Contents

Review and Assessment of Air Quality in the Borough of Dartford Updating and Screening Assessment

1.0 Executive Summary

Section 88(2) of the Environment Act 1995 places a statutory duty on local authorities to review and assess the air quality within their area and take account of Government Guidance when undertaking such work. Since 1997, following the introduction of the National Air Quality Strategy and Air Quality Regulations (1997), Dartford Borough Council has undertaken its first round of review and assessments of air quality and this was completed in 2002. This was a phased process (Stages 1- 4) which culminated in the declaration of an Air Quality Management Area (for nitrogen dioxide and fine particles) along the A282 Tunnel Approach Road and the drawing up of action plan measures.

There have been a number of changes since the last round of review and assessments which have been taken into account in this assessment; including a revised National Air Quality Strategy (2000) and Addendum (2003), new Air Quality Regulations (2000 and 2002), new Guidance LAQM.PG (03) and LAQM.TG (03) and new vehicle emissions factors (2002). There have also been improvements in the information available to assess local air quality, including extensive monitoring data, screening tools and emissions inventories.

This updating and screening (USA) report is the first stage of the second round of review and assessment to be completed by May 2003. A more detailed second stage will follow, to be completed by April 2004. The format of the USA follows that of the checklists in the Guidance document LAQM.TG (03) Technical Guidance. The USA considers the seven priority pollutants with health based Air Quality Objectives (AQO) as laid down in Regulations and assesses the likelihood that the AQOs will be met by their target dates.

Having considered each pollutant in turn and presented evidence to support the assessment of each, it is concluded that AQOs for carbon monoxide, benzene, 1,3-butadiene, lead and sulphur dioxide will be met. There will be no requirement to undertake a detailed assessment for these pollutants.

There is sufficient evidence to warrant proceeding to a detailed assessment for the following pollutants and Objectives:

- Nitrogen dioxide (NO_2) – annual mean Objective 2005
- Fine particles (PM_{10}) – 24 hour mean Objective 2004 and annual mean 2010

The hotspots identified in this assessment which require further consideration, in addition to the A282 AQMA, for both NO_2 and PM_{10} (2004), include A226/B255 junction and Bean Interchange. In addition, for NO_2, a number of junctions and busy roadsides have been identified which are predicted to exceed the 2005 annual mean Objective. With regard to the 2010 PM_{10} annual mean Objective, widespread exceedences are predicted in urban areas, especially near busy roadsides.

2.0 Introduction

The Environment Act 1995 introduced a system of local air quality management (LAQM), placing new legal duties on local authorities to assess the air quality in their area, and a requirement for the Government to publish a National Air Quality Strategy containing air quality targets which would protect people's health.

The National Air Quality Strategy (NAQS) was published in 1997 and has since been revised in 2000. The Strategy contains standards and objectives for eight air pollutants; nitrogen dioxide (NO_2), sulphur dioxide, carbon monoxide, fine particles (PM_{10}), ozone, lead, 1,3-butadiene and benzene. Local authorities have a responsibility to assess levels of these pollutants, with the exception of ozone, and implement measures to reduce pollution where objectives are not met by the target deadlines which range from 2003 to 2010. Objectives included in the Air Quality Regulations 2000 and (Amendment) Regulations 2002 which will need to be assessed for the purpose of local air quality management are shown in Table 1.

Table1:

Pollutant	**Objective**		**Date to be achieved by**
	Concentration	**Measured as**	
Benzene	5 ppb 1.5ppb	Running annual mean Annual mean	31 December 2003 31 December 2010
1,3-butadiene	1 ppb	Running annual mean	31 December 2003
Carbon monoxide	10mg/m3(8.6 ppm)	Maximum daily running 8 hour mean	31 December 2003
Lead	0.5μg/m^3 0.25μg/m^3	Annual mean Annual mean	31 December 2004 31 December 2008
Nitrogen dioxide*	200μg/m^3 * not to be exceeded more than 18 times a year 40μg/m^3*	1 hour mean annual mean	31 December 2005 31 December 2005
Fine particles (PM_{10})	50μg/m^3 not to be exceeded more than 35 times a year 40μg/m^3 20μg/m^3	24 hour mean Annual mean Annual mean	31 December 2004 31 December 2004 31 December 2010
Sulphur dioxide	100 ppb not to be exceeded more than 35 times a year 47 ppb not to be exceeded more than 3 times a year 132 ppb not to be exceeded more than 24 times a year	15 minute mean 24 hour mean 1 hour mean	31 December 2005 31 December 2004 31 December 2004

ppb = parts per billion, ppm = parts per million, μg/m^3 = micrograms per cubic metre.
* These are provisional objectives. EU Limit values for nitrogen dioxide are to be met by 2010.

Local authorities must review and assess current and projected pollutant levels and where it appears the Objectives will not be met by the designated time they must declare an Air Quality Management Area (AQMA) and draw up action plans to meet the Objectives.

New vehicle emissions factors have been published in 2002 which will have an impact on previous review and assessment work. This will effect road traffic emission predictions, especially for nitrogen dioxide which has been underestimated previously. Areas which were identified as marginally meeting Objectives will need to be reconsidered.

During the first round of review and assessments two pollutants were taken forward to the more detailed Stage 3 Review and Assessment, fine particles (PM_{10}) and nitrogen dioxide (NO_2), and an area of exceedence for these Objectives was predicted along the A282 Tunnel Approach Road. An Air Quality Management Area was declared in October 2001 and a draft action plan has been drawn up with relevant partners and consultees. The major cause of the problem is the impact of emissions from locally, regionally and nationally generated traffic movements along the A282 on the residential properties in close proximity to this major road. The problem reduces with increasing distance from the roads of concern and relatively small areas are involved.

Table 2: Summary of the first round of review and assessments

Stage 1 (June 1998)	**Stage 2 (December 1998)**	**Stage 3 (December 2000)**	**AQMA Declaration (October 2001)**	**Stage 4 (April 2002)**
Benzene			**A282 Tunnel Approach Road**	Further assessment of ***Nitrogen dioxide & PM_{10}*** in the AQMA
1,3-Butadiene				
Carbon monoxide	Carbon monoxide			
Lead				
Nitrogen dioxide	Nitrogen dioxide	*Nitrogen dioxide*		
PM_{10}	PM_{10}	*PM_{10}*		
Sulphur dioxide	Sulphur dioxide			

In the next round of review and assessments, Stages 1 – 3 will be replaced by an Updating and Screening Assessment (equivalent to Stage 1 &2) and Detailed Assessment (equivalent to Stage 3). The process will be ongoing, with a new round of assessments starting every three years.

New Guidance has been introduced this year to improve the review and assessment process -LAQM.TG (03) and LAQM.PG (03). Much has been learnt since the last round and this will be reflected in the format of this assessment which is more prescriptive and appropriately targeted to the relevant hotspots.

3.0 Updating and Screening Assessment

This section of the report provides a review and assessment of levels of carbon monoxide, benzene, 1, 3 – butadiene, lead, nitrogen dioxide, sulphur dioxide and fine particles (PM_{10}) within the Borough of Dartford. An assessment of each pollutant is made to determine whether the Air Quality Objectives are likely to be met by the target years (see Table1). A number of information sources have been used as the basis of this assessment, including monitoring data undertaken within the Borough (or comparative data from appropriate sites in the Kent and National monitoring networks), Kent County Council traffic data 1993-2002, public registers and information from operators of industrial processes, and National Atmospheric Emissions Inventory (NAEI) data. Screening tools, Design Manual for Roads and Bridges Screening model v.1 (DMRB) and industrial sources spreadsheets, have been provided by DEFRA to aid this screening process and these have been used as appropriate.

3.1 Carbon monoxide

3.11 Objective

10mg/m3(8.6 ppm)	Maximum daily running 8 hour mean	To be met by 31st December 2003

The Objective for Carbon Monoxide has been tightened since the first round of review and assessment from 10ppm to 8.6ppm, to bring it in line with the EU Directive limit value.

3.12 Health Effects

The main health problem from exposure to carbon monoxide gas is the formation of carboxyhaemoglobin, which deprives the blood of oxygen. This can cause headaches, dizziness, nausea and at very high levels, death. Elderly people, pregnant women, young children and people with heart disease and lung disease are more sensitive to carbon monoxide.

3.13 Sources

The main source of carbon monoxide which contributes to ambient pollution levels is road transport. Carbon monoxide is formed through incomplete combustion of fuels and petrol-engine vehicles contribute the most emissions. In Dartford, road transport causes 81% of carbon monoxide emissions (NAEI 2000 Inventory).

3.14 Assessment

At a National level, transport policy measures combined with tighter vehicle emissions and fuel quality standards will make a significant contribution to the reduction of carbon monoxide levels and should be sufficient to meet the AQO in all locations. However,

although National studies show the AQO will be met, local air quality should still be assessed to ensure there are no hotspots with relevant exposure.

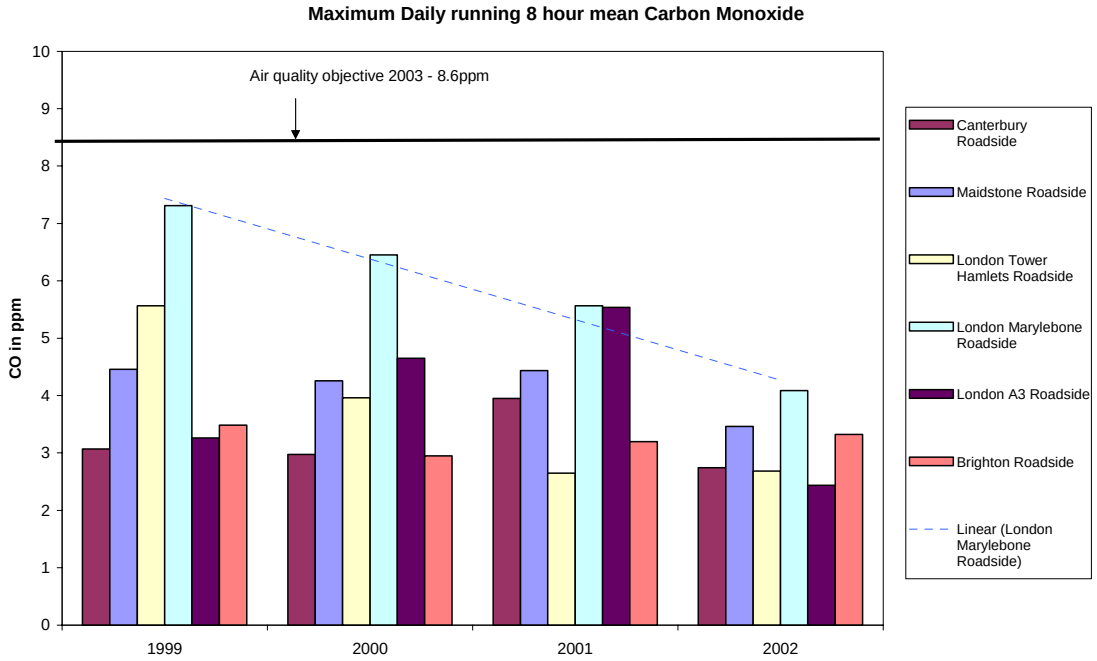
During Dartford's last round of review and assessments, carbon monoxide was assessed in Stage 1 and 2 and was predicted to meet the old AQO. No detailed assessment was required. To date, there have been no Air Quality Management Areas in the UK for carbon monoxide.

(A) Monitoring data

There are no monitoring sites for carbon monoxide in Dartford and therefore comparative data from busy roadside sites in the surrounding area of Kent, London and the South East have been considered for the period 1999 – 2002. The maximum daily running 8 hour means for a number of roadside sites are shown in table 3 and the graph below. The AQO is met at all these sites, as with all other sites in the National Network, and the overall trend shows levels are reducing over time. Dartford, bordering outer London Boroughs, is unlikely to be dissimilar in this regard and the predicted background (2003) for Dartford of 0.27 – 0.36ppm also compares favourably with neighbouring Borough Bexley (suburban site).

Table 3:

Site	**Year**	**Maximum daily running 8 hour mean in ppm**	**annual mean**	**data capture**
Canterbury Roadside	1999	*3.1*	*0.8*	38%
	2000	3.0	0.7	93%
	2001	4.0	0.7	95%
	2002	2.7	0.5	93%
Maidstone Roadside	1999	*4.5*	*1.0*	38%
	2000	4.3	1.0	92%
	2001	4.4	1.0	94%
	2002	3.5	0.7	99%
London Tower Hamlets Roadside	1999	5.6	1.0	96%
	2000	4.0	0.8	95%
	2001	2.7	0.6	97%
	2002	2.7	0.5	97%
London Marylebone Kerbside	1999	7.3	1.8	95%
	2000	6.5	2.0	96%
	2001	5.6	1.5	96%
	2002	4.1	1.2	97%
London A3 Roadside	1999	3.3	0.9	97%
	2000	4.7	0.8	97%
	2001	5.5	0.8	98%
	2002	2.4	0.6	97%
Brighton Roadside	1999	3.5	0.7	94%
	2000	*3.0*	*0.7*	65%
	2001	3.2	0.7	95%
	2002	3.3	0.6	97%



(B) Very busy roads and junctions

The criteria for a 'very busy road' have been given as:
>80000 vehicles per day – single carriageway
>120000 vehicles per day – dual carriageway
>140000 vehicles per day – motorways
(junction flows should be added)
IF there is relevant exposure within 10m
IF the background in 2003 is estimated as being above 1mg/m3

Estimated background maps (www.airquality.co.uk/archive/laqm/tools.php) show Dartford has an annual mean background level in 2001 of 0.31 – 0.423mg/m3, which is equivalent to 0.26 – 0.35mg/m3 in 2003. Therefore the background levels do not fit the criteria as they are <1mg/m3. However, there is one road that would fit the remaining criteria for the number of vehicles per day and relevant exposure and that is the A282 Tunnel Approach Road. A DMRB assessment was carried out and this predicts an annual mean carbon monoxide level of 0.52 mg/m3 at the nearest receptor location for 2003.

Conclusion:
The predicted annual mean concentration at the nearest receptor to the busiest road in Dartford is well below the 2mg/m3 level above which detailed assessment is required. The monitoring data shows the 8-hour objective is met when the annual mean is less than 2mg/m3.
It is concluded that there is sufficient evidence not to proceed to a detailed assessment for carbon monoxide.

3.2 Benzene

3.21 Objective

5 ppb 1.5ppb	Running annual mean Annual mean	31 December 2003 31 December 2010

The Objective for benzene has been strengthened since the first round of review and assessment, with the introduction of a new annual mean Objective for 2010 of 1.5ppb.

3.22 Health Effects

Benzene is a volatile organic compound which is known to cause cancer. As such there is no safe level that can be specified for ambient air concentrations of benzene. However, the levels specified in the Objectives are kept as low as practicable and represent only a very small risk to health.

3.23 Sources

The main source of benzene which contributes to ambient pollution levels is road transport and petrol refining and distribution. Petrol-engine vehicles exhausts contribute the major emissions from road transport. In Dartford, road transport contributes 55% of benzene emissions and other transport contributes 31% (NAEI 2000 Inventory).

3.24 Assessment

At a National level, tighter vehicle emissions and fuel quality standards will make a significant contribution to the reduction of benzene levels. Under EU legislation, benzene levels in petrol of up to 5% by volume were allowable prior to 2000. Since 2000, this has reduced to 1% and levels in the UK are approximately 0.7%. Legislation is in place to control emissions from storage and distribution of petrol through vapour recovery. These tighter controls on petrol are reflected in the reductions in measured benzene at monitoring sites throughout the UK. It is expected that the 2003 Objective will be met at all locations, but there is the possibility of roadside/kerbside sites exceeding the tighter 2010 Objective and local measures may be required.

During Dartford's last review and assessment benzene was assessed in Stage 1 and the evidence suggested that the Objective would be met at all locations. No detailed assessment was required. No AQMAs were declared in the UK for the 2003 Objective.

Only local authority areas with major industrial petroleum processes will need to assess the 2003 Objective. Dartford does not come into that category and therefore it is the 2010 Objective which requires consideration.

