Dublin Airport Air Quality Monitoring
Annual Report 2022

Sustainability Department
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Glossary
Abbreviation Definition
EPA Environmental Protection Agency
NO Nitrogen Oxide
NO₂ Nitrogen Dioxide
NOx Oxides of Nitrogen
PM₁₀ Airborne Particulate Matter, particle size less than 10 micron.
AQI Health Air Quality Index for Health
The Regulations Ambient Air Quality Standards Regulations 2011

Version Control

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<th>Prepared by:</th>
<th>Reviewed by:</th>
<th>Date:</th>
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<td>Sustainability Project Officer</td>
<td>Sustainability Department</td>
<td>March 2023</td>
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Executive Summary

daan undertakes a programme of air quality monitoring at Dublin Airport (DAP) and in surrounding communities. Monitoring is undertaken using a stationary continuous air monitoring station located within the DAP boundary. Air quality is also monitored at 11 locations within and outside the airport boundary using passive diffusion tube sampling.

This report provides an overview of the results of air quality monitoring undertaken by daa at DAP in 2022. Air monitoring locations are listed in Table 1 and presented as Figure 1 of this report.

The Ambient Air Quality Standards Regulations 2011 (the Regulations), S.I. No. 180 of 2011, implement EU Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe. The Regulations are referred to in this report for comparison purposes only. It should be noted that there is no requirement under the Regulations for individual companies or operators to carry out air monitoring. In Ireland, compliance with the Regulations is the responsibility of the Environmental Protection Agency (EPA), which is deemed to be the competent authority for the purpose of EU Directive 2008/50/EC. The EPA is required to submit an annual Air Quality report to the Minister of Communications, Climate Action and the Environment and to the European Commission. The latest EPA Report entitled “Air Quality in Ireland 2021” was published in September 2022 and is available on the EPA website. The 2022 report will likely be published later in 2023.

Data collected from all of the daa monitoring locations presented in this report were within the limit values mandated in the 2011 Regulations. The results of the NO$_2$ and PM$_{10}$ concentrations using the online analyser indicate concentrations are below the relevant annual limit value of 40μg/m$^3$ and within the allowed criteria of short-term limit values. The average annual emissions for NO$_2$ was 19 μg/m$^3$. Passive sampling NO$_2$ results have been largely consistent with 2021 concentrations. The highest NO$_2$ concentrations were recorded at the Dublin Airport bus depot which experiences significant vehicular activity. daa will continue to closely monitor trends in air quality monitoring results at this location.

In collaboration with the EPA, Dublin Airport’s continuous air monitoring station can be viewed live on the EPA website: https://airquality.ie/. This further demonstrates daa’s commitment to work with regulators and communities to ensure that there is transparency about air quality information at the airport.
1.0 Introduction

1.1 Background
Dublin Airport (DAP) is located approximately 10km north of Dublin city. The areas to the west of the airport are predominantly rural in nature. The airport is surrounded by Swords Village to the north and Santry to the south. The airport is bounded on two sides by the busiest motorways in the country: the M1 and the M50. The M1 motorway is approximately 1km east of the current location of the airport’s onsite air quality monitoring station and the M50 motorway is approximately 2.5km south of the monitoring location.

1.2 Purpose
The purpose of this report is to present an overview of the results of air quality monitoring conducted onsite at DAP and at external monitoring locations in the vicinity of the airport in 2022. The Ambient Air Quality Standards Regulations 2011 (the Regulations), S.I. No. 180 of 2011, implement EU Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe. This report compares the data collected during daa’s monitoring programme with limit values contained in The Ambient Air Quality Standards Regulations 2011 (the Regulations) to assess air quality at each monitoring location.

The Regulations are referred to in this report for comparison and reference purposes only. There is no requirement under the Regulations that companies or operators shall carry out air quality monitoring. In Ireland, compliance with the Regulations is the responsibility of the Environmental Protection Agency (EPA), which is deemed to be the competent authority.

A range of parameters are recorded at DAP’s continuous on-site monitoring station as follows:

- Sulphur dioxide (SO₂);
- Oxides of nitrogen NOₓ (NO and NO₂);
- Carbon monoxide (CO);
- Ozone (O₃);
- Particulate Matter (PM₁₀).
Diffusion tube samplers located in communities surrounding the airport monitor the following parameters:

- Sulphur dioxide
- Nitrogen Dioxide (NO₂);
- Benzene;
- Ethylbenzene;
- m- and p-Xylene;
- o-Xylene;
- Toluene;
- Ozone.

The results of air quality monitoring for all of the above parameters are reviewed by daa on a continuous basis.

