

2012 Air Quality Updating and Screening Assessment for the Royal Borough Of Greenwich

In fulfillment of Part IV of the Environment Act
1995
Local Air Quality Management

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Executive Summary

The Council is required to review and assess air quality against the objectives in the Air Quality Regulations 2000 and amendment regulations as part of a rolling three-year cycle ending in 2017. The air quality objectives to be assessed are for the following seven pollutants: carbon monoxide, benzene, 1,3-butadiene, lead, nitrogen dioxide, sulphur dioxide and particles (PM₁₀).

The role of the local authority Review and Assessment process is to identify any relevant areas where it is considered that the government's air quality objectives for the above air pollutants will be exceeded. The Royal Borough of Greenwich has previously undertaken the earlier rounds of Review and Assessment of local air quality management and identified areas where some of the objectives are exceeded and where there is relevant public exposure.

This report concerns the fifth round Updating and Screening Assessment of air quality in the Royal Borough of Greenwich area. For this, pollution sources have been re-examined and recent air quality monitoring checked in the Borough in accordance with Defra LAQM guidance.

The report identifies that:

For carbon monoxide, benzene, 1,3-butadiene, lead and sulphur dioxide there is not a significant risk of the objectives being exceeded in the Council's area.

For nitrogen dioxide and particles PM₁₀ the Council has previously designated an AQMA across the Borough. The findings from this report indicate that the AQMA should be maintained.

In view of the findings from the report the Council will undertake the following actions:

1. Undertake consultation with the statutory and other consultees as required.
2. Maintain the existing monitoring programme.
3. Continue with the implementation of its Air Quality Action Plan in pursuit of the AQS objectives.
4. Prepare for the submission of its next Air Quality Progress Report.

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I Introduction

I.1 Description of Local Authority Area

The Royal Borough of Greenwich is part of Inner London, situated to the south east of the centre of London. The river Thames borders to the north with Tower Hamlets and Newham on the opposite bank, with the Boroughs of Lewisham to the west, Bexley to the east and Bromley to the south. The Royal Borough covers an area of more than 5,000 hectares and includes the major district centres of Greenwich (a World Heritage site), Woolwich, Eltham, Charlton and Thamesmead. Royal Greenwich was also a host borough for the 2012 London Olympics. The estimated population for 2011 is 245,600 (from the Office of National Statistics (ONS)) and this will increase as approximately 18,000 new homes will be constructed in Royal Greenwich over the next years.

The main sources of atmospheric pollutants are road transport, although there are important industrial sources to the north of the Royal Borough and close to its boundaries. The principal roads through the Royal Borough include the A102 (M), A2, the A20, the A205, A206 and A207. The southern portal of the Blackwall tunnel is also within the Royal Borough.

I.2 Purpose of Report

This report fulfils part of the requirements of the Local Air Quality Management regime as set out in Part IV of the Environment Act (1995), the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 and the relevant Policy and Technical Guidance documents. This placed an obligation on local authorities to review and assess air quality in their areas on a regular basis and determine whether or not the air quality objectives are likely to be achieved. Where exceedences are considered likely, the local authority must then declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives.

The objective of this Updating and Screening Assessment (USA) is to identify any matters that have changed which may lead to risk of an air quality objective being exceeded. A checklist approach and screening tools are used to identify significant new sources or changes and whether there is a need for a Detailed Assessment. The USA report should provide an update of any outstanding information requested previously in Review and Assessment reports.

1.3 Air Quality Objectives

The air quality objectives applicable to LAQM in England are set out in the Air Quality (England) Regulations 2000 (SI 928), The Air Quality (England) (Amendment) Regulations 2002 (SI 3043), and are shown in Table I.1. This table shows the objectives in units of microgrammes per cubic metre $\mu\text{g m}^{-3}$ (milligrammes per cubic metre, mg m^{-3} for carbon monoxide) with the number of exceedences in each year that are permitted (where applicable).

Table I.1 Air Quality Objectives included in Regulations for the purpose of LAQM in England

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 $\mu\text{g m}^{-3}$	Running annual mean	31.12.2003
	5.00 $\mu\text{g m}^{-3}$	Running annual mean	31.12.2010
1,3-Butadiene	2.25 $\mu\text{g m}^{-3}$	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg m^{-3}	Running 8-hour mean	31.12.2003
Lead	0.5 $\mu\text{g m}^{-3}$	Annual mean	31.12.2004
	0.25 $\mu\text{g m}^{-3}$	Annual mean	31.12.2008
Nitrogen dioxide	200 $\mu\text{g m}^{-3}$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 $\mu\text{g m}^{-3}$	Annual mean	31.12.2005
Particles (PM_{10}) (gravimetric)	50 $\mu\text{g m}^{-3}$, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 $\mu\text{g m}^{-3}$	Annual mean	31.12.2004

Sulphur dioxide	350 $\mu\text{g m}^{-3}$, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 $\mu\text{g m}^{-3}$, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu\text{g m}^{-3}$, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.4 Summary of Previous Review and Assessments

The Royal Borough of Greenwich has previously completed all earlier stages of air quality review and assessment as required under the LAQM regime. As part of its earlier duties the Council completed a Detailed Assessment for nitrogen dioxide (NO_2) and particles (PM_{10}) in 2000. The aim of this was to determine with reasonable certainty whether or not there is a likelihood of the AQ objectives being achieved. The assumptions used were therefore in depth and the data used were quality assured to a high standard. This allowed the Council to have confidence in reaching a decision whether to declare an Air Quality Management Area or not. When carrying out its Detailed Assessment the Council applied its best estimates to all components used to produce the estimated future concentrations.

Modelled predictions confirmed that the annual mean NO_2 and PM_{10} objectives were exceeded. These predictions highlighted that the objectives were exceeded in areas close to busy roads and junctions throughout the Borough. Relevant public exposure was identified in these areas and on the basis of the findings the Council designated the whole Borough an Air Quality Management Area (AQMA) for the NO_2 and PM_{10} in 2000.

The Council's subsequent Updating and Screening Assessments were also completed and the findings were in accordance with those of the earlier Detailed Assessment.

2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

The Council has undertaken automatic monitoring in the Borough at 11 fixed long-term sites since the previous Updating and Screening Assessment. The automatic sites operating since the previous report are:

Eltham (GR4) - a suburban background site in the east of the Borough (this site has been operating since 1995) and is part of the government's AURN.

Trafalgar Road (GR5) – roadside site located next to a leisure centre (this site started operating during 1996).

Blackheath Hill (GR7) - a site located next to a block of flats close to Blackheath Hill (monitoring at this site commenced in 2002). The sample inlet is located 20m from the road.

Woolwich Flyover (GR8) – a site located under the flyover of the A102 and next to a busy roundabout. The sample inlet is 3m high and in line with the façade of the nearest house. It is approximately 3m from the kerb. This site commenced operating in 2004.

Westhorne Avenue (GR9) – a site located near to housing in the grounds of a community centre (monitoring at this site commenced in 2004). The sample inlet is approximately 12m from the kerb of the A205.

Burrage Grove (GR10) – a roadside site located on the A206 in Thamesmead West. Monitoring started in 2004. The sample inlet is approximately 3m from the kerb.

Millennium Village (GR12) - a background site (close to industry) towards the north of the Royal Borough on the Greenwich Peninsula and monitoring commenced in 2004.

Plumstead High Street (GR13) – a roadside site located, towards the northeast of the Royal Borough. Monitoring started in 2006. The site is adjacent to housing and the sample inlet is approximately 3m from the kerb.

Falconwood (GB6) - a roadside site on the A2 close to the Borough boundary (it is shared with the LB of Bexley and has been operating since 2000). The sample inlet is located 12m from the road. GB0 is also located at this site (it monitors PM_{10} using a FDMS analyser).

Thamesmead (BX3) – is a suburban background site that opened in 1998, located at a school. $PM_{2.5}$ is currently the only monitored pollutant at this site.

Fiveways, Sidcup Road (GN4) - a roadside site on the A20 that started operating in late January 2011. The sample inlet is located 2m from the road.

The above sites are also representative of relevant exposure. All the sites are part of the London Air Quality Network and therefore the standards of QA/QC are similar to those of the government's AURN sites. Regular calibrations are carried out, with subsequent data ratification undertaken by the ERG at King's College London. In all cases the data are fully ratified unless reported otherwise. Further details of the sites can be found at www.londonair.org.uk.

Table 2.1 Details of Automatic Monitoring Sites

Site Name	Site Type	Easting	Northing	Pollutants Monitored	In AQMA?	PM ₁₀ Monitoring Technique	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance (m) to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
Eltham (GR4)	Suburban	543978	174655	NO ₂ PM ₁₀ PM _{2.5} (FDMS) SO ₂ (and O ₃)	Y	FDMS	Y	N/A	N
Trafalgar Road (GR5)	Roadside	538960	177954	NO ₂ PM ₁₀	Y	TEOM	Y	5	Y
Blackheath Hill (GR7)	Roadside	538141	176710	NO ₂ PM ₁₀ (FDMS)	Y	FDMS	Y	20	N
Woolwich Flyover (GR8)	Roadside	540200	178367	NO ₂ PM ₁₀ (PM _{2.5} and O ₃)	Y	FDMS	Y	3	Y
Westhorne Avenue (GR9)	Roadside	541879	175016	NO ₂ PM ₁₀ PM _{2.5} (FDMS) (and O ₃)	Y	FDMS	Y	12	N
Burrage Grove (GR10)	Roadside	544084	178881	NO ₂ PM ₁₀ PM _{2.5} (FDMS) (and O ₃)	Y	FDMS	Y (I)	3	Y

Site Name	Site Type	Easting	Northing	Pollutants Monitored	In AQMA?	PM ₁₀ Monitoring Technique	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance (m) to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
Millennium Village (GR12)	Industrial background	540169	178999	NO ₂ PM ₁₀ PM _{2.5} (FDMS)	Y	FDMS	Y	N/A	Y
Plumstead High St (GR13)	Roadside	545560	178526	NO ₂ PM ₁₀ PM _{2.5} (FDMS) (and O ₃)	Y	FDMS	Y	5	Y
Falconwood (GB6)	Roadside	544997	175098	NO ₂ PM ₁₀ PM _{2.5} (FDMS) (and O ₃)	Y	FDMS	Y (5)	12	Y
Thamesmead (BX3)	Suburban	547323	181231	PM _{2.5}	Y	FDMS	Y	N/A	N
Fiveways Sidcup Road (GN4)	Roadside	543582	172653	NO ₂ PM ₁₀ (FDMS)	Y	FDMS	Y (5)	2	Y

Notes:

- 1) GB0 is a FDMS analyser located at the Falconwood GB6 site.
- 2) BX3 in Thamesmead, previously monitored PM₁₀ it now only monitors PM_{2.5} (since 2005).

