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Air Pollution in the UK 2012

Compliance Assessment Summary

September 2013

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A report prepared by Ricardo-AEA for Defra and the Devolved Administrations.

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Executive Summary

The UK is required to report air quality data on an annual basis under the following European Directives:

- The Council Directive on ambient air quality and cleaner air for Europe (2008/50/EC).
- The Fourth Daughter Directive 2004/107/EC under the Air Quality Framework Directive (1996/62/EC).

This document has been prepared to accompany and summarise the UK's 2012 submission on air quality to the European Commission, presenting a summary of the UK's compliance with the above Directives, based upon measurements from national air pollution monitoring networks and air pollution modelling. This includes details of the exceedances reported in 2012.

This document is an extract from a larger report, "Air Pollution in the UK 2012", which, in addition to the compliance summary also provides background information on the pollutants covered by these Directives and the UK's own 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.

These data are produced on behalf of Defra (the Department for Environment, Food and Rural Affairs) and the Devolved Administrations of Scotland, Wales and Northern Ireland.

The 2012 results can be summarised as follows:

- There were no exceedances of any EU limit values for sulphur dioxide.
- The UK exceeded the limit value for hourly mean nitrogen dioxide (NO_2) in two zones (out of the total of 43). The remaining 41 zones were compliant.
- The number of zones that exceeded the limit value for annual mean NO_2, (or the limit value plus margin of tolerance where a time extension was in place), was 34. Of the nine compliant zones, five were within the limit value, and a further four were covered by a time extension and were within the limit value plus the applicable margin of tolerance.
- After subtraction of the contribution from natural sources all zones met the limit value for daily mean concentration of PM_{10} particulate matter.
- All zones met the limit value for annual mean concentration of PM_{10} particulate matter.
- All zones met the target value for annual mean concentration of $PM_{2.5}$ particulate matter, and the Stage 1 limit value, which comes into force in 2015. After subtraction of the natural contribution, one zone did not meet the Stage 2 limit value which must be met by 2020.
- Exceedances were reported for the long term ozone objective for human health in 41 zones, and exceedances were reported for the long term ozone objective for vegetation in three zones.
- Two zones exceeded the target value for nickel in 2012, as has been the case since 2008.
- Eight zones exceeded the target value for benzo[a]pyrene in 2012.

Copies of previous annual submissions can be found on the Commission website: http://cdr.eionet.europa.eu/gb/eu/annualair. For more information on air quality in the UK visit the Defra website at www.gov.uk/defra and the UK Air Quality websites at http://uk-air.defra.gov.uk/, www.scottishairquality.co.uk, www.welshairquality.co.uk and www.airqualityni.co.uk.

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1 Introduction

All Member States of the European Union (EU) must comply with Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe[1] and the Fourth Air Quality Daughter Directive[2] (2004/107/EC). These Directives require all Member States, including the UK, to undertake air quality assessment, and to report the findings to the European Commission on an annual basis.

The UK has statutory monitoring networks in place to meet the requirements of these Directives, with air quality modelling used to supplement the monitored data.

The results are submitted to the European Commission each year, in the form of a standard questionnaire which each Member State must complete. The UK's annual submission, together with those from previous years, can be found on the Commission website: http://cdr.eionet.europa.eu/gb/eu/annualair.

This document presents an assessment of the UK's compliance with the limit values, target values and long term objectives set out in the Air Quality Directive and the 4th Daughter Directive, and compares this with recent years. This is based upon the data submitted to the European Commission.

Links to the EU Directives on ambient air quality are provided on Defra's web pages at www.defra.gov.uk/environment/quality/air/air-quality/eu/. The Air Quality Directive itself can also be found at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:152:0001:0044:EN:PDF.

