

COVID impacts on Ozone and Ozone Precursors in Maricopa County

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December 17, 2020

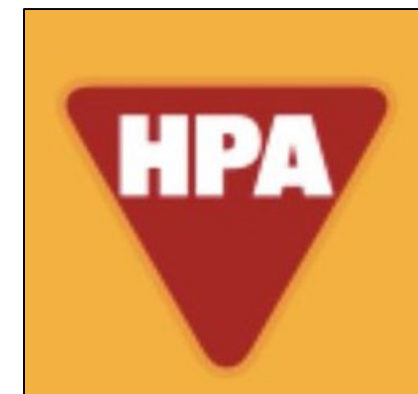
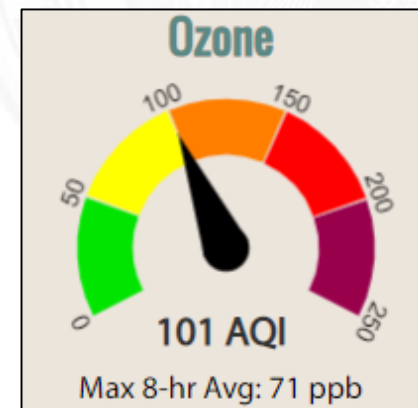
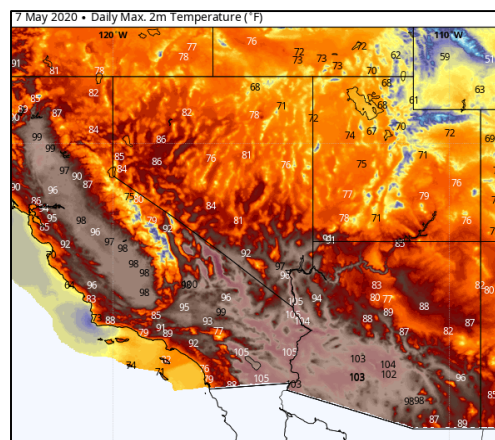
How do Emissions Impact Air Quality

Emissions

+

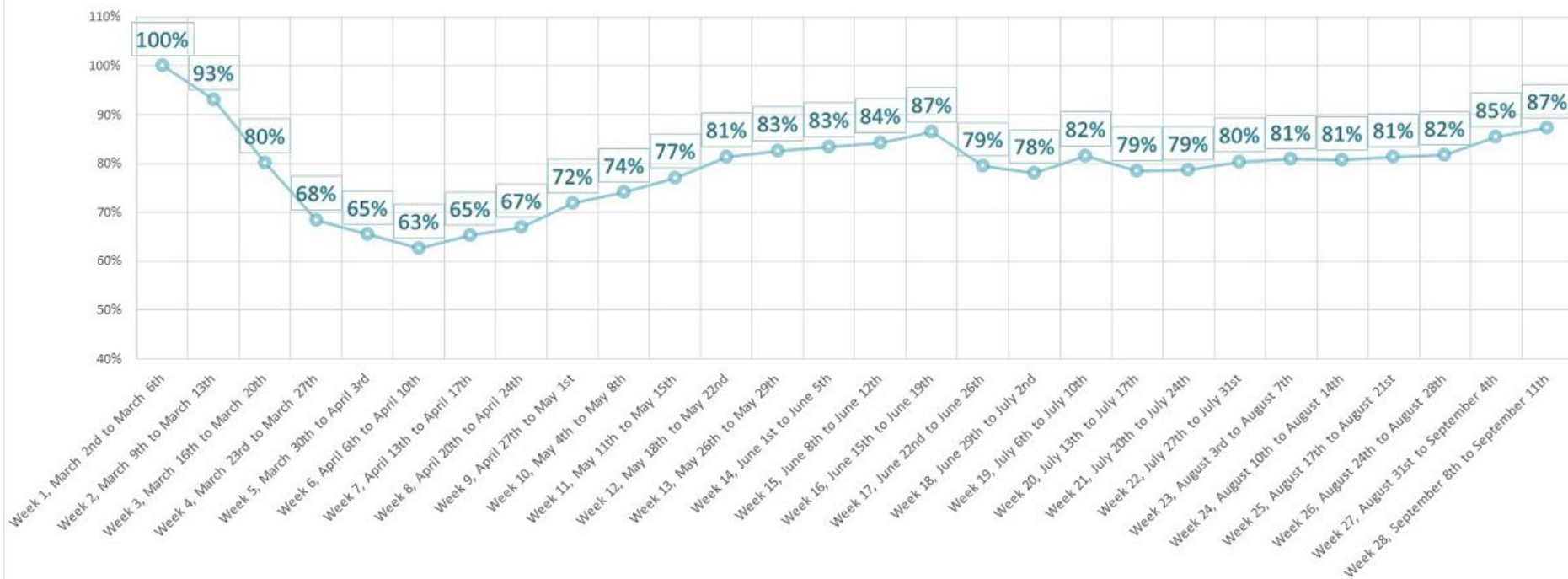
Meteorology
& Chemistry

= Air Quality



Average Weekday Traffic Volume vs. Norm

Average Weekday Traffic Volume (vehicles traveled) Compared to Normal Condition in Maricopa County

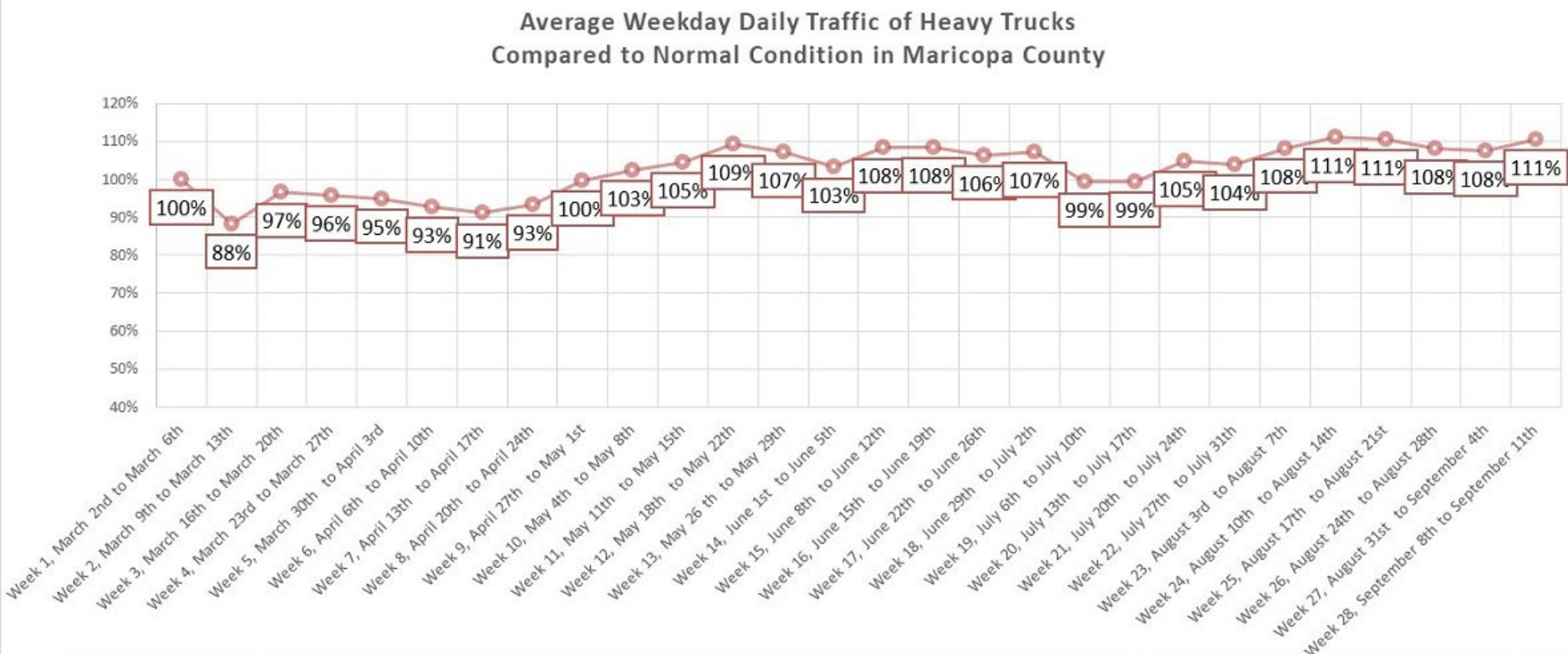


-If we assume the traffic in week 1 of March as normal condition, the percentage is calculated as average weekday daily traffic in a given week compared to average weekday daily traffic in week 1 of March, 2020.

-The traffic volume data is provided by ADOT on selected automatic traffic recorders on freeways and arterial streets in Maricopa county.

Graph per MAG Analysis of ADOT data

Average Heavy Truck Weekday Traffic vs. Norm



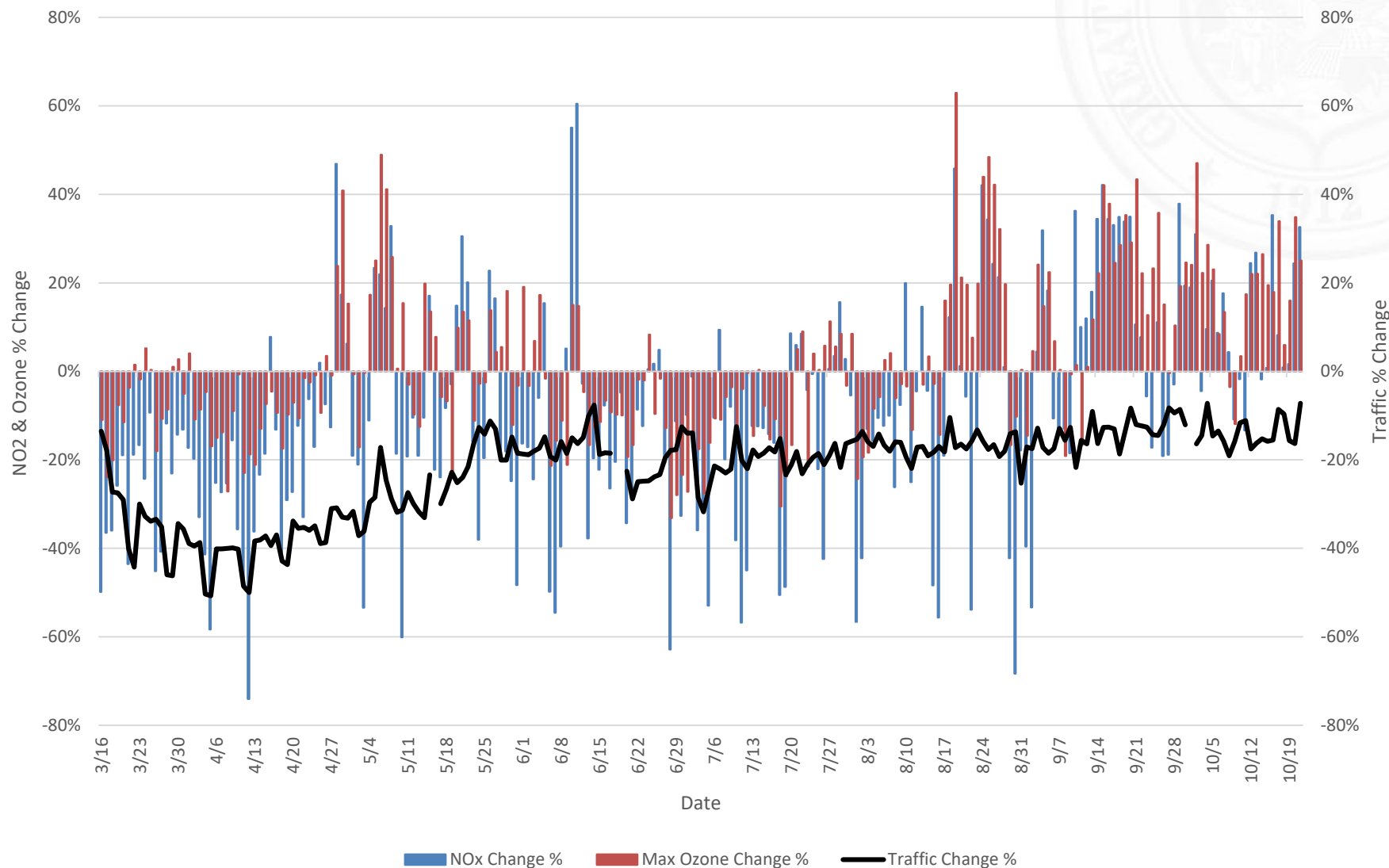
-The heavy truck volume data is provided by ADOT on selected automatic traffic recorders on freeways and arterial streets in Maricopa county. The heavy truck is defined as a truck with single-trailer or multi-trailer and more than 2-axle.

