

New EU Air Quality Directives – How does Scotland compare?

Dr Jack Davison

Senior Data Analyst, Ricardo

A wide-angle photograph of the Earth as seen from space, showing the curvature of the planet, the blue atmosphere, and white clouds over a dark brown and green landmass.

New EU Air Quality Directives - *how does Scotland compare?*

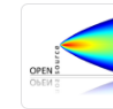
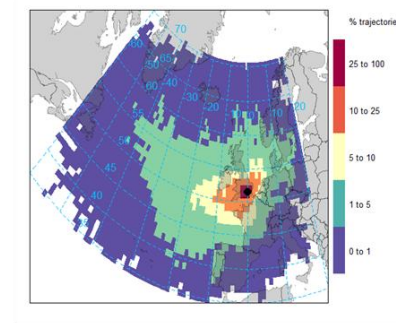
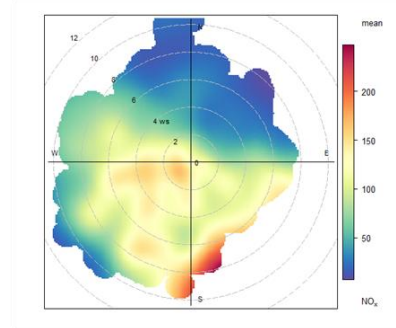
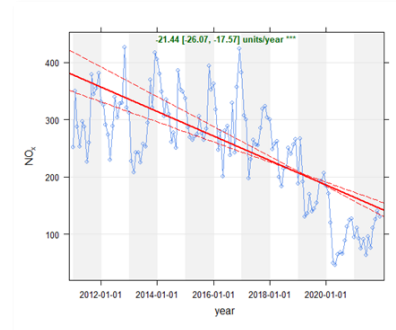
Dr Jack Davison | Wednesday 26th March 2025

Introductions



Dr Jack Davison, Senior Data Analyst

- **Data specialist**, with a focus on atmospheric composition (air quality, meteorology)
- **R programming expert & trainer**
- **Open-source developer**, including on the **openair project**



The Openair Project

Open Source Tools for Air Quality Data Analysis

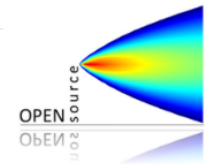
10 followers United Kingdom <https://openair-project.github.io/book/>

README.md

The Openair Project: Open Source Tools for Air Quality Data Analysis

The openair toolkit is a family of R packages developed for the purpose of analysing air quality data — or more generally atmospheric composition data. The packages are extensively used in academia and the public and private sectors. The project was initially funded by the [UK Natural Environment Research Council \(NERC\)](#), with additional funds from the [UK Department for Environment Food & Rural Affairs \(Defra\)](#).

Learn more in the [openair book](#).



Pinned

Customize pins

openair Public

Open source tools for air quality data analysis
R 309 116

openairmaps Public

Open source tools to create maps of air pollution data
R 21 7

worldmet Public

Open source tools to access NOAA Integrated Surface Database (ISD) surface meteorological observations
R 54 18

deweather Public

Open source tools to remove the influence of meteorology from atmospheric composition data
R 38 12

book Public

An online guide for the openair family of R packages
TeX 22 20

CONTENTS

New EU Legislation

How does the SAQD compare?

A deeper dive into NO₂

Wrap Up

Context

The EU has set new air quality standards to protect human health and the environment

- Define common methods to monitor, assess and inform on ambient air quality in the EU;
- **Establish objectives for ambient air quality to avoid, prevent or reduce harmful effects on human health and the environment;**
- Guide the assessment of air quality supported by a representative high-quality monitoring network, with more than 4,000 air quality monitoring stations across the EU and an enhanced use of air quality modelling;
- Exchange reliable, objective and comparable information on air quality, including to the wider public.

Read more at:

<https://environment.ec.europa.eu/topics/air/air-quality>

Read the directive:

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L_202402881

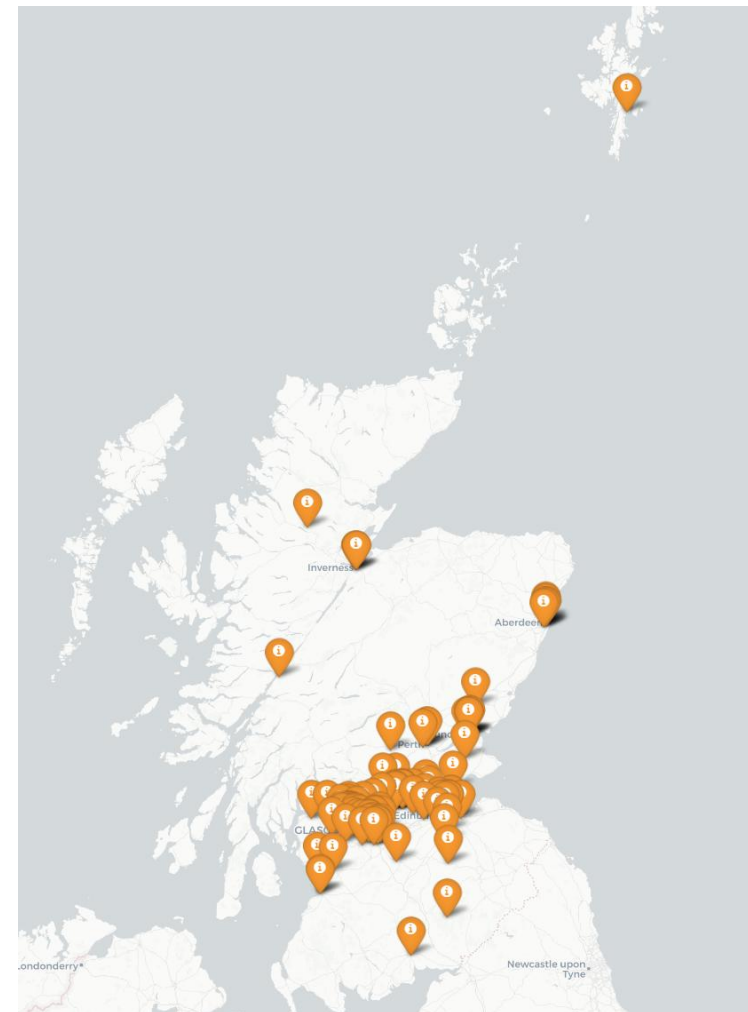
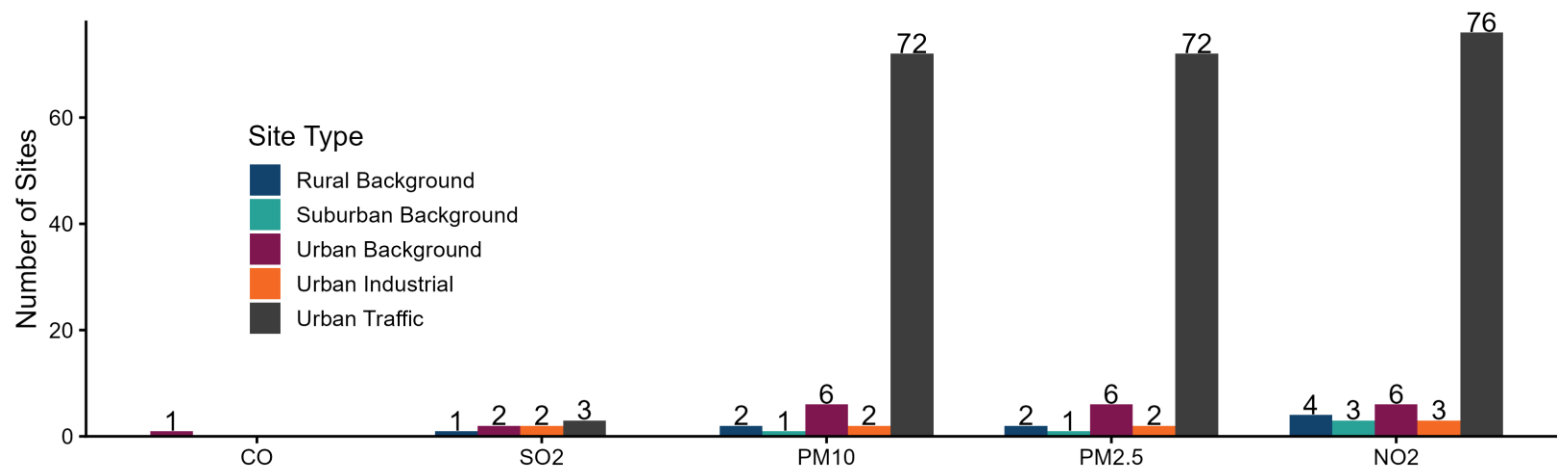
Pollutant	Measure	Scotland		EU		WHO		Unit
		Limit	Permitted	Limit	Permitted	Limit	Permitted	
Benzene	Annual	3.25	—	3.4	—	—	—	$\mu\text{g m}^{-3}$
CO	8-hour running	10	—	—	—	—	—	mg m^{-3}
CO	24-hour	—	—	4	18	4	4	mg m^{-3}
NO ₂	1-hour	200	18	200	3	—	—	$\mu\text{g m}^{-3}$
NO ₂	24-hour	—	—	50	18	25	4	$\mu\text{g m}^{-3}$
NO ₂	Annual	40	—	20	—	10	—	$\mu\text{g m}^{-3}$
O ₃	8-hour running	100	10	—	—	100	4	$\mu\text{g m}^{-3}$
PM ₁₀	24-hour	50	7	45	18	45	4	$\mu\text{g m}^{-3}$
PM ₁₀	Annual	18	—	20	—	15	—	$\mu\text{g m}^{-3}$
PM _{2.5}	24-hour	—	—	25	18	15	4	$\mu\text{g m}^{-3}$
PM _{2.5}	Annual	10	—	10	—	5	—	$\mu\text{g m}^{-3}$
SO ₂	15-minute	266	35	—	—	—	—	$\mu\text{g m}^{-3}$
SO ₂	1-hour	350	24	350	24	—	—	$\mu\text{g m}^{-3}$
SO ₂	24-hour	125	3	50	18	40	4	$\mu\text{g m}^{-3}$
SO ₂	Annual	—	—	20	—	—	—	$\mu\text{g m}^{-3}$

