Air quality monitoring using sensor network at University Hospitals Plymouth

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2024 Clean Air Conference – 3 Oct 2024
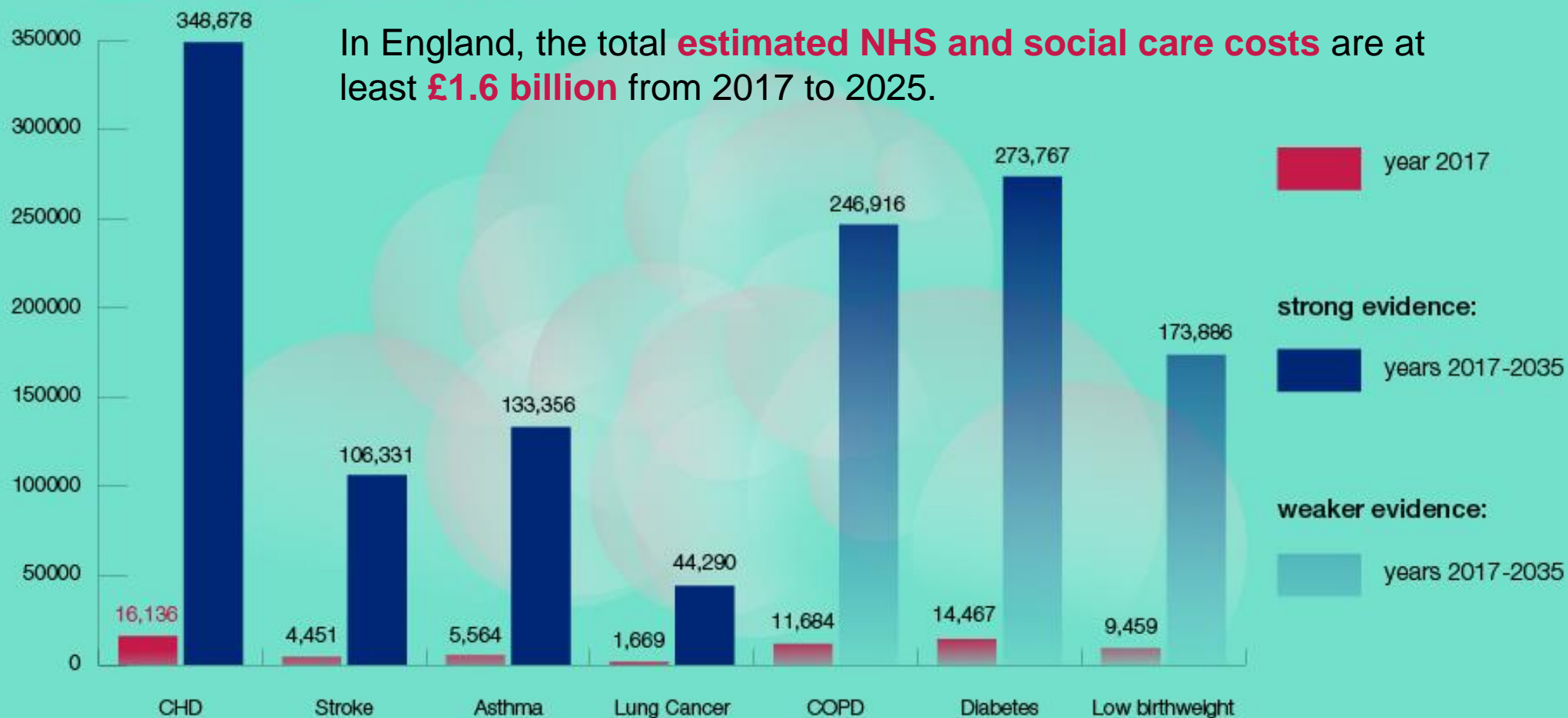
UNIVERSITY OF PLYMOUTH

NHS University Hospitals Plymouth NHS Trust

Conditions associated with exposure to PM$_{2.5}$

Cumulative incidence cases attributable to PM$_{2.5}$ in England by disease and total between 2017 and 2035

In England, the total **estimated NHS and social care costs** are at least **£1.6 billion** from 2017 to 2025.

