Ricardo
Spotlight on Local Air Quality

14th May 2025

Ricardo Spotlight on Air Quality: The Polls

Access via the QR code with your smart phones

……Or join us at menti.com

and use joining code 8501 2164

Let the voting begin!

Ricardo Spotlight on Air Quality: An Introduction

- Welcome!
- Local authority (and their air quality partners') webinar
- Free!
- Interactive
- Current topics
- Who are the presenters?

Jo Solan

Lynda Stefek

Jekabs Jursins

Alfie Nash

Which Local Authority do you represent?

AGENDA

Low-Cost Sensors and QA/QC: Domestic Burning Project

AQ modelling: Establishing AQ targets & measures

A day in the life – Ricardo LSO & QAQC Audits

Phase outs: 2G, 3G, & Electricity Meters

EMAQ Live!

Q&As

Low-cost sensors and the need for QA/QC: Defra funded domestic burning project

Lynda Stefek: Transport for Greater Manchester

Poll

How much do you think our Lower-Cost Sensors cost, each?

A: ~£100

B: ~£500

C: ~£3000

D: ~£4000

Answer D: Approx £4,000

'Premium' Air Quality Monitor
£13 from TEMU

£74 from
Amazon

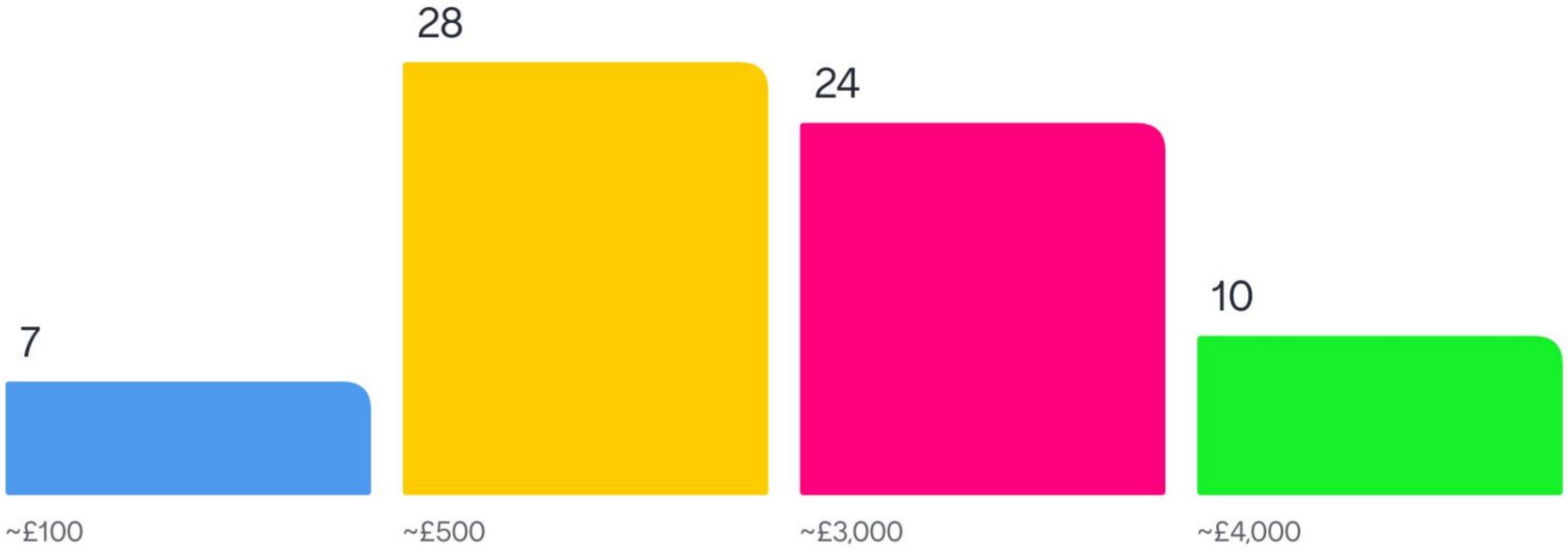
PM2.5 Accuracy:
- ±10 μg/m³ (0-100μg/m³)
- ±10% (100-500μg/m³)

£211 from Amazon

MCERT
£2,000 - £4,000 from manufacturer depending on the pollutants

[MCERTS Certified Products: Indicative Ambient Particulate Monitors Archives - CSA Group]

How much do you think each TfGM sensor costs?



The primary aim of the project

To influence the reduction of particulate emissions in Greater Manchester through targeted messaging and interventions, informed by an updated emissions inventory for PM2.5, targeted monitoring and innovative local research, with a long-term objective of encouraging behaviour change through informed choices.

Two-phase approach:

1. **Evidence Base** - Determine proportion of PM2.5 across Greater Manchester attributable to domestic burning, **supported by detailed monitoring programme using lower-cost sensors across the region**, with additional research into demographics, attitudes and behaviours of current contributors to these emissions.
2. **Marketing and Communications Campaign** - Launch two campaigns, drawing on the above evidence base for improved targeting.

Detailed monitoring programme – Data we can have confidence in

The only thing worse than no data is poor quality data.

- How reliable is data from Lower-Cost Sensors?
- The devil is in the detail and the application of LCS.
- MCERT Indicative Ambient Particulate Monitors
- **Qualitative measurements** – rely on instrument factory calibration
- **Quantitative measurements** – requires ongoing QA/QC and local calibration

Poll

Under the Air Quality Directive 2008 what do you think the is the acceptable level of uncertainty for Lower-Cost Sensor particulate monitoring?

A: +/- 20%

B: +/- 30%

C: +/- 40%

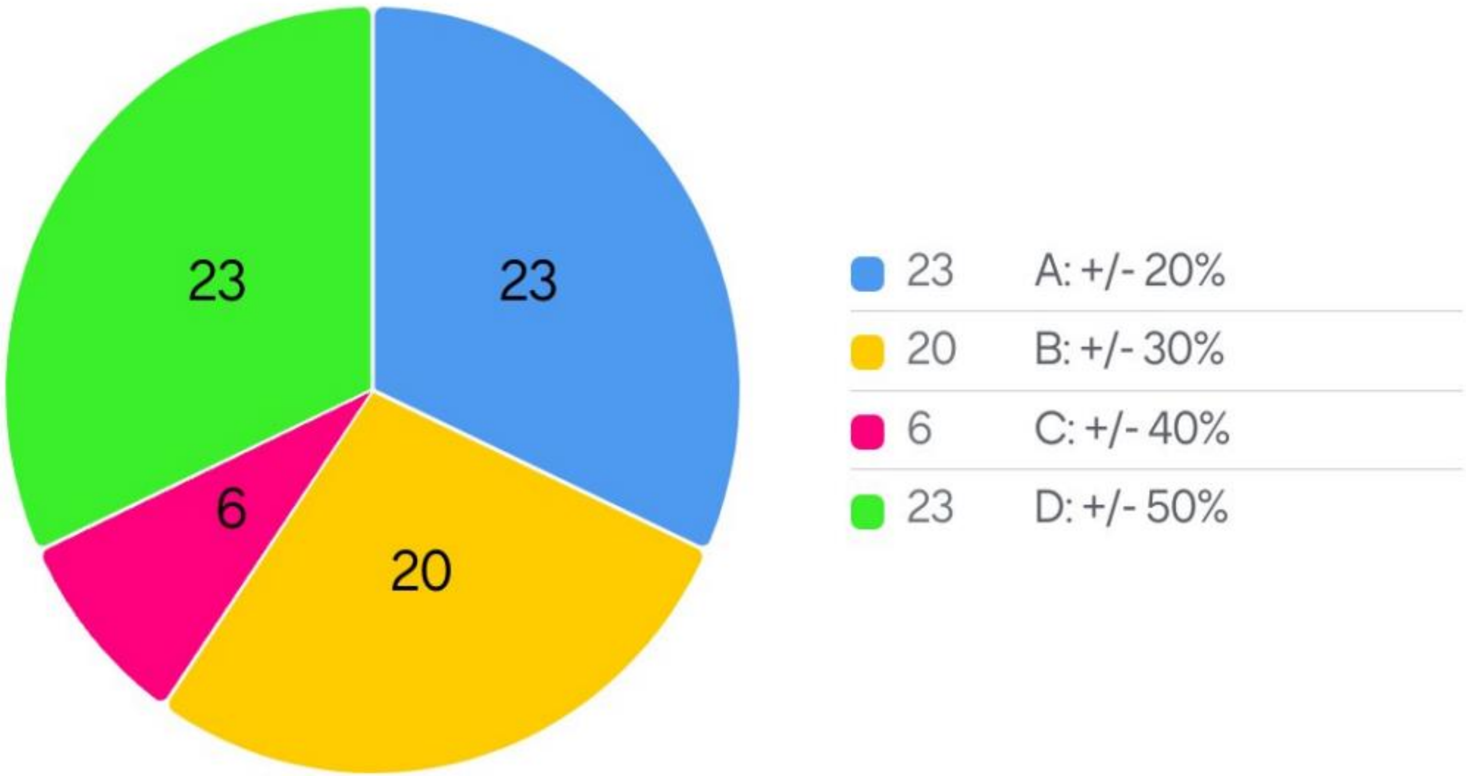
D: +/- 50%

Answer

Air Quality Directive (2008) – defines the uncertainty of indicative monitors as +/- 50% (for PM)

MCERTS Certified Products: Indicative Ambient Particulate Monitors Archives - CSA Group

Under the AQD, 2008, what do you think the is the acceptable level of uncertainty for Low-Cost Sensors?



Guidance available at the time on the use of LCS

Department for Environment Food & Rural Affairs

UK AIR

Air Information Resource

Search on UK Air

Home | Air Pollution | Data | Monitoring Networks | Library | Science & Research | AQMAS | SCA

Home > Science & Research > Air Quality Expert Group > Publications > AQEG advice on the use of 'low-cost' pollution sensors

AQEG advice on the use of 'low-cost' pollution sensors

- 'Low-cost' pollution sensors - understanding the uncertainties
- How do sensors perform compared to reference instruments?
- When could I use a low-cost sensor?

Until relatively recently the vast majority of real-time measurements of air quality in UK were made by established reference methods, using sophisticated analytical instruments that meet well-defined international standards for the quality of the data produced. However, in the last decade there has been rapid growth in the development of low-cost sensors for air pollution measurement and considerable media coverage of these technologies.

We refer in this advice to low-cost sensors which are designed to measure regulated pollutants in ambient air, for which equivalence with European or US reference methods has not been demonstrated, and are often available at lower cost than reference-equivalent instruments. Low-cost in this context can mean many things, ranging from simple single pollutant sensors in units that are sold for a few tens of pounds to relatively sophisticated multi-pollutant devices that include communications and meteorological capabilities and may cost several thousand pounds, but which differ from reference methods because of their compactness, mobility and lower power consumption.

Low-cost sensors are highly attractive for many different reasons – they potentially allow for far greater density of measurements to be made, let individuals measure pollution in their local environment, they may be carried on a person to estimate exposure, or be integrated into networks into local air pollution management systems.

Many different low-cost sensors are being commercialized and the technology and marketplace is evolving very rapidly. For this reason it is difficult for Defra and the Air Quality Expert Group to use its usual format of detailed review reports to provide updates or advice to interested parties on the state of the art. There is a substantial risk that such studies may well be out of date by the time of publication.

Instead Defra and AQEG will use this part of the UK-Air website to provide regular updates on the science and application of air pollution sensors, their uncertainties and recommendations and advice on where they may, or may not, be appropriate to use. Links to the latest review articles on this subject will also be provided.

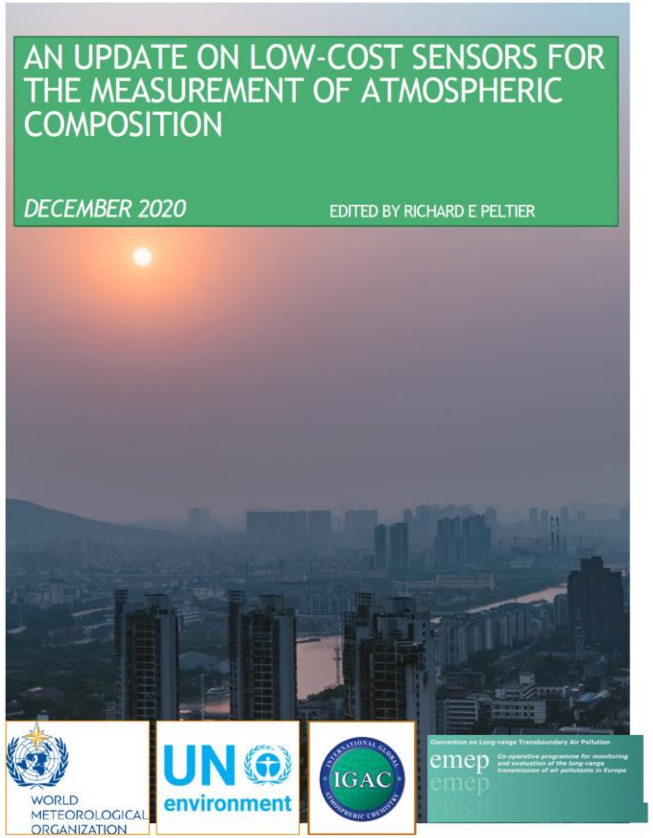
A further comprehensive resource for information on air pollution sensors can currently be found on the US Environment Protection Agency website:

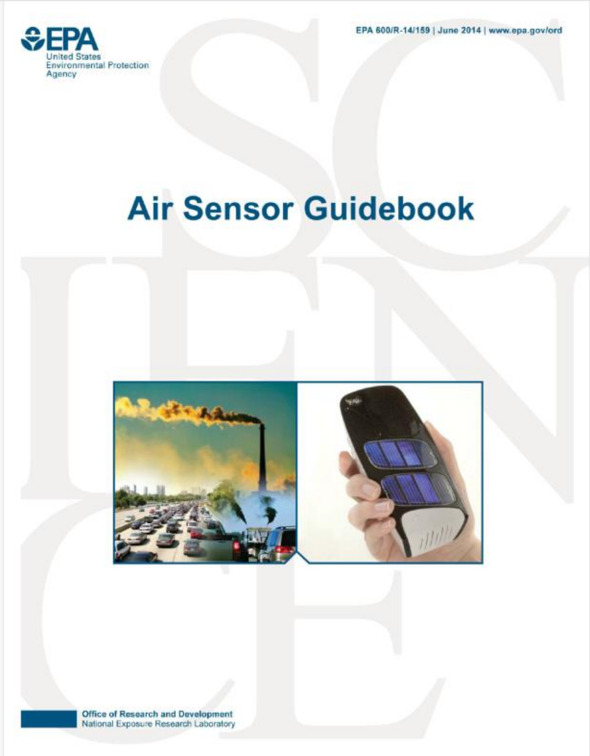
https://www.epa.gov/air-sensor-toolbox/how-use-air-sensors-air-sensor-guidebook#pane-1

Air Quality Expert Group

About the Air Quality Expert Group

Publications





Preparing the Tender documents – QA/QC

Quality Data was an important focus of the Specification

Stage 1: Site Selection, Monitor Verification and Data Transmission Planning

Stage 2: Unit Calibration, Supply, Delivery, and Installation

Stage 3: Monitoring, Data Integrity and System Security (including Data Transmission and Storage)

Stage 4: Maintenance, Quality Assurance and Quality Control (QA/QC)

Monitoring Protocol

The Supplier must calibrate all Indicative Monitors in accordance with the Monitoring Protocol.

Ensuring that they are fully calibrated before the Data Hub goes live.

Calibration programme for the Indicative Monitors to ensure monitoring data meets MCERTS requirements for indicative quantitative measurements throughout the lifetime of the project.

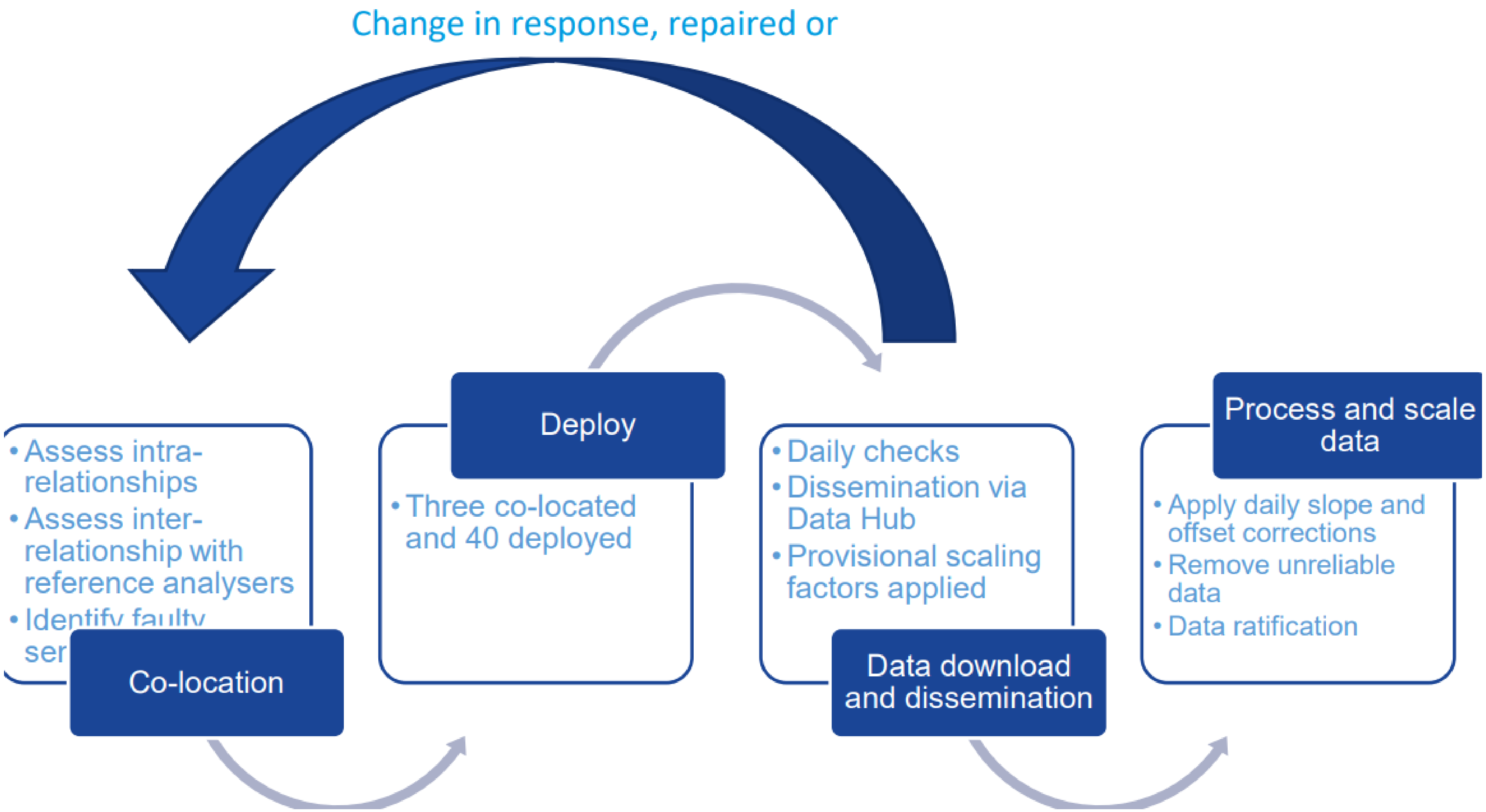
The calibration results must demonstrate, by statistical test results compared to a reference analyser, good performance, including accuracy and precision.

This performance must be demonstrated as capable of being maintained over a comparable time period to the project timescales.

Evidence and results of calibration to address any drift and ratified measured data must be shared with The Authority on a monthly basis.

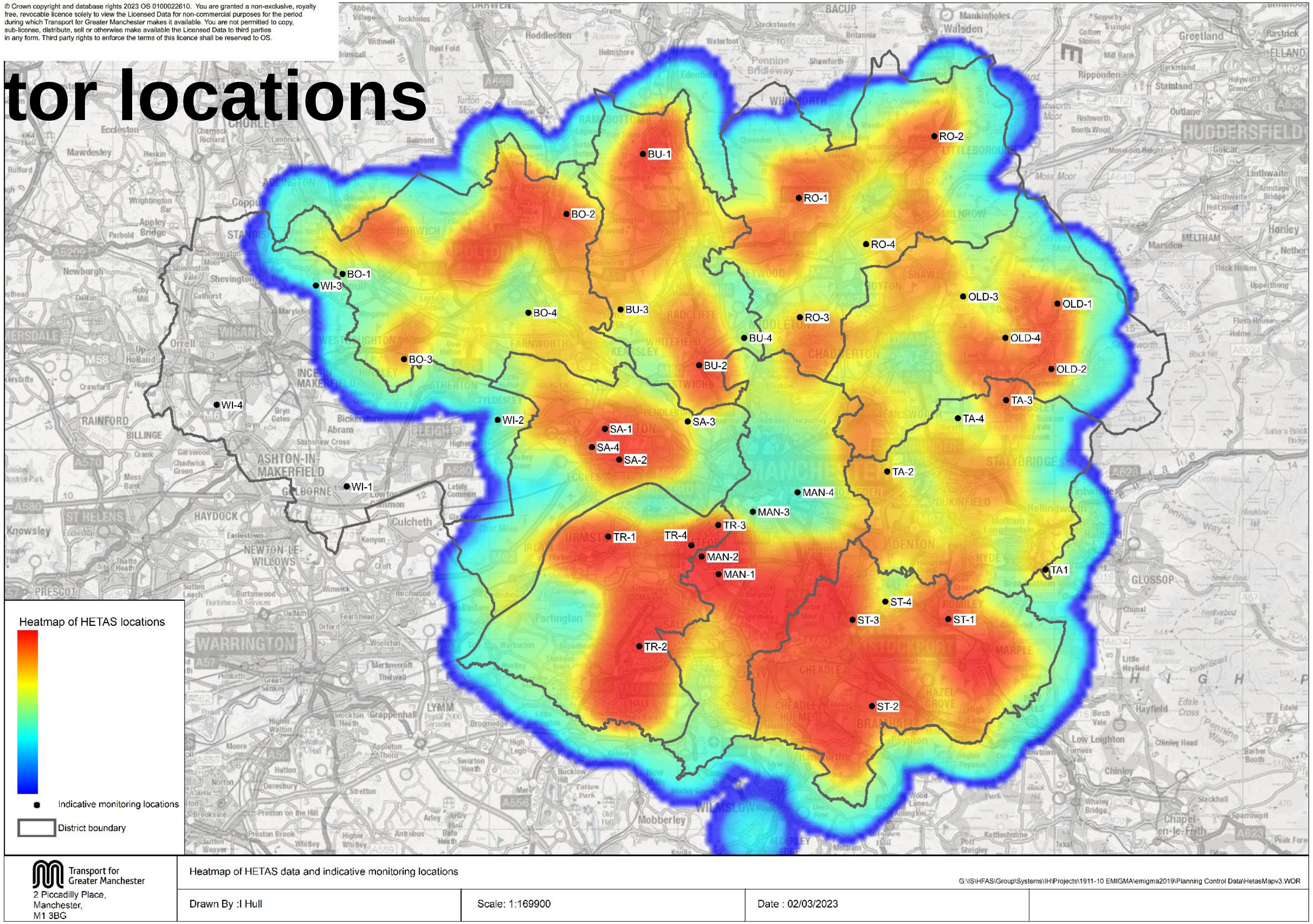
Additionally, any monitors that are delivering sub-standard results, or have failed, must also be reported, together with planned actions and timescales for corrective action or replacement.

