IMPLICATIONS OF ELEVATED GASOLINE SULFUR CONTENT ON AIR QUALITY IN CENTRAL TEXAS AND BEYOND

TEXAS TRANSPORTATION INSTITUTE
TRANSPORTATION, AIR QUALITY, AND HEALTH SYMPOSIUM
AUSTIN, TEXAS
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Presentation Overview

- Review of Tier 2 and Tier 3 Standards
- The Austin Metro Area
- “Fuel Regions” for Emissions Modeling
- NO_X Emissions at Sulfur Levels 10 – 90 ppm
- Sulfur Levels by Gasoline Grade
- Conclusions & Implications

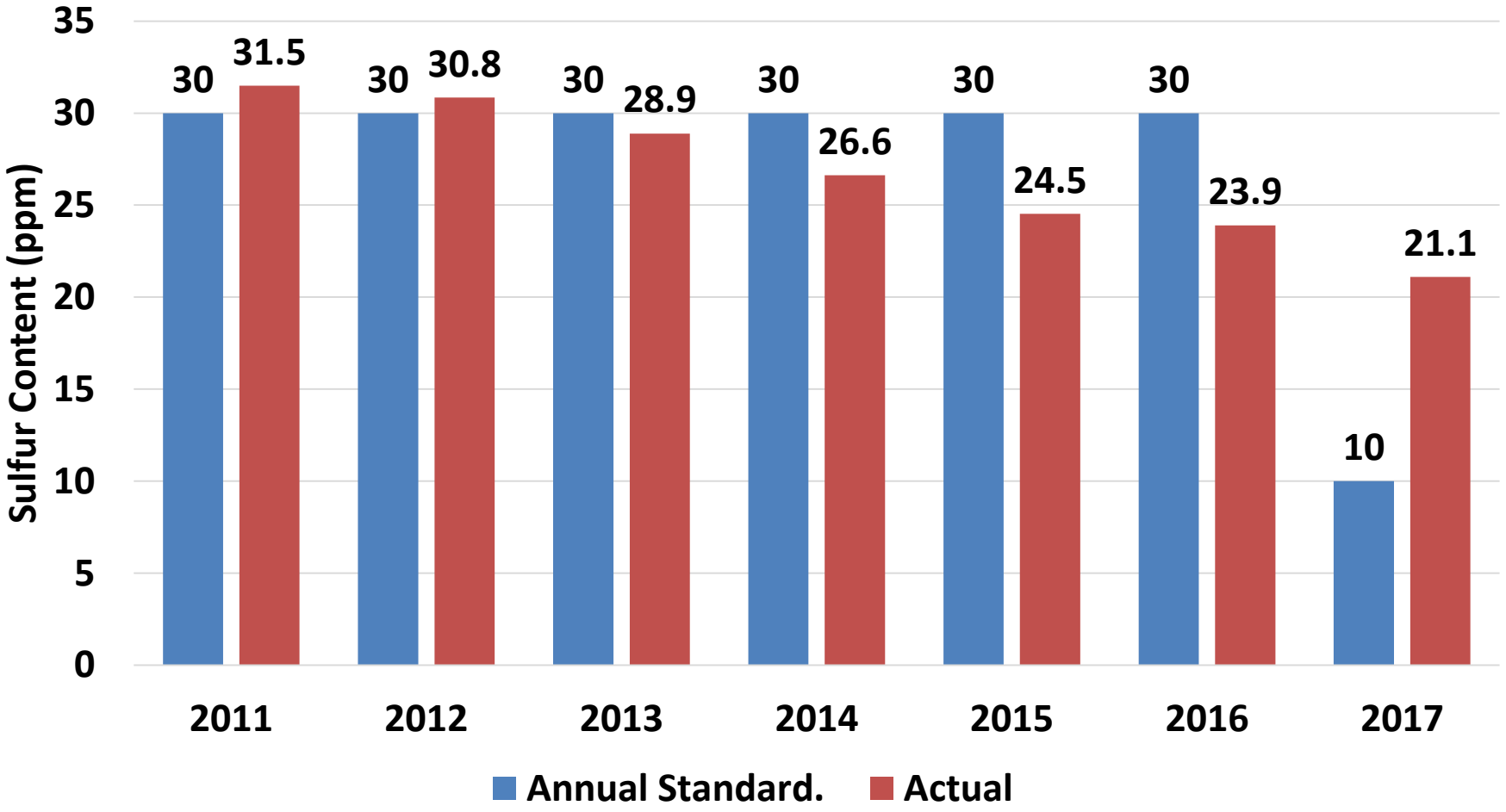
Tier 2 and Tier 3 Standards

- Tier 2 and Tier 3 light-duty vehicle and fuel standards treat on-road emissions as a single system
- This approach recognizes that fuel properties have an impact on performance of pollution control equipment
- Tier 2: published in 2000, in effect 2004 – 2016
  - **30 ppm** annual avg. sulfur content
  - 80 ppm refinery gate per-gallon cap, 95 ppm downstream cap
- Tier 3: published in 2014, in effect 2017+
  - **10 ppm** annual avg. sulfur content
  - 80 ppm refinery gate per-gallon cap, 95 ppm downstream cap

Tier 3 Gas Sulfur Compliance Flexibilities

- Per-gallon caps:
  - 80 ppm at the refinery gate
  - 95 ppm downstream
- Delayed compliance until 2020:
  - “Small Refiners:” <1,500 employees company-wide with 2012 input of <155,000 barrels per day
  - “Small Volume Refinery:” <75,000 barrels per day input
- Averaging, banking, and trading:
  - 5-year useful life (i.e., 2017 credits can be used 2018 – 2022)
  - Over-compliance with Tier 2 standards in 2012 – 2016 can be used to exceed 10 ppm annual standard 2017 – 2019