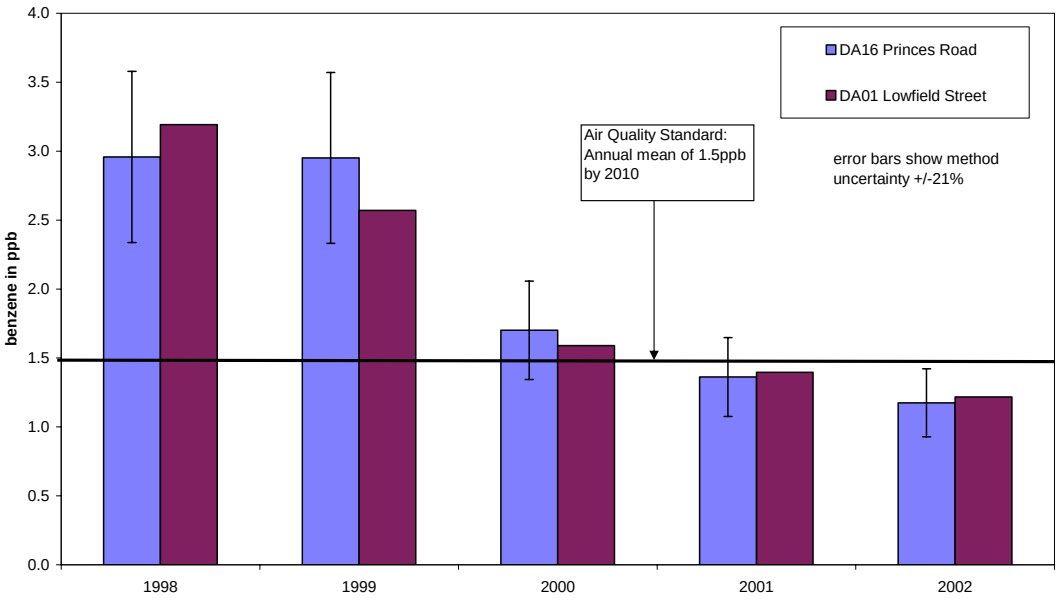
(A) Monitoring data

Two kerbside diffusion tube monitoring sites for benzene have been set up since 1998:

1) Lowfield Street (town centre) – 19000v/d (2002) 5%HGV
2) Princes Road junction – 41000v/d (1999) 4%HGV

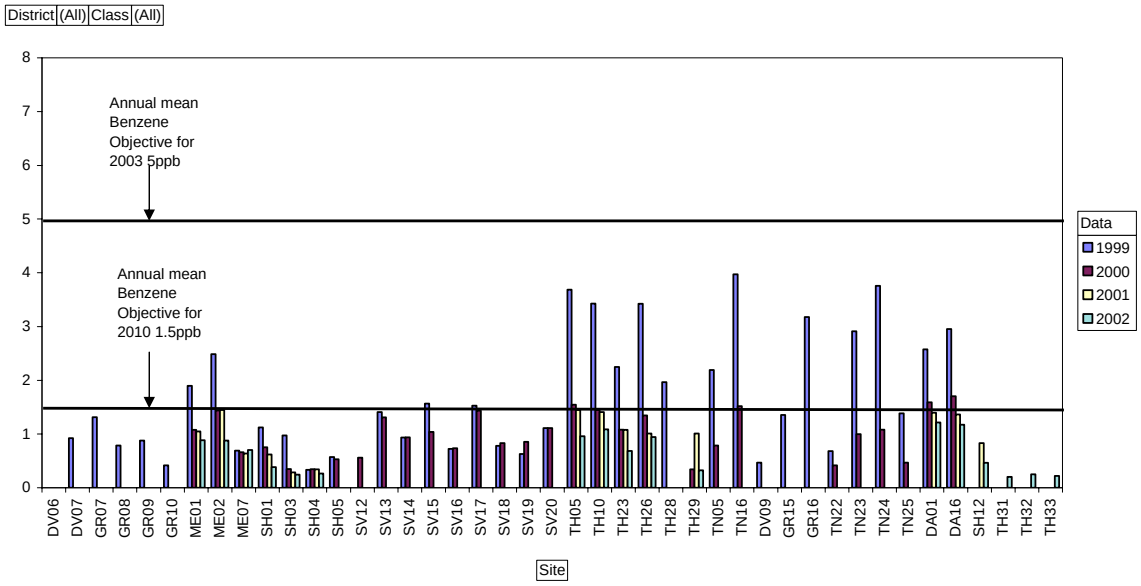
QA/QC	
Monitoring method	VOC sorbent diffusion tube (chromosorb106)
Laboratory for analysis	Gradko International Limited – UKAS accredited and participation in WASP Scheme
Uncertainty of measurement	Laboratory method GLM4 - +/- 21% uncertainty
Limit of detection	2.8 ng
Uptake rate	1.28ng/ppm/min
Monitoring period	Monthly exposure
BTEX ratio	1:2.9:0.64:1.51:0.83 (6 months average). Variation in ratio up to 35%; neither elevated TEX (suggesting not local source) nor one particular compound standing out.

Annual mean benzene concentrations in ppb: Dartford kerbside diffusion tube sites



The results show benzene levels at the kerbside reducing significantly over time and levels are currently below the Objective for 2010.

A similar pattern is seen across the Kent network diffusion tube sites, with all sites meeting the Objective for 2010 as shown in the graph below.



Levels of benzene have decreased significantly across the national automatic network sites and the annual mean Objective for 2010 is being currently met. The most significant reductions are seen at roadside and kerbside locations and levels will reduce still further by 2010.

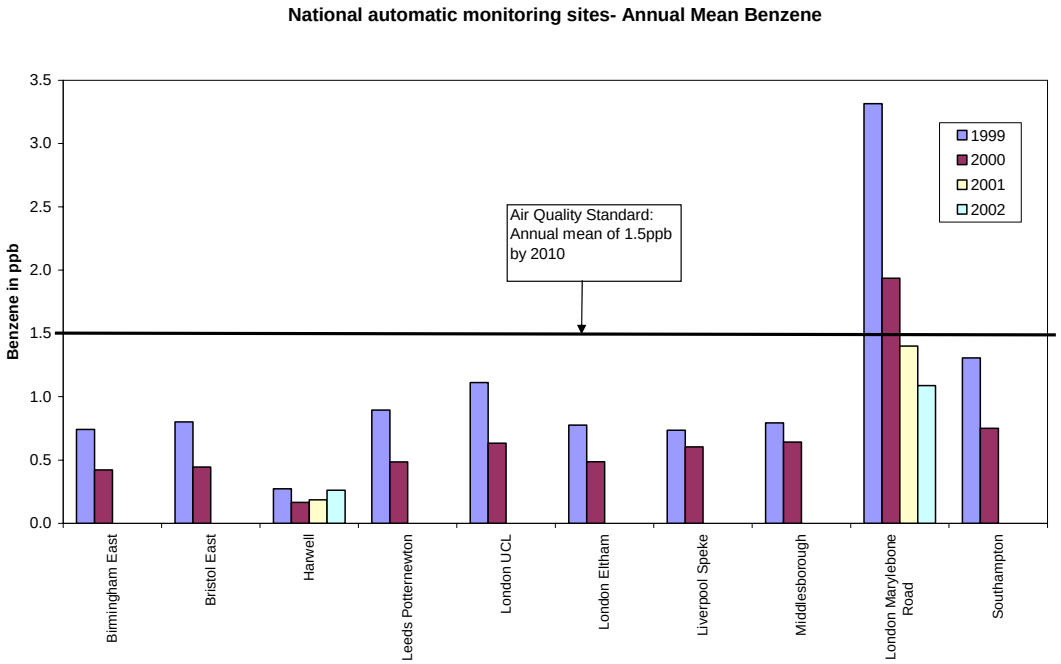


Table 4:

Benzene annual mean in ppb									
Site	**Type**	**1999**	**%data capture**	**2000**	**%data capture**	**2001**	**%data capture**	**2002**	**%data capture**
Birmingham East	Urban Background	0.74	86	0.42	92				
Bristol East	Urban Background	0.80	92	0.44	89				
Harwell	Rural	0.27	89	0.16	93	0.19	93	0.26	82
Leeds Potternewton	Urban Centre	0.89	77	0.48	90				
London UCL	Roadside	1.11	93	0.63	86				
London Eltham	Urban background	0.78	94	0.49	86				
Liverpool Speke	Urban background	0.73	82	0.60	88				
Middlesborough	Urban industrial	0.79	98	0.64	91				
London Marylebone Road	Kerbside	3.31	80	1.94	90	1.40	85	1.09	96
Southampton	Urban centre	1.31	95	0.75	86				

(B) Very Busy Roads or Junctions

The criteria for a 'very busy road' have been given as:

- >80000 vehicles per day – single carriageway
- >120000 vehicles per day – dual carriageway
- >140000 vehicles per day – motorways

(junction flows should be added)
IF there is relevant exposure within 10m
IF the background in 2010 is estimated as being above 2ug/m3.

Estimated background maps (www.airquality.co.uk/archive/laqm/tools.php) show Dartford has an annual mean background level in 2001 of 0.498 – 0.774ug/m3 and 0.34 – 0.508ug/m3 in 2010. Therefore the background levels do not fit the criteria as they are <2ug/m3. However, as with the carbon monoxide assessment, there is one road that would fit the remaining criteria for the number of vehicles per day and relevant exposure: the A282 Tunnel Approach Road. A DMRB assessment was carried out and this predicts an annual mean benzene level of 0.76 ug/m3 at the nearest receptor location for 2010. This is well below the annual mean Objective of 1.5ug/m3 for 2010.

(C) Industrial sources

There are no significant industrial processes in the Borough, such as petrochemical or carbonisation works or petrol terminals, which will give rise to significant quantities of benzene.

The only relevant processes in the checklist (Annex2) are combustion processes (Authorised IPPC processes: LittleBrook Power Station, GlaxoSmithKline, ArjoWiggins), but this is shown as having very small contributions. The emissions inventory for Dartford (NAEI 2000) shows no point source emissions of benzene.

The nearest petrol terminals to Dartford are in the Borough of Thurrock across the Thames; the nearest being 700m outside the Borough.

(D) Petrol Stations

Emissions of benzene from petrol stations with a large throughput of petrol may be sufficient to put the 2010 Objective at risk, if there is heavy traffic on roads nearby. The criteria for such petrol stations are:

- Annual throughput of petrol >2000m3
- Nearby busy road with >30000 vehicles/day
- Relevant exposure within 10m of the pump

There are two petrol stations which fit the first two criteria:
ESSO Springhead Service Station (adjacent to the A2 – 108000 vehicle/day)
ESSO Winston Service Station (adjacent to Junction 1B of the A282 – 40000 vehicles/day)

However, there is no relevant exposure within 10m of the pump for either location.

(E) Major fuel storage depots

There are no major fuel storage depots handling petrol within the Borough or bordering the Borough boundary.

Conclusion:

There are no major industrial petroleum processes in the Borough which warrant further consideration of the 2003 Objective. Measured and predicted levels in Dartford show that this Objective will be met at all locations.

With regard to the 2010 Objective, there are no significant industrial sources of benzene. The predicted annual mean concentration at the nearest receptor to the busiest road in Dartford is well below the 1.5ug/m3 Objective for 2010. The monitoring data within and outside the Borough show no exceedences of the annual mean Objective for 2010 at kerbside locations. As levels will be reduced even further by 2010, the Objective is expected to be met at all locations.
It is concluded that there is sufficient evidence not to proceed to a detailed assessment for benzene.

3.3 1,3 – Butadiene

3.31 Objective

2.25ug/m3 (1 ppb)	Maximum running annual mean	To be met by 31 December 2003

3.32 Health Effects

1,3 – Butadiene, like benzene, is a volatile organic compound which is known to cause cancer. As such there is no safe level that can be specified for ambient air concentrations of 1,3 - Butadiene. However, the level specified in the Objective is kept as low as practicable and the risk to health is exceedingly small.

3.33 Sources

The main source of 1,3 - Butadiene which contributes to ambient pollution levels is petrol-engine vehicles exhausts and industrial processes using 1,3 – Butadiene e.g. synthetic rubber manufacture. In Dartford, road transport contributes 74.5% of 1,3 – Butadiene emissions and other transport contributes 13.6% (NAEI 2000 Inventory). There are no industrial point sources of 1,3 – Butadiene in Dartford.

3.34 Assessment

At a National level, tighter vehicle emissions and fuel quality standards will make a significant contribution to the reduction of 1,3 - Butadiene levels. These tighter controls on petrol as well as the increasing number of vehicles equipped with three way catalysts are reflected in the reductions in measured 1,3 - Butadiene at monitoring sites throughout the UK. Only authorities with relevant exposure in the vicinity of a major industrial process using or storing 1,3 – Butadiene are expected to proceed beyond a USA assessment for this pollutant, as the Objective should be met at all other locations.

During Dartford's last review and assessment 1,3 - Butadiene was assessed in Stage 1 and the evidence suggested that the Objective would be met at all locations. No detailed assessment was required. No AQMAs were declared in the UK for the 2003 Objective.

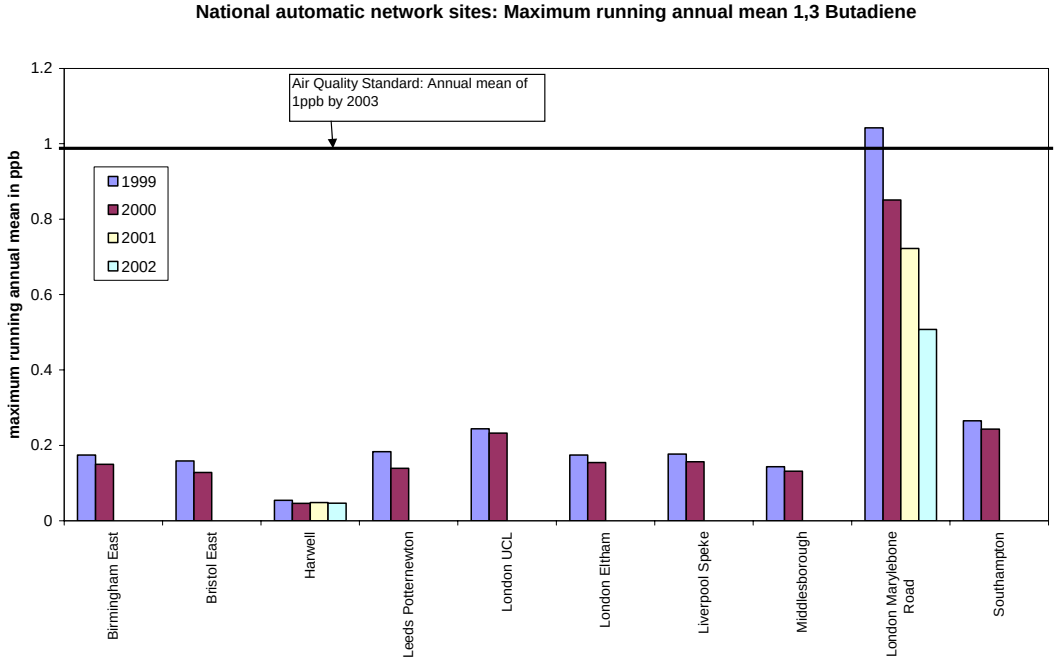
(A) Monitoring data

There are no monitoring sites for 1,3 – Butadiene in the Borough of Dartford or within the Kent monitoring network. Monitoring data for 1999 – 2002 for sites within the National network are shown below. A significant reduction in 1,3 – Butadiene can be seen at the busy kerbside location Marylebone Road with the reduction in emissions from traffic. All sites meet the annual mean Objective for 2003. It is expected that the London monitoring sites will be comparable with urban areas of Dartford, and the estimated

background for 2003 is 0.08 – 0.13ppb which compares favourably to the range of background monitoring site types shown in table 5.

Table 5:

1,3 Butadiene in ppb									
Maximum running annual mean									
Site	**Type**	**1999**	**%data capture**	**2000**	**%data capture**	**2001**	**%data capture**	**2002**	**%data capture**
Birmingham East	Urban Background	0.17	86	0.15	92				
Bristol East	Urban Background	0.16	93	0.13	89				
Harwell	Rural	0.05	89	0.05	93	0.05	93	0.05	23
Leeds Potternewton	Urban Centre	0.18	77	0.14	93				
London UCL	Roadside	0.24	93	0.23	87				
London Eltham	Urban background	0.17	95	0.15	86				
Liverpool Speke	Urban background	0.18	80	0.16	87				
Middlesborough	Urban industrial	0.14	97	0.13	91				
London Marylebone Road	Kerbside	1.04	79	0.85	91	0.72	86	0.51	96
Southampton	Urban centre	0.26	96	0.24	86				



(B) & (C) Industrial sources – new or substantially increased emissions

Annex 2 checklist shows a list of relevant industrial sources with the potential to emit significant quantities of 1,3 – Butadiene. There are no significant industrial sources of 1,3 – Butadiene in the area.

The only relevant processes in the checklist (Annex2) are combustion processes (Authorised IPPC processes: LittleBrook Power Station, GlaxoSmithKline, ArjoWiggins), but this is shown as having very small contributions. The emissions inventory for Dartford (NAEI 2000) shows no point source emissions of 1,3 - Butadiene.

Conclusion:

Monitoring data from the National network show no exceedences of the annual mean Objective for 2003 at all locations, including busy roadsides, since 1999 and levels are falling over time. Comparison with measured background levels and estimated background levels for Dartford for 2003 suggest that levels in Dartford will similarly be well below the 2003 Objective. There are no significant major industrial sources in the area which would warrant further consideration.
It is concluded that there is sufficient evidence not to proceed to a detailed assessment for 1,3 - butadiene.

