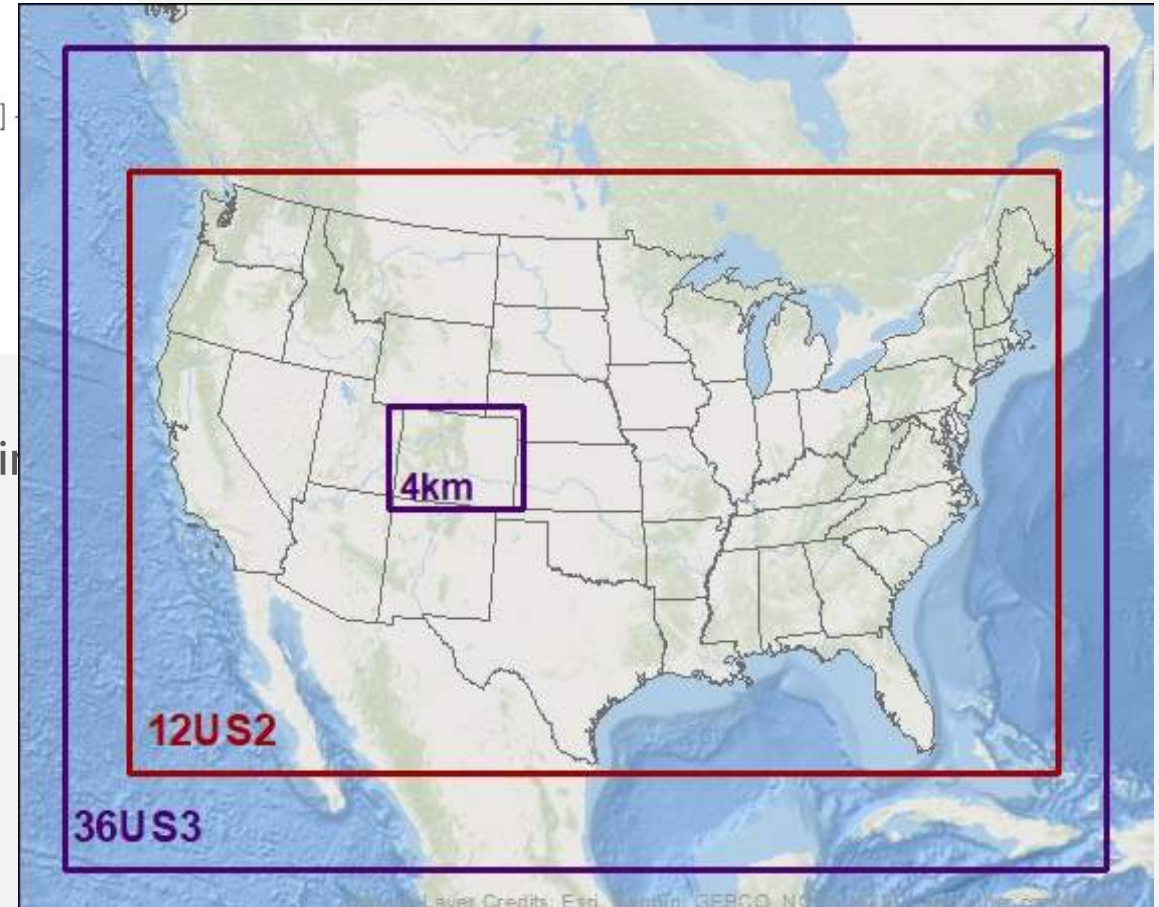
Requires a 9% reduction in VOC (or NOx) between 2017 and 2020 based on initial base year (2011) inventory



PGM Divides Modeling Domain into Boxes (Grid Cells)



DM/NFR NAA 36/12/4-km Domains



- 36/12/4-km Grid Resolution Modeling Domain
 - Two-way grid nesting between domains
 - 4-km Domain covering Colorado
 - 36/12-km domains same as EPA's 2016v1 modeling platform
 - Can use EPA 36/12-km emission inputs
- June 4th – RAQC Modeling Forum – Presentations and recording available at raqc.org

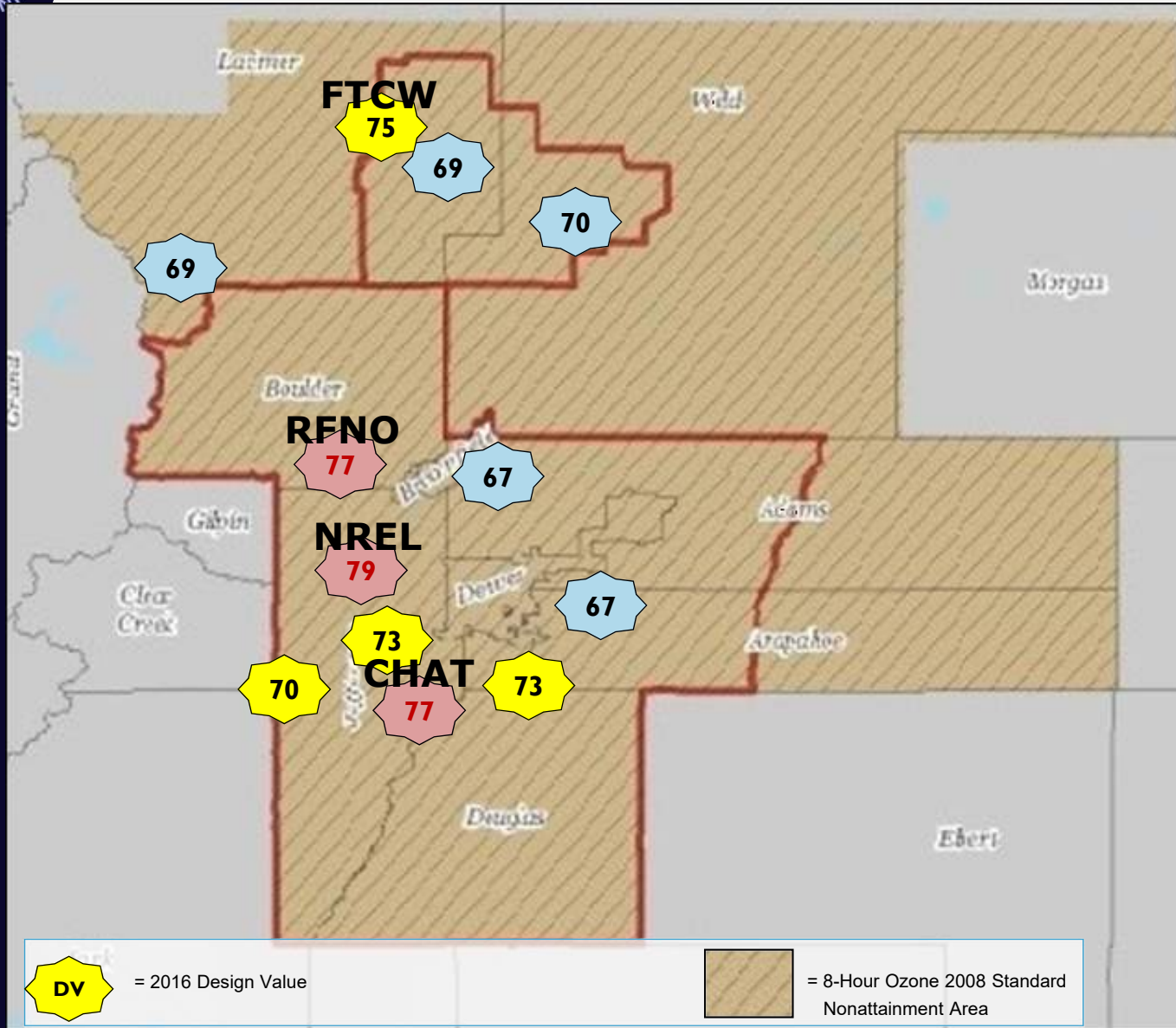


NUMEROUS EMISSIONS CONTROL PROGRAMS ALREADY IN PLACE

- New vehicle emission standards**
- Inspection and maintenance program**
- Gasoline and diesel fuel standards and requirements**
- National small engine, non-road and off-road limits**
- Industrial source permitting and emission controls**
- Numerous standards for commercial solvents/paints/coatings supplies and use**
- Architectural and industrial maintenance coatings and consumer products**
- Oil and gas industry regulations**
- Transportation planning and transit**
- Public education and outreach**