-The percentage is calculated as average weekday daily traffic of heavy truck compared to average weekday daily traffic of heavy truck during normal condition in week 1 of March, 2020.

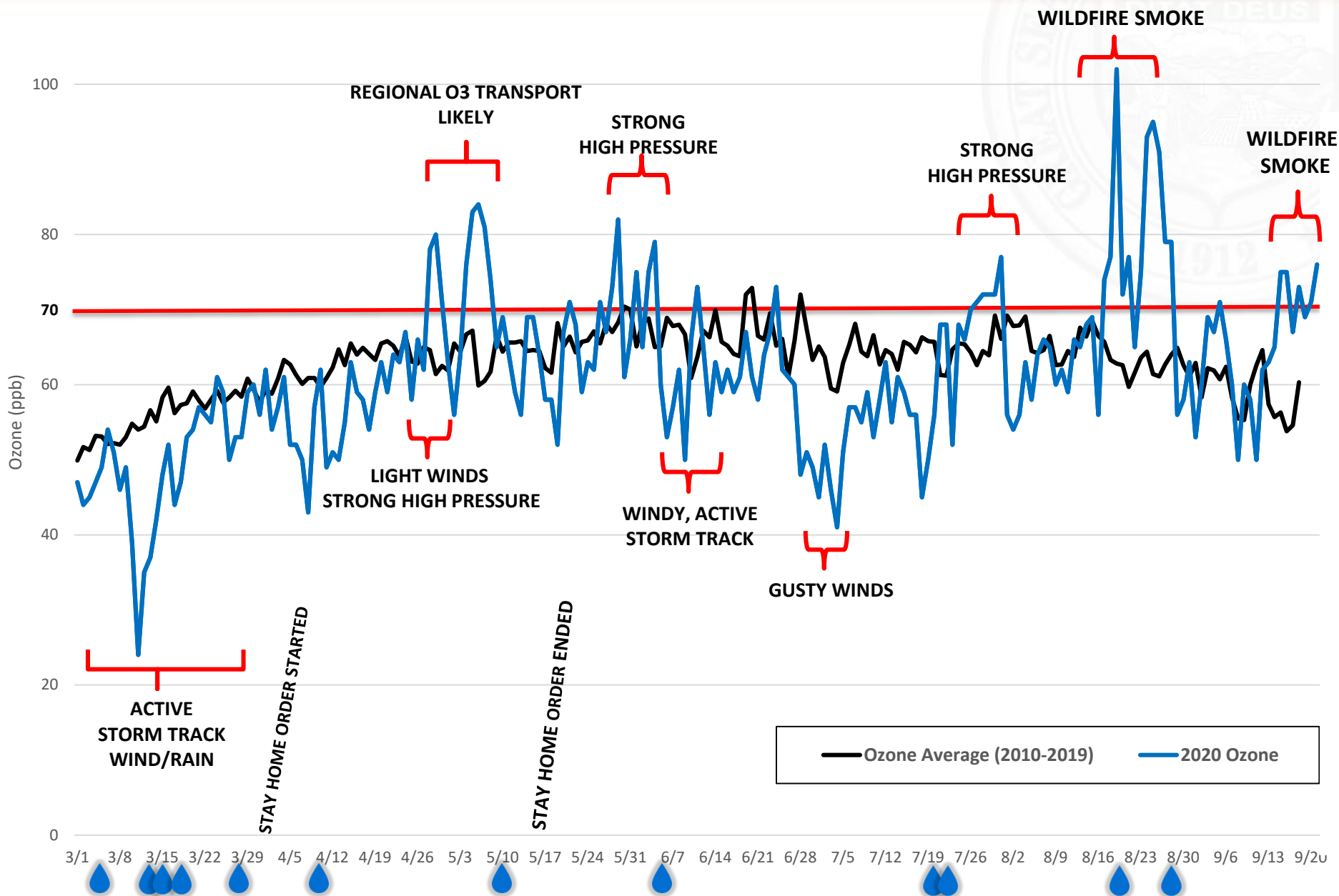
Graph per MAG Analysis of ADOT data

Phoenix NOx & Ozone Change vs Traffic Change

Max Monitored NOx & Ozone Change vs Traffic Change

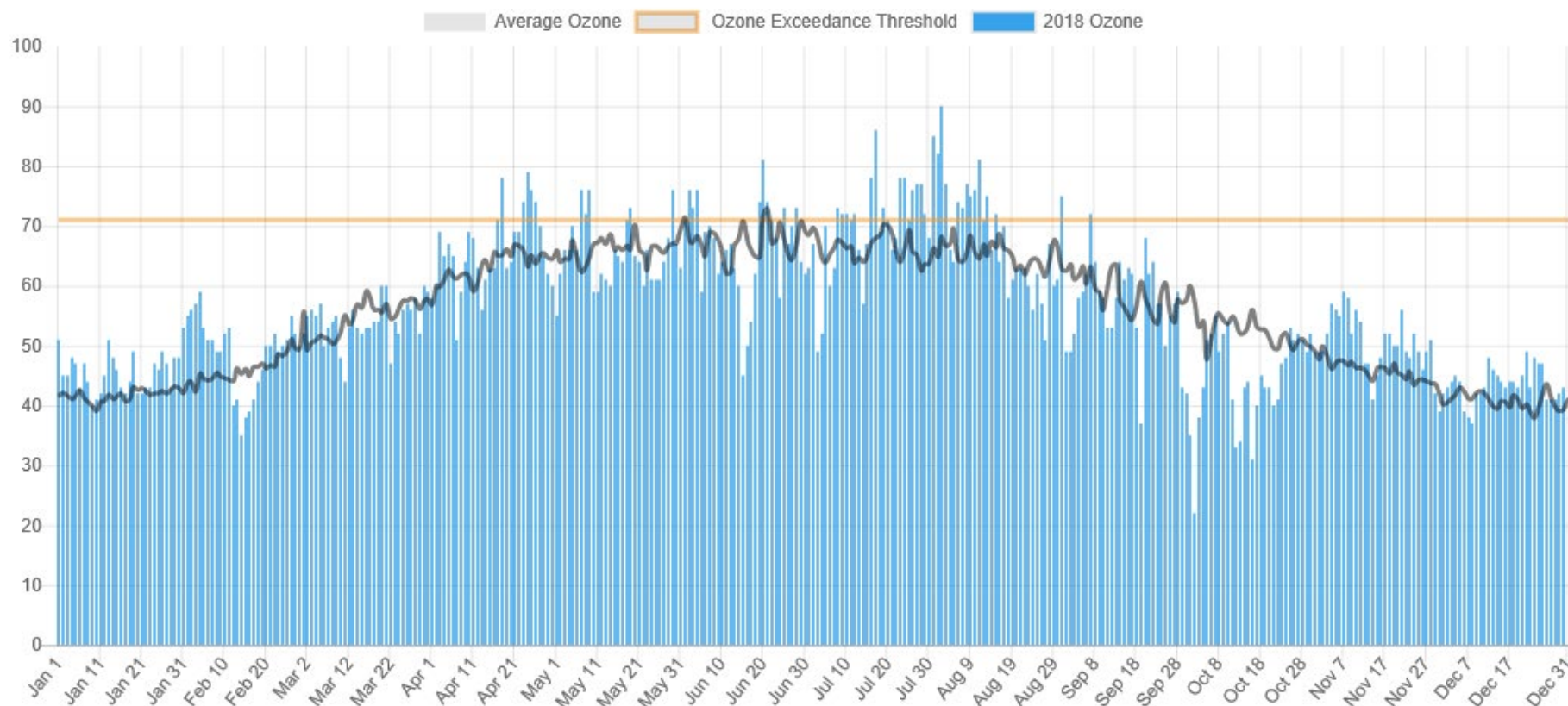


Phoenix 2020 Ozone vs Average (2010-2019)