3.4 Lead

3.41 Objective

0.5μg/m^3	Annual mean	To be met by 31 December 2004
0.25μg/m^3	Annual mean	To be met by 31 December 2008

The Objective for lead has been strengthened since the first round of review and assessment, with a new tighter annual mean Objective for 2008 of 0.25ug/m3.

3.42 Health Effects

Children are the most sensitive to lead poisoning. The greatest cause of concern is the exposure to lead by young children who may result in behavioural problems, lower learning ability and lack of concentration.

3.43 Sources

Most of the airborne emissions of lead in the UK pre 2000 were from petrol engine motor vehicles. Leaded petrol was banned in the UK with effect from 1st January 2000 and this has resulted in significant reductions of lead emissions. The main source of emissions of lead is now from industrial activity, such as battery manufacture and non-ferrous metal production and foundry processes.

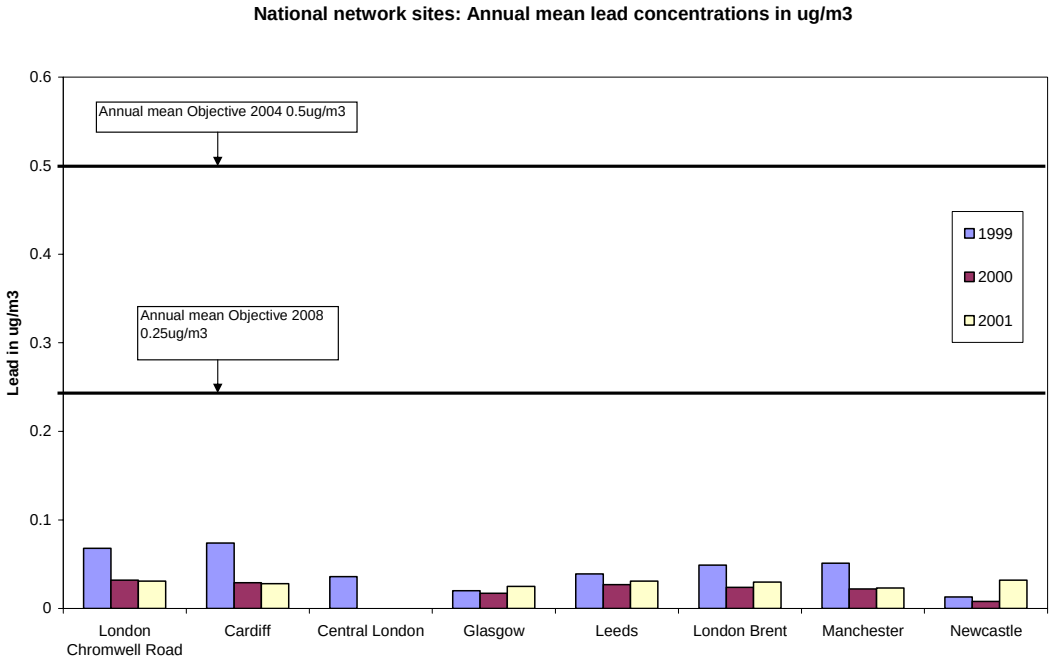
3.44 Assessment

At a National level, the EU Auto-oil Programme has delivered significant reductions in lead through the banning of leaded petrol. Emissions of lead are now restricted to relevant locations in the vicinity of major industrial processes that emit significant quantities of lead. Measured data shows that kerbside and background sites will meet the Objective for 2004 and 2008, but there may be exceedences in the vicinity of a major industrial plant. Detailed assessment will only be required where relevant major industrial processes are present.

In the first round of review and assessment, lead was assessed in Stage 1 and there was sufficient evidence to suggest that the 0.5ug/m3 Objective would be met. No detailed assessment was required. There have been no AQMAs in the UK for lead in the first round of review and assessments.

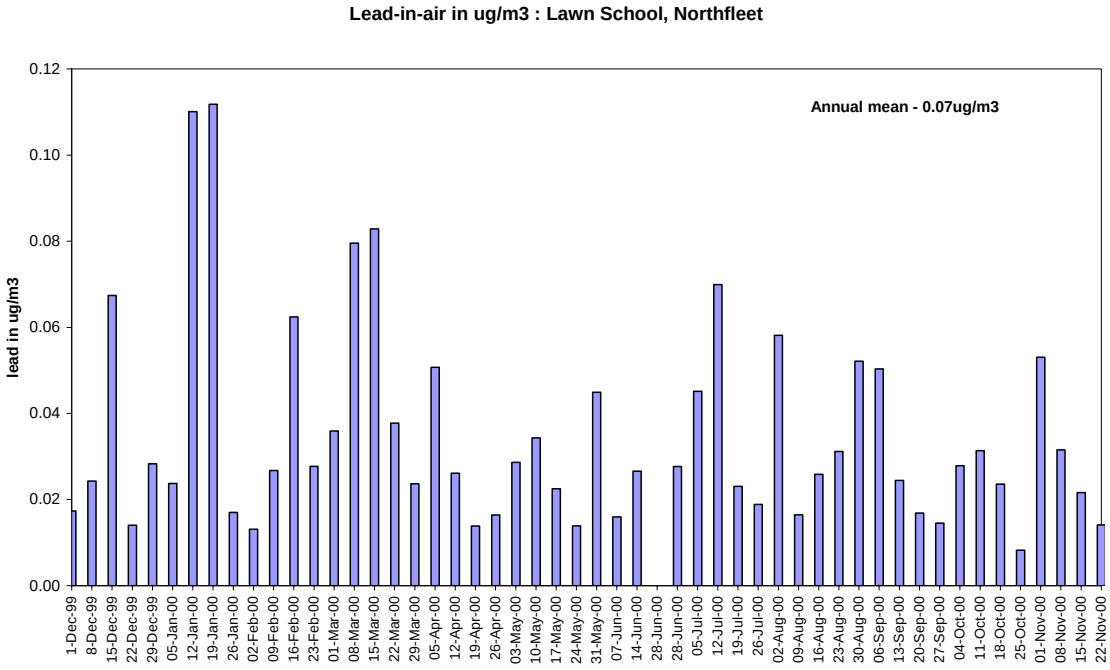
(A) Monitoring data

There are no monitoring sites for lead in Dartford. Data has therefore been considered from the national network sites, which are likely to be comparable with locations in Dartford. The chart below shows kerbside and urban background sites in the national network – all these sites are well below the Objectives for 2004 and 2008.



A 12 month monitoring study has been undertaken in 1999-2000 in neighbouring borough Gravesham, as part of the DEFRA heavy metal's survey, in the vicinity of Britannia Refined Metals Limited which operates a lead refinery and lead-acid battery recycling facility. The monitoring was undertaken at an industrial background site in a

nearby school and the results are shown in the graph below. The annual mean of 0.07ug/m3 is well below the Objectives for 2004 and 2008.



(B) & (C) Industrial Sources – new and substantially increased emissions

There are no industrial processes in the Borough which emit significant quantities of lead.

The nearest lead process is Britannia Refined Metals (BRM) Limited in the neighbouring borough of Gravesham, which is approximately 500m from the nearest relevant exposure in Dartford. The NAEI emissions inventory (2000) shows emissions of lead of 2.4 tonnes from this process. The immediate area around this plant is an industrial estate in Northfleet. As part of their IPPC Application, an air quality assessment (December 2001) was carried out using ADMS dispersion modelling. This showed that the contribution of airborne lead from the process was confined to the immediate vicinity of the plant, within the industrial estate where there were no sensitive receptors. The maximum contribution to the annual mean at ground level was predicted as 0.9ug/m3. The maximum contribution to the annual mean at the nearest sensitive receptor was predicted as 0.029ug/m3. When added to the estimated background levels in the area of 0.04ug/m3 (urban background sites in the National network range from 0.008 – 0.032ug/m3 between 2000 – 2001) this gives an annual mean of 0.069ug/m3 which is below the Objectives for 2004 and 2008.

Conclusions:

The monitoring results from the National network (urban background and kerbside sites) and from the heavy metal survey in Gravesham show that the Objectives for 2004 and 2008 are already being met at these sites. With no industrial processes for lead in the

area, it is expected that the levels in Dartford would largely be comparable and the Objectives will be met. The industrial process, BRM, in the neighbouring borough Gravesham has been assessed through modelling and monitoring requirements of their IPPC permit and the levels at the nearest sensitive receptors are predicted as being below the Objectives for 2004 and 2008, although levels will be slightly elevated above background levels.

It is concluded that there is sufficient evidence not to proceed to a detailed assessment for lead.

3.5 Nitrogen dioxide

3.51 Objectives

200μg/m^3 * not to be exceeded more than 18 times a year	1 hour mean	To be met by 31 December 2005
40μg/m^3*	annual mean	To be met by 31 December 2005

* These are provisional objectives. EU Limit values for nitrogen dioxide are to be met by 2010.

3.52 Health effects

Nitrogen dioxide causes inflammation of the lungs at high concentrations. Long term exposure may affect lung function and may heighten the response to allergens. People with asthma are the most sensitive to this pollutant.

3.53 Sources

The main source of nitrogen dioxide is combustion process, including road transport emissions and industrial, commercial and domestic combustion emissions. The NAEI emissions inventory (2000) shows road transport accounting for 50% of nitrogen dioxide emissions in the Dartford area, as a whole, but this increases up to 99% in some 1x1km grid squares.

3.54 Assessment

At a National level policy measures have been put in place which has led to the decline in nitrogen dioxide levels from road transport, and commercial industrial sectors. Emissions from road transport will be significantly reduced through reductions in emission limits for new vehicles and through improvements to fuel quality as part of the Auto Oil programme. Industrial sources make only a small contribution to annual mean nitrogen dioxide levels, and this is the Objective which is most difficult to meet. National studies show that there may be exceedences of the annual mean Objective at busy roadsides outside of London in 2005 and 2010. Over 100 AQMAs were declared for nitrogen dioxide (annual mean) in the UK during the first round of review and assessment and 95% of these were due to traffic emissions.

During Dartford's first round of review and assessment, nitrogen dioxide was assessed at Stage 1, 2 and 3. There were exceedences of the annual mean predicted along the A282 Tunnel Approach Road and an AQMA for nitrogen dioxide annual mean has been declared. Since the last review the vehicle emissions factors have been changed and nitrogen dioxide was previously underestimated. Areas that were previously marginally below the Objectives will therefore need to reconsidered, as areas of exceedence may now be predicted for target years.

(A) Monitoring data outside an AQMA

There are 3 automatic monitoring stations at roadside sites in Dartford with chemiluminescent analysers which have been running since 1999, as shown in Table 6.

Table 6 – Site details

Site	Address	Grid Ref	NO_x Analyser
D1	Adjacent to Ightham Cottages, Bean Road, Bean.	558622,172752	API M200A
D2	Corner of Lowfield Street and Instone Road, Dartford	554117,173852	API M200A
D3	Outside 1 Ivy Villas, Station Road, Greenhithe	558460,174671	API M200A

To ensure a high standard of performance of the continuous analysers is maintained, the three sites have undergone an independent 6 monthly audit by AEA Technology (up to 2002) to assess their performance. The audit results for 2000 - 2002 confirm that the analysers are responding well and are in line with the standards maintained for the national AUN monitoring network.

EnviroTechnology carry out routine six monthly servicing of the stations and any necessary emergency call-outs to ensure a data capture rate of 90% as specified in LAQM.TG(03).Two weekly site calibrations are carried out in-house and data is checked daily to keep data loss to a minimum. Kings College ERG download and ratify the data from the sites as network managers for the Kent Air Quality Monitoring Network.

These are supplemented by 22 nitrogen dioxide diffusion sites, 9 within the AQMA. The QA/QC details of the analysis of the tubes are shown in table 7.

Table 7

QA/QC	
Monitoring method	Nitrogen dioxide diffusion tube
Laboratory for analysis	Gradko International Limited – UKAS accredited; participation in AEA NO2 survey QA/QC Scheme and WASP Scheme
Tube preparation	Prior to May 2001 – 50%TEA/water Post May 2001 – 20%TEA/water
Analysis method	Analysed on UVS 003 Cecil
Uncertainty of measurement	+/-7.6%
Limit of detection	0.01ug
Monitoring period	Monthly exposure.

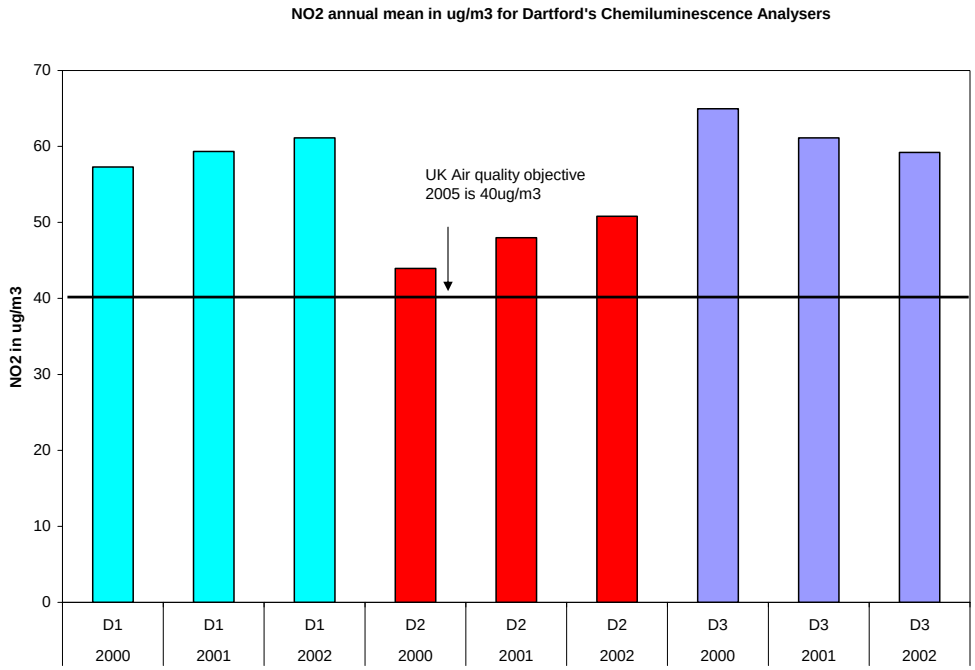
Monitoring results are shown in Table 8 for 2000 – 2002. For the nitrogen dioxide diffusion tube sites, a bias adjustment factor has been used. For 2000, results of the laboratory inter-comparison exercise were used (1.18), but since 2001, results from the co-location of triplicate tubes at D1 automatic station have been used. In 2001, the bias adjustment factor was calculated as 1.21 (diffusion tube bias 17.5% under read) and in 2002, the bias adjustment factor was 1.18 (diffusion tube bias 15% under read).

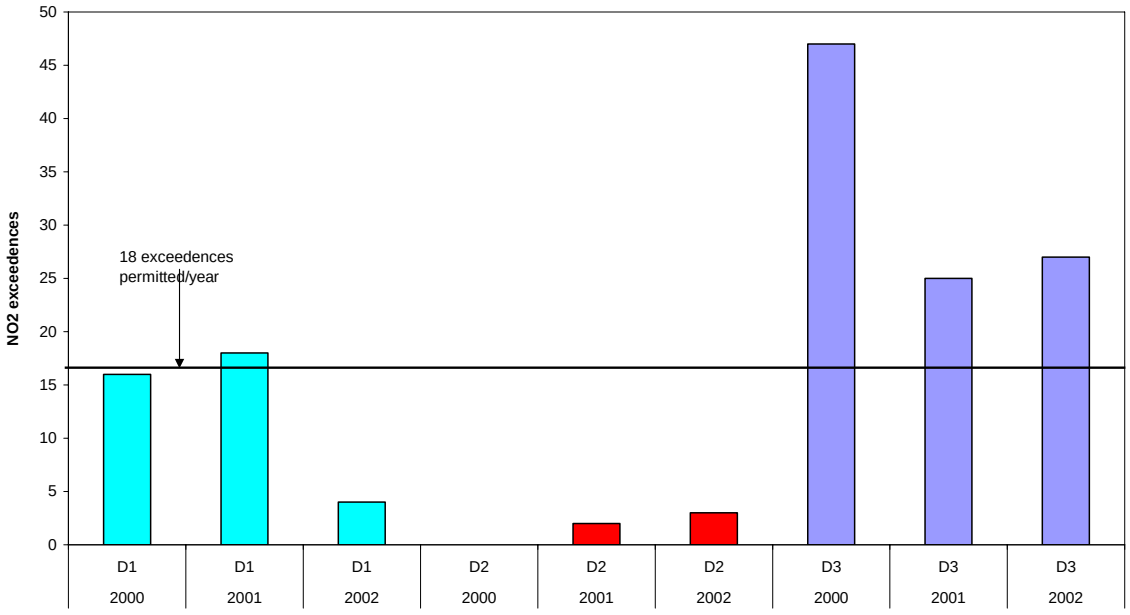
The data for the roadside automatic monitoring sites show that the annual mean standard is not being currently met at all sites and the hourly standard is not being met at the D3 Greenhithe site. The annual means are increasing at two sites (D1 and D2), but decreasing at the D3 site. Projection to 2005 and 2010 show that these sites will fail to meet the 2005 Objective, but the D2 Town centre site may meet the 2010 Objective.