To date and in line with air quality reporting at many airports, daa has focussed reporting on the most important parameters:

- Nitrogen Dioxide (NO₂) and Particulate Matter (PM₁₀) at the DAP automatic station; and
- Nitrogen Dioxide (NO₂) and Benzene using diffusion tubes at 11 offsite locations.
2.0 Monitoring Locations

A list of the ambient air quality sampling locations is presented in Table 1. Sampling locations are presented in Figure 1.

<table>
<thead>
<tr>
<th>Ref</th>
<th>Location</th>
<th>Method</th>
<th>Parameters</th>
</tr>
</thead>
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<td><strong>On-site</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dublin Airport</td>
<td>Continuous analyser</td>
<td><strong>NO₂</strong> NO₂ (\text{PM}_{10})</td>
</tr>
<tr>
<td>A1</td>
<td>Forrest Little Golf Club</td>
<td>Passive Tubes</td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td>Kilreesk Lane, St. Margaret’s</td>
<td>Passive Tubes</td>
<td></td>
</tr>
<tr>
<td>A3</td>
<td>Ridgewood Estate West, Swords</td>
<td>Passive Tubes</td>
<td></td>
</tr>
<tr>
<td>A4</td>
<td>St. Margaret’s School and Parish House</td>
<td>Passive Tubes</td>
<td></td>
</tr>
<tr>
<td>A5</td>
<td>Fire Station, Huntstown, Dublin Airport</td>
<td>Passive Tubes</td>
<td></td>
</tr>
<tr>
<td>A6</td>
<td>Southern Boundary Fence, Dublin Airport</td>
<td>Passive Tubes</td>
<td></td>
</tr>
<tr>
<td>A7</td>
<td>Western Boundary Fence, Dublin Airport</td>
<td>Passive Tubes</td>
<td></td>
</tr>
<tr>
<td>A8</td>
<td>St. Nicholas of Myra School, Malahide Road</td>
<td>Passive Tubes</td>
<td></td>
</tr>
<tr>
<td>A9</td>
<td>Naomh Mearnóg GAA Club, Portmarnock.</td>
<td>Passive Tubes</td>
<td></td>
</tr>
<tr>
<td>A10</td>
<td>Oscar Papa Site, Portmarnock.</td>
<td>Passive Tubes</td>
<td></td>
</tr>
<tr>
<td>A11</td>
<td>Airport Bus Depot</td>
<td>Passive Tubes</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Community Ambient Air Quality Monitoring Locations
Figure 1 Air Quality Monitoring Locations
3.0 Parameters and Sampling Methodology

3.1 Offsite Passive Sampling

3.1.1 Nitrogen Dioxide (NO$_2$) and Benzene (C$_6$H$_6$)  
DAA has installed a network of passive diffusion tube samplers in areas surrounding the  
airport. Monitoring locations are shown on Figure 1 and listed in Table 1. The diffusion  
tubes are exposed for approximately 4-week intervals and record monthly mean  
concentrations. The tubes are analysed using UV Spectrophotometry at a UKAS (United  
Kingdom Accreditation Service) accredited laboratory. Results are expressed in μg/m$^3$  
(micrograms per cubic metre). Monthly mean concentrations have been averaged to give  
an annual mean, presented in Figure 2, which can be compared with limit values.

3.2 Onsite Sampling

3.2.1 Equipment Calibration  
An external expert service provider undertakes routine servicing of the DAP air quality  
monitoring equipment. Additionally, the monitoring station undergoes a full service twice  
yearly. During routine visits, air filters are replaced, and the instruments are calibrated to  
EPA gas standards. The technician also inspects the functionality of the station and  
sampling system. An emergency call-out service is also offered by the service provider as  
and when required. The calibration process takes approximately 24 hours and data  
collection resumes after this 24-hour period. The dates of calibration and maintenance of the  
air monitoring equipment in 2022 were as follows:

- 10$^{th}$ March
- 26$^{th}$ April
- 16$^{th}$ May
- 1$^{st}$ June
- 7$^{th}$ July
- 8$^{th}$ August

Calibration visits were not completed at the DAP continuous air quality monitor in Q4 2022  
due to delays in engineer availability from the service provider arising as a result of Brexit.  
The service provider has advised that attendance delays for customers in Ireland will be  
reduced from Q1 2023.

In 2022, due to down times of the monitoring equipment during calibration and equipment  
malfunction approximately 94% of NO$_2$ data and 98% of PM$_{10}$ was captured.
3.2.2 Nitrogen Dioxide (NO₂)
Onsite monitoring of NO₂ is carried out on a continuous basis at the continuous airport monitoring station. Measurement of NO₂ is carried out using a Horiba APNA-370 ambient NOx monitor which employs a crossflow modulated chemiluminescence method. The results are expressed in μg/m³.