2018 Phoenix Max Daily 8-Hour Ozone

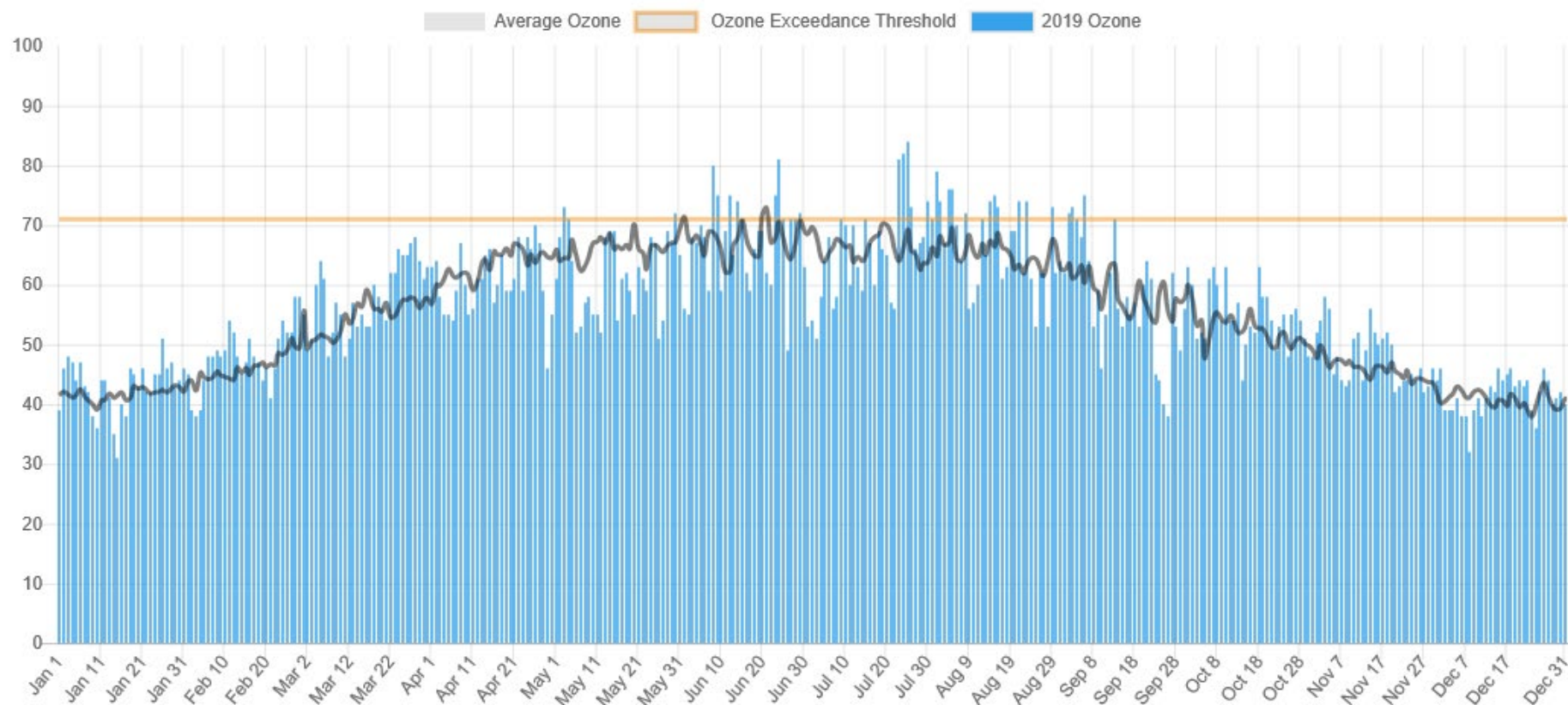
2018 Phoenix Ozone



	Good Days	Moderate Days	Exceedance days
Number of Days	171	140	53

2019 Phoenix Max Daily 8-Hour Ozone

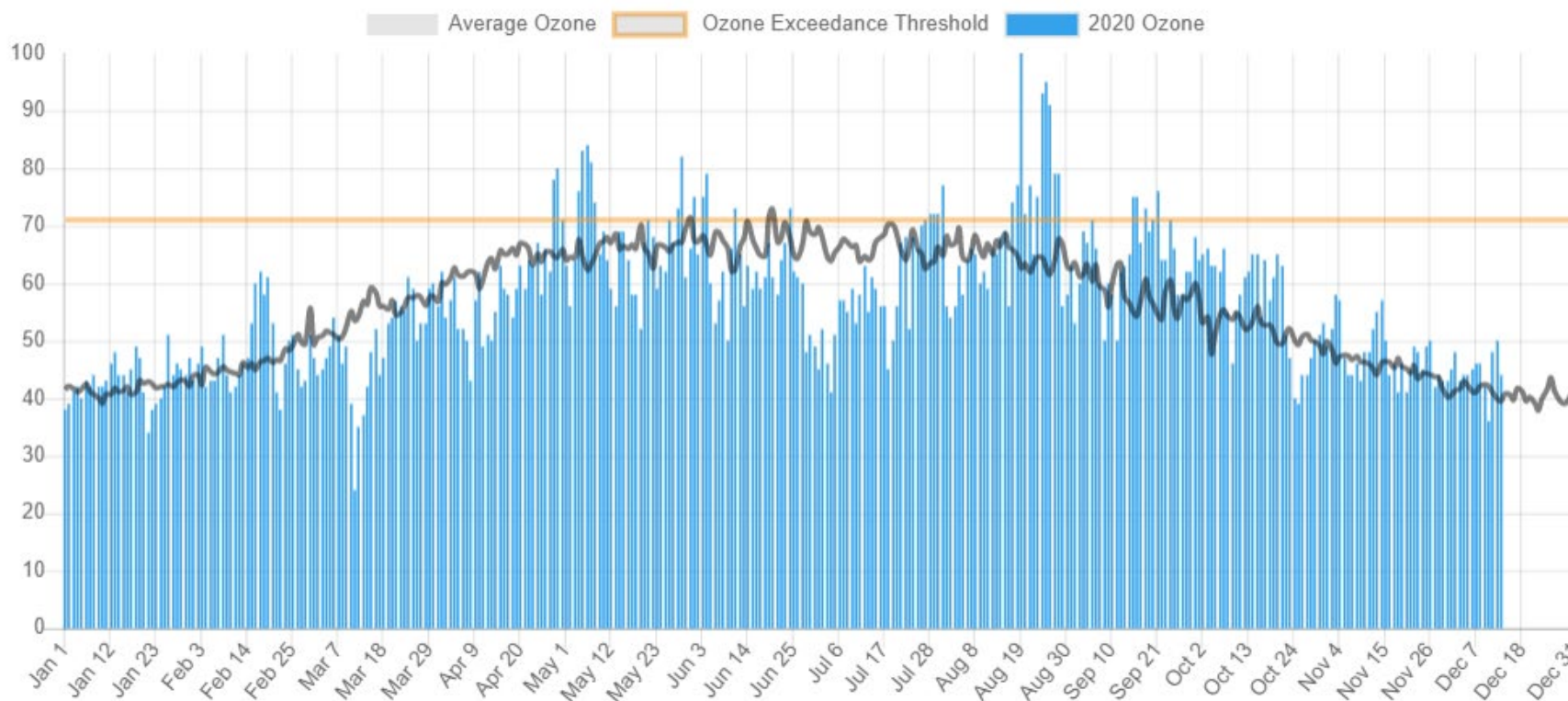
2019 Phoenix Ozone



	Good Days	Moderate Days	Exceedance days
Number of Days	167	159	39

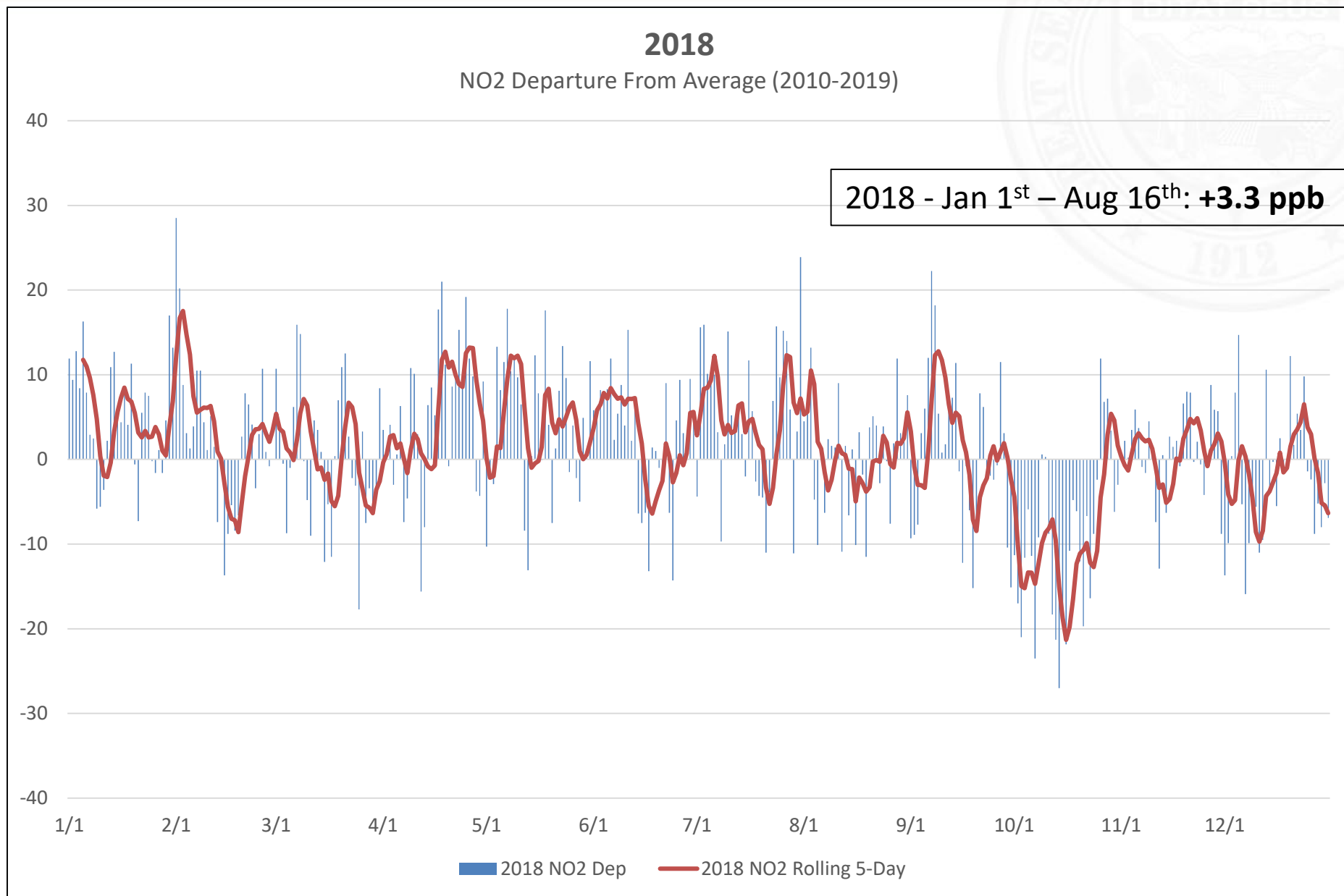
2020 Phoenix Max Daily 8-Hour Ozone

2020 Phoenix Ozone

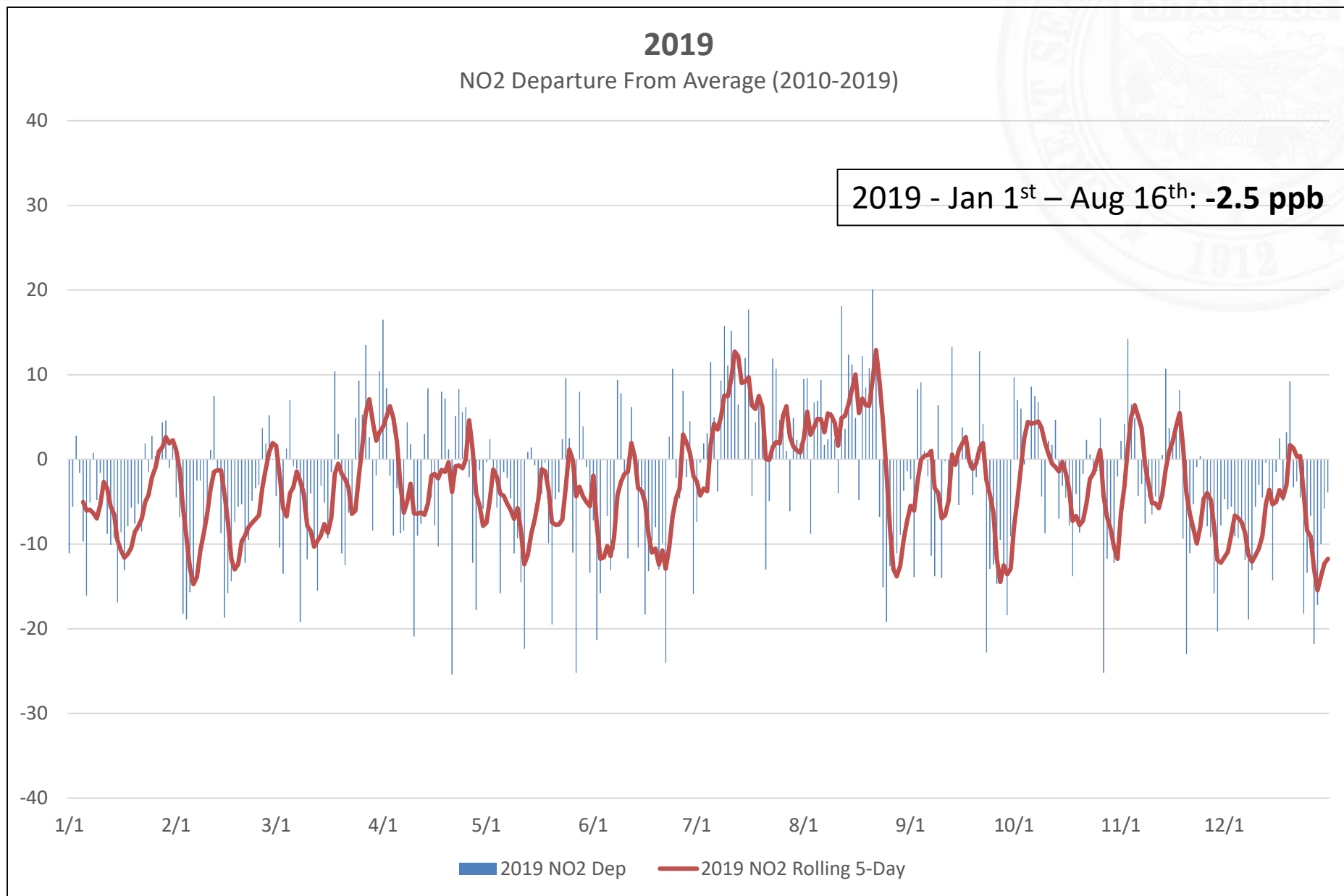


	Good Days	Moderate Days	Exceedance days
Number of Days	158	150	40

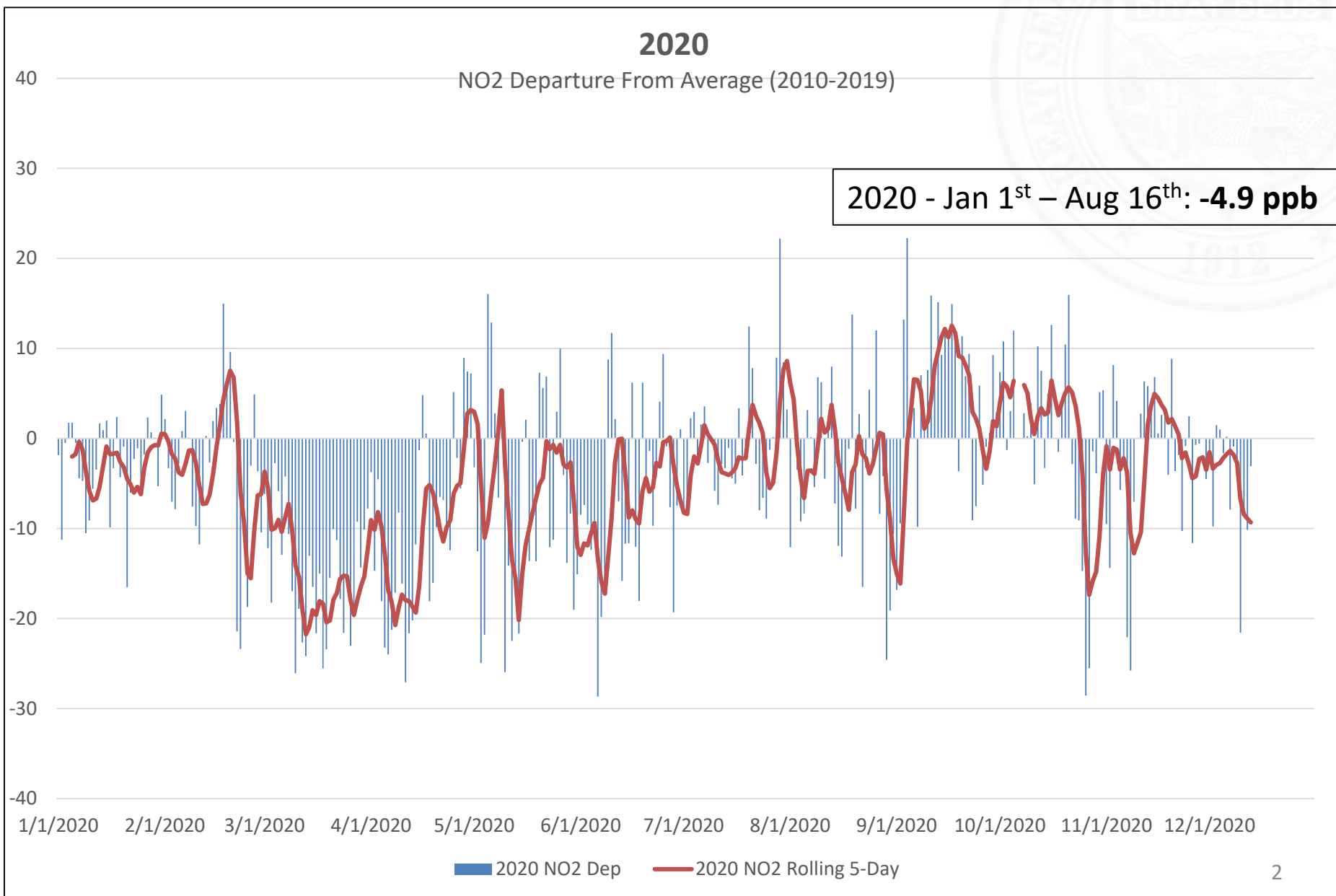
2018 NO2 Departure from Normal



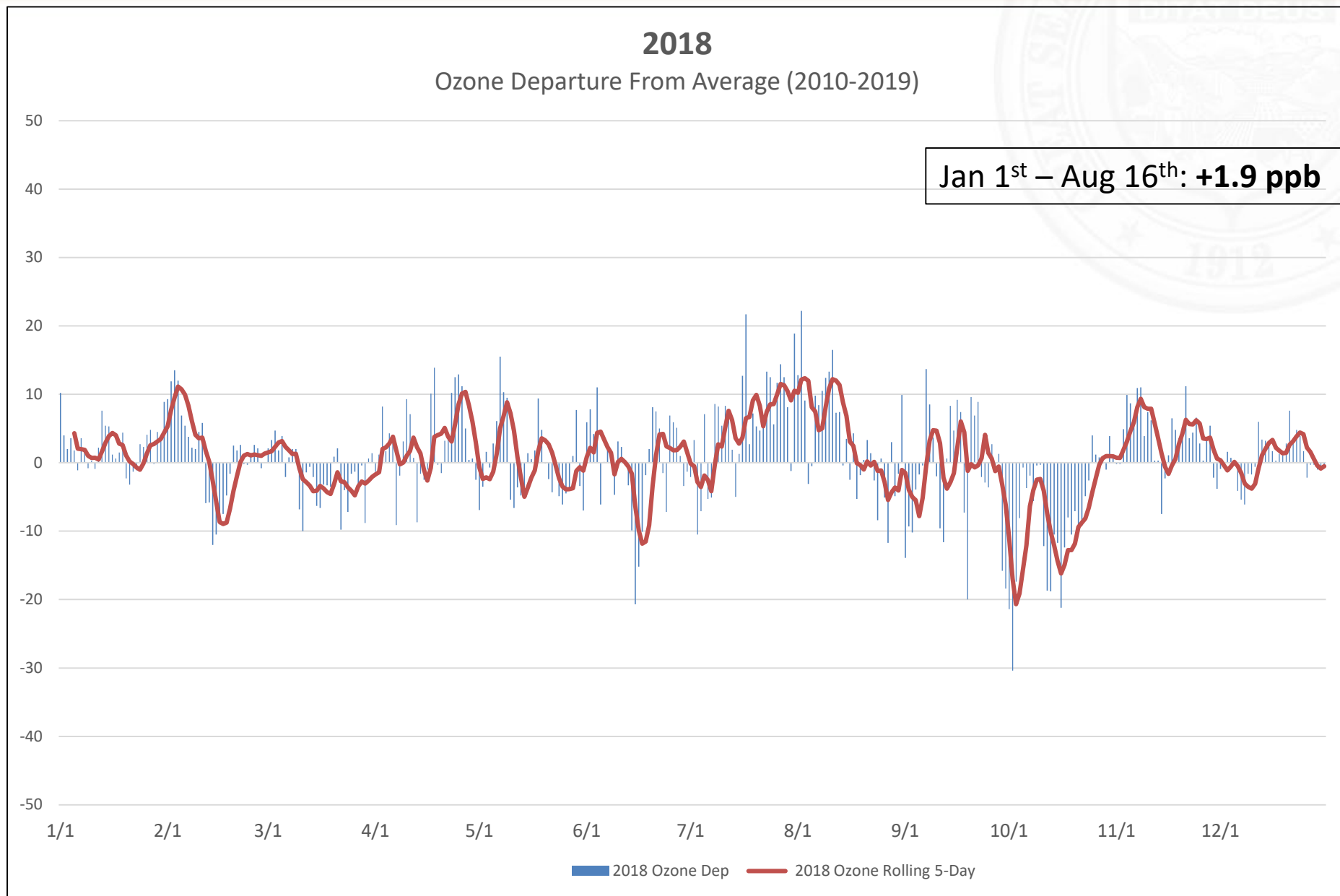
2019 NO2 Departure from Normal



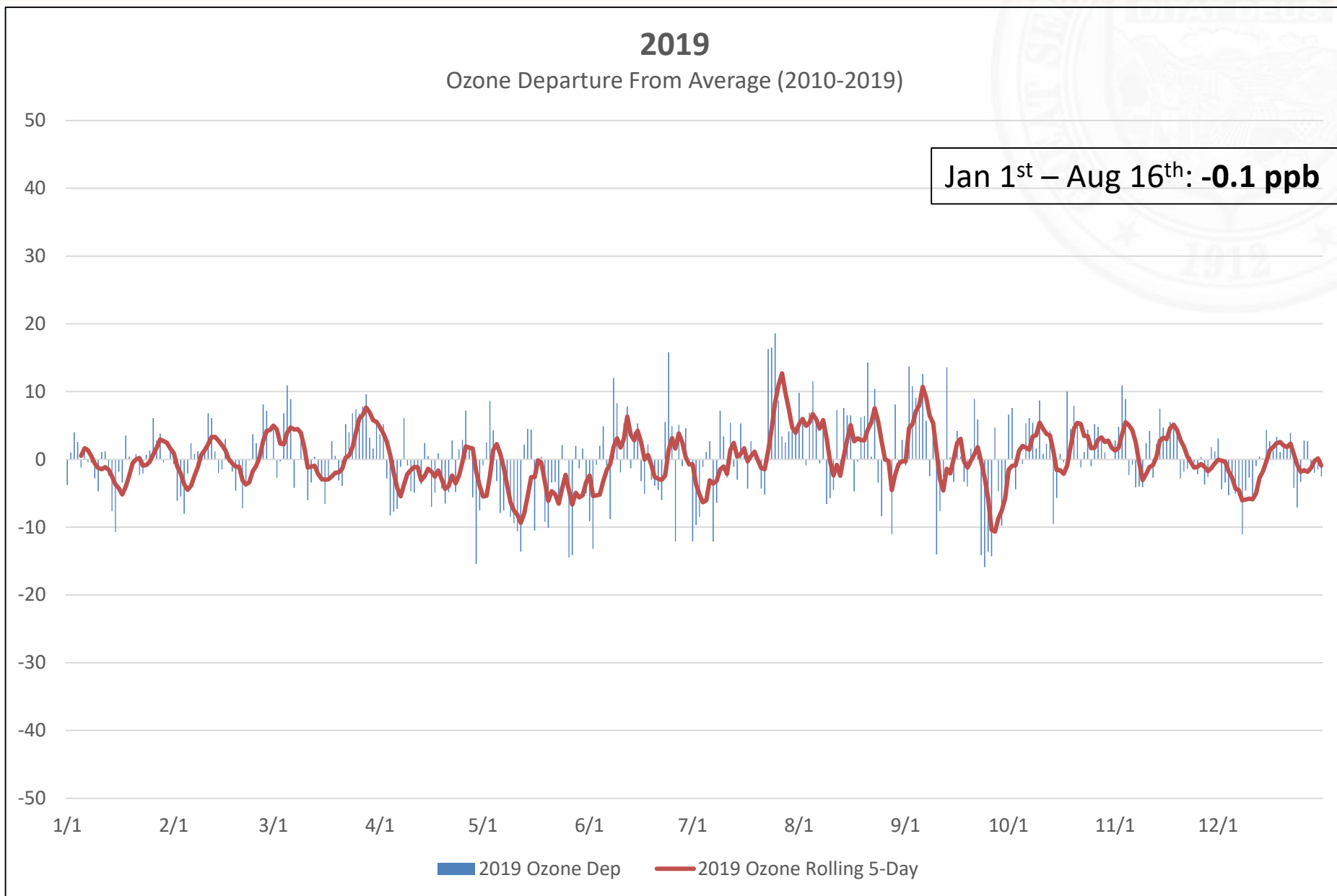
2020 NO2 Departure from Normal



