Comparison of 2020 and 2021 Nitrogen Oxides, Fine Particle and Benzene Concentrations in New Jersey with Data from 2017-2019 and Long-Term Trend Data

Analysis of the Covid-19 Impact on Air Quality in New Jersey

NJDEP Bureau of Air Monitoring

Updated 10/1/2021

Contents

- Covid-19 timeline
- Summary of short-term impacts to air quality due to stay-at-home directive
- Long term trends in air quality
- Is Covid-19 continuing to impact air quality in 2021?
- Monthly data in 2020 and 2021 from NJ stations
- Summary

Covid-19 Timeline

- 3/21/20 Stay-at-home directive
- 6/9/20 Stay-at-home lifted
- 7/2/20 Casinos re-open
- 8/13/20 Schools re-open
- 9/4/20 Indoor dining resumes
- 12/11/20 1st Covid-19 vaccine approved for emergency use
- 12/18/20 2nd Covid-19 vaccine approved for emergency use
- 2/5/21 Bars re-open
- 2/27/21 3rd Covid-19 vaccine approved for emergency use
- 5/19/21 Outdoor gathering limit removed
- 6/4/21 Public Health Emergency lifted

Summary of Short-term Covid-19 Impacts

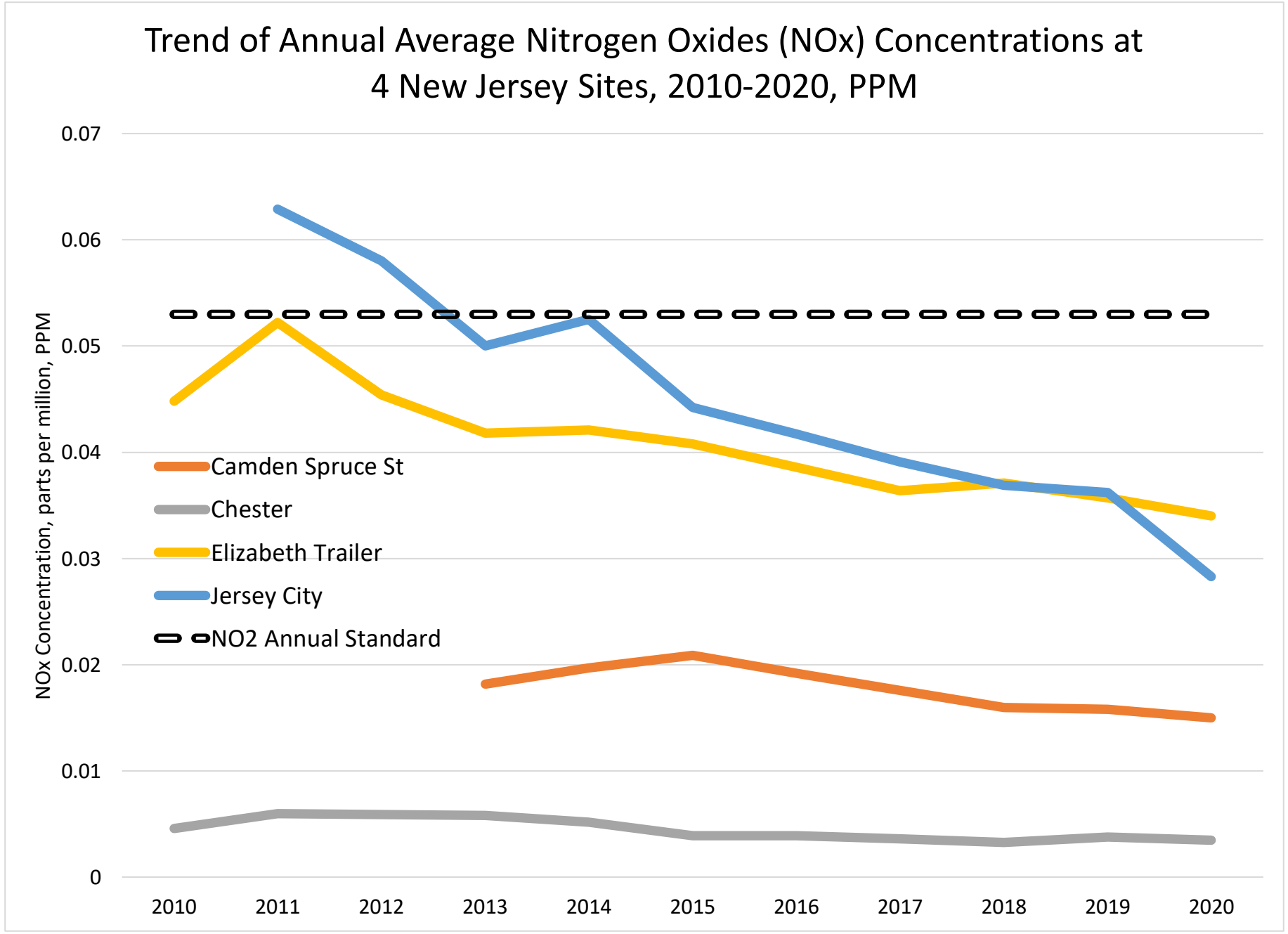
- 50% reduction in light duty traffic in April 2020
- 30% reduction in heavy duty traffic in April 2020
- >40% reduction in monthly NOx concentrations at urban air monitoring stations, April-May 2020
- >30% reduction in monthly PM2.5 concentrations at urban air monitoring stations, April-May 2020
- >20% reduction in monthly benzene concentrations at urban air monitoring stations, March-May 2020

Analysis of Long-term Trends

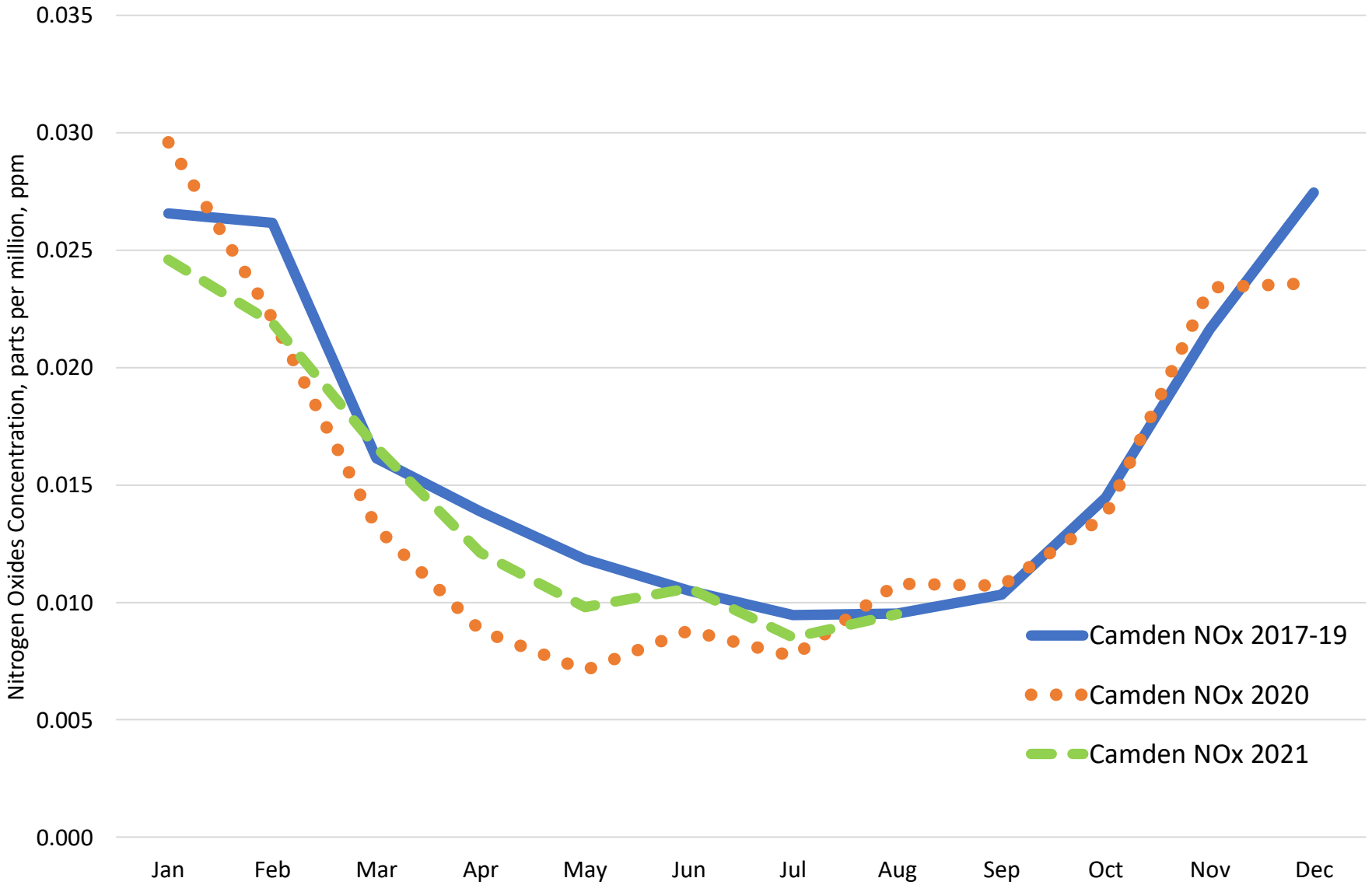
- Air Quality
  - Nitrogen oxides (NOx)
  - Fine Particles (PM2.5)
  - Benzene
  - Data for urban and background air monitoring stations from 2010-2019
- Energy Consumption
  - Retail electrical sales
  - Motor Gasoline consumption
- Are short-term Covid-19 impacts to air quality continuing in 2021?