2.1.2 Non-Automatic Monitoring Sites

The Royal Borough of Greenwich started its diffusion tube monitoring to supplement and extend its understanding of air quality. Following some initial changes to the network, the site locations have remained broadly the same since 2000.

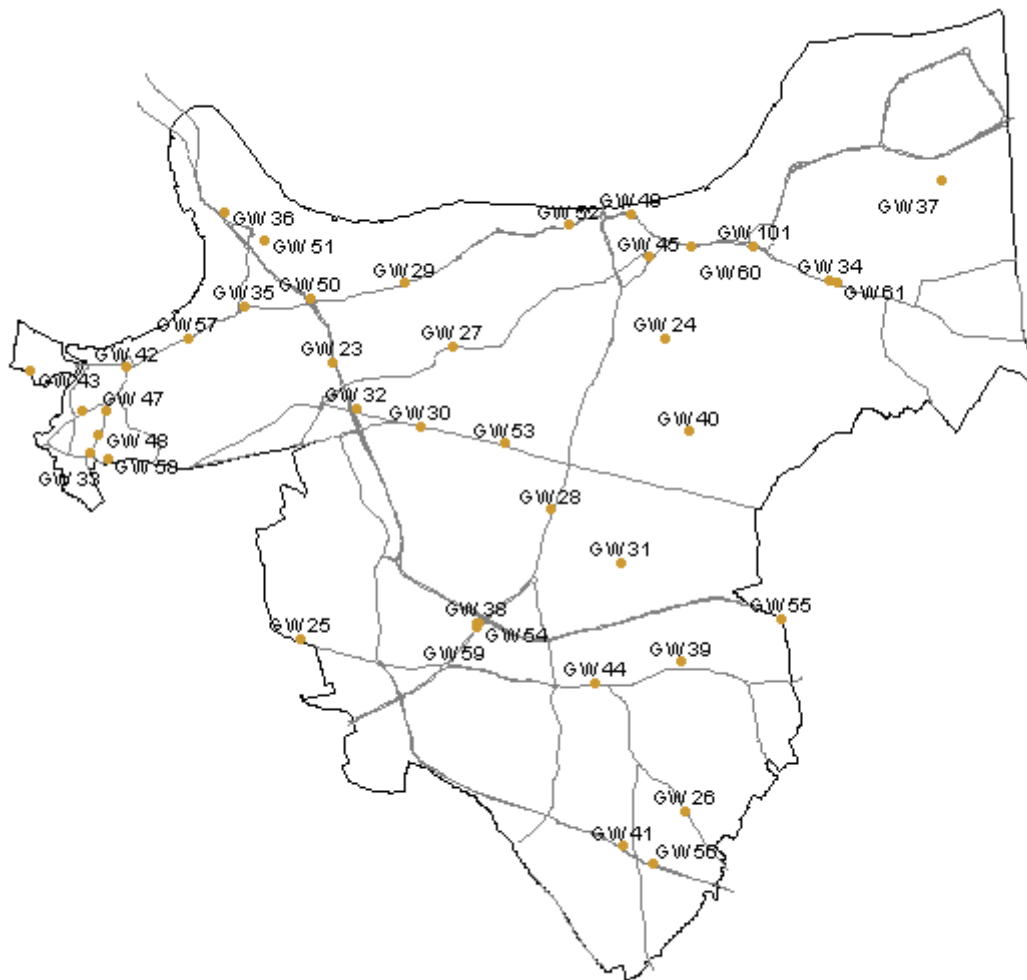
Nitrogen dioxide

During the 2009 – 2011 period, 58 diffusion tubes at 42 locations throughout the Borough were deployed as part of the London Wide Environment Programme (LWEP). The diffusion tubes used were supplied by Bureau Veritas and analysed by Gradko International using a preparation method of 50% TEA in acetone.

Gradko participates in the Health and Safety Laboratory's (HSL) Workplace Analysis Scheme for Proficiency (WASP) programme for diffusion tubes, which provides a Quality Assurance / Quality Control (QA/QC). The scheme is an important QA/QC exercise for laboratories supplying diffusion tubes to local authorities for use in the context of Local Air Quality Management (LAQM). Between January 2010 and December 2011, Gradko achieved a satisfactory Performance Criteria Score in the laboratory performance testing rounds 108 - 114 and 116 - 120. The precision results were also good for this period.

The locations of the diffusion tubes are illustrated in Figure 2.1. The monitoring also includes eight triplicate sites co-located with automatic monitoring stations.

Diffusion tube site	Continuous site	Location
GW39	Greenwich 4	Eltham
GW57	Greenwich 5	Trafalgar Road
GW55	Greenwich Bexley 6	Falconwood A2
GW58	Greenwich 7	Blackheath Hill
GW50	Greenwich 8	Woolwich Road Flyover
GW59	Greenwich 9	Westhorne Avenue
GW60	Greenwich 10	Burrage Grove A206
GW61	Greenwich 12	Millennium Village

Figure 2.1 Map of Non-Automatic Monitoring Sites in R.B of Greenwich

A major disadvantage of undertaking monitoring using diffusion tubes is that the method is less precise and accurate than continuous monitoring. The recommended methods to reduce errors include the use of good QA/QC practices and bias adjustment factors that are derived from co-location studies between continuous analysers and diffusion tubes.

The bias adjustment factors are specific to each year, analysing laboratory, method of analysis and location. The factors are therefore also limited to the data supplied. The Review and Assessment website advises that “in many cases, using an overall correction factor derived from as many co-location studies as possible will provide the ‘best estimate’ of the ‘true’ annual mean concentration, it is important to recognise that there will still be uncertainty associated with this bias adjusted annual mean. One analysis has shown that the uncertainty for tubes bias

adjusted in this way is $\pm 20\%$ (at 95% confidence level). This compares with a typical value of $\pm 10\%$ for chemiluminescence monitors subject to appropriate QA/QC procedures.”

A local bias adjustment factor was calculated to apply bias correction to the raw diffusion tube results. This factor was obtained from the LWEPP programme and based on triplicate tubes that were co-located alongside eleven continuous NO₂ monitoring sites in London. The measurement data used from the continuous monitoring sites covered the same period of diffusion tube monitoring. Period mean NO₂ concentrations were calculated for each diffusion tube exposure period. Data capture statistics for the same periods were also determined.

The continuous monitoring data and raw triplicate tube concentrations were inputted into the Bias Adjustment Calculator tool to calculate bias adjustment factors. This was carried out for each of the above continuous monitoring sites. An average was taken to obtain the mean local bias adjustment factor. Bias correction factors were undertaken using the most recent default factor spreadsheet from Defra’s helpdesk (March 2013). These default factors are based on statistical analyses of reported data provided by other local authorities.

Year	Bias Default factor	Local Bias factor
2009	0.97 (16 studies)	0.97
2010	1.03 (16 studies)	1.06
2011	0.95 (25 studies)	1.02

There was reasonable agreement between the sets of factors, with slightly poorer agreement for 2011. There are many potential reasons for this discrepancy, however good precision was indicated by the local triplicate studies.

The choice of bias factors is discussed in the TG09 guidance and this suggests that both precision and QA/QC procedures are important, although the final choice is down to the local authority concerned. Based on the good precision of the local studies the local bias factors were used. This is also consistent with the Council’s most recent progress reports. The local default factors indicate that the diffusion tube results for slightly underestimate continuously monitored concentrations for two years and overestimate for one year.

Benzene

In addition to the NO₂ diffusion tube monitoring the Council also undertakes the monitoring of benzene using passive diffusion tubes at eleven sites (ten of which are roadside and the other is a background site). The tubes are supplied and analysed by Gradko International Ltd, a UKAS accredited laboratory. The Council does not operate continuous analyser for benzene and hence no bias correction has been undertaken. The monitored sites are all co-located with NO₂ diffusion tube sites at site numbers GW 29, 33, 34, 35, 39 (triplicate tubes exposed), 41, 42, 50, 51, 54 and 55 as shown in Table 2.2.

