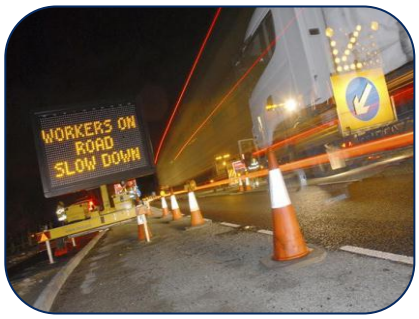
Transport Research Laboratory
Creating the future of transport




CLIENT PROJECT REPORT CPR2628

Air Quality Detailed Assessment

Stratford St Andrew

Savage, A., and Turpin, K.

Prepared for: Suffolk Coastal District Council, Environmental Protection

Project Ref:

Quality approved:

Julie Austin (Project Manager)

Kevin Turpin (Technical Referee)

Disclaimer

This report has been produced by the Transport Research Laboratory under a contract with Suffolk Coastal District Council. Any views expressed in this report are not necessarily those of Suffolk Coastal District Council.

The information contained herein is the property of TRL Limited and does not necessarily reflect the views or policies of the customer for whom this report was prepared. Whilst every effort has been made to ensure that the matter presented in this report is relevant, accurate and up-to-date, TRL Limited cannot accept any liability for any error or omission, or reliance on part or all of the content in another context.

When purchased in hard copy, this publication is printed on paper that is FSC (Forest Stewardship Council) and TCF (Totally Chlorine Free) registered.

Contents amendment record

This report has been amended and issued as follows:

Version	Date	Description	Editor	Technical Referee
1	June 2013	First draft	AS	KT
2	July 2013	Final report	AS	KT

Executive summary

This report constitutes a detailed assessment of annual mean nitrogen dioxide (NO_2) concentrations in Stratford St. Andrew, a village located on the A12 within Suffolk Costal District Council.

The detailed assessment methodology takes into account the results from the NO_2 diffusion tube monitoring data collected by the local authority. In addition to this, a spatial analysis has been conducted to firstly determine the likely emissions profile owing to the traffic activity and secondly to understand the relationship between this profile and the monitoring data. A spatial buffer zone has been applied to confirm the extent of exceedence of the annual mean objective with confidence.

Based on the results of this analysis and a precautionary approach, it is recommended that an Air Quality Management Area (AQMA) should be declared along the extent of the buffer zone. This would include the area of exceedence of the annual mean NO_2 objective and the zone in which any low emission or traffic management measures could apply. Alternatively, the local authority may choose to declare the AQMA to include the area of exceedence only. In this case, the AQMA boundary would encompass the four houses at 1-5 Long Row.

Following the AQMA declaration, the local authority is required to produce a further assessment of air quality within 12 months and to develop an Air Quality Action Plan with targeted measures to improve air quality along this stretch of the A12.

Contents

1 Introduction

This report constitutes a detailed assessment of air quality for Stratford St. Andrew, a village located on the A12, approximately 27 kilometres north east of Ipswich within Suffolk Coastal District Council (SCDC). The detailed assessment focuses on the annual mean nitrogen dioxide (NO_2) objective. This detailed assessment report fulfils the requirements of the Local Air Quality Management (LAQM) framework, introduced under Part IV of the Environment Act 1995. Under this framework, local authorities are required to assess concentrations of specified air pollutants against standards and objectives listed in the Air Quality Strategy (AQS) document for England, Scotland, Wales and Northern Ireland (Defra, 2007). In England, the air quality objectives applicable to LAQM are implemented by the Air Quality (England) Regulations 2000 (SI 928) and the Air Quality (England) (Amendment) Regulations 2002 (SI 3043). A summary of the regulated pollutants and the relevant AQS objectives is presented in Appendix A.

SCDC has completed four rounds of air quality review and assessment as part of this LAQM process and is currently undergoing round five. A summary of the main findings from each review and assessment report is given in Appendix B. To date, SCDC has declared two Air Quality Management Areas (AQMAs) for the annual mean NO_2 objective. The first is in the market town of Woodbridge around the junction with The Thoroughfare, Lime Kiln Quay Road and St John's Street and the second is for a single property on Ferry Lane close to the Port of Felixstowe. Action plans have been developed and are being implemented for both AQMAs.

The most recent Updating and Screening Assessment report produced in 2012 (SCDC, 2012) identified that there was a risk of exceedence of the annual mean NO_2 objective at Stratford St. Andrew on the A12. The local authority increased monitoring during 2012 with triplicate diffusion tubes which confirmed this exceedence and the need to proceed to a detailed assessment.

2 Aims of detailed assessment

In situations where a risk of an air quality objective being exceeded has been identified at a location with relevant public exposure, the local authority is required to undertake a detailed assessment (Defra, 2009). The purpose of the detailed assessment is to determine with reasonable certainty whether or not a likely exceedence will occur. Where a likely exceedence is identified, then the local authority will need to determine the magnitude and geographical extent of the exceedence in order to declare an AQMA. Although there are no prescribed methodologies for a detailed assessment, a local authority should have confidence in their results and conclusions.

A detailed assessment will need to consider points of maximum relevant public exposure (i.e. those locations with the highest concentrations) and estimate the population exposed to concentrations above the objective.

The detailed assessment methodology for Stratford St. Andrew takes into account the results from the nitrogen dioxide (NO_2) diffusion tube monitoring data collected by SCDC. Based on the data it is likely that the location of adjacent houses to the diffusion tube STA1 would be subject to exceedences of the annual mean objective. The detailed assessment presents this data and predicts the likelihood of exceedences further along the road to provide confidence in the AQMA boundary.

In summary, the detailed assessment involves the following methodologies;

1. Appraisal of the characteristics of the traffic activity assumed for the assessment area (Section 3);
2. Presentation of the annual mean NO_2 concentration recorded at the existing monitoring sites (Section 4)
3. Determining the likely emissions profile owing to the traffic activity (Section 5);
4. Understanding of the relationship between the diffusion tube monitoring data recorded at the various monitoring sites and emissions profile (Section 5);
5. Developing a robust methodology which incorporates the findings in (3) to produce a map confirming the extent of exceedences at relevant locations as the basis for the AQMA boundary (Section 5).

3 Description of Stratford St. Andrew

3.1 Location

Stratford St. Andrew is a small village located on the A12 in the Suffolk Coastal District (see Figure 1). There are approximately 15 houses located along the A12 itself, a filling station and a garage. The speed limit entering the village when approaching from the north is 30 mph (see Figure 2) and this increases to 50 mph leaving the village, when leaving towards the south (see Figure 3).

