



# Air Emission and Pollution Levels during the Pandemic in the Greater Athens Area, Greece

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**“Impact of restriction measures due to COVID-19 pandemic in terms of air pollution and climate change in the Greater Area of Athens (Greece)” (93Y046Ψ8OX-08Λ, 15-06-2020).**



# Introduction - Questions

COVID-19 pandemic provided scientists and policy makers with the unique opportunity to study an **unprecedented large scale experiment**, namely the effects of containment measures on emissions from various sources and, consequently, on air pollutant levels



What is the impact of the lockdown restrictions?

Air - Road - Marine - Traffic limitations

Which are the fluctuations on air pollutant emissions and atmospheric pollutant concentrations?

How are the emission sources related to air pollutant concentrations?



# Introduction

## NO<sub>2</sub> concentrations decrease

- Barcelona 50% Baldasano, J. M., 2020
- Madrid 62% Baldasano, J. M., 2020
- Portugal 41% Gama et al., 2021
- UK 38% Wyche et al., 2021
- Milan 61.4% Collivignarelli et al., 2020
- 4 European cities & one Chinese 53-65% Sicard et al., 2020

## PM<sub>10</sub> concentrations decrease

- Milan 48.0% Collivignarelli et al., 2020
- 4 European cities & one Chinese 8% & 42% Sicard et al., 2020
- India 36.8% Mor, S., et al., 2021 whereas north India 58% Srivastava et al., 2021

### Greek studies

- Koukouli. et al. 2021: Decline of mean tropospheric NO<sub>2</sub> by **11-15%** whereas total emissions over Greece declined by around **10%**
- Grivas et al. 2020: Studied NO<sub>2</sub>, CO, CO<sub>2</sub>, PM<sub>2.5</sub> and BC concentrations at an urban background station in central Athens → mean concentration decrease ranging from **32 to 42%**.



# Study Area



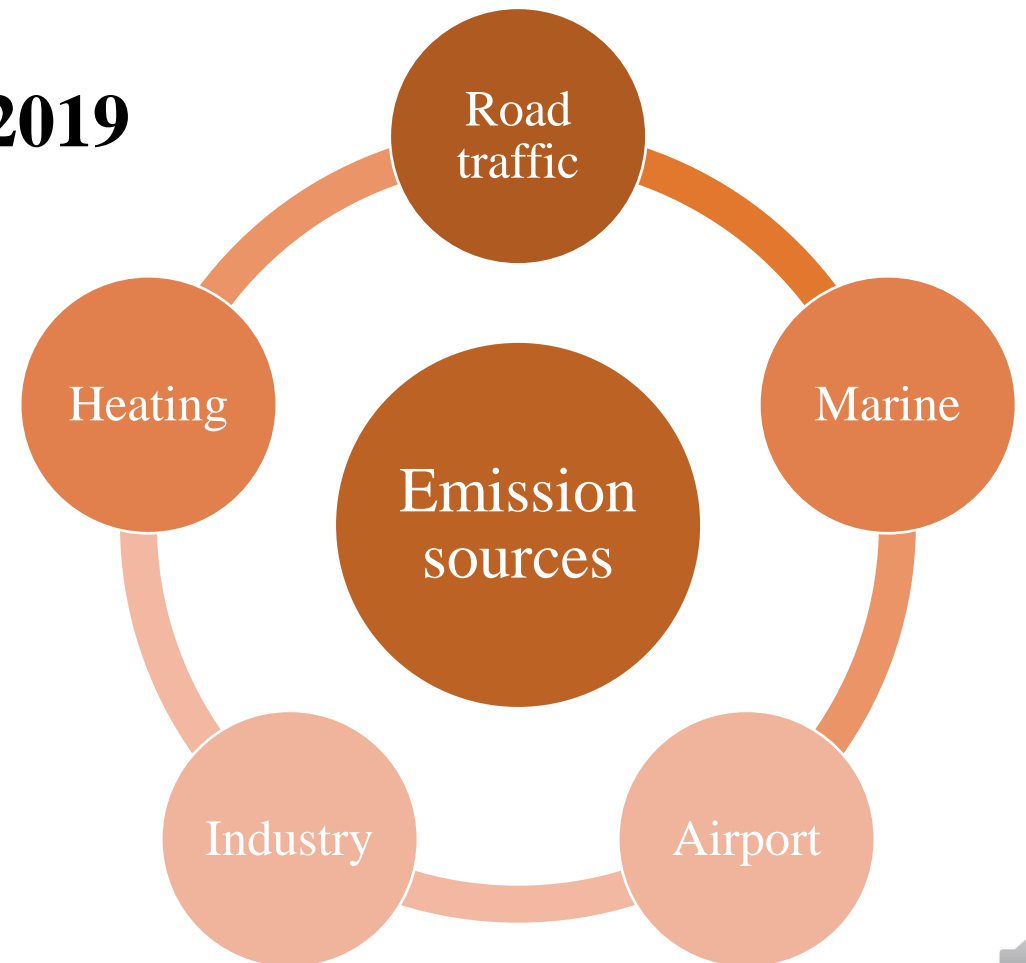
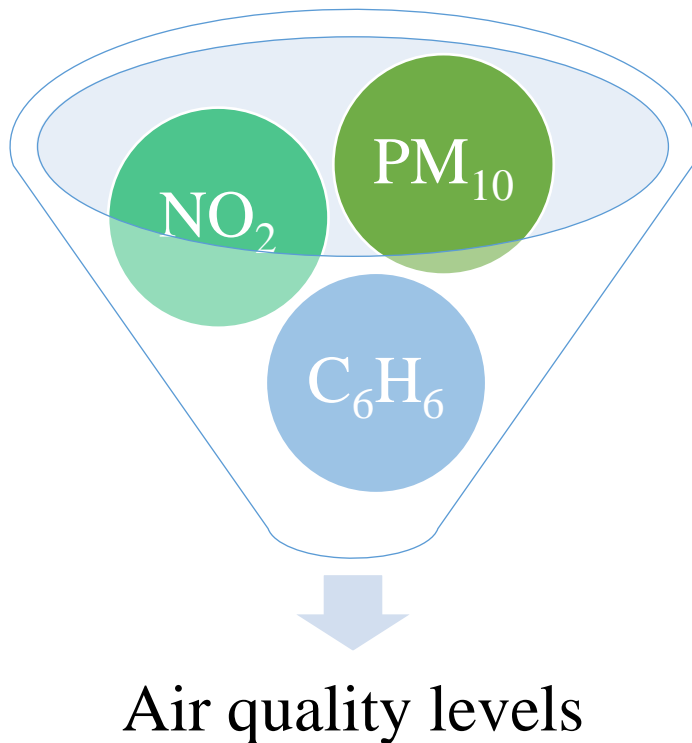
**Urban/traffic**