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

2 Definition of Zones

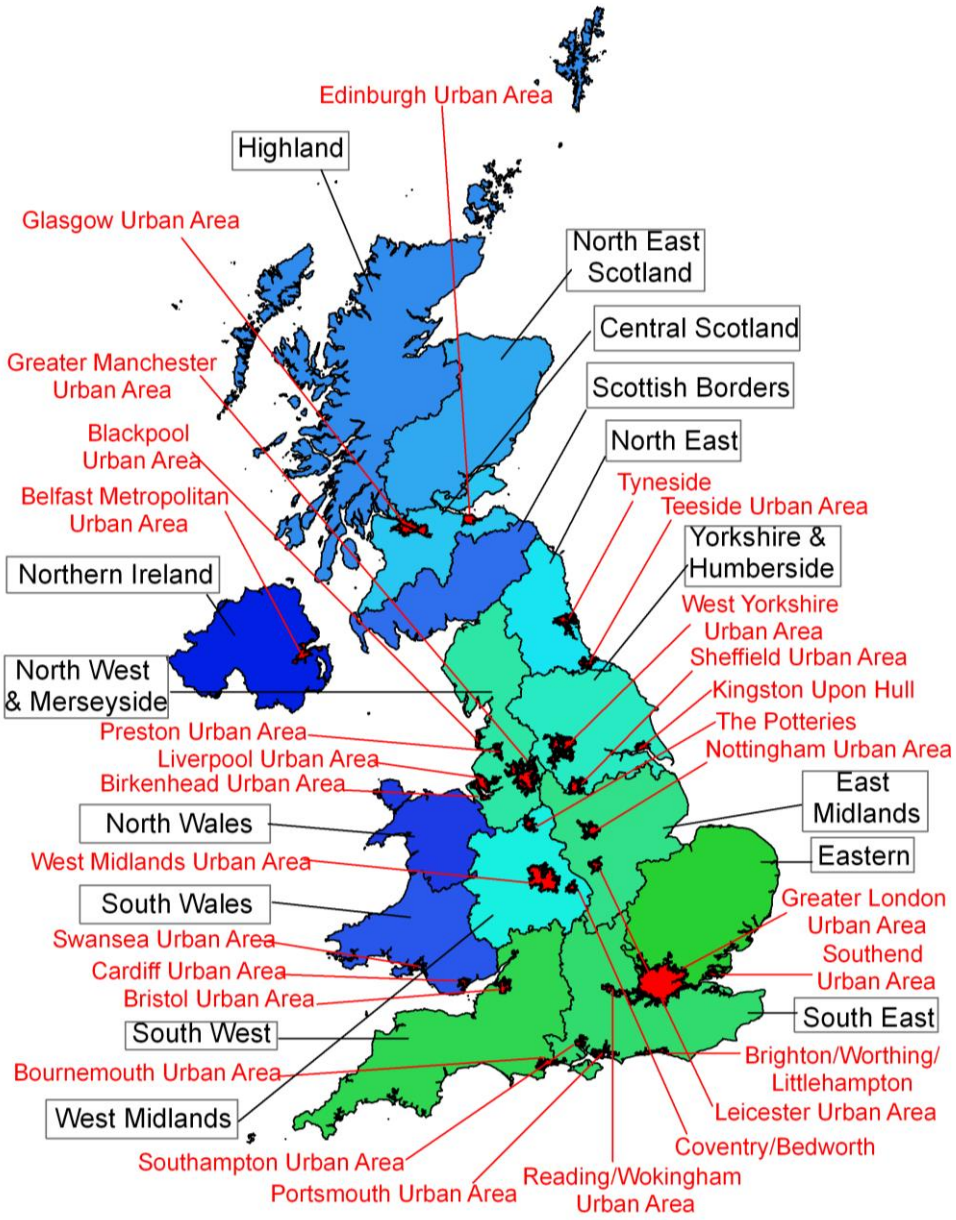
The UK is divided into 43 zones for air quality assessment. There are 28 agglomeration zones (large urban areas) and 15 non-agglomeration zones. Details are included in Form 2 of the Questionnaire (the annual compliance assessment report to the European Commission). Each zone is assigned an identification code. Zones are listed in Table 2-1 and shown in Figure 2-1.

Table 2-1 UK Zones and Agglomerations for Ambient Air Quality Reporting 2012

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

Ag = agglomeration zone, Non-ag = non-agglomeration zone

Figure 2-1 UK Zones and Agglomerations for Ambient Air Quality Reporting 2012



Agglomeration zones (red)
Non-agglomeration zones (blue/green)

3 Air Quality Assessment for 2012

The air quality assessment for each pollutant is derived from a combination of measured and modelled concentrations. Where both measurements and model results are available the assessment of compliance for each zone is based on the higher concentration of the two.

The results of the air quality assessment submitted to the European Commission are summarised in the tables below. The tables have been completed as follows:

- Where all measurements were within the relevant limit values in 2012, the table shows this as "OK".
- Where a margin of tolerance is applicable, if some or all measurements were above the limit value, but within the limit value plus margin of tolerance, the table shows this as "≤LV +MOT".
- In the above cases, where compliance was determined by modelling or supplementary assessment, this is indicated by "(m)" – i.e. "OK (m)" or "≤LV +MOT (m)" as appropriate.
- Where locations were identified as exceeding a limit value, limit value plus margin of tolerance, target value, long-term objective, this is identified as ">LV", ">LV+MOT", ">TV" or ">LTO" as applicable.
- Where an exceedance was determined by modelling or supplementary assessment, this is indicated by (m), as above.

