



## **Possible Effects of COVID-19 Stay-At-Home Order on St. Louis Area Air Quality**

May 11, 2020

The Missouri Department of Natural Resources is continuing to evaluate the possible effects on air quality of the COVID-19 stay-at-home order, issued for St. Louis City and County beginning on March 23, 2020 through May 4, 2020. This is an updated analysis extending the initial analysis forward from April 15 through May 4. The trends during this additional time period remain similar to the initial time period.

Since the COVID-19 event is having an impact on emission from many sources across the country and the world, the following analysis is based on limited observational data and the department is not drawing conclusions as a result of this analysis.

An effect of the order is a reduction in motor vehicle traffic, because fewer people are commuting to work and fewer people are driving on the weekend. Motor vehicle exhaust is a significant source of nitric oxide (NO), which is oxidized in the atmosphere to nitrogen dioxide (NO<sub>2</sub>). Therefore, a reduction in traffic would be expected to lead to a reduction in the NO<sub>2</sub> concentration in the air, especially near major highways.

The near-roadway NO<sub>2</sub> monitoring network was established to measure the population exposure to peak 1-hour NO<sub>2</sub> concentrations. Peak 1-hour concentrations of NO<sub>2</sub> result from many sources that emit nitric oxide in addition to motor vehicles, including but not limited to, industrial boilers, furnaces, factories, power plants, fires, and certain home heating appliances. Therefore, these near-roadway sites were established within 50 meters (or 164 feet) of road segments with the highest traffic volumes in areas with populations of one million people or more to measure worst-case peak 1-hour NO<sub>2</sub> concentrations from all these sources in areas with the high population density.

It is important to recognize that ambient air NO<sub>2</sub> monitors alone are not able to directly identify the source of the NO<sub>2</sub> pollution they measure. Source apportionment of the monitored ambient NO<sub>2</sub> is a complex analysis involving many factors and is beyond the scope of this observational analysis.

NO<sub>2</sub>, among other pollutants, is a precursor to ground level ozone. Unlike NO<sub>2</sub>, ozone is not directly emitted by sources, but a pollutant formed in the atmosphere by very complex chemical reactions involving oxides of nitrogen and volatile organic compounds in the presence of sunlight and other conducive weather conditions. Maximum ozone concentrations are typically monitored 10 to 30 miles down wind of precursor emission sources. The department intends to conduct more observational analysis of ozone concentrations during this period, but weather conditions during March and April are generally not conducive to producing significant peak ozone concentrations from precursor pollutants.

The Department operates two near-road air monitoring sites in the St. Louis area, one in Forest Park adjacent to I-64 and one (called Rider Trail I-70, Figure 1) adjacent to I-70 north of St. Louis, just west of the I-270 interchange. Locations of these sites are shown on the map in Figure 2. Neither of these sites are in violation of the NO<sub>2</sub> national ambient air quality standard (NAAQS); see [dnr.mo.gov/env/apcp/docs/nitrogendioxidemonitordata.pdf](https://dnr.mo.gov/env/apcp/docs/nitrogendioxidemonitordata.pdf). However, analysis of data from these sites still shows the effect of vehicle traffic. We have evaluated NO<sub>2</sub> data from these sites in the past: We calculated and graphed average NO<sub>2</sub> concentrations by time of day, and separately for weekdays, weekends and major holidays. The weekday averages clearly show higher concentrations during early morning and early evening that probably are caused by increased commuter traffic at those times. The weekend averages do not show the same peaks.

To evaluate the effect of the stay-at-home order on air quality, we generated the graphs described above for the period of March 23 to May 4 for 2019 and 2020. Graphs are shown on the following pages. The weekday graphs from the two near-road sites (Figures 3 and 4) still show morning and evening peaks, possibly caused in part from truck traffic, but the NO<sub>2</sub> concentrations measured in 2020 are significantly lower than those in 2019 for all hours of the day. The weekend graphs (Figures 5 and 6) show a similar reduction and the 2020 graph is somewhat flatter than the 2019 graph.

Graphs from the community-oriented Blair Street site in north central St. Louis (Figures 7 and 8) are similar to those for the near-road sites, but are not as pronounced, suggesting that sources besides motor vehicles may contribute to the NO<sub>2</sub> concentration at that site.