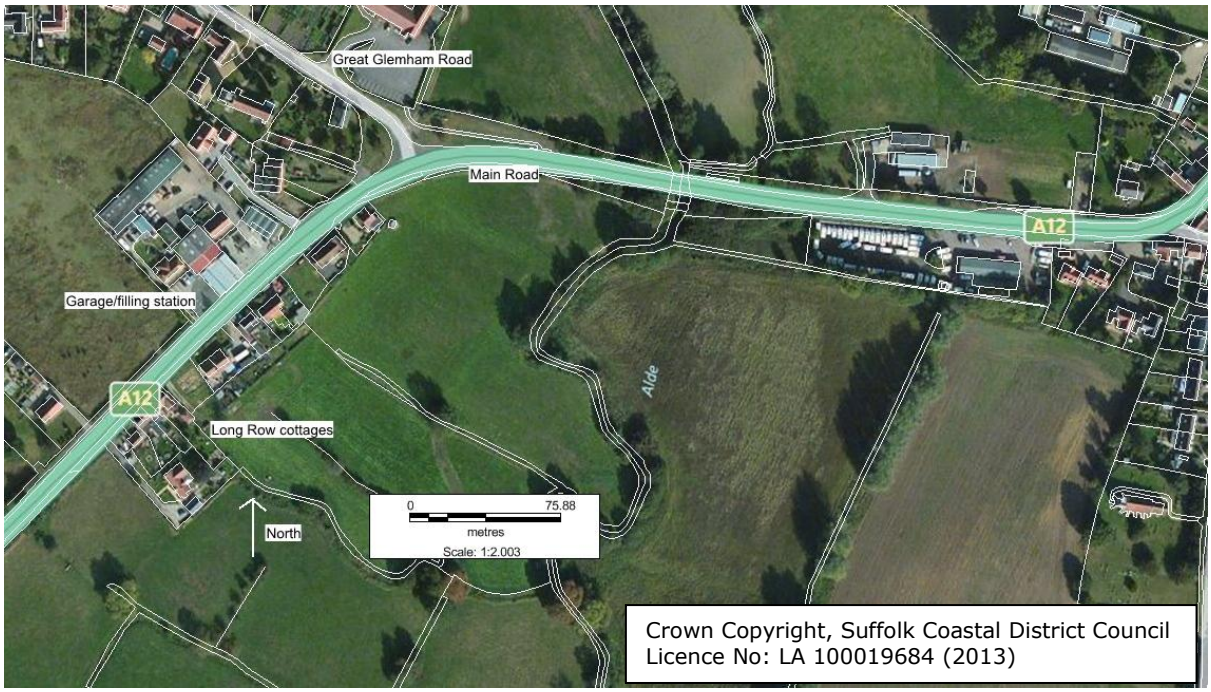


Figure 1: Location of Stratford St Andrew.

Figure 2: Approach to Stratford St. Andrew from the north.

Figure 3: 50 mph speed limit leaving village towards the south.

3.2 Traffic characteristics

Given the characteristic of weather patterns it is expected that pollutant concentrations to the east of the road would be higher than the west. This is perhaps marginal given the trajectory of the road at this location which runs south west to north east. Under these conditions emissions would tend to disperse more so along the length of the road. A certain amount of recirculation and entrainment of emissions close to the terraced houses (Long Row) is likely to lead to elevated concentrations.

The average annual traffic flow along this stretch of the A12 is approximately 15,000 vehicles per day with 6 percent of heavy goods vehicles. A traffic survey that was conducted in May 2013 recorded a 7 day average daily traffic flow of 15,132 at Long Row cottages[1]. There tends to be little congestion in the village, although some queues can form when vehicles turn right into the garage, when approaching from the north.

The speed limit changes from 30 mph as you approach the village from the north to 50 mph as you leave to the south. This change in speed limit occurs at a point fairly close to the end terrace (Long Row). The traffic survey conducted in May 2013 had two count sites; one at Long Row cottages and one at the garage/filling station (see Figure 1). The average 7 day speed at the cottages was found to be 33 mph in both directions and 29 miles per hour at the garage/filling station. However, there were more vehicles that exceeded the 30 mph speed limit by more than 5 mph at Long Row Cottages (26 percent of vehicles approaching the village from the south) compared to 6 percent at the garage/filling station.

It is reasonable to conclude therefore that vehicles accelerate adjacent to Long Row cottages before actually reaching the permitted 50 mph section of road. Conversely, vehicles approaching the village from the south are decelerating from 50 mph down to 30 mph. Under these conditions emissions will increase in the south-westerly wind direction but decrease in the north-easterly wind direction.

3.3 Relevant exposure

The nearest properties to the road are a row of 4 cottages (1-5 Long Row). These are situated 2 metres from the kerb, approaching the village from the south (see Figure 4). Other properties in the village are set back from the road. The local authority has had diffusion tubes located on the façade of 1 Long Row since 2011 with triplicate tubes since 2012.

[1] Survey date 11-17 May 2013. Data sent by D Lavender, SCDC (June 2013).

Figure 4: Long row cottages, approaching from the south.

4 Monitoring data

4.1 Summary of monitoring undertaken

NO_2 diffusion tube monitoring took place at six locations along the A12 close to Stratford St. Andrew in 2012 and at three sites in 2011. Details of diffusion tube site locations are provided in Table 1. These represent worst-case exposure and are located on property facades where possible.

A map showing the locations of the diffusion tubes that were operational during 2012 along the A12 is provided in Figure 5.

The diffusion tubes are supplied and analysed by Environmental Scientifics Group (ESG), Didcot, using the 50% v/v TEA (triethanolamine) in acetone method. Diffusion tubes can over or under read and the annual average obtained needs to be corrected to take account of laboratory bias thus improving accuracy. This can be done either by using a combined 'national' bias adjustment factor for the laboratory for the specific year or a local factor from diffusion tubes co-located with automatic monitoring sites. In the absence of any automatic monitoring sites, the local authority using the national bias adjustment factor to correct the data. In 2012 this was 0.79 based on the June 2013 version of the national bias adjustment factor spreadsheet[2] (see Appendix C).