● New EU Limit
 ● EU equal to Scotland
 ● EU lower than Scotland
 ● Scotland lower than EU

Methodology

{openair} has been used to access data from 99 monitoring sites.

- 2024 data is considered as it's the most recent complete year - *although not completely ratified yet!*
- Data is to be compared with the Scottish and EU limits, as well as the WHO 2021 guidelines.
- Further analysis was undertaken to assess certain monitoring sites across the network.



Comparison with limits

The EU has set new air quality standards to protect human health and the environment

Define common methods to monitor, assess and inform on ambient air quality in the EU

Establish objectives for ambient air quality to avoid, prevent or reduce harmful effects on human health and the environment

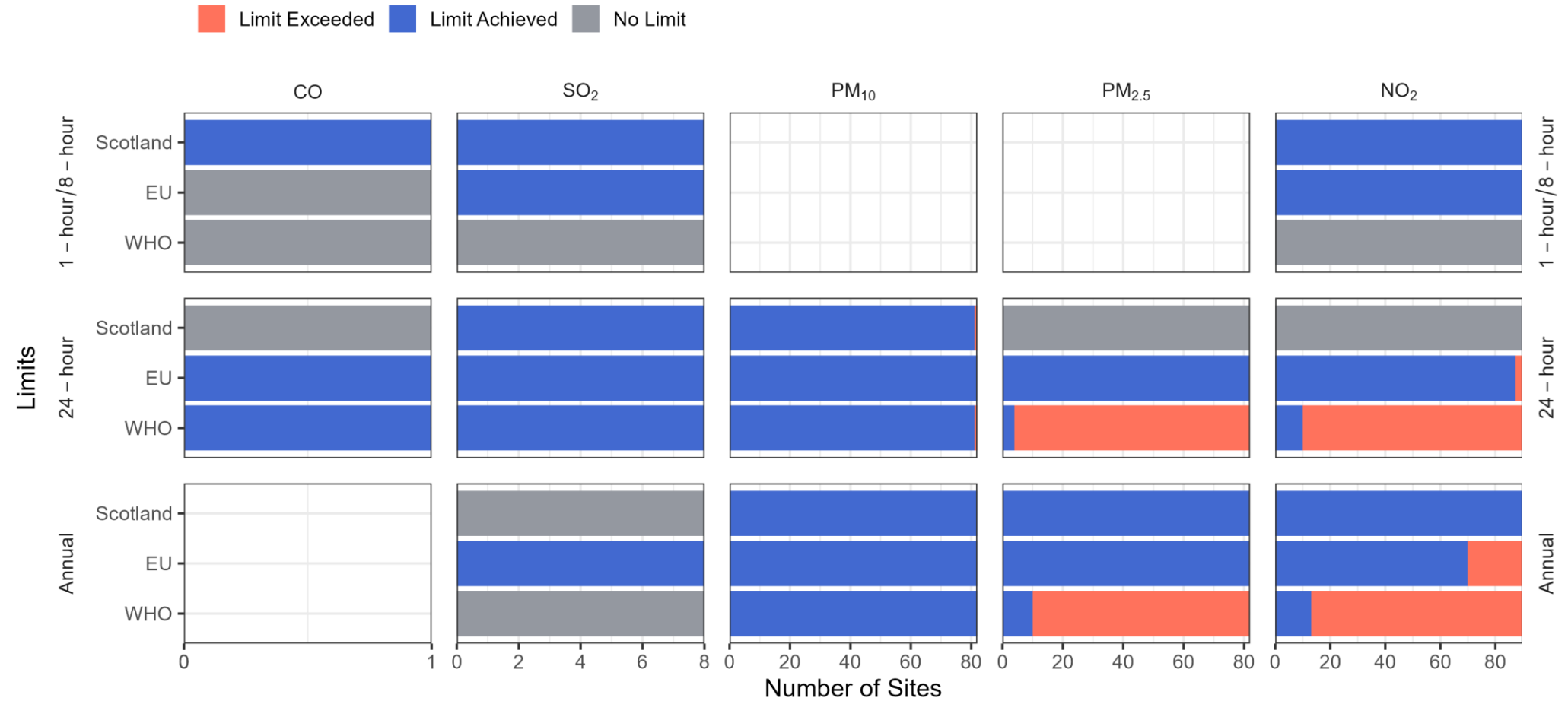
Guide the assessment of air quality required by a representative high quality monitoring network, with more than 8000 air quality monitoring stations across the EU and an enhanced use of air quality modelling

Exchange results, evidence and comparable information on air quality, including to the wider public

Read more at: <https://ec.europa.eu/transport/air-quality/air-quality-standards>

View the brochure: <https://ec.europa.eu/transport/air-quality/air-quality-standards-brochure>

Country	Year	CO	SO ₂	PM ₁₀	PM _{2.5}	NO ₂	Other
EU	2010	Exceeded	Exceeded	Exceeded	Exceeded	Exceeded	Exceeded
EU	2015	Exceeded	Exceeded	Exceeded	Exceeded	Exceeded	Exceeded
EU	2020	Exceeded	Exceeded	Exceeded	Exceeded	Exceeded	Exceeded
EU	2025	Achieved	Achieved	Achieved	Achieved	Achieved	Achieved
EU	2030	Achieved	Achieved	Achieved	Achieved	Achieved	Achieved
EU	2035	Achieved	Achieved	Achieved	Achieved	Achieved	Achieved
EU	2040	Achieved	Achieved	Achieved	Achieved	Achieved	Achieved
EU	2045	Achieved	Achieved	Achieved	Achieved	Achieved	Achieved
EU	2050	Achieved	Achieved	Achieved	Achieved	Achieved	Achieved



* 8-Hour running for CO, otherwise 1-hour

Comparison with limits

The EU has set new air quality standards to protect human health and the environment

Define common methods to monitor, assess and report on ambient air quality in the EU

Establish objectives for ambient air quality to avoid, prevent or reduce harmful effects on human health and the environment