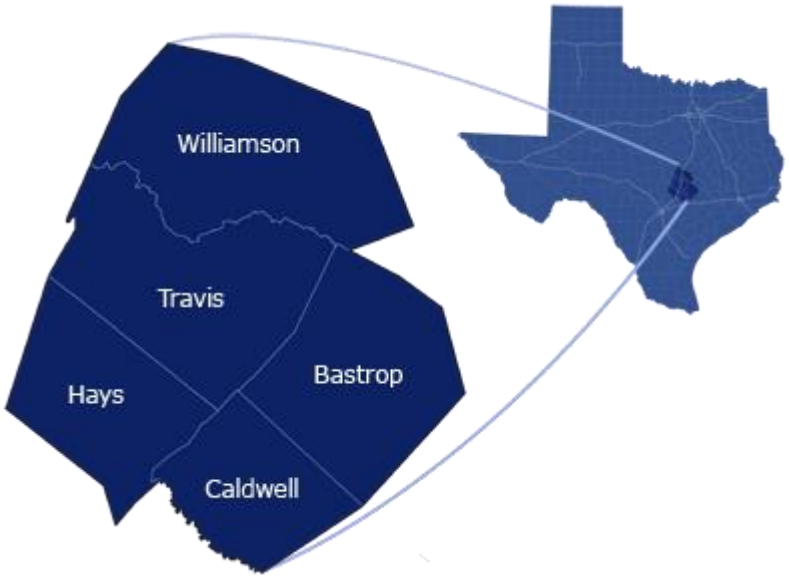
Nation-wide Gasoline Sulfur Compliance Data



Source: EPA. Public Data on Gasoline Fuel Quality properties.
Available at: https://www.epa.gov/fuels-registration-reporting-and-compliance-help/public-data-gasoline-fuel-quality-properties

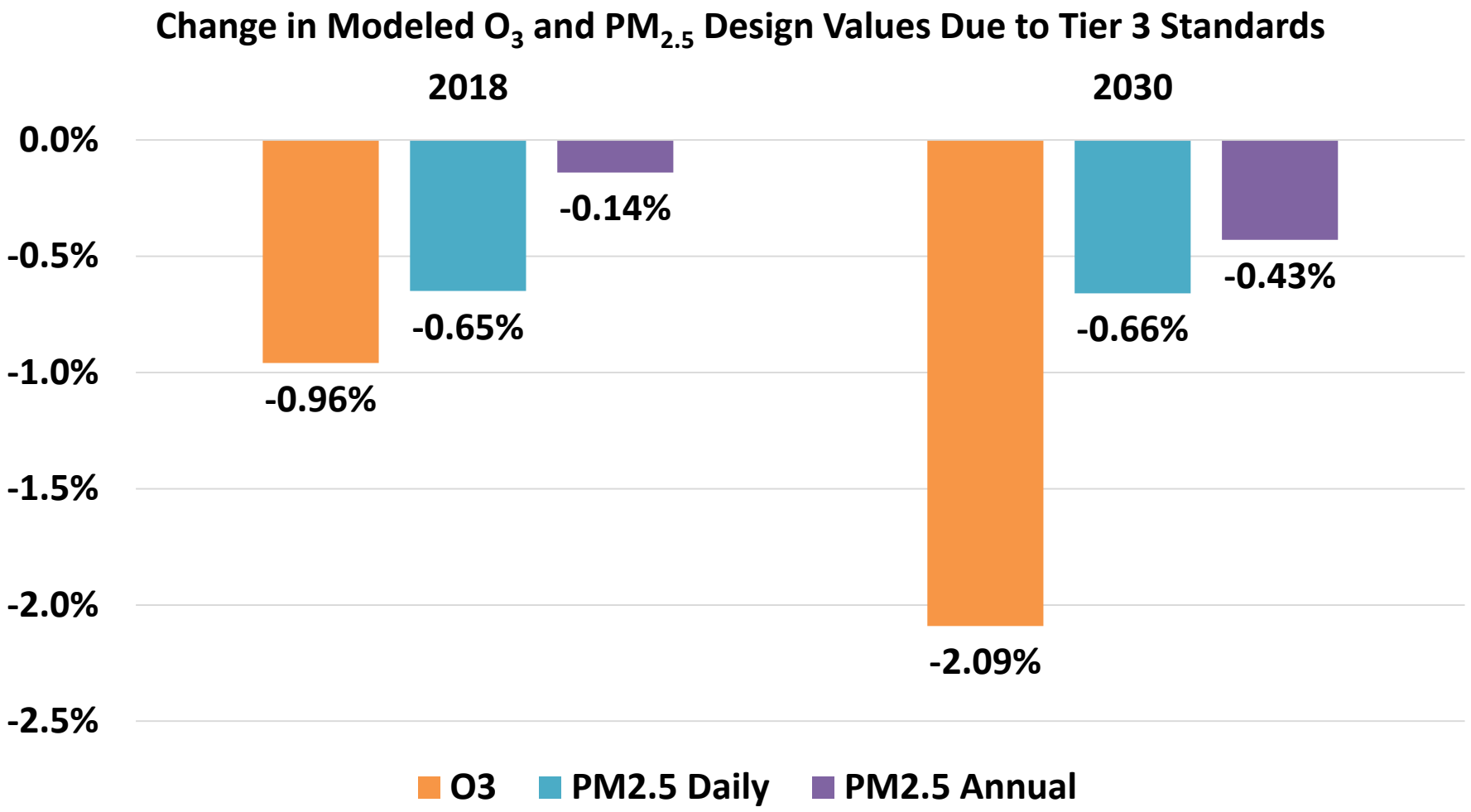
The Austin Metro Area

- Austin is the largest city in the U.S. in compliance with all air quality standards
- Home to two largest counties in the country with an I/M program not required to have one
- At significant risk for violating the ozone standard by the end of 2019



