Thornes et al. (2020), **Proposed Interventions to reduce noxious air pollution at Birmingham New Street station**,
Proceedings of the Institution of Civil Engineers – Transport,
https://doi.org/10.1680/jtran.19.00061

- High levels of NOx in the enclosed railway station due to Diesel passenger trains.
- 98 ventilation fans installed and driven by CO_2 sensors but NOx levels still too high.
- Intervention to install over 100 new NO_2 and NO sensors to drive the fans instead.
- Other future plans eg to introduce hybrid trains that can switch off Diesel engines and use electrified entry into the station.
- Success of Interventions?

Key reports

PHE (2019) Review of interventions to improve outdoor air quality and public health
https://www.gov.uk/government/publications/improving-outdoor-air-quality-and-health-review-of-interventions

AQEG (2020) Assessing the Effectiveness of Interventions on Air Quality https://uk-air.defra.gov.uk/library/reports.php?report_id=1004

SUCCESS OF AN INTERVENTION?
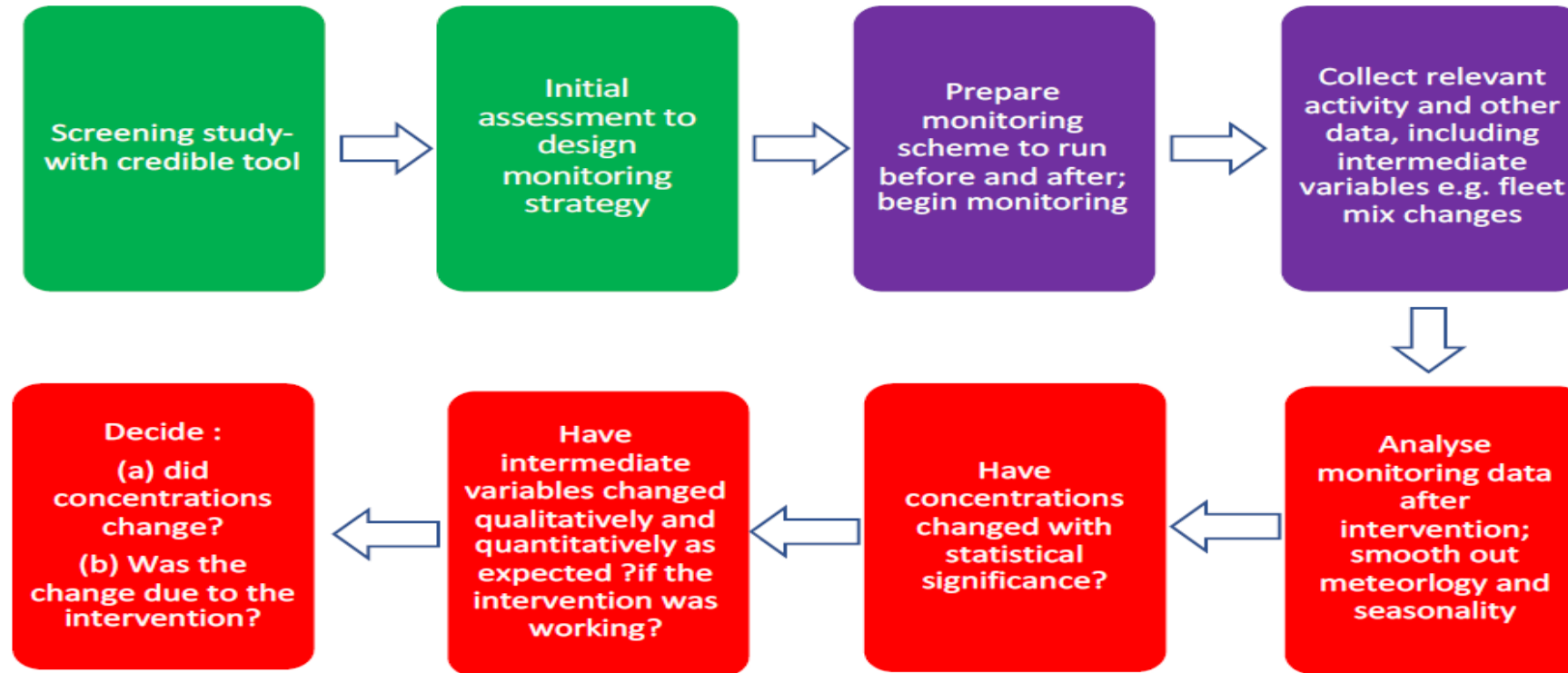
Colour code: Green: prior to intervention   Purple: during intervention   Red: After intervention

Birmingham New Street Summary

- Birmingham New Street (BNSS) is the busiest station outside London (entries & exits and interchanges). Normally up to 200,000 passenger movements per day. A £600m upgrade completed in 2015 including 98 ventilation fans.

- 12 platforms lie beneath the concourse in a tunnel like environment which traps the diesel air pollution.

