

# Automatic Urban & Rural Network: Assessment of Site Classifications

**Report to the Department for Environment, Food  
and Rural Affairs, Scottish Government, Welsh  
Assembly Government and the DoE in N. Ireland**

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## Executive summary

The sites currently in the Automatic Urban and Rural Network (AURN) have been assessed for compliance with the requirements of the EU Directive on ambient air quality 2008/50/EC. This places requirements on site location and sampling criteria, which must be met by all sites used to ensure the UK's compliance with the Directive.

Of the 134 sites in the network as of October 2010 and several which have yet to be commissioned into the network, eight have been identified as not fully meeting the requirements. These are:

Brighton Roadside  
Bristol Old Market  
Bury Roadside  
Great Dun Fell  
Leicester Centre  
London Cromwell Road 2  
Sandwell West Bromwich  
Weybourne

The reasons for non-compliance are described and possible solutions provided.

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# 1 Introduction

A new air quality Directive (2008/50/EC) of the European Parliament and of the Council of 21<sup>st</sup> May 2008, on ambient air quality and cleaner air for Europe) was adopted in June 2008. The new Directive, which comes into force in mid-2011, will streamline the European Union's air quality legislation with a single integrated instrument. The Directive defines the siting criteria for monitoring sites on a macro- and micro scale. This document summarises a review of the current AURN sites against these requirements and identifies sites that are not compliant.

Many sites are affiliated to the network, and were in operation for Local Air Quality Management purposes prior to becoming part of the network. It is important that the suitability of these sites is assessed and documented to ensure the UK's continued compliance with the Directive. Over time, local site conditions do change, for example new buildings, vegetation or industrial development. Some sites have been discontinued, replaced or relocated, or have been upgraded as required.

The Directive limit values are in force at all locations in a Member State, but assessment against the limit values is not required at certain locations listed in Annex III, i.e. where the public have no access, where occupational health and safety legislation is applicable, and on the carriageway or central reservation of roads (though York Fishergate is an example where the central reservation is accessed by the public and therefore monitoring is applicable). There are requirements for the protection of human health, as well as for vegetation and ecosystems. The Directive defines separate criteria for ozone, recognizing the long-range transport mechanism that influences ambient ozone concentrations.

The Directive refers to sites located near roads as traffic-orientated. Historically, in the UK, sites close to significant roads as "Roadside" (2-10 metres from the kerb) or "Kerbside"-within 1 metre of the kerb. These definitions have no status in the Directive, but are frequently reflected in the site nomenclature.

## 2 Directive Requirements

### 2.1 Background

The AURN has its roots in the original Statutory Urban Network (SUN) and the Rural network, with the first site established at Sibton in 1973. Several of the sites considerably pre-date the relevant Directives, and have been retained in the network to provide long-term information on air quality, and therefore may not meet the current requirements. A more thorough history is given in Air Pollution in the UK: 2008 <http://www.airquality.co.uk/annualreport/annualreport2008.php>

The network has grown in response to legislative, scientific, technical and policy requirements over the years. There are currently a total of 131 sites measuring nitrogen dioxide, sulphur dioxide, ozone, carbon monoxide and airborne particles (PM<sub>10</sub> and PM<sub>2.5</sub>). Currently, many of the sites in operation are affiliated to the network, i.e. are owned and operated by non-central government organisations (mainly local authorities), although several affiliated sites are equipped with some fully funded analysers (eg particle analysers). These sites may have been installed originally to meet the requirements of the review and assessment process for Local Air Quality Management. In order to ensure the UK's compliance with the EU air quality Directives, it is important that the sites are sited according to the specified requirements (Directive 2008/50/EC, Annex III and VIII-ozone)

Sites are defined by the following categories:

Background	Places representative of exposure of the general urban population
Traffic	At least 25 metres from the edge of major junctions and no more than 10 metres from the kerbside
Industrial	Site in residential area downwind of specific source

In addition, the area surrounding the site is also described as urban, suburban, or rural.

### 2.2 Macroscale Requirements

For pollutants other than ozone, the macroscale siting requirements are defined for protection of human health, and for protection of vegetation and ecosystems. These requirements are intended to ensure that sites are representative of the areas in which they are located, are not unduly affected by specific processes (except for industrially focussed sites), and are typical of areas where the population may be exposed for a significant time.

The Directive defines the requirements as follows:

#### 1. Protection of human health

(a) Sampling points directed at the protection of human health shall be sited in such a way as to provide data on the following:

- the areas within zones and agglomerations where the highest concentrations occur to which the population is likely to be directly or indirectly exposed for a period which is significant in relation to the averaging period of the limit value(s),
- levels in other areas within the zones and agglomerations which are representative of the exposure of the general population,

*(b) Sampling points shall in general be sited in such a way as to avoid measuring very small micro-environments in their immediate vicinity, which means that a sampling point must be sited in such a way that the air sampled is representative of air quality for a street segment no less than 100 metre length at traffic-orientated sites and at least 250 × 250 metres at industrial sites, where feasible;*

*(c) Urban background locations shall be located so that their pollution level is influenced by the integrated contribution from all sources upwind of the station. The pollution level should not be dominated by a single source unless such a situation is typical for a larger urban area. Those sampling points shall, as a general rule, be representative for several square kilometres;*

