



Department  
for Environment  
Food & Rural Affairs

# Air Pollution in the UK 2021 – Compliance Assessment Summary

September 2022

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We work closely with our 33 agencies and arm's length bodies on our ambition to make our air purer, our water cleaner, our land greener and our food more sustainable. Our mission is to restore and enhance the environment for the next generation, and to leave the environment in a better state than we found it.



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# Executive Summary

The UK's Air Quality Standards Regulations require reporting of ambient air quality data on an annual basis. This is done via the UK-AIR website at <https://uk-air.defra.gov.uk/>. These data are reported on behalf of Defra (the Department for Environment, Food and Rural Affairs) and the Devolved Administrations of Scotland, Wales and Northern Ireland.

This Compliance Assessment Summary has been prepared to accompany and summarise the UK's 2021 submission on air quality. It presents a summary of the UK's compliance with the Air Quality Standards Regulations, based on measurements from national air pollution monitoring networks and supplementary assessment (which includes air pollution modelling). It includes details of the exceedances of air quality limit values and target values reported in 2021, and a comparison with previous years since 2008.

This document is an extract from a larger report, '*Air Pollution in the UK 2021*', which, in addition to the compliance summary, also provides background information on the pollutants covered by the above Regulations and the UK Air Quality Strategy; their sources, effects, how they are measured and modelled in the UK, and details of their spatial distribution and changes over time. The pollutants covered in this report are:

- Nitrogen oxides (NO<sub>x</sub>) comprising NO and NO<sub>2</sub>
- PM<sub>10</sub> and PM<sub>2.5</sub> particles
- Ozone (O<sub>3</sub>)
- Sulphur dioxide (SO<sub>2</sub>)
- Carbon Monoxide (CO)
- Benzene
- 1,3-Butadiene
- Metals: lead, cadmium, nickel and mercury, and the metalloid arsenic
- Polycyclic aromatic hydrocarbons (PAH).

For the purposes of air quality monitoring and assessment of compliance with the Air Quality Standards Regulations, the UK is divided into 43 zones. The 2021 results are summarised below:

- The UK met the limit value for hourly mean nitrogen dioxide (NO<sub>2</sub>) in all 43 zones.
- 33 zones met the limit value for annual mean NO<sub>2</sub>, with only 10 zones exceeding.
- The low number of zones exceeding the annual mean limit value is in part attributed to the ongoing Covid-19 restrictions which continued to reduce traffic on many roads in 2021.
- All non-agglomeration zones complied with the critical level for annual mean NO<sub>x</sub> concentration, set for protection of vegetation. (This has been the case in all years from 2008 onwards).
- All zones met the limit value for daily mean concentration of PM<sub>10</sub> particulate matter, without the need for subtraction of the contribution from natural sources.
- All zones met the limit value for annual mean concentration of PM<sub>10</sub> particulate matter, without the need for subtraction of the contribution from natural sources.

- All zones met both limit values for annual mean concentration of PM<sub>2.5</sub> particulate matter: the Stage 1 limit value, which came into force on 1<sup>st</sup> January 2015, and the Stage 2 limit value to be met by 2020.
- The UK has previously achieved its 2020 national exposure reduction target for PM<sub>2.5</sub>, based on the Average Exposure Indicator (AEI) statistic. In 2021, the three-year running mean AEI was 9 µg m<sup>-3</sup>; this statistic has therefore remained within the target value.
- All zones met both the target values for ozone; the target value based on the maximum daily eight-hour mean, and the target value based on the AOT40 statistic.
- Four zones were compliant with the long-term objective for ozone, set for the protection of human health. This is based on the maximum daily eight-hour mean.
- 42 zones met the long-term objective for ozone, set for the protection of vegetation. This is based on the AOT40 statistic, explained in Section 3 of this report.
- All zones met the limit values for sulphur dioxide, carbon monoxide, benzene and lead, and the target values for arsenic and cadmium.
- Four zones exceeded the target value for nickel.
- Two zones exceeded the target value for benzo[a]pyrene.

It was reported last year that the pandemic restrictions of 2020 appeared to have substantially increased compliance with the limit values for nitrogen dioxide in 2020 compared to 2019. (This did not mean concentrations of other pollutants were unaffected: however, the UK was already fully compliant with the limit values for other relevant pollutants.) In 2021, measured urban concentrations of NO<sub>2</sub> were typically higher than in 2020 but still lower than their pre-pandemic levels. Ten zones exceeded the annual mean NO<sub>2</sub> limit value in 2021 compared to five in 2020; however, there were still considerably fewer zones exceeding than in pre-pandemic years, when the majority of zones exceeded.

Ozone is also of particular interest in the context of the Covid-19 restrictions. This pollutant is removed from the air by reaction with nitric oxide (NO), which is a component of vehicle emissions. The 2020 data suggested that traffic reductions may have allowed ozone concentrations in some urban areas to become higher than they otherwise would have. However, ambient ozone concentrations are greatly influenced by meteorological conditions in any given year. The year 2021 appears to have been a 'low' year for ozone, as shown by the relatively high level of compliance with the long-term objective for vegetation: just one zone exceeded, the lowest number since 2017.

For more information on air quality in the UK visit the Defra website at [gov.uk/defra](https://gov.uk/defra) and the UK Air Quality websites at [uk-air.defra.gov.uk/](https://uk-air.defra.gov.uk/), [scottishairquality.scot/](https://scottishairquality.scot/), [airquality.gov.wales](https://airquality.gov.wales) and [airqualityni.co.uk](https://airqualityni.co.uk).

# 1 Introduction

Clean air is vital for people's health and the environment, essential for making sure our cities are welcoming places for people to live and work now and in the future, and for our prosperity. Improving air quality remains a key priority for the UK.

In the UK, concentrations of a range of pollutants in ambient air are regulated by the Air Quality Standards Regulations as follows:

- The Air Quality Standards Regulations 2010 in England (UK Government, 2010), and their December 2016 amendment (UK Government, 2016)
- The Air Quality Standards (Scotland) Regulations 2010 in Scotland (Scottish Government, 2010), and their December 2016 amendment (Scottish Government, 2016)
- The Air Quality Standards (Wales) Regulations 2010 in Wales (Welsh Government, 2010)
- The Air Quality Standards Regulations (Northern Ireland) 2010 (Department of Environment Northern Ireland, 2010) and their December 2016 amendment (DAERA, 2017)
- The Air Quality Standards Regulations (Gibraltar) and their December 2016 amendment (HM Government of Gibraltar, 2016)

These Regulations have their origins in the following European Union legislation:

- Directive 2008/50/EC of 21<sup>st</sup> May 2008, on Ambient Air Quality and Cleaner Air for Europe (European Parliament and Council of the European Union, 2008)
- Directive 2004/107/EC of 15<sup>th</sup> December 2004 (European Parliament and Council of the European Union, 2004).

The Air Quality Standards Regulations set 'limit values', 'target values' and 'long-term objectives' for ambient concentrations of pollutants. These are explained below, as well as provisions regarding monitoring, and reporting of data.

**Limit values** are legally binding and must not be exceeded. They are set for individual pollutants and comprise a concentration value, an averaging period for the concentration value, a number of exceedances allowed (per year) and a date by which this must be achieved. Some pollutants have more than one limit value, for example relating to short-term average concentrations (such as the hourly mean) and long-term average concentrations (such as the annual mean).

**Target values** and **long-term objectives** are set for some pollutants and are configured in the same way as limit values. These are not legally binding, but the UK must take all necessary measures not entailing disproportionate costs to meet the target values and long-term objectives.