[2] http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html

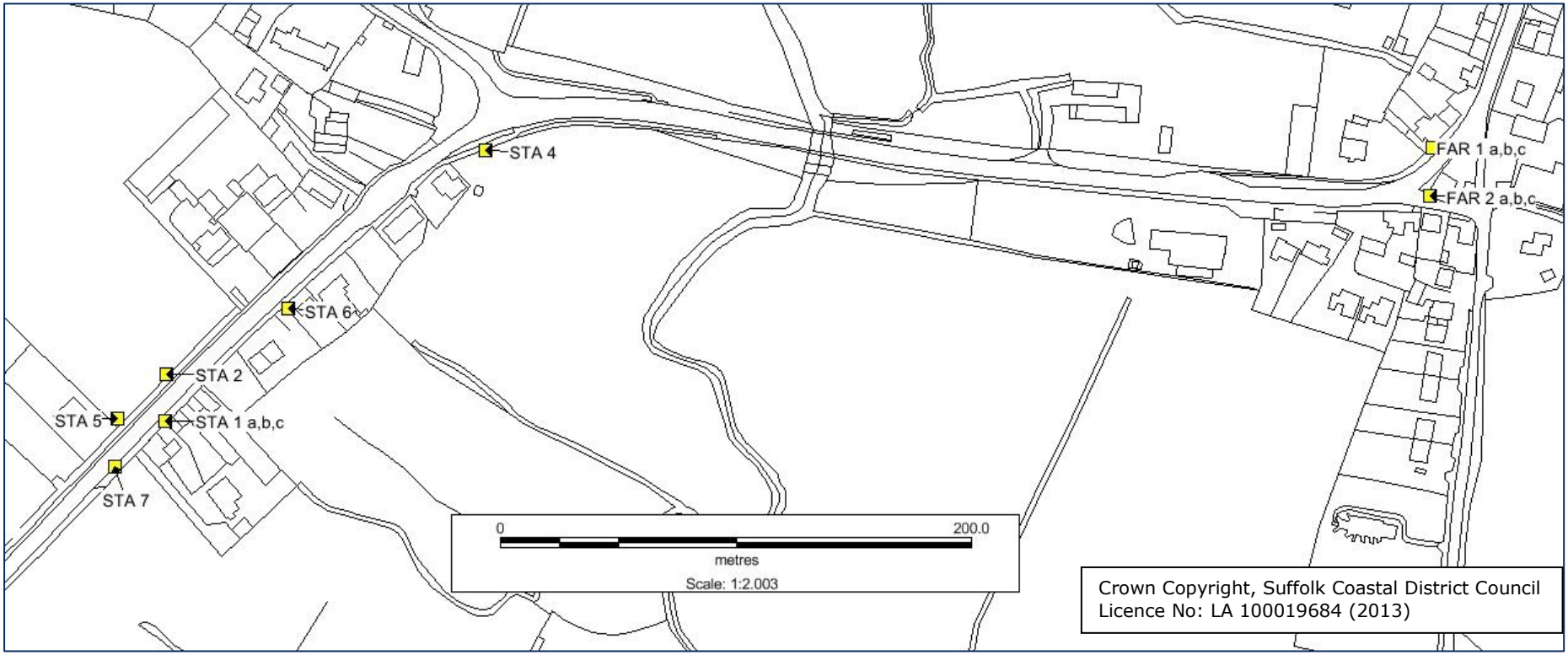


Figure 5: Location of NO_2 diffusion tubes in Stratford St. Andrew.

Table 1: Details of diffusion tube monitoring sites.

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
FAR1 a,b,c	Farnham 1	Roadside	63627	26013	1.76	NO_2	No	N	Y 0m	3	Yes
FAR2 a,b,c	Farnham 2	Roadside	63627	26011	1.92	NO_2	No	N	Y 0m	2	Yes
STA1 a,b,c	Stratford St. Andrew 1	Roadside	63574	25999	1.62	NO_2	No	N	Y 0m	2	Yes
STA2	Stratford St. Andrew 2	Roadside	63574	26001	1.78	NO_2	No	N	N 23m	1.72	Yes
STA4	Stratford St. Andrew 4	Roadside	63587	26011	1.78	NO_2	No	N	N 35m	3.8	Yes
STA5	Stratford St. Andrew 5	Roadside	63572	25999	1.20	NO_2	No	N	N 38m	2	No
STA6	Stratford St. Andrew 5	Roadside	63579	26004	1.71	NO_2	No	N	Y	6.9	No
STA7	Stratford St. Andrew 5	Roadside	63572	25997	1.56	NO_2	No	N	N 19m	1.85	Yes

*STA6 and 7 were installed in 2013.

4.2 Comparison of monitoring results with air quality objectives

This section presents the annual mean NO_2 concentrations measured at the diffusion tube sites during 2011 and 2012 (see Table 2).

Table 2: Annual mean NO_2 concentrations, 2011-2012.

Site ID	Location	Triplicate or Collocated Tube	Data Capture 2012 (%)	Annual mean concentration (bias adjusted) µg/m^3	
				2012	2011
FAR1 a,b,c	Turret House, The Street, Farnham	Triplicate	100	25.8	28.6
FAR2 a,b,c	Post Office Stores, The Street, Farnham,	Triplicate	100	30.7	32.6
STA1 a,b,c	1 Long Row, Main Road, Stratford St. Andrew	Triplicate	100	**42.4**	**43.3**
STA2	Opposite 1-5 London Row, Main Road	-	100	26.1	-
STA4	Lowestoft Street sign, on bend of Main Road.	-	100	24.0	-
STA5	Great Glemham sign, opposite 1-5 London Row (from March 2012).	-	75	18.2	-

*Note site STA3 was taken down in March 2012 and replaced with STA5, so no data were available.

The results show that the annual mean objective of 40 µg/m^3 was only exceeded at site STA1, which is located approximately 2 metres from the roadside and directly on the façade of the property at 1 Long Row. Concentrations in 2012 were slightly lower than those measured in 2011 but were still above the objective. Concentrations at all other diffusion tube sites are well below the objective. This includes the two diffusion tubes at the neighbouring village of Farnham which are located on properties at a similar distance to the road as STA1. The traffic flow is similar to that in Stratford St. Andrew and the speed limit in Farnham is also 30 mph.

Data for 2013 are available for the first four months of the year. These are presented as indicative only in Table 3 and have been adjusted by the 2012 bias adjustment factor of 0.79.

Table 3: Indicative NO_2 concentrations Jan-April 2013.

Site ID	Concentration (bias adjusted) Jan-April 2013 (µg/m^3)
FAR 1a,b,c	31.7
FAR2 a,b,c	31.9
STA1 a,b,c	39.7
STA2	25.3
STA4	19.1
STA5	N/A
STA6	24.1
STA7	34.1

5 Spatial Analysis

5.1 Introduction

This section of the report involves a spatial analysis of the 2012 annual mean monitoring concentrations in order to confirm or otherwise the extent to which the annual mean objective for NO_2 is being exceeded. There is no prescribed methodology developed to interpolate air quality concentration values between measurements. There are however a number of techniques that can be applied if sufficient point data are made available. For example these techniques include natural-neighbour interpolation which enables the creation of optimal surfaces for air pollution data (Northwood Technologies, 2001). However, for this particular location, data points were too limited to conduct interpolation modelling. Therefore under the circumstances it was considered more appropriate to conduct a semi-quantitative analysis examining the recorded concentrations in the context of space and the existing traffic situation.