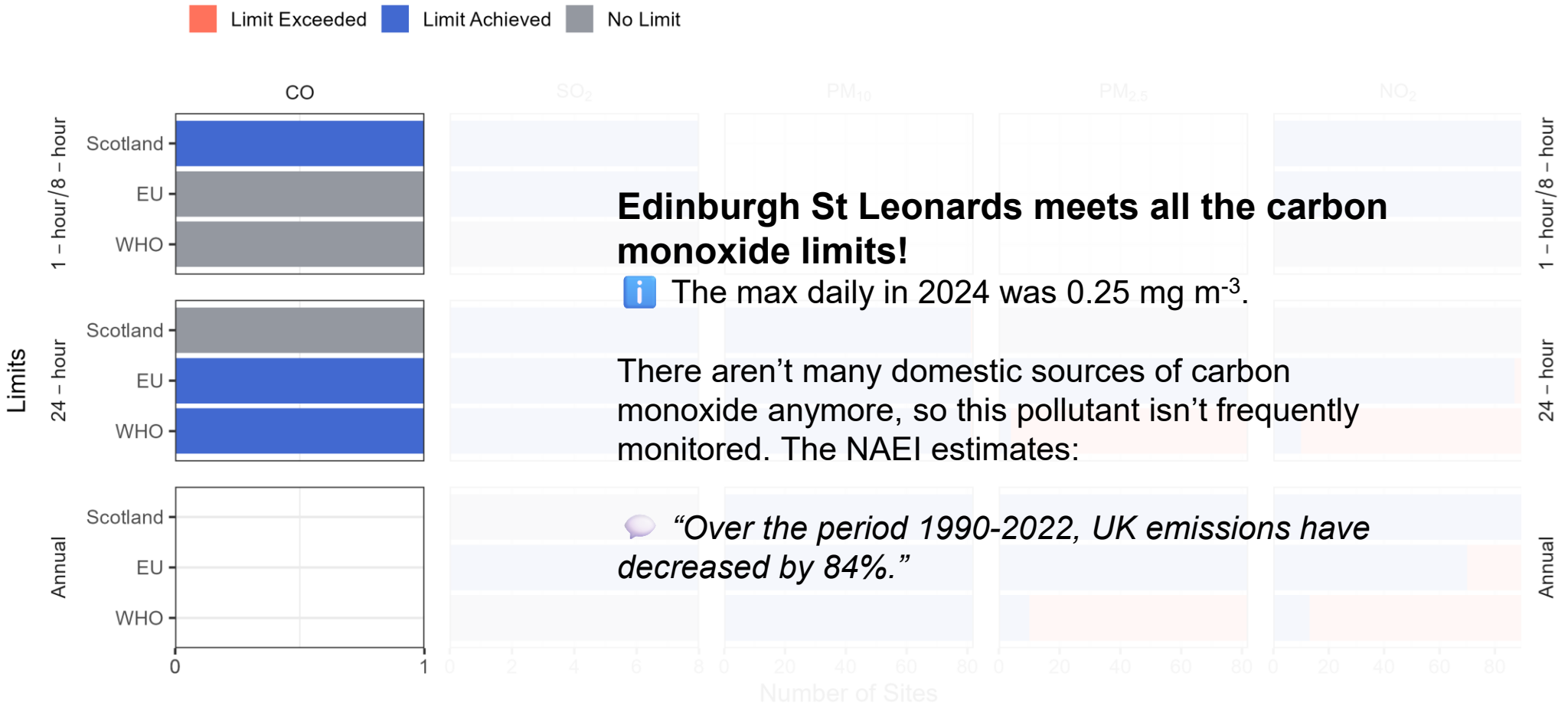
Guide the assessment of air quality required by a the introduction of high quality monitoring networks, with more than 8000 air quality monitoring stations across the EU and an enhanced use of air quality modelling

Exchange results, capacities and comparable information on air quality, including to the wider public

Read more at: <https://ec.europa.eu/transport/air-quality/air-quality-standards>

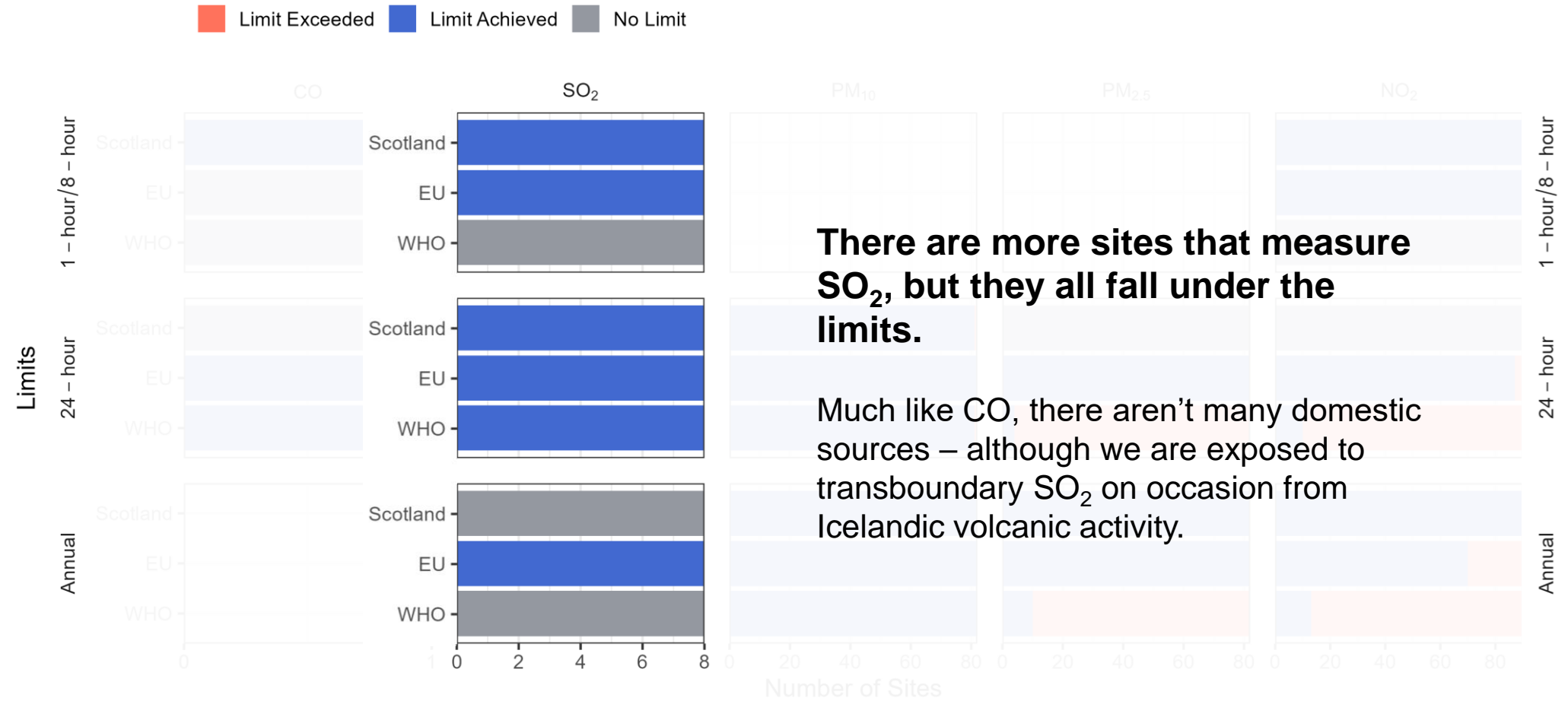
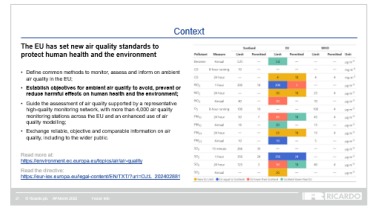
View the brochure: <https://ec.europa.eu/transport/air-quality/air-quality-standards-brochure>

Country	PM10	PM2.5	NO2	O3	CO	SO2
EU	45	25	40	120	10	40
UK	40	20	40	120	10	40
WHO	35	15	40	120	10	40



* 8-Hour running for CO, otherwise 1-hour

Comparison with limits



There are more sites that measure SO₂, but they all fall under the limits.