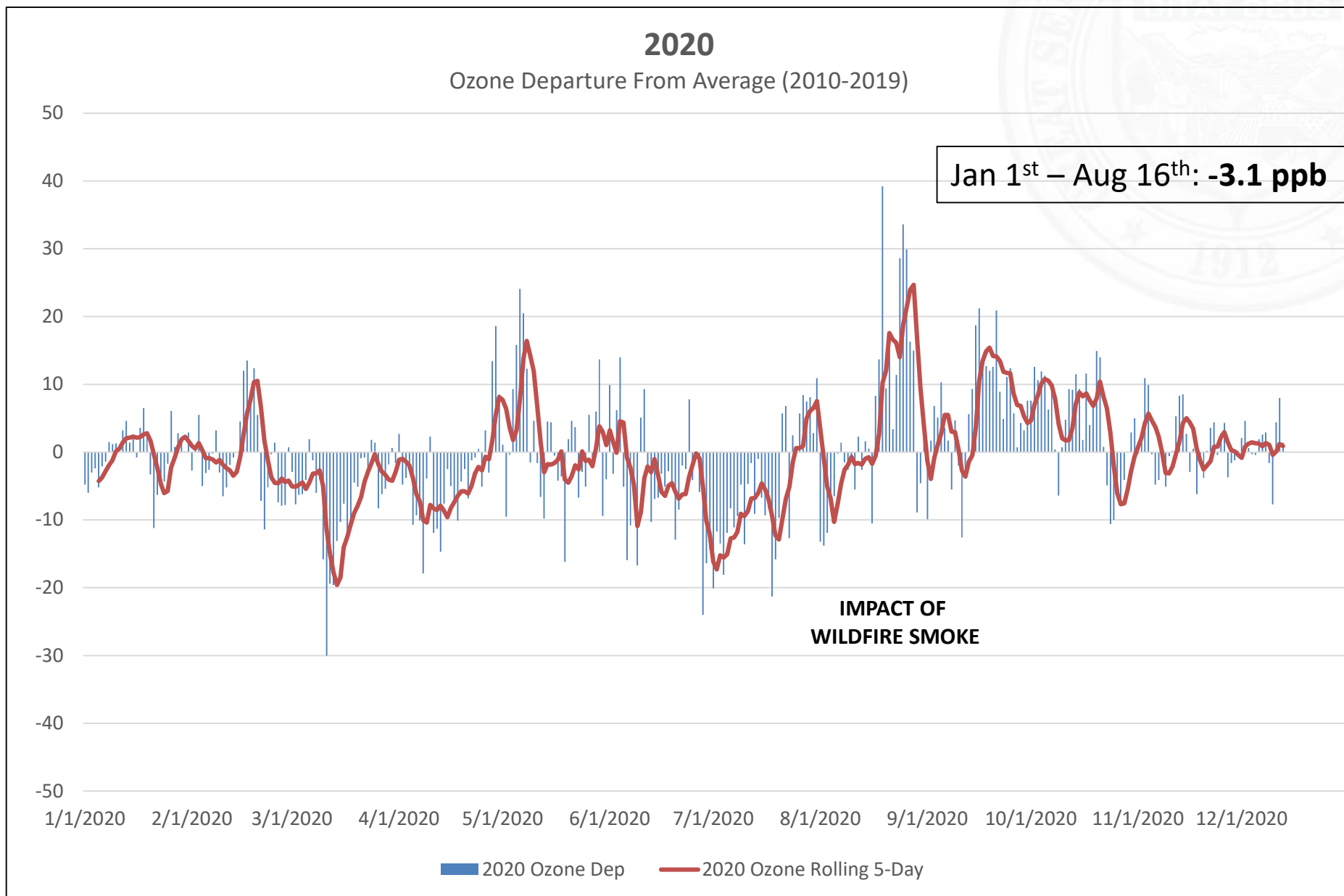
2018 Ozone Departure from Normal



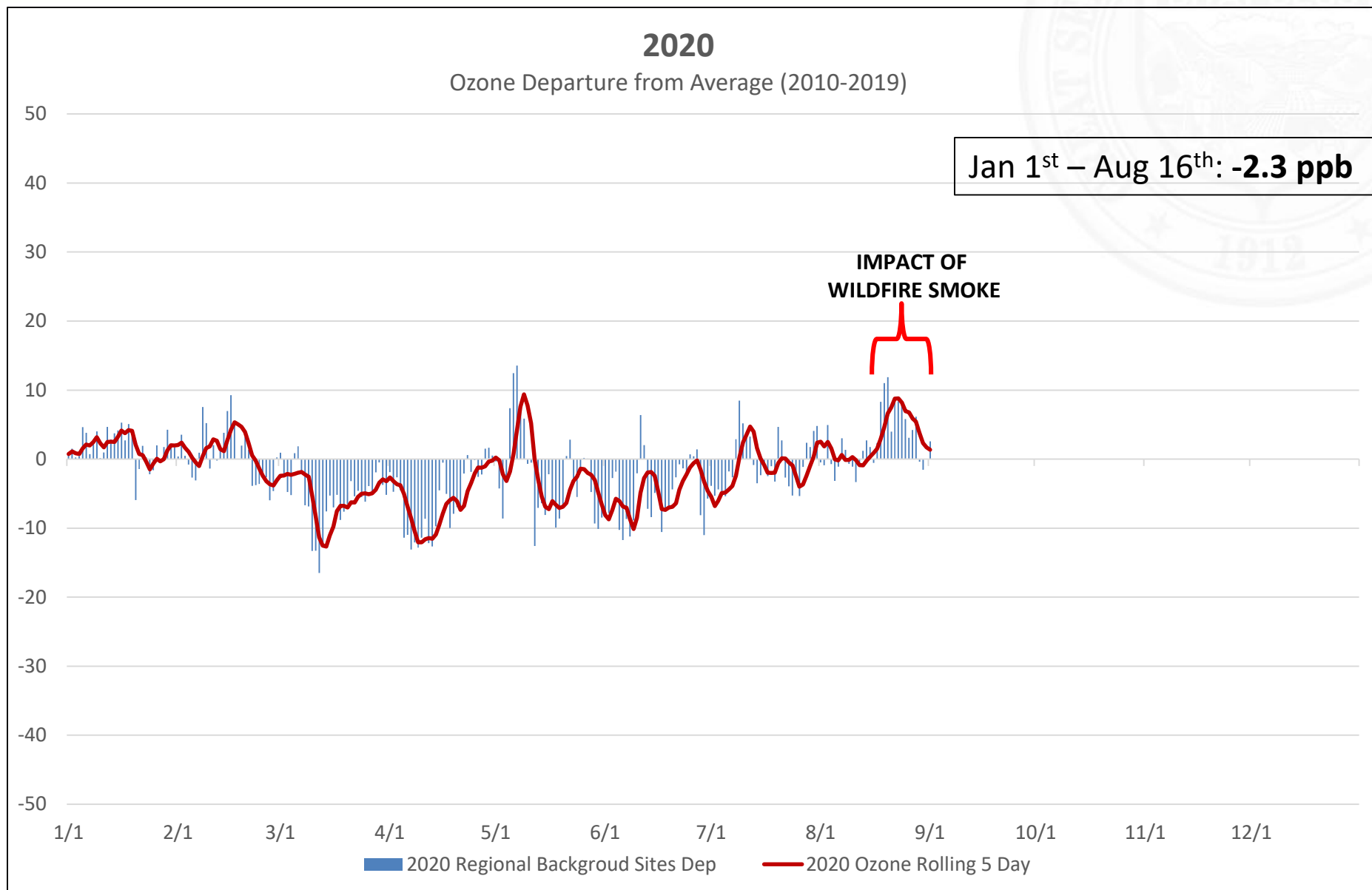
2019 Ozone Departure from Normal



2020 Ozone Departure from Normal

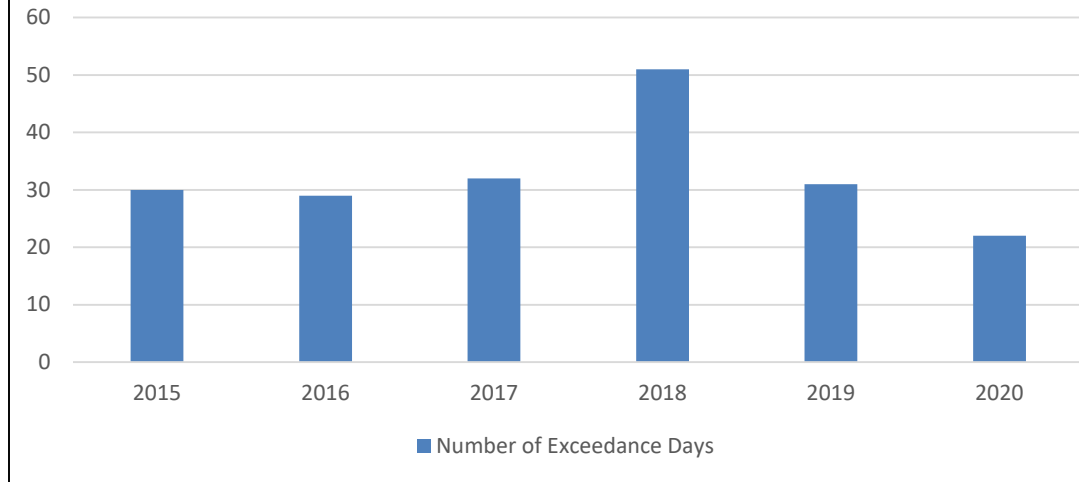


Regional Ozone Background Departure from Normal



5 Year Phoenix NAA Ozone Exceedance Info

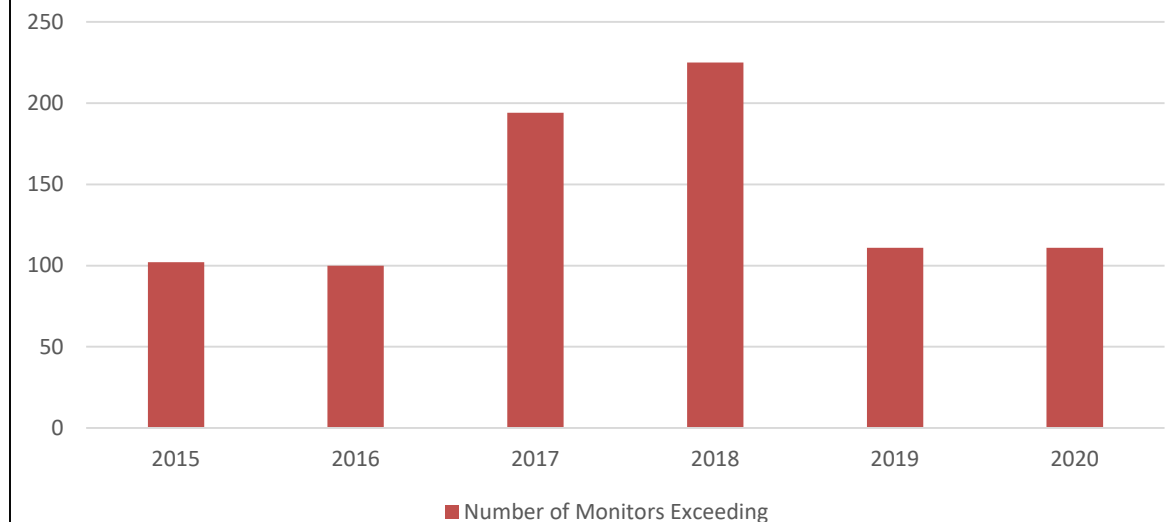
Number of Exceedance Days Through 8/16



- 2020 saw 9 fewer exceedance days than 2019 through 8/16
- On average, most years experience about 30 exceedance days from 1/1 to 8/16
- 2018 is an outlier, as it saw over 50 Ozone exceedances during that period

- Both 2019 and 2020 had the same number of monitors exceed in the Phoenix NAA through 8/16
- Several 2020 exceedance days saw widespread exceedances at many monitors across the Phoenix NAA