Improving upon MCERTS – Ricardo's Protocol



Choosing monitor locations

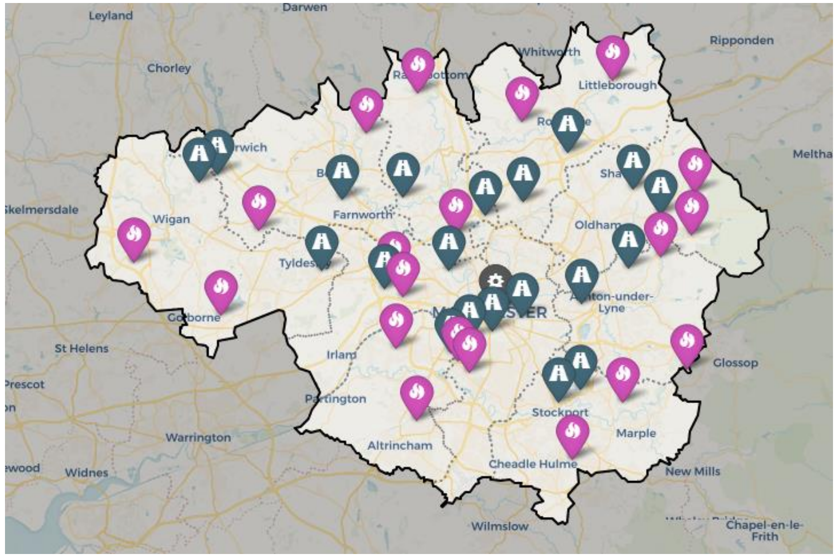
- HETAS data used to understand likely locations of wood-burning stoves.
- Backed up by local knowledge, complaints data and site visits



Calibration and Co-Location

- 43 monitors were calibrated by co-location prior to deployment in Greater Manchester

- 3 Indicative Monitors were co-located at Piccadilly AURN Realtime monitoring station giving greater confidence in the responses of the monitors.



What do the data show?

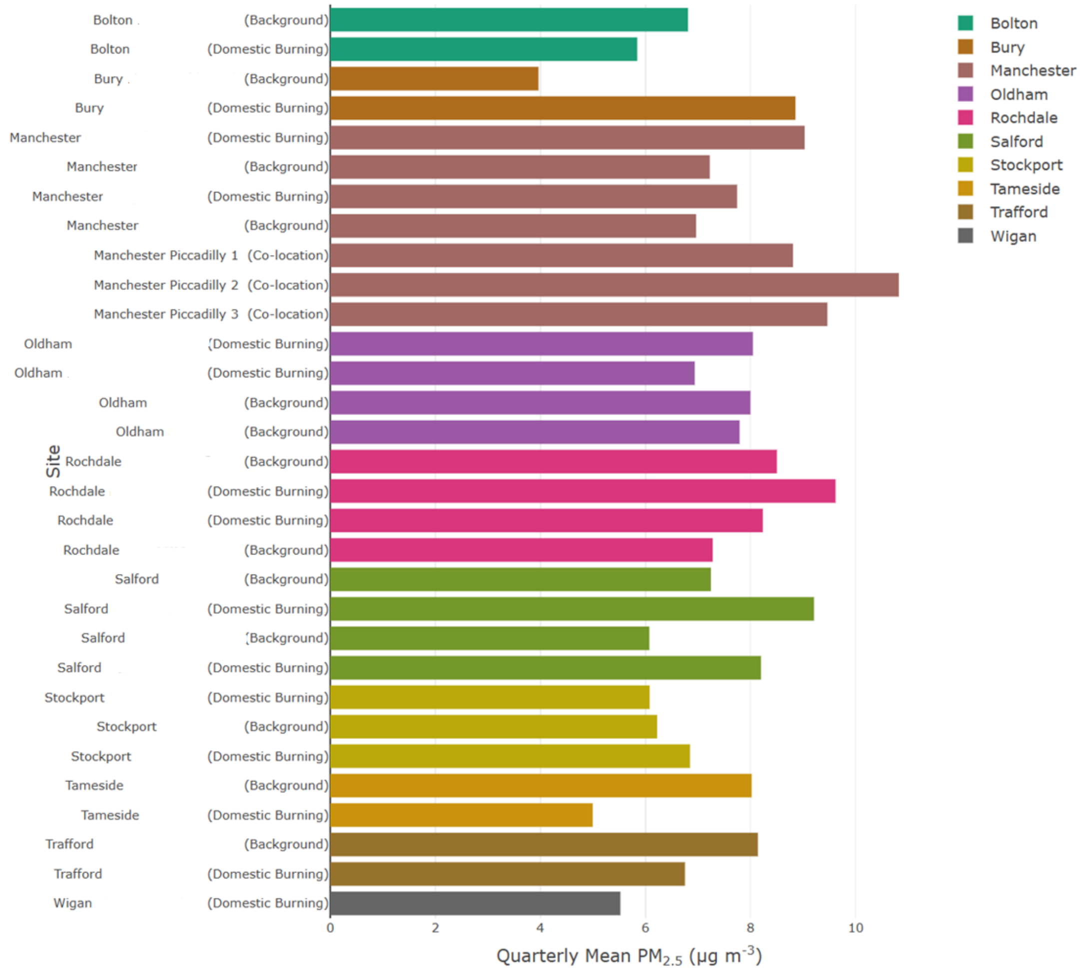
4 Data Summary for all sites

4.1 Summary statistics

The plot tab shows the quarterly mean for indicative sites by the selected pollutant. The colours of bars represent the sensors located in each district. The table tab concluded the statistics of the measurements.

PM_{10} $PM_{2.5}$ NO_2 O_3 CO CO_2

Plot Table



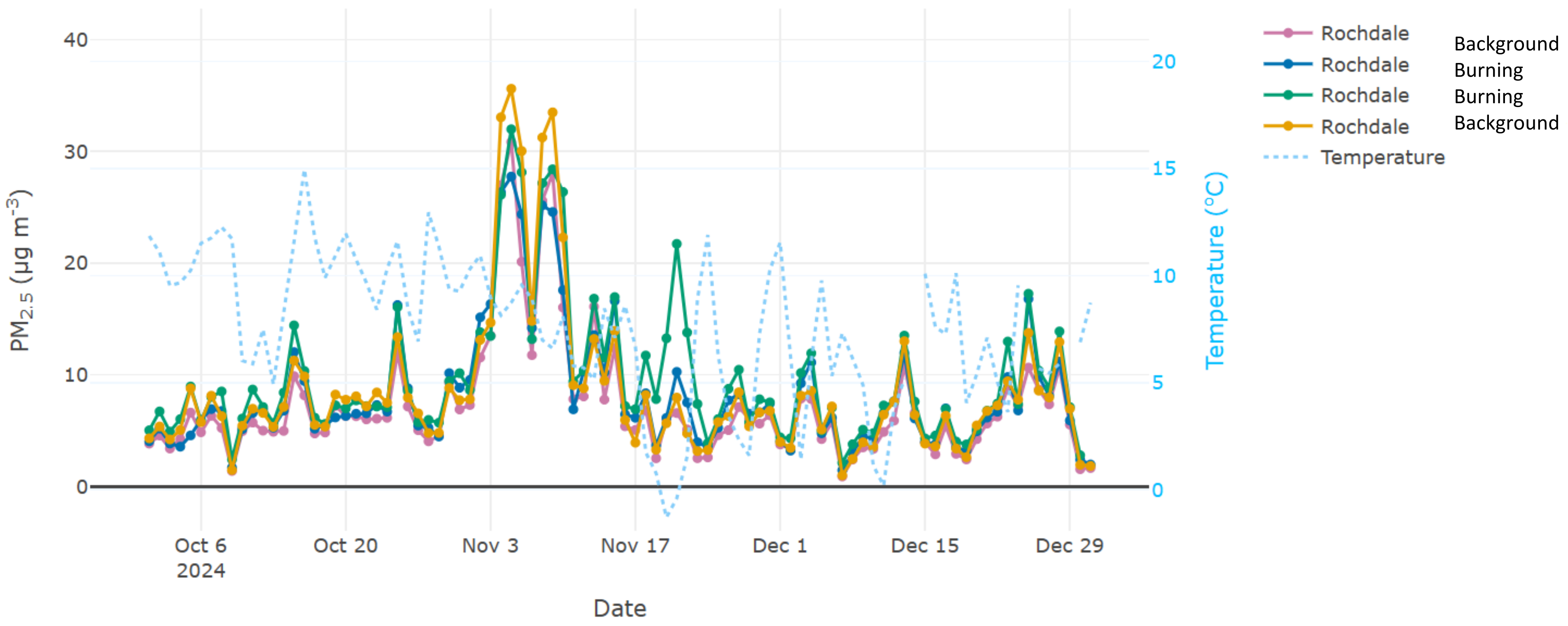
N.B. These data are currently provisional/unratified

What do the data show?

Time series plot

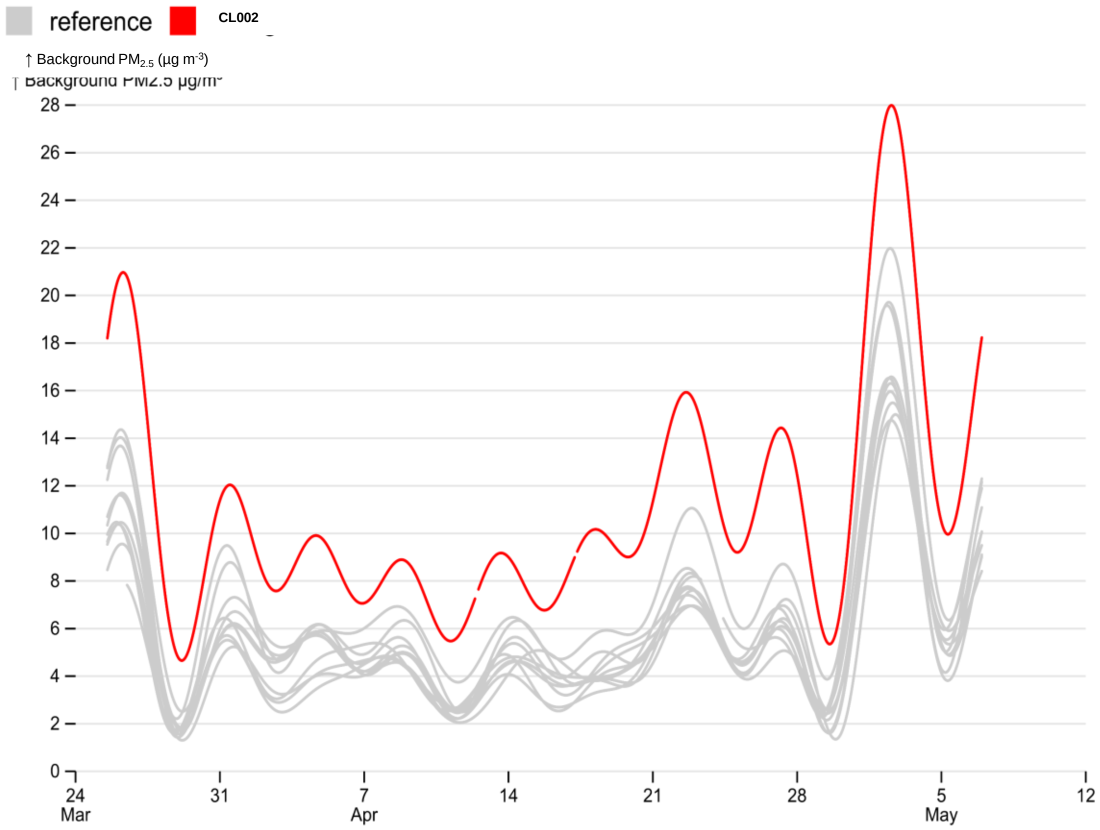
The plots below show the time series of concentrations for this quarter. Each pollutant is presented on a different tab and all sites are shown on each plot for comparison. A daily average resolution has been chosen as the most appropriate metric over a variety of different time windows. Zooming in on specific periods of the plot can be done by dragging a box over the section of the main plot frame. To return to the default (all data) zoom level, double click the plot. Holding the mouse over the lines will highlight specific values and time stamp for that record for each station.

PM_{10} | $PM_{2.5}$ | NO_2 | O_3 | CO | CO_2

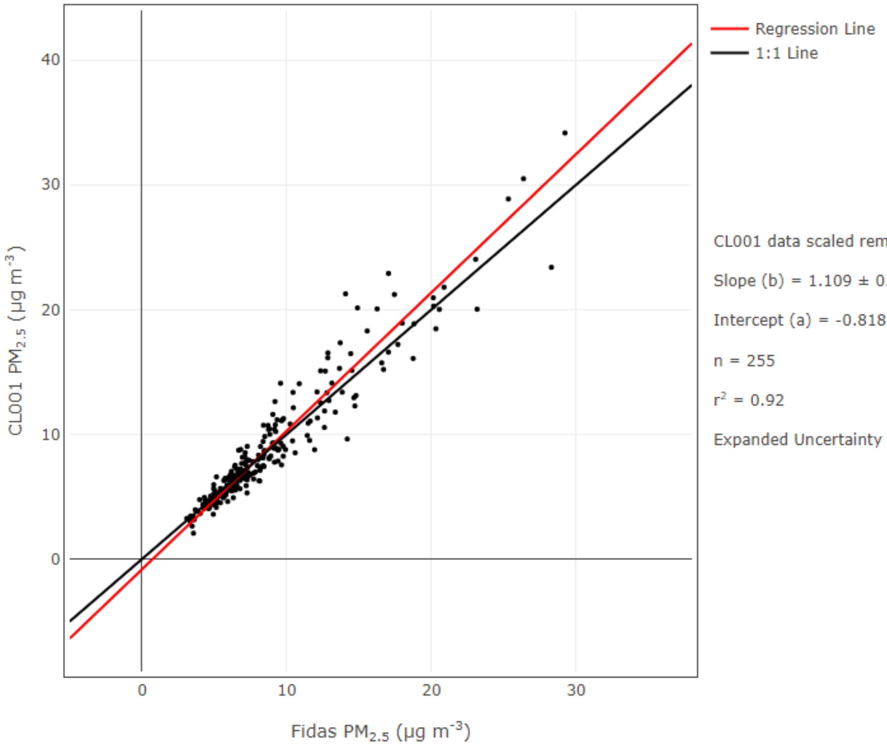


Regional Adjustment – Extracting the "Background Signal"

- Rural background concentrations consistent across >100 km
- Urban background concentrations consistent across areas of a city
- How can we extract the "background signal" from measurements:
  - Find commonality across the reference network
  - Frequency analysis - extract low frequency trends e.g. 1-min to hourly peaks due to local sources; background concentrations will vary over several days.



Co-location Uncertainty



CL001 data scaled remotely

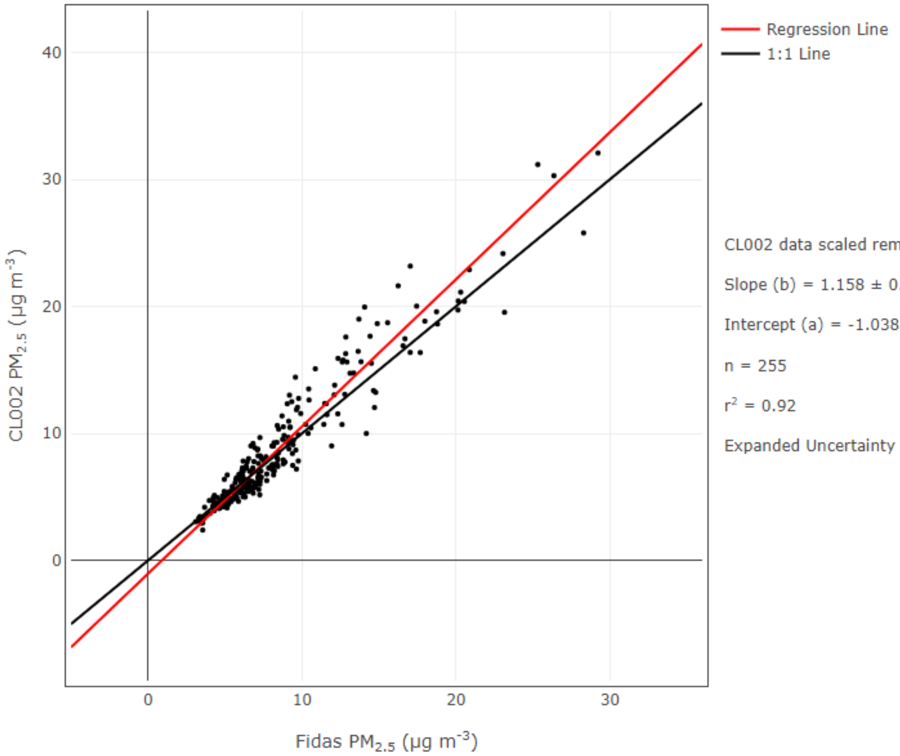
Slope (b) = 1.109 ± 0.02 (Significant)

Intercept (a) = -0.818 ± 0.195 (Significant)

n = 255

$r^2 = 0.92$

Expanded Uncertainty (W_{CM}) = 18.9%, passes 50% criterion



CL002 data scaled remotely

Slope (b) = 1.158 ± 0.021 (Significant)

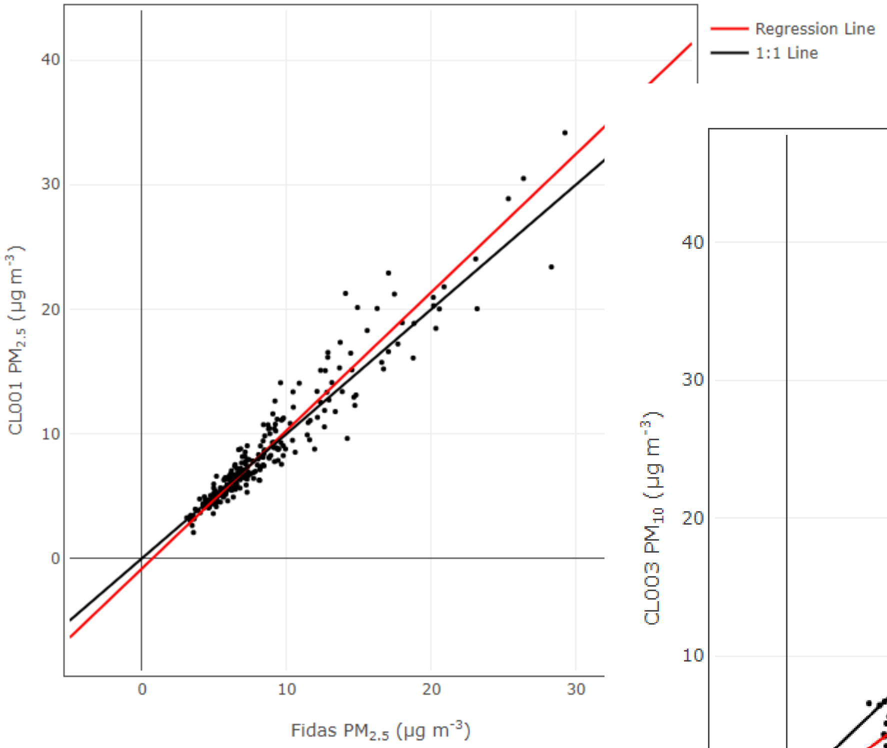
Intercept (a) = -1.038 ± 0.202 (Significant)

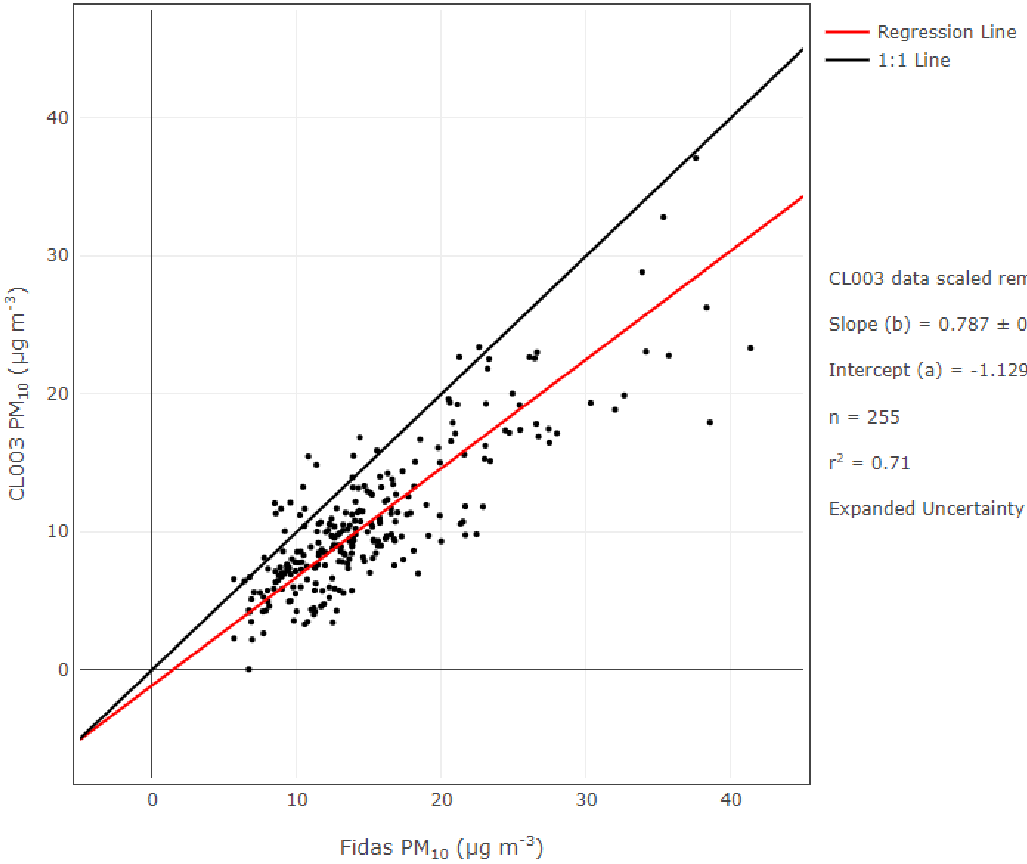
n = 255

$r^2 = 0.92$

Expanded Uncertainty (W_{CM}) = 26.6%, passes 50% criterion

Co-location Uncertainty





:d remotely

8 ± 0.021 (Significant)

1.038 ± 0.202 (Significant)

:ainty (W_{CM}) = 26.6%, passes 50% criterion

CL003 data scaled remotely

Slope (b) = 0.787 ± 0.028 (Significant)