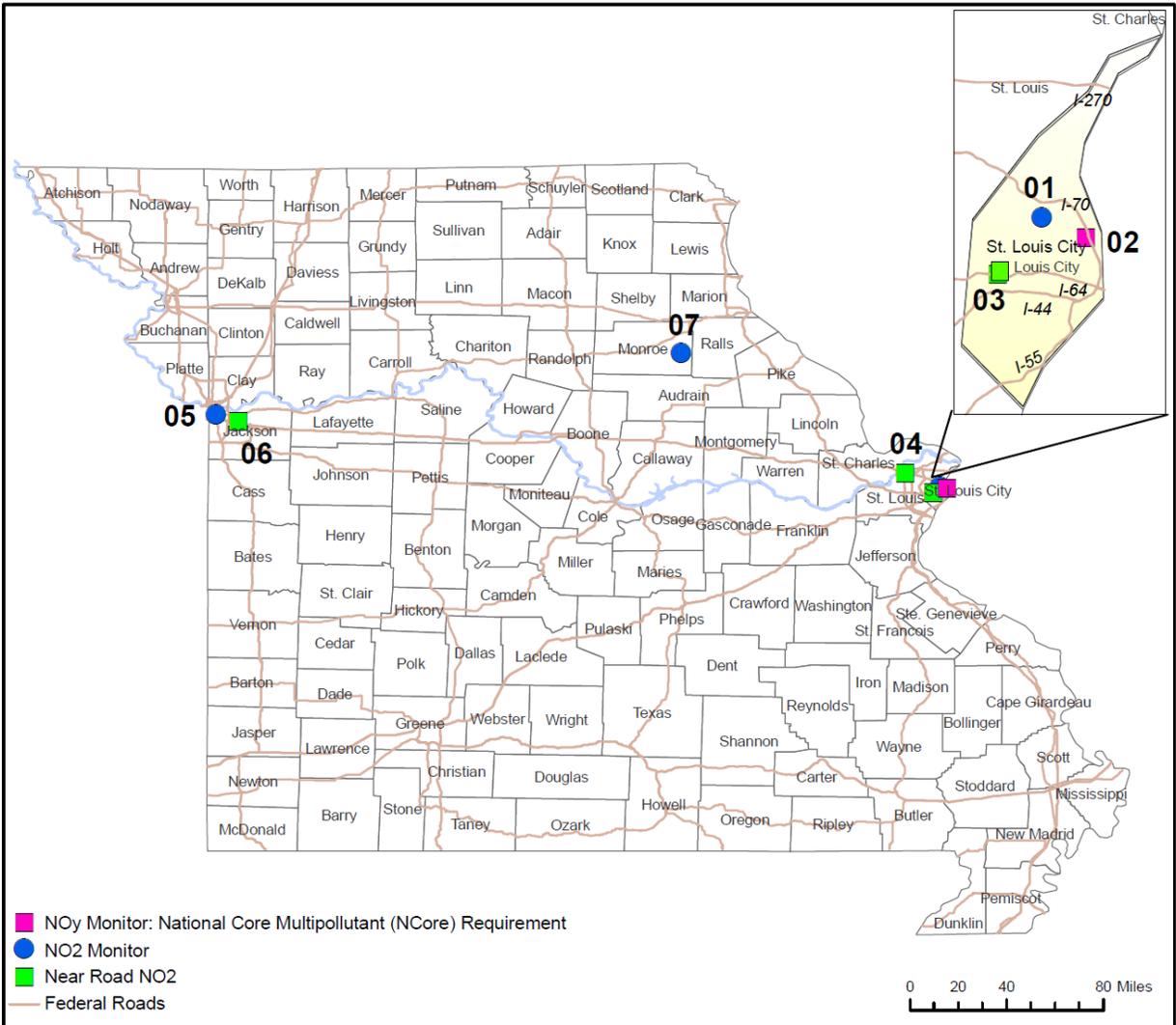
The Department will continue to evaluate the possible effects on air quality of the stay-at-home order by extending this analysis in time both as the order continues and when the order is rescinded and people return to usual activity. We will also evaluate other air pollutants for possible effects.

For more information about nitrogen dioxide, see the following EPA website, which includes links to additional information on health effects, standards, implementation, at [.epa.gov/no2-pollution](https://epa.gov/no2-pollution).