- Approximately 45% of trains that serve BNSS are diesel. Up to 600 diesel train movements per day.

- University of Birmingham and Network Rail worked in collaboration with the HPRU and developed an extensive monitoring campaign to better understand the air quality in and around the station during 2016/17.
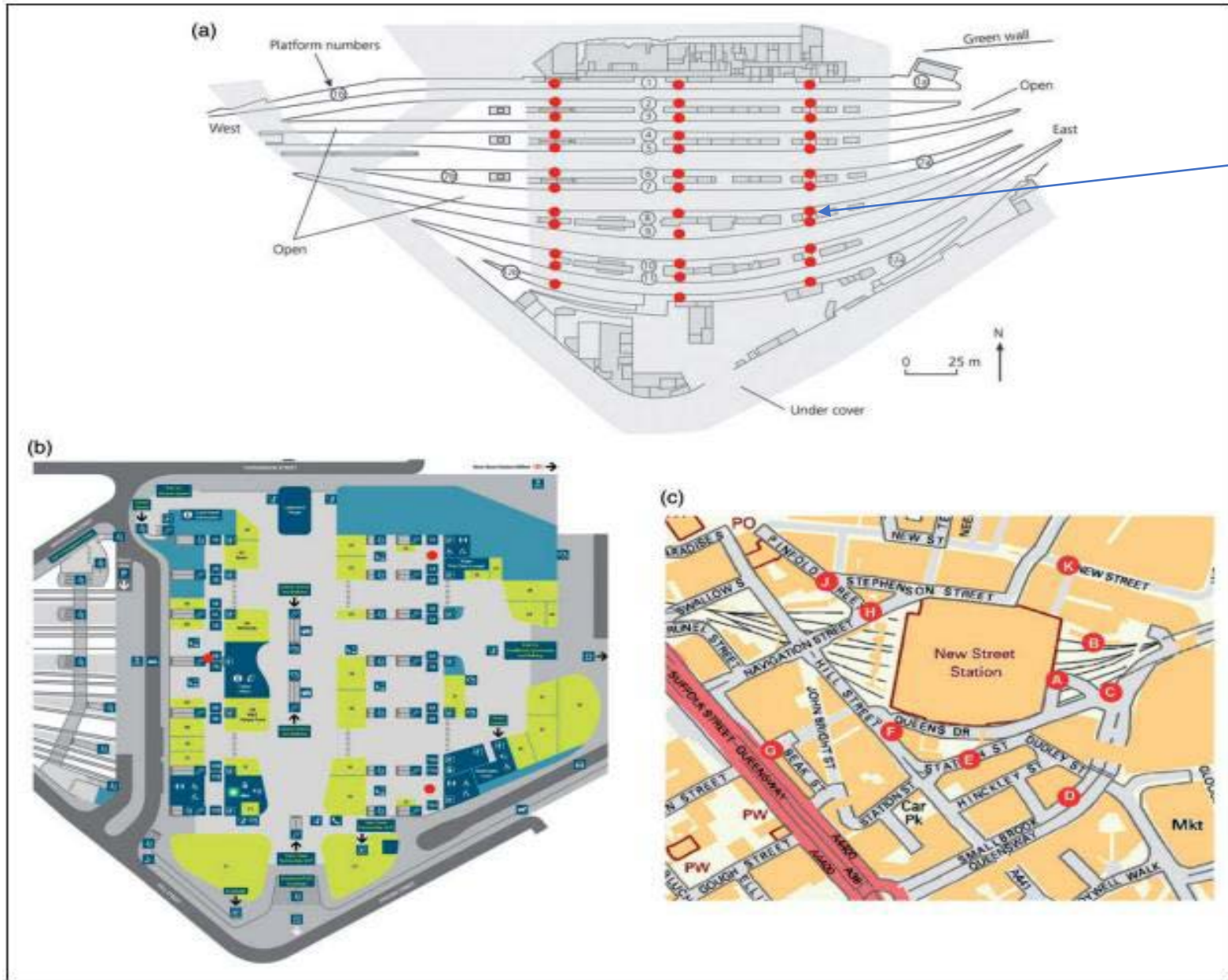
(a)

Platform numbers

Green wall

West

Open

East

Open

N

0   25 m

Under cover

(b)