*(d) Where the objective is to assess rural background levels, the sampling point shall not be influenced by agglomerations or industrial sites in its vicinity, i.e. sites closer than five kilometres;*

*(e) Where contributions from industrial sources are to be assessed, at least one sampling point shall be installed downwind of the source in the nearest residential area. Where the background concentration is not known, an additional sampling point shall be situated within the main wind direction;*

*(f) Sampling points shall, where possible, also be representative of similar locations not in their immediate vicinity;*

*(g) Account shall be taken of the need to locate sampling points on islands where that is necessary for the protection of human health.*

## *2. Protection of vegetation and natural ecosystems*

*Sampling points targeted at the protection of vegetation and natural ecosystems shall be sited more than 20 kilometres away from agglomerations or more than 5 kilometres away from other built-up areas, industrial installations or motorways or major roads with traffic counts of more than 50 000 vehicles per day, which means that a sampling point must be sited in such a way that the air sampled is representative of air quality in a surrounding area of at least 1000 square kilometres. A Member State may provide for a sampling point to be sited at a lesser distance or to be representative of air quality in a less extended area, taking account of geographical conditions or of the opportunities to protect particularly vulnerable areas.*

*Account shall be taken of the need to assess air quality on islands.*

It is of course difficult to establish that a site is located at the point where the highest concentration will be encountered, as (except for traffic and industrial sites) the site needs to be located away from specific sources such as traffic or incinerators. In many cases, site selection would have been backed up by diffusion tube surveys or modelling, but in most cases, practical constraints have a more significant contribution to site location. This is recognised in the microscale requirements of the Directive.

## **2.3 Microscale Requirements**

The microscale requirements are intended to ensure that the measurements made at each site are representative of that location, and no local adverse conditions will compromise the integrity of the data. The requirements are defined as:

*In so far as is practicable, the following shall apply:*

- the flow around the inlet sampling probe shall be unrestricted (free in an arc of at least 270°) without any obstructions affecting the airflow in the vicinity of the sampler (normally some metres away from buildings, balconies, trees and other obstacles and at least 0.5 metres from the nearest building in the case of sampling points representing air quality at the building line),*
- in general, the inlet sampling point shall be between 1.5 metres (the breathing zone) and 4 metres above the ground. Higher positions (up to 8 metres) may be necessary in some*

*circumstances. Higher siting may also be appropriate if the station is representative of a large area,*

- *the inlet probe shall not be positioned in the immediate vicinity of sources in order to avoid the direct intake of emissions unmixed with ambient air,*
- *the sampler's exhaust outlet shall be positioned so that recirculation of exhaust air to the sampler inlet is avoided,*
- *for all pollutants, traffic-orientated sampling probes shall be at least 25 metres from the edge of major junctions and no more than 10 metres from the kerbside.,*

The Directive recognises that practical constraints such as power supplies, security, safety and planning may be taken into account. These factors are frequently the dominant factor in deciding where monitoring sites can be located, and monitoring cannot always be carried out at the most favourable location. Sites located in existing buildings very often have the sample inlet mounted on the wall of the building, thus limiting the angle of airflow around the inlet, but this does not necessarily mean the site is unrepresentative. Compromises are inevitable but these should not be allowed to overly degrade data quality. Regular review of site suitability is necessary, and is currently carried out by the QA/QC Unit every six months. The Directive requires that site location reviews are carried out regularly, and it is intended that this process will address this requirement. It is suggested that site photographs should be occasionally updated on the AURN information site (<http://aurn.defra.gov.uk/>) in order to help identify local changes. LSOs are also encouraged to report anything that might affect the measurements from the site.

## 2.4 Ozone Criteria

The siting criteria for ozone sites are defined in Annex VIII of the Directive

	Objectives of measurement	Representative	Macroscale criteria
Urban	Protection of human health: to assess the exposure of the urban population to ozone, i.e. where population density and ozone concentration are relatively high and representative of the exposure of the general population	A few km <sup>2</sup>	Away from the influence of local emissions such as traffic, petrol stations, etc.; vented locations where well mixed levels can be measured; locations such as residential and commercial areas of cities, parks (away from the trees), big streets or squares with very little or no traffic, open areas characteristic of educational, sports or recreation facilities
Suburban	Protection of human health and vegetation: to assess the exposure of the population and vegetation located in the outskirts of the agglomeration, where the highest ozone levels, to which the population and vegetation are likely to be directly or indirectly exposed occur	Some tens of km <sup>2</sup>	At a certain distance from the area of maximum emissions, downwind following the main wind direction/directions during conditions favourable to ozone formation; where population, sensitive crops or natural ecosystems located in the outer fringe of an agglomeration are exposed to high ozone levels; where appropriate, some suburban stations also upwind of the area of maximum emissions, in order to determine the regional background levels of ozone
Rural	Protection of human health and vegetation: to assess the exposure of population, crops and natural ecosystems to sub-regional scale ozone concentrations	Sub-regional levels (some hundreds of km <sup>2</sup> )	Stations can be located in small settlements and/or areas with natural ecosystems, forests or crops; representative for ozone away from the influence of immediate local emissions such as industrial installations and roads; at



			open area sites, but not on summits of higher mountains
Rural background	Protection of vegetation and human health: to assess the exposure of crops and natural ecosystems to regional-scale ozone concentrations as well as exposure of the population	Regional/national/continental levels (1 000 to 10 000 km <sup>2</sup> )	Station located in areas with lower population density, e.g. with natural ecosystems, forests, at a distance of at least 20 km from urban and industrial areas and away from local emissions; avoid locations which are subject to locally enhanced formation of ground-near inversion conditions, also summits of higher mountains; coastal sites with pronounced diurnal wind cycles of local character are not recommended.