Nitrogen Oxides, NOx

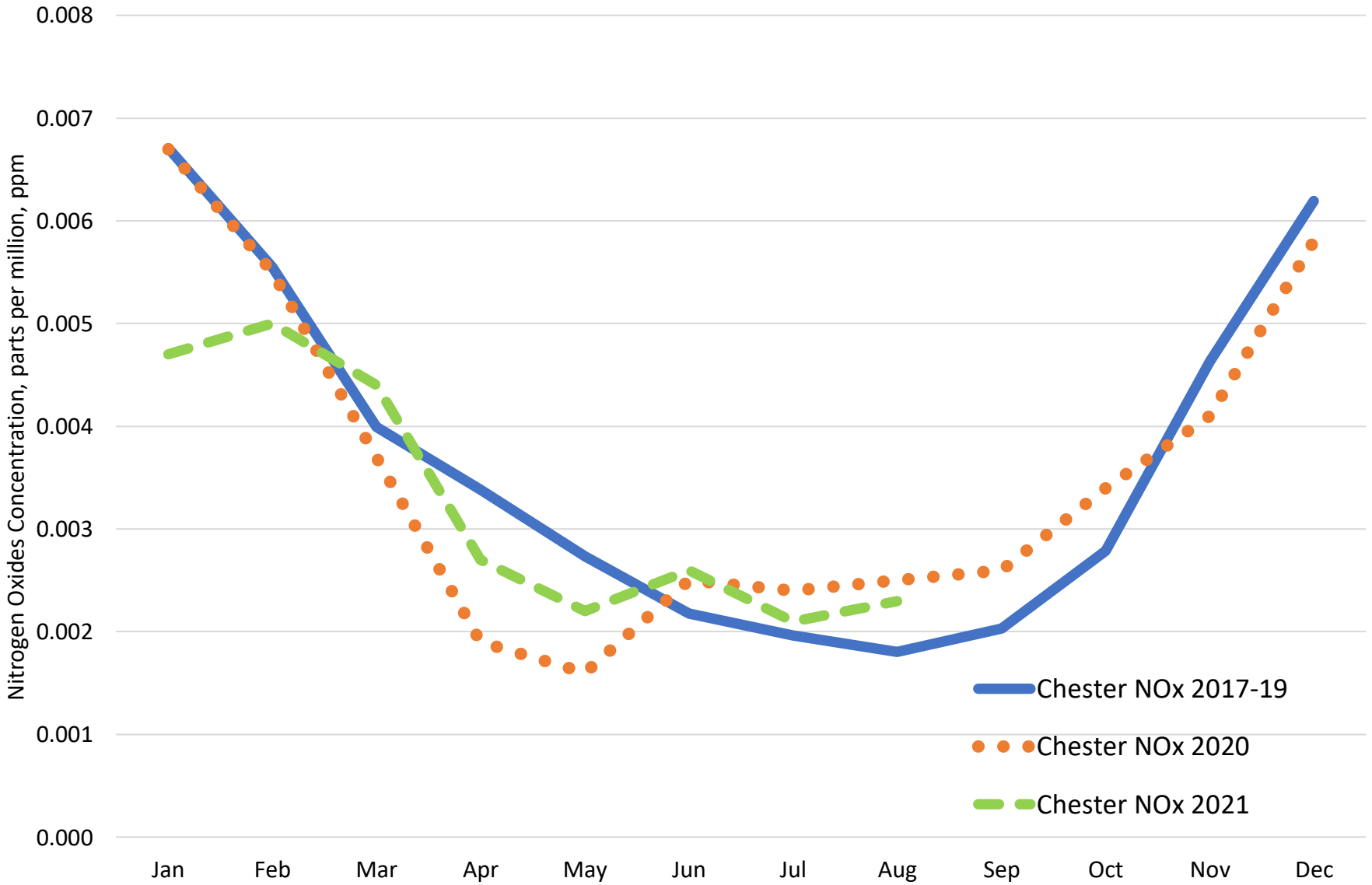
- Chester: background site
- Urban stations
  - Camden Spruce Street
  - Elizabeth Lab (NJ Turnpike Exit 13)
  - Jersey City
- NOx: sum of nitric oxide (NO) and nitrogen dioxide (NO_2) concentrations
  - NO_2 annual standard: 0.053 ppm
  - There is no federal health standard for NOx


Trend of Annual Average Nitrogen Oxides (NOx) Concentrations at 4 New Jersey Sites, 2010-2020, PPM
NOx Concentration, parts per million, PPM
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
Camden Spruce St
Chester
Elizabeth Trailer
Jersey City
NO2 Annual Standard

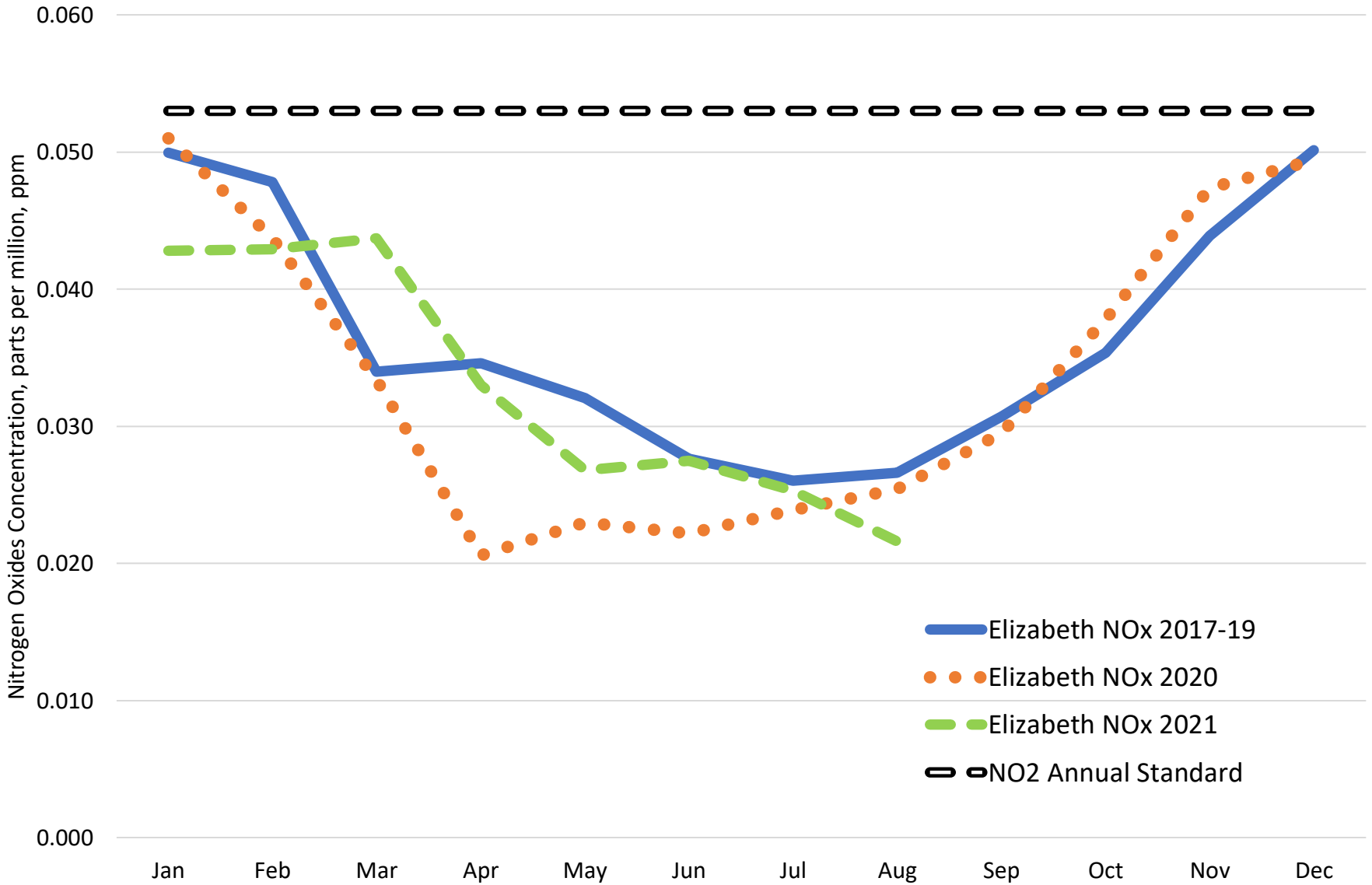
Monthly Average Nitrogen Oxides (NOx) Concentrations at Camden in 2017-19 Compared with 2020 and 2021, ppm