- Highest gasoline sulfur levels in the state

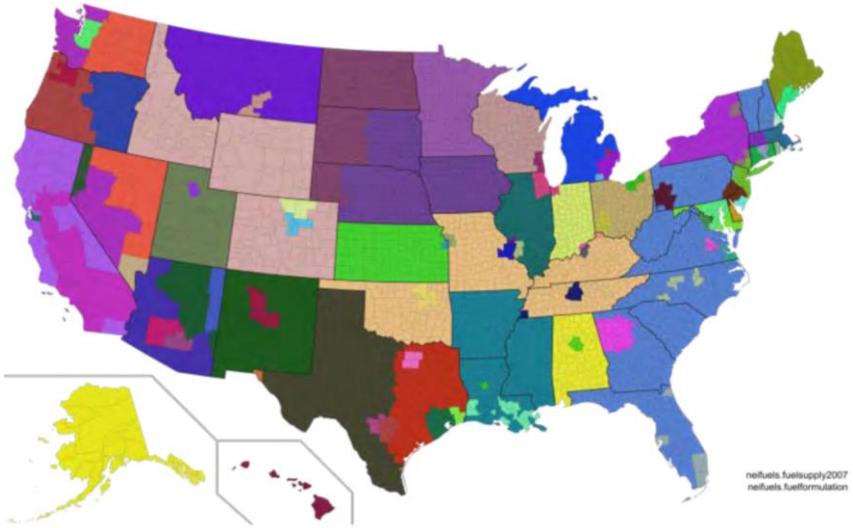
Tier 3 Vehicle & Fuel Standards Air Quality Impact in Austin Area



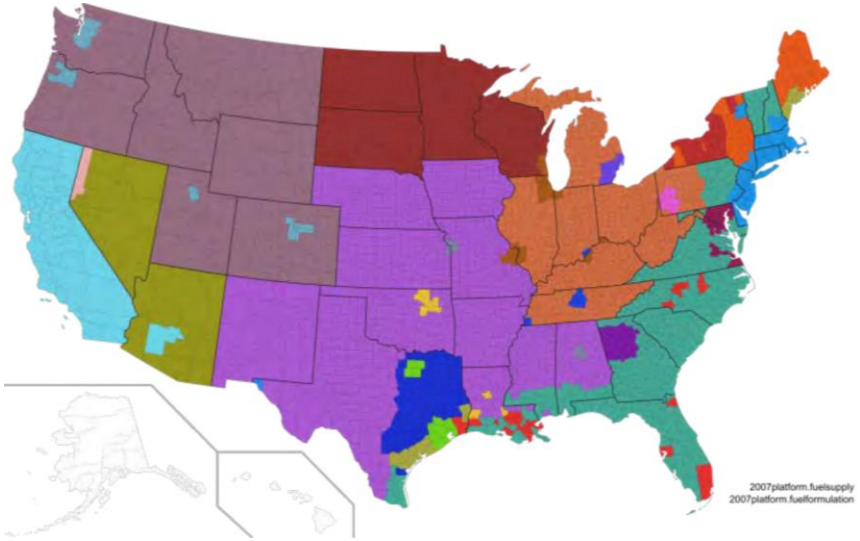
Source: EPA. *Air Quality Modeling Technical Support Document: Tier 3 Motor Vehicle Emission and Standards*. February 2014. EPA-454/R-14-002. Available at: https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-control-air-pollution-motor-vehicles-tier-3.