Zones that complied with the relevant limit values, targets or long-term objectives are shaded blue, while those that did not are shaded red.

Where a time extension has been granted, and a margin of tolerance applies, zones that exceeded the relevant limit value but not the limit value plus margin of tolerance are shaded orange. For ozone, zones that met the relevant target value but not the long-term objective are shaded purple.

The abbreviation "n/a" (not applicable) means that an assessment is not relevant for this zone, such as for the NO_X vegetation critical level in agglomeration zones.

3.1 Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe

Sulphur dioxide (SO_2): the results of the air quality assessment for sulphur dioxide are presented in Form 8a of the Questionnaire.

In 2012, all zones and agglomerations within the UK complied with the limit values for 1-hour mean and 24-hour mean SO_2 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_2 concentration, set for protection of ecosystems. (These are not applicable to built-up areas).

Nitrogen dioxide (NO_2): the results of the air quality assessment for nitrogen dioxide for each zone are presented in Form 8b of the Questionnaire, and summarised in Table 3-1.

Two zones had locations where the 1-hour limit value (200 µg m^{-3}) was exceeded on more than the permitted 18 occasions during 2012: Greater London Urban Area (UK0001) and the South East (UK0031). Forty-one of the UK's 43 zones and agglomerations complied with the 1-hour mean NO_2 limit value.

Five zones ***met*** the annual mean limit value for NO_2 in 2012:

- Blackpool Urban Area (UK0022)

- Preston Urban Area (UK0023)
- Highland (UK0039)
- Scottish Borders (UK0040)
- Northern Ireland (UK0043).

The remaining 38 zones had locations with measured or modelled annual mean NO_2 concentrations higher than the annual mean limit value (40 µg m^{-3}). The UK has been granted a time extension for compliance with the NO_2 annual limit value in the following ten zones and agglomerations;

- Nottingham Urban Area,
- Leicester Urban Area,
- Portsmouth Urban Area,
- Reading/Wokingham Urban Area,
- Southend Urban Area,
- Edinburgh Urban Area,
- Cardiff Urban Area,
- Central Scotland,
- North Wales and
- Northern Ireland

This extension applies until 1st January 2015 for all but Reading/Wokingham Urban Area (where it applied until 1st January 2013) and Northern Ireland zone (where it applies until 1st January 2014).

The following four zones exceeded the annual mean limit value, but were within the annual mean limit value plus margin of tolerance in 2012:

- Reading/Wokingham Urban Area,
- Southend Urban Area,
- Edinburgh Urban Area, and
- Central Scotland.

Therefore, a total of nine zones and agglomerations were compliant either with the annual mean NO_2 limit value, or where applicable the annual mean limit value plus margin of tolerance. The remaining 34 zones and agglomerations exceeded the annual mean limit value, or annual mean limit value plus margin of tolerance.

All non-agglomeration zones within the UK complied with the critical level for annual mean NO_X concentration, set for protection of vegetation.

PM_{10} Particulate matter: the results of the air quality assessment for PM_{10} for each zone are presented in Form 8c of the Questionnaire, and summarised in Table 3-2.

There were no longer any time extensions in place for PM_{10} during 2012. The former time extension for compliance with the 24-hour PM_{10} limit value in the Greater London Urban Area (UK0001) expired on 10th June 2011.

Under the Air Quality Directive, Member States are required to inform the Commission where exceedances of PM_{10} limit values are due to natural sources, and where this is the case, the exceedance does not count as non compliance. The Greater London zone (UK001) exceeded the daily limit value (50 µg m^{-3}) in 2012 due to natural sources. Following subtraction of natural source contribution, the number of exceedances was reduced from 46 to 35 days. Therefore, all zones were compliant with the daily mean limit value. *In Table 3-2 natural source contribution has only been subtracted for zone UK0001.*

All zones and agglomerations complied with the annual mean limit value of 40 µg m^{-3} for PM_{10}.

$PM_{2.5}$ Particulate matter: the results of the air quality assessment for $PM_{2.5}$ for each zone are presented in Form 9c of the Questionnaire, and summarised in Table 3-3. This table includes the target value (25 µg m^{-3} to be achieved by 1st Jan 2010), the Stage 1 limit value (25 µg m^{-3} to be achieved by 1st Jan 2015) and the Stage 2 limit value (20 µg m^{-3} to be achieved by 1st Jan 2020). All three apply to the calendar year mean.

Natural contributions have been removed from the $PM_{2.5}$ exceedance listed in Table 3-3. Exceedance of limit values of $PM_{2.5}$ due to natural events (1999/30/EC Article 5(4)) or natural contributions (2008/50/EC Article 20) are as follows:

- Measured exceedance of the Stage 2 limit value in zone UK0001 (site: London Marylebone Road, annual mean: 21 µg m^{-3}). This remains even if the natural contribution (sea salt) is subtracted.