Table 2.2 Details of Non-Automatic Monitoring Sites

Ref (Tube no.)	Address	Easting	Northing	Location	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
GW23 (1)	Siebert Rd	540420	177706	Roadside	Y	17.2	Y
GW24 (2)	Plumstead Common Rd	543806	177951	Roadside	Y	3.0	Y
GW25 (3)	Eltham Rd	540099	174881	Roadside	Y	3.0	Y
GW26 (4)	Foots Cray Rd	544015	173139	Roadside	Y	0.5	Y
GW27 (5)	Charlton Village	541645	177874	Roadside	Y	0.5	Y
GW29 (6)	Woolwich Rd Charlton	541167	178512	Roadside	Y	1.5	Y
GW32 (7)	Banchory Rd	540664	177235	Roadside	Y	17.1	Y
GW33 (8)	Blackheath Hill	537971	176776	Roadside	Y	1.5	Y
GW34 (9)	Bannockburn School	545490	178543	Roadside	Y	3.0	Y
GW35 (10)	Woolwich Rd Greenwich	539527	178281	Roadside	Y	1.5	Y
GW36 (11)	Boord St	539320	179234	Roadside	Y	30.0	Y
GW37 (12)	De Lucy School	546630	179557	Background	Y	215.0	N
GW38 (13)	Westhorne Av	541885	175045	Intermediate	Y	30.0	N
GW39 (14,15,16)	Bexley Rd ECC (Triplicate co-located site)	543986	174660	Intermediate	Y	65.0	N
GW40 (17)	Shrewsbury House	544065	176996	Background	Y	575.0	N
GW41 (18)	Sidcup Rd	543391	172765	Roadside	Y	3.0	Y
GW42 (19)	Greenwich Church St	538317	177652	Roadside	Y	2.0	Y
GW43 (20)	Creek Rd	537353	177632	Roadside	Y	2.0	Y
GW44 (21)	Eltham High St	543096	174439	Roadside	Y	3.6	Y
GW48 (23)	Greenwich South St	538044	176960	Roadside	Y	2.5	Y
GW49 (24)	Woolwich High St	543472	179217	Roadside	Y	1.0	Y
GW50 (25,26,27)	Woolwich Flyover (Triplicate co-located site)	540203	178367	Roadside	Y	3.5	Y
GW51 (28)	Bugsbys Way	539638	179024	Roadside	Y	2.0	Y

GW52 (29)	Woolwich High St	542842	179108	Roadside	Y	1.5	Y
GW53 (30)	Shooters Hill Rd	542181	176878	Roadside	Y	1.5	Y
GW54 (31)	Westhorne Av	541915	175039	Roadside	Y	2.5	Y
GW55 (32,33,34)	Crown Woods Way (Triplicate co-located site)	545005	175097	Roadside	Y	1.5	Y
GW56 (35)	Sidcup Rd	543679	172598	Roadside	Y	1.5	Y
GW57 (36,37,38)	Trafalgar Rd Greenwich (Triplicate co-located site)	538968	177955	Roadside	Y	7.0	Y
GW58 (39,40,41)	Blackheath Hill (Triplicate co-located site)	538143	176712	Roadside	Y	4.0	Y
GW59 (42,43,44)	Westhorne Av (Triplicate co-located site)	541883	175016	Roadside	Y	13.0	Y
GW60 (45,46,47)	Burrage Grove (Triplicate co-located site)	544086	178882	Roadside	Y	16.9	Y
GW61 (50,51,52)	Millennium Village (Triplicate co-located site)	540175	179000	Intermediate	Y	n/a	N
GW101 (48)	Plumstead Rd	544727	178884	Roadside	Y	1.0	Y
GW102 (49)	Plumstead Rd	544075	178898	Roadside	Y	1.0	Y
GW103 (54)	Wricklemarsh Rd	540935	176575	Roadside	Y	9.0	Y
GW104 (55)	Sun Lane	540743	177072	Roadside	Y	12.5	Y
GW105 (56)	Cliftons Roundabout	541143	174294	Roadside	Y	5.0	Y
GW106 (22)	Grand Depot Rd	543505	178576	Roadside	Y	1.0	Y
GW28 (58)	Dunblane Rd	542656	176207	Roadside	Y	7.5	Y
GW30 (53)	Indus Rd	541372	177070	Roadside	Y	5.0	Y
GW31 (57)	Deansfield School	543383	175664	Roadside	Y	3.0	Y

2.2 Comparison of Monitoring Results with Air Quality Objectives

The monitoring reported below represents the continuous and non-continuous results for recent years' monitoring. Results from previous years can be found in earlier Council reports. For automatic sites details can also be found on the London Air Quality Network website (see <http://www.londonair.org.uk/london/asp/lahome.asp>). The results are reported in accordance with the requirements of TG09.

2.2.1 Nitrogen Dioxide

The results for nitrogen dioxide are reported separately for the Council's automatic sites and diffusion tube network. The automatic results are directly compared to the annual mean and hourly mean objectives, whereas the diffusion tube results are compared to the annual mean objective and also to an annual mean of $60 \mu\text{g m}^{-3}$, which represents an indicative value to represent the hourly mean objective. This is in line with TG09 guidance.

Automatic Monitoring Data

The following table (Table 2.3) provides detail of the monitoring and also the results at the sites that monitor NO_2 across the Royal Borough of Greenwich. The results are for the period from 2007 to 2011 inclusive. They include areas described as urban background and suburban; which are typical of much of the Royal Borough, along with roadside locations representing those parts of the Borough close to major roads.

Data capture for 2011 at the sites was good (representing around 90% of the year), apart from GN4 at Fiveways on Sidcup Road. Operation at this site only started in February with 99% data capture for the period monitored; overall for the year it was 85%. For previous years the data capture was also good, the only sites not achieving at least 90% data capture were GR4 and GR9 in 2009 (both exceeded 85%), plus GR5 and GR10 in 2007 as reported in earlier Council reports.

The urban background and suburban sites (GR12 and GR4) both met the AQS annual mean objective of $40 \mu\text{g m}^{-3}$ for the period reported, with concentrations around $36 \mu\text{g m}^{-3}$ or less at GR12, which is closer to central London, and around $25 \mu\text{g m}^{-3}$ or less at the GR4 site, which is towards the outskirts of the Royal Borough.

The GB6 roadside site at Falconwood (shared with Bexley Council) exceeded the objective for all years reported, with the highest monitored concentration exceeding $50 \mu\text{g m}^{-3}$ arising in 2010. In all other years the annual mean concentration was between 41 and $48 \mu\text{g m}^{-3}$.

The roadside site close to the Woolwich flyover (GR8) recorded the highest concentrations, with a peak in 2009 of $82 \mu\text{g m}^{-3}$. Levels since have dropped, but are still around $70 \mu\text{g m}^{-3}$.

All of the roadside sites exceeded the objective for all years recorded, including the most recently opened site at Fiveways on the Sidcup Road (GN4). The levels monitored were between 42 and $51 \mu\text{g m}^{-3}$ for these sites. Six of the sites also recorded the lowest concentrations in 2011, however this does not necessarily indicate that concentrations are now reducing, rather it is more likely to represent interannual variation as a result of meteorology over the year.

Table 2.4 provides a comparison with the AQS hourly mean objective, which requires that the number of periods that exceed a 24-hour mean of $200 \mu\text{g m}^{-3}$ does not arise more than 18 times over a calendar year. These episodic periods arise during meteorological conditions that are conducive e.g. such as settled conditions in the wintertime when there is reduced dispersion from local sources. The results for the sites show that the only site to exceed the hourly mean objective was the GR8 roadside site, for all years recorded other than 2011. The hourly mean standard was exceeded at this in 2011 six times. Other sites regularly exceeding the hourly mean standard were sites at Trafalgar Road (GR5), Burrage Grove (GR10) and Falconwood (GB6). However none of these sites approached the objective of more than 18 periods, with 7 periods being the highest number during any one year.

Table 2.3 Results of Automatic Monitoring of Nitrogen Dioxide: Comparison with Annual Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for period of monitoring % ^a	Valid Data Capture 2011 % ^b	Annual Mean Concentration $\mu\text{g m}^{-3}$				
					2007	2008	2009	2010	2011 ^c
Eltham (GR4)	Suburban	Y	N/a	91	30	26	24	24	23
Trafalgar Road (GR5)	Roadside	Y	N/a	100	66	53	48	47	42
Blackheath Hill (GR7)	Roadside	Y	N/a	100	49	46	43	43	48
Woolwich Flyover (GR8)	Roadside	Y	N/a	99	71	70	82	73	67
Westthorne Avenue (GR9)	Roadside	Y	N/a	99	45	42	45	46	43
Burrage Grove (GR10)	Roadside	Y	N/a	100	58	51	49	53	43
Millennium Village (GR12)	Industrial background	Y	N/a	95	38	36	36	36	33
Plumstead High St (GR13)	Roadside	Y	N/a	92	45	44	44	42	42
Falconwood (GB6)	Roadside	Y	N/a	97	48	41	45	51	42
Fiveways Sidcup Road (GN4)	Roadside	Y	99	85	-	-	-	-	47

^a i.e. data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

^b i.e. data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%.)

^c 2011 includes provisional data

Notes: Bold indicates that AQS objective exceeded; italics indicates < 90% valid data capture.

Table 2.4 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for period of monitoring % ^a	Valid Data Capture 2011 % ^b	Number of Exceedences of Hourly Mean (200 µg m ⁻³)				
					2007	2008	2009	2010	2011 ^c
Eltham (GR4)	Suburban	Y	N/a	91	0	0	0	4	0
Trafalgar Road (GR5)	Roadside	Y	N/a	100	6	2	2	0	0
Blackheath Hill (GR7)	Roadside	Y	N/a	100	5	0	0	0	1
Woolwich Flyover (GR8)	Roadside	Y	N/a	99	58	41	53	38	6
Westhorne Avenue (GR9)	Roadside	Y	N/a	99	3	1	0	0	0
Burrage Grove (GR10)	Roadside	Y	N/a	100	7	1	3	1	1
Millennium Village (GR12)	Urban background	Y	N/a	95	5	2	0	0	0
Plumstead High St (GR13)	Roadside	Y	N/a	92	4	0	0	1	0
Falconwood (GB6)	Roadside	Y	N/a	97	0	0	6	5	7
Fiveways Sidcup Road (GN4)	Roadside	Y	N/a	85	-	-	-	-	0

^a i.e. data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

^b i.e. data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%.)

^c 2011 includes provisional data

Notes: Bold indicates that AQS objective exceeded; italics indicates < 90% valid data capture.

Diffusion Tube Monitoring Data

The results given in Table 2.5 are the bias adjusted values of the tubes exposed (as detailed earlier) and annual mean concentrations in excess of the $40 \mu\text{g m}^{-3}$ annual mean NO_2 objective are highlighted in bold.

The overall data capture rates for the 42 diffusion tube monitoring sites during 2009, 2010 and 2011 were high. These 42 sites include 8 co-located sites. For 2009 the data capture achieved an average of 86% for all site types mainly as a result of one month's missing data. For 2010 and 2011 overall data capture exceeded 95%. The results for all sites with less than 12 months data capture were annualised using factors derived from nearby LAQN background sites. The factors ranged from 0.92 to 1.05, with the majority between 0.98 and 1.01, indicating a very small adjustment only.