Fuel Regions in MOVES Model

MOVES2010



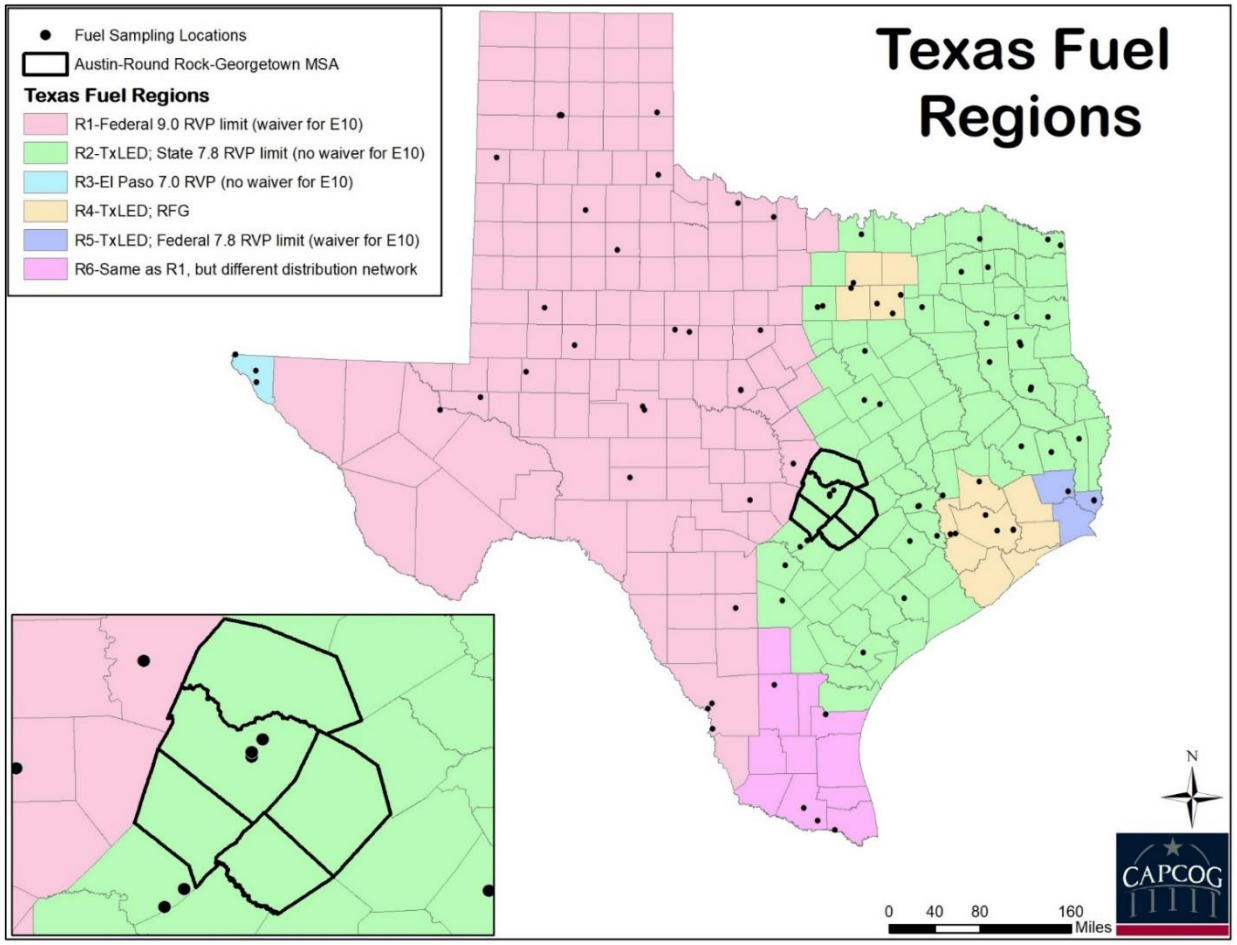
MOVES2014b



"We initially based these fuel regions on existing PADD boundaries (a historic division of fuel supply areas originally developed in the 1950s), and then adjusted to ***account for broad fuel distribution corridors and the presence of bulk fuel pipelines and terminals****…Using these terminal locations, we could group areas sharing connections to similar pipeline networks as a part of defining the new regional fuel areas. Within these broad fuel regions, we* ***further identified areas requiring additional unique fuel qualities, due to federal, state, or local fuel quality standards****"*

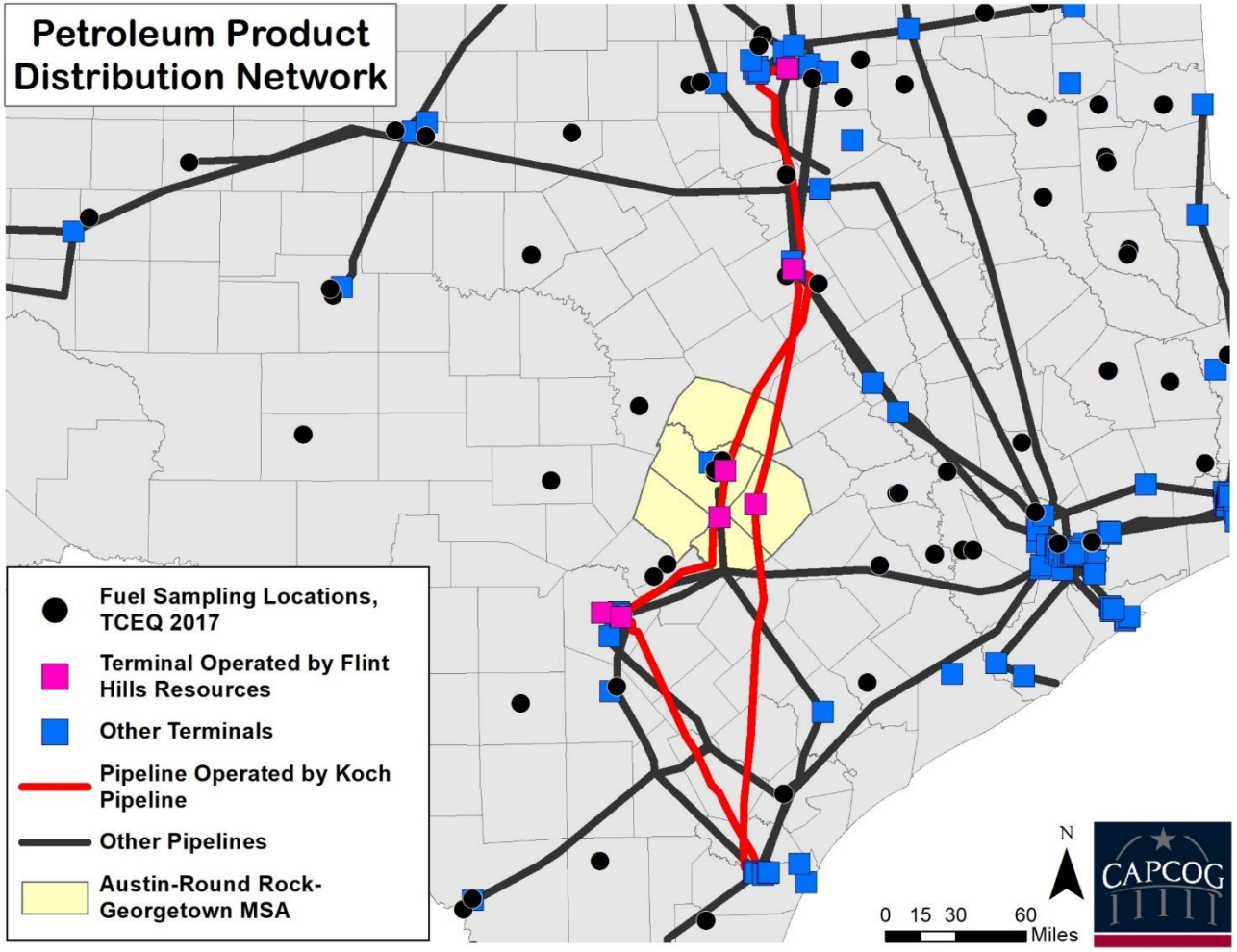
Source: EPA. *Fuel Supply Defaults: Regional Fuels and the Fuel Wizard in MOVES2014b.* July 2018. EPA-420-R-18-008. Available at: https://www.epa.gov/moves/moves-onroad-technical-reports