Table 8: Roadside automatic monitoring site data

Year	Site	Pollutant	annual mean	No. exceedences 1 hour	NO2 99.8th percentile	% data capture	2005 (from2000 - 2002 data)	2005 max predicted conc.	2010 max predicted conc.
2000	D1	NO_2 in ug/m3	**57**	16		97	**49**		
2001	D1	NO_2 in ug/m3	**59**	**18**		91	**53**		
2002	D1	NO_2 in ug/m3	**61**	4		99	**56**	**56**	**46**
2000	D2	NO_2 in ug/m3	**44**	0		92	38		
2001	D2	NO_2 in ug/m3	**48**	2		94	**43**		
2002	D2	NO_2 in ug/m3	**51**	3	142	72	**47**	**47**	38
2000	D3	NO_2 in ug/m3	**65**	**47**		98.3	**56**		
2001	D3	NO_2 in ug/m3	**61**	**25**		99	**55**		

2002	D3	NO_2 in ug/m3	**59**	**27**		95	**55**	**56**	**46**
Exceedences are shown in **bold.**									
Percentiles are provided where data capture is less than 90%.									





The results of the diffusion tube survey (Table 9) show that background sites (with the exception of Queens Gardens within the AQMA -50m from A282) currently meet the annual mean Objectives. Roadside sites currently fail to meet the annual mean Objective. Projections to 2005, show that most roadside sites will exceed the annual mean Objective, with the exception of the Dartford Road site. By 2010, many roadside sites are predicted to meet the EU Limit value. There are sites within the AQMA, as well as at busy junctions (A266/B255, Bean interchange, Princes Road/A255) and along busy roads (London Road) where further assessment will be required with regard to levels at nearby sensitive receptors.

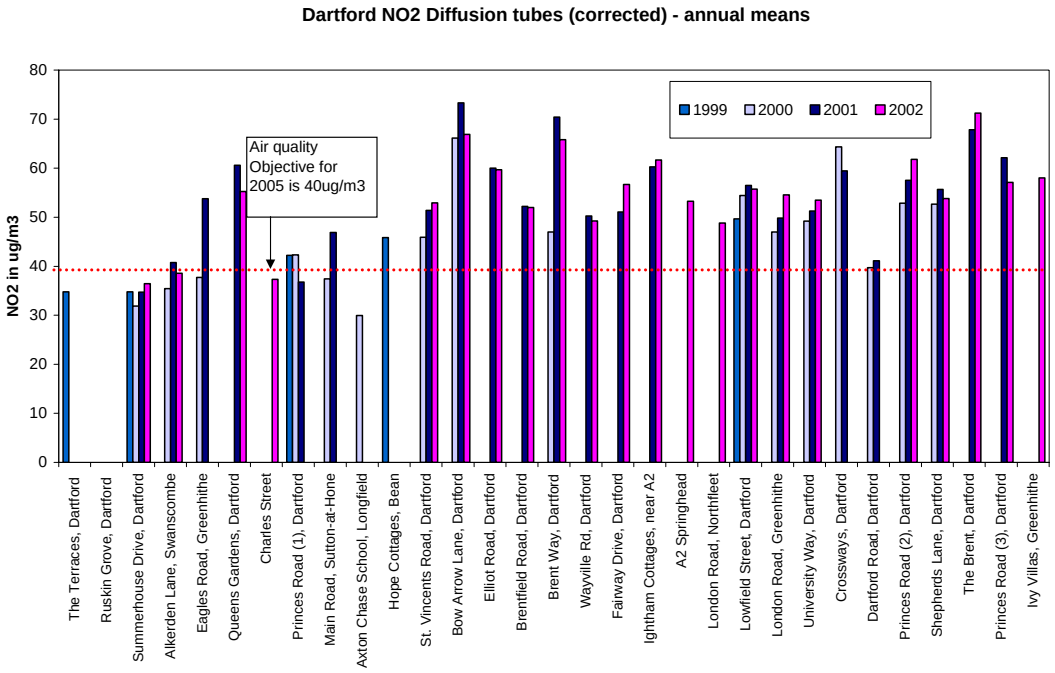
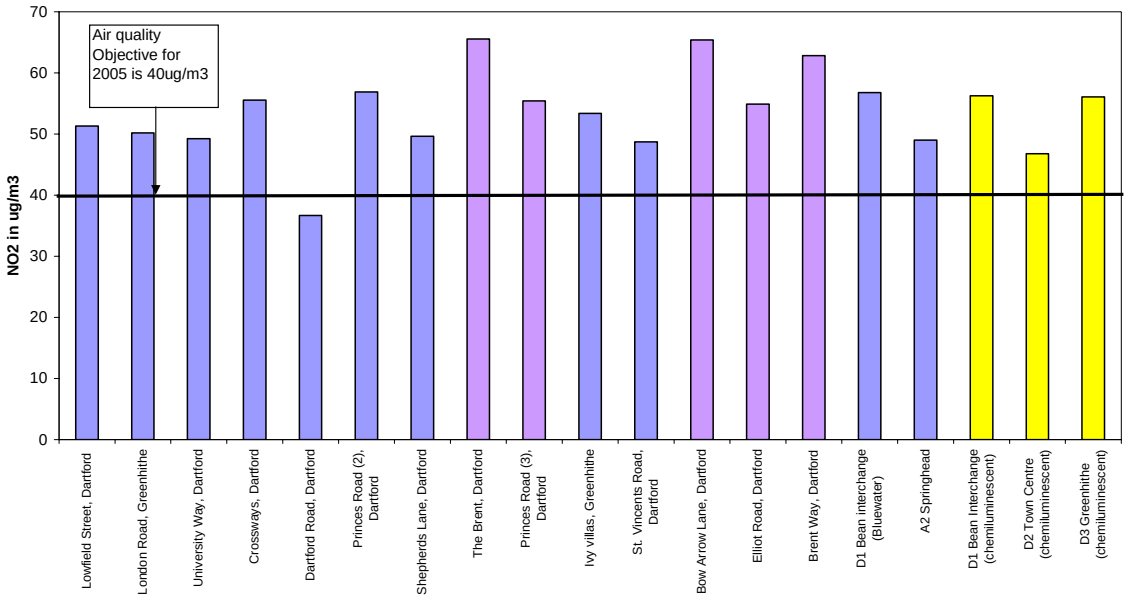


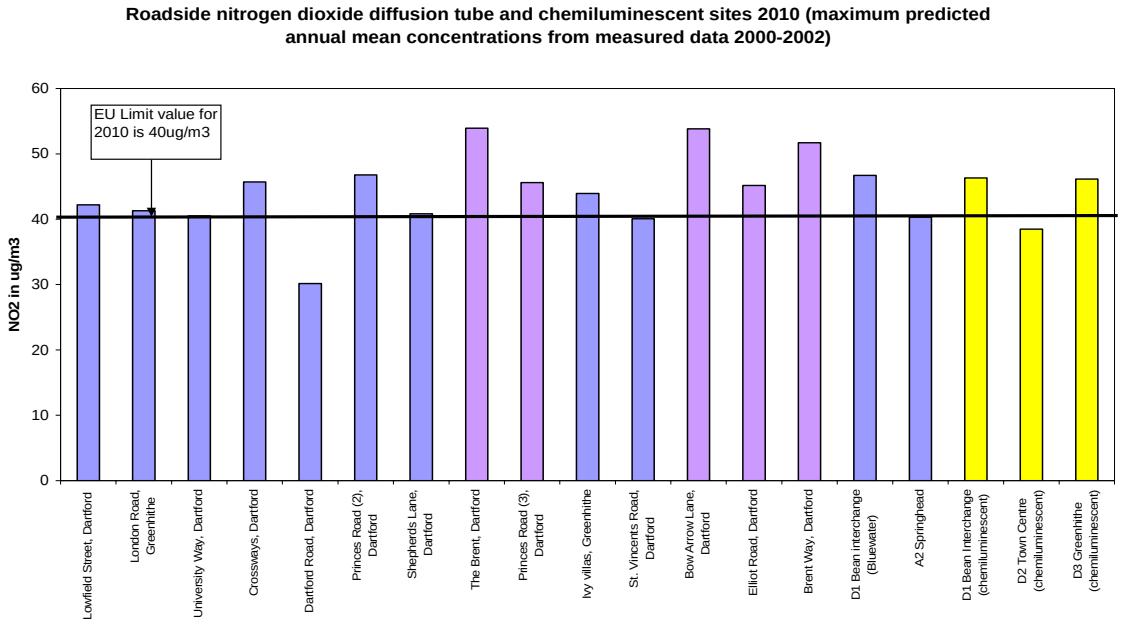
Table 9 – Nitrogen dioxide diffusion tube sites

Ref	x	y	Site	2000	2001	2002	2005(from 2000)	2005(from 2001)	2005(from 2002)	2005 (max predicted conc.)	2010(max predicted conc.)
DA01	554187	173985	Lowfield Street, Dartford	54	56	56	47	50	51	51	42
DA10	559189	174872	London Road, Greenhithe	47	50	55	41	44	50	50	41
DA12	553277	175345	University Way, Dartford	49	51	53	42	46	49	49	41
DA13	556913	175395	Crossways, Dartford	64	59		56	53		56	46
DA15	553232	174274	Dartford Road, Dartford	40	41		34	37		37	30

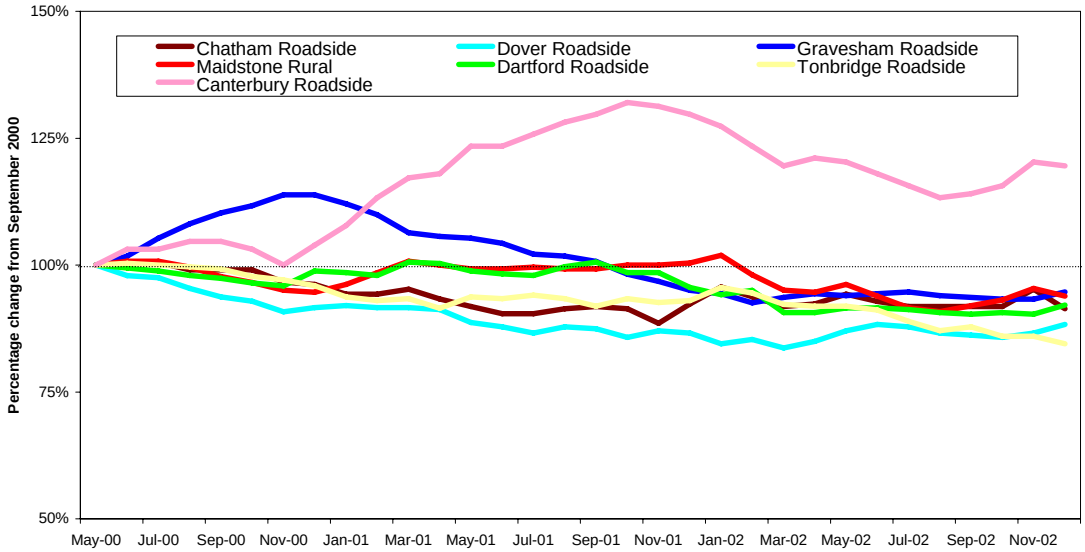
DA16	554108	173318	Princes Road (2), Dartford	53	58	62	46	51	57	57	47
DA17	552732	173689	Shepherds Lane, Dartford	53	56	54	45	50	50	50	41
DA23	555751	173900	The Brent, Dartford		68	71		61	66	66	54
DA26	555880	173365	Princes Road (3), Dartford		62	57		55	53	55	46
DA28	558460	174671	Ivy villas, Greenhithe			58			53	53	44
DA11	555320	173963	St. Vincents Road, Dartford	46	51	53	40	46	49	49	40
DA14	555484	174441	Bow Arrow Lane, Dartford	66	73	67	57	65	62	65	54
DA20	555660	174863	Elliot Road, Dartford		60	60		54	55	55	45
DA22	555600	174030	Brent Way, Dartford	47	70	66	41	63	61	63	52
DA05	558578	172821	D1 Bean interchange (Bluewater)		60	62		54	57	57	47
DA29	561421	172716	A2 Springhead			53			49	49	40

Roadside nitrogen dioxide diffusion tube and chemiluminescent sites 2005 (maximum predicted annual mean concentrations from measured data 2000-2002)

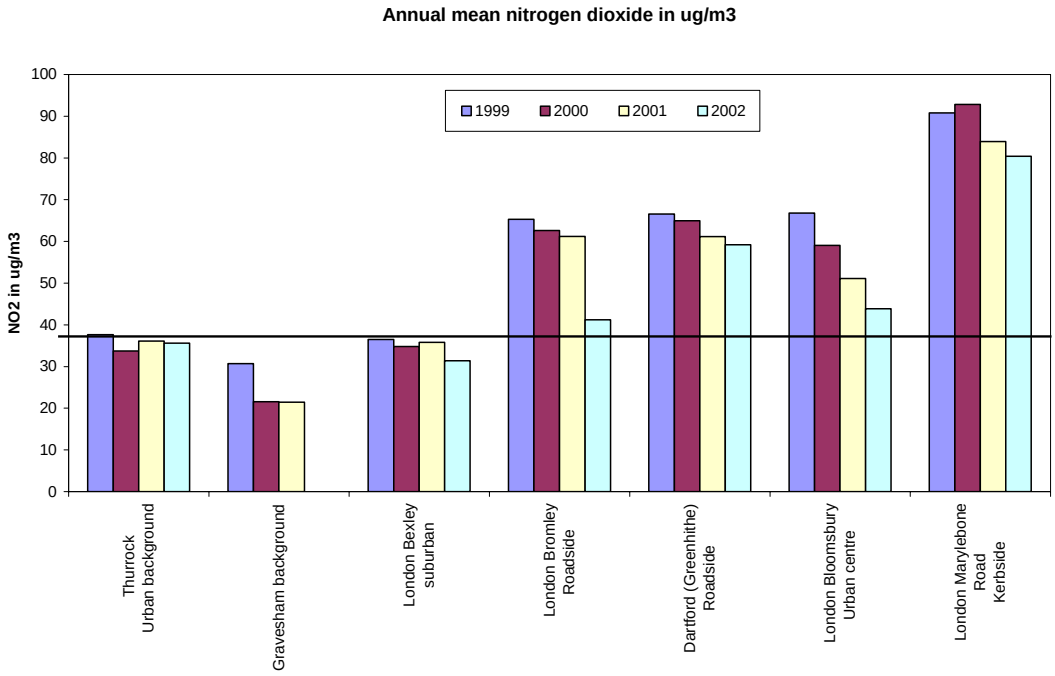




The graph below shows the overall trends in nitrogen dioxide at roadside sites in Kent since 2000. At the majority of sites, levels can be seen to be decreasing over time.



Dartford currently has no background automatic monitoring sites, but sites in neighbouring Boroughs Gravesham, Thurrock and Bexley show that nitrogen dioxide levels are below the annual mean Objective. At roadside sites in the National network, similarly to Dartford (Greenhithe) roadside site, levels are above the Objective, but the levels are decreasing over the period 1999 - 2002.



(B) Monitoring data within an AQMA

Apart from the 9 nitrogen dioxide diffusion tube sites within the AQMA (as shown above), a portable Streetbox NO_2 analyser, supplied and calibrated by Learian Designs Limited has been used to monitor nitrogen dioxide levels. This was co-located with automatic analysers prior to its establishment in the AQMA to establish a bias correction factor. One of the automatic air quality monitoring stations is being relocated into the AQMA this year to provide more detailed and accurate information within this area of predicted exceedence for nitrogen dioxide.

The diffusion tube results within the AQMA show that levels are currently above the Objective level and at the roadside sites projection to 2005 and 2010 shows there will still be exceedences.

The Streetbox co-location with the chemiluminescent analyser is shown below. The Streetbox is a screening tool which overestimates nitrogen dioxide levels. A bias adjustment factor of 0.78 was applied to the data. The results of periodic monitoring undertaken at 3 sites during 2002 are shown in Table 10 below. All estimated annual means are above the annual mean Objective. The highest levels are at Elliot Road, on the west side of the A282 near junction 1a where queuing up to the Dartford Crossing tolls often occurs.