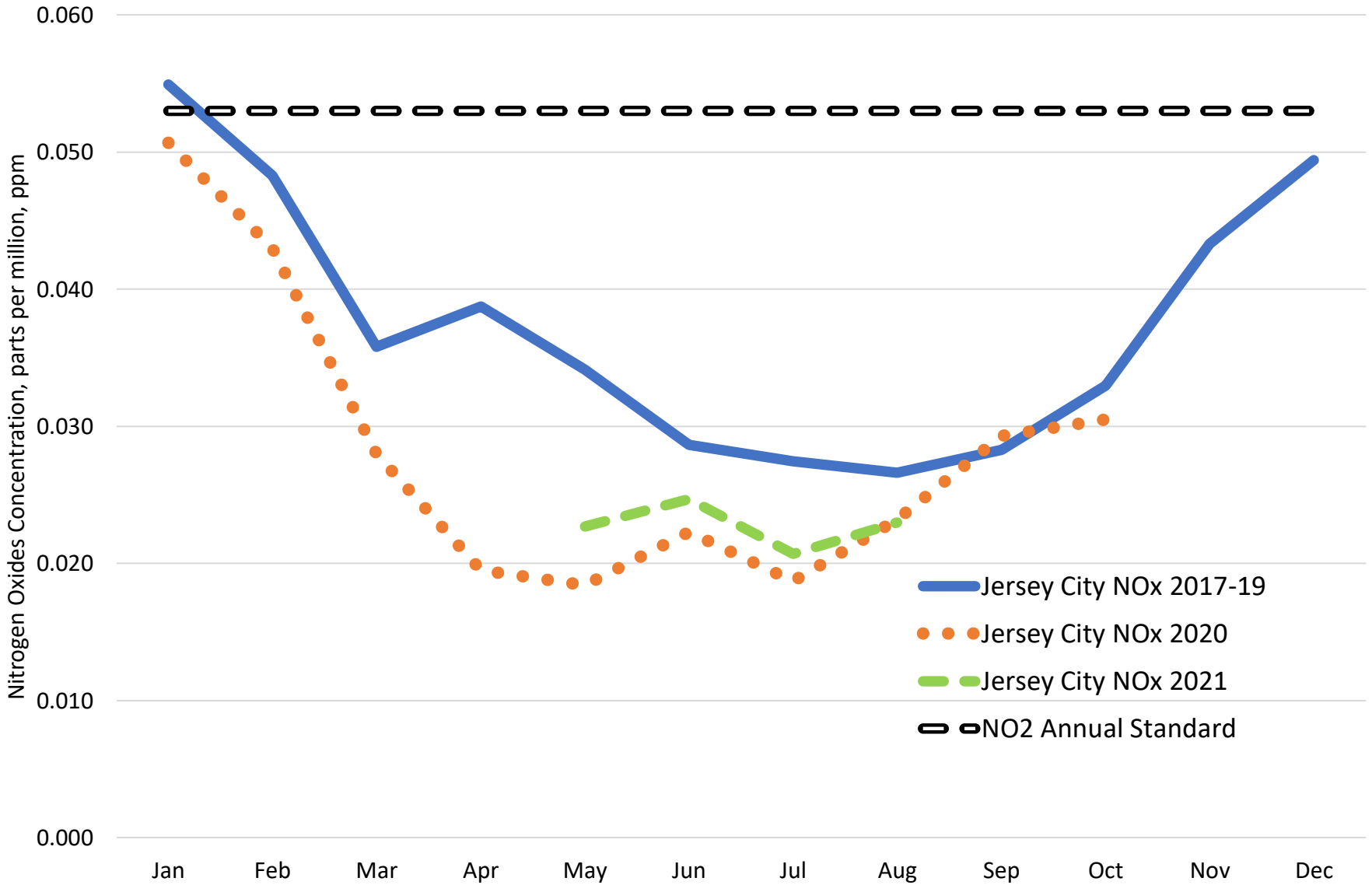
Monthly Average Nitrogen Oxides (NOx) Concentrations at Chester in 2017-19 Compared with 2020 and 2021, ppm



Monthly Average Nitrogen Oxides (NOx) Concentrations at Elizabeth in 2017-19 Compared with 2020 and 2021, ppm



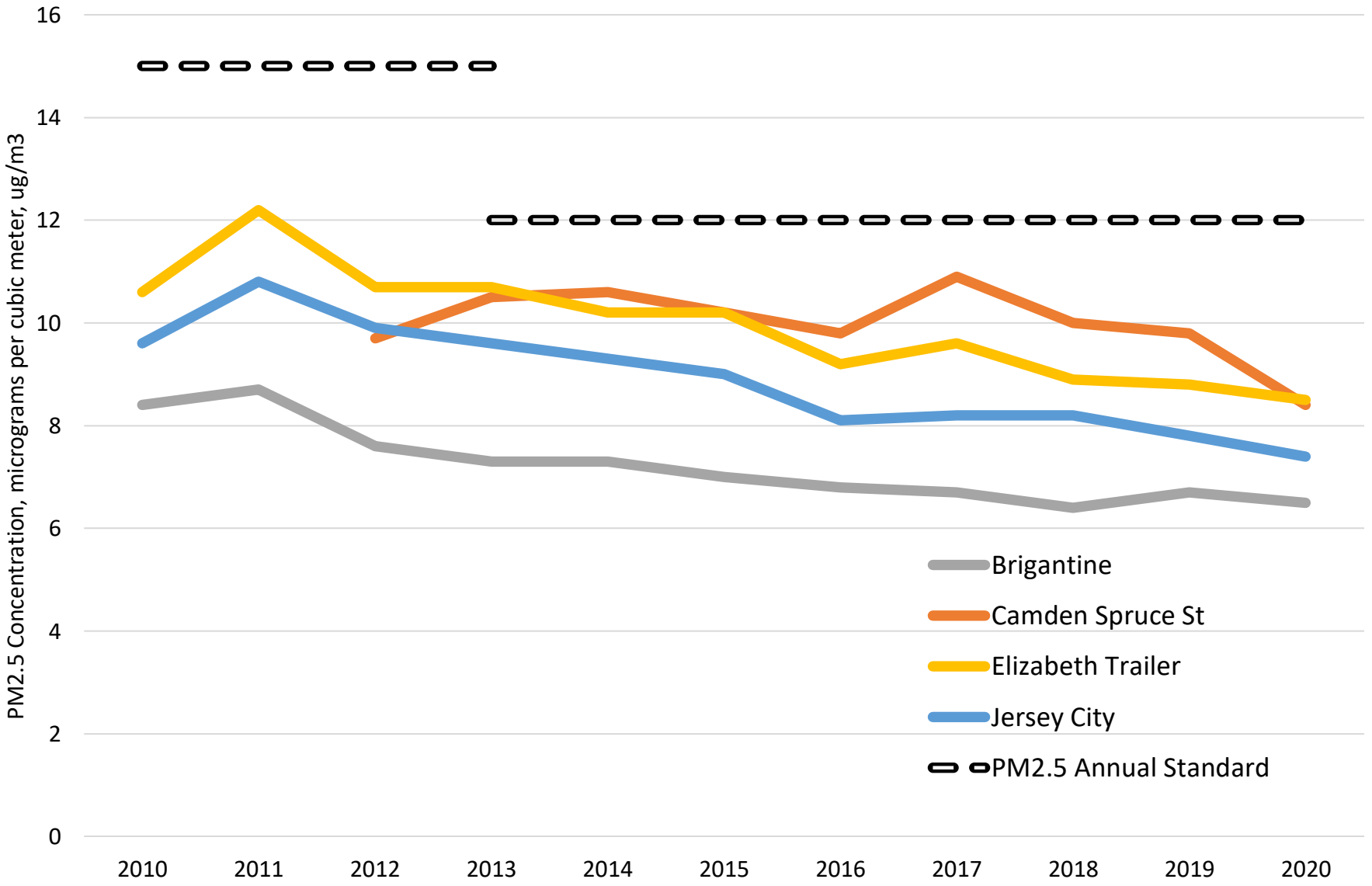
Monthly Average Nitrogen Oxides (NOx) Concentrations at Jersey City in 2017-19 Compared with 2020 and 2021, ppm