**Semi-urban/  
industrial**



# Introduction

- ❖ Lockdown period: March-May 2020
- ❖ March-May **2020** VS March-May **2017-2019**



# Materials and methods

## *Collection of input data*

Statistical **fuel consumption** for all fuel types per sector and usage and **indices** for the industrial production and economic turnover per sector from the Hellenic Ministry of the Environment and Energy, to reliably estimate **emissions from all sources** in the Greater Athens Area (GAA).

### **Road, air and marine traffic data**

- Region of Attica
- Hellenic Civil Aviation Authority (HCAA)
- Piraeus Port Authority (PPA)

**Air quality measurements** were acquired by the

- National Air Pollution Monitoring Network (NAPMN)
- Athens International Airport (AIA) monitoring network
- Monitoring station of the Piraeus Port Authority (PPA)

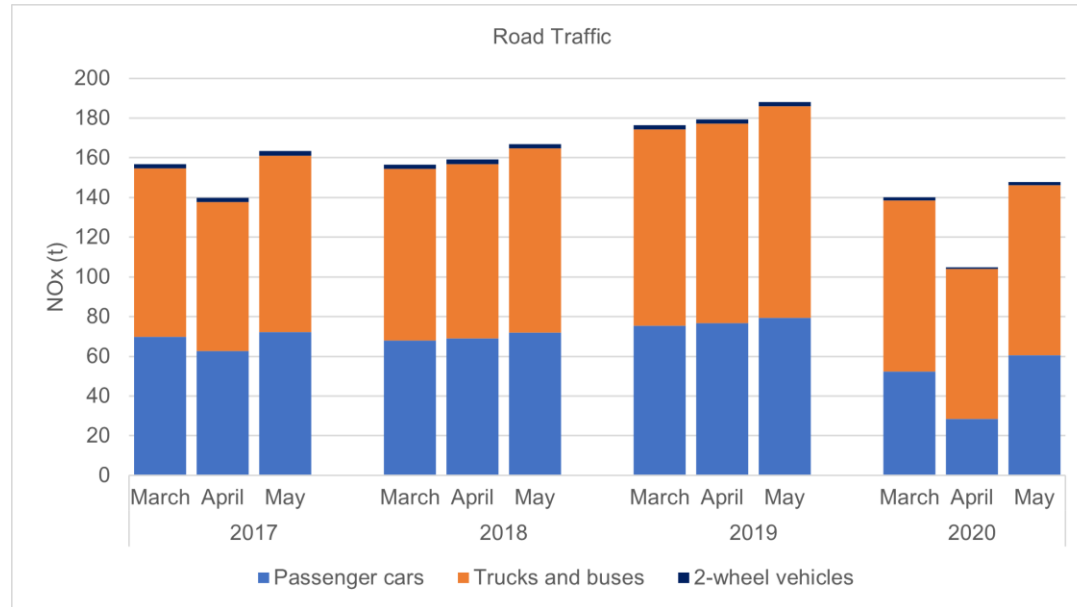
## *Calculation of air pollutant emissions*

Methodologies applied in the Greek National Inventories under the **United Nations Framework Convention on Climate Change (UNFCCC)** and the **National Emissions Ceiling (NEC)** Directive (EU 2016/2284) for the period 2017 to 2020.





