Air Quality Health Monitoring Task Force Meeting

North Central Texas Council of Governments

May 29, 2020

For audio please dial in,
Conference Line: 1-800-250-3900
Participant Pin: 442318#

Please Remain Muted If Not Speaking

North Central Texas Council of Governments

Air Quality Monitoring Strategies and Modeling of Chronic Health Risks Related to Traffic-Related Air Pollution

University of Texas at Arlington

Steve Mattingly and Kate Hyun with Jaesik Choi

Low cost sensors (Particulate Matter)

Vendor	Reliability (Performance)		Capital Cost US Dollars in 2020	Ease of Installation	Ease of Operation[5]
	Correlation/Linearity to regulatory sensor	Root-mean Precision (coefficient of variation in 1h) (%)			
Alphasense	0.007 ($PM_{2.5}$) 0.01 (PM_{10})	108 ($PM_{2.5}$) 101 (PM_{10})	$500 (in 2018)	Unavailable	Unavailable
Shinyei	0.45~0.6	20	$2,200	Fair	Good
Dylos	0.63~0.67(PRO) 0.58(DC1100)	15 (Small particle count) 10 (Large particle count)	$199.99(DC1100) $260.99~289.99(DC1100-PRO)	Good (DC1100)	Good (DC1100)
HabitatMap	0.65~0.66	6	$249	Unavailable	Unavailable
MetOne	0.32~0.41	NA	$1,768	Good	Good
Wicked Device	-0.06~0.4	Unavailable	$280	Unavailable	Unavailable
CairPol CairClip	0.06	Unavailable	Unavailable	Good	Very good
Speck	0.01	37	$149	Unavailable	Unavailable
RTI	0.72	Unavailable	$2,000 (in 2014)	Good	Fair
Perkin-Elmer	0.00	Unavailable	$5,200 (in 2015)	Unavailable	Unavailable
TSI	0.78 to 0.81	41	$909	Unavailable	Unavailable
TZOA	0.44 to 0.52	17	$400 (in 2017)	Unavailable	Unavailable

Low cost sensors (Gaseous Sensors)

Vendor	Reliability (Performance)		Capital Cost US Dollars in 2020
	Correlation/Linearity to regulatory sensor	Root-mean Precision (coefficient of variation in 1h) (%)	
AQMesh	0.39~0.45 (O_3) 0.14~0.32 (NO_2)	>90 (O_3) >85 (NO_2)	Unavailable
CairClip	0.82~0.94 (O_3) 0.42~0.76(NO_2)	O_3: 9.5 ppb (sensor's precision)	Unavailable
GasSensing	0.91~0.97	73	325
Wicked Device	-0.25~-0.22	Unavailable	Unavailable
Weather Telematics	0.95	Unavailable	Unavailable
Cairclip	0.98	NA (O_3 and NO_2)	Unavailable
AirCasting	0.8	Unavailable	Unavailable
Platypus	0.39~0.45 (O_3) 0.14~0.32 (NO_2)	Unavailable	Unavailable
CitiSense	0.82~0.94 (O_3) 0.42~0.76(NO_2)	O_3: NA	Unavailable
CU Boulder Hannigan Lab	0.88 (O_3) Unavailable (NO_2)	O_3: 46.2 ppb (sensor's precision)	Unavailable
Unitec	Benzene only: 0.9	0.2 ppb (sensor's precision)	Unavailable

Technologies Adopted by California Air Resources Board (CARB)

- CARB is not using low cost sensors for regulatory purposes

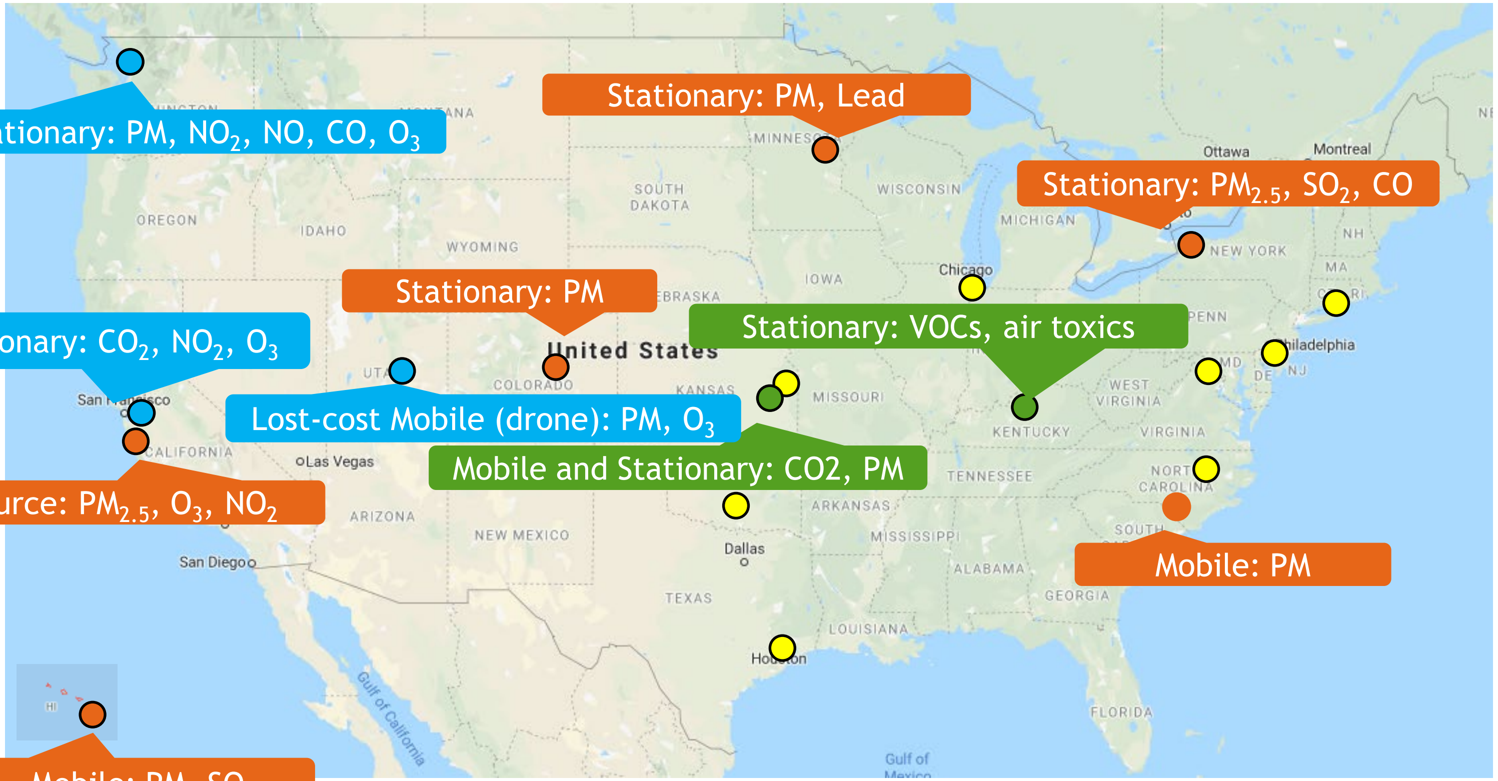
Measurement Technology	Approximate Cost	# of Manufacturers	Expertise Level	Air Monitoring Application	Species§
Gravimetric Analysis	$2,000~$25,000	50 ~ 100	1-2 (minimum level of expertise)	• Source Attribution • Hotspot Identification	PM
Particle Counting	Up to $50,000	~ 100+	1-2	• Health Resources • Hotspot Identification	PM
Conductivity Detection	Up to $50,000	~ 100+	1-2	• Source Attraction • Health Research • Explanatory Monitoring • Hotspot Identification	PM Toxic VOCs Toxic Metals Gaseous Criteria Pollutants
Ionization	$2,000~$50,000	~ 100	2	• Source Attraction • Hotspot Identification	PM Toxic VOCs

https://ww2.arb.ca.gov/capp-resource-center/community-air-monitoring/outline-of-measurement-technologies#techtbl

Air Quality Monitoring Network and Programs - Overview

- EPA currently focuses on development and assessment of low-cost sensors.
- Communities focus on collecting air pollutant data with utilizing cost-effective (or low-cost) monitors/sensors.
  - Community-based research effort to demonstrate near real-time air monitoring technology, engage the public in learning about local air quality
  - Monitor air quality in communities where people with low incomes and communities of color might be disproportionately impacted by pollution from highway traffic, air traffic, and industrial sources
- State-of-the-art sensors are mobile-friendly.
  - EPA (shoebox-sized and lightweight system)
  - University of Utah (drone-based)