2016 5-YEAR BASE DESIGN VALUES (DVB)

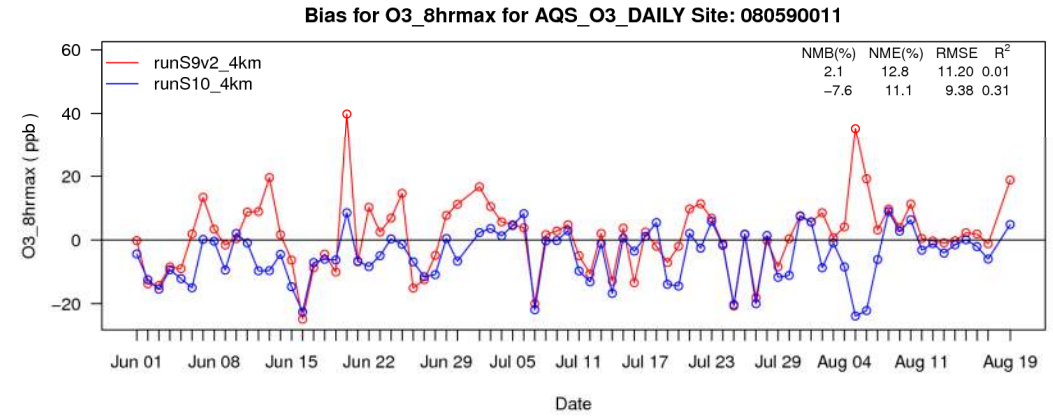
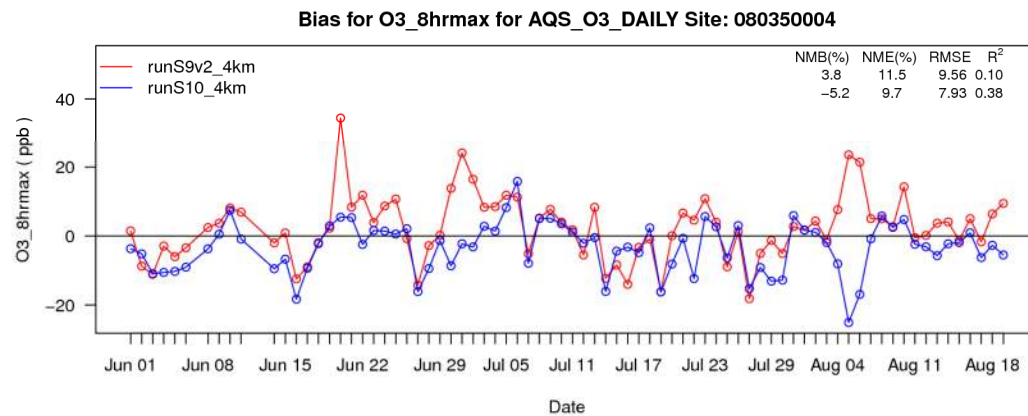
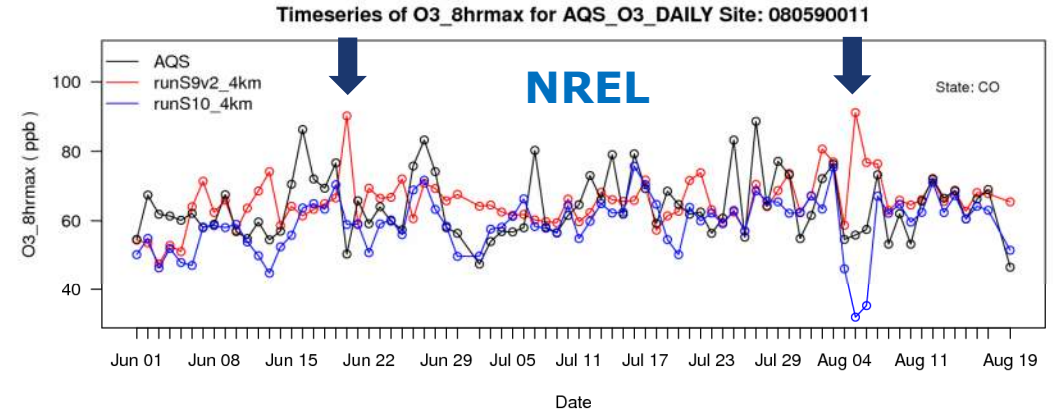
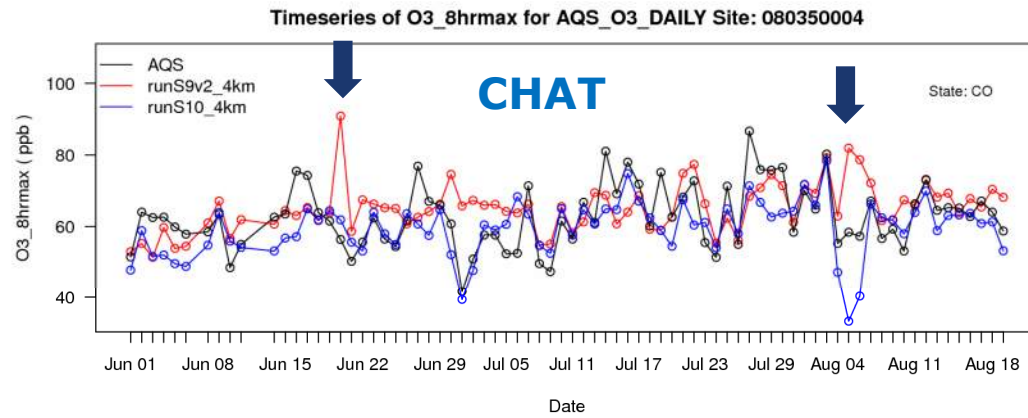


Monitor	2016 Design (ppb) Value
Chatfield	77.3
Rocky Flats North	77.3
NREL	79.3
Fort Collins West	75.7
Welby	67.0
Highlands	73.0
Aurora East	67.7
Welch	73.0
Aspen Park	70.0
Rock Mountain NP	69.0
Fort Collins CSU	69.0
Greeley	70.0