**Figure 1. Rider Trail I-70 air monitoring site, St. Louis area**

**Figure 2. Missouri Statewide Nitrogen Dioxide (NO2) Monitoring Network, 2020**



**St. Louis Area**

- 01 Margaretta+
- 02 Blair Street\*\*
- 03 Forest Park, I-64\*
- 04 Rider Trail, I-70\*

**Kansas City Area**

- 05 Troost
- 06 Blue Ridge, I-70\*

**Outstate Area**

- 07 Mark Twain State Park\*\*\*

+Near-Road sites  
 \*\*National (NCore) multi-pollutant site  
 \*\*\*Background site  
 +Discontinued Monitor



Figure 3. Weekday Nitrogen Dioxide (NO<sub>2</sub>) Concentrations by Hour of the Day at Forest Park I-64 (STL)  
 Near-Roadway Site  
 St. Louis Area Stay-At-Home Order Effective on Mar. 23, 2020  
 Data is from Mar. 23 to May 4 of 2019 and 2020  
 (Preliminary Data)

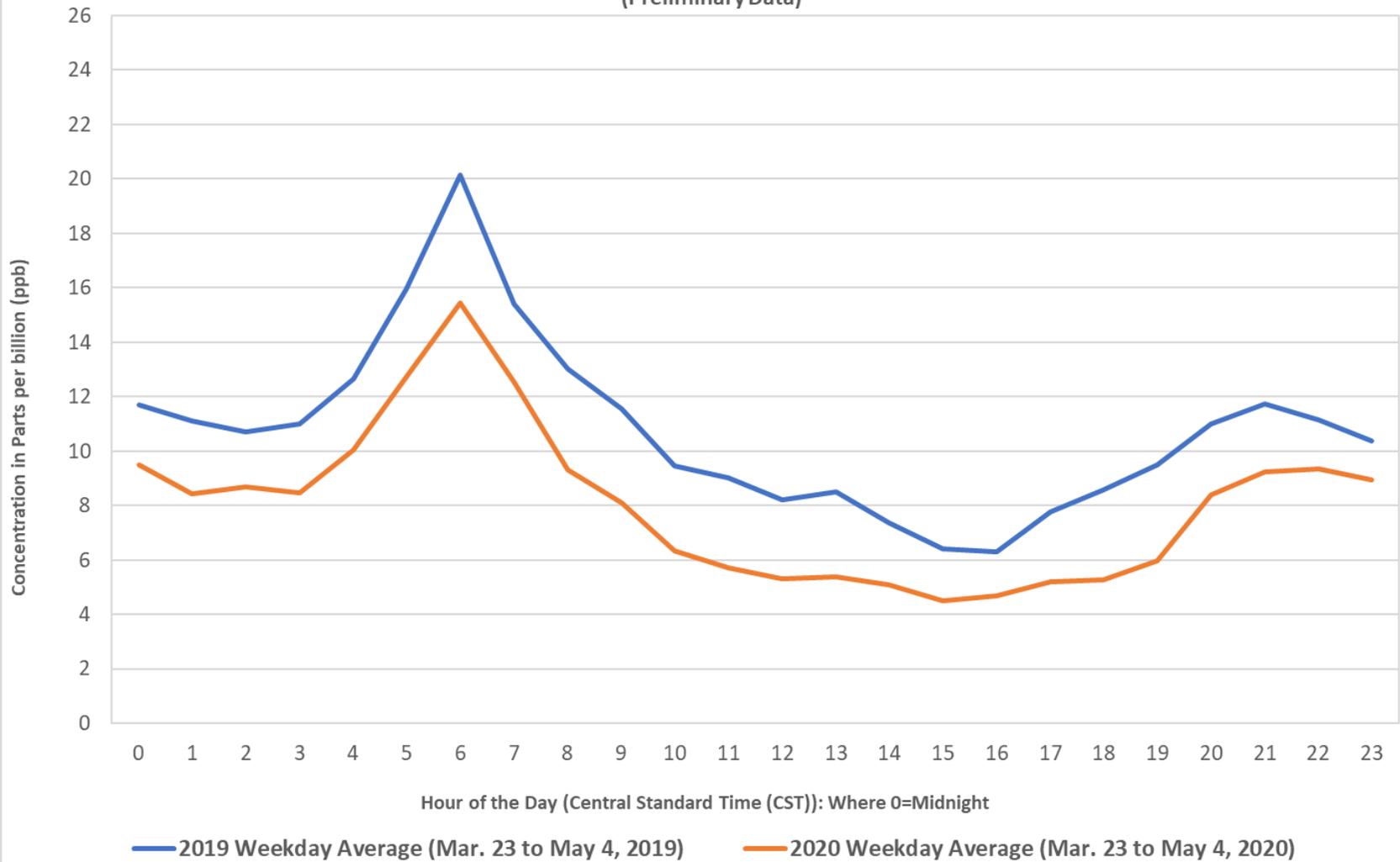
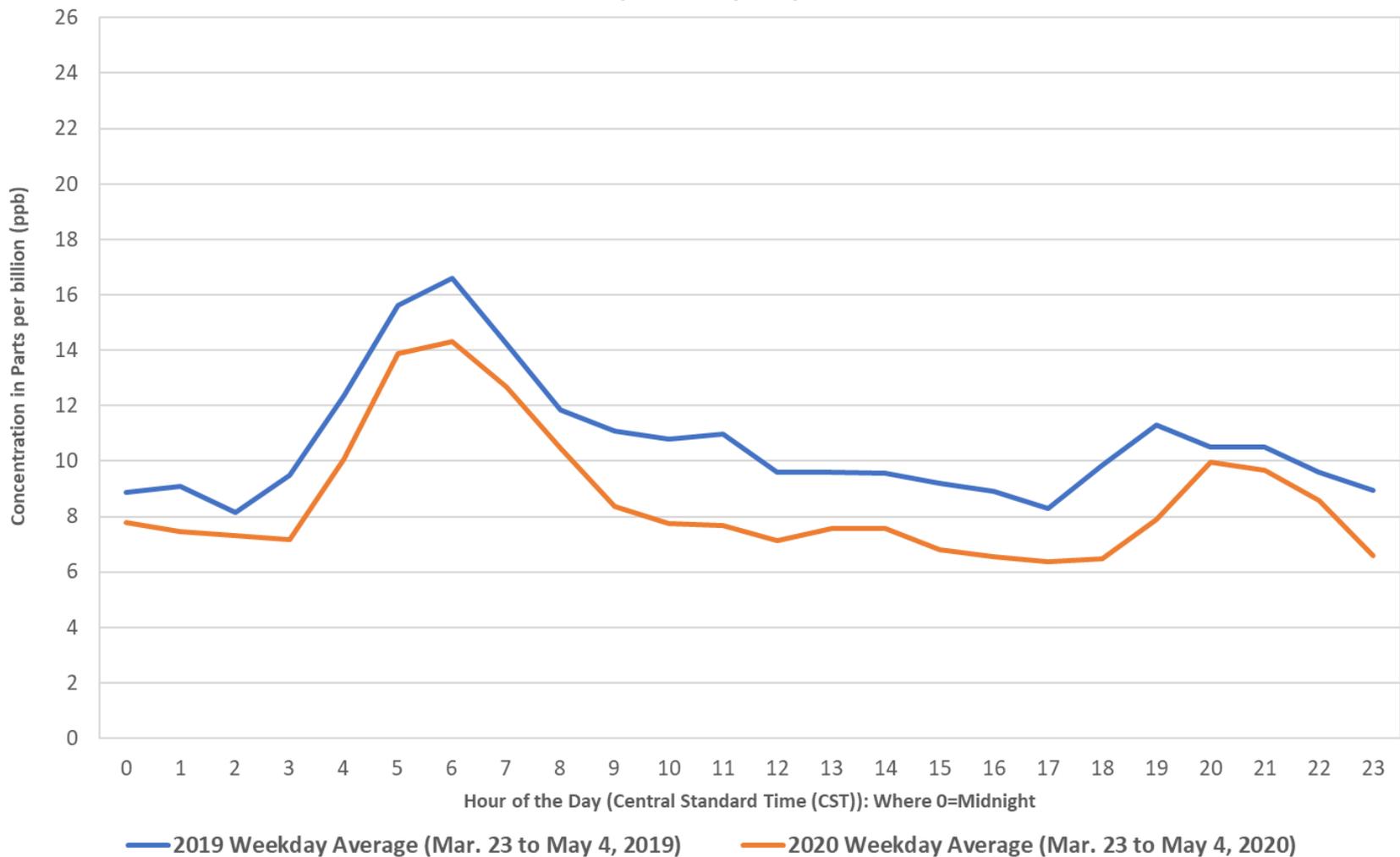
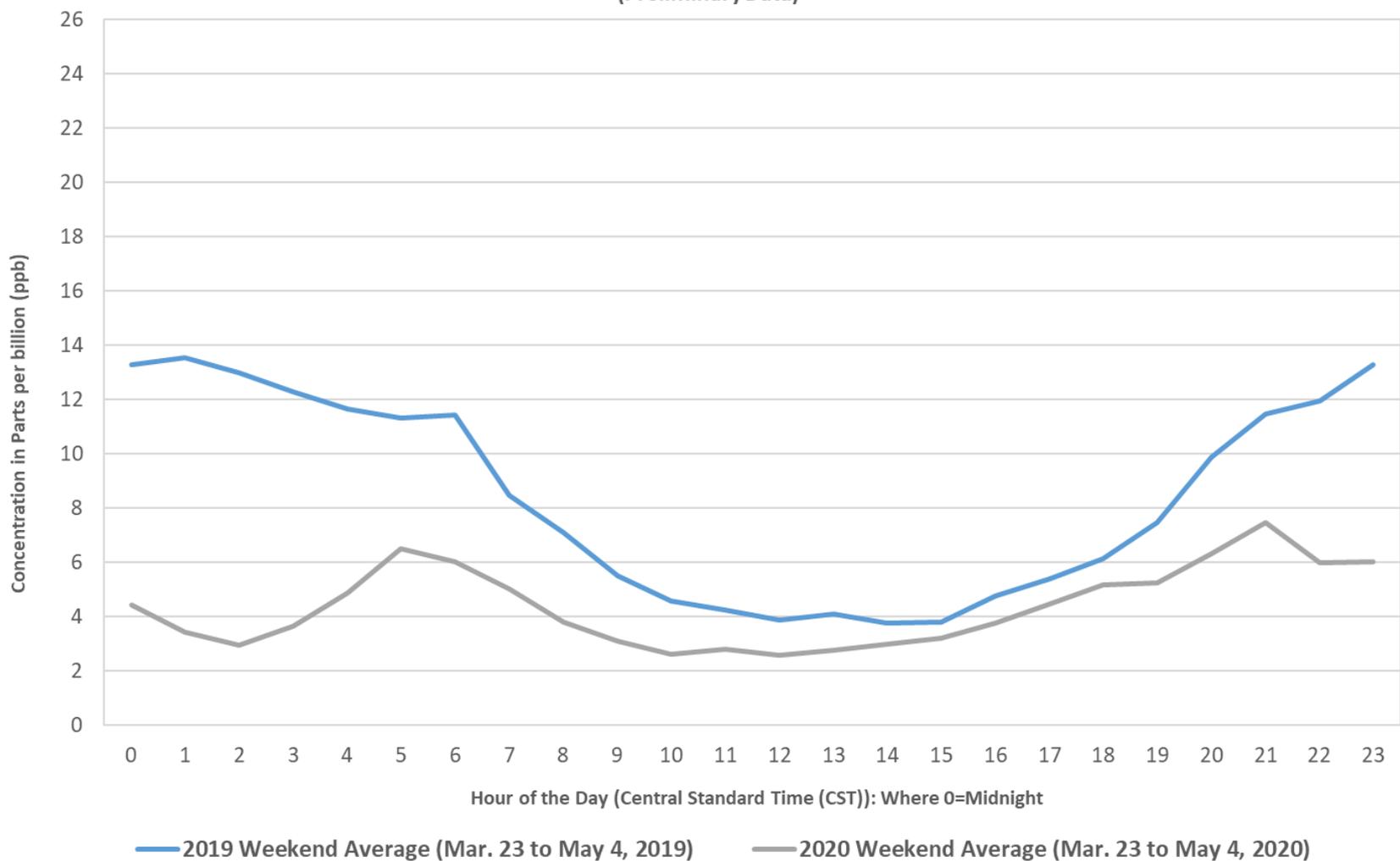