EPA sponsored Air Quality Monitoring Network and Program - nationwide



- EPA-led
- EPA Village Green station
- Community-based
- University-led

Air Quality Monitoring Network and Programs – EPA sponsored (1): **Village Green Project**

Village Green station in Durham, NC

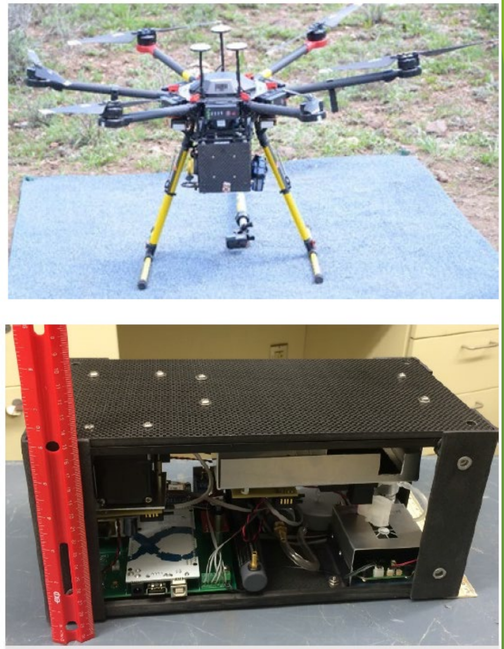
Air measurement instrumentation, miniaturized and low power computer technology, solar panels and communications equipment using park benches

- A community-based activity to demonstrate the capabilities of new real-time monitoring technology to measure $PM_{2.5}$ and O_3
- 8 locations:
  - Houston, TX
  - Durham, NC (a pilot location)
  - Washington, DC
  - Kansas City, KS
  - Philadelphia, PA
  - Oklahoma City, OK
  - Hartford, CT
  - Chicago, IL
- Community-based program to improve understanding of air quality and to increase community awareness of local air quality conditions.

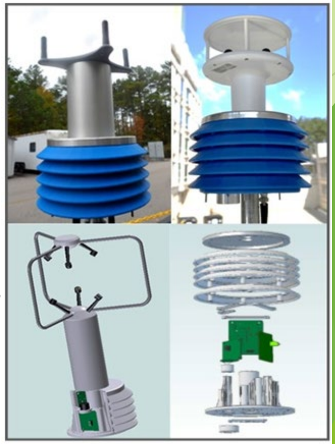
https://www.epa.gov/air-research/village-green-project

Air Quality Monitoring Network and Programs – EPA sponsored (2): **Innovative Approaches**

- Kolibri
  - Drone-based monitor/sensor
  - Monitors PM, Bioaerosol, Polycylic aromatic hydrocarbons, CO, CO_2, NO_x, SO_x
  - Started in 2016
- Kansas City Transportation and Local-Scale Air Quality Study
  - Monitors PM and CO_2
  - Location: Argentine, KS and Kansas City, KS
  - Started in fall 2017
- Next Generation Emission Measurement program
  - Collaboration among industry, communities, and agencies in Kenterkey
  - Monitors VOCs and air toxics
  - Started in Aug 2017



Top: *Kolibri sampling system attached to sUAS*
Bottom: *Kolibri sampling system*



Spod fenceline sensor system

https://www.epa.gov/sites/production/files/2020-05/documents/kolibri_factsheet_v2_tagged.pdf
https://www.epa.gov/air-research/kansas-city-transportation-and-local-scale-air-quality-study
https://www.epa.gov/air-research/researchers-conduct-next-generation-emission-measurement-demonstration-project-provide

Conclusion

- Examples of low-cost air quality sensor networks appear throughout the country
- EPA focuses on development and assessment of new low cost sensor types and performance through community-based and University-led programs
- Most communities (local) focus on monitoring pollutants and providing current air quality in their local areas
  - EPA Village Green projects worked with communities for education purposes and piloting new sensors of next-generation air measurement technology.
- University-led research typically focuses on development of the low-cost or cost-effective sensors using cutting-edge technology

NEAR-ROAD MONITORING

Nick Van Haasen

Air Quality Health Monitoring Task Force Meeting
May 29, 2020

North Central Texas
Council of Governments

BACKGROUND

- Air pollution could be higher close to major roadways. Near-road air pollutant levels and types of air pollutants vary with traffic patterns, roadway design, and vehicle mix.

- Monitoring near-road air pollution will help to understand the health impacts of roadway traffic better and potentially minimize health issues.

- Near-road air monitoring sites are located within a few hundred meters - about 500-600 feet of the busiest roadways across the country.

Source: Minnesota Pollution Control Agency (MPCA) and EPA

NITROGEN DIOXIDE (NO_2)

Title 40 CFR §58, Appendix D, Section 4.3.2 requires one microscale near-road NO_2 monitor located near a major road with high annual average daily traffic counts in each Core-Based Statistical Area (CBSA) with a population of 1,000,000 or more persons.

An additional near-road monitor is required in each CBSA with a population of 2,500,000 or more persons.

DFW Near-Road Monitor(s):

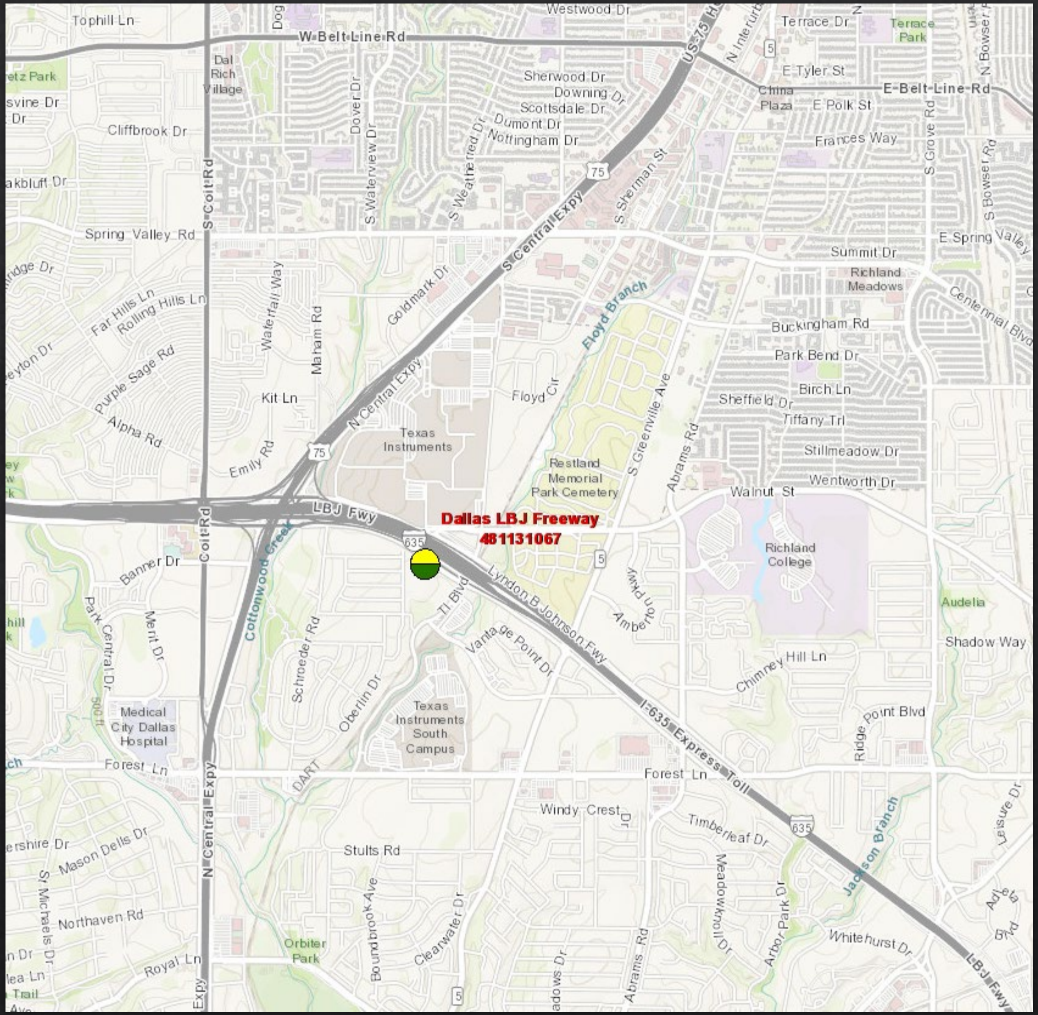
- **Dallas LBJ Freeway**
- **Fort Worth California Parkway North**