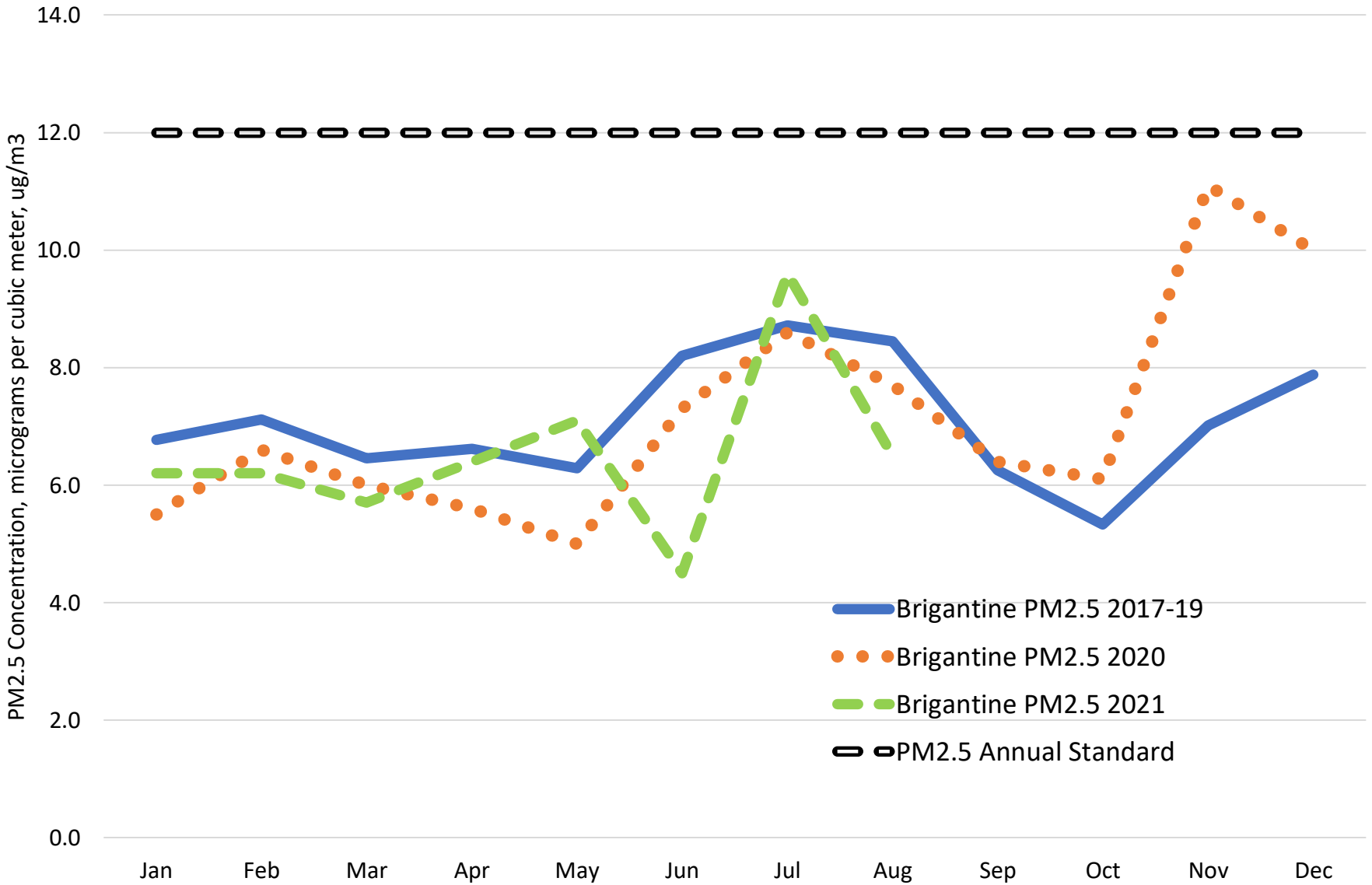
Fine Particulates, $PM_{2.5}$

- Brigantine: background site
- Urban stations
  - Camden Spruce Street
  - Elizabeth Lab (NJ Turnpike Exit 13)
  - Jersey City
- Current $PM_{2.5}$ annual standard: 12.0 ug/m^3

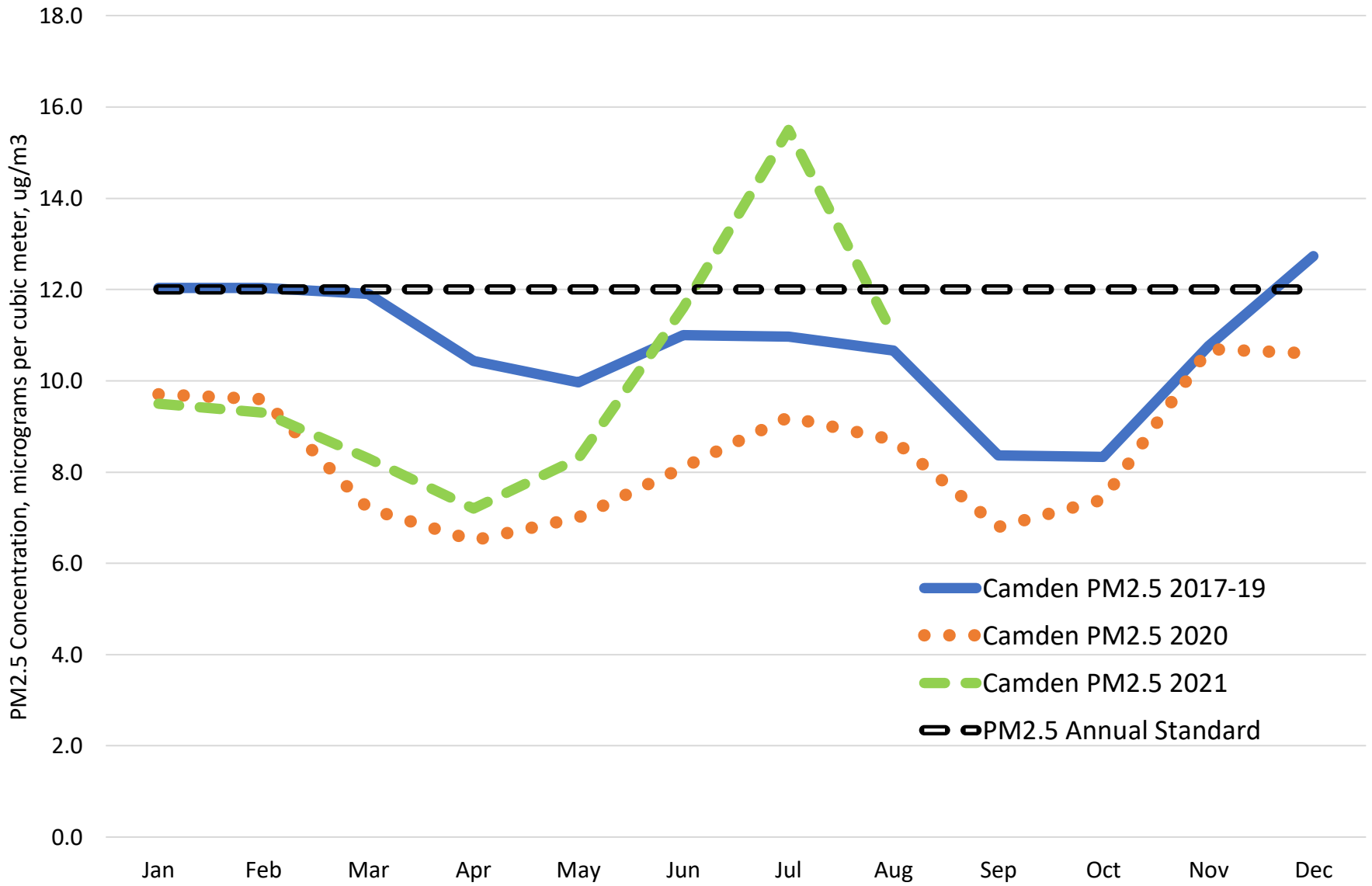
Trend in Annual Average Fine Particulate (PM2.5) Concentrations at 4 New Jersey Sites, 2010-2020, micrograms per cubic meter