Much like CO, there aren't many domestic sources – although we are exposed to transboundary SO₂ on occasion from Icelandic volcanic activity.

* 8-Hour running for CO, otherwise 1-hour



Comparison with limits

The EU has set new air quality standards to protect human health and the environment

Define common methods to monitor, assess and report on ambient air quality in the EU.

Establish objectives for ambient air quality to avoid, prevent or reduce harmful effects on human health and the environment.

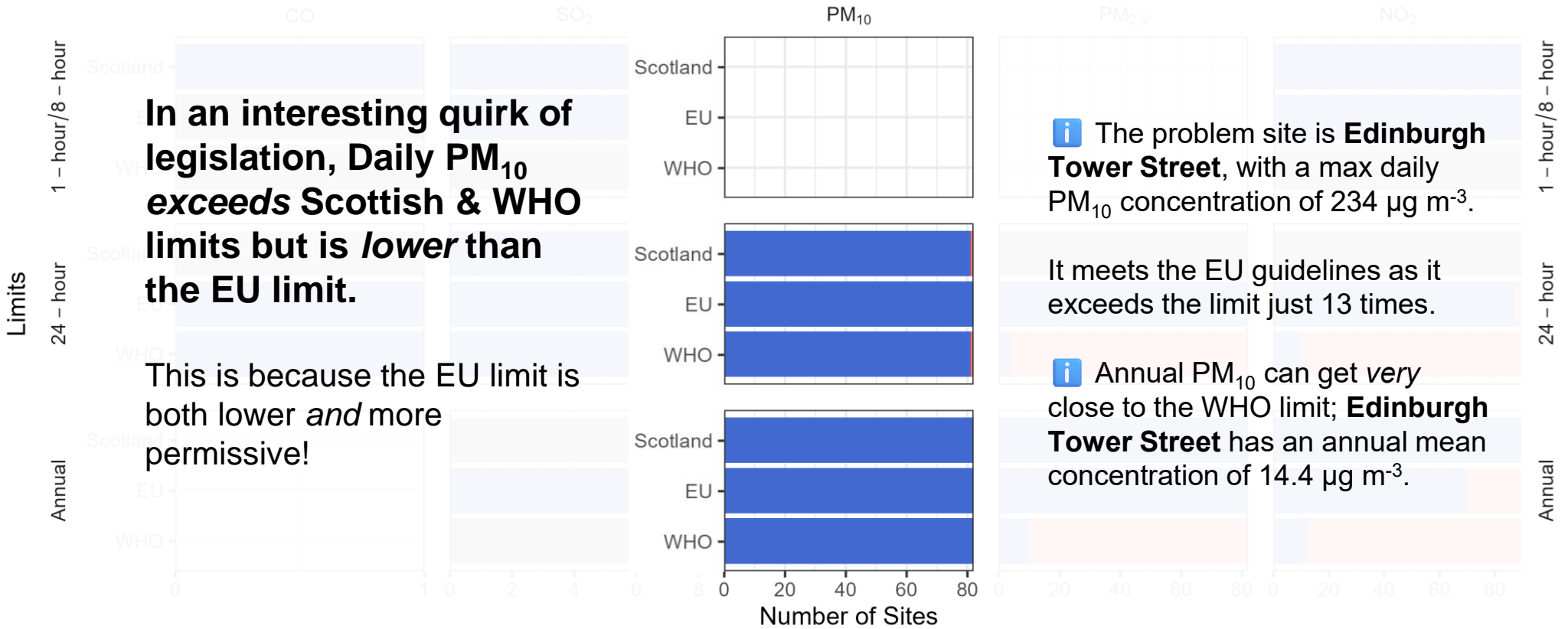
Guide the assessment of air quality against by a the maximum 100 quality monitoring stations, with more than 6000 air quality monitoring stations across the EU and an extensive use of air quality modelling.

Exchange results, capacities and comparable information on air quality, including to the wider public.

Read more at: <https://ec.europa.eu/europe-press/en/press-releases/2020/06/20200616>

Read the full report: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32020R0662&from=doc>

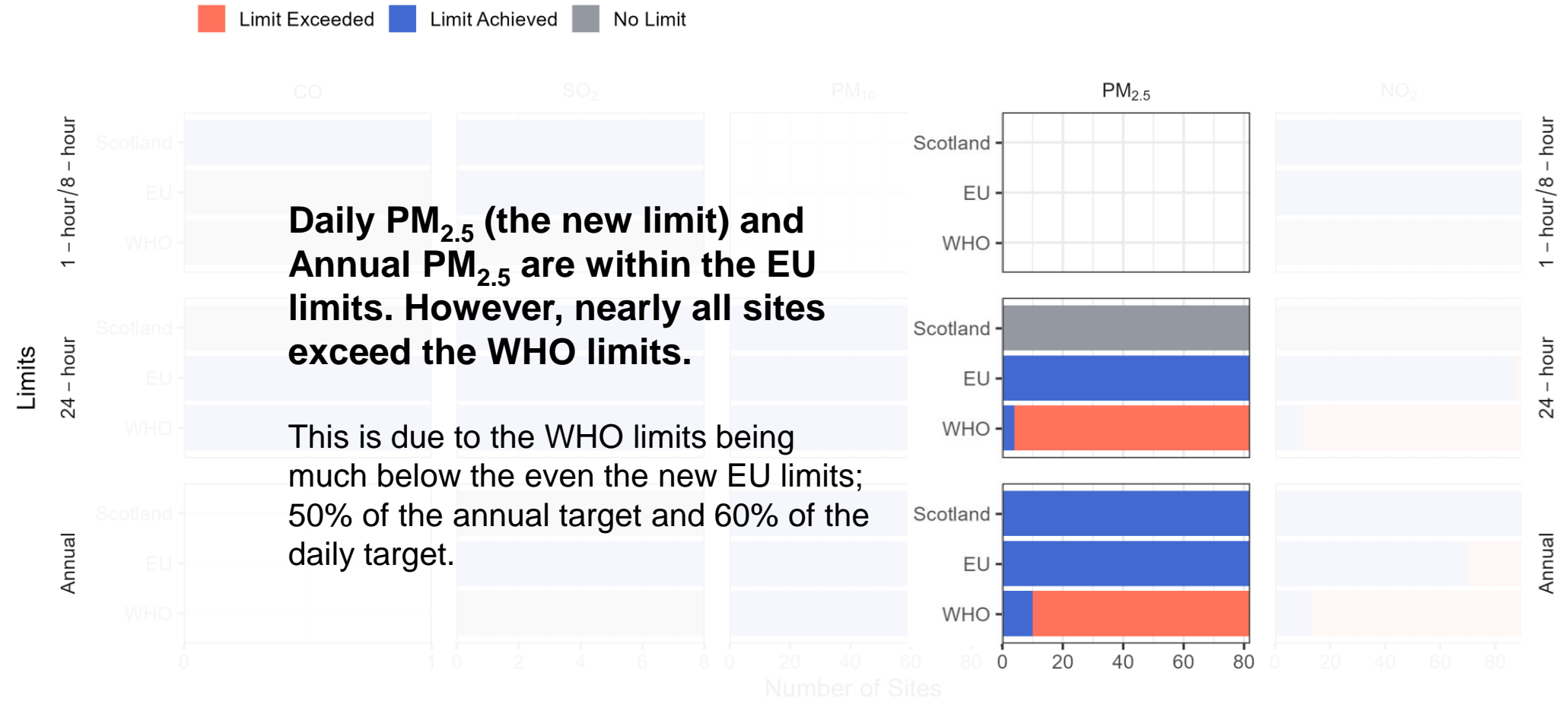
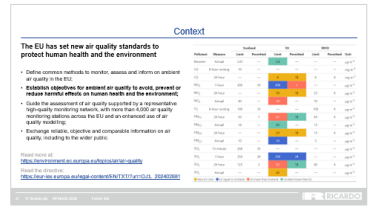
■ Limit Exceeded
 ■ Limit Achieved
 ■ No Limit



* 8-Hour running for CO, otherwise 1-hour



Comparison with limits



Daily PM_{2.5} (the new limit) and Annual PM_{2.5} are within the EU limits. However, nearly all sites exceed the WHO limits.