Figure 4. Weekday Nitrogen Dioxide (NO<sub>2</sub>) Concentrations by Hour of the Day at Rider Trail I-70 (STL)  
Near-Roadway Site  
St. Louis Area Stay-At-Home Order Effective on Mar. 23, 2020  
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(Preliminary Data)



**Figure 5. Weekend Nitrogen Dioxide (NO<sub>2</sub>) Concentrations by Hour of the Day at Forest Park I-64 (STL)  
Near-Roadway Site  
St. Louis Area Stay-At-Home Order Effective on Mar. 23, 2020  
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(Preliminary Data)**



**Figure 6. Weekend Nitrogen Dioxide (NO<sub>2</sub>) Concentrations by Hour of the Day at Rider Trail I-70 (STL)  
Near-Roadway Site  
St. Louis Area Stay-At-Home Order Effective on Mar. 23, 2020  
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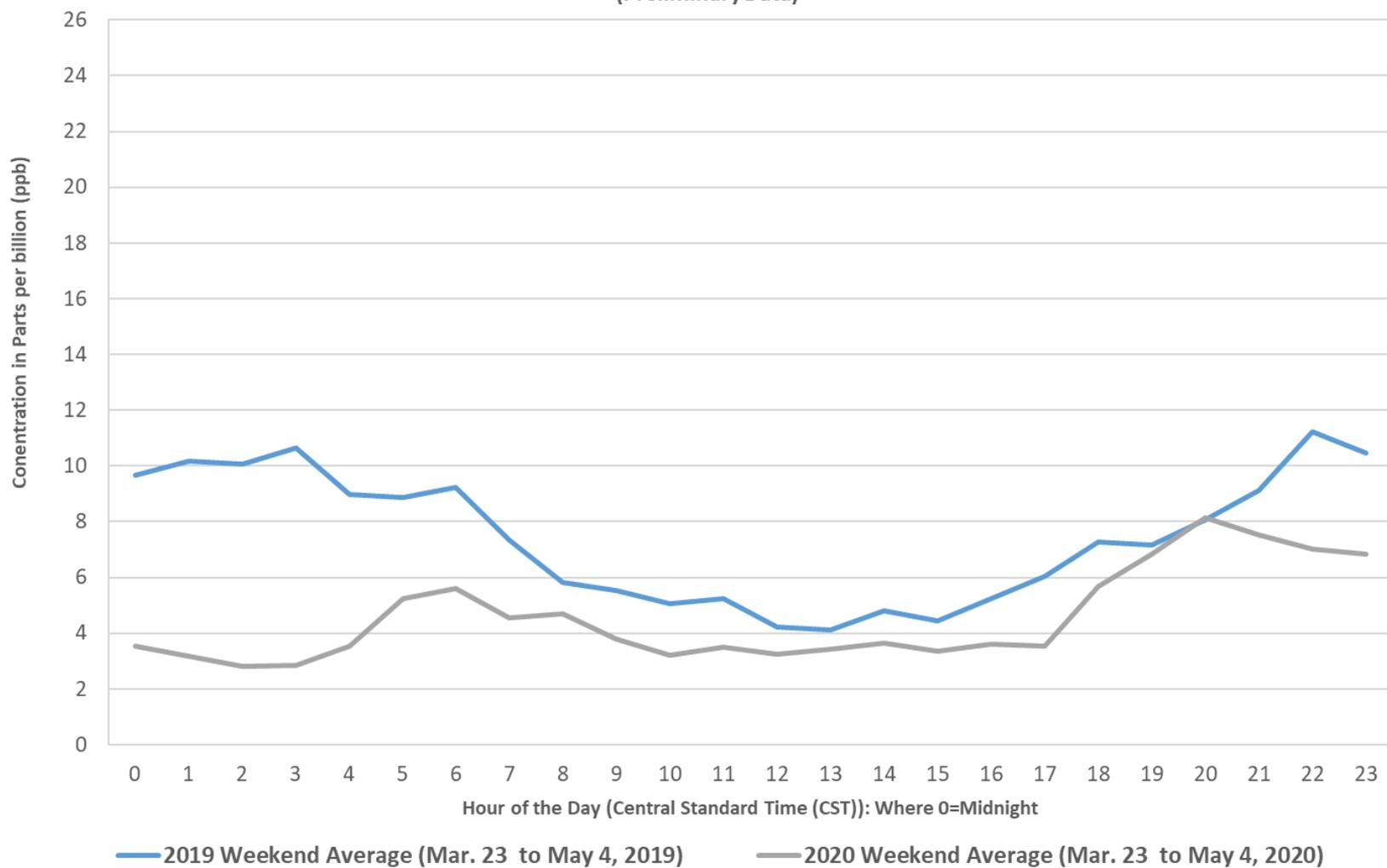
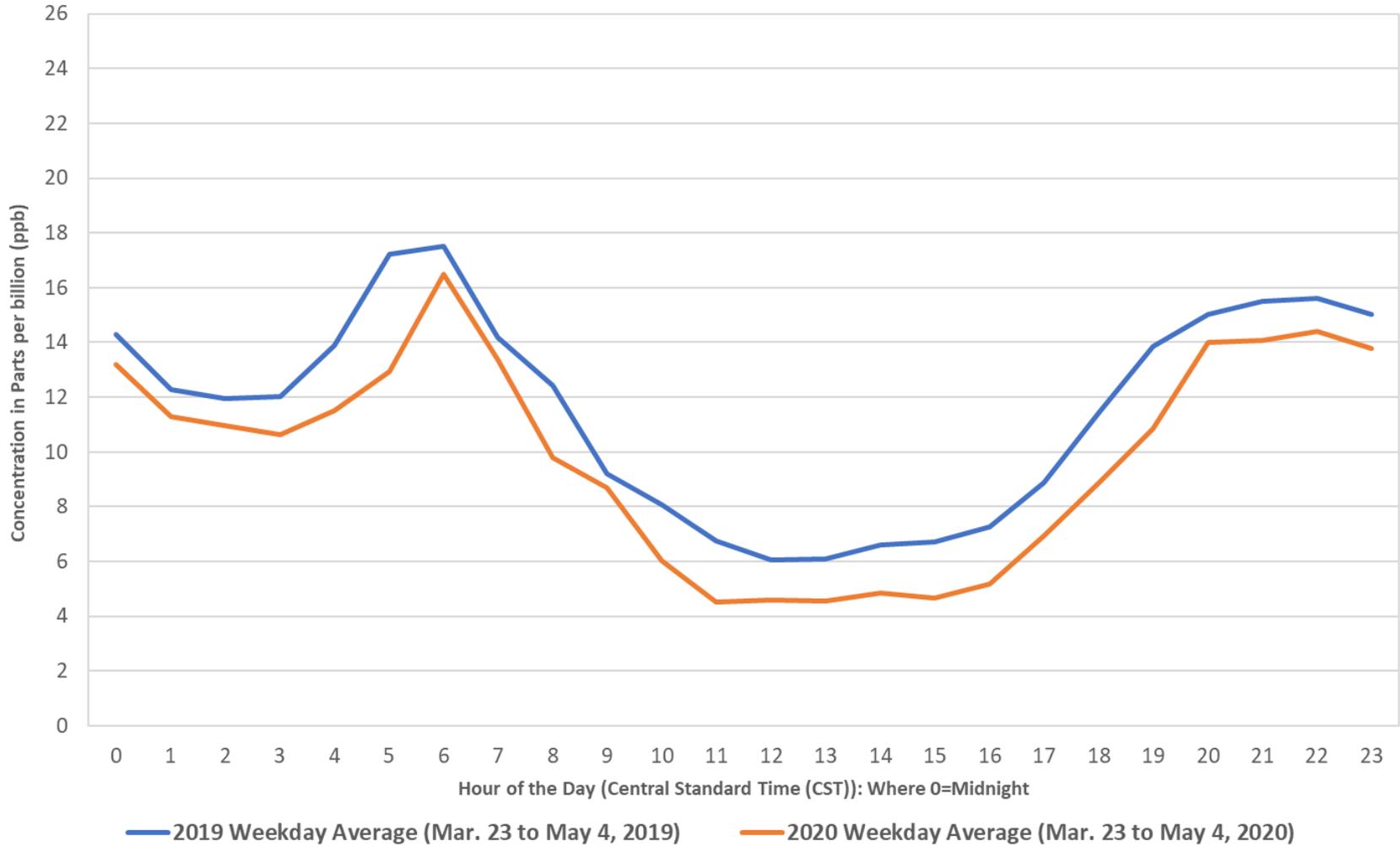


Figure 7. Weekday Nitrogen Dioxide (NO<sub>2</sub>) Concentrations by Hour of the Day at Blair Street (STL)  
 Area Wide Site  
 St. Louis Area Stay-At-Home Order Effective on Mar. 23, 2020  
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 (Preliminary Data)



**Figure 8. Weekend Nitrogen Dioxide (NO<sub>2</sub>) Concentrations by Hour of the Day at Blair Street (STL)  
 Area Wide Site  
 St. Louis Area Stay-At-Home Order Effective on Mar. 23, 2020  
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