For microscale criteria, those defined for the other pollutants in 2.3 above apply, with the additional requirement that sites should be more than 10 metres from roads, increasing with traffic density.

Ladybower is classed as a background rural site, as it is at least 20 kilometres from the Greater Manchester agglomeration and is representative of a considerable area within the Peak District National Park. The air quality observed at this site, however, is influenced by industrial emissions from urban areas under certain meteorological conditions. Glazebury too, is affected by local emissions, in this case from major roads, and is therefore classified as rural.

## 2.5 Sites yet to be Affiliated

The process of updating the network is still ongoing, and a small number of sites have therefore yet to be added to the network to ensure Directive compliance. The process of site selection included assessment against the requirements of the Directive, and sites approved for affiliation will be compliant. Some minor site specific requirements (eg sample inlet location) may need to be checked following installation of any additional equipment required for affiliation.

### 3 Site assessments

The process of assessing the site compliance used the following inputs:

- Site criteria assessed at 6-monthly QA/QC audits carried out by AEA staff. A questionnaire was appended to the audit spreadsheet which recorded site information such as sample height, local sources etc
- Information available on the AURN site information website, including maps and photographs
- Google Earth, useful for determining distances to roads, junctions, etc and general topography and urban layout
- Specific information based on observations of staff who have visited the sites recently

Each site was then considered individually against the Directive requirements, and those not compliant are listed below:

Site	Reason for noncompliance	Comments
Brighton Roadside	Site on major road junction	Location not representative of area
Bristol Old Market	Site on major road junction	Location not representative of area
Bury Roadside	Site within major road junction	Site also too far from carriageway to be Roadside
Great Dun Fell	Site in elevated location (900m asl)	Site originally intended for research purposes
Leicester Centre	Site between two large office blocks preventing free air movement	Location not representative of area
London Cromwell Road 2	Site on major road junction	Within 25m of junction
Sandwell West Bromwich	Site in car park on top floor	Not representative of local area; may be affected by traffic in car park
Weybourne	Site on coast	Prevailing weather conditions so near sea may affect concentrations

In addition, several sites were identified to not be fully compliant with the Directive, and site operators/equipment service units are to consider making improvements to enhance compliance:

Glasgow City Chambers, Oxford Centre Roadside, Sibton: Check sample inlets are more than 0.5 metres from side of enclosure/building façade.

There are several sites (particularly Traffic sites and those in existing buildings) where the sample inlet is restricted to less than 270 degrees. It is not thought that these significantly affect measured concentrations. Several sites sample at heights greater than 8m, but this may be acceptable where the site is representative of a larger area (e.g. Glasgow City Chambers). All sites in the AURN comply with this. Many traffic-orientated sites (e.g. Exeter Roadside) are influenced by standing traffic, but this does not adversely affect the representation of the area in general.

There are several Industrial sites in the AURN-Grangemouth, Middlesbrough, Port Talbot Margam and Scunthorpe Town. Of these, only Port Talbot Margam is in prevailing wind from the process of interest, as the others are located close to the sea, and there is no significant population exposure downwind of the sites. There are few meteorological measurements available at AURN sites to accurately assess wind direction; reliable data need to be obtained from the most appropriate meteorological station, which may be some distance away.

Assessments of data quality are regularly carried out from a significant number of non-AURN monitoring sites where the air quality objectives may be exceeded. Where such exceedences may

affect the status of the relevant agglomeration or zone, consideration is given to affiliate these sites into the AURN. Where a site is a possible candidate for affiliation, these are looked at in detail at whether the site is compliant with the more detailed siting requirements of the Directive.

## **4 Recommendations**

It is important that the UK monitoring network meets the requirements of the Directive. The UK will shortly be undertaking a full and up to date assessment of the number and types of sites required for compliance with Directive 2008/50/EC and will review whether the eight non-compliant sites listed in this report are necessary or surplus to requirements.