National Ambient Air Quality Standards (NAAQS) Table

Pollutant	Primary/ Secondary	Averaging Time	Level	Form
Nitrogen Dioxide (NO_2)	primary and secondary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		1 year	53 ppb	Annual Mean

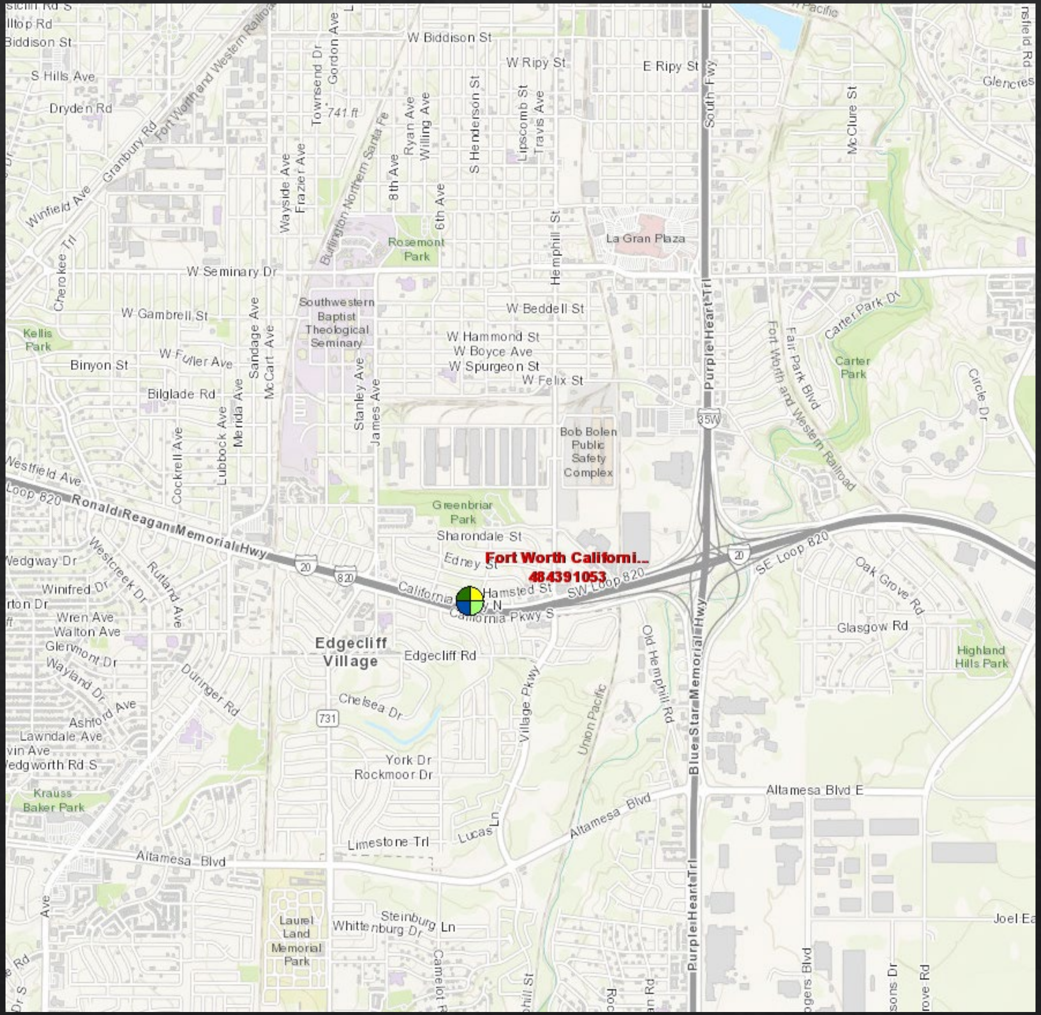
Source: EPA

NEAR-ROAD MONITOR 1: DALLAS LBJ FREEWAY



Source: TCEQ

NEAR-ROAD MONITOR 2: FORT WORTH CALIFORNIA PARKWAY



Source: TCEQ

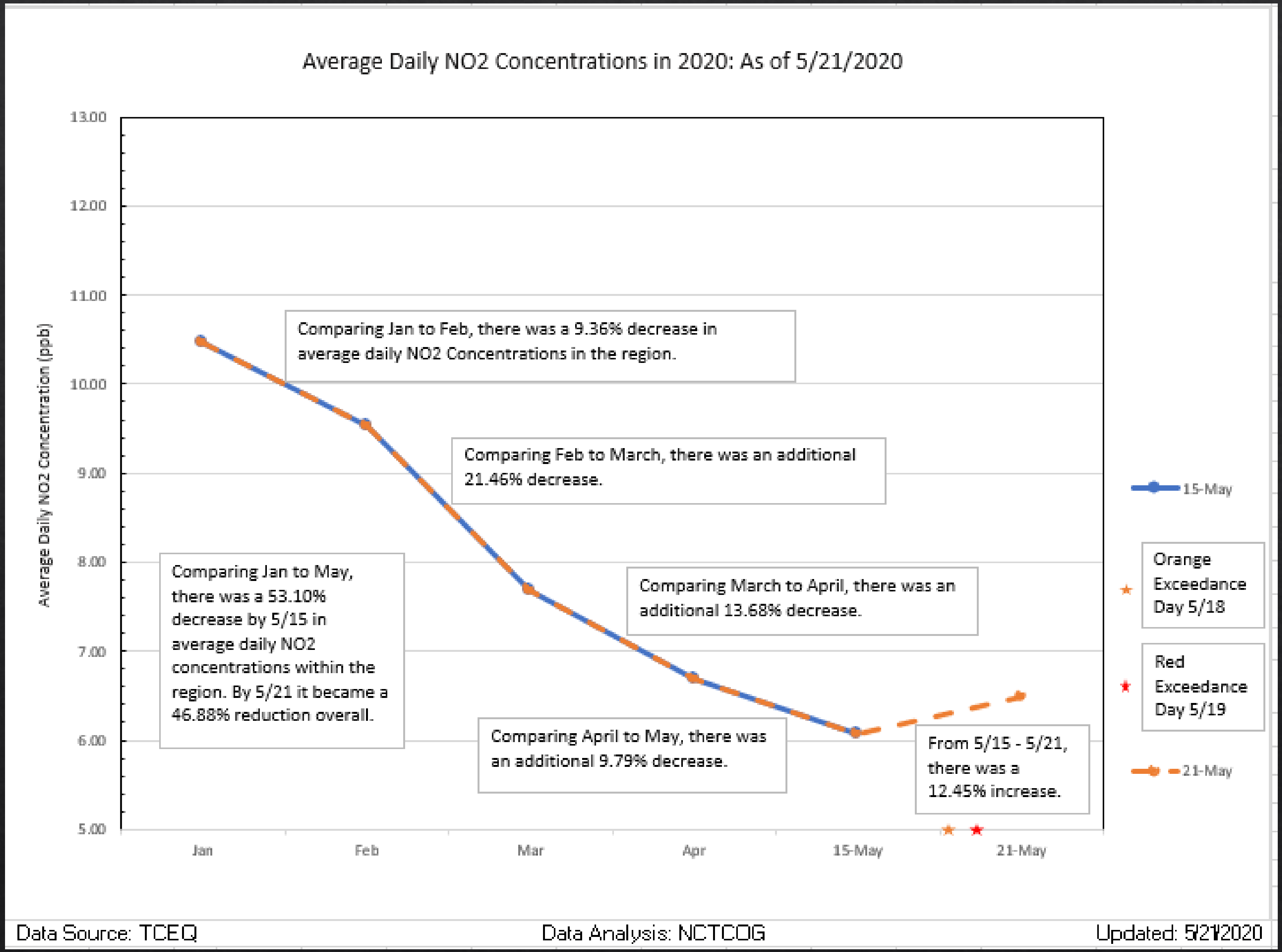
NO_2 VALUES

1-hour NAAQS (100 ppb)		
Site Name	2015 - 2017 1-hour Design Value (ppb)	2016 - 2018 1-hour Design Value (ppb)
Dallas LBJ Freeway (deployed April 2014)	44	43
Fort Worth California Parkway (deployed March 2015)	N/A	43

1-year (Annual) NAAQS (53 ppb)				
Site Name	2015 Annual Design Value (ppb)	2016 Annual Design Value (ppb)	2017 Annual Design Value (ppb)	2018 Annual Design Value (ppb)
Dallas LBJ Freeway (deployed April 2014)	10	9	9	10
Fort Worth California Parkway (deployed March 2015)	9 (partial year)	12	12	11

Source: EPA and TCEQ

REGIONAL NITROGEN DIOXIDE (NO_2) MONITOR DATA



PARTICULATE MATTER OF 2.5 MICROMETERS OR LESS ($PM_{2.5}$)

Title 40 CFR §58, Appendix D, Section 4.7.1(b)(2) requires collocating one Federal Reference Method (FRM) or Federal Equivalent Method (FEM) $PM_{2.5}$ monitor with one required near-road NO_2 monitor in CBSAs with populations of 1,000,000 or more persons.