All monitoring sites are located within 10 metres of the road centre line and within a 240 metre relatively straight section of the A12 as it passes through Stratford St. Andrew (see Figure 5). The road is slightly elevated (by less than two metres over a 200 metre section) as described by Figure 6. The road section levels out slightly at the junction of Great Glemham Road. Typically the gradient ranges from an ascent of 0.5 percent to a decent of 1.5 percent

The characterisation of the traffic situation for an average weekday is described as follows. Traffic approaching from the south will naturally slowdown in order to meet the 30 mph limit resulting in slower vehicle operation (indicated by the slower average speeds) travelling on the section of road adjacent to Great Glemham Road. Conversely, traffic approaching from the north will slow down adjacent to Great Glemham Road but then appear to gradually increase their speed as they approach the 50 mph limit just ahead of diffusion tube monitoring sites STA1 and STA5.

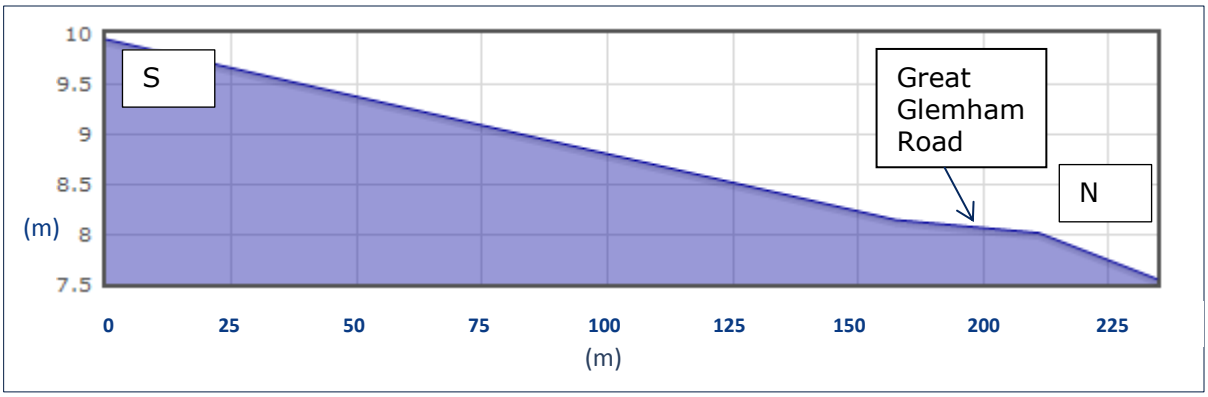


Figure 6: Road elevation of the A12 through Stratford St. Andrew.

5.2 Concentration profiles

To further understand the monitoring observations in the context of the monitoring site locations, the road geometry, built morphology and the traffic situation it was considered useful to examine concentration profiles. In this respect, an analysis was conducted to

compare the concentration at the monitoring site with the likely concentration along the road centre line adjacent to each monitoring site respectively. In order to achieve this various input values were applied to the annual mean NO_2 concentration fall off with distance calculator provided on the LAQM website[3]. The purpose of this approach was to try to gain a better understanding of what level of concentration might be expected at the source to achieve the observed roadside annual mean NO_2 concentrations and to highlight the level of consistency between the source contribution and observed values. The results of this exercise are shown in Figure 7 and Table 4. Figure 7 shows the estimated drop off in concentration from the road centre line to the STA1 monitoring site. The road centre line is considered appropriate to represent the source as emissions are generated by traffic moving in both directions. For site STA1 the calculator estimates a centre line annual mean NO_2 concentration of ~85 µg/m^3. This is in contrast if measured concentrations are used from the other monitoring sites where estimates of a road centre line concentration ranged from ~30 µg/m^3 (using site STA5) to ~50 µg/m^3 (using site STA2). A background concentration of 10.5 µg/m^3 was considered in all cases.[4]

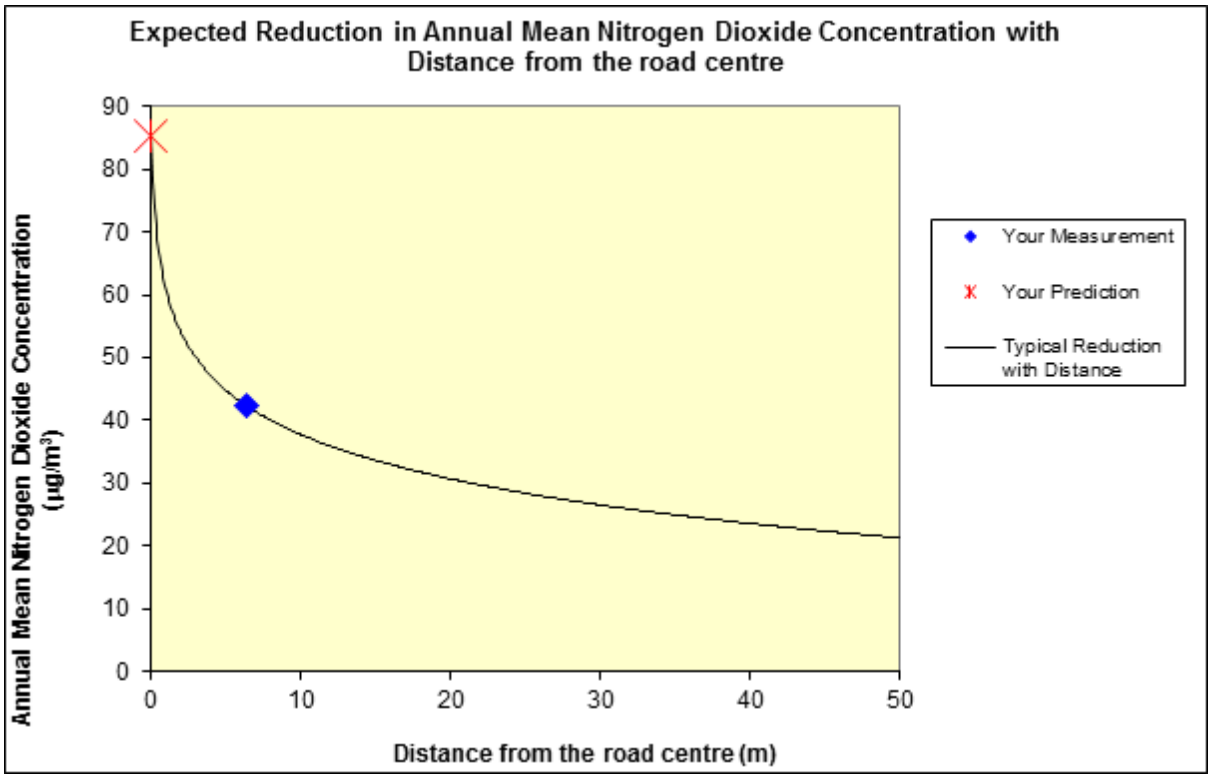


Figure 7: Estimate of monitoring site STA1 annual mean NO_2 contribution

[3] http://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html
[4] Taken from Defra background maps available from the LAQM website for year 2012

Table 4: Estimated annual mean NO_2 concentrations at road centre lines adjacent to each monitoring site.