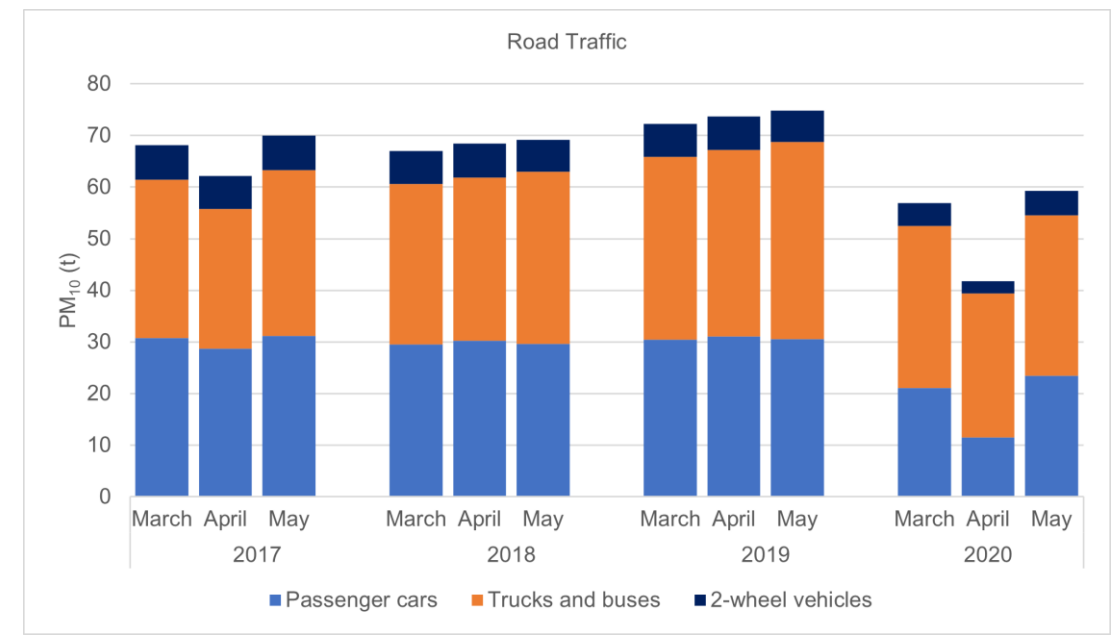
# Road traffic emissions for the period March to May 2017-2020