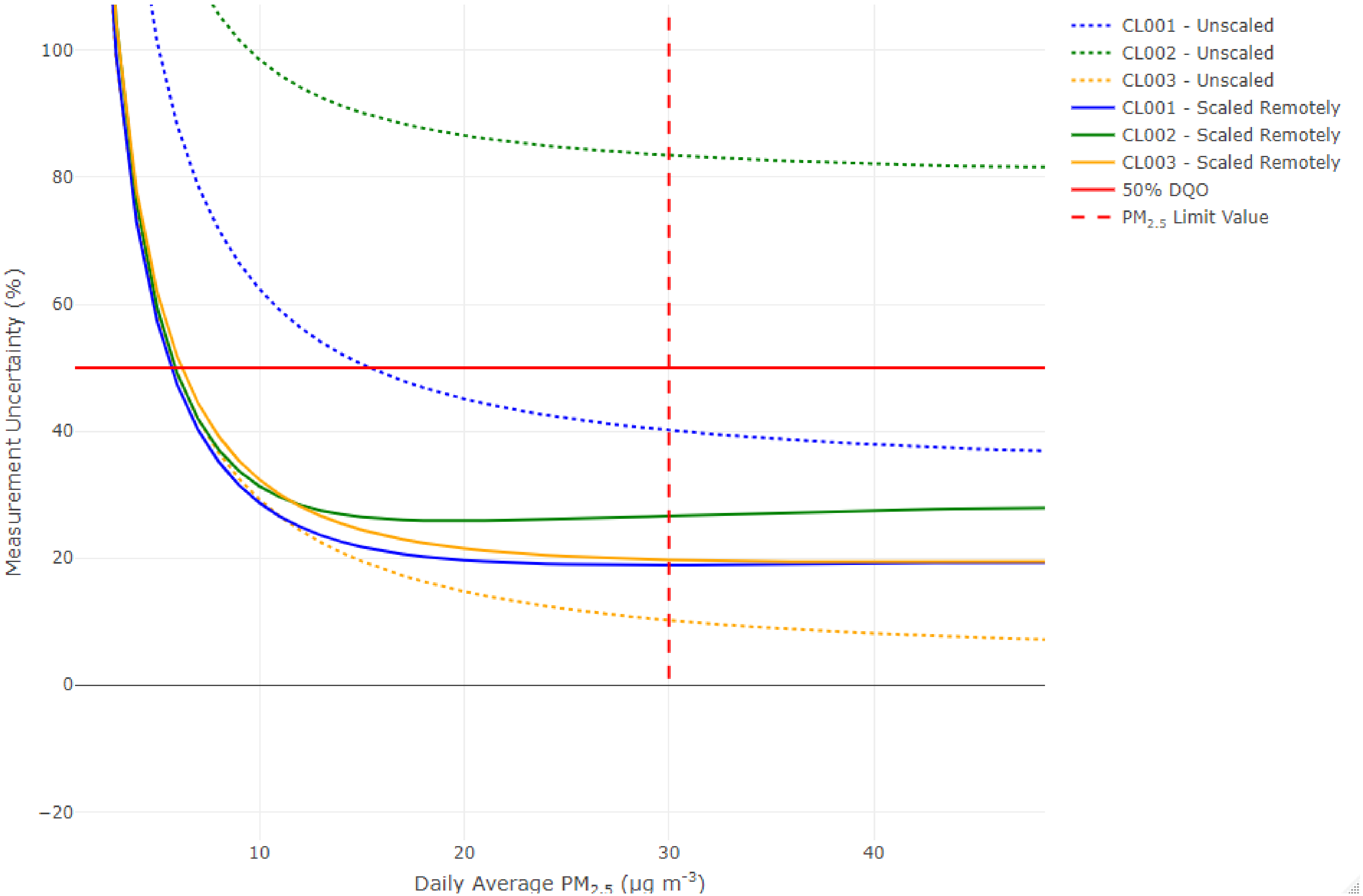
Intercept (a) = -1.129 ± 0.45 (Significant)

n = 255

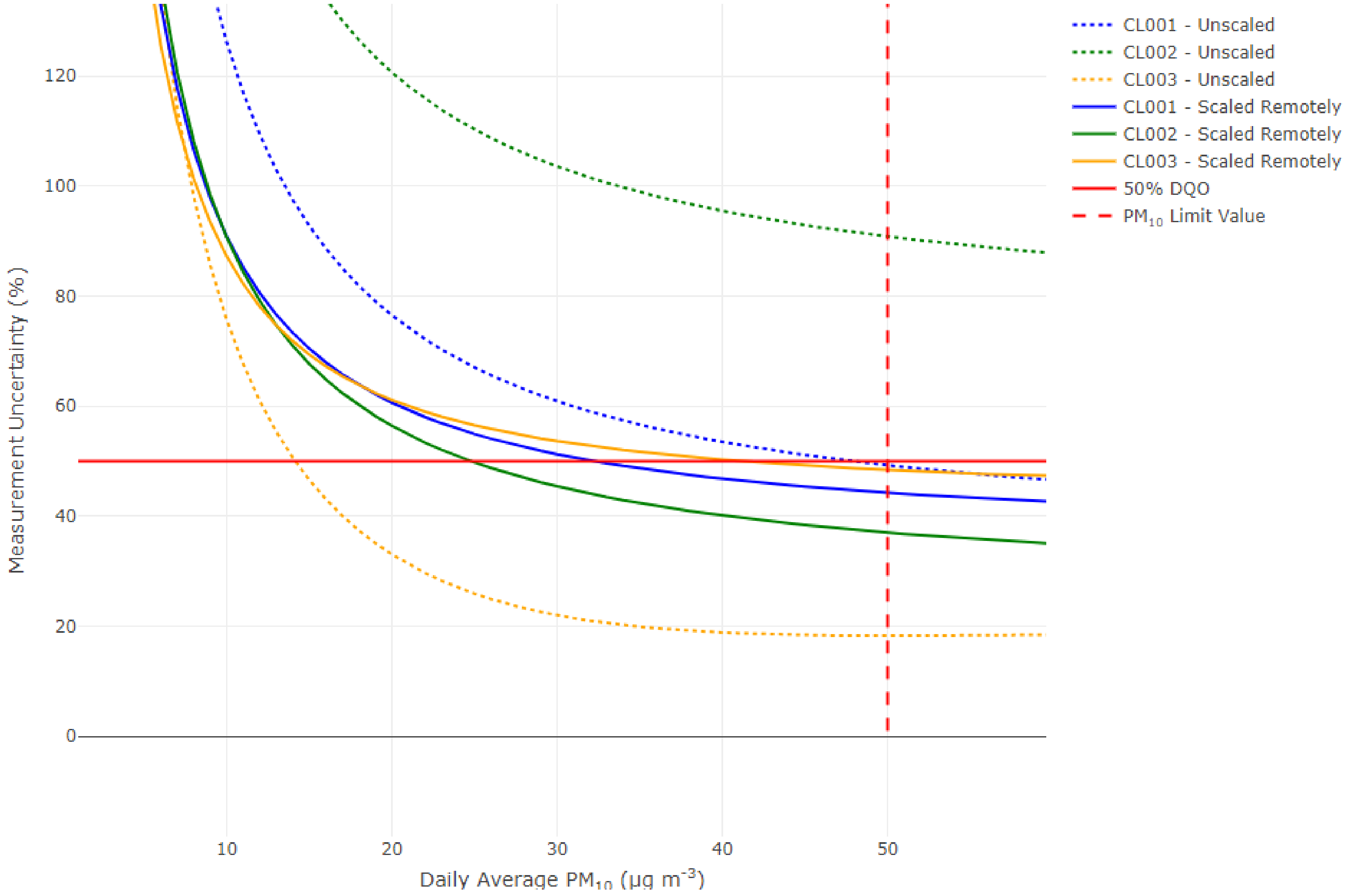
r^2 = 0.71

Expanded Uncertainty (W_{CM}) = 48.4%, passes 50% criterion

Co-location Uncertainty – $PM_{2.5}$

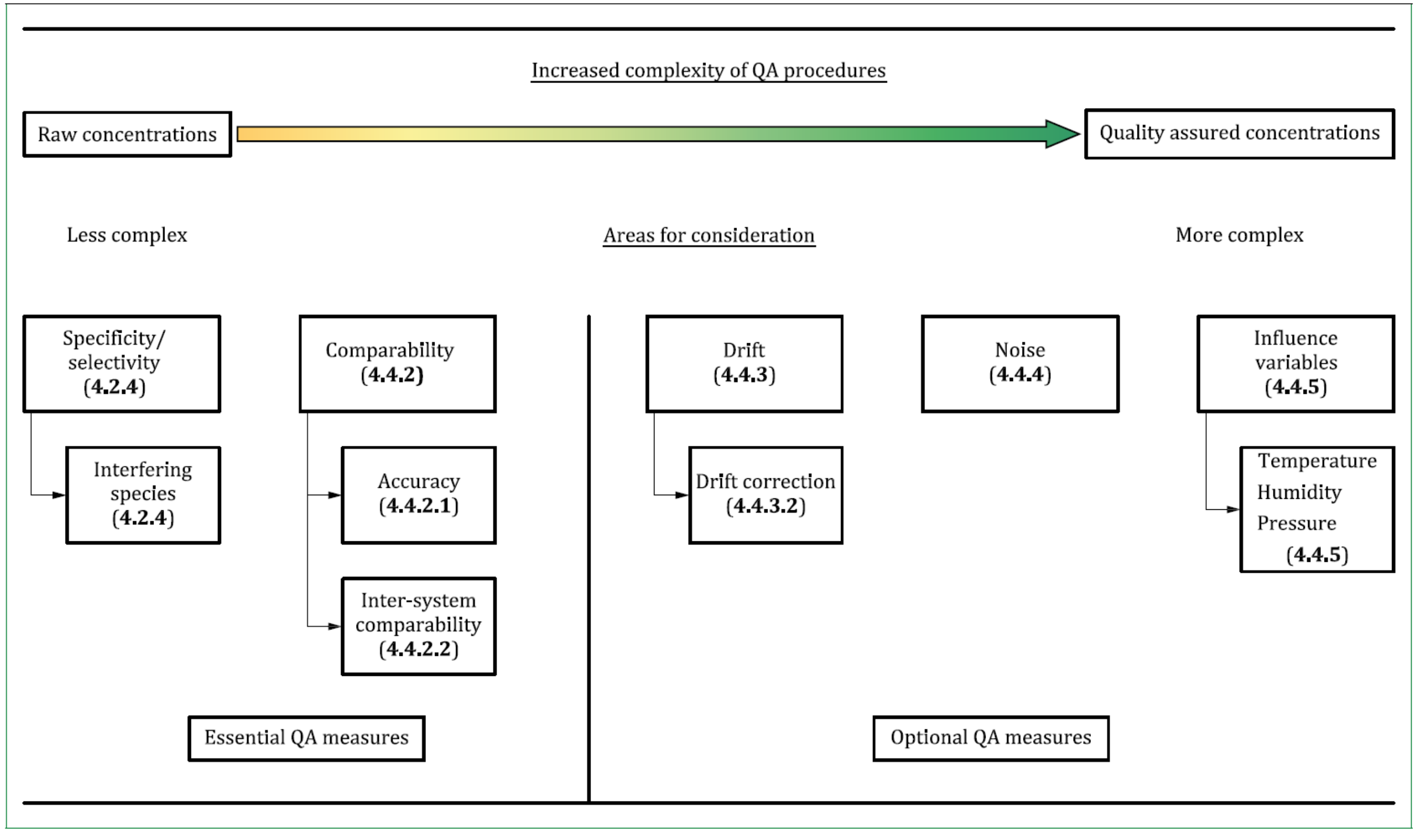


Co-location Uncertainty – PM_{10}



2023 Code of Practice – Lower Cost Sensors

Figure 6 – Common measurement artefacts and areas for consideration



Preliminary monitoring data

- Transboundary sources – known
- On 29 May 2024 a volcanic erupted in Iceland.
- Our indicative monitors recorded spikes in $PM_{2.5}$ concentrations 31 May to 1 June.
- Analysis and modelling of this period indicates a large proportion of $PM_{2.5}$ was transboundary.

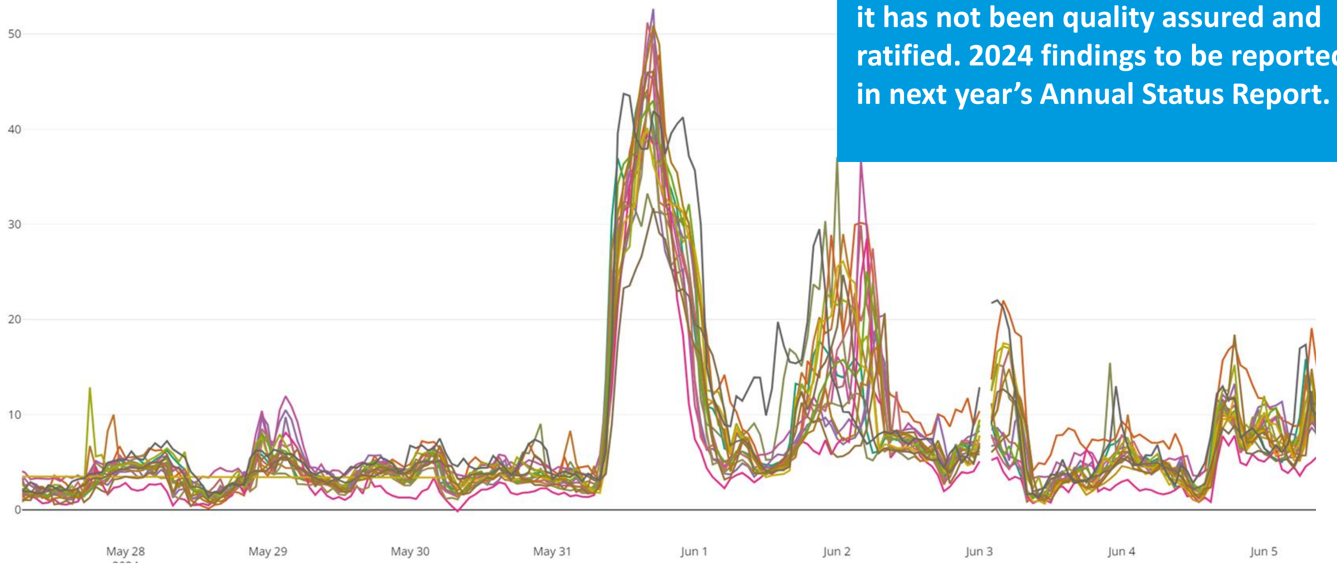
15:50 29 May

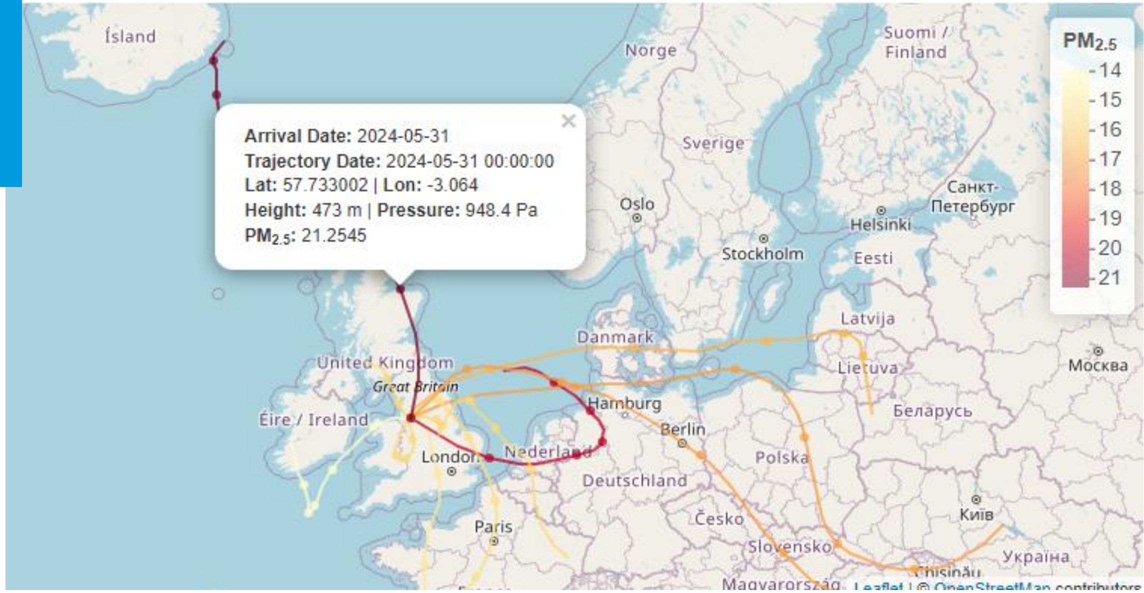
Stream footage of new volcanic eruption in Iceland

A volcano in southwestern Iceland has erupted, sending glowing hot lava shooting 50 metres (164ft) into the air.

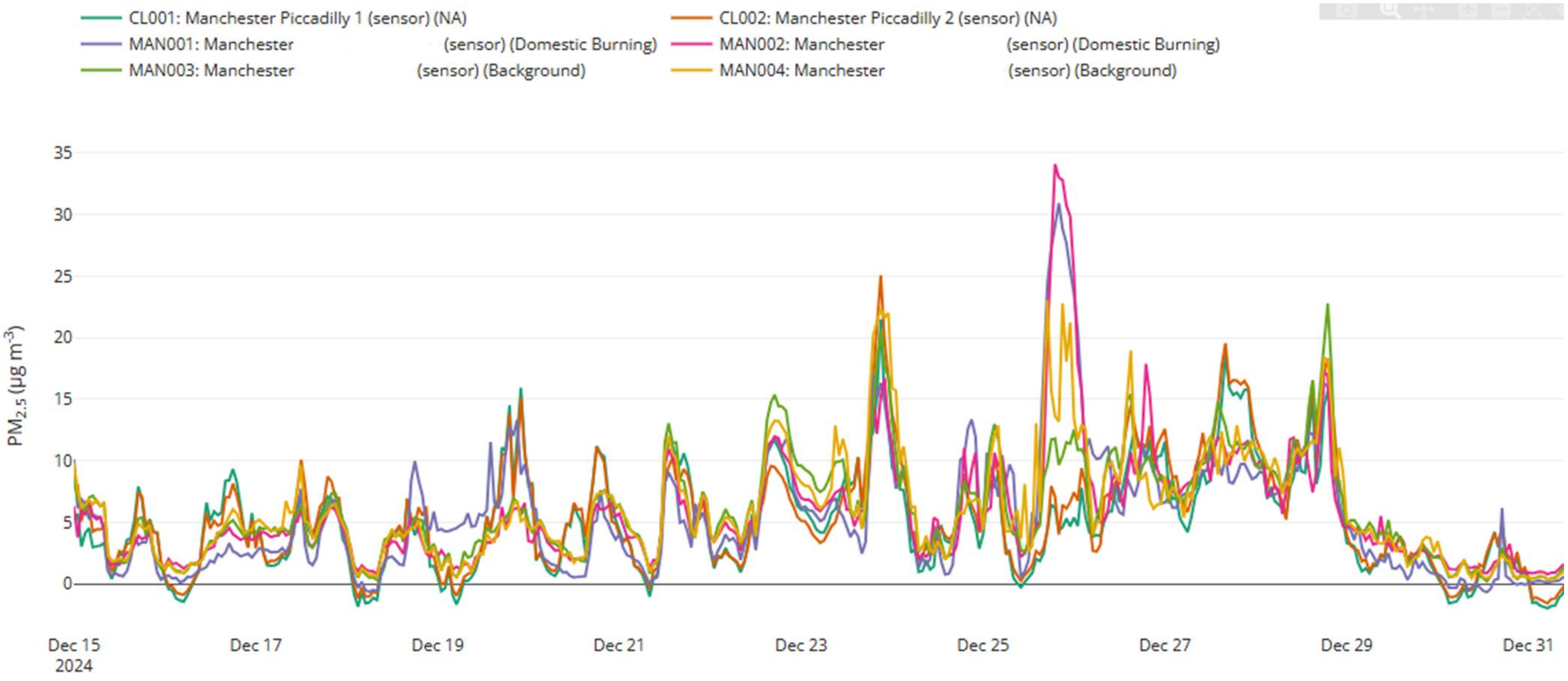
It's the fifth eruption since December on the Reykjanes peninsula - located near the country's capital Reykjavik.

NOTE: Data collection is on-going, it has not been quality assured and ratified. 2024 findings to be reported in next year's Annual Status Report.



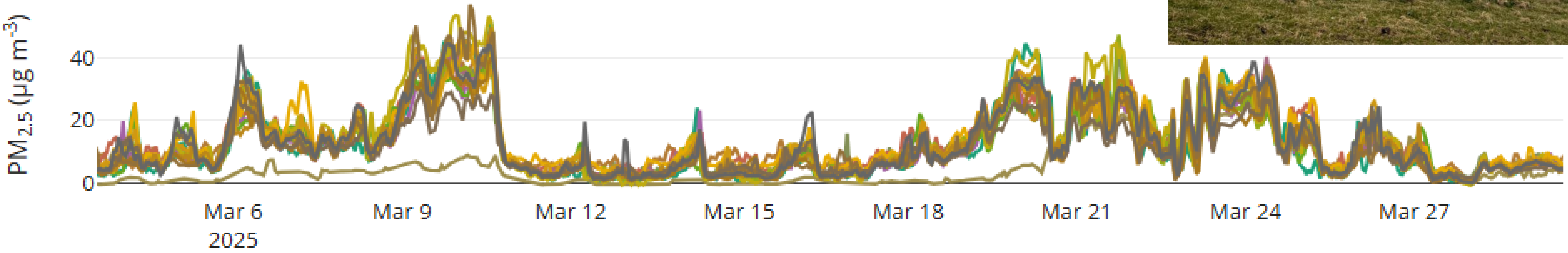


Christmas Celebrations?



Transport for Greater Manchester

Moor Fires March 2025



Any Questions?

Using AQ modelling to support local authorities in establishing AQ targets & measures

Jekabs Jursins: Ricardo

Air quality targets – why aim beyond legal requirements?

UK legal obligation

Why set bespoke targets?

Higher ambition, voluntary

Legal requirements for meeting air quality standards

- Environmental Targets (Fine Particulate Matter) (England) Regulations 2023
  - Supporting the delivery of national $PM_{2.5}$ targets, including 2028 and 2040
- Air Quality Standards Regulations 2010 & Air Quality (England) Regulations 2000
  - Legal obligation to meet limit values for NO_2, PM_{10}, SO_2, lead etc.

	Year to meet limit value	Annual mean limit value (μg/m^3)
NO_2	Current	40
PM_{10}	Current	40
$PM_{2.5}$	Current	20
	2028	12
	2040	10

Protection of human health

- WHO global air quality guidelines (2021)

Table 0.1. Recommended AQG levels and interim targets

Pollutant	Averaging time	Interim target 1	2	3	4	AQG level
$PM_{2.5}$, μg/m^3	Annual	35	25	15	10	5
	24-hour[a]	75	50	37.5	25	15
PM_{10}, μg/m^3	Annual	70	50	30	20	15
	24-hour[a]	150	100	75	50	45
O_3, μg/m^3	Peak season[b]	100	70	–	–	60
	8-hour[a]	160	120	–	–	100
NO_2, μg/m^3	Annual	40	30	20	–	10
	24-hour[a]	120	50	–	–	25
SO_2, μg/m^3	24-hour[a]	125	50	–	–	40
CO, mg/m^3	24-hour[a]	7	–	–	–	4

[a] 99th percentile (i.e. 3–4 exceedance days per year).
[b] Average of daily maximum 8-hour mean O_3 concentration in the six consecutive months with the highest six-month running-average O_3 concentration.