DFW Near-Road Monitor: Fort Worth California Parkway North

National Ambient Air Quality Standards (NAAQS) Table

Pollutant	Primary/ Secondary	Averaging Time	Level	Form
Particle Pollution ($PM_{2.5}$)	Primary	1 year	12.0 $\mu g/m^3$	Annual mean, averaged over 3 years
	Secondary	1 year	15.0 $\mu g/m^3$	Annual mean, averaged over 3 years
	Primary and Secondary	24 hours	35 $\mu g/m^3$	98th percentile, averaged over 3 years

Source: EPA

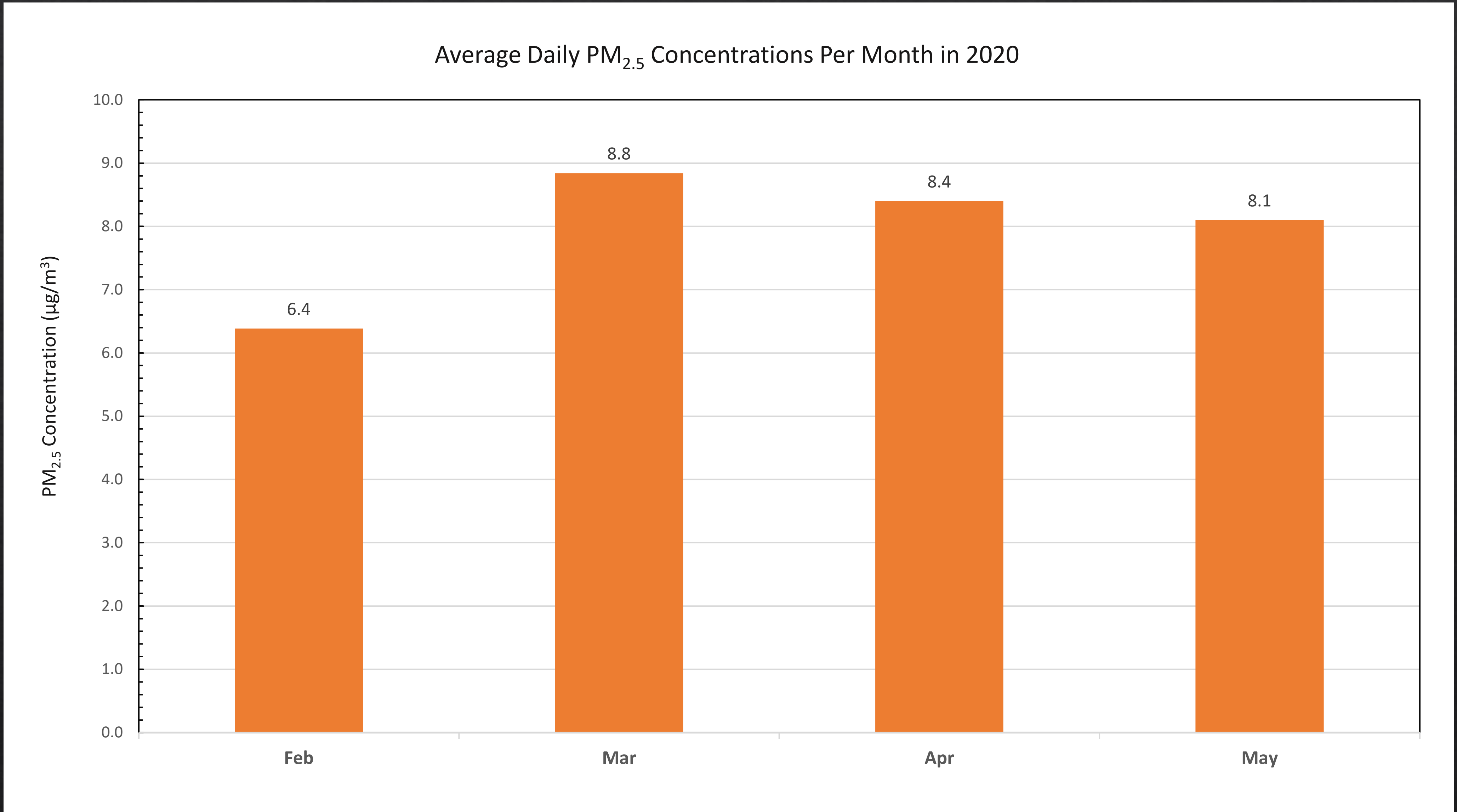
$PM_{2.5}$ VALUES

24-hour NAAQS (35 µg/m³)	
Site Name	2016 - 2018 24-hour Design Value (µg/m³)
Fort Worth California Parkway (deployed March 2015)	18 µg/m³

1-year (Annual) NAAQS (12.0 µg/m³)	
Site Name	2016 - 2018 Annual Design Value (µg/m³)
Fort Worth California Parkway (deployed March 2015)	8.6 µg/m³

Source: EPA and TCEQ

REGIONAL $PM_{2.5}$ MONITOR DATA



Data Source: Texas Commission on Environmental Quality
Data Analysis: North Central Texas Council of Governments

THANK YOU

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OCTOBER 19, 2017

Vivek Thimmavajjhala

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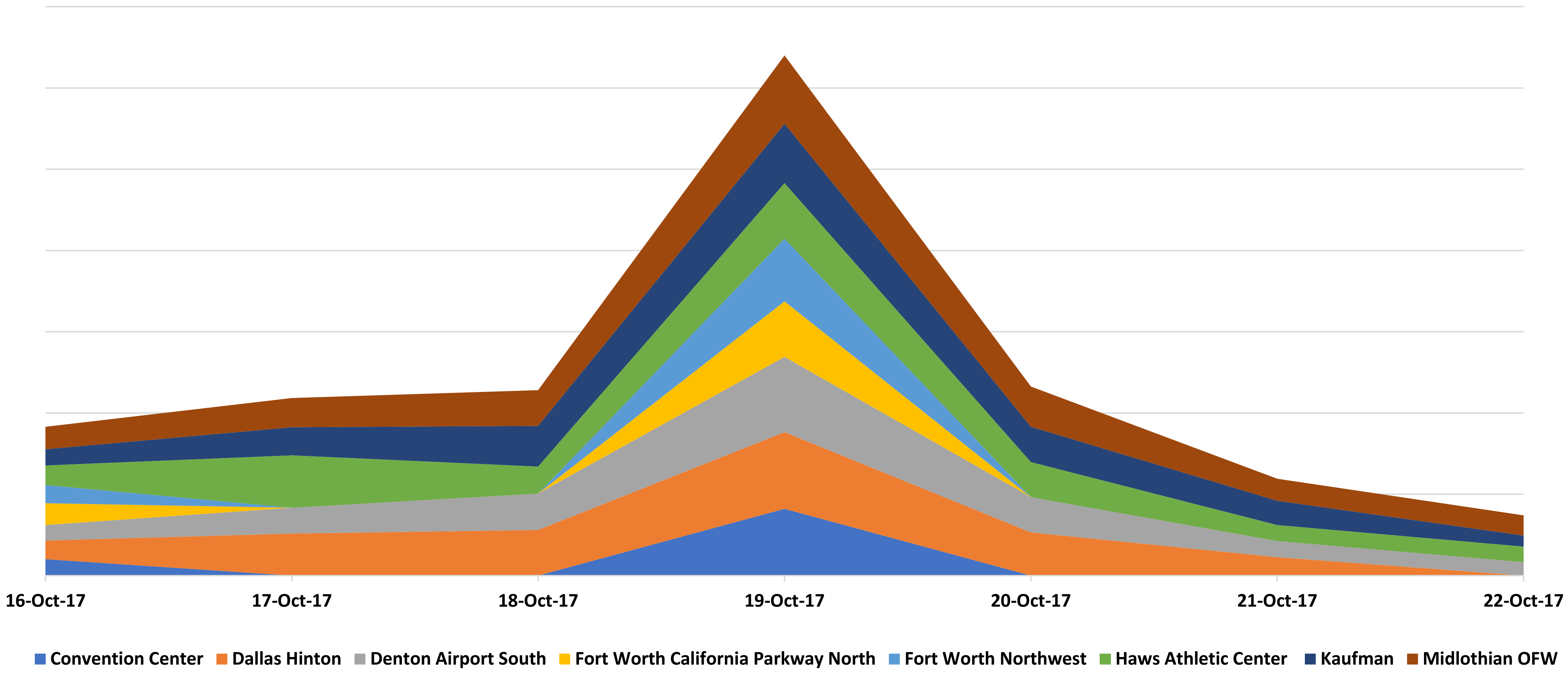
WHAT HAPPENED?