# Appendices

# Appendix 1

## Site classifications (by DEM category)

Site Code	AURN Site Name	Grid Reference	Northing	Easting	DEM Site Classification	Area
ABD	Aberdeen	NJ 94416 07408	394416	807408	Background	Urban
ABD7	Aberdeen Union Street Roadside	NJ 93655 05984	393655	805984	Traffic	Urban
ARM6	Armagh Roadside	H 87600 45800	287600	345800	Traffic	Urban
AH	Aston Hill	SO 29902 90062	329902	290062	Background	Rural
ACTH	Auchencorth Moss	NT 22050 56250	322050	656250	Background	Rural
AUT2	Auchencorth Moss PM10 PM25	NT 22050 56250	322050	656250	Background	Rural
BALM	Ballymena	D 11990 02630	311900	402600	Background	Urban
BAR2	Barnsley 12	SE 34276 06542	434276	406542	Background	Urban
BAR3	Barnsley Gawber	SE 32529 07472	432529	407472	Background	Urban
BATH	Bath Roadside	ST 75882 66096	375882	166096	Traffic	Urban
BEL2	Belfast Centre	J 33900 74400	333900	374400	Background	Urban
BIL	Billingham	NZ 46962 23650	446962	523650	Industrial	Urban
BIR1	Birmingham Tyburn	SP 11561 90431	411561	290431	Background	Urban
BIRT	Birmingham Tyburn Roadside	SP 11556 90456	411556	290456	Traffic	Urban
BLCB	Blackburn Darwen Roadside	SD 68167 24452	368167	424452	Traffic	Urban
BLC2	Blackpool Marton	SD 33856 34738	333856	434738	Background	Urban
BOT	Bottesford	SK 79768 37654	479768	337654	Background	Rural
BORN	Bournemouth	SZ 12320 93344	412320	93344	Background	Urban
BRT3	Brighton Preston Park	TQ 30508 06222	530508	106222	Background	Urban
BRIT	Brighton Roadside	TQ 31307 04305	531307	104305	Traffic	Urban
BRS2	Bristol Old Market	ST 59570 73173	359570	173173	Traffic	Urban
BRS8	Bristol St Paul's	ST 59501 73935	359501	173935	Background	Urban
BURY	Bury Roadside	SD 80922 04772	380922	404772	Traffic	Urban
BUSH	Bush Estate	NT 24626 63880	324626	663880	Background	Rural
CAM	Cambridge Roadside	TL 45248 58155	545248	258155	Traffic	Urban
CA1	Camden Kerbside	TQ 26640 84433	526640	184433	Traffic	Urban
CANT	Canterbury	TR 16198 57330	616198	157330	Background	Urban
CARD	Cardiff Centre	ST 18417 76505	318417	176505	Background	Urban
CARL	Carlisle Roadside	NY 39442 55956	339442	555956	Traffic	Urban
MACK	Charlton Mackrell	ST 52235 28853	352235	128853	Background	Rural
CHAT	Chatham Centre Roadside	TQ 77487 66947	577487	166947	Traffic	Urban
CHP	Chepstow A48	ST 53126 93461	353126	193461	Traffic	Urban
CHS6	Chesterfield	SK 36351 70682	436351	370682	Background	Urban
CHS7	Chesterfield Roadside	SK 36351 70682	436351	370682	Traffic	Urban
COV3	Coventry Memorial Park	SP 32801 77340	432801	277340	Background	Urban
CWMB	Cwmbran	ST 30510 95436	330510	195436	Background	Urban
DERY	Derry	C 42900 17200	242900	417200	Background	Urban

DUMB	Dumbarton Roadside	NS 49724 72042	249724	672042	Traffic	Urban
DUMF	Dumfries	NX 97012 76278	297012	576278	Traffic	Urban
EB	Eastbourne	TQ 60085 02118	560085	102118		Urban
ED3	Edinburgh St Leonards	NT 26250 73132	326250	673132	Background	Urban
ESK	Eskdalemuir	NT 23528 03030	323500	602800	Background	Rural
EX	Exeter Roadside	SX 91940 92840	291940	92840	Traffic	Urban
FW	Fort William	NN 10849 74421	210849	774421	Background	Suburban
GLA3	Glasgow Centre	NS 58902 65028	258902	665028	Background	Urban
GLA	Glasgow City Chambers	NS 59528 65308	259528	665308	Background	Urban
GLA4	Glasgow Kerbside	NS 58708 65200	258708	665200	Traffic	Urban
GLAZ	Glazebury	SJ 68733 96034	368733	396034	Background	Rural
GRAN	Grangemouth	NS 93837 81035	293837	681035	Industrial	Urban
GRA2	Grangemouth Moray		--	--	Background	Urban
GDF	Great Dun Fell	NY 71020 32190	371020	532190	Background	Rural
HG1	Haringey Roadside	TQ 33885 90669	533885	190669	Traffic	Urban
HAR	Harwell	SU 46772 86020	446772	186020	Background	Rural
HAR5	Harwell PARTISOL	SU 46772 86020	446772	186020	Background	Rural
HM	High Muffles	SE 77535 93865	477535	493865	Background	Rural
HORE	Horley	TQ 28225 42344	528225	142344	Background	Suburban
HUL2	Hull Freetown	TA 09478 29329	509478	429329	Background	Urban
INV2	Inverness	NH 65720 45680	265720	845680	Traffic	Urban
LB	Ladybower	SK 16575 89565	416575	389565	Background	Rural
LEAM	Leamington Spa	SP 31932 65743	431932	265743	Background	Urban
LEED	Leeds Centre	SE 29976 34268	429976	434268	Background	Urban
LED6	Leeds Headingley Kerbside	SE 27991 36071	427991	436071	Traffic	Urban
LEIC	Leicester Centre	SK 58767 04083	458767	304083	Background	Urban
LEOM	Leominster	SO 49773 58387	349773	258387	Background	Suburban
LERW	Lerwick	HU 45337 39683	445337	1139683	Background	Suburban
LV6	Liverpool Queen's Drive Roadside	SJ 36171 94956	336171	394956	Traffic	Urban
LVP	Liverpool Speke	SJ 43860 83598	343860	383598	Background	Urban
BEX	London Bexley	TQ 51852 76396	551852	176396	Background	Suburban
CLL2	London Bloomsbury	TQ 30107 82041	530107	182041	Background	Urban
CRD2	London Cromwell Road 2	TQ 26530 78975	526530	178975	Traffic	Urban
LON6	London Eltham	TQ 43978 74668	543978	174668	Background	Suburban
HG2	London Haringey	TQ 29914 89132	529914	189132	Background	Urban
HRL	London Harlington	TQ 08299 77809	508299	177809	Industrial	Urban
HR3	London Harrow Stanmore	TQ 17899 92334	517899	192334	Background	Urban
HIL	London Hillingdon	TQ 06933 78607	506933	178607	Background	Urban
MY1	London Marylebone Road	TQ 28120 82000	528120	182000	Traffic	Urban
MYP	London Marylebone Road PARTISOL	TQ 28120 82000	528120	182000	Traffic	Urban
KC1	London N. Kensington	TQ 24040 81740	524040	181740	Background	Urban
KC1P	London N. Kensington PARTISOL	TQ 24040 81740	524040	181740	Background	Urban
TED	London Teddington	TQ 15538 70427	515538	170427	Background	Urban
HORS	London Westminster	TQ 29796 78949	529796	178949	Background	Urban
LN	Lough Navar	H 06500 54500	206500	354500	Background	Rural