Natural contributions have *only* been removed where there was an exceedance, i.e. only for London and only for the Stage 2 limit value.

Annual mean concentrations of $PM_{2.5}$ were within the target value of 25 µg m^{-3} in all zones and agglomerations.

Under the Air Quality Directive, Member States will be required to achieve a national exposure reduction target for $PM_{2.5}$, over the period 2010 to 2020. This is based on the Average Exposure Indicator statistic. The Average Exposure Indicator (AEI) for the UK is calculated as follows: the arithmetic mean $PM_{2.5}$ concentration at appropriate UK background urban sites only is calculated for three consecutive calendar years, and the mean of these values taken as the AEI.

The AEI for the reference year (2010) was used to determine the National Exposure Reduction Target (NERT), to be achieved by 2020 (see Annex XIV of the Air Quality Directive). The UK's reference year AEI was 13 µg m^{-3}; on this basis, the Air Quality Directive sets an exposure reduction target of 15%. (The detailed methodology and results of this calculation are presented in Defra's technical report on UK air quality assessment[3].)

The AEI for the reference year 2015 is set at 20 µg m^{-3} as an Exposure Concentration Obligation (ECO) in the Air Quality Directive. The UK already meets this obligation. There are no obligations or target values for the years *between* 2010, 2015 and 2020, but the running AEIs for these intervening years give an indication of progress towards the 2020 target.

The running year AEI for 2012 was calculated as follows:

- 2010: 13 µg m^{-3}
- 2011: 14 µg m^{-3}
- 2012: 12 µg m^{-3}.

The mean of these three values (to the nearest integer) is 13 µg m^{-3}.

Carbon monoxide (CO), benzene and lead: the results of the air quality assessment for lead, benzene and CO are presented in Forms 8d, 8e and 8f of the Questionnaire respectively. All zones and agglomerations were compliant with the limit values for these three pollutants in 2012. The 2012 compliance assessment for CO was based on objective estimation (explained in Defra's technical report on UK air quality assessment[3]) underpinned by NAEI emission trends, AURN measurement trends and historical modelling.

Ozone (O_3): the results of the air quality assessment for ozone for each zone are presented in Form 9a of the Questionnaire, and summarised in Table 3-4.

For ozone, 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. Forty-one of the 43 zones and agglomerations were *above* the long-term objective (LTO) for health, the exceptions being Edinburgh Urban Area (UK0025) and North East Scotland (UK0038).

There is also a target value based on the AOT40 statistic[1]. The AOT40 statistic (expressed in µg m^{-3} .hours) is the sum of the difference between hourly concentrations greater than 80 µg m^{-3} (= 40 ppb) and 80 µg m^{-3} over a given period using only the one-hour values measured between 0800 and 2000 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. Three zones were above the long-term objective for vegetation: these were the South West, the North East and Yorkshire and Humberside.

Table 3-1 Results of Air Quality Assessment for Nitrogen Dioxide in 2012

Zone	Zone code	NO_2 LV for health (1hr mean)	NO_2 LV for health (annual mean)	NOx critical level for vegetation (annual mean)
Greater London Urban Area	UK0001	> LV	> LV	n/a
West Midlands Urban Area	UK0002	OK	> LV	n/a
Greater Manchester Urban Area	UK0003	OK	> LV	n/a
West Yorkshire Urban Area	UK0004	OK	> LV	n/a
Tyneside	UK0005	OK	> LV	n/a
Liverpool Urban Area	UK0006	OK	> LV (m)	n/a
Sheffield Urban Area	UK0007	OK	> LV (m)	n/a
Nottingham Urban Area *	UK0008	OK	> LV + MOT (m)	n/a
Bristol Urban Area	UK0009	OK	> LV (m)	n/a
Brighton/Worthing/Littlehampton	UK0010	OK	> LV (m)	n/a
Leicester Urban Area *	UK0011	OK	> LV + MOT (m)	n/a
Portsmouth Urban Area *	UK0012	OK	> LV + MOT (m)	n/a
Teesside Urban Area	UK0013	OK	> LV (m)	n/a
The Potteries	UK0014	OK	> LV (m)	n/a
Bournemouth Urban Area	UK0015	OK	> LV (m)	n/a
Reading/Wokingham Urban Area *	UK0016	OK	≤ LV + MOT (m)	n/a
Coventry/Bedworth	UK0017	OK	> LV (m)	n/a
Kingston upon Hull	UK0018	OK	> LV (m)	n/a
Southampton Urban Area	UK0019	OK	> LV (m)	n/a
Birkenhead Urban Area	UK0020	OK (m)	> LV (m)	n/a
Southend Urban Area *	UK0021	OK (m)	≤ LV + MOT (m)	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	≤ LV + MOT (m)	n/a
Cardiff Urban Area *	UK0026	OK	> LV + MOT (m)	n/a
Swansea Urban Area	UK0027	OK	> LV (m)	n/a
Belfast Urban Area	UK0028	OK	> LV (m)	n/a
Eastern	UK0029	OK	> LV (m)	OK
South West	UK0030	OK	> LV	OK
South East	UK0031	> LV	> LV	OK
East Midlands	UK0032	OK	> LV	OK
North West & Merseyside	UK0033	OK	> LV (m)	OK (m)
Yorkshire & Humberside	UK0034	OK	> LV (m)	OK
West Midlands	UK0035	OK	> LV (m)	OK (m)
North East	UK0036	OK	> LV (m)	OK (m)
Central Scotland *	UK0037	OK	≤ LV + MOT (m)	OK (m)
North East Scotland	UK0038	OK	> LV	OK (m)
Highland	UK0039	OK	OK	OK (m)
Scottish Borders	UK0040	OK	OK	OK
South Wales	UK0041	OK	> LV (m)	OK
North Wales *	UK0042	OK	> LV + MOT (m)	OK
Northern Ireland *	UK0043	OK	OK	OK (m)

