Kent and Medway Air Quality Monitoring Network

Annual Report 2010




Report for Medway Council on behalf of the Kent and Medway Air Quality Monitoring Network

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Executive summary

This report provides a summary and analysis of air quality data from the Kent & Medway Air Quality Monitoring Network for 2010. The management of the network was taken over by AEA on 1 April 2007. This report includes a summary of the results, a comparison with the Air Quality Objectives, an investigation of episodes, an analysis of trends and a discussion on Sustainability Indicators. A detailed analysis of nitrogen dioxide (NO_2) diffusion tube results submitted is also provided and a brief description of progress with Review and Assessment for each participating Local Authority is also given.

Network Performance

Twenty of the fifty nine network analysers failed to meet the target of 90% data capture during 2010. The majority of data losses over a period were due to analyser or logger faults, power cuts or communication issues. Six of the twenty analysers failed to reach the 75% threshold: five were caused primarily by the closure of the Rochester Stoke AURN site between November 2009 and June 2010 following a leaking cabin; the sixth was the Ashford oxides of nitrogen (NO_x) analyser which had an undiagnosed fault from the start of the year until the end of May 2010. The overall data capture for the network including all losses was 90.6%.

Statistical summary and comparison with Air Quality Objectives

- In 2010 all sites continued to meet the carbon monoxide (CO) and sulphur dioxide (SO_2) Objectives.

- As with the previous three years, all sites met the annual mean particulate matter (PM_{10}) Objective of 40µgm^{-3} and no sites exceeded the 24-hr mean Objective during 2010.

- The Chatham Luton background site was the only site that exceeded the ozone 8-hr rolling mean Objective. This was driven primarily by high concentrations during the summer months.

- A total of nine sites failed to meet the annual mean NO_2 Objective of 40µgm^{-3} (21ppb). In common with previous years, the majority of the sites failing to meet this objective were either roadside or kerbside sites. The exception to this was again the background site at Dover Docks. This site is classified as Urban Industrial and these exceedences indicate a significant contribution from the dock area to NO_2 concentrations which is likely to be influenced by vehicle movements. Dartford St Clements continued to be the only site to breach the hourly mean NO_2 Objective. The number of exceedences at this site fell from 64 in 2008, 34 in 2009 to 19 in 2010 however this is most likely due to the data gap during the first three months of 2010.

Air pollution episodes

- Only one monitoring site in the network reported a breach of the NO_2 "Moderate" band. This was Dover Docks on the 20th of July and it is likely that this was driven by localised emissions from the dock activities.

- There were a large number of days which recorded "Moderate" concentrations of ozone during 2010 mostly occurring between April and July. During this period Kent saw some elevated ozone concentrations due to favourable weather conditions allowing increased photochemical activity which drives ozone production. The highest period of breaches of the Objective occurred between 22nd of June and 3rd of July.

- In common with previous years, Dartford St Clements and Gravesham Industrial Background saw the most days breaching the “Moderate” PM_{10} banding.

- In 2010 the Dover Docks site recorded a single breach of the “Moderate” SO_2 air pollution which is a reduction from the fifteen recorded breaches in 2009. The source of this pollution has been shown to be from the shipping activity at the docks.

- No significant increase in PM_{10} or SO_2 was observed at the network sites during the period when the UK was effected by the ash cloud produced by the Eyjafjallajökull volcano in Iceland.

Trends in Pollution Levels

Background NO_2 concentrations have remained relatively stable at the Kent monitoring sites since the mid-2000’s albeit with variations between measurement periods. The general trend at the background sites was an overall reduction in NO_2 concentrations during 2010. A number of sites showed a slight increase at the end of 2010 reflecting an increase in NO_2 concentration seen during the cold weather experienced across the UK December.

Some reductions were seen at roadside sites during 2010 however this is thought to have been influenced by a general reduction in concentrations across the region rather than any significant reduction in local emissions sources. In contrast, the roadside sites which recorded an increase in concentrations (Swale Ospringe Roadside 2, Tunbridge Wells A26 Roadside and Maidstone A229) are likely to have been significantly influenced by changes in local emissions.

There were some observable short term variations in rolling annual mean concentrations, particularly at the Chatham Luton Background site. However, there was no discernable long term reduction or increase in rolling annual mean ozone concentration at the sites in the network.

A proportion of the particulate matter present in Kent is from non-local sources, most significantly London and mainland Europe. This results in relatively high background and rural concentrations of PM_{10} across Kent. This non-local nature of particulate matter makes a significant reduction in ambient concentrations difficult. Monitoring data show that the contribution from road traffic results in increased concentrations at the roadside sites (e.g. Dover Centre, Tunbridge Wells A26, Maidstone A229, Ashford and Chatham).

PM_{10} concentrations at the TEOM and BAM analyser sites had remained relatively constant over the period 1998 to 2007. Between 2008 and 2010 there was some variation in the rolling annual mean concentration however there is a general downward trend in concentrations at almost all of the sites.

Sustainability Indicators

There has been a general reduction in the overall sustainability indicator for both urban and rural monitoring sites however there is always some inter-year variability. In 2010 the overall rural indicator for Kent increased due to a significant increase in breaches at the Chatham Luton Background sites following a large reduction seen in 2009.

Diffusion Tube Monitoring

In addition to the automatic monitoring, most of the Kent and Medway Local Authorities supplement their automatic monitoring of NO_2 with indicative measurements made using diffusion tubes. Twelve of the participating authorities have submitted NO_2 diffusion tube data for the year 2010. This report presents a summary of NO_2 diffusion tube results for each Local Authority.

Review and Assessment

Updates of the Review and Assessment position for each member authority have been supplied and are summarised in Section 7.

Table of contents

1 Introduction

The Kent and Medway Air Quality Monitoring Network was formed in 1997 to ensure a coordinated approach to air quality monitoring and reporting across the county. This report uses monitoring results from the network to describe how pollution levels compare to national standards and guidelines, describes the occurrence of pollution episodes over the past year and presents trends in concentrations since 1997.

While accurate measurements from continuous air quality monitors form the basis of the network and this report, non-continuous diffusion tube monitoring results are also presented. Although less accurate, this method is far more widespread than continuous monitoring, so results can provide a more local sense of pollution levels. Due to the very large number of diffusion tube monitoring sites throughout the county, results from each site are not discussed, but shown in graphical form, and sites aggregated by site types. Recommendations for bias factor calculations are also given.

Finally, an update of each District and Borough's progress in the Review and Assessment process is presented. This report, and all of its predecessors, is available for downloading on the network Internet pages[1]. All network data used to compile the report are available for downloading online[2].

Please note that local authorities periodically undertake short term monitoring campaigns to assess concentrations at local hot spots identified by their Local Air Quality Management Review and Assessment processes. Please contact individual local authorities for results of these monitoring campaigns.

[1] www.kentair.org.uk
[2] http://www.kentair.org.uk/reports.php

2 Monitoring results

2.1 Changes to the network during 2010

The sites that make up the Kent and Medway Air Quality Monitoring Network are presented on a map in Appendix A and further details are provided in Appendix B. A number of changes occurred to these sites and within the Network during 2010. These are summarised below:

1. Dover Langdon Cliff was closed on 4th March.
2. The Maidstone Rural site was extensively upgraded with additional monitoring capability in May to facilitate a separate research project[3]. As part of this work the PM_{10} TEOM was upgraded from a TEOM to a FDMS-TEOM at the end of May.
3. A new site, Canterbury St Peters Place, was affiliated into the network on 30th July.
4. Chatham Roadside was affiliated into the UK Automatic Urban and Rural Network on 1st July and renamed Chatham Centre Roadside. As part of this affiliation the PM_{10} TEOM was upgraded from a TEOM to a FDMS-TEOM. A $PM_{2.5}$ FDMS-TEOM was also installed at the site.
5. The Swale Sheerness site was closed on 9th November.

The change of particulate monitoring technique at Chatham Centre Roadside and Maidstone Rural means that there will be the opportunity in future years for TEOM data in Kent to be corrected using more locally situated FDMS analysers (see Section 2.3). However this also has implications for long term trend monitoring. As discussed in Section 5.4 the change in instrument marks the end of the long term trend monitoring undertaken by the TEOM analysers and the start of a new period of trend monitoring of both total PM_{10} and the volatile and non-volatile fractions.

2.2 Network performance

Table 2.1 shows the ratified data capture rates for each network analyser during 2010. The target is to achieve 90% for each analyser, although sites with data capture greater than 75% are still valid statistically. Any datasets with capture rates lower than 75% are likely to be unrepresentative of a full annual period and annual statistics may be skewed.

The majority of data losses over the period were due to analyser or logger faults, power cuts or communication issues. Twenty analysers failed to achieve 90% data capture during the year. Six of these failed to reach the 75% threshold: five were caused primarily by the closure of the Rochester Stoke AURN site between November 2009 and June 2010 following a leaking cabin; the sixth was the Ashford oxides of nitrogen (NO_x) analyser which had an undiagnosed fault from the start of the year until the end of May. All significant periods of data loss are detailed in Table 2.2.

[3] The additional monitoring capability at Maidstone Rural has been included to assist with the ClearfLo (Clean Air for London) Project. This is a collaborative scientific project to set up air pollution monitoring sites alongside meteorological measurements to investigate boundary layer pollution across London. For more information see: http://www.clearflo.ac.uk/.

Table 2.1: Network data capture for 2010

(red, underlined figures show data capture rates less than 90%).

Site	CO	NO_2	O_3	PM_{10}	$PM_{2.5}$	SO_2	Site Average
Ashford Background	-	55.9	87.9	81.5	-	-	75.1
Canterbury	-	99.0	-	-	-	-	99.0
Canterbury Military Road	-	78.0	-	-	-	-	92.5
Canterbury PM_{10}	-	-	-	98.8	-	-	98.8
Canterbury Roadside	-	95.1	-	-	-	-	95.1
Canterbury St Peters Place	-	96.2	-	-	-	-	96.2
Chatham Centre Roadside#	-	90.0	-	97.5	92.9* (46.8)	-	92.9
Chatham Luton Background	78.9	78.2	82.1	84.4	-	78.1	80.7
Dartford Bean Interchange Roadside	-	99.2	-	98.9	-	-	99.1
Dartford St Clements Roadside	-	99.4	-	96.1	-	-	97.8
Dartford Town Centre Roadside	-	93.2	-	91.1	-	-	92.2
Dover Centre Roadside	-	-	-	97.5	-	-	97.5
Dover Docks	-	98.8	-	-	-	97.7	98.3
Dover Langdon Cliff*	-	-	-	-	-	97.6 (16.8)	97.6
Dover Old Town Hall Roadside	-	97.4	-	-	-	-	97.4
Folkestone Suburban	-	96.6	98.7	84.0	-	95.3	93.7
Gravesham A2 Roadside	-	99.0	-	91.3	-	-	95.2
Gravesham Industrial Background	-	95.3	-	96.8	-	-	96.1
Maidstone A229 Kerbside	-	97.7	-	97.8	-	-	97.8
Maidstone Rural	-	97.9	84.2	88.1	-	98.3	92.1
Rochester Stoke	-	33.2	55.8	0.0	54.2	43.8	37.4
Swale Ospringe Roadside 2	-	97.4	-	82.0	-	-	89.7
Swale Sheerness*	-	99.5 (85.4)	-	86.1 (73.9)	-	99.5 (85.4)	95.0
Thanet Airport	-	87.5	-	-	-	-	87.5
Thanet Birchington Roadside	-	97.7	-	91.3	-	-	94.5
Thanet Margate Background	-	99.8	-	-	-	-	99.8
Thanet Ramsgate Roadside	-	92.7	-	96.6	-	-	94.7
Tonbridge Roadside 2	-	98.9	-	-	-	-	98.9
Tunbridge Wells A26 Roadside	-	98.8	-	99.5	-	-	99.2
Tunbridge Wells Town Centre	-	96.2	-	-	-	-	96.2
Number of sites	1	26	5	18	2	7	30
Network Mean (%)	78.9	92.0	81.7	86.8	73.6	87.2	90.6

* For sites and instruments established/removed between 01/01/2010 and 31/12/2010 data capture is given as a proportion of the operational period (and in brackets as a proportion of the full calendar year).

Combined data from pre-AURN and AURN monitoring periods.

Table 2.2: Significant issues leading to data capture below 90%.

Site	Pollutant	Data Capture	Issue
Ashford Background	NO_2	55.9	The analyser was producing high values from December 2009 although the data looked to be responding as expected with respect to diurnal patterns. Repeated call-outs found no issues with the unit. A hot spare installation identified that there was indeed a problem and a different analyser was installed in May 2010.
	PM_{10}	87.9	Fault with unit from 15th June to 21st July. Analyser replaced with a spare but this was damaged following water ingress. Over hanging trees cut back and repaired TEOM reinstalled.
	O_3	81.5	A communication issue with the ozone analyser arose following installation of a new communication system in May. This was resolved at the end of June.
Canterbury Military Road	NO_2	78.0	Data loss occurred from early May through to early July. This was caused by an unresolved analyser fault and a faulty hot spare.
Chatham Luton Background	CO	78.9	Communication was lost to the site on 9th August following the installation of a new cabin. This was caused initially by the phone line awaiting connection and secondarily by issues with the set up of the site. The slightly different data capture rates reflect the different communication set up for the different analysers which were resolved at different times, as well as some short period of data loss seen on some analysers across the rest of the year.
	NO_2	78.2	
	O_3	82.1	
	PM_{10}	84.4	
	SO_2	78.1	
Folkestone Suburban	PM_{10}	84.0	Fault with the TEOM from 1st January to 4th February. Fault resolved on the 5th engineer call out visit when sensor unit replaced. Two additional short term period of data loss in June and July due to noisy instrument. Both rectified by an engineer call out.
Maidstone Rural	O_3	84.4	Analyser was removed on 9th June for repair and was replaced on 31st July.
	PM_{10}	88.1	The new FDMS installed at the start of July was faulty and was diagnosed to have a fault with the tapered element. No PM_{10} data were collected from 2nd to 26th July.
Rochester Stoke AURN	NO_2	33.2	The site was closed from 9th November 2009 until 10th June 2010 due to a leaking cabin. Following installation of the new cabin, faults were found with the NO_2 and SO_2 analysers. The PM_{10} FDMS had continual faults following reinstallation which resulted in no data capture for the 2010 period.
	O_3	55.8	
	PM_{10}	0.0	
	$PM_{2.5}$	54.2	
	SO_2	43.8	
Swale Ospringe 2	PM_{10}	82.0	The six monthly service visit on 9th June found that the TEOM was partially sampling internally. This had caused some lower data than usual from this site but the PM_{10} data was still a reasonable concentration. Data from this point back to 13th April had to be deleted.
Swale Sheerness	PM_{10}	86.1	The TEOM was internally sampling from 20th January until 1st March 2010.
Thanet Airport	NO_2	87.5	Communication issues with the site occurred from 24th May until 11th June and from 18th June until 14th July.

2.3 Statistical summary and comparison with the Air Quality Objectives

Details of the annual average concentrations for 2010 are given in Table 2.3. Data are compared to the UK Air Quality Objectives in Table 2.4. The Objectives are listed in Appendix C.

As discussed in previous annual reports, the latest Defra Technical Guidance (LAQM.TG (09)) requires the use of the Volatile Correction Model (www.volatile-correction-model.info) to correct TEOM data against FDMS-TEOM data. This is a change to the previous requirement to apply a correction factor of 1.3 to raw TEOM data. To comply with this requirement the calculation of all statistics for TEOM PM_{10} data for 2010 have been corrected using the Volatile Correction Model (VCM), although it must be noted that some of the FDMS-TEOM data sourced from the London Air Quality Network were provisional at the time of these analyses. The calculation was undertaken using the VCM web portal. The VCM works by using the volatile particulate matter measurements provided by nearby FDMS-TEOM instruments (within 130 km) to assess the loss of PM_{10} from the TEOM; this value is then added back onto the TEOM measurements. The resulting corrected measurements have been demonstrated as equivalent to the gravimetric reference equivalent.

Due to only recent data being available from FDMS-TEOM analysers it is not possible to correct all historical TEOM data in the same manner. TEOM data with the 1.3 correction factor applied is also still used for daily air quality forecasting. For this reason all of the PM_{10} data presented in Sections 3, 4 and 5 are based on TEOM data corrected with a factor of 1.3. However, in this section, where comparisons are made with the UK Air Quality Objectives, the VCM corrected TEOM data are presented.

As discussed in Section 2.2 the TEOM analysers at the Chatham Centre and Maidstone Rural site were upgraded to FDMS-TEOM analysers during 2010. For these sites the PM_{10} TEOM data has been corrected using the VCM calculations up to the point that the TEOMs were upgraded.

As with previous reports all PM_{10} BAM data has been corrected to gravimetric equivalent by using a factor of 0.83. These values are used throughout the report.

As with previous years all sites met all CO and SO_2 Objectives.

Only Chatham Luton background saw an exceedence of the ozone 8-hr rolling mean Objective. This was driven primarily by high concentrations during the summer months.

As with the previous three years, all sites met the annual mean PM_{10} Objective of 40µgm^{-3}. Similarly no sites exceeded the 24-hr mean Objective during 2010.

In common with previous years, many of the network roadside sites failed to meet the annual mean nitrogen dioxide (NO_2) Objective of 40µgm^{-3} (21ppb). In total nine sites failed to meet this Objective. As with previous years most of the sites failing to meet this objective were roadside or kerbside sites. The exception to this was again the background site at Dover Docks. This site is classified as Urban Industrial and these exceedences indicate a significant contribution from the dock area to NO_2 concentrations. Dartford St Clements was again the only site to breach the hourly mean NO_2 Objective. The number of exceedences at this site fell from 64 in 2008 and 34 in 2009 to 19 in 2010.

Table 2.3: Annual average concentrations, 2010. PM_{10} TEOM data has been VCM corrected.

Site	CO (mgm^{-3})	PM_{10} (μgm^{-3})	$PM_{2.5}$ (μgm^{-3})	NO_2 (μgm^{-3})	O_3 (μgm^{-3})	SO_2 (μgm^{-3})
Roadside						
Canterbury Military Road				34		
Canterbury Roadside				36		
Canterbury St Peters Place				45		
Chatham Centre Roadside		22	13	33		
Dartford Bean Interchange Roadside		25		54		
Dartford St Clements Roadside		28		57		
Dartford Town Centre Roadside		24		51		
Dover Old Town Hall Roadside				41		
Dover Centre Roadside		27				
Gravesham A2 Roadside		23		37		
Maidstone A229 Kerbside		25		56		
Swale Ospringe Roadside 2		27		39		
Tunbridge Wells A26 Roadside		27		57		
Thanet Birchington Roadside		24		35		
Thanet Ramsgate Roadside		28		26		
Tonbridge Roadside 2				49		
Background						
Ashford Background		21		18	39	
Canterbury		20		18		
Chatham Luton Background	0.3	20		24	46	4
Dover Langdon Cliff						7*
Dover Docks				48		13
Folkestone Suburban		20		18	46	4
Gravesham Industrial Background		32		28		
Swale Sheerness		24		21		2
Tunbridge Wells Town Centre				26		
Thanet Airport				18		
Thanet Margate Background				20		
Rural						
Maidstone Rural		15		17	46	2
Rochester Stoke		No data	10*	24*	42*	2*

* Annual data capture less than 75%. Annual mean only indicative.

Table 2.4; Comparison with Air Quality Objectives 2010.
PM_{10} TEOM data has been VCM corrected.
(red, underlined figures show exceedences of the objective).

	CO	NO$_2$		O$_3$	PM$_{10}$		SO$_2$		
Period	Running 8-hr mean	1-hr mean	Annual Mean	Max daily running 8-hr mean	24-hr mean	Annual mean	24-hr mean	1-hr mean	15-min mean
Limit/target	10 mgm^{-3}	200 µgm^{-3}	40 µgm^{-3}	100 µgm^{-3}	50 µgm^{-3}	40 µgm^{-3}	125 µgm^{-3}	350 µgm^{-3}	266 µgm^{-3}
No. of exceedences	-	18	-	10	35	-	3	24	35
Roadside									
Canterbury Military Roadside		0	34						
Canterbury Roadside		0	36						
Canterbury St Peters Place		0	**45**						
Chatham Centre Roadside		0	33		1	22			
Dartford Bean Interchange		3	**54**		4	25			
Dartford St Clements		**19**	**57**		20	28			
Dartford Town Centre		2	**51**		5	24			
Dover Old Town Hall		5	**41**						
Dover Centre Roadside					9	27			
Gravesham A2 Roadside		0	37		2	23			
Maidstone A229 Kerbside		3	**56**		3	25			
Swale Ospringe 2 Roadside		0	39		10	27			
T. Wells A26 Roadside		1	**57**		3	27			
Thanet Birchington Roadside		0	35		6	24			
Thanet Ramsgate Roadside		0	26		16	28			
Tonbridge Roadside 2		0	**49**						
Background									
Ashford Background		0*	18*	4	0	21			
Canterbury		0	18		0	20			
Chatham Luton Background	1.4	0	24	**21**	1	20	0	0	0
Dover Langdon Cliff							0	0	0
Dover Docks		13	**48**				0	0	1
Folkestone Suburban		0	18	4	0	20	0	0	0
Gravesham Ind. Background		0	28		27	31			
Swale Sheerness		0	21		4*	24*	0	0	0
T. Wells Town Centre		2	26						
Thanet Airport		0	18						
Thanet Margate Background		0	20						
Rural									
Maidstone Rural		0	17	3	0	15			
Rochester Stoke		0*	24	5	-	-	0	0	0

* Data capture close to or less than 75%. Data indicative of annual exceedences only.

3 Air pollution episodes 2010

In this section the data are firstly compared to the index and banding system approved by the Committee on Medical Effects of Air Pollution Episodes (COMEAP). The exceedences of the AQS Objectives are then investigated on a pollutant by-pollutant basis and a number of specific episodes are discussed in more detail.

There were no notable pollution events in Kent and few across the UK during 2010. However, there were a few pollution incidents of interest that are considered on a pollutant-by-pollutant basis below.

3.1 Comparison with the AQ Banding System

The index and banding system is used within the UK to provide information about air quality levels and to allow sensitive individuals to take action if required. The descriptions associated with each band are provided in Table 3.1. Table 3.2 presents the number of days when pollutant concentrations within the Kent and Medway network reached “Moderate”, “High” or “Very High” levels.

Table 3.1: Air quality bandings and description.

Band	Index	Health Descriptor
Low	1 to 3	Effects are unlikely to be noticed even by individuals who know they are sensitive to air pollutants
Moderate	4 to 6	Mild effects, unlikely to require action, may be noticed amongst sensitive individuals.
High	7 to 9	Significant effects may be noticed by sensitive individuals and action to avoid or reduce these effects may be needed (e.g. reducing exposure by spending less time in polluted areas outdoors). Asthmatics will find that their 'reliever' inhaler is likely to reverse the effects on the lung.
Very High	10	The effects on sensitive individuals described for 'High' levels of pollution may worsen.

Table 3.2: Number of days with Moderate, High and Very High concentrations.

	NO_2		O_3	PM_{10}			SO_2
	Moderate	**High**	**Moderate**	**Moderate**	**High**	**Very High**	**Moderate**
Roadside							
Canterbury Military Roadside	0						
Canterbury Roadside	0						
Chatham Centre Roadside	0			1			
Dartford Bean Interchange	0			1			
Dartford St Clements	0			11			
Dartford Town Centre	0			2			
Dover Old Town Hall	0						
Dover Centre Roadside				1			
Gravesham A2 Roadside	0			0			
Maidstone A229 Kerbside	0			4			
Swale Ospringe 2 Roadside	0			6			
T. Wells A26 Roadside	0			3			
Thanet Birchington Roadside	0			4			
Thanet Ramsgate Roadside	0			8			
Tonbridge Roadside 2	0						
Background							
Ashford Background	0		10	0			
Canterbury	0			0			
Dover Langdon Cliff							0
Dover Docks	1						1
Gravesham Ind. Background	0			16			
Chatham Luton Background	0		39	1			0
Swale Sheerness	0			5			0
T. Wells Town Centre	0	0					
Thanet Airport	0						
Thanet Margate Background	0						
Folkestone Suburban	0		16	0			0
Rural							
Maidstone Rural	0		10	0			0
Rochester Stoke	0		13	0			0

In common with previous years there were no days when concentrations of CO reached Moderate concentrations or above. This has therefore not been included in Table 3.2.

The Dover Docks site was the only site that recorded and incident of “Moderate” NO_2 concentrations. One day exceed the “Moderate” band which was the 20th July 2010 and was most likely due to localised conditions or emissions, such as vehicles entering and exiting the port and the shipping activity.

For ozone, there were a large number of days which recorded “Moderate” during 2010. These periods of exceedence are discussed in section 3.2.

In previous years the bandings for PM_{10} were relevant for TEOM monitors only. This PM_{10} air quality index for TEOM monitors was not directly transferable to other reference equivalent monitors and required updating. The results of the PM_{10} equivalence programme[4] have been analysed to develop an equation to produce a second set of bandings for reference equivalent monitors as follows:

Reference equivalent PM_{10} = TEOM x 1.3 – 2.2494

It has been accepted by COMEAP that on this basis the air quality index for PM_{10} and breakpoints for “Low”, “Moderate”, “High” or “Very High” pollution can be assigned to old TEOMs as before and can be recalculated for reference equivalent data[5]. Please note that this is not the same equation for correcting raw TEOM to gravimetric equivalent. Further information is available on the UK Air Quality Archive[6].

Gravesham Industrial Background saw the most days breaching the “Moderate” banding with 16 days in total. This was followed by Dartford St Clements with 11 days. No sites saw breaches of the “High” banding or the “Very High” banding.

There are several specific industrial sources of SO_2 in Kent, such as power stations and shipping. Pollution abatement equipment at power stations has helped reduce emissions, such that moderate SO_2 levels are now rare. The Dover Docks site, however, recorded 1 day of “Moderate” SO_2 air pollution. The source of this pollution has been shown to be from shipping activity at the docks.

3.2 Ozone

The maximum hourly averaged ozone concentration in 2009 was 131 μgm^{-3} at the Folkestone Suburban monitoring site on 27th June. This breached the Moderate air quality band at air pollution index 5 – there were no incidents of High air pollution or above due to ozone in the KMAQMN during 2010.

When comparing the 2010 monitoring results against the Air Quality Strategy objective of 100 μgm^{-3} as a daily maximum 8-hour running mean (not to be exceeded on more than 10 days), Figure 3.1 shows that there were a few periods of increased photochemical pollution during the year.

[4] http://www.airquality.co.uk/reports/cat05/0606130952_UKPMEquivalence.pdf

[5] Reference Equivalent refers to the measurement method found to be equivalent to CEN standard EN12341 for PM_{10}. This includes the following monitors found in Kent: corrected TEOM (TEOMx1.3 – 2.249 or Volatile Correction Model (VCM) corrected TEOM); FDMS-TEOM; corrected BAM.

[6] http://www.airquality.co.uk/news/Revised_PM10_Air_Quality_Index_for_Reference_Equivalent_Data_ver_2.pdf

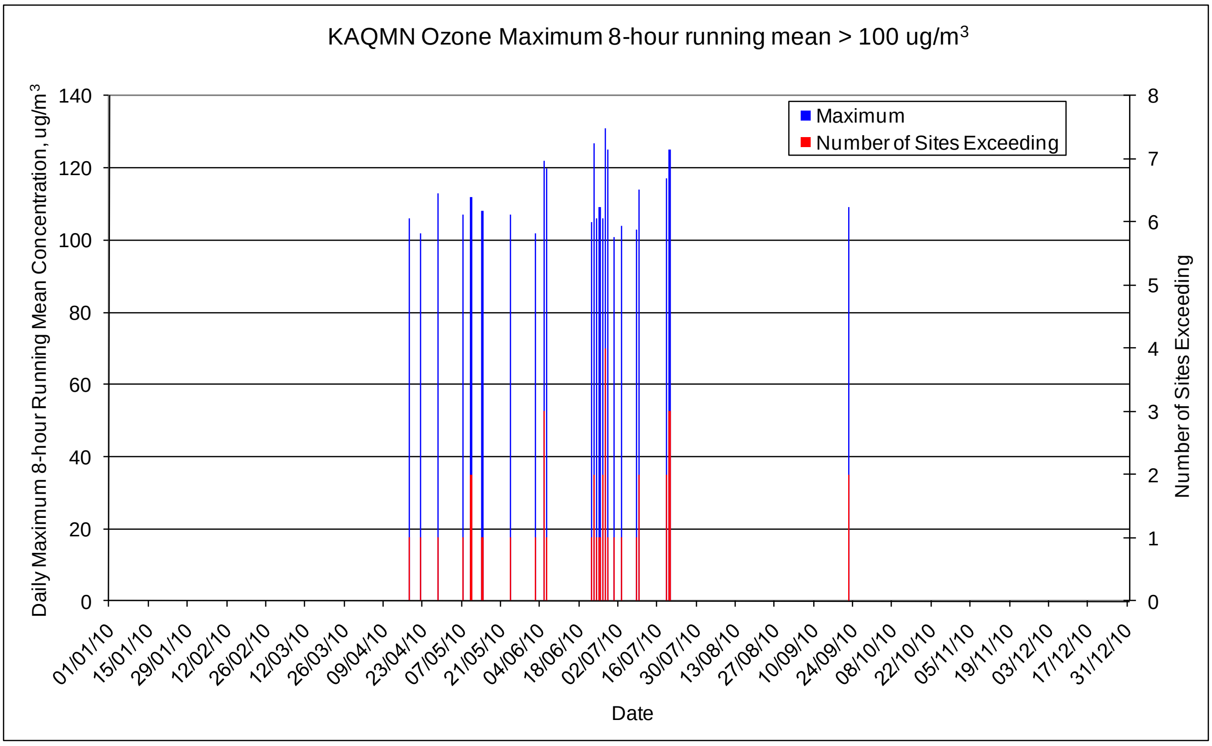


Figure 3.1: Periods and number of sites when ozone maximum 8-hr running mean concentrations exceeded 100 µgm^{-3}.

A number of the exceedences were seen only at one site, Chatham Luton. Most of the exceedences of the Moderate band occurred between April and July with one days exceedence on 22nd September.

Ozone concentrations in Kent followed a similar pattern to UK wide ozone concentrations during 2010. Moderate days were measured at many sites in the UK AURN network between March to mid July. An additional shorter period with exceedences was seen at the beginning of August with a spell of exceedences also seen in the mid September. However 2010 saw no significant High episodes across the UK.

The occasions where Kent saw some elevated ozone concentrations were due to short periods of favourable weather conditions. For example, the highest frequency of breaches of the Objective occurred between 22nd June and 3rd July. This period was characterised by settled weather with high pressure dominating. Most places stayed dry with plenty of sunshine and it was warm or very warm. The highest temperature of the year to date, 30.9 °C, was recorded at Gravesend (Kent) on 27th June[7].

3.3 PM_{10} Particulate Matter

A large number of sites across Kent breached the 50 µgm^{-3} daily mean AQS Objective but none exceeded the 35 exceedences permitted during a calendar year. As with previous years the highest number of exceedences were measured at Gravesham Industrial Background (20 exceedences) and Dartford St Clements Roadside (27 exceedences). Swale Sheerness recorded the highest daily mean of 92 µgm^{-3}. In contrast to previous years there were no periods when PM_{10} pollution events were widespread across the KMAQMN. There were 20 stations across Kent which monitored PM_{10} during 2010 and the maximum number of stations seeing exceedences of the Objective on any one day never exceeded nine during the year. This is illustrated in Figure 3.2 below where there is a general low frequency of exceedences spread throughout the year.

[7] http://www.metoffice.gov.uk/climate/uk/2010/june.html

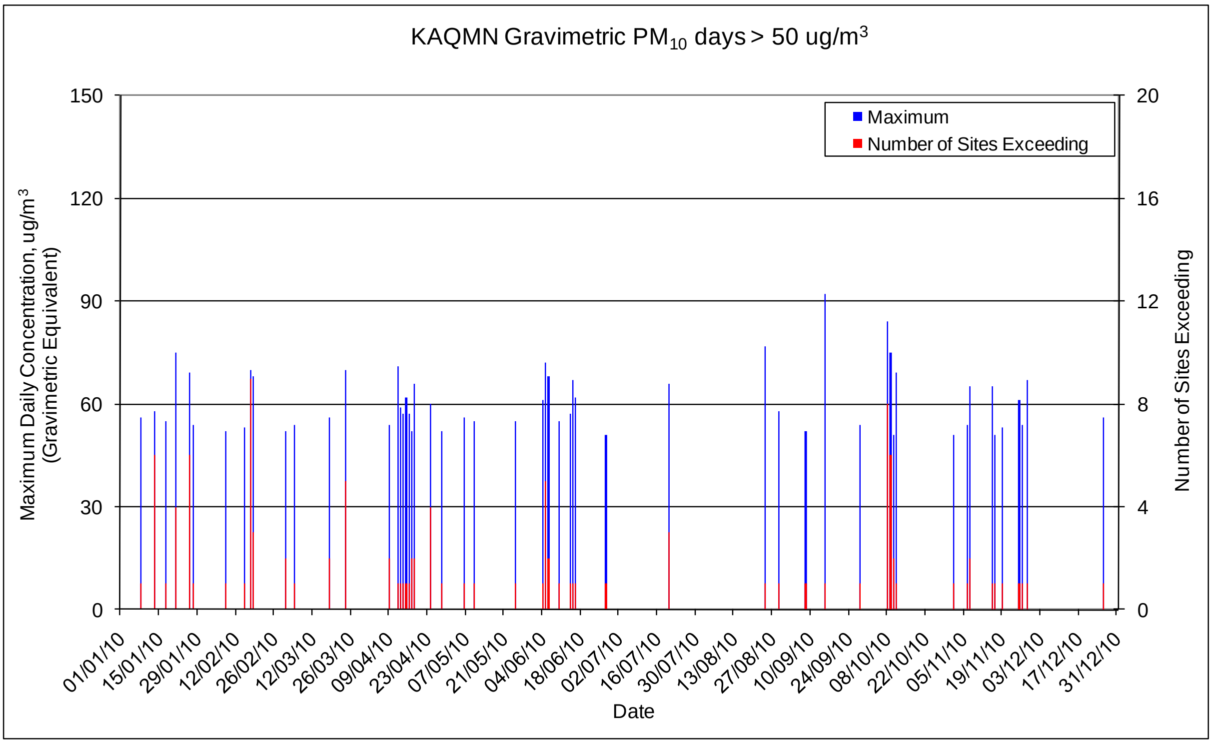


Figure 3.2: Periods and number of sites when gravimetric equivalent PM_{10} 24-hr mean concentrations exceeded 50 µgm^{-3}.

The UK as a whole saw a reduced number of exceedences during 2010 and the significant periods of elevated concentrations during 2010 were seen primarily across the north of England, Scotland and Northern Ireland[8].

3.4 Sulphur Dioxide

Sulphur dioxide is now very much a localised problem across the UK, only recognised as causing possible problems in areas close to:

- Domestic coal burning.
- Diesel and steam railways.
- Industrial use of high sulphur fuels.
- Shipping.

This is very much the situation in Kent with exceedences of the 266 µgm^{-3} 15-minute SO_2 objective only being recorded at 1 of the 7 SO_2 monitoring stations during 2010. The maximum 15-minute concentration was 301 µgm^{-3} recorded at Dover Docks on 16th February. This was the only exceedence of the objective in the whole of Kent during 2010 compared to 20 exceedences recorded in 2009.

[8] UK Air Quality Forecasting: Annual Report 2010. Produced by AEA on behalf of Defra – report pending publication.

3.5 Nitrogen dioxide

Exceedences of the 200 µgm^{-3} air pollution standard during 2010 were mainly limited to roadside, kerbside and industrial sites. Dartford St Clements was the only site to measure more than the allowed 18 exceedences with 19 recorded. This was 15 less than 2009. This is reflected nationally with no widespread NO_2 episodes seen during 2010. The exceedences seen in Kent were spread throughout the year with only one period where more than two sites recorded an exceedence - as can be seen in Figure 3.3 below. The 19th November saw three sites, Dartford St Clements, Dartford Town Centre and Tunbridge Wells Town Centre exceeding the Objective. This was preceded by exceedences at one or two sites on each of 14th, 15th and 16th November. This coincided with a period of still weather which reduced the dispersion of pollutants and so affected primarily those sites close to emissions sources. A notable period of elevated concentrations was also seen during December. Mean temperatures were 5 °C below average across most of the UK, and it was the coldest December on record for over 100 years. This type of weather pattern can lead to elevated concentrations due to temperature inversions creating poor dispersion conditions and higher domestic emissions from heating. Although this period did not lead to a large number of exceedences of the hourly Objective, elevated concentrations were seen across Kent with exceedence at Tonbridge Roadside and Dover Docks.