Two sites were located at urban background locations (GW37 and GW40), representing relevant exposure. The results met the objective for all years, with concentrations ranging from 22 to $29 \mu\text{g m}^{-3}$. Of the three sites described as intermediate, two met the objective (GW38 and the co-located GW39) for each year monitored. The other intermediate site GW61 located at the Millenium Village on the Greenwich Peninsula exceeded the objective. This is a co-located site and the results for the automatic monitoring site GR12 were given in Table 2.3. (As noted earlier the continuous results indicated that the objective was met; this discrepancy between sets of results can be explained by the lower accuracy of diffusion tubes and the bias adjustment factor for the used, which was a London based figure, rather than one based on this specific site).

Of the roadside sites, one met the annual mean objective of $40 \mu\text{g m}^{-3}$ for all years reported (GW31) and five others met the objective in 2011. These were GW23, GW26, GW28 and GW30. The 2011 results for these sites were lower than the other years reported and with the exception of GW23, the diffusion tubes at these sites were all located more than 5m from the nearest kerb.

The 26 remaining sites (excluding co-located sites) exceeded the objective in 2011, as well as 2009 and 2010. The average concentration for these sites was $53 \mu\text{g m}^{-3}$ indicating that for the majority the objective was easily exceeded. The highest concentrations arose at Plumstead Road (GW101), exceeding $80 \mu\text{g m}^{-3}$ in 2011. Two other sites exceeded $70 \mu\text{g m}^{-3}$, these were on Woolwich Road (GW35 and GW50). The other site on Woolwich Road (GW29) also exceeded this level in both 2009 and 2010.

In total 22 of these 26 sites recorded bias adjusted concentrations greater than $45 \mu\text{g m}^{-3}$. GW51 on Bugbys Way had the lowest concentration (that exceeded the objective) recording $41.9 \mu\text{g m}^{-3}$ in 2011.

In previous years the number of sites exceeding the objective was slightly higher with 29 sites in 2010 and 28 in 2009 (both excluding co-located sites). The mean concentration for these in 2009 was $54 \mu\text{g m}^{-3}$ and $56 \mu\text{g m}^{-3}$ in 2010. All of the roadside either represent or are close to locations with relevant exposure.

In 2011 six of the network sites (GW29, GW35, GW43, GW54, GW101 and GW102) recorded concentrations greater than $60 \mu\text{g m}^{-3}$, suggesting the possibility that the hourly mean objective might also be exceeded. These sites also exceeded this level in 2009 and 2010. All are located either close to a road junction or close to slow moving and idling traffic and in view of this it is not considered that there is relevant exposure for the purposes of the 1-hour objective.

Table 2.5 Results of Nitrogen Dioxide Diffusion Tubes (2009 to 2011)

Ref	Address	Location	2009	2010	2011
GW23 (1)	Siebert Rd	Roadside	42.8	48.6	39.4
GW24 (2)	Plumstead Common Rd	Roadside	51.1	58.3	53.1
GW25 (3)	Eltham Rd	Roadside	53.6	55.5	48.0
GW26 (4)	Foots Cray Rd	Roadside	42.8	37.5	32.5
GW27 (5)	Charlton Village	Roadside	51.6	53.8	46.1
GW29 (6)	Woolwich Rd Charlton	Roadside	70.7	70.7	65.0
GW32 (7)	Banchory Rd	Roadside	48.3	50.9	47.8
GW33 (8)	Blackheath Hill	Roadside	59.8	67.1	59.2
GW34 (9)	Bannockburn School	Roadside	51.3	52.1	48.2
GW35 (10)	Woolwich Rd Greenwich	Roadside	74.4	73.8	71.5
GW36 (11)	Boord St	Roadside	54.2	46.0	52.6
GW37 (12)	De Lucy School	Background	28	26.5	28.9
GW38 (13)	Westhorne Av	Intermediate	36.9	38.6	36.2
GW39 (14,15,16)	Bexley Rd ECC (Triplicate site)	Intermediate	25.1	25.4	23.1
GW40 (17)	Shrewsbury House	Background	22.5	25.4	22.6
GW41 (18)	Sidcup Rd	Roadside	45	47.2	48.5
GW42 (19)	Greenwich Church St	Roadside	58.1	59.8	56.0
GW43 (20)	Creek Rd	Roadside	59.1	61.6	62.3
GW44 (21)	Eltham High St	Roadside	61.1	70.5	48.4
GW48 (23)	Greenwich South St	Roadside	47.1	49.2	47.4
GW49 (24)	Woolwich High St	Roadside	50.3	46.3	43.7
GW50 (25,26,27)	Woolwich Flyover (Triplicate site)	Roadside	75.3	72.6	75.5
GW51 (28)	Bugsbys Way	Roadside	50.5	47.1	41.9
GW52 (29)	Woolwich High St	Roadside	44.8	54.4	48.5
GW53 (30)	Shooters Hill Rd	Roadside	46.3	44.9	43.3
GW54 (31)	Westhorne Av	Roadside	60.6	61.2	60.8
GW55 (32,33,34)	Crown Woods Way (Triplicate site)	Roadside	51	58.8	53.2

GW56 (35)	Sidcup Rd	Roadside	56.1	64.2	53.5
GW57 (36,37,38)	Trafalgar Rd Greenwich (Triplicate site)	Roadside	43.6	46.7	43.1
GW58 (39,40,41)	Blackheath Hill (Triplicate site)	Roadside	47	52.3	50.7
GW59 (42,43,44)	Westhorne Av (Triplicate site)	Roadside	44.6	54.8	44.3
GW60 (45,46,47)	Burrage Grove (Triplicate site)	Roadside	41.6	46.4	41.3
GW61 (50,51,52)	Millennium Village (Triplicate site)	Intermediate	42.2	41.0	40.7
GW101 (48)	Plumstead Rd	Roadside	78.7	79.8	85.3
GW102 (49)	Plumstead Rd	Roadside	67.6	68.5	65.3
GW103 (54)	Wricklemarsh Rd	Roadside	44.7	45.8	47.7
GW104 (55)	Sun Lane	Roadside	50.3	50.4	55.2
GW105 (56)	Cliftons Roundabout	Roadside	54.9	72.4	51.0
GW106 (22)	Grand Depot Rd	Roadside	43.5	45.0	43.8
GW28 (58)	Dunblane Rd	Roadside	38.8	40.8	37.8
GW30 (53)	Indus Rd	Roadside	38.1	41.7	37.9
GW31 (57)	Deansfield School	Roadside	32	35.1	34.5

Notes: Bold indicates that AQS objective exceeded; reduced font size indicates a co-located site.

2.2.2 PM_{10}

The TG09 guidance highlights that the TEOM instruments cannot be strictly used to measure PM_{10} concentrations for comparison with the air quality objectives, as the instrument was not found to conform to the equivalence criteria relating to the gravimetric European reference method, whereas the FDMS analyser was found to be equivalent. Previously for the TEOM a correction using a factor of 1.3 was accepted; now however the VCM (Volatile Correction Model) has been adopted.

This method is based on the assumption that the volatile component of PM_{10} lost during the heated sampling of PM with the standard TEOM is consistent across a defined geographical area. The model uses the FDMS purge measurement as an indicator of this volatile component. As FDMS instruments have met the equivalence criteria, the VCM correction is also considered equivalent to the European reference method.

The results for the Greenwich sites are reported below as **reference equivalent**, these represent either FDMS (and gravimetric) measurements (where no correction has been made) or TEOM measurements that were corrected using the VCM.

The GR8 monitoring site close to the Woolwich Flyover is the only site to exceed the annual mean objective for the period 2007 to 2011 shown in Table 2.7. This table shows gravimetric equivalent results and the GR8 exceeded $40 \mu\text{g m}^{-3}$ as an annual mean in 2008 only. Since then the annual mean has dropped to a level of around $35 \mu\text{g m}^{-3}$.

Of the other sites only two sites recorded concentrations greater than $30 \mu\text{g m}^{-3}$ in 2011; GR7 on Blackheath Hill and GN4 on the A20 at Fiveways, both of these sites are close to busy roads. The other automatic Greenwich sites recorded levels of between 22 and $28 \mu\text{g m}^{-3}$. The suburban background site (GR4) recorded a level of $23 \mu\text{g m}^{-3}$. For most sites concentrations were similar to previous years. The exceptions were the GR7 and GR10 site

were annual mean concentrations have increased since 2007. At the most polluted site GR8 concentrations have slightly decreased in 2010 and 2011 from the peak in 2008.

The daily mean objective, which has been exceeded more widely across the UK than the annual mean objective, is reported in Table 2.8. The monitoring results for the GR8 roadside site show that the daily mean objective of not more than 35 days with a mean 24-hour concentration greater than $50 \mu\text{g m}^{-3}$ was exceeded for all of the period shown, other than 2010 when it recorded 33 days that exceeded. The GR7 site on Blackheath Hill also exceeded the objective in 2011 only.

Other sites to approach the objective (with 32 days that exceeded) included the GR10 roadside site at Burrage Grove, which located close to the busy A206 Plumstead Road. The newly installed GN4 site at Fiveways near the A20 had 26 days that exceeded with reduced data capture, the 90th percentile was almost $50 \mu\text{g m}^{-3}$ indicating that the objective was closely approached here. Similarly the GB0, the FDMS site located at the GB6 site in Falconwood also had 25 days exceeding in 2011, again with a 90th percentile of almost $50 \mu\text{g m}^{-3}$.

All years when monitoring was undertaken at Greenwich sites had some periods when the standard was exceeded. This was mostly 10 days or less. For 2011 however the sites had an increased number of days that exceed compared to previous years. (The only exception to this was the GR8 site). This was mainly as a result of the episodes that arose in the early part of the year and also during November. These peaks in PM_{10} concentrations occur during periods of stable conditions, specifically during winter London sources can dominate concentrations, at other times high pressure systems can lead to imported transboundary PM_{10} from elsewhere in the UK and Europe.

The concentrations measured in Greenwich are considered typical of those measured elsewhere across London (King's College London).