LV = limit value, MOT = margin of tolerance, (m) indicates that the compliance or exceedance was determined by modelling.

Asterisk (*) indicates a time extension granted.

Table 3-2 Results of Air Quality Assessment for PM_{10} in 2012 (after subtraction of contribution from natural sources where applicable).

Zone	Zone code	PM_{10} LV (daily mean)	PM_{10} LV (annual mean)
Greater London Urban Area	UK0001	OK (m)	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 (m)	OK (m)
Bristol Urban Area	UK0009	OK	OK
Brighton/Worthing/Littlehampton	UK0010	OK (m)	OK (m)
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 (m)	OK (m)
Reading/Wokingham Urban Area	UK0016	OK	OK
Coventry/Bedworth	UK0017	OK (m)	OK (m)
Kingston upon Hull	UK0018	OK	OK
Southampton Urban Area	UK0019	OK	OK
Birkenhead Urban Area	UK0020	OK (m)	OK (m)
Southend Urban Area	UK0021	OK (m)	OK (m)
Blackpool Urban Area	UK0022	OK (m)	OK (m)
Preston Urban Area	UK0023	OK (m)	OK (m)
Glasgow Urban Area	UK0024	OK (m)	OK (m)
Edinburgh Urban Area	UK0025	OK (m)	OK (m)
Cardiff Urban Area	UK0026	OK	OK
Swansea Urban Area	UK0027	OK	OK
Belfast 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	OK
Highland	UK0039	OK	OK
Scottish Borders	UK0040	OK (m)	OK (m)
South Wales	UK0041	OK	OK
North Wales	UK0042	OK	OK
Northern Ireland	UK0043	OK	OK

Prior to the subtraction of natural source contribution Greater London (UK0001) exceeded the daily mean limit value on more than the permitted 35 occasions (based upon the modelling assessment only). However, subtraction of the contribution from natural sources reduced the number of exceedances of this limit value from 46 to 35. Natural sources have only been subtracted for zone UK0001 in this table and only for the daily mean limit value.

LV = limit value, (m) indicates that the compliance or exceedance was determined by modelling.

Table 3-3 Results of Air Quality Assessment for $PM_{2.5}$ in 2012 (after subtraction of contribution from natural sources where applicable).