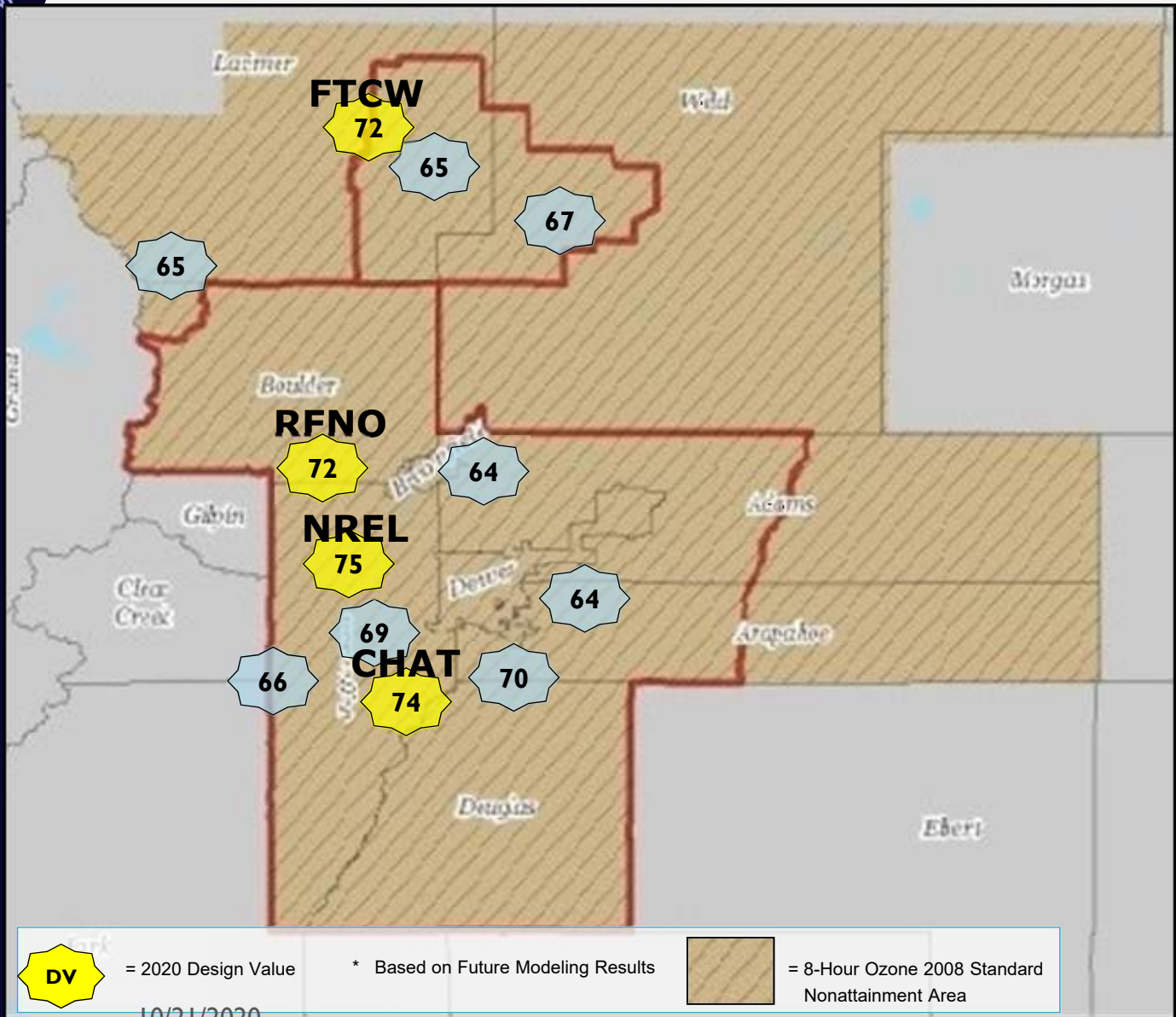
S9 and S10 DMAX8 Ozone (top) and Bias (bottom) Time Series

- S9 overestimation due to large model miss on a few days, such as June 20 and Aug 5
- S10 general ozone underestimation





2020 MODELED ATTAINMENT DEMONSTRATION



Monitor	2020 S10 3x3 Design Value (ppb)
Chatfield	74.4
Rocky Flats North	72.7
NREL	75.9
Fort Collins West	72.0
Welby	64.4
Highlands	70.6
Aurora East	65.3
Welch	69.7
Aspen Park	66.3
Rocky Mountain NP	65.7
Fort Collins CSU	65.7
Greeley/Weld Twr	67.0

10/21/2020



Ozone Bias & Error & Design Value Projection Procedures

- Green achieves Performance Goal
 - Yellow achieves Performance Criteria
- CAMx S10 (WRF/NAM) Base Case**

AQS ID	Name	NMB	NME	FB	FE
80050002	HIGH	-1.7	9.7	-1.9	10.1
80310002	CAMP	2.0	10.0	1.8	10.2
80350004	CHAT	-5.2	9.7	-5.3	10.1
80410013	ACAD	-5.4	9.8	-6.1	10.2
80410016	MANI	1.7	8.9	1.3	8.7
80590005	WELC	-0.8	9.5	-0.8	9.6
80590006	RFNO	-4.5	9.1	-4.7	9.4
80590011	NREL	-7.6	11.1	-7.9	11.8
80677001	IGNA	0.8	9.6	0.8	9.7
80690007	RMNP	-0.8	9.0	-0.7	9.1
80690011	FTCW	-6.4	9.5	-6.6	9.9
80691004	FTCO	2.4	9.7	2.4	9.8
80830006	CORT	5.7	9.3	5.6	9.1
80830101	MESA	1.6	8.0	1.4	7.9
81230009	WELD	-5.7	9.0	-6.2	9.5
CASTNet	Name	NMB	NME	FB	FE
ROM206	ROM1	-0.1	8.3	-0.1	8.4
ROM406	ROM2	-0.8	9.0	-0.7	9.1

Highest Modeled MDA8 Ozone Days at NREL with Corresponding Observed Values

- EPA Guidance recommends using the top 10 modeled ozone days to develop Relative Response Factors (RRFs)

$$RRF = \sum \text{Ozone}_{2020} / \sum \text{Ozone}_{2016}$$

$$\text{Ozone DVF} = \text{Ozone DVB} \times \text{RRF}$$

- Top 10 modeled ozone days (green)
- Top 10 modeled days overlaps with many top 20 observed ozone days (yellow)
- Alternative 2020 ozone DV projection approach to add ozone MPE criteria when selecting top 10 days (blue):
 - Require predicted/observed ozone values to be within 10% and 15% of each other

Date	Obs	S10	Bias	Bias%
7/16/2016	79.3	75.7	-3.5	-4%
8/3/2016	76.3	75.3	-0.9	-1%
6/27/2016	83.3	71.7	-11.6	-14%
8/12/2016	72.1	71.0	-1.1	-2%
7/17/2016	69.3	70.4	1.1	2%
6/19/2016	76.6	70.3	-6.3	-8%
6/26/2016	75.8	68.9	-6.9	-9%
7/27/2016	88.6	68.6	-20.0	-23%
8/14/2016	68.8	67.2	-1.5	-2%
8/1/2016	61.5	67.1	5.6	9%
8/7/2016	73.3	67.1	-6.1	-8%
7/6/2016	58.0	66.3	8.3	14%
7/28/2016	64.3	65.6	1.4	2%
7/29/2016	77.1	65.4	-11.7	-15%
7/13/2016	66.1	64.9	-1.2	-2%
6/17/2016	72.0	64.9	-7.1	-10%
8/9/2016	62.0	64.7	2.7	4%
7/18/2016	59.3	64.7	5.5	9%
7/10/2016	61.5	64.4	2.9	5%
8/16/2016	66.3	64.2	-2.1	-3%
7/21/2016	61.9	63.9	2.0	3%
6/16/2016	86.3	63.7	-22.6	-26%
8/2/2016	72.1	63.4	-8.7	-12%
6/18/2016	69.4	63.3	-6.0	-9%
6/28/2016	74.1	63.3	-10.9	-15%
8/17/2016	69.0	63.0	-6.0	-9%
7/25/2016	83.3	62.9	-20.3	-24%
7/15/2016	61.9	62.4	0.6	1%
8/11/2016	65.6	62.4	-3.2	-5%
8/13/2016	66.5	62.4	-4.1	-6%



WEIGHT OF EVIDENCE ANALYSIS

- Sensitivities:
 - Exclusion of Exceptional Events
 - Model Performance Attainment Test Using Various Bias Thresholds
- Weather-Corrected Trends
- Trends in Ambient Air Quality and Emissions
- Additional Measures Implemented Between 2017 and 2020 that Reduce Emissions

7 x 7 Matrix with 4 km Grid

	1	2	3	4	5	6	7
1	4 km	4 km	4 km	4 km	4 km	4 km	4 km
2	4 km	4 km	4 km	4 km	4 km	4 km	4 km
3	4 km	4 km	4 km	4 km	4 km	4 km	4 km
4	4 km	4 km	4 km	<i>Monitor</i>	4 km	4 km	4 km
5	4 km	4 km	4 km	4 km	4 km	4 km	4 km
6	4 km	4 km	4 km	4 km	4 km	4 km	4 km
7	4 km	4 km	4 km	4 km	4 km	4 km	4 km

Monitor	2020 S10 3x3 Design Value (ppb)	2020 S10 1x1 Design Value (ppb)	2020 S10 7x7 Design Value (ppb)	Without Flagged Exceptional Events (3x3)	2020 S10 15% Performance Criteria (3x3)
Chatfield	74.4	74.5	73.7	73.9	74.4
Rocky Flats North	72.7	72.8	72.9	72.2	73.2
NREL	75.9	76.8	75.2	74.7	76.0
Fort Collins West	72.0	72.0	71.6	70.2	72.1



MOTOR VEHICLE EMISSIONS BUDGETS

- Motor Vehicle Emissions Budgets (MVEB) are the total allowable emissions, as defined in a submitted or approved SIP, allocated to highway and transit vehicle use for the purpose of attaining the National Ambient Air Quality Standards (NAAQS)
- MVEBs are required for Transportation Conformity to:
 - Ensure federally funded or approved highway and transit activities “conform to” the purpose of the SIP (i.e. do not exceed the allowable emissions budget)
- Current budgets for nitrogen oxides (NO_x) and volatile organic compounds (VOC) for the 2008 Ozone NAAQS were established in 2016 and found adequate by EPA in 2018.