3.2.3 Particulate Matter (PM₁₀)
PM₁₀ is defined as airborne particulate matter with an aerodynamic diameter equal to or less than 10μm. PM₁₀ is monitored on a continuous basis at the airport monitoring station.

The PM₁₀ instrument automatically measures and records airborne particulate concentration levels using the principle of beta ray attenuation. The sampler monitors the PM₁₀ content of air by drawing a measured volume of air through a chamber containing a pre-conditioned and pre-weighed filter in accordance with the internationally accepted US EPA protocol for PM₁₀ sampling. The results are expressed in μg/m³.
4.0 Monitoring Results

4.1 Offsite NO₂ Monitoring Results

Figure 2 presents the annual mean NO₂ concentration for each location based on the monthly passive tube sampling. The Regulations mandate that the annual mean limit value must be below 40 μg/m³ for NO₂. As can be seen from Figure 2, the annual mean values were below the limit at all locations. It is noted that the Terminal 1 staff shuttle bus stop was suspended from 2nd June 2022 to accommodate the temporary installation of covered areas for passengers outside Terminal 1. This bus stop reopened in Q4 on 10th October 2022.

*Figure 2: 2022 Average NO₂ Concentrations by location*

*A11 is the bus depot*
4.2 Offsite Benzene (C₆H₆) Monitoring Results

Figure 3 presents the mean Benzene concentration for each location, based on the monthly passive tube sampling in 2022. The Regulations mandate an annual mean limit value of 5 μg/m³ for Benzene. As can be seen from Figure 3, the annual mean values were well below the limit value of 5 μg/m³ and less than 1 μg/m³ at all monitoring locations.

**Figure 3:** 2022 Average Monthly Benzene (C₆H₆) Concentrations by location
4.3 Odours

Fuel odours may arise from many sources including road traffic, ground handling equipment as well as aircraft on the ground. Depending on weather conditions, odours from fuel (hydrocarbons) may be detected at locations close to the airport. As discussed in section 4.2 of this report, diffusion tubes’ results for benzene indicate that the average concentrations are well below the national limit value at all locations.

The human nose is extremely sensitive and can detect very low concentrations of hydrocarbons in the air. Weather also impacts the dispersion of odour and affects the strength of odour and locations affected.
4.4 On-site Airport Monitoring Station Results: Daily Average NO₂

NO₂ concentrations are measured at the automatic station at DAP. Figure 4 presents the daily average NO₂ concentrations measured during 2022. The equivalent daily average was calculated as 19 μg/m³.

![Daily Average NO₂ Concentrations January - December](image)

**Figure 4: Daily Average NO₂ 2022**

- N – No Data
- C - Calibration
4.5 On-site Airport Monitoring Station Results: PM$_{10}$

Daily average PM$_{10}$ concentrations recorded at the automatic station in DAP in 2022 are presented in Figure 5. The mean PM$_{10}$ was calculated as 12 µg/m$^3$. The Regulations set a 24-hour PM$_{10}$ limit value of 50 µg/m$^3$, and an annual mean limit value of 40 µg/m$^3$ as shown in Table 2.

<table>
<thead>
<tr>
<th>Objective</th>
<th>Averaging Period</th>
<th>Limit or Threshold Value (µg/m$^3$)</th>
<th>No. of Allowed Exceedances (Regulations 2011)</th>
<th>No. of Exceedances</th>
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<tr>
<td>PM$_{10}$ Limit</td>
<td>24 hour</td>
<td>50</td>
<td>Not to be exceeded on more than 35 days per year</td>
<td>1</td>
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<tr>
<td>Value</td>
<td>Calendar Year</td>
<td>40</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

Table 2 PM$_{10}$ Limit Values
Figure 5: Daily Average PM$_{10}$ 2022

Daily Average PM$_{10}$ Concentrations January - December

Annual limit value, 40µg/m$^3$

**N** – No Data

**C** – Calibration
5.0 Onsite: Annual Average NO$_2$ and PM$_{10}$ (2012-2022)

Annual mean NO$_2$ and PM$_{10}$ are presented in Table 3 for the automatic station onsite at DAP. The trends over ten years are shown in Figure 6. For both parameters, annual limits are below the threshold limits outlined in the Regulations.