(c)
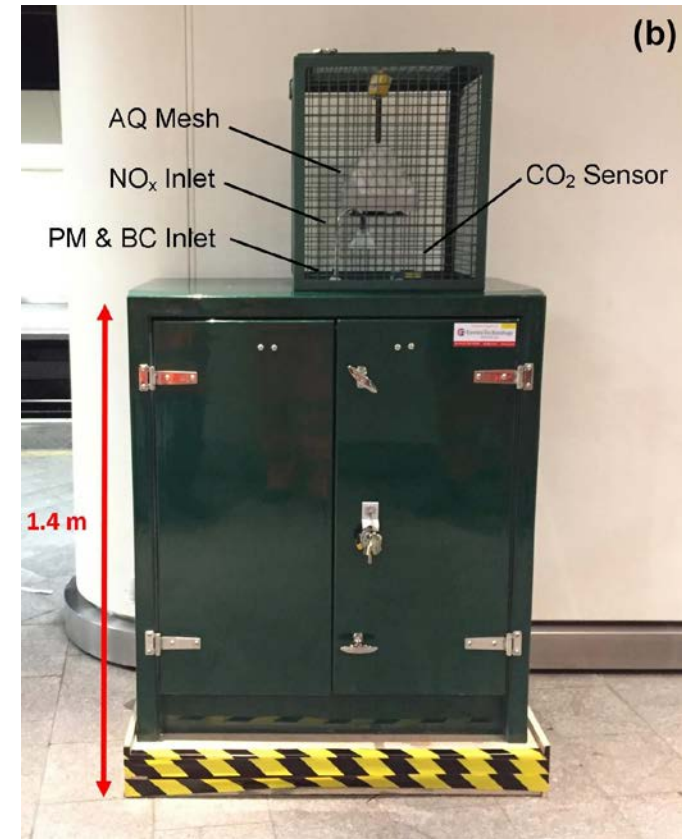
Diffusion Tubes

The experiments – main sites
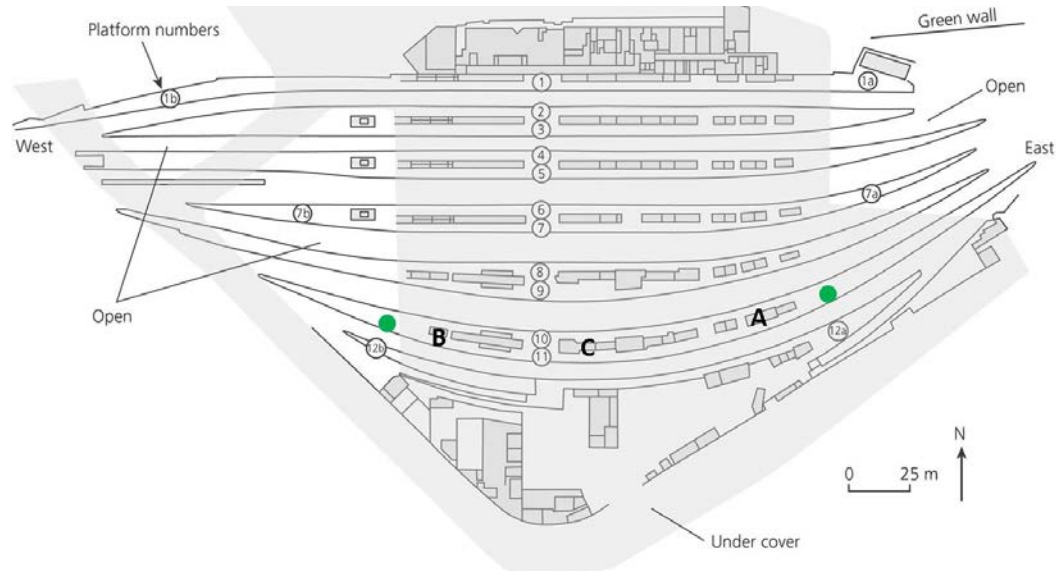
Monitoring Location	Pollutants Monitored	Meteorological Measurements
A & B	NO_x, PM, CO_2	Wind
C	NO_x, PM, CO_2, BC	n/a

DAQI: BNS vs A4540 & Moor Street

New Legislation from August 2018

- Nitrogen Dioxide NO2 WEL
- 8-hour TWA 0.5 ppm (955 ug/m3)
- 15-min STEL 1.0 ppm (1,910 ug/m3)

- Nitrogen Monoxide NO WEL
- 8-hour TWA 2.0 ppm (2,500 ug/m3)