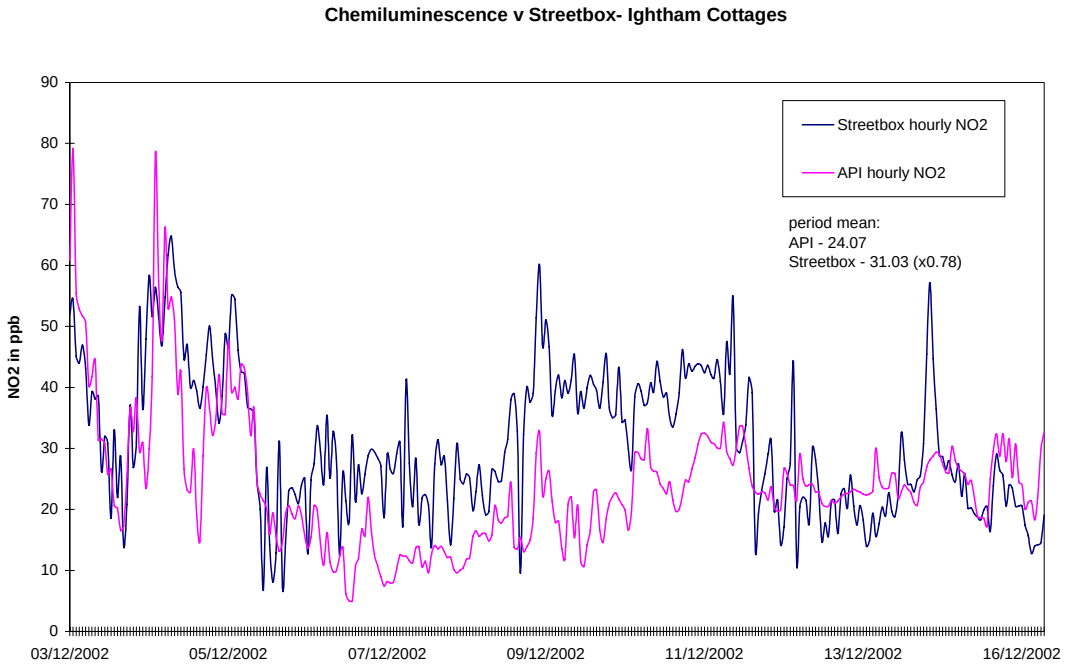


Table 10 – Streetbox nitrogen dioxide periodic monitoring data

Short term site	Long term site	Annual mean 2001	Period mean 2002	Ratio
Queens Gardens		Estimated: 0.987 x 34= **33.6**	34	
	D1	31	30	1.033
	D3	32	34	0.941
	average			0.987
Elliot Road		Estimated: 0.964 x 50=**48.1**	50	
	D1	31	36	0.861
	D3	32	30	1.067
	average			0.964
Brent Way		Estimated: 1.29 x 27=**34.8**	27	
	D1	31	21	1.476
	D3	32	29	1.103
	average			1.29

The monitoring data within the AQMA support the need for a detailed assessment for nitrogen dioxide.

(C) Narrow Congested Streets

Narrow congested streets were considered in the first round of review and assessments. Dartford town centre one way system could be classed within this category. Measured levels of nitrogen dioxide at the D2 Town Centre (Lowfield Street) roadside monitoring

site suggest that the hourly Objective will be met, but not the annual mean Objective for 2005.

There is relevant exposure on Instone Street/Highfield Street 5m from the roadside. A DMRB assessment has been undertaken which predicts annual mean levels of 41.3ug/m3 in 2005. The predicted level is greater than the annual mean Objective for 2005 and therefore progression to a detailed assessment is required.

(D) Junctions

Busy junctions were not considered to have been assessed adequately during the first round of review and assessments and therefore warrant further consideration. DMRB model assessments have been carried out at relevant junctions.

The criteria for a busy junction are:

- >10000 vehicles per day
- AND exposure within 10m of the kerb

The following junctions have >10000 vehicles per day *and* relevant exposure:

- A226 East Hill/The Brent/St Vincents Road/Watling Street

DMRB (2005) – **40.8ug/m3**

- Princes Road/A225 Lowfield Street

DMRB (2005) – **41.1ug/m3**

- Princes Road/Heath Lane

DMRB (2005) – 39ug/m3

- A226 East Hill/Park Road

DMRB (2005) – **42.3ug/m3**

A226 / St Vincents Road/Watling Street junction, Princes Road/A225 Lowfield Street junction and A226/Park Road junctions should be progressed to a detailed assessment for nitrogen dioxide.

(E) Busy streets where people may spend an hour or more close to traffic

Dartford town centre high street is pedestrianised, but there are shops along the one way system through Dartford which has greater than 10000 per day e.g. the Priory Centre on Lowfield Street. However, it is unlikely that people would spend an hour or more close to the roadside and roadside monitoring at the D2 Town Centre site on Lowfield Street shows the 1 hour Objective is already being met.

(F) Roads with high flows of buses and or HGVs

High flows of buses/HGVs is taken as >25% of the vehicle composition.
The only locations where this criterion is met is at J1a of the A282 and Littlebrook Way, where there is Crossways industrial estate, Dartford ferry terminal and Littlebrook Power Station Complex. There is no relevant exposure in these locations.

(G) New roads

There are no new roads constructed since the last review. It is expected that there will be new roads to be considered during the next review, once major developments such as Eastern Quarry, Dartford Park and Ebbsfleet achieve planning approval.

Proposals for dualling of Thames Road in the neighbouring borough of Bexley show a predicted increase of traffic of 13% along University Way. An air quality assessment undertaken as part of the proposal indicated that the annual mean Objective would be marginally breached at the nearest receptor. This will require further assessment at the detailed stage.

(H) Roads close to the Objective in the first round

Roads identified as marginally meeting the annual mean Objective in the first round of assessments (>36ug/m3) include:

- University Way
- London Road (Greenhithe)
- B255/A226 Junction
- Bean Interchange (North junction)

These will require further assessment at the detailed stage due to changes in emissions factors.

(I) Roads with significantly changed traffic flows

Roads with >25% increase in traffic flows and which were previously close to the Objective require assessment.

The A226/B255 Junction has significantly increased its flow since the building of Crossways Boulevard, linking this junction to J1A of the A282 and with the development of Bluewater. Traffic counts available from 1993 – 2000 show an increase in over 50% during this time: 21238 (1993), 24272 (1996), 37203 (1999) and 43407 (2000). This junction is a major node in the area and has been identified as being at risk of exceeding the Objectives.

This junction will require further assessment in the detailed stage.

(J) Bus stations

Large bus stations with sensitive receptor nearby require further consideration. The bus station in Dartford Town Centre consists of a number of bus stops on the way system through Dartford, opposite Central Park, which are not enclosed. There is no relevant exposure within 10m and flows are less than 1000 buses per day. A detailed assessment is therefore not required for nitrogen dioxide at this location.

(K) New Industrial sources

There are no new industrial sources with significant emissions of nitrogen dioxide as per Annex 2 checklist.

(L) Industrial sources with substantially increased emissions

The largest industrial source of nitrogen dioxide emissions in Dartford is IPPC A1 Process Littlebrook Power Station. The emissions have decreased from 910t (2000) to 891t (2001). The air quality assessment for the IPPC Application predicted further reductions over time and no exceedences of the Objectives are expected. Other permitted A1 processes in the area, GlaxoSmithKline and Arjo Wiggins Limited have similarly reduced nitrogen dioxide emissions. It is not expected that emissions from these sources will lead to a breach of the Objectives.

(M) Aircraft

There is no relevant exposure within 1000m of an airport boundary.

Conclusions:

The assessment for nitrogen dioxide has identified a number of traffic related hotspots where potential exceedence of the annual mean Objective may occur. Monitoring information supports the declaration of the current AQMA and projections to 2005 indicate that other roadside sites and busy junctions may exceed the annual Objective. **It is concluded that there is sufficient evidence to proceed to a detailed assessment for nitrogen dioxide.**

3.6 Sulphur dioxide

3.61 Objectives

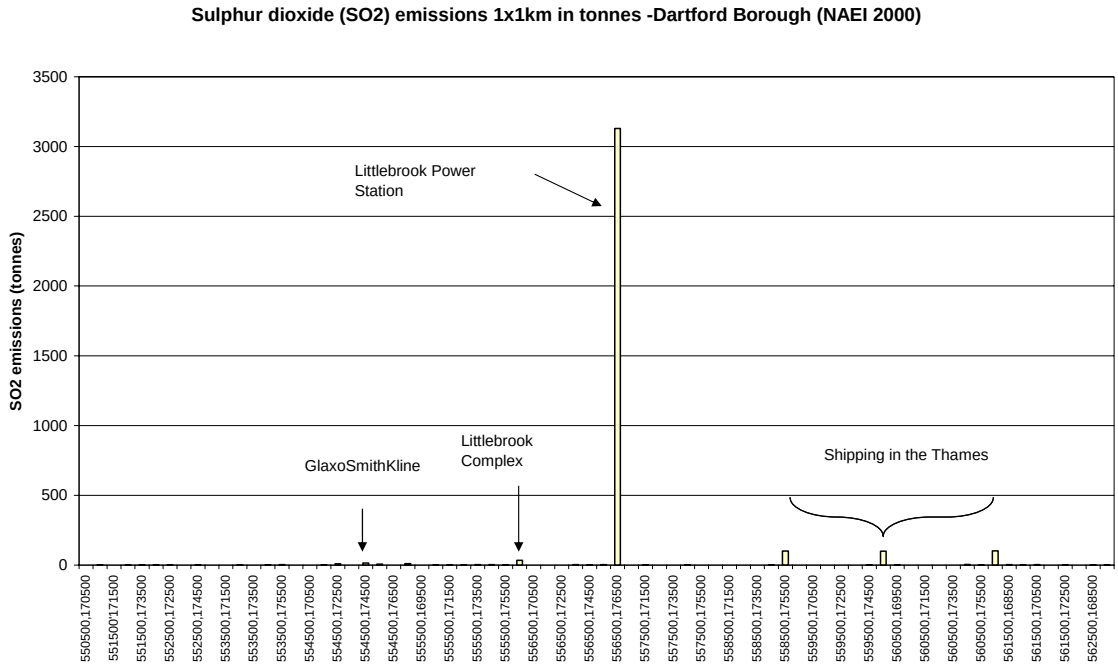
100 ppb not to be exceeded more than 35 times a year	15 minute mean	To be met by 31 December 2005
47 ppb not to be exceeded more than 3 times a year	24 hour mean	To be met by 31 December 2004
132 ppb not to be exceeded more than 24 times a year	1 hour mean	To be met by 31 December 2004

3.62 Health Effects

Sulphur dioxide is an irritant and can cause a feeling of chest tightness and a narrowing of the airways. Those who suffer from asthma are more sensitive than other people and it can aggravate existing chronic lung disease.

3.63 Sources

The main source of sulphur dioxide gas is the combustion of fossil fuels containing sulphur, such as coal and heavy oil. Large scale industrial combustion processes, such as power stations, are the main sources, as well as shipping and commercial and domestic combustion. The NAEI emissions inventory (2000) for Dartford shows 85% of sulphur dioxide emissions are from industrial point sources (largely from Littlebrook Power Station) and 12% from other transport (shipping along the Thames).

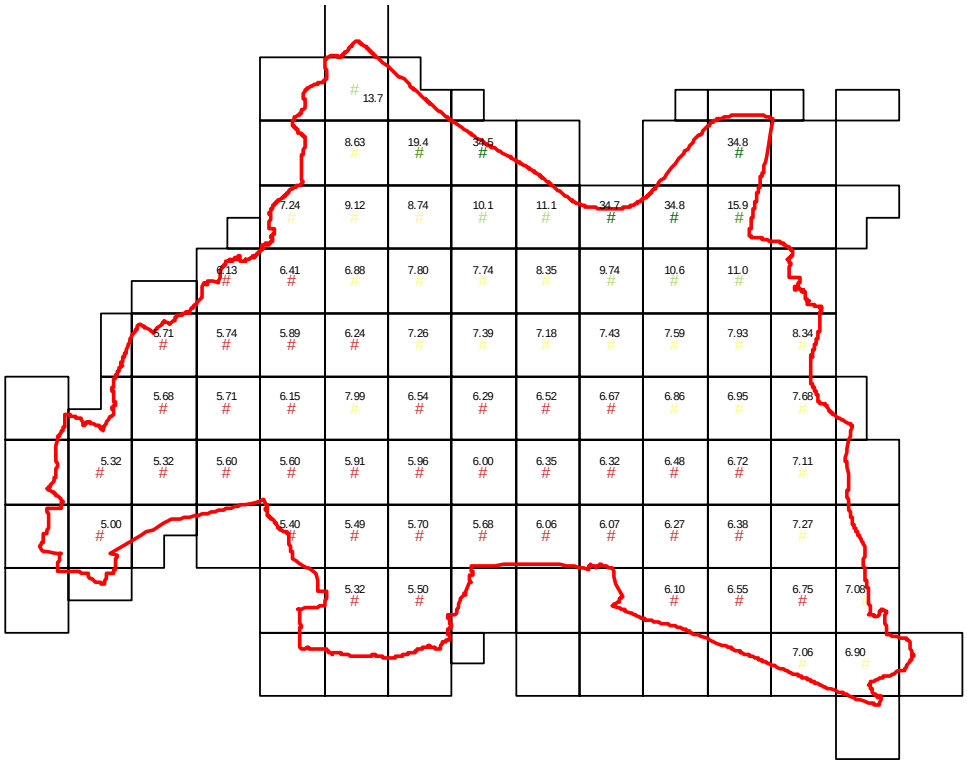


3.64 Assessment

At a National level, the Government is committed to continuing to achieve substantial reductions in sulphur dioxide, through measures targeted at the electricity generation industry and through commitments under the sulphur dioxide protocol. The Environment Agency in 2000 announced new controls on emissions for coal and oil fired power stations which would ensure that coal and oil fired power stations will meet the Objectives for sulphur dioxide. There are not expected to be any exceedences due to power stations alone, but there may be due to coal or oil fired burners, domestic coal burning or shipping. A small number of AQMAs have been declared for sulphur dioxide during the first round of review and assessment.

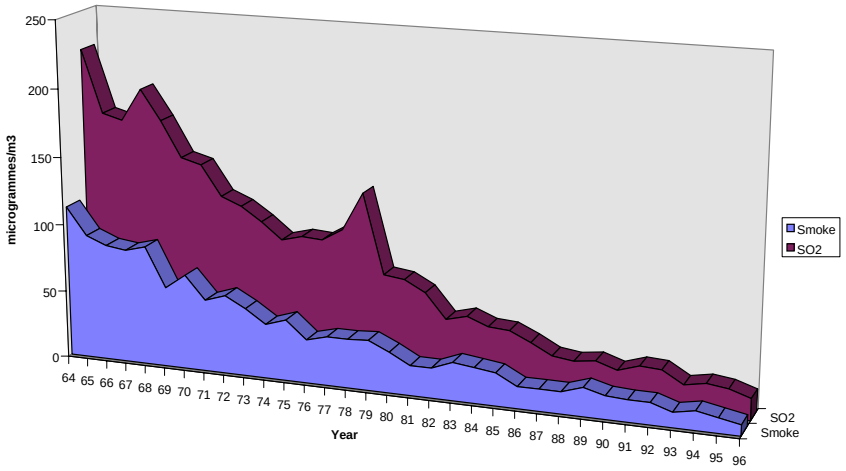
During Dartford's first round of review and assessment, sulphur dioxide was assessed in Stage 1 and 2. The evidence supported no further assessment of sulphur dioxide, as Objectives should be achieved. The main concern was occasional plume grounding from nearby power stations, but it was recognised that this would be rare and unpredictable and governed by prevailing meteorological conditions.

Estimated background data for 2001 indicate variable levels across the Borough from 5 – 34.8 ug/m3 annual mean (average 8.8ug/m3). The higher levels are found in north Dartford which borders the Thames and is largely due to shipping.



(A) Monitoring data

There are currently no monitoring sites for sulphur dioxide in the Dartford area. Historically, monitoring was carried out from 1964 to 1996 using an 8 port bubbler sampler in the town centre. This has been useful in assessing the long term trends of sulphur dioxide in the area.

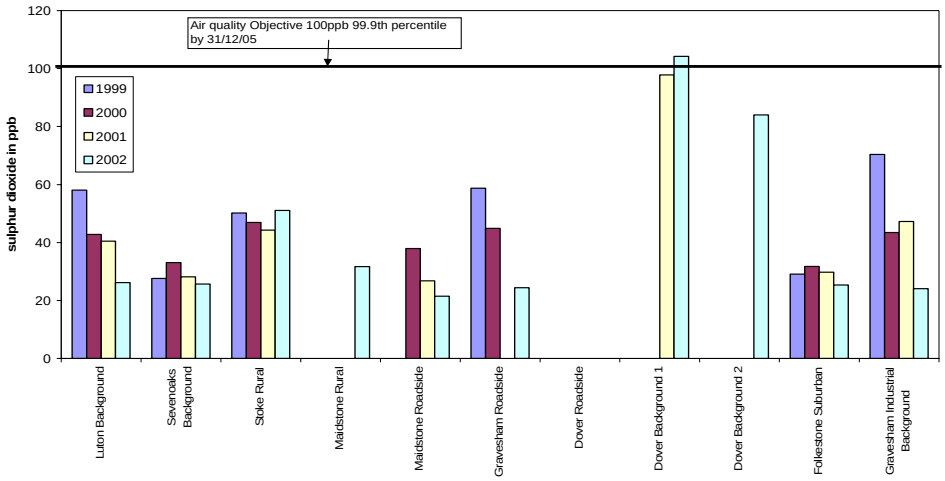


There are a number of locations in the Kent Network, including neighbouring Borough Gravesham, at a range of site types which can be considered as being comparable to locations in Dartford (Table 11 & 12). Dover sites are the exception, being a major port, where sulphur dioxide levels are elevated above those in the rest of Kent and AQMA has been declared. Since 1999, there have been no exceedences of the Objectives for sulphur dioxide, except at Dover where the 15 minute Objective is being exceeded (Table 11).