MVEB SUBREGIONS

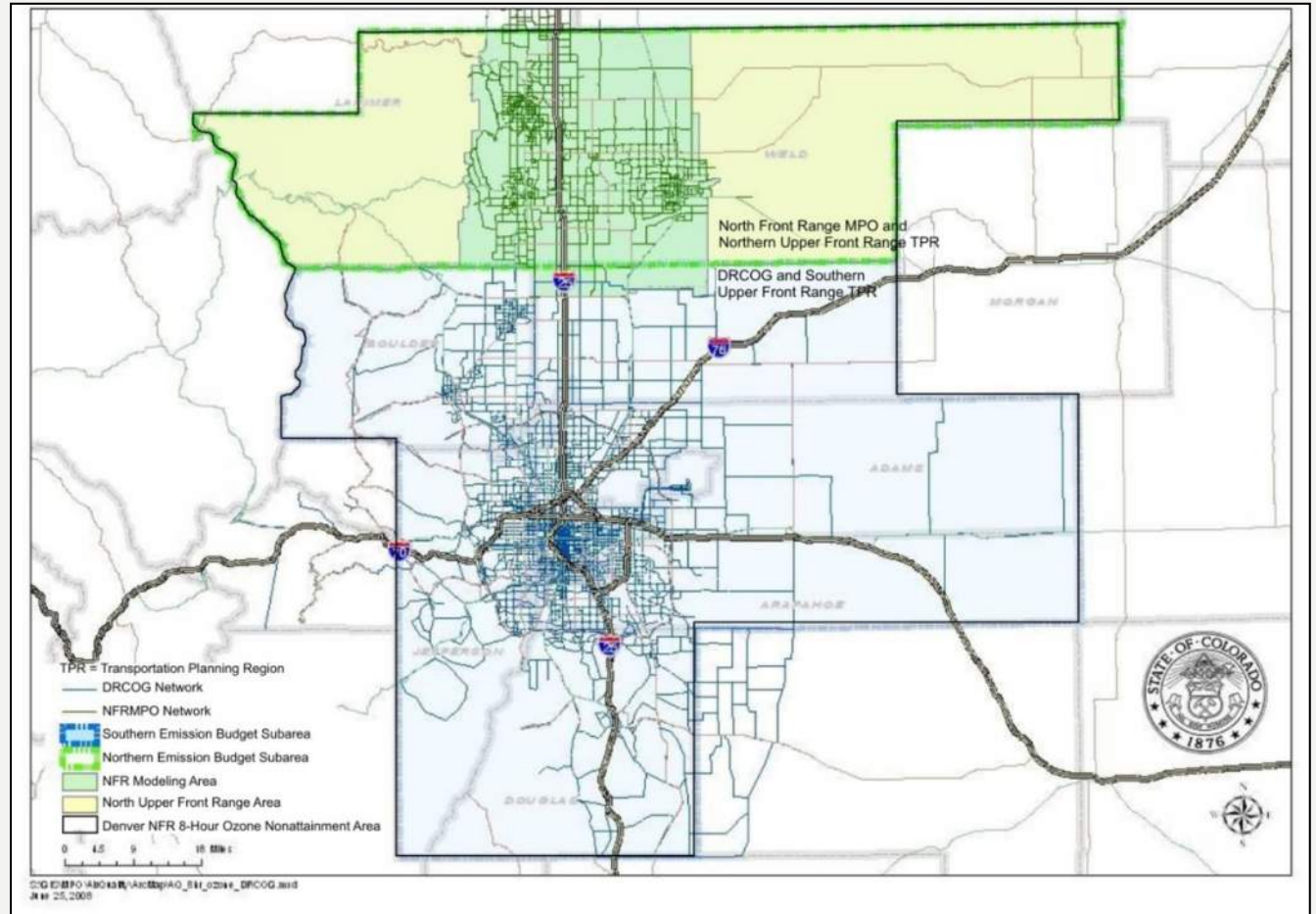
Both a regional and two subregional budgets are set for the two metropolitan planning areas within the ozone nonattainment area:

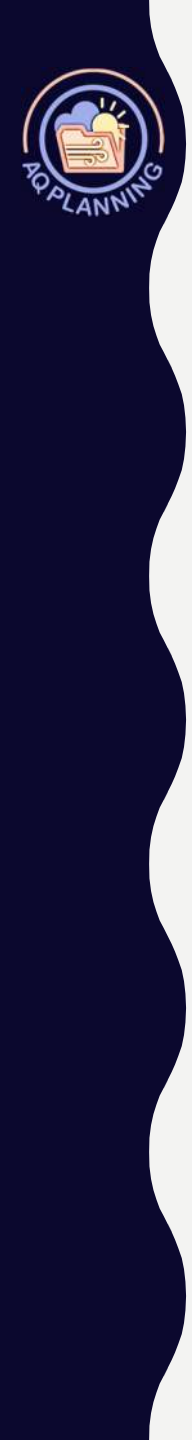
Northern Subregion

North Front Range Metropolitan Planning Organization (NFRMPO) planning area and northern portion of Upper Front Range Transportation Planning Region (TPR)

Southern Subregion

Denver Regional Council of Governments (DRCOG) planning area and southern portion of Upper Front Range TRP