LH	Lullington Heath	TQ 53855 01740	553855	101740	Background	Rural
MH	Mace Head	L 74000 32000	-120000	410000	Background	Rural
MAN3	Manchester Piccadilly	SJ 84310 98325	384310	398325	Background	Urban
MAN4	Manchester South	SJ 83912 85828	383912	385828	Background	Suburban
MKTH	Market Harborough	SP 83337 95905	483337	295905	Background	Rural
MID	Middlesbrough	NZ 50480 19632	450480	519632	Background	Urban
MOLD	Mold	SJ 23561 63406	323561	363406	Background	Suburban
PEMB	Narberth	SN 14527 12686	214640	212700	Background	Rural
NEWC	Newcastle Centre	NZ 25016 64940	425016	564940	Background	Urban
NCA3	Newcastle Cradlewell Roadside	NZ 25989 65850	425989	565850	Traffic	Urban
NPT3	Newport	ST 32471 89615	332471	189615	Background	Urban
NTON	Northampton	SP 76111 64524	476111	264524	Background	Urban
NO12	Norwich Lakenfields		--	--	Background	Urban
NOTT	Nottingham Centre	SK 57420 40050	457420	340050	Background	Urban
OX	Oxford Centre Roadside	SP 51366 06152	451366	206152	Traffic	Urban
OX8	Oxford St Ebbes	SP 51225 06009	451225	206009	Background	Urban
PEEB	Peebles	NT 24812 41083	324812	641083	Background	Urban
PLYM	Plymouth Centre	SX 47742 54610	247742	54610	Background	Urban
PT4	Port Talbot Margam	SS 77600 88500	277600	188500	Industrial	Urban
PT1	Port Talbot Margam PM10 PM2.5	SS 77600 88500	277600	188500	Industrial	Urban
PMTH	Portsmouth	SU 65686 03607	465686	103607	Background	Urban
PRES	Preston	SD 55248 30143	355248	430143	Background	Urban
REA1	Reading New Town	SU 73441 73198	473441	173198	Background	Urban
ROCH	Rochester Stoke	TQ 83133 76220	583133	176220	Background	Rural
ECCL	Salford Eccles	SJ 77932 98713	377932	398713	Industrial	Urban
SALT	Saltash Roadside	SX 41613 59402	241613	59402	Traffic	Urban
WBRO	Sandwell West Bromwich	SP 00395 91503	400395	291503	Background	Urban
SDY	Sandy Roadside	TL 16450 49616	516450	249616	Traffic	Urban
SCN2	Scunthorpe Town	SE 90421 10812	490421	410812	Industrial	Urban
SHE2	Sheffield Centre	SK 35134 86885	435134	386885	Background	Urban
SHE	Sheffield Tinsley	SK 40240 90585	440240	390585	Background	Urban
SIB	Sibton	TM 36295 71870	636295	271870	Background	Rural
SOUT	Southampton Centre	SU 42565 12255	442565	112255	Background	Urban
SEND	Southend-on-Sea	TQ 85566 86130	585566	186130	Background	Urban
OSY	St Osyth	TM 10426 13205	610426	213205	Background	Rural
HOPE	Stanford-le-Hope Roadside	TQ 69400 82710	569400	182710	Traffic	Urban
EAGL	Stockton-on-Tees Eaglescliffe	NZ 41620 13673	441620	513673	Traffic	Urban
STOK	Stoke-on-Trent Centre	SJ 88348 47894	388348	347894	Background	Urban
STOR	Storrington Roadside	TQ 08991 14249	508991	114249	Traffic	Urban
SV	Strath Vaich	NH 34829 74785	234829	874785	Background	Rural
SUN2	Sunderland Silksworth	NZ 38142 54478	438142	554478	Background	Urban
SWA1	Swansea Roadside	SS 65341 94458	265341	194458	Traffic	Urban
THUR	Thurrock	TQ 61018 77894	561018	177894	Background	Urban
TH2	Tower Hamlets Roadside	TQ 35914 82230	535914	182230	Traffic	Urban
WAL2	Walsall Willenhall	SJ 97860 01173	397860	301173	Background	Urban