This is due to the WHO limits being much below the even the new EU limits; 50% of the annual target and 60% of the daily target.

* 8-Hour running for CO, otherwise 1-hour

Comparison with limits

The EU has set new air quality standards to protect human health and the environment

Define common methods to monitor, assess and report on ambient air quality in the EU

Establish objectives for ambient air quality to avoid, prevent or reduce harmful effects on human health and the environment

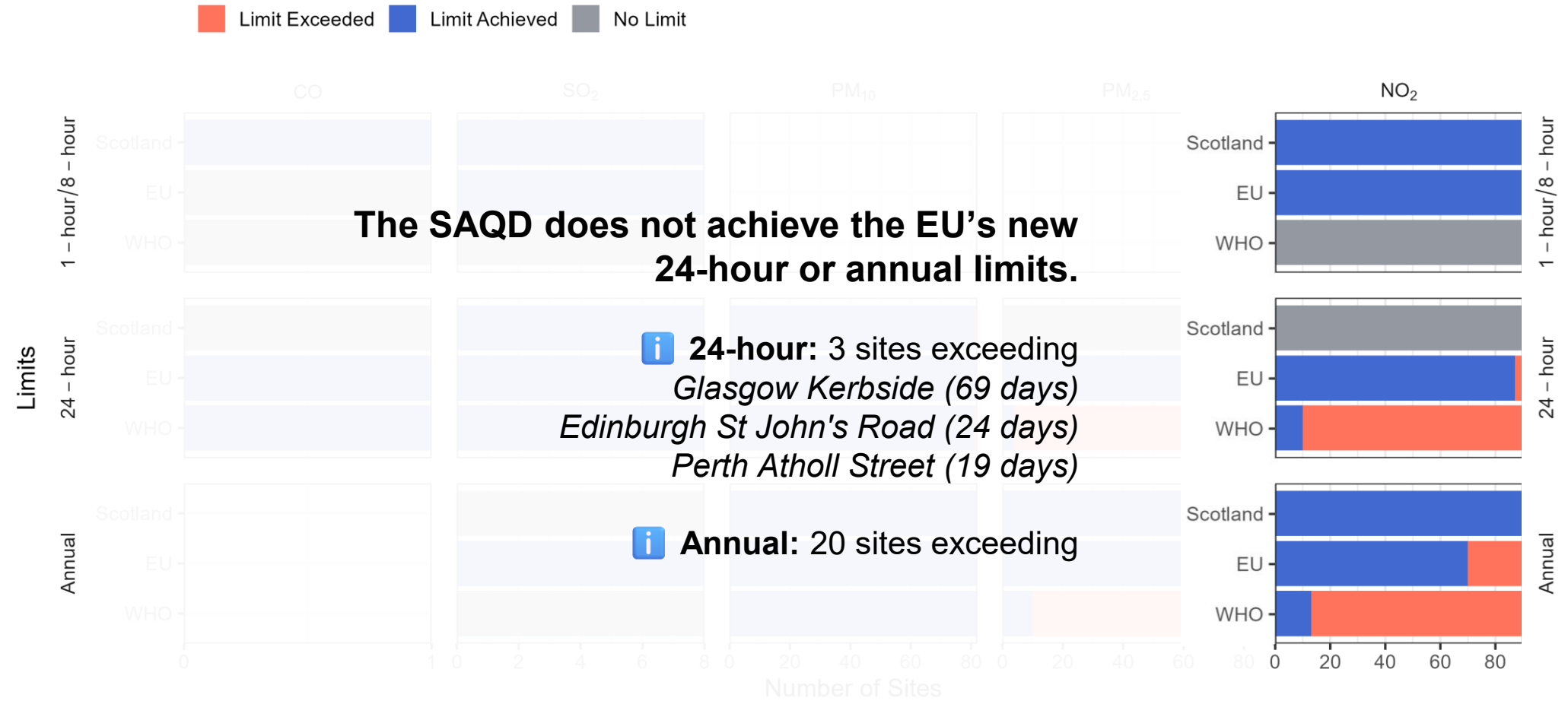
Guide the assessment of air quality against by a the respective high quality monitoring network, with more than 6000 air quality monitoring stations across the EU and environment use of air quality modelling

Exchange results, updates and comparable information on air quality, including to the wider public

More info at: <https://ec.europa.eu/transport/air-quality/air-quality-directive>

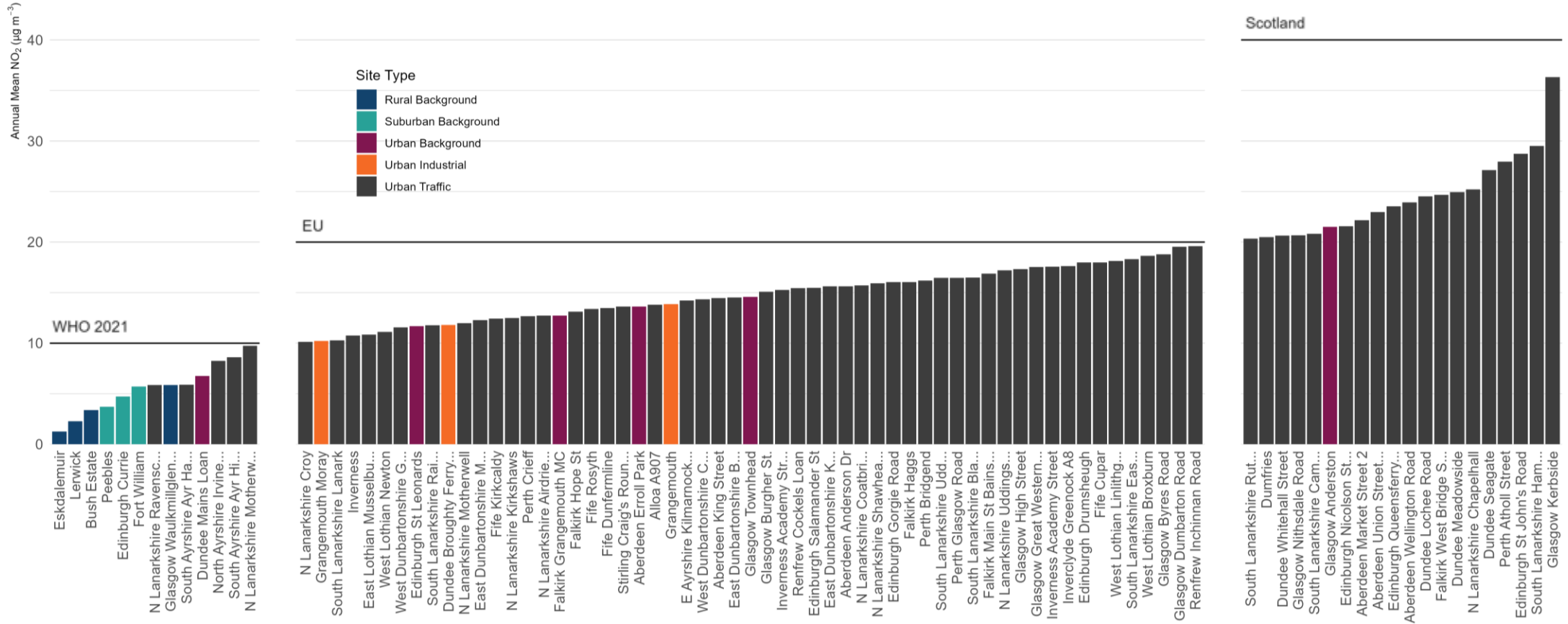
Read the brochure: <https://ec.europa.eu/transport/air-quality/air-quality-directive>

EU Air Quality Standards: <https://ec.europa.eu/transport/air-quality/air-quality-directive>