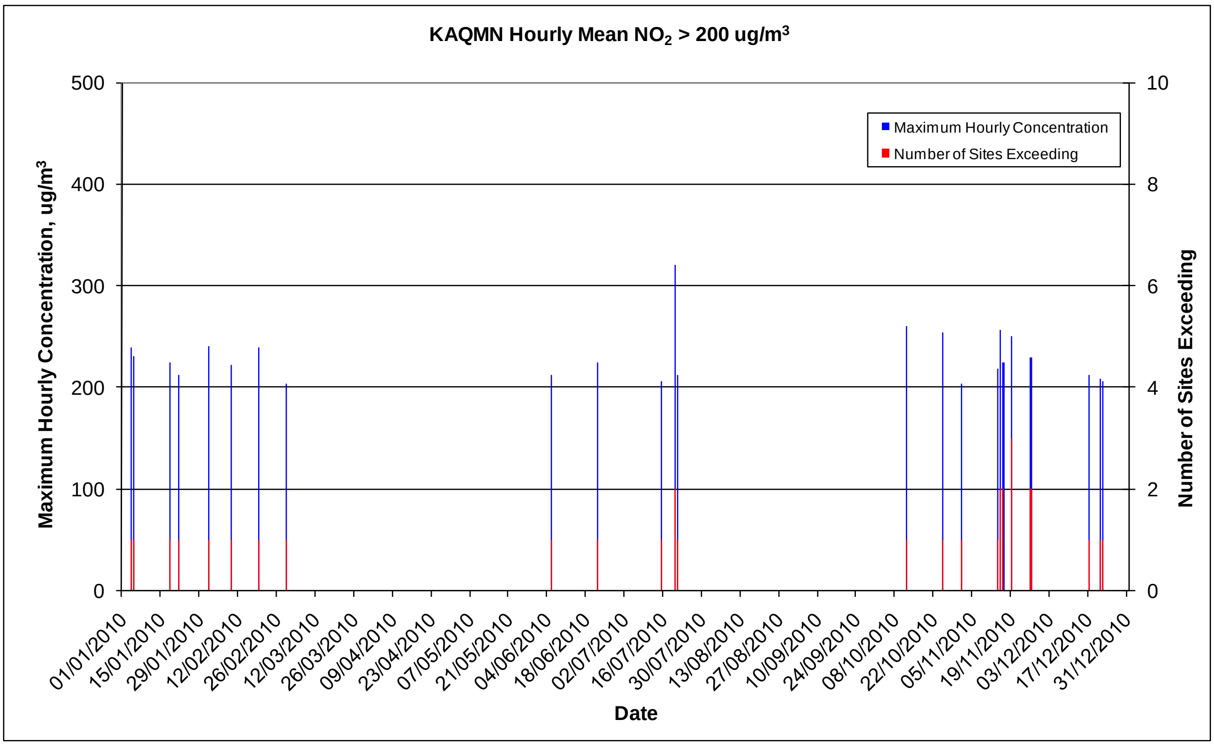


Figure 3.3: Periods and number of sites when NO_2 hourly mean concentrations exceeded 200 µgm^{-3}.

3.6 Unusual events – the Eyjafjallajökull volcano

On April 14th a sub-glacial summit eruption began at Eyjafjallajökull volcano in Iceland, resulting in the much publicised air traffic disruption and initially causing much concern over ground-level air quality. On May 4th the Icelandic Metrological Office (IMO) released a statement stating that the eruption had become more explosive and was producing more ash. This coupled with the metrological conditions at the time were responsible for transporting the ash cloud over the UK.

During periods when the plume was over or close to the UK, daily analysis of UK air quality monitoring results were provided to assess if there was any ground-level impact. The levels of PM_{10} continued to remain low across the UK with little evidence of any plume grounding in the monitoring data. There were also no significant increases in concentrations of SO_2, a gaseous pollutant expected to be found in volcanic plumes, throughout the AURN.

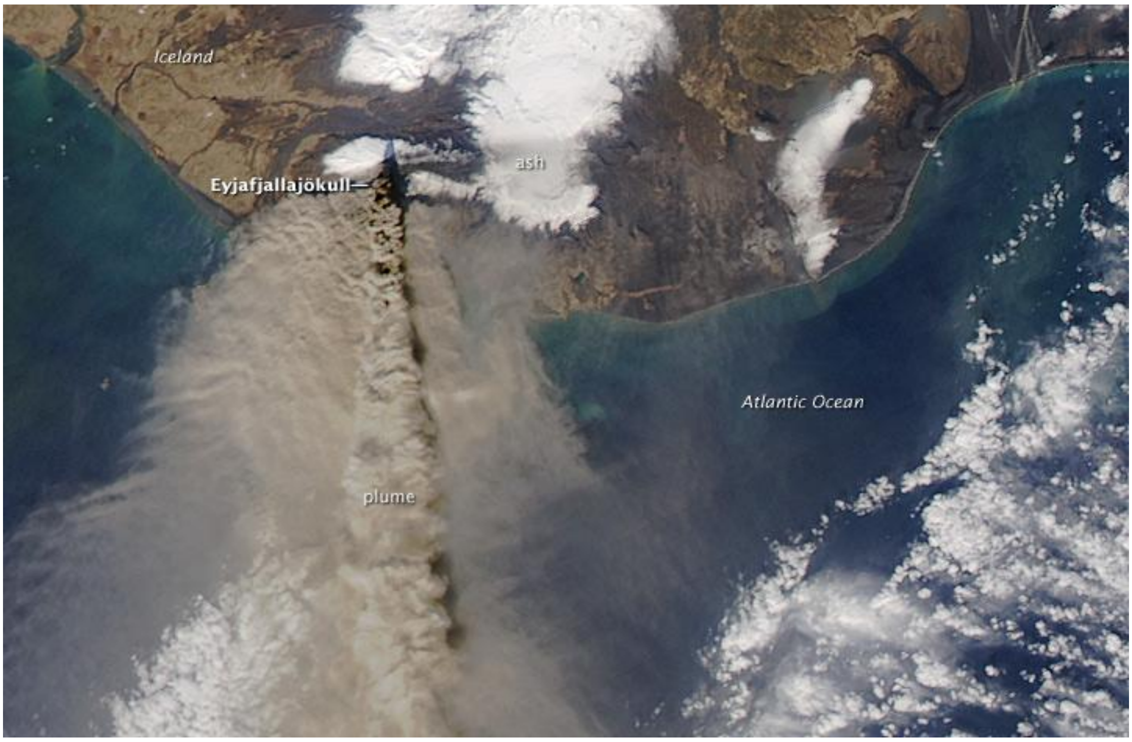


Figure 3.4: Satellite image of the eruption from Eyjafjallajökull volcano.

4 Sustainability indicators

In 1999, an air quality indicator was introduced in support of the UK Sustainable Development Strategy. When this strategy was updated in 2005, the opportunity was taken to introduce two new air quality indicators to better reflect the effects on health of long-term exposure to lower levels of pollution.

The indicators are as follows:

- Annual average urban PM_{10} particulate concentrations (roadside and background);
- Annual average ozone concentrations measured as the daily maximum 8-hour running mean (rural and urban background);
- Total number of days in which one or more of the specified pollutants were recorded as 'moderate' or worse air pollution (the original headline indicator).

The two new air quality indicators allow trends to be monitored for annual exposure to the two pollutants believed to have the greatest effect on human health, particles and ozone. For particles, the indicator has been introduced because there is evidence that suggests long-term exposure to even low levels of particulate (PM_{10}) may have a significant effect on public health. The annual mean values for particulates are a useful measure of overall exposure to particulates at all concentrations. The annual average measures of PM_{10} have been included to reflect this. The impact of long term exposure to low levels of ozone is currently less clear, but if there is no lower limit on the levels which have a health impact then the parameter used in the new indicator gives the best representation of the total annual impact of the short term effects of ozone pollution.

The original Headline Indicator is defined as the number of days of moderate (or above) pollution as calculated by the banding system for carbon monoxide, nitrogen dioxide, sulphur dioxide, ozone and PM_{10} particles (days with moderate levels of more than one species only count once). In practice, the most significant contributors are ozone and PM_{10}. This indicator is calculated using a fixed subset of sites meeting certain criteria for pollutants measured; these are listed in Table 4.1. Sites must fulfil the following criteria:

- Rural sites should be included if they measure ozone, and ideally PM_{10};
- Urban Background sites should be included if they measure at least PM_{10}, ozone and sulphur dioxide;
- Roadside sites if they measure PM_{10}.

These were chosen on the basis of effects on health and advice from the Department of Health Committee on Medical Effects of Air Pollutants and reflect the increased risk of suffering health effects by vulnerable groups on specific days. Sites may be omitted from a year's calculation if specific local factors (e.g. building work) are cited. Data capture must be at least 75% across the year (as well as summer for ozone) for sites to be included.

Figure 4.1 and Figure 4.2 present the data for the PM_{10} and ozone annual average indicators for the UK as a whole, and across the Kent & Medway network. Ozone is split between rural and urban sites, and PM_{10} by roadside and urban. The PM_{10} indicator is calculated from the average annual mean gravimetric PM_{10} concentration at all sites. The ozone indicator is calculated from the maximum daily 8-hour average ozone concentration (i.e. the average across all sites of each day's highest 8-hour running average concentration).

There has been a general decrease in particulate concentrations in the UK since 1997. The Kent & Medway network was fairly small in the early years, and the indicator may have been influenced by the introduction of specific sites.

In 2000 the Gravesham sites were included in the network and this contributed to an increase in roadside and, more markedly, urban background PM_{10} concentrations in Kent. Since 2000 the roadside indicator for Kent has followed the trends of the UK indicator fairly closely. The increase in the number of episodes seen at the Gravesham Industrial site in 2007 compared to 2006 resulted in a slight increase in the indicator for urban background PM_{10} in Kent in 2007. This situation improved through to 2010 for both site types however there was a slight increase in the number of episodes in 2010 at the urban sites that was mirrored by the UK indicator for urban sites.

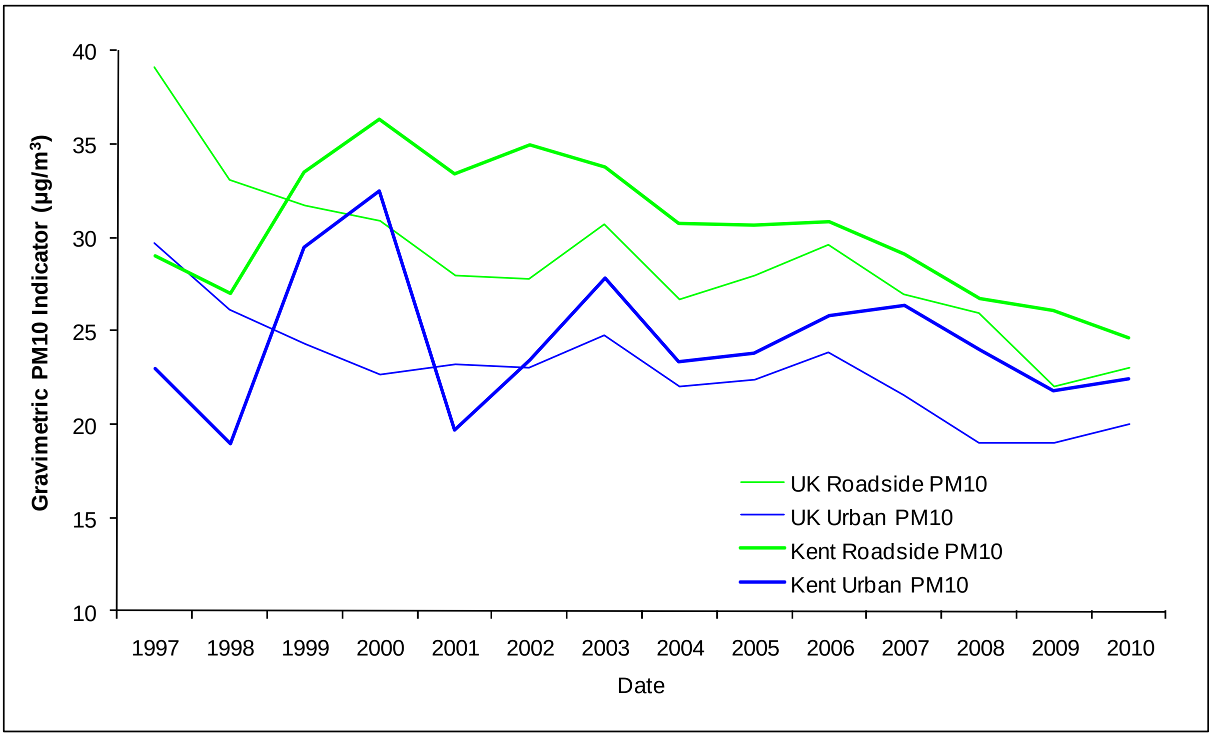


Figure 4.1: Annual average PM_{10} Air Quality Indicator for Kent and UK, 1997 to 2010.

Over the last two years both UK indicators for ozone (rural and urban) and the rural indicator for Kent have seen a reduction in concentrations. This could possibly be attributed to a reduction in the emission of nitrogen oxides which generally leads to a reduction in ozone close to the source of emission (e.g. from transport). However, Figure 4.2 shows that the urban indicator for Kent has shown an increase in concentration. This is primarily driven by an increase in exceedences at the Chatham Luton Background site during 2010.

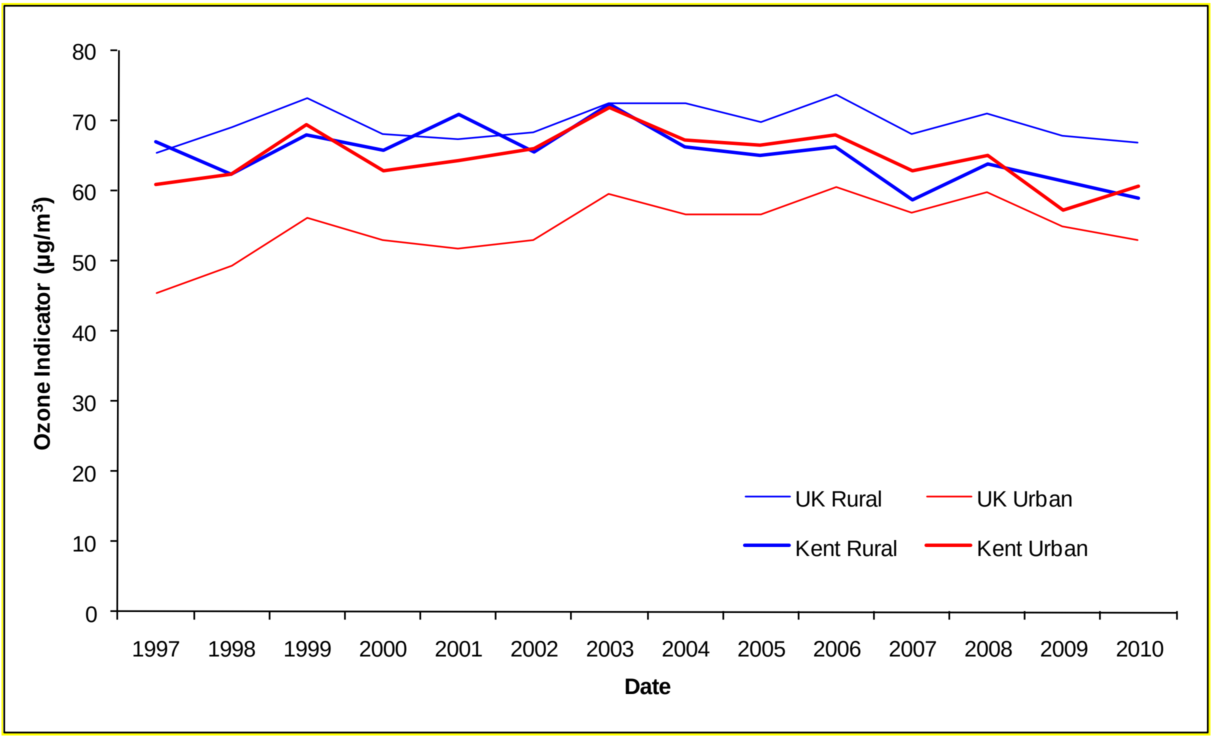


Figure 4.2: Mean daily maximum running 8-hr average ozone Air Quality Indicator for Kent and UK, 1997 to 2010.

Table 4.1: Number of days when one or more of specified pollutants recorded "Moderate" or worse concentrations - Headline Air Quality Indicator.

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Ashford Background													24	10
Chatham Luton Background	61	26	59	24	41	45	86	57	47	42	44	56	3	40
Chatham Roadside	14	1	3	1	8	1	12	3	3	7	7	3	2	1
Folkestone Suburban	26	38	85	37	42	51	72	38	49	59	49	45	22	16
Maidstone A229 Kerbside			5	11	15	5	30	6	9	13	15	10	0	4
Maidstone Rural			52	37	92	62	100	45	33	57	44	49	28	10
Rochester Stoke	72	44	66	39	64	52	70	60	37	53	42	33	13*	13*
Thanet Rural		1	11	37	16	24	41	19	9	27	4	-	-	-
Kent Overall Rural Indicator	72	23	43	38	57	46	70	41	26	46	30	33	26	10
Kent Overall Urban Indicator	34	22	38	18	27	26	50	26	27	30	29	29	7	15
UK Rural Indicator	42	29	48	28	34	32	64	45	40	55	28	47	32	22
UK Urban Indicator	39	25	33	20	23	19	48	22	21	38	24	27	10	8

* not used in the calculation of the rural indicator as data capture too low.

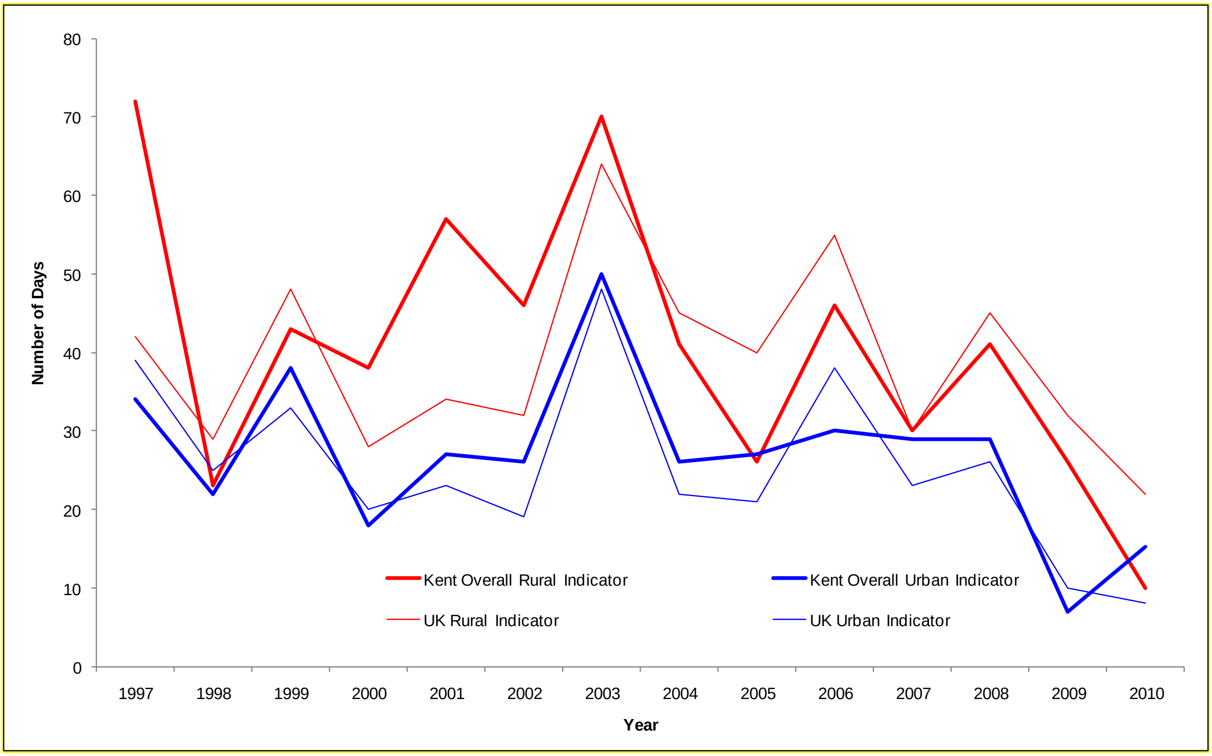


Figure 4.3: Headline Air Quality Indicator for Kent and UK – the total number of days with pollutant concentrations recorded "Moderate" or above.

Table 4.1 shows the results for the Headline (original) Air Quality Indicator. Only those sites in the Kent and Medway network that fulfil the selection criteria are included. Figure 4.3 presents these data for Kent and the UK. As reported previously the indicators all show the largest peak in 2003 as a result of the hot summer, which contributed to elevated levels of pollutants. In 2009 there was a significant decrease in the number of recorded days where concentrations were recorded at moderate or above. At the urban sites in 2010, however, there was an increase. The cause of this was due to a significant drop in the recorded breaches at the Chatham Luton Background site in 2009 and subsequent increase in 2010 to the number of breaches prior to the drop in 2009. Of the 40 breaches recorded in 2010 39 were attributed to ozone. Further local investigation would be required to ascertain the cause of this fluctuation.

Overall there is an observable downward trend since the peak in concentrations in 2003 at a UK level and in Kent.

5 Trends in pollution levels, 1997-2010

Air quality is heavily influenced by prevailing meteorological conditions, and any long-term trend in pollution levels can be difficult to identify amongst short-term variations. Settled conditions in winter, for instance, frequently lead to higher annual average NO_2 concentrations, whereas hot, sunny weather in summer gives higher ozone concentrations. To go some way towards smoothing out these short-term fluctuations and to identify any long-term trends, data can be presented as rolling annual means. This calculates an average each month for the previous 12-month period. This calculation is only deemed valid if there is at least 75% data capture over the 12 months in question. This can result in some gaps in the rolling annual mean plots where periods of data loss occur.

This section presents running annual means for the 12 years over which the monitoring network has operated. It is, of course, not possible to calculate running annual means for the first 12 months of operation of each site and so only those sites which were in operation before 1998 have rolling annual means for the 1998 period.

5.1 Carbon monoxide

During 2010 CO measurement were only obtained at the Chatham Luton Background site. The CO measurements at the Maidstone A229 Roadside and Canterbury Roadside sites ceased in November 2009 and December 2006 respectively.

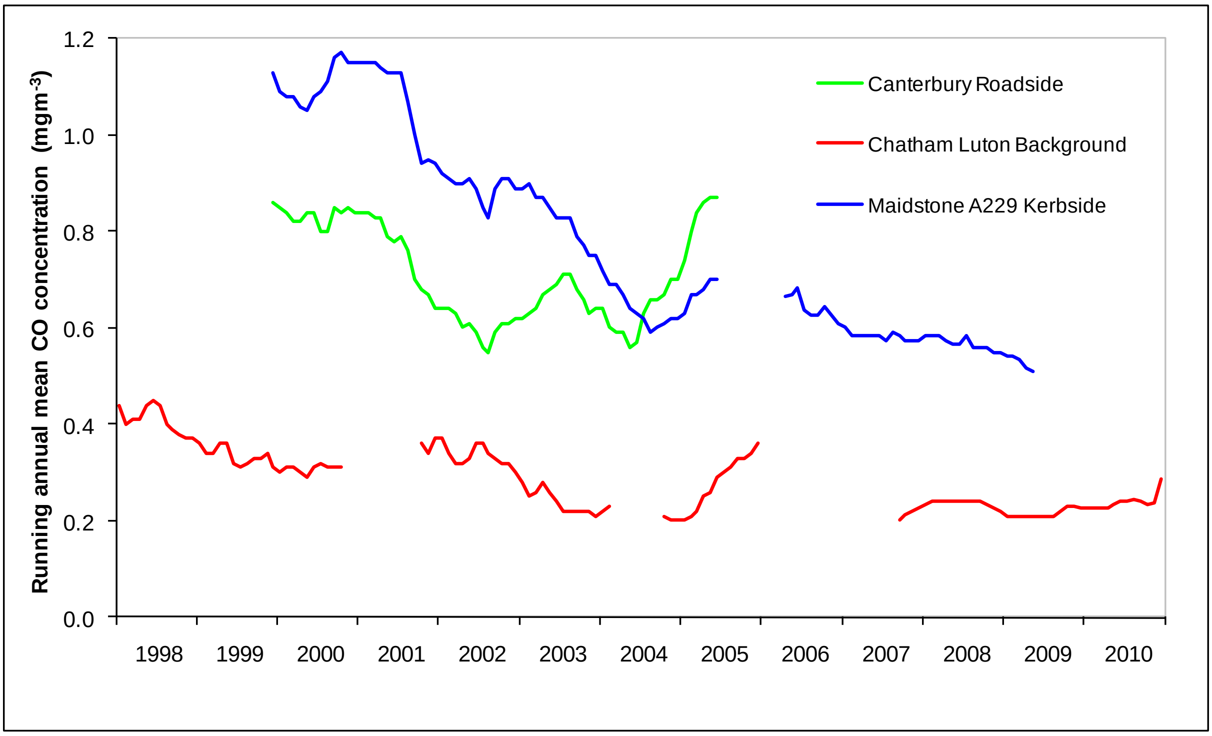


Figure 5.1 Trends in running annual mean CO concentrations.

As reported previously CO emissions are associated with combustion sources, particularly road transport. The general shift towards vehicles with clean burn engines and catalytic converters has produced a significant drop in CO concentrations across the UK as a whole. The EU air quality standard for CO is based on a running 8-hour mean and is 10 mg m^{-3}. This air quality standard has not been exceeded in the Kent monitoring network over the last 12 years. Indeed concentrations in Kent have been less than 10% of this standard for almost the full time series as presented in Figure 5.1. Concentrations have also generally dropped over the reported time period.

5.2 Nitrogen dioxide

The data for nitrogen dioxide from each site are split across three graphs for ease of presentation. The roadside sites are split into rough geographic regions of east and west whilst the background and rural sites are displayed on a third, separate graph. The data from Dover Docks has been included in the graph displaying the eastern roadside sites due to the concentrations being more comparable to those recorded at the roadside sites. Figure 5.2 and Figure 5.3 show that during 2010 there was a mixed trend in concentrations of NO_2 across Kent. A number of sites saw a definite increase in concentrations during 2010. These were Swale Ospringe Roadside 2, Dover Docks, Tunbridge Wells A26 Roadside, Dartford Town Centre and Maidstone A229. In contrast some sites saw an evident reduction in concentration; these were Thanet Ramsgate Roadside, Thanet Birchington Roadside and Dartford Bean Interchange.

Figure 5.4 shows that background concentrations have remained relatively stable since the mid-2000's with the expected variations between measurement periods. In 2010 all background and rural sites continued to be well below the annual mean Objective concentration. The general trend at the background sites was a reduction in NO_2 concentrations during 2010, except for Canterbury and Tunbridge Wells Town Centre, which have remained fairly stable. A number of sites show a slight increase at the end of 2010 reflecting the increase in NO_2 concentration seen during the cold weather experienced across the UK in December.

The evidence provided by the background sites suggests that the reduction seen at roadside sites during 2010 was significantly influenced by a general reduction in concentrations across the region during 2010 as opposed to being solely attributable to any significant reduction in local emissions sources. In contrast, those roadside sites which recorded an increase in concentrations are likely to have been significantly influenced by changes in local emissions.

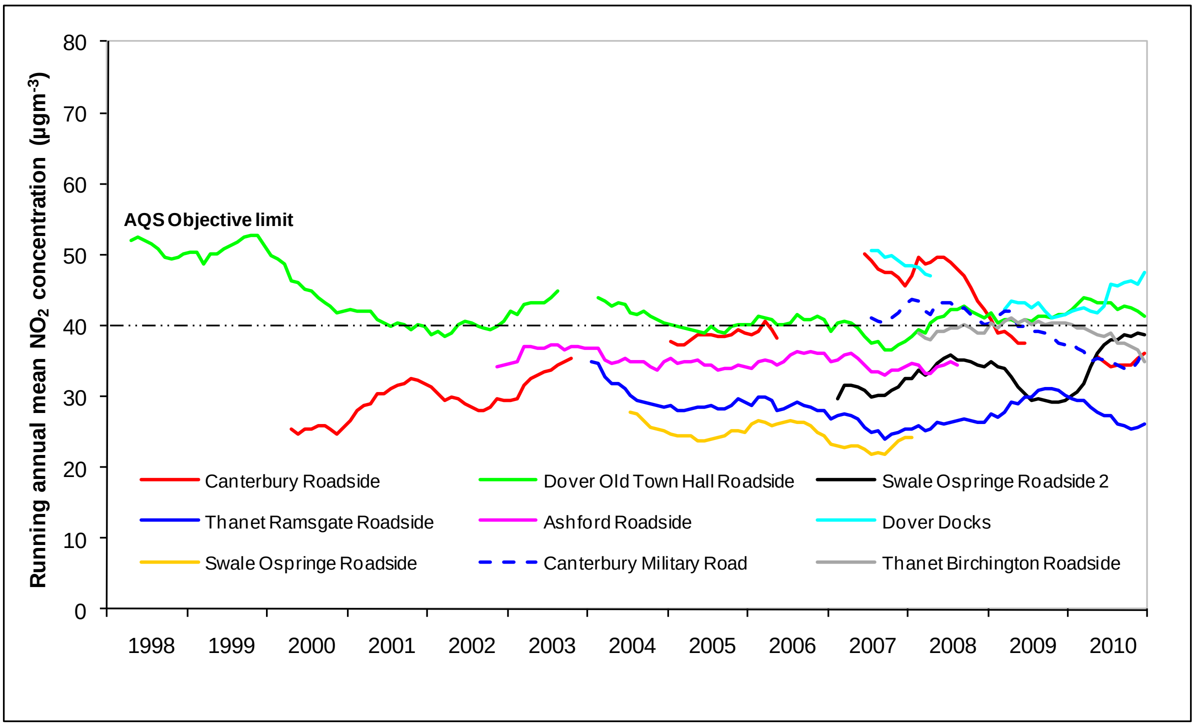


Figure 5.2: Trends in running annual mean NO_2 concentrations – eastern roadside sites.

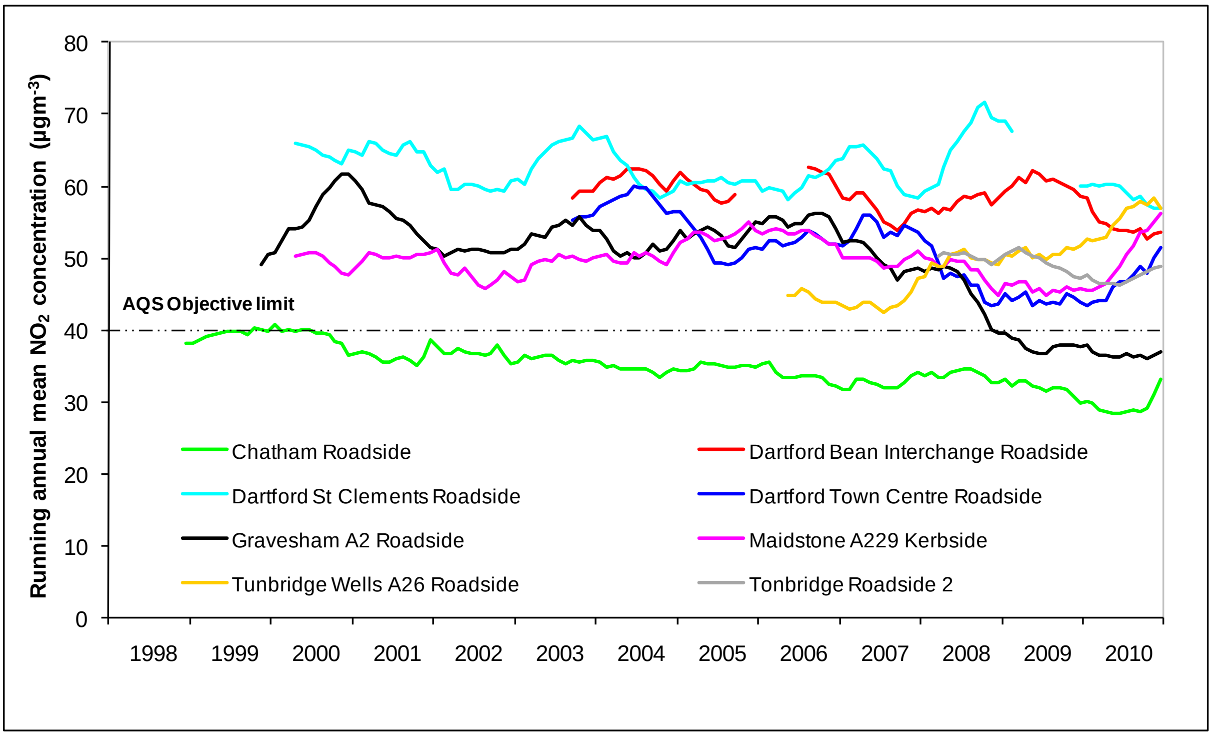


Figure 5.3: Trends in running annual mean NO_2 concentrations - western roadside sites.

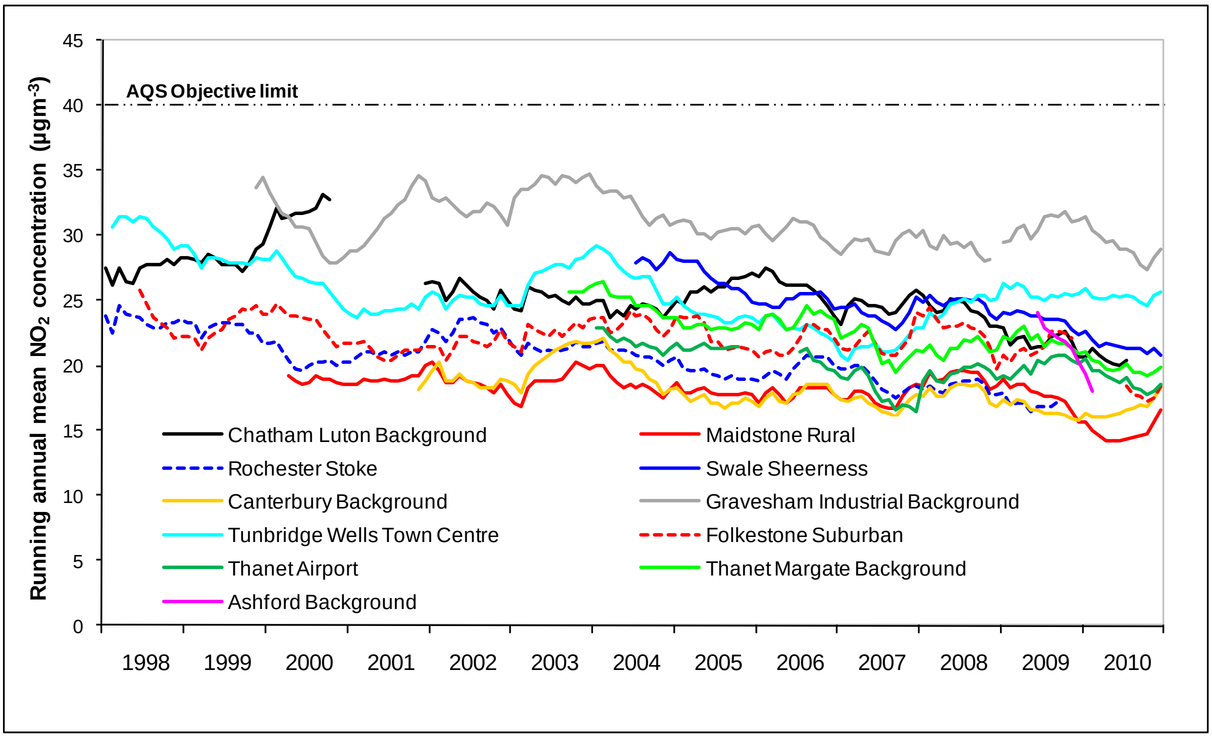


Figure 5.4: Trends in running annual mean NO2 concentrations – background and rural sites.