Table 2.6 Results of Automatic Monitoring of PM₁₀: Comparison with Annual Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for monitoring Period % ^a	Valid Data Capture 2011 % ^b	Confirm Gravimetric Equivalent (Y or NA)	Annual Mean Concentration µg m ⁻³				
						2007	2008	2009	2010	2011
GR4	Suburban	Y	N/a	94	Y	18	21	26	23	23
GR5	Roadside	Y	N/a	100	Y	23	22	21	22	23
GR7	Roadside	Y	N/a	99	Y	26	26	24	28	32
GR8	Roadside	Y	N/a	100	Y	37	41	37	33	35
GR9	Roadside	Y	N/a	98	Y	25	23	23	22	23
GR10	Roadside	Y	N/a	95	Y	23	26	25	28	28
GR12	Industrial background	Y	N/a	95	Y		23	20	22	25
GR13	Roadside	Y	N/a	91	Y	23	20	20	20	22
GB6	Roadside	Y	N/a	-	Y	26	24	28	-	-
GB0 ^c	Roadside	Y	N/a	87	Y	-	-	23	27	27
GN4	Roadside	Y	N/a	77	Y	-	-	-	-	30

^a i.e. data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

^b i.e. data capture for the full calendar year.

^c GB6 and GB0 are located at the same site at Falconwood; GB0 is a FDMS monitor that replaced the previous PM₁₀ monitor.

Table 2.7 Results of Automatic Monitoring for PM₁₀: Comparison with 24-hour mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for monitoring Period % ^a	Valid Data Capture 2011 % ^b	Confirm Gravimetric Equivalent	Number of Exceedences of 24-Hour Mean (50 µg m ⁻³)				
						2007	2008	2009	2010	2011 ^c
GR4	Suburban	Y	N/a	94	Y	3	13	11	4	22
GR5	Roadside	Y	N/a	100	Y	23	13	4	2	18
GR7	Roadside	Y	N/a	99	Y	28	16	12	20	41
GR8	Roadside	Y	N/a	100	Y	59	81	44	33	42
GR9	Roadside	Y	N/a	98	Y	10	22	13	9	25
GR10	Roadside	Y	N/a	95	Y	19	13	0	18	32
GR12	Urban	Y	N/a	95	Y	-	22	12	9	25
GR13	Roadside	Y	N/a	91	Y	1	14	6	7	16
GB6	Roadside	Y	N/a	-	Y	29	22	3	-	-
GB0	Roadside	Y	N/a	87	Y	-	-	9	16	25 (47)
GN4	Roadside	Y	N/a	77	Y	-	-	-	-	26 (49)

^a i.e. data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

^b i.e. data capture for the full calendar year.

^c For where data capture is less than 90%, the 90th percentile of 24-hour means is given in brackets.

2.2.3 Sulphur Dioxide

Automatic monitoring of SO₂ is undertaken at the representative AURN suburban background GR4 site in Eltham. The results for 2011 are given in Table 2.9 below. These show that there were no periods that exceeded the 15 minute, hourly or 24 hourly standards in the UK AQS objectives. The results for the period from 2007 (see earlier Greenwich reports) also recorded no periods when these standards were exceeded. As a consequence the AQS objectives were not exceeded.

Table 2.8 Results of Automatic Monitoring of SO₂: Comparison with AQS Objectives

Site ID	Site Type	Within AQMA?	2011 Valid Data Capture %	Number of Exceedences		
				15-minute Objective (266 µg m ⁻³)	1-hour Objective (350 µg m ⁻³)	24-hour Objective (125 µg m ⁻³)
GR4	Suburban	Y	99	0	0	0

2.2.4 Benzene

Benzene was Council monitored using diffusion tubes at ten roadside sites and one background site (using 4 tubes) in the Borough in 2009. This monitoring was curtailed in mid 2010 and then recommenced in 2011 at three sites only. This was rationalisation was due to both the low concentrations measured and also for cost savings. The sites are co-located with the nitrogen dioxide tube sites as described earlier. The annual mean results for the period 2009 to 2011 are given in Table 2.8. Data capture for the sites in 2009 was over 96%, 50% in 2010 and 83% in 2011.

The monitored results indicate that the 2003 AQS objective (of 16.25 µg m⁻³) was not exceeded during the period of monitoring. The benzene monitoring also confirms that the stricter 2010 objective (of 5 µg m⁻³) was also not exceeded at any of the sites over this period. The Council's previous reports highlights that concentrations have reduced over time. The monitoring reported here indicates that concentrations decreased between 2009 and 2011 at

the three monitored sites (two roadside and one background). This is due to the continuing effects of stricter emission controls, particularly with regard to road transport sources.

Table 2.9 Results of Automatic Monitoring of Benzene: Comparison with AQS Objective

Site ID	Site Type	Within AQMA?	2009	2010	2011
GW29	Roadside	Y	2.3	<i>1.8</i>	-
GW33	Roadside	Y	2.5	<i>2.0</i>	-
GW34	Roadside	Y	2.0	<i>1.7</i>	-
GW35	Roadside	Y	2.4	<i>1.8</i>	-
GW39 (mean)	Background	Y	1.6	<i>1.1</i>	1.3
GW41	Roadside	Y	1.9	<i>1.2</i>	-
GW42	Roadside	Y	2.2	<i>1.6</i>	1.8
GW50	Roadside	Y	2.7	<i>1.6</i>	2.1
GW51	Roadside	Y	1.9	<i>1.2</i>	-
GW54	Roadside	Y	2.3	<i>1.6</i>	-
GW55	Roadside	Y	1.7	<i>1.2</i>	-

(Note – italics represents < 75% data capture)

2.2.5 Summary of Compliance with AQS Objectives

The Royal Borough of Greenwich has examined the results from monitoring in the Borough. Concentrations are above the objectives for annual mean and hourly mean nitrogen dioxide, plus daily mean and annual mean PM₁₀ within the designated Borough wide AQMA, therefore there is no need to proceed to a Detailed Assessment.

Concentrations of sulphur dioxide and carbon monoxide are all below the objectives at relevant locations, therefore there is no need to proceed to a Detailed Assessment for these pollutants.

3 Road Traffic Sources

The focus of attention for road traffic sources is on those relevant locations close to busy roads, especially in congested areas and near to junctions, where traffic emissions are higher, and in built up areas where the road is canyon like and buildings restrict the dispersion and dilution of pollutants. Only those locations, which have not been assessed during the earlier rounds or where there has been a change or new development, are assessed.

The 2008 London Atmospheric Emissions Inventory (LAEI) has been used to identify changed flows and as reported earlier the Council previously designated the whole of the Borough as an AQMA.

3.1 Narrow Congested Streets with Residential Properties Close to the Kerb

Concentrations are often higher where traffic is slow moving, with stop/start driving, and where buildings on either side reduce dispersion. Screening models so far have not proved helpful at identifying potential exceedences, which have only been identified by monitoring. This assessment is for NO₂ only.

Previous Review and Assessments undertaken by the Council investigated the presence of narrow roads with residential properties close to the kerb. The TG09 guidance requires the identification of residential properties within 2 m of the kerb. The roads previously identified are all within the Council's AQMA and this situation has not changed.

The Royal Borough of Greenwich confirms that there are no new/newly identified congested streets with a flow above 5,000 vehicles per day and residential properties close to the kerb, that have not been adequately considered in previous rounds of Review and Assessment.

3.2 Busy Streets Where People May Spend 1-hour or More Close to Traffic

These include some street locations where individuals may regularly spend 1-hour or more, for example, streets with many shops and streets with outdoor cafes and bars, close to road traffic where there may be high concentrations of NO₂. (Note - those people that are occupationally exposed are not included, as they are not covered by the regulations). The assessment is for NO₂ only.

Busy streets where people may spend an hour or more close to traffic were examined in previous assessments. There has been no change to the previous findings since then and no new roads have been constructed with traffic flows greater than 10,000 vehicles per day in the Council's area.

The Royal Borough of Greenwich confirms that there are no new/newly identified busy streets where people may spend 1 hour or more close to traffic.

3.3 Roads with a High Flow of Buses and/or HGVs.

These include street locations in the Borough where traffic flows are not necessarily high (i.e. fewer than 20,000 vehicles per day) but where there are an unusually high proportion of buses and/or HGVs. The assessment is for both NO₂ and PM₁₀ and is dependent on the proximity of relevant exposure within 10 m of the kerbside. The Council in earlier Review and Assessments identified those roads within the Borough with high flows of heavy-duty vehicles. No new roads relevant to this section have been identified in the Borough.

The Royal Borough of Greenwich confirms that there are no new/ newly identified roads with high flows of buses/HDVs.

3.4 Junctions

Air pollutant concentrations are usually higher close to junctions, due to the combined impact of traffic emissions on roads forming the junction, and to the higher emissions due to stop start driving. The assessment is for both NO₂ and PM₁₀ and is dependent on the proximity of relevant exposure within 10 m of the kerbside.

There is no change to the previously reported situation concerning junctions and no new or newly identified junctions with relevant exposure within 10 m.

The Royal Borough of Greenwich confirms that there are no new/ newly identified busy junctions/ busy roads.

3.5 New Roads Constructed or Proposed Since the Last Round of Review and Assessment

The approach to considering new roads depends on whether or not an assessment was carried out in advance of building the new road. The assessment is for both NO₂ and PM₁₀ and is dependent on the proximity of relevant exposure within 10 m of the kerbside.

There have been no new or proposed roads in the Borough where an air quality assessment was required.

The Royal Borough of Greenwich confirms that there are no new/ proposed roads.

3.6 Roads with Significantly Changed Traffic Flows

Only roads with significantly changed traffic flows that have not already been considered above were investigated. The assessment is for both NO₂ and PM₁₀.

A comparison of traffic flows from the latest version of the London Atmospheric Emissions Inventory confirms that there are no new roads with significantly changed traffic flows.

The Royal Borough of Greenwich confirms that there are no new/ newly identified roads with significantly changed traffic flows.