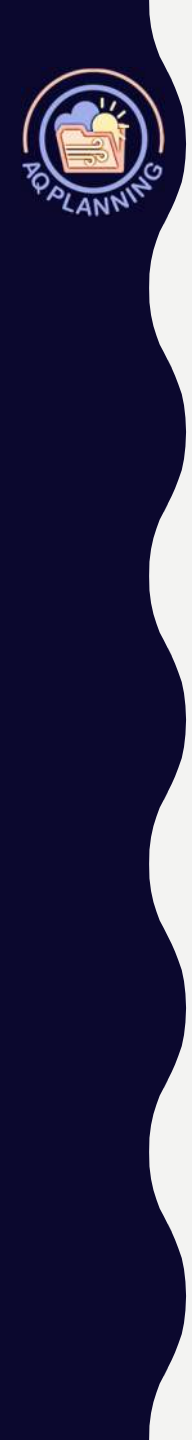


SETTING OF NEW BUDGETS

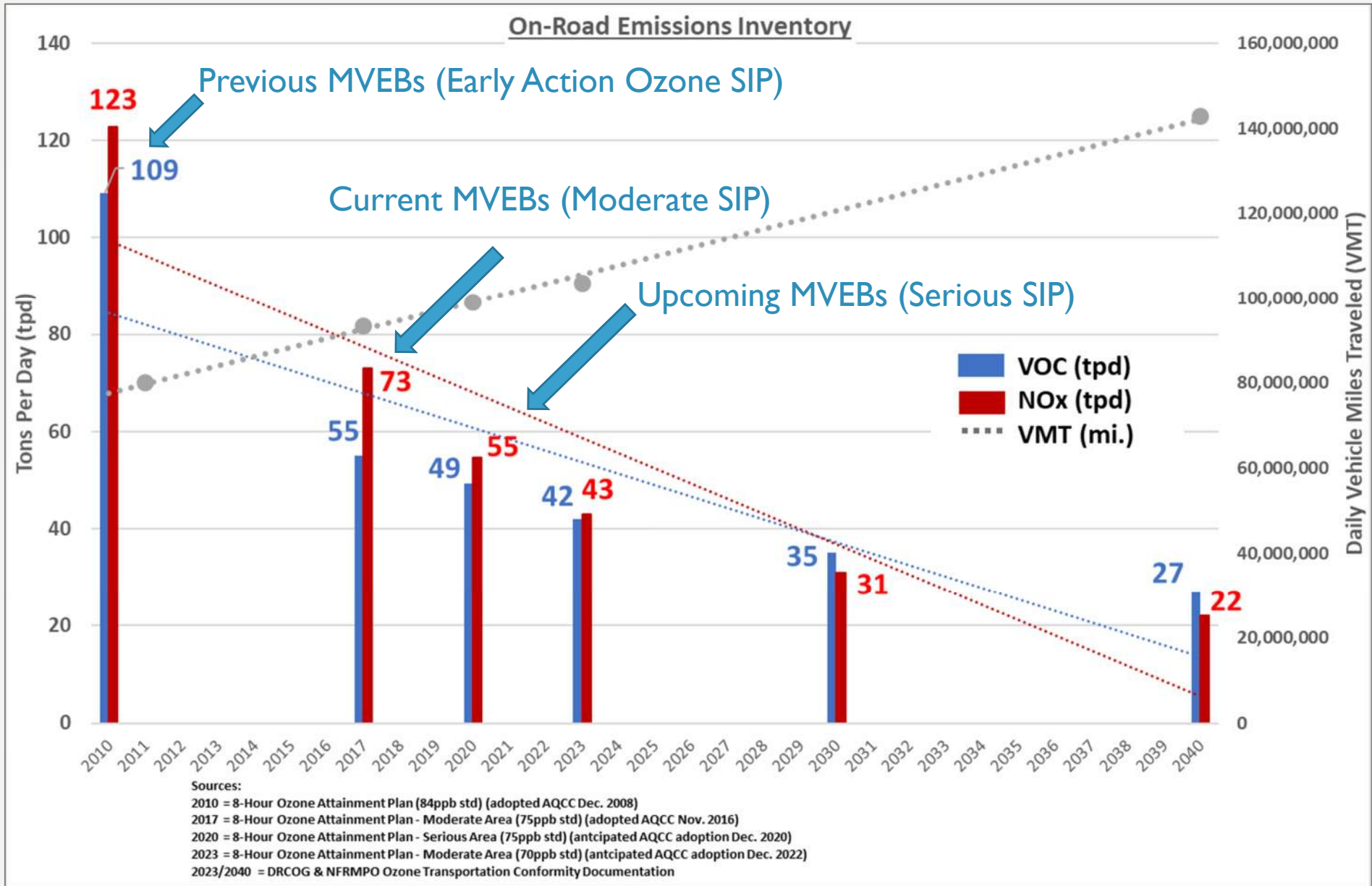
- New, updated budgets are being set as part of the Serious SIP revision
- Based on 2020 mobile source emissions inventory
- Will be in effect for:
 - 2008 (75 ppb) Ozone NAAQS
 - 2015 (70 ppb) Ozone NAAQS
- Will be effective upon EPA’s finding of adequacy or approval
 - Estimated mid to late 2021

Motor Vehicle Emissions Budgets	2020	
	VOC (tpd)	NO _x (tpd)
Northern Subarea Budget (NFRMPO& UFR TPR Subarea)	8.2	9.7
Southern Subarea Budget (DRCOG & UFR TPR Subarea)	41.2	45.0
Total Nonattainment Area Budget (Entire Nonattainment Area)	49.4	54.7

* MVEB and subsequent conformity analyses are expressed as whole numbers.
10/21/2020 RAQC - 2020 Ozone Season and Serious SIP