5.3 Ozone

Figure 5.5 shows the trends in running annual mean ozone concentrations over the last twelve year period. Due to the key role played by sunlight in the formation of ozone, the highest annual mean concentrations tend to be recorded in years of long hot summers. The peak in running annual mean between 2006 and 2007 shows the influence of the good weather during the summer of 2006. The effect of the bad summer during 2007 and 2008 can be seen with the drop in running annual mean concentrations towards the end of each of these years. The trend at Chatham Luton Background over recent years can be seen to be atypical of ozone trends in Kent. There was a significant drop in ozone concentration during 2009 followed by a large increase in 2010 to concentrations higher than seen in previous years. The reason for this fluctuation is unknown. Some pollutants do react with ozone in the ambient air resulting in a reduction in ozone concentrations. It is possible that some localised activities during 2009 were creating the conditions for this to occur, but this is difficult to ascertain in hindsight.

Although there are some observable short term trends in the rolling annual mean concentration of ozone at the other sites during the twelve year period, there is no discernable long term reduction or increase in concentrations.

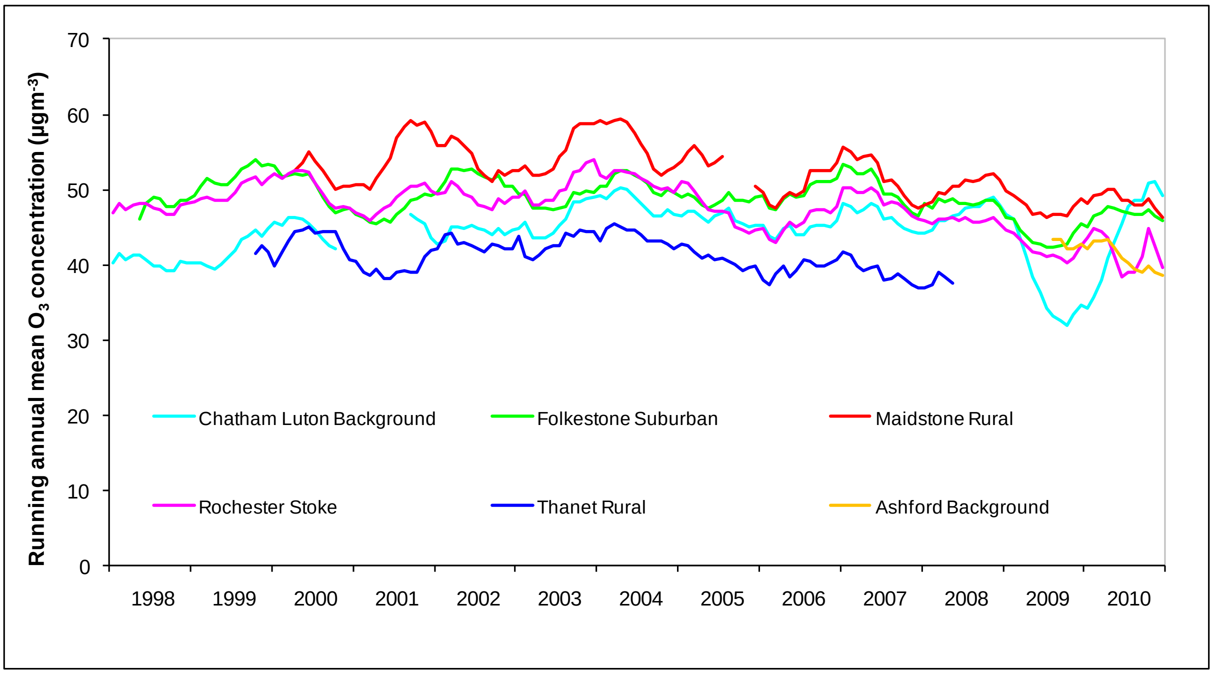


Figure 5.5: Trends in running annual mean ozone concentrations.

5.4 Fine particles (PM_{10} and $PM_{2.5}$)

Until 2010 there were two types of analyser employed in the Kent Network for measuring particulate matter - the Beta Attenuation Monitor (BAM) and the Tapered Element Oscillating Microbalance (TEOM). These use very different detection methods, and the data from each may not be strictly comparable. The BAM requires a correction factor of 0.83 to produce data comparable to the gravimetric reference standard for PM_{10}. As discussed in Section 2.3 the correction for the TEOM has changed from the application of a factor of 1.3 to the use of the Volatile Correction Model, which corrects TEOM data against FDMS data. For the purpose of long-term analysis, however, there is limited historical FDMS data with which to correct old TEOM datasets. For this reason the data from the TEOM analysers presented in this section have been corrected by the 1.3 correction factor to allow for the continued trend comparison.

As discussed in Section 2.1 two of the TEOM analysers, at Chatham Roadside and Maidstone Rural sites, were upgraded with FDMS units during 2010. As this is a different measurement technique it is not viable to consider long term results from the two analyser types as comparable. These will therefore be regarded as a third analyser type going forward. For 2010 there was not sufficient data to allow the display of rolling annual averages for these two new instruments. These will be considered within the 2011 report.

As particulate matter is frequently transported considerable distances in the atmosphere, sources may be a considerable distance from the receptor sites. This means that rural sites may have concentrations close to those of urban background stations. Local abatement measures can only have a limited effect on measured concentrations at these sites. However, roadside sites do have a considerable contribution from local sources (vehicle emissions, tyre/brake dust, re-suspended particles etc).

Figure 5.6 and Figure 5.7 show the trends in the running annual average PM_{10} concentrations at TEOM and BAM sites in the KMAQMN respectively. As discussed in previous reports a proportion of the particulate matter present in Kent is from non-local sources, most significantly London and mainland Europe. This results in relatively high background and rural concentrations of PM_{10} across Kent as can be seen in Figure 5.6. This non-local nature of particulate matter makes a significant reduction in ambient concentrations difficult. The TEOM data show that the contribution from road traffic results in increased concentrations at the roadside sites compared to background sites (e.g. Dover Centre, Tunbridge Wells A26, Maidstone A229, Ashford and Chatham)

Figure 5.6 shows that concentrations at all TEOM sites had remained relatively constant over the period 1998 to 2007. Between 2008 and 2010 there was some variation in the rolling annual mean concentration however there has been a general downward trend in concentrations at almost all of the sites. The reduction in concentrations looks to be driven, at least partly, by a reduction in background concentrations which is likely to be due to the wet summers which occurred between 2007 and 2010 resulting in particulate being removed from the air by rain. During 2010 the majority of the sites showed a decrease in annual mean concentration, however there were three exceptions: Ashford Background; Folkestone Suburban; and Chatham Luton Background. This suggests an increase in the local PM_{10} source at these sites.

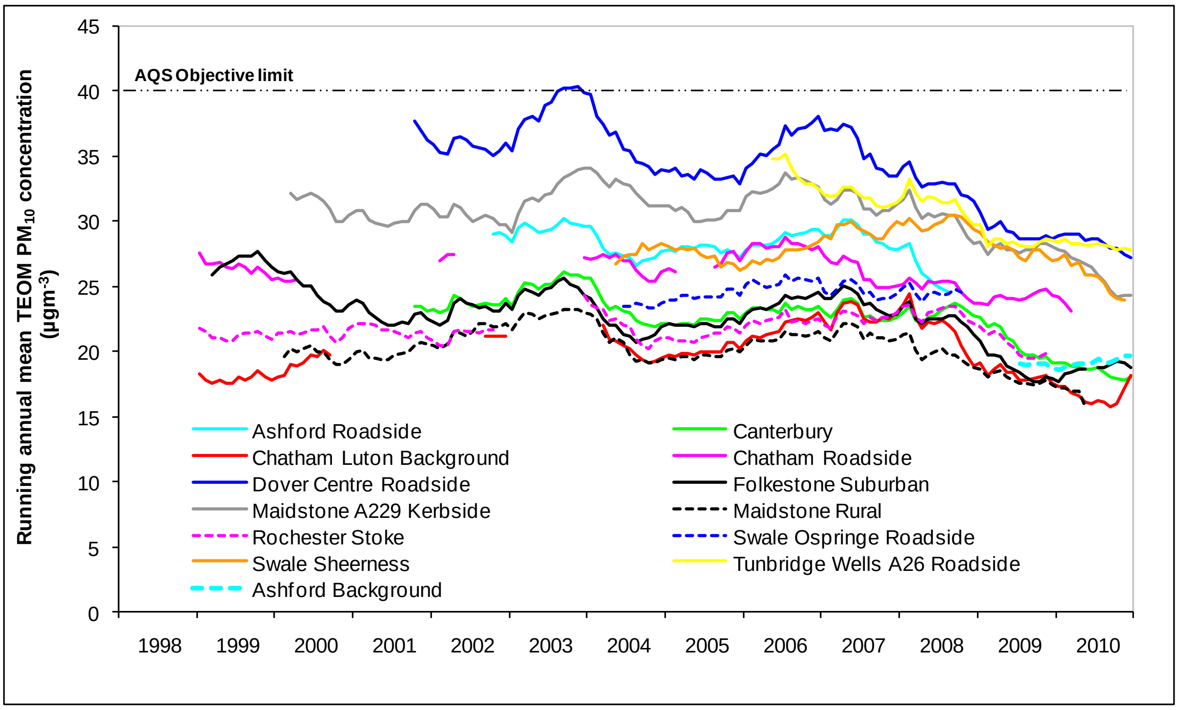


Figure 5.6: Trends in running annual mean TEOM PM_{10} concentrations (1.3 correction factor applied).

Overall trends at sites with BAM analysers show a similar pattern to those observed by the sites with TEOM analysers. Figure 5.7 shows a reduction in annual running mean concentrations between 2008 and mid 2010 at the majority of the sites. The main exceptions to this are the Thanet Ramsgate Roadside and Gravesham Industrial sites which do not show the same degree of reduction suggesting a significant impact from local emission sources at these locations. The other four BAM sites all saw an increase in concentration during the second half of 2010. This is also seen in the Chatham Luton Background TEOM data in Figure 5.6.

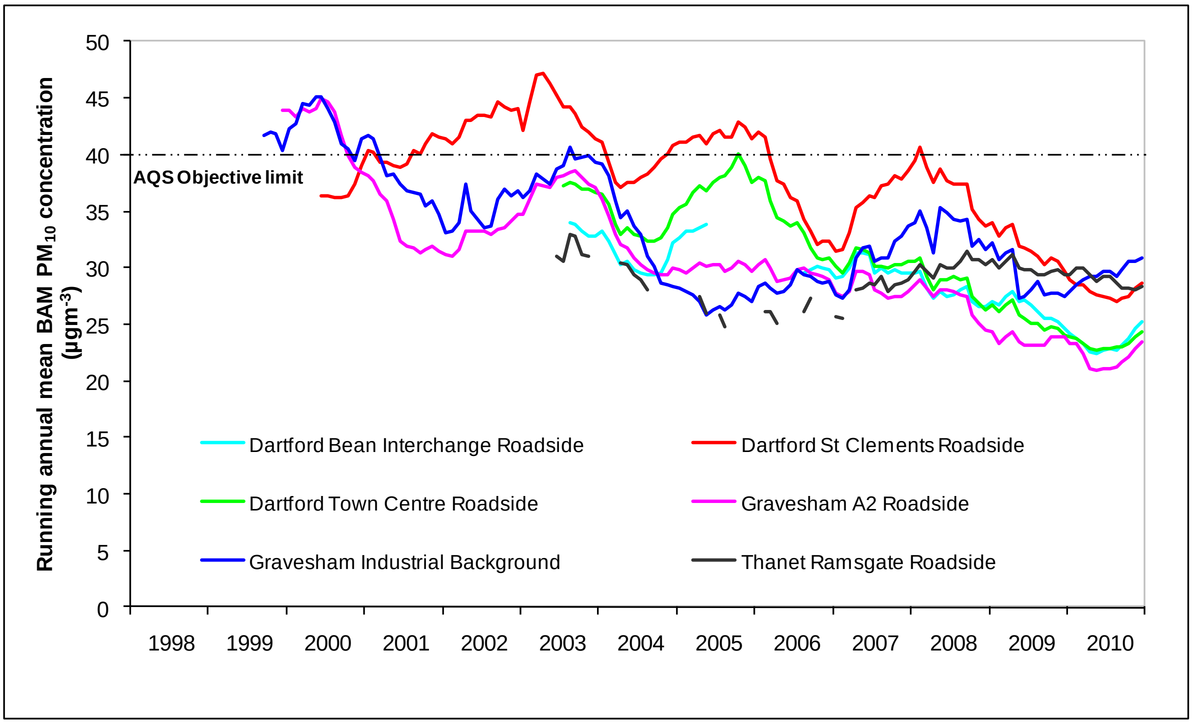


Figure 5.7: Trends in running annual mean BAM PM_{10} concentrations. (0.83 correction factor applied).

Running annual mean concentrations for $PM_{2.5}$ at Rochester Stoke are shown in Figure 5.7. This figure remains unchanged from the figure reported in the previous report due to low data capture between mid-2009 and mid-2010. There is currently no factor applied to $PM_{2.5}$ data derived from TEOM analysers. This figure therefore presents raw data. Concentrations have been fairly constant at this site since 1999. Slightly higher levels were observed in 2003, in common with PM_{10} levels at many sites. Concentrations have seen a reduction from 2006 to 2009. In future reports data from a newly installed PM2.5 FDMS analyser at Chatham Centre Roadside will be included in this analysis.

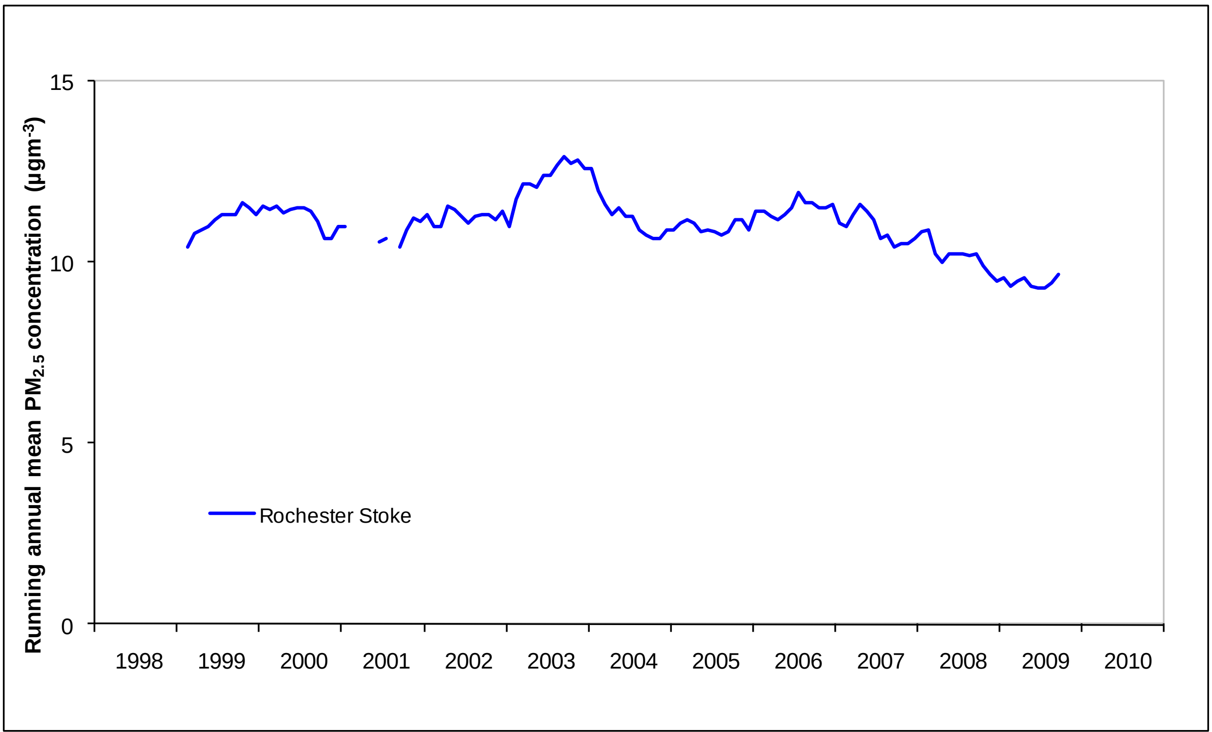


Figure 5.8: Trends in running annual mean PM2.5 concentrations.

5.5 Sulphur dioxide

The key sources of SO_2 in Kent are the power stations and other industrial sites in the north of the county, and shipping activities in the vicinity of Folkestone and Dover. Figure 5.9 shows how trends at the sites in the north of the county have reduced over the period, reflecting a reduction in emissions from the industrial sources. One exception to this trend was an increase in concentrations at the Chatham Luton background site over 2006 and 2007. During 2008 and 2009 this site saw a steady reduction in concentrations but this has been followed by a small increase in 2010. A small increase was also seen at the Folkestone Suburban site.

The site at Dover Docks highlights the fact that the key issue for SO_2 concentrations in Kent is shipping activity. The site at Dover Docks has concentrations significantly higher than at any of the other sites in the network. There is an observable reduction in SO_2 concentration at the Dover Docks site between 2007 and 2010 since the new site location was established. The impact of the Dover port activities are also evident at the Dover Langdon Cliff site which had seen an increase in concentrations during 2008 and 2010 prior to the site being removed, although a significant reduction in levels is noted since 2004 due to a reduction in sulphur content of ship bunker fuels.

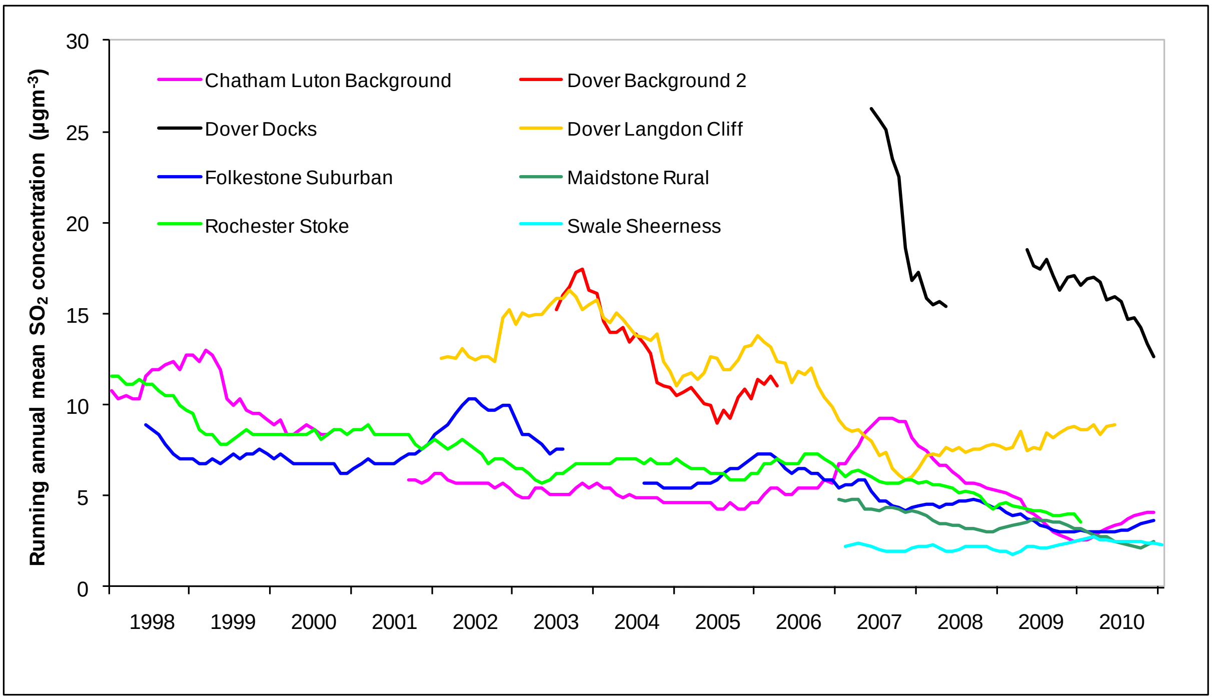


Figure 5.9: Trends in running annual mean SO_2 concentrations.

6 Diffusion tube results

6.1 Introduction

In addition to the automatic monitoring discussed in the previous sections, most of the Kent and Medway Local Authorities supplement their automatic monitoring of nitrogen dioxide (NO_2) with indicative measurements made using diffusion tubes. Diffusion tubes are a type of passive sampler that absorbs the pollutant of concern (in this case nitrogen dioxide) directly from the ambient air for a period of days or weeks. They are then analysed in a laboratory, and the ambient concentration of NO_2 (averaged over their exposure period) is calculated. Diffusion tubes do not need a power supply, can be fixed unobtrusively to street furniture or buildings, and their low cost makes them a useful tool for investigating spatial variation in NO_2 concentrations.

This section presents a summary of each Local Authority's NO_2 diffusion tube results for 2010 and, where applicable, a discussion of trends over the past 10 years. Typically, the Kent and Medway Local Authorities may operate one or two automatic NO_2 monitoring sites (perhaps one at an urban background location and one at a roadside location), together with numerous diffusion tube sites around the District. Table 6.1 shows the total number of sites operated during part or all of 2010, by each Authority. Where tubes are exposed in triplicate at a site, this is counted as one site even if the Local Authority uses different site identification numbers for the tubes.

Table 6.1: NO_2 Diffusion tube sites in Kent and Medway, 2010.

Local Authority	Number of sites	Comments	Analytical laboratory used in 2010 *
Ashford District Council	14	-	ESG Harwell
Canterbury	27	-	ESG Harwell
Dartford	46	4 new sites started up during 2010.	Gradko International
Dover	22	-	ESG Harwell
Gravesham	52	6 new sites started up, and 1 closed down, during 2010.	ESG Harwell
Maidstone	49	2 new sites started up.	ESG Harwell
Medway	23		ESG Harwell
Sevenoaks	-	-	-
Shepway			ESG Harwell
Swale	59	6 new sites started up, and 6 closed down, during 2010.	ESG Harwell
Thanet	25	1 new site started up, and 3 closed down, during 2010.	ESG Harwell
Tonbridge & Malling	32	3 new sites started up, and 7 closed down, during 2010.	ESG Harwell
Tunbridge Wells	22	1 new site started up during 2010.	ESG Harwell

* Note: The majority of sites in this network have used tubes prepared and analysed by ESG Harwell(formerly known as Harwell Scientifics) since 2005, but prior to this various other analytical laboratories were used.

6.2 Accuracy and bias adjustment

In spite of their convenience and ease of use, diffusion tubes have limitations – they do not offer the same accuracy and precision as more expensive automatic methods, and are therefore only considered to be an "indicative" monitoring technique. Also, with a typical exposure period of days or weeks (one month is typical in this context) they are unsuitable for monitoring short-term averages (such as the 1-hour mean).

A further limitation of diffusion tubes is that their accuracy may be affected by a number of sources of interference – both during exposure and at the analysis stage – which can cause them to exhibit so-called 'bias' i.e. under-read or (more commonly) over-read relative to the automatic analyser. For this reason, for the purpose of Local Air Quality Management, the accuracy of the diffusion tubes should be quantified by means of a co-location study, in which diffusion tubes are exposed at the same site as an automatic analyser throughout the duration of the survey. The ratio of the automatic analyser to the diffusion tube result is used as a "bias adjustment factor" and applied to the annual means measured by the diffusion tubes at the other sites.

A bias adjustment factor has therefore been applied to the diffusion tube annual means presented in this report. For diffusion tubes prepared and analysed by Harwell Scientifics, the adjustment factor used is 0.85. This is a combined bias adjustment factor for 2010, downloadable from the Defra Local Air Quality Management Support web page at http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html (April 2011 version). The bias adjustment factor for ESG Harwell was based on 18 co-location studies carried out Local Authorities in the UK, ten of which were by Authorities in Kent. All the Kent and Medway Local Authorities use ESG Harwell's tubes, except one. The exception is Dartford Borough Council, which uses tubes from Gradko International. The combined bias adjustment factor used for their 2010 results (from the same source, and based on 39 co-location studies) was 0.92.

It should be noted that diffusion tube accuracy can vary over time, and can vary depending on the laboratory used to prepare and analyse the tubes. Bias adjustment factors were not widely available prior to around 2000. Also, although the majority of Kent Local Authorities now use the same laboratory, this has not always been the case. **Therefore, the results in the long-term trend plots have not been bias-adjusted and should be treated with caution.**

6.3 Diffusion tube results 2010

This section reports the results of each Local Authority diffusion tube monitoring in 2010. For each Authority, the following are shown:

1. Annual mean NO_2 concentrations measured in 2010 at all diffusion tube sites, in the form of a bar chart. These bar charts illustrate the range of annual mean concentrations measured in each Authority. Sites of different types (e.g. kerbside, roadside, urban background) are shown in different colours. Only sites with at least 9 months' valid data are shown as any less than this would not provide an accurate estimation of the annual mean. The appropriate bias adjustment factor has been applied to the annual means.
2. A comparison of monthly mean NO_2 concentrations measured by diffusion tubes, against data recorded by co-located automatic analysers, where available. **The NO_2 diffusion tube data are not bias adjusted for this comparison.**
3. The following sections also look at trends in NO_2 concentration, as measured by long-running sites. These are illustrated by time series charts of annual mean concentration from 2005. (In some cases it is possible to plot reliable annual means from 2000). As most Kent and Medway Authorities now operate a large number of

sites, these charts do not show all sites. Instead, for clarity, the charts show the average for long-running sites in each of the main categories (kerbside, roadside, urban background). Also included are the annual means from any automatic monitoring sites (shown as a dotted line), and any diffusion tube sites that are co-located with them. **As bias corrections were not available in the earliest years shown, the diffusion tube results presents in these figures are not bias adjusted.**

6.3.1 Ashford Borough Council

Figure 6.1 shows bias adjusted annual mean NO_2 concentrations measured at Ashford Borough Council diffusion tube sites during 2010. There were 14 sites in operation during the year.

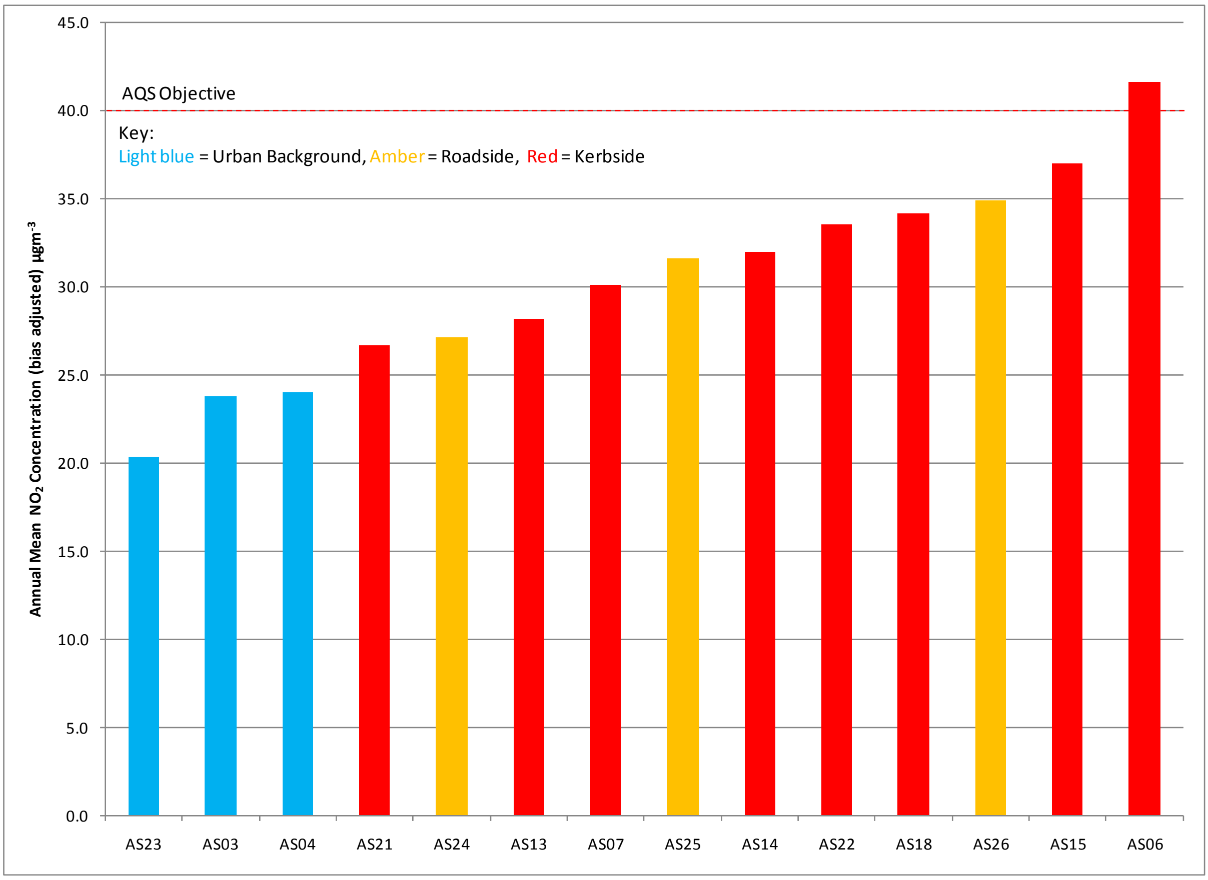


Figure 6.1: Annual mean NO_2 at diffusion tube sites in Ashford, 2010.

The majority of Ashford's sites are classified as kerbside, that is, they are within 1m of the kerb of a busy road. However, all of the sites recorded annual means within the AQS Objective of 40 µg m^{-3}.

Diffusion tubes were co-located with automatic analysers at two sites: Ashford Background, and Ashford M20 Background (the latter was a short-term monitoring site set up outside of the KMAQMN in response to concerns about high concentrations at a specific location). Figure 6.2 shows unadjusted monthly mean results from the co-located diffusion tubes and automatic analyser at the Ashford Background site, at Ashford School. There were no automatic monitoring data for the earlier part of the year: however, during the latter part of the year the diffusion tubes at this site typically over-estimated relative to the automatic analyser. This is a similar pattern to that observed in 2009.

Figure 6.3 shows the unadjusted monthly means from the diffusion tubes and automatic analyser at Ashford M20 Background. The diffusion tubes at this site also typically over-estimated relative to the automatic analyser. However, there was one anomalous low tube result in July 2010: this is clearly an "outlier" and is suspected to be due to a faulty tube. The suspect result has been circled in Figure 6.3.

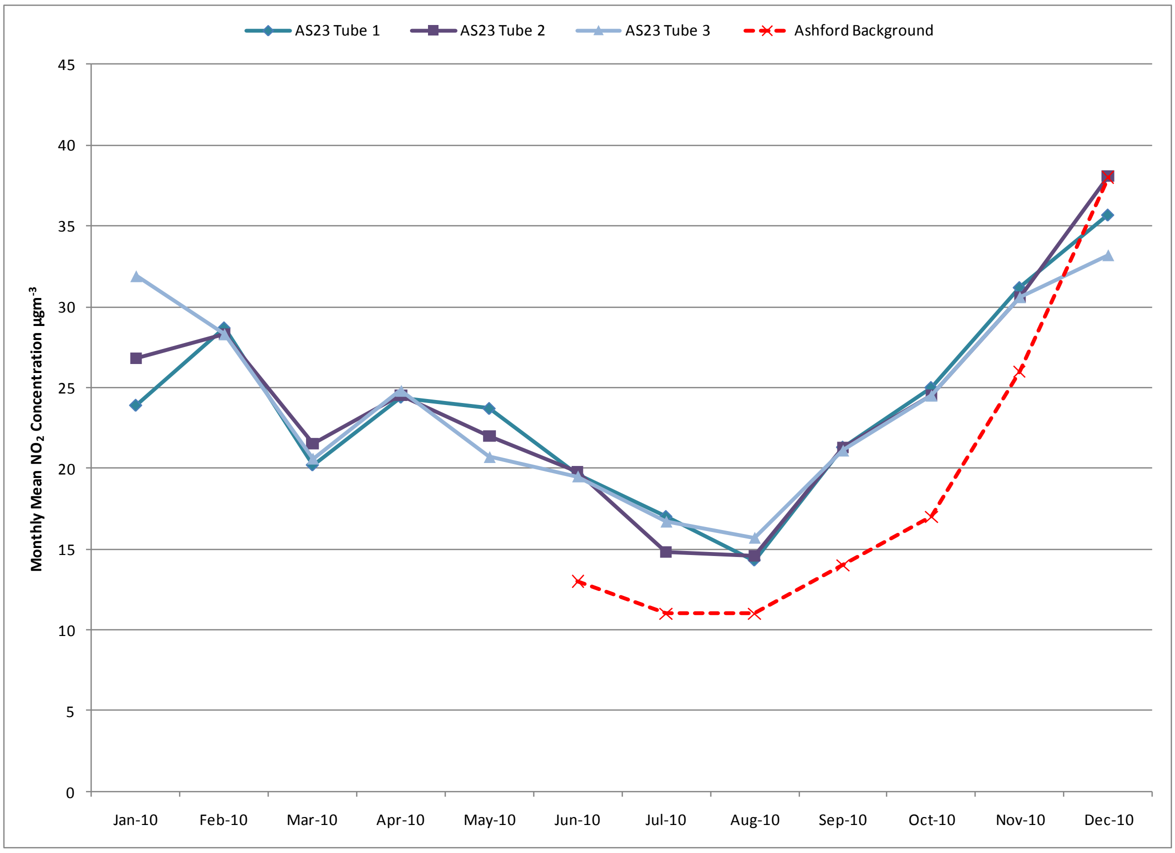


Figure 6.2: Comparison of diffusion tubes and automatic analyser, Ashford Background 2010 (no bias adjustment factor applied).

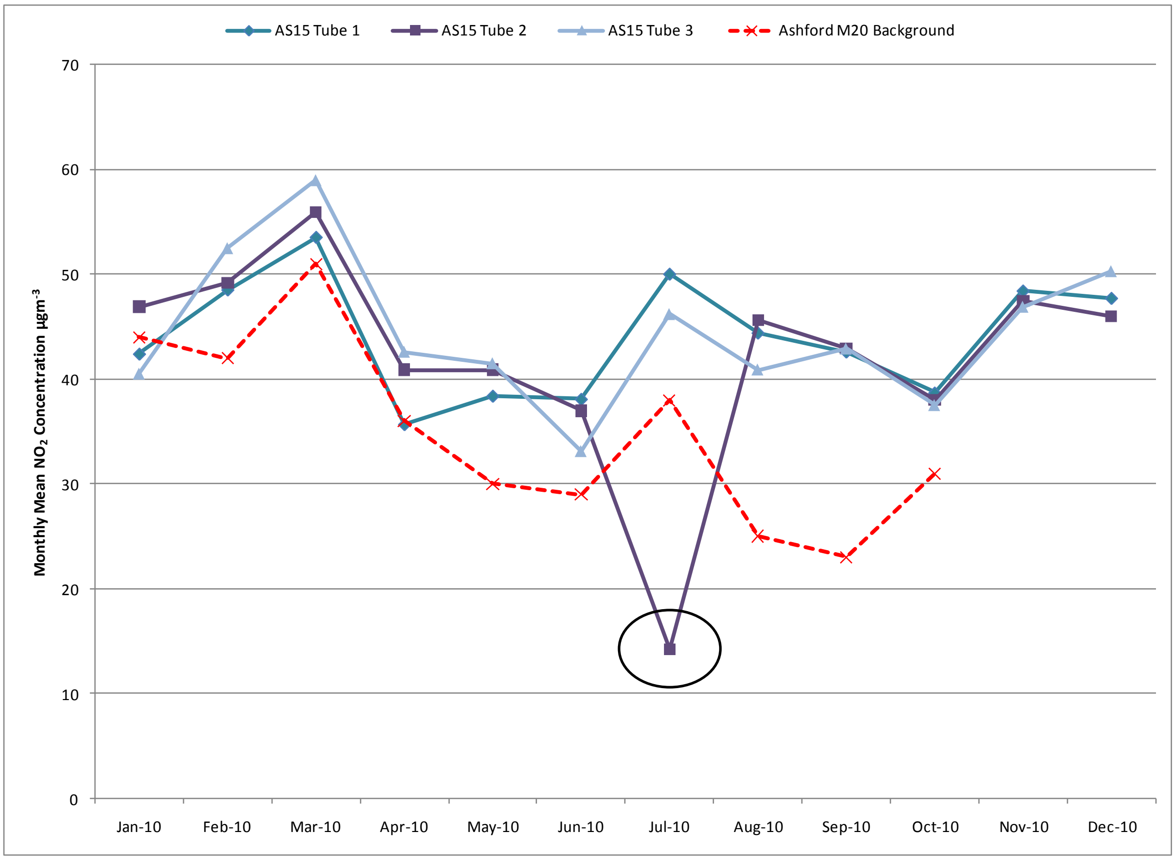


Figure 6.3: Comparison of diffusion tubes and automatic analyser, Ashford M20 Background 2010 (no bias adjustment factor applied).