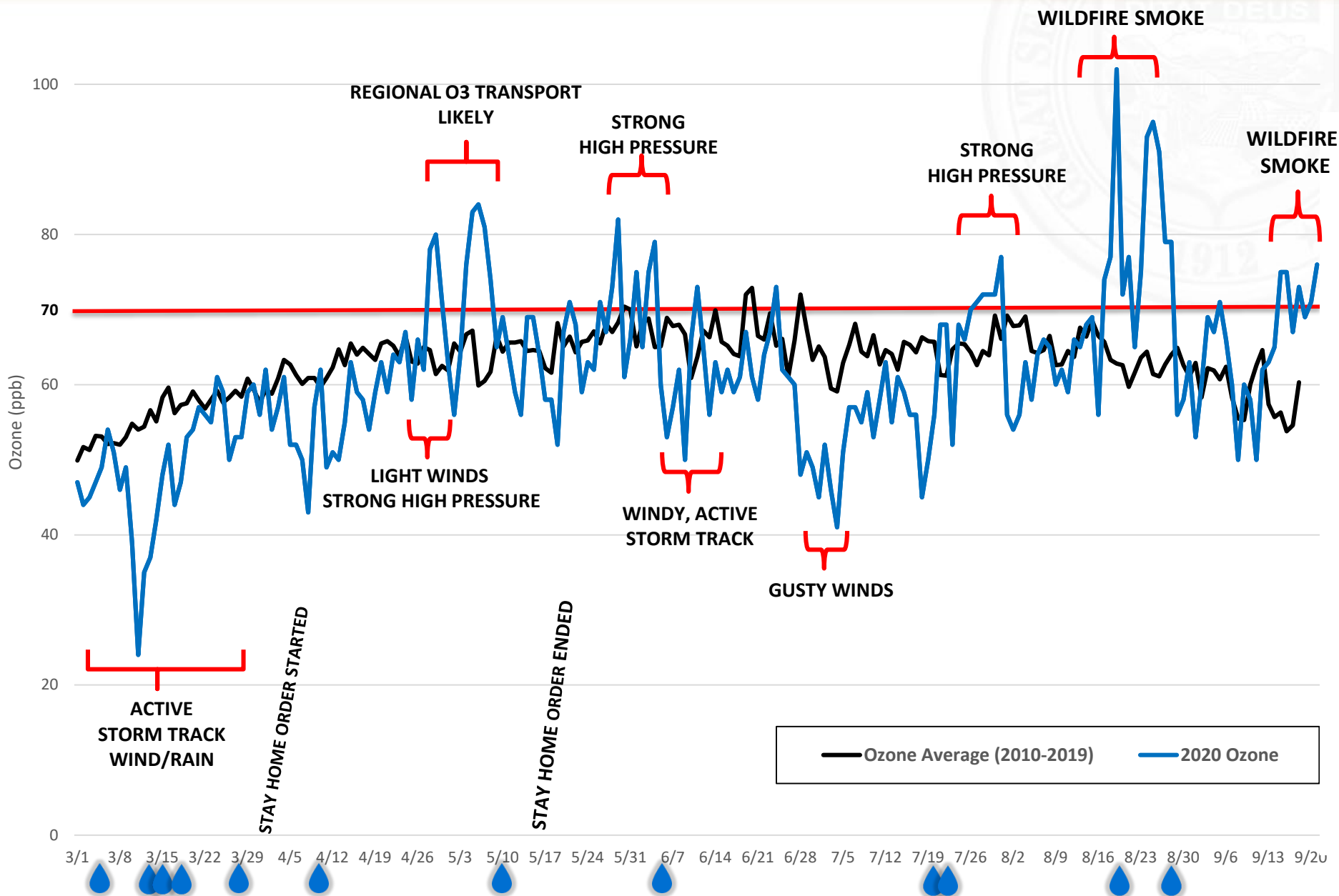
Number of Monitors Exceeding Through 8/16



Number of Ozone Exceedances per Monitor

Maricopa County	2018	2019	2020	2020 Excluding Smoke Exceedances
Blue Point	21	8	16	11
Buckeye	1	1	2	0
Cave Creek	11	3	14	7
Central Phoenix	5	6	7	5
Dysart	9	1	15	8
Falcon Field	22	13	20	15
Fountain Hills	14	1	8	1
Glendale	3	2	5	1
Humboldt Mountain	12	7	6	2
Mesa	23	13	15	7
North Phoenix	14	13	15	7
Phoenix Supersite	7	1	10	5
Pinnacle Peak	27	17	13	6
South Phoenix	6	5	5	0
South Scottsdale	3	1	18	10
Tempe	2	0	11	7
West Chandler	2	6	5	1
West Phoenix	6	3	10	4

Phoenix 2020 Ozone vs Average (2010-2019)



■ Average values for May 3rd – 7th

	Wind	Ozone	NO2	Temp	Height
Average	6.16	<u>77.6</u>	34	102.2	5876
Max	7.3	84	49	106	5900