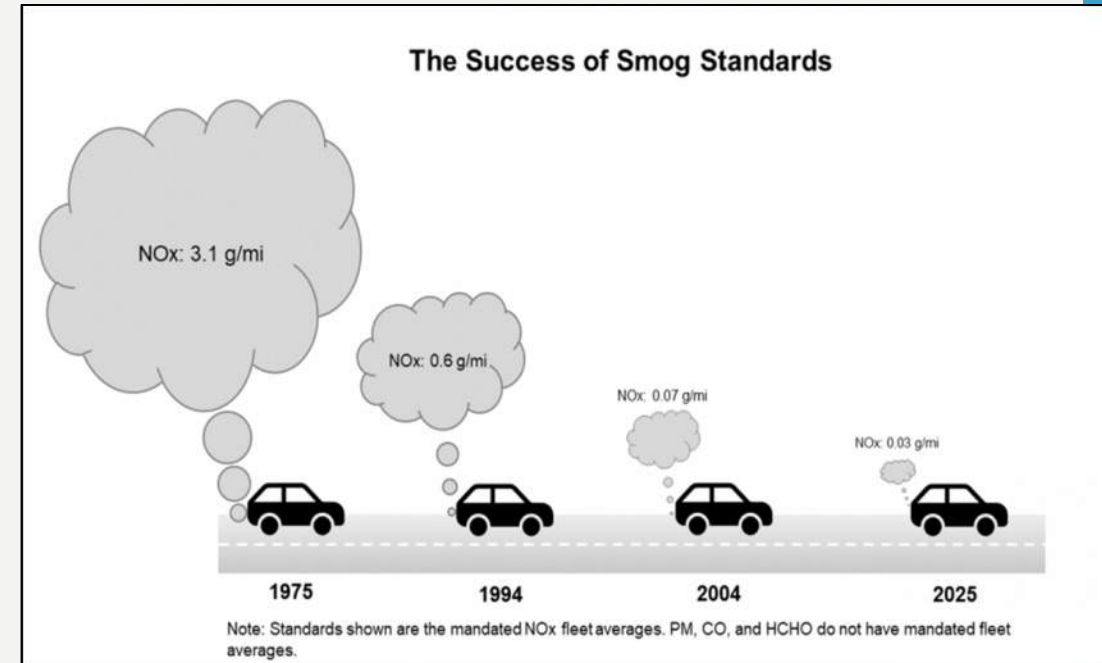
MVEB NOX AND VOC TRENDS





CLEAN FUEL FLEET PROGRAM

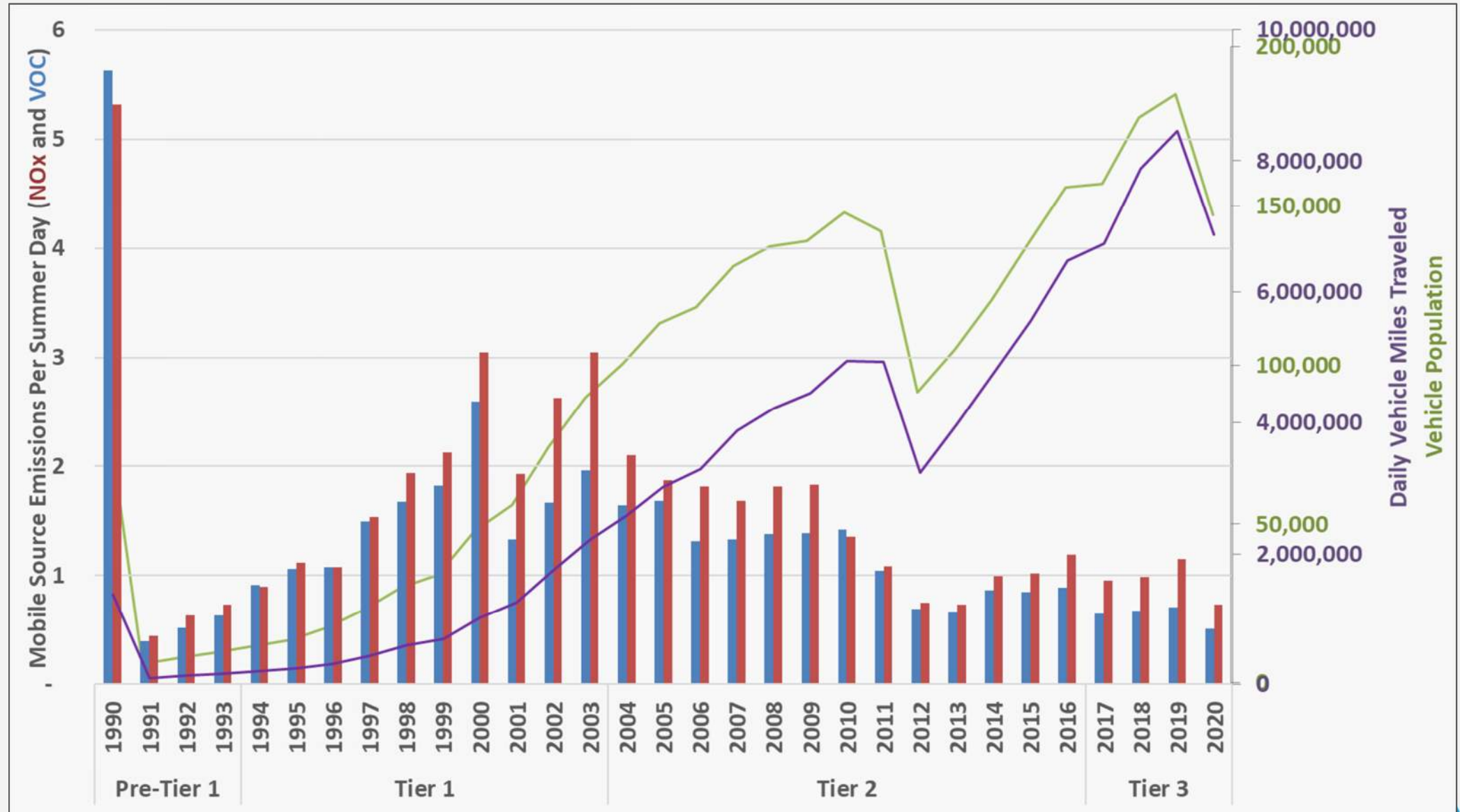
- Requires fleet operators with 10 or more centrally-fueled vehicles or vehicles capable of being centrally-fueled to include a specified percentage of clean-fuel vehicles (CFV) in their purchases each year.
- In March 2016, EPA noted that the CFFP standards have been superseded by newer, more stringent standards, and thus Tier 2+ vehicles are as clean as or cleaner than this requirement.



- EPA has proposed revisions to this requirement, which will likely include a Zero Emission Vehicle (ZEV) component and which Colorado should be able to meet with the adoption of AQCC Reg. No. 20 in 2019.



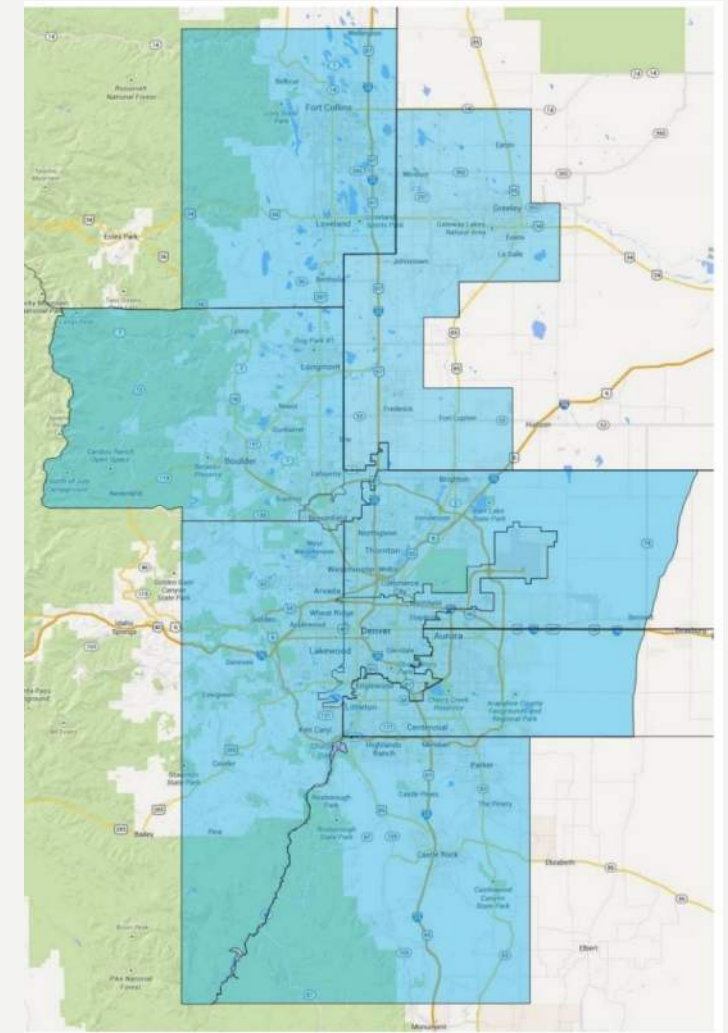
DM/NFR NONATTAINMENT AREA ON-ROAD FLEET TRENDS





ENHANCED I/M PROGRAM REVISIONS

- **2016-Reincorporated North Front Range into the I/M SIP**
 - Larimer/Weld had been State-Only enhanced counties since 2010
 - Needed to show Moderate attainment
- **New ‘Serious’ I/M Compliance Statement**
 - Serious NA requires an Enhanced I/M Program
 - A requirement that Colorado already meets (since 1995)
- **Minor revisions to inspection procedures and clarity of the rule including:**
 - Clean screen low emitter index update
 - OBD Readiness and pass/fail criteria
 - OBD Fraud Identification
- **All I/M SIP revisions from 2013 – 2017 were approved By EPA February 7, 2019**
- **New closing statement confirming Colorado’s current I/M program meets the Enhanced I/M Performance Standard**
 - Thereby meeting SIP requirements for I/M in Serious Nonattainment

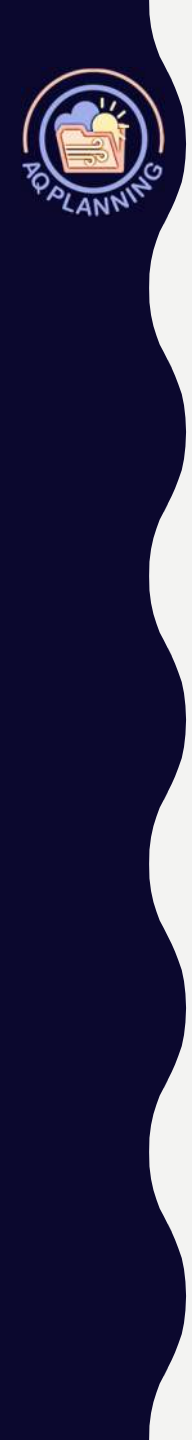




CONTINGENCY MEASURES

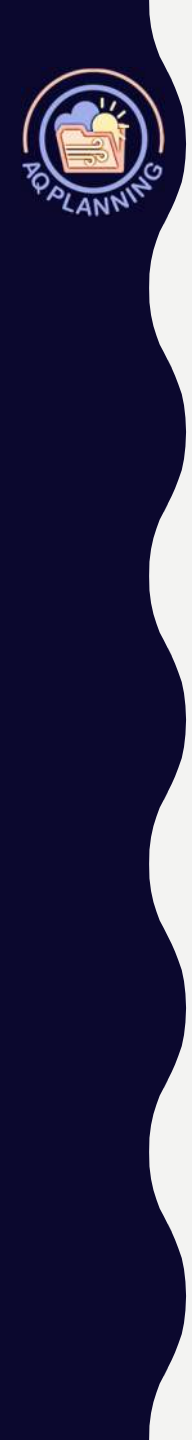
- State's may use federal measures to meet the Contingency Plan requirement.
- Future year reduction in NO_x and VOC from on-road mobile source emissions is being used for the Serious SIP.