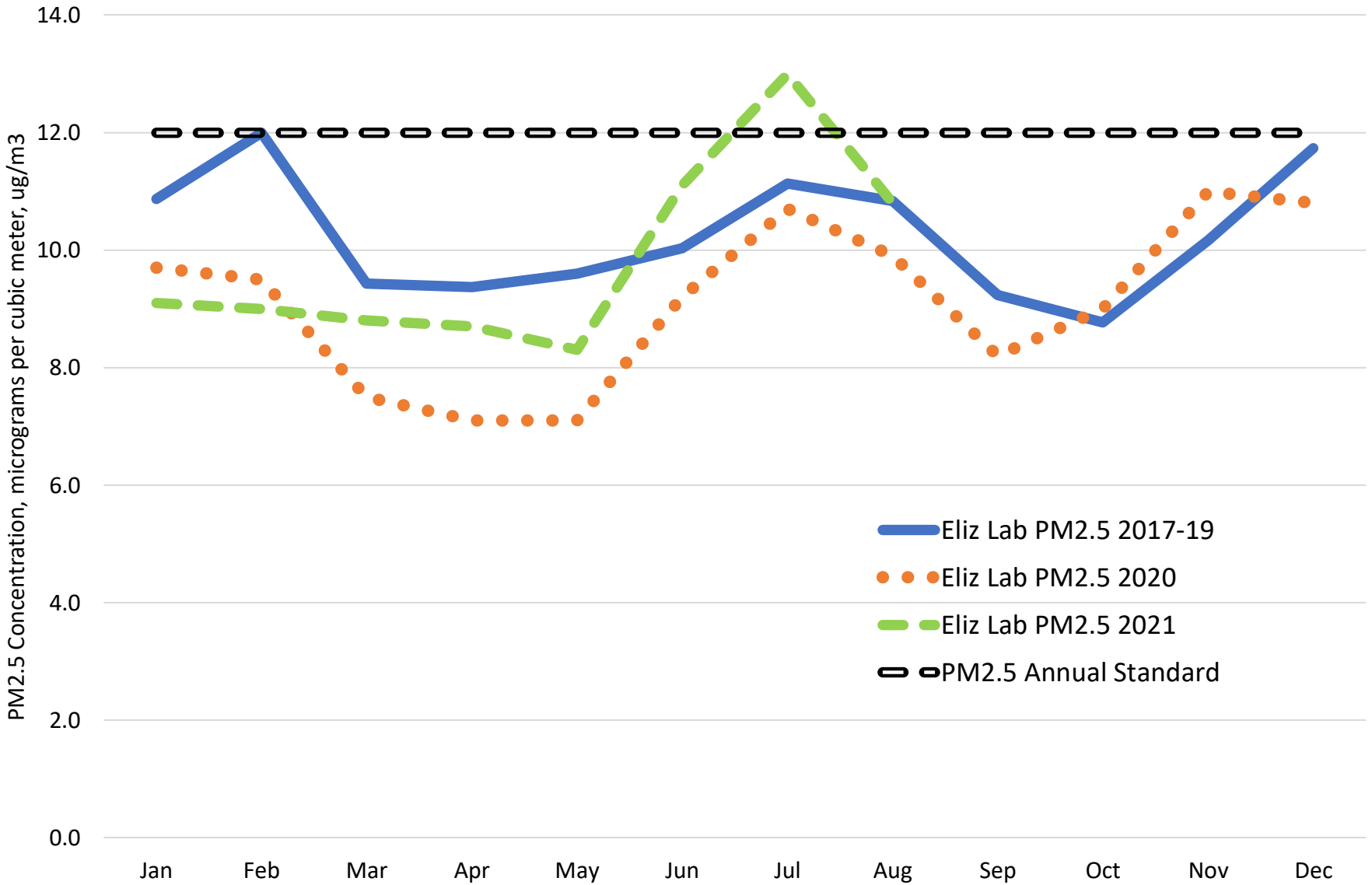
Monthly Average Fine Particle (PM2.5) Concentrations at Brigantine in 2017-19 Compared with 2020 and 2021, ug/m3



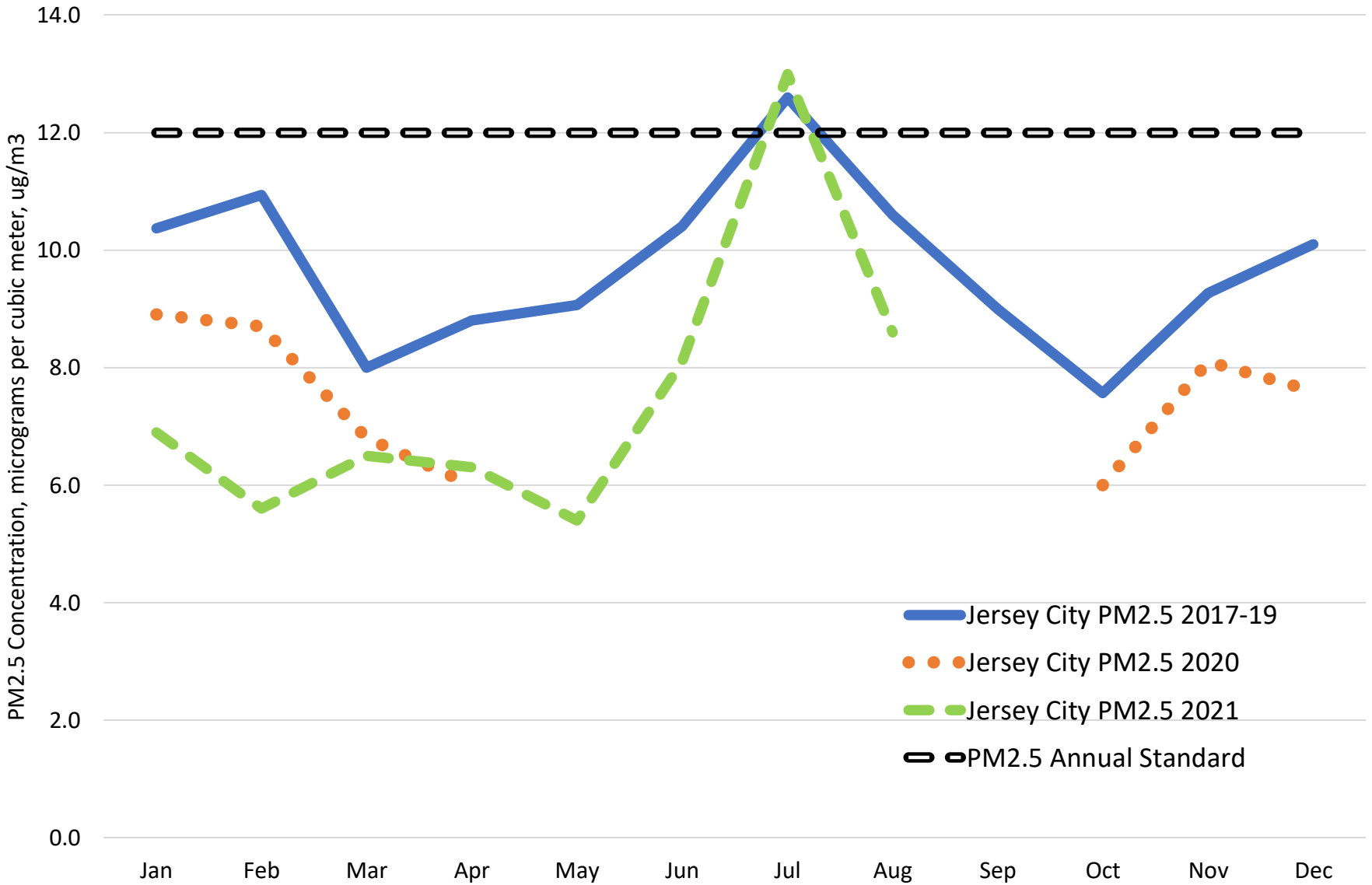
Monthly Average Fine Particle (PM2.5) Concentrations at Camden in 2017-19 Compared with 2020 and 2021, ug/m3



Monthly Average Fine Particle (PM2.5) Concentrations at Elizabeth in 2017-19 Compared with 2020 and 2021, ug/m3



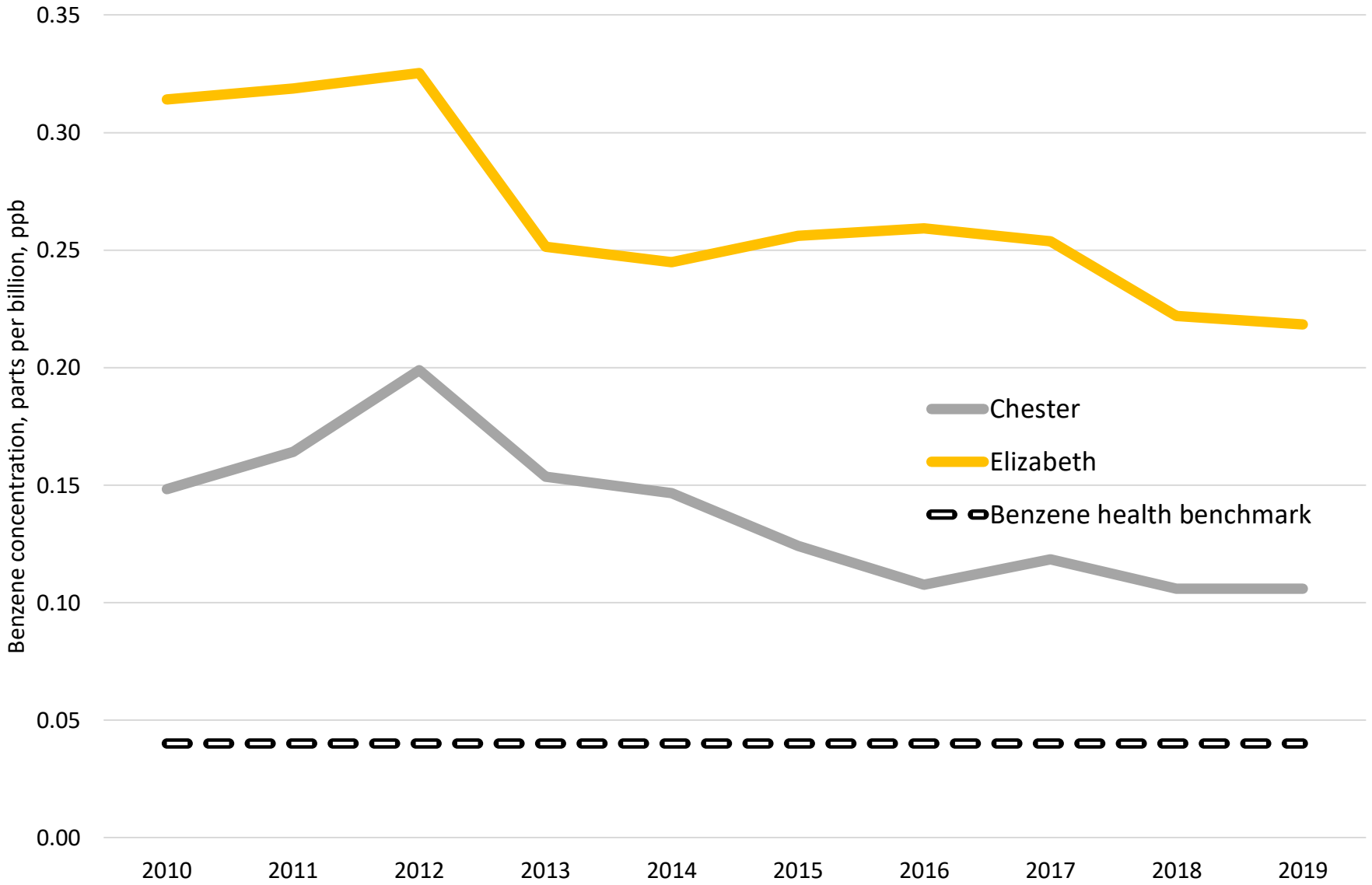
Monthly Average Fine Particle (PM2.5) Concentrations at Jersey City in 2017-19 Compared with 2020 and 2021, ug/m3