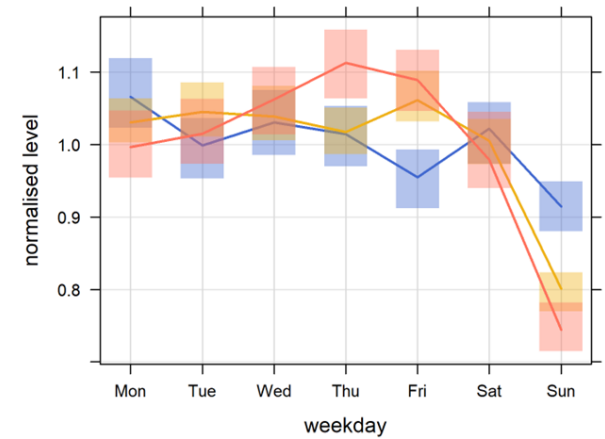
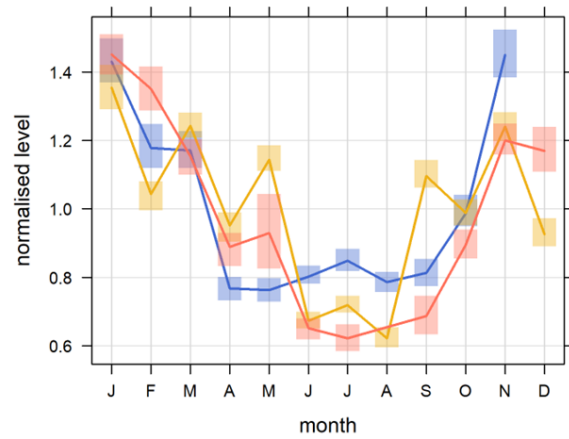
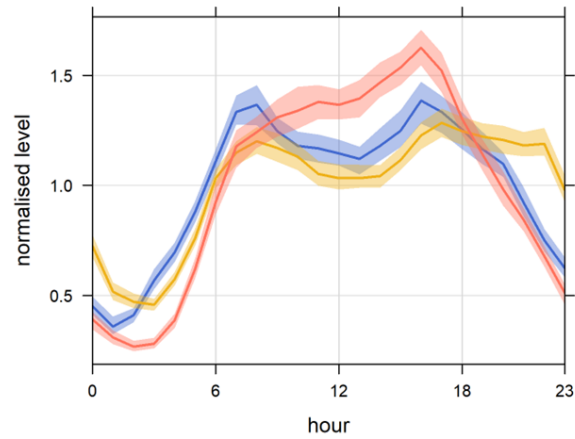
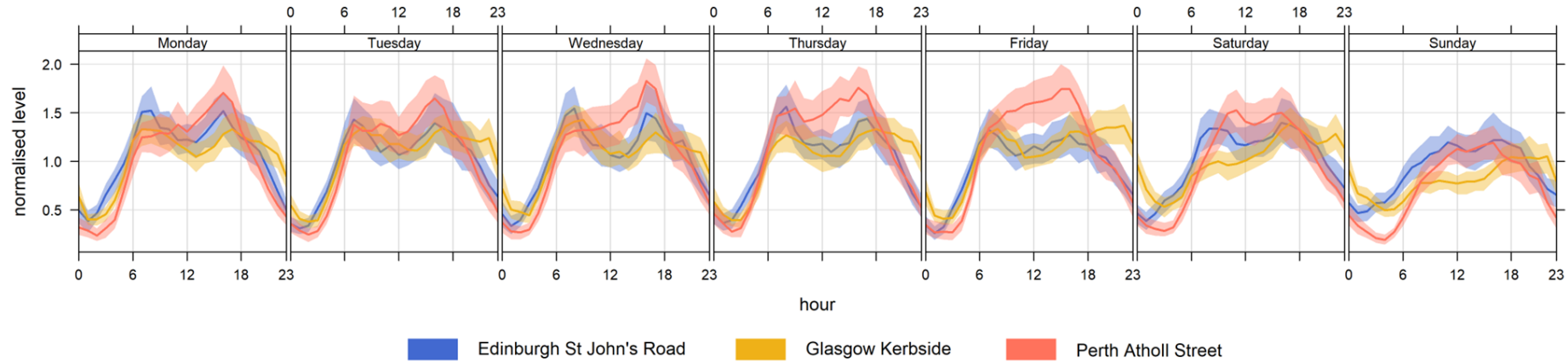


* 8-Hour running for CO, otherwise 1-hour

Annual mean NO₂ in 2024



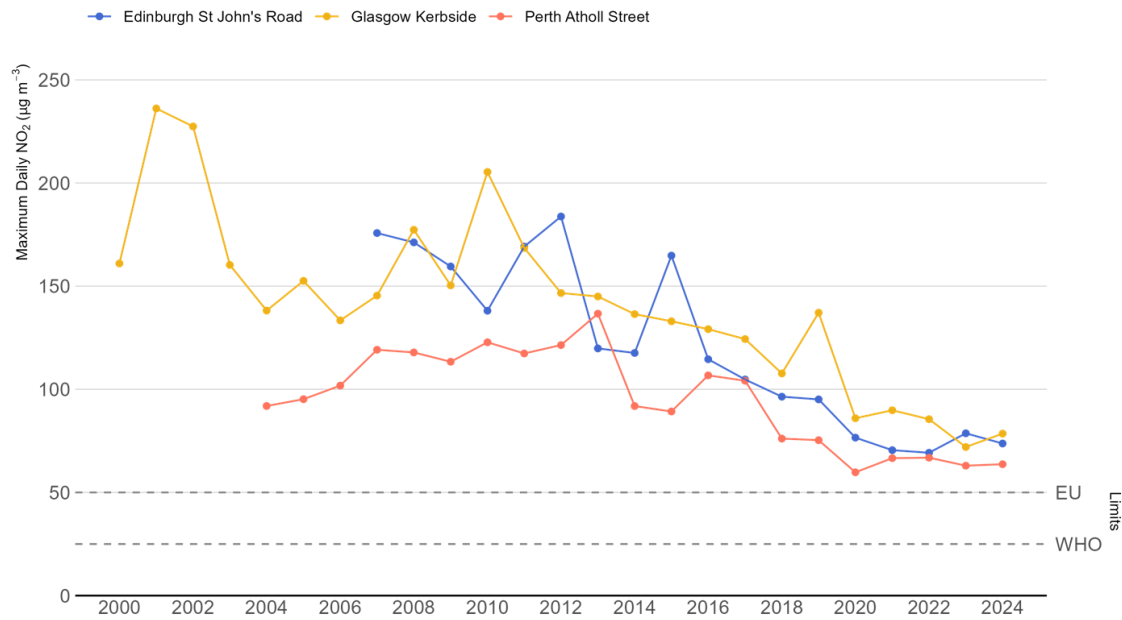
Temporal Profile of Top 3 Sites



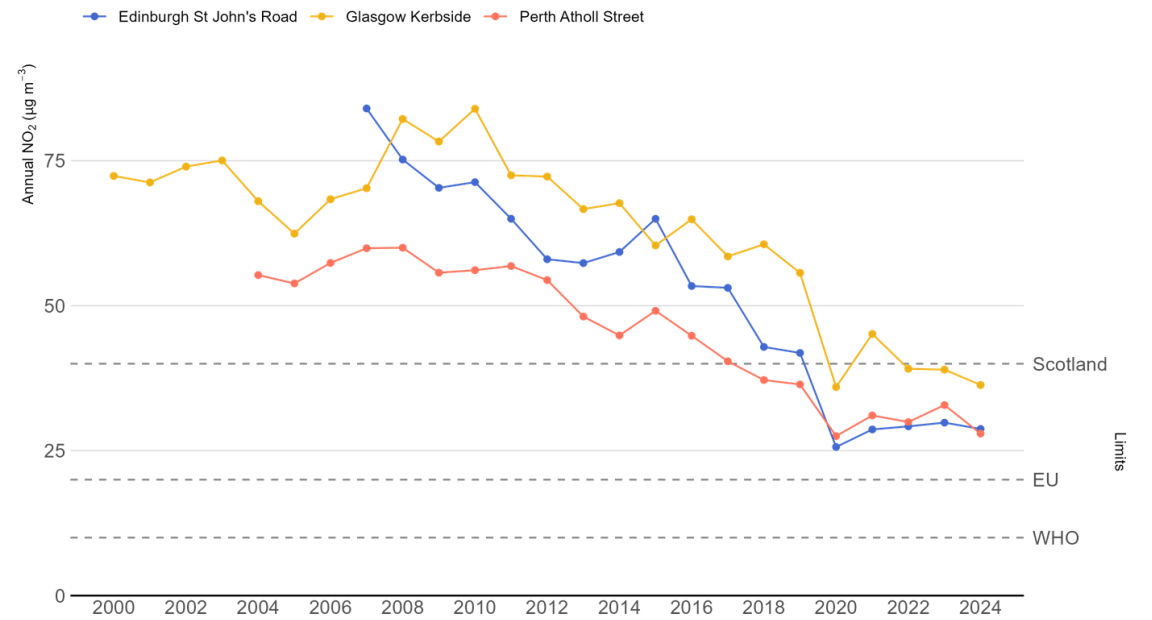
mean and 95% confidence interval in mean