Monitoring site ID	2012 Annual Mean NO_2 ($\mu g/m^3$)	Background Annual Mean NO_2 ($\mu g/m^3$)	Distance from the road centre line to the monitoring site (m)	Estimated Annual Mean NO_2 ($\mu g/m^3$) at road centre line using drop off calculator
STA1a,b,c	42.4	10.5	6.5	85.7
STA2	26.1	10.5	8.0	49.9
STA4	24.0	10.5	9.7	47.1
STA5	18.2	10.5	9.4	31.1

Of the other three monitoring sites, STA2 and 5 are located opposite STA1 in locations with similar geography. STA4 is located on the same side of the road as STA1 with geography similar to that of sites STA2 and 5. It is also worth noting that the predominant wind direction is along the trajectory of the road from the south-west to the north-east. Hence, emissions from road traffic are more likely to be confined to the road rather than being dispersed to any particular relevant location.

The results of this exercise appear to suggest site STA1 exhibits a substantial difference in terms of drop-off characteristics to the other three monitoring sites. Moreover, the drop-off characteristics of the other three sites cannot be explained by the curve shown in Figure 7. It is therefore suggested that the measured annual mean NO_2 concentrations are somewhat influenced by the physical attributes of the site (i.e. assuming that all monitoring sites are subject to identical regional weather patterns).

Given the analysis above it is reasonable to suggest that the exceedence of the annual mean NO_2 objective recorded at STA1 is influenced more so by the physical attributes of the monitoring location. More specifically, it is likely that the built form and orientation of Long Row cottages combined with localised weather patterns create unfavourable dispersion characteristics which elevate concentrations.

There is also another confounding factor which cannot be taken into account within this analysis. Vehicles leaving the village to the south will have a tendency to accelerate on the section of road directly adjacent to Long Row cottages as the speed limit changes from 30 to 50 mph. Conversely, deceleration events occur by the traffic approaching Stratford St. Andrew from the south. It is the net effect on emissions which need to be characterised in order to fully understand the contribution from the traffic at this particular location. It is likely that these effects can only be fully resolved by monitoring the traffic situation using driving cycle analysis.

5.3 Proposed area of exceedence

The traffic flow is similar through the village in the target section of the A12. Based on the recent traffic survey, average speeds change from 33 mph entering from the south to 29 mph towards Great Glemham Road. An exceedence of the annual mean NO_2 objective is consistent with the physical and geographical attributes associated with the diffusion tube; STA1. By applying a buffer or zone using the precise distance between

the road centre line and STA1 provides a reasonable indication of other relevant locations where similar affects may be expected (i.e. similar physical attributes would need to be assessed). Figure 8 indicates this buffer zoning based on two buffer zones. The red buffer zone represents the distance between the road centre line and the STA1 monitoring site (6.5 metres) and the blue buffer zone represents the average distance between the road centre line and site STA2 and STA5 (8.7 metres). By having two zones the methodology attempts to extend the consistency of interpretation.

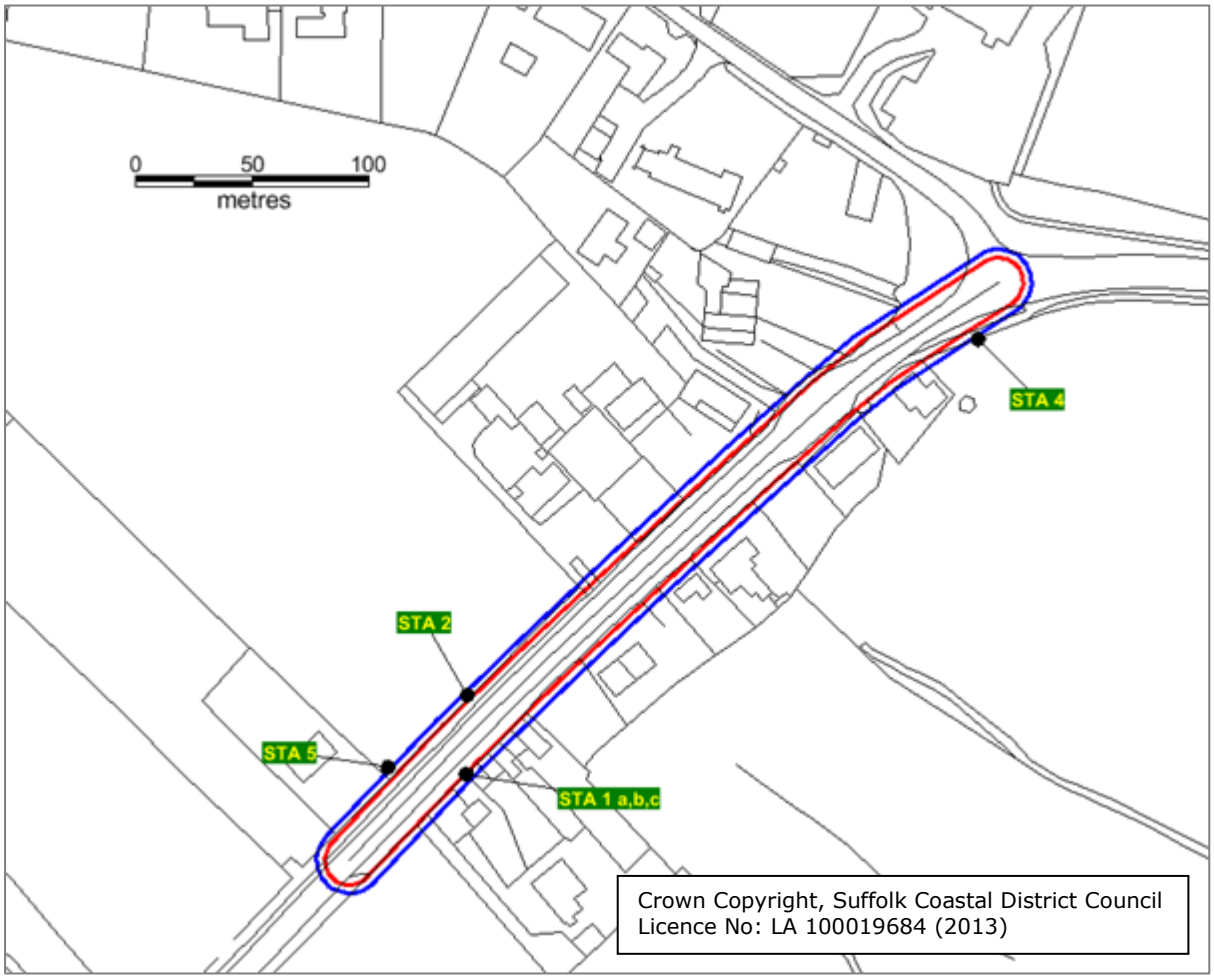


Figure 8: Air quality based buffer zones applied to the A12 at Stratford St. Andrew.