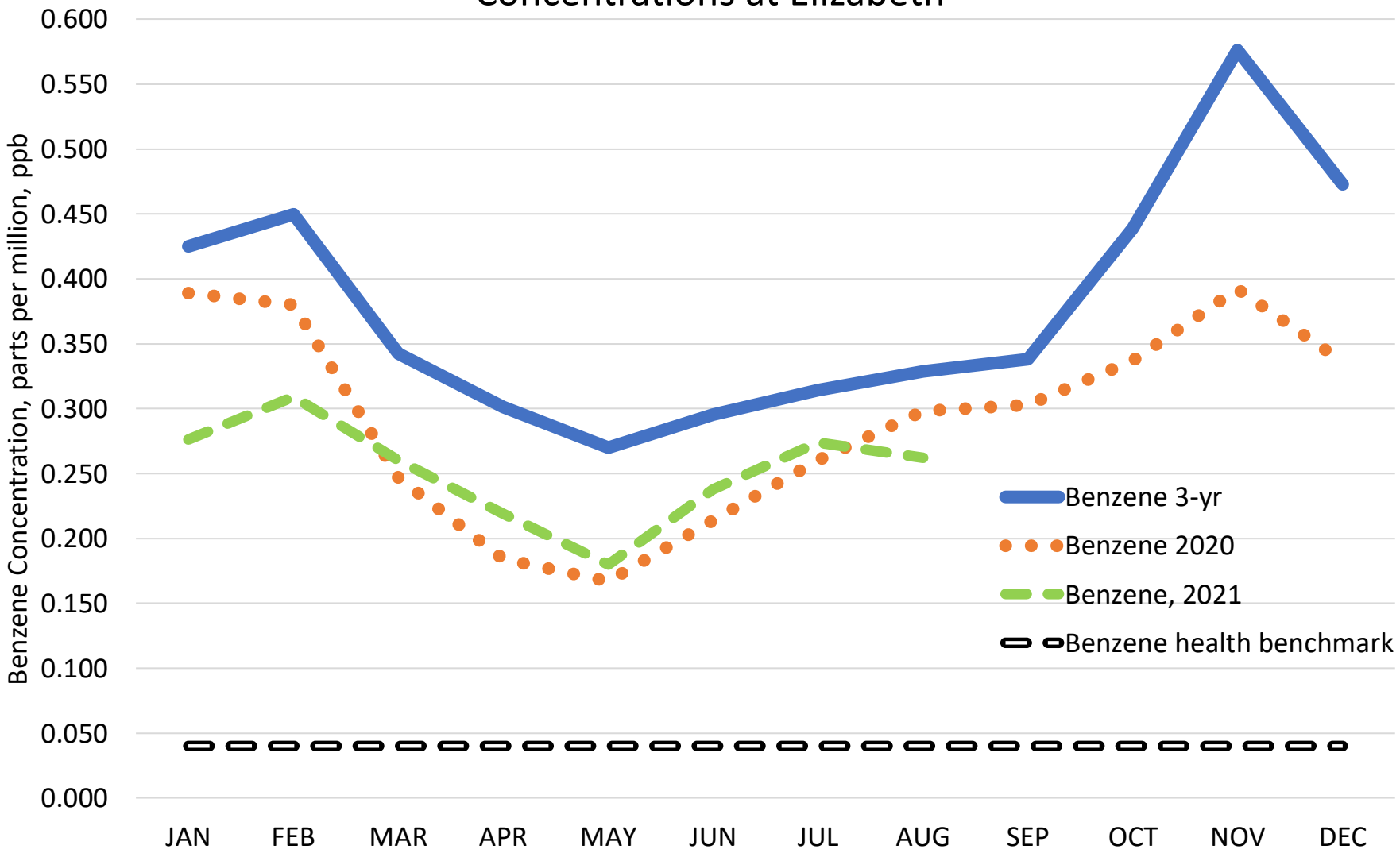
Benzene

- Chester: background site
- Urban station: Elizabeth Lab (NJ Turnpike Exit 13)
- Benzene long-term health benchmark: 0.04 ppb (0.13 ug/m3)

Trend in Annual Average Benzene Concentrations (24-Hr Samples Analyzed by TO-15) at Chester and Elizabeth, 2010-2019, ppb



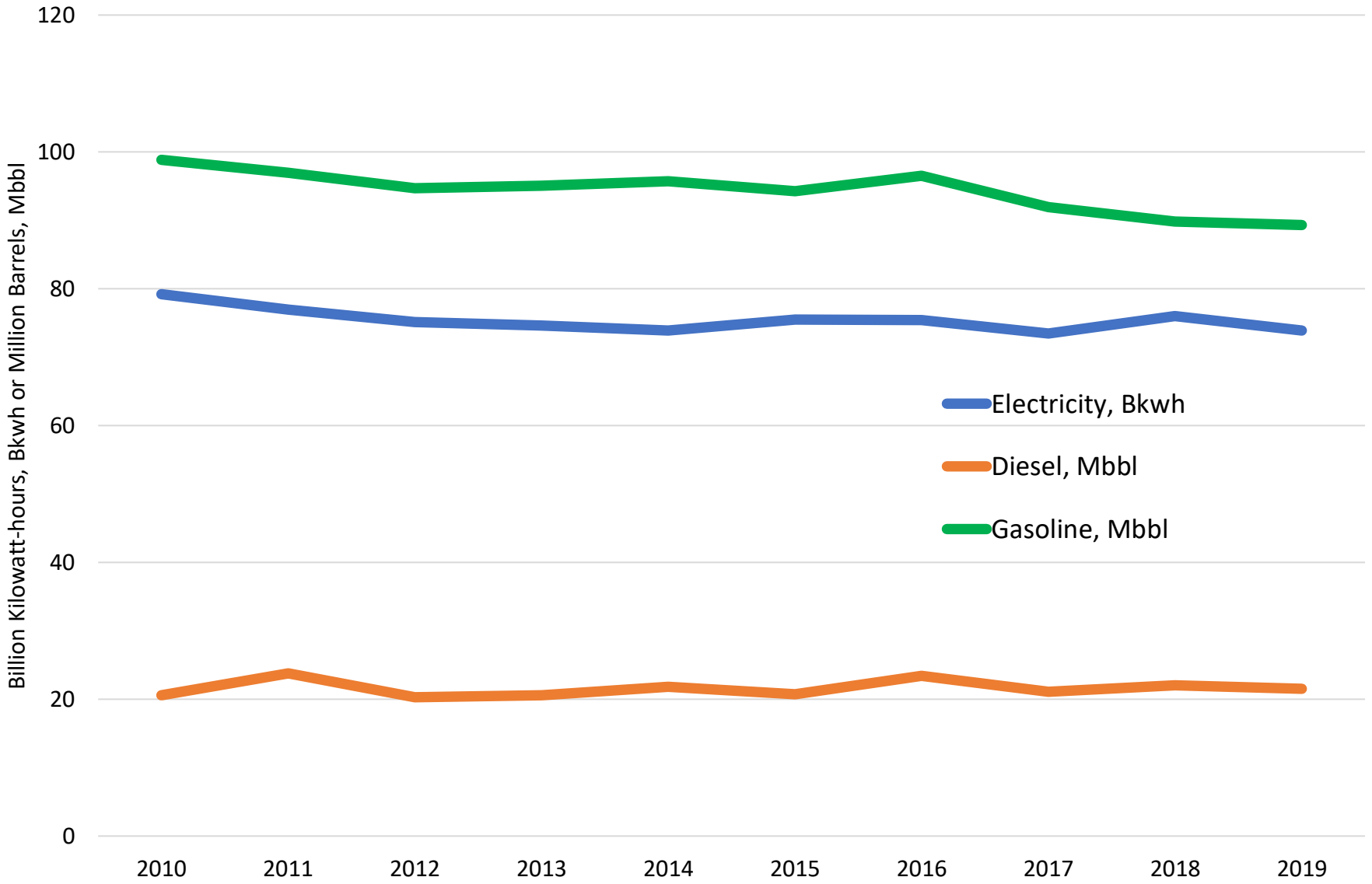
Comparison of 3-Year Average (2016, 2017, 2019) Monthly Benzene Concentrations with 2020, 2021 Monthly Benzene Concentrations at Elizabeth