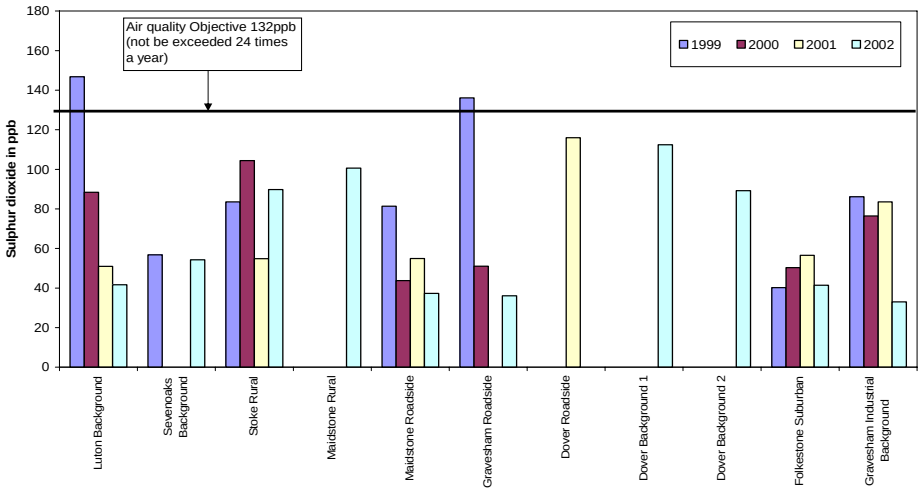
Table 11

Sulphur dioxide - 99.9th Percentile 15 minute means (Objective 100ppb - 99.9th percentile by 31/12/05)									
site	**type**	**1999**	**%data capture**	**2000**	**%data capture**	**2001**	**%data capture**	**2002**	**%data capture**
Luton Background	Urban background	58	87	43	55	40	80	26	77
Sevenoaks Background	Urban background	28	61	33	59	28	74	26	58
Stoke Rural	Rural	50	72	47	75	44	77	51	62
Maidstone Rural	Rural							32	57
Maidstone Roadside	Roadside			38	94	27	92	21	31
Gravesham Roadside	Roadside	59	96	45	55			24	43
Dover Background 1	Urban background					98	71	**104**	88
Dover Background 2	Urban background							84	34
Folkestone Suburban	Suburban	29	92	32	89	30	86	25	85
Gravesham Industrial Background	Industrial	70	94	43	92	47	86	24	82

Kent&Medway Air Quality Monitoring Network: Sulphur dioxide 99.9th percentile 15 minute means



Kent&Medway Air Quality Network Sites: Sulphur dioxide maximum hourly mean in ppb



Kent&Medway Air Quality Monitoring Network - sulphur dioxide maximum 24 hour mean

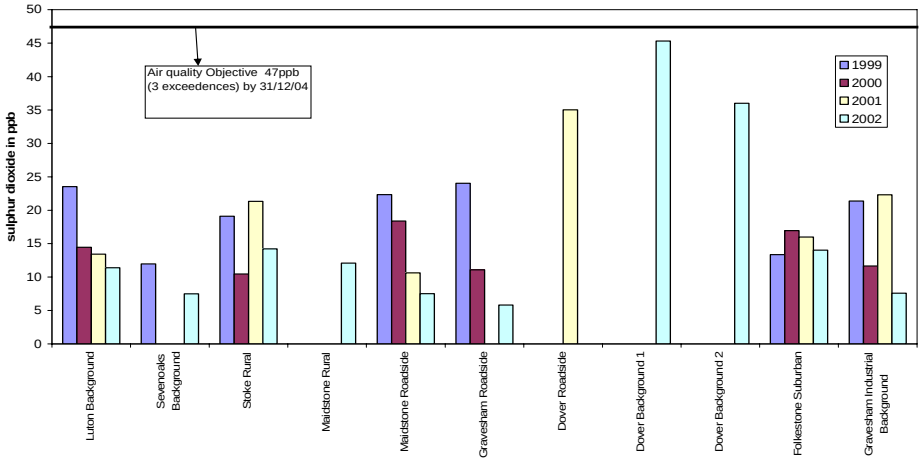


Table 12

Sulphur dioxide - Maximum 1 hour mean (Objective 132ppb - 99.7th percentile by 31/12/04)									
site	**type**	**1999**	**%data capture**	**2000**	**%data capture**	**2001**	**%data capture**	**2002**	**%data capture**
Luton Background	Urban background	**147**	94	88	61	51	86	42	85
Sevenoaks Background	Urban background	57	64					54	65
Stoke Rural	Rural	84	82	104	81	55	84	90	74
Maidstone Rural	Rural							101	59
Maidstone Roadside	Roadside	81	56	44	92	55	92	37	32
Gravesham Roadside	Roadside	**136**	94	51	54			36	44
Dover Roadside	Roadside					116	71		
Dover Background 1	Urban background							112	89
Dover Background 2	Urban background							89	35
Folkestone Suburban	Suburban	40	92	50	87	57	86	41	87
Gravesham Industrial Background	Industrial	86	92	76	90	84	85	33	84
Exceedence of the Standard shown in **bold**									
At Luton and Gravesham Roadside there was 1 exceedence of the Standard in 1999(Hourly Objective for 2004 allows up to 24)									
Sulphur dioxide - Maximum 24 hour mean (Objective 47ppb - 99th percentile by 31/12/04)									
site	**type**	**1999**	**%data capture**	**2000**	**%data capture**	**2001**	**%data capture**	**2002**	**%data capture**
Luton Background	Urban background	24	94	14	61	13	86	11	85
Sevenoaks Background	Background	12	64					7	65
Stoke Rural	Rural	19	82	10	81	21	84	14	74
Maidstone Rural	Rural							12	59
Maidstone Roadside	Roadside	22	56	18	92	11	92	8	32
Gravesham Roadside	Roadside	24	94	11	54			6	44
Dover Roadside	Roadside					35	71		
Dover Background 2	Urban background							36	35
Folkestone Suburban	Suburban	13	92	17	87	16	86	14	87
Gravesham Industrial Backgd	Industrial	21	92	12	90	22	85	8	84

As the Borough of Dartford is in the Thames Gateway, bordering London, relevant sites in the National Network have also been considered, including neighbouring Boroughs Bexley and Thurrock. There have been no exceedences of the 15minute, hourly or 24 hourly Objectives for sulphur dioxide at any of these locations during 1999 – 2002 as shown in the graphs and tables (13 to15) below.

Table 13

Sulphur dioxide - 99.9th percentile 15 minute means (Objective 100ppb - 99.9th percentile by 31/12/05)									
site	**type**	**1999**	**%data capture**	**2000**	**%data capture**	**2001**	**%data capture**	**2002**	**%data capture**
London Bexley	suburban	62	81	48	87	58	72	43	77
London Bloomsbury	Urban background	58	91	56	91	41	90	25	84
London Cromwell Road 2	Roadside	24	92	17	88	18	78	12	68
London Marylebone Road	Kerbside	26	91	31	85	33	81	25	91
Rochester	rural	50	70	45	66	44	75	49	82
Thurrock	urban background	54	82	70	77	50	74	42	62
Exceedence of the Standard shown in **bold**									

National automatic network: sulphur dioxide 15 minute mean 99.9th percentile in ppb

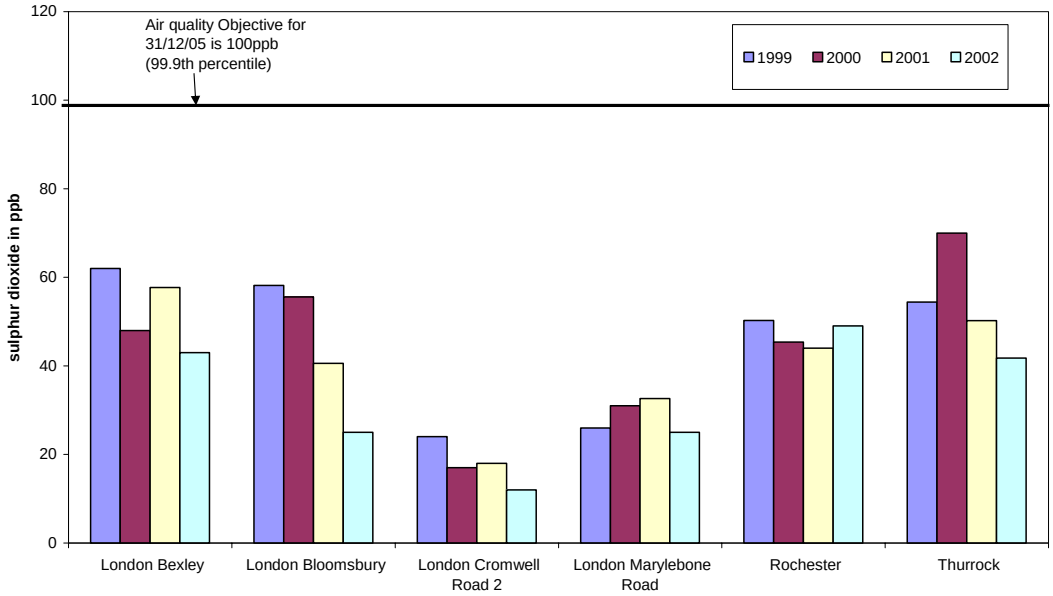


Table 14

Sulphur dioxide - Maximum 1 hour mean (Objective 132ppb - 99.7th percentile by 31/12/04)									
site	**type**	**1999**	**%data capture**	**2000**	**%data capture**	**2001**	**%data capture**	**2002**	**%data capture**
London Bexley	suburban	125	88	70	92	92	77	50	82
London Bloomsbury	Urban background	79	95	70	96	50	92	28	88
London Cromwell Road 2	Roadside	31	95	22	91	25	82	24	79
London Marylebone Road	Kerbside	47	93	39	61	51	83	35	92
Rochester	rural	83	75	75	70	55	78	88	86
Thurrock	urban background	66	85	91	82	69	79	73	68
Exceedence of the Standard shown in **bold**									

National network sites: Maximum hourly sulphur dioxide in ppb

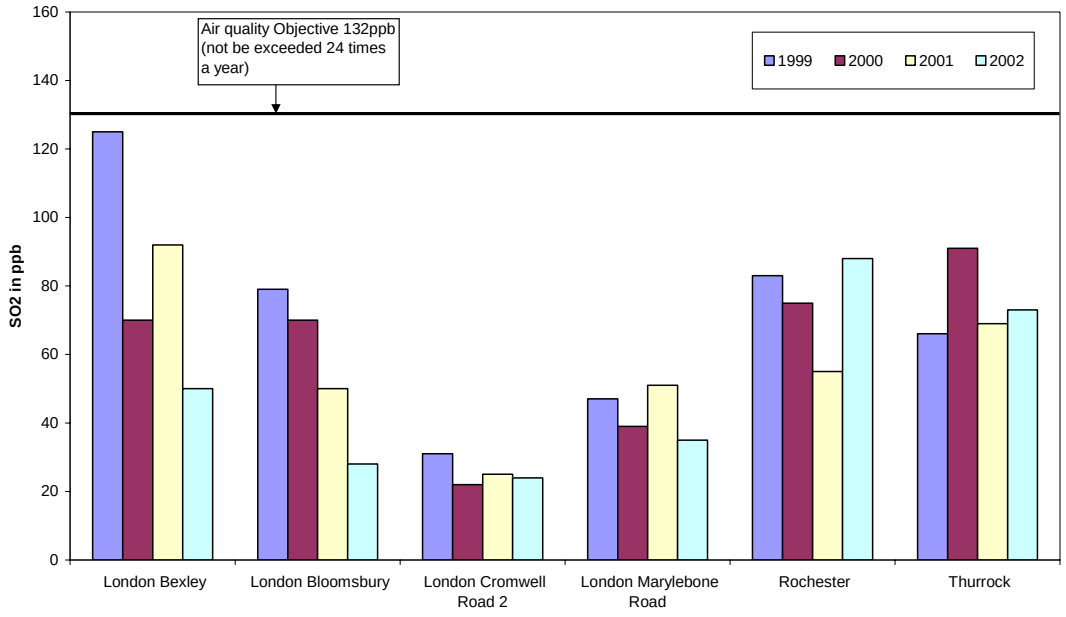
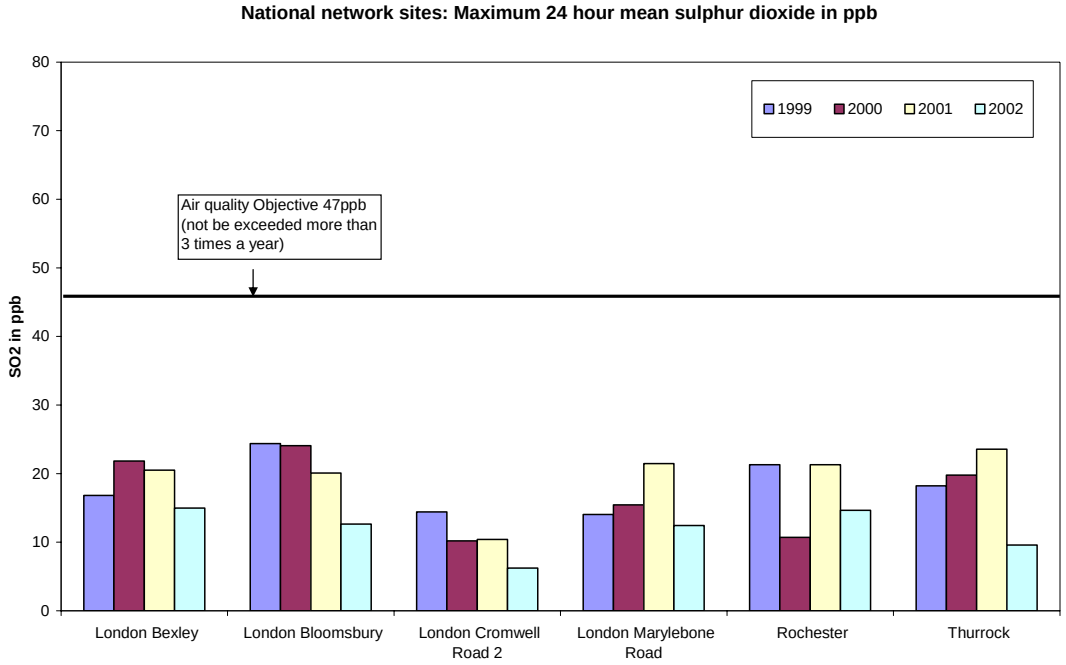


Table 15

Sulphur dioxide - Maximum 24 hour mean (Objective 47ppb - 99th percentile by 31/12/04)									
site	**type**	**1999**	**%data capture**	**2000**	**%data capture**	**2001**	**%data capture**	**2002**	**%data capture**
London Bexley	Suburban	17	88	22	92	21	77	15	82

London Bloomsbury	Urban background	24	95	24	96	20	92	13	88
London Cromwell Road 2	Roadside	14	95	10	91	10	82	6	79
London Marylebone Road	Roadside	14	93	15	61	21	83	12	92
Rochester	Rural	21	75	11	70	21	78	15	86
Thurrock	Urban Background	18	85	20	82	24	79	10	68
Exceedence of the Standard shown in **bold**									



(B) Monitoring data within an AQMA

No AQMAs for sulphur dioxide have been declared in Dartford.

(C) & (D) New industrial sources and sources with substantially increased emissions

There are no new relevant industrial sources in the area likely to release significant quantities of sulphur dioxide, as per checklist in Annex 2.

There are four large industrial A1 processes which emit sulphur dioxide to atmosphere, as shown in table 16 below. None of these have substantially increased sulphur dioxide emissions and three of the processes have reduced their emissions to below 10 tonnes. The emissions are well below the threshold for the industrial nomograms for these processes. Arjo Wiggins Limited use a low sulphur fuel oil (0.2%) as a standby fuel; the main fuel being used is gas. The air quality assessment undertaken as part of their IPPC application shows sulphur dioxide emissions to be small and well below the emission limits.