Min	5	64	17	97	5860

■ Average values for May 27th – 31st

	Wind	Ozone	NO2	Temp	Height
Average	7.56	<u>69.8</u>	21	109.2	5900
Max	9	82	31	112	5930
Min	5.9	61	15	107	5880

Transport of ozone & precursors into AZ may also be a key factor tied to the winds and concentrations seen

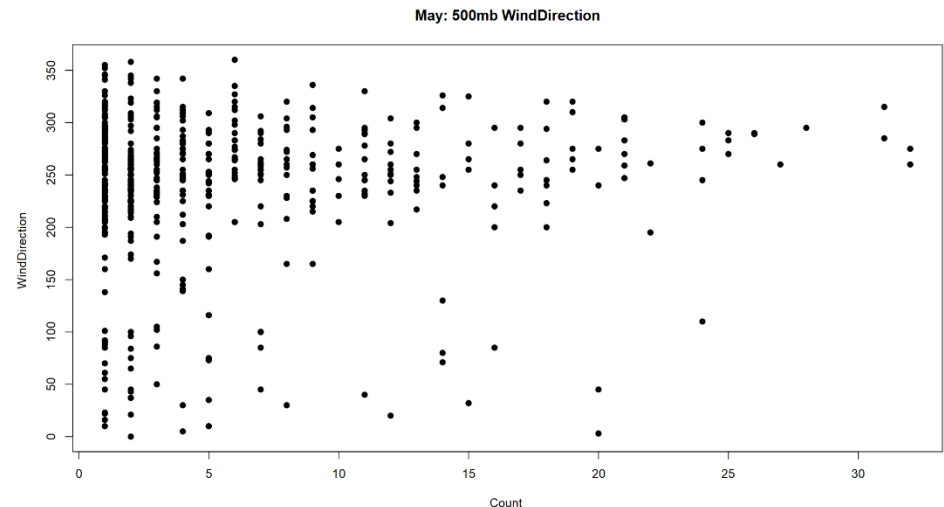
Ozone Exceedance Days In May

When more monitors across AZ exceed 70ppb, it is likely there are westerly winds

(1) Table shows the number of monitors that exceeded 70ppb in May. You can see 50% of the monitors in the state exceeded on May 7, 2020 (indicating possible regional transport event)

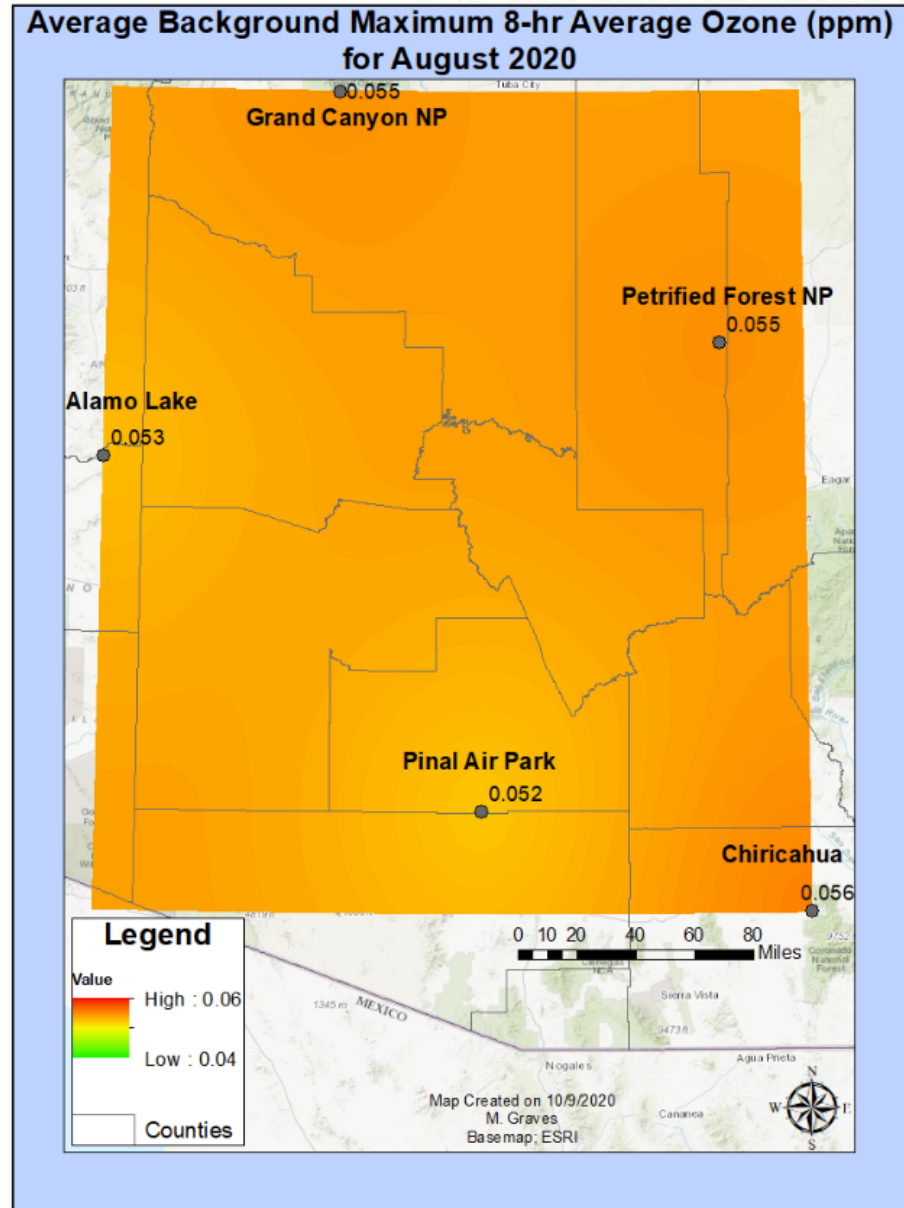
(2) Scatter plot shows that it is very likely westerly winds at 500mb mean more monitors will exceed (transport)