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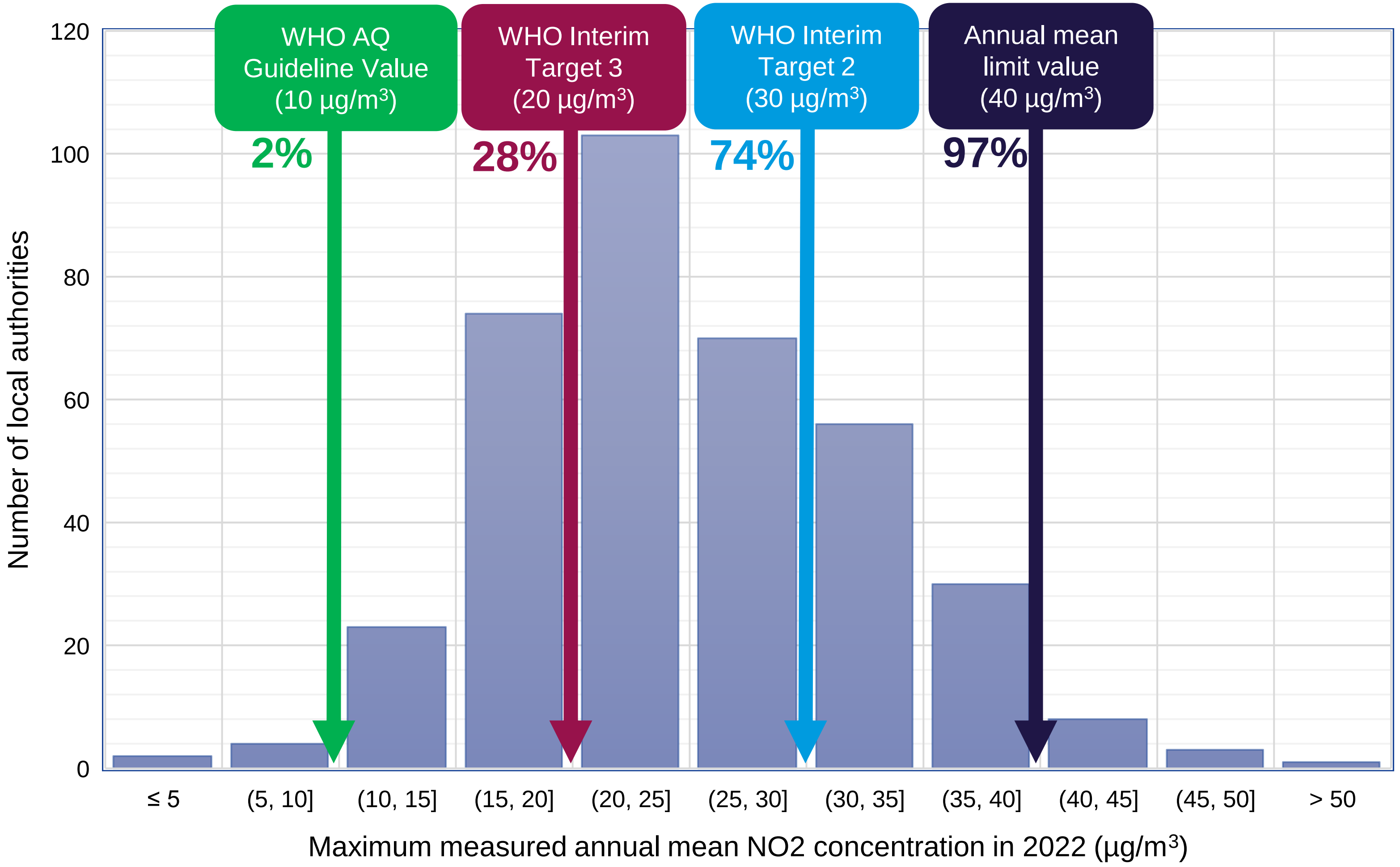
Air quality targets – where are Local Authorities at now?



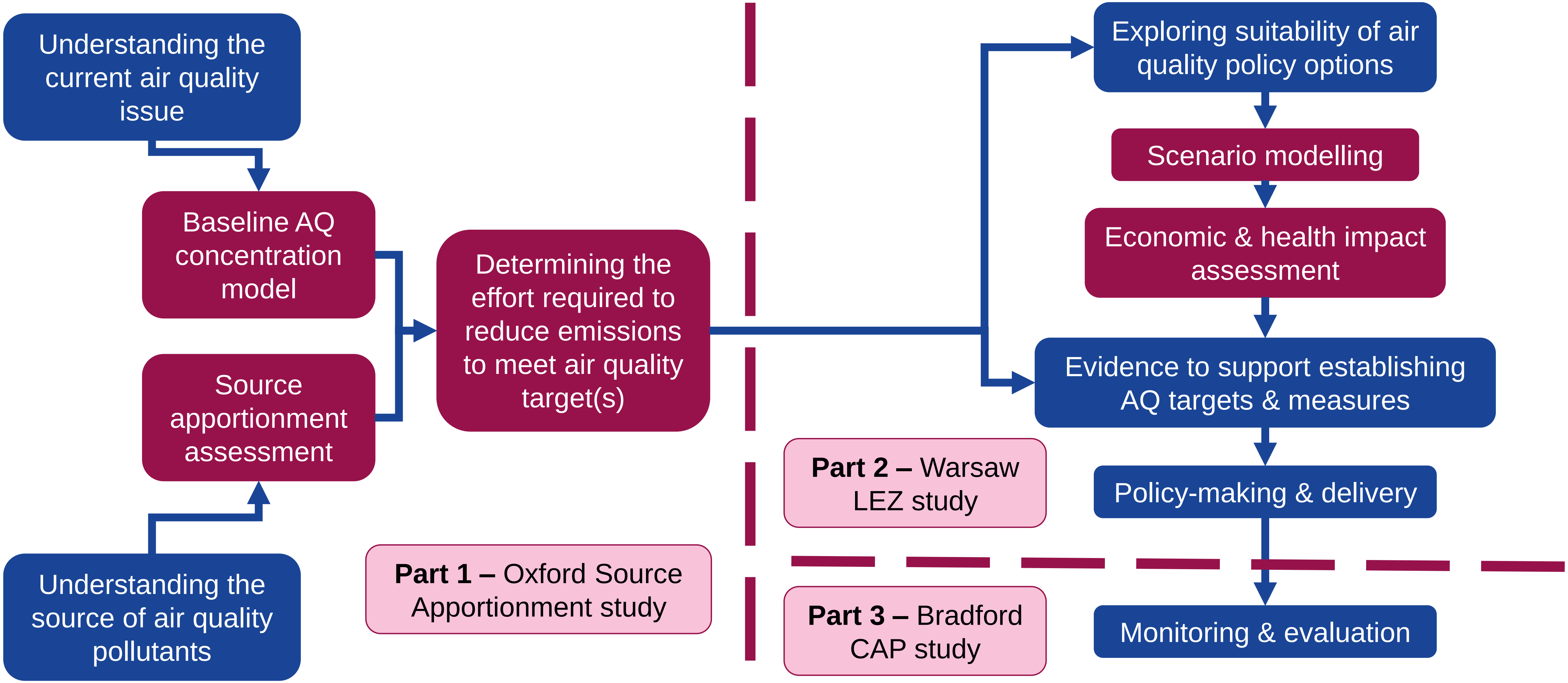
Source: [Nitrogen Dioxide annual mean Local Authority 2022 | Air Quality Compliance Data Hub]

Targets beyond legal obligations are not "one-size-fits-all"

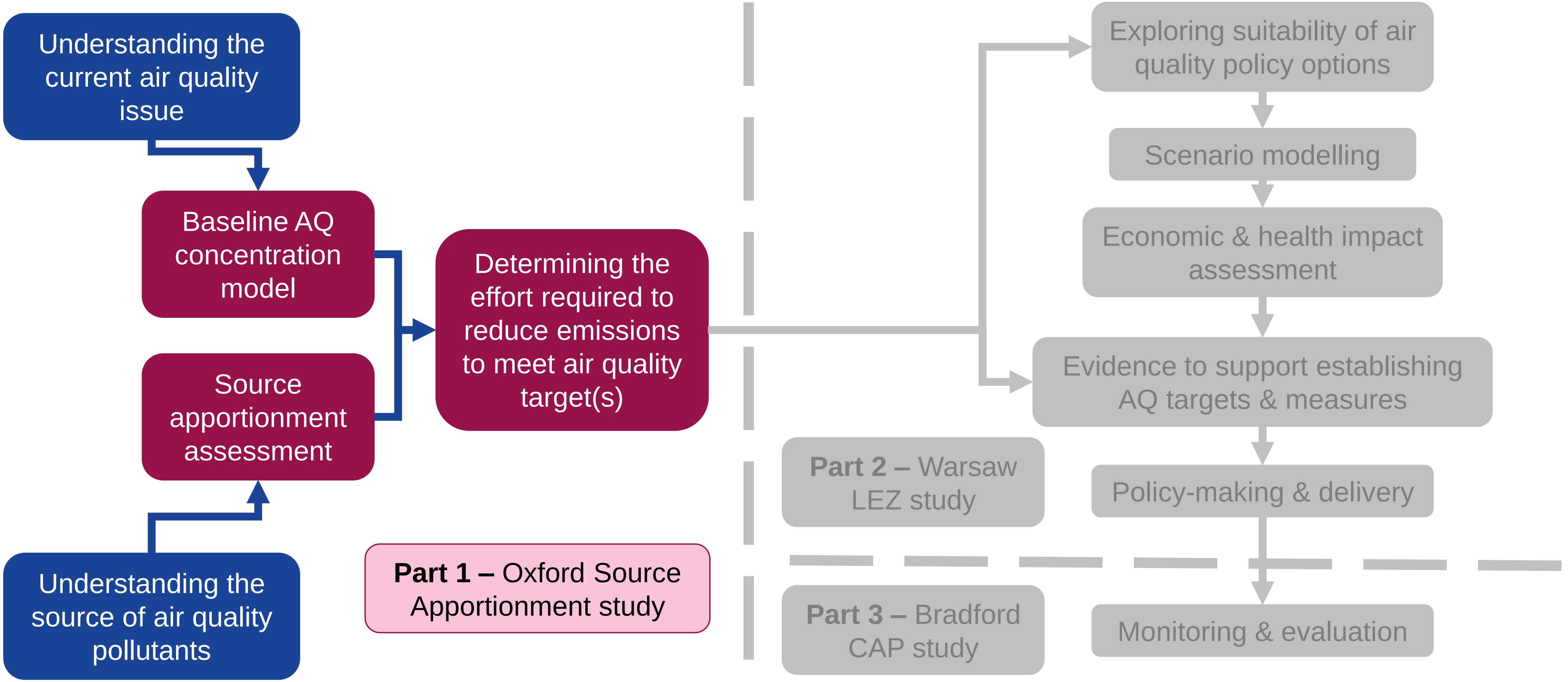
Local Authority AQAP	Target year	Annual mean concentration target value (µg/m^3)
Oxford City Council Air Quality Action Plan 2021-2025	**2025**	NO_2 – **30** µg/m^3
Slough Borough Council Air Quality Action Plan 2024-2028 (draft)	**2028**	NO_2 – **35** µg/m^3
Winchester City Council Air Quality Strategy	**2030**	NO_2 – **30** µg/m^3 $PM_{2.5}$ – **10** µg/m^3

How can local authorities establish targets that are ambitious, but achievable?

Using AQ modelling to support establishing AQ targets & measures



Using AQ modelling to support establishing AQ targets & measures



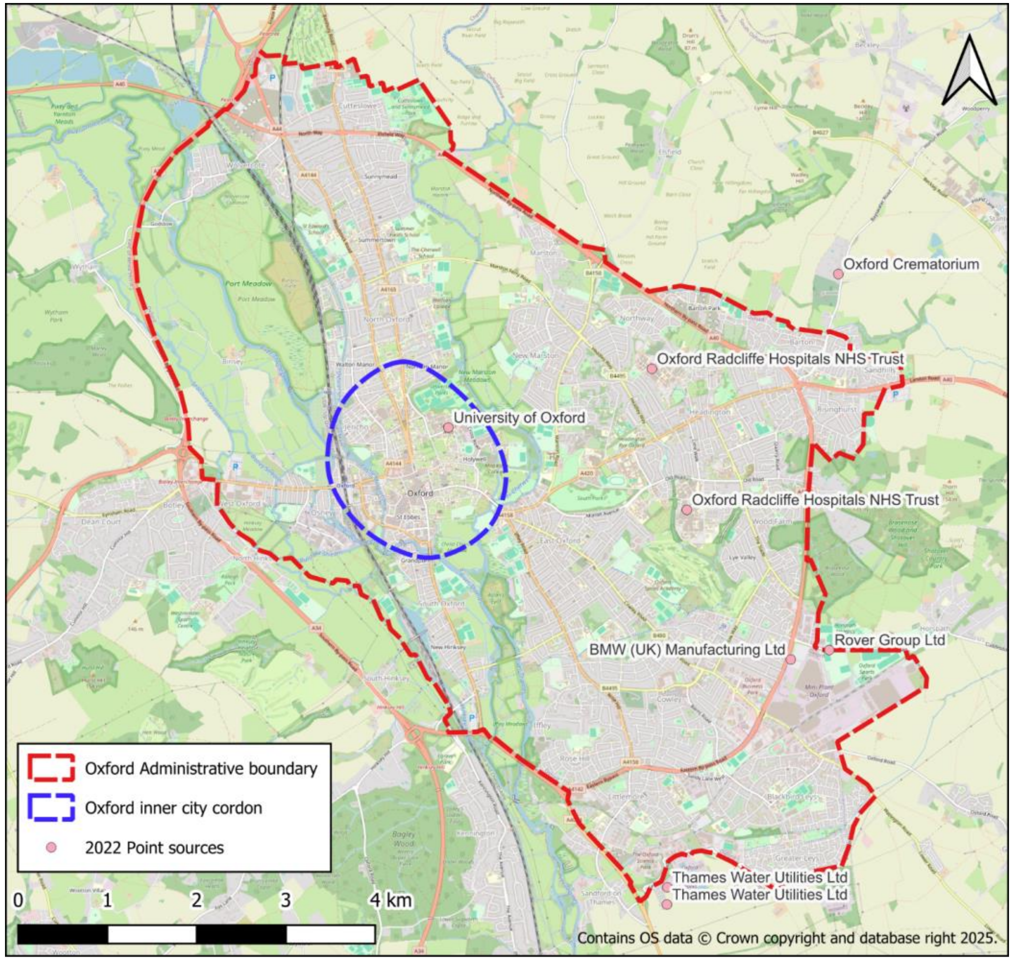
Oxford Source Apportionment – Context & Aims

Context:

- Oxford City Council's AQAP includes an annual mean NO_2 target of 30 µg/m³ by 2025
- Exceedances of Oxford target value in 2022 at three locations:
  - St Clements
  - Worcester Street
  - Botley Interchange

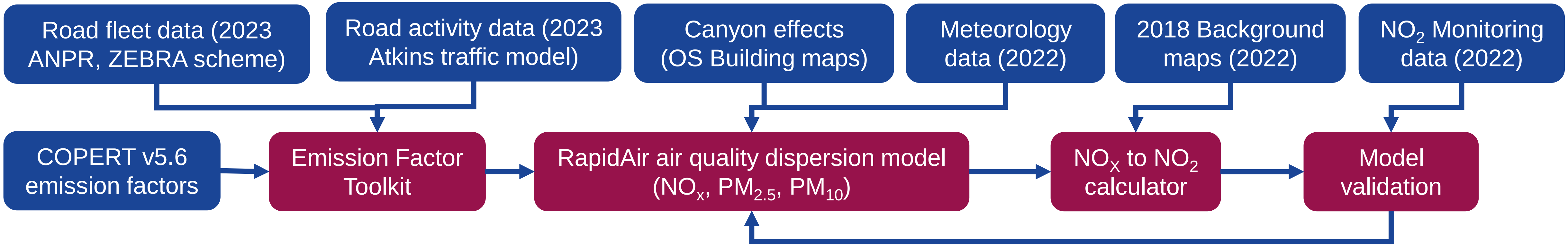
Aims:

- **Understand the contribution of all sources of road emissions** to exceedances of the air quality objectives within Oxford's AQMA.
- **Identify the reduction in pollutant emissions required** to attain the OCC NO_2 annual mean target within the AQMA, to determine the scale of effort likely to be require.

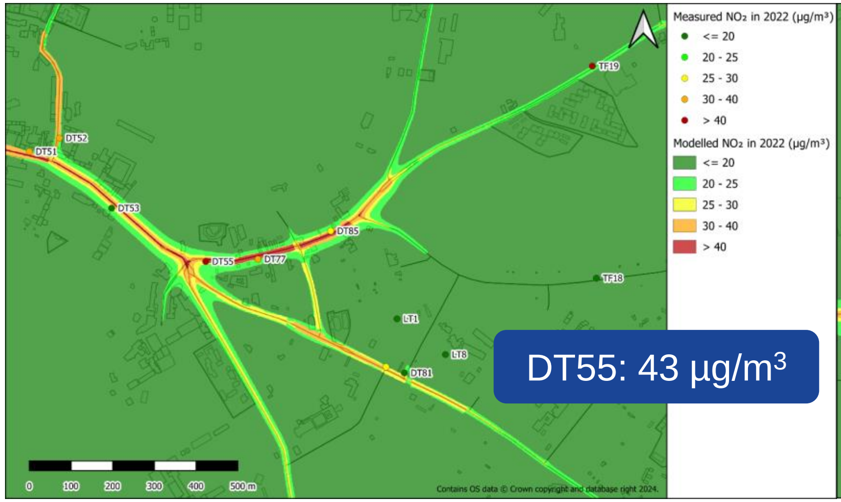


Source: Ricardo, [Oxford Source Apportionment Study | Oxford City Council]

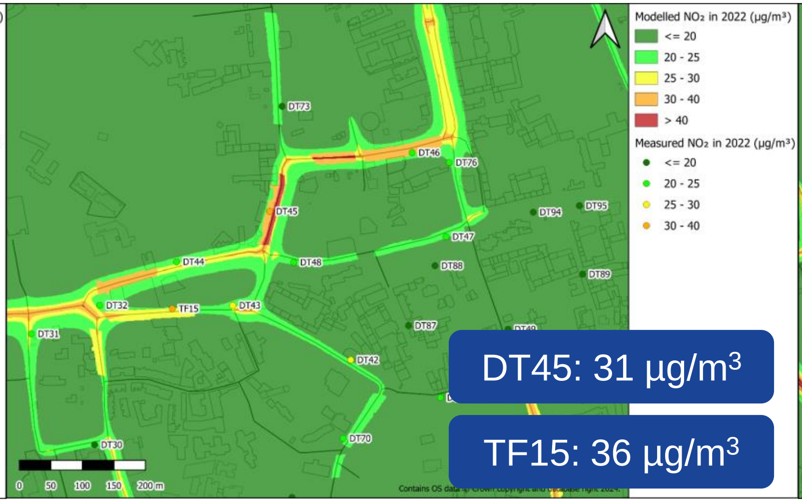
Oxford Source Apportionment – baseline air quality model



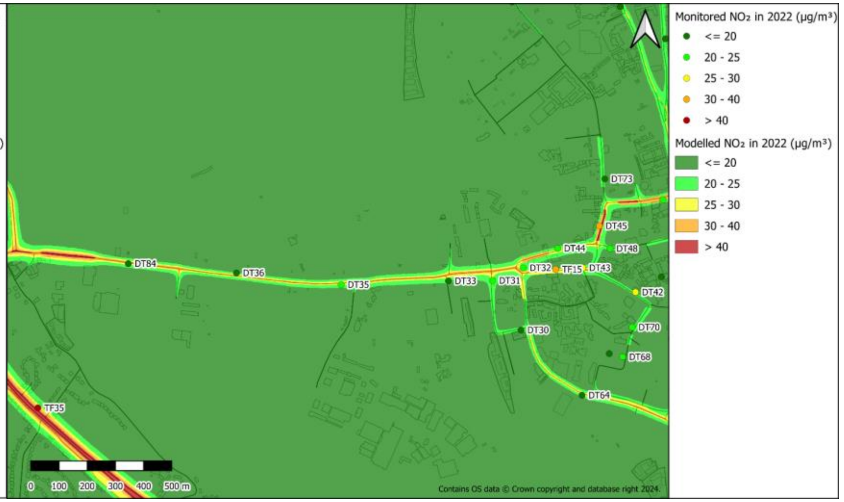
St Clements / The Plain



George Street / Park End Street / Worcester Street



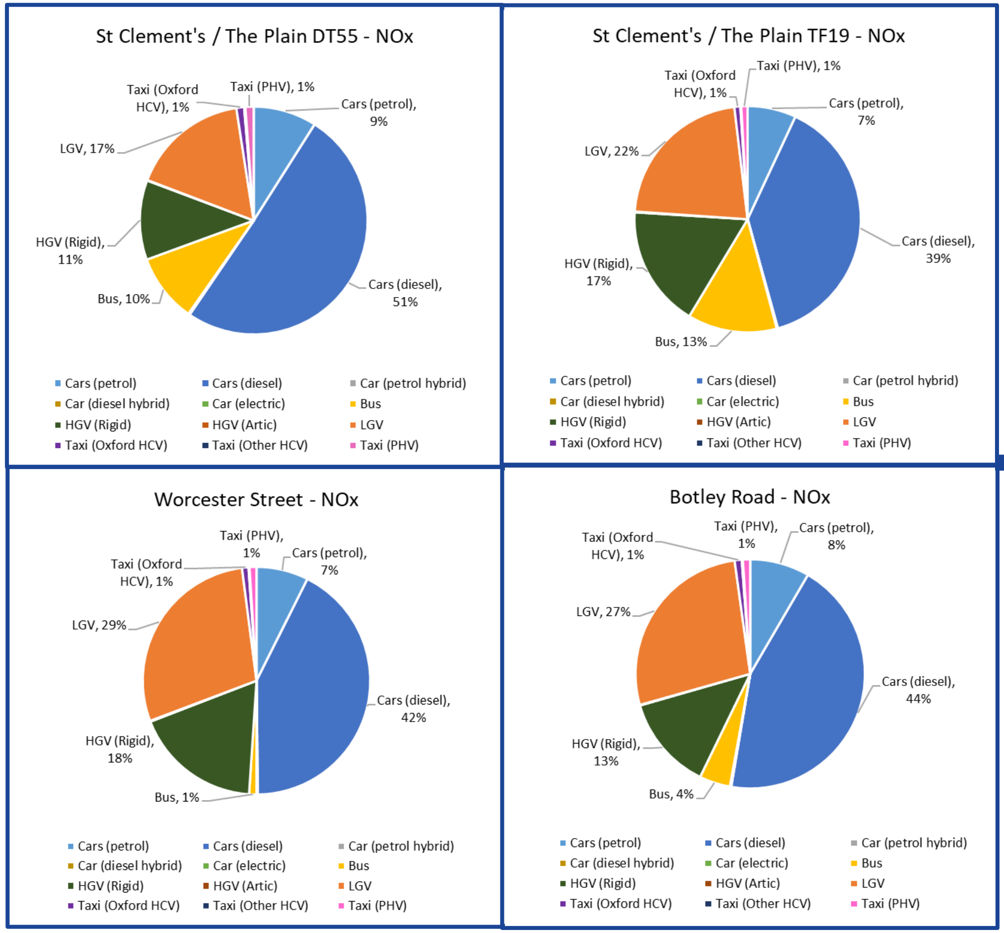
Botley Road



Source: Ricardo, [Oxford Source Apportionment Study | Oxford City Council]

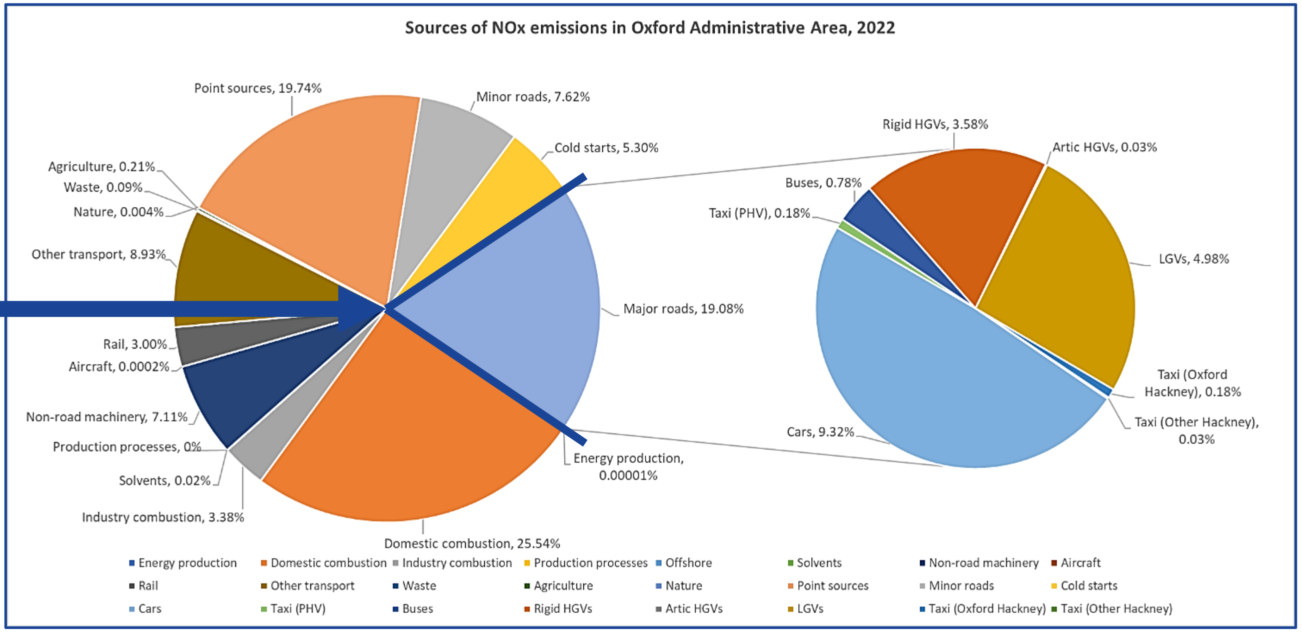
Oxford Source Apportionment – NOx emission sources

2022 baseline air quality model - NOx



Source: Ricardo, [Oxford Source Apportionment Study | Oxford City Council]

2022 National Atmospheric Emissions Inventory - NOx



Why focus on road emissions specifically?