TCEQ Fuel Regions and 2017 ERG Sampling Locations



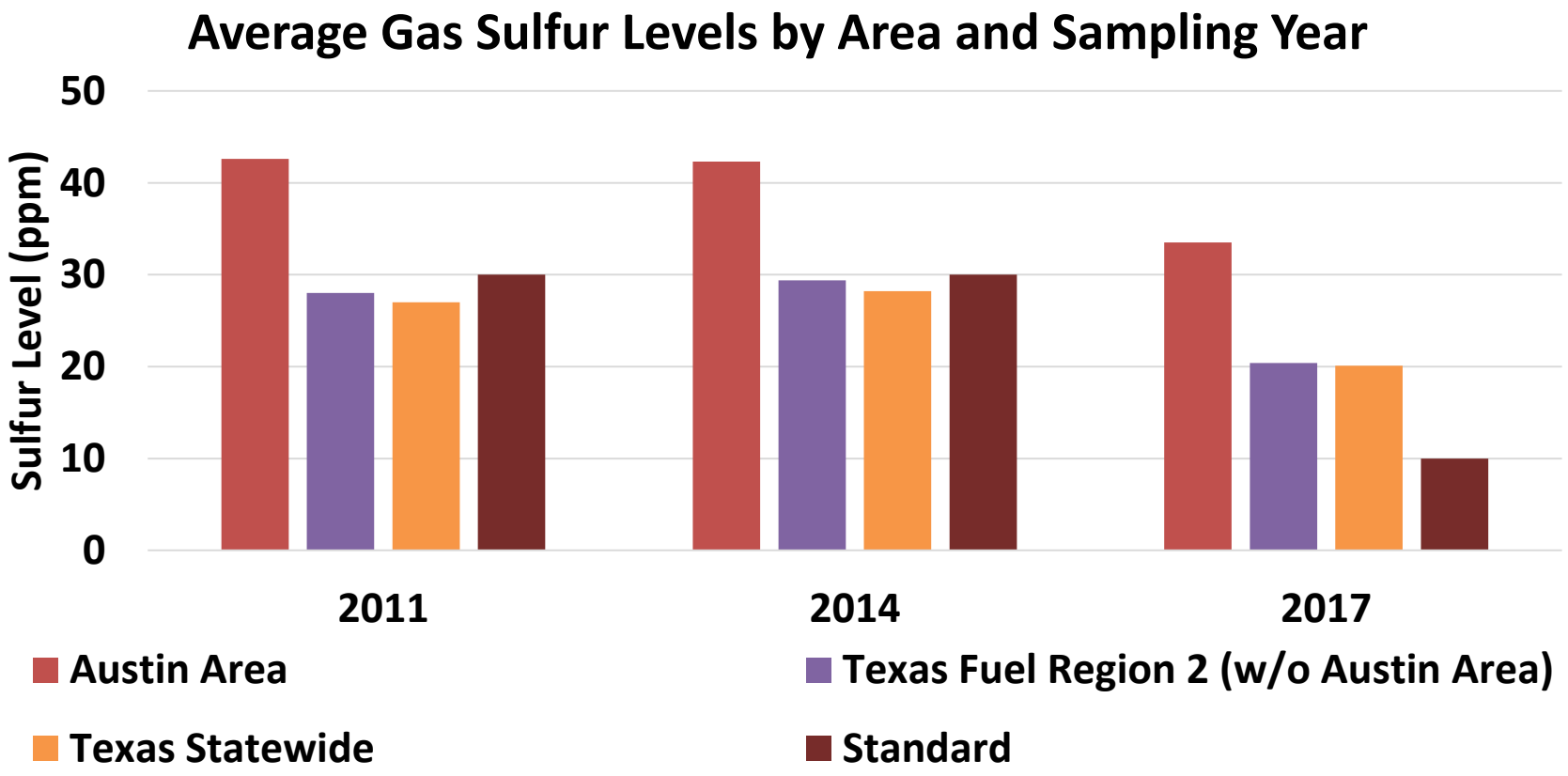
Source: ERG. *2017 Summer Fuel Study*. Prepared for TCEQ. August 31, 2017.
Available at: https://www.tceq.texas.gov/airquality/airmod/project/pj_report_mob.html