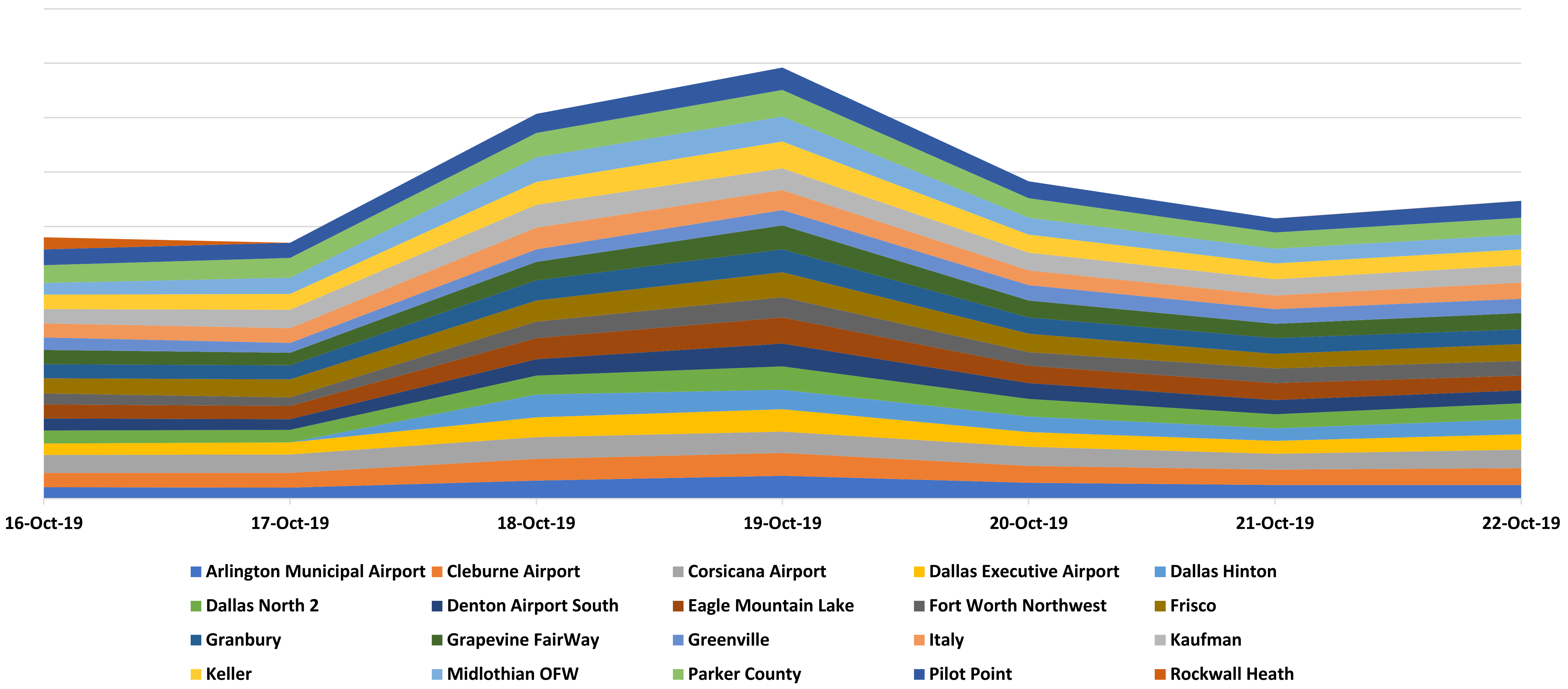
A haze occurred in the North Central Texas region, primarily in the Arlington, Mansfield, and Grand Prairie areas

Image Source: Brian Luenser

HOW WERE THE MONITOR READINGS?
Particulate Matter (PM) 2.5

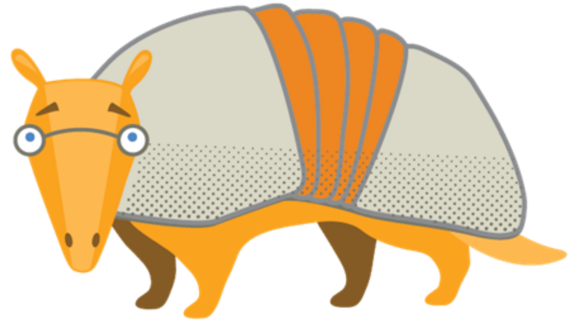


HOW WERE THE MONITOR READINGS?
Ozone



WHAT WAS DONE?
(NCTCOG's ACTIONS)

- Issued a PM alert through the "Air North Texas"
- Responded to various enquires throughout the region
- Coordinated with the cities and local governments in an effort to determine source of the haze
- Discussed with the EPA and the TCEQ regarding the source of the haze and further actions
- The event could not be classified as an exceptional event in accordance with EPA's definition



Orange Particulate Matter Alert
Level Orange

Particulate matter (PM) is currently at Level Orange in the Dallas-Fort Worth area. Children, older adults and people with lung disease, such as asthma, emphysema, or chronic bronchitis, should limit outdoor activity. If PM reaches Level Red, Children, older adults and people with lung disease, such as asthma, emphysema, or chronic bronchitis, should avoid outdoor activity. All other people should limit prolonged outdoor exertion if PM reaches Level Red.

For more information, visit AirNorthTexas.org.

WHAT WAS THE SOURCE?

Identified Potential Sources:

Controlled burn in Ellis county

OR

ALIENS!!

Image Source: Getty Images

WHAT NEXT?

- Working with the Air Quality Health task force to determine the correlation between the pollutant levels and available health data, such as (but not limited to),
  - Asthma data
    - Hospital discharges
    - Outpatient visits
  - Pharmacy visits data
- Appropriateness of existing PM monitors
- Other

NEED MORE INFORMATION?