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WAR	Warrington	SJ 59129 88219	359129	388219	Background	Urban
WEYB	Weybourne	TG 09832 43775	609832	343775	Background	Rural
WFEN	Wicken Fen	TL 56310 69210	556310	269210	Background	Rural
WIG5	Wigan Centre	SD 57825 06025	357825	406025	Background	Urban
TRAN	Wirral Tranmere	SJ 32096 86644	332096	386644	Background	Urban
WREX	Wrexham	SJ 32862 49904	332862	349904	Traffic	Urban
YW	Yarner Wood	SX 78605 78948	278605	78948	Background	Rural
YK10	York Bootham	SE 60000 52808	460000	452808	Background	Urban
YK11	York Fishergate	SE 60744 51133	460744	451133	Traffic	Urban

## Appendix 2

# AURN Compliance with EU Directive-Summary

### England

SITE	Compliant with Annex 3 Section B: Macroscale	Compliant with Annex 3 Section C: Microscale	Compliance with Annex VIII Ozone	Comments
Barnsley 12	Yes	Yes	-	
Barnsley Gawber	Yes	Yes	Yes	
Bath Roadside	Yes	Yes	-	
Billingham	Yes	Yes	-	
Birmingham Acocks Green	Yes	-		Not yet installed; microscale requirements not yet fully assessed
Birmingham Centre	Yes	Yes	Yes	
Birmingham Tyburn	Yes	Yes	Yes	
Blackburn Roadside	Yes	Yes	-	
Blackpool Marton	Yes	Yes	Yes	
Bottesford	Yes	Yes	Yes	
Bournemouth	Yes	Yes	Yes	
Brighton Preston Park	Yes	Yes	Yes	
Brighton Roadside	No	Yes	-	Site on major road junction
Bristol Old Market	No	Yes	-	Site on major road junction
Bristol St Paul's	Yes	Yes	Yes	
Bury Roadside	No	Yes	-	Site on major road junction. Site also too far from carriageway to be Roadside
Cambridge Roadside	Yes	Yes	-	
Canterbury	Yes	Yes	Yes	
Carlisle Roadside	Yes	Yes	-	
Charlton Mackrell	Yes	Yes	Yes	
Chatham Roadside	Yes	Yes	-	
Chesterfield	Yes	Yes	-	
Chesterfield Roadside	Yes	Yes	-	
Coventry Memorial Park	Yes	Yes	Yes	
Eastbourne	Yes	Yes	-	
Exeter Roadside	Yes	Yes	Yes	

<b>SITE</b>	Compliant with Annex 3 Section B: Macroscale	Compliant with Annex 3 Section C: Microscale	Compliance with Annex VIII Ozone	Comments
Glazebury	Yes	Yes	Yes	
Great Dun Fell	Yes	Yes	No	Site originally intended for research purposes
Harwell	Yes	Yes	Yes	
Harwell Partisols	Yes	Yes	-	
High Muffles	Yes	Yes	Yes	
Horley	Yes	Yes	-	
Hull Freetown	Yes	Yes	Yes	
Ladybower	Yes	Yes	Yes	
Leamington Spa	Yes	Yes	Yes	
Leeds Centre	Yes	Yes	Yes	
Leeds Headingley Roadside	Yes	Yes	-	
Leicester Centre	No	Yes	Yes	Site surrounded by tall buildings preventing representative sampling
Leominster	Yes	Yes	Yes	
Lincoln Roadside	Yes	-	-	Not yet installed; microscale requirements not yet fully assessed
Liverpool Queen's Drive Roadside	Yes	Yes	-	
Liverpool Speke	Yes	Yes	Yes	
Lullington Heath	Yes	Yes	Yes	
Manchester Piccadilly	Yes	Yes	Yes	
Manchester South	Yes	Yes	Yes	
Market Harborough	Yes	Yes	Yes	
Middlesbrough	Yes	Yes	Yes	
Newcastle Centre	Yes	Yes	Yes	
Newcastle Cradlewell Roadside	Yes	Yes	-	
Northampton	Yes	Yes	Yes	
Norwich Lakenfields	Yes	Yes	-	
Nottingham Centre	Yes	Yes	Yes	
Oxford Centre Roadside	Yes	Yes	-	Check sample inlets are more than 0.5m from side of enclosure/building façade.
Oxford St Ebbes	Yes	Yes	Yes	
Plymouth Centre	Yes	Yes	Yes	
Portsmouth	Yes	Yes	Yes	
Preston	Yes	Yes	Yes	
Reading New Town	Yes	Yes	Yes	
Rochester Stoke	Yes	Yes	Yes	
Salford Eccles	Yes	Yes	Yes	
Saltash Roadside	Yes	Yes	-	
Sandwell West Bromwich	No	Yes	Yes	Site not representative of surrounding area; may be affected by traffic in car park. Site