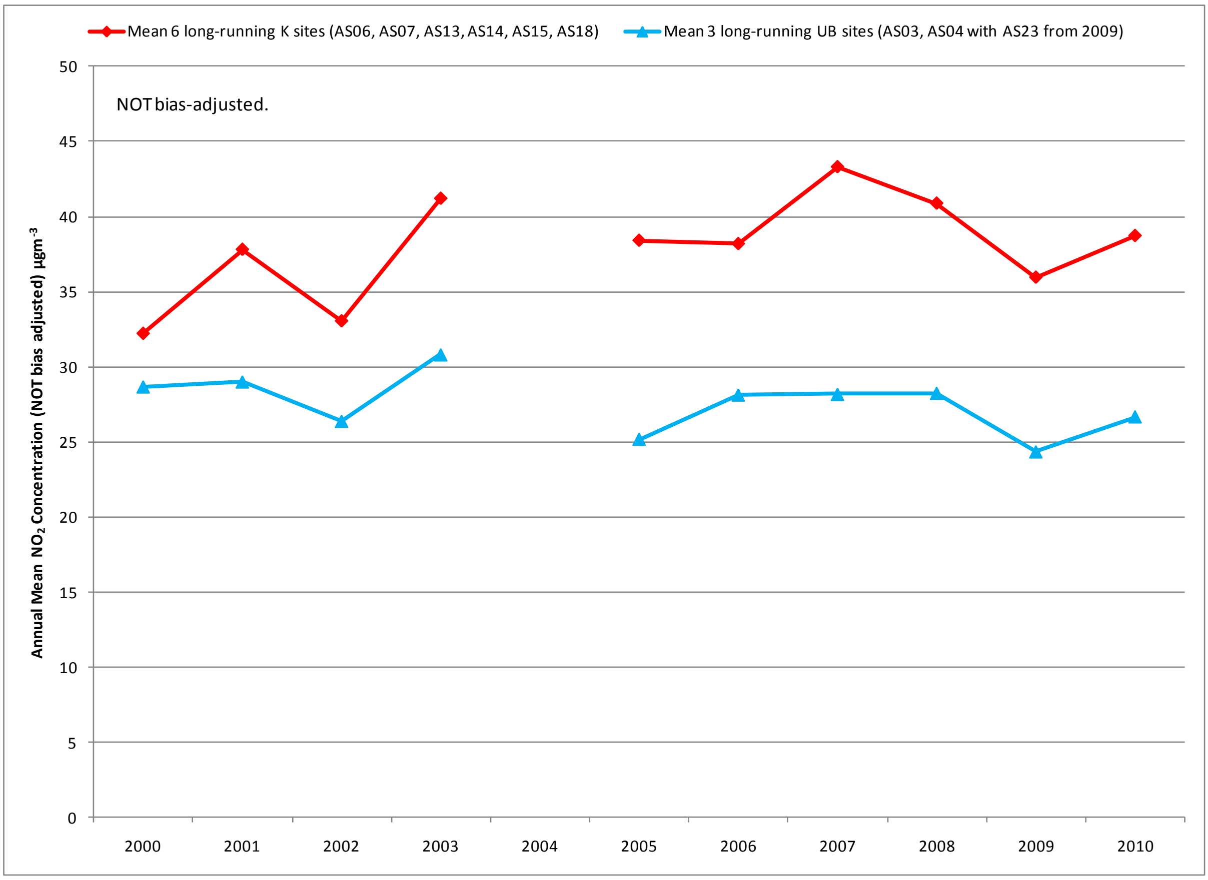


Figure 6.4: Time Series of NO_2 Concentrations in Ashford (no bias adjustment factor applied)

Figure 6.4 shows how the *unadjusted* annual means as measured at Ashford diffusion tube sites have changed since 2000. The average for six long-running kerbside sites, and two long-running urban background sites (with a third included from 2009) are shown. Roadside sites are not included, as none of Ashford's roadside sites have been in operation for sufficiently long to reliably represent long-term trends. Nor are the automatic sites included, as these have only been in operation since 2008.

In general, there are no clear trends, although the average for all kerbside sites appears to have increased slightly since the early years of the decade, then decreased since 2007.

6.3.2 Canterbury City Council

Figure 6.5 shows the annual mean NO_2 concentrations measured at Canterbury City Council diffusion tube sites during 2010.

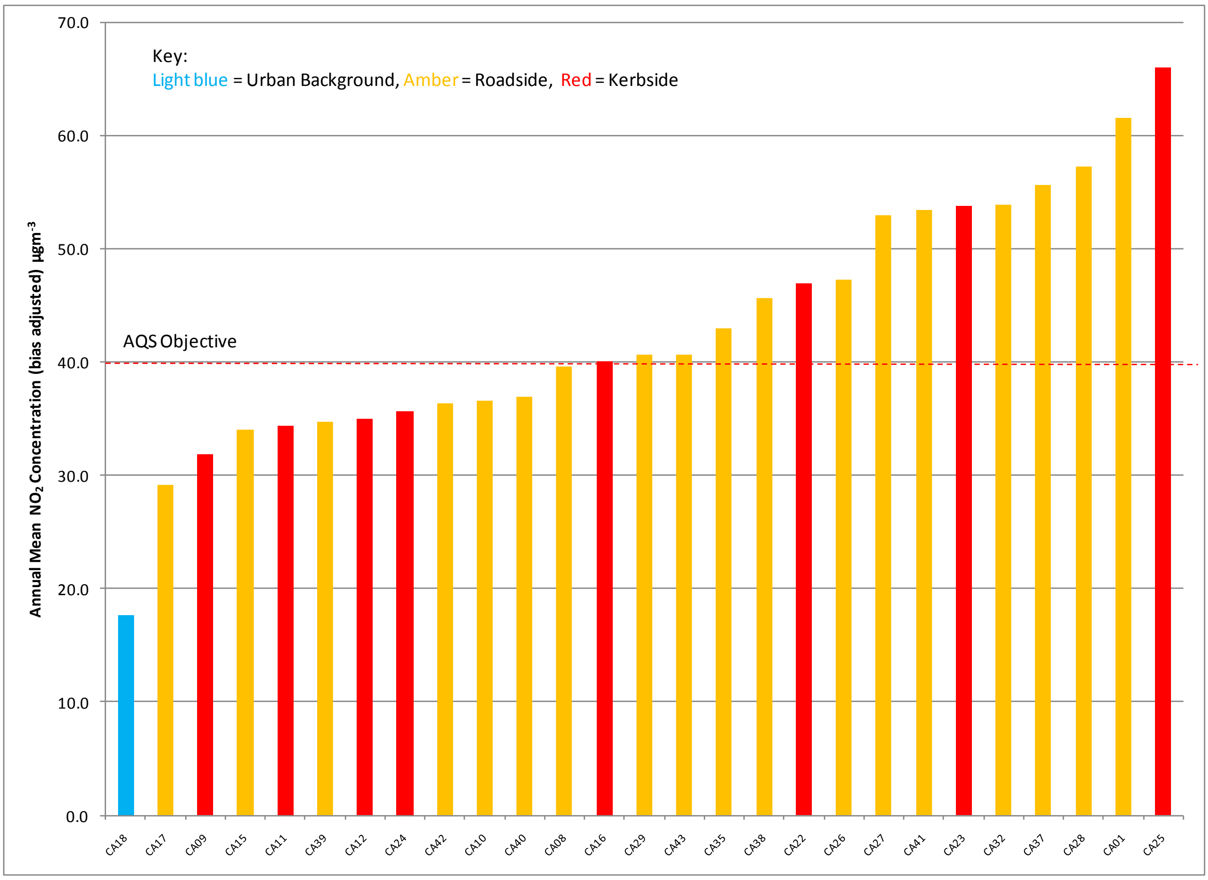


Figure 6.5: Annual mean NO_2 at diffusion tube sites in Canterbury, 2010

Canterbury operated 27 diffusion tube sites, including two which were co-located with automatic monitoring sites. The majority of Canterbury sites are classified as roadside, with some kerbside and one urban background. Approximately half the sites recorded an annual mean in excess of the AQS Objective of 40 µg m^{-3} – a similar proportion to that reported in 2008 and 2009. However, many sites, including the only urban background site, were well below the Objective.

Although the urban background site recorded the lowest concentrations, many of the highest concentrations were recorded at sites classified as roadside, not kerbside. This is in contrast to the expected pattern of kerbside sites showing highest concentrations, although it may be the case that the roads beside which these roadside sites were located were particularly busy.

Diffusion tubes are co-located (in triplicate) with the automatic analysers at the Canterbury (the urban background site at Chaucer School) and Canterbury Military Road sites. Figure 6.6 and Figure 6.7 compare the monthly mean results from the diffusion tubes and automatic analysers at these two sites respectively. The tubes over-estimate compared to the automatic analyser at both sites. At Canterbury Urban Background, the over-estimation (positive bias) of the diffusion tube results appears to have been greater in the latter part of the year (as was also observed in 2007, 2008 and 2009). This may be due to site-related factors, for example this site may be exposed to strong winds (a source of positive bias) during some months.

At Canterbury Military Road, the diffusion tubes appear to over-estimate considerably (with respect to the automatic analyser), particularly in the summer. The tubes at this site also over-estimated in 2009, but to a lesser extent.

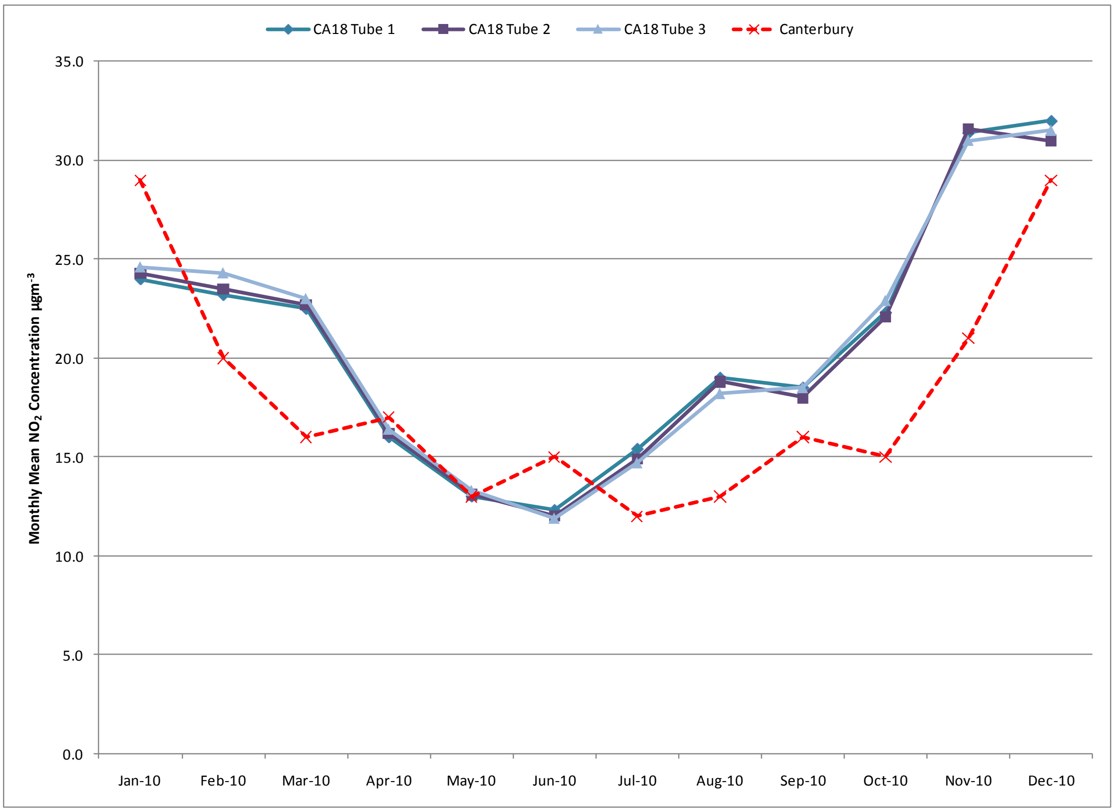


Figure 6.6: Comparison of diffusion tubes and automatic analyser, Canterbury Urban Background (Chaucer School), 2010

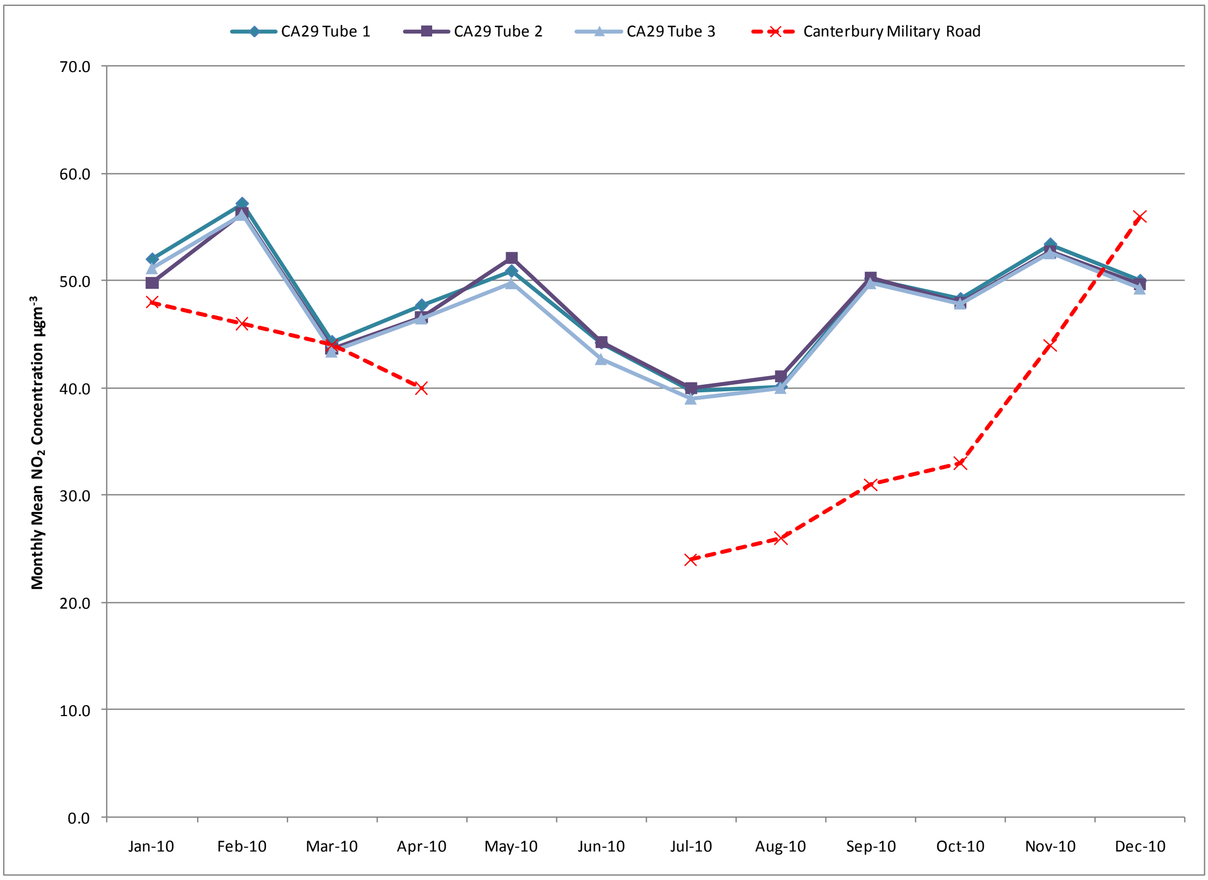


Figure 6.7: Comparison of diffusion tubes and automatic analyser, Canterbury Military Road 2010.

Figure 6.8 shows how the annual means as measured by Canterbury's diffusion tube sites have changed since 2005. (Earlier years are not shown because the prior to 2005 the number of sites was small, and sites were re-organised in 2004). Since 2005 there have been substantial numbers of both kerbside and roadside sites in Canterbury. Both show a similar trend, with annual mean NO_2 concentrations having increased until around 2007 but then remained stable.

Canterbury's few urban background sites have always measured considerably lower concentrations than the roadside sites. Only two urban background sites CA17 and CA18, have been in operation long enough to represent trends: the mean of these two sites appears to show a slight downward trend.

Data from the automatic analysers at Canterbury and Canterbury Military Road are shown as dotted lines, and the co-located diffusion tube sites are shown by solid lines of the same colour.

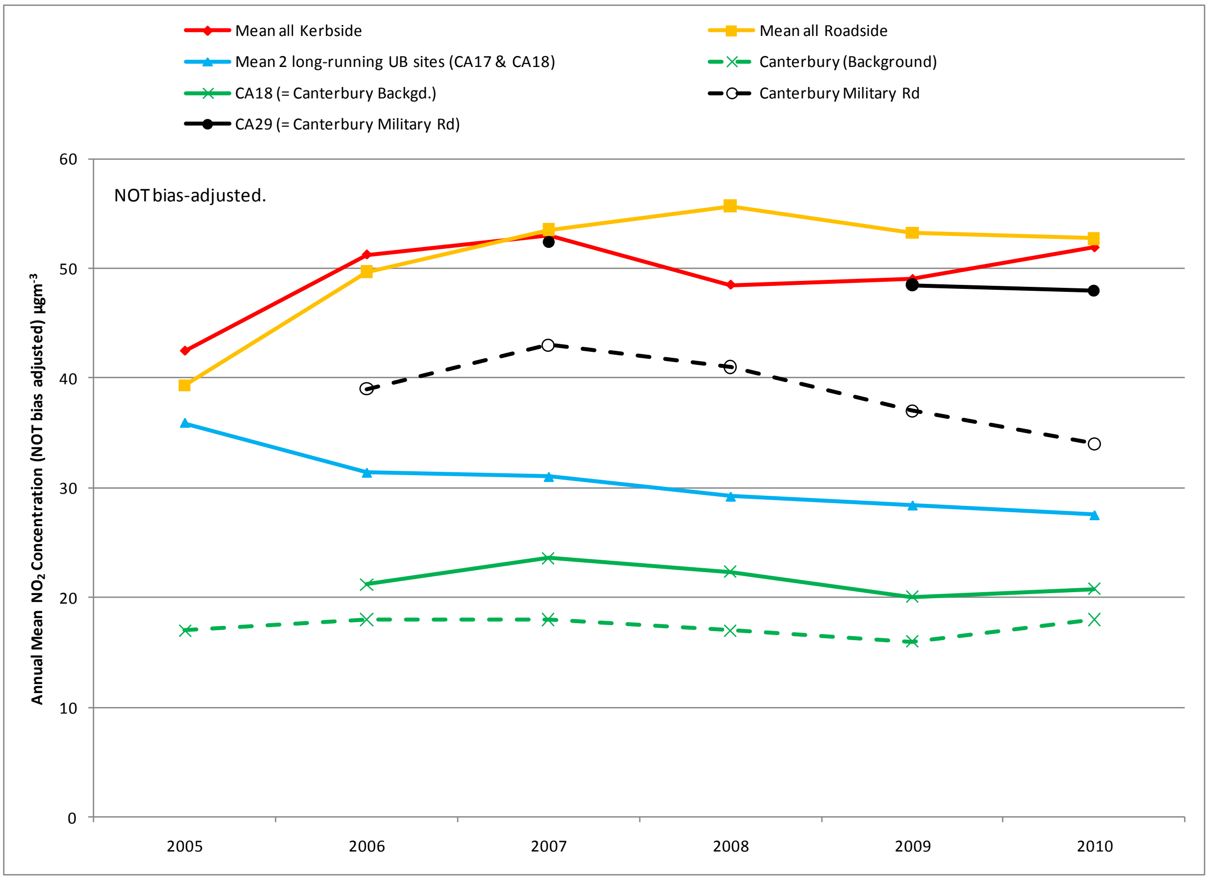


Figure 6.8: Time series of NO_2 concentrations in Canterbury (no bias adjustment factor applied).

6.3.3 Dartford Borough Council

Dartford Borough Council operated 46 diffusion tube sites during 2010. The tubes were analysed by Gradko International, and a combined bias adjustment factor of 0.92 has been applied to the annual means. Because of the large number of sites, the 2010 annual means are shown here in two separate charts. Figure 6.9 and Figure 6.10 show the annual mean NO_2 concentrations measured at kerbside sites and at other site types respectively, during 2010 (three sites are not included because they measured less than nine valid monthly means in the year).

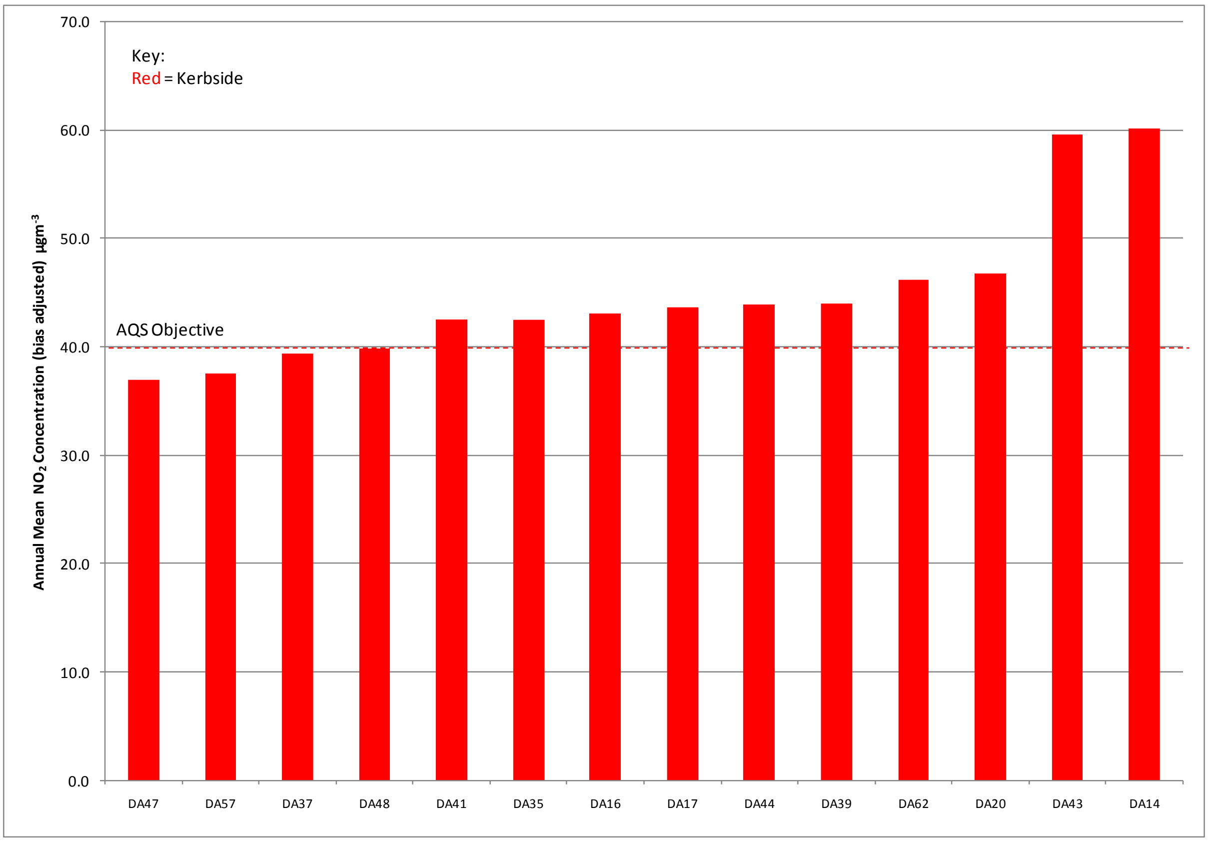


Figure 6.9: Annual mean NO_2 at kerbside diffusion tube sites in Dartford, 2010

Dartford is close to Greater London than most of the other London Boroughs and is relatively built-up, with many busy roads. The majority of kerbside sites in Dartford exceeded the AQS Objective of 40 μgm^{-3} for annual mean NO_2 in 2010. Approximately half the roadside sites, and one of the urban background sites, also exceeded the AQS objective. The high concentration recorded by the urban background site DA59 suggests this site may be incorrectly classified.

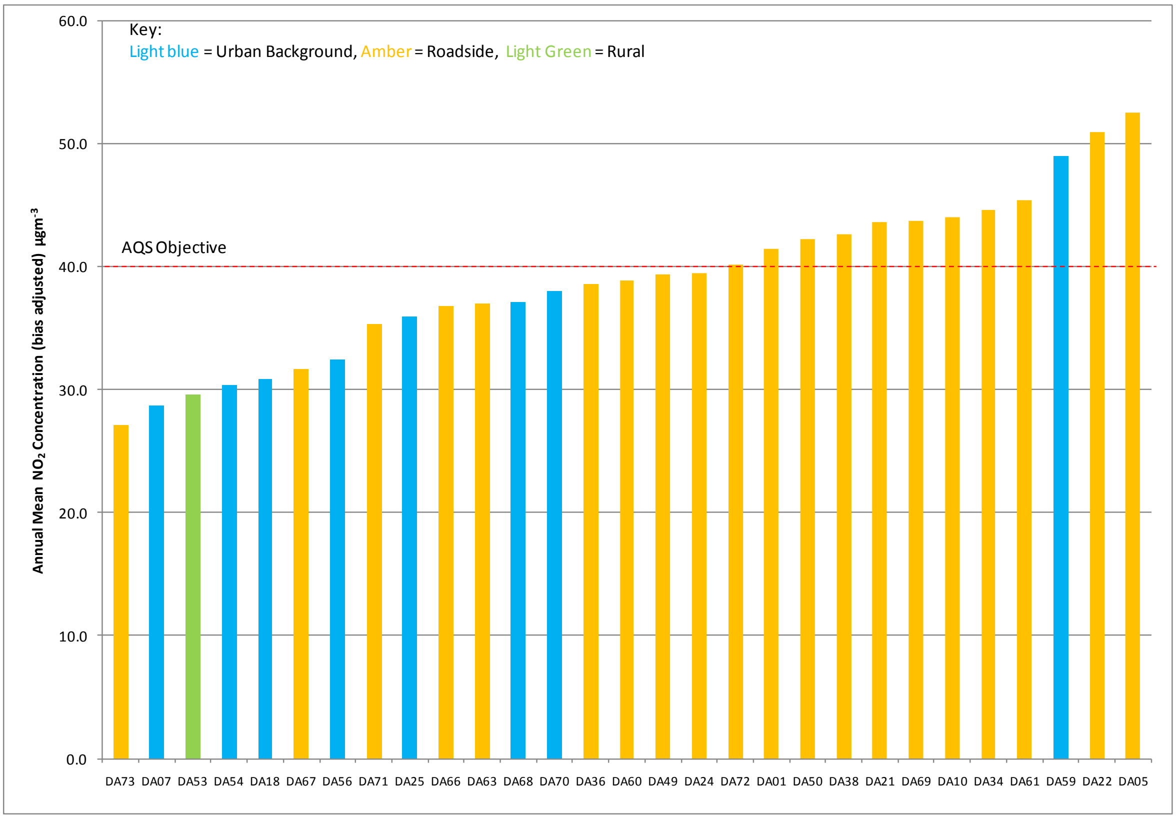


Figure 6.10: Annual mean NO_2 at roadside and urban background diffusion tube sites in Dartford, 2010

Dartford has three automatic NO_2 monitoring sites – Dartford Bean Interchange (roadside), Dartford St Clements (roadside) and Dartford town Centre (roadside). However, diffusion tubes are only co-located at one of these sites – Dartford Bean Interchange. Figure 6.11 shows unadjusted diffusion tube and automatic analyser results from the Dartford Bean Interchange site, where the two methods are co-located. Dartford BC use diffusion tubes from Gradko International which has resulted in a slightly different bias adjustment factor (0.92) being used for these diffusion tubes.

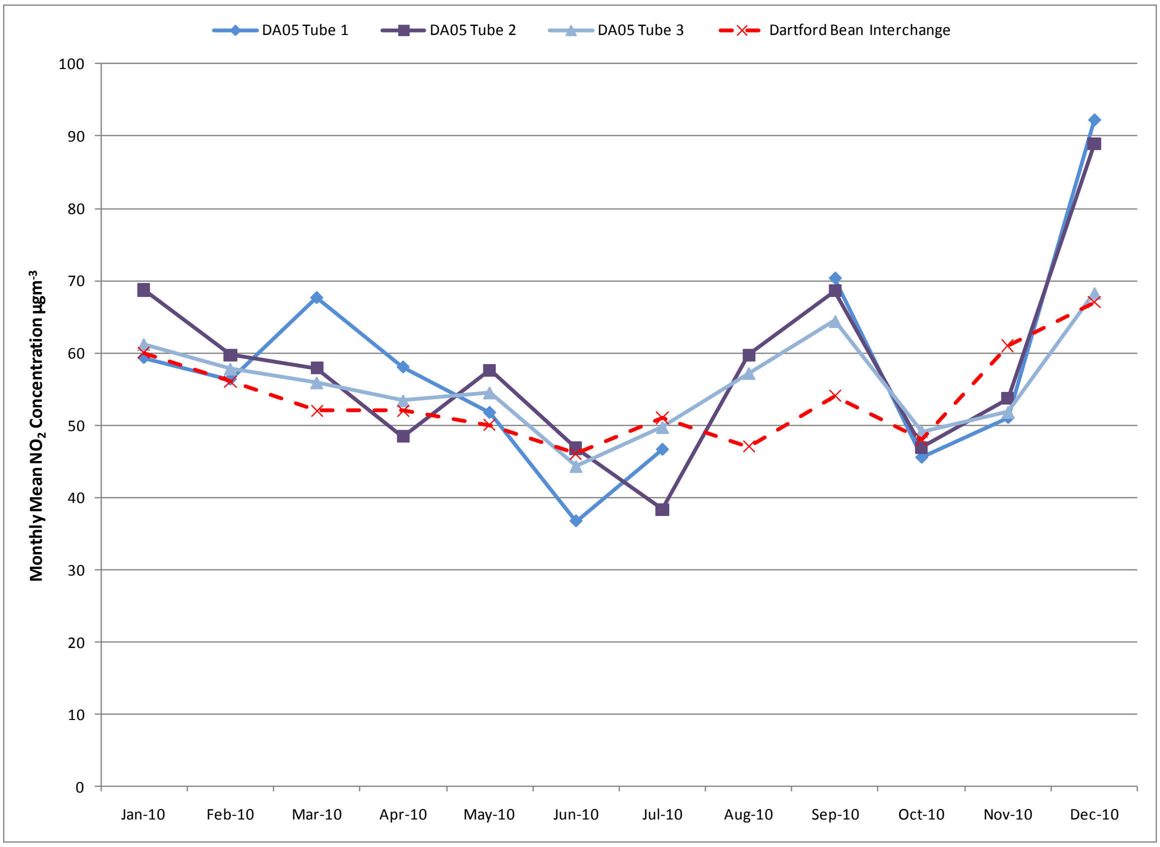


Figure 6.11: Comparison of diffusion tubes and automatic analyser, Dartford Bean Interchange (Roadside) 2010 (no bias adjustment factor applied).

Figure 6.12 shows a time series of annual mean NO_2 concentrations in Dartford. Because the size and composition of the network has been relatively stable over the past decade, and the laboratory used has not changed, this time series has been plotted back to 2000.

The means for kerbside and roadside are based on all sites: Dartford has operated a substantial number of kerbside and roadside sites over this period. For urban background they are based on the mean of the only three long-running sites of this type, DA07, DA18 and DA25. The diffusion tube data indicate a general increase in NO_2 concentrations over the period 2000 to 2003. From 2003 onwards there appears to be a slight downward trend in ambient NO_2 concentrations across the sites.

Also shown is the result from the Dartford Bean Interchange automatic monitoring site (the dotted line), and its co-located diffusion tube site DA05 (shown as a solid line of the same colour).

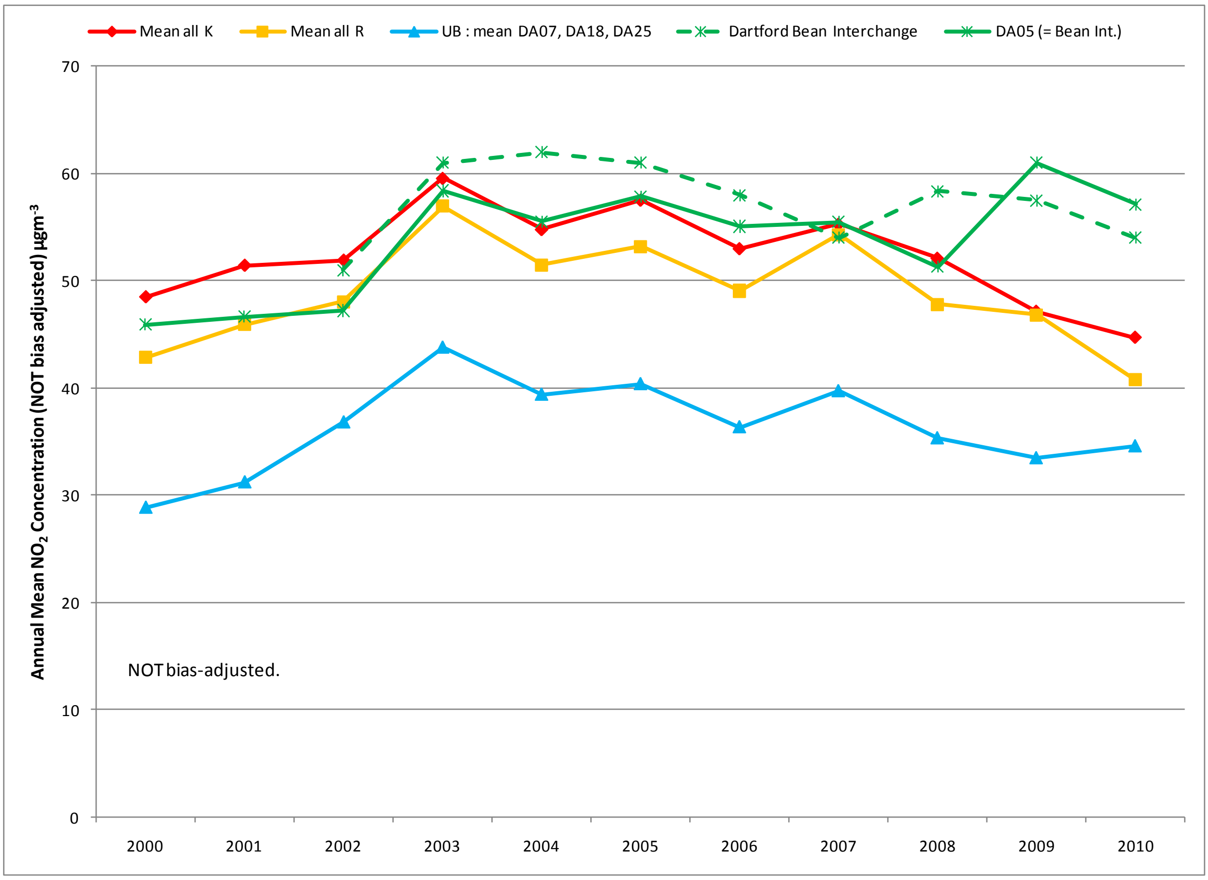


Figure 6.12: Time series of NO_2 concentrations in Dartford (no bias adjustment factor applied).

6.3.4 Dover District Council

Figure 6.13 shows the adjusted annual mean NO_2 concentrations measured at Dover District Council diffusion tube sites during 2009. Dover DC operates 22 diffusion tube sites (counting the co-located triplicate tubes, DV06-DV08, at Dover Old Town Hall as one site). Of these, 18 had at least nine months capture and are included in Figure 6.13. A large proportion of the sites are roadside or kerbside, and more than half exceeded the AQS Objective of 40 µg m^{-3}. The two sites with the highest annual mean concentration in 2010 were urban background sites, DV23 and DV24 (one site, DV15, recorded a higher annual mean of 75 µg m^{-3}, but as this site had only eight months data is not included in the chart). As in some other Kent Local Authorities, the site type is not a good predictor of the magnitude of the NO_2 concentration and may possibly indicate an incorrect site classification.