In the first instance, the red buffer zone indicates that the facades of all the cottages on Long Row would be subject to an exceedence of the annual mean NO_2 objective. Currently, no other relevant receptors are indicated as having exceedences along the section of road according to this methodology. Extending the methodology to the blue buffer zone provides an indication of relevant receptors that may be subject to annual mean NO_2 concentrations similar to those recorded at sites STA2 and STA5 and not of concern in terms of impact to health.

Although the monitoring data suggest that the exceedence of the annual mean NO_2 objective is confined to Long Row cottages, the methodology applied in this detailed assessment has taken a precautionary approach to suggest elevated NO_2 concentrations at this location may extend beyond Long Row cottages as defined by the red buffer zone.

The technical Guidance LAQM.TG(09) (Defra, 2009) requires local authorities to estimate the number of people exposed to concentrations above the relevant air quality objectives. Therefore based on the red buffer zone, there are currently four properties in the exceedence area (1-5 Long Row), with an estimate of two people per property, the population exposure would be eight people.

6 Conclusions and actions

Based on the analysis shown in Section 5 it is recommended that an AQMA for annual mean NO_2 is declared with the boundary corresponding to the red buffer zone. The buffer takes a precautionary approach to include the zone where an exceedence of the annual mean NO_2 objective may occur but also the zone in which any low emission or traffic management measures would apply in order to influence an improvement in air quality. This would allow emission reductions to be pursued along the entire length of the road and not just adjacent to Long Row. In this respect, it is less likely that exceedences would not be transferred to other properties, as a result of introducing traffic management measures.

Alternatively, SCDC may decide to declare an AQMA for the area of exceedence only. In this case, the AQMA boundary would encompass the four properties in 1-5 Long Row rather than be extended along the red buffer zone.

Under the current LAQM system, the local authority is required to conduct a Further Assessment (FA) of air quality within 12 months of the AQMA declaration. The FA is intended to supplement the information provided in the detailed assessment to confirm the exceedence, define the improvement in air quality and provide information on source contributions. The local authority is then required to develop an Air Quality Action Plan providing appropriate measures to improve NO_2 concentrations within the AQMA.

As part of this process, the local authority has installed two new diffusion tubes in 2013, one in the 50 mph zone (STA7) and another (STA6) further into the village at a property at a similar distance to STA1.

In addition, other sites to consider for further monitoring include;

- At further residential properties in close proximity to the road (i.e. those indicated by the blue buffer zone).
- At the same distance from the road as STA1 but approximately 5 metres from Long Row cottages to avoid the effect of building-wake.
- Further into the 50 mph zone in order to assist any future analysis of low emission transport measures.
- Siting diffusion tubes at different heights from the ground.

As part of the Further Assessment and action plan process, the local authority could also consider a more detailed analysis of vehicle driving patterns using instantaneous emissions modelling to help target the development of mitigation measures.

References

AEA Technology (2001). Air Quality Review and Assessment – Stage 3: A report produced for Suffolk Coastal District Council [online]. Available: http://www.suffolkcoastal.gov.uk/NR/rdonlyres/FAEC8C9E-FE33-424B-BC38-73FBA21D0E18/0/Stage3SupplementreportN02.pdf.

AEA Technology (2005). Detailed assessment of the Woodbridge Road junction [online]. Available: http://www.suffolkcoastal.gov.uk/NR/rdonlyres/CA0E6145-1740-43F5-A0BA-6DE66F4CE8BE/0/AirQualityReportForWoodbridgeJunction.pdf.

Defra (2003). Local Air Quality Management Technical Guidance LAQM TG (03). Department for Environment, Food and Rural Affairs. Defra, London.

Defra (2007). The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. Department for Environment, Food and Rural Affairs in partnership with the Scottish Executive, Welsh Assembly Government and Department of the Environment Northern Ireland. Defra, London.

Defra (2009). Local Air Quality Management Policy Guidance LAQM PG (09). Department for Environment, Food and Rural Affairs. Defra, London.

Northwood Technologies (2001). Vertical mapper contour modelling and display software for MapInfo Professional: User guide. Northwood Technologies, Canada.

SCDC (1999). Report on the first stage review and assessment of air quality in Suffolk Coastal. Suffolk Coastal District Council.

SCDC (2000). Report on the Second Stage Review and Assessment of Air Quality in the Suffolk Coastal District. Suffolk Coastal District Council.

SCDC (2001). Report on the Third Stage Review and Assessment of Air Quality in the Suffolk Coastal District. ENV/254/17. Suffolk Coastal District Council.

SCDC (2003). Report on the Updating and Screening Assessment of Air Quality in the Suffolk Coastal District. ENV/254/22. Suffolk Coastal District Council.

SCDC (2004). Report on the Detailed Assessment and Continued Updating and Screening Assessment of Air Quality in the Suffolk Coastal District. ENV/254/23. Suffolk Coastal District Council.

SCDC (2005). Progress Report Air Quality in the Suffolk Coastal District. ENV/254/24. Suffolk Coastal District Council.

SCDC (2006). Report on the Updating and Screening Assessment of Air Quality in the Suffolk Coastal District. ENV/254/25. Suffolk Coastal District Council.

SCDC (2008a). Air Quality Review and Assessment. Detailed Assessment for Adastral Close and Ferry Lane, Felixstowe. Suffolk Coastal District Council.

SCDC (2008b). Progress Report Air Quality in the Suffolk Coastal District. ENV/254/26. Suffolk Coastal District Council.

SCDC (2009). Report on the Updating and Screening Assessment of Air Quality in the Suffolk Coastal District. ENV/254/64. Suffolk Coastal District Council.

SCDC (2010). Progress Report Air Quality in the Suffolk Coastal District. ENV/254/65. Suffolk Coastal District Council.

SCDC (2011a). Progress Report Air Quality in the Suffolk Coastal District. ENV/254/66. Suffolk Coastal District Council.

SCDC (2011b). Air quality action plan for the Woodbridge Jucntion. ENV/254/67. Suffolk Coastal District Council.

SCDC (2012). Report on the Updating and Screening Assessment of Air Quality in the Suffolk Coastal District. ENV/254/68. Suffolk Coastal District Council.

TRL Ltd (2010). Further Assessment for the Air Quality Management Area at Ferry Lane, Felixstowe. J S Price, A M Savage and K Turpin (TRL) CLIENT PROJECT REPORT CPR1080.

TRL (2012). Local Air Quality Management Action Plan for the Air Quality Management Area at Ferry Lane, Felixstowe J Price and K Turpin. CLIENT PROJECT REPORT CPR1391.