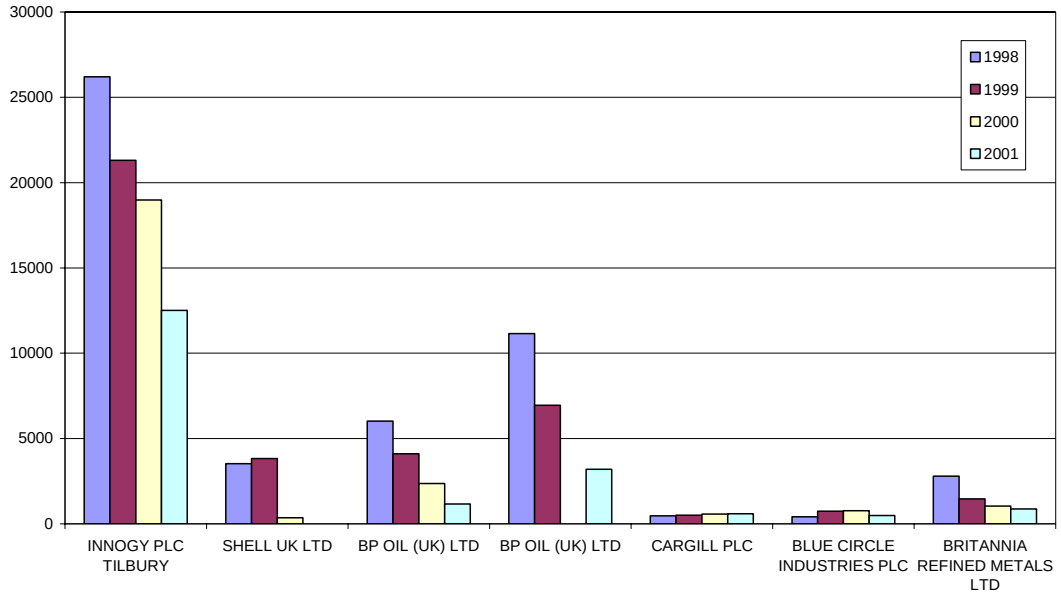
An air quality strategy management plan was undertaken by Innogy Plc as part of their IPPC Application for LittleBrook Power Station in 2001, to ensure Air Quality Objectives would be met. This involved dispersion modelling and use of local monitoring information and emissions from other nearby power stations was taken into account. The results showed that the Objectives for sulphur dioxide would be met. To ensure compliance would be achieved, upwind and compliance monitoring stations (Bexley and Thurrock) have been set up and the impact of the station on Objectives will be reviewed quarterly.

Table 16

Site Details:				**Release data (t)**			
Operator Name	**Authorisation No.**	**Site Address**	**Process Type**	**1998**	**1999**	**2000**	**2001**
INNOGY PLC	AA3166	LITTLEBROOK D POWER STATION	combustion processes			3034	2690
		LITTLEBROOK MANOR WAY					
		DARTFORD					
		KENT					
		DA1 5PT					
GLAXOSMITHKLINE	AJ2372	TEMPLE HILL	manufacture and use of organic chemicals	<10 t	<10	<10	<10
		DARTFORD					
		DA1 5AH					
GLAXOSMITHKLINE	AK6853	TEMPLE HILL	manufacture and use of organic chemicals	30	37.1	13.9	<10
		DARTFORD					
		DA1 5AH					
ARJO WIGGINS LTD	AU7206	DARTFORD PAPER MILL	paper and pulp manufacturing processes	24			5
		PRIORY ROAD NORTH					
		DARTFORD					
		KENT					
		DA1 2BW					
Ref: EA Pollution inventory							

Emissions of sulphur dioxide from relevant industrial processes in neighbouring boroughs were assessed. The emissions from these large industrial processes can be seen to be decreasing over time.

Sulphur dioxide emissions in tonnes - Neighbouring Authorities Part A processes



There are a number of power stations in the Thames Gateway area with the potential to impact on Dartford through plume grounding, as shown in the map below. Emissions of sulphur dioxide from these processes are decreasing and monitoring stations surrounding Dartford, in Bexley, Gravesham, Thurrock and Sevenoaks all show measured levels are below the Objectives.

(E)Areas of domestic coal burning

The majority of Dartford Borough is within a Smoke Control Area and therefore emissions from domestic chimneys are controlled. There are no significant coal burning areas in Dartford and therefore no significant sources of sulphur dioxide from domestic combustion which would lead to exceedences of the Objectives.

(F)Small boilers >5MW (thermal)

A small boiler survey (>1MW) was carried out in 1998, for educational institutions, hospitals, hotels, large commercial premises and industrial processes. This showed that the majority of boilers in the Borough were gas fired and below 5MW. Only Joyce Green Hospital, with four 3.6MW heavy fuel boilers, was identified as having the potential for localised elevated sulphur dioxide emissions and this has since closed. No new premises have >5MW boilers or use coal or fuel oil.

(G) Shipping

The estimated background data 2001 for Dartford indicates that there are elevated levels of sulphur dioxide in North Dartford, from shipping along the Thames.

There may be exceedences of the 15 minute Objective, as found in the vicinity of the major port Dover, where there are a large number of movements of ships entering a port and relevant exposure (within 1km).

There are three areas of ship docking in Dartford, which have been considered.

- Littlebrook power station jetty – No relevant exposure within 1km of the berths and <5000 movements per annum
- Dartford ferry terminal – Relevant exposure (650m) but <5000 movements per annum
- Lafarge Redland Aggregates jetty – Relevant exposure (300m) but <5000 movements per annum

None of the shipping berths in Dartford fit the criteria for detailed assessment.

(H) Railways

The NAEI emissions inventory 2000 for Dartford shows that railways account for 0.36 tonnes per annum of sulphur dioxide across the Borough, which is 0.01% of total emissions.

Only where diesel locomotives are regularly stationary for 15 minutes or more with relevant exposure within 15m, would the 15 minute Objective for sulphur dioxide be at risk. There are two major railway routes through Dartford linking Kent Boroughs to London. The majority of trains on these lines are electric. Diesel locomotives are not regularly stationary at stations in the Dartford area for 15minutes or more, where there is relevant exposure to the public.

Conclusion:
Assessment of monitoring data, local sources and emissions inventories show that levels of sulphur dioxide are reducing with time. There are no significant local sources of sulphur dioxide that warrant detailed assessment. Power stations in the vicinity have been assessed as part of their IPPC applications and are predicted to meet Objectives. It is expected that sulphur dioxide 15minute, hourly and 24 hour Objectives will be met at all locations in Dartford.
It is concluded that there is sufficient evidence not to proceed to a detailed assessment for sulphur dioxide.

3.7 Fine particles (PM_{10})

3.71 Objectives

50μg/m^3 not to be exceeded more than 35 times a year	24 hour mean	To be met by 31 December 2004
40μg/m^3	Annual mean	To be met by 31 December 2004
50μg/m^3 not to be exceeded more than 35 times a year	24 hour mean	To be met by 31 December 2010
50μg/m^3 not to be exceeded more than 7 times a year	24 hour mean	To be met by 31 December 2010
20μg/m^3	Annual mean	To be met by 31 December 2010

There are two new fine particles Objectives for 2010 which strengthen those for 2004. They are not included in Regulations at present, but it is recommended that some consideration be given to them during this review and assessment for longer term planning.

3.72 Health Effects

The size of the particles for which the Objectives are set are 10μm or less as these are most likely to be deposited in the lung. Fine particles have been linked with a number of respiratory illnesses, including asthma. Of more concern is that long- term exposure to fine particles has recently been found to cause premature death from heart disease and lung disease. Fine particles may also cause lung cancer, since cancer-causing compounds found in exhaust fumes attach themselves to the surface of the particles, which may then be breathed into the lungs.

3.73 Sources

There are a wide range of sources of fine particles. Particles can be divided into three categories: primary, secondary and coarse particles. Sources of primary particles include emissions from road traffic, power stations and industries; secondary particles include sulphates and nitrates formed by chemical reactions; and coarse particles include resuspended and wind blown dusts, construction and quarry processes, sea salt and biological particles. These sources include local, regional and distant sources. Regional

and long distance sources (e.g. from mainland Europe) form a large proportion of annual mean PM_{10} background sources. Local air quality management focuses on identifying the local sources which emit significant quantities of PM_{10}. NAEI emissions inventory (2000) for Dartford shows 44% of PM_{10} from traffic, 22% from quarrying and construction activities and 14% from industry. The proportion due to traffic will be much greater near busy roadsides, as within the AQMA.

3.74 Assessment

At a National level, policy measures for the transport and industrial sectors have led to a reduction in fine particles levels. There will be further reductions through tighter controls on industry, as well as through vehicle emissions controls and improved fuel quality standards. Reductions of secondary particles are expected through EU legislation on the Acidification Strategy. National policy analysis suggests that outside London, the PM_{10} 2004 Objectives are only likely to be exceeded adjacent to busy roadsides, where there is large domestic coal burning or near industrial processes with uncontrolled emissions. However, exceedences of the 2010 annual mean Objective are only likely to occur at busy roadsides in the UK, with the exception of London and the South East which will also have exceedences at background locations. Dartford's estimated background for 2010 is 18.9 – 22.5ug/m^3 and therefore widespread exceedences of the 2010 Objective are likely in urban areas, especially near to busy roadsides.

During Dartford's first round of review and assessments, PM_{10} was assessed at Stage 1, 2 and 3 and an area of exceedence of the 24 hour Objective was found along the A282 Tunnel Approach Road. An AQMA for PM_{10} and nitrogen dioxide has been declared due to traffic emissions along this busy road. There were over 50 AQMAs in the UK declared for PM_{10} and the majority of these were due to traffic emissions. New vehicle emissions factors (2002) have been introduced which will need to be considered during the next round of review and assessment; modelling undertaken as part of the Stage 4 assessment indicates that the extent of the area of exceedence for PM_{10} was previously overestimated and the drop off (to background) of PM_{10} from traffic emissions is much closer to the roadside.

(A) Monitoring data outside an AQMA

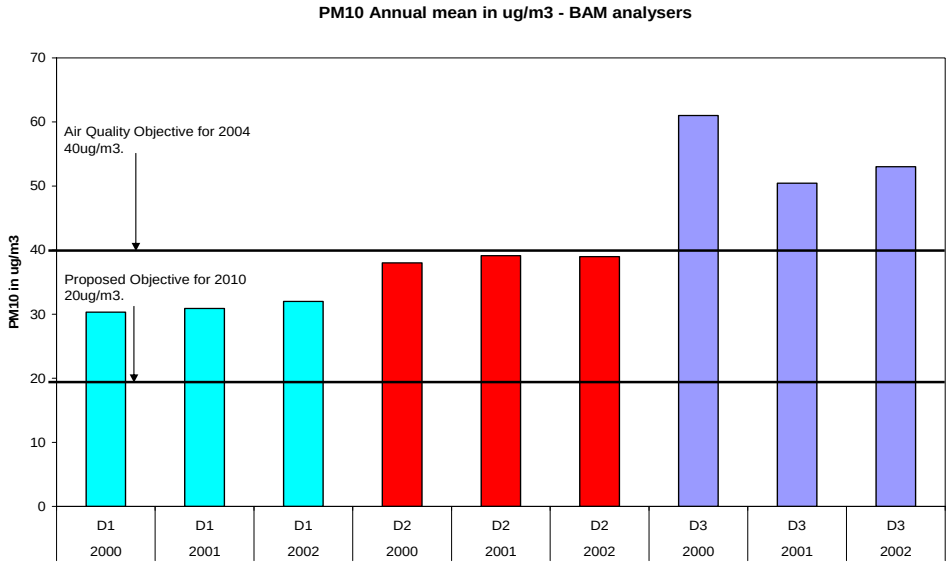
PM_{10} monitoring using BAM continuous analysers has been carried out since mid 1999 at Dartford's three roadside sites in Dartford (site details and QA/QC as section 3.54). Results have been projected to 2004 and 2010 to compare with the annual mean Objectives. The results in table 17 below show that the roadside site D3 at Greenhithe is not predicted to meet the 2004 Objective and none of the roadside stations are predicted to meet the 2010 Objective.

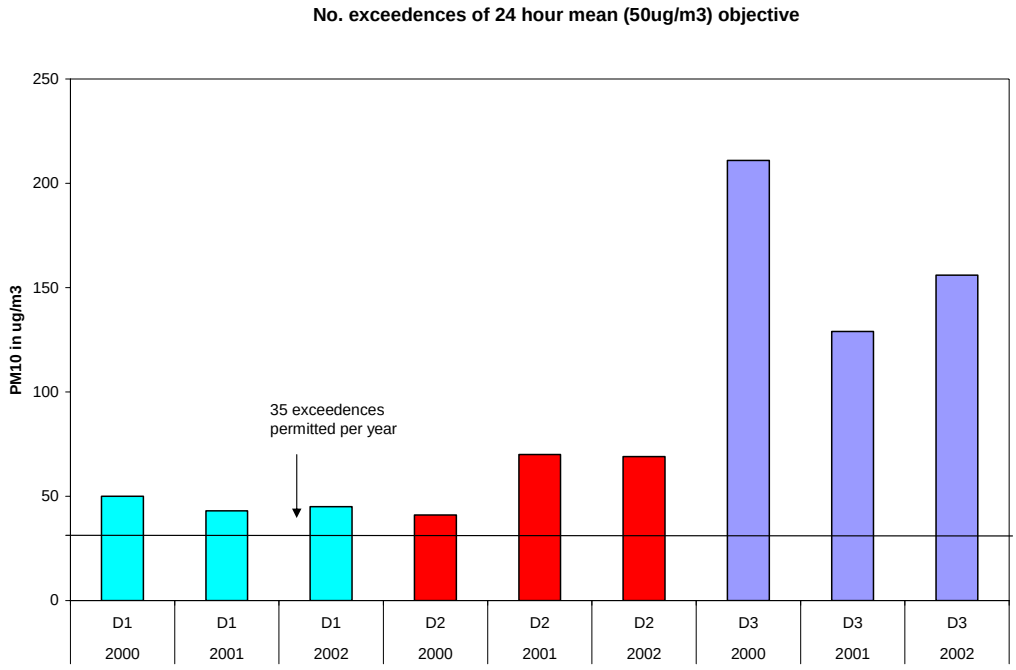
Table 17

Year	Site	Pollutant	annual mean	No. exceedences 24 hour	PM10 90th percentile	No. exceedences 1 hour	NO2 99.8th percentile	% data capture	2005 (from2000 - 2002 data)	2005 max predicted conc	2010 max predicted conc	2004 PM10 predicted conc.	2010 PM10 predicted conc
2000	D1	PM_{10} in µg/m3	30	**50**				99.9				29	**27**
2001	D1	PM_{10} in µg/m3	31	**43**				97.7				30	**27**
2002	D1	PM_{10} in µg/m3	32	**45**				91				31	**28**
2000	D2	PM_{10} in µg/m3	38	**41**				99.5				36	**33**
2001	D2	PM_{10} in µg/m3	39	**70**	**67**			85.2				37	**34**
2002	D2	PM_{10} in µg/m3	39	**69**	**67**			87.7				38	**35**
2000	D3	PM_{10} in µg/m3	**61**	**211**				95				**57**	**51**
2001	D3	PM_{10} in µg/m3	**50**	**129**				96				**47**	**43**
2002	D3	PM_{10} in µg/m3	**53**	**156**	**92**			86				**51**	**46**

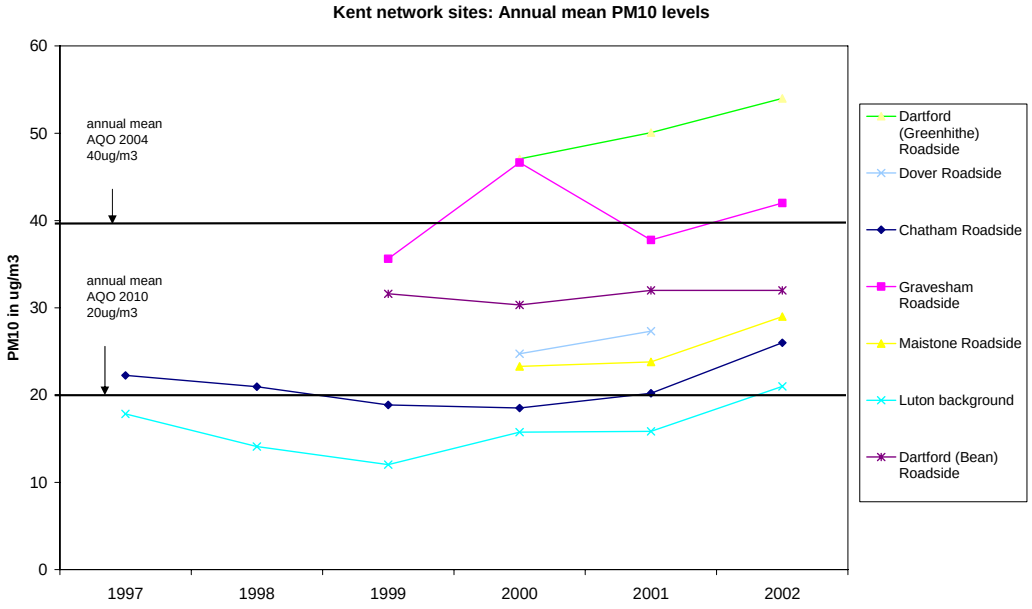
Exceedences are shown in **bold.**

Percentiles are provided where data capture is less than 90%.