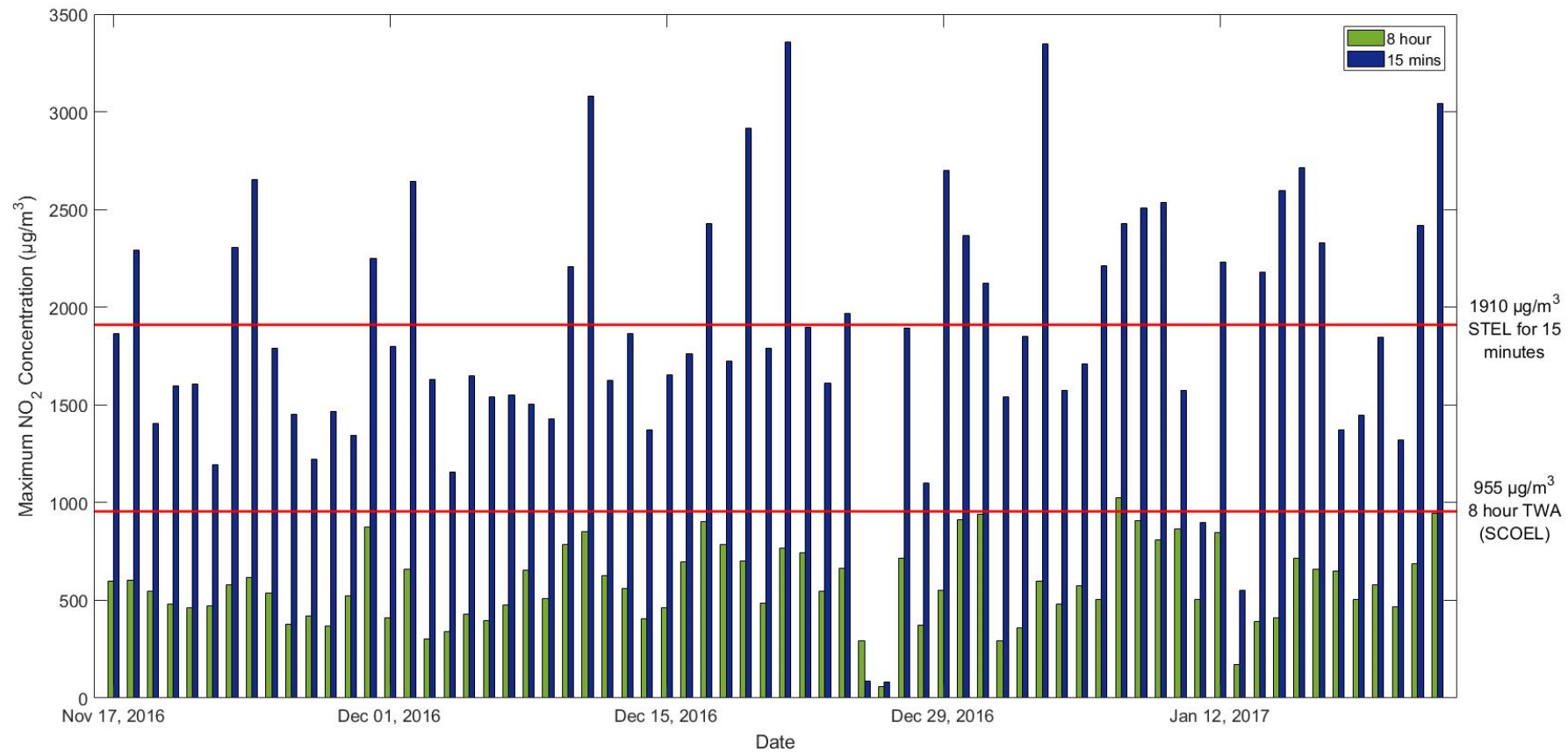# Workplace Exposure Limits (WEL) NO2
15 min STEL Exceeded on 40% of days