Legend:
- year 2017
- strong evidence: years 2017-2035
- weaker evidence: years 2017-2035

Condition	year 2017	years 2017-2035
CHD	16,136	348,878
Stroke	4,451	106,331
Asthma	5,564	133,356
Lung Cancer	1,669	44,290
COPD	11,684	246,916
Diabetes	14,467	273,767
Low birthweight	9,459	173,886

NHS
University Hospitals
Plymouth
NHS Trust

For A Greener Future

2023 – 2028

Clean Air Hospital Framework

Co-designed by Great Ormond Street Hospital and Global Action Plan

global
action
plan
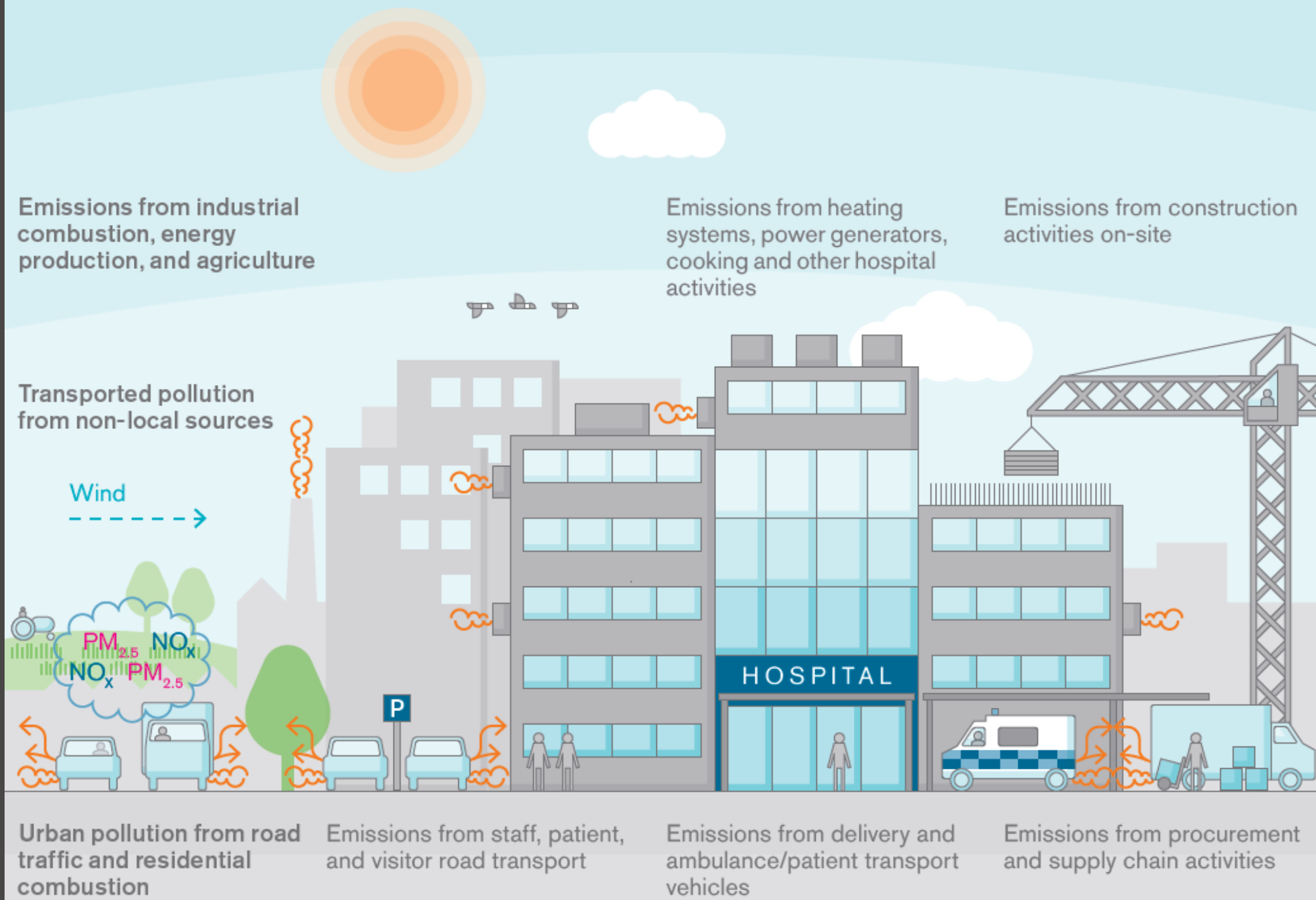OUR LIVES. OUR PLANET.