Month	Day	Year	Monitors Exceeding	Monitors Available	% Exceeding
5	11	2003	32	43	74%
5	25	2011	32	44	73%
5	31	2008	31	43	72%
5	24	2011	31	43	72%
5	14	2012	31	45	69%
5	16	2003	28	45	62%
5	3	2008	27	46	59%
5	27	1999	26	45	58%
5	20	2012	26	45	58%
5	10	2003	25	44	57%
5	26	1999	25	46	54%
5	13	2012	25	46	54%
5	11	2002	24	43	56%
5	31	2012	24	45	53%
5	7	2020	24	48	50%



August 2020 Ozone Background (Estimates)

- Kriging Analysis using Alamo Lake, Grand Canyon, Chiricahua, Petrified Forest and Pinal Air Park monitors as “background/transport” indicators
- For August 2020, the map indicates monthly average values across AZ were in the 52-55 ppb range
- Historical August averages at these five sites range from about 45 to 57 ppb, depending on the year
- Annual Design Values (4th high over 3 Yrs) are closer to 65, as indicated by Alamo Lake’s current DV in La Paz County on the next slide

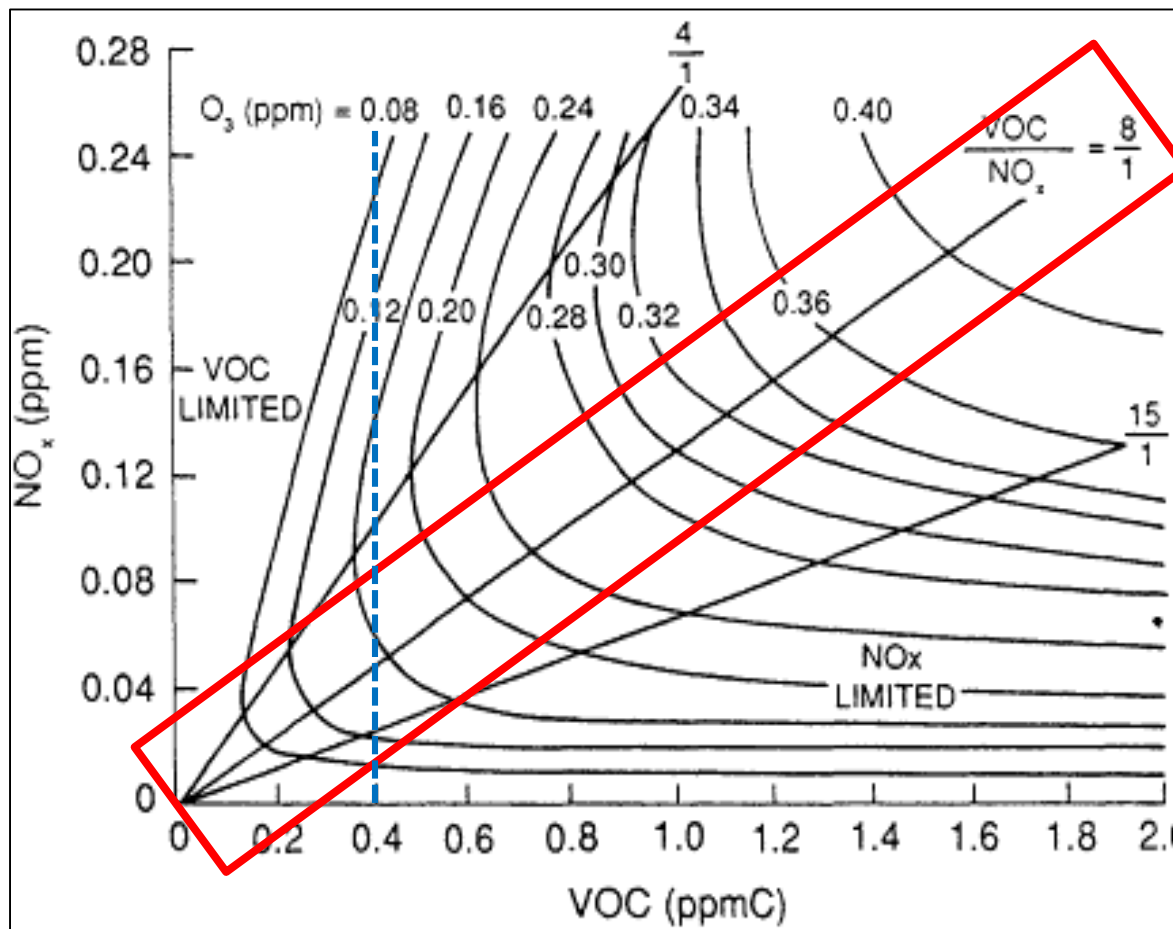


Annual 4th Highest Daily Max 8-Hour Average

County	Nonattainment Area	2018	2019	2020 (preliminary)	*Preliminary 2020 Design Value
Cochise	None	67	66	66	66
Coconino	None	67	63	61	63
Gila	Phx NAA	76	75	81	77
Graham	--	--	--	--	--
Greenlee	--	--	--	--	--
La Paz	None	70	62	64	65
Maricopa	PHX NAA	80	74	83	79
Mohave	--	--	--	--	--
Navajo	None	69	66	67	67
Pima	None	71	65	71	69
Pinal	Phx NAA	76	72	80	76
Pinal Other	None	66	69	76	70
Santa Cruz	--	--	--	--	--
Yavapai	None	65	61	66	64
Yuma	Yuma NAA	74	65	67	68

VOC and NOx Relationships are Important!

VOC Limited – Typical “Urban”



NOx Limited – Typical “Suburban” or “Rural”

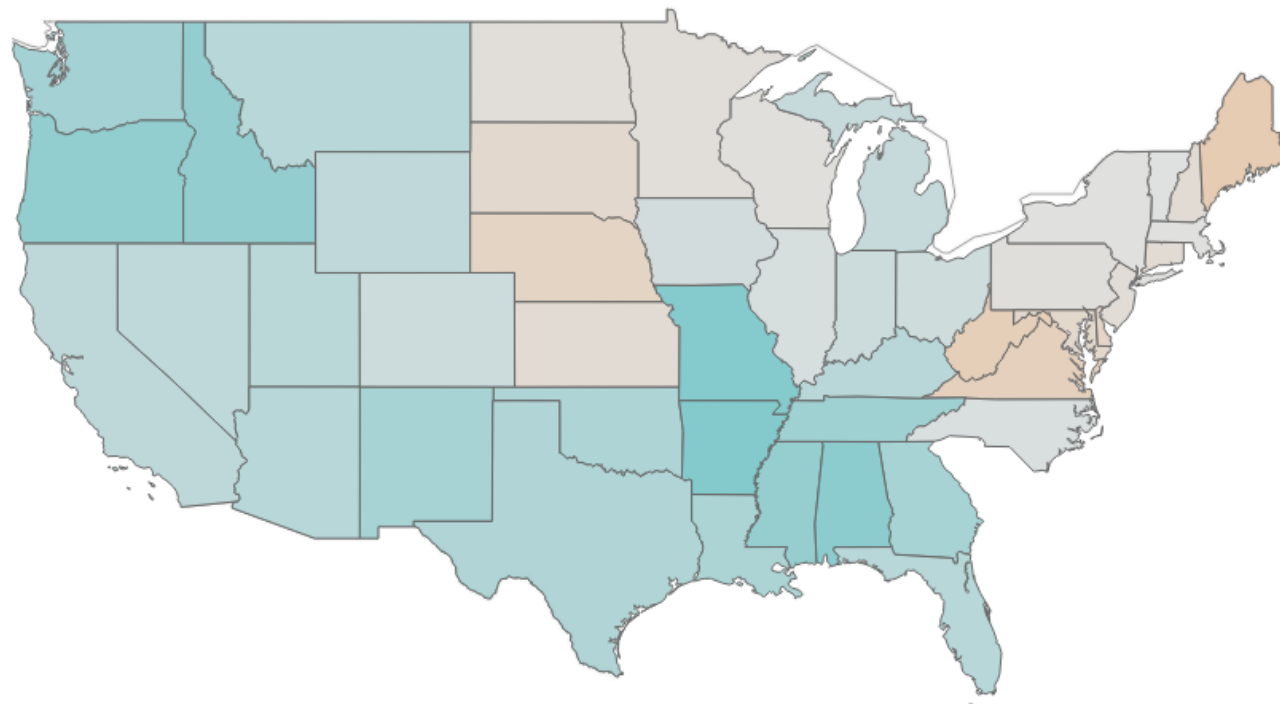
- Used to understand ozone control strategies
- Ratios can vary with location, time of day, and season
- Studies have shown that a decrease in NO_x can result in no ozone change, or even increased ozone, in some cases (weekend effect)
- Currently, there is not sufficient monitoring coverage to observe what ratios exist across much of the Phoenix area

Ozone Across the U.S. April - June

Ozone

June 24 - June 30

Alaska



© 2020 Mapbox © OpenStreetMap

Updated 7/8/2020 1:26:35 AM UTC

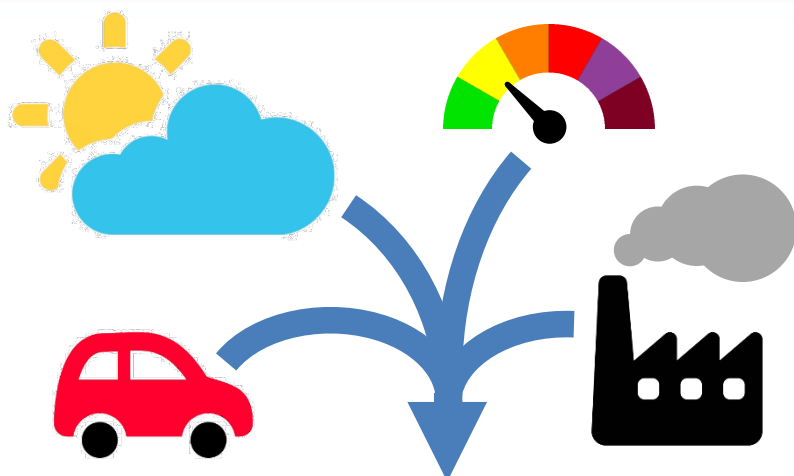
Use the slider below to change the week

Note: Some state data is unavailable.