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EFFECTS OF COVID-19 ON TRANSPORTATION AND RELATED HEALTH IMPACTS

Chris Klaus

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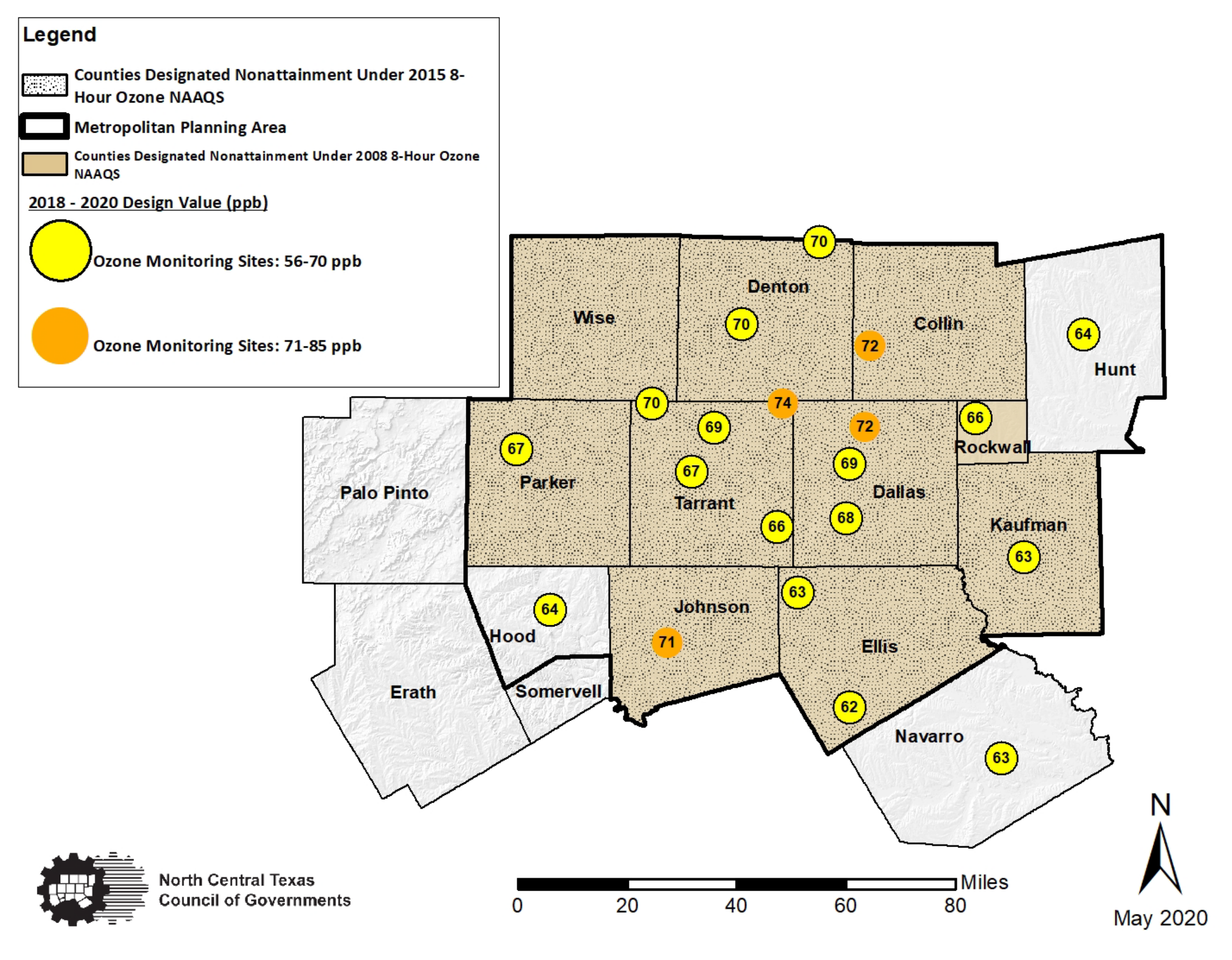
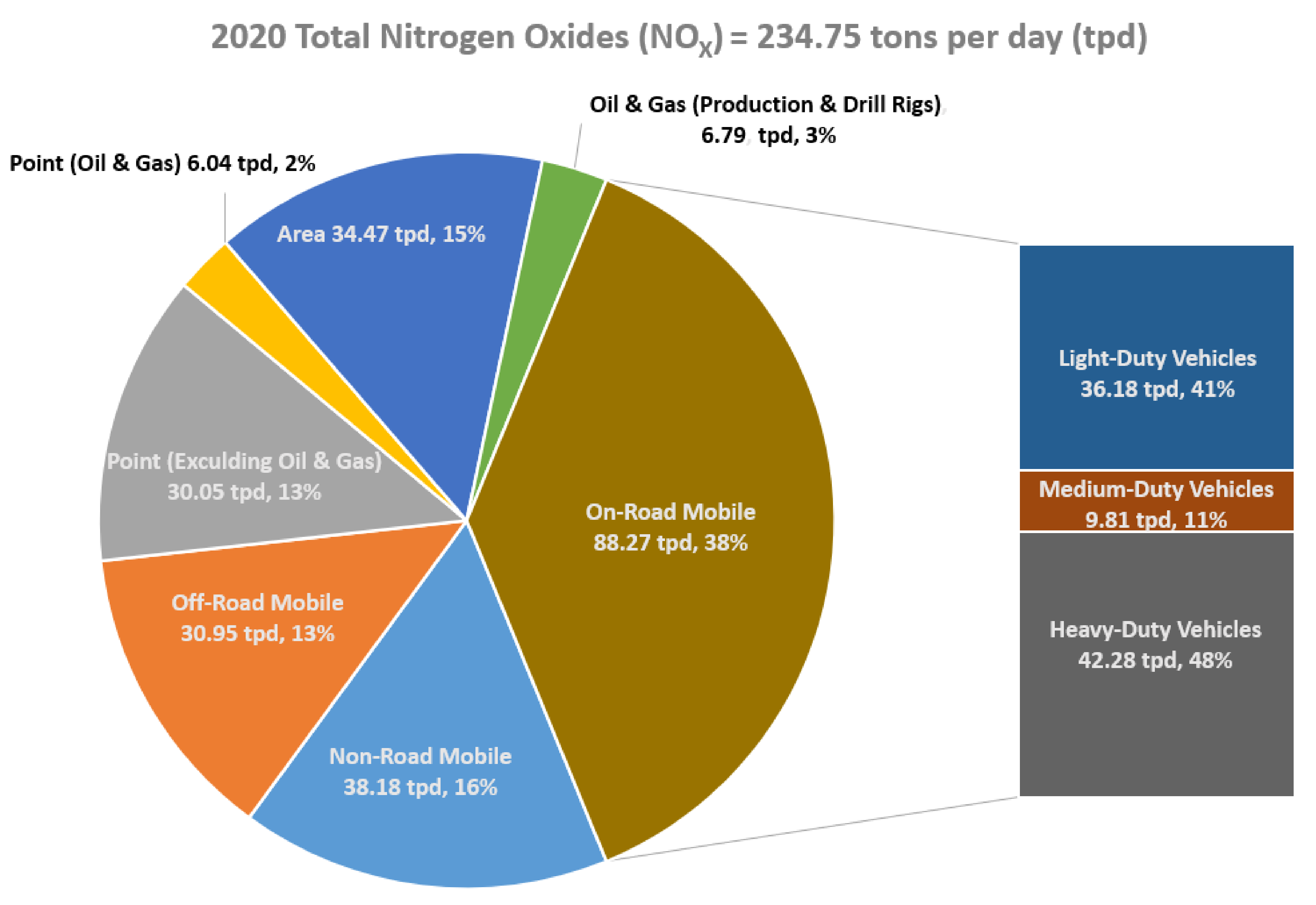
DFW OZONE NONATTAINMENT AREA



Colors represent Air Quality Index breakpoints

Attainment Goal - According to the US EPA National Ambient Air Quality Standards, attainment is reached when, at each monitor, the three-year average of the annual fourth-highest daily maximum eight-hour average ozone concentration is less than or equal to 70 parts per billion (ppb).