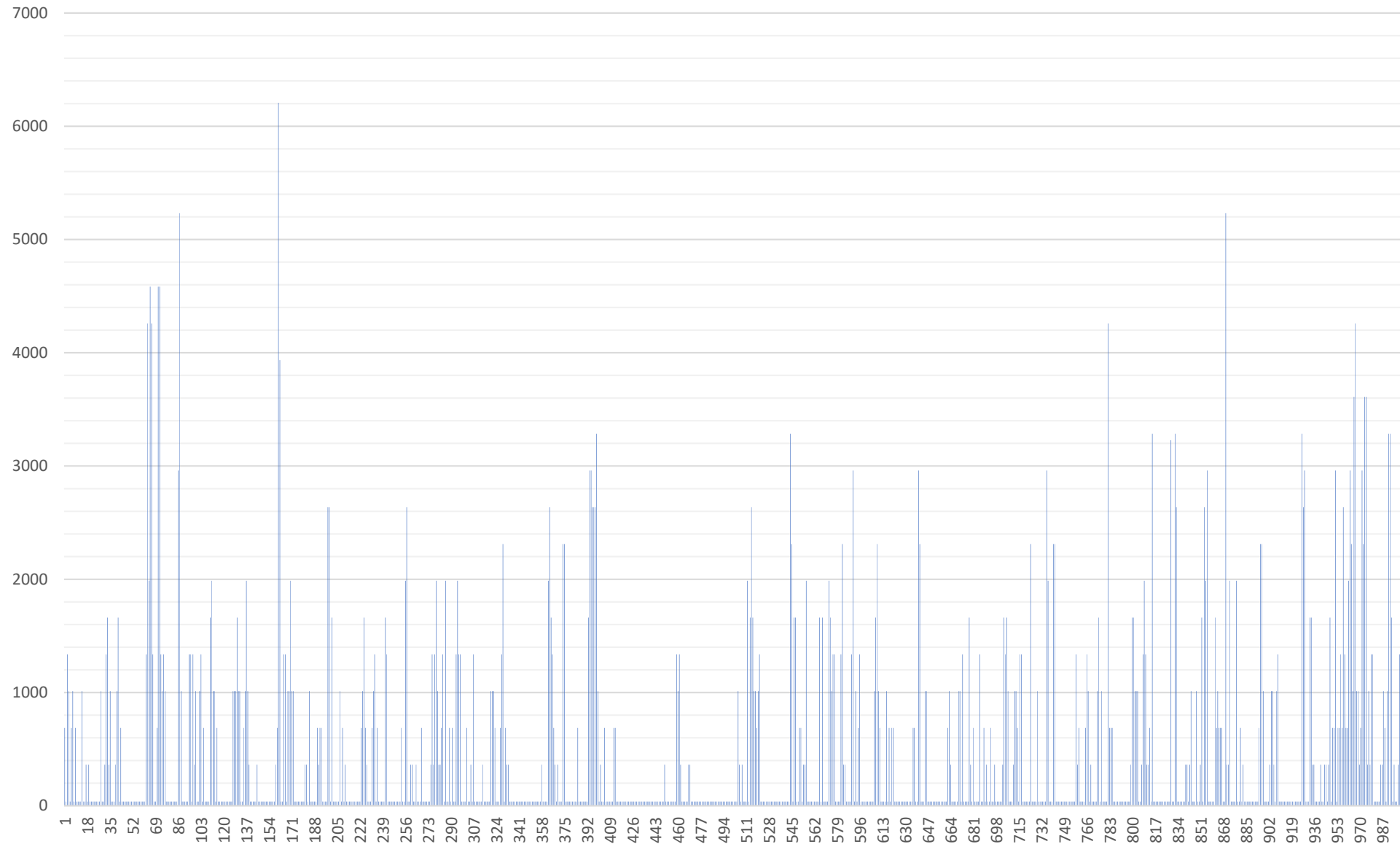
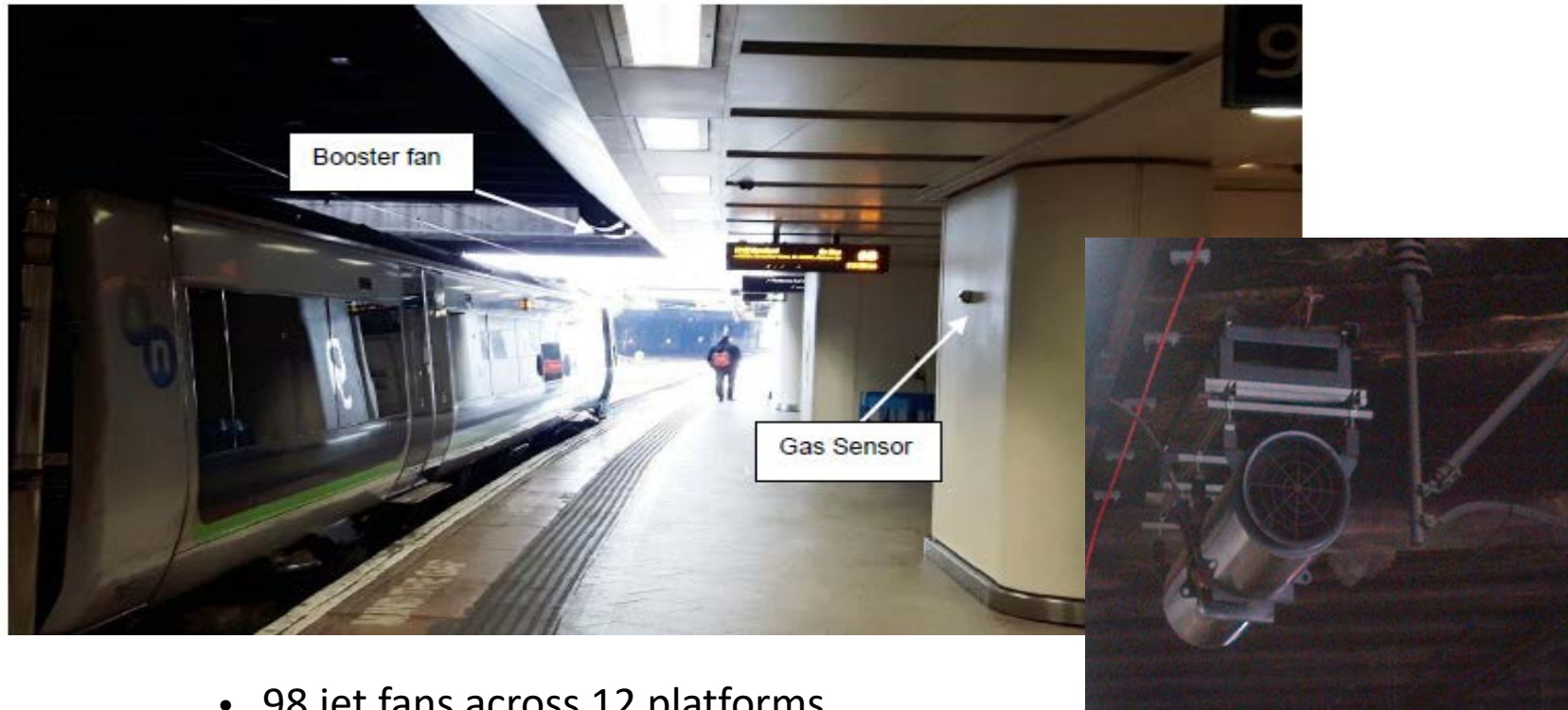# Comparison RSSB Study: Kings X, Edinburgh & Birmingham NSS