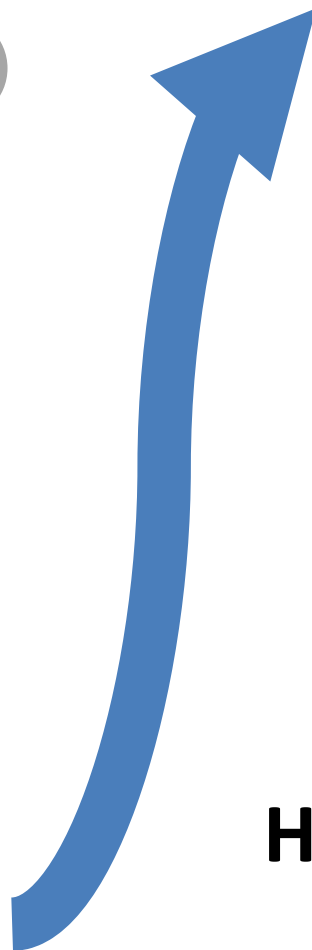
"Score" means the concentration of the pollutant was less than (below zero) or more than (above zero) expected. Researchers compared the pollutant's concentration in the same week over the last 10 years, while adjusting for whether the region has been getting cleaner or dirtier over that same period (similar to adjusting prices for inflation).

METHODOLOGY & D...



Ozone (O_3)
Predictions

Variable
Importance
Analysis

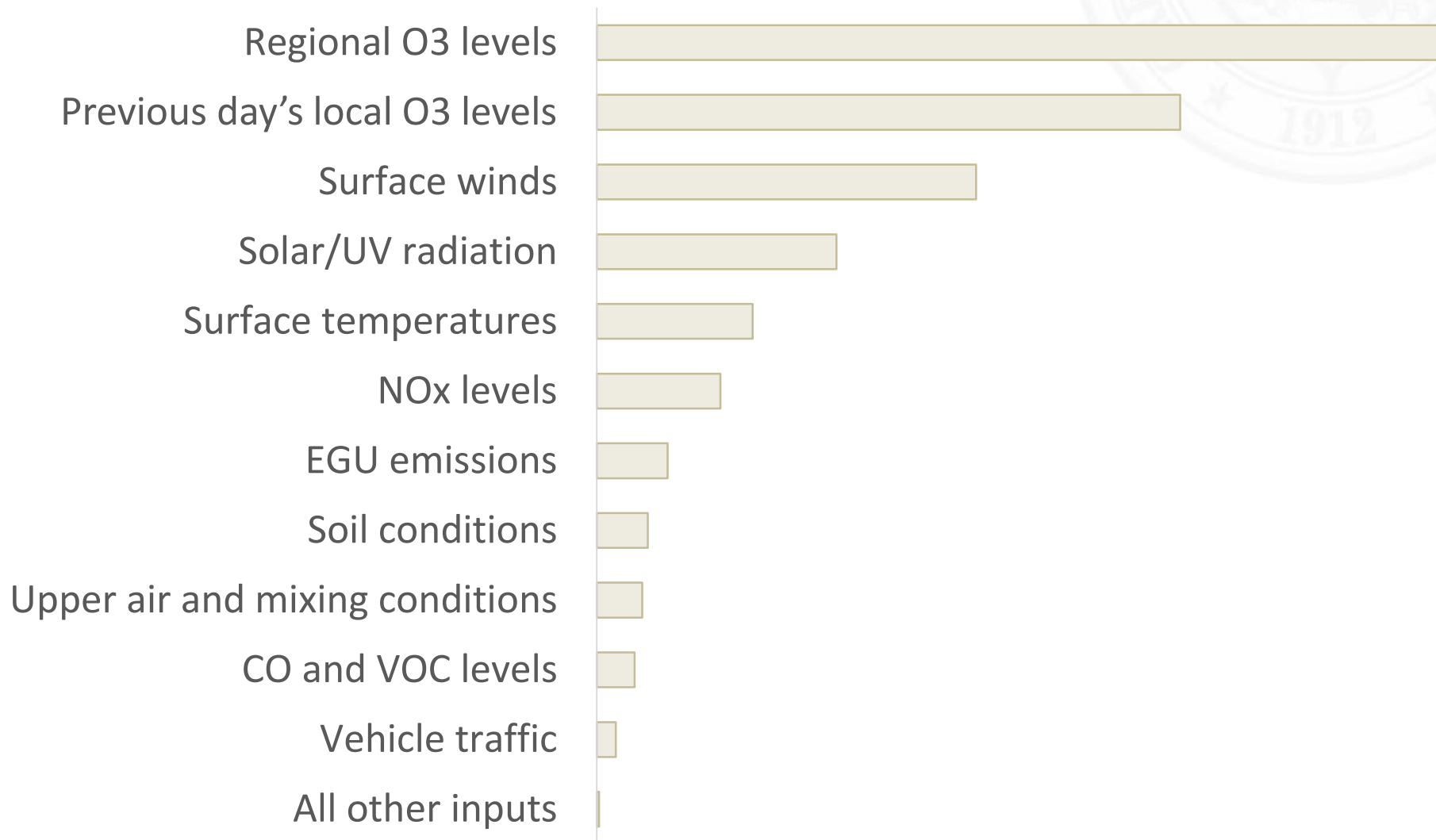


What factors could have
meaningful impacts on
 O_3 in Phoenix?



How can we influence
 O_3 in Phoenix?

Predictive Weights of Input Variable Categories in Preliminary AI Modeling



What Do We Know?

- Freeway traffic, NOx and Ozone decreased – still had Ozone exceedances
- Ozone formation highly dependent on weather
- Background and transport are key contributors to ozone levels
- Reducing VMTs alone will not resolve the ozone exceedances

- We need more NO_x and VOC data across Maricopa County
 - VOC and NO_x are limited spatially to the JLG Supersite location
 - VOC data is limited to 1-in-6 run day schedules
- Unknown temporal variability of VOCs throughout the day
- Lacking info about both local factors and upwind factors that might influence ozone during the pandemic:
 - Local / Residential Area Traffic
 - Construction Activities (NO_x)
 - Cloud Cover and Spatial UV changes
 - Vegetation Types
 - Vegetative Health
- Vertical Pollution Profile

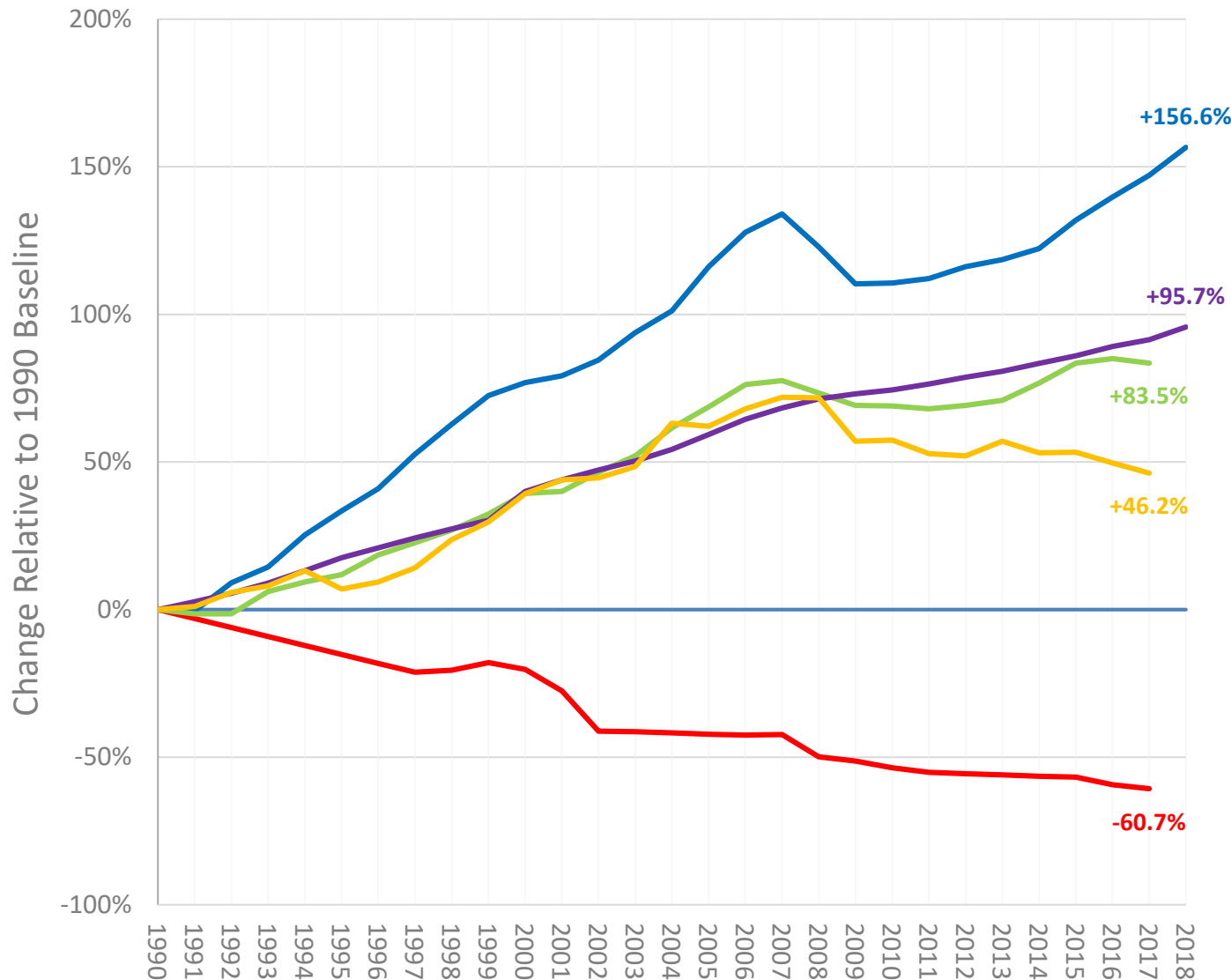
- 93 control measures
- ADEQ Voluntary Programs
- Arizona has reduced emissions by over 60% since 1990
- Arizona Utilities and others have committed to voluntary clean energy goals
- ACC goal of 100% non-fossil fuel by 2050

- Continue to work on finding ERCs
 - ADEQ Portable Sources
- 25.8 VOC ERCs certified this year
- Available ERCs in Arizona Emissions Bank

Pollutant	Credit (Tons)
NOx	17.14
VOC	302.64

- Ozone Enhanced Monitoring Plan
- VOC data review for better understanding the VOC components most associated with elevated ozone
- Auto GC equipment will provide continuous data to assist in understanding of ozone precursors at JLG SS
- Continued review of transport issues and regional ozone exceedances
 - International transport (179b demonstration)
 - Stratospheric intrusions

Economic & Air Quality Trends in AZ since 1990



Inflation-adjusted GDP

U.S. Bureau of Labor Statistics,
U.S. Bureau of Economic Analysis

Population

U.S. Census Bureau

Highway Miles Driven

Arizona Department of Transportation

Fossil Fuel Energy Consumption

U.S. Energy Information Administration

Criteria Air Pollutant Emissions

U.S. Environmental Protection Agency;
Wildfires and prescribed burns excluded

Questions?