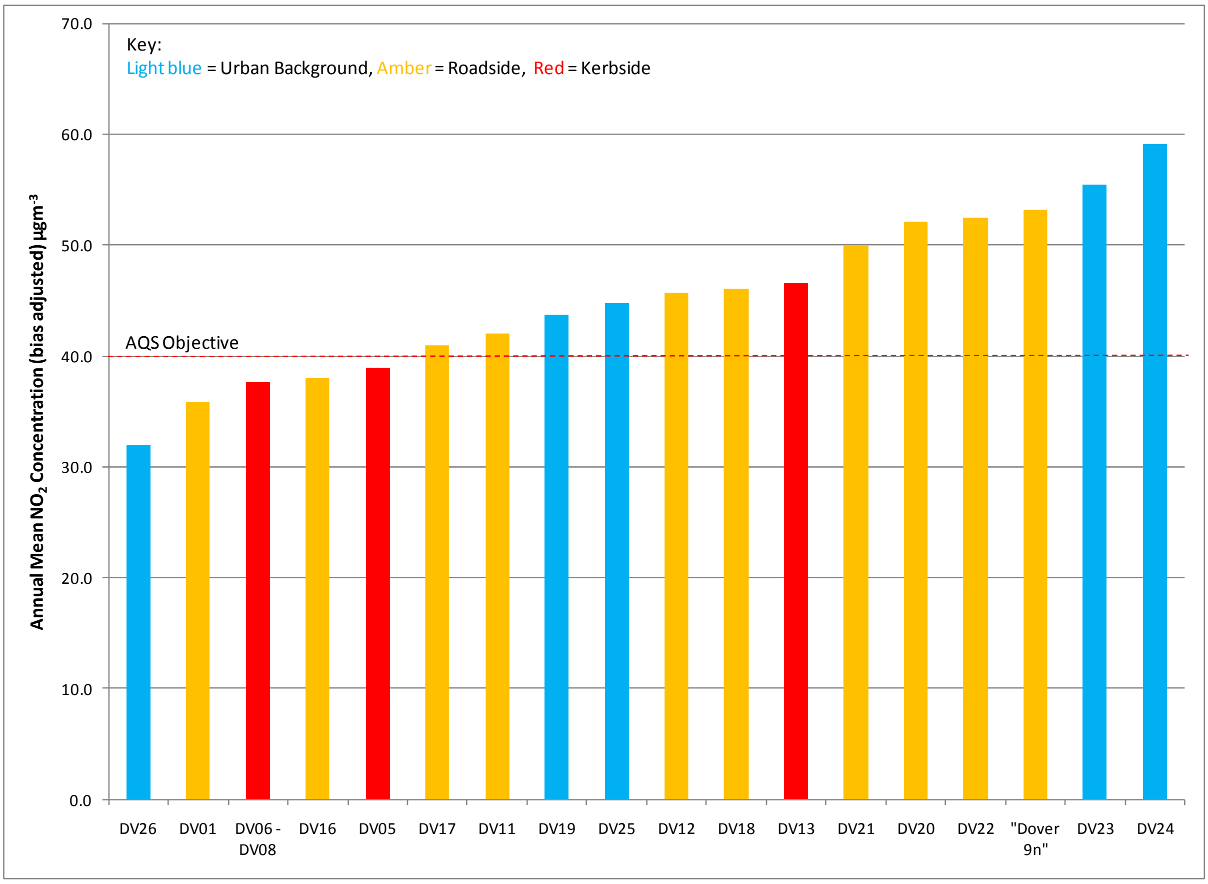


Figure 6.13: Annual mean NO_2 at diffusion tube sites in Dover, 2010

Figure 6.14 shows co-located diffusion tube and automatic analyser results from the Dover Old Town Hall site. This site is co-located with diffusion tube sites DV06, DV07 and DV08 (which are currently reported as three separate sites despite being co-located and fixed to the same piece of street furniture). As observed elsewhere, the tubes mostly (although not always) over-estimated relative to the automatic analyser. There was one suspect diffusion tube result, the DV06 tube result for March 2010 (circled in the graph) which was substantially higher than the other two results and appears to be an outlier.

Figure 6.15 shows how the annual means as measured by Dover's diffusion tube sites have changed since 2005. Earlier years are not shown, as site changes and changes of tube supplier mean that data for these earlier years are not comparable with more recent data. Urban background sites are not included, as there are no long-running examples. There appears to be no trend in the concentrations measured by the diffusion tubes: NO_2 concentrations appear stable.

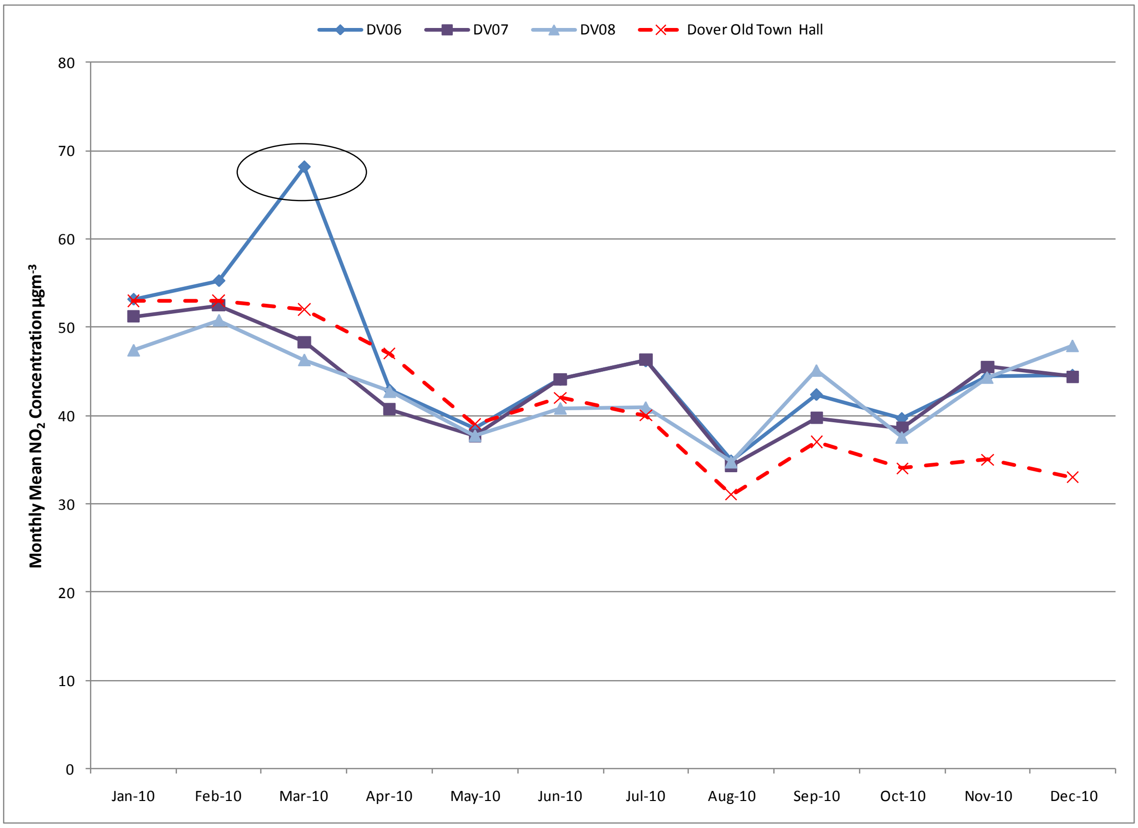


Figure 6.14: Comparison of diffusion tubes and automatic analyser, Dover Old Town Hall (Roadside) 2010 (no bias adjustment factor applied).

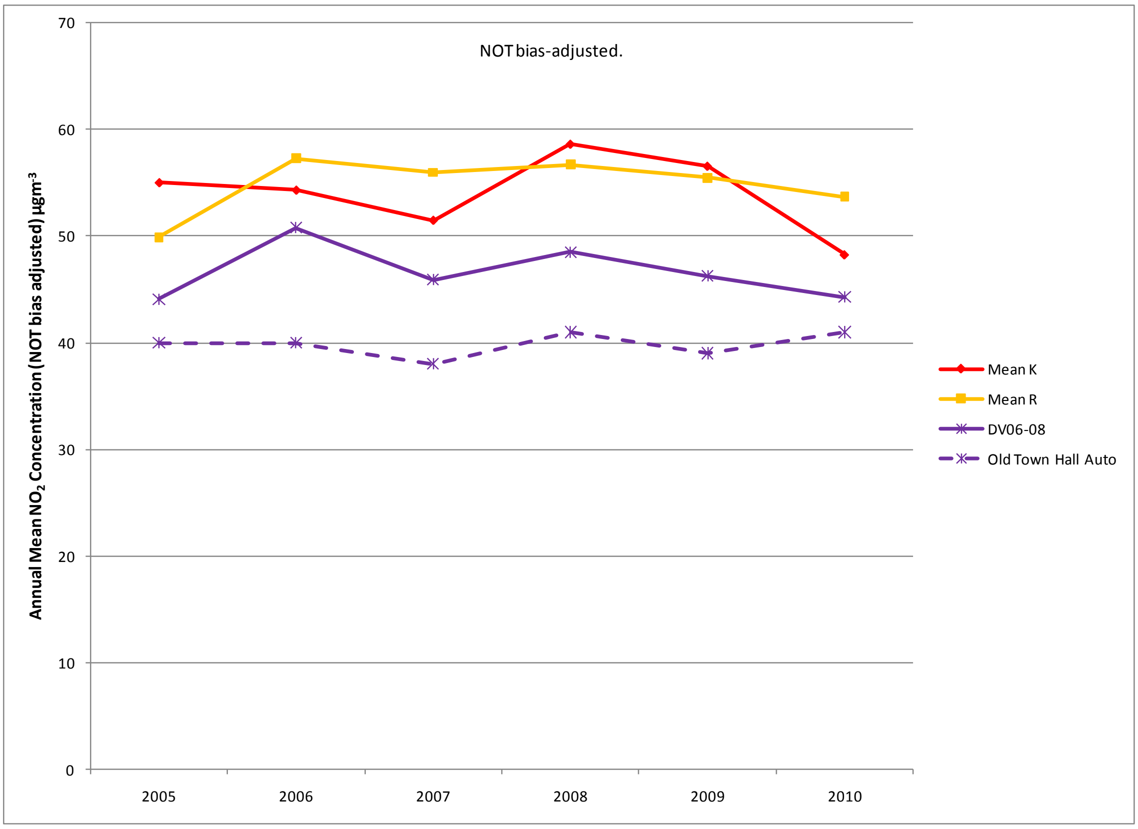


Figure 6.15: Time series of mean NO_2 concentrations in Dover (no bias adjustment factor applied).

6.3.5 Gravesham Borough Council

Figure 6.16 shows the annual mean NO_2 concentrations measured at Gravesham Borough Council's diffusion tube sites during 2010. Gravesham operates a large number of sites – there were 52 in operation during part or all of 2010 (counting co-located triplets as one site), of which 44 had at least nine months data. A substantial proportion of the sites, formerly classified as kerbside, have been re-classified as roadside: the majority of Gravesham's sites are now roadside.

Approximately two-thirds of the sites were within the Air Quality Strategy Objective for annual mean NO_2 in 2010.

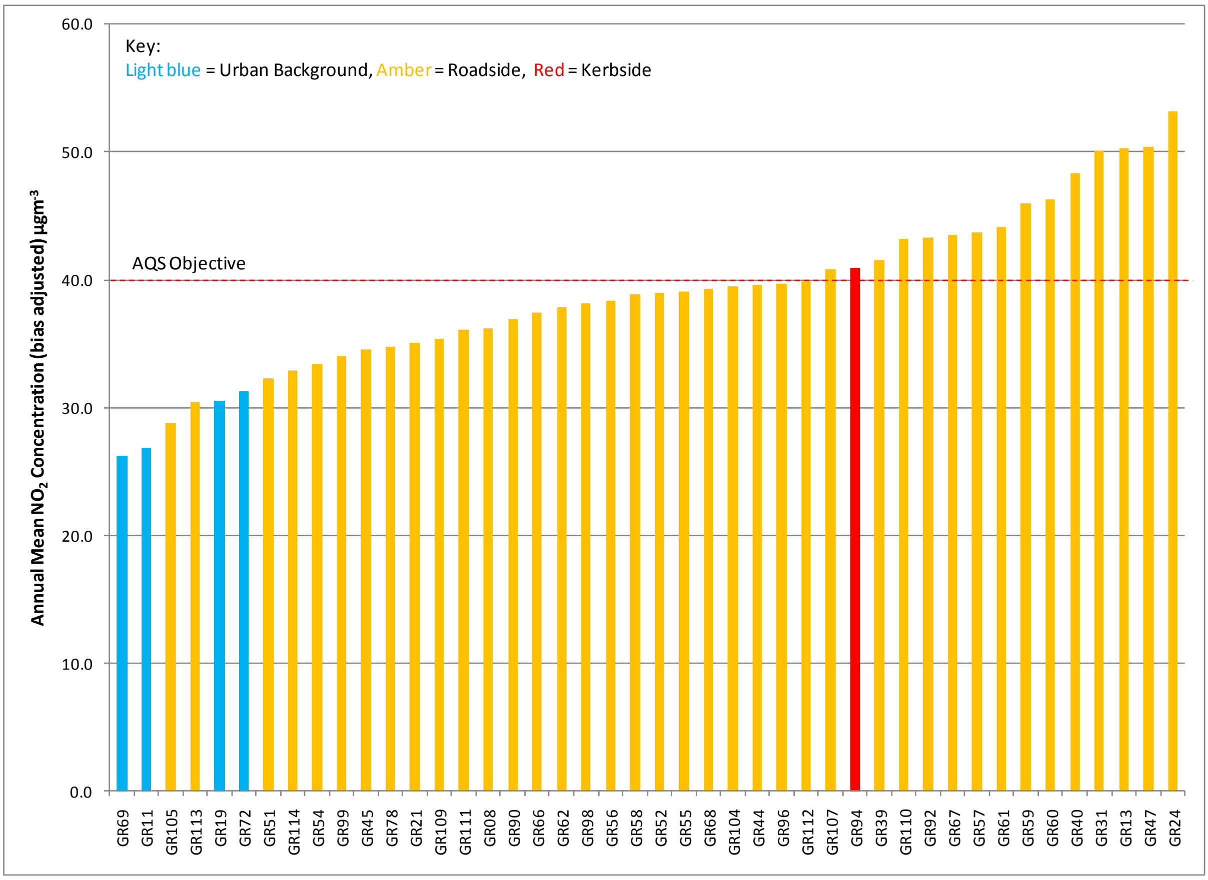


Figure 6.16: Annual Mean NO_2 at Diffusion Tube Sites in Gravesham, 2010.

Figure 6.17 and Figure 6.18 show co-location results at Gravesham A2 Roadside and Gravesham Industrial Background respectively. Generally, the diffusion tube results reflected those of the automatic analyser, typically over-estimating slightly. The positive bias was greater during the latter part of the year, at both sites.

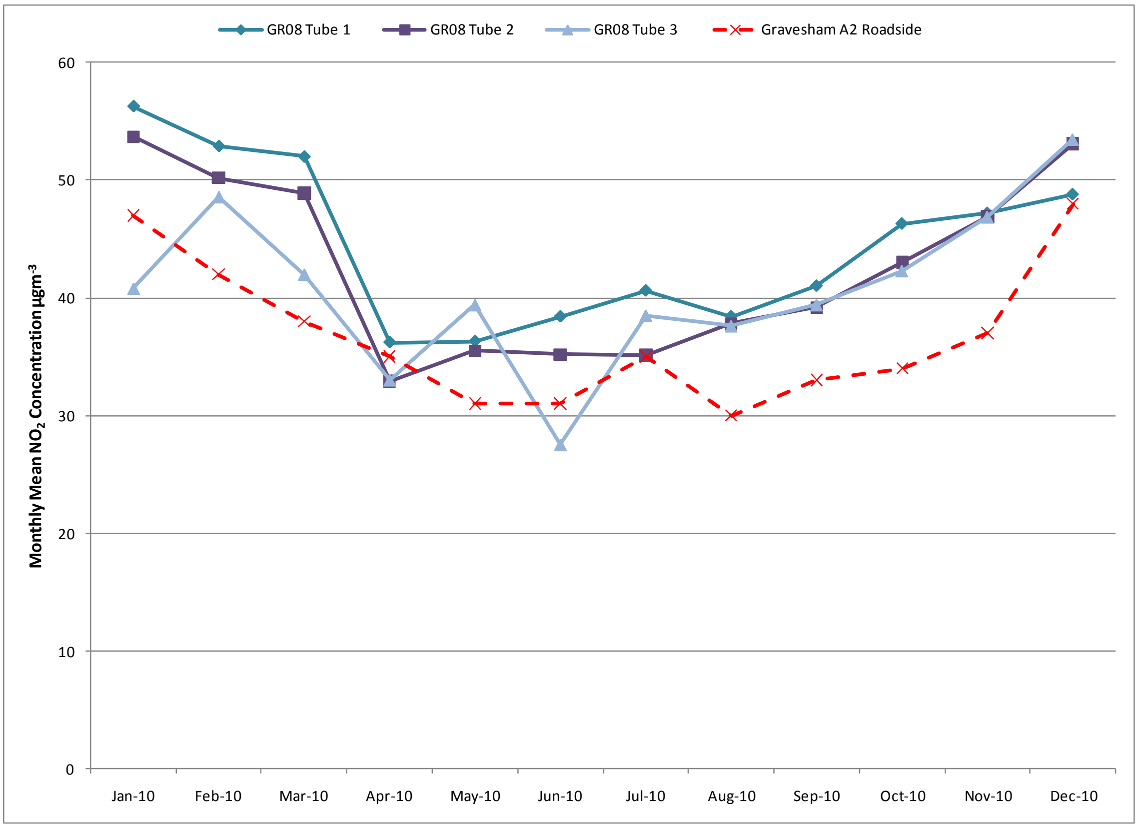


Figure 6.17: Comparison of diffusion tubes and automatic analyser, Gravesham Roadside 2010 (no bias adjustment factor applied).

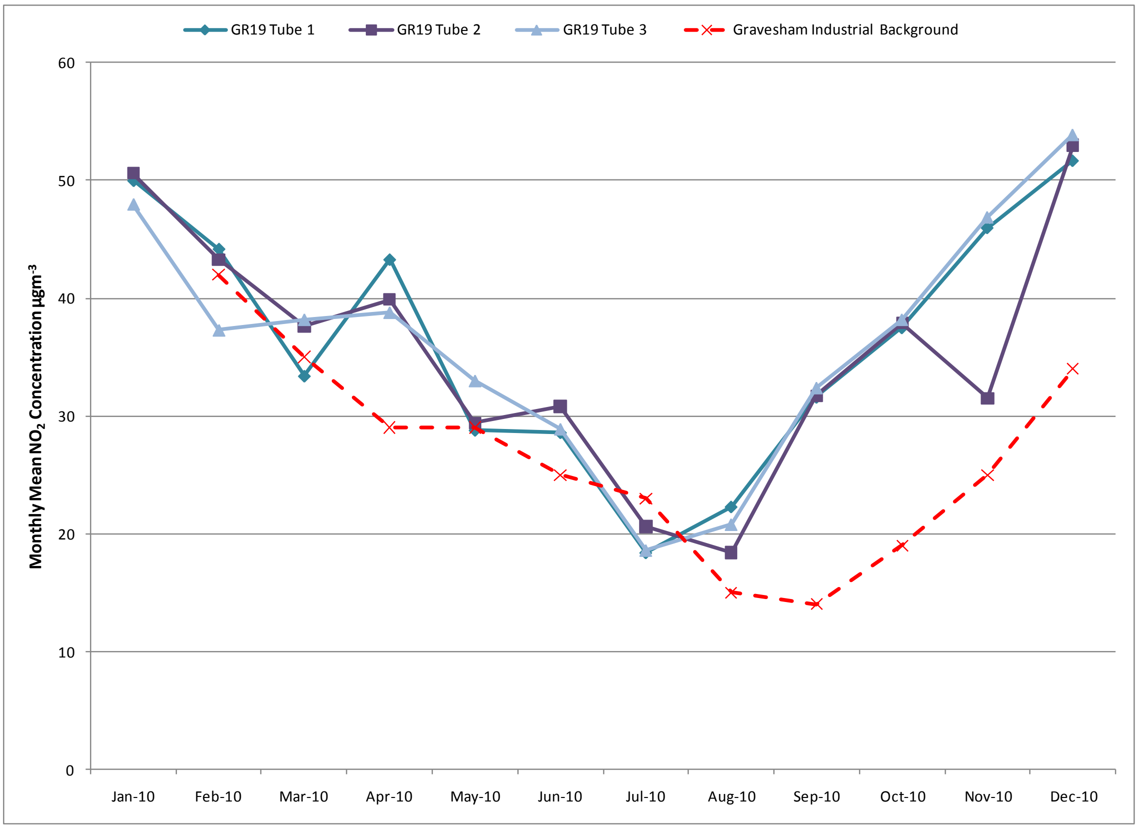


Figure 6.18: Comparison of diffusion tubes and automatic analyser, Gravesham Industrial (Urban Background) 2010. (No bias adjustment factor applied).

Figure 6.19 shows how the annual means as measured by Gravesham's diffusion tube sites have changed since 2005. The number of diffusion tube sites increased considerably in 2005, so earlier years are not shown. Kerbside and roadside sites have been treated as a single category, because many of the sites designated "kerbside" up to and including 2009 have now been reclassified as "roadside" – leaving just one kerbside site in 2010.

Data from the two automatic monitoring sites at which diffusion tubes are co-located are represented by dotted lines. The corresponding diffusion tube values are shown by solid lines of the same colour.

The most marked trend is that annual mean NO_2 concentrations at Gravesham Roadside have decreased considerably in recent years, and is now below the AQS Objective.

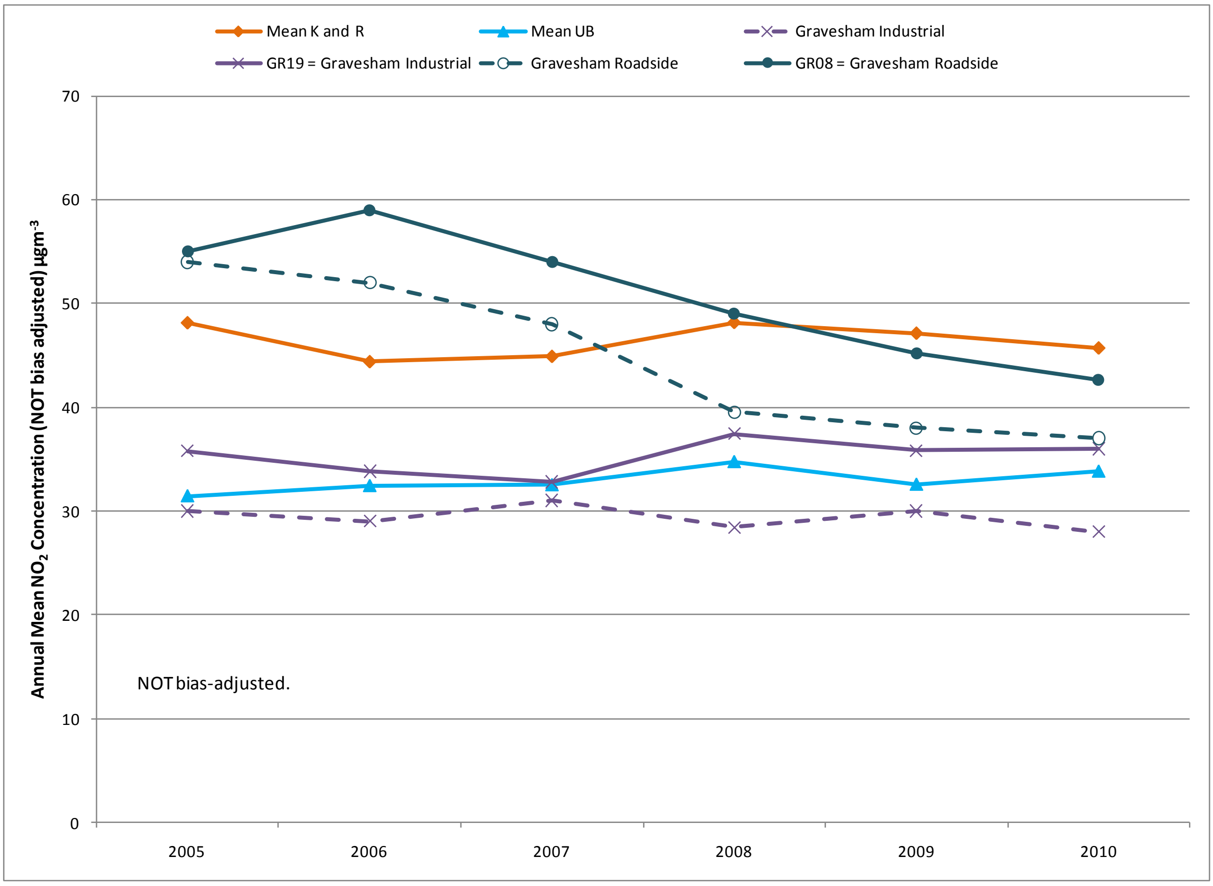


Figure 6.19: Time series of NO_2 concentrations in Gravesham (no bias adjustment factor applied).

6.3.6 Maidstone Borough Council

Figure 6.20 and Figure 6.21 show the annual mean NO_2 concentrations measured at Maidstone Borough Council's diffusion tube sites during 2010. Maidstone operated a total of 49 sites during part or all of 2010, including three new sites which started up part way through the year. 44 sites had at least nine months data in 2010. As there are a large number of sites in Maidstone, they have been divided between two graphs for clarity: Figure 6.20 shows kerbside sites only, Figure 6.21 shows all other types.

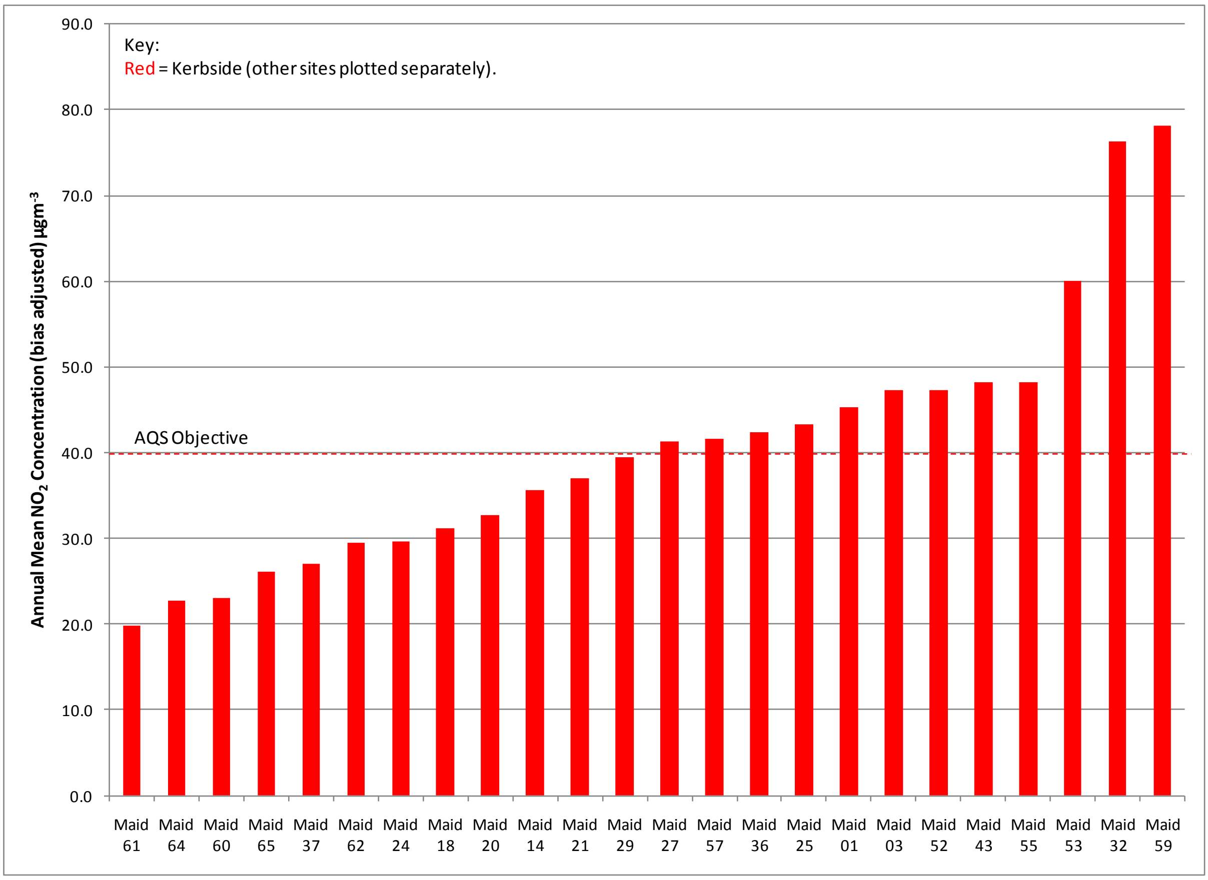


Figure 6.20: Annual Mean NO_2 at Kerbside Diffusion Tube Sites in Maidstone, 2010.

Approximately half of Maidstone's kerbside diffusion tube sites, together with three roadside diffusion tube sites, measured annual means greater than the AQS Objective of 40 µg m^{-3}. The highest annual mean concentration was measured at site Maid 59, located on Upper Stone Street, Maidstone. The site recording the second highest annual mean concentration, Maid 32, has measured high values in previous years. Maid 32 is located at The Pilot pub, beside a busy major road which is in a street canyon with a steep gradient and a relatively large proportion of HDV vehicles.

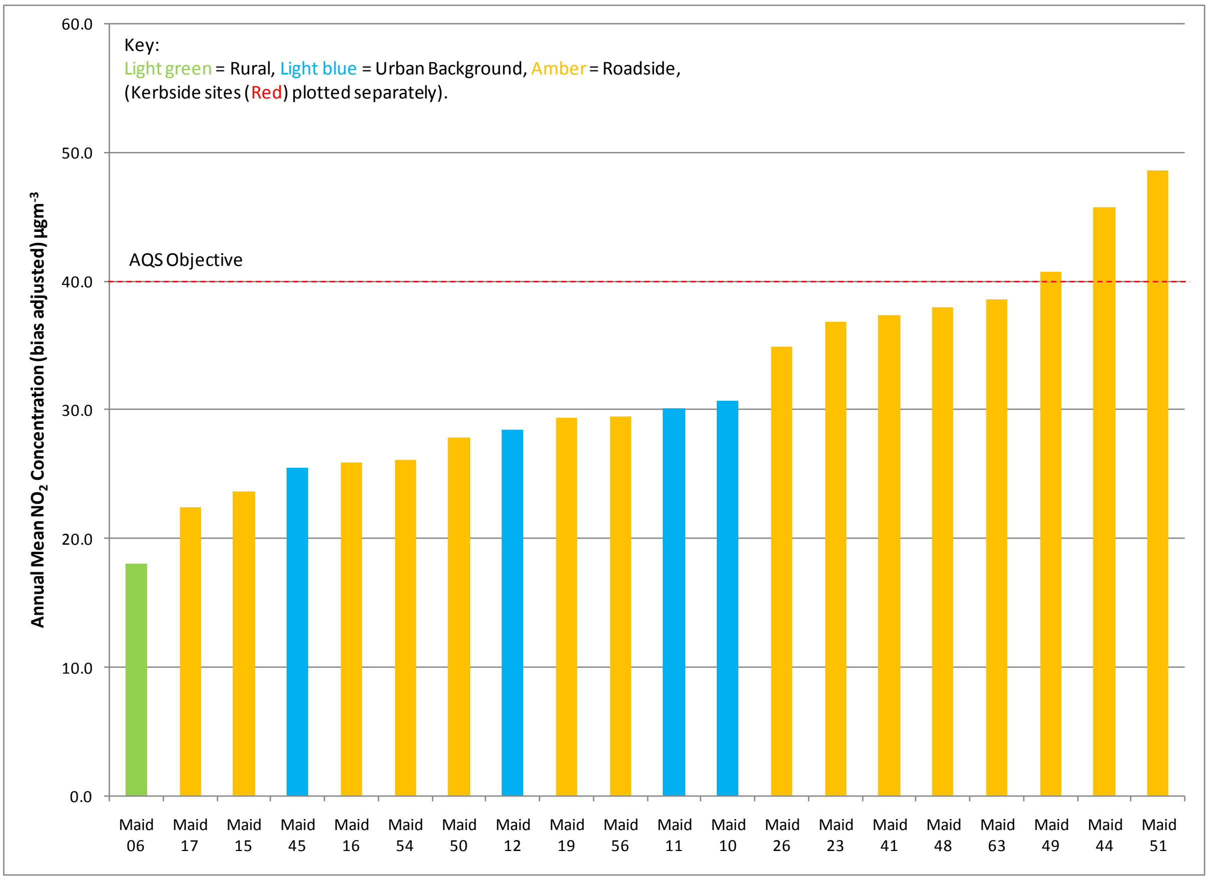


Figure 6.21: Annual Mean NO_2 at Non-Kerbside Diffusion Tube Sites in Maidstone, 2010.

Figure 6.22 and Figure 6.23 show unadjusted co-location results at Maidstone A229 Kerbside (near the kerb of the A229 at the Maidstone Bridge Gyratory), and Maidstone Rural (near the County Showground at Scragged Oak Road, Detling), respectively. At Maidstone Rural, both automatic and diffusion tube results show a strong seasonal pattern, being higher in the winter than the summer. This pattern is not evident at Maidstone A229 Kerbside, where traffic is the main source of NO_2: this source remains relatively constant throughout the year.

Figure 6.24 shows how the annual mean NO_2 concentrations at Maidstone's two automatic monitoring sites and the co-located diffusion tube sites have changed since 2005. Because there were gaps in the dataset for earlier years, and a major re-organisation of the sites in 2008, only these two long-running sites are shown. The graph appears to show no clear trends in NO_2 concentrations in recent years (2006 onwards). The co-located diffusion tubes typically over-read compared to the automatic analysers, although this was not the case at Maidstone A229 Kerbside in 2010.

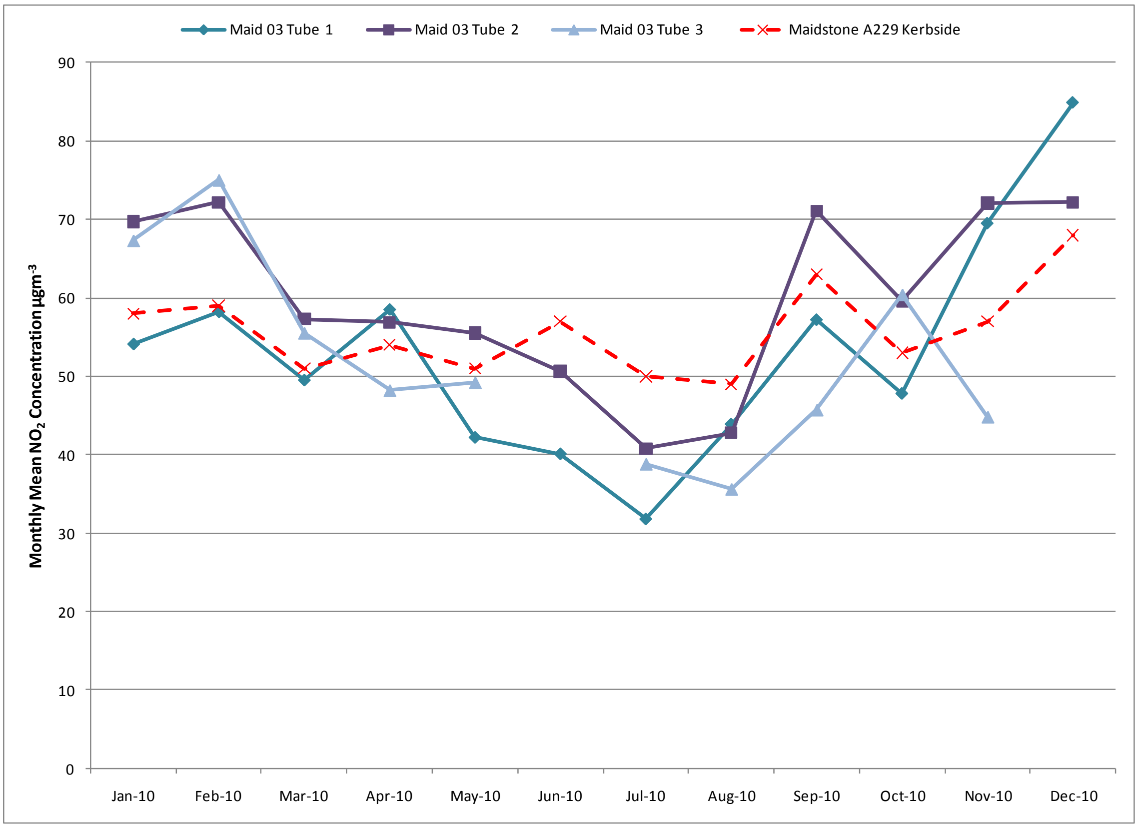


Figure 6.22: Comparison of diffusion tubes and automatic analyser, Maidstone A229 Kerbside 2010 (no bias adjustment factor applied).