Fuel Distribution Network for Austin and Surrounding Areas



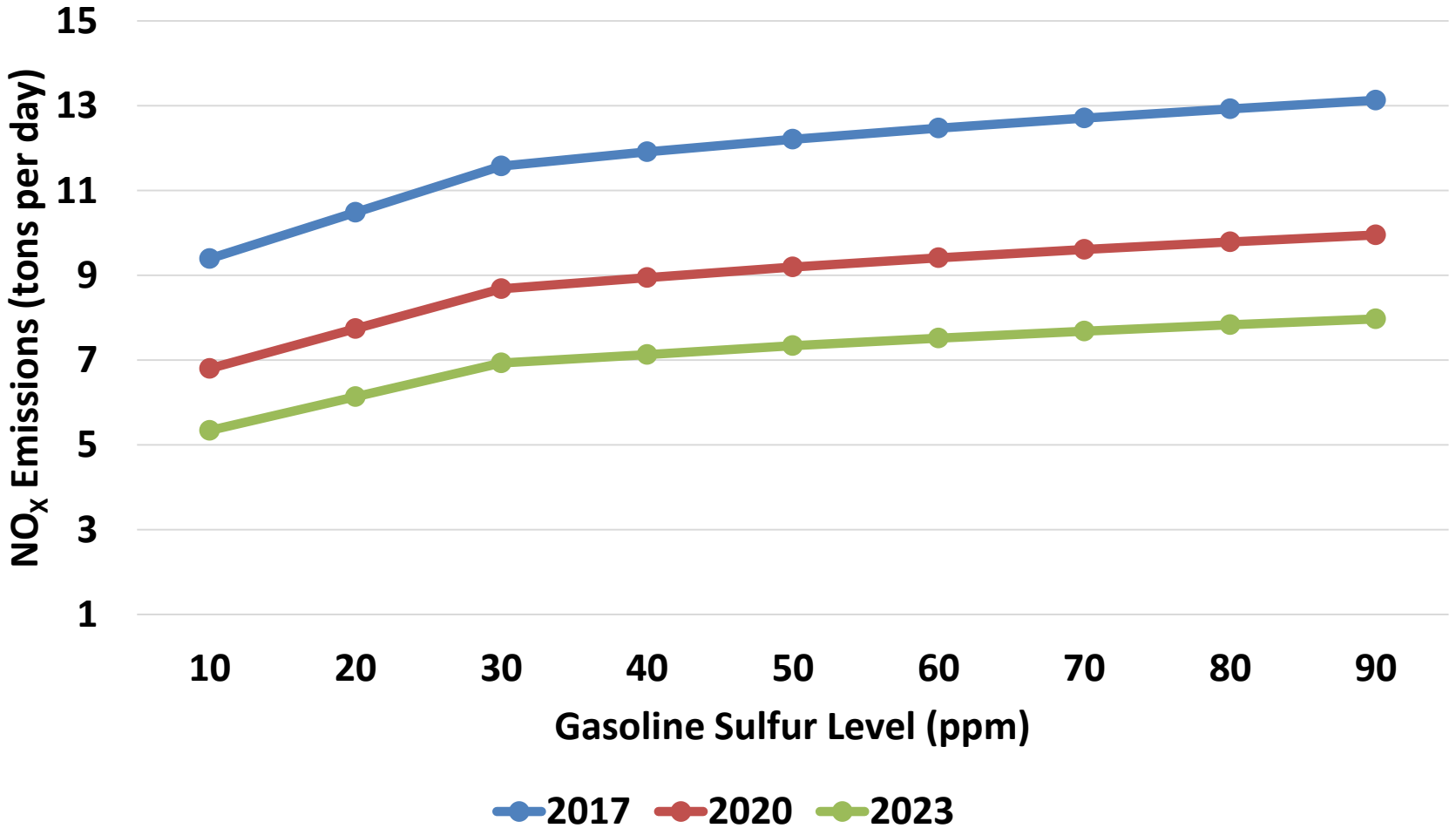
Distribution Network Source: EIA. Shapefiles for Petroleum Product Pipelines as of 2/23/2018 and Petroleum Product Terminals as of 1/18/2019. Available at: https://www.eia.gov/maps/layer_info-m.php

Average Austin Area Gasoline Sulfur Levels Compared to "Fuel Region 2" and Statewide