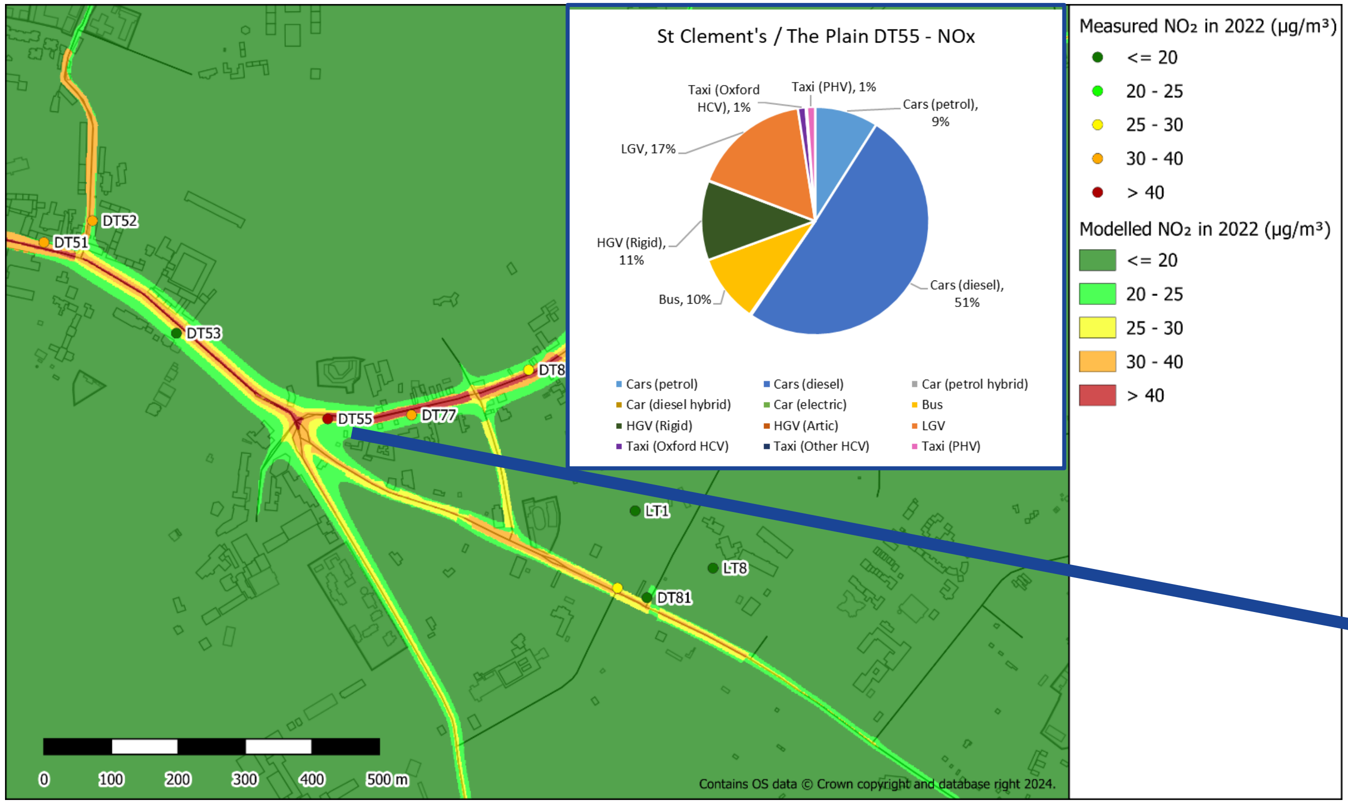
Context

Where are the exceedances?

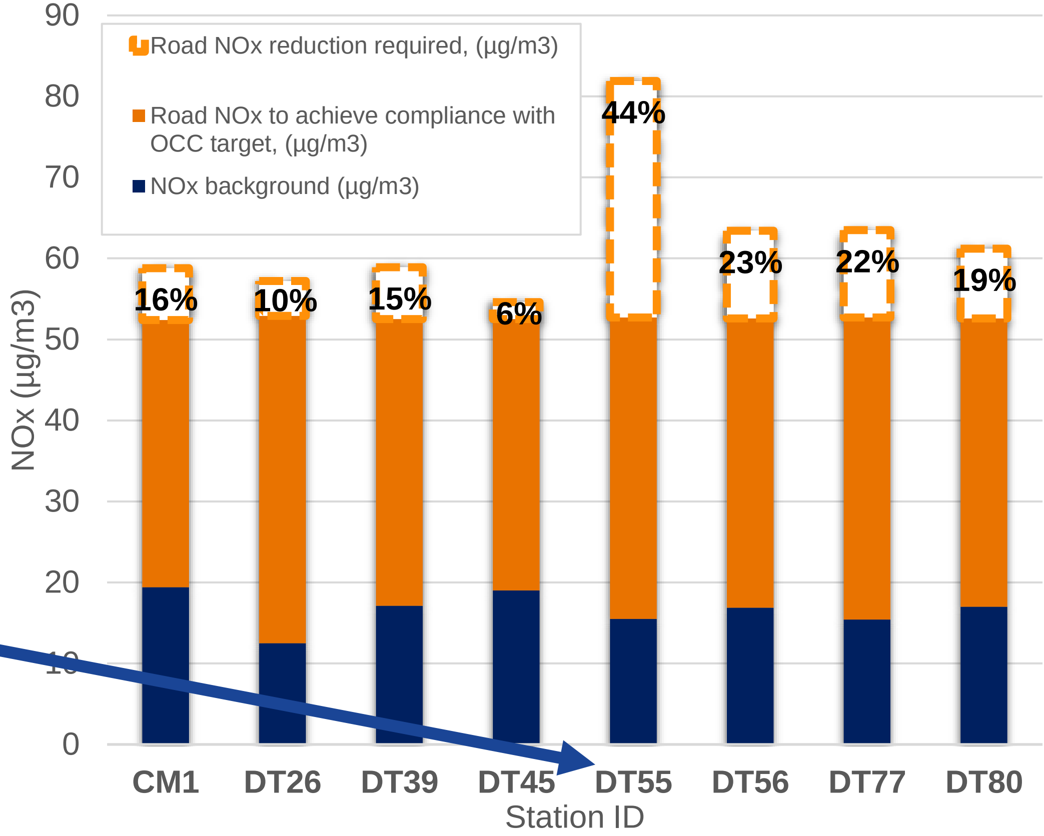
Where is the exposure?

Case Study – Oxford – effort required to meet NO_2 30 µg/m³ target

St Clements / The Plain



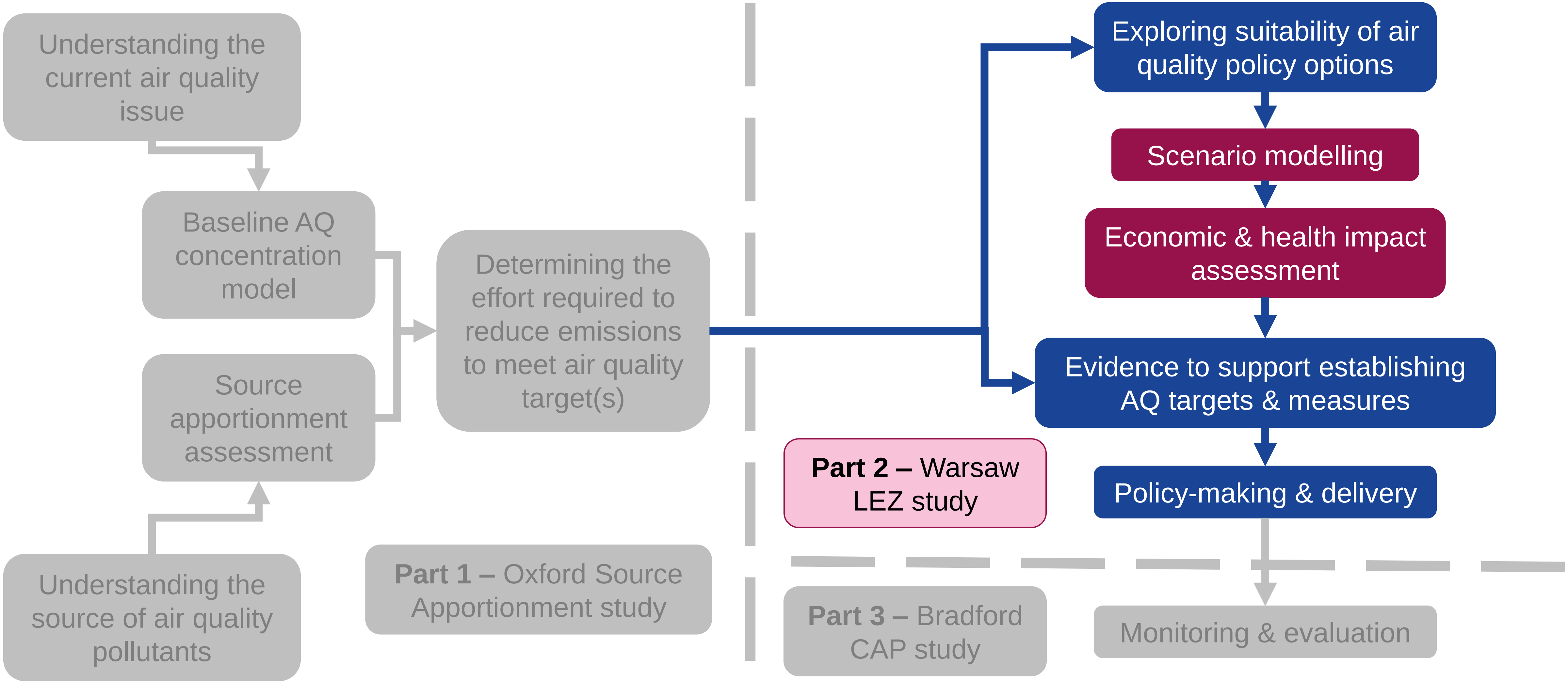
Source: Ricardo, [Oxford Source Apportionment Study | Oxford City Council]



Evidence to support mitigation measures

What next?

Using AQ modelling to support establishing AQ targets & measures



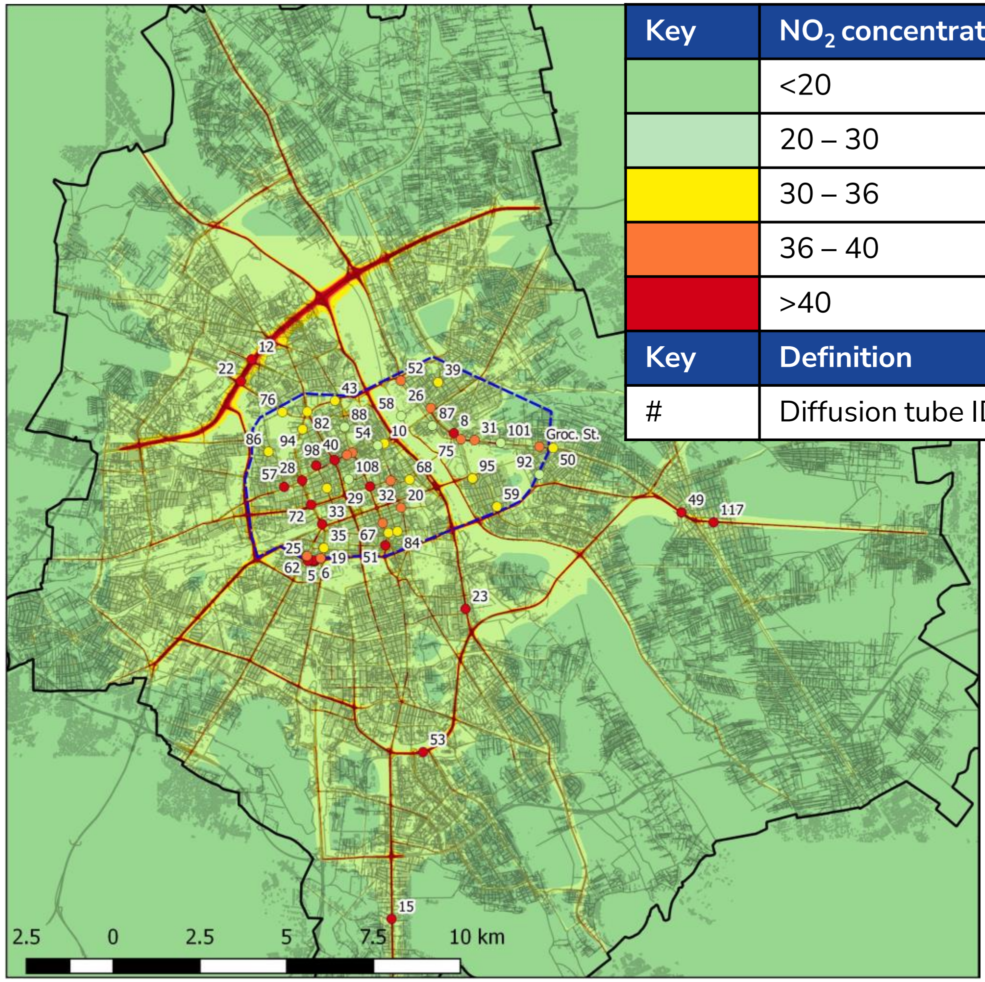
Case Study – Warsaw LEZ – Context & Aims

Context:

- Exceedances of EU annual mean limit value (40 µg/m³) in 2022 at one automatic monitoring station and widespread at diffusion tubes.
- Around 1,900 premature deaths in Warsaw annually are attributed to poor air quality.
- Warsaw has one of the highest car-ownership rates across Europe.

Aims:

- Estimate the potential NO_2, $PM_{2.5}$ and PM_{10} concentration reduction for four LEZ scenarios.
- Assess the **health and economic impacts** within Warsaw for each LEZ scenarios.



Key	NO_2 concentration (µg/m³)
	<20
	20 – 30
	30 – 36
	36 – 40
	>40
Key	**Definition**
#	Diffusion tube ID

Source: Ricardo, Delivering Warsaw's first Low Emission Zone

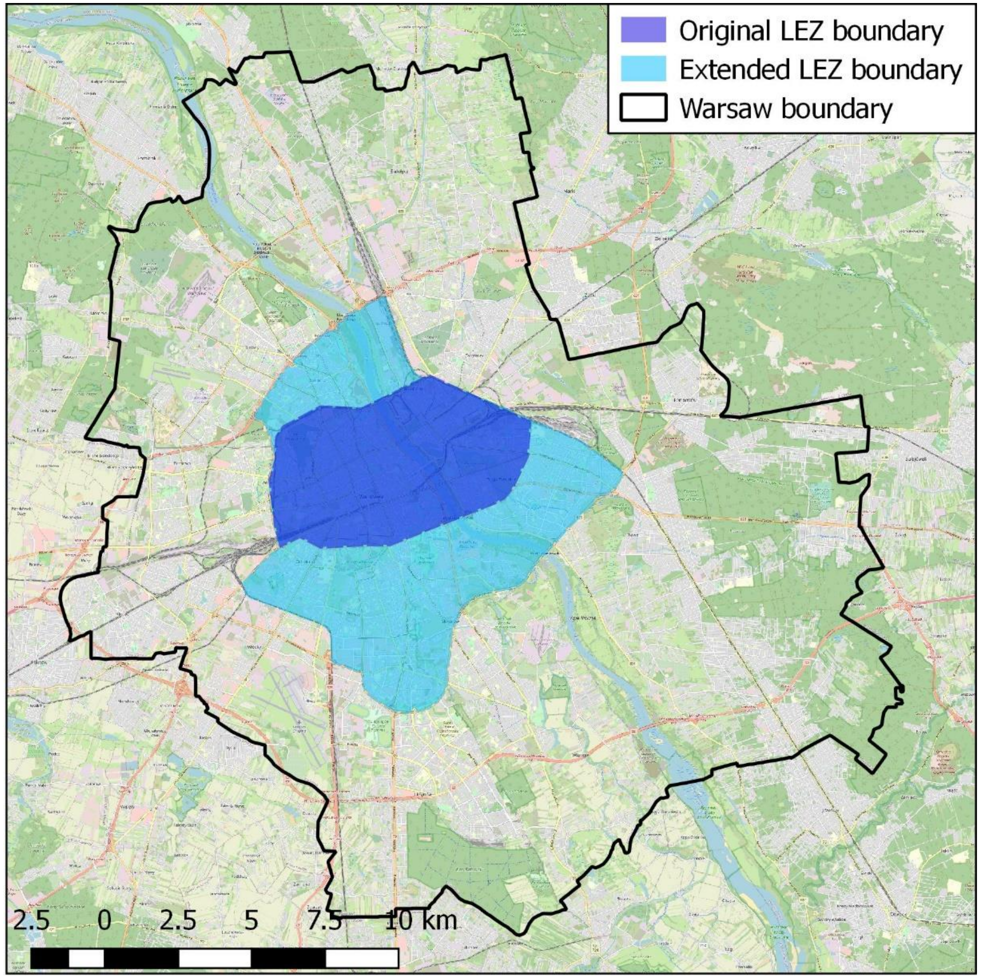
Case Study – Warsaw LEZ – Scenario Options

Scenarios

We have provided NO_2, PM_{10} and $PM_{2.5}$ annual mean concentration outputs for:

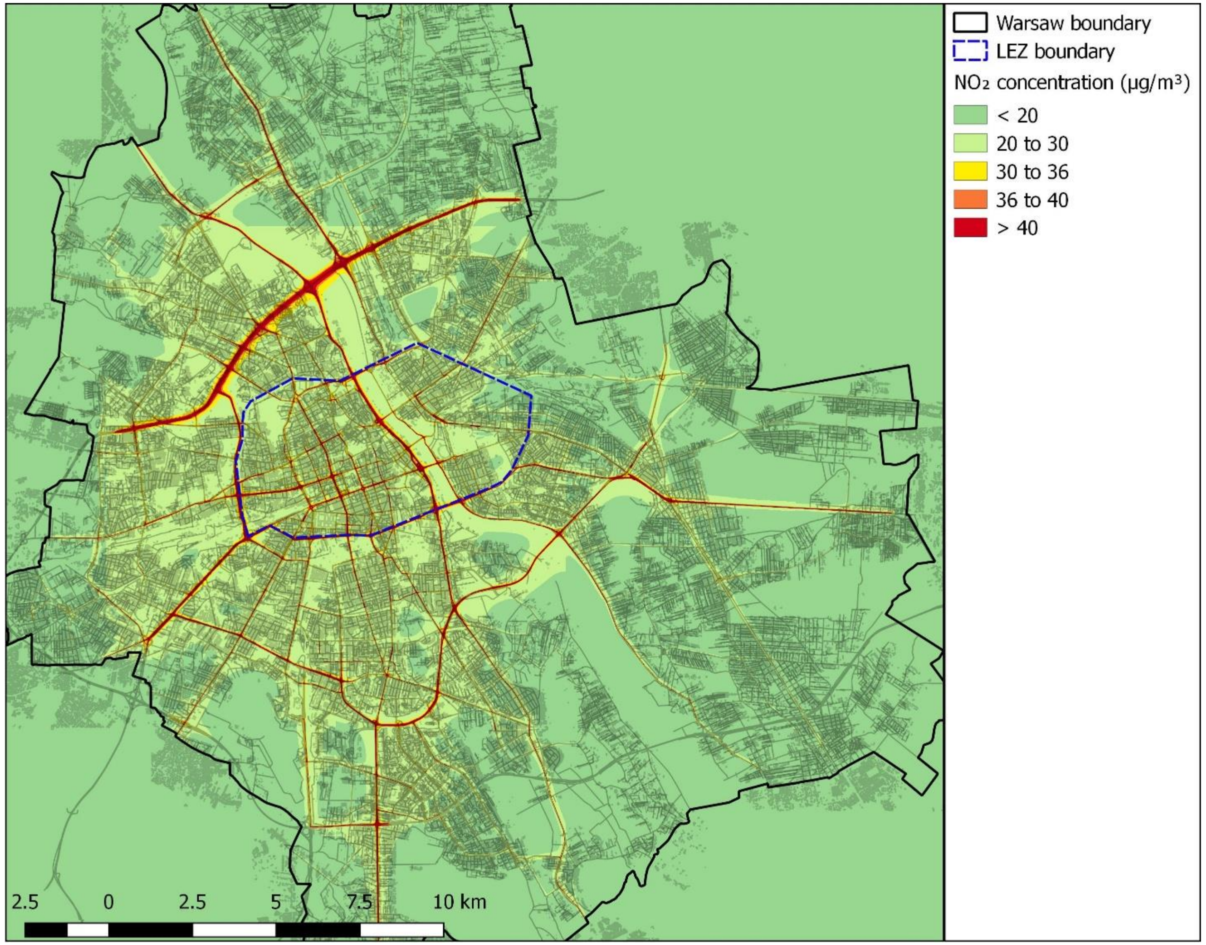
- **2019 base year** for model validation against monitored data
- **2026 Baseline** future scenario against which to compare the LEZ scenarios
- **2026 Phase 2** – Euro 3 Petrol, Euro 5 Diesel
- **2026 Phase 2A** (extended zone with exemptions) – Euro 3 Petrol, Euro 5 Diesel
- **2026 Phase 3** – Euro 4 Petrol, Euro 6 Diesel
- **2026 Phase 3A** (extended zone) – Euro 4 Petrol, Euro 6 Diesel