NHS
Great Ormond Street
Hospital for Children
NHS Foundation Trust

4. Adopt the Clean Air Hospital Framework to achieve an 'Excellent' score of 70% by 2028

Fig 1. Sources of ambient air pollution at healthcare sites

Emissions from industrial combustion, energy production, and agriculture

Emissions from heating systems, power generators, cooking and other hospital activities

Emissions from construction activities on-site

Transported pollution from non-local sources

Wind

PM$_{2.5}$ NO$_x$
NO$_x$ PM$_{2.5}$

HOSPITAL

Urban pollution from road traffic and residential combustion

Emissions from staff, patient, and visitor road transport

Emissions from delivery and ambulance/patient transport vehicles

Emissions from procurement and supply chain activities

Baldo et al. 2023

Study aim

- Assess the spatial variation in pollutant levels at the hospital
- Understand how weather patterns influence pollutant levels
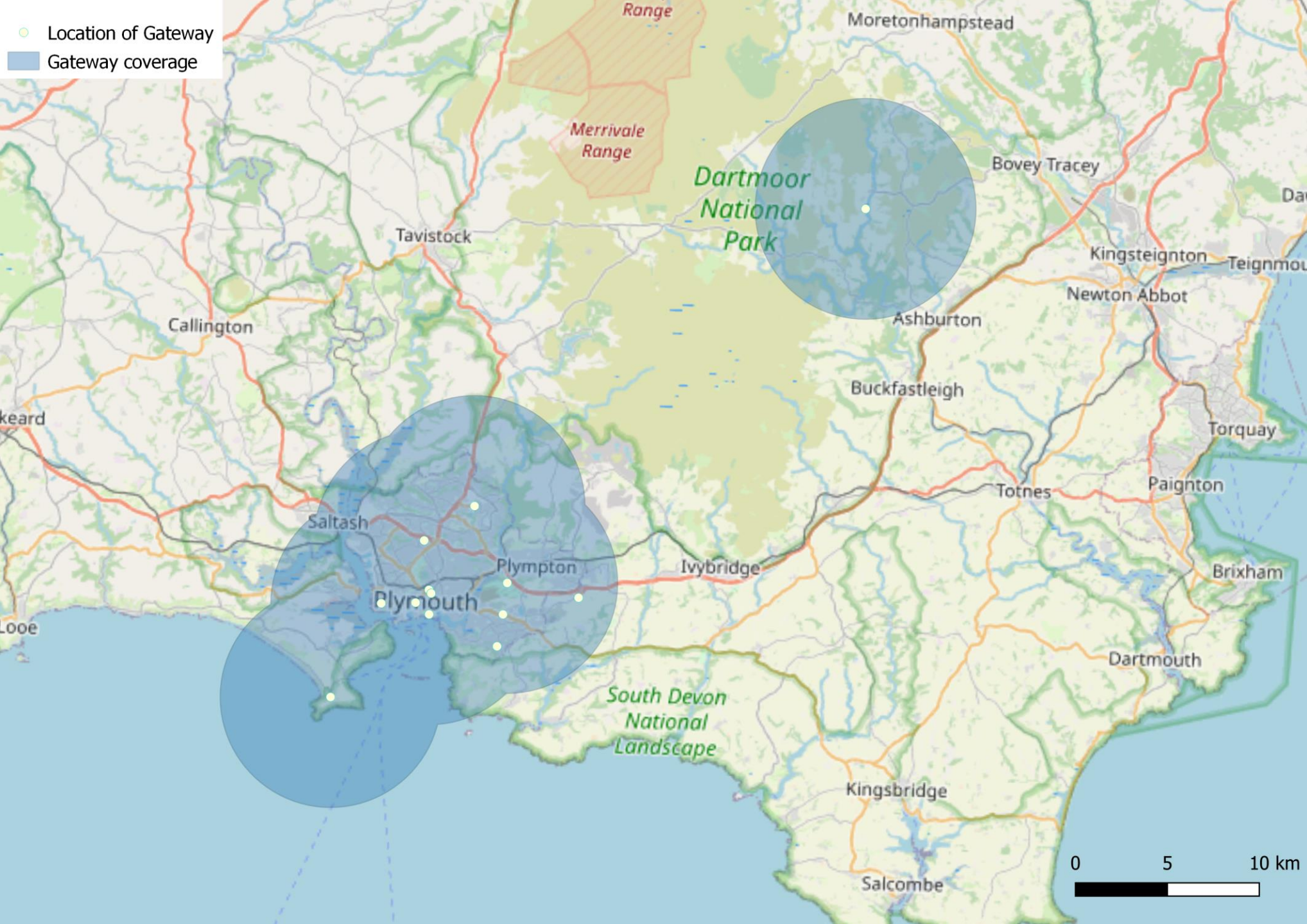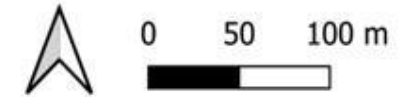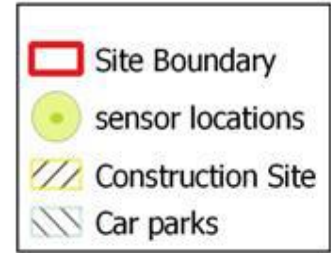
Sensors location website:
https://arcg.is/fvHW