		Emissions (tpd)*		
Line #	Description	VOC	NOx	
3% Contingency Requirement				
1	NAA 2011 base year emissions inventory	518.8	320.0	
2	3% contingency reduction goal (NOx and/or VOC)	1.0%	2.0%	3% needed
3	3% contingency reduction goal (NOx and/or VOC)	5.2	6.4	
4	NAA 2020 on-road mobile emissions inventory	49.9	56.8	
5	NAA 2022 on-road mobile emissions inventory	44.5	47.3	4% achieved
6	Total creditable mobile source reductions in 2022	5.4	9.5	
7	% contingency reductions achieved	1.0%	3.0%	
8	Excess (+) / Shortfall (-)	0.2	3.1	
Is 3% Contingency Requirement Met?		Yes	Yes	



SIP RACT Basics

- Reasonably Available Control Technology (RACT) SIPs must
 - Contain adopted RACT regulations
 - CTG VOC source categories
 - Major sources
 - Conclude that existing provisions are still RACT
 - Contain negative declarations (no sources)
- States must refer to
 - Current EPA guidance – Control Technique Guidelines (CTG) and Alternative Control Techniques (ACT)
 - Current economic and technological feasibility
 - Other available and relevant information
- RACT must be implemented by July 20, 2021



Major (≥ 50) Sources

VOC

- ACH Foam
- Atlas Roofing
- Avago Technologies
- BASF Corporation
- Boulder Scientific
- Carestream
- Circle Graphics
- Coblaco
- Coors Brewing Endline
- Costco
- Frederic Printing
- Front Range Energy
- Golden Aluminum
- Greeley Energy Facility
- Intertape
- Magellan Pipeline
- Musket Corporation
- Northern Priming and Prestain
- Owens Corning Roofing
- Rocky Mountain Prestain
- Sandoz
- Sun Mountain
- TruStile Doors
- Upsher-Smith

NO_x

- Astrazeneca
- Avago Technologies
- Centura Health St. Anthony Hospital
- Comcast
- CoorsTek – Ninth Street & Clear Creek Valley Plant
- Cyxtera Communications
- Denver – DIA
- Front Range Energy
- Golden Aluminum
- Greeley Energy Facility
- Leprino Foods
- Nestle Purina
- PSCo – Blue Spruce
- PSCo Lookout Center
- Qwest
- SWG – Arapahoe & Valmont
- Swift Beef
- University of Colorado Denver Anschutz
- Waste Management – DADS



NANSR - APPLICABILITY

Nonattainment Status	Threshold for Major stationary source (in ozone nonattainment area)	Major modification (Physical change resulting in a significant increase of emissions)	Offsets, for ozone nonattainment*
Marginal			at least 1.1:1
Moderate	100 tpy VOC or NOx	40 tpy VOC or NOx	at least 1.15:1
Serious	50 tpy VOC or NOx	25 tpy VOC or NOx	at least 1.2:1
Severe	25 tpy VOC or NOx	25 tpy VOC or NOx	at least 1.3:1
Extreme	10 tpy VOC or NOx	any increase of VOC or NOx	at least 1.5:1

*Offsets can be found by reducing emissions from other sources within the nonattainment area or acquiring credits from an “emission bank”



RACM Evaluation Criteria

- 1) Necessary to demonstrate attainment
- 2) Are technologically or economically feasible
- 3) Have been successfully implemented in other Serious nonattainment areas
- 4) Could be implemented by ozone season 2020
- 5) Could qualify as SIP measures by being:
 - Quantifiable;
 - Enforceable;
 - Permanent; and
 - Surplus



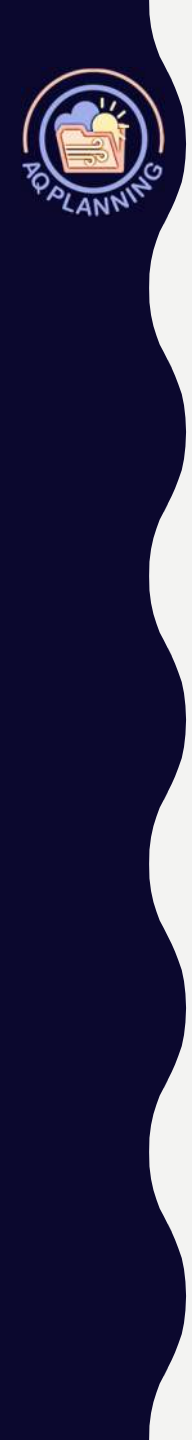
RACM Evaluation

Categories of Strategies Evaluated

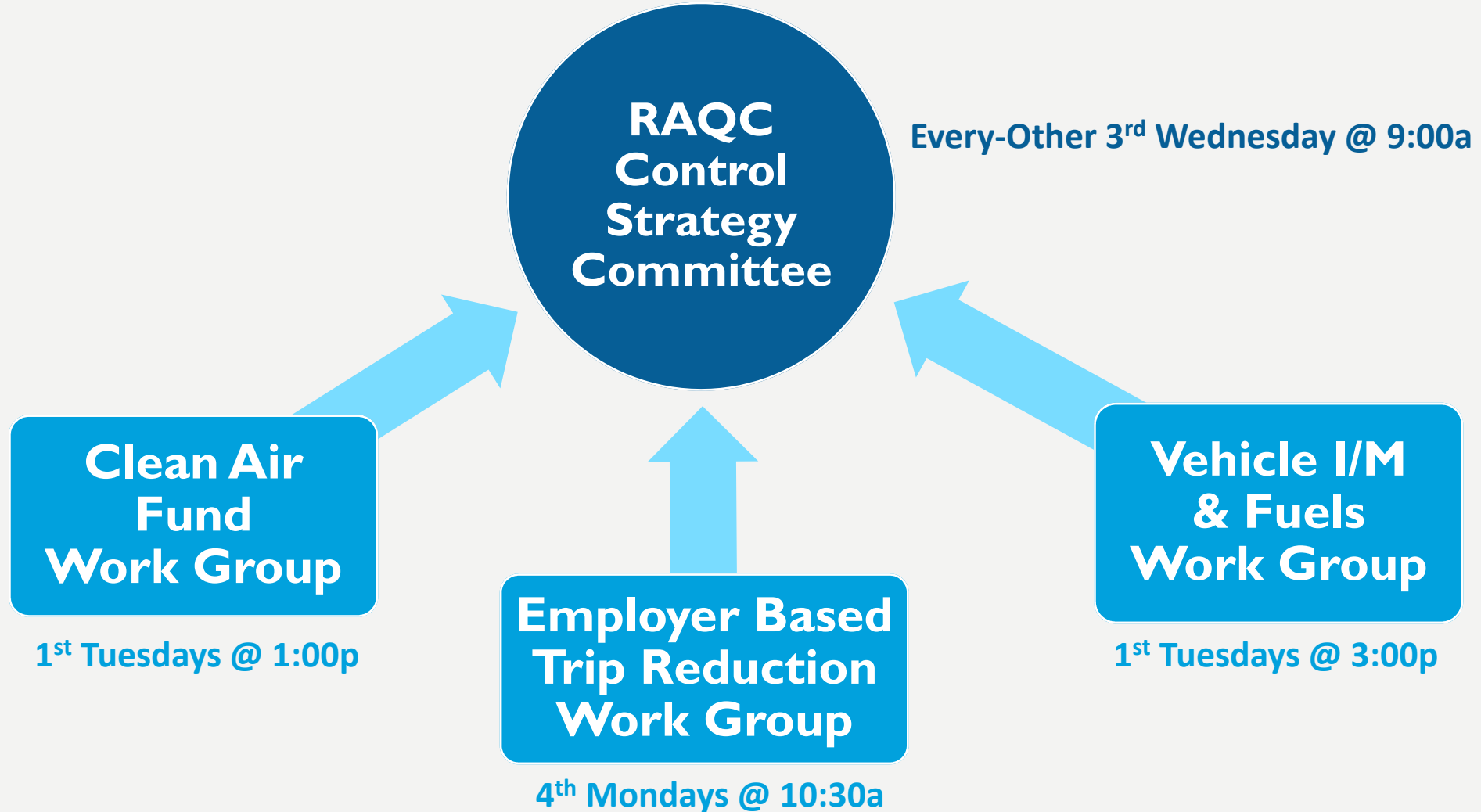
- Oil and Gas
- Vehicle
 - Inspection and Maintenance (I/M)
 - Fuels
- Transportation and Land Use
- Local Government Policies
- Outreach