The Air Quality Standards Regulations include detailed provisions on the **monitoring and reporting** of air quality, including:

- The division of the UK into zones for the purposes of compliance reporting.
- The location and number of sampling points.
- The measurement methods to be used.
- Data quality objectives.
- Siting criteria each monitoring station must meet.
- Provision for reporting compliance.
- Provision of information to the public.

The Air Quality Standards Regulations require the UK to undertake air quality assessment and report the findings on an annual basis. The UK has statutory monitoring networks in place to meet the requirements of the above Regulations, with supplementary assessment (including air quality modelling) used to supplement the monitored data.

Further information on air quality in the UK can be found on Defra's online UK Air Information Resource (UK-AIR), at <https://uk-air.defra.gov.uk> .

## 2 Definition of Zones

The UK is divided into 43 zones for air quality assessment. There are 28 agglomeration zones (large urban areas) and 15 non-agglomeration zones. Each zone has an identification code (**Table 2-1**). Zones are shown in **Figure 2-1**.

**Table 2-1 UK Zones for Ambient Air Quality Reporting 2021**

| Zone                            | Zone code | Zone type         |
|---------------------------------|-----------|-------------------|
| Greater London Urban Area       | UK0001    | Agglomeration     |
| West Midlands Urban Area        | UK0002    | Agglomeration     |
| Greater Manchester Urban Area   | UK0003    | Agglomeration     |
| West Yorkshire Urban Area       | UK0004    | Agglomeration     |
| Tyneside                        | UK0005    | Agglomeration     |
| Liverpool Urban Area            | UK0006    | Agglomeration     |
| Sheffield Urban Area            | UK0007    | Agglomeration     |
| Nottingham Urban Area           | UK0008    | Agglomeration     |
| Bristol Urban Area              | UK0009    | Agglomeration     |
| Brighton/Worthing/Littlehampton | UK0010    | Agglomeration     |
| Leicester Urban Area            | UK0011    | Agglomeration     |
| Portsmouth Urban Area           | UK0012    | Agglomeration     |
| Teesside Urban Area             | UK0013    | Agglomeration     |
| The Potteries                   | UK0014    | Agglomeration     |
| Bournemouth Urban Area          | UK0015    | Agglomeration     |
| Reading/Wokingham Urban Area    | UK0016    | Agglomeration     |
| Coventry/Bedworth               | UK0017    | Agglomeration     |
| Kingston upon Hull              | UK0018    | Agglomeration     |
| Southampton Urban Area          | UK0019    | Agglomeration     |
| Birkenhead Urban Area           | UK0020    | Agglomeration     |
| Southend Urban Area             | UK0021    | Agglomeration     |
| Blackpool Urban Area            | UK0022    | Agglomeration     |
| Preston Urban Area              | UK0023    | Agglomeration     |
| Glasgow Urban Area              | UK0024    | Agglomeration     |
| Edinburgh Urban Area            | UK0025    | Agglomeration     |
| Cardiff Urban Area              | UK0026    | Agglomeration     |
| Swansea Urban Area              | UK0027    | Agglomeration     |
| Belfast Metropolitan Urban Area | UK0028    | Agglomeration     |
| Eastern                         | UK0029    | Non-agglomeration |
| South West                      | UK0030    | Non-agglomeration |
| South East                      | UK0031    | Non-agglomeration |
| East Midlands                   | UK0032    | Non-agglomeration |
| North West & Merseyside         | UK0033    | Non-agglomeration |
| Yorkshire & Humberside          | UK0034    | Non-agglomeration |
| West Midlands                   | UK0035    | Non-agglomeration |
| North East                      | UK0036    | Non-agglomeration |
| Central Scotland                | UK0037    | Non-agglomeration |
| North East Scotland             | UK0038    | Non-agglomeration |
| Highland                        | UK0039    | Non-agglomeration |
| Scottish Borders                | UK0040    | Non-agglomeration |
| South Wales                     | UK0041    | Non-agglomeration |
| North Wales                     | UK0042    | Non-agglomeration |
| Northern Ireland                | UK0043    | Non-agglomeration |



**Figure 2-1 UK Zones for Ambient Air Quality Reporting 2021**



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## 3 Air Quality Assessment for 2021

The air quality assessment for each pollutant is derived from a combination of measured pollutant concentrations from the Automatic Urban and Rural Network (AURN) and supplementary assessment (that is, modelling using the Pollution Climate Mapping (PCM) model, supplementary NO<sub>2</sub> diffusion tube measurements from the UK Urban Nitrogen Dioxide Network - the UUNN - or objective estimation, as explained in Defra's technical report on UK air quality assessment (Pugsley, K. L. et al., 2022) ). Where both measurements and supplementary assessment results are available for a zone, the assessment of compliance for each zone is based on the higher concentration of the two.

However, in the case of NO<sub>2</sub>, an additional rule has been introduced in 2021. This is used where there is roadside monitoring (an AURN monitoring site, a UUNN diffusion tube monitoring site, or both) on a major urban road, which is also modelled by the PCM model. This rule determines the order of precedence of these data sources when used in compliance assessment and is described in section 3.1 below.

### 3.1 New Approach for Nitrogen Dioxide at Roadside

In previous compliance assessments, including in 2020, the approach taken when assessing NO<sub>2</sub> concentrations at roadside locations where both modelled and measured concentrations were available was to report all concentrations, but to always use the highest concentration to determine the compliance status, whether measured or modelled. This is a conservative approach in which an exceedance is always reported if any of the data indicate one, but it does not consider the quality of the evidence available. The availability of a new source of evidence - the UUNN, which was established in 2020 - prompted a review of the approach for NO<sub>2</sub>.

A study led by Defra working closely with members of their independent Air Quality Expert Group (AQEG) compared the quality of modelled NO<sub>2</sub> concentrations from the PCM model to measured concentrations from the UUNN and AURN. This concluded that the AURN provides the most accurate assessment of NO<sub>2</sub> concentrations, followed by the UUNN, and then the PCM model.

The method for determining compliance for NO<sub>2</sub> has therefore been adjusted to reflect this, so that the best available evidence is used. As in previous years, all modelled and measured NO<sub>2</sub> concentrations are reported as part of the assessment, but the order of precedence, for any given major urban road, is as follows:

1. If AURN measurements are available, these have been used to assess compliance in preference to values from the UUNN and/or the PCM model for the same major urban road:
2. If UUNN measurements (but not AURN measurements) are available, the UUNN measurements have been used to assess compliance in preference to values from the PCM model for the same major urban road.

This order of precedence only applies to results for the same major urban road. So, compliance or exceedance of a particular zone for NO<sub>2</sub> could in theory still be determined on the basis of modelling if the highest concentration for that zone was a modelled value for a location without co-located monitoring.

No change has been made to the method for determining compliance for other pollutants. This means that the most appropriate evidence-based approach is taken for each pollutant.

## 3.2 Compliance Summary

The air quality compliance assessment for each calendar year must be published by Defra by 30<sup>th</sup> September the following calendar year. The results of the air quality assessment for 2021 are summarised in the tables below. The tables have been completed as follows:

- Where all measurements were within the relevant limit values in 2021, the table shows this as 'OK'.
- In the above cases, where compliance was determined by supplementary assessment only, this is indicated by '(s only)', i.e. 'OK (s only)'.
- Where locations were identified as exceeding a limit value, target value or long-term objective, this is identified as '>LV', '>TV' or '>LTO' as applicable.
- Where a non-compliance was determined by supplementary assessment, this is indicated by '(s only)', as above.
- The abbreviation 'n/a' (not applicable) means that an assessment is not relevant for this zone, such as for the NO<sub>x</sub> vegetation critical level in agglomeration zones.
- Zones that complied with the relevant limit values, targets or long-term objectives are shaded blue, while those that did not are shaded red. For ozone, zones that met the relevant target value but not the long-term objective are shaded purple.