Study area

Prevailing winds (SW)
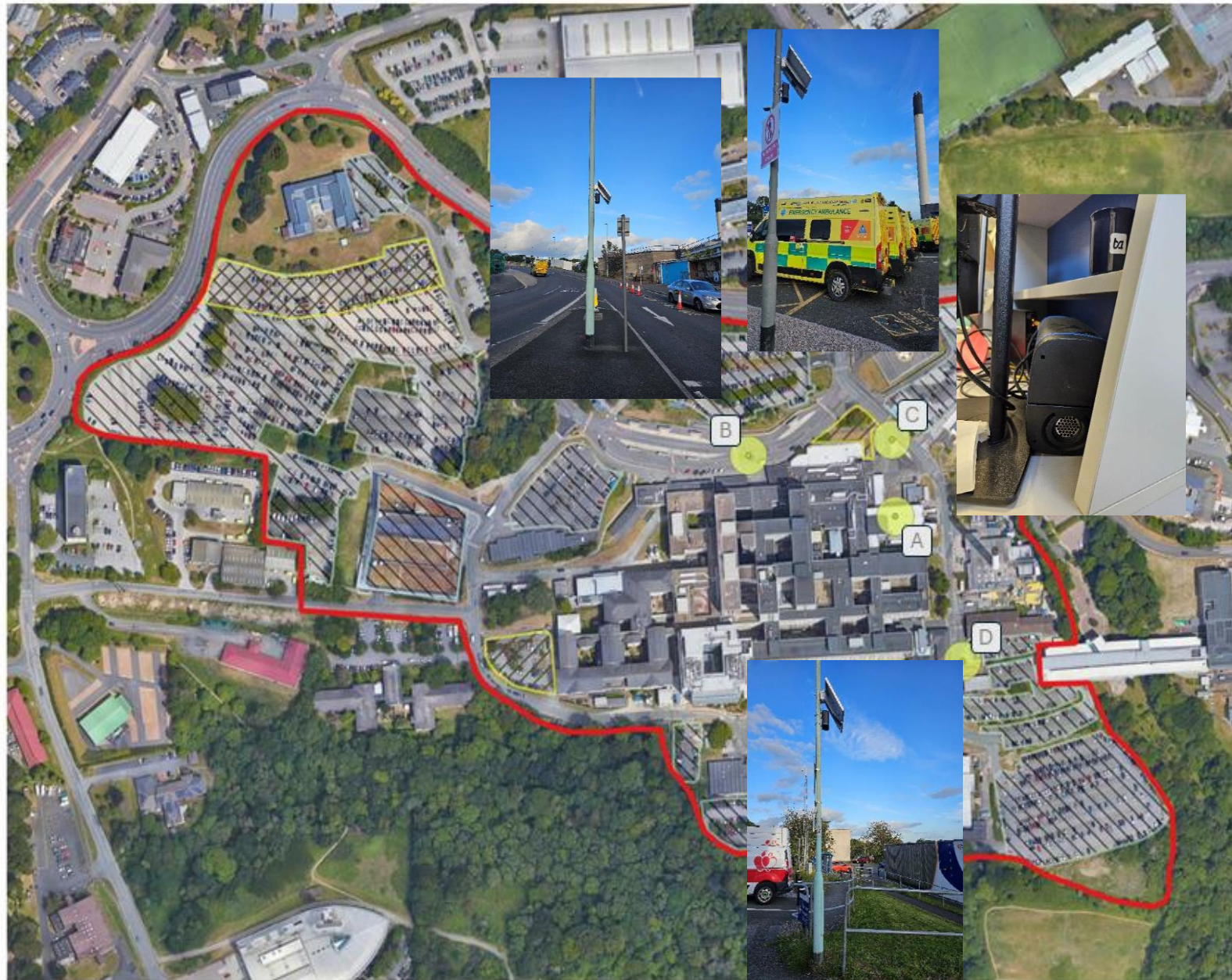
Site Boundary
Plymouth Airport
Sewage Works
Millbay Docks
Cattedown Industrial Estate
Devonport Industrial Area
A 38
A 386