Glossary of terms and abbreviations

AADT	Annual average daily traffic
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
Defra	Department for Environment, Food and Rural Affairs
LAQM	Local air quality management
LAQM TG	Local air quality management technical guidance
LDV	Light duty vehicle (between 3.5 tonnes and 7.5 tonnes)
LGV	Light goods vehicle
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_X	Oxides of nitrogen
O_3	Ozone
PM	Particulate matter
PM_{10}	Particulate matter with an aerodynamic diameter less than 10 microns
SCDC	Suffolk Coastal District Council
SO_2	Sulphur dioxide
TEA	Triethanloamine
TRL	Transport Research Laboratory
UKAS	United Kingdom Accreditation Service

Appendix A Air quality pollutants and objectives

The air quality objectives applicable to LAQM in England are set out in the Air Quality (England) Regulations 2000 (SI 928), The Air Quality (England) (Amendment) Regulations 2002 (SI 3043), and are shown in Table 1.1. This table shows the objectives in units of micrograms per cubic metre μg/m^3 (milligrammes per cubic metre, mg/m^3 for carbon monoxide) with the number of exceedences in each year that are permitted (where applicable).

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 μg/m^3	Running annual mean	31.12.2003
	5.00 μg/m^3	Running annual mean	31.12.2010
1,3-Butadiene	2.25 μg/m^3	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.5 μg/m^3	Annual mean	31.12.2004
	0.25 μg/m^3	Annual mean	31.12.2008
Nitrogen dioxide	200 μg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 μg/m^3	Annual mean	31.12.2005
Particles (PM_{10}) (gravimetric)	50 μg/m^3, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 μg/m^3	Annual mean	31.12.2004
Sulphur dioxide	350 μg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 μg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 μg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

Appendix B LAQM process

Report and reference	Main outcomes
First stage review and assessment (SCDC, 1999)	Negligible risk of exceedence of the air quality objectives for benzene and 1,3-butadiene and no further action needs to be taken. The risk of exceedence of the air quality objectives for lead, carbon monoxide (CO), NO_2, PM_{10} and sulphur dioxide (SO_2). Proceed to a second stage review and assessment.
Second stage review and assessment (SCDC, 2000)	Negligible risk of exceedence of the air quality objectives for lead and CO. Significant risk of exceedence of the air quality objectives for NO_2, PM_{10} and SO_2 at relevant locations and further review and assessment is necessary.
Third stage review and assessment (SCDC, 2001)	Insufficient information to date and therefore further review and assessment required for: • SO_2 and PM_{10} emissions from shipping at the Port of Felixstowe. • PM_{10} emissions from the combined emission 'footprint' of Roadworks (1952) Limited and Sinks Pit Quarry. Risk of NO_2 air quality objectives being exceeded and further review and assessment required for: • Emissions from traffic using the A1152 (specifically the crossroads of the A1152 and B1438 at Melton) • Emissions from traffic using Lime Kiln Quay Road/The Thoroughfare/St John's Street junction, Woodbridge.
Air quality review and assessment stage 3 (AEA Technology, 2001)	Unlikely risk of exceedence of the air quality objectives for NO_2 at the Melton and Woodbridge road junctions and an AQMA is not required.
USA report (SCDC, 2003)	Potential risk of exceedence of the air quality objectives for lead, NO_2, PM_{10} and SO_2 at receptor locations. Further investigation is necessary.
Detailed assessment and USA report (SCDC, 2004)	Potential risk of exceedence of the air quality objectives for NO_2, PM_{10} and SO_2 at receptor locations. Further investigation is necessary for: • Emissions of NO_2 from traffic using the junction of Lime Kiln Quay Road/The Thoroughfare St John's Street junction, Woodbridge. • Emissions of NO_2, PM_{10} and SO_2 from activities on and associated with the Port of Felixstowe.
Progress report (SCDC, 2005)	Outlines the findings of detailed modelling undertaken as part of the FSR planning application. Exceedence of the air quality objective for annual mean NO_2 in 2005 at receptor locations situated in The Downs (close to the Port of Felixstowe Road), Spriteshall Lane (close to Dock Spur roundabout) and the Dooley Inn, Ferry Lane.
Detailed assessment of the Woodbridge road junction (AEA Technology, 2005)	**Declaration of an AQMA for the annual mean NO_2 objective for Lime Kiln Quay Road/The Thoroughfare/St John's Street junction, Woodbridge.**
USA report (SCDC, 2006)	Potential risk of exceedence of the air quality objectives for NO_2, PM_{10} and SO_2 at receptor locations resulting from emissions from activities on and associated with the Port of Felixstowe. A detailed assessment is required to investigate these emissions.

Detailed assessment for Adastral Close and Ferry Lane, Felixstowe (SCDC, 2008a)	Exceedence of the annual mean objective for NO_2 at the Dooley Inn, Ferry Lane, Felixstowe. Risk of exceedence of the annual mean objective for NO_2 at fifteen properties at the west end of Adastral Close in 2010 and beyond following the FSR. Source apportionment studies indicated that container handling operations by rubber tyred gantry (RTG) crane and internal movement vehicles (IMVs) will potentially make the greatest contribution to oxides of nitrogen (NO_X) concentrations in 2010 both at Adastral Close and the Dooley Inn, Ferry Lane. **Declaration of an AQMA for the annual mean NO_2 objective for the Dooley Inn, Ferry Lane, Felixstowe.**
Progress report (SCDC, 2008b)	Work on production of the draft action plan for Woodbridge is continuing. Public consultation will be undertaken following Defra's approval of the completed draft action plan.
USA report (SCDC, 2009)	No requirement to proceed to a Detailed Assessment for any pollutant. Risk of exceedence in AQMAs remains. Ongoing work to identify biomass combustion plant within the district.
Progress report (SCDC, 2010)	No requirement to proceed to a Detailed Assessment for any pollutant. Risk of exceedence in AQMAs remains. 21 sites that have biomass plant with a thermal output greater than 50Kw within the district have been identified.
Further assessment for Adastral Close and Ferry Lane, Felixstowe (TRL, 2010)	Confirmed detailed assessment with exceedence of the NO_2 annual mean objective concentration predicted at the Dooley Inn public house on Ferry Lane. There are no predicted exceedences of the PM_{10} or SO_2 objectives in the base year of 2008. The existing AQMA boundary is valid and should be maintained. A source apportionment exercise determined that container handling activities in the port and heavy duty vehicles (HDVs) on roads external to the port made the greatest contribution to NO_X concentrations at this receptor.
Progress report (SCDC, 2011)	Risk of exceedence of the annual mean NO_2 objective in AQMAs remains. Risk of exceedence of annual mean NO_2 objective in Stratford St. Andrew. Two existing industrial installations identified which require further emission information to be collected to determine whether a Detailed Assessment is required. Biomass screening assessment conducted. Four boilers required additional investigation to be presented in next annual report (2013).
Final air quality action plan for Woodbridge junction AQMA (SCDC, 2011b)	The plan confirms the likely source of NO_2 from transport and in particular from HGVs and suggests that a 16 percent reduction in traffic emissions of NO_x is required to achieve the objective. The Action Plan recommended 20 measures for implementation to aim to reduce emissions by 10 percent by 2015. It also sets out a framework of partnership working with other organisations and the requirement to balance the requirements of local businesses and community against improving local air quality.