Conclusion

- No strategies were determined to be RACM for the Serious SIP
- However, many are still being evaluated for future implementation through the RAQC Control Strategy Committee




RAQC CONTROL STRATEGY COMMITTEE

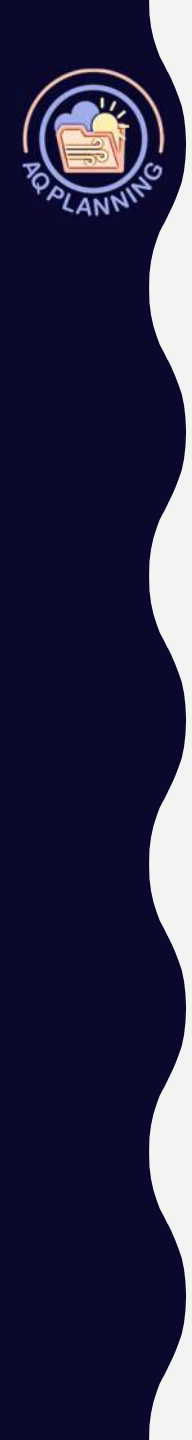


Meetings open to the public. raqc.org/control-strategy-committee-information/
Sign-up for notifications: raqc.org/email-signup/



SERIOUS SIP REVIEW AND APPROVAL SCHEDULE

Action	Date
RAQC Board Review of SIP Chapters	Jan. –June 2020
FINAL Proposed SIP to RAQC Board for Endorsement	August 7, 2020
AQCC SIP Public Comment and Rulemaking Process	Sept. – Dec. 2020
Request for Rulemaking Hearing	Sept. 17, 2020
 Stakeholder Process	Sept. – Dec. 2020
AQCC Rulemaking Hearing and SIP Approval	Dec. 16-18, 2020
Colorado Legislative Review of SIP Regulations	Jan. 2021
Serious SIP Submittal to EPA	Feb. 2021



OZONE PLANNING TIMELINE – BOTH STANDARDS

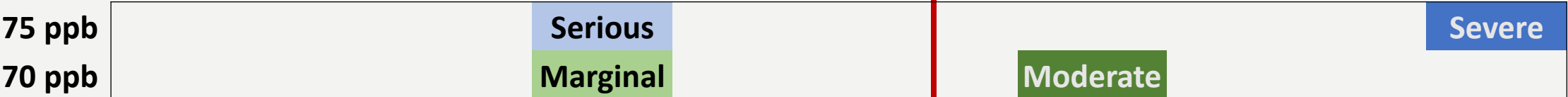
Attainment Years



SIP Due



Attainment Deadline



Reclassification

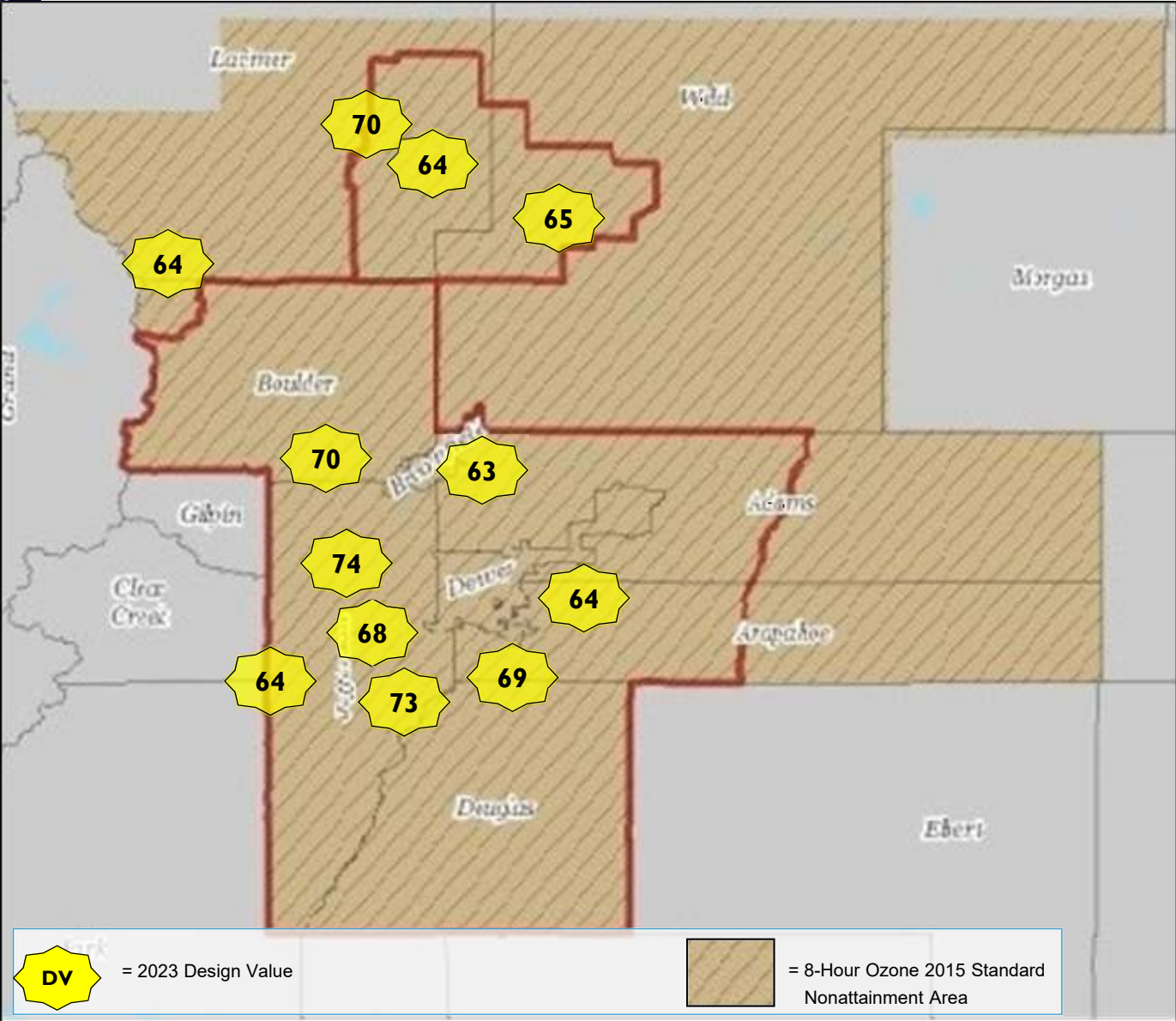


2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027

Next Plan(s) to Develop ►



2023 FORECAST DESIGN VALUES (DVF) (3X3)



Monitor	2023 S10 3x3 Design Value (ppb)
Chatfield	73.1
Rocky Flats North	70.9
NREL	74.4
Fort Collins West	70.8
Welby	63.4
Highlands	69.5
Aurora East	64.3
Welch	68.2
Aspen Park	64.8
Rocky Mountain NP	64.8
Fort Collins CSU	64.6
Greeley/Weld Twr	65.9



Questions?

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