0   1   2 km

Plymouth

Site plan

Study period: 1 June 2023 – 31 May 2024

Legend:
- Site Boundary
- sensor locations
- Construction Site
- Car parks

0 50 100 m
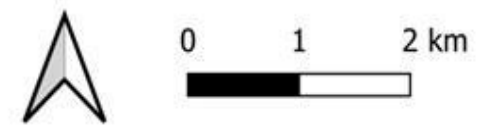
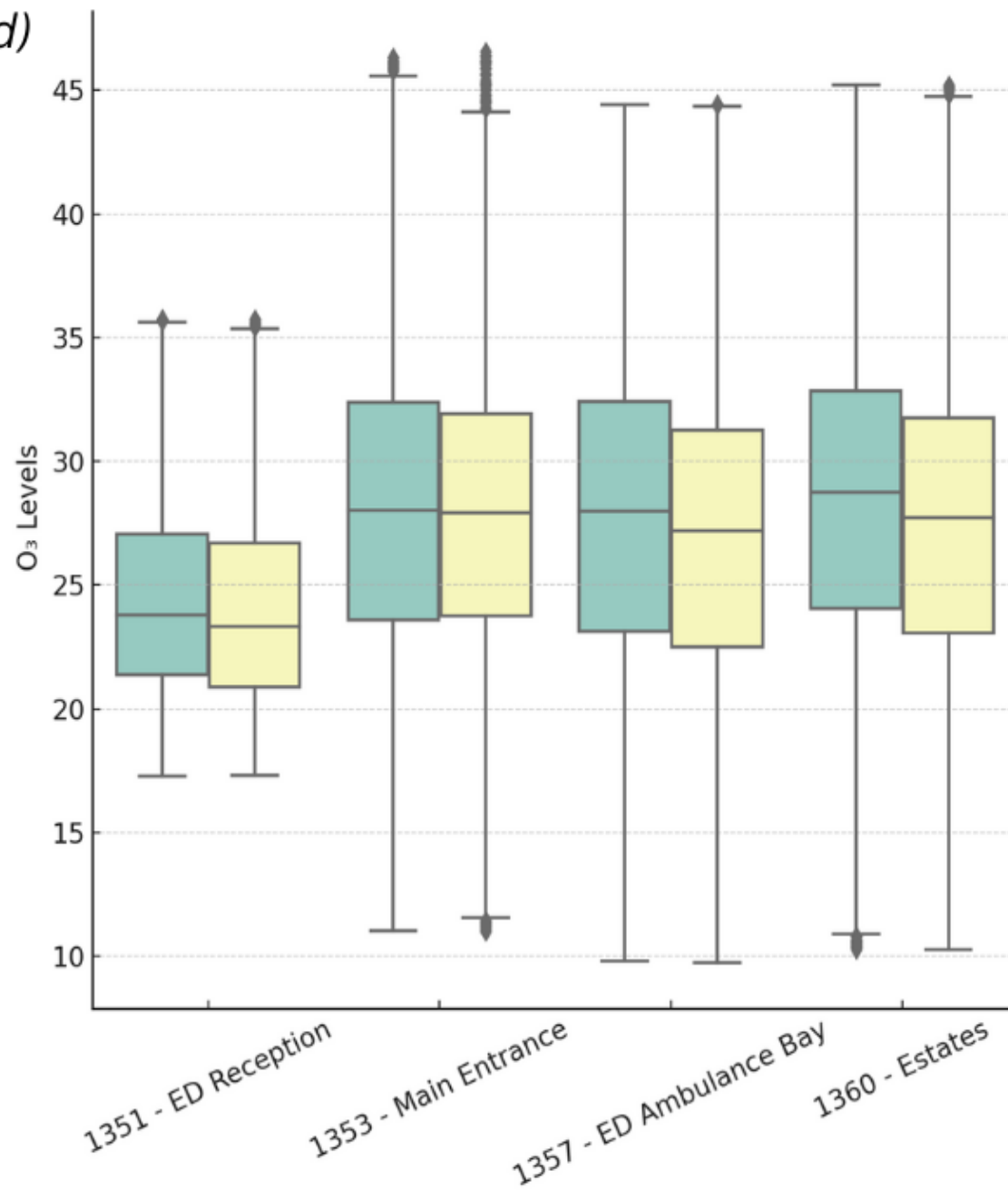| CODE	LOCATION
A	1351 – ED Reception
B	1353 – Main Entrance
C	1357 – ED Ambulance Bay
D	1360 - Estates