There are no longer any zones where margins of tolerance apply.

**Sulphur dioxide (SO<sub>2</sub>):** in 2021, all zones and agglomerations within the UK complied with the limit values for 1-hour mean and 24-hour mean SO<sub>2</sub> concentration, set for protection of human health. All non-agglomeration zones within the UK also complied with the critical levels for annual mean and winter mean SO<sub>2</sub> concentration, set for protection of ecosystems (these are not applicable to built-up areas).

**Carbon monoxide (CO), benzene and lead:** all zones and agglomerations were compliant with the limit values for these three pollutants in 2021. The 2021 compliance assessment for CO has been based on objective estimation, as explained in Defra's technical report on UK air quality assessment (Pugsley, K. L. et al., 2022). This is underpinned by National Atmospheric Emissions Inventory (NAEI) emission trends, AURN measurement trends and historical modelling assessments.

**Nitrogen dioxide (NO<sub>2</sub>):** in 2021 not all zones and agglomerations were compliant with the limit values. The results of the air quality assessment for nitrogen dioxide for each zone are summarised in **Table 3-1**.

All zones and agglomerations were compliant with the 1-hour limit value ( $200 \mu\text{g m}^{-3}$ ) in 2021, with none exceeding this limit value on more than the permitted 18 occasions. In recent years only a few zones (typically one or two) have exceeded this limit value, 2021 is the second year in which all zones have been compliant.

Thirty-three zones met the annual mean limit value for  $\text{NO}_2$  ( $40 \mu\text{g m}^{-3}$ ) in 2021. The 10 zones that exceeded this limit value were:

- Greater London Urban Area
- West Midlands Urban Area
- Greater Manchester Urban Area
- West Yorkshire Urban Area
- Liverpool Urban Area
- Sheffield Urban Area
- Nottingham Urban Area
- Bristol Urban Area
- Glasgow Urban Area
- South Wales.

The previous year (2020) saw a large reduction in the number of zones exceeding the annual mean limit value: just five zones exceeded in 2020 compared to 33 zones in 2019. This was attributed to the reduced road traffic flows brought about by the Covid-19 pandemic lockdown restrictions. The 2021 data suggest that  $\text{NO}_2$  concentrations have increased in 2021 compared to 2020 but remain lower than their pre-pandemic levels.

All non-agglomeration zones within the UK complied with the critical level for annual mean  $\text{NO}_x$  concentration, set for protection of vegetation, as has been the case for many years.

As part of the 2017 UK plan for tackling roadside nitrogen dioxide concentrations (Defra, 2017), local authorities with exceedances of the annual mean nitrogen dioxide limit value have been required to develop local plans or studies to consider measures to achieve the statutory limit value within the shortest possible time. These studies or plans may include local scale modelling and/or monitoring data, and in some cases the local data presents different results to the national air quality assessment. This is partly due to local monitoring being sited differently to national monitoring in order to target pollution hotspots. Where possible, Defra are working to develop and improve the national  $\text{NO}_2$  compliance assessment to better reflect local level  $\text{NO}_2$  concentrations. This included establishing the UUNN in 2020, to provide more local  $\text{NO}_2$  measurement data.

**Table 3-1 Results of Air Quality Assessment for Nitrogen Dioxide in 2021**

| Zone                            | Zone code | NO <sub>2</sub> LV for health (1hr mean) | NO <sub>2</sub> LV for health (annual mean) | NO <sub>x</sub> critical level for vegetation (ann. mean) |
|---------------------------------|-----------|--|---|---|
| Greater London Urban Area       | UK0001    | OK                                       | > LV  | n/a   |
| West Midlands Urban Area        | UK0002    | OK                                       | > LV (s only)                               | n/a   |
| Greater Manchester Urban Area   | UK0003    | OK                                       | > LV (s only)                               | n/a   |
| West Yorkshire Urban Area       | UK0004    | OK                                       | > LV (s only)                               | n/a   |
| Tyneside                        | UK0005    | OK                                       | OK  | n/a   |
| Liverpool Urban Area            | UK0006    | OK                                       | > LV (s only)                               | n/a   |
| Sheffield Urban Area            | UK0007    | OK                                       | > LV (s only)                               | n/a   |
| Nottingham Urban Area           | UK0008    | OK                                       | > LV (s only)                               | n/a   |
| Bristol Urban Area              | UK0009    | OK                                       | > LV (s only)                               | n/a   |
| Brighton/Worthing/Littlehampton | UK0010    | OK                                       | OK  | n/a   |
| Leicester Urban Area            | UK0011    | OK                                       | OK  | n/a   |
| Portsmouth Urban Area           | UK0012    | OK                                       | OK  | n/a   |
| Teesside Urban Area             | UK0013    | OK                                       | OK  | n/a   |
| The Potteries                   | UK0014    | OK                                       | OK  | n/a   |
| Bournemouth Urban Area          | UK0015    | OK                                       | OK  | n/a   |
| Reading/Wokingham Urban Area    | UK0016    | OK                                       | OK  | n/a   |
| Coventry/Bedworth               | UK0017    | OK                                       | OK  | n/a   |
| Kingston upon Hull              | UK0018    | OK                                       | OK  | n/a   |
| Southampton Urban Area          | UK0019    | OK                                       | OK  | n/a   |
| Birkenhead Urban Area           | UK0020    | OK                                       | OK  | n/a   |
| Southend Urban Area             | UK0021    | OK                                       | OK  | n/a   |
| Blackpool Urban Area            | UK0022    | OK                                       | OK  | n/a   |
| Preston Urban Area              | UK0023    | OK                                       | OK  | n/a   |
| Glasgow Urban Area              | UK0024    | OK                                       | > LV  | n/a   |
| Edinburgh Urban Area            | UK0025    | OK (s only)                              | OK  | n/a   |
| Cardiff Urban Area              | UK0026    | OK                                       | OK  | n/a   |
| Swansea Urban Area              | UK0027    | OK                                       | OK  | n/a   |
| Belfast Urban Area              | UK0028    | OK                                       | OK  | n/a   |
| Eastern                         | UK0029    | OK                                       | OK  | OK  |
| South West                      | UK0030    | OK                                       | OK  | OK  |
| South East                      | UK0031    | OK                                       | OK  | OK  |
| East Midlands                   | UK0032    | OK                                       | OK  | OK  |
| North West & Merseyside         | UK0033    | OK                                       | OK  | OK (s only)   |
| Yorkshire & Humberside          | UK0034    | OK                                       | OK  | OK  |
| West Midlands                   | UK0035    | OK                                       | OK  | OK (s only)   |
| North East                      | UK0036    | OK                                       | OK  | OK (s only)   |
| Central Scotland                | UK0037    | OK                                       | OK  | OK (s only)   |
| North East Scotland             | UK0038    | OK                                       | OK  | OK (s only)   |
| Highland                        | UK0039    | OK                                       | OK  | OK (s only)   |
| Scottish Borders                | UK0040    | OK                                       | OK  | OK (s only)   |
| South Wales                     | UK0041    | OK                                       | > LV  | OK  |
| North Wales                     | UK0042    | OK                                       | OK  | OK  |
| Northern Ireland                | UK0043    | OK                                       | OK  | OK (s only)   |

LV = limit value, (s only) indicates the compliance or exceedance was determined by supplementary assessment only.