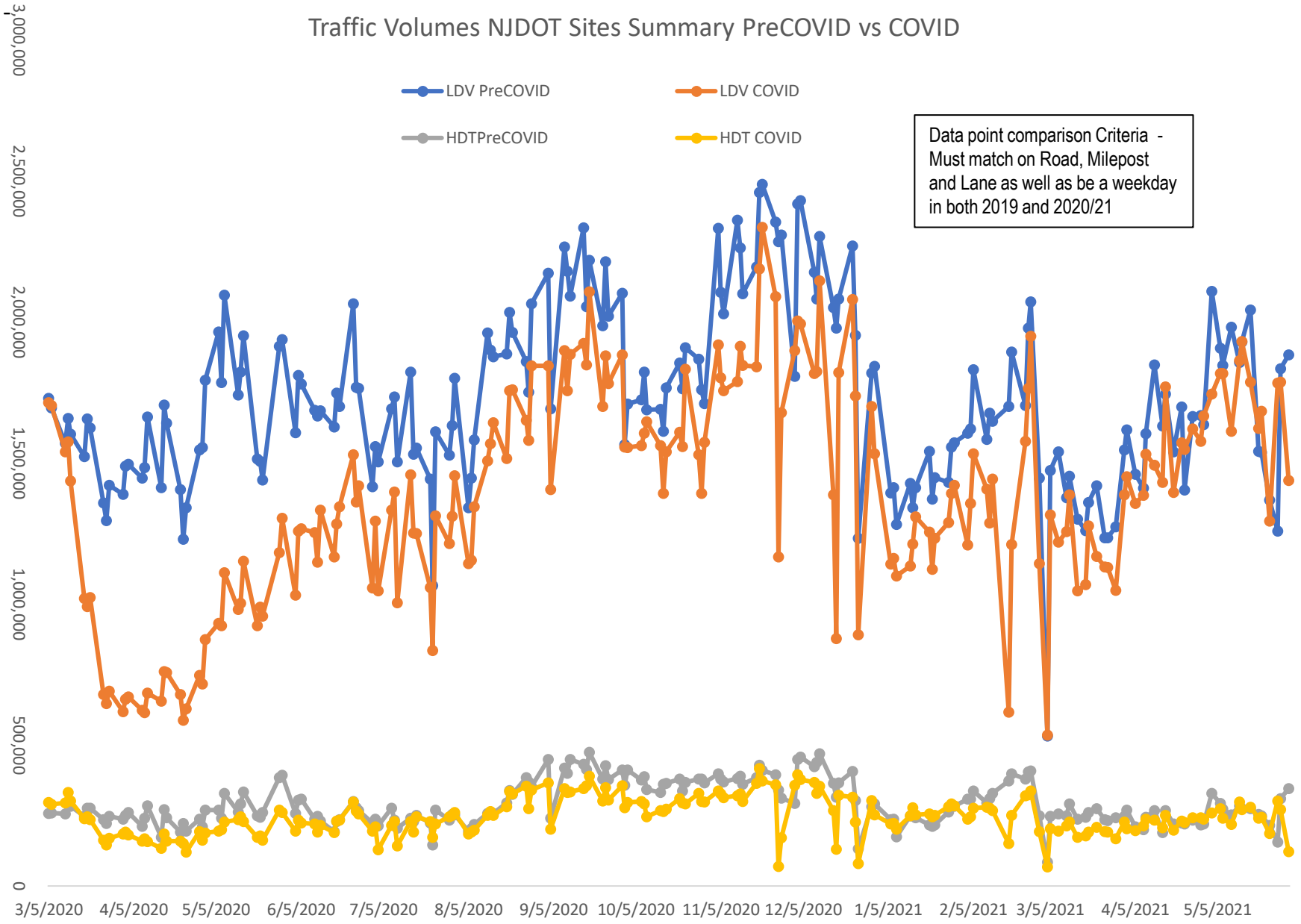
NJ Energy Consumption and Traffic Counts

- Electricity Retail Sales in New Jersey, 2010-2019
  - Source: US Energy Information Agency, www.eia.gov
- Transportation Petroleum Consumption Estimates in New Jersey, 2010-2019
  - Diesel
  - Motor Gasoline
  - Source: US Energy Information Agency, www.eia.gov
- Traffic counts for light-duty and heavy-duty vehicles
  - Source: NJDOT

Trend in Electricity and Transportation Fuel Consumption in New Jersey, 2010-2019



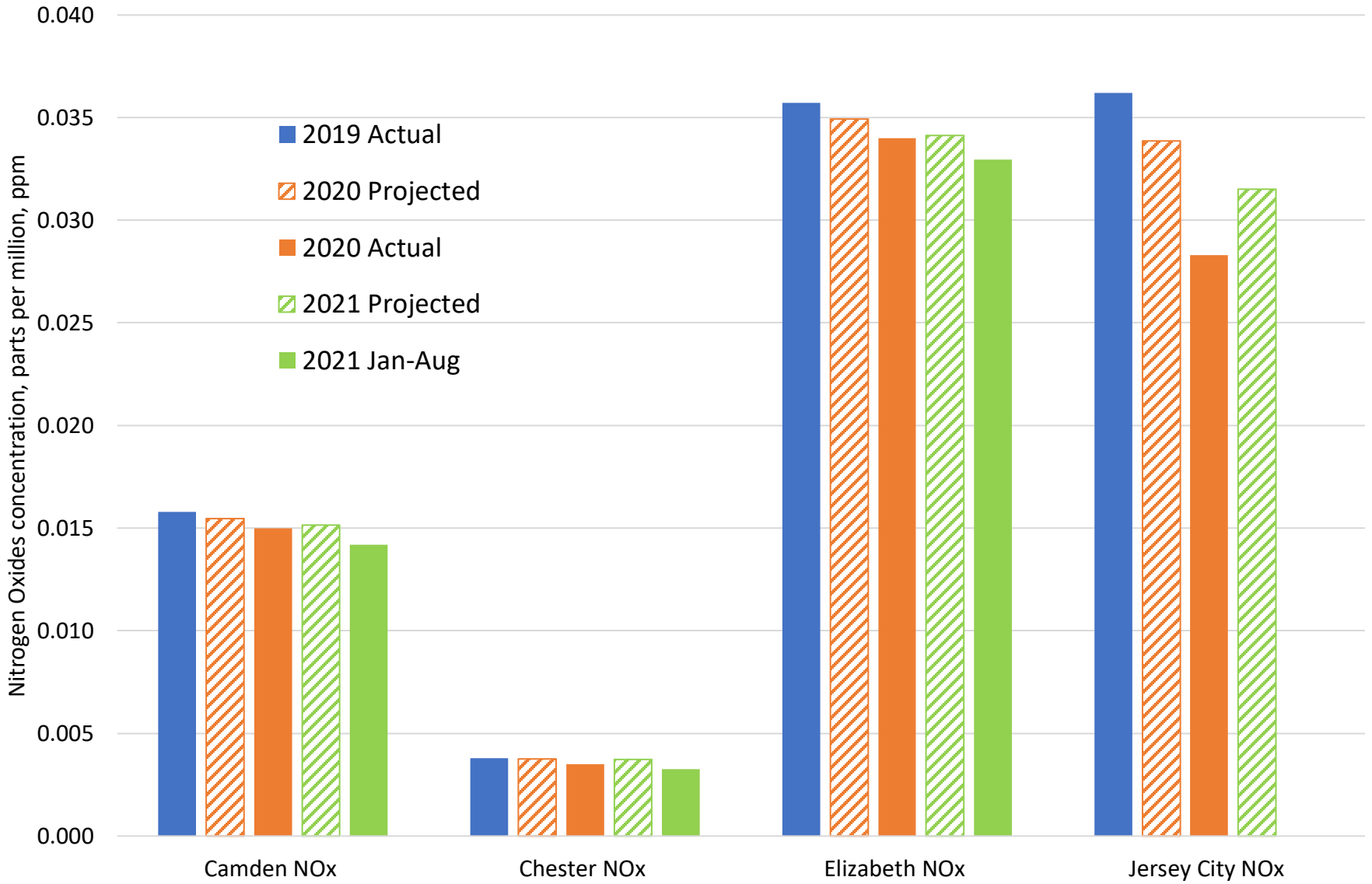
7:30 -


Traffic Volumes NJDOT Sites Summary PreCOVID vs COVID
LDV PreCOVID
LDV COVID
HDTPreCOVID
HDT COVID
Data point comparison Criteria - Must match on Road, Milepost and Lane as well as be a weekday in both 2019 and 2020/21
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
3/5/2020
4/5/2020
5/5/2020
6/5/2020
7/5/2020
8/5/2020
9/5/2020
10/5/2020
11/5/2020
12/5/2020
1/5/2021
2/5/2021
3/5/2021
4/5/2021
5/5/2021