NITROGEN OXIDES (NO_X) EMISSION SOURCES

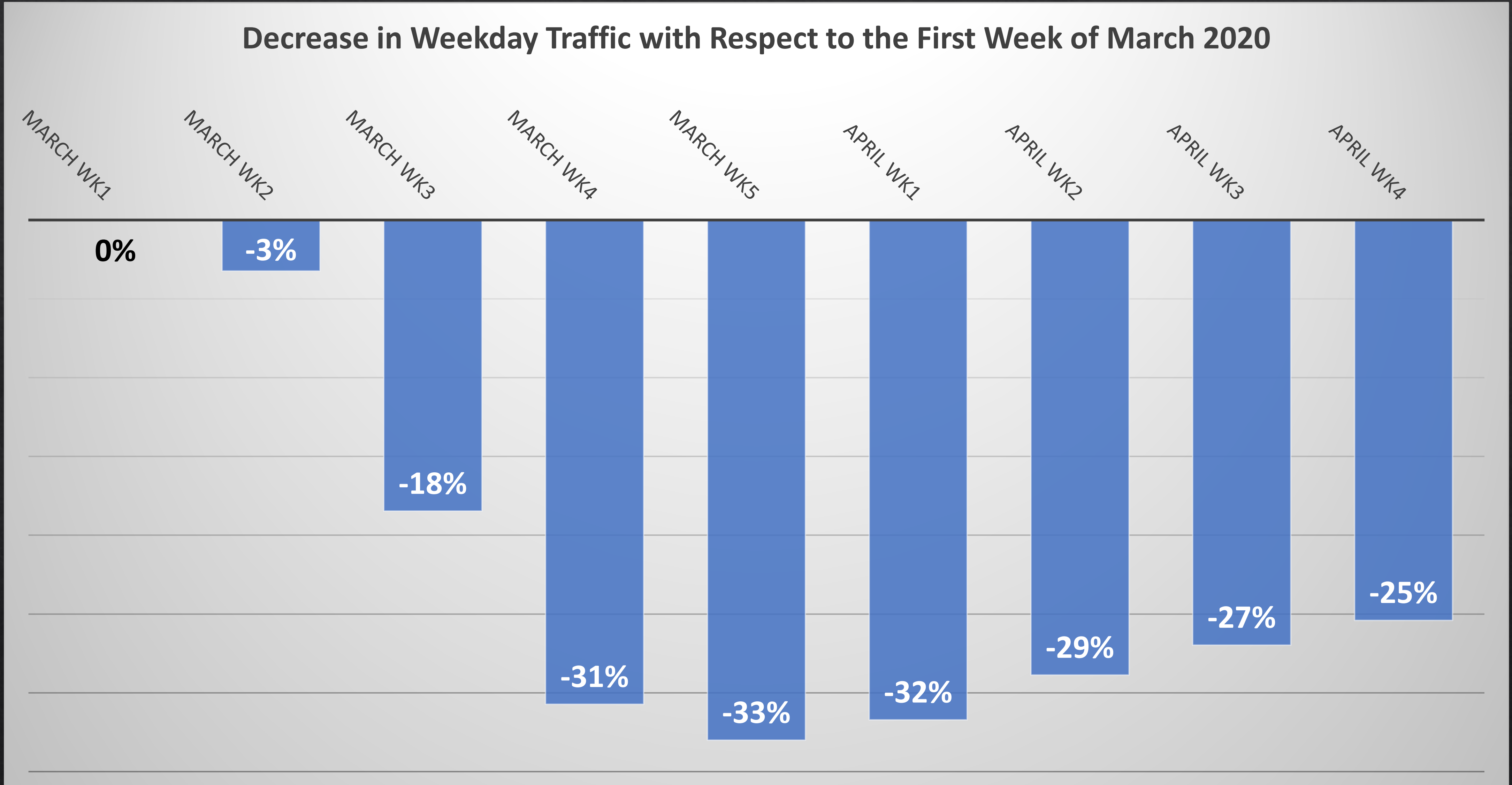


Source: Dallas-Fort Worth Serious Classification Attainment Demonstration State Implementation Plan Revision for the 2008 Eight-Hour Ozone National Ambient Air Quality Standard, September, 2019

POLICY METRICS

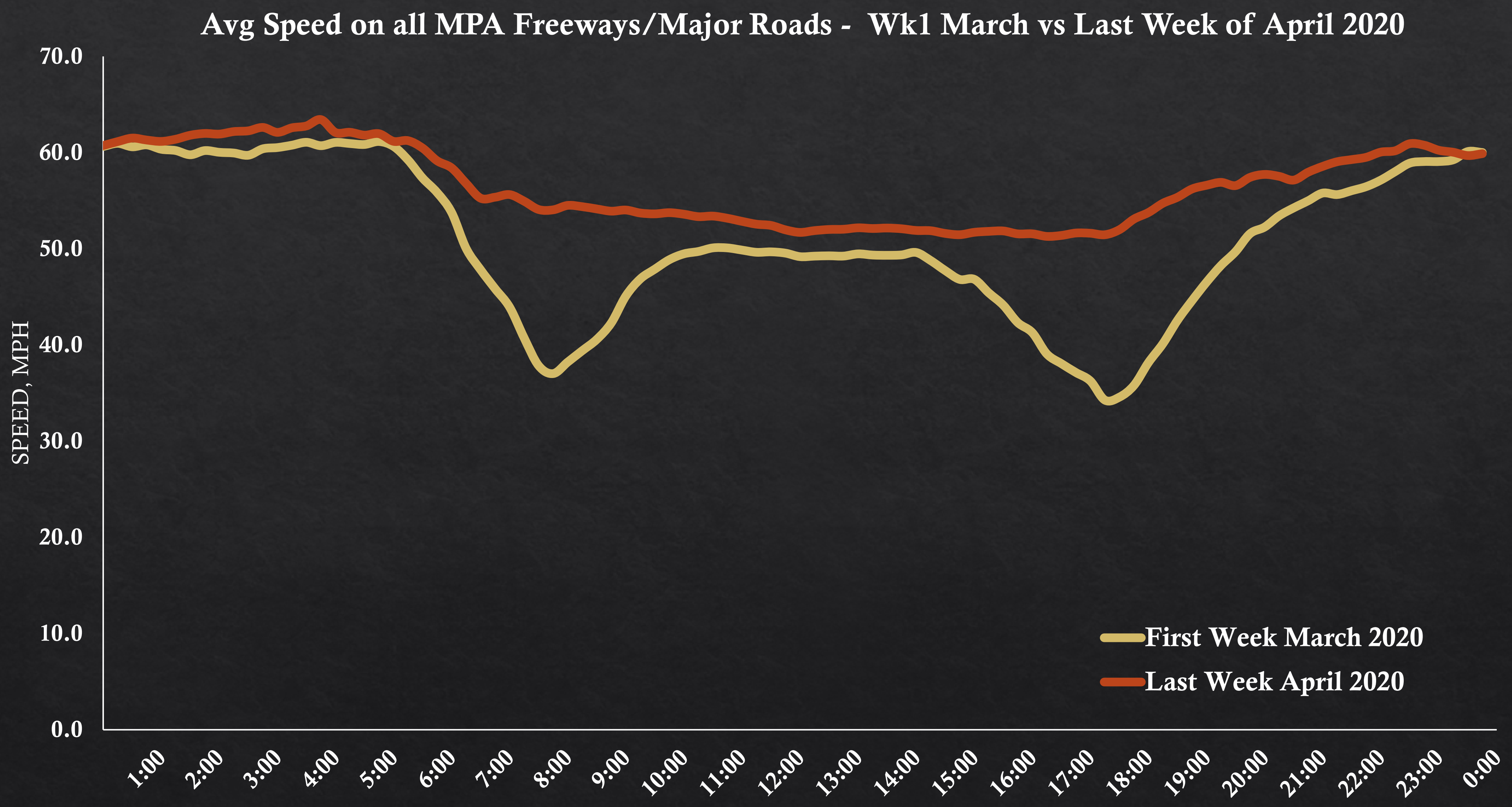
1. Travel behavior response to COVID-19
2. Financial implications to traditional revenue sources
3. Benefits of travel behavior responses to areas of RTC responsibility (e.g., Congestion Management System, national performance measures, ozone standard)
4. Prioritization of infrastructure improvements that offset unemployment increases