**Particulate Matter as PM<sub>10</sub>:** all zones and agglomerations were compliant with the annual mean limit value of 40 µg m<sup>-3</sup> for PM<sub>10</sub>. All zones and agglomerations were also compliant with the daily mean limit value of 50 µg m<sup>-3</sup>, which must not be exceeded more than 35 times a year. The results of the air quality assessment for PM<sub>10</sub> for each zone, with respect to the daily mean and annual mean limit values, are summarised in **Table 3-2**.

Under the Air Quality Standards Regulations, the UK is required to identify any exceedances of PM<sub>10</sub> limit values which are due to natural sources (for example sea salt). Where this is the case, the exceedance does not count as non-compliance. Particulate matter from sea salt is modelled and has been used in the past to determine whether compliance with the limit values has been achieved after contribution from natural sources has been subtracted. However, in 2021 there were no modelled exceedances of either the 24-hr or annual mean limit values, so no subtraction of contribution from natural sources has been carried out.

**Particulate Matter as PM<sub>2.5</sub>:** all zones met the Stage 1 limit value (25 µg m<sup>-3</sup> to be achieved by 1<sup>st</sup> Jan 2015) which came into force on 1<sup>st</sup> January 2015, and the Stage 2 limit value (20 µg m<sup>-3</sup> which was to be achieved by 1<sup>st</sup> Jan 2020). Both limit values apply to the annual mean, based on the calendar year.

The results of the air quality assessment for PM<sub>2.5</sub> for each zone are summarised in **Table 3-3**. Subtraction of PM<sub>2.5</sub> contributions due to natural sources was not necessary for any zone.

Under the Air Quality Standards Regulations, the UK was required to achieve a National Exposure Reduction Target (NERT) for PM<sub>2.5</sub>, over the period 2010 to 2020. This is based on the Average Exposure Indicator (AEI) statistic. The AEI for the UK is calculated as follows:

- (i) Each year, the annual arithmetic mean PM<sub>2.5</sub> concentration is calculated for the designated AEI subset of urban background sites<sup>1</sup>.
- (ii) The mean of the most recent three calendar years' values is taken as the AEI.

The AEI for the reference year (2010) was 13 µg m<sup>-3</sup>; based on this, the Air Quality Standards Regulations set an exposure reduction target of 15%, which equated to reducing the AEI to 11 µg m<sup>-3</sup> by 2020. (The detailed methodology and results of this calculation are presented in Defra's technical report on UK air quality assessment (Pugsley, K. L. et al., 2022).)

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<sup>1</sup> The sites used for calculation of the AEI are all the urban background PM<sub>2.5</sub> monitoring sites that were in operation in the baseline year. Urban background sites that started monitoring PM<sub>2.5</sub> later, or were not classified as urban background in the baseline year, are not included. (The exception is where the new site is the relocation of an existing AEI site that has been moved by a short distance, and to a similar environment). This means that the AEI is calculated on a largely consistent group of sites from year to year.

**Table 3-2 Results of Air Quality Assessment for PM<sub>10</sub> in 2021**

| Zone                            | Zone code | PM <sub>10</sub> LV (daily mean) | PM <sub>10</sub> LV (annual mean) |
|---------------------------------|-----------|----------------------------------|-----------------------------------|
| Greater London Urban Area       | UK0001    | OK                               | OK                                |
| West Midlands Urban Area        | UK0002    | OK                               | OK                                |
| Greater Manchester Urban Area   | UK0003    | OK                               | OK                                |
| West Yorkshire Urban Area       | UK0004    | OK                               | OK                                |
| Tyneside                        | UK0005    | OK                               | OK                                |
| Liverpool Urban Area            | UK0006    | OK                               | OK                                |
| Sheffield Urban Area            | UK0007    | OK                               | OK                                |
| Nottingham Urban Area           | UK0008    | OK                               | OK                                |
| Bristol Urban Area              | UK0009    | OK                               | OK                                |
| Brighton/Worthing/Littlehampton | UK0010    | OK (s only)                      | OK (s only)                       |
| Leicester Urban Area            | UK0011    | OK                               | OK                                |
| Portsmouth Urban Area           | UK0012    | OK                               | OK                                |
| Teesside Urban Area             | UK0013    | OK                               | OK                                |
| The Potteries                   | UK0014    | OK                               | OK                                |
| Bournemouth Urban Area          | UK0015    | OK (s only)                      | OK (s only)                       |
| Reading/Wokingham Urban Area    | UK0016    | OK                               | OK                                |
| Coventry/Bedworth               | UK0017    | OK                               | OK                                |
| Kingston upon Hull              | UK0018    | OK                               | OK                                |
| Southampton Urban Area          | UK0019    | OK                               | OK                                |
| Birkenhead Urban Area           | UK0020    | OK                               | OK                                |
| Southend Urban Area             | UK0021    | OK                               | OK                                |
| Blackpool Urban Area            | UK0022    | OK                               | OK                                |
| Preston Urban Area              | UK0023    | OK                               | OK                                |
| Glasgow Urban Area              | UK0024    | OK                               | OK                                |
| Edinburgh Urban Area            | UK0025    | OK                               | OK                                |
| Cardiff Urban Area              | UK0026    | OK                               | OK                                |
| Swansea Urban Area              | UK0027    | OK                               | OK                                |
| Belfast Metropolitan Urban Area | UK0028    | OK                               | OK                                |
| Eastern                         | UK0029    | OK                               | OK                                |
| South West                      | UK0030    | OK                               | OK                                |
| South East                      | UK0031    | OK                               | OK                                |
| East Midlands                   | UK0032    | OK                               | OK                                |
| North West & Merseyside         | UK0033    | OK                               | OK                                |
| Yorkshire & Humberside          | UK0034    | OK                               | OK                                |
| West Midlands                   | UK0035    | OK                               | OK                                |
| North East                      | UK0036    | OK                               | OK                                |
| Central Scotland                | UK0037    | OK                               | OK                                |
| North East Scotland             | UK0038    | OK (s only)                      | OK (s only)                       |
| Highland                        | UK0039    | OK                               | OK                                |
| Scottish Borders                | UK0040    | OK (s only)                      | OK (s only)                       |
| South Wales                     | UK0041    | OK                               | OK                                |
| North Wales                     | UK0042    | OK                               | OK                                |
| Northern Ireland                | UK0043    | OK                               | OK                                |

*Subtraction of natural source contribution was not carried out for any zones in 2021. LV = limit value, (s only) indicates that the compliance or exceedance was determined by supplementary assessment only.*