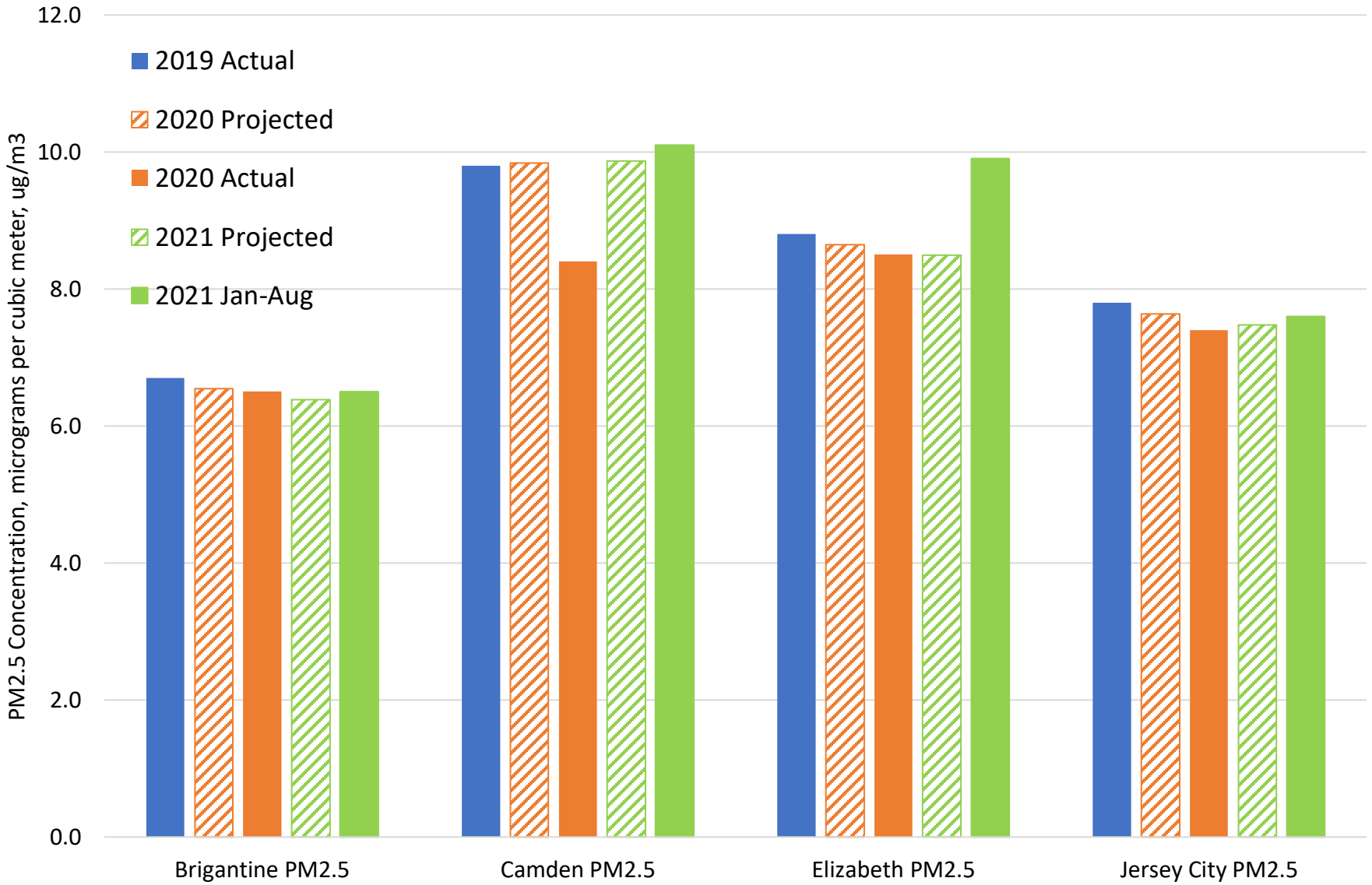
Summary

- Calculated projected concentrations for 2020 and 2021 by applying average annual % change from long-term trend data to actual 2019 concentrations
- Compared projected 2020 and 2021 concentrations with actual levels from 2020 and from January – August 2021
- Is Covid-19 still impacting air quality in 2021? (Are actual levels in 2021 lower than projected levels?)
  - NOx: Yes, actual levels in 2021 are 4-14% lower than projected NOx levels
  - PM2.5: No, because of outside forces (wildfires)
  - Benzene: Not conclusive because benzene levels in 2019 were also low
  - Traffic counts for light-duty and heavy-duty vehicles NJ are back to pre-Covid-19 levels
- 2021 has not ended, higher concentrations could be measured

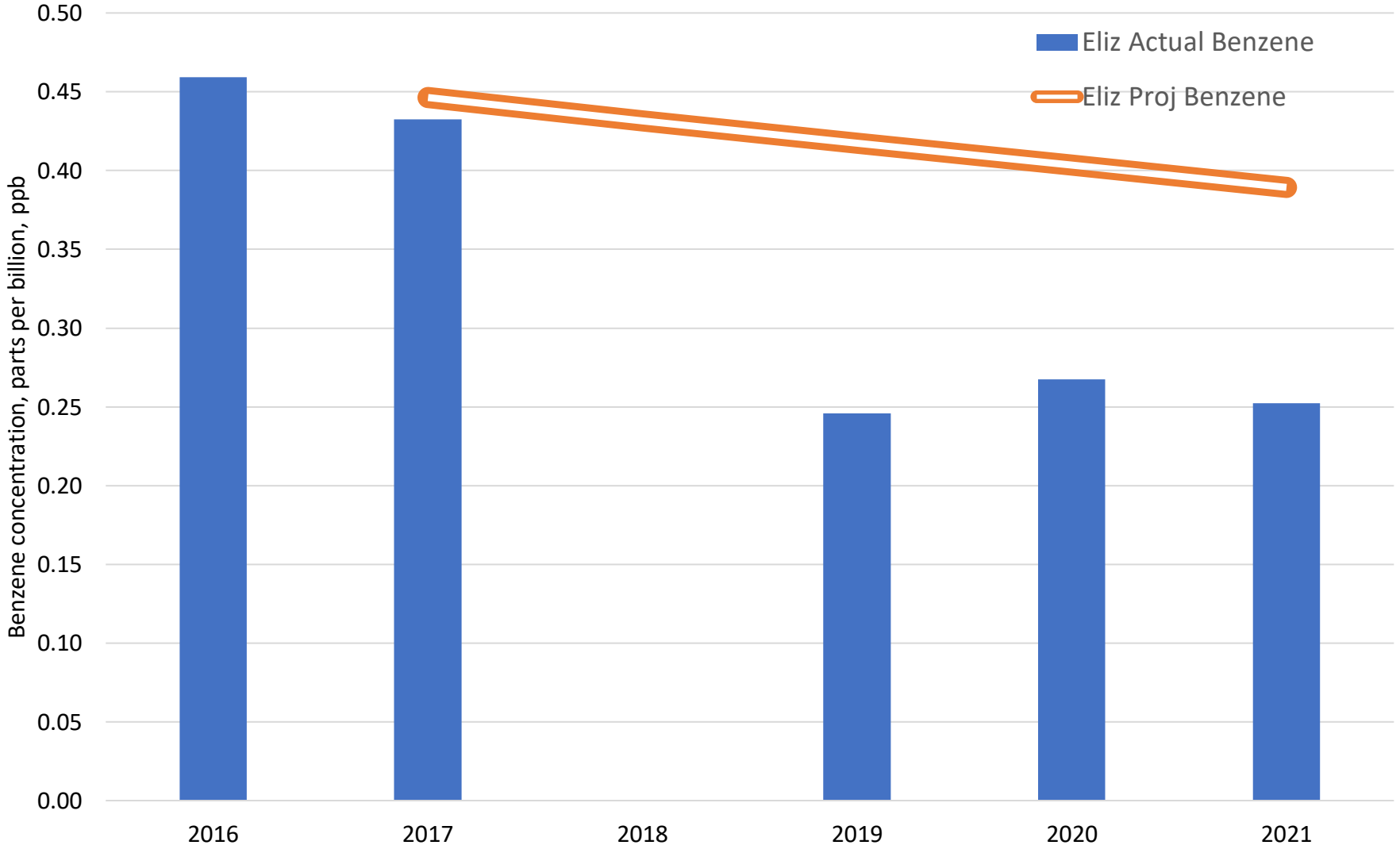
Comparison of Actual Nitrogen Oxides Concentrations in 2019 with Projected and Actual Concentrations in 2020 and 2021, ppm



Comparison of Actual PM2.5 Concentrations in 2019 with Projected and Actual Concentrations in 2020 and 2021, ug/m3



Comparison of Actual Benzene Concentrations (from hourly GC-PID monitor) at Elizabeth in 2016 with Actual and Projected Concentrations, 2017-2021, ppb



End

www.nj.gov/dep/airmon

Luis Lim, Chief, Bureau of Air Monitoring

New Jersey Department of Environmental Protection

Luis.Lim@dep.nj.gov

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION