Air Quality Monitoring at East Midlands Airport

Annual Report for 2025

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Issue 2	01/05/26	Issue 1	Sion Carpenter
Issue 2	04/06/26	Amended table in '10.4 Appendix 4 – Long Term EMA Annual Average Concentrations' updated 2025 EMA annual averages	Sion Carpenter

Executive summary

This report provides details of air quality monitoring conducted at East Midlands Airport during 2025. The work was carried out by Ricardo on behalf of Manchester Airport Group plc. The aims of the programme are to monitor air pollution around the airport, to assess compliance with relevant national air quality objectives, and to investigate changes in air pollutant concentrations over time.

Automatic continuous monitoring was carried out at a single location within the Aeropark on the outskirts of the airport. The station monitored oxides of nitrogen (nitric oxide and nitrogen dioxide) and Particulate Matter (PM_{10}). The minimum applicable data capture target of 90%, for the European Commission Air Quality Directive, was achieved for the station's PM and NO_x instruments.

The UK Air Quality Strategy (AQS) hourly mean objective for NO_2 is 200 µg m^{-3}, with no more than 18 exceedances allowed each year. The East Midlands Airport air quality site registered no exceedances to this value during the year. Therefore, the site met this objective for 2025.

The annual mean AQS objective for NO_2 is 40 µg m^{-3}. The annual mean was 10.6 µg m^{-3} and so this limit was met at the East Midlands Airport air quality site.

PM_{10} may exceed the 24-hour mean limit of 50 µg m^{-3} no more than 35 times per year to meet the AQS objective. During 2025, there were two exceedances of the limit value registered at the site. This AQS objective was therefore met. The annual mean AQS target for PM_{10} is 40 µg m^{-3}. The annual mean was 13.1 µg m^{-3} and so this objective was met at the East Midlands Airport air quality site.

The annual mean AQS objective for $PM_{2.5}$ is 25 µg m^{-3}. The site registered an annual average of 8.0 µg m^{-3}, this objective was therefore met, in addition to the 2040 target of 10 µg m^{-3}.

Average concentrations of NO, NO_2 and PM_{10} at the site were generally comparable to those measured at urban background and rural air pollution monitoring sites and lower than urban traffic sites. A comparison to 2024 data showed a slight increase in both annual mean NO_2, PM_{10} and $PM_{2.5}$ readings.

The pattern of monthly averaged concentrations throughout the year showed that concentrations of NO_2, which is predominantly a secondary pollutant but does have primary components, showed the highest levels were from the winter months. PM_{10} showed no seasonal variation.

Wind speed and direction data gathered from the Met Office Database were used to investigate effects on pollutant concentrations and potential sources. Bivariate plots of pollutant concentration indicated that nearby sources, such as the perimeter road, were probably the main source of NO_2. There also appeared to be a contribution from the southeast at moderate wind speeds, possibly indicating a source further away. To the immediate southeast is the main passenger terminal. The M1 runs roughly north to south to the east with junction 23A to the southeast.

For PM_{10} and $PM_{2.5}$, concentrations were elevated under calm conditions, with the highest concentrations occurring with moderate winds from the northeast, the direction of junction 24 of the M1 and a large construction area. Elevated levels were also seen from the east, the direction of the runway, and the southwest, the direction of the West Apron.

Contents

1 Introduction

1.1 Background

This is a summary report for Manchester Airport Group - East Midlands Airport for the period Wednesday 1st January 2025 to Wednesday 31st December 2025.

Airports are potentially significant sources of many air pollutants. Aircraft jet engines emit pollutants including oxides of nitrogen (NO_x), carbon monoxide (CO), oxides of sulphur (SO_x), particulate matter, hydrocarbons from partially combusted fuel, and other trace compounds. There are also pollutant emissions from the airside vehicles, and from the large number of road vehicles travelling to and from the airport each day. East Midlands Airport handled around 4 million passengers[1] in 2025 in addition to over 280,000 tonnes of cargo [2]. The airport is situated next to the M1 motorway and near the urban areas of Nottingham and Derby, containing many domestic, commercial and industrial sources of pollution.

Manchester Airport Group plc therefore carries out monitoring of ambient air quality at a single site located to the north of the runway in the bordering Aeropark. The site is also located close to some of the airports nearest neighbouring residents.

The pollutants monitored at this site include:

• Oxides of nitrogen (nitric oxide (NO) and nitrogen dioxide (NO_2)).

• Particulate matter (PM_{10} and $PM_{2.5}$).

Ricardo was contracted by Manchester Airport Group plc (MAG) to carry out the required programme of air pollution measurements during 2025 and this report presents and summarises the fully validated and quality-controlled dataset for the period 1st January 2025 to 31st December 2025.

Data in the annual report have been processed according to the rigorous quality assurance and quality control procedures used by Ricardo, identical to those used on data in the national network. These ensure the data are reliable, accurate and traceable to UK national measurement standards.

1.2 Aims and Objectives

The aim of this monitoring programme is to monitor concentrations of several important air pollutants around the airport. The results of the monitoring are used to assess whether applicable national air quality objectives have been met, and how pollutant concentrations in the area have changed over time. Additionally, Met Office meteorological data were used to investigate the importance of various sources of pollution.

It is important to note that the pollutants measured in this study will have originated from a wide variety of sources, both local and long range. Not all of these sources will be directly connected with the airport. Monitoring data collected at East Midlands are compared in this report with:

• Relevant UK air quality limit values and objectives.

• Corresponding results from a selection of national air pollution monitoring sites.

• Statistics related to airport activity.

In addition, periods of relatively high pollutant concentrations are examined in more detail.

2 Details of the Monitoring Report

2.1 Pollutants Monitored

2.1.1 Nitrogen Oxides (NO_x)

Combustion processes emit a mixture of oxides of nitrogen - NO and NO_2 - collectively termed NO_x.

i. NO is described as a primary pollutant (meaning it is directly emitted from source). NO is not known to have any harmful effects on human health at ambient concentrations. However, it undergoes oxidation in the atmosphere to form the secondary pollutant NO_2.

ii. NO_2 has a primary (directly emitted) component and a secondary component, formed by oxidation of NO. NO_2 is a respiratory irritant and is toxic at high concentrations. It is also involved in the formation of photochemical smog and acid rain and may cause damage to crops and vegetation.

Of the NO_x emissions (including NO_2) considered to be airport-related, over 50% arise from aircraft during take-off and landing, with around two-thirds of all emissions occurring at some distance from airport ground-level.

Based on 2024 calendar year emissions data from the 2026 submission of National Atmospheric Emissions Inventory (NAEI) data to the EU, in the UK, civil aircraft taking off and landing (up to a height of 1000m) are estimated to contribute 2.4% to the total reported UK emissions of NO_x[3].

The Air Quality Expert Group (AQEG) has stated that: "Around a third of all NO_x emissions from the aircraft (including ground-level emissions from auxiliary power units, engine testing etc., as well as take-off and landing) occur below 100 m in height. The remaining two-thirds occur between 100 m and 1000 m and contribute little to ground-level concentrations. Receptor modelling studies show the impact of airport activities on ground-level NO_2 concentrations. Studies have shown that although emissions associated with road traffic are smaller than those associated with aircraft, their impact on population exposure at locations around the airport are larger"[4].

Previous rounds of review and assessment within the Local Air Quality Management (LAQM), process have not highlighted any cases where airports appear to have caused exceedances of air quality objectives for particulate matter measured as PM_{10}. Therefore, in the context of LAQM, the key pollutant of concern from airports is NO_2. Local authorities whose areas contain airports with over 10 million passengers per annum must take these into account in their annual review and assessment of air quality.

2.1.2 Particulate Matter

Airborne particulate matter varies widely in its physical and chemical composition, source and particle size. The term "PM_{10}" is used to describe particles with an effective size less than 10 µm and "$PM_{2.5}$" particles less than 2.5 µm. These are of greatest concern with regard to human health, as they are small enough to penetrate deep into the lungs. They can cause inflammation and a worsening of the condition of people with heart and lung diseases. In addition, they may carry surface absorbed carcinogenic compounds into the lungs. Larger particles, meanwhile, are not readily inhaled, and are removed relatively efficiently from the air by sedimentation.

The main sources of airborne particulate matter in the UK are combustion (industrial, commercial and residential fuel use). The next most significant source is road vehicle emissions. Based on 2024 NAEI data, 0.1% of UK total PM_{10} and 0.2% of $PM_{2.5}$ emissions are believed to originate from civil aircraft taking off and landing [5].

Previous rounds of review and assessment within the LAQM process have not highlighted any cases where airports appear to have caused exceedances of air quality objectives for particulate matter measured as PM_{10} or $PM_{2.5}$.

3 Data Description

3.1 Monitoring Data

Data contained within this report is managed by Ricardo and stored in a dedicated, secure database. This report was generated using the fully ratified data that had passed through our vigorous QAQC procedures and was available at the time of compilation (3 pm on Tuesday March 31, 2026).

Some of the plots provided in this report use associated meteorological data (typically wind speed and wind direction) in order to show measured pollutant concentrations in a dispersion context. Very few monitoring stations provide quality controlled met data, therefore these reports import data from the Met Office Data Point.

Gaseous pollutant mass units are at 20 °C and 1013 mb. NO_x mass units are NO_x as NO_2 µg m^{-3}. Particulate matter concentrations are reported at ambient temperature and pressure.

3.2 Relevant Pollution Limit Values

The European Air Quality Directive and Fourth Daughter Directive set out legal limits for different pollutants as Limit Values, Target Values or Long Term Objectives to protect human health. With the UK's exit from the EU the UK's Air Quality Strategy (AQS) is no longer tied to that of the EU, however the current objectives are at least as stringent as the EC limit values.

Legal limits for different pollutants in the UK are set out in the Air Quality Standards Regulations 2010. The Limit Values and Target Values for England are summarised in the table below. Local authorities don't typically measure ozone, benzene, B[*a*]P or metals that are captured within Defra's national networks. All pollutants measured have been included in this data summary for completeness, irrespective of their significance for local authority policy interests.

Pollutant	Averaging period	Legal Value	Applies
Particles (PM_{10})	24 hours	50 µg m^{-3} (35 allowed)	UK
Particles (PM_{10})	1 year	40 µg m^{-3}	UK
Fine particles ($PM_{2.5}$)	1 year	12 µg m^{-3}	England (interim by 2028)
Fine particles ($PM_{2.5}$)	1 year	10 µg m^{-3}	England (by 2040)
Nitrogen dioxide (NO_2)	1 hour	200 µg m^{-3} (18 allowed)	UK
Nitrogen dioxide (NO_2)	1 year	40 µg m^{-3}	UK
Ozone (O_3)	Maximum daily 8 hours	100 µg m^{-3} (10 allowed)	UK
Sulphur dioxide (SO_2)	15 minutes	266 µg m^{-3} (35 allowed)	UK
Sulphur dioxide (SO_2)	1 hour	350 µg m^{-3} (24 allowed)	UK
Sulphur dioxide (SO_2)	24 hours	125 µg m^{-3} (3 allowed)	UK
Polycyclic Aromatic Hydrocarbons	1 year	0.25 ng m^{-3}	UK
Benzene	Running 1 year	16.25 µg m^{-3}	UK
Benzene	1 year	5 µg m^{-3}	England and Wales
1,3-butadiene	Running 1 year	2.25 µg m^{-3}	UK
Carbon monoxide (CO)	Maximum daily 8 hours	10 mg m^{-3}	UK
Lead (Pb)	1 year	0.25 µg m^{-3}	UK

3.2.1 World health Organisation

The World Health Organisation (WHO) issued non-mandatory, advisory, guidelines for a variety of pollutants in 2005 using currently available scientific evidence on the effects of air pollution on human health. New, updated, guidelines were introduced in September 2021 which significantly reduced the Annual mean limit of NO_2 from 40 µg m^{-3} to 10 µg m^{-3} and the 24h mean being reduced to 25 µg m^{-3}.

In light of the growing evidence of harm that PM_{10} and $PM_{2.5}$ can cause the Annual mean limits were reduced from 20 µg m^{-3} to 15 µg m^{-3} and 10 µg m^{-3} to 5 µg m^{-3} respectively[6].

3.2.2 The UK Air Quality Strategy

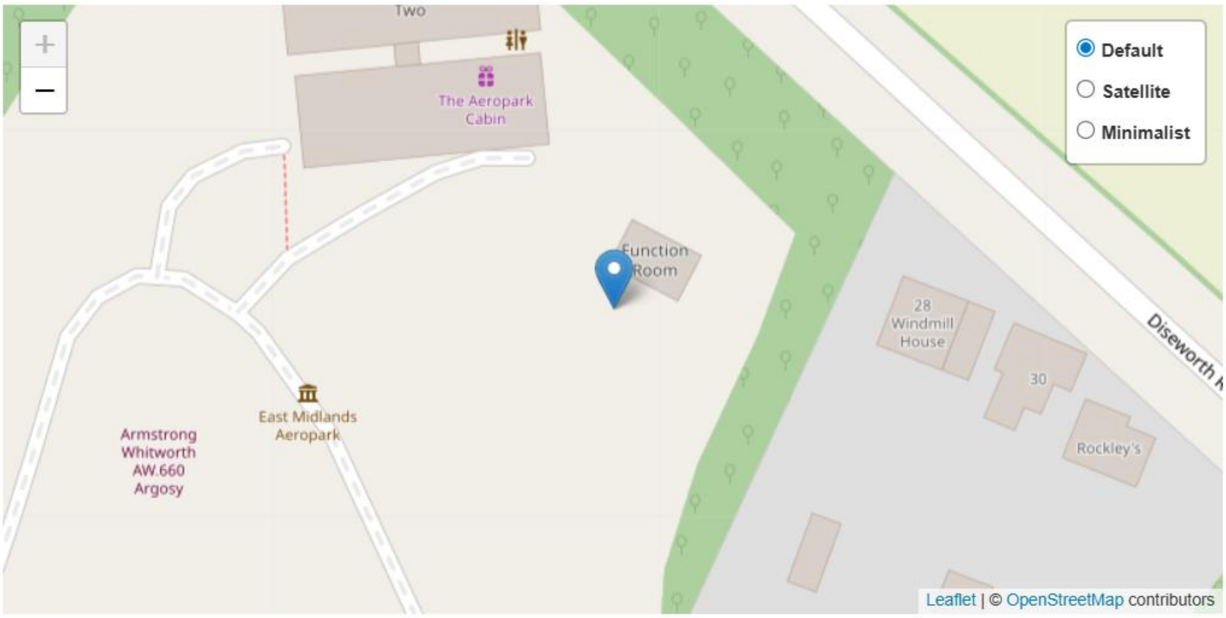
The Environment Act 1995 required the UK to transpose the original EU Directive on Ambient Air Quality and Cleaner Air for Europe (2008/50/EC and its update EU/1480)[7] into UK law. It also placed a requirement on the Secretary of State for the Environment to produce a national Air Quality Strategy (AQS) containing standards, objectives and measures for improving ambient air quality. The original AQS was published in 1997, and contained air quality objectives based on the recommendations of the Expert Panel on Air Quality Standards (EPAQS) regarding the levels of air pollutants at which there would be little risk to human health.

The AQS has since undergone a number of revisions, and as of the Environment Act 2021 must be reviewed at least every 5 years. These revisions have reflected improvements in the understanding of air pollutants and their health effects. They also incorporated new European limit values, both for pollutants already covered by the Strategy and for newly introduced pollutants such as polycyclic aromatic hydrocarbons and $PM_{2.5}$. The latest version of the strategy was published by Defra in 2023[8] which changed $PM_{2.5}$ objectives for England only. With the UK's exit from the EU the UK's AQS is no longer tied to that of the EU, however the current objectives are at least as stringent as the EC limit values, with the exception of $PM_{2.5}$. The UK government has made changes to reduce the limit value of $PM_{2.5}$ this has been updated in the report. The current UK air quality objectives for the pollutants monitored at East Midlands Airport are presented in the table in section 4.2. Note that not all of these objectives are relevant to the East Midlands Airport air quality station as the site only measures NO_2, PM_{10} and $PM_{2.5}$.

4 Monitoring Stations

A summary of site information is presented in the below map and table. Automatic monitoring was carried out at a single site during 2025 and is referred to as East Midlands Airport. The location description of the site falls into the category "other" as defined by the Defra Technical Guidance on air quality monitoring LAQM.TG(22)[9], (i.e. "any special source-oriented or location category covering monitoring undertaken in relation to specific emission sources such as power stations, car-parks, airports or tunnels").

The monitoring site is located within the Aeropark to the north of the runway and perimeter road, 288m from the runway centre and 101m from the perimeter road. The curb side of the closest public road - Diseworth road is 28m to the northeast of the site. The prevailing wind direction is from the southwest.



Site Name	Variable	Date Started	Date Ended
East Midlands Airport	NO_2	01/01/2015	Ongoing
East Midlands Airport	PM_{10}	01/01/2015	Ongoing
East Midlands Airport	$PM_{2.5}$	22/12/2016	Ongoing

5 Automatic Monitoring Techniques

The following techniques were used for the automatic monitoring of NO_x (i.e. NO and NO_2) and PM:

• PM_{10}, $PM_{2.5}$: Fine Dust Analysis Systems (FIDAS)

• NO, NO_2 – Chemiluminescence (Thermo I series)

Each analyser provided a continuous output, proportional to the pollutant concentration. This output was recorded and stored every 10 seconds and averaged on a 15-minute basis. The 15-minute average values were stored within the analyser's internal data logger. The analysers were connected to a code activated switch and modem and interrogated by telephone to download the data to Ricardo. Data were downloaded daily during the period 05.00 to 19.00.

The data were converted to concentration units at Ricardo and averaged to hourly mean concentrations.

$PM_{2.5}$ data measured using a FIDAS instrument has a correction factor applied being divided by 1.06 as per the Certification - MCERTS for UK Particulate Matter specification. No correction is required for PM_{10}.

Monthly calibrations were performed by Ricardo to monitor the performance of the analysers. Data from these monthly checks, and from two six-monthly independent QA/QC audits carried out by Ricardo, were used by Ricardo to scale and ratify the data. The analysers were also serviced on a six-monthly basis to ensure their continued operation. Information on Quality Assurance and Quality Control is provided in Appendix I. All ambient concentration measurements in the report are quoted in micrograms per cubic metre (µg m^{-3}) at reference conditions of 20 °C, 1013 mbar.

6 Data Analysis

6.1 Units

Measured concentrations are reported in micrograms per cubic metre (µg m^{-3}).

PM_{10} and $PM_{2.5}$ are conventionally reported in units of µg m^{-3}, micrograms per cubic metre.

In this report, the mass concentration of NO_x has been calculated as follows: NO_x µg m^{-3} = (NO ppb+NO_2 ppb)*1.91 and is termed "NO_x reported as NO_2".

This conforms to the requirements of the EC Directive on Ambient Air Quality and Cleaner Air for Europe and is also the convention generally adopted in air quality modelling.

6.2 Summary Statistics

The below two tabs contain summary statistics for the reported collection of measurement sites. "Cumulative Statistics" contains all data from the beginning of the year *up until and including* the reported period, whereas "Monthly Statistics" contains data for *only* the reported period. The following tables present pollutant statistics for the period from the start of the year to the end of the reported year.
The **Low**, **Moderate** and **High** indicate the number of days for a particular pollutant when the concentrations are in the corresponding AQI bands from the beginning of the year until the end of the reported year.

NO_2 PM_{10} $PM_{2.5}$

Search

Site	Data Capture	$\mu g\ m^{-3}$			DAQI		
		Hourly Mean	Hourly Max	Hours Exceeding 200 $\mu g\ m^{-3}$	Low	Moderate	High
East Midlands Airport	99.7%	10.6	78.9	0	365	0	0

NO_2 PM_{10} $PM_{2.5}$

Search

Site	Data Capture	$\mu g\ m^{-3}$			DAQI		
		Hourly Mean	Max Daily Mean	Days Exceeding 50 $\mu g\ m^{-3}$	Low	Moderate	High
East Midlands Airport	97.4%	13.1	55.2	2	354	1	0

NO_2 PM_{10} $PM_{2.5}$

Search

Site	Data Capture	$\mu g\ m^{-3}$		DAQI		
		Hourly Mean	Max Daily Mean	Low	Moderate	High
East Midlands Airport	97.4%	8.0	45.9	353	2	0

6.3 Comparison with Air Quality Objectives

A data capture target of 90% is recommended in the Defra Technical Guidance LAQM.TG(22), this target was achieved for all pollutants. The data capture target does not include losses due to regular calibration or maintenance of the instrument and any data capture rate above 75% is deemed representative of the full annual period. We will continue to review, assess and advise MAG if this situation changes.

The annual, hourly (NO_2) and daily (PM_{10}) objectives specified by Defra were not exceeded at East Midlands Airport in 2025.

The details of UK air quality standards (AQS) and objectives specified by Defra are provided in Section 4.2.

The AQS objective for hourly mean NO_2 concentration is 200 $\mu g\ m^{-3}$ which may be exceeded up to 18 times per calendar year. During 2025 there were no hourly mean NO_2 measurements exceeding 200 $\mu g\ m^{-3}$ meaning that NO_2 levels stayed within the Defra "Low" band for the whole year, and the AQS objective was accomplished for 2025.

The annual mean AQS objective for NO_2 is 40 µg m^{-3}. The annual mean at East Midlands was recorded at 10.6 µg m^{-3} this objective was therefore met.

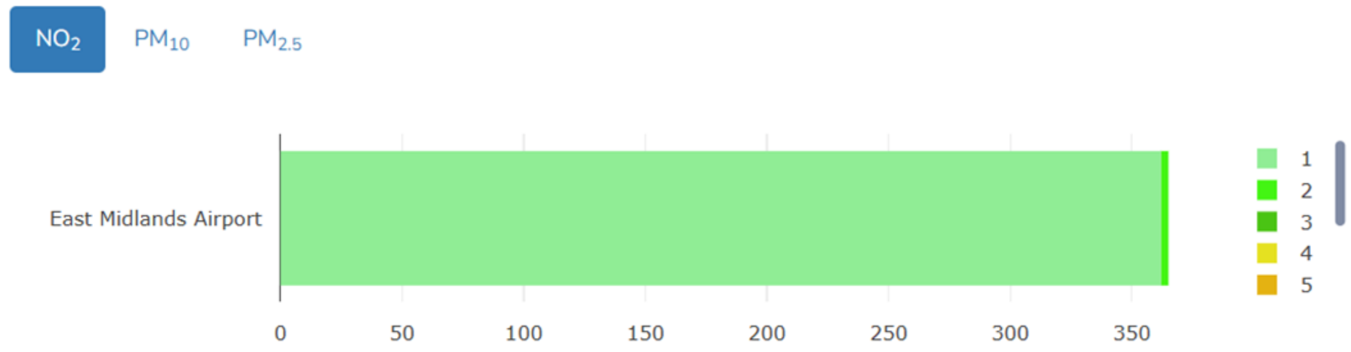
The AQS objective for PM_{10} is a maximum of 50 µg m^{-3} for 24-hour mean periods, not to be exceeded more than 35 times a year. There were two exceedances, the maximum value being 55.3 µg m^{-3}. This means the site was well within the yearly maximum permitted number of 35 exceedances, therefore meeting the AQS objective for 24-hour mean PM_{10}.

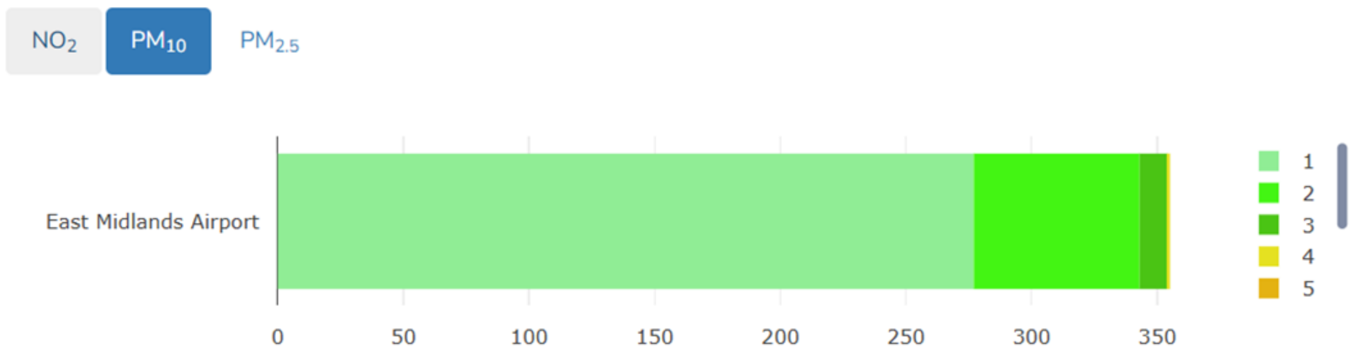
The annual mean AQS objective for PM_{10} is 40 µg m^{-3}. The site registered an annual average of 13.1 µg m^{-3}, this objective was therefore met.

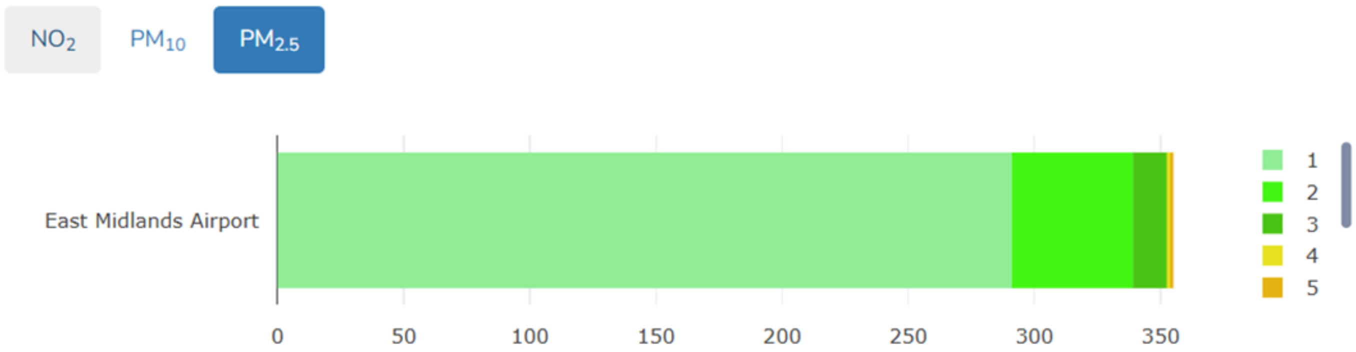
The annual mean AQS objective for $PM_{2.5}$ is 25 µg m^{-3}. The site registered an annual average of 8.0 µg m^{-3}, this objective was therefore met, in addition to the 2040 target of 10 µg m^{-3}.

6.4 AQ Index Distribution

The plots below illustrate the distribution of AQ index values for each site by pollutant. They show the number of days that site concentrations are in each index. More information on the AQ Index is available from GOV.UK.







6.5 Polar Plot Map

In order to investigate the possible sources of air pollution being monitored around the Airport, meteorological data measured close to the site was used to add a directional component to the air pollutant concentrations. Wind speed and direction data was gathered using data gathered from the Met Office meteorological database.

These plots should be interpreted as follows:

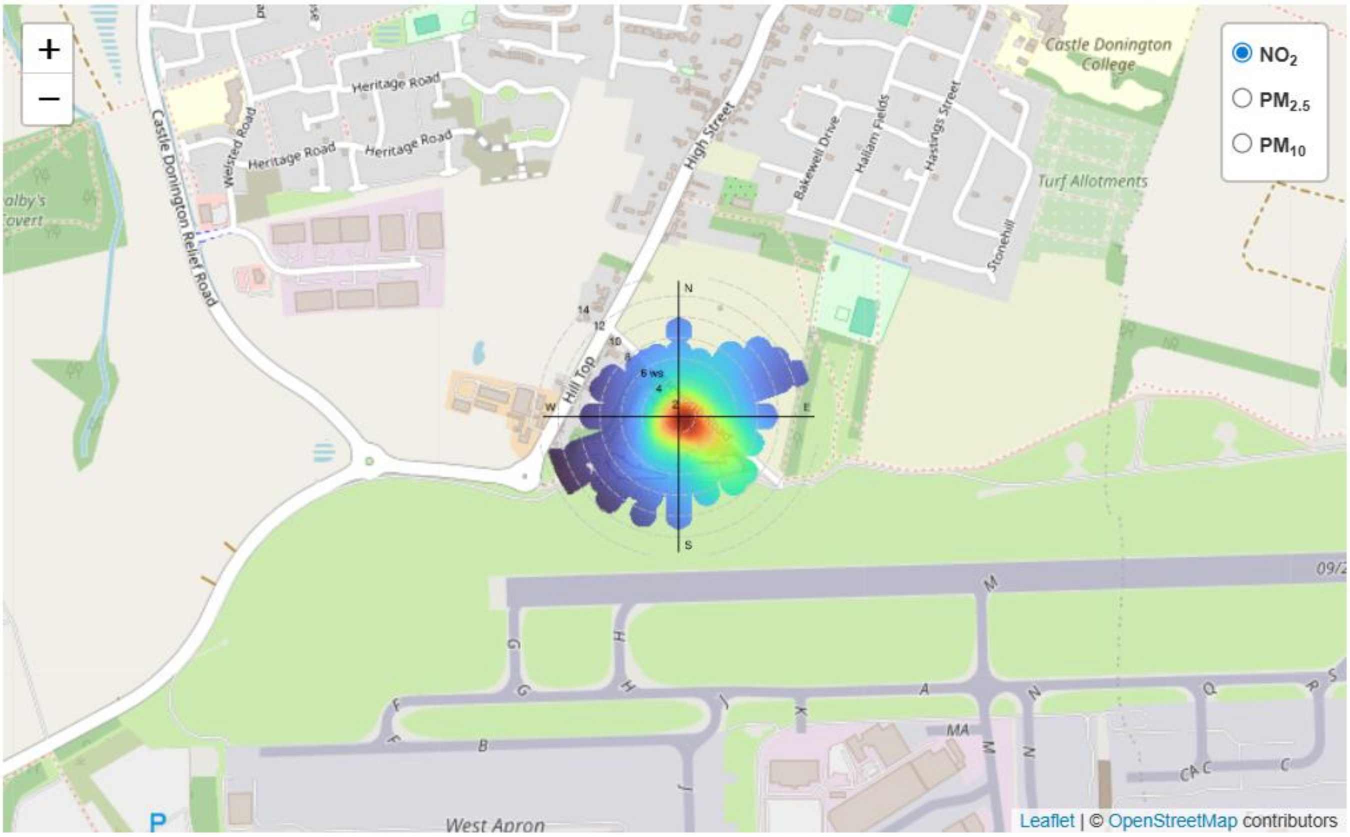
• The wind speed is indicated by the distance from the centre of the plot; the grey circles indicate wind speeds in 2 m s^{-1} intervals.

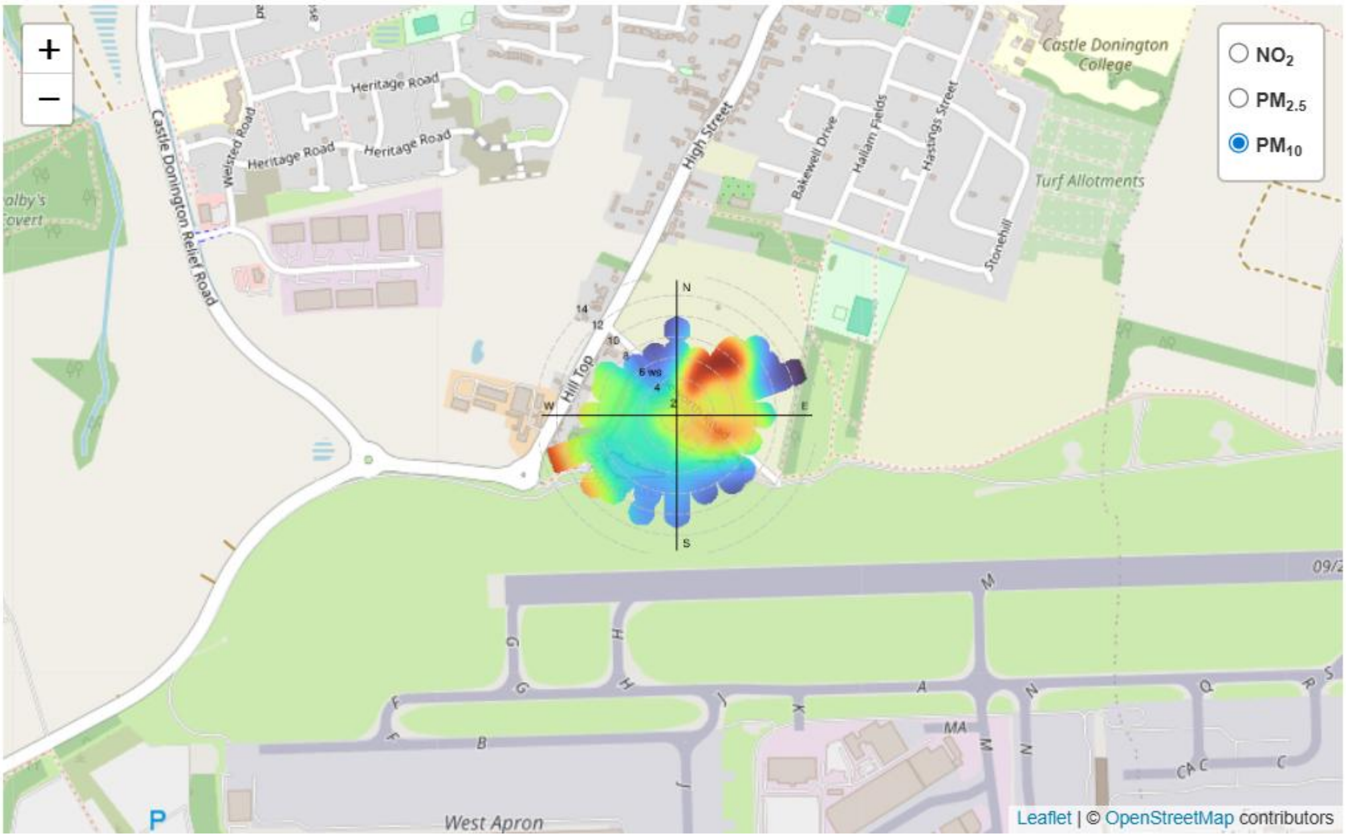
• The relative pollutant concentration is indicated by the colour, with reds indicating higher concentrations and blues lower concentrations.

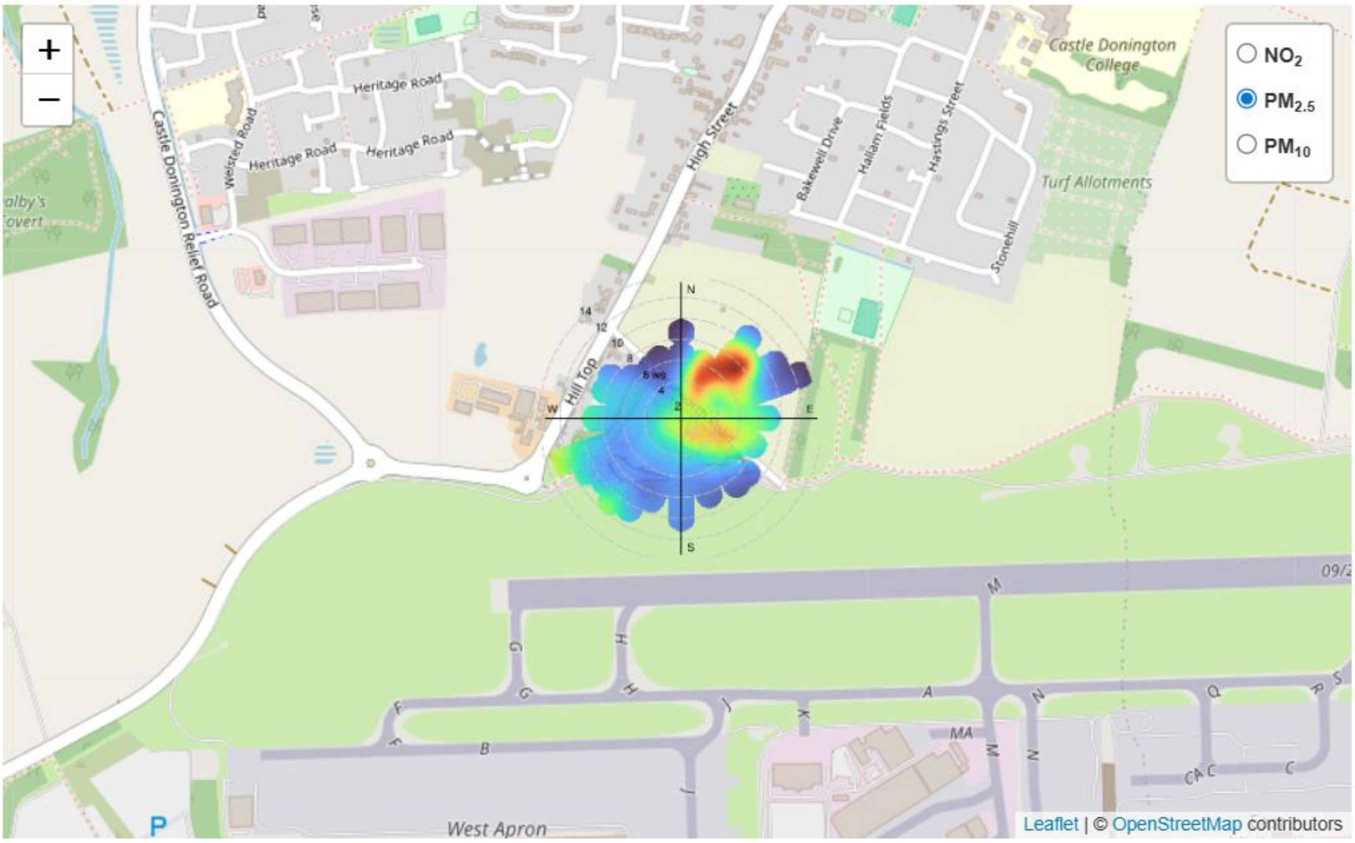
These plots therefore show how pollutant concentrations varied with wind direction and wind speed.

The plots do not show distance of pollutant emission sources from the monitoring site. However, in the case of primary pollutants such as NO, the concentrations at very low wind speeds are dominated by emission sources close by, while at higher wind speeds, effects are seen from sources further away.

These plots are useful to help identify primary pollutants which are emitted directly into the atmosphere, especially when multiple plots are used in conjunction to “triangulate” a common source. For pollutants with a secondary component (i.e. formed through chemical reactions in the atmosphere, e.g. NO_2, $PM_{2.5}$ and O_3) the directional signature seen in the measurements may not be as strong.


NO2
PM2.5
PM10
Castle Donington College
Heritage Road
Welsted Road
Castle Donington Relief Road
High Street
Bakewell Drive
Hallam Fields
Hastings Street
Stonehill
Turf Allotments
Hill Top
N
E
S
W
West Apron
Leaflet | © OpenStreetMap contributors


NO2
PM2.5
PM10
Castle Donington College
Heritage Road
Welsted Road
Castle Donington Relief Road
High Street
Bakewell Drive
Hallam Fields
Hastings Street
Stonehill
Turf Allotments
Hill Top
N
E
S
W
West Apron
Leaflet | © OpenStreetMap contributors

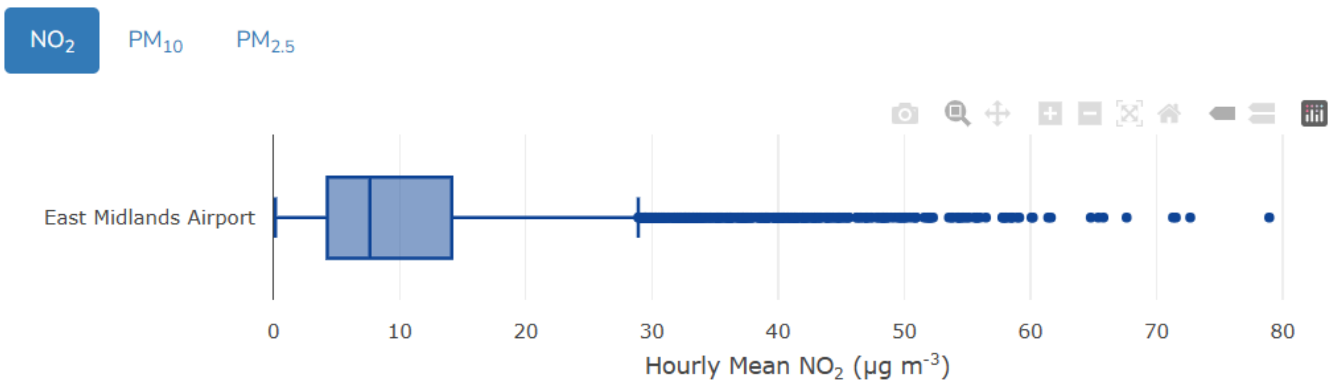


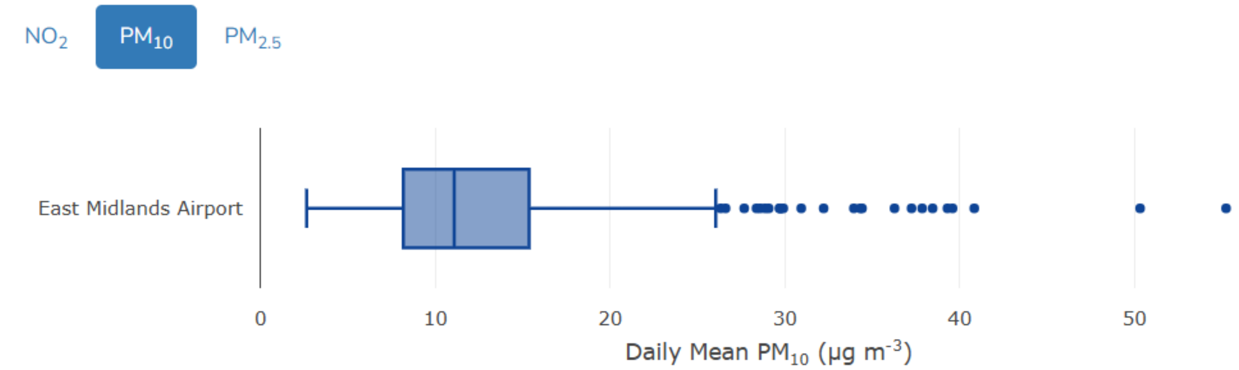
The highest concentrations of NO_2 were associated with light winds (<5 ms^{-1}). Moderate winds (5 - 10 ms^{-1}) from the southeast also contributed, which is within the direction of the main runway, airport terminal, western maintenance area and central aprons.

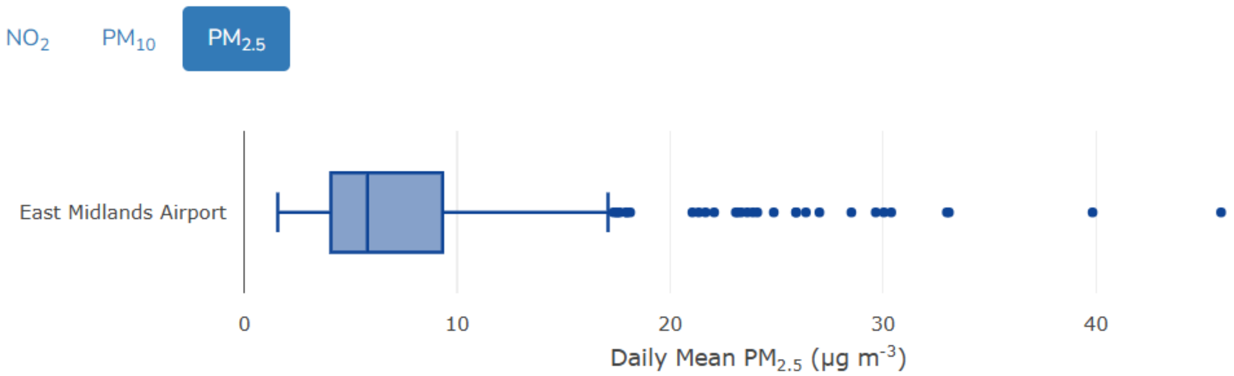
Elevated concentrations of PM occurred under moderate winds from the northeast where both construction activity at the SEGRO East Midlands Gateway and the large housing development along the western side of Castle Donnington are located. These construction sites likely contributed to increased PM levels due to earthworks, heavy vehicle movements and dust resuspension. In addition, elevated concentrations were also recorded under winds from the northeast and southeast, pointing to other potential PM sources. These include road traffic emissions from the nearest public road and airport related activities at the Western Apron, where aircraft movements, ground support operations and fuel combustion can contribute to particulate pollution. A further signal was seen from the east, the direction of the runway.

6.6 Box Plots

The plots below are box and whisker plots to show the distribution in concentrations for each monitoring station. The boxes demarcate the lower quartile, median and upper quartile. The whiskers extend to the maximum and minimum values within median ± 1.5 times interquartile range (IQR). Values outside the median ± 1.5 times IQR are generally considered as outliers.

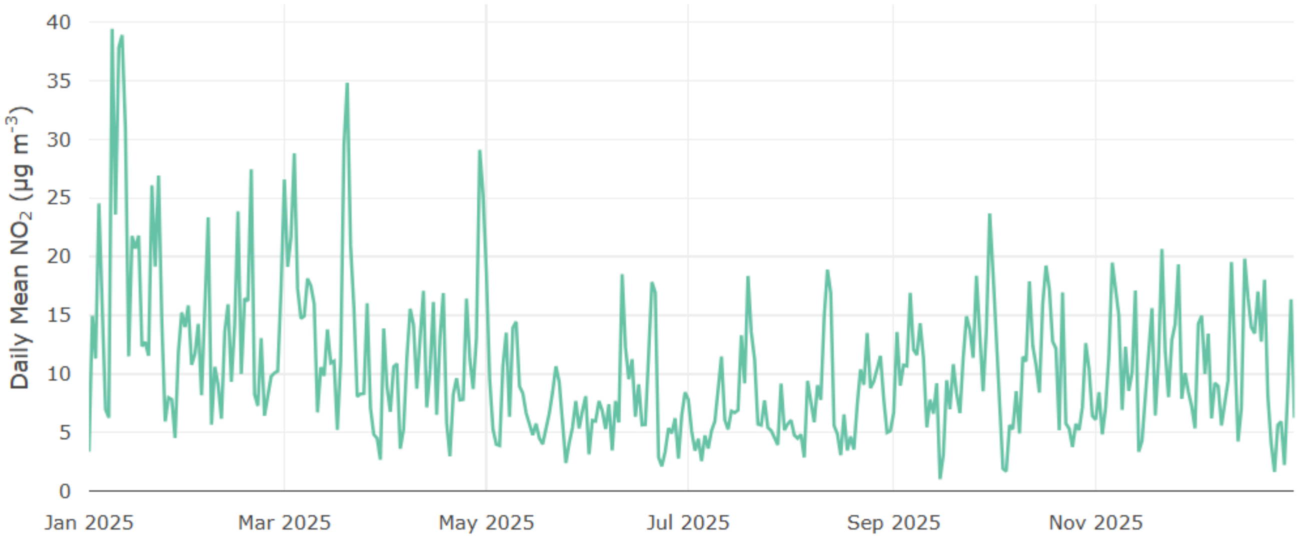

NO2
PM10
PM2.5
East Midlands Airport
0
10
20
30
40
50
60
70
80
Hourly Mean NO2 (µg m-3)

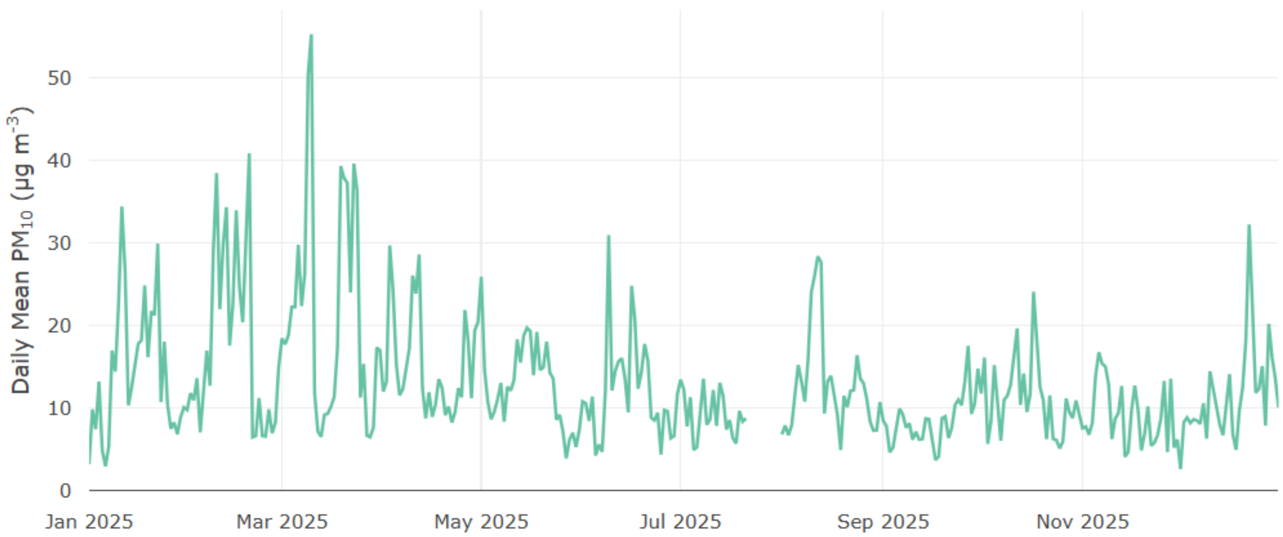

NO2
PM10
PM2.5
East Midlands Airport
0
10
20
30
40
50
Daily Mean PM10 (µg m-3)

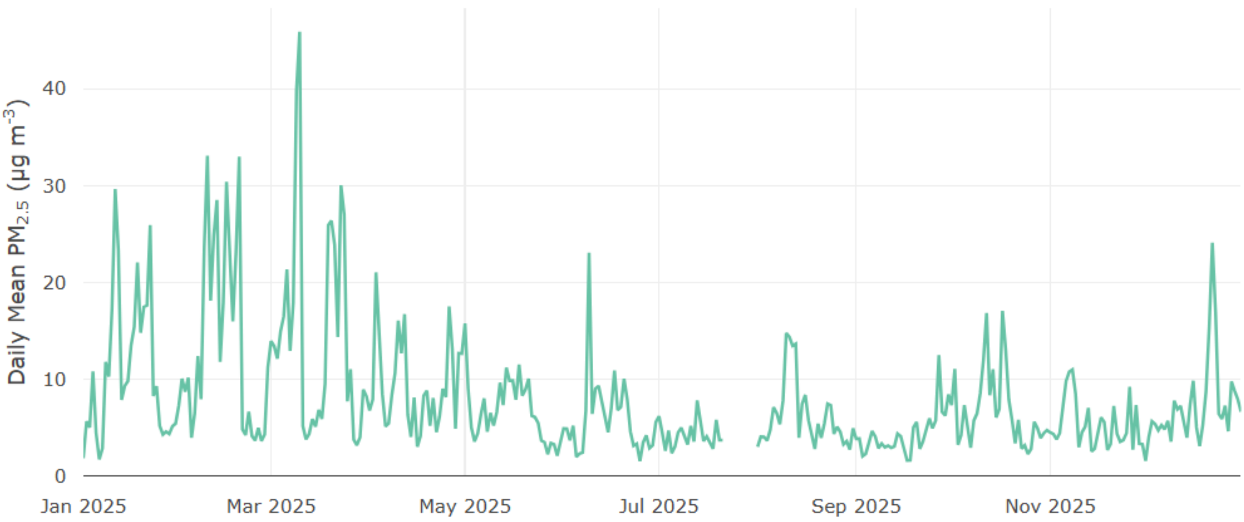

NO2
PM10
PM2.5
East Midlands Airport
0
10
20
30
40
Daily Mean PM2.5 (µg m-3)

6.7 Time Series Plot

The plots below show the time series of concentrations in 2025.



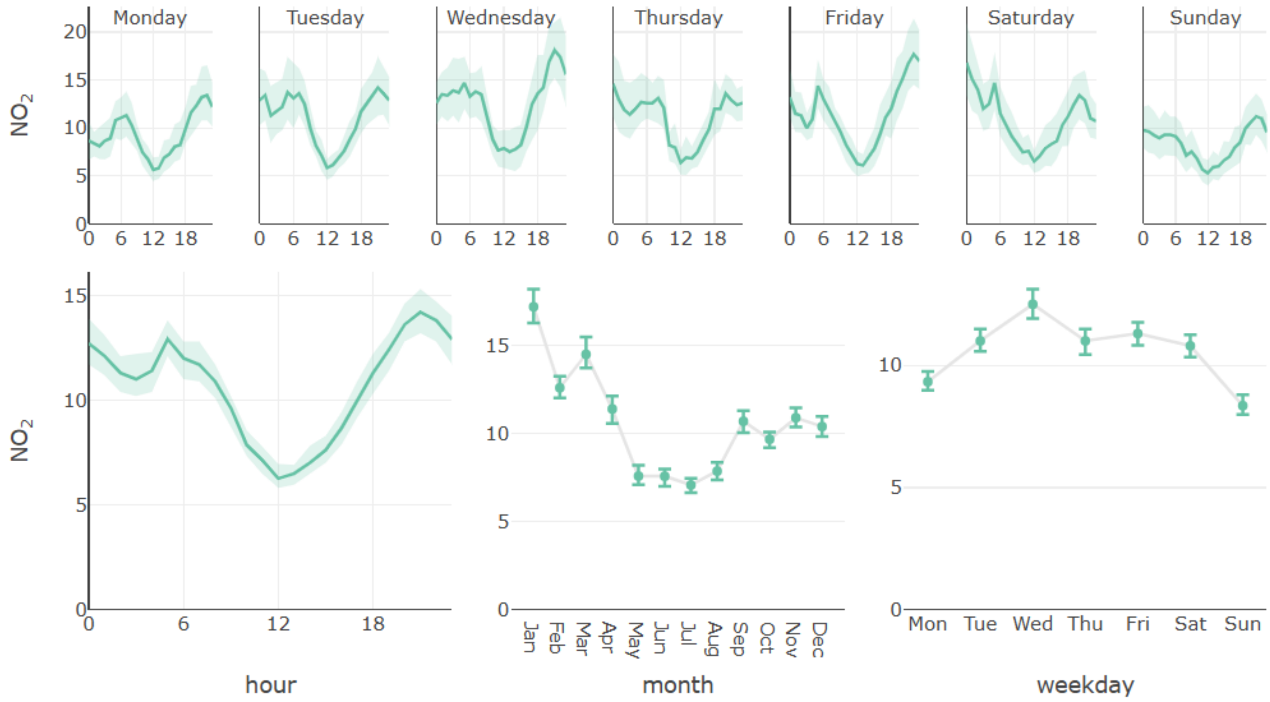


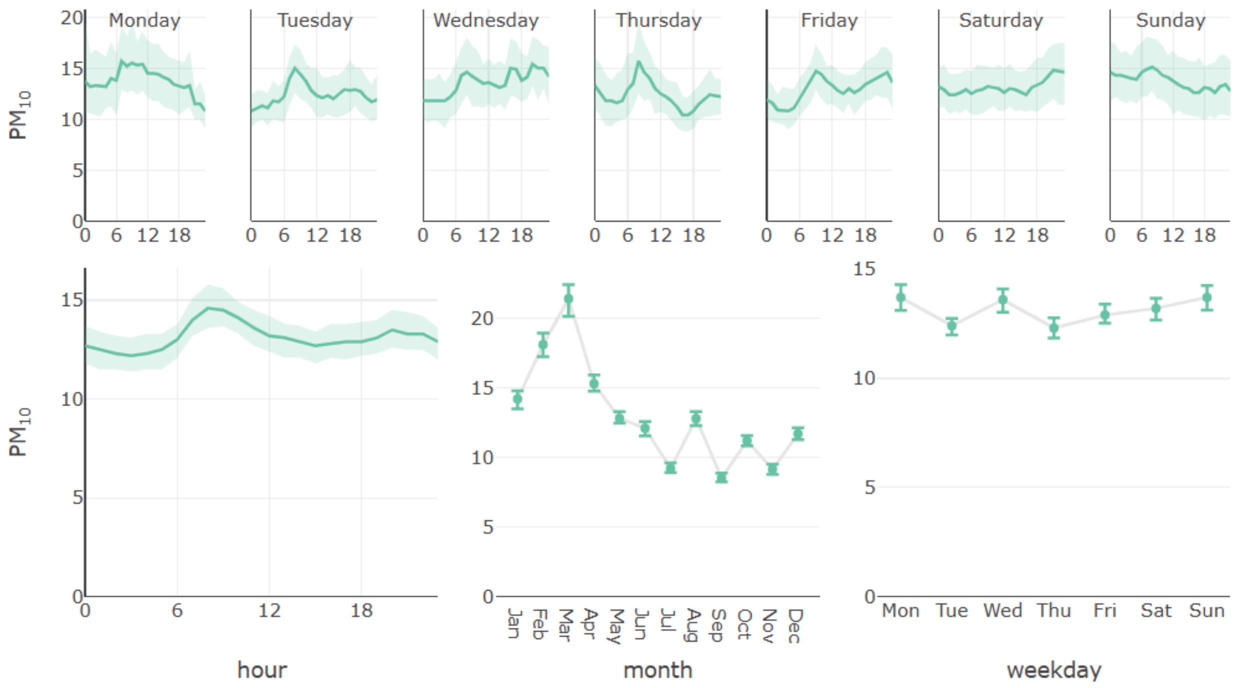


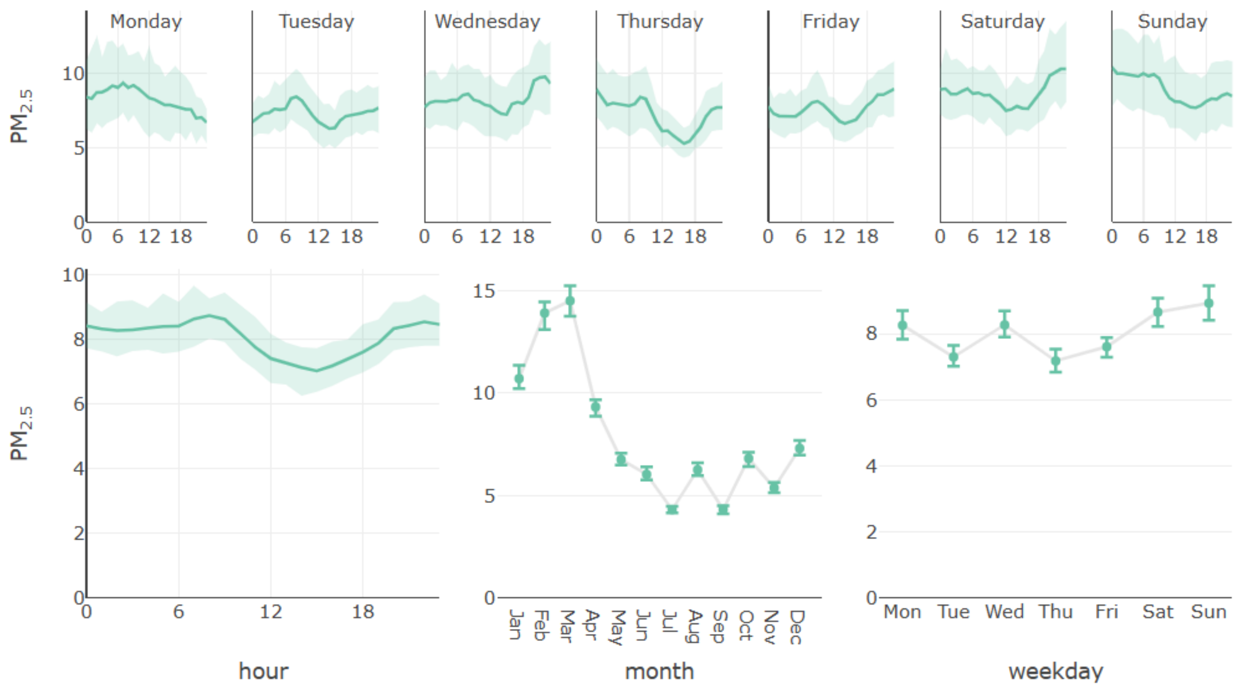
Daily Mean PM2.5 (µg m-3)
40
30
20
10
0
Jan 2025
Mar 2025
May 2025
Jul 2025
Sep 2025
Nov 2025

6.8 Time Variation Plot

These plots show concentrations over different time intervals such as diurnal, day of week and, if relevant, month of year. The topmost frame shows the concentrations as they vary by hour of the day and day of the week. The hour of the day variation is summarised on its own in the lower left pane and the variation by day of the week is shown in the lower right pane. These plots often help explain variations in concentration according to the emissions activity associated with them. For example, NO_x concentrations at roadside sites tend to exhibit peaks according to morning and evening traffic rush hours and tend to decline over weekends when there is generally lower traffic volumes.




Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
PM10
hour
month
weekday
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Mon Tue Wed Thu Fri Sat Sun


Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
PM2.5
hour
month
weekday
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Mon Tue Wed Thu Fri Sat Sun

6.8.1 Seasonal Variations

Seasonal variations are common for the pollutants measured at this site and can be observed in the 'month' plots. Clear seasonal variation can be seen in the NO_2 concentrations. The autumn and winter months recorded higher levels when emissions may be higher, and periods of cold, still weather reduce pollutant dispersion.

PM_{10} and $PM_{2.5}$ concentrations, showed some seasonal variation, with February and March being the highest months. This pattern may be influenced by a combination of factors including meteorological conditions, increased atmospheric stability reducing pollutant dispersion; regional pollution episodes; and local emissions, including biomass burning for residential heating, and potential secondary PM formation from precursor gases which could also play a role in the observed peaks.

6.8.2 Diurnal Variations

The diurnal variation analysis viewed in the 'hour' plot shows typical urban area daily patterns for NO_2. Pronounced peaks can be seen for these pollutants during the morning, corresponding to rush hour traffic between 05:00 and 09:00. Concentrations tend to decrease during the middle of the day, with an evening road traffic rush-hour peak, building up from early afternoon and slowly dropping over the night. Concentrations of oxidising agents in the atmosphere (particularly ozone) tend to increase in the afternoon, leading to enhanced oxidation of NO to NO_2 and therefore a larger and more persistent peak.

The diurnal patterns for PM are determined by two main factors. The first is emissions of primary particulate matter, from sources such as vehicles. The second factor is the reaction that occurs between sulphur dioxide, NO_x and other chemical species, forming secondary sulphate and nitrate particles. Small morning and afternoon road traffic rush-hour peaks for both PM_{10} and $PM_{2.5}$ can be seen in the data that are similar to the diurnal pattern of NO_2.

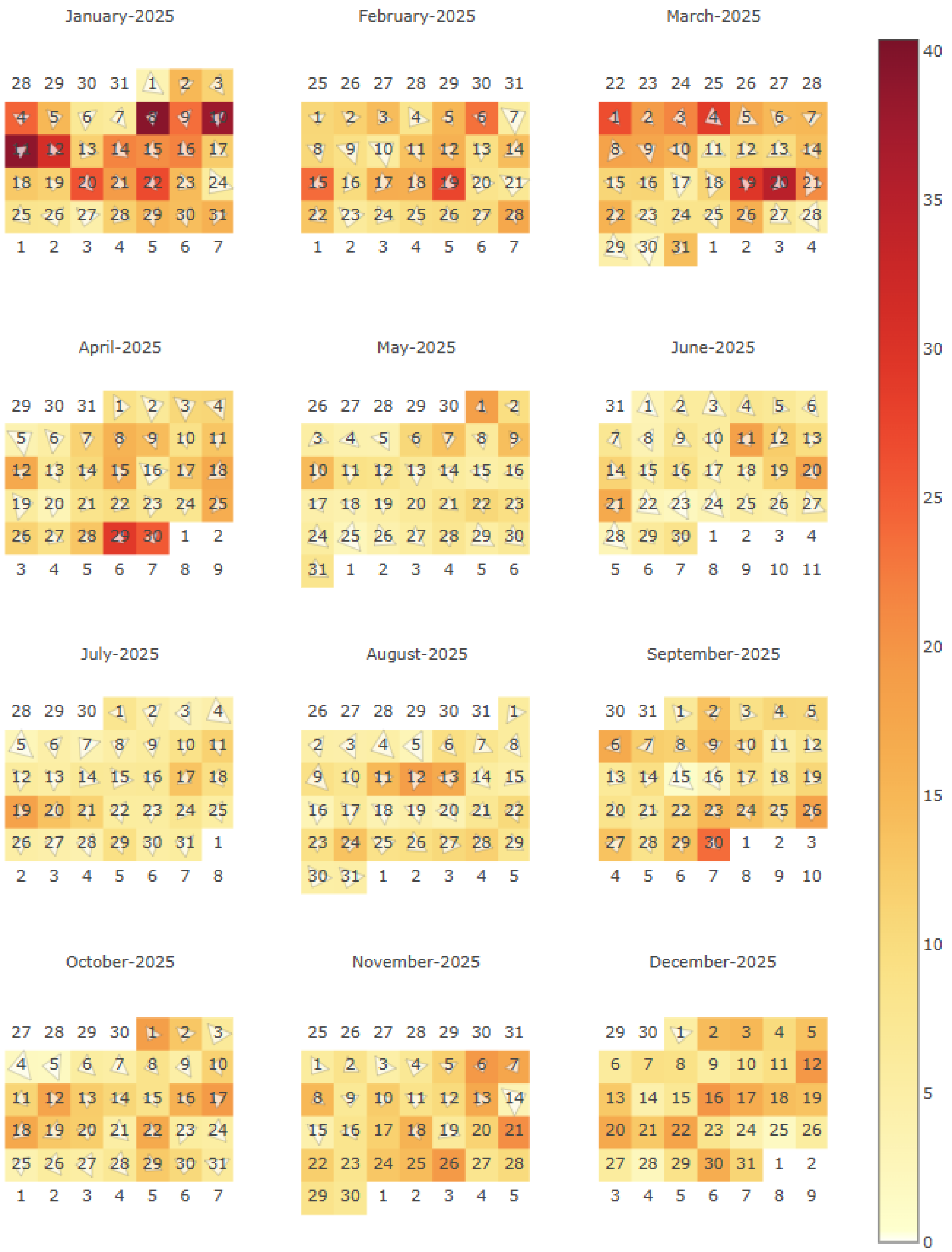
6.8.3 Weekly Variations

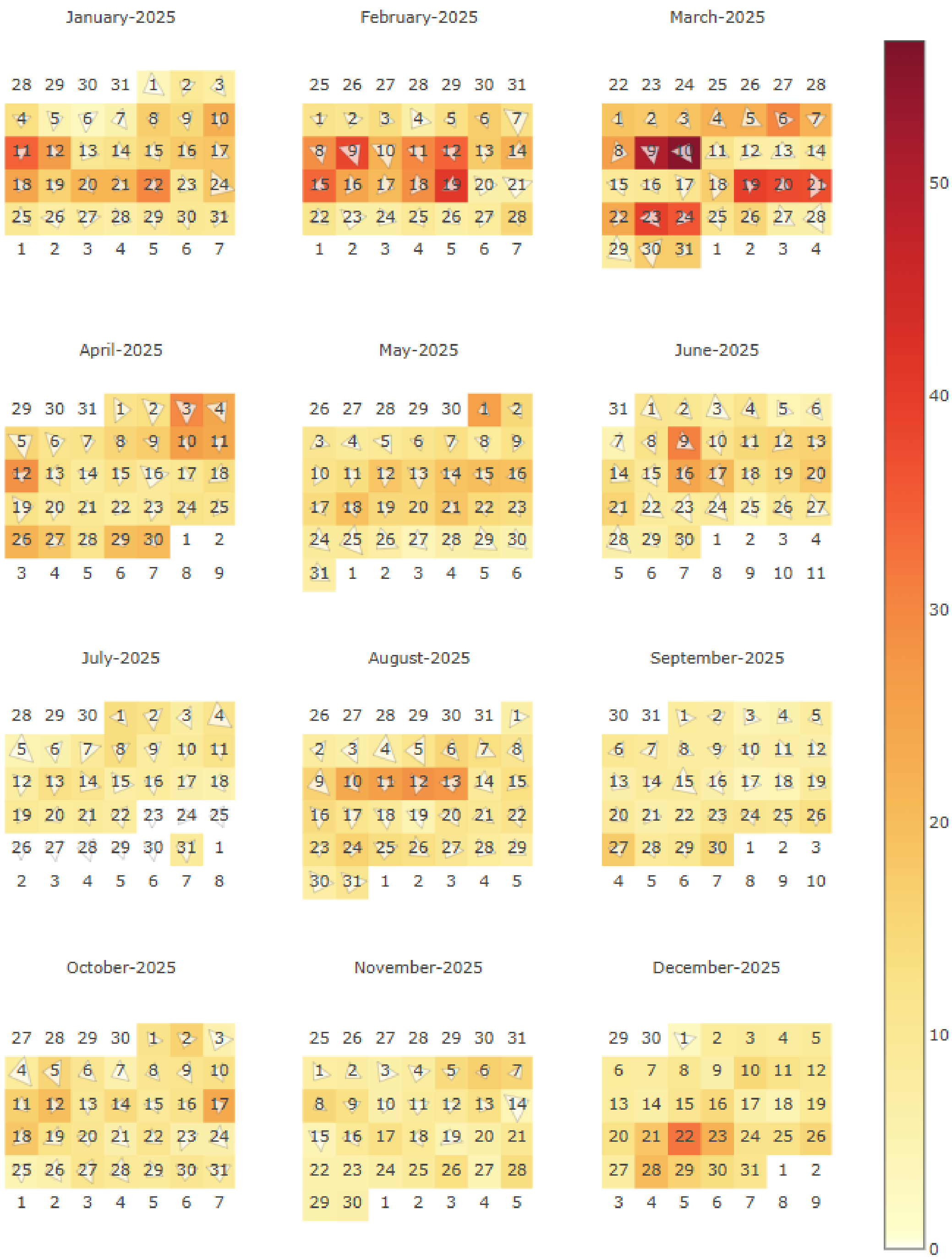
The analyses of each pollutant's weekly variation indicate a consistent diurnal pattern observed across all days of the week. For NO_2, pronounced peaks occur during the morning and afternoon rush hours, reflecting the influence of traffic emissions. These peaks are most prominent on weekdays, likely due to commuting activity, overall NO_2 concentrations are lower over the weekend, which can be attributed to reduced traffic volumes and decreased economic activity.

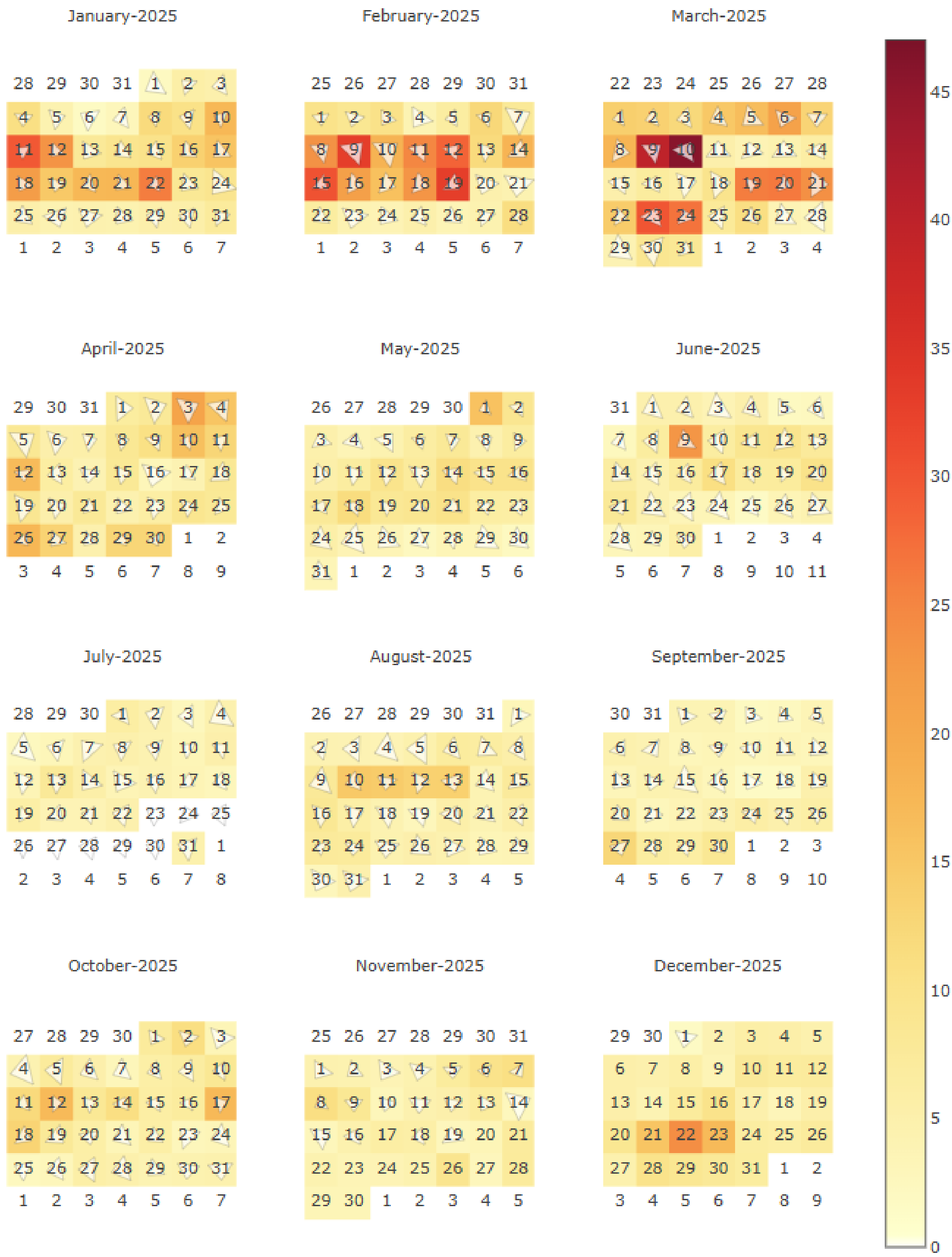
Unlike NO_2, PM_{10} and $PM_{2.5}$ concentrations do not show a clear weekly trend. This suggests that PM concentrations are influenced by a wider range of sources beyond direct emissions from traffic, such as regional pollution transport and meteorological conditions.

6.9 Calendar Plot

The plots below show daily variation in concentrations by pollutant across the period of the report, as laid out in a calendar style. This allows intuitive viewing of day to day headline trends in the wider context of the period. The background colours shown for each day relate to the concentration. An arrow visualises the daily average wind, with the direction indicating wind direction (of origin) and the size wind speed.




January-2025
February-2025
March-2025
April-2025
May-2025
June-2025
July-2025
August-2025
September-2025
October-2025
November-2025
December-2025
50
40
30
20
10
0



The calendar plots, show how pollutant levels change on a day-by-day basis and make it easy to identify both short and long-term pollution events, along with periods of low pollution. In addition, the size and direction of the triangle shows the wind speed and direction for that day.

The NO_2 plot shows that the highest value for the year was recorded on the 8th of January. The UK AIR Measurement summary (https://uk-air.defra.gov.uk/latest/measurement-summary-map.php) show that all areas of the UK were within the Low band. While the concentrations seen on this day at East Midlands Airport are elevated relative to the rest of the year, they were within the Low band as well.

The PM_{10} plot shows that the highest daily PM level was recorded on the 10th of March, on this day Moderate pollution levels were recorded across the central and southwestern parts of the UK. This was largely influenced by transboundary pollution transport over long distances, while stable atmospheric conditions may have limited dispersion, allowing PM concentrations to accumulate. Given these conditions, this can be classified as a regional pollution episode rather than one primarily driven by local sources.

With all three calendar plots, if compared to the previous year's report, it must be noted that the colour scaling is individual to each year and that darker colours this year may have been lighter in previous due to the lower concentrations.

6.10 Back Trajectory Analysis

The back trajectory plots show data from the HYSPLIT model run in analysis mode. This shows the air mass back trajectories for the period covered by the report. Two different kinds of plot are shown. The first statistically groups the trajectories into similar clusters, which is most useful to get an overview of air mass origins during the report period. Plots showing the trajectories associated with the top ten most polluted days provide information on the trajectory direction associated with the top ten measured concentrations for each pollutant during the report period.

Air mass back trajectories over these spatial scales do not vary locally so the receptor location used in this report has been selected from a range of national receptor locations maintained by Ricardo. The receptor point is used here is Bottesford which is 37.2 km away from the centre of all monitoring stations analysed in this report.

This section reviews the most significant periods of high air pollution concentrations for the whole year.

The NO_2 plot shows that the three days with the highest concentrations occurred with air masses from the north during winter, looking back at the calendar plot all three days were associated with low wind speeds, cold still air will have led to reduced dispersion and atmospheric mixing.

The PM plots show that the highest concentrations occurred with air masses coming over from the near continent, these air masses often result in transboundary PM from industrial areas in the low countries and northern France being measured.

7 Comparison with Other Local Monitoring Sites, the Previous Year and Passenger Numbers

2025 Annual mean pollutant concentrations from the East Midlands station site are compared in the table below, with those measured at other air quality monitoring sites in the East Midlands zone and the EMA annual mean from the previous year. The sites selected are all part of the Defra UK national Automatic Urban and Rural Network (AURN) and are as follows:

- Leicester University: an urban background site located within the grounds of Leicester University.
- Leicester A594 Roadside: an urban traffic site located on the inner ring road.
- Nottingham Kenmore Gardens: an urban background site in Nottingham city centre.
- Burton-On-Trent Horninglow: an urban background site on the outskirts of the town.
- Chilbolton: a rural site in Oxfordshire, included for comparative purposes.

Site/Year	Type	NO_2 µgm^{-3}	PM_{10} µgm^{-3}
EMA 2024	Other	10	11
EMA 2025	Other	11	13
Leicester University	Urban Background	17	12
Leicester A594	Urban Traffic	27	15
Nottingham Kenmore Gardens	Urban Background	14	15
Burton-On-Trent Horninglow	Urban Background	16	13
Chilbolton	Rural	6	11

The annual mean NO_2 concentrations at East Midlands Airport are lower than those recorded at any of the urban sites but higher than those recorded at the rural site.

The annual mean PM_{10} concentrations at East Midlands Airport are lower than those recorded at the urban traffic site and are similar to those recorded at the rural and urban background sites, which is to be expected given East Midlands Airport is a semi-rural location.

The annual mean for all pollutants showed a slight increase compared to last year. Passenger numbers continue to be lower than pre COVID-19 with the total passenger numbers for 2025 decreasing 4.3% from 4,136,286 to 3,959,234. Any differences will be impacted upon by external factors such as changes in local road networks, as well as metrological conditions and so cannot be completely to attributed actions undertaken by the airport.

For years prior to 2024, refer to Appendix 4, which has annual average concentrations recorded from the East Midlands air quality station between 2016 and 2025.

8 Conclusions

The following conclusions have been drawn from the results of the air quality monitoring programme at East Midlands Airport during 2025.

Oxides of nitrogen and particulate matter (as PM_{10} and $PM_{2.5}$) were monitored throughout 2025 at a single site located in the Aeropark bordering the northern edge of the airport. The conclusions of the 2025 monitoring programme are summarised below:

1. Data capture of at least 90% was achieved at the site for all pollutants meaning the annual means are representative.
2. During 2025 there were no exceedances of the AQS objective of 200 $\mu g\ m^{-3}$ for hourly mean NO_2. Up to 18 exceedances are permitted each year and so East Midland Airport is well within the limit.
3. The annual mean for NO_2 was 10.6 $\mu g\ m^{-3}$ and so did not exceed the annual mean AQS objective of 40 $\mu g\ m^{-3}$ for NO_2 in 2025.
4. There were two exceedances of the AQS objective for 24-hour mean of 50 $\mu g\ m^{-3}$ (not to be exceeded more than 35 times a year) and the annual mean PM_{10} of 13.1 $\mu g\ m^{-3}$ meant the East Midlands Airport air quality site did not exceed the 40 $\mu g\ m^{-3}$ annual limit for PM_{10}.
5. The annual mean for $PM_{2.5}$ was 8.3 $\mu g\ m^{-3}$ and the target value is 20 $\mu g\ m^{-3}$ and so this was met. It also met both the interim target of 12 $\mu g\ m^{-3}$ (to be achieved by 2028) and legally binding target of 10 $\mu g\ m^{-3}$ (to be achieved by 2040).
6. The diurnal patterns of concentrations of all pollutants were similar to those observed at other urban monitoring sites. Peak concentrations of NO_2 and particulate matter coincided with the morning and evening rush hour periods.
7. Meteorological data was used allowing the effect of wind direction and speed to be investigated. A bivariate plot of NO_2 showed that the highest concentrations were associated with calm conditions, moderate winds (<10 ms^{-1}) from the southeast also contributed. High concentrations of PM occurred under light to moderate winds from the northeast and southwest also contributing.
8. Mean concentrations of pollutants in 2025 were comparable with those measured at urban background and rural monitoring sites and lower than local urban traffic sites.

9. The annual means of NO_2, PM_{10} and $PM_{2.5}$ in 2025 are slightly higher than those recorded in 2024, when rounded to the nearest integer.

9 Acknowledgements

Ricardo would like to thank East Midlands Airport and the TSE team at East Midlands Airport for their assistance with this work.

10 Appendices

10.1 Appendix 1 – Continuous Monitoring Methods

The following continuous monitoring methods were used at the East Midlands Airport air quality monitoring station:

NO, NO_2: chemiluminescence with ozone.

FIDAS: Fine Dust Analysis Systems.

These methods were selected in order to provide real-time data. The chemiluminescence and the UV absorption analysers are the European reference method for ambient NO_2 monitoring. Each analyser provides a continuous output, proportional to the pollutant concentration. This output is recorded and stored every 10 seconds, and averaged to 15 minute average values by the on-site data logger. This logger is connected to a modem and interrogated twice daily, by telephone, to download the data to Ricardo. The data are then converted to concentration units and averaged to hourly mean concentrations. The NO_x analyser is equipped with an automatic calibration system, which can be triggered daily under the control of the on board data logger. Fully certificated calibration gas cylinders are also used at each site for manual calibration.

The FIDAS unit employs a white light LED light scatter method that offers additional information on both particle size distribution from 0.18 to 30 microns (PM_1, $PM_{2.5}$, PM_4, PM_{10} and Total Suspended Particles (TSP).

10.2 Appendix 2 – Quality Assurance and Quality Control

Ricardo operates air quality monitoring stations within a tightly controlled and documented quality assurance and quality control (QA/QC) system. These procedures are documented in the AURN QA/QC manual.

Elements covered within this system include: definition of monitoring objectives, equipment selection, and site selection, protocols for instrument operation calibration, service and maintenance, integrity of calibration gas standards, data review, scrutiny and validation.

All gas calibration standards used for routine analyser calibration are certified against traceable primary gas calibration standards at the Gas Standards Calibration Laboratory at Ricardo. The calibration laboratory operates within a specific and documented quality system and has UKAS accreditation for calibration of the gas standards used in this survey.

An important aspect of QA/QC procedures is the regular six-monthly inter calibration and audit check undertaken at every monitoring site. This audit has two principal functions: firstly, to check the instruments and the site infrastructure, and secondly to recalibrate the transfer gas standards routinely used on-site, using standards recently checked in the calibration laboratory. Ricardo's audit calibration procedures are UKAS accredited to ISO 17025. In line with current operational procedures within the Defra AURN, full inter calibration audits take place at the end of winter and summer. At these visits, the essential functional parameters of the monitors such as noise, linearity and, for the NO_x monitor, the efficiency of the NO_2 to NO converter are fully tested. In addition, the on-site transfer calibration standards are checked and re-calibrated if necessary, the air intake sampling system is cleaned and checked and all other aspects of site infrastructure are checked.

All air pollution measurements are reviewed daily by experienced staff at Ricardo. Data are compared with corresponding results from AURN monitoring stations and with expected air pollutant concentrations under the prevailing meteorological conditions. This review process rapidly highlights any unusual or unexpected measurements, which may require further investigation. When such data are identified, attempts are made to reconcile the data against known or possible local air pollution sources or local meteorology, and to confirm the correct operation of all monitors. In addition, the results of the daily automatic instrument calibrations are examined to identify any possible instrument faults. Should any faults be identified or suspected, arrangements are made for Ricardo personnel or equipment service contractors to visit the site as soon as possible.

At the end of every quarter, the data for that period are reviewed to check for any spurious values and to apply the best daily zero and sensitivity factors, and to account for information which only became available after the initial daily processing. At this time, any data gaps are filled with data from the data logger back-up memory to produce as complete a data record as possible.

Finally, the data are re-examined on an annual basis, when information from the six-monthly inter calibration audits can be incorporated. After completion of this process, the data are fully validated and finalised, for compilation in the annual report. Following these three-stage data checking and review procedures allows the overall accuracy and precision of the data to be calculated. The accuracy and precision figures for the pollutants monitored at East Midlands Airport are summarised below.

	NO_2 μgm^{-3}	PM_{10} μgm^{-3}	$PM_{2.5}$ μgm^{-3}
Precision	±2.5	±2	±2
Accuracy	±14%	±7.5%	±9.3%

10.3 Appendix 3 – Conversion Factors

All of the air quality monitoring equipment at both sites is housed in purpose-built enclosures. The native units of the analysers are volumetric (e.g. ppb). Conversion factors from volumetric to mass concentration measurement for gaseous pollutants are provided below:

NO 1 ppb = 1.25 μg m^{-3}

NO_2 1 ppb = 1.91 μg m^{-3}

In this report, the mass concentration of NO_x has been calculated as follows: NO_x μg m^{-3} = (NO ppb + NO_2 ppb) x 1.91. This complies with the requirements of the Air Quality Directive1 and is also the convention generally adopted in air quality modelling.

10.4 Appendix 4 – Long Term EMA Annual Average Concentrations

Long term annual average concentrations recorded from the East Midlands air quality station are presented below.

	NO_2 µgm^{-3}	PM_{10} µgm^{-3}	$PM_{2.5}$ µgm^{-3}
2016	22	16	12
2017	14	12	8
2018	15	13	9
2019	14	13	8
2020	10	11	7
2021	11	12	7
2022	12	13	8
2023	10	11	7
2024	10	11	7
2025	11	13	8

11 References

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3. National Atmospheric Emissions Inventory (2023) (online). Available at https://naei.energysecurity.gov.uk/sites/default/files/2026-03/GB_IIR_2026_Final.pdf (accessed 24 March 2026).↩
4. Air Quality Expert Group (2004) Nitrogen dioxide in the United Kingdom [online]. London, UK: Department for Environment, Food and Rural Affairs. Available at: http://uk-air.defra.gov.uk/library/aqeg/publications [Accessed 27 March 2026].↩
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6. World Health Organization. (2021). WHO global air quality guidelines: particulate matter ($PM_{2.5}$ and PM_{10}), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide. World Health

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7. EC (2008) Council Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe [online]. Available from: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32008L0050:EN:NOT (accessed 17 March 2022). And Commission Directive (EU) 2015/1480 of 28 August 2015 amending several annexes to Directives 2004/107/EC and 2008/50/EC of the European Parliament and of the Council laying down the rules concerning reference methods, data validation and location of sampling points for the assessment of ambient air quality (Text with EEA relevance). Available from http://data.europa.eu/eli/dir/2015/1480/oj (Accessed 21 March 2026).↩
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9. Department for Environment, Food and Rural Affairs (2018). Part IV of the Environment Act 1995. Local air quality management - Technical Guidance LAQM.TG (22) [online]. London, UK: Department for Environment, Food and Rural Affairs in partnership with the Scottish Executive, Welsh Assembly Government and Department of the Environment Northern Ireland. Available from: https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf (accessed 21 March 202).↩

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