**Table 3-3 Results of Air Quality Assessment for PM<sub>2.5</sub> in 2021**

| Zone                            | Zone code | PM <sub>2.5</sub> Stage 1 limit value (annual mean, for 1 <sup>st</sup> Jan 2015) | PM <sub>2.5</sub> Stage 2 limit value (annual mean, for 1 <sup>st</sup> Jan 2020) |
|---------------------------------|-----------|---|---|
| Greater London Urban Area       | UK0001    | OK  | OK  |
| West Midlands Urban Area        | UK0002    | OK  | OK  |
| Greater Manchester Urban Area   | UK0003    | OK  | OK  |
| West Yorkshire Urban Area       | UK0004    | OK  | OK  |
| Tyneside                        | UK0005    | OK  | OK  |
| Liverpool Urban Area            | UK0006    | OK (s only)   | OK (s only)   |
| Sheffield Urban Area            | UK0007    | OK  | OK  |
| Nottingham Urban Area           | UK0008    | OK  | OK  |
| Bristol Urban Area              | UK0009    | OK  | OK  |
| Brighton/Worthing/Littlehampton | UK0010    | OK  | OK  |
| Leicester Urban Area            | UK0011    | OK  | OK  |
| Portsmouth Urban Area           | UK0012    | OK (s only)   | OK (s only)   |
| Teesside Urban Area             | UK0013    | OK  | OK  |
| The Potteries                   | UK0014    | OK  | OK  |
| Bournemouth Urban Area          | UK0015    | OK  | OK  |
| Reading/Wokingham Urban Area    | UK0016    | OK  | OK  |
| Coventry/Bedworth               | UK0017    | OK  | OK  |
| Kingston upon Hull              | UK0018    | OK  | OK  |
| Southampton Urban Area          | UK0019    | OK  | OK  |
| Birkenhead Urban Area           | UK0020    | OK  | OK  |
| Southend Urban Area             | UK0021    | OK  | OK  |
| Blackpool Urban Area            | UK0022    | OK  | OK  |
| Preston Urban Area              | UK0023    | OK  | OK  |
| Glasgow Urban Area              | UK0024    | OK  | OK  |
| Edinburgh Urban Area            | UK0025    | OK  | OK  |
| Cardiff Urban Area              | UK0026    | OK  | OK  |
| Swansea Urban Area              | UK0027    | OK  | OK  |
| Belfast Metropolitan Urban Area | UK0028    | OK  | OK  |
| Eastern                         | UK0029    | OK  | OK  |
| South West                      | UK0030    | OK  | OK  |
| South East                      | UK0031    | OK  | OK  |
| East Midlands                   | UK0032    | OK  | OK  |
| North West & Merseyside         | UK0033    | OK  | OK  |
| Yorkshire & Humberside          | UK0034    | OK  | OK  |
| West Midlands                   | UK0035    | OK  | OK  |
| North East                      | UK0036    | OK  | OK  |
| Central Scotland                | UK0037    | OK  | OK  |
| North East Scotland             | UK0038    | OK (s only)   | OK (s only)   |
| Highland                        | UK0039    | OK  | OK  |
| Scottish Borders                | UK0040    | OK (s only)   | OK (s only)   |
| South Wales                     | UK0041    | OK  | OK  |
| North Wales                     | UK0042    | OK  | OK  |
| Northern Ireland                | UK0043    | OK  | OK  |

*Subtraction of natural source contribution was not carried out for any zones in 2021.*

*LV = limit value, (s only) indicates the compliance or exceedance was determined by supplementary assessment only.*



The UK achieved the NERT for PM<sub>2.5</sub> in 2016, well before the 2020 target year, but has continued to report the AEI annually. Most recent annual mean urban background PM<sub>2.5</sub> concentrations were as follows:

- 2019: 10 µg m<sup>-3</sup>
- 2020: 8 µg m<sup>-3</sup>
- 2021: 8 µg m<sup>-3</sup>

The three-year running mean AEI for 2021 (calculated as the mean of the above annual values, to the nearest integer), is 9 µg m<sup>-3</sup>. Therefore, the UK remained compliant with the NERT in 2021.

**Ozone:** all zones and agglomerations met the target values for health and for protection of vegetation. The results of the air quality assessment for ozone are summarised in **Table 3-4**.

For ozone (O<sub>3</sub>), there is a target value based on the maximum daily 8-hour mean. All 43 zones and agglomerations were compliant with this target value. There is also a long-term objective for protection of human health, based on the maximum daily 8-hour mean. Only four of the 43 zones and agglomerations were compliant with the long-term objective (LTO) for health in 2021.

There is also a target value based on the AOT40 statistic. The AOT40 statistic (expressed in µg m<sup>-3</sup>.hours) is the sum of the difference between hourly concentrations greater than 80 µg m<sup>-3</sup> (= 40 ppb) and 80 µg m<sup>-3</sup> over a given period using only the hourly mean values measured between 08:00 and 20:00 Central European Time each day. All 43 zones and agglomerations met the target value based on the AOT40 statistic. There is also a long-term objective, for protection of vegetation, based on this statistic; one zone exceeded this long-term objective for vegetation in 2021.

The UK met all target values for O<sub>3</sub> in 2021 as it has done for many years. The number of zones exceeding the long-term objective for vegetation (one) was the lowest since 2017.

Ozone concentrations – and hence the number of zones exceeding the LTOs - fluctuate from year to year as ozone is a transboundary pollutant and its formation is influenced by meteorological factors. The year 2021 appears to have been a year of relatively low ozone concentrations, with relatively few exceedances of the LTO for vegetation, and no substantial ozone pollution episodes.

**Table 3-4 Results of Air Quality Assessment for Ozone in 2021**

| Zone                            | Zone code | O <sub>3</sub> TV and LTO for health (8hr mean) | O <sub>3</sub> TV and LTO for vegetation (AOT40) |
|---------------------------------|-----------|---|--|
| Greater London Urban Area       | UK0001    | Met TV, > LTO                                   | OK   |
| West Midlands Urban Area        | UK0002    | Met TV, > LTO                                   | OK   |
| Greater Manchester Urban Area   | UK0003    | Met TV, > LTO (s only)                          | OK   |
| West Yorkshire Urban Area       | UK0004    | Met TV, > LTO                                   | OK   |
| Tyneside                        | UK0005    | Met TV, > LTO (s only)                          | OK   |
| Liverpool Urban Area            | UK0006    | Met TV, > LTO (s only)                          | OK (s only)                                      |
| Sheffield Urban Area            | UK0007    | Met TV, > LTO (s only)                          | OK   |
| Nottingham Urban Area           | UK0008    | Met TV, > LTO (s only)                          | OK   |
| Bristol Urban Area              | UK0009    | Met TV, > LTO                                   | OK   |
| Brighton/Worthing/Littlehampton | UK0010    | Met TV, > LTO                                   | OK   |
| Leicester Urban Area            | UK0011    | Met TV, > LTO (s only)                          | OK   |
| Portsmouth Urban Area           | UK0012    | Met TV, > LTO (s only)                          | OK   |
| Teesside Urban Area             | UK0013    | Met TV, > LTO (s only)                          | OK   |
| The Potteries                   | UK0014    | Met TV, > LTO (s only)                          | OK   |
| Bournemouth Urban Area          | UK0015    | Met TV, > LTO                                   | OK   |
| Reading/Wokingham Urban Area    | UK0016    | Met TV, > LTO (s only)                          | OK   |
| Coventry/Bedworth               | UK0017    | Met TV, > LTO                                   | OK   |
| Kingston upon Hull              | UK0018    | Met TV, > LTO                                   | OK   |
| Southampton Urban Area          | UK0019    | Met TV, > LTO (s only)                          | OK   |
| Birkenhead Urban Area           | UK0020    | Met TV, > LTO                                   | OK   |
| Southend Urban Area             | UK0021    | Met TV, > LTO                                   | OK   |
| Blackpool Urban Area            | UK0022    | Met TV, > LTO                                   | OK   |
| Preston Urban Area              | UK0023    | Met TV, > LTO                                   | OK   |
| Glasgow Urban Area              | UK0024    | OK  | OK   |
| Edinburgh Urban Area            | UK0025    | OK  | OK   |
| Cardiff Urban Area              | UK0026    | Met TV, > LTO                                   | OK   |
| Swansea Urban Area              | UK0027    | Met TV, > LTO (s only)                          | OK   |
| Belfast Metropolitan Urban Area | UK0028    | Met TV, > LTO (s only)                          | OK   |
| Eastern                         | UK0029    | Met TV, > LTO                                   | OK   |
| South West                      | UK0030    | Met TV, > LTO                                   | Met TV, > LTO                                    |
| South East                      | UK0031    | Met TV, > LTO                                   | OK   |
| East Midlands                   | UK0032    | Met TV, > LTO                                   | OK   |
| North West & Merseyside         | UK0033    | Met TV, > LTO                                   | OK   |
| Yorkshire & Humberside          | UK0034    | Met TV, > LTO                                   | OK   |
| West Midlands                   | UK0035    | Met TV, > LTO                                   | OK   |
| North East                      | UK0036    | Met TV, > LTO (s only)                          | OK   |
| Central Scotland                | UK0037    | OK  | OK   |
| North East Scotland             | UK0038    | OK (s only)                                     | OK   |
| Highland                        | UK0039    | Met TV, > LTO                                   | OK   |
| Scottish Borders                | UK0040    | Met TV, > LTO (s only)                          | OK   |
| South Wales                     | UK0041    | Met TV, > LTO                                   | OK   |
| North Wales                     | UK0042    | Met TV, > LTO                                   | OK   |
| Northern Ireland                | UK0043    | Met TV, > LTO (s only)                          | OK   |