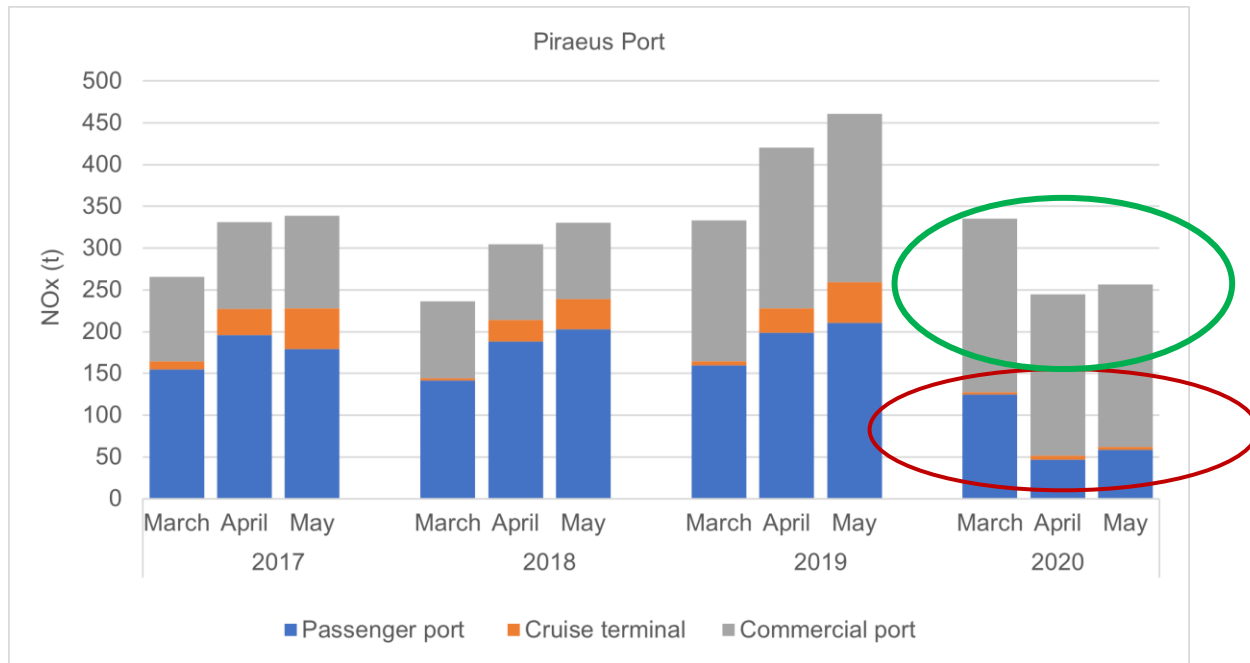
Road traffic → 20 to 40% ↓

Passenger car → > 55%

Trucks and buses → 25-30%

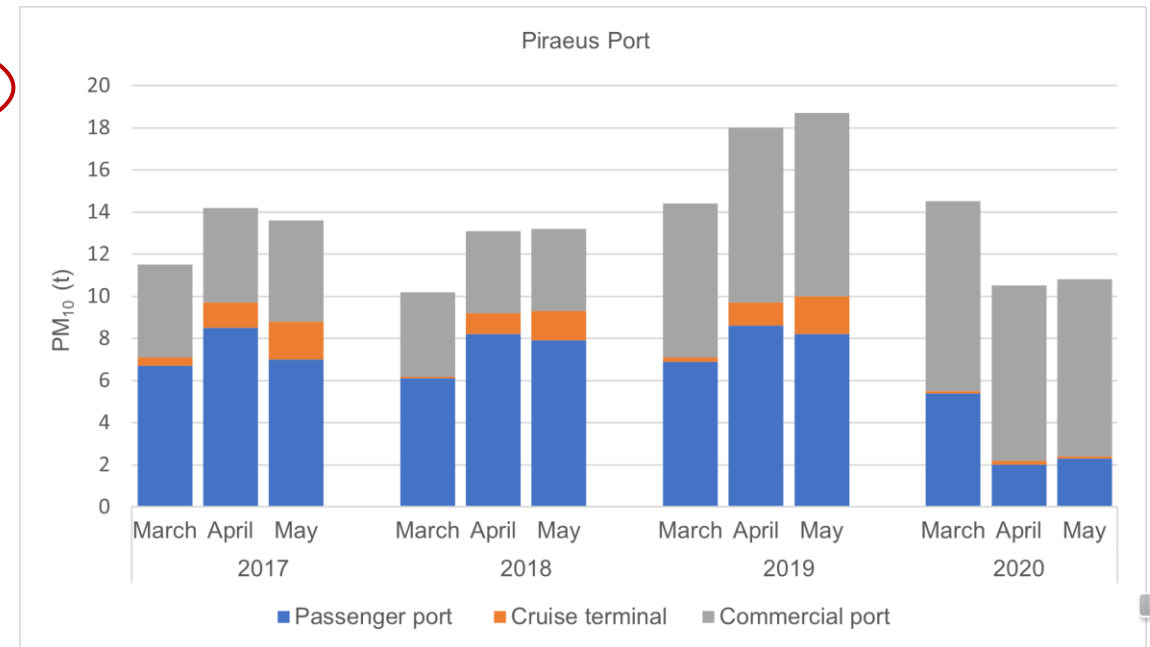


# Emissions from the Piraeus Port for the period March to May 2017-2020



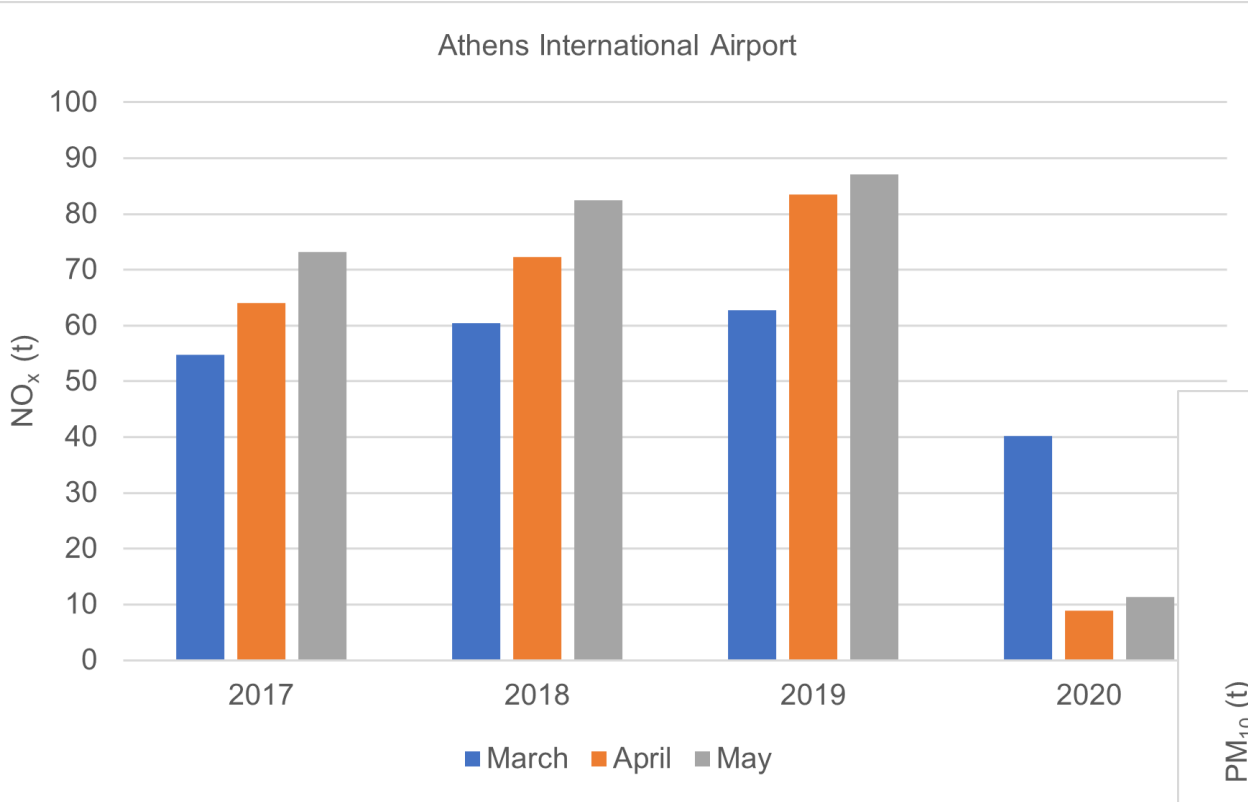