Zone	Zone code	$PM_{2.5}$ target value (annual mean for 1st Jan 2010)	$PM_{2.5}$ Stage 1 limit value (annual mean, for 1st Jan 2015)	$PM_{2.5}$ Stage 2 limit value (annual mean, for 1st Jan 2020)
Greater London Urban Area	UK0001	OK	OK	> LV
West Midlands Urban Area	UK0002	OK	OK	OK
Greater Manchester Urban Area	UK0003	OK	OK	OK
West Yorkshire Urban Area	UK0004	OK	OK	OK
Tyneside	UK0005	OK	OK	OK
Liverpool Urban Area	UK0006	OK	OK	OK
Sheffield Urban Area	UK0007	OK	OK	OK
Nottingham Urban Area	UK0008	OK	OK	OK
Bristol Urban Area	UK0009	OK	OK	OK
Brighton/Worthing/Littlehampton	UK0010	OK	OK	OK
Leicester Urban Area	UK0011	OK	OK	OK
Portsmouth Urban Area	UK0012	OK	OK	OK
Teesside Urban Area	UK0013	OK	OK	OK
The Potteries	UK0014	OK	OK	OK
Bournemouth Urban Area	UK0015	OK	OK	OK
Reading/Wokingham Urban Area	UK0016	OK	OK	OK
Coventry/Bedworth	UK0017	OK (m)	OK (m)	OK (m)
Kingston upon Hull	UK0018	OK	OK	OK
Southampton Urban Area	UK0019	OK	OK	OK
Birkenhead Urban Area	UK0020	OK	OK	OK
Southend Urban Area	UK0021	OK (m)	OK (m)	OK (m)
Blackpool Urban Area	UK0022	OK (m)	OK (m)	OK (m)
Preston Urban Area	UK0023	OK	OK	OK
Glasgow Urban Area	UK0024	OK	OK	OK
Edinburgh Urban Area	UK0025	OK (m)	OK (m)	OK (m)
Cardiff Urban Area	UK0026	OK (m)	OK (m)	OK (m)
Swansea Urban Area	UK0027	OK	OK	OK
Belfast Urban Area	UK0028	OK	OK	OK
Eastern	UK0029	OK	OK	OK
South West	UK0030	OK (m)	OK (m)	OK (m)
South East	UK0031	OK	OK	OK
East Midlands	UK0032	OK	OK	OK
North West & Merseyside	UK0033	OK	OK	OK
Yorkshire & Humberside	UK0034	OK	OK	OK
West Midlands	UK0035	OK	OK	OK
North East	UK0036	OK	OK	OK
Central Scotland	UK0037	OK	OK	OK
North East Scotland	UK0038	OK	OK	OK
Highland	UK0039	OK	OK	OK
Scottish Borders	UK0040	OK (m)	OK (m)	OK (m)
South Wales	UK0041	OK	OK	OK
North Wales	UK0042	OK	OK	OK
Northern Ireland	UK0043	OK	OK	OK

Prior to subtraction of natural source contribution, the Greater London Urban Area (UK0001) exceeded the Stage 2 limit value (to be met by 1st Jan 2020). The exceedance of the Stage 2 limit value remained after the subtraction of the natural $PM_{2.5}$ contribution. Natural sources have only been subtracted for zone UK0001 in this table, and only for the Stage 2 limit value.

LV = limit value, (m) indicates that the compliance or exceedance was determined by modelling.

Table 3-4 Results of Air Quality Assessment for Ozone in 2012

Zone	Zone code	O_3 TV and LTO for health (8hr mean)	O_3 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	OK
West Yorkshire Urban Area	UK0004	Met TV, > LTO	OK
Tyneside	UK0005	Met TV, > LTO (m)	OK
Liverpool Urban Area	UK0006	Met TV, > LTO (m)	OK
Sheffield Urban Area	UK0007	Met TV, > LTO	OK
Nottingham Urban Area	UK0008	Met TV, > LTO	OK
Bristol Urban Area	UK0009	Met TV, > LTO	OK
Brighton/Worthing/Littlehampton	UK0010	Met TV, > LTO	OK
Leicester Urban Area	UK0011	Met TV, > LTO (m)	OK
Portsmouth Urban Area	UK0012	Met TV, > LTO	OK
Teesside Urban Area	UK0013	Met TV, > LTO (m)	OK
The Potteries	UK0014	Met TV, > LTO	OK
Bournemouth Urban Area	UK0015	Met TV, > LTO	OK
Reading/Wokingham Urban Area	UK0016	Met TV, > LTO	OK
Coventry/Bedworth	UK0017	Met TV, > LTO	OK
Kingston upon Hull	UK0018	Met TV, > LTO (m)	OK
Southampton Urban Area	UK0019	Met TV, > LTO	OK
Birkenhead Urban Area	UK0020	Met TV, > LTO (m)	OK
Southend Urban Area	UK0021	Met TV, > LTO	OK (m)
Blackpool Urban Area	UK0022	Met TV, > LTO	OK
Preston Urban Area	UK0023	Met TV, > LTO	OK
Glasgow Urban Area	UK0024	Met TV, > LTO (m)	OK
Edinburgh Urban Area	UK0025	OK	OK
Cardiff Urban Area	UK0026	Met TV, > LTO	OK
Swansea Urban Area	UK0027	Met TV, > LTO	OK
Belfast Urban Area	UK0028	Met TV, > LTO (m)	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	Met TV, > LTO
West Midlands	UK0035	Met TV, > LTO	OK
North East	UK0036	Met TV, > LTO (m)	Met TV, > LTO (m)
Central Scotland	UK0037	Met TV, > LTO (m)	OK
North East Scotland	UK0038	OK	OK
Highland	UK0039	Met TV, > LTO	OK
Scottish Borders	UK0040	Met TV, > LTO	OK
South Wales	UK0041	Met TV, > LTO	OK
North Wales	UK0042	Met TV, > LTO	OK
Northern Ireland	UK0043	Met TV, > LTO	OK

TV = target value, LTO = long-term objective, (m) indicates that the compliance or exceedance was determined by modelling.