Earthsense air quality monitor

AQI results by location and diurnal period
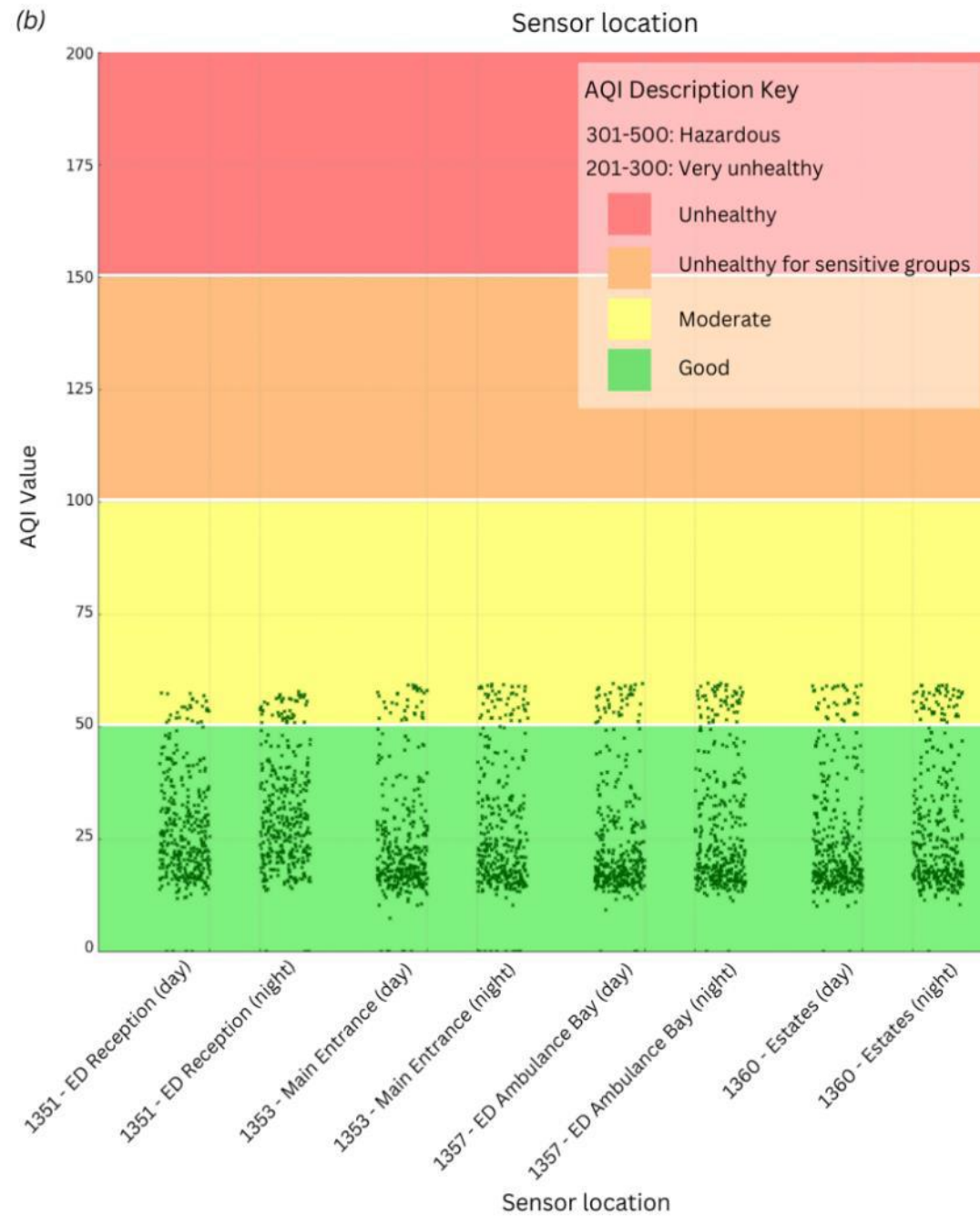
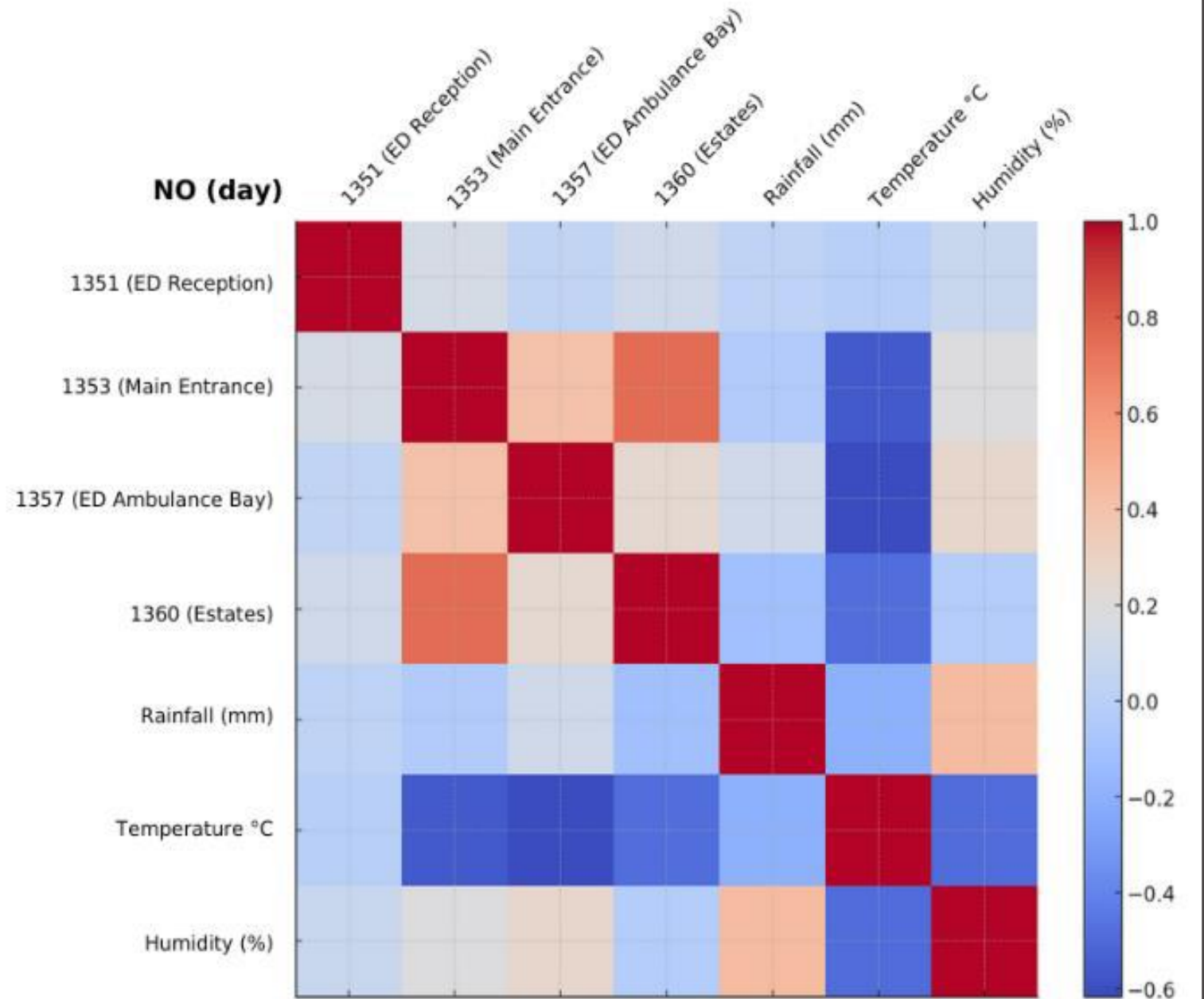# O₃ level (day vs night)