Commercial port ↑ or **stable**

Passenger port ↓ **20 to 80%**

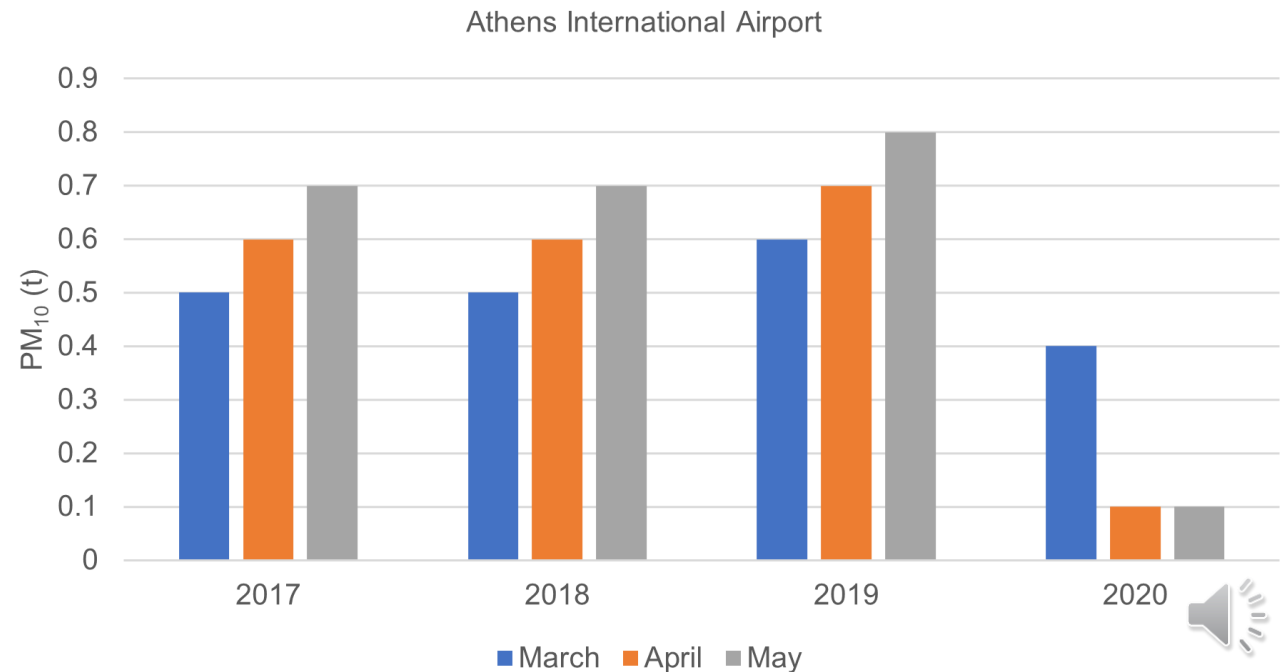




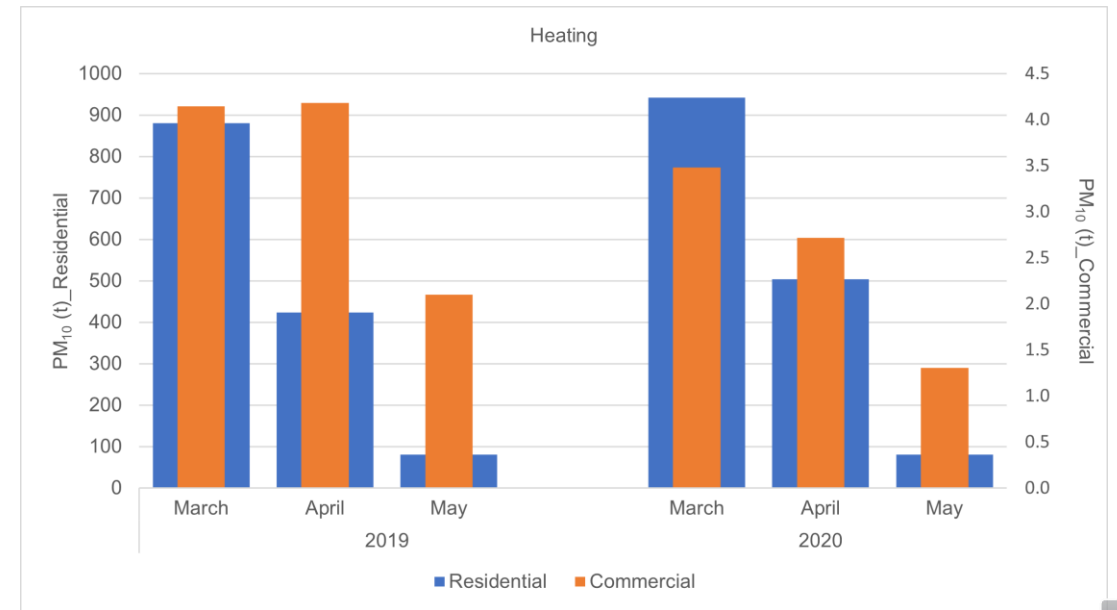
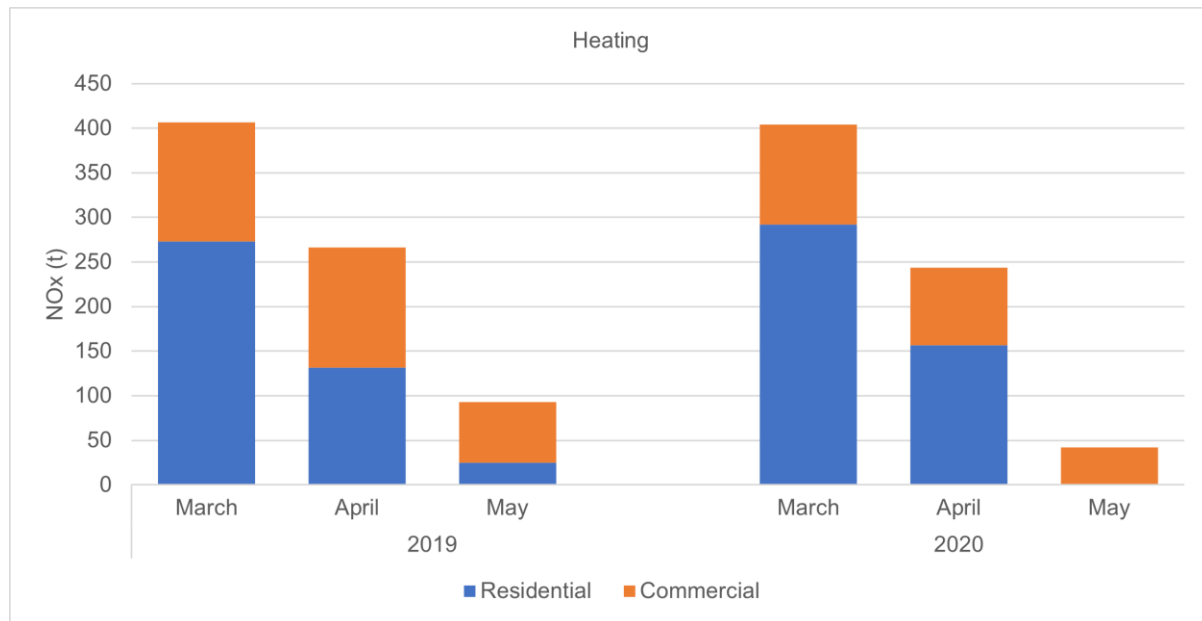
# Emissions from the Athens International Airport for the period March to May 2017-2020