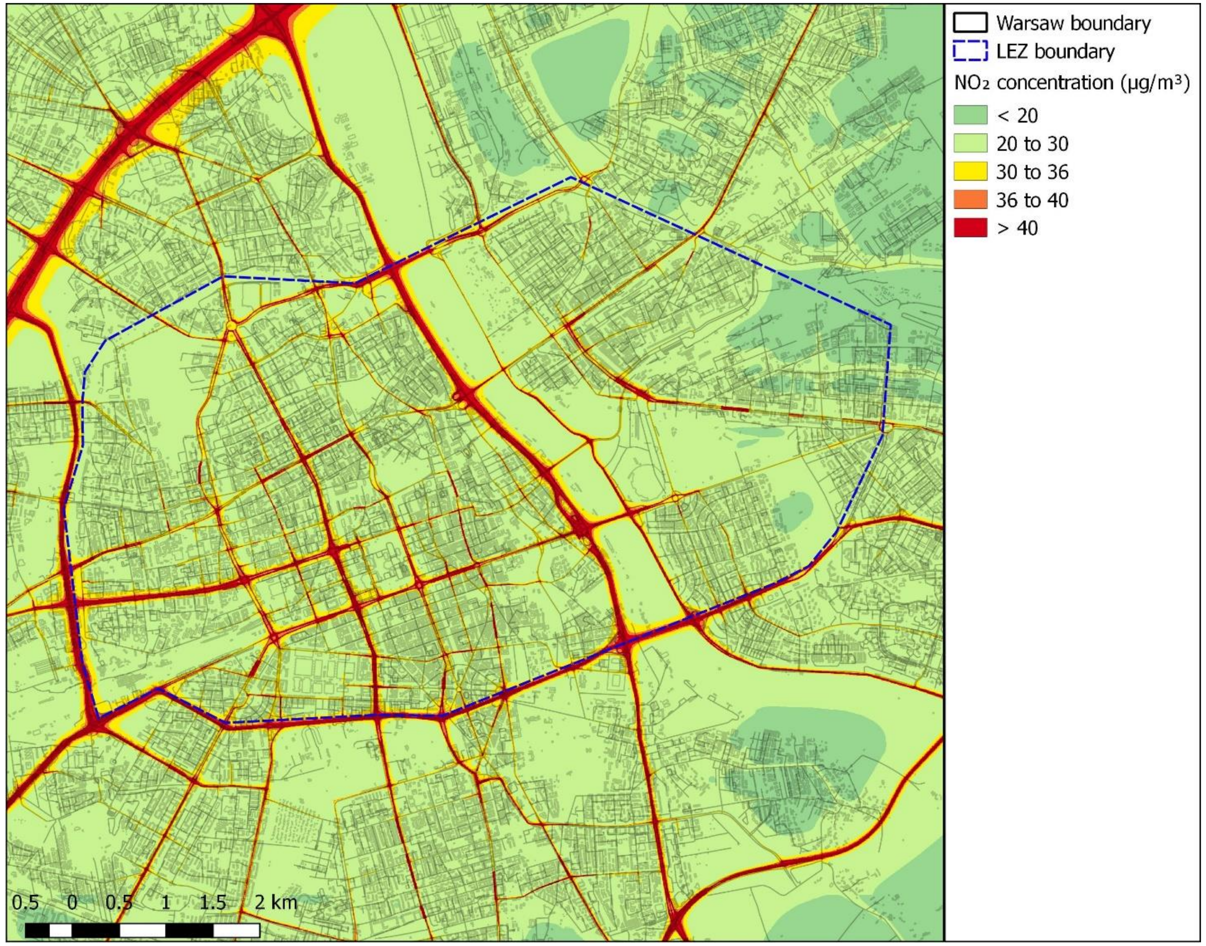
Phase	Minimum Euro Standard		Implementation Year	
-	Diesel	Petrol	Option 1	Option 2
1	Euro 4	Euro 2	2024	2024
2	**Euro 5**	**Euro 3**	**2026**	2025
3	**Euro 6**	**Euro 4**	2028	**2026**
4	Euro 6d	Euro 5	2030	2027
5	Euro 6d	Euro 6	2032	2028
6	Euro 7	Euro 6d	2034	2030
7	Euro 7	Euro 7	2035	2035
8	ZEV	ZEV	2038	2038



Source: Ricardo, Delivering Warsaw's first Low Emission Zone

Case Study – Warsaw LEZ – 2026 Baseline

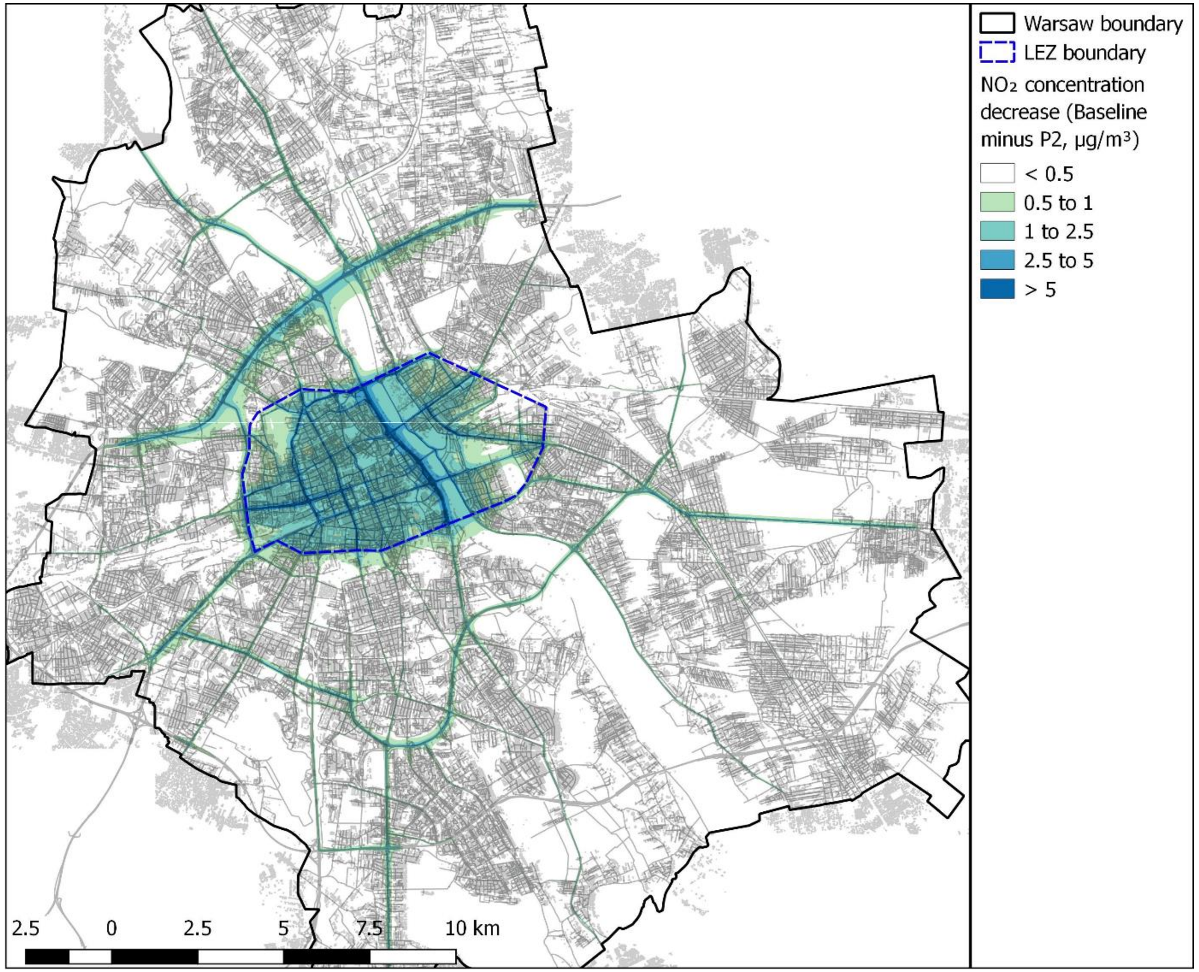




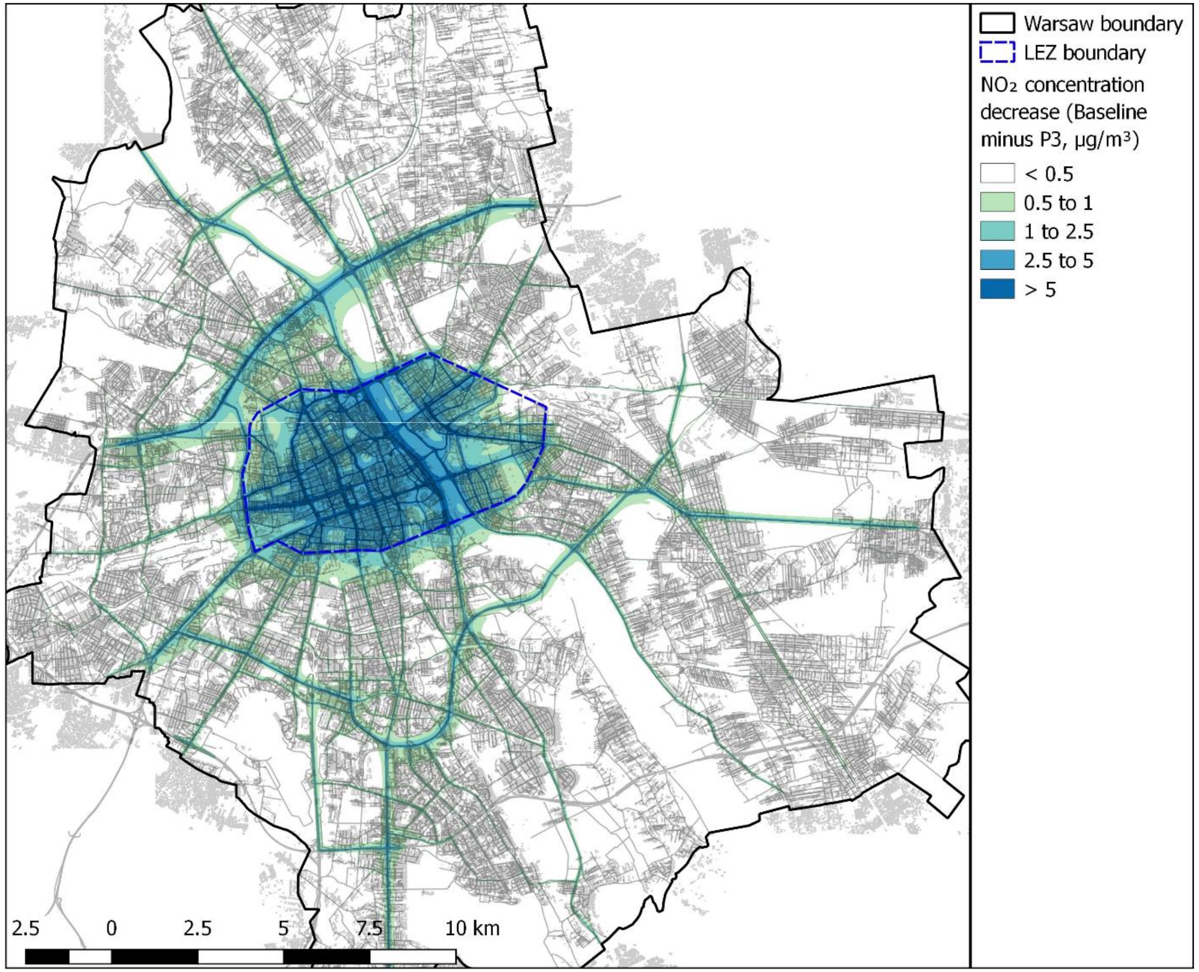
Source: Ricardo, [Delivering Warsaw's first Low Emission Zone]

Case Study – Warsaw LEZ – NO_2 concentration change from LEZ implementation

Phase 2 minus 2026 Baseline



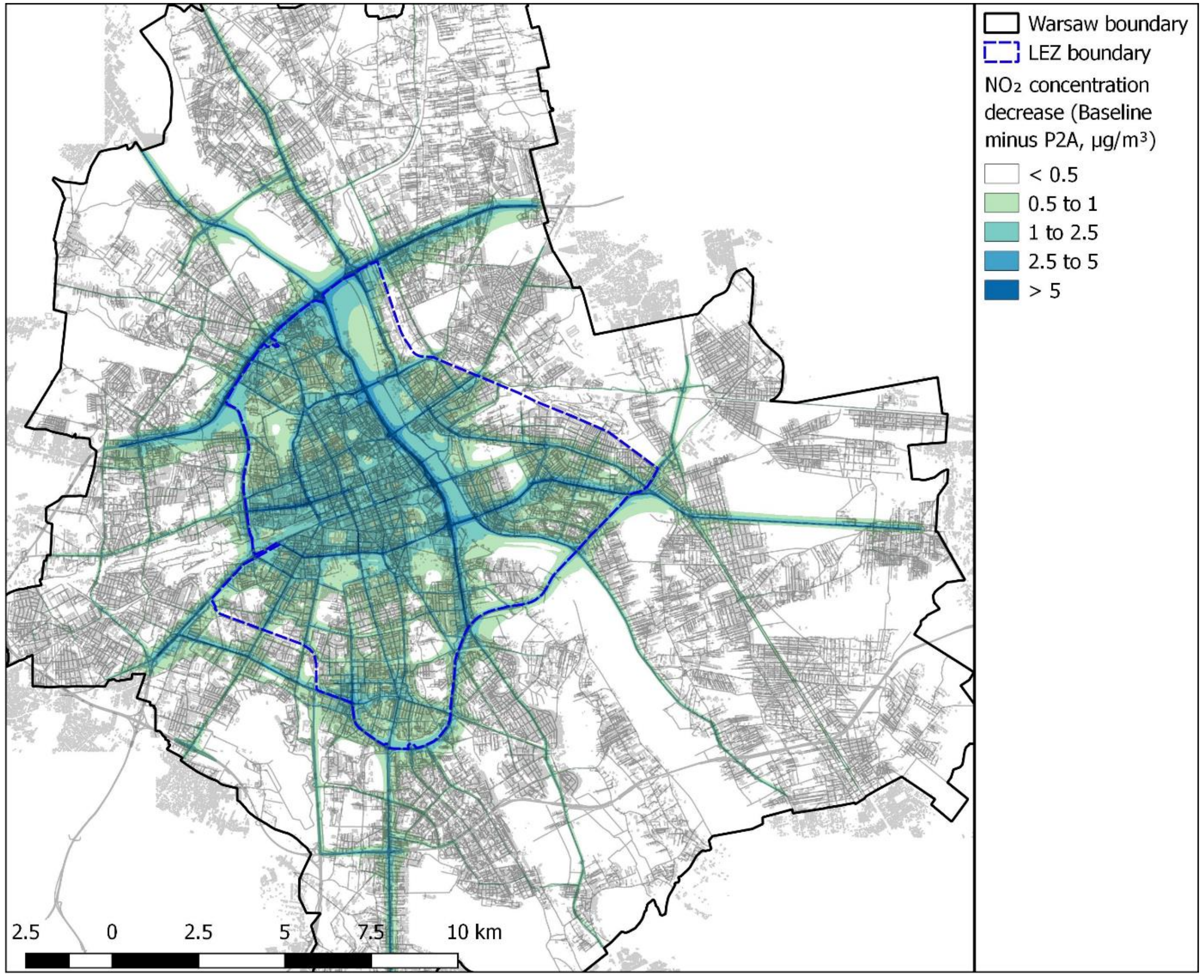
Phase 3 minus 2026 Baseline



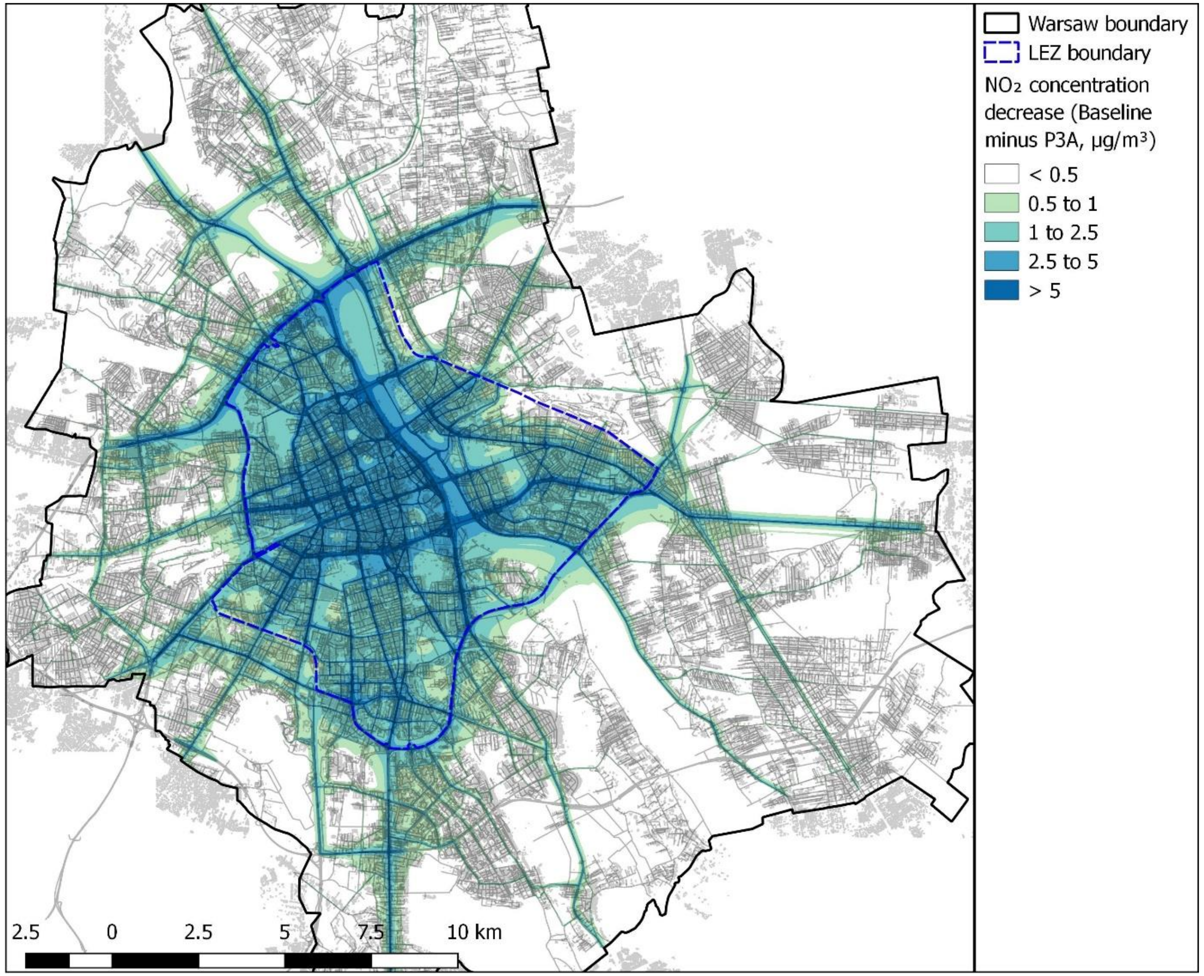
Source: Ricardo, Delivering Warsaw’s first Low Emission Zone

Case Study – Warsaw LEZ – NO_2 concentration change from LEZ implementation

Phase 2a minus 2026 Baseline



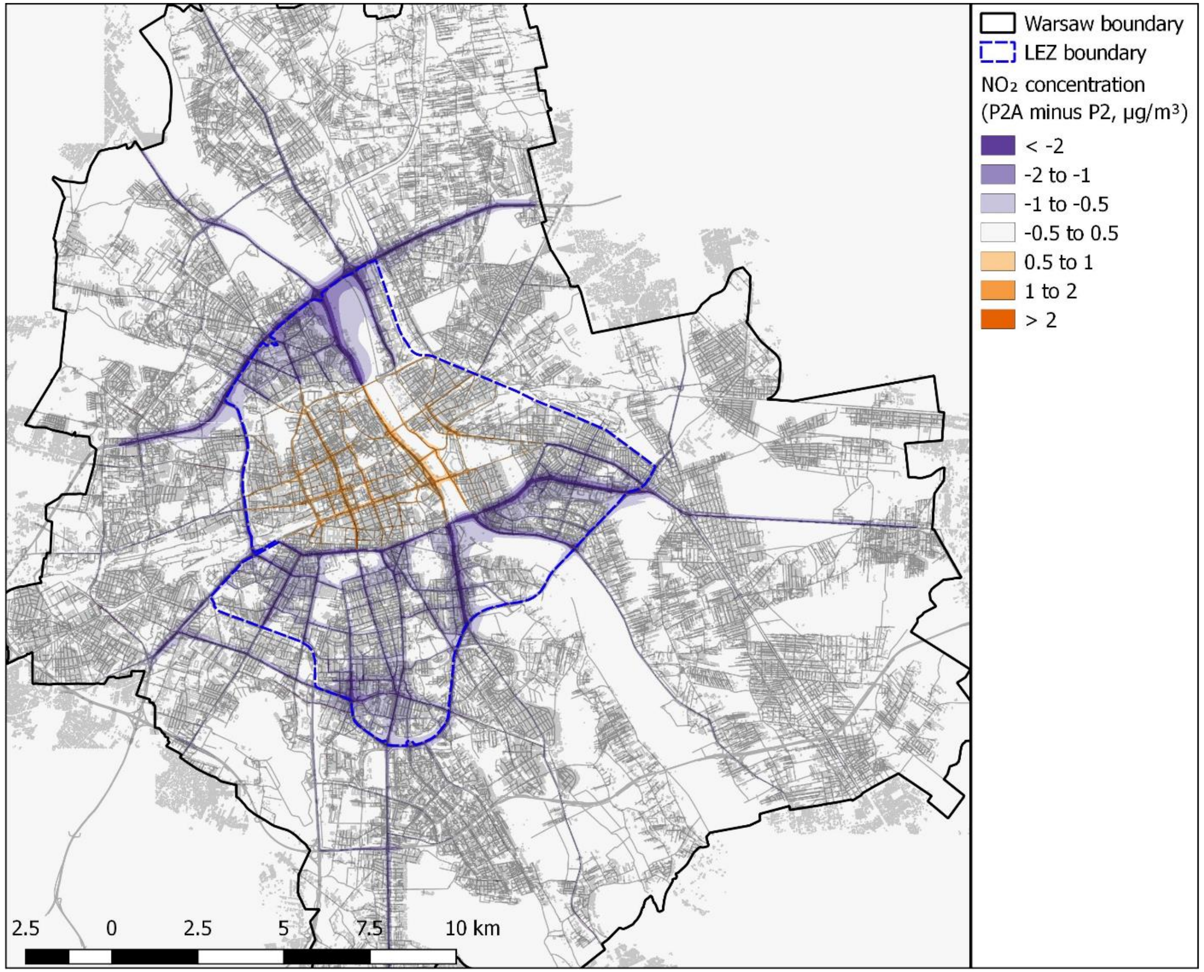
Phase 3a minus 2026 Baseline



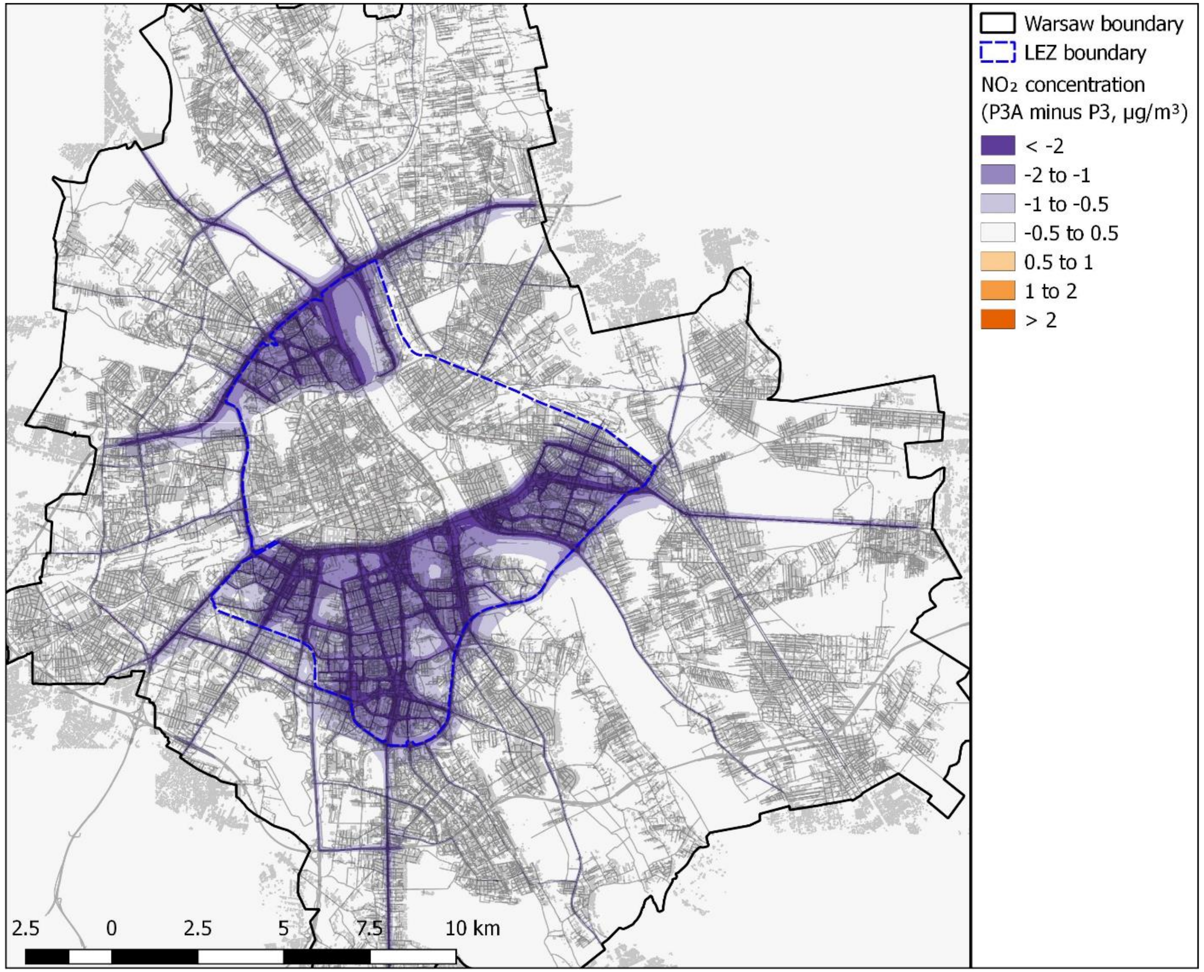
Source: Ricardo, Delivering Warsaw's first Low Emission Zone

Case Study – Warsaw LEZ – NO_2 concentration change from LEZ implementation

Phase 2a minus Phase 2



Phase 3a minus Phase 3



Source: Ricardo, Delivering Warsaw's first Low Emission Zone

Case Study – Warsaw LEZ – NO_2 concentration at monitoring sites

Site ID	Original location	Extended location	Modelled NO_2 concentration ($\mu g/m^3$)						
			2026 Baseline	2026 Phase 2A	Phase 2A – Baseline	Phase 2A – Baseline (% of Baseline)	2026 Phase 3A	Phase 3A – Baseline	Phase 3A – Baseline (% of Baseline)
DT_28	LEZ	LEZ	52.37	45.02	-7.35	-14.03%	36.55	-15.82	-30.21%
DT_29	LEZ	LEZ	46.69	41.68	-5.01	-10.73%	33.73	-12.96	-27.76%
DT_98	LEZ	LEZ	45.68	42.18	-3.50	-7.66%	34.66	-11.02	-24.12%
DT_33	LEZ	LEZ	44.57	39.74	-4.83	-10.84%	33.01	-11.56	-25.94%
DT_8	LEZ	LEZ	44.08	39.12	-4.96	-11.25%	31.39	-12.69	-28.79%
DT_51	LEZ	LEZ	44.98	41.26	-3.72	-8.27%	31.32	-13.66	-30.37%
DT_40	LEZ	LEZ	44.27	40.75	-3.52	-7.95%	33.47	-10.80	-24.40%
DT_72	LEZ	LEZ	42.54	36.06	-6.48	-15.23%	29.99	-12.55	-29.50%
DT_57	LEZ	LEZ	42.13	38.42	-3.71	-8.81%	32.27	-9.86	-23.40%
DT_26	LEZ	LEZ	39.54	35.10	-4.44	-11.23%	28.11	-11.43	-28.91%
DT_32	LEZ	LEZ	39.49	35.68	-3.81	-9.65%	28.53	-10.96	-27.75%
DT_64	LEZ	LEZ	38.57	34.73	-3.84	-9.96%	28.44	-10.13	-26.26%
DT_55	LEZ	LEZ	38.91	35.75	-3.16	-8.12%	29.94	-8.97	-23.05%
DT_62	LEZ	LEZ	38.86	35.72	-3.14	-8.08%	29.92	-8.94	-23.01%
DT_75	LEZ	LEZ	38.59	35.24	-3.35	-8.68%	28.56	-10.03	-25.99%
DT_20	LEZ	LEZ	39.34	36.58	-2.76	-7.02%	28.07	-11.27	-28.65%
DT_31	LEZ	LEZ	37.29	32.88	-4.41	-11.83%	27.37	-9.92	-26.60%
DT_52	LEZ	LEZ	37.09	32.50	-4.59	-12.38%	27.01	-10.08	-27.18%
244A Grochowska Street	**LEZ**	**LEZ**	36.27	30.66	-5.61	-15.47%	25.90	-10.37	-28.59%
DT_67	LEZ	LEZ	36.12	33.39	-2.73	-7.56%	27.23	-8.89	-24.61%
DT_43	LEZ	LEZ	35.49	31.28	-4.21	-11.86%	27.09	-8.40	-23.67%
DT_39	LEZ	LEZ	35.05	32.68	-2.37	-6.76%	27.27	-7.78	-22.20%
DT_95	LEZ	LEZ	35.10	32.21	-2.89	-8.23%	26.47	-8.63	-24.59%
83/89 Solidarności Street	**LEZ**	**LEZ**	38.23	35.50	-2.73	-7.14%	29.69	-8.54	-22.34%
DT_86	LEZ	LEZ	34.83	32.63	-2.20	-6.32%	28.65	-6.18	-17.74%

Source: Ricardo, [Delivering Warsaw's first Low Emission Zone]

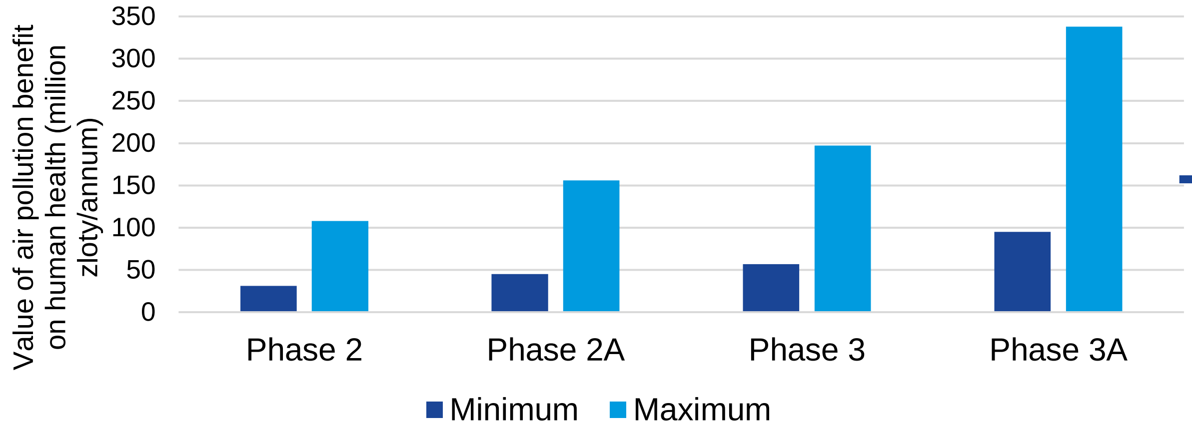
Case Study – Warsaw LEZ – health & economic impact assessment

Air quality pollutant concentrations

Population distribution & health data

Health Impact Assessment

- Mortality rates
- Life expectancy
- Lung cancer
- Restricted activity days
- Emergency hospital admissions (respiratory/cardio-vascular)
- Work-days lost
- Strokes



Cost-benefit analysis

	Results (Million zloty)	Smaller zone		Extended zone	
		Phase 2	*Phase 3*	Phase 2A	Phase 3A
Savings	Health impacts	*793*	*1,430*	*1,140*	*2,460*
	Change in fuel use	*1,260*	*2,121*	*2,180*	*3,880*
	Change in non-fuel vehicle operating costs	*240*	*297*	*439*	*543*
	GHG Emissions	*201*	*335*	*346*	*612*
Costs	Vehicle upgrade costs	*-753*	*-1,087*	*-1,330*	*-1,990*
	Residual value of scrapped vehicles	*-14.9*	*-48.2*	*-23.6*	*-88.3*
	Welfare impacts of cancelled trips	*-28.9*	*-59.4*	*-33.1*	*-81.5*
	Change in travel time	*-50*	*-102*	*-59.6*	*-136*
	Implementation costs	*-10.8*	*-10.8*	*-19.7*	*-19.7*
Benefit:Cost ratio		***2.91***	***3.20***	***2.80***	***3.24***
Net present value		***1,630***	***2,880***	***2,640***	***5,180***

Source: Ricardo, Delivering Warsaw's first Low Emission Zone

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Case Study – Warsaw LEZ – Mentimeter question

Which Warsaw LEZ design do you think was selected for implementation?

- **#1** – Phase 2 (**less-strict** EURO class requirements, **original** LEZ boundary)
- **#2** – Phase 3 (**stricter** EURO class requirements, **original** LEZ boundary)
- **#3** – Phase 2A (**less-strict** EURO class requirements, **larger** LEZ boundary, exemptions for residents)
- **#4** – Phase 3A (**stricter** EURO class requirements, **larger** LEZ boundary)
- **#5** – Something more ambitious than Phase 3A
- **#6** – Something less ambitious than Phase 2
- **#7** – City of Warsaw decided to not implement a LEZ in the end

Case Study – Warsaw LEZ – policy-making & delivery

Answer #6

Source: City of Warsaw, [Clean Transport Zone in Warsaw - Transport]

Exploring suitability of air quality policy options

Scenario modelling

Economic & health impact assessment

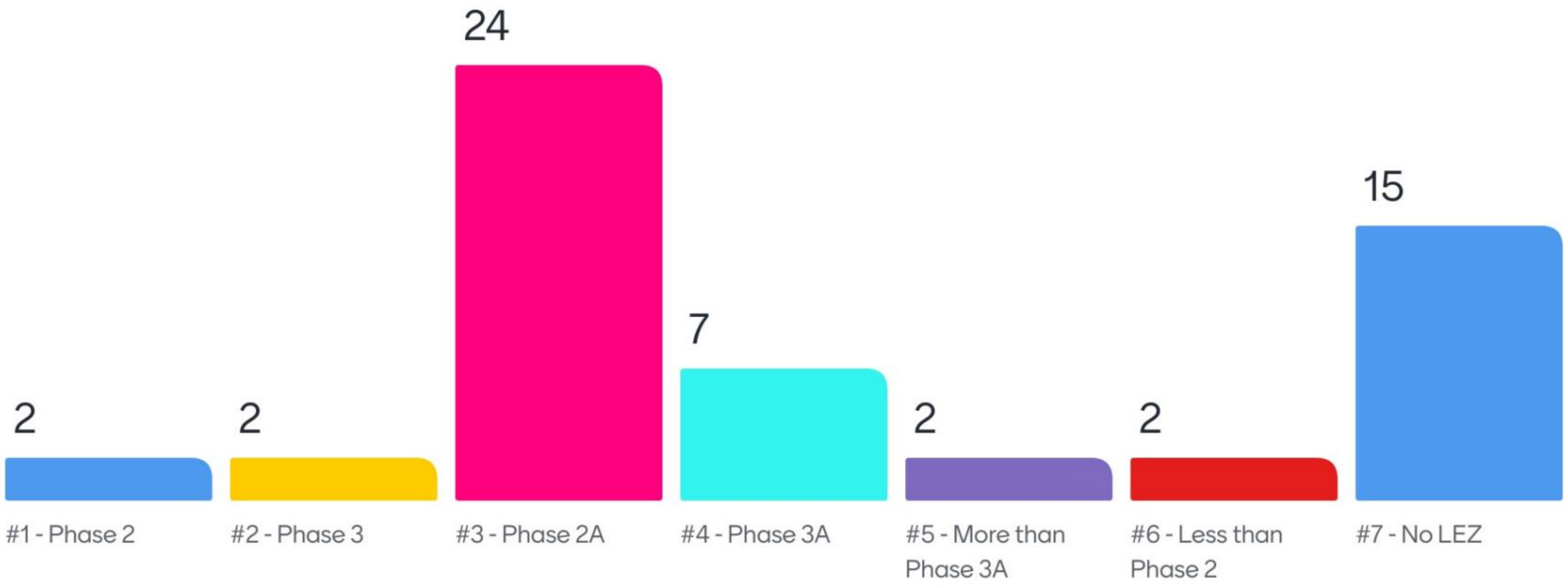
Evidence to support establishing AQ targets & measures

Public & stakeholder consultation

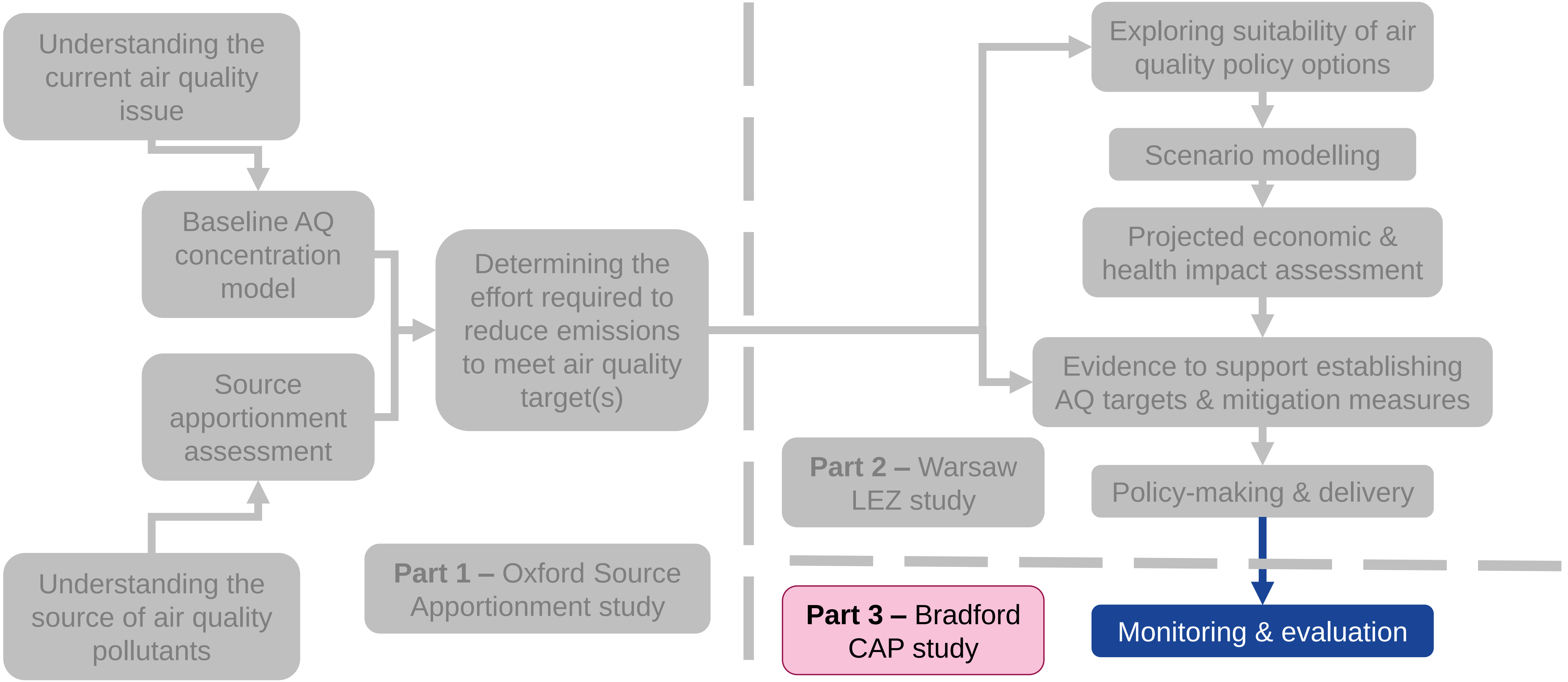
Policy-making & delivery

- Warsaw LEZ implemented in July 2024 covering 37 km^2
- Exemptions for residents in the zone until 2026, and indefinitely for senior & disabled citizens

Which Warsaw LEZ design do you think was selected for implementation?



Using AQ modelling to support establishing AQ targets & measures



  May 2025

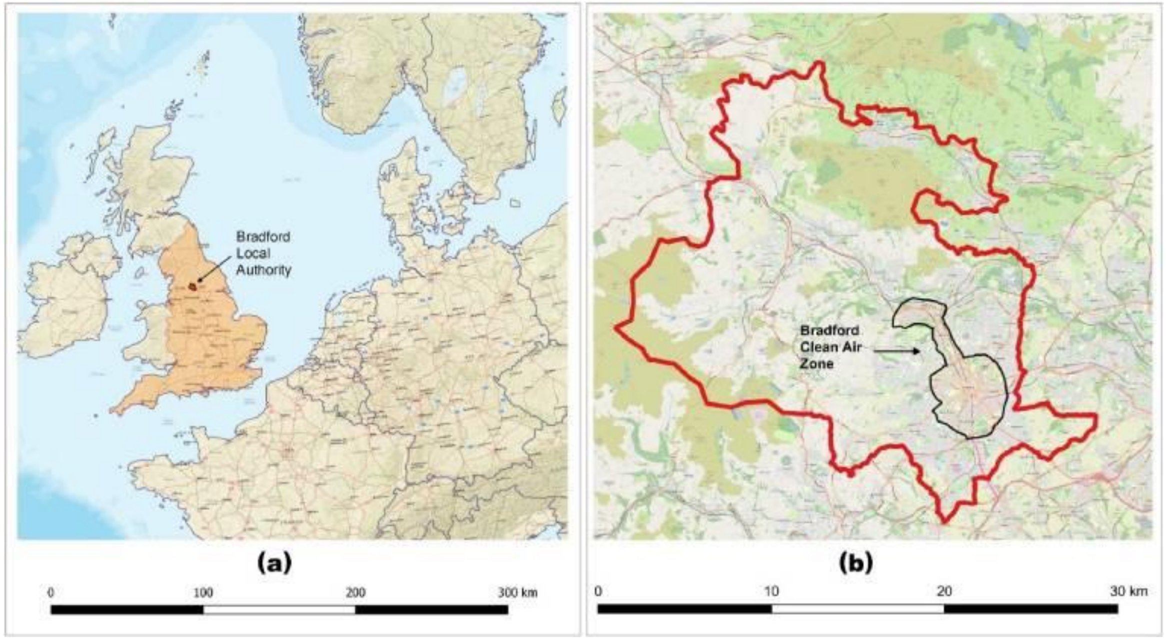
Case Study – City of Bradford – Clean Air Plan impacts

Context:

- City of Bradford Metropolitan District Council implemented a Clean Air Zone in September 2022 as part of its Clean Air Plan from Oct 2021.
- The Bradford CAZ applies to buses, coaches, LGVs, HGVs and taxis.
- Study compared primary care visits, emergency visits and air quality of a baseline (Jan 2018 – Feb 2020) and CAP implementation period (Oct 2021 – Sep 2023).

Findings:

- Average annual mean NO_2 decreased by 2.4 µg/m^3 per year since the implementation of the Clean Air Plan.
- £38.5k monthly cost reduction in primary and emergency healthcare visits attributable to the Clean Air Plan.
- 24-month period only included first year of CAZ implementation.
- Conditions related to long-term exposure may take longer to emerge.