TV = target value, LTO = long-term objective, (s only) indicates the compliance or exceedance was determined by supplementary assessment only.

In 2021 there was one measured exceedance of the ozone population information threshold of 180  $\mu\text{g m}^{-3}$  (at one site, Rochester Stoke, a rural site in Kent), but no exceedances of the population warning threshold of 240  $\mu\text{g m}^{-3}$ . The population information threshold exceedance is detailed in **Table 3-5**. This occurred at 15:00 on 30<sup>th</sup> March 2021.

Several other AURN sites in the south and east of England also detected an isolated 'spike' in ozone at the same time on the same date, though only at Rochester Stoke was the measured concentration above the population information threshold.

**Table 3-5 Measured Exceedances of the Ozone Information Threshold Value in 2021**

| Site name       | Zone code | Number of 1-hour exceedances of information threshold | Maximum 1-hour concentration ( $\mu\text{g m}^{-3}$ ) |
|-----------------|-----------|---|---|
| Rochester Stoke | UK0031    | 1   | 216   |

*Table 3-5 shows the exceedances of the ozone information threshold in the verified dataset.*

(Exceedances of the population information threshold were also measured at the Lerwick monitoring site in Shetland, during the period 4<sup>th</sup> – 6<sup>th</sup> June: however, these were later confirmed not to be genuine, but due to an instrument malfunction. The spurious data were rejected at the data verification stage.)

The air quality assessments for arsenic (As), cadmium (Cd), nickel (Ni) and benzo[a]pyrene (B[a]P) are summarised in **Table 3-6**. All zones met target values for arsenic and cadmium, but some zones exceeded the target value for nickel, or nickel and benzo[a]pyrene.

Concentrations of Ni exceeded the target value in four zones: Sheffield Urban Area, Yorkshire and Humberside, Swansea Urban Area and South Wales. These exceedances are attributed to emissions from industrial sources.

Concentrations of benzo[a]pyrene were above the target value in two of the same zones; Swansea Urban Area and South Wales. These exceedances are also attributed to emissions from industrial sources.

**Table 3-6 Results of Air Quality Assessment for As, Cd, Ni and B[a]P in 2021**

| Zone                            | Zone code | As TV       | Cd TV       | Ni TV         | B[a]P TV      |
|---------------------------------|-----------|-------------|-------------|---------------|---------------|
| Greater London Urban Area       | UK0001    | OK          | OK          | OK            | OK            |
| West Midlands Urban Area        | UK0002    | OK          | OK          | OK            | OK            |
| Greater Manchester Urban Area   | UK0003    | OK (s only) | OK (s only) | OK (s only)   | OK            |
| West Yorkshire Urban Area       | UK0004    | OK (s only) | OK (s only) | OK (s only)   | OK            |
| Tyneside                        | UK0005    | OK (s only) | OK (s only) | OK (s only)   | OK            |
| Liverpool Urban Area            | UK0006    | OK (s only) | OK (s only) | OK (s only)   | OK (s only)   |
| Sheffield Urban Area            | UK0007    | OK          | OK          | > TV (s only) | OK            |
| Nottingham Urban Area           | UK0008    | OK (s only) | OK (s only) | OK (s only)   | OK            |
| Bristol Urban Area              | UK0009    | OK (s only) | OK (s only) | OK (s only)   | OK            |
| Brighton/Worthing/Littlehampton | UK0010    | OK (s only) | OK (s only) | OK (s only)   | OK (s only)   |
| Leicester Urban Area            | UK0011    | OK (s only) | OK (s only) | OK (s only)   | OK (s only)   |
| Portsmouth Urban Area           | UK0012    | OK (s only) | OK (s only) | OK (s only)   | OK (s only)   |
| Teesside Urban Area             | UK0013    | OK (s only) | OK (s only) | OK (s only)   | OK            |
| The Potteries                   | UK0014    | OK (s only) | OK (s only) | OK (s only)   | OK (s only)   |
| Bournemouth Urban Area          | UK0015    | OK (s only) | OK (s only) | OK (s only)   | OK (s only)   |
| Reading/Wokingham Urban Area    | UK0016    | OK (s only) | OK (s only) | OK (s only)   | OK (s only)   |
| Coventry/Bedworth               | UK0017    | OK (s only) | OK (s only) | OK (s only)   | OK (s only)   |
| Kingston upon Hull              | UK0018    | OK (s only) | OK (s only) | OK (s only)   | OK (s only)   |
| Southampton Urban Area          | UK0019    | OK (s only) | OK (s only) | OK (s only)   | OK (s only)   |
| Birkenhead Urban Area           | UK0020    | OK (s only) | OK (s only) | OK (s only)   | OK (s only)   |
| Southend Urban Area             | UK0021    | OK (s only) | OK (s only) | OK (s only)   | OK (s only)   |
| Blackpool Urban Area            | UK0022    | OK (s only) | OK (s only) | OK (s only)   | OK (s only)   |
| Preston Urban Area              | UK0023    | OK (s only) | OK (s only) | OK (s only)   | OK (s only)   |
| Glasgow Urban Area              | UK0024    | OK (s only) | OK (s only) | OK (s only)   | OK            |
| Edinburgh Urban Area            | UK0025    | OK (s only) | OK (s only) | OK (s only)   | OK            |
| Cardiff Urban Area              | UK0026    | OK (s only) | OK (s only) | OK (s only)   | OK            |
| Swansea Urban Area              | UK0027    | OK          | OK          | > TV          | > TV (s only) |
| Belfast Urban Area              | UK0028    | OK          | OK          | OK            | OK            |
| Eastern                         | UK0029    | OK          | OK          | OK            | OK            |
| South West                      | UK0030    | OK          | OK          | OK            | OK            |
| South East                      | UK0031    | OK          | OK          | OK            | OK            |
| East Midlands                   | UK0032    | OK          | OK          | OK            | OK            |
| North West & Merseyside         | UK0033    | OK (s only) | OK (s only) | OK (s only)   | OK            |
| Yorkshire & Humberside          | UK0034    | OK          | OK          | > TV (s only) | OK            |
| West Midlands                   | UK0035    | OK          | OK          | OK            | OK (s only)   |
| North East                      | UK0036    | OK (s only) | OK (s only) | OK (s only)   | OK            |
| Central Scotland                | UK0037    | OK          | OK          | OK            | OK            |
| North East Scotland             | UK0038    | OK (s only) | OK (s only) | OK (s only)   | OK (s only)   |
| Highland                        | UK0039    | OK (s only) | OK (s only) | OK (s only)   | OK            |
| Scottish Borders                | UK0040    | OK          | OK          | OK            | OK (s only)   |
| South Wales                     | UK0041    | OK          | OK          | > TV (s only) | > TV (s only) |
| North Wales                     | UK0042    | OK (s only) | OK (s only) | OK (s only)   | OK (s only)   |
| Northern Ireland                | UK0043    | OK (s only) | OK (s only) | OK (s only)   | OK            |

TV = target value, (s only) indicates the compliance or exceedance was determined by supplementary assessment only.