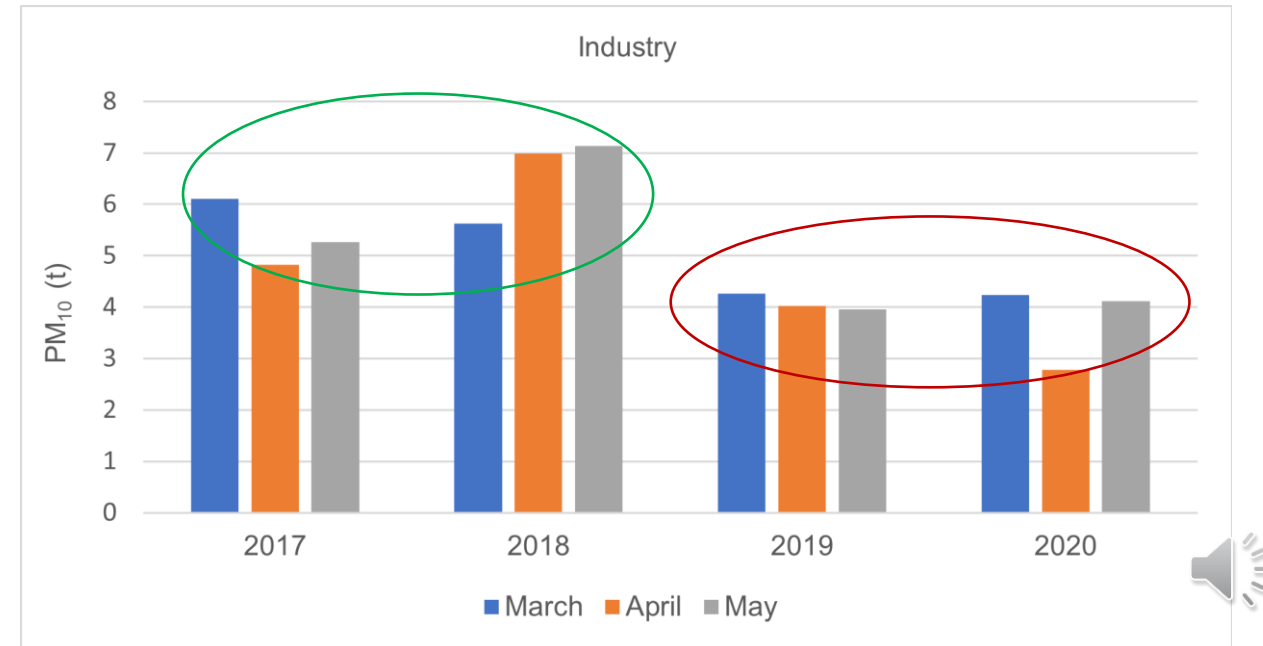
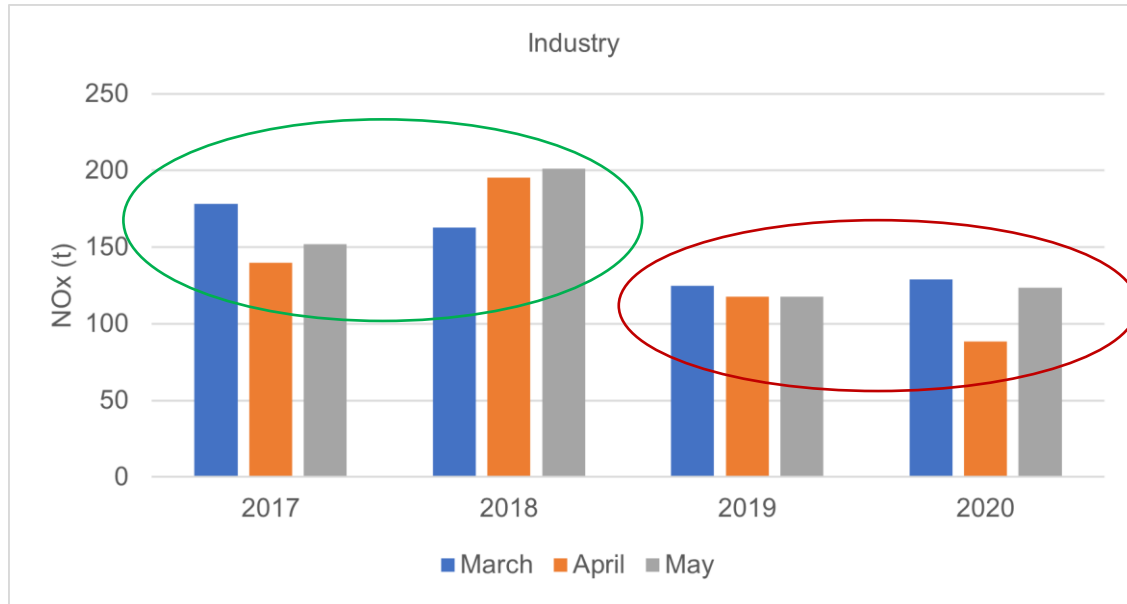
Air traffic emissions **35% - 90%**