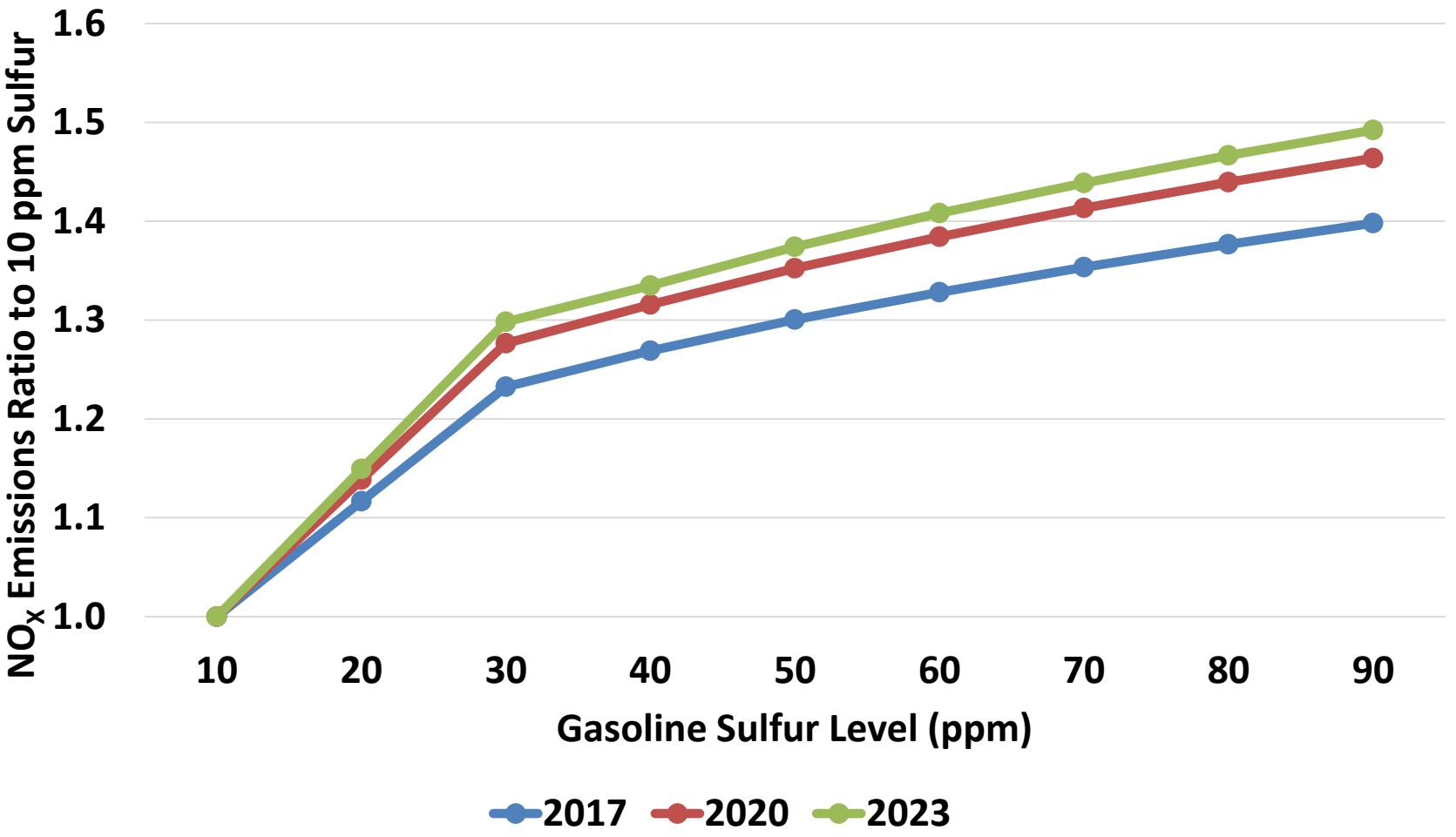


Sources: ERG. *2017 Summer Fuel Study*. August 31, 2017. Available at: https://www.tceq.texas.gov/airquality/airmod/project/pj_report_mob.html
EIA. *Refiner Motor Gasoline Sales Volume*: Texas. Available at: https://www.eia.gov/dnav/pet/pet_cons_refmg_d_STX_VTR_mgalpd_a.htm

Travis County Gasoline Vehicle NO_X Emissions for 2017, 2020, and 2023

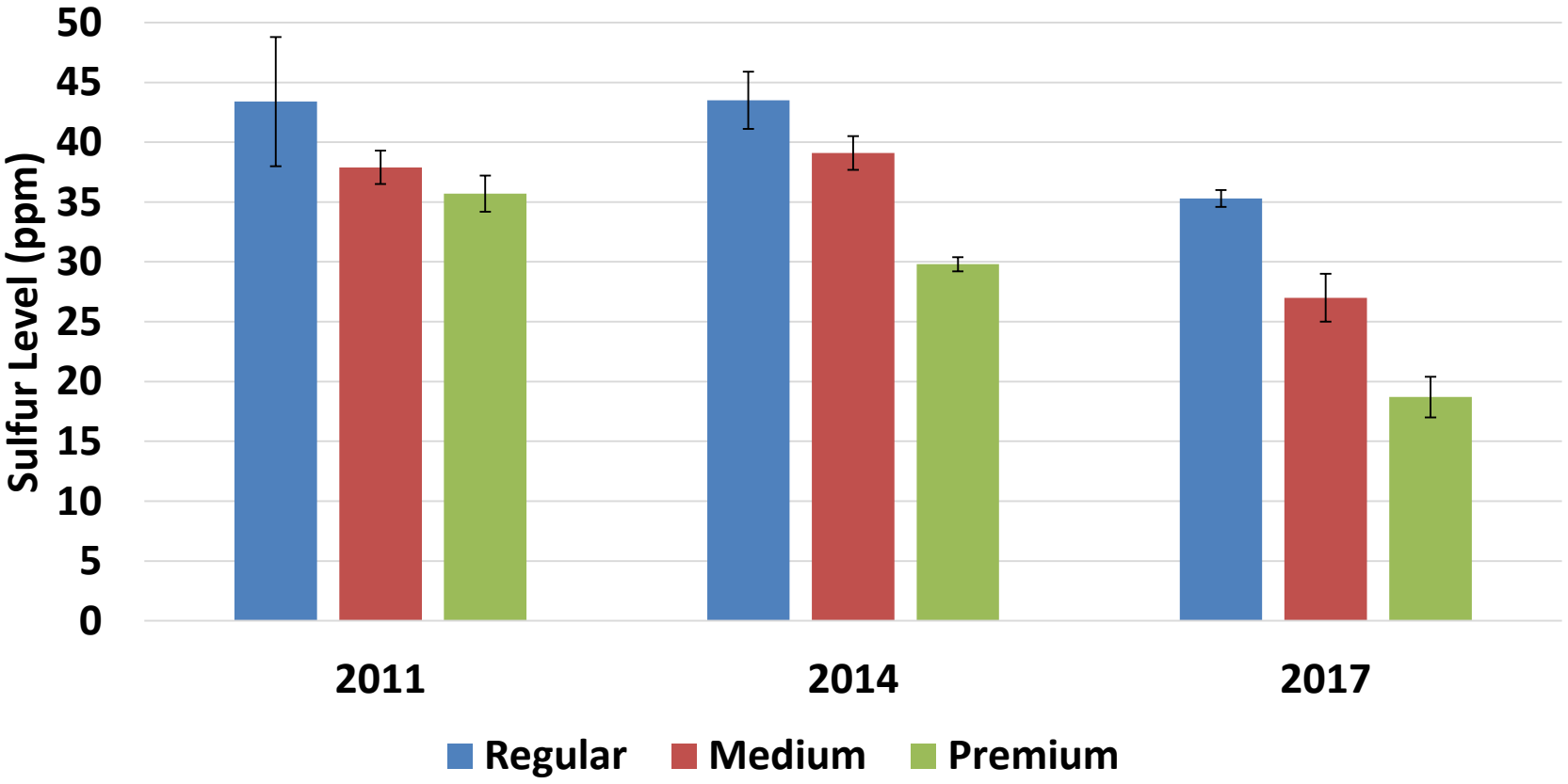


Travis County Gasoline Vehicle NO_X Emissions for 2017, 2020, and 2023 Relative to 10 ppm Sulfur