## 4 Comparison with Previous Years

This section provides information on non-compliances in previous years from 2008 onwards. (2008 is the year that the Air Quality Directive - which was subsequently transposed into UK legislation by the Air Quality Standards Regulations – came into force.)

For **SO<sub>2</sub>**, **PM<sub>2.5</sub>**, **lead**, **benzene** and **CO**, the UK has been compliant with Air Quality Standards Regulations limit values (apart from the PM<sub>2.5</sub> Stage 2 indicative limit value) in all years since 2008. For information on compliance with the 1<sup>st</sup> and 2<sup>nd</sup> Daughter Directives for all pollutants in earlier years, please see the 2012 or earlier reports in this series, which can be found here: [uk-air.defra.gov.uk/library/annualreport/](http://uk-air.defra.gov.uk/library/annualreport/).

The UK has been compliant with the limit values for both **lead** and **CO** since 2003, and for **benzene** since 2007: these limit values are the same as those contained in the 1<sup>st</sup> and 2<sup>nd</sup> Daughter Directives, which the Air Quality Directive (and therefore the Air Quality Standards Regulations) superseded.

For nitrogen dioxide, **Table 4-1** summarises the results of the air quality assessment in years from 2008 to 2021. This table shows the numbers of zones exceeding the limit value (plus any agreed margin of tolerance, in cases where a time extension had been granted). The right-hand column contains notes on the effects of any time extensions, the last of which ended on 1<sup>st</sup> January 2015.

All non-agglomeration zones within the UK have complied with the critical level for annual mean NO<sub>x</sub> concentration, set for protection of vegetation, in years 2008 onwards.

For PM<sub>10</sub>, **Table 4-2** summarises the results of the air quality assessment in years from 2008 to 2021. There are notes in the right-hand column explaining the effects of the time extensions which were in place up to the end of 2011 for some zones.

For ozone, **Table 4-3** summarises annual exceedances of the target value for human health (based on the maximum daily 8-hour mean), the target value for protection of vegetation (based on the AOT40 statistic), and the two long-term objectives (LTOs) based on these two metrics.

Finally, for the pollutants formerly covered by the Fourth Daughter Directive - arsenic (As), cadmium (Cd), nickel (Ni) and benzo[a]pyrene (B[a]P) - **Table 4-4** summarises the numbers of zones with exceedances of target values in previous years.

**Table 4-1 Non-Compliances with Limit Values for Nitrogen Dioxide, 2008-2021**

| Year | Zones Exceeding NO <sub>2</sub> LV for health (1hr mean) | Zones Exceeding NO <sub>2</sub> LV for health (annual mean) | Notes on Time Extensions   |
|------|--|---|--|
| 2008 | 3 zones (London, Glasgow, N.E. Scotland)                 | 40 zones  | -  |
| 2009 | 2 zones (London, Glasgow)                                | 40 zones  | -  |
| 2010 | 3 zones (London, Teesside, Glasgow)                      | 40 zones  | -  |
| 2011 | 3 zones (London, Glasgow, South East)                    | 35 zones  | <i>A further 5 zones exceeded the annual mean NO<sub>2</sub> LV in 2011 but were covered by time extensions and within the LV+ Margin of Tolerance (MOT), therefore compliant.</i> |
| 2012 | 2 zones (London, South East)                             | 34 zones  | <i>A further 4 zones exceeded the annual mean NO<sub>2</sub> LV in 2012 but were covered by time extensions and within the LV+ MOT, therefore compliant.</i>                       |
| 2013 | 1 zone (London)  | 31 zones  | <i>A further 7 zones exceeded the annual mean NO<sub>2</sub> LV in 2013 but were covered by time extensions and within the LV+ MOT, therefore compliant.</i>                       |
| 2014 | 2 zones (London, South Wales)                            | 30 zones  | <i>A further 8 zones exceeded the annual mean NO<sub>2</sub> LV in 2014 but were covered by time extensions and within the LV+ MOT, therefore compliant.</i>                       |
| 2015 | 2 zones (London, South Wales)                            | 37 zones  | <i>2015 was the first year with no time extensions for NO<sub>2</sub>: this is the reason for the apparent increase in zones exceeding between 2014 and 2015.</i>                  |
| 2016 | 2 zones (London, South Wales)                            | 37 zones  | <i>No time extensions in place.</i>  |
| 2017 | 2 zones (London, South Wales)                            | 37 zones  | <i>No time extensions in place.</i>  |
| 2018 | 2 zones (London, South Wales)                            | 36 zones  | <i>No time extensions in place.</i>  |
| 2019 | 1 zone (South Wales)                                     | 33 zones  | <i>No time extensions in place.</i>  |
| 2020 | None   | 5 zones   | <i>No time extensions in place.</i>  |
| 2021 | None   | 10 zones  | <i>No time extensions in place.</i>  |

**Table 4-2 Non-Compliances with the Limit Values for PM<sub>10</sub>, 2008-2021**

| <b>Year</b> | <b>PM<sub>10</sub> LV<br/>(annual mean)</b> | <b>PM<sub>10</sub> LV<br/>(daily mean)</b>                           | <b>Notes on Time Extensions and<br/>Subtraction of Natural contribution</b>  |
|-------------|---|--|--|
| <b>2008</b> | None  | 2 zones (1 zone after subtraction of natural contribution)           | -  |
| <b>2009</b> | None  | 3 zones (1 zone after subtraction of natural contribution)           | -  |
| <b>2010</b> | None  | None (after subtraction of natural contribution)                     | One zone exceeded the daily mean PM10 limit value more than the permitted 35 times in 2010, after subtraction of natural contribution. This zone was covered by a time extension and was within the LV+MOT so was therefore compliant. |
| <b>2011</b> | None  | None (after subtraction of natural contribution)                     | One zone exceeded the daily mean PM10 limit value more than the permitted 35 times in 2011, after subtraction of natural contribution. This zone was covered by a time extension and was within the LV+MOT so was therefore compliant. |
| <b>2012</b> | None  | None (after subtraction of natural contribution. No time extension.) | -  |
| <b>2013</b> | None  | None (after subtraction of natural contribution. No time extension.) | -  |
| <b>2014</b> | None  | None (after subtraction of natural contribution. No time extension.) | -  |
| <b>2015</b> | None  | None (after subtraction of natural contribution. No time extension.) | -  |
| <b>2016</b> | None  | None   | -  |
| <b>2017</b> | None  | None   | -  |
| <b>2018</b> | None  | None   | -  |
| <b>2019</b> | None  | None   | -  |
| <b>2020</b> | None  | None   | -  |
| <b>2021</b> | None  | None   | -  |