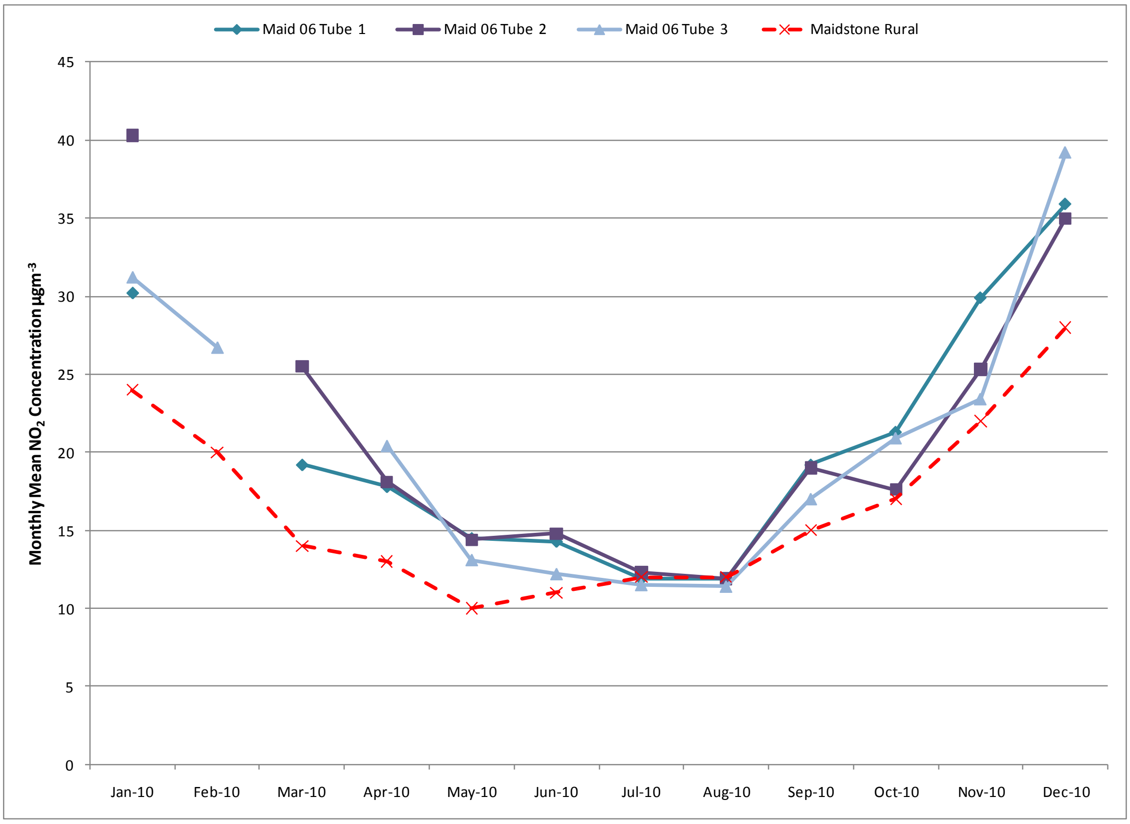


Figure 6.23: Comparison of diffusion tubes and automatic analyser, Maidstone Rural 2010 (no bias adjustment factor applied).

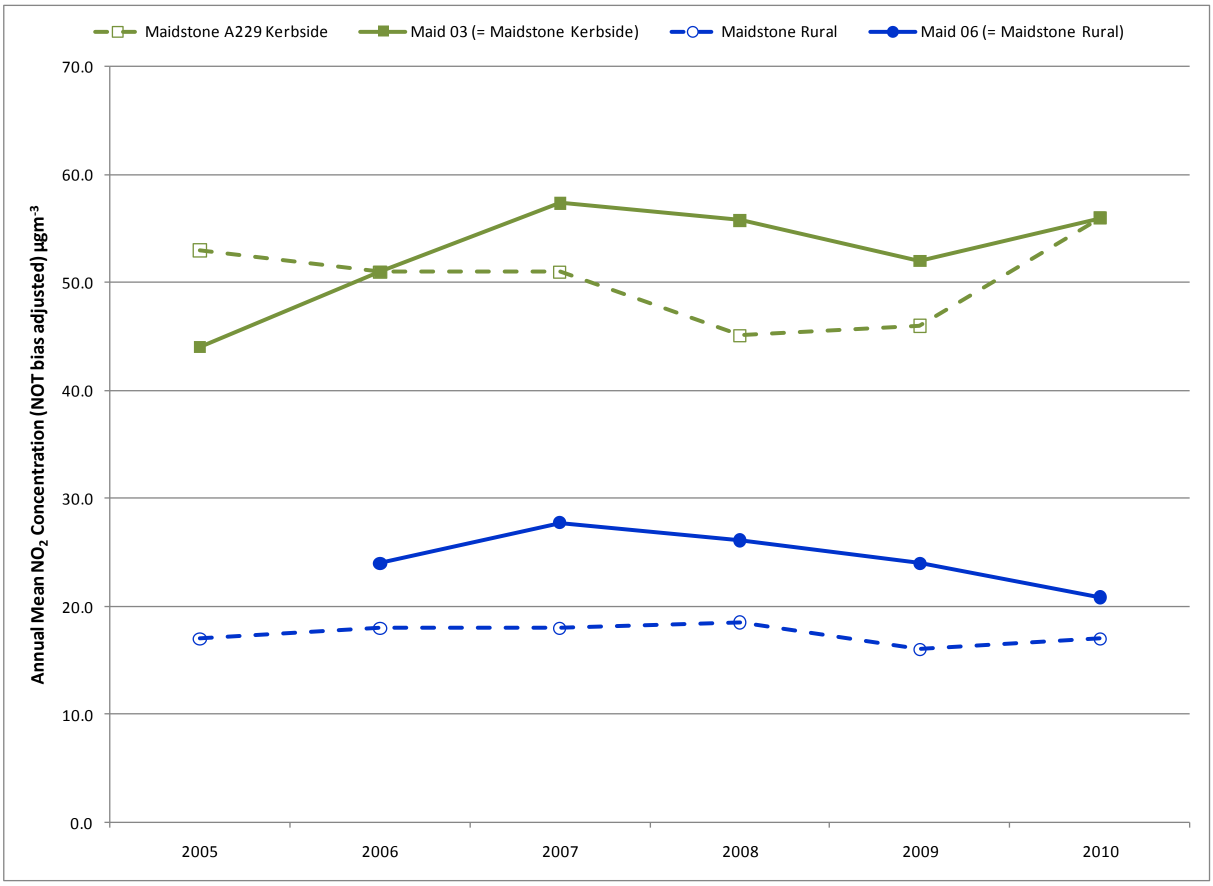


Figure 6.24: Time series of NO_2 concentrations at long-running and co-located sites in Maidstone (no bias adjustment factor applied).

6.3.7 Medway Council

Figure 6.25 shows the annual mean NO_2 concentrations measured at Medway Council's diffusion tube sites during 2010. Medway operated 23 sites during 2010: however, only 14 of these achieved at least nine months' valid data. The reason was that the December 2009-January 2010 and November-December 2010 tube changes were unavoidably delayed by adverse weather (in particular, heavy snow).

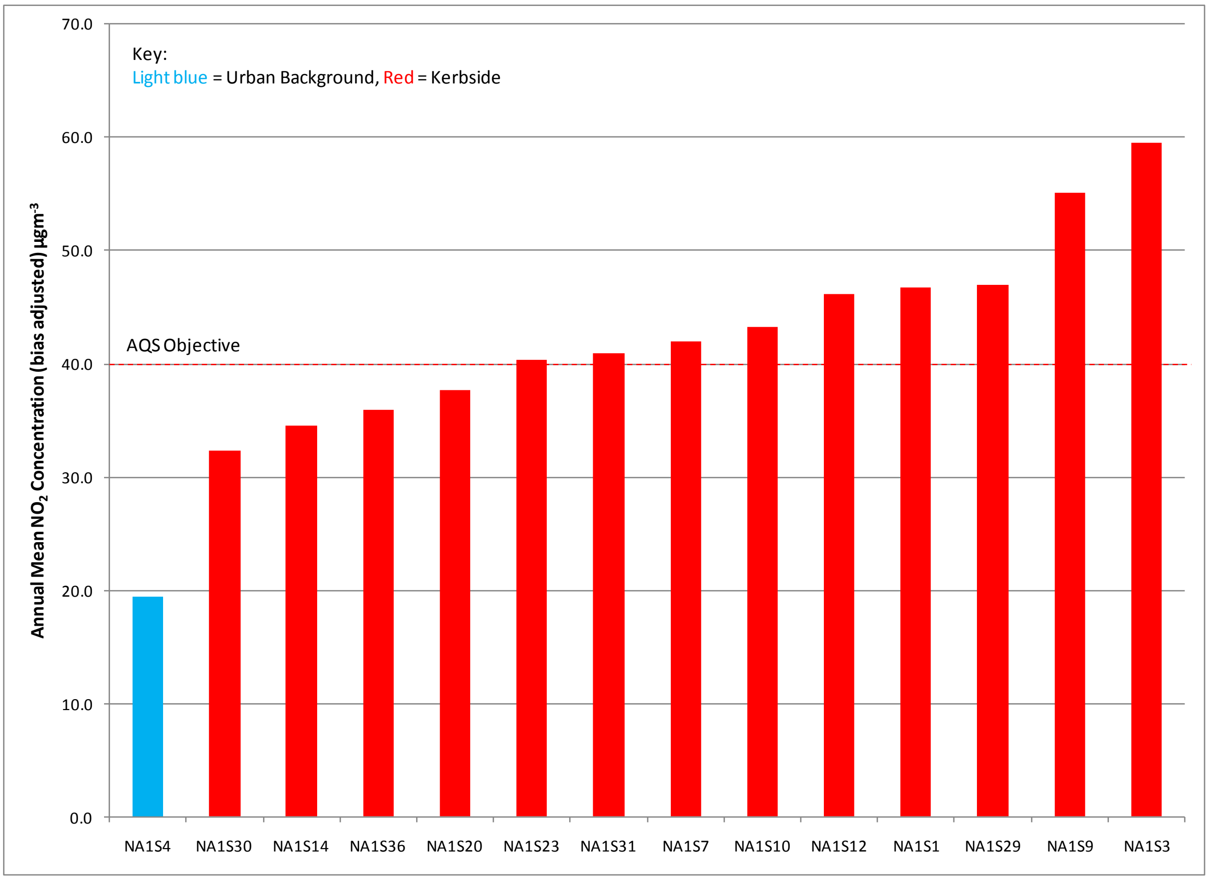


Figure 6.25: Annual mean NO_2 at diffusion tube sites in Medway, 2010.

The majority of Medway's sites are kerbside: approximately two thirds exceeded the AQS Objective of 40 µg m^{-3} in 2010.

Medway District Council operated three automatic NO_2 monitoring sites during 2010: Chatham Luton (Urban Background), Chatham Roadside (which was affiliated into the AURN as Chatham Centre Roadside as of 1st July 2010) and Rochester Stoke Rural. Diffusion tubes are co-located at each one (in triplicate). Rochester Stoke Rural was out of operation for much of the year due to problems resulting from water ingress. Figure 6.26 and Figure 6.27 show co-location results from Chatham Luton and Chatham Roadside respectively.

Medway's sites were substantially re-organised at the start of 2007, and none remain in their previous locations. Many were moved only a short distance - for example to the nearest building façade – but this is a significant change in the case of a kerbside or roadside site. Therefore, sites have not been in operation for the minimum five years generally accepted as the minimum required to assess trends. For information on trends in nitrogen dioxide concentration the reader should refer to the automatic NO_2 monitoring section. Please also refer to earlier annual reports from the Kent Network for earlier diffusion tube data[9].

[9] Previous annual reports can be found at: http://www.kentair.org.uk/reports.php?report_type=1&start=0&sub_cat_submit=Show+Reports

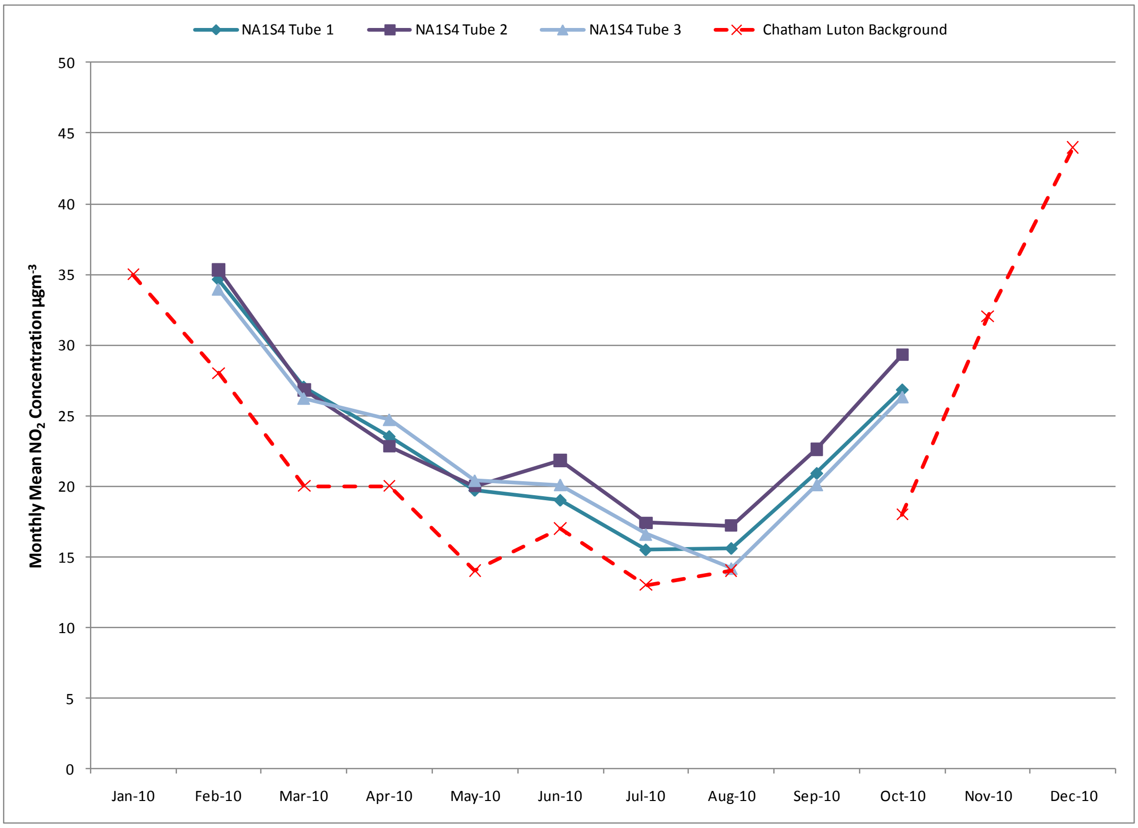


Figure 6.26: Comparison of diffusion tubes and automatic analyser, Chatham Luton (Urban Background) 2010 (no bias adjustment factor applied).

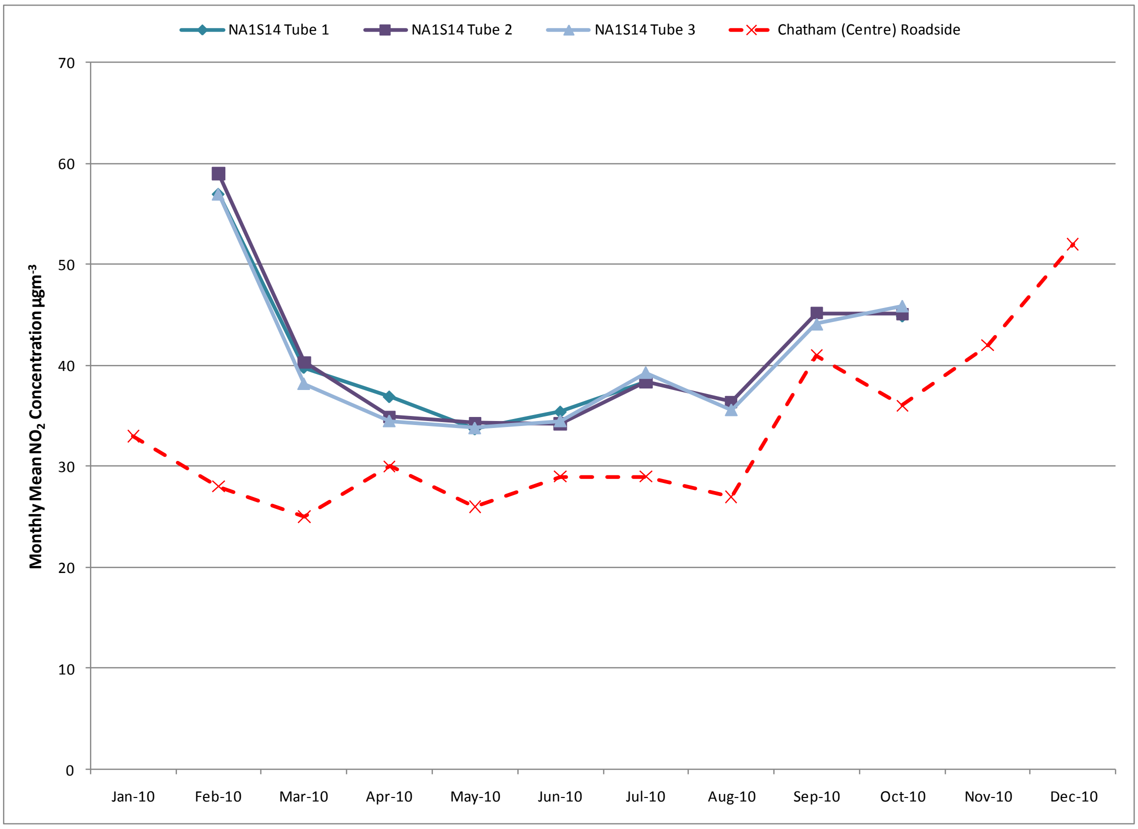


Figure 6.27: Comparison of diffusion tubes and automatic analyser, Chatham Roadside 2010 (no bias adjustment factor applied).

6.3.8 Sevenoaks District Council

Sevenoaks District Council is not a member of the Kent and Medway Air Quality Monitoring Network. Please contact the Local Authority directly for information on local air quality.

6.3.9 Shepway District Council

Shepway District Council operated diffusion tubes at nine sites during 2010. The majority were roadside sites. Figure 6.28 shows the annual means at the nine sites, all of which were within the annual mean AQS Objective of 40 µg m^{-3} (please note, the site numbers used here are those used on the Kent and Medway Air Quality Website: different site numbers are used in Shepway's most recent Progress Report).

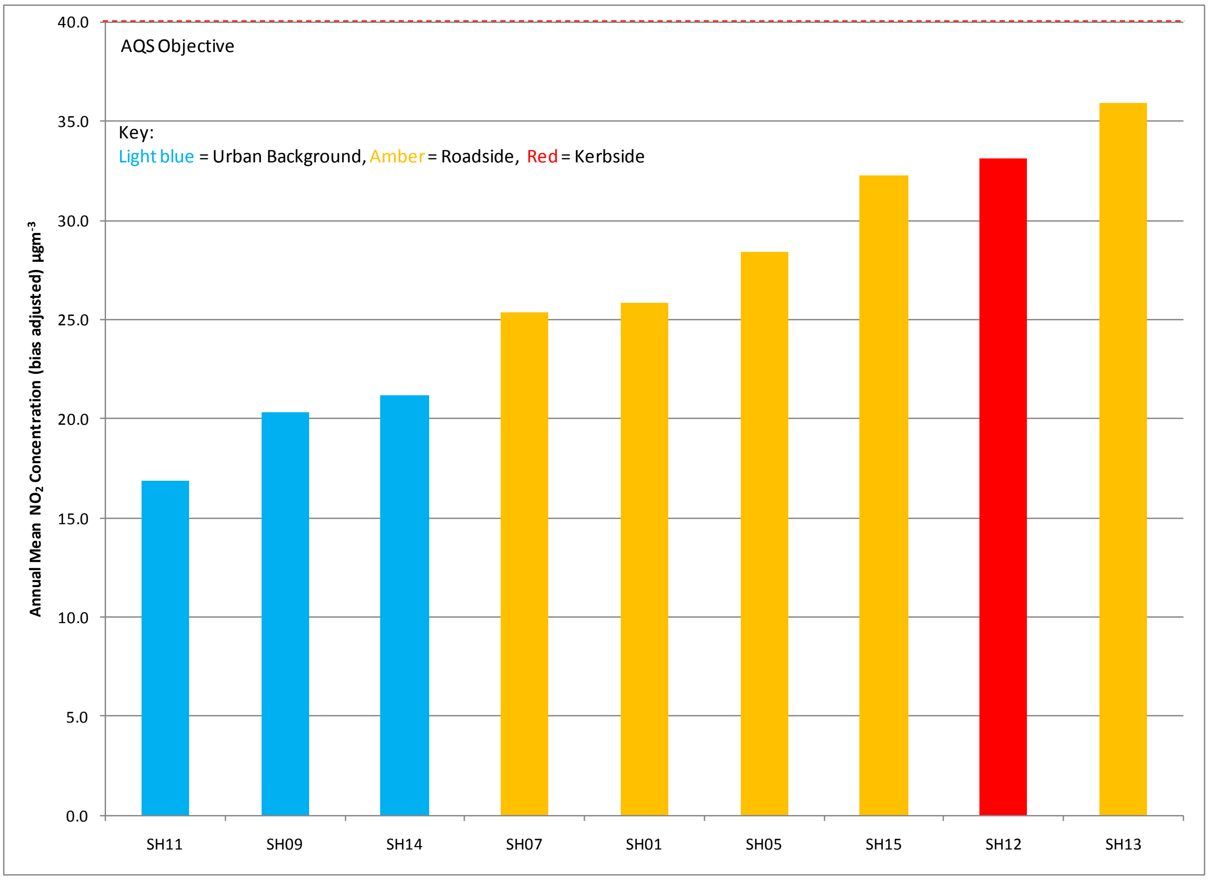


Figure 6.28: Annual mean NO_2 at diffusion tube sites in Shepway, 2010.

Shepway District Council do not monitor NO_2 using automatic methods at any of the diffusion tube sites, so it is not possible to compare the two methods. Shepway only began diffusion tube monitoring in 2008, so as yet there are insufficient data to plot long term trends.

6.3.10 Swale Borough Council

Figure 6.29 shows the adjusted annual mean NO_2 concentrations measured at Swale Borough Council diffusion tube sites during 2010. Swale had 59 sites in operation during part or all of 2010, of which one site closed down, and six started up, during the year. 51 sites had at least 9 months data, and these are included in Figure 6.29.

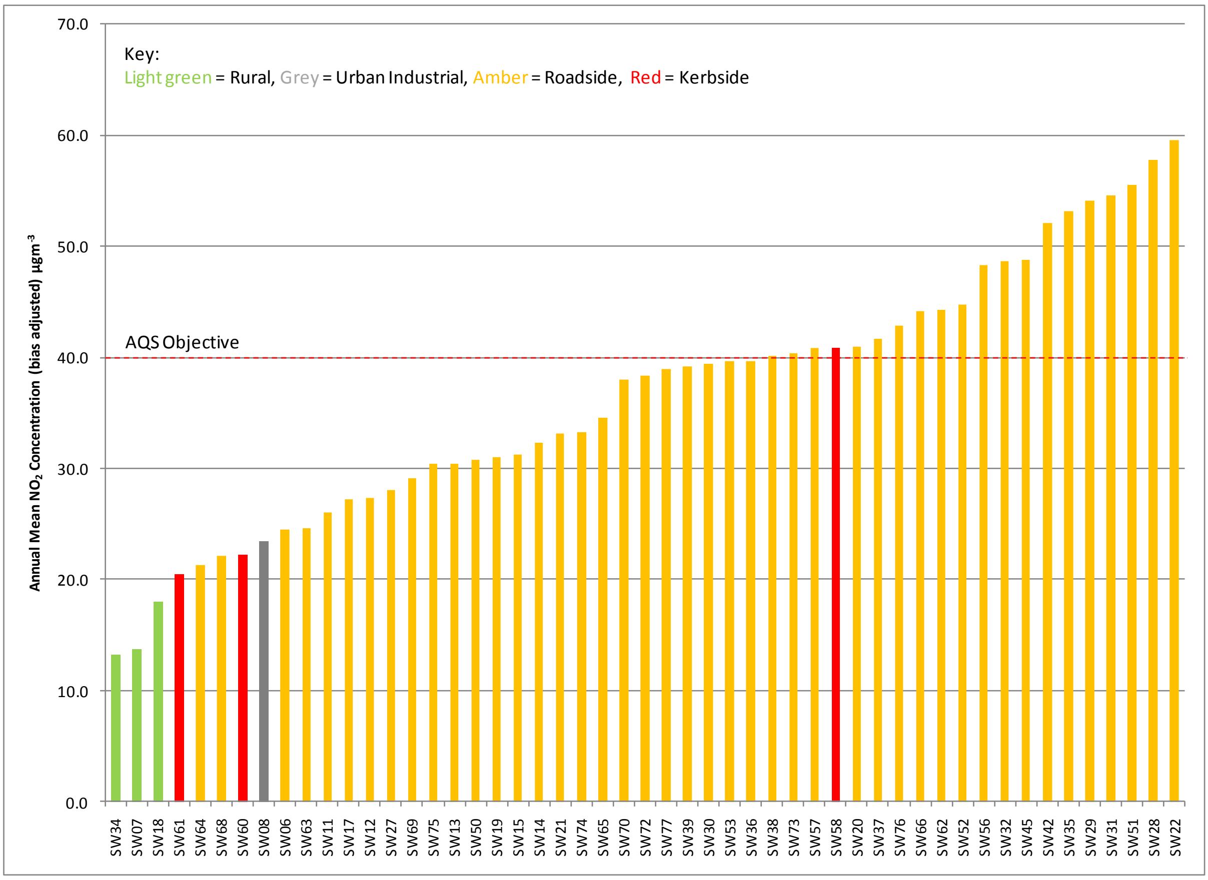


Figure 6.29: Annual mean NO_2 at diffusion tube sites in Swale, 2010.

Most Swale sites are designated as ‘roadside’: a substantial number have been re-classified, having been formerly designated as “kerbside”. Just over one third of the 51 sites exceeded the AQS Objective of 40 µg m^{-3} in 2010.

Diffusion tubes are co-located with automatic NOx monitors at both of Swale’s automatic monitoring sites, Swale Ospringe Roadside 2 and Swale Sheerness (Urban Background). (A temporary third automatic monitoring site, Swale Newington 2, was in operation from 1st June 2010 to 11th January 2011 only.) Figure 6.30 and Figure 6.30 show monthly diffusion tube and automatic analyser results at these two sites.

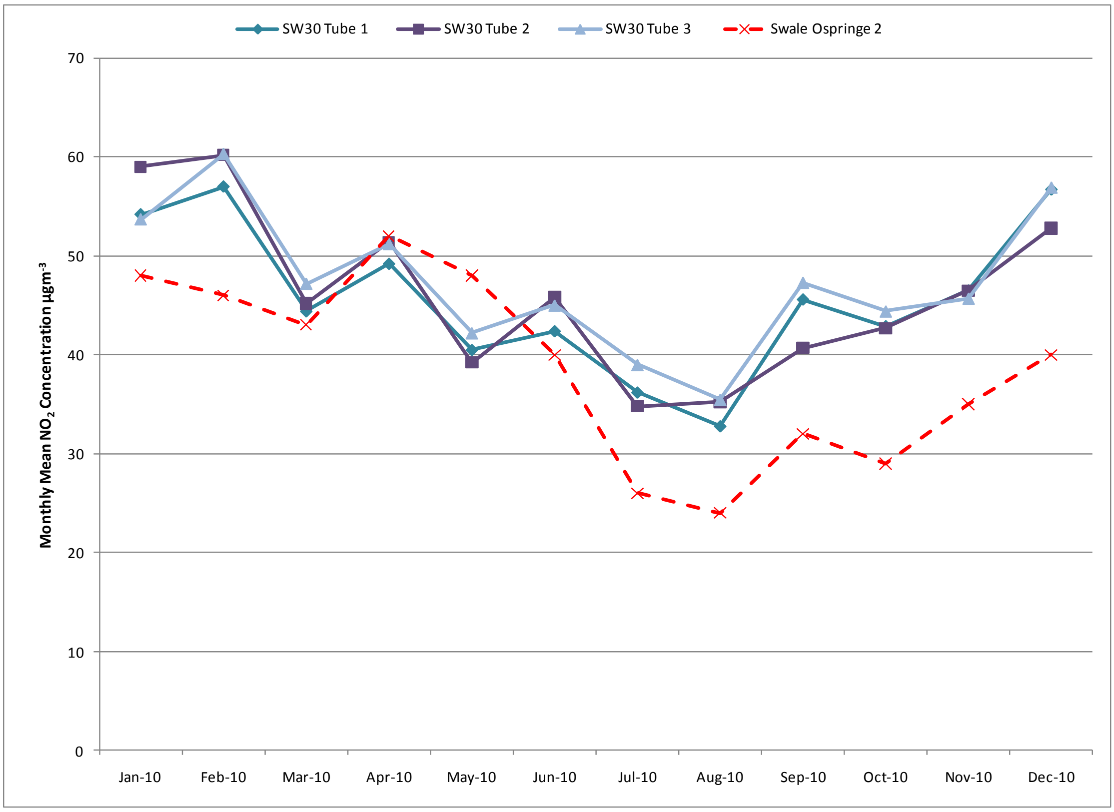


Figure 6.30: Comparison of diffusion tubes and automatic analyser, Swale Ospringe Roadside 2, 2010 (no bias adjustment factor applied).

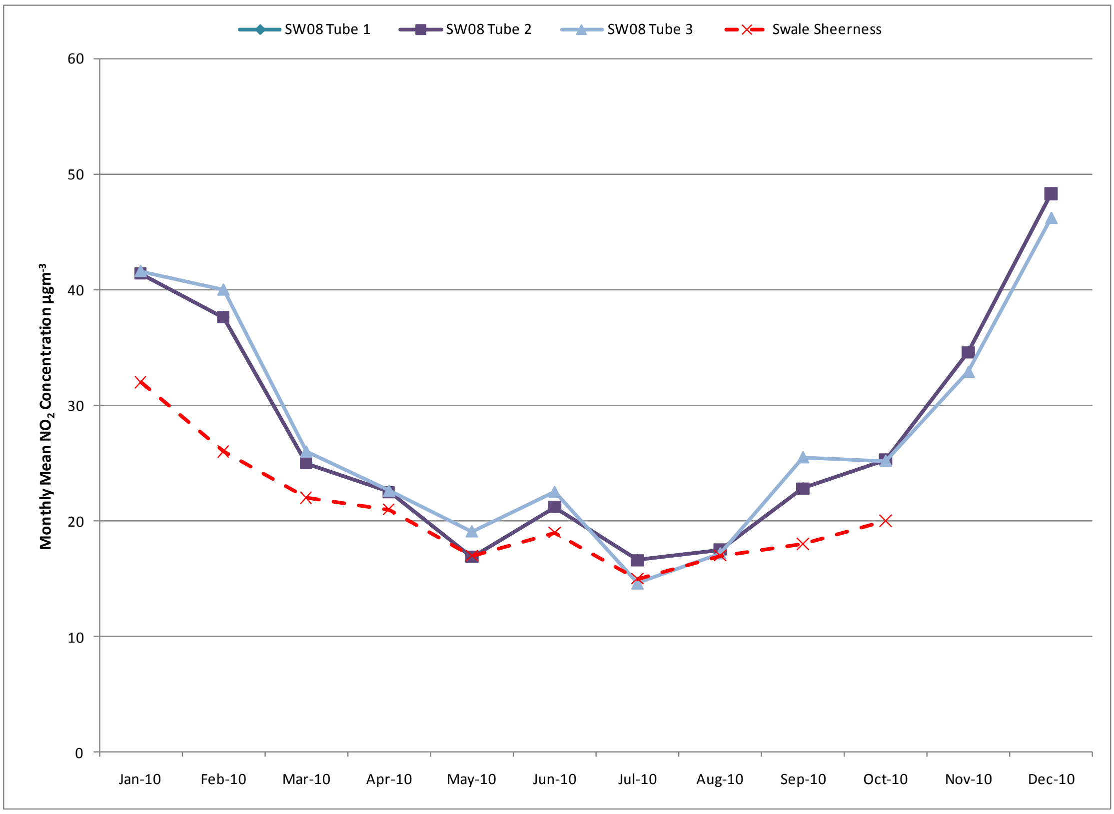


Figure 6.31: Comparison of diffusion tubes and automatic analyser, Swale Sheerness 2010 (no bias adjustment factor applied).

The majority of Swale's diffusion tube sites started in 2005. Figure 6.32 therefore shows trends in the average kerbside, roadside, and urban background concentrations (averages of all sites), since 2005. Recently, Swale re-classified the majority of their kerbside sites as roadside, leaving just three genuine kerbside sites. For this reason, kerbside and roadside sites have not been separated in this graph, but an average for both site categories is shown. Figure 6.32 includes a time-series of annual means at the two automatic sites currently operating in Swale, and their co-located diffusion tubes.

The average NO_2 concentration for all roadside and kerbside sites appears to have increased substantially since 2007: however, the upward trend has flattened off in the past three years. This "flattening off" is also seen in the data from SW30, co-located with Swale Ospringe Roadside 2.

The diffusion tubes at site SW08 (co-located with Swale Sheerness) typically overestimated relative to the automatic analyser, but were still comparable. By contrast, the diffusion tubes at Swale Ospringe Roadside 2 (which is located on the other side of the same road as the former Swale Ospringe Roadside site) over-read considerably. It is possible this may be due to a street canyon effect, e.g. wind turbulence.

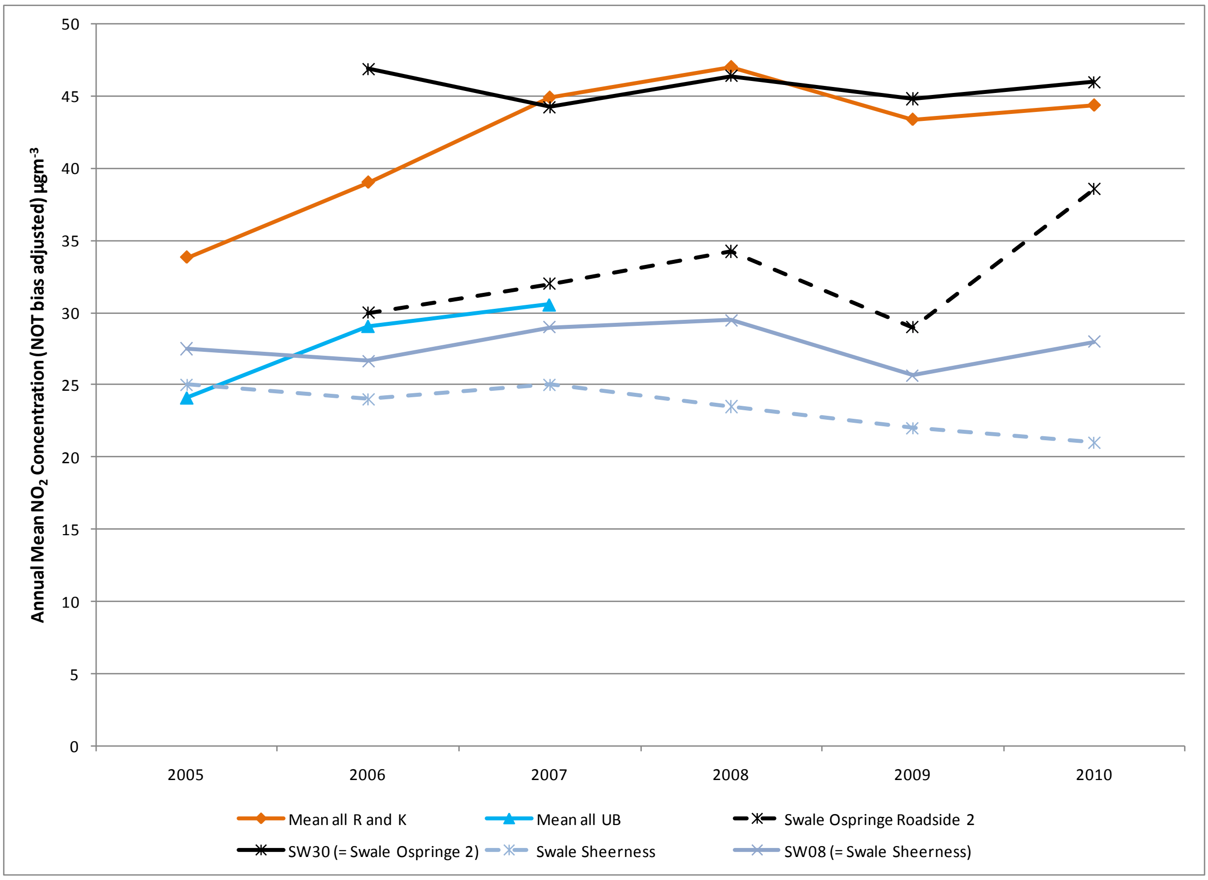


Figure 6.32: Time series of NO_2 concentrations at co-located sites in Swale (no bias adjustment factor applied).