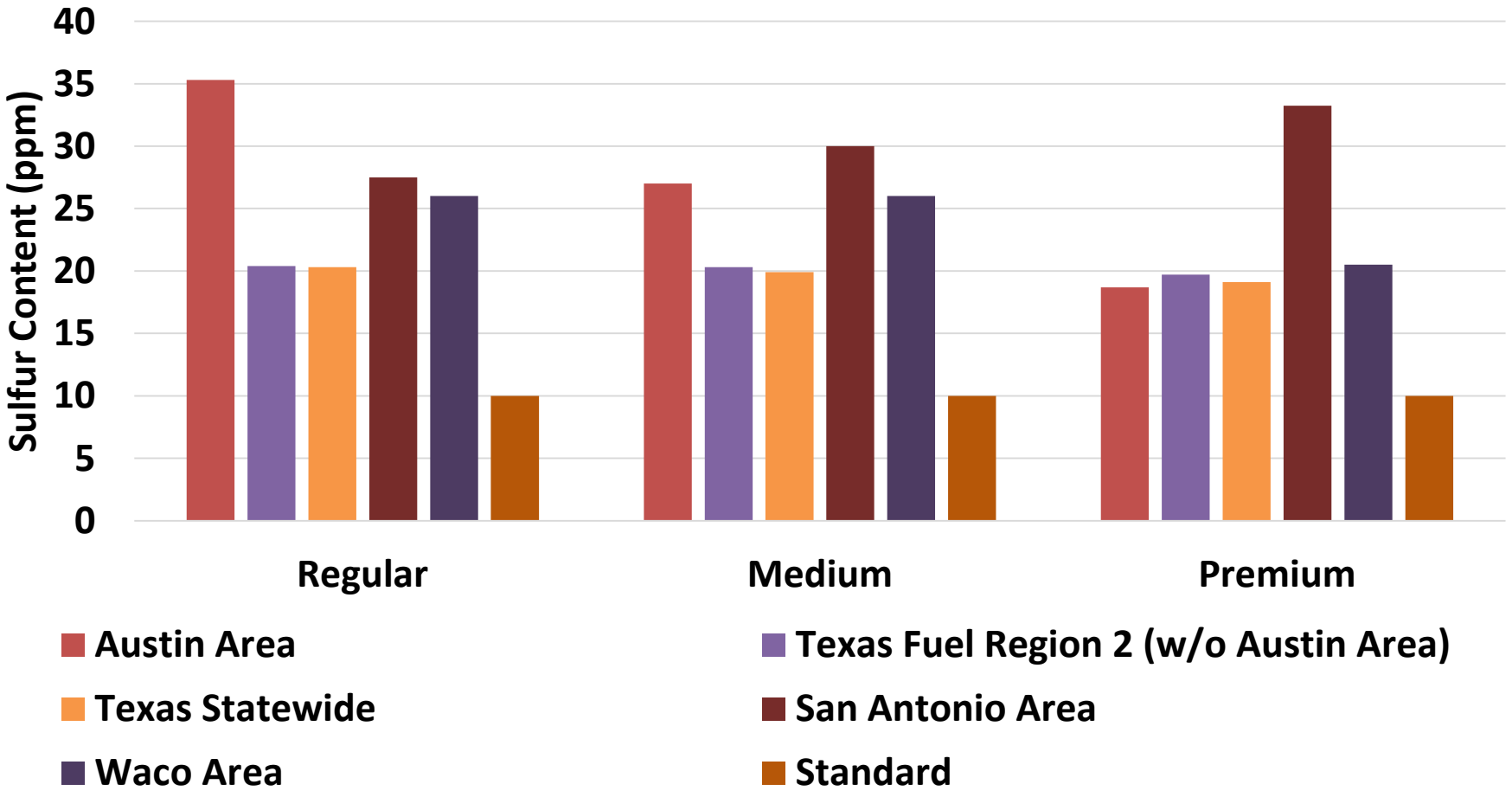
Variation in Sulfur Content by Grade

Austin Area Gasoline Sulfur Levels by Grade and Sampling Year



Sources:
ERG. *2011 Summer Fuel Study (revised)*. Prepared for TCEQ. August 31, 2011; Revised March 2015.
ERG. *2014 Summer Fuel Study (revised)*. Prepared for TCEQ. August 15, 2014; Revised January 2015.
ERG. *2017 Summer Fuel Study*. Prepared for TCEQ. August 31, 2017.
Available at: https://www.tceq.texas.gov/airquality/airmod/project/pj_report_mob.html

2017 Average Austin Area Gasoline Sulfur Levels Compared to Other Areas by Grade



Source: ERG. *2017 Summer Fuel Study*. Prepared for TCEQ. August 31, 2017.
Available at: https://www.tceq.texas.gov/airquality/airmod/project/pj_report_mob.html

Conclusions & Implications

- Ozone modeling projections are likely overly optimistic for some areas due to Tier 3 compliance flexibilities
- It may be appropriate to model downstream sulfur levels 10-15 ppm above the refinery gate standard
- There is significant variability in gasoline sulfur levels even within regions with the same fuel regulations
- There can be significant differences in gasoline sulfur content by fuel grade
- Tighter per-gallon caps at the refinery gate and downstream can help improve compliance with air quality standards

Thank You!

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