<table>
<thead>
<tr>
<th>Location</th>
<th>Year</th>
<th>NO$_2$ (µg/m$^3$)</th>
<th>PM$_{10}$ (µg/m$^3$)</th>
</tr>
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<tbody>
<tr>
<td>Dublin Airport Station</td>
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<td>19</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>2021</td>
<td>19</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>2020</td>
<td>22</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>2019</td>
<td>28</td>
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<td></td>
<td>2018</td>
<td>28</td>
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<tr>
<td></td>
<td>2012</td>
<td>19</td>
<td>20</td>
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</table>

| Annual Limit Value    | Regulations | 40 | 40 |

Table 3 Annual Mean NO$_2$ and PM$_{10}$ Concentrations at Dublin Airport

Notes
1. Values rounded to the nearest number.

![Figure 6](image-url)  
**Figure 6** Annual Mean NO$_2$ and PM$_{10}$ Concentrations at Dublin Airport
PM$_{10}$ and NO$_2$ results monitored at DAP are well below limits contained in the Regulations. Elevated readings of PM$_{10}$ and NO$_2$ can occur for a variety of reasons, from both natural and manmade sources including international volcanic eruptions, vehicle traffic, agriculture, industrial emissions, de-icing of roads, etc.
6.0 Results Summary

The EPA is the designated Competent Authority in Ireland for the coordination of ambient air quality monitoring in accordance with the Regulations and undertakes monitoring throughout the country. The tables below compare DAP’s annual NO$_2$ and PM$_{10}$ average concentrations with the EPA national network stations records for years 2012 - 2021.

<table>
<thead>
<tr>
<th>Location</th>
<th>NO$_2$ ($\mu$g/m$^3$)</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022(^1)</th>
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<td>Winetavern St.</td>
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<td>31</td>
<td>31</td>
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<td>37</td>
<td>27</td>
<td>29</td>
<td>28</td>
<td>15</td>
<td>24</td>
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</tr>
<tr>
<td>Rathmines</td>
<td></td>
<td>19</td>
<td>17</td>
<td>18</td>
<td>20</td>
<td>17</td>
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<td>Dublin Airport Station(^2)</td>
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<td>23</td>
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<td>28*</td>
<td>28*</td>
<td>22</td>
<td>23</td>
<td>19</td>
</tr>
</tbody>
</table>

| Annual Limit Value | NO$_2$ (\mu g/m$^3$) | 40   |

*Elevated readings linked to construction activity.

**Table 4** NO$_2$ comparisons with EPA national network stations (2013 – 2021)

<table>
<thead>
<tr>
<th>Location</th>
<th>PM$_{10}$ ($\mu$g/m$^3$)</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
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<td>Rathmines</td>
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<td>Dublin Airport Station(^2)</td>
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<td>20</td>
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<td>16</td>
<td>11</td>
<td>12</td>
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</tbody>
</table>

| Annual Limit Value | PM$_{10}$ (\mu g/m$^3$) | 40   |

**Table 5** PM$_{10}$ comparisons with EPA national network stations (2013 – 2021)

**Notes**

1. 2022 EPA monitoring data has not yet been published.
2. Values rounded to the nearest whole number.
7.0 Conclusion

7.1 Onsite Monitoring
The results of the NO\textsubscript{2} and PM\textsubscript{10} concentrations using the online analyser indicate concentrations are below the relevant annual limit value of 40µg/m\textsuperscript{3} and within the allowed criteria of short-term limit values. The annual average annual emissions for PM\textsubscript{10} was 12 µg/m\textsuperscript{3} while NO\textsubscript{2} was 19 µg/m\textsuperscript{3}.

In collaboration with the EPA, Dublin Airport’s continuous air monitoring can be viewed on the EPA website at: https://airquality.ie/. daa is committed to working with regulators and the local community to ensure that there is transparency about air quality information at the airport.

7.2 Offsite Monitoring
NO\textsubscript{2} readings at Dublin Airport remained largely consistent between 2021 and 2022. While monitoring results at all locations were within the annual limit of 40µg/m\textsuperscript{3} the highest NO\textsubscript{2} concentrations were identified at the Dublin Airport bus depot location (A11) with an average of 39.5 µg/m\textsuperscript{3} recorded. A high volume of vehicular activity occurs in this area. In previous years preceding the COVID-19 pandemic, the annual average of NO\textsubscript{2} at this location has exceeded the ambient limit value. It is noted that the Terminal 1 staff shuttle bus stop was suspended from 2\textsuperscript{nd} June until 10\textsuperscript{th} October 2022 to accommodate the temporary installation of covered areas for passengers outside Terminal 1. daa will continue to closely monitor emission levels at this location.