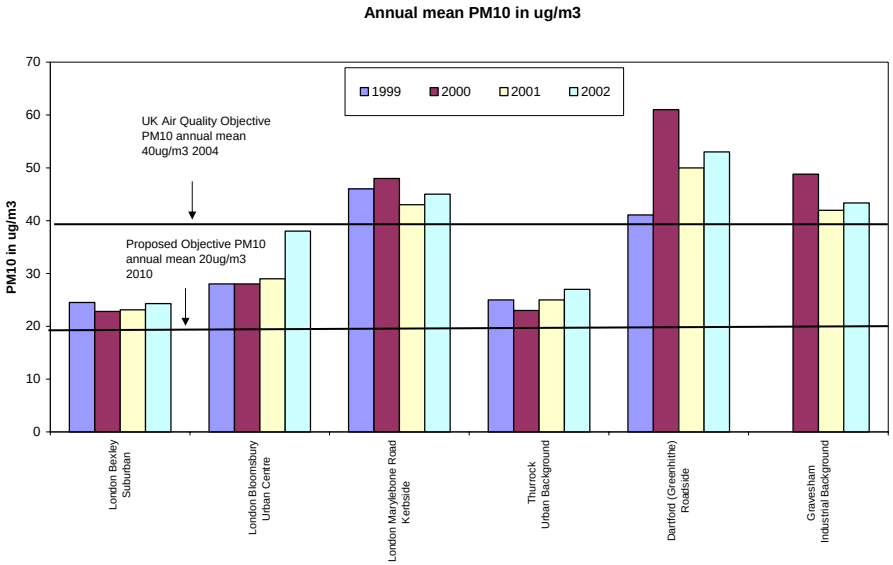
Monitoring results from the Kent Network show that the trend in PM_{10} levels appears to be either increasing or, at best, stabilising in Kent. This does not therefore correspond to the expected reductions from National studies and does not bode well for meeting the 2010 Objective at a large number of areas in Kent. The Gravesham and Dartford (Greenhithe) Roadside sites are the only sites with measured results above the 2004 annual mean Objective – while North Kent Boroughs do have higher background levels and greater sources, the method of measurement also plays a large factor in this, as all other sites have TEOM analysers and not BAM analysers which tend to over read.



Results from the National network (Table 18) indicate that neighbouring boroughs, Bexley and Thurrock background sites will meet the 2004 Objective and this is expected to be the case in Dartford. Once again the differences in method of measurement can be seen as Dartford Greenhithe BAM exceeds the London Marylebone Road TEOM, despite the smaller traffic flows and lower background levels.

Table 18

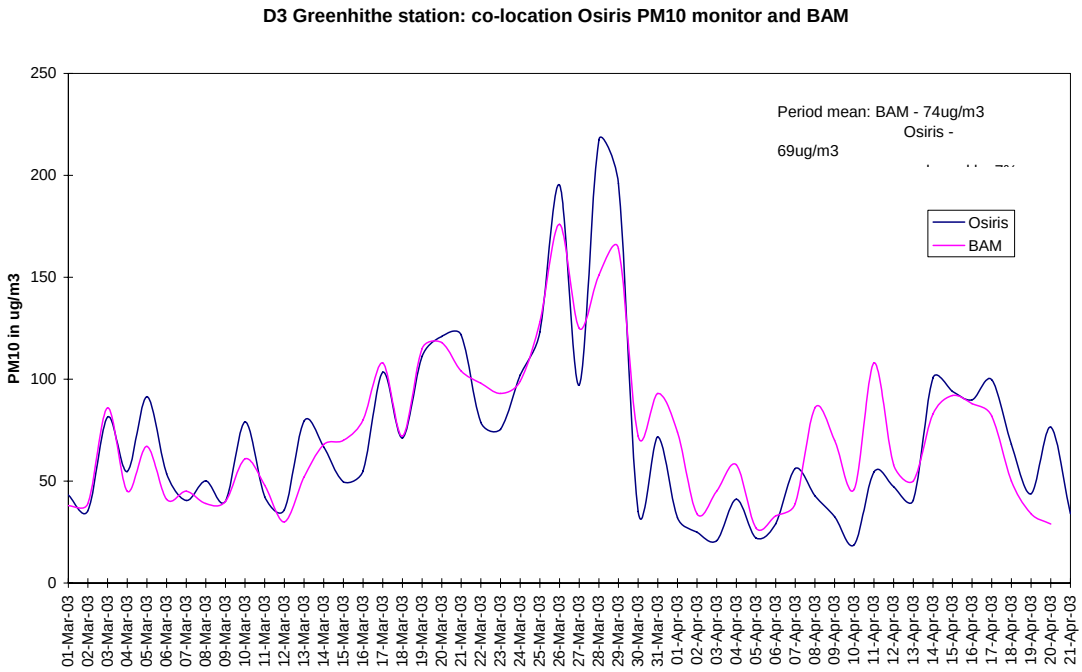
PM10 in ug/m3		**1999**			**2000**			**2001**			**2002**		
Site	**Analyser**	annual mean	No. days >=50ug/m3	%data capture	annual mean	No. days >=50ug/m3	%data capture	annual mean	No. days >=50ug/m3	%data capture	annual mean	No. days >=50ug/m3	%data capture
London Bexley Suburban	TEOM	25	17	98	23	10	100	23	15	95	24	11	97
London Bloomsbury Urban Centre	TEOM	28	21	96	28	13	97	29	20	98	38	**43**	85
London Marylebone Road Kerbside	TEOM	**46**	**111**	95	**48**	**157**	99	**43**	**106**	89	**45**	**125**	98
Thurrock Urban Background	TEOM	25	15	95	23	11	93	25	13	76	27	18	82
Dartford (Greenhithe) Roadside	BAM	**41**	**36**	49.5	**61**	**211**	95	**50**	**129**	96	**53**	**156**	86
Gravesham Industrial Background	BAM				**49**	**119**	96	**42**	**102**	95	**43**	**107**	94
Exceedences are shown in **bold**													
Teom data has been factored up by 1.3													

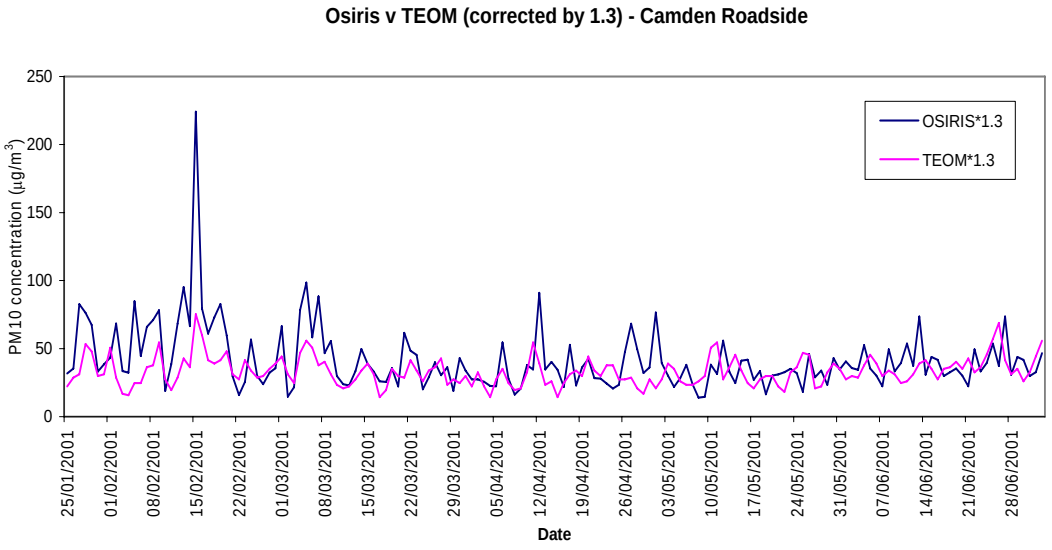


(B) Monitoring data within an AQMA

Two portable Osiris particle monitors have been utilised within the AQMA since mid 2001 as a screening tool. The Osiris uses a light scattering technique to determine the concentration of fine particles passing through PM_{10}, PM_5 and $PM_{2.5}$ impactors. The light scattered by the particles in the sampled air is converted into an electrical pulse proportional to the size of the particle. Results are expressed in ug/m3 with a resolution down to 0.01. The Osiris is serviced and calibrated by Turnkey Instruments annually and on-going maintenance is carried out in house.

The Osiris has been co-located with BAM and TEOM analysers and the results show that the Osiris under reads BAM PM_{10} levels, but over reads the TEOM PM_{10} levels. Results from an initial BAM/Osiris co-location trial in 2001 at Gravesham Roadside showed that the Osiris was significantly under reading PM_{10} levels. Since the original trial the Osiris monitors have been recalibrated and correspond much better to the BAM, as shown in the graph below. Over the monitoring period, the Osiris under reads the BAM by 7% and data has been bias corrected.





The results of periodic monitoring over the last 2 years at 4 sites are shown in table 19; Bow Arrow Lane sites has been located permanently at this site, while the second monitor has been moved to the other 3 sites for approximately six months. The results in the table below show that background site (53m) Queens Gardens and intermediate site (25m) Brent Way have annual means below the 2004 Objective. Elliot Road (19m) and Bow Arrow Lane (11m) exceed the annual mean Objective for 2004. The 90th percentiles for these monitoring sites is >50ug/m3 at Elliot Road, Brent Way and Bow Arrow, but is 39 at the Queens Gardens site.

Table 19

Short term site	Long term site	Annual mean 2000 or 2001	Period mean 2001 or 2002	Ratio AM/PM
Queens Gardens		Estimated: 0.93*27=25	27	
07/02 – 12/02	D1	31	35	0.886
	D2	39	41	0.951
	D3	50	53	0.943
	average			0.93
Elliot Road		Estimated: 1.046*42= **44**	42	
07/01 – 11/01	D1	30	33	0.909
	D2	38	36	1.056
	D3	61	52	1.17
	average			1.046
Brent Way		Estimated: 0.973*39=38	39	
11/01 – 05/02	D1	31	31	1
	D2	39	40	0.975
	D3	50	53	0.943

	average			0.973
Bow Arrow Lane		Estimated: 1.045*39=**41**	39	
07/01-12/01	D1	30	32	0.938
	D2	38	38	1
	D3	61	51	1.196
	average			1.045
01/02 – 12/02		**48** (81% data capture)		

(C) Busy Roads and Junctions -2010 Objectives

Not applicable outside Scotland.

(D) Junctions

Busy junctions were not considered to have been assessed adequately during the first round of review and assessments and therefore warrant further consideration.

The criteria for a busy junction are:

- >10000 vehicles per day
- AND exposure within 10m of the kerb

The following junctions have >10000 vehicles per day and relevant exposure:

- A226 East Hill/The Brent/St Vincents Road/Watling Street

DMRB (2004) – 25ug/m3

- Princes Road/A225 Lowfield Street

DMRB (2004) – 25ug/m3

- A226 East Hill/Park Road

DMRB (2004) – 26ug/m3

- Princes Road/Heath Lane

DMRB (2004) – 25ug/m3

It is not necessary to progress to a detailed stage for PM_{10} at these junctions.

(E) Roads with High Flows of HGVs and/or buses

Roads with >20% HGV/Buses with exposure within 10m of the roadside require further assessment. In Dartford, the only roads with >20% HGVs are J1A of A282, LittleBrook Road and Crossways Boulevard which feed into industrial estates. There is no relevant exposure within 10m of the roadside.

(F) New roads constructed or proposed since the last review

There are no new roads since the last review. No further assessment is warranted. There will be new roads with proposals for major development within the area, but these will need to be considered once planning approval has been granted.

(G) Roads close to the Objective in the first round

The new vehicle emissions factors (2002) should be used in the detailed assessment stage for any roads which were marginally below the 24 hour 2004 Objective (>30 exceedences) in the previous round of review and assessments.

Roads in Dartford close to the Objective in Dartford were:

- Bean Interchange (North Junction)
- Junction A226/B255 Greenhithe

These locations require further consideration using the new emission factors in the detailed assessment.

(H) Roads with significantly changed traffic flows

Roads with significantly changed flows of >25% should be assessed. Traffic data from 1993 – 2002 was considered. This showed that the A226/B225 Greenhithe Junction has increased by over 50% since 1993. Monitoring undertaken at this junction suggests that PM_{10} levels have increased from 2000-2002 and the Objectives for 2004 will not be achieved. A detailed assessment will be required at this junction.

(I) New industrial sources

There are no relevant new industrial sources likely to emit significant quantities of PM_{10}, in accordance with the Annex2 checklist.

There were three new regulated mobile crusher/screening operations (PG3/16) in 2001/2 which have the potential to emit fugitive dust emissions locally. These are controlled by local authority permit conditions and emissions are not considered significant to warrant detailed assessment.

(J) Industrial sources with substantially increased emissions

Industrial sources identified as being potentially significant sources of PM_{10} during the last round of review and assessment which have increased their emissions by >30% require assessment.

There were no significant industrial sources of PM_{10} identified in the area during the first round. The Environment Agency emissions inventory 1998 – 2001 for the large A1 industrial sites in Dartford (Littlebrook Power Station, GlaxoSmithKline and ArjoWiggins) show emissions of <1t for all processes. PM_{10} levels from major processes

in neighbouring boroughs similarly show no substantial increases and most processes are showing reductions.

(K) Areas of domestic solid fuel burning

The majority of Dartford Borough is within a Smoke Control Area and therefore emissions from domestic chimneys are controlled. There are no significant coal burning areas in Dartford and therefore no significant sources of PM_{10} from domestic combustion which would lead to exceedences of the Objectives. NAEI emissions inventory (2000) for Dartford shows domestic PM_{10} emissions as 3% of total emissions.

(L) Quarries

Quarries where there is relevant exposure near to the source of dust emissions require assessment. There are two quarries within the Dartford area with relevant exposure:

- Eastern Quarry – quarry activities are carried out within a deep quarry and the topography assists with containing emissions. There have been no dust complaints or visual emissions from the site which would warrant further assessment. Major mixed-use development is proposed within Eastern Quarry (2005 – 2025) and quarry activities will continue during the initial phase of this proposed development (up to 2008 when the process will close). The impact on receptors will be assessed as part of the planning application process.
- Pinden Quarry – Pinden Quarry is bunded around the perimeter of the site adjacent to the nearest receptors. The site is regulated by the Environment Agency and Dartford Borough Council and dust control measures are in place. There is a water suppression system on the perimeter as well as at source and wheel washing facilities; this system is currently being upgraded. There have been occasional dust complaints from the site, but none substantiated to date through visual assessment or dust gauges. There are no significant dust emissions from this process which warrant detailed assessment.

(M) Aircrafts

There is no relevant exposure within 1000m of an airport boundary.

Conclusions:
The assessment for fine particles has identified a number of traffic related hotspots where potential exceedence of the Objectives for 2004 and 2010 may occur. Monitoring information supports the declaration of the current AQMA, although the data supports reducing the distance of the boundary of the AQMA from the roadside. For 2004, the A226/B255 and Bean Interchange junctions require further assessment using the new emission factors. The assessment of the 2010 Objective suggests that widespread exceedences of the Objective will occur, especially at busy roadsides.
It is concluded that there is sufficient evidence to proceed to a detailed assessment for fine particles (PM_{10}).

4.0 Conclusions

This report has considered the sources, health effects, available data and the likelihood that the seven priority pollutants' health based Air Quality Objectives (AQO) will be met by their target dates. A determination has been made of the need for a detailed assessment of these pollutants and evidence is provided in support.

Having considered each pollutant in turn and presented the evidence to support the assessment of each, it is concluded that the Objectives specified in Air Quality Regulations will not be exceeded for the following pollutants:

- carbon monoxide
- benzene
- 1,3-butadiene
- lead
- sulphur dioxide

There will be no requirement to undertake a detailed assessment for these pollutants.

However, there is sufficient evidence to warrant proceeding to a detailed assessment for the following pollutants and Objectives:

- Nitrogen dioxide (NO_2) – annual mean Objective 2005
- Fine particles (PM_{10}) – 24 hour mean Objective 2004 and annual mean 2010

The hotspots identified in this assessment which require further consideration, in addition to the A282 AQMA, for both NO_2 and PM_{10} (2004), include A226/B255 junction and Bean Interchange. In addition, for NO_2, a number of junctions and busy roadsides have been identified which are predicted to exceed the 2005 annual mean Objective. With regard to the 2010 PM_{10} annual mean Objective, widespread exceedences are predicted in urban areas, especially near busy roadsides.

5.0 Recommendations

Dartford Borough Council should proceed immediately with Detailed Review and Assessment of Air Quality within the Borough for the following pollutants:

- **Nitrogen dioxide**
- **Fine particles (PM10)**

Detailed assessment should focus on the traffic hotspots at busy junctions and roadsides which have been identified in this updating and screening assessment.