SITE	Compliant with Annex 3 Section B: Macroscale	Compliant with Annex 3 Section C: Microscale	Compliance with Annex VIII Ozone	Comments
				being replaced by Birmingham Acocks Green
Sandy Roadside	Yes	Yes	-	
Scunthorpe Town	Yes	Yes	-	
Sheffield Centre	Yes	Yes	Yes	
Sheffield Tinsley	Yes	Yes	-	
Sibton	Yes	Yes	Yes	Check sample inlets are more than 0.5m from side of enclosure/building façade.
Southampton Centre	Yes	Yes	Yes	
Southend-on-Sea	Yes	Yes	Yes	
St Osyth	Yes	Yes	Yes	
Stanford-le-Hope Roadside	Yes	Yes	-	
Stockton-on-Tees Eaglescliffe	Yes	Yes	-	
Stoke-on-Trent Centre	Yes	Yes	Yes	
Storrington Roadside	Yes	Yes	-	
Sunderland Silksworth	Yes	Yes	Yes	
Thurrock	Yes	Yes	Yes	
Walsall Willenhall	Yes	Yes	Yes	
Warrington	Yes	Yes	-	
Weybourne	Yes	Yes	No	Prevailing weather conditions so near sea may affect concentrations
Wicken Fen	Yes	Yes	Yes	
Wigan Centre	Yes	Yes	Yes	
Wirral Tranmere	Yes	Yes	Yes	
Yarner Wood	Yes	Yes	Yes	
York Bootham	Yes	Yes	-	
York Fishergate	Yes	Yes	-	On central reservation which is accessed by the public and therefore the Directive is applicable

**London**

SITE	Compliant with Annex 3 Section B: Macroscale	Compliant with Annex 3 Section C: Microscale	Compliance with Annex VIII Ozone	Comments
Camden Kerbside	Yes	Yes	-	
Haringey Roadside	Yes	Yes	-	
London Bexley	Yes	Yes	-	
London Bloomsbury	Yes	Yes	Yes	
London Cromwell Road 2	No	Yes	-	Site on major road junction
London Eltham	Yes	Yes	Yes	
London Haringey	Yes	Yes	Yes	
London Harlington	Yes	Yes	Yes	

<b>SITE</b>	Compliant with Annex 3 Section B: Macroscale	Compliant with Annex 3 Section C: Microscale	<b>Compliance with Annex VIII Ozone</b>	<b>Comments</b>
London Hillingdon	Yes	Yes	Yes	
London Marylebone Road	Yes	Yes	Yes	
London N. Kensington	Yes	Yes	Yes	
London Stanmore	Yes	Yes	-	
London Teddington	Yes	Yes	Yes	
London Westminster	Yes	Yes	Yes	
Southwark Roadside	-	-	-	Site not operational since 2006
Tower Hamlets Roadside	Yes	Yes	-	

### Wales

<b>SITE</b>	Compliant with Annex 3 Section B: Macroscale	Compliant with Annex 3 Section C: Microscale	<b>Compliance with Annex VIII Ozone</b>	<b>Comments</b>
Aston Hill	Yes	Yes	Yes	
Cardiff Centre	Yes	Yes	Yes	
Chepstow A48	Yes	Yes	-	
Cwmbran	Yes	Yes	Yes	
Mold	Yes	Yes	Yes	
Narberth	Yes	Yes	Yes	
Newport	Yes	Yes	-	
Port Talbot Margam	Yes	Yes	Yes	
Swansea Roadside	Yes	Yes	-	
Wrexham	Yes	Yes	-	

### Scotland

<b>SITE</b>	Compliant with Annex 3 Section B: Macroscale	Compliant with Annex 3 Section C: Microscale	<b>Compliance with Annex VIII Ozone</b>	<b>Comments</b>
Aberdeen	Yes	Yes	Yes	
Aberdeen Union St Roadside	Yes	Yes	-	
Auchencorth Moss	Yes	Yes	Yes	
Bush Estate	Yes	Yes	Yes	
Dumbarton Roadside	Yes	Yes	-	
Dumfries	Yes	Yes	-	
Edinburgh St Leonards	Yes	Yes	Yes	
Eskdalemuir	Yes	Yes	Yes	
Fort William	Yes	Yes	Yes	
Glasgow Centre	Yes	Yes	Yes	
Glasgow City Chambers	Yes	Yes	-	Check sample inlets are more than 0.5m from side of enclosure/building façade.
Glasgow Kerbside	Yes	Yes	-	

<b>SITE</b>	Compliant with Annex 3 Section B: Macroscale	Compliant with Annex 3 Section C: Microscale	<b>Compliance with Annex VIII Ozone</b>	<b>Comments</b>
Grangemouth	Yes	Yes	-	
Grangemouth Moray School	Yes	Yes	-	
Inverness	Yes	Yes	-	
Lerwick	Yes	Yes	Yes	
Peebles	Yes	Yes	Yes	
Strath Vaich	Yes	Yes	Yes	
West Dumbarton Roadside	Yes	Yes	-	

**Ireland**

<b>SITE</b>	Compliant with Annex 3 Section B: Macroscale	Compliant with Annex 3 Section C: Microscale	<b>Compliance with Annex VIII Ozone</b>	<b>Comments</b>
Armagh Roadside	Yes	Yes	-	
Ballymena	Yes	Yes	-	
Belfast Centre	Yes	Yes	Yes	
Derry	Yes	Yes	Yes	
Lough Navar	Yes	Yes	Yes	
Mace Head	Yes	Yes		Global Atmosphere site; not intended for compliance

## Appendix 3

# Assessment Methodology

### Example-Leeds Centre

Leeds Centre is situated in an open area in Queens Square Court. It is 30 m from major road, and 40m from the junction to the north-west. The site environment is shown in Figure A1, and a photograph of the site in Figure A2:

**Figure A1: Aerial Photograph of the area (courtesy Google Earth)**



**Figure A2: Photograph of Leeds Centre Site**

Considering each point of the Directive given in Section 2.1 in turn:

### **Macroscale Requirements**

#### *Protection of human health*

*(a) Sampling points directed at the protection of human health shall be sited in such a way as to provide data on the following:*

- the areas within zones and agglomerations where the highest concentrations occur to which the population is likely to be directly or indirectly exposed for a period which is significant in relation to the averaging period of the limit value(s),*
- levels in other areas within the zones and agglomerations which are representative of the exposure of the general population,*

**The site is surrounded by residential and commercial premises, where people could reasonable expect to spend many hours at a time. The site is situated well within the Leeds City area, and local air quality will be influenced by a variety of activities and processes. Given the central location, pollution levels can be expected to be amongst the highest in the area, without the influence of any specific source. The Leeds General Infirmary is close by.**

**The site is classified as an Urban Background site.**

*(b) Sampling points shall in general be sited in such a way as to avoid measuring very small micro-environments in their immediate vicinity, which means that a sampling point must be sited in such a way that the air sampled is representative of air quality for a street segment no less than 100 metre length at traffic-orientated sites and at least 250 × 250 metres at industrial sites, where feasible;*

**The site is in an open environment, but not focussed specifically on traffic-related emissions. It is sufficiently far from the road to ensure this.**

*(c) Urban background locations shall be located so that their pollution level is influenced by the integrated contribution from all sources upwind of the station. The pollution level should not be dominated by a single source unless such a situation is typical for a larger urban area. Those sampling points shall, as a general rule, be representative for several square kilometres;*



**As in (a) above, the measured pollution is from all urban sources in the city area. This is an area of many square kilometres. The A58(M) Inner Ring Road is 150m north of the site, with a daily traffic flow of approximately 93,500 vehicles per day.**

*(d) Where the objective is to assess rural background levels, the sampling point shall not be influenced by agglomerations or industrial sites in its vicinity, i.e. sites closer than five kilometres;*

**Not applicable in this case**

*(e) Where contributions from industrial sources are to be assessed, at least one sampling point shall be installed downwind of the source in the nearest residential area. Where the background concentration is not known, an additional sampling point shall be situated within the main wind direction;*

**Not applicable in this case**

*(f) Sampling points shall, where possible, also be representative of similar locations not in their immediate vicinity;*

**The site is typical of the Leeds centre area; a mixture of commercial and residential properties, some open space and major roads nearby.**

*(g) Account shall be taken of the need to locate sampling points on islands where that is necessary for the protection of human health.*

**Not applicable in this case**

## *2. Protection of vegetation and natural ecosystems*

*Sampling points targeted at the protection of vegetation and natural ecosystems shall be sited more than 20 kilometres away from agglomerations or more than 5 kilometres away from other built-up areas, industrial installations or motorways or major roads with traffic counts of more than 50 000 vehicles per day, which means that a sampling point must be sited in such a way that the air sampled is representative of air quality in a surrounding area of at least 1000 square kilometres. A Member State may provide for a sampling point to be sited at a lesser distance or to be representative of air quality in a less extended area, taking account of geographical conditions or of the opportunities to protect particularly vulnerable areas.*

*Account shall be taken of the need to assess air quality on islands.*

**Not applicable to an urban environment**

## **Microscale Requirements**

*In so far as is practicable, the following shall apply:*

- the flow around the inlet sampling probe shall be unrestricted (free in an arc of at least 270°) without any obstructions affecting the airflow in the vicinity of the sampler (normally some metres away from buildings, balconies, trees and other obstacles and at least 0.5 metres from the nearest building in the case of sampling points representing air quality at the building line),*

**The sampling inlet has been checked regularly at QA/QC audits, and is configured in line with these requirements. It is and free from obstructions for 360 degrees, but with some shielding to the south-east due to a building 20 metres away. Some vegetation is evident around the site, which may need cutting back at some stage.**

- *in general, the inlet sampling point shall be between 1.5 metres (the breathing zone) and 4 metres above the ground. Higher positions (up to 8 metres) may be necessary in some circumstances. Higher siting may also be appropriate if the station is representative of a large area,*

**The inlet is approximately 4 metres from the ground.**

- *the inlet probe shall not be positioned in the immediate vicinity of sources in order to avoid the direct intake of emissions unmixed with ambient air,*

**Although an urban site, the sample inlet is adequately positioned away from any specific local sources (such as vehicles)**

- *the sampler's exhaust outlet shall be positioned so that recirculation of exhaust air to the sampler inlet is avoided,*
- *for all pollutants, traffic-orientated sampling probes shall be at least 25 metres from the edge of major junctions and no more than 10 metres from the kerbside.,*

As described above, the site is 30m from the kerb but is not traffic-oriented. The vent from the cabin is not close to the sample inlet.

## **Ozone**

The Leeds Centre site measures ozone, amongst other pollutants. The macroscale requirements for ozone are, for an urban site:

*Away from the influence of local emissions such as traffic, petrol stations, etc.; vented locations where well mixed levels can be measured; locations such as residential and commercial areas of cities, parks (away from the trees), big streets or squares with very little or no traffic, open areas characteristic of educational, sports or recreation facilities*

**The site is located in a residential/commercial area away from trees, traffic and specific local sources. The site is typical of an area of several square kilometres. The area is representative of areas where significant numbers of people will be exposed for an appropriate length of time.**

**There are reports of building work in the area surrounding the site, and the macroscale siting requirements will need to be reviewed on completion.**



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