6.3.11 Thanet District

Figure 6.33 shows the bias-adjusted annual mean NO_2 concentrations measured at Thanet District Council's diffusion tube sites during 2010.

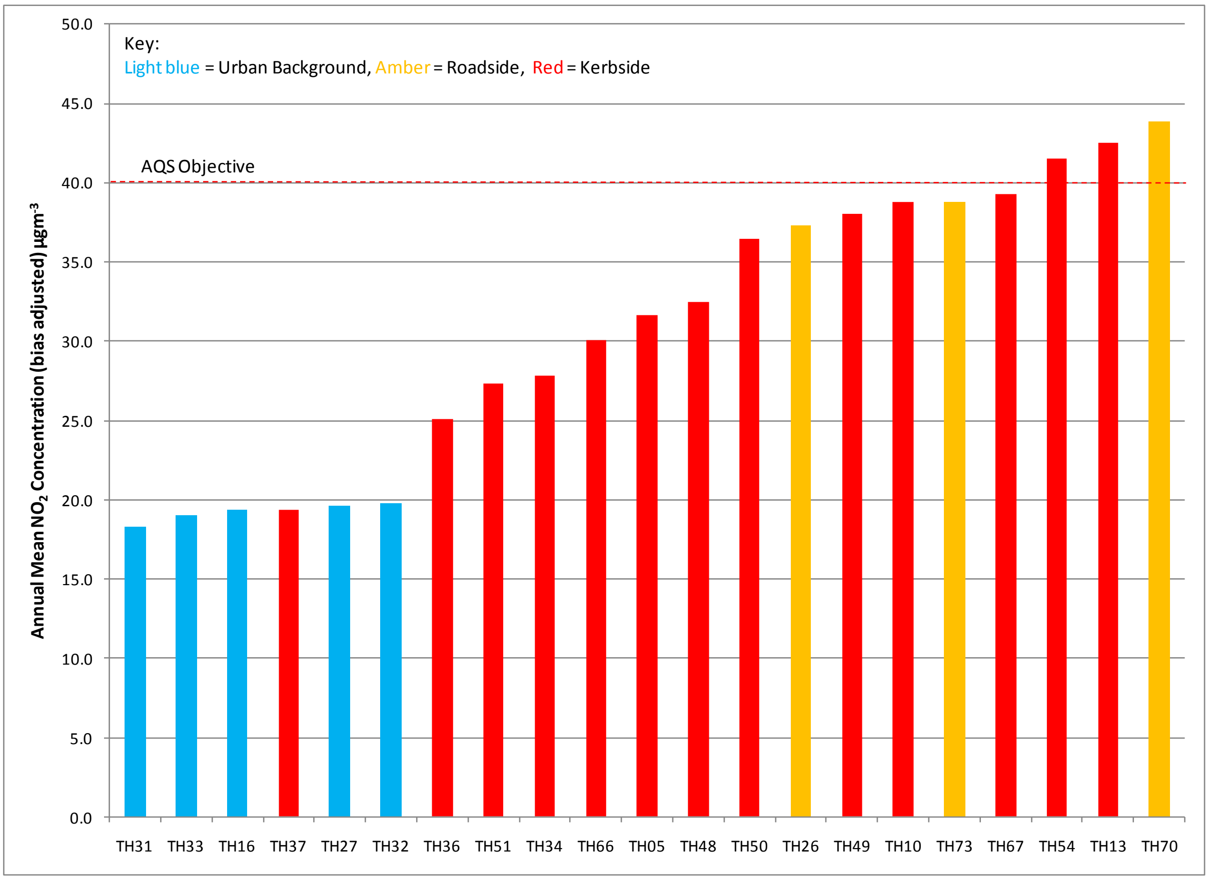


Figure 6.33: Annual Mean NO_2 at Diffusion Tube Sites in Thanet.

The majority of Thanet's sites are kerbside, but only two Thanet sites exceeded the AQS Objective of 40 µg m^{-3}. Highest concentrations were measured at TH70 on the High Street, St Lawrence, also TH13 at The Square, Birchington. These sites also showed highest concentrations in 2009 and 2008.

Figure 6.34, Figure 6.35, and Figure 6.36 show diffusion tube co-location results at the three Thanet automatic NO_2 monitoring sites – Thanet Airport (Urban Background), Thanet Birchington Roadside, and Thanet Ramsgate Roadside respectively. (Diffusion tubes were not co-located at the fourth automatic monitoring site, Thanet Margate.)

It should be noted that the tubes at Thanet Birchington Roadside are not as closely co-located with the automatic analyser as the other two sites, being 5m from the inlet. Also, the diffusion tubes are approximately 1m from the kerb, whereas the automatic analyser inlet is approximately 4m from the kerb.

Diffusion tubes at all three sites exhibit positive bias but it is more pronounced for Thanet Airport and Thanet Birchington, possibly due to site-related factors.

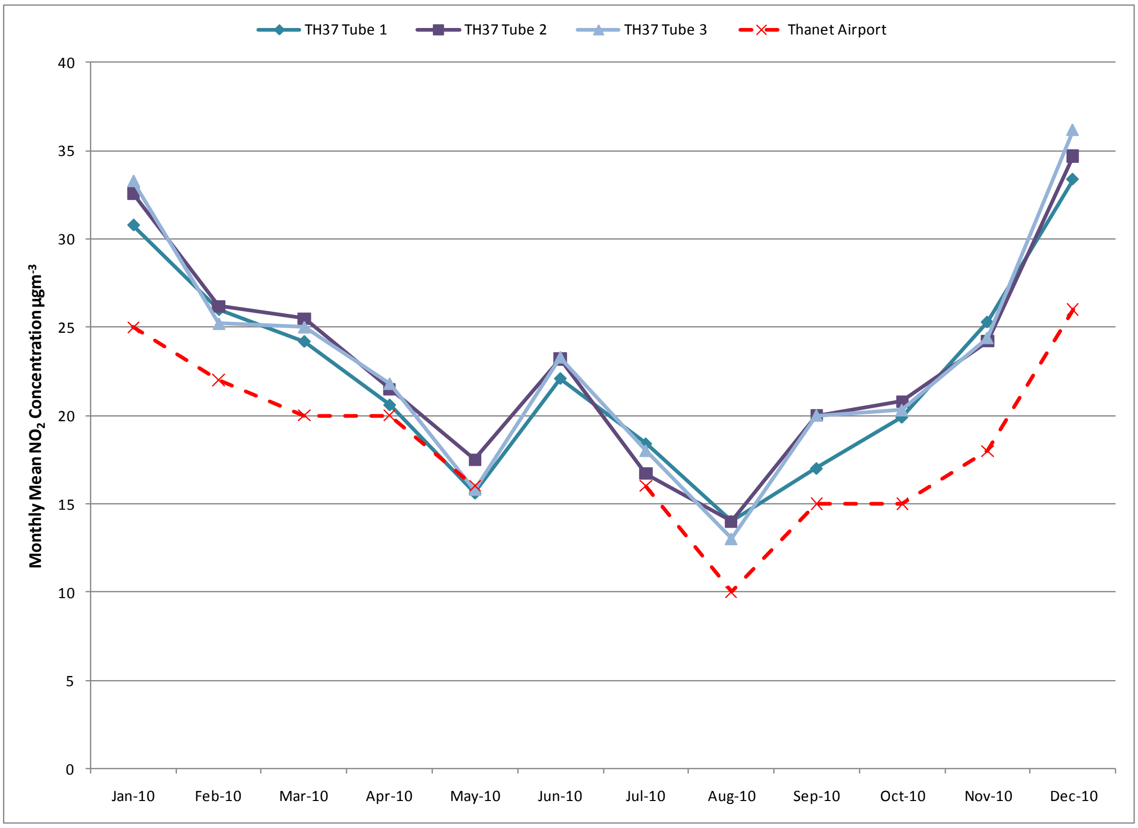


Figure 6.34: Comparison of diffusion tubes and automatic analyser, Thanet Airport 2010 (no bias adjustment factor applied).

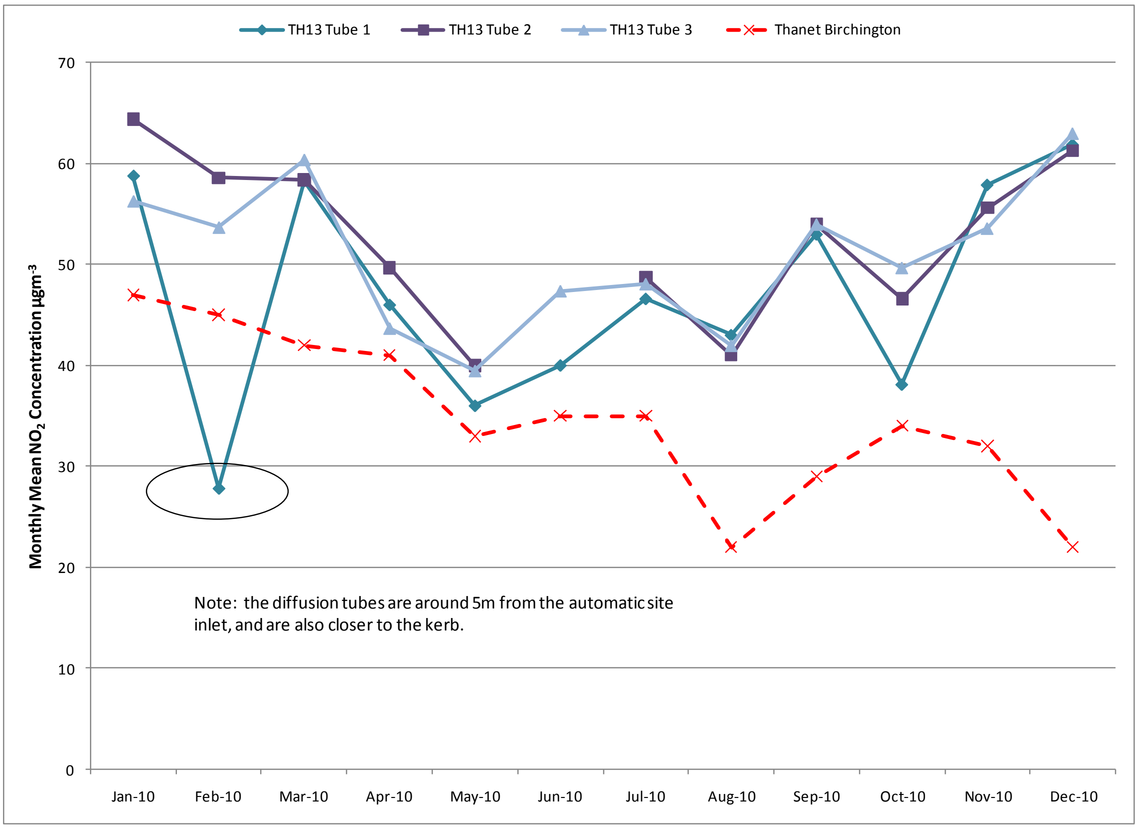


Figure 6.35: Comparison of diffusion tubes and automatic analyser, Thanet Birchington Roadside 2010 (no bias adjustment factor applied). Nearby not co-located.

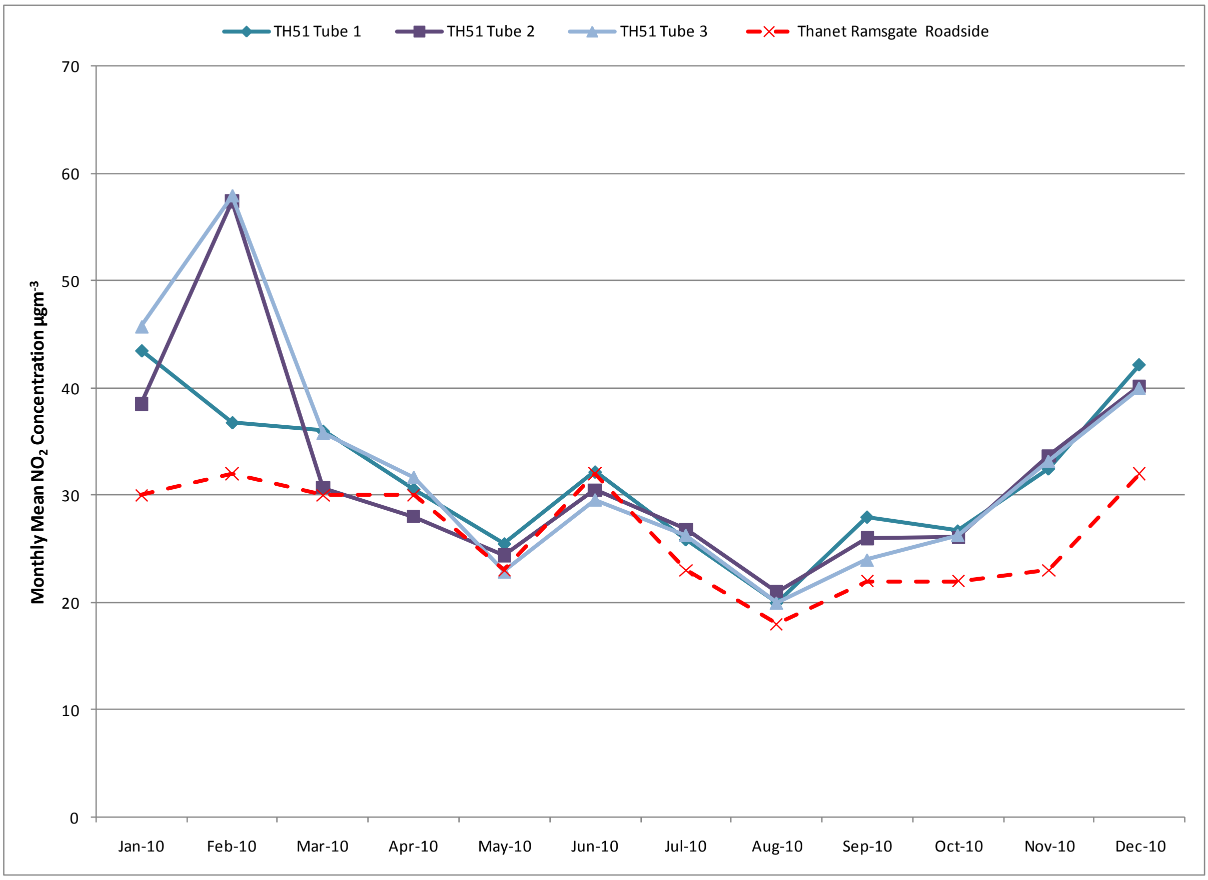


Figure 6.36: Comparison of diffusion tubes and automatic analyser, Thanet Ramsgate Roadside 2010 (no bias adjustment factor applied).

Figure 6.37 shows a time series of mean concentrations. This shows the means for all kerbside, all roadside and all urban background diffusion tube sites. Please note roadside sites are represented by just one long-running site, TH26. Urban background sites are represented by five long-running sites.

Also shown are the annual means for the four automatic sites and the diffusion tube sites co-located with them. The diffusion tube data are not bias adjusted. The diffusion tube data do not show any clear trend in NO_2 concentration. Similarly, the long-running automatic sites (Thanet Airport, Thanet Margate Background and Thanet Ramsgate Roadside) show no clear upward or downward trends.

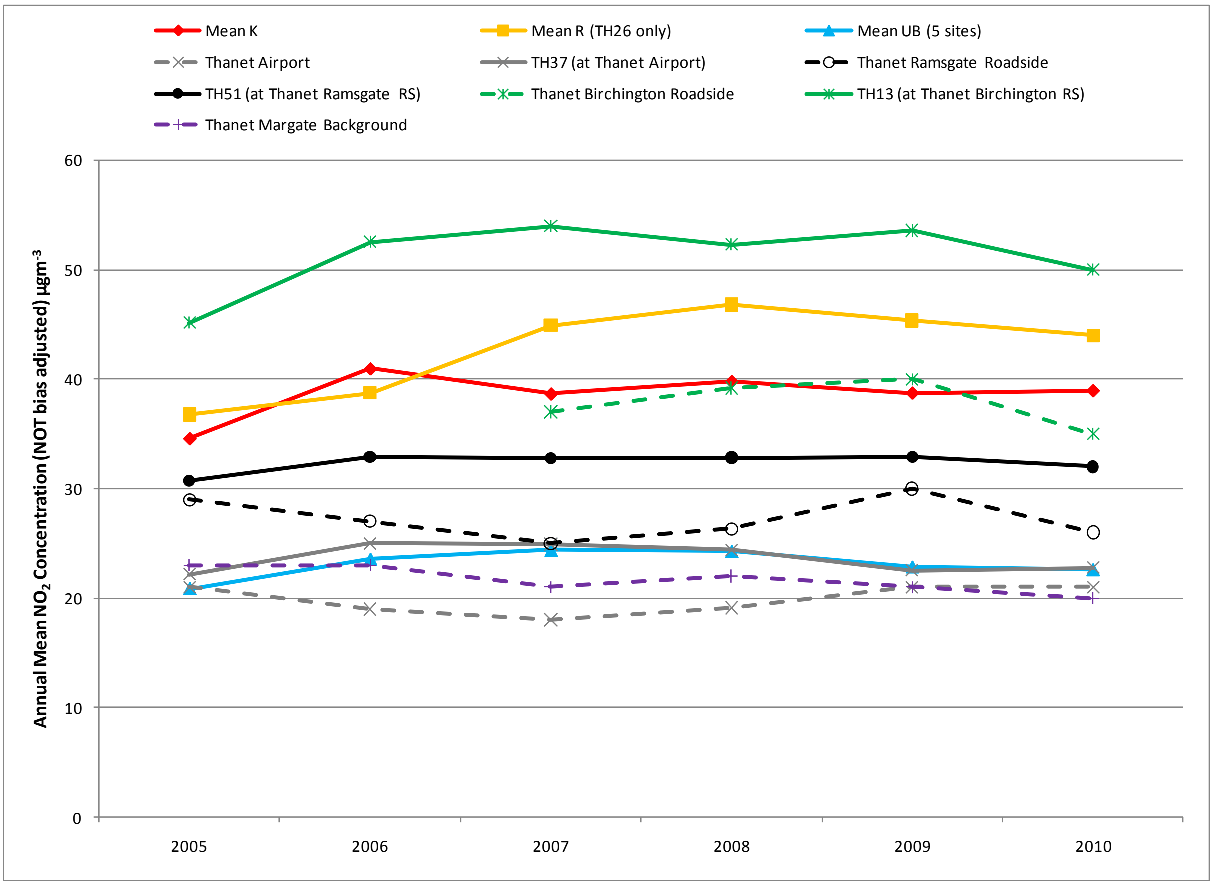


Figure 6.37: Time series of NO_2 concentrations at diffusion tube and automatic monitoring sites in Thanet (no bias adjustment factor applied).

6.3.12 Tonbridge and Malling Borough Council

Figure 6.38 shows the annual mean NO_2 concentrations measured by Tonbridge and Malling Borough Council during 2010. During June 2010 the Council made some changes to their network. The total number of sites was reduced from 29 to 25 - this included seven sites being closed and three new sites being started. The number of sites with triplicate tubes was also increased from 4 to 6. Overall 32 locations were monitored at during 2010, however only 21 of these locations generated data for 9 months or more. The results for these 21 locations are shown in Figure 6.38.

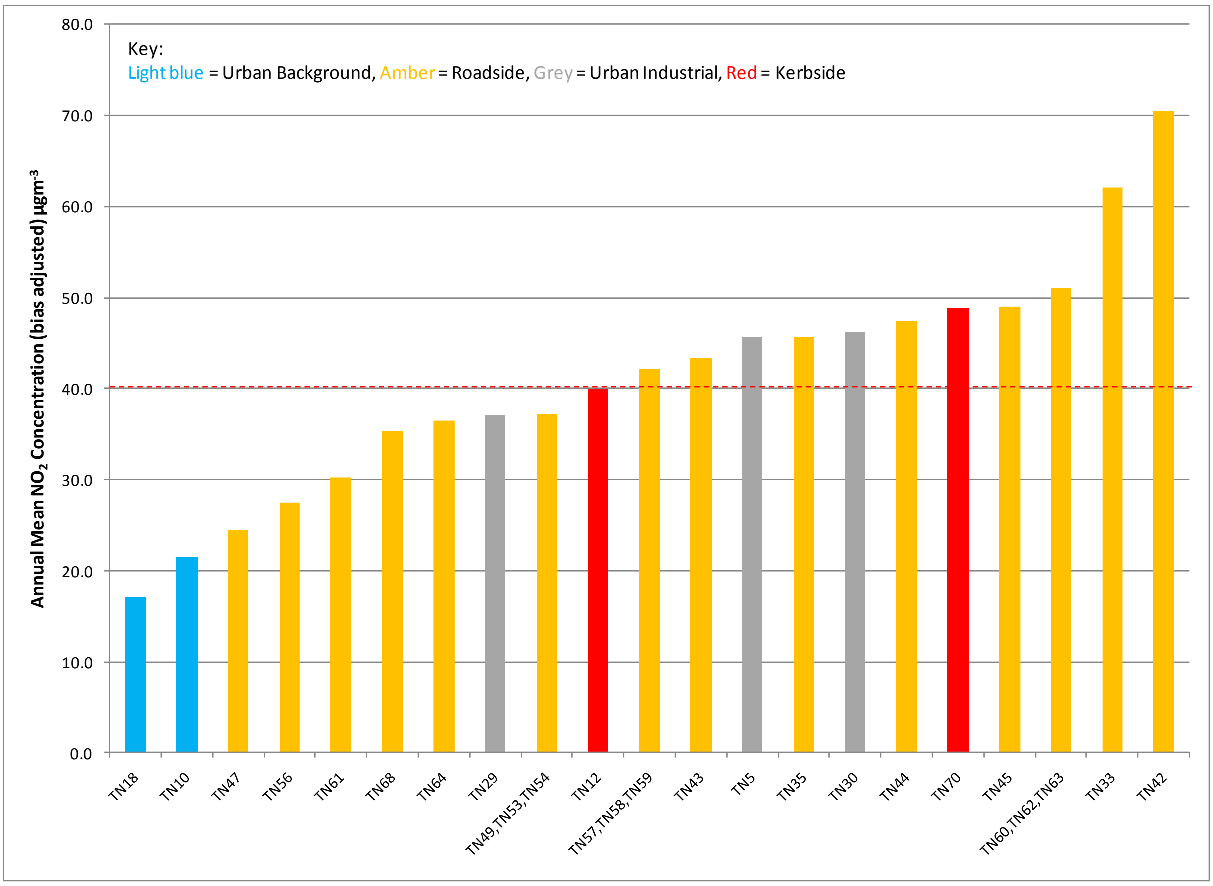


Figure 6.38: Annual mean NO_2 at diffusion tube sites in Tonbridge and Malling, 2010.

The majority of the sites in this Borough are roadside, with a few urban industrial, kerbside and urban background sites. Over half of the sites exceeded the AQS annual mean Objective of 40 µg m^{-3}. The highest annual mean concentration was measured at site TN42, Tonbridge Road, Wateringbury. This was also the highest site in 2008 and 2009.

Tonbridge and Malling has one automatic monitoring site: Tonbridge Roadside 2. However, diffusion tubes are not co-located with the automatic analyser, because the position of the inlet would make it difficult to change the tubes easily and safely. Therefore, a comparison of monthly means measured by the two methods cannot be included here.

Relatively few of Tonbridge and Malling's current sites have been in operation long enough to assess trends, so for information on trends in nitrogen dioxide concentration the reader should refer to the automatic NO_2 monitoring section.

6.3.13 Tunbridge Wells Borough Council

Figure 6.39 shows the adjusted annual mean NO_2 concentrations measured at Tunbridge Wells Borough Council diffusion tube sites during 2010. There were 21 sites in operation, all of which achieved at least 9 months data capture.

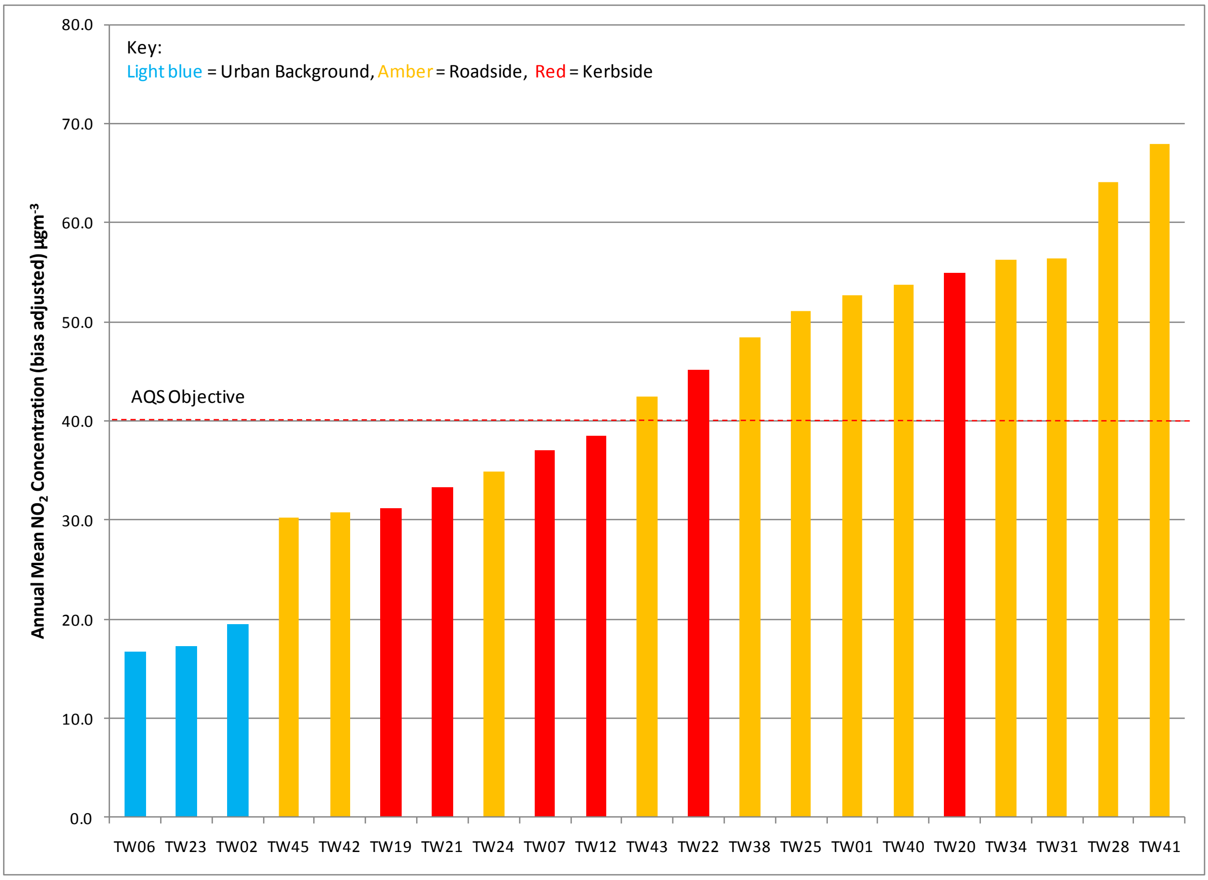


Figure 6.39: Annual mean NO_2 at diffusion tube sites in Tunbridge Wells, 2010.

The majority of Tunbridge Wells' sites are either kerbside or roadside. As noted in both 2008 and 2009, the roadside sites appear to be giving typically higher annual mean results than the kerbside sites. The reason for this is not known, but one possible explanation is that the roadside sites may be associated with busier roads than the kerbside sites. Around half the sites exceeded the AQS annual mean Objective of 40 μgm^{-3} in 2010. Urban background levels were well below the Objective.

Tunbridge Wells has two automatic monitoring sites - Tunbridge Wells Town Centre and Tunbridge Wells Roadside (on the A26 St John's Road). Only the latter has diffusion tubes co-located with it. Figure 6.40 shows a comparison of unadjusted monthly mean concentrations for 2010, as measured by the diffusion tubes and the automatic analyser. The diffusion tubes clearly show positive bias with respect to the automatic analyser.

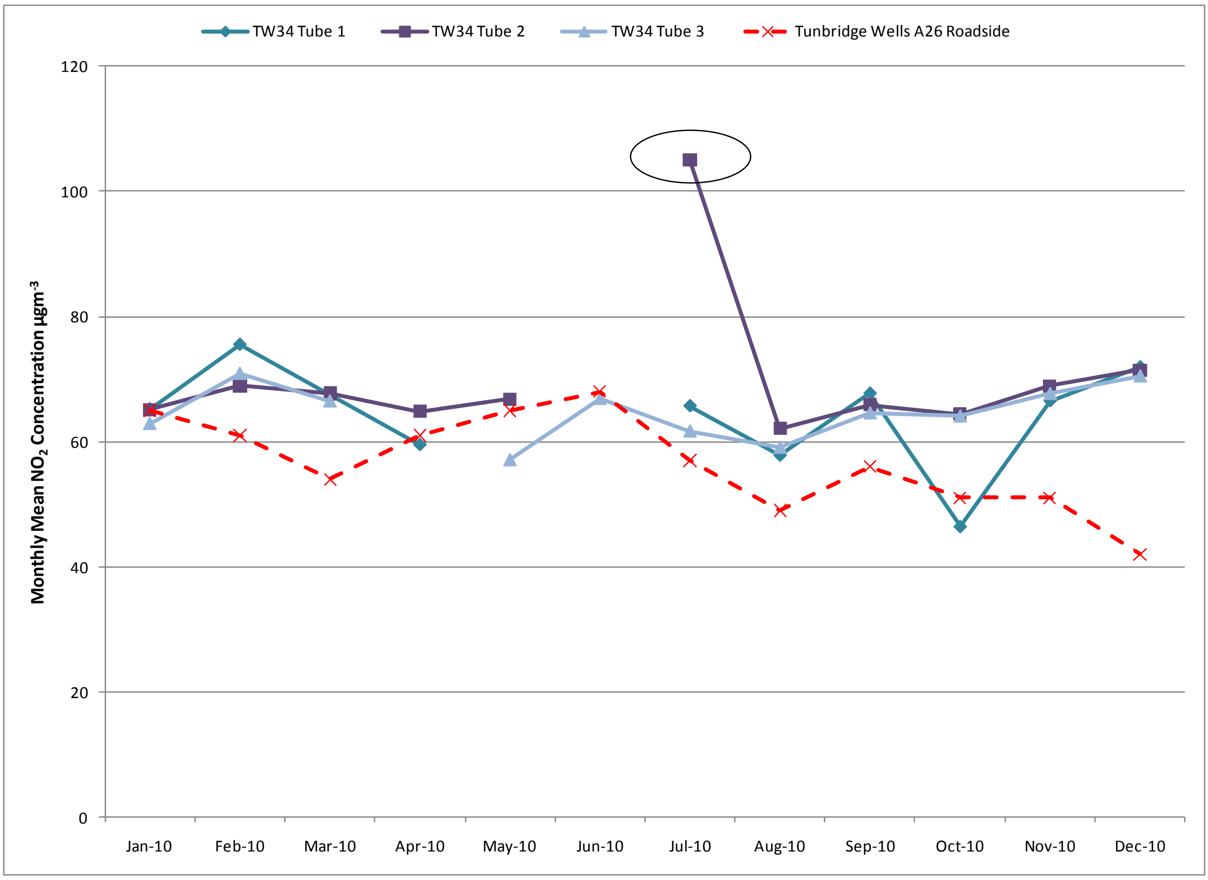


Figure 6.40: Comparison of diffusion tubes and automatic analyser, Tunbridge Wells A26 Roadside 2010 (no bias adjustment factor applied).

Tunbridge Wells has a number of long-running sites, and it is possible to plot a time series from 2000. Figure 6.41 compares the results from the automatic sites with the unadjusted mean of the diffusion tube sites. The latter are divided into three categories: roadside, kerbside and urban background. The mean roadside concentration (based on the three long-running sites) is shown only from 2005, as prior to this there was only one site.

The means for long-running kerbside and roadside diffusion tube sites show an upward trend over the last 10 years. A similar trend is seen in the Tunbridge Wells A26 Roadside data. Please note that the trends identified on the basis of diffusion tubes in this situation should be treated with caution: there have been changes in the supplier/analyst of the tubes over the past 10 years, so it is possible that the accuracy of the tubes may have changed over this period.

The mean concentration for urban background sites shows no clear trend. The urban background automatic site, Tunbridge Wells Town Centre, similarly indicates stable concentrations.

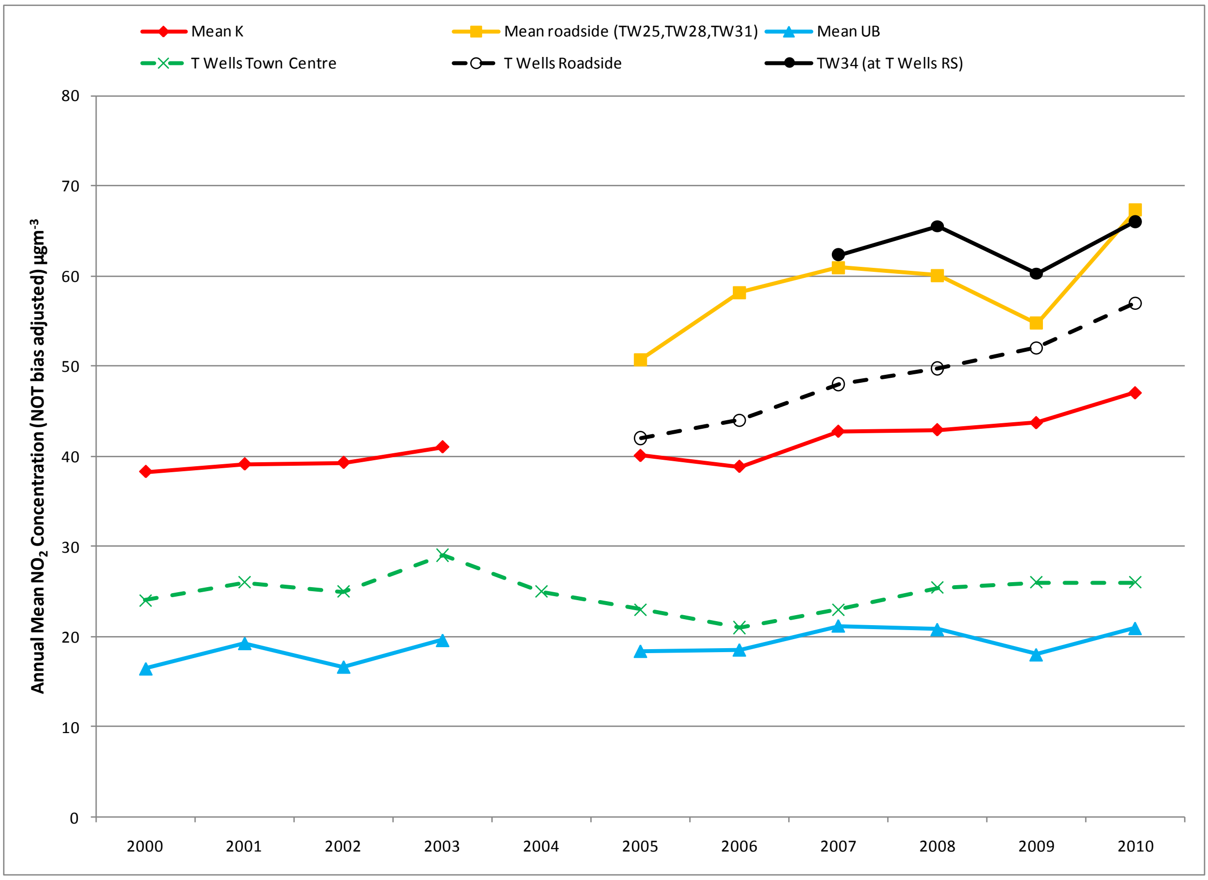


Figure 6.41: Time series of NO_2 concentrations at co-located sites in Tunbridge Wells (no bias adjustment factor applied).