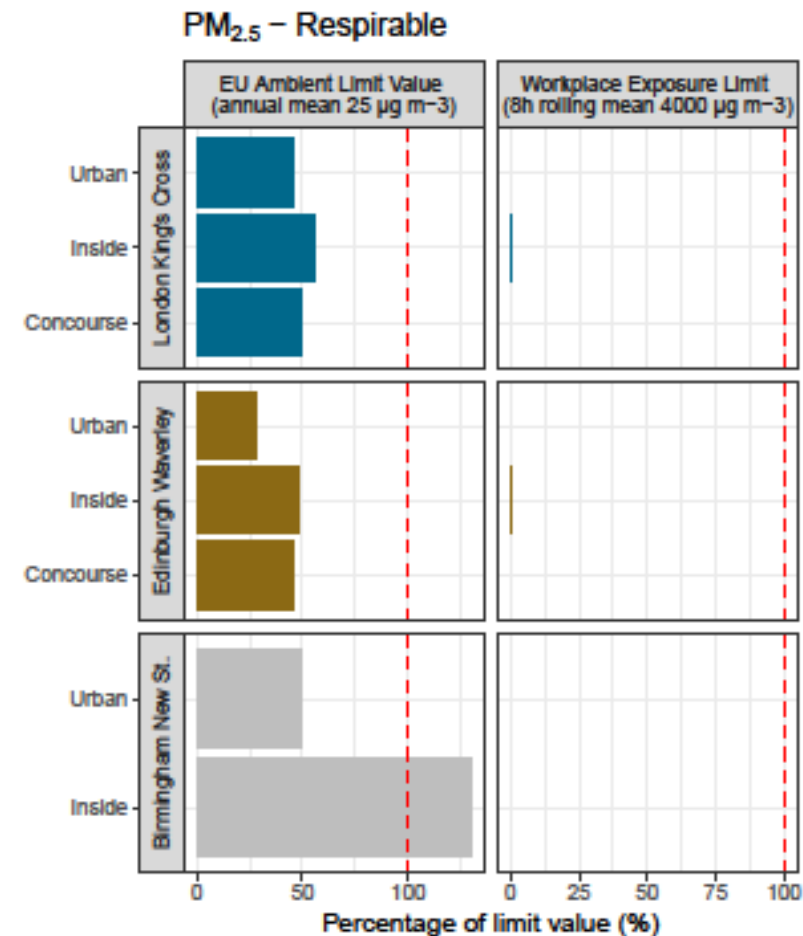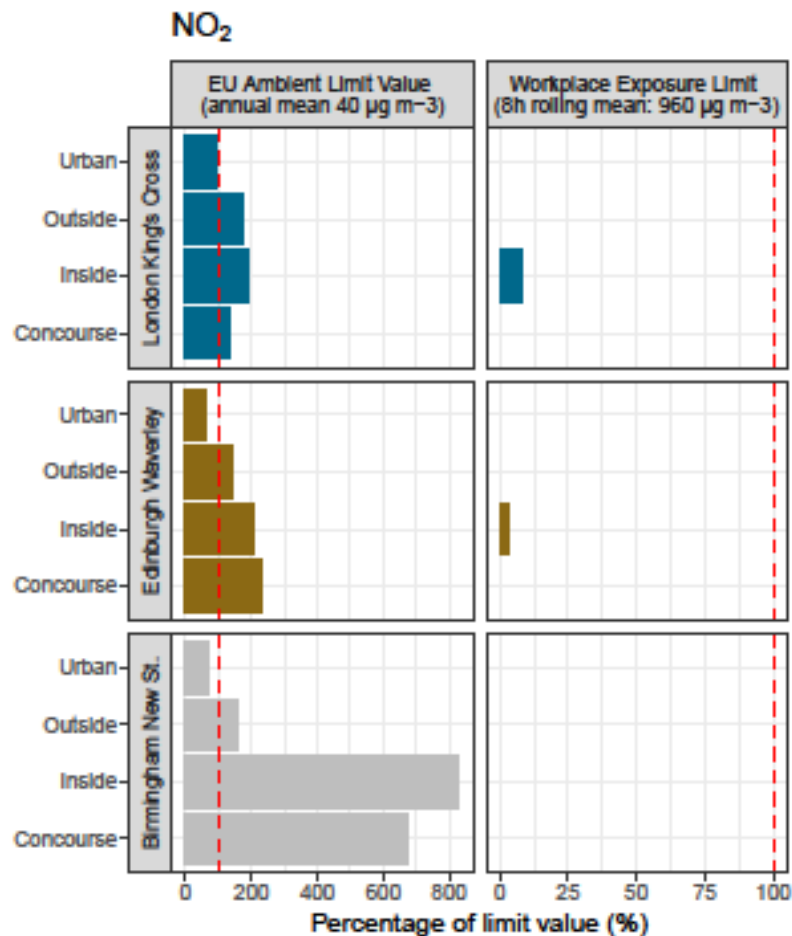
Intervention: New CO2 & NO & NO2 Sensors BNSS