Annual NO₂ Trends

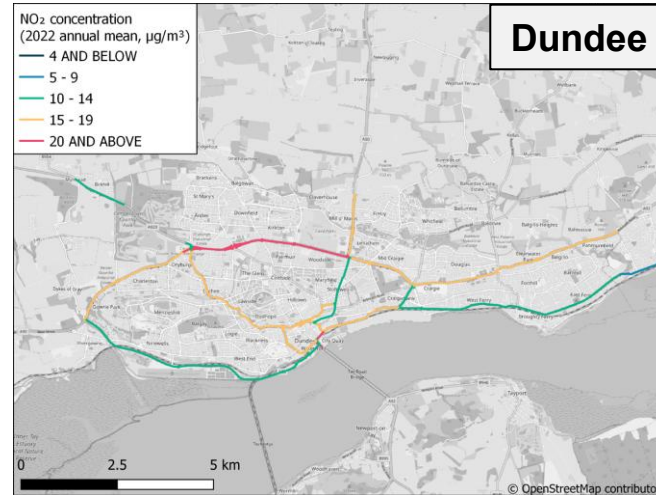
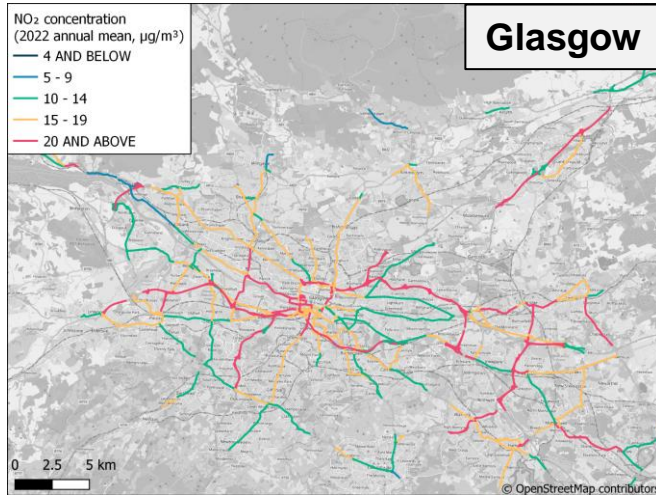
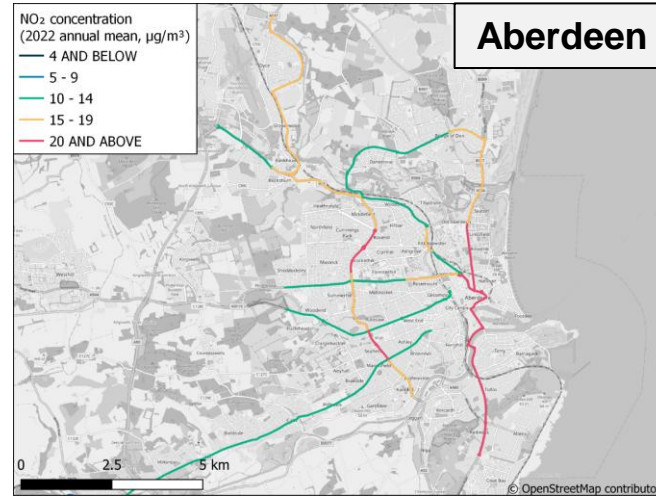
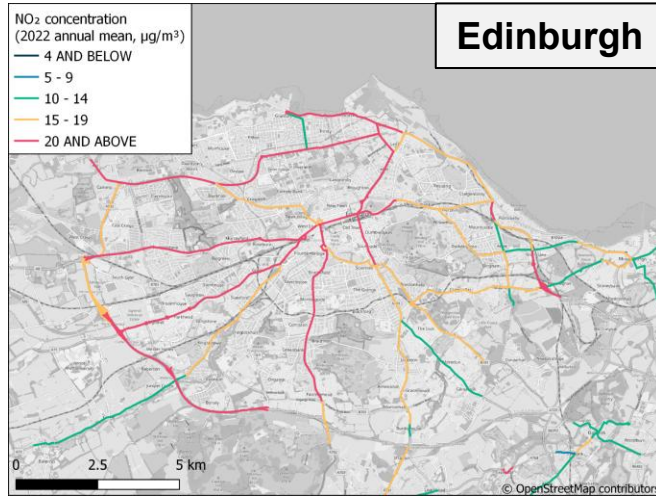
Maximum Daily NO₂



Annual Mean NO₂



Evidence from Modelling (2022)



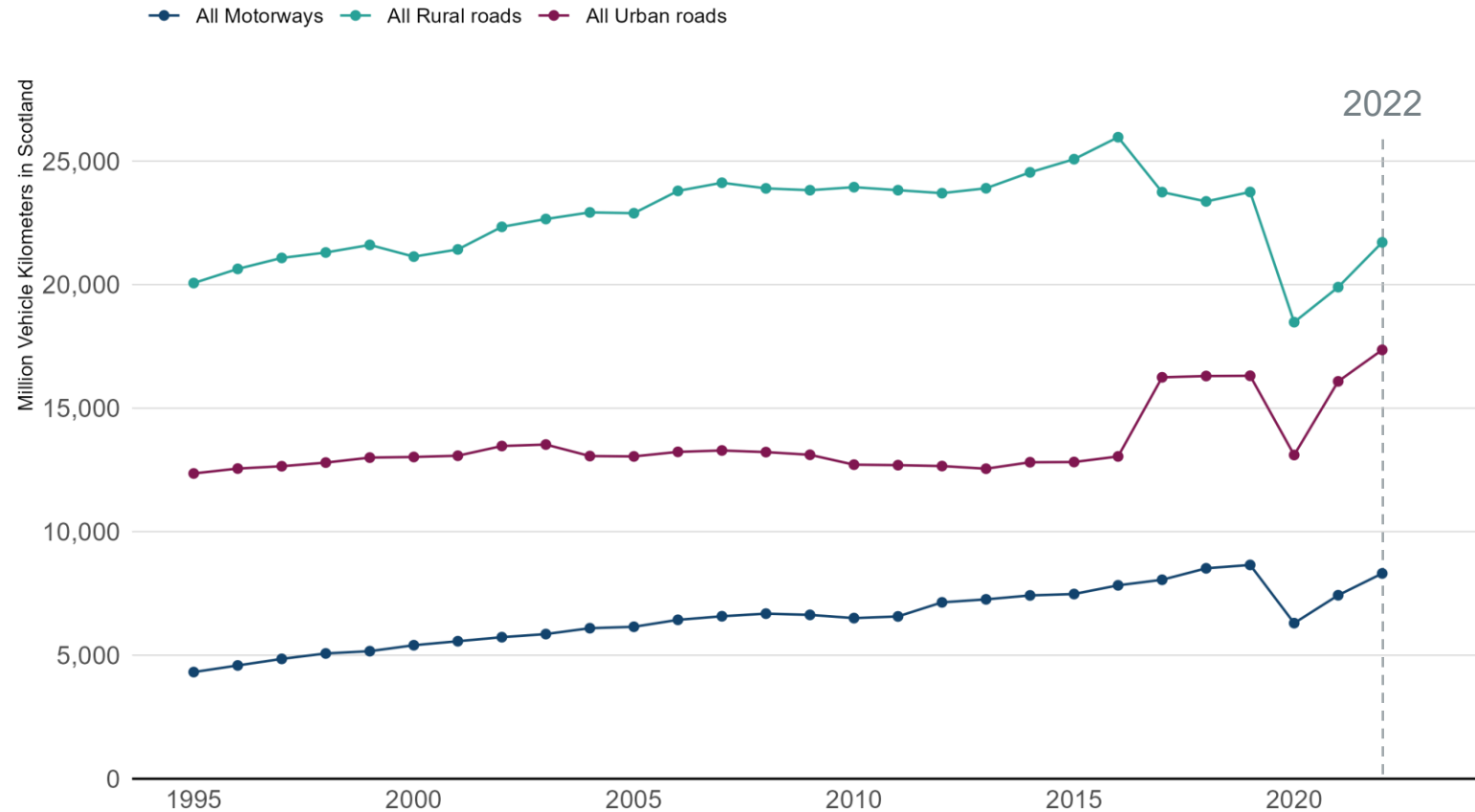
i There were **949** major urban roads modelled in this dataset and of those, **153** roads have a value **greater than or equal to 20 µg m⁻³** (~16% of roads).

i No modelled PM values were greater than the new EU annual limits.