6.4 Investigation of diffusion tube performance

6.4.1 Comparison of NO_2 diffusion tube and automatic analyser results

As explained in Section 6.2, diffusion tubes may be affected by a number of sources of interference which can cause them to exhibit so-called 'bias' i.e. under-read or (more commonly) over-read relative to the automatic analyser. It has therefore become common practice for Local Authorities to carry out co-location studies, in which diffusion tubes are exposed at the same site as an automatic analyser, and to use the results to calculate a "bias adjustment factor" which can then be applied to the annual means measured by the diffusion tubes at the other sites.

As highlighted above, most of the Kent and Medway sites carried out at least one co-location study in 2010, with diffusion tubes exposed in triplicate at the automatic monitoring site. This provides a good opportunity to investigate the precision and accuracy of the tubes used, and whether there are significant differences in their performance at roadside sites compared with urban background sites.

Precision and bias values for the triplicate co-located tubes at each site were calculated using the Precision and Bias spreadsheet tool (developed by AEA), which can be downloaded from http://laqm.defra.gov.uk/bias-adjustment-factors/local-bias.html .

Table 6.2 summarises the results of the various co-location studies carried out in Kent and Medway in 2010. All Local Authorities used tubes from Harwell Scientifics, except Dartford, who used tubes from Gradko International. The mean percentage biases presented in the table therefore exclude Dartford. Thanet Birchington was also excluded from the averages: this is not a true co-location, as the diffusion tubes are located several metres closer to the kerb than the automatic analyser inlet.

The annual mean percentage bias of the diffusion tubes used at the above Kent and Medway sites in 2010 ranged from 0% to 40%, with a mean of 18% (i.e. on average the diffusion tubes over-estimated annual mean NO_2 concentration by 18% relative to the reference measurement from the automatic analyser).

The mean bias adjustment factor, based on all the above co-located sites, was 0.83. This is close to the combined bias adjustment factor of 0.85, obtained from the spreadsheet of co-location results provided by Defra and available for download at http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html (April 2011 version). The fact that the two values are so close may be partly due to the fact that the 18 co-location studies on which this combined bias adjustment factor was based, included ten Kent and Medway studies.

The precision is expressed here in terms of the mean coefficient of variation (CV) of triplicate tube measurements. (The coefficient of variation, also known as the relative standard deviation, is the standard deviation expressed as a percentage of the mean). The mean CV of all the co-located triplets in this study was 4%. (This is good result; as a general indication, the annual mean CV should be within 10%).

Table 6.2: Precision of diffusion tubes, and bias relative to automatic analyser (2010).

Site name	Type	Mean NO_2[10] (automatic) µg m^{-3}	Mean NO_2 (tubes) µg m^{-3}	Mean bias %	Mean CV of triplets[11] %	Bias adjustment factor
Maidstone A229 Kerbside *(Precision worse than other sites).*	K	56	56	0	12	1.00
Canterbury Military Road	R	39	48	21	1	0.82
Chatham Centre Roadside	R	29	41	40	2	0.71
Dover Old Town Hall Roadside *(High outlier rejected in Mar)*	R	42	44	5	4	0.95
Gravesham A2 Roadside	R	37	43	16	7	0.86
Swale Ospringe Roadside 2	R	39	46	20	4	0.83
Thanet Ramsgate Roadside *(Low outlier rejected in Feb)*	R	26	33	27	4	0.79
Tunbridge Wells A26 Roadside *(High outlier rejected in Jul)*	R	56	65	17	5	0.86
Maidstone Rural	RU	16	21	28	9	0.78
Ashford Background *(Low outlier rejected in Jul)*	UB	18	24	25	3	0.80
Ashford M20 Background	UB	35	44	28	5	0.78
Canterbury	UB	18	21	15	2	0.87
Chatham Luton Background	UB	20	25	31	4	0.77
Gravesham Ind. Background *(Low outlier rejected in Nov)*	UB	29	38	31	5	0.76
Swale Sheerness	UB	21	25	21	4	0.83
Thanet Airport	UB	19	23	25	4	0.80
Not included in averages: Dartford Bean Interchange (use a different analyst)	*R*	*54*	*57*	*6*	*8*	*0.94*
Thanet Birchington RS	*R*	*35*	*51*	*46*	*5*	*0.68*
Mean All		31	37	18	4	0.83
Mean KS & RS		41	47	18	5	0.85
Mean UB		23	28	18	3	0.80
Mean Rural		16	21	28	9	0.78

[10] The mean shown here is based only on the months with a valid monthly mean for automatic analyser and diffusion tubes, and may differ from the annual means presented elsewhere in this report for the automatic sites.
[11] The CV (Coefficient of Variation) represents the precision of diffusion tube surveys. When the CV of a single period is above 20%, the period measurement is considered of poor precision. All others, below 20%, are considered of good precision. The average CV of the different periods of monitoring is used to assess the overall precision of the survey. It is considered that if the average CV is above 10%, the survey is of poor precision.

6.4.2 Comparison of diffusion tube performance at roadside, urban background and rural sites

Differences in precision and accuracy between tubes exposed at roadside and urban background sites were investigated. There are theoretical reasons why diffusion tube performance might possibly vary at sites of different types: for example, wind turbulence from passing traffic at roadside sites might contribute to positive bias. The Kent and Medway Network provides a good opportunity to investigate this, as

- it contains a large proportion of diffusion tubes all prepared and analysed by the same laboratory (so there are no inter-laboratory variations), and
- all the Authorities follow the same calendar of exposure periods.

In 2010, the mean percentage bias for roadside and kerbside sites was 18%, compared with 18% also for urban background sites. On average, diffusion tubes at kerbside and roadside sites therefore over-estimated by a similar amount (relative to the automatic analyser).

Previous years have not shown a consistent pattern in this respect. In 2009, the mean bias at kerbside and roadside sites in Kent and Medway was 27%, compared with 15% for urban background (and urban industrial) sites. In 2008, the mean percentage bias for roadside and kerbside sites was 25%, compared with 30% for urban background (and urban industrial) sites. In 2007, the mean percentage bias was 26% at roadside and kerbside sites, compared with 20% at urban background sites. Therefore, the Kent diffusion tubes do not appear to show any clear differences in diffusion tube accuracy between roadside/kerbside and urban background sites.

Both types of sites also showed similar diffusion tube precision (expressed as the coefficient of variation of the tube triplets).

Co-location of diffusion tubes was undertaken at two rural sites – Maidstone Rural, and Medway's Rochester Stoke site. Rochester Stoke was out of operation for a large proportion of the year, so diffusion tube precision and accuracy has not been assessed for this site. In 2009 and 2008, both rural sites both showed relatively high diffusion tube bias. However, in 2010, diffusion tube bias at Maidstone Rural was 28%, which was within the range observed for the other site types.

7 Review and Assessment update

Part IV 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. This section describes significant developments in individual Local Authority Review and Assessment process since the last report in 2009.

Full details of the responsibilities of local authorities with regard to local air quality management are given at http://www.defra.gov.uk/environment/airquality/laqm.htm

7.1 Ashford Borough

Ashford BC has recently completed its 2011 Progress Report and had it approved by Defra. This report includes the final monitoring data from a temporary station at Lees Road, Willesborough. The twelve month monitoring programme at this location used a continuous chemilluminescent analyser. The data generated for nitrogen dioxide at this location indicates that the 12 month mean concentration was well below the annual objective. As such, it is not anticipated that a detailed assessment will be required here.

The diffusion tube network has not identified any exceedences of the nitrogen dioxide objective.

Proposals for a new M20 Junction 10A, recently announced by the Highways Agency, have been suspended indefinitely.

7.2 Canterbury City

In 2006 Canterbury City Council declared its first Air Quality Management Area (AQMA) covering parts of Broad Street and Military Road, which was based upon exceedence of the Annual Mean Objective for nitrogen Dioxide.

The Council has now finalised an Air Quality Action Plan covering this AQMA, which has been approved by Defra and adopted by the Council. Comments from Defra have indicated that the Action Plan is a potential example of best practice.

During 2009 the Council carried out a combined Detailed and Further Assessment looking at new hotspots, which were identified from monitoring carried out in 2008, in the 2008 Detailed Assessment, and in the 2009 Updating and Screening Assessment.

The combined assessment report has concluded that further exceedences of the Annual Mean Objective for nitrogen dioxide, outside of the existing AQMA, in:

- St.Dunstans Street
- North Lane
- St.Peters Place
- Rheims Way
- Wincheap
- Pin Hill
- Upper Bridge Street
- Sturry Road

These areas are very closely linked to each other, and encompass parts of the city inner ring road and the busy A28 corridor through the city.

The combined assessment report has also concluded that there is now an exceedence of the 1-hour mean Objective for nitrogen dioxide in the Broad Street/Military Road AQMA, and in Wincheap.

Therefore it shall also be necessary to amend the Broad Street/Military Road AQMA to include exceedence of the 1-hour mean Objective for nitrogen dioxide, together with a slightly increased area of exceedence.

Public consultation on further AQMA declarations started on 6 December 2010, and is due to end on 4 March 2011. The consultation outlines the options available to the council for declaring additional AQMAs. Three options were put forward to define the size and shape of the new AQMAs, and a survey has been carried out asking residents and businesses for their opinion on which option should be pursued. Responses will be evaluated after the consultation period has closed, so that the matter can be reported back to the council's General Purposes Committee, who will decided on which option to pursue, and to approve the declaration. This process is expected to be completed by the autumn of 2011.

The council has also completed its 2010 Annual Progress Report, which considered monitoring data for 2009. The conclusions of the report, which have been accepted by Defra, are that there were no further exceedences outside of the current Broad Street/Military Road AQMA, or emerging AQMAs. Therefore a Detailed Assessment is not required for submission in 2011.

7.3 Dartford Borough

The 2009 updating and screening assessment identified a number of hotspots through monitoring data and DMRB assessment where NO_2 levels were identified in excess of the objective levels. These locations include areas in close proximity to existing AQMAs.

As a result the following six areas were identified as requiring detailed assessment:-

- A282 AQMA: This area was declared as an AQMA in 2001 but monitoring has shown exceedences beyond the extent of the original declared area.
- M25/Hawley Road: A road leading from the town centre AQMA which it passes beneath the A2 and the M25 where diffusion tube monitoring has shown exceedences at road side locations.
- A2/Church Hill: A road that crosses over the A2 with residential properties in close proximity where diffusion tube monitoring has shown exceedences at road side locations.
- Church Hill/Hawley Road: A congested junction on a road leading out of town where diffusion tube monitoring has shown exceedences at road side locations.
- Green Street Green Road: A road with residential exposure that runs beneath the A2 close to the junction with the M25
- Overy Liberty (Dartford Town Centre AQMA): An area included within the town centre AQMA which was declared in 2006 for exceedences of the annual average NO_2 objective. Diffusion tube monitoring in this area has shown levels in excess of 60°μgm^{-3}.

A detailed assessment was carried out in 2010 for these six identified areas. The detailed assessment indicated that there is a risk of exceedence of the annual mean NO_2 objective at all six locations. Three of these areas (A282, Overy Liberty & Green St Green Road) also showed a predicted annual mean concentration in excess of 60 μgm^{-3}, indicating a risk of additional exceedence of the hourly NO_2 objective.

It is therefore necessary to amend the existing AQMAs or to declare new AQMAs to cover these identified areas. Dartford Borough Council is currently considering options with respect to the boundaries of these new AQMAs.

7.4 Dover District

Dover Council currently monitors at three sites within the district. Since the removal of the Langdon Cliff site situated above the Dover Eastern Docks, there have been no exceedences of the 15 minute SO_2 AQ objective at the remaining site within the dock area. Whilst the existing AQMA declared for SO_2 will remain, monitoring results will be closely monitored over the next year or two in order to determine if a revocation of the AQMA is possible.

Heavy goods vehicle traffic continues to pour into Dover on the two main trunk routes and projections indicate that traffic flow levels will continue to rise over the next few years. The second AQMA in the district for NO_2 was made in 2009. The areas identified where there are exceedences is particularly relevant in light of Dover Harbour Board plans to redevelop the Western Docks (T2) by increasing the number of shipping berths and changing the A20 access route locally. The Harbour Revision Order submitted to Department for Transport in 2010 is still under consultation and a decision is awaited. The Council are keen to see redevelopment plans for main access routes into Dover including KCC plan 'Growth without Gridlock' which could see significant improvements in air pollution levels on the A20 access route into Dover.

Air Quality is being closely examined in the Dover District through the planning process, following publication of the Local Development Framework and Whitfield Supplementary Planning Documents and opportunities have been taken to promote low emission technologies & strategies within the document including provision for vehicle electric charging points.

The 2011 Annual Progress Report will include an update on the Council's Action Plan which includes proposed measures, both direct and indirect to improve air quality in the district. The Council remains focused on delivering improvements in air pollution levels.

7.5 Gravesham Borough

Following on from the Detailed Assessment of May 2009 a public and statutory consultation was undertaken and the declaration of two further Air Quality Management Areas was completed in January 2010 adding to the existing 5 AQMAs. These were the Parrock Street AQMA , which was effectively an extension of the existing A226 One-way System Gravesend AQMA and the Echo Junction AQMA.

The fourth round Updating and Screening Assessment (2009) reported that there were seventeen diffusion tube sites exceeding the annual mean NO_2 objective. Of these sites, all were either within an existing AQMA or were already being assessed through the 2009 Detailed Assessment.

The Annual Progress Report 2010 concluded that there were no exceedences outside the AQMAs. It recommended installing additional monitoring as necessary to assess baseline conditions prior to the proposed Transport Quarter development in Gravesend town centre. The Annual Progress Report 2011 similarly concluded that there were no exceedences outside the AQMAs.

Both existing Action Plans (A2 Trunk Road AQMA and the Northfleet Industrial AQMAs 2004 & the Urban AQMAs 2006) have been reviewed and a new draft Action Plan has been drawn up to incorporate all seven of the existing AQMAs including those declared in 2010.

The actions and measures within the two existing Action Plans and Air Quality Strategy continue to be progressed and reported on to Defra at the required intervals. The implementation of the new Action Plan will commence once it has been through the necessary consultation and Committee procedures.

A Further Assessment has just been undertaken of the A2 Trunk Road AQMA as an update to the information in the Stage 4 assessment and provides more up-to-date information to assist with the formulation of the new Action Plan. This has been done due to the significant changes that have occurred in the A2 Trunk Road AQMA with the carriageway's realignment to the South (further away from many of the residential properties in the AQMA).

The findings of the Further Assessment show that concentrations have significantly reduced and that air quality objectives are being met for nitrogen dioxide (NO_2) and particulates (PM_{10}) at the continuous monitoring sites. However, data from diffusion tube monitoring sites indicate that exceedences of the annual mean NO_2 objective are still being measured within the AQMA. Updated modelled results indicate that there is still a risk of exceedence of the annual mean NO_2 objective within the A2 Trunk Road AQMA, at 60 receptors in the Pepper Hill and Marling Cross areas. The maximum predicted annual mean NO_2 concentration is 46.6 μgm^{-3}. The air quality objectives for PM_{10} are predicted to be met.

The council will now consider amending the existing A2 Trunk Road AQMA Order, after the relevant consultations, to better represent the smaller area of exceedence.

7.6 Maidstone Borough

The Council adopted the finalised Maidstone Town AQMA Action Plan 2010 on December 3rd 2010 and Quantification of the Action Plan measures will be carried out in 2011/12.

The main priorities for actions/targets for 2011/12 will be guided by the Air Quality and Transport Steering group. Once agreed, the benefits of the projects to a specific hotspot(s) will be estimated and they will be the focus of the group's efforts during the year. Proposed projects/schemes may include the following:

1) Bus fleet travelling through AQMA [Measure 6,21]

2) Business Travel Planning within AQMA [Measure 29], including the New Ways 2 Work Partnership

3) UTMC within AQMA [Measure 3]

4) Optimisation of the types and distribution of HGVs in Maidstone town [Measure 7]

The automatic monitoring results for 2010 indicate air quality objectives will be met with the exception of the annual mean NO_2 objective at the A229 Roadside site. This site is already within the Maidstone Town AQMA and no detailed assessment is required. The 2010 diffusion tube results show 16 sites exceeding the annual mean NO_2 objective. These are all located within the Maidstone Town AQMA, with the exception of a roadside site at 1 Pilgrim Way. Triplicate tubes on the facade of this property (the closest –worst case- receptor to the A249), were set up in 2010 and show an annual mean concentration of 34 μgm^{-3} therefore at the façade the annual objective is currently being met. There is therefore no requirement to undertake a detailed assessment for this location, but monitoring of this location will continue to demonstrate continued compliance with the annual mean objective.

With respect to the potential hourly NO_2 objective, sites which have annual mean concentrations in 2010 which are >60 μgm^{-3} and are at risk of exceeding the hourly objective include:

- Maid 53 Wheatsheaf PH, Loose Road/Sutton Road Junction
- Maid 32, 58 and Maid 59 Upper Stone Street.

These are within the Maidstone Town AQMA and have been previously assessed in the Further Assessment 2009, which concluded that these areas are at risk of exceedence with respect to the hourly objective. An emissions Inventory of Lower Stone Street is programmed for the 2011 and a new automatic NOx monitoring location is being set up along Lower Stone Street. This will run for 6-8 months and then be moved to the Wheatseaf PH.

7.7 Medway

Medway's first Air Quality Management Area (AQMA) was declared in 2004 for the pollutant nitrogen dioxide and comprised six separate locations in the urban part of the district. An Air Quality Action Plan was produced in July 2005 and annual reports have been published since then. Exceedences of the annual mean NO_2 objective at four sites outside of the existing AQMA were noted within the 2007 progress report, which meant that a Detailed Assessment (DA) was required for those areas. Work on the DA started at the end of 2008. Medway published its third Updating and Screening Assessment in April 2009. It concluded that there was a requirement to undertake a DA for annual average NO_2. Medway's DA was published in August 2009 and recommended extending the current AQMA declaration and declaring new areas as AQMAs. A twelve-week consultation with statutory consultees on the proposed revocation of the first AQMA and replacement with a new AQMA ended on 26 March 2010.

Medway Council declared the following three new AQMAs on 6 August 2010: -

- A large central Medway AQMA which includes the existing AQMAs of Frindsbury Road, Cuxton Road, Strood Centre, Rochester Centre and Chatham Centre but also includes the new areas of Luton Road, Chatham Hill and High Street, Chatham
- A smaller AQMA along High Street, Rainham
- A smaller AQMA at Pier Road, Gillingham

Major regeneration continues within Medway, including the extensive waterfront developments at Rochester and Gillingham. A number of planning applications for housing and employment developments were approved in 2010. The Environmental Health team continue to work closely with internal planners and transport planners on air quality issues related to transport and land use planning.

Medway Council's Local Transport Plan 3 came into effect on 1 April 2011 and runs until 2026. The document sets out a programme of works over the fiifteen-year period of the plan and includes measures which impact on air quality. The Environmental Health team were consulted during the development of the plan. Some of the key features during 2010 include the development of many workplace and school travel plans. For example, 45 schools in Medway have walking buses in operation helping to reduce congestion at the beginning and end of the school day. Furthermore over 89% of all Medway schools have now developed school travel plans. In addition there has been an overall increase in the cycle network which now extends to over 100 km.

7.8 Shepway District

Shepway DC has not been required to declare an Air Quality Management Area and have recently completed a 2011 Progress report, which supports this decision.

The main conclusions and recommendations were that the 2010 monitoring results have shown that the prescribed objectives are all being met. The highest monitored levels are still at the busy roadside sites in Folkestone town. Therefore it is recommended that the Council continues to monitor at these locations to demonstrate continued compliance with the prescribed objectives.

At the start of 2012 Shepway DC will be adding two additional diffusion tube monitoring sites, located in Lydd and Hawkinge. This is due to the anticipated heavy developments commencing with in these areas.

Shepways 2011 Progress Report has also been submitted to DEFRA and is awaiting approval.

7.9 Swale Borough

The 4th round of the review and assessment process commenced in 2009 with the USA. This identified exceedences of the annual mean at eight locations in Swale. Work has been undertaken to address these areas as a corporate priority

7.9.1 Newington AQMA

During the third round of review and assessment, commencing in 2006, a detailed assessment was required for NO_2 along the A2 at Ospringe and Newington. The Detailed Assessment carried out in 2007 recommended that the Council consider declaring an AQMA on the basis of the potential exceedences in the Newington High Street assessment area. Swale Borough Council installed a temporary continuous monitoring site in the High Street to provide more accurate monitoring of nitrogen dioxide levels. The temporary NO_X monitoring at Newington proved the need to declare an AQMA in the High Street and an AQMA was declared in 2009. A second temporary NO_X monitoring campaign was undertaken in Newington during the summer of 2010 proving the need for a permanent monitoring station. A suitable location was agreed and a new permanent NOx monitoring cabinet was installed adjacent to the Co-op Store in the High Street in December 2010. Community steering group meetings were held during 2009-2010 and a draft action plan was created and submitted to DEFRA. Feedback was received in March and a steering group to discuss the next steps will be held on 13th June 2011.

7.9.2 Monitoring on Sheppey

An increasing trend for PM_{10} concentrations was recorded at the Sheerness monitoring site and there were numerous complaints from residents about visible dust emissions in Sheerness, Ridham and Upchurch. Much effort has gone into locating the likely sources including partnership work with the Environment Agency. Monitoring has been undertaken to investigate whether the levels exceed the air quality objectives and whether these will require consideration due to the increased emissions from industrial activity in the area in the next round of review and assessment (2010). Monitoring locations were chosen to reflect local pollution sources, relevant exposure and to investigate the potential sources of the exceedences. Air Quality Consultants have undertaken an Updating and Screening Assessment in 2008 and a Progress Report, further assessment and Detailed Assessment in 2010 and also an emissions inventory for Sheppey has been completed for submission to Defra in May 2011. This proved the case for re-siting the particulate monitoring to a worse case receptor location in Bluetown near Sheerness Port. This work is in progress but will depend on resources and grant allocations for DEFRA and other competing funding priorities.

Indicative monitoring using an Osiris was undertaken during 2010 at Sheerness and Ospringe that enabled us to check the Osiris was accurate by co- locating it with the continuous monitoring equipment.

7.9.3 Industrial Site Ridham

The Osiris was re-sited at Ridham in an industrial area to provide evidence that the particulate levels in Ridham were a potential hazard. Remedial action and enforcement of permit conditions was jointly undertaken with the industries to minimise the pollution at source.

7.9.4 Sittingbourne Road traffic

Two areas in Sittingbourne were identified where the annual mean NO_2 levels have been measured, through the diffusion tube survey, to exceed the national objectives and where there is relevant exposure: St Paul's Street and East Street. It was not possible to find a location for a continuous monitor in East Street and so eventually permission for one was agreed to be sited at Canterbury Road which is pending installation. A Defra funding application was not successful for the second location. A further grant application for the use of existing equipment from other locations will be submitted in 2011. Meanwhile diffusion tubes from other areas were moved and sited in these areas of concern.

7.9.5 Planning Developments

There are a number of large-scale development proposals identified in the Swale area with the potential to impact significantly on transport and local air quality. These include CHP plant and biomass installations. Officers have commented on planning applications to request conditions for mitigation of pollutants from developments. The Council is considering the current monitoring strategy in the light of these development proposals to ensure there is suitable coverage to assess any future impacts. In addition the Council is considering potential projects regarding air quality and health and climate change related issues in particular areas of the Borough. Monitoring would be subject to the achievement of funding through future Air Quality grants, continuation of staff resources and joint work with Highways regarding traffic control.

7.9.6 Ospringe AQMA

The detailed assessment at Ospringe proved the need for a 2nd AQMA to be declared. A public meeting was held on 3rd March 2011 and the AQMA order has been prepared for submission to Defra. An action plan steering group meeting is proposed for summer 2011.

7.9.7 General

LAQM Reports were produced during 2010. These include:

- Progress report 2010
- Ospringe Detailed Assessment 2010
- Further assessment Newington 2010
- Newington AQMA action Plan

7.10 Thanet District

Following the designation of Thanet's second AQMA in April 2010 at High Street St Lawrence, Ramsgate a temporary continuous monitor was installed for 6 months to help inform the Further Assessment. This in turn will aid the development of the subsequent Action Plan. The draft Action plan will be out for public consultation in July/August 2012 and will also incorporate the measures for Birchington AQMA.

The 2011 Annual Progress Report indicated that for Thanet 2010 was low pollution year with only locations within the existing AQMAs exceeding annual nitrogen dioxide levels. No areas outside the AQMAs failed the objectives.

Thanet District Council continues to operate an extensive monitoring programme which also includes four continuous analysers as well as 22 diffusion tube locations.

7.11 Tonbridge & Malling

Tonbridge and Malling Borough Council completed 2010 Annual Progress Report which proposed the following actions arising from the report to:

- Undertake additional monitoring at Sevenoaks Road, Borough Green and proceed to a Detailed Assessment of NO_2 should monitoring demonstrate a risk of exceedence of the annual mean objective once the full year's dataset is collated;
- Progress to a 2011 Annual Progress Report, to be completed by April 2011.

- An Air Quality Action Plan to be prepared for all six declared AQMAs within the Borough.

A full year's dataset for Borough Green has demonstrated an exceedence of the annual mean objective for NO_2, hence the 2011 Annual Progress Report is recommending the Council proceed to a Detailed Assessment for Borough Green.

The draft Air Quality Action Plan for all 6 AQMAs has been produced it has been submitted to DEFRA and their comments are awaited. The 2011 Action Plan will incorporate the Action Plan adopted in 2003, which was developed to improve the air quality within the M20 AQMA.

The 2010 continuous monitoring result for the roadside site, located within the Tonbridge AQMA continues to demonstrate an exceedence of the annual mean objective for NO_2.

The Council's Annual Progress Report has been submitted to DEFRA and is awaiting approval.

7.12 Tunbridge Wells Borough

Tunbridge Wells Borough Council's Annual Progress Report 2011 provides an air quality update within the Borough and can be viewed on the authority's website.

The 2010 continuous monitoring results show exceedences of the annual mean NO_2 objective at the roadside site located on the A26 within the AQMA for all years monitored. All other objectives are met in all years. The upward trend for the NO_2 annual mean concentration at the A26 roadside monitoring site continues.

The Council is in the process of declaring an extension to the current AQMA further south along the A26 to include the London Road / Major York junction. Pembury Rd was subject of a Detailed Assessment and the Council commenced a year long continuous monitoring survey for NO_2 and concluded that levels are within the annual mean NO_2 objective for 2010.

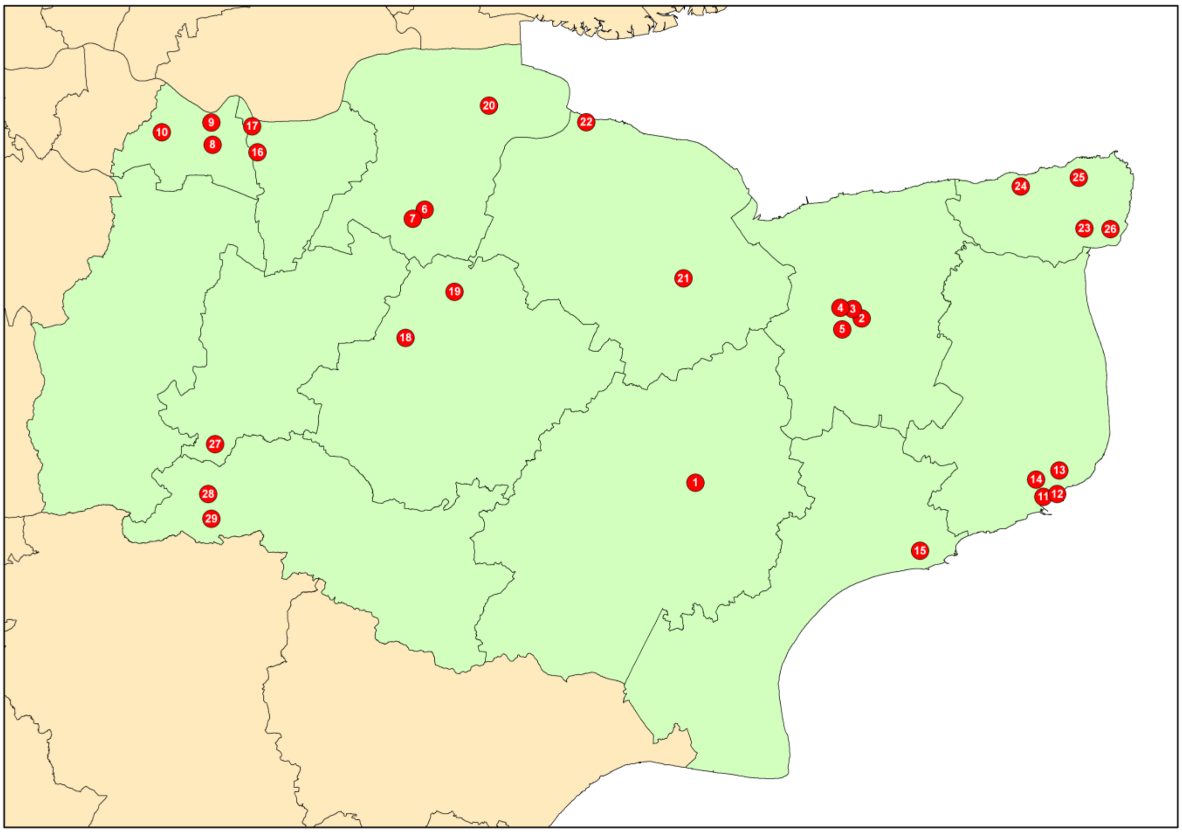
The Action Plan for the A26 AQMA, was adopted by Cabinet in March 2010. Measures include supporting the Quality Bus Partnership and working with Kent County Council to support the development of school and work place travel plans. The Council is also developing its own Borough Transport Strategy and Cycle Strategy and includes "local air quality" as one of its objective, with the Air Quality Action Plan and the Borough Transport Strategy intrinsically linked. The Council will also explore the feasibility of Low Emission Zones for Busses and HGV's and review the potential for an accelerated uptake of low emission busses.

The new Pembury Hospital is due to be completed and fully operational in September 2011. The development includes a biomass burner. A new biomass burner has been granted permission by Kent County Council at The Skinners Academy in Tunbridge Wells although specific details on the size and location of the plant are still being clarified at this time.

Work is continuing on developing an air quality and planning guidance document for developers, planning officers and air quality professionals, including guidance on renewable energy and its impact on local air quality.

Appendices

Appendix 1 - Location of Monitoring Sites



1	Ashford Background	16	Gravesham A2 Roadside
2	Canterbury	17	Gravesham Industrial Background
3	Canterbury Military Road	18	Maidstone A229 Kerbside
4	Canterbury Roadside	19	Maidstone Rural
5	Canterbury St Peters Place	20	Rochester Stoke
6	Chatham Centre Roadside	21	Swale Ospringe Roadside 2
7	Chatham Luton Background	22	Swale Sheerness
8	Dartford Bean Interchange Roadside	23	Thanet Airport
9	Dartford St Clements Roadside	24	Thanet Birchington Roadside
10	Dartford Town Centre	25	Thanet Margate Background
11	Dover Centre Roadside	26	Thanet Ramsgate Roadside
12	Dover Docks	27	Tonbridge Roadside 2
13	Dover Langdon Cliff	28	Tunbridge Wells A26 Roadside
14	Dover Old Town Hall Roadside	29	Tunbridge Wells Town Centre
15	Folkstone Suburban		

Appendix 2 - Site Names 2010

Site Abbreviation	New name	Information
ZA2	Ashford Background	A292 Ashford School
ZY1	Canterbury	Western edge of Chaucer Technology School
ZY2	Canterbury Roadside	St Dunstan's Canterbury
ZY4	Canterbury St Peters Place	A290 St Peters Place
ZC1	Chatham Centre Roadside	Watling Street Chatham Girls' School Chatham
ZL1	Chatham Luton Background	Luton Junior School Luton Road Chatham
ZR3	Dartford Bean Interchange Roadside	Ightham Cottages Bean Interchange A2
ZR1	Dartford St Clements Roadside	London Road A226 Greenhithe
ZR2	Dartford Town Centre Roadside	Instone Street Dartford Town Centre
ZD3	Dover Langdon Cliff	Langdon Cliff, Dover
ZD6	Dover Docks	Dover Eastern Docks
ZD1	Dover Old Town Hall Roadside	Old Town Hall Dover
ZD2	Dover Centre Roadside	Junction of Townwall Street and Woolcomber Street Dover
ZF1	Folkestone Suburban	Cheriton Road Sports Ground Folkestone
ZG3	Gravesham Industrial Background	Lawn Road School High Street Northfleet
ZG2	Gravesham A2 Roadside	A2 Painters Ash School Masefield Rd Northfleet
ZM2	Maidstone A229 Kerbside	Fairmeadow Maidstone Bridge Gyratory Maidstone
ZM3	Maidstone Rural	Nr County Show Ground Detling. Nearest road A249.
ZS1	Rochester Stoke	North corner of playing field in Lower Stoke primary school.
ZW2	Swale Sheerness	Sheerness
ZW3	Swale Ospringe Roadside 2	Ospringe Faversham
ZH3	Thanet Airport	Manston Airport
ZH2	Thanet Margate Background	Salmestone School College Rd Margate
ZH5	Thanet Birchington Roadside	Birchington
ZH4	Thanet Ramsgate Roadside	Boundary Road Ramsgate
ZT2	Tunbridge Wells Town Centre	Tunbridge Wells Town Hall
ZT4	Tunbridge Wells A26 Roadside	A26 St Johns Road Tunbridge Wells
ZT5	Tonbridge Roadside 2	12-14 High Street, Tonbridge

Appendix 3 - UK National Air Quality Objectives

Pollutant	Air Quality Objective		To be achieved by
	Concentration	Measured as	
Benzene			
All authorities	16.25 µg m^{-3}	Running annual mean	31 December 2003
England and Wales	5.00 µg m^{-3}	Annual mean	31 December 2010
Scotland and N. Ireland	3.25 µg m^{-3}	Running annual mean	31 December 2010
1,3-Butadiene	2.25 µg m^{-3}	Running annual mean	31 December 2003
Carbon Monoxide			
England, Wales and N. Ireland	10.0 mg m^{-3}	Maximum daily running 8-hour mean	31 December 2003
Scotland Only	10.0 mg m^{-3}	Running 8-hour mean	31 December 2003
Lead	0.5 µg m^{-3}	Annual mean	31 December 2004
	0.25 µg m^{-3}	Annual mean	31 December 2008
Nitrogen Dioxide	200 µg m^{-3} not to be exceeded more than 18 times a year	1-hour mean	31 December 2005
	40 µg m^{-3}	Annual mean	31 December 2005
Particles (PM_{10}) (gravimetric)			
All authorities	50 µg m^{-3}, not to be exceeded more than 35 times a year	24 hour running mean	31 December 2004
	40 µg m^{-3}	Annual mean	31 December 2004
Scotland Only	50 µg m^{-3}, not to be exceeded more than 7 times a year	24 hour running mean	31 December 2010
	18 µg m^{-3}	Annual mean	31 December 2010
Particles ($PM_{2.5}$) (gravimetric) *			
	25 µg m^{-3} (target)	Annual mean	2020
All authorities	15% cut in urban background exposure	Annual mean	2010 - 2020
Scotland Only	12 µg m^{-3} (limit)	Annual mean	2010
Sulphur dioxide	350 µg m^{-3}, not to be exceeded more than 24 times a year	1-hour mean	31 December 2004
	125 µg m^{-3}, not to be exceeded more than 3 times a year	24-hour mean	31 December 2004
	266 µg m^{-3}, not to be exceeded more than 35 times a year	15-minute mean	31 December 2005
PAH *	0.25 ng m^{-3}	Annual mean	31 December 2010
Ozone *	100 µg m^{-3} not to be exceeded more than 10 times a year	8 hourly running or hourly mean*	31 December 2005

* not included in regulations at present.

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