Platform 4 NO2 15 Minute Max Values (ug/m3) 3rd – 13th August 2020

Ventilation System at New Street

- 98 jet fans across 12 platforms

- Fans are bi-directional depending upon wind direction

- Remove air pollution towards end of platforms into open space

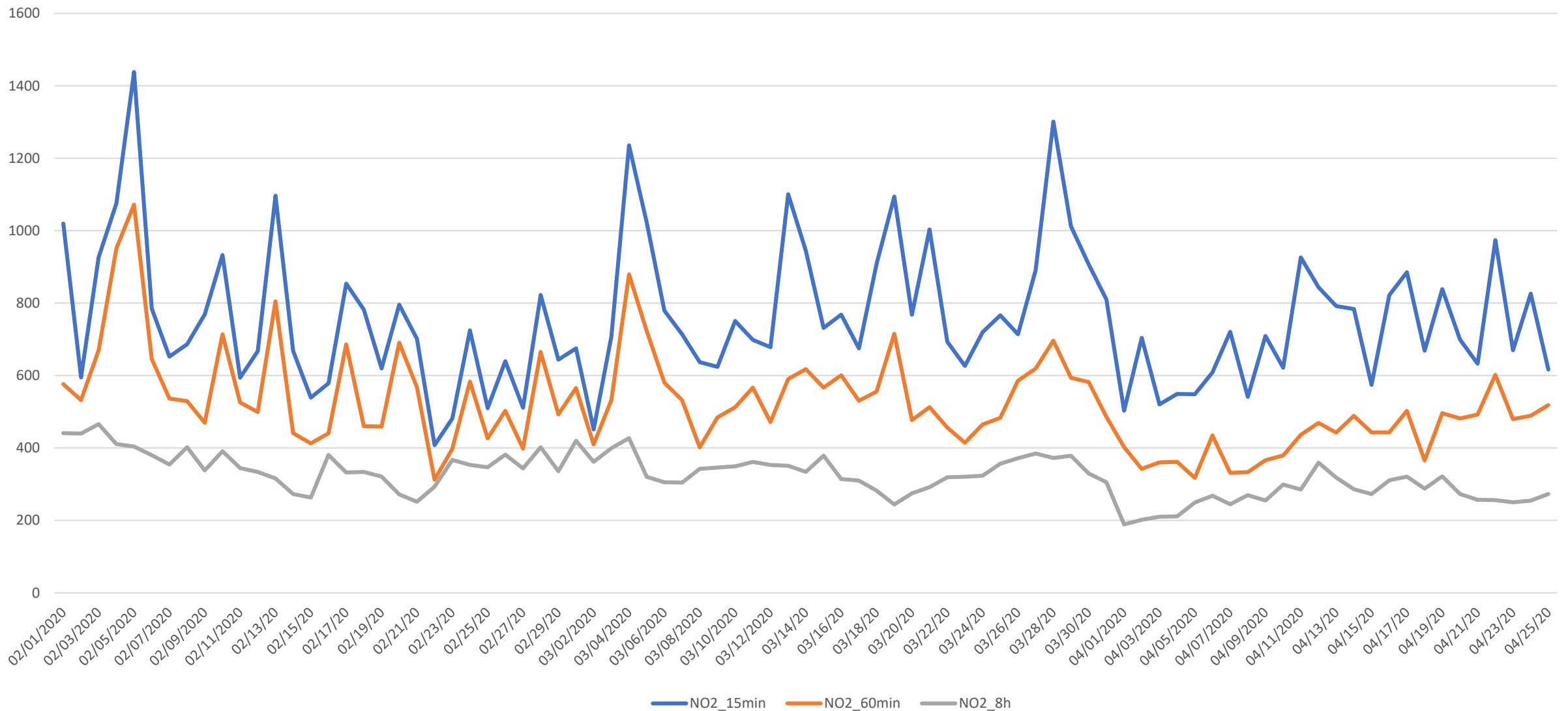- Array of 100 new NO/NO2 sensors that control 8 speeds for each fan over 12 zones