3.7 Bus and Coach Stations

This section only applies to bus stations or sections of bus stations that are not enclosed, and where there is relevant exposure, including at nearby residential properties. The assessment is for both the annual mean and the 1-hour NO₂ objectives. (Note - the term “bus” in this instance is used to signify both buses and coaches).

Bus stations in Greenwich were examined in previous USAs and found not to require further investigation. Based on the TG09 guidance if such sources were previously considered and are within an existing AQMA there is no need to proceed further.

The Royal Borough of Greenwich confirms that there are no relevant bus stations in the Local Authority area.

4 Other Transport Sources

4.1 Airports

Aircraft are potentially significant sources of nitrogen oxides (NO_x) emissions, especially during takeoff. The TG09 guidance used new information, which has resulted in the criteria to trigger a Detailed Assessment being relaxed, while the requirement to assess PM₁₀ has been removed. Thus this section only applies to NO₂. (Note – any road traffic using airports was considered in the previous section.)

The nearest airport, London City Airport, is outside the Borough, on the north side of the Thames from Greenwich in Newham. It is thus sufficiently distant not to be relevant. Furthermore passenger numbers of around 3 million passengers per annum are below the threshold of 10 million passengers per annum as given in the TG09 guidance.

The Royal Borough of Greenwich confirms that there are no airports in the Local Authority area.

4.2 Railways (Diesel and Steam Trains)

Stationary locomotives, both diesel and coal fired, can give rise to high levels of sulphur dioxide (SO₂) close to the point of emission. Recent evidence also suggests that moving diesel locomotives, in sufficient numbers, can also give rise to high NO₂ concentrations close to the track where, along busy lines, emissions can be equivalent to those from a busy road.

4.2.1 Stationary Trains

Previous rounds of Review and Assessment also found that there are no areas within the Borough where diesel or steam locomotives are stationary for periods of 15 minutes or more and within 15 m of locations where regular outdoor exposure arises. This situation has not changed.

The Royal Borough of Greenwich confirms that there are no locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m.

4.2.2 Moving Trains

Diesel locomotives use rail lines that run through Greenwich, however these are not included within the list of lines (from Table 5.1 of TG09), which identify those with a “high” usage of diesel locomotives.

The Royal Borough of Greenwich confirms that there are no locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m.

4.3 Ports (Shipping)

The assessment for shipping needs to consider SO₂ only. The northern Borough boundary aligns the river Thames and although there are some ship movements in this area they are not sufficient to require further investigation based on the TG09 guidance.

The Royal Borough of Greenwich confirms that there are no ports or shipping that meet the specified criteria within the Local Authority area.

5 Industrial Sources

5.1 Industrial Installations

The Council and the Environment Agency (EA) control industrial sources within the Borough under the Environmental Permitting Regulations (England and Wales) 2010, as amended. The Council also has control over some smaller industrial and commercial sources, largely through the Clean Air Act, with its associated control of the stack heights. As a result of these controls, there are relatively few sources that may be relevant under the Local Air Quality Management (LAQM) regime. Many of these sources were also addressed during previous rounds of Review and Assessment. The focus is thus on new installations and those with significantly changed emissions.

Industrial sources are considered unlikely to make a significant local contribution to annual mean concentrations, but could be significant in terms of the short-term objectives in the Borough. Sources in neighbouring authorities and the combined impact of several sources are considered. The approach used is based on use of the planning and permitting processes. The assessment considers all the LAQM pollutants, including those most at risk of requiring further work (SO₂, NO₂, PM₁₀ and benzene).

5.1.1 New or Proposed Installations for which an Air Quality Assessment has been Carried Out

Since the last round of Review and Assessment there have been no applications received for installations where an Air Quality Assessment has been carried out.

The Royal Borough of Greenwich has assessed new/ proposed industrial installations, and concluded that it will not be necessary to proceed to a Detailed Assessment.

5.1.2 Existing Installations where Emissions have Increased Substantially or New Relevant Exposure has been Introduced

The lists of existing Part A and B processes that are regulated under the Environmental Permitting regime are provided in the Appendices. These are all processes with low emissions of LAQM pollutants. None of these have increased emissions by greater than 30% (as referred to in the TG09 guidance) and no new relevant exposure has been introduced nearby.

The Royal Borough of Greenwich confirms that there are no industrial installations with substantially increased emissions or new relevant exposure in their vicinity within its area or nearby in a neighbouring authority.

5.1.3 New or Significantly Changed Installations with No Previous Air Quality Assessment

Since the last round of Review and Assessment the Council has received no applications for new installations. No other applications have been received for new or proposed sources where it has been determined that the installation is likely to give rise significant pollutant emissions.

The Royal Borough of Greenwich confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

5.2 Major Fuel (Petrol) Storage Depots

This was previously assessed in earlier rounds of Review and Assessment and it was found that there are no major petrol storage depots in the Borough. This situation has not changed.

There are no major fuel (petrol) storage depots within the Local Authority area.

5.3 Petrol Stations

There is some evidence that petrol stations could emit sufficient benzene to put the 2010 objective at risk of being exceeded, especially if combined with higher levels from nearby busy roads. Some sites in the Borough have however already incorporated petrol vapour recovery (PVR) systems, furthermore those service stations with petrol sales above 3.5 million litres per annum were required to install Stage 2 PVR systems before the 1st January 2010 deadline to comply with UK legislation to reduce petrol vapour (and benzene) from vehicles.

The previous round of Review and Assessment assessed all petrol stations for a throughput of more than 2000 m³ of petrol, and a busy road nearby. Of these none were found to have relevant exposure within 10m of the pumps and therefore it was not necessary to go to a Detailed Assessment. There has been no change in this situation for this round.

The Royal Borough of Greenwich confirms that there are no petrol stations meeting the specified criteria.

5.4 Poultry Farms

Some local authorities in England have identified potential exceedences of the PM₁₀ objectives associated with emissions from poultry farms (defined as chickens (laying hens and broilers), turkeys, ducks and guinea fowl). These relate to large farms (> 100,000 birds) that are regulated by the EA. None however exist within the Council's area.

The Royal Borough of Greenwich confirms that there are no poultry farms meeting the specified criteria.

6 Commercial and Domestic Sources

Biomass burning can lead to an increase in PM₁₀ emissions, from the combustion process itself and also by aerosol formation from the volatile materials distilled from the wood. Compared to conventional gas burning, biomass burning can also result in an increase in NO_x emissions due to the fuel-derived portion that is not present in gas combustion.

The whole Borough however is a Smoke Control Area, meaning that the emission of smoke from chimneys of domestic premises and other buildings is not permitted. Furthermore furnaces, chimneys and industrial processes are monitored carefully and only authorised appliances (as listed under the Smoke Control Area Orders) can be used to burn solid fuels such as coal, coke and wood.

6.1 Biomass Combustion – Individual Installations

The use of biomass to generate energy has potentially significant benefits for the reduction of greenhouse gas emissions. However there are concerns that an increase in biomass combustion in urbanised areas could be detrimental to air quality, particularly with respect to PM₁₀ and NO₂. The TG09 guidance includes a procedure to determine the impact of biomass combustion plant to see if there is the potential for the air quality objectives to be exceeded.

Following this the Council has assessed for individual combustion plant burning biomass ranging from 20 MW down to 50 kW units and no new plant have been identified that have not previously been considered.

The Royal Borough of Greenwich has assessed the biomass combustion plant, and concluded that it will not be necessary to proceed to a Detailed Assessment.

6.2 Biomass Combustion – Combined Impacts

As already outlined the Council is a Smoke Control Area and therefore any biomass burning using non-authorised appliances is considered minimal. There is however the potential that many small biomass combustion installations (including domestic solid-fuel burning), whilst individually acceptable, could in combination lead to unacceptably high PM₁₀ concentrations, particularly in areas where PM₁₀ concentrations are close to or above the objectives. The impact of domestic biomass combustion in most areas is thought to be small at the time of writing, but could become more important in future. The potential for combined impacts, other than that discussed above, will be assessed should future plant be proposed. Currently there is minimal domestic solid fuel burning as discussed in the next section.

The Royal Borough of Greenwich has assessed the combined impact of biomass combustion, and concluded that it will not be necessary to proceed to a Detailed Assessment.

6.3 Domestic Solid-Fuel Burning

The previous rounds of Review and Assessment identified areas where domestic solid fuel burning gives rise to exceedences of the objective for SO₂. PM₁₀ from domestic solid fuel burning was also covered above.

The whole of the Borough is designated a Smoke Control Area and there are no areas of significant domestic solid fuel use in the Borough. This position has not changed from the previous USA, which confirmed that no areas of significant domestic solid fuel burning were identified. Gas is widely available in the Borough and it remains the predominant fuel used for domestic water and space heating.

The Royal Borough of Greenwich confirms that there are no areas of significant domestic fuel use in the Local Authority area.

7 Fugitive or Uncontrolled Sources

Dust emissions from uncontrolled and fugitive sources can give rise to elevated PM₁₀ concentrations. These sources can include, but are not limited to the following sites: quarrying and mineral extraction sites, landfill sites, coal and material stockyards, or materials handling, major construction works and waste management sites. Dust can arise from the passage of vehicles over unpaved ground and along public roads that have been affected by dust and dirt tracked out from dusty sites. Other sources of dust are from the handling of dusty materials, the cutting of concrete, etc and wind-blown dust from stockpiles and dusty surfaces.

The Royal Borough of Greenwich has previously identified fugitive and uncontrolled particulate matter emissions on the Greenwich Peninsula near Tunnel Avenue. These emissions are associated with installations that are regulated under the Environmental Permitting regime and also are not considered to arise in locations where there is relevant exposure.

The Crossrail project is a major construction project in London that will provide a new east/west rail crossing for London. It is set to pass through the northern part of the borough of Greenwich, with stations planned in Woolwich (at the Royal Arsenal) and Abbey Wood (where the eastern arm of the Crossrail line terminates and links with the North Kent line). The project will run until 2017, with major construction sites in the Borough. The Council currently monitors compliance with environmental controls, including dust, at the active construction sites in the Borough.