In 2012 there were two measured exceedances of the ozone information thresholds and no exceedances of any of the alert threshold. The information threshold exceedances are detailed in Table 3-5.

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

Site name	Zone code	Number of 1-hour exceedances of information threshold	Maximum 1-hour concentration (µg m^{-3})
London N. Kensington	UK0001	2	186
Charlton Mackrell	UK0030	1	182

3.2 Fourth Daughter Directive 2004/107/EC

The results of the air quality assessment for arsenic (As), cadmium (Cd), nickel (Ni) and benzo[a]pyrene (B[a]P) for each zone are presented in Form 9b of the Questionnaire, and illustrated in Table 3-6.

All zones and agglomerations met the target values for arsenic and cadmium. Two zones (Swansea Urban Area and the South Wales zone) exceeded the target value for nickel. In both these zones, the exceedance has been attributed to industrial sources.

Concentrations of B[a]P were above the target value in eight zones (Teesside Urban Area, Swansea Urban Area, Belfast Urban Area, Yorkshire and Humberside, the North East, South Wales, North Wales and Northern Ireland). In Belfast Urban Area, Northern Ireland and North Wales, the exceedance of the target value is attributed to the relatively high level of domestic coal and solid fuel use in these zones. In Teesside, Swansea and the North East, the exceedance is attributed to emissions from industrial sources. In the other two zones, the exceedances are attributed to a combination of industrial sources and domestic solid fuel use. All the remaining 35 zones were compliant with the target value for B[a]P, as shown in Table 3-6.

Table 3-6 Results of Air Quality Assessment for As, Cd, Ni and benzo[a]pyrene in 2012

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

TV = Target Value, (m) indicates that the compliance or exceedance was determined by modelling.

Total deposition rates of arsenic, cadmium, nickel, mercury and PAH compounds (in µg m^{-2} per day), at two rural sites (representing the north and the south of the UK), are also reported in the Questionnnaire (Form 16d). Table 3-7 shows the mean total deposition rates for these species reported for 2012 at the two rural sites where they are measured. There are no limit values or target values for deposition.

Table 3-7 Annual Mean Daily Deposition Rates of 4th Daughter Directive Pollutants

Site	Zone	As µgm^{-2}day^{-1}	Cd µgm^{-2}day^{-1}	Ni µgm^{-2}day^{-1}	B[a]P µgm^{-2}day^{-1}
Harwell	South East	0.15	0.021	0.37	0.036
Auchencorth Moss	Central Scotland	0.14	0.016	0.58	0.050

4 Comparison with Previous Years

Table 4-1 to Table 4-5 summarise the results of the air quality assessment for 2012 and provide a comparison with the results of the assessments carried out in previous years since 2008 (the year in which the Air Quality Directive came into force). For information on compliance with the 1st and 2nd Daughter Directives in earlier years, please see previous reports in this series. There are no longer any margins of tolerance (MOT) in force except where granted by a time extension. Table 4-1 shows the number of zones exceeding the limit value itself: where some of these were within the limit value plus an agreed MOT (and therefore compliant) this is explained in the table or its footnotes.

Table 4-1 (Part 1 of 2) Exceedances of Limit Values for Air Quality Directive

Pollutant	Averaging time	2008	2009	2010	2011	2012
SO_2	1-hour	None	None	None	None	None
SO_2	24-hour	None	None	None	None	None
SO_2	Annual[i]	None	None	None	None	None
SO_2	Winter[i]	None	None	None	None	None
NO_2	1-hour[ii]	3 zones measured (London, Glasgow, NE Scotland)	2 zones measured (London, Glasgow)	3 zones measured (London, Teesside, Glasgow)	3 zones measured (London, Glasgow, South East)	2 zones measured (London, South East)
NO_2	Annual	40 zones (10 measured + 30 modelled)	40 zones (9 measured + 31 modelled)	40 zones (11 measured + 29 modelled)	40 zones (8 measured, + 32 modelled)[iii]	38 zones (10 measured + 28 modelled)[iv]
NO_x	Annual[i]	None	None	None	None	None

[i] Applies to vegetation and ecosystem areas only. Critical Levels are already in force, no MOT.
[ii] No modelling for 1-hour LV.
[iii] Five of the 40 zones that exceeded the annual mean NO_2 LV in 2011 were covered by time extensions and were within the LV+ MOT.
[iv] Four of the 38 zones that exceeded the annual mean NO_2 LV in 2012 were covered by time extensions and were within the LV+ MOT; an additional five zones had time extensions but exceeded the MOT.