EMSOL DATA
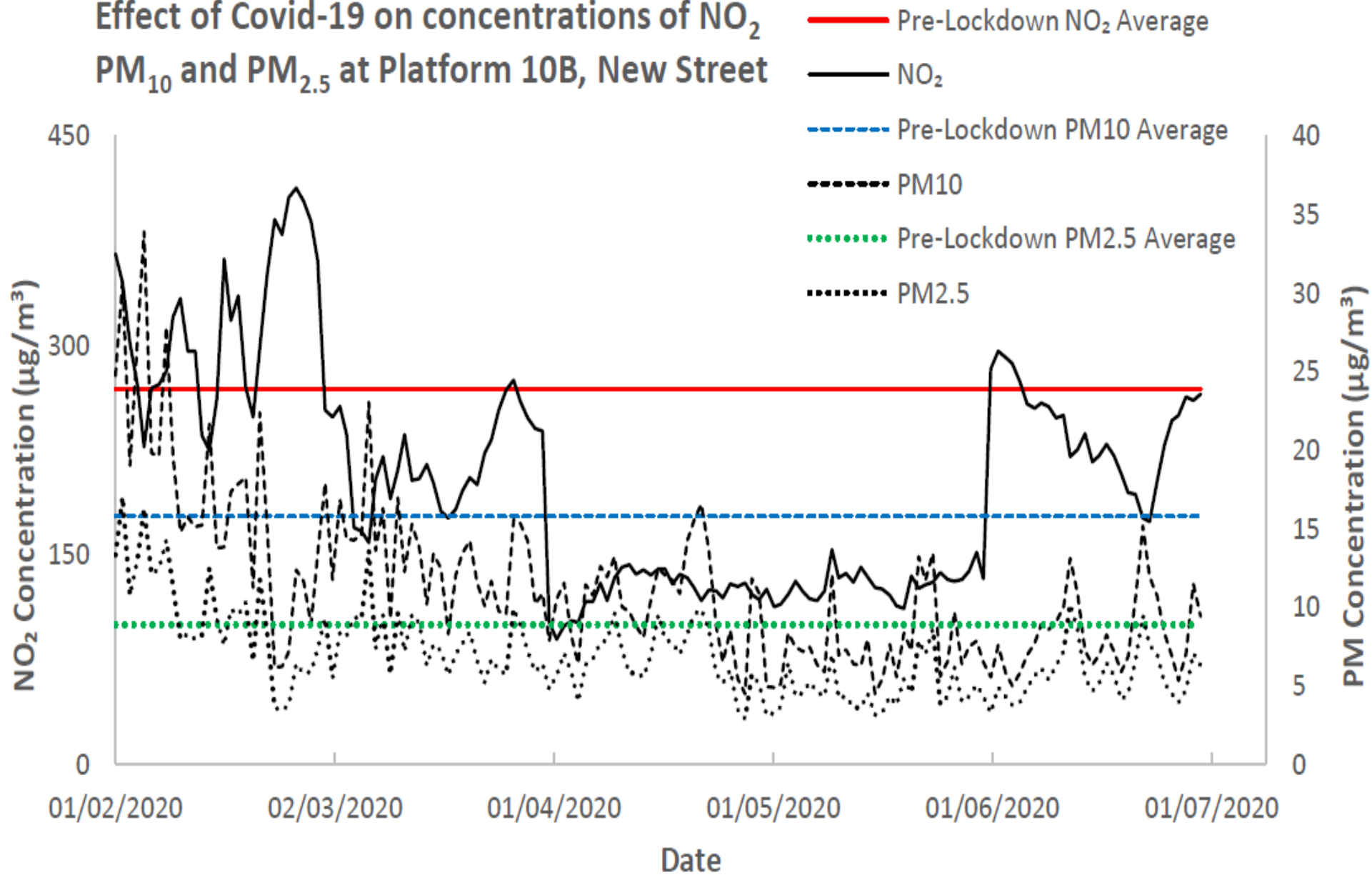
Daily 15min, 60min & 8hr Maximum NO2 Levels (ug/m3)
Platform 11B   February:April 2020 (EMSOL data)

NO2_15min   NO2_60min   NO2_8h

Effect of Covid-19 on concentrations of NO_2 PM_{10} and $PM_{2.5}$ at Platform 10B, New Street

Initial Conclusions

- The success of the interventions is still being monitored.

- Complications from Covid-19!

- The new NO and NO2 sensors do seem to have activated the ventilation fans more frequently and lowered overall NOX levels by up to about 30%. Levels are still too high.

- An unintended consequence is that as the fans are more often on, and on full power, this proves to be both a noise hazard and causes an increase in the carbon footprint of the station!

- The reduced timetable in Covid-19 lockdown has reduced levels by up to a further 30%.