**Table 4-3 Exceedances of Target Values for Ozone (Health) and Long-Term Objectives, 2008-2021**

| <b>Year</b> | <b>8-Hour Mean Target Value</b> | <b>AOT40 Target Value</b> | <b>8-Hour Mean LTO</b> | <b>AOT40 LTO</b> |
|-------------|---------------------------------|---------------------------|------------------------|------------------|
| <b>2008</b> | 1 zone measured (Eastern)       | None                      | 43 zones               | 41 zones         |
| <b>2009</b> | None                            | None                      | 39 zones               | 10 zones         |
| <b>2010</b> | None                            | None                      | 41 zones               | 6 zones          |
| <b>2011</b> | None                            | None                      | 43 zones               | 3 zones          |
| <b>2012</b> | None                            | None                      | 41 zones               | 3 zones          |
| <b>2013</b> | None                            | None                      | 33 zones               | 8 zones          |
| <b>2014</b> | None                            | None                      | 32 zones               | 3 zones          |
| <b>2015</b> | None                            | None                      | 43 zones               | 1 zone           |
| <b>2016</b> | None                            | None                      | 42 zones               | 5 zones          |
| <b>2017</b> | None                            | None                      | 34 zones               | None             |
| <b>2018</b> | None                            | None                      | 43 zones               | 38 zones         |
| <b>2019</b> | None                            | None                      | 43 zones               | 6 zones          |
| <b>2020</b> | None                            | None                      | 40 zones               | 16 zones         |
| <b>2021</b> | None                            | None                      | 39 zones               | 1 zone           |



**Table 4-4 Zones Exceeding Target Values for As, Cd, Ni and B[a]P, 2008-2021**

| Year | As   | Cd   | Ni  | B[a]P  |
|------|------|------|---|--|
| 2008 | None | None | 2 (Swansea, South Wales)                                    | 6 (Yorks. & Humberside, Teesside, Northern Ireland, Swansea, South Wales, Belfast)                               |
| 2009 | None | None | 2 (Swansea, South Wales)                                    | 6 (Yorks. & Humberside, Northern Ireland, Teesside, Swansea, North East, South Wales)                            |
| 2010 | None | None | 2 (Swansea, South Wales)                                    | 8 (Yorks. & Humberside, Northern Ireland, Teesside, Belfast, W Midlands, North East, South Wales, North Wales.)  |
| 2011 | None | None | 2 (Swansea, South Wales)                                    | 7 (Yorks. & Humberside, N. Ireland, Teesside, Swansea, Belfast, North East, South Wales)                         |
| 2012 | None | None | 2 (Swansea, South Wales)                                    | 8 (Yorks. & Humberside, Teesside, Swansea, Belfast, the North East, South Wales, North Wales, Northern Ireland.) |
| 2013 | None | None | 2 (Swansea, South Wales)                                    | 6 (Yorks. & Humberside, Teesside, Swansea, East Midlands, North East, South Wales.)                              |
| 2014 | None | None | 3 (Sheffield, Swansea, South Wales)                         | 6 (Yorks. & Humberside, Teesside, Swansea, East Midlands, North East, and South Wales).                          |
| 2015 | None | None | 2 (Swansea, South Wales)                                    | 5 (Yorks. & Humberside, Teesside, Swansea, the North East and South Wales).                                      |
| 2016 | None | None | 3 (Sheffield, Swansea, South Wales)                         | 4 (Yorks. & Humberside, Swansea, South Wales and Northern Ireland).  |
| 2017 | None | None | None  | 3 (Yorks. & Humberside, Swansea and South Wales)   |
| 2018 | None | None | 4 (Sheffield, Yorks. & Humberside, Swansea and South Wales) | 3 (Yorks. & Humberside, Swansea and South Wales)   |
| 2019 | None | None | 4 (Sheffield, Yorks. & Humberside, Swansea and South Wales) | 3 (Yorks. & Humberside, Swansea and South Wales)   |
| 2020 | None | None | 4 (Sheffield, Yorks. & Humberside, Swansea and South Wales) | 3 (Yorks. & Humberside, Swansea and South Wales)   |
| 2021 | None | None | 4 (Sheffield, Yorks. & Humberside, Swansea and South Wales) | 2 (Swansea and South Wales)  |

Additional information from the Devolved Administrations of Scotland, Wales and Northern Ireland can be found at:

- The Scottish Government Air Quality web page at <https://www.scotland.gov.uk/Topics/Environment/waste-and-pollution/Pollution-1/16215>
- The Welsh Government Environment and Climate Change web pages at <https://gov.wales/environment-climate-change> .
- The Northern Ireland Department of Agriculture, Environment and Rural Affairs (DAERA) web page at <https://www.daera-ni.gov.uk/topics/protect-environment> .

## 5 References

DAERA, 2017. *The Air Quality Standards (Amendment) Regulations (Northern Ireland) 2017*. [Online]

Available at: <https://www.legislation.gov.uk/nisr/2017/2/contents/made>  
[Accessed 21 July 2022].

Defra, 2017. *UK plan for tackling roadside nitrogen dioxide concentrations*. [Online]

Available at: <https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017>  
[Accessed 21 July 2022].

Department of Environment Northern Ireland, 2010. *The Air Quality Standards Regulations (Northern Ireland) 2010*. [Online]

Available at: <https://www.legislation.gov.uk/nisr/2010/188/contents/made>  
[Accessed 21 July 2022].

European Parliament and Council of the European Union, 2004. *Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air*. [Online]

Available at: <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32004L0107:EN:NOT>  
[Accessed 21 July 2022].

European Parliament and Council of the European Union, 2008. *Council Directive on ambient air quality and cleaner air for Europe (2008/50/EC)*. [Online]

Available at: <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32008L0050:EN:NOT>  
[Accessed 21 July 2022].

HM Government of Gibraltar, 2016. *Environment (Air Quality Standards) (Amendment) Regulations 2016 (Legal Notice No. 2016/242)*. [Online]

Available at: <https://www.gibraltarlaws.gov.gi/legislations/environment-air-quality-standards-amendment-regulations-2016-2922>  
[Accessed 21 July 2022].

Pugsley, K. L. et al., 2022. *Technical report on UK supplementary modelling assessment under the Air Quality Standards Regulations 2010 for 2020*. [Online]

Available at: [https://uk-air.defra.gov.uk/assets/documents/reports/cat09/2203150935\\_2020\\_PCM\\_technical\\_report.pdf](https://uk-air.defra.gov.uk/assets/documents/reports/cat09/2203150935_2020_PCM_technical_report.pdf)  
[Accessed 04 August 2022].

Scottish Government, 2010. *The Air Quality Standards (Scotland) Regulations*. [Online]

Available at: <https://www.legislation.gov.uk/ssi/2010/204/made>  
[Accessed 21 July 2022].

Scottish Government, 2016. *The Air Quality Standards (Scotland) Amendment Regulations 2016*. [Online]

Available at: <https://www.legislation.gov.uk/ssi/2016/376/contents/made>

[Accessed 21 July 2022].

UK Government, 2010. *UK Air Quality Standards Regulations 2010*. [Online]

Available at: <https://www.legislation.gov.uk/uksi/2010/1001/contents/made>

[Accessed 21 July 2022].

UK Government, 2016. *The Air Quality Standards (Amendment) Regulations 2016*. [Online]

Available at: <https://www.legislation.gov.uk/uksi/2016/1184/contents/made>

[Accessed 21 July 2022].

Welsh Government, 2010. *The Air Quality Standards (Wales) Regulations*. [Online]

Available at: <https://www.legislation.gov.uk/wsi/2010/1433/contents/made>

[Accessed 21 July 2022].