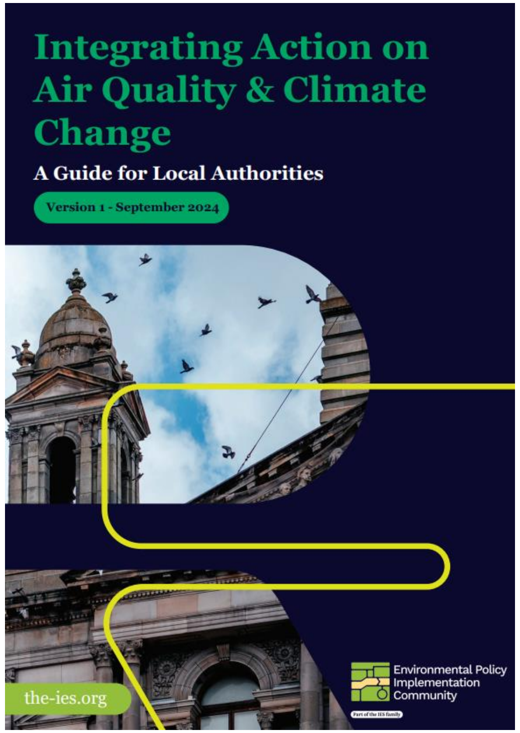


Source: Mebrahtu et. al,, 2025. Impact of an urban city-wide Bradford clean air plan on health service use and nitrogen dioxide 24 months after implementation: An interrupted time series analysis (Fig. 1)

Some useful resources for air quality measures

Clean Air Fund

Clean Air Zones:
Practical guidance for cities



Environmental Policy Implementation Community

Integrating Action on Air Quality &
Climate Change

Any Questions?

Email: jekabs.jursins@ricardo.com

LinkedIn: https://www.linkedin.com/in/jekabs-jursins/

‘A day in the life’; LSO calibrations, QA/QC audits and fieldwork challenges

Alfie Nash: Ricardo

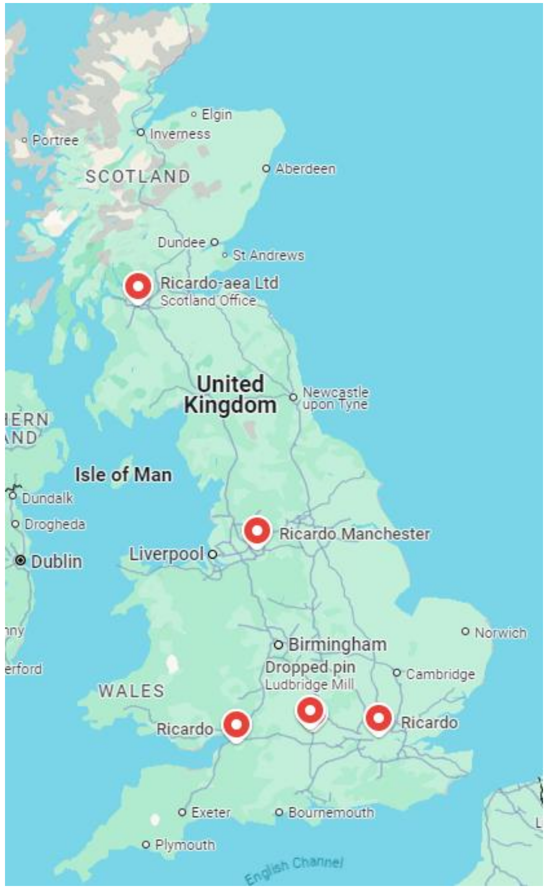
The Ricardo Air Quality Field Team

Where are we?

- Harwell (Didcot)
- Manchester ☼
- Glasgow
- London & Bristol (mainly LSO support)

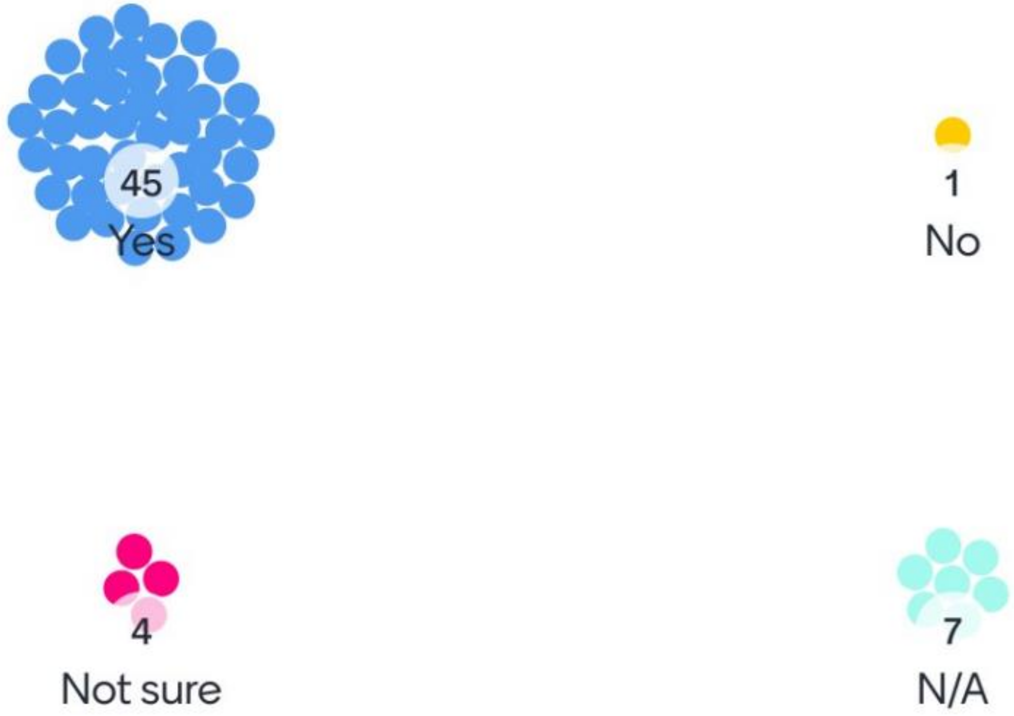
What do we do?

- Various local site operator (LSO) duties: calibrations, diffusion tube changes, benzene tube changes, PAH filter changes.
- QA/QC audits on automatic and non-automatic monitoring stations
- Comms – installations, data collection and data management
- Other work: industrial monitoring, remote sensing/point sampling, international work…



Poll: Are LSO calibrations carried out at your monitoring stations?

Are routine LSO calibrations currently carried out at your AQMS location/s?



LSO calibrations & routine site visits – why are they needed?

Gases:

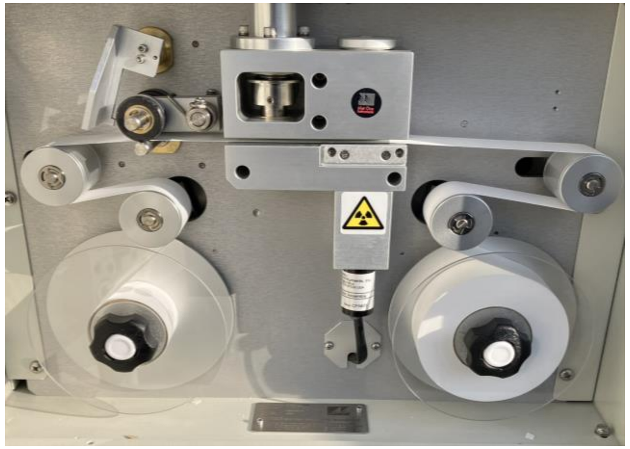
- Retrospective data scaling using the zero and span response.
- Changing filters for optimal analyser operation.

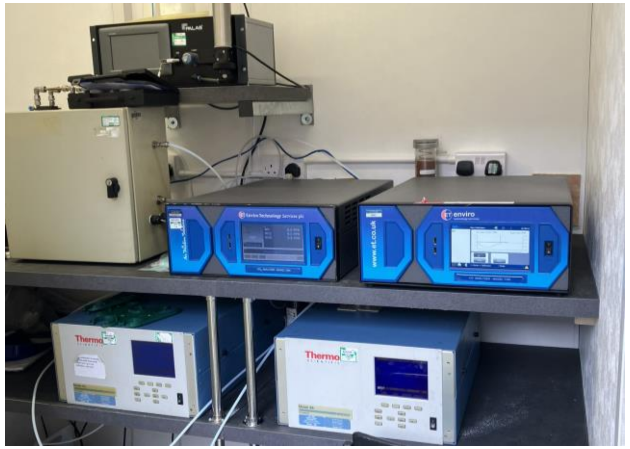
Particulates:

- Leak checks (e.g. BAM analysers).
- Filters / tape changes.

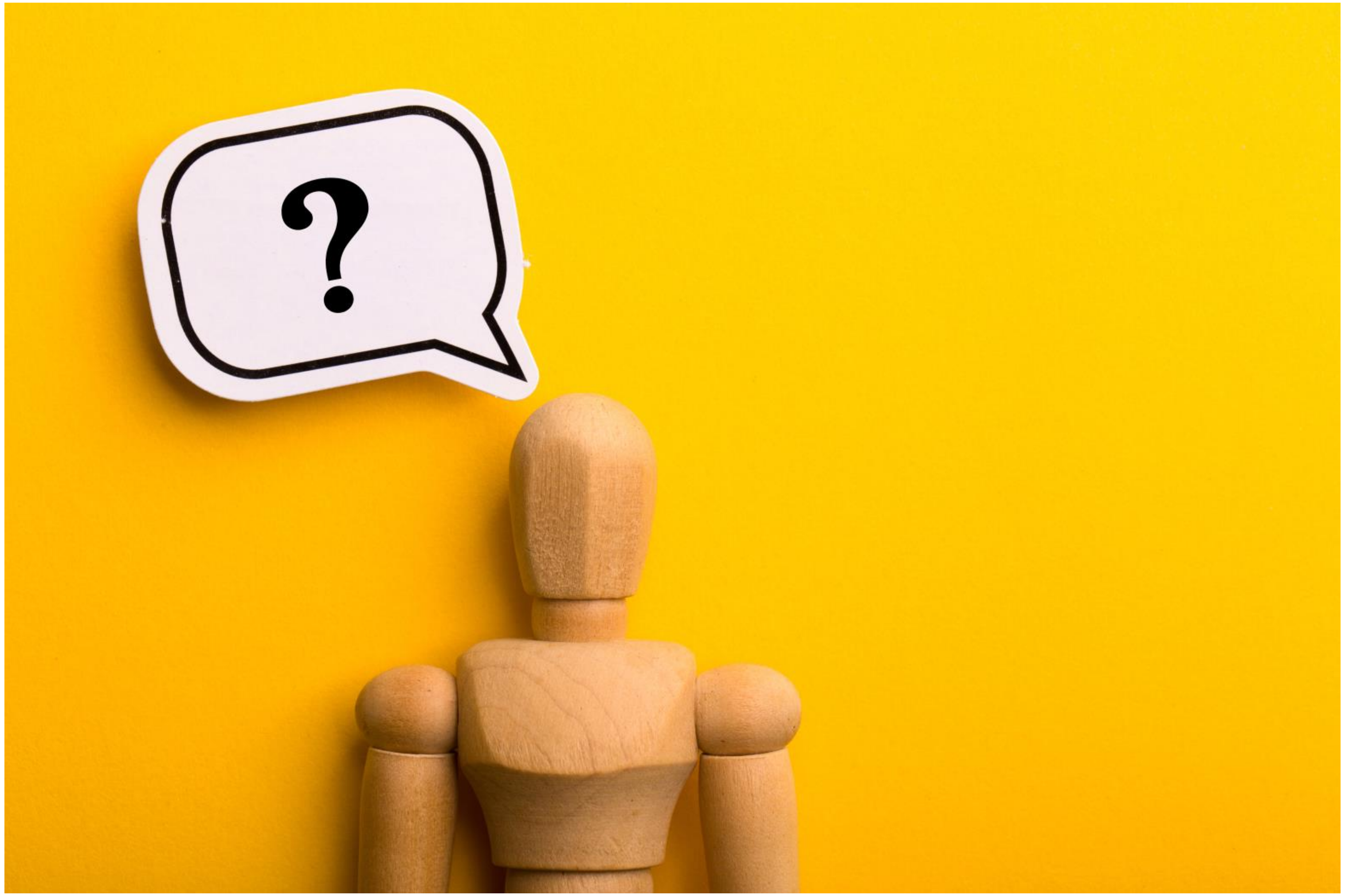
Site:

- Instrument faults (e.g. aircon issues)
- Site infrastructure.
- Changes in the ambient environment.

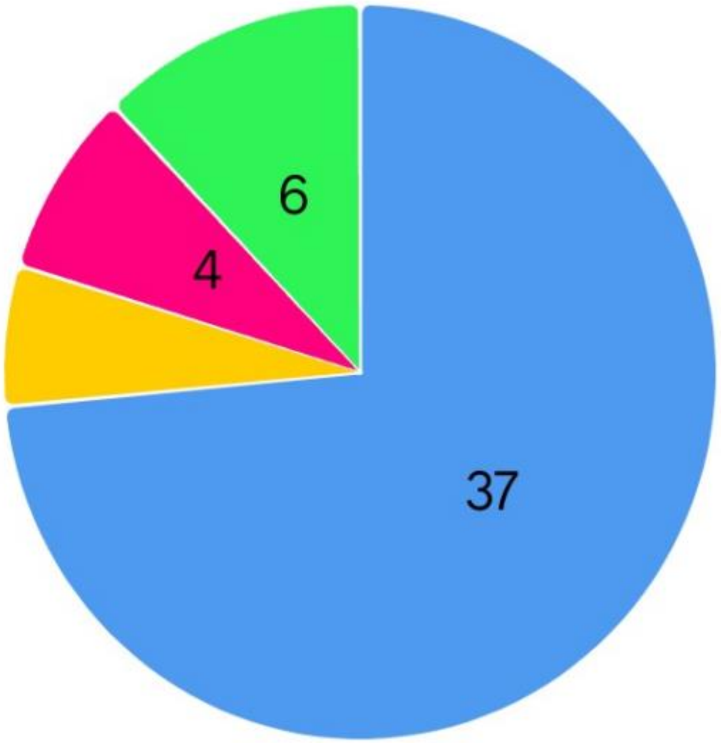




Poll: Are Ricardo QAQC audits carried out at your monitoring stations?



Do you currently undertake Ricardo QA/QC Audits at your automatic AQMS location/s?



37	Yes
3	No
4	Not sure
6	N/A - No automatic AQMS

What is a QA/QC Audit?

A “performance check” of monitoring equipment.

Gases:

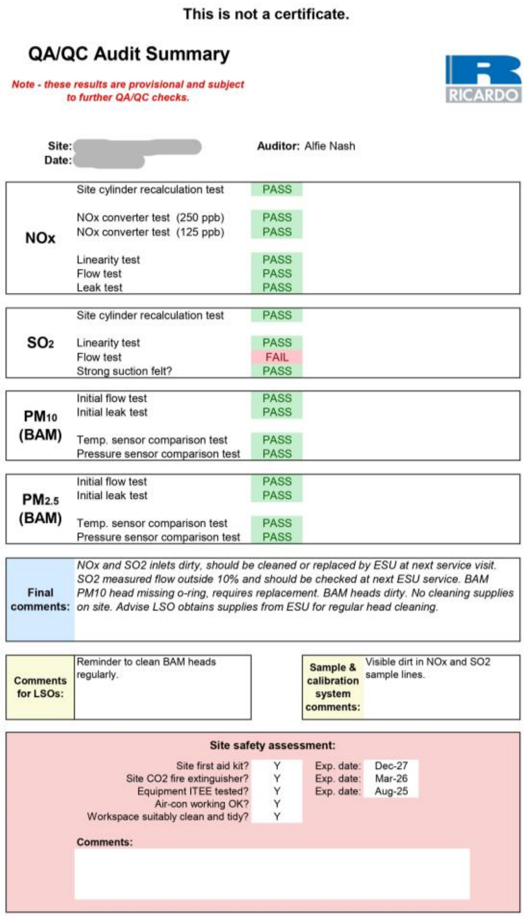
- Site cylinder recalculation tests
- Site calibration system integrity checks
- Site zero comparison tests
- Linearity tests
- Flow and leak tests (where applicable)
- Direct NO_2 response test (NO_x analysers only)
- NO_2 converter tests (NO_x analysers only).

Site:

- H&S risk assessments
- Inlet measurements (LAQM TG22/LLAQM TG19).

Particulates:

- Flow tests
- Leak tests (where applicable)
- Sample system checks (e.g. PM sampling head cleanliness)
- Ambient temperature/pressure sensor tests
- K0 tests (TEOM / FDMS analysers only).



This is not a certificate.

QA/QC Audit Summary

Note - these results are provisional and subject to further QA/QC checks.

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Site: [redacted]
Date: [redacted]
Auditor: Alfie Nash

NOx	Site cylinder recalculation test	PASS
	NOx converter test (250 ppb)	PASS
	NOx converter test (125 ppb)	PASS
	Linearity test	PASS
	Flow test	PASS
	Leak test	PASS
SO_2	Site cylinder recalculation test	PASS
	Linearity test	PASS
	Flow test	FAIL
	Strong suction felt?	PASS
PM_{10} (BAM)	Initial flow test	PASS
	Initial leak test	PASS
	Temp. sensor comparison test	PASS
	Pressure sensor comparison test	PASS
$PM_{2.5}$ (BAM)	Initial flow test	PASS
	Initial leak test	PASS
	Temp. sensor comparison test	PASS
	Pressure sensor comparison test	PASS

Final comments: *NOx and SO2 inlets dirty, should be cleaned or replaced by ESU at next service visit. SO2 measured flow outside 10% and should be checked at next ESU service. BAM PM10 head missing o-ring, requires replacement. BAM heads dirty. No cleaning supplies on site. Advise LSO obtains supplies from ESU for regular head cleaning.*

Comments for LSOs: Reminder to clean BAM heads regularly.

Sample & calibration system comments: Visible dirt in NOx and SO2 sample lines.

Site safety assessment:

Site first aid kit?	Y	Exp. date:	Dec-27
Site CO2 fire extinguisher?	Y	Exp. date:	Mar-26
Equipment ITEE tested?	Y	Exp. date:	Aug-25
Air-con working OK?	Y		
Workspace suitably clean and tidy?	Y		

Comments:

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Some notes on best practice:

LSO calibrations:

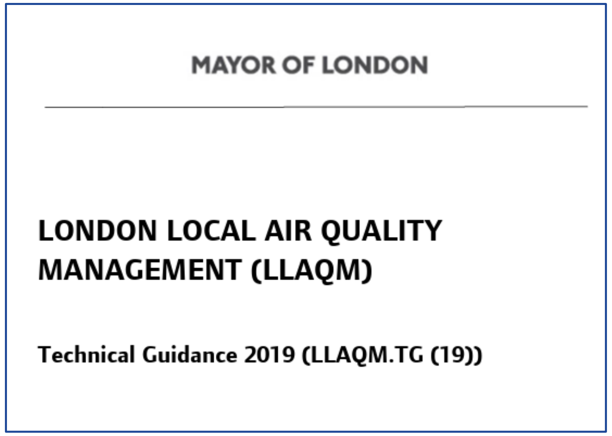
- Carried out 2-weekly for roadside locations or sites where high concentrations are known.
- Carried out 4-weekly at other site locations.

QA/QC audits:

- Carried out every 6-months.

ESU services:

- Carried out every 6-months**,** within 3 weeks of the audit.
- Strongly recommended to be done **after** the audit has taken place!

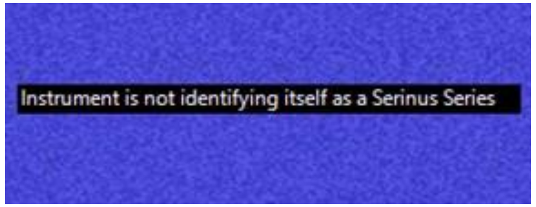


What does this all look like for a Ricardo air quality field worker?

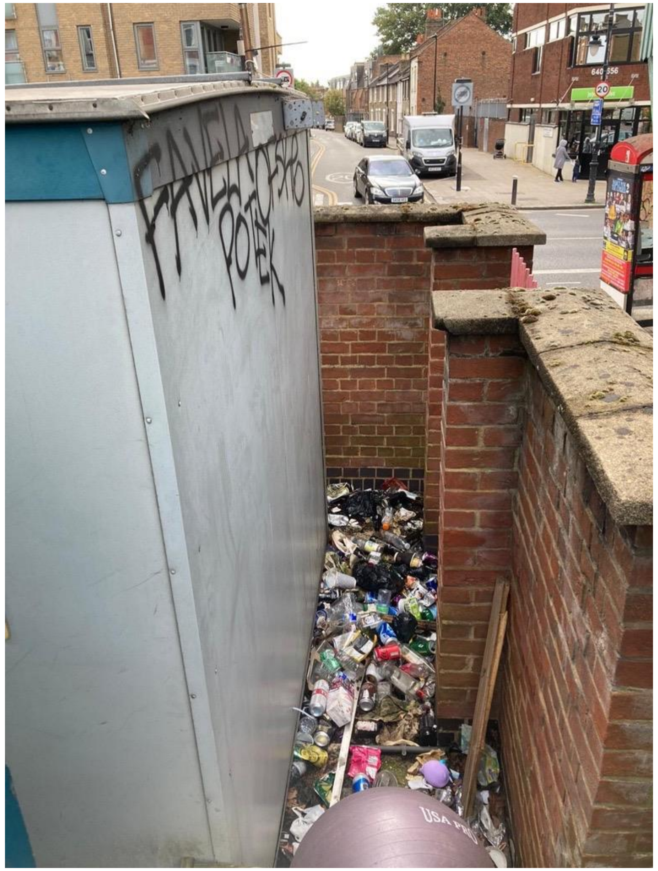
In 2025 so far, our air quality field team has carried out **526 audit visits** and **956 LSO visits**… we are a bustling and busy team!

A “varied routine” best describes it.

And like any job, it's not without its challenges… (natural)



And like any job, it's not without its challenges… (human)







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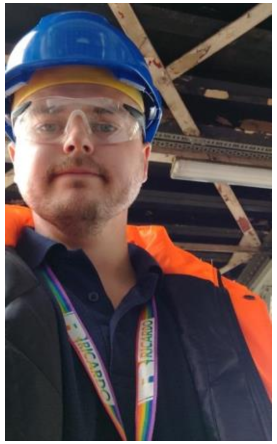
But it’s not all doom and gloom!

But it’s not all doom and gloom!

A snapshot of other work we do…

A snapshot of other work we do…



Take home messages

LSO calibrations and QA/QC audits:

- They fundamental to running an air quality site / monitoring network.
- We hope to foster a better understanding about what we do and why it is important.

Working in the field is challenging…

- But it's where we exercise and grow our technical expertise!
- Challenges can reflect wider issues around air quality.

Ricardo is here to help…

- Provision of services: LSO calibrations, QA/QC audits, comms, sensor installations, remote sensing, data management…
- Training, guidance, methods of best practice.

Any Questions?

The Phase out of 3G, 2G and RTS/DTS electricity meters

2G & 3G Connections	RTS/DTS Meters
Gradual phase out over remainder of 2025 for 3G	Phase out by 30th June 2025
Phase out up to 2033 for 2G	Upgrade to smart meters
Upgrades of comms to ensure longevity of data management	Check AQMS supplies
4G Comms solutions	Interruption to data

RTS/DTS electricity meters

Source: Google.co.uk

EMAQ Live!

Attenborough Hall, Leicester City Hall

Tuesday 9th September 2025, 09:30 – 16:00

- Local authority staff involved in improving air quality, representatives from environmental health, planning, transport, public health and climate teams
- Expert speakers, roundtable discussions on challenges and opportunities for improving UK air quality, and developments in local air quality management
- **Free** for EMAQ+ subscribers, or £95 for local authorities that do not hold an EMAQ+ subscription
- Email emaq@ricardo.com to secure your place (up to 3 places per local authority)

Thank you for joining us!