# Emissions from residential and commercial heating for the period March to May 2019-2020

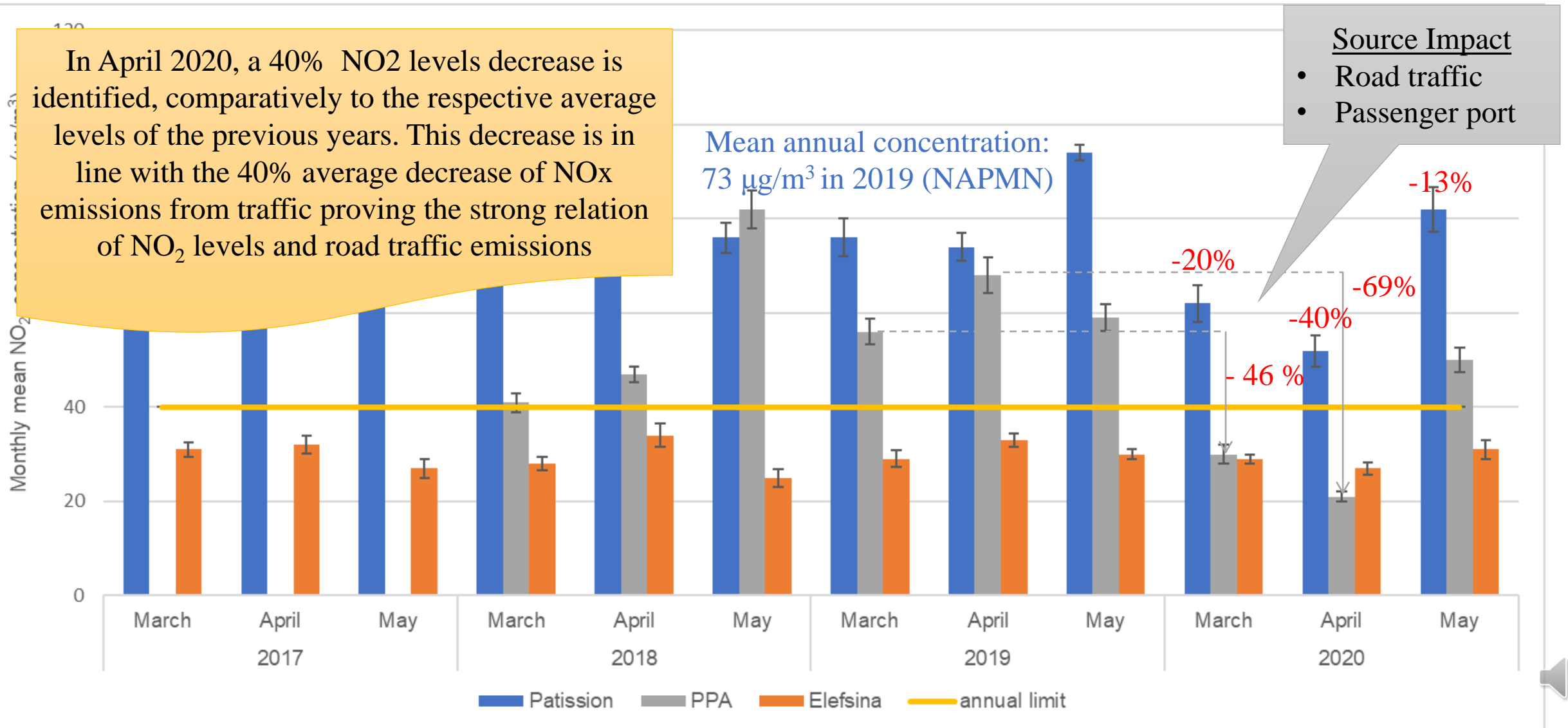


# Emissions from industry for the period March to May 2017-2020



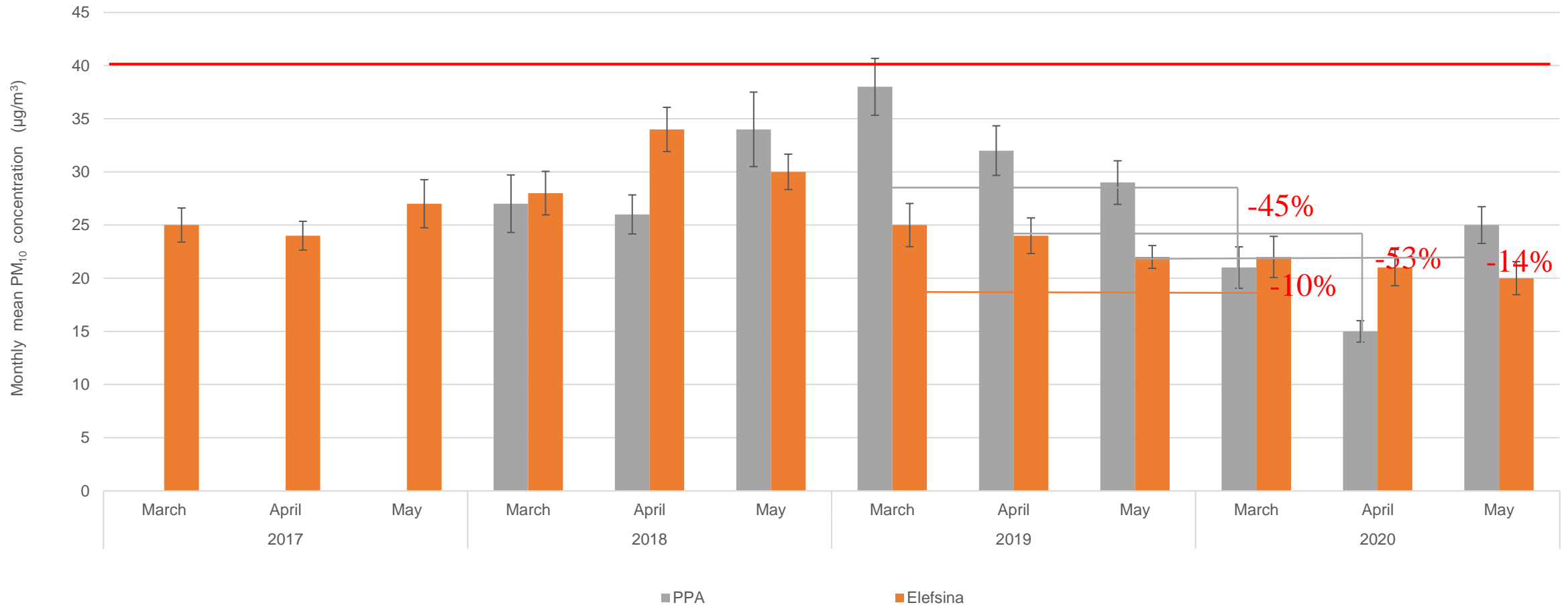
# Air quality levels

## Urban traffic stations /Semi-urban industrial station



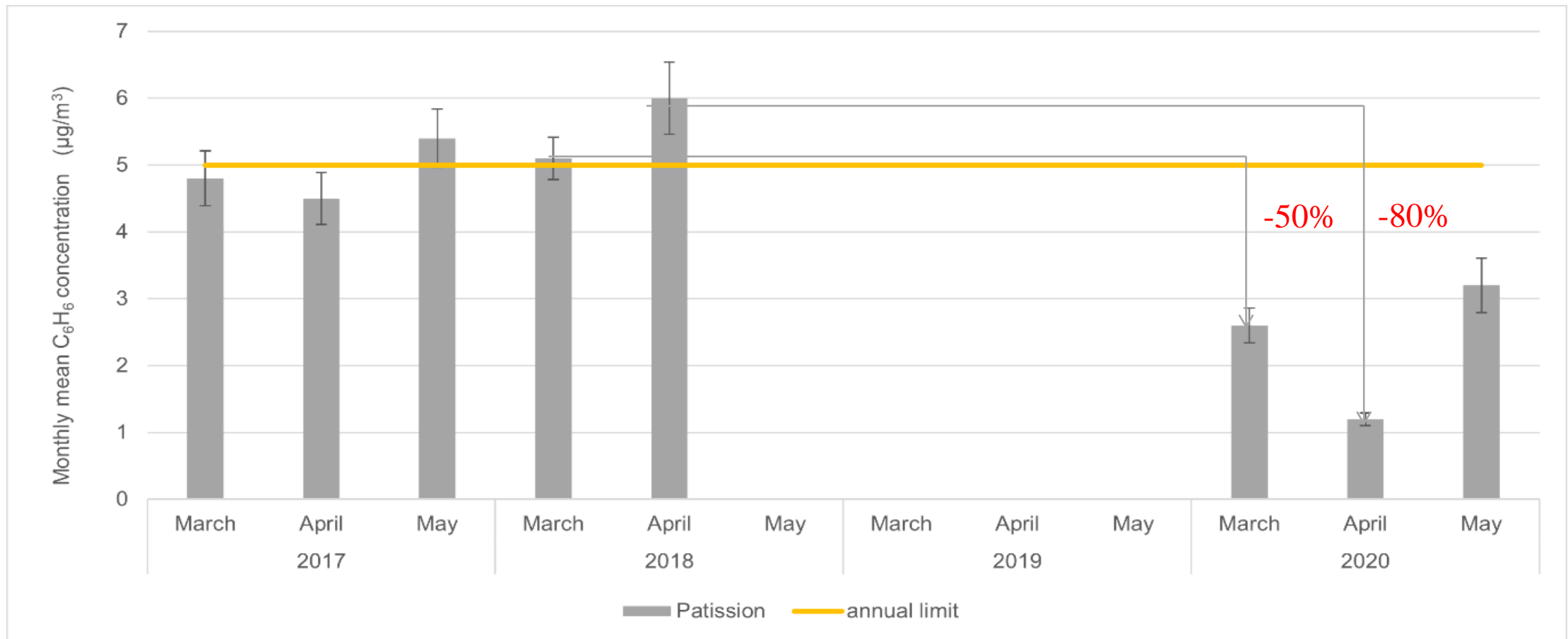
# Air quality levels

## Urban traffic station /Semi-urban industrial station



# Air quality levels - Benzene ( $C_6H_6$ )

## Patission urban traffic station



# Conclusions

- During the lockdown, road, marine and air traffic emissions decreased by 40-90 %.
- NO<sub>2</sub> concentrations reduced by 38-71% in the urban traffic stations whereas PM<sub>10</sub> declined by 10-53%.
- Benzene concentrations were significantly reduced up to 80% reflecting emission decreases from petrol vehicles ( $R^2=97\%$ ).
- In Patission station, despite the significant decrease of road traffic emissions, the mean monthly concentrations still exceed the annual limit value.





Thank you for your  
attention! 😊