No other additional fugitive and uncontrolled particulate matter emissions have been identified based on local professional knowledge, recent air quality assessments or recent complaints to the Council.

The Royal Borough of Greenwich confirms that there are no additional potential sources of fugitive particulate matter emissions in the Local Authority area, apart from those near Tunnel Avenue and Crossrail. Close attention will be maintained on those areas located close to the potential sources of fugitive particulate matter.

8 Conclusions and Proposed Actions

8.1 Conclusions from New Monitoring Data

Monitoring within the Borough confirmed that the annual mean nitrogen dioxide objective continues to be widely exceeded at roadside and background locations. The Council monitors 11 locations continuously and 39 other locations across the Borough using diffusion tubes. Most of the sites monitored are considered to represent relevant exposure. Of these the continuous background sites, plus the industrial site in the Borough met the relevant annual mean objectives in 2011 for nitrogen dioxide. The roadside sites however exceeded the annual mean objective. In 2011 the bias adjusted diffusion results for the Borough showed 26 of the 34 locations monitored exceeded the objective, with six exceeding an annual mean of $60 \mu\text{g m}^{-3}$.

A brief analysis of the Greenwich diffusion tube monitoring results, comparing the 2009 results to 2011 indicates that there were very slightly fewer locations exceeding the objective in 2011. Eighty two percent of sites exceeded in 2009, compared to 76% in 2011. However even with this reduction, which may be due many different factors, the monitoring clearly shows that there remains widespread exceedence of the objective across the Borough.

The Council's most recent PM_{10} monitoring indicates that the daily mean objective has been exceeded recently within the Borough at the GR8 (under the Woolwich flyover) and GR7 (Blackheath Hill) sites. Other sites within the Borough have met the objectives. An analysis of trends in London (KCL, 2009) however confirms that concentrations do not appear to be reducing and there is also evidence indicating that close to roadsides PM_{10} from primary sources may be increasing. The 2011 monitoring of sulphur dioxide and benzene confirms that the objectives for these pollutants have been met.

Based on these findings from monitoring in the Borough, the Council, having previously designated the Borough as an Air Quality Management Area, does not need to undertake a

Detailed Assessment as no new potential or actual exceedences at relevant locations were established.

8.2 Conclusions from Assessment of Sources

The Council has assessed the likely impacts of local developments for road transport, other transport, industrial processes, commercial/domestic, fugitive emissions, plus residential and commercial sources. The findings have indicated that there are no new changes that require the Council to undertake a Detailed Assessment.

8.3 Proposed Actions

This report follows the technical guidance (TG09) produced for this round of Review and Assessment. It therefore fulfils this part of the continuing LAQM process.

The results, from following this methodology, are that the Council has not identified an additional risk of the air quality objectives for the LAQM pollutants: carbon monoxide, benzene, 1,3-butadiene, lead and sulphur dioxide, being exceeded anywhere in the Council's area. Thus the Council need not proceed beyond the updating and screening assessment for these pollutants. For nitrogen dioxide and particles (PM₁₀) the Council has previously designated the Borough as an AQMA. The findings from this report indicate that the AQMA should be maintained.

The Council will therefore undertake the following actions:

1. Undertake consultation on the findings arising from this report with the statutory and other consultees as required.
2. Maintain the existing monitoring programme.

3. Continue with the implementation of its Air Quality Action Plan in pursuit of the AQS objectives.
4. Prepare for the submission of its 2013 Air Quality Progress Report.

9 References

Defra, 2007. Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volume I). Defra, London. Cm 7169.

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KCL, 2009. Air Quality in London 2006-7. London Air Quality Network Report 14. ERG, King's College London 2009.

KCL, 2012. Air Quality in London GLA Health and Environment briefing note. KCL July 2012.

Royal Borough of Greenwich (2009). Local Air Quality Management – Updating and Screening Assessment 2009.

Royal Borough of Greenwich (2010) Local Air Quality Management – Progress Report 2010.

Appendices

Appendix I: Relevant Part A installations in Greenwich

Type of process	Company Name	Site Address
Acid Processes	European Colour (Pigments) Ltd	Nathan Way, West Thamesmead Business Park SE28 0AY
Combustion Processes	EDF Powerlink Ltd	Greenwich Generating Station, Old Woolwich Road, SE10 9NY
Combustion Processes	Tate & Lyle UK Limited	Thames Bank House, Tunnel Avenue, Greenwich

Appendix 2: Part B installations in Greenwich

Ref	Reg. Category	Name	Address	Postcode	Status
102	Cremation of Human Remains	Eltham Crematorium	Crown Woods Way, Eltham	SE9 2RF	Permitted
110	Concrete Batching	Tarmac	Murphy's Wharf, Lombard Wall, Charlton	SE7 7SH	Permitted
112	Roadstone Coating	Aggregate Industries (UK) Ltd	Angerstein Wharf, Horn Lane, Greenwich	SE100RT	Permitted
126	Ferrous and Non-Ferrous Metal Processing	Essex Replica Castings (Basildon) Ltd	108-112 Westmoor Street, Charlton	SE7 8NQ	Permitted
130	Ferrous and Non-Ferrous Metal Processing	Stone Foundries	Woolwich Road, Woolwich	SE7 8SL	Permitted
138	Roadstone Coating	Tarmac	Riverside Wharf, Herringham Road, Charlton	SE7 8SJ	Permitted
140	Manufacture of Printing Inks	Apollo Colours Ltd	127 Nathan Way, West Thamesmead Business Park, London	SE28	Permitted
141	Concrete Batching	London Concrete	Angerstein Wharf, Horn Lane, Greenwich	SE10	Permitted
144	Fixed Concrete Crusher	Day Aggregates	Murphy's Wharf, Lombard Wall, Charlton	SE7 7SH	Permitted
145	Concrete Batching	Hanson Premix	303 Tunnel Avenue, Greenwich	SE100QE	Permitted
147	Fixed Concrete Crusher	Murphy's (Waste) Ltd	Transfer Station, Horn Lane, Greenwich	SE100RT	Permitted
148	Concrete Batching	CEMEX	Angerstein Wharf, Horn Link Way, Greenwich	SE100RT	Permitted
150	Concrete Batching	Euromix Concrete Ltd	Brewery Wharf, Norman Road, Greenwich	SE109QZ	Permitted
152	Vehicle Respraying	Southside Accident Repair centre	123/125 Nathan Way, Thamesmead	SE280AB	Permitted
153	Mobile Concrete Crusher	O'Keefe Construction (Greenwich) Ltd	St. Andrew's House, 1 Dreadnought Street, Greenwich	SE100PU	Permitted
201	Petrol Station	Asda Petrol Station	Bugsby Way, Charlton	SE7 7ST	Permitted
202	Petrol Station	Total Fina	176 Footscray Road, New Eltham	SE9	Permitted
203	Petrol Station	Morrison Petrol Station	Thamesmere Drive, Thamesmead	SE288RE	Permitted
204	Petrol Station	J Sainsbury plc	Messeter Place, Eltham	SE9	Permitted
205	Petrol Station	Star Lee Service Station	1 Sidcup Road, Lee	SE128BL	Permitted
206	Petrol Station	Snax 24 Ltd PFS	79 Kidbrooke Park Road, Blackheath	SE3	Permitted

Ref	Reg. Category	Name	Address	Postcode	Status
208	Petrol Station	JET Service Station	177-189 Creek Road, Deptford	SE8 3OU	Permitted
210	Petrol Station	Trafalgar Filling Station	43-45 Trafalgar Road, Greenwich	SE109TT	Permitted
211	Petrol Station	Hexagon Service Station	340 Woolwich Road, Charlton	SE7	Permitted
213	Petrol Station	Thamesmead Service Station	1-3 Bostall Hill, Abbey Wood	SE2 0RB	Permitted
215	Petrol Station	Eltham Service Station	39-41 Eltham High Street, Eltham	SE9 1DH	Permitted
216	Petrol Station	Shell Service Station	160-168 Plumstead Common Road, Plumstead	SE18 2UL	Permitted
217	Petrol Station	Lakedale Service Station	190-214 Plumstead High Street, Plumstead	SE18 1JH	Permitted
218	Petrol Station	Blackheath Service Station	37A Shooters Hill Road, Blackheath	SE3 7HS	Permitted
219	Petrol Station	Shell Service Station	165 Shooters Hill Road, Blackheath	SE3	Permitted
220	Petrol Station	Shell Service Station	Next to 551 Sidcup Road, Eltham	SE9 3AF	Permitted
221	Petrol Station	Shell Service Station	728 Sidcup Road, Eltham	SE9	Permitted
223	Petrol Station	Shell Service Station	7-9 Tudor Parade, Well Hall Road, Eltham	SE9 5SX	Permitted
224	Petrol Station	Clifton Service Station	59 Sidcup Road, Lee	SE12 8BL	Permitted
230	Petrol Station	WJ King (Garages) Ltd	40 Artillery Place, Woolwich	SE184AE	Permitted
231	Petrol Station	J Sainsbury plc	Bugsby Way, Charlton	SE10	Permitted
232	Petrol Station	Crown Woods S/stn	Bexley Road	SE9 2NL	Permitted
301	Dry Cleaners	The Village Dry Cleaners	135 Lee Road	SE3 9DS	Permitted
302	Dry Cleaners	Panache Dry Cleaners	192 Court Road, Eltham	SE9 4EW	Permitted
303	Dry Cleaners	Westmount Dry Cleaners	146 Westmount Road, Eltham	SE9 1XA	Permitted
304	Dry Cleaners	Greenwich Dry Cleaners	25 Woolwich Road, Greenwich	SE10 0RA	Permitted
305	Dry Cleaners	Taylor's Cleaners	68 Herbert Road, Plumstead	SE18 3SH	Permitted
306	Dry Cleaners	Westcombe Dry Cleaners	74 Westcombe Hill	SE3 7DY	Permitted
307	Dry Cleaners	Morrisons Supermarket	2 Twin Tumps Way	SE28 8RD	Permitted
308	Dry Cleaners	Cleantech Dry Cleaners	213 Eltham High Street	SE9 1TX	Permitted
309	Dry Cleaners	Elegance Dry Cleaners	172 Westcombe Hill	SE3 7DH	Permitted