🌟 Thank you to **Dr Jasmine Wareham** & the Ricardo Air Quality Modelling Team

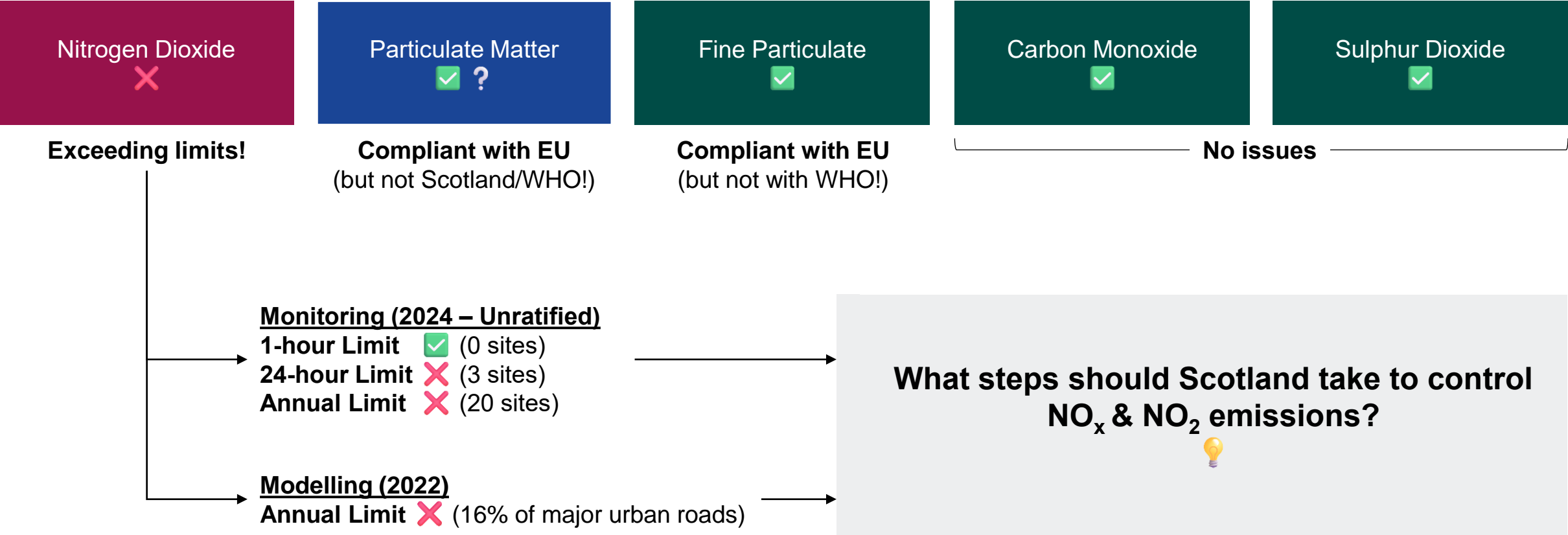
See: <https://www.scottishairquality.scot/data/mapping>

Activity: Annual Traffic Trends



<https://www.transport.gov.scot/our-approach/statistics/#42763>

Scotland & New EU Air Quality Standards: in Summary



Comparison with limits (2023)

Context

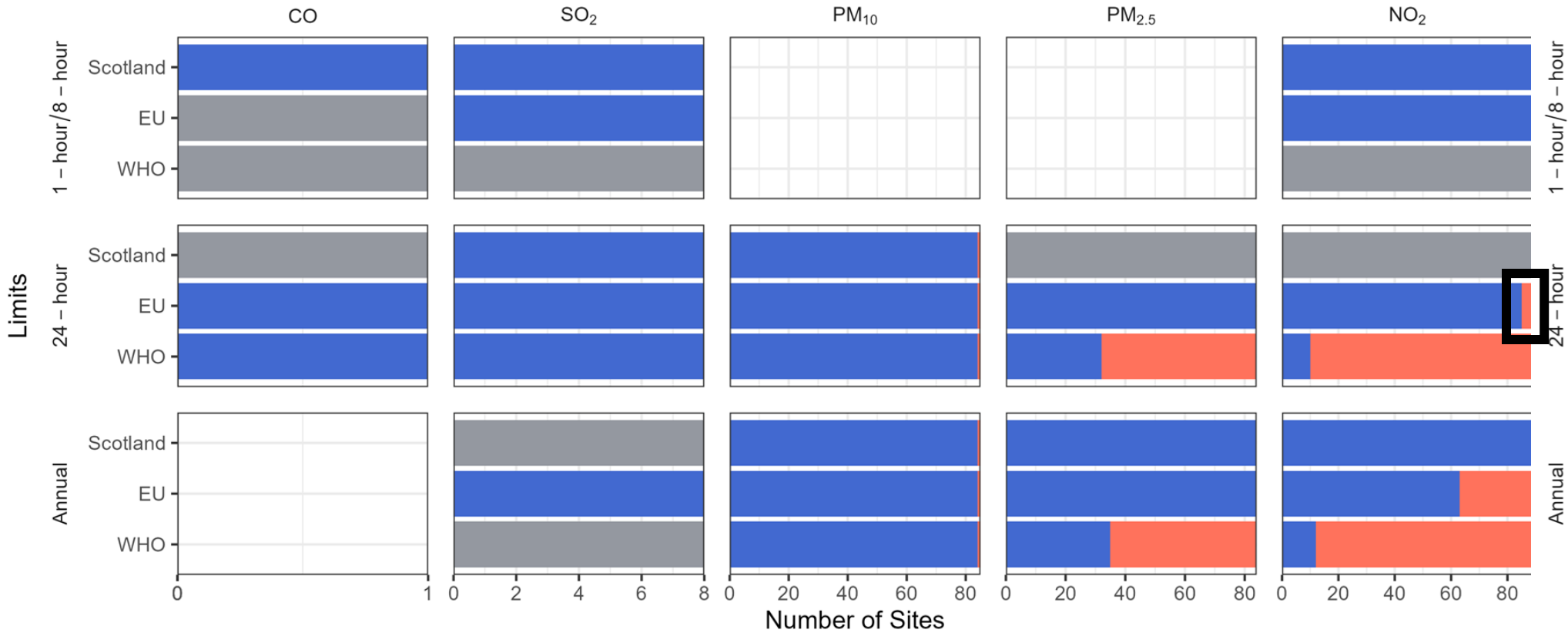
The EU has set new air quality standards to protect human health and the environment

- Define common methods to monitor, assess and inform on ambient air quality in the EU
- Establish objectives for ambient air quality to avoid, prevent or reduce harmful effects on human health and the environment
- Guide the assessment of air quality required by a the maximum 100 quality monitoring stations, with more than 6000 air quality monitoring stations across the EU and an extensive use of air quality modelling
- Exchange results, updates and comparable information on air quality, including to the wider public

Read more at: <https://ec.europa.eu/transport/air-quality/>

View the document: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023/0001&from=doc>

■ Limit Exceeded
 ■ Limit Achieved
 ■ No Limit



Dundee Lochee Road
(24 days)

Edinburgh St John's Road
(25 days)

Falkirk West Bridge Street
(23 days)

Glasgow Kerbside
(75 days)

* 8-Hour running for CO, otherwise 1-hour