Correlation between NO and weather variables

Influence of rush hours on air quality at the hospital

(a) Mean NO Levels by Hour for Each Location

(f) Mean PM10 Levels by Hour for Each Location
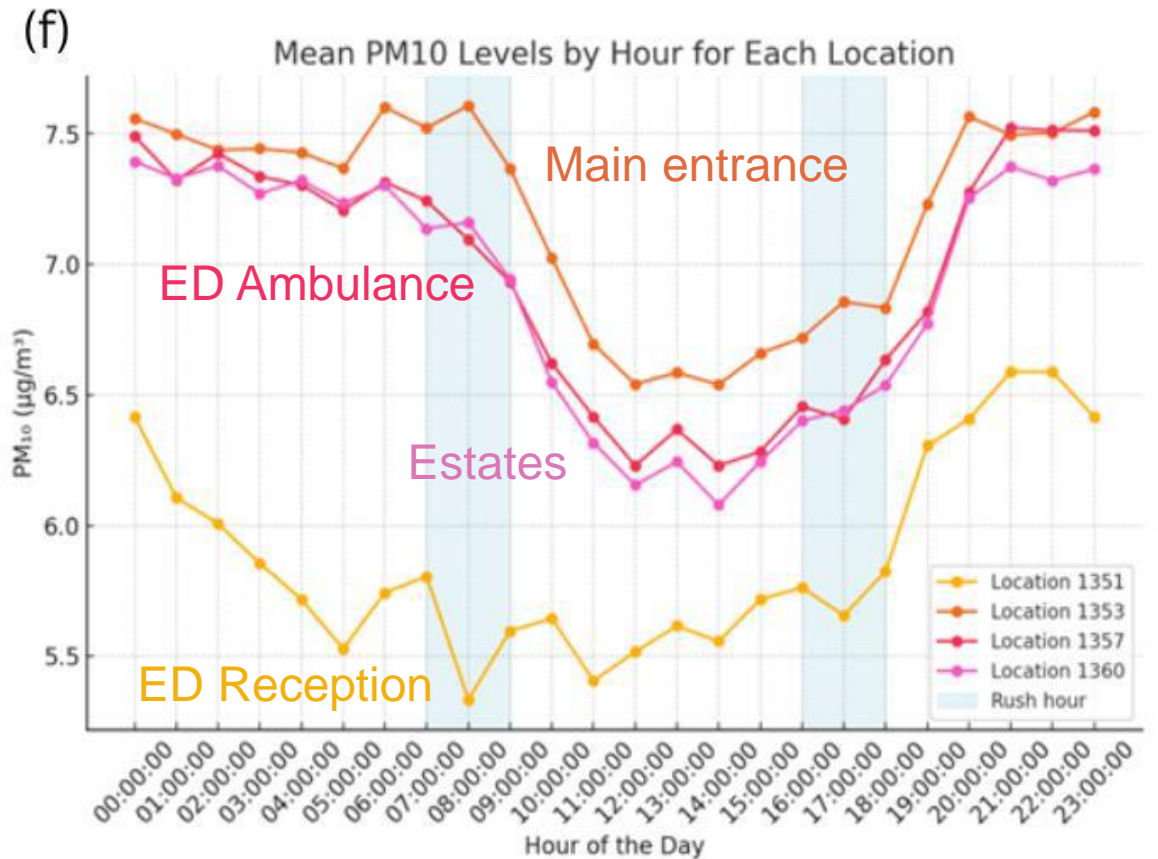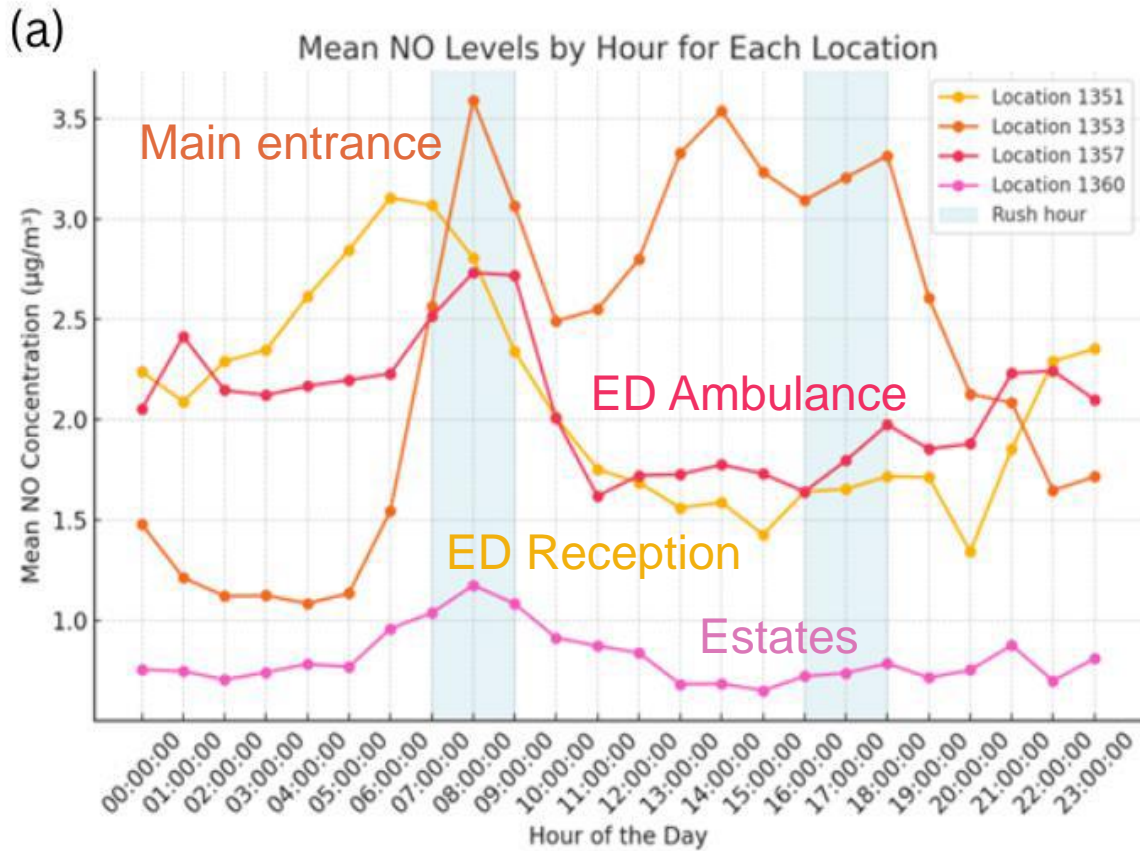
WHO Air Quality Guidelines (2021 AQGs)
PM10 – 45 µg/m³ (24-hour mean)

Practical implications

Ventilation and Filtration Systems

Traffic Management and Hospital Layout

Greener transportation options and sustainable building design

Health matters: air pollution - GOV.UK (www.gov.uk)