Table 4-1 is continued on next page.

Table 4-1 (Part 2 of 2) Exceedances of Limit Values for Air Quality Directive

Pollutant	Averaging time	2008	2009	2010	2011	2012
PM_{10}	Daily	2 zones (1 measured + 1 modelled) *1 zone measured after subtraction of natural contribution*	3 zones (1 measured + 2 modelled) *1 zone modelled after subtraction of natural contribution*	1 (modelled, after subtraction of natural contribution: time ext. granted.)	1 (modelled, after subtraction of natural contribution)[v]	None (after subtraction of natural contribution. No time extension.)
PM_{10}	Annual	None	None	None	None	None
Lead	Annual	None	None	None	None	None
Benzene	Annual	None	None	None	None	None
CO	8-hour	None	None	None	None	None

[v] The one zone that exceeded the daily mean PM_{10} limit value more than the permitted 35 times in 2011 was covered by a time extension, and was within the LV+MOT.

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 1st and 2nd Daughter Directives, which the Air Quality Directive superseded.

Table 4-2 Exceedances of Air Quality Directive Target Values for Ozone (Health)

Pollutant	Averaging time	2008	2009	2010	2011	2012
O_3	8-hour	1 zone measured (Eastern)	None	None	None	None
O_3	AOT40	None	None	None	None	None

Table 4-3 Exceedances of Air Quality Directive Long Term Objectives for Ozone

Pollutant	Averaging time	2008	2009	2010	2011	2012
O_3	8-hour	43 zones (35 measured + 8 modelled)	39 zones (25 measured + 14 modelled)	41 zones (19 measured + 22 modelled)	43 zones (31 measured + 12 modelled)	41 zones (31 measured and 10 modelled)
O_3	AOT40	41 zones (25 measured + 16 modelled)	10 zones (8 measured + 2 modelled)	6 zones (3 measured + 3 modelled)	3 zones (2 measured + 1 modelled)	3 zones (2 measured + 1 modelled)

Table 4-4 Exceedances of 4th Daughter Directive Target Values

Pollutant	Averaging time	2007	2008	2009	2010	2011	2012
As	Annual	None	None	None	None	None	None
Cd	Annual	None	None	None	None	None	None
Ni	Annual	1 zone (Swansea Urban area, measured but low data capture, so reported as m)	2 zones modelled (Swansea, S Wales, measured at non-network site, so reported as m)	2 zones modelled (Swansea, S Wales)	2 zones modelled (Swansea, S Wales)	2 zones, 1 measured 1 modelled (Swansea, S Wales)	2 zones, 1 measured 1 modelled (Swansea, S Wales)
B[a]P	Annual	1 zone measured (Yorkshire & Humberside)	6 zones, (3 zones measured Yorkshire & Humberside, Teesside, N Ireland + 3 zones modelled Swansea, S Wales, Belfast)	6 zones, (2 zones measured Yorkshire & Humberside, N Ireland + 4 zones modelled Teesside, Swansea, North East, S Wales)	8 zones, (2 zones measured: Yorkshire & Humberside, N Ireland + 6 zones modelled; Teesside, Belfast, W Midlands, North East, S Wales, N Wales.)	7 zones (2 measured; Yorkshire & Humberside, N Ireland, + 5 modelled; Teesside, Swansea, Belfast, North East, South Wales)	8 zones (1 measured; Yorkshire & Humberside, + 7 modelled; Teesside, Swansea, Belfast, the North East, South Wales, North Wales, Northern Ireland.)

Table 4-5 Exceedances of Air Quality Directive Target Value for $PM_{2.5}$

Pollutant	Averaging time	2009	2010	2011	2012
$PM_{2.5}$	Annual	None	None	None	None

References

[1] 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 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32008L0050:EN:NOT (Accessed 15 July 2013).

[2] 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 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32004L0107:EN:NOT, (Accessed 15 Jul 2013).

[3] Brookes, D. M. et al., (in preparation) *"Technical report on UK supplementary assessment under the Air Quality Directive (2008/50/EC), the Air Quality Framework Directive (96/62/EC) and Fourth Daughter Directive (2004/107/EC) for 2011"*. AEA report number AEA/ENV/R/3316. (To be made available on UK-AIR at http://uk-air.defra.gov.uk/library)