FREEWAY VOLUMES DURING COVID-19



Source: Traffic Radars on TxDOT Dallas and Fort Worth Districts

AVERAGE SPEED BY TIME OF DAY DURING COVID-19



Source: INRIX data delivered by FHWA through NPMRDS

ANNUAL OZONE COMPARISON DURING COVID-19

North Central Texas Ozone Comparison

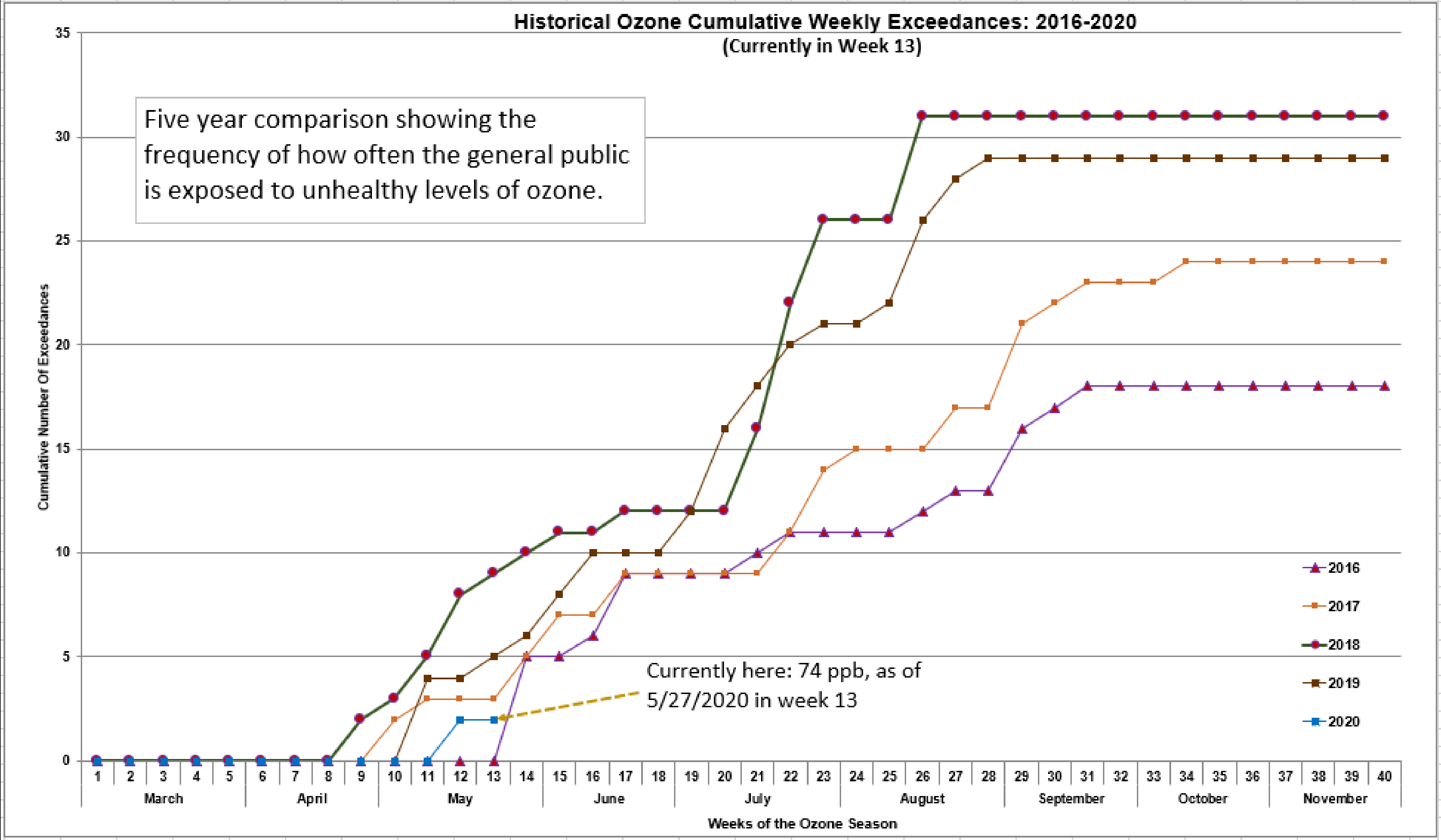
	2017	2018	2019	2020*
		3 Year Design Value		
March	2 yellow days High: 62 at Eagle Mtn Lake	8 yellow days High: 63 at Denton	10 yellow days High: 66 at Cleburne	3 yellow days High: 64 at Pilot Point
April	10 yellow days High: 68 at Dallas Hinton	16 yellow days 2 orange days High: 81 at Dallas North High: 81 at Dallas Hinton	12 yellow days High: 69 at Greenville	8 yellow days High: 69 at Rockwall High: 69 at Grapevine
May	15 yellow days 5 orange days High: 80 at Dallas North High: 80 at Dallas Hinton	9 yellow days 6 orange days 2 red days High: 92 at Eagle Mtn Lake	6 yellow days 5 orange days High: 80 at Pilot Point	9 yellow days 1 orange day 1 red day High: 86 at Grapevine Fairway

Data Source: TCEQ
Data Analysis: NCTCOG

* as of May 27, 2020. At this time last year (May 27, 2019), there were five Yellow days and four Orange Exceedance days.

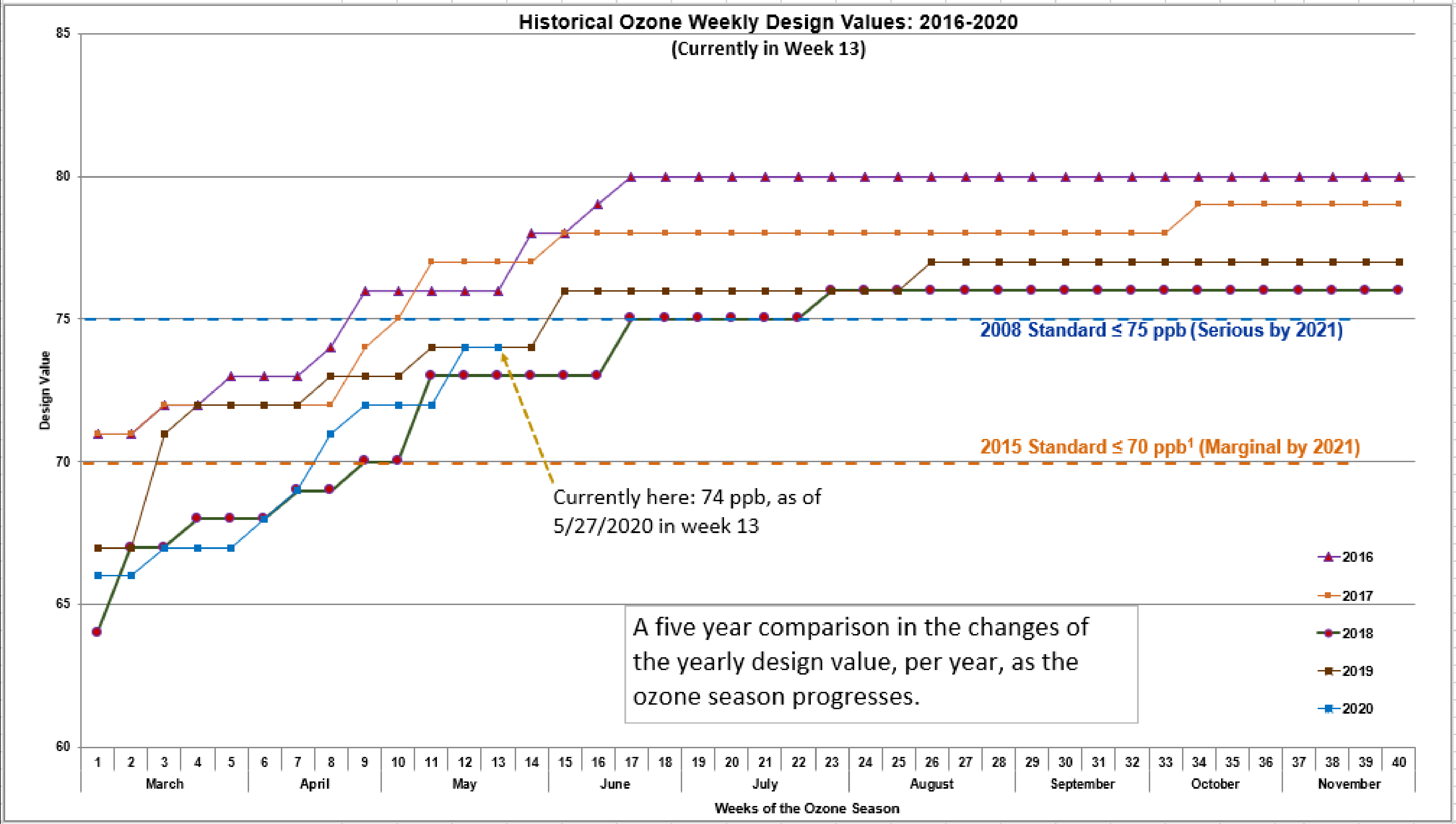
Data Source: Texas Commission on Environmental Quality
Data Analysis: North Central Texas Council of Governments

CUMULATIVE OZONE EXCEEDENCES, 2016-2020



Data Source: Texas Commission on Environmental Quality
Data Analysis: North Central Texas Council of Governments

WEEKLY OZONE DESIGN VALUES, 2016-2020



Data Source: Texas Commission on Environmental Quality
Data Analysis: North Central Texas Council of Governments

REGIONAL AIR QUALITY IMPACTS DURING COVID-19

Reduced Vehicle Emissions

Lowest Frequency of High-Level, Unhealthy Ozone Exposure Days *(prior to exceedances on May 17, 2020)*

Cleaner Air = Blue(r) Skies

Positive Health Impacts? (Under Review)

How Can We Sustain Impacts? (To be Determined)

- Electric and Fuel Cell Vehicles
- Travel Demand Management (Telecommuting)

THANK YOU

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