Ref	Reg. Category	Name	Address	Postcode	Status
310	Dry Cleaners	Collins Cleaners	3 Stratheden Parade	SE3 7SX	Permitted
311	Dry Cleaners	Well Hall Express	18 Well Hall Parade, Eltham	SE9 6SP	Permitted
312	Dry Cleaners	Woolwich Express	59 Woolwich New Road	SE18 6ED	Permitted
313	Dry Cleaners	Cleaners of Eltham	10 Well hall Road, Eltham	SE9 6SF	Permitted
314	Dry Cleaners	Tailored Press	130 Plumstead Common Road	SE182UL	Permitted
315	Dry Cleaners	Soma Dry Cleaners	237 Greenwich High Road	SE108NB	Permitted
316	Dry Cleaners	Collins Dry Cleaners	168 Trafalgar Road, Greenwich	SE10 9TZ	Permitted
318	Dry Cleaners	Spotless Dry Cleaners	168 Shooters Hill Road	SE3 8RP	Permitted
319	Dry Cleaners	Early Bird Dry Cleaners	139 Plumstead High Street	SE18 SE	Permitted
320	Dry Cleaners	Sew Clean	252 Plumstead High Street	SE18 1JN	Permitted
321	Dry Cleaners	Rosam Dry Cleaners	173 Trafalgar Road	SE109TX	Permitted
322	Dry Cleaners	Unique Dry Cleaners	6 Frances Street, Woolwich	SE185EF	Permitted
323	Dry Cleaners	Court Yard Dry Cleaners	29 Court Yard, Eltham	SE9 5PR	Permitted
324	Dry Cleaners	Victory Dry Cleaners	196 Bexley Road	SE9 2PH	Permitted
325	Dry Cleaners	Asik Dry Cleaners	88 Plumstead High Street	SE18 1SL	Permitted
326	Dry Cleaners	Attrill's	413, Footscray Road	SE9 3UL	Permitted
327	Dry Cleaners	Village Dry Cleaners	1 The Village, Charlton	SE7 8UG	Permitted
328	Dry Cleaners	Royal Dry Cleaners	27 Lewisham Road	SE137QS	Permitted

Appendix 3: 2011 Diffusion tube results in Greenwich

2011 Unadjusted NO₂ diffusion tube results for Greenwich

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
GW23	50.72	43.09	51.80	42.48	16.87	32.73	45.14	33.42	26.64	38.73	49.48	32.22
GW24	58.79	48.71	71.43	59.28		50.25	57.71	52.46	41.65	49.18	54.74	41.44
GW25	52.97	49.22	56.12	46.43	38.21	48.12	44.86	40.58	43.44	51.11		44.75
GW26	39.22	34.34	40.53	38.69	20.35	23.82	27.23	26.51	22.47	31.60	45.43	31.69
GW27	54.88	47.05	52.21	46.29	38.49	40.13	39.20	43.26	40.90	46.64	49.68	43.05
GW28	42.73	49.32	40.16	42.65	28.24	35.65	29.42	31.31	35.76	38.55		32.89
GW29	73.16	72.22	69.14	69.11	56.32	56.40	57.84	59.65	48.21	67.79	72.23	62.80
GW30	45.73	40.12	47.26	39.43	26.73	35.20		32.67	36.12	38.43		38.94
GW31	37.09	33.62	39.78	37.23	24.57	31.32	40.94	28.14	30.37	32.80	0.30	70.29
GW32	54.28	53.21	50.08	48.40	36.37	43.16	38.95	43.29	43.03	45.43	57.08	49.57
GW33	57.87	60.67	64.26	68.41	54.88	69.40	59.02	57.19	44.17	29.76	74.38	56.20
GW34	55.83	58.29	50.07	38.69	42.03	48.82	44.32	45.00	45.91	28.10	51.76	58.83
GW35	66.02	57.97	79.53		56.68	76.59	63.84	74.36	72.33	42.45	87.74	84.46
GW36	92.62	53.34	47.59	52.31	39.36	44.37	36.78	44.66	40.21	58.41	53.94	55.08
GW37	29.72	25.24	32.01	27.11	43.69					25.06	33.28	29.91
GW38	38.26	38.66	45.19	41.09	26.76	28.64	36.00	29.28	29.45	40.87	44.53	26.64
GW40	29.08	27.94	26.67	27.11	11.86	20.32	13.65	19.61	15.41	19.07	30.15	24.50
GW41	43.21	47.12	44.10	48.37	41.57	45.48	43.75	50.09	50.58	58.29	55.18	42.33
GW42	53.94	52.04	63.17		45.82	52.93	57.94	54.24	45.78	59.42	66.47	44.70
GW43	58.15	57.94	56.01	71.79	49.05	56.04	59.68	57.69	60.48	68.35	77.49	60.30
GW44	40.43	53.42	63.84	52.73	41.56	42.80	50.92	43.48	38.10	43.77	56.04	42.40
GW48	50.92	51.17	49.84	55.77	39.51	41.84	42.67	40.24	41.40	46.27	51.86	45.82
GW49	45.87	47.67	51.41	51.00	31.95	33.90	41.13	37.10	36.41	47.15	52.68	38.04
GW51	52.48	49.84	50.00	46.93	30.58	46.80	39.49	37.95	48.71	47.03	0.26	43.14
GW52	60.68	43.33	78.47	55.75	29.39	41.55	43.21	41.11	33.56	45.44	57.37	40.75
GW53	54.67		51.54	50.22	32.06	35.60	30.04	34.57	38.41	42.89	47.77	44.16
GW54	57.18		66.62	87.91		55.98	58.07	51.47	50.01	61.84	68.27	46.34
GW56	63.85	57.12	66.44	77.55	49.18	31.35	38.64	47.77	37.61	49.90	82.09	28.38
GW10	81.94		82.65	87.29	77.86	80.19	63.55		82.48	96.03	90.26	91.00
GW10	68.77	53.41		76.99	59.38	59.91	29.57	58.56	84.55	61.36		63.87
GW10	55.28	49.88	43.43	50.20	35.96	50.65	35.82	47.64	43.85	49.68	51.20	
GW10	53.91	59.26	49.40	68.32	39.51	52.13	55.09	50.34	50.74	57.96	56.82	
GW10	61.76	49.77					32.25	55.11	44.89	49.57	50.47	60.53
GW10	47.10	46.89	50.31	55.18	28.69	36.30	42.08	37.72	35.76	41.54	50.05	43.91
GW39	27.01	26.10	30.04	29.71	16.91	20.20	15.04	19.66	20.39	25.31	26.52	21.06

GW39	26.67	24.32	25.96	28.15	15.53	16.29	17.44	19.05	20.70	23.75	22.55	24.90
GW39	27.81	23.71	30.16	27.93	15.16	18.78	16.54	18.10	20.57	24.47	28.90	21.55
GW50	72.03	72.04	67.32	79.02	77.88	77.06	66.85	80.26	83.17	81.07	72.91	74.24
GW50	71.79	74.05	58.25	76.82	75.05	88.13	66.24	81.18	86.95	41.37	73.85	81.96
GW50	65.98	70.39	62.16	74.70	74.85	61.84	66.65	76.60	85.84	83.69	73.32	88.26
GW55	66.04	53.17	73.32	77.39	43.70	39.74	50.58	45.18	37.69	51.06	74.91	38.63
GW55	56.42	57.52	74.19	51.62	39.69	42.63	56.56	50.32	32.30	50.06	69.13	35.49
GW55	61.46	58.64	81.93	56.40	36.69	40.89	54.73	46.74	35.53	28.94	71.66	38.26
GW57	48.96	44.76	45.93	53.09	33.38	45.11	38.11	37.66	37.17	38.12	47.46	39.07
GW57	47.86	47.14	49.88	53.60	36.41	32.27	38.27	38.63	35.08	38.55	43.73	40.71
GW57	53.67	46.45	52.33	45.87	31.59	38.93	46.54	36.98	37.15	38.60	41.89	41.83
GW58	51.78	58.81	67.46	54.35	53.33	52.21	44.71	42.54	43.73	49.36	52.71	41.72
GW58	51.20	51.58	55.12	56.06	83.74	48.06	47.83	44.28	49.46	49.70	54.87	40.11
GW58	50.83	52.22	53.58	54.82	41.06	48.22	42.23	42.44	41.28	26.70	55.24	37.73
GW59	43.55	47.06	57.02	51.48	34.63	39.51	42.75	36.92	35.83	47.23	47.52	32.53
GW59	45.96	45.19	55.77	51.85	36.80	37.65	42.80	37.45	38.17	45.07	50.84	38.24
GW59	46.04	46.19	54.54	51.07	36.29	36.24	39.96	39.73	39.00	47.12	54.85	29.98
GW60	47.07	35.40	49.27	45.32	30.83	30.89	42.21	32.21	28.41	32.85	38.12	32.29
GW60	40.47			49.08	31.78	33.28	41.67	34.54	26.26	34.44	39.89	32.63
GW60	44.77	36.58		91.71	33.62	32.97	84.09	36.62	27.00	33.74	41.48	31.27
GW61	48.04	44.54	50.06	45.00	30.68	34.13	28.47	32.01	33.63	43.86	50.25	41.48
GW61	48.27	44.15	50.06	45.55	25.34	38.87	30.48	30.48	35.29	42.27	51.15	38.89
GW61	50.30	40.94	51.13	45.93	30.97	33.56	23.35	29.83	38.20	42.59	44.86	

2011 Annualising factors for Greenwich sites

Sites	Factor
GW24	0.977172
GW25/ 28	1.003681
GW35/ 42	1.012387
GW53	1.01196
GW103/ 104/61c	1.002429
GW60c	1.031239
GW30	0.977089
GW54	0.98769
GW101	1.003934
GW102	1.038738
GW60b	1.048246
GW37	0.920125
GW105	0.98906