Final air quality action plan for Ferry Lane, Felixstowe (TRL, 2012)	The action plan identifies measures to be adopted as part of the formal action plan. There are five main measures to be pursued by the local authority and Port Authority.
USA report (SCDC, 2012)	No requirement to proceed to a Detailed Assessment for any pollutant. Risk of exceedence in AQMAs remains. Risk of exceedence of annual mean NO_2 objective at Stratford St. Andrew on A12. SCDC to increase monitoring with triplicate tubes before determining whether detailed assessment is required. Report includes an update on progress made on the Woodbridge and Felixstowe action plans.

Appendix C Diffusion tube bias adjustment factors

The analytical laboratory used for supply and analysis of NO_2 diffusion tubes in 2012 was ESG Didcot (previously Harwell Scientifics). The monitoring is undertaken using Palmes passive diffusion tubes exposed on a monthly basis. The tubes are prepared by spiking acetone:triethanloamine (TEA) (50:50) onto the grids prior to the tubes being assembled. The tubes are then desorbed with acetone and the extract analysed using a segmented flow auto-analyser with ultraviolet detection. The laboratory is formally accredited under the United Kingdom Accreditation Scheme (UKAS).

Combined "national" bias adjustment factors for UK diffusion tube laboratories, based upon Local Authority co-location studies throughout the UK, are provided on behalf of Defra and the Devolved Administrations. The national bias adjustment factor given for ESG (Didcot) in 2012, in the June 2013 edition of 'National Spreadsheet of Bias Adjustment Factors' was **0.79**, using results from 38 different studies (as seen in the screenshot below).

National Diffusion Tube Bias Adjustment Factor Spreadsheet — Spreadsheet Version Number: 06/13

Follow the steps below **in the correct order** to show the results of **relevant** co-location studies
Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods
Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet
This spreadhseet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.

This spreadsheet will be updated at the end of September 2013

LAQM Helpdesk Website

The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory.

Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.

Step 1:	Step 2:	Step 3:	Step 4:
Select the Laboratory that Analyses Your Tubes from the Drop-Down List	Select a Preparation Method from the Drop-Down List	Select a Year from the Drop-Down List	Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor[3] shown in blue at the foot of the final column.
If a laboratory is not shown, we have no data for this laboratory.	If a preparation method is not shown, we have no data for this method at this laboratory.	If a year is not shown, we have no data[2]	If you have your own co-location study then see footnote[4]. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@uk.bureauveritas.com or 0800 0327953

Analysed By[1]	Method (To undo your selection, choose (All) from the pop-up list)	Year[2] (To undo your selection, choose (All))	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m³)	Automatic Monitor Mean Conc. (Cm) (µg/m³)	Bias (B)	Tube Precision[5]	Bias Adjustment Factor (A) (Cm/Dm)
ESG Didcot	50% TEA in Acetone	2012	UB	Falkirk Council	12	27	24	10.8%	G	0.90
ESG Didcot	50% TEA in acetone	2012	R	Thanet District Council	12	32	25	27.2%	G	0.79
ESG Didcot	50% TEA in acetone	2012	KS	Marylebone Road Intercomparison	11	127	95	34.1%	G	0.75
ESG Didcot	20% TEA in Water	2012	KS	Marylebone Road Intercomparison	11	129	95	36.2%	G	0.73
ESG Didcot	50% TEA in acetone	2012	B	Stockton on Tees	12	28	21	33.8%	G	0.75
ESG Didcot	50% TEA in acetone	2012	R	Stockton on Tees	11	22	17	29.9%	G	0.77
ESG Didcot	50% TEA in acetone	2012	SU	Thanet District Council	12	21	18	16.6%	G	0.86
ESG Didcot	50% TEA in acetone	2012	UB	CITY OF YORK COUNCIL	12	28	24	15.3%	P	0.87
ESG Didcot	50% TEA in acetone	2012	R	CITY OF YORK COUNCIL	12	41	32	30.5%	P	0.77
ESG Didcot	50% TEA in acetone	2012	R	CITY OF YORK COUNCIL	12	37	28	31.4%	G	0.76
ESG Didcot	50% TEA in acetone	2012	R	CITY OF YORK COUNCIL	12	41	30	34.4%	G	0.74
ESG Didcot	50% TEA in Acetone	2012	KS	Suffolk Coastal District Council	12	50	44	13.8%	G	0.88
ESG Didcot	50% TEA in Acetone	2012	R	Maidstone Borough Council	12	48	44	11.2%	P	0.90
ESG Didcot	50% TEA in Acetone	2012	B	Maidstone Borough Council	12	20	14	45.3%	G	0.69
ESG Didcot	50% TEA in acetone	2012	R	Armagh City and District Council	12	40	27	45.3%	G	0.69
ESG Didcot	50% TEA in acetone	2012	R	Dumfries and Galloway Council	12	38	33	14.2%	G	0.88
ESG Didcot	50% TEA in acetone	2012	R	Cambridge City Council	12	46	35	31.5%	G	0.76
ESG Didcot	50% TEA in Acetone	2012	R	Suale Borough Council	11	44	32	38.7%	G	0.72
ESG Didcot	50% TEA in acetone	2012	R	Northumberland County Council	12	36	28	31.1%	S	0.76
ESG Didcot	50% TEA in acetone	2012	R	North Down Borough Council	12	45	33	36.6%	G	0.73
ESG Didcot	50% TEA in acetone	2012	R	Medway Council	11	38	32	18.7%	G	0.84
ESG Didcot	50% TEA in acetone	2012	UB	Medway Council	11	25	24	2.3%	G	0.98
ESG Didcot	50% TEA in acetone	2012	B	Medway Council	10	29	19	51.3%	P	0.66
ESG Didcot	50% TEA in acetone	2012	R	Lisburn City Council	9	28	25	13.4%	P	0.88
ESG Didcot	50% TEA in acetone	2012	R	Down District Council	11	50	38	32.1%	G	0.76
ESG Didcot	50% TEA in acetone	2012	R	Castlereagh Borough Council	12	48	30	61.9%	G	0.62
ESG Didcot	50% TEA in acetone	2012	R	Bridgend County Borough Council	12	28	27	4.5%	G	0.96
ESG Didcot	50% TEA in acetone	2012	R	Tunbridge Wells BC	12	62	49	27.0%	G	0.79
ESG Didcot	50% TEA in Acetone	2012	R	West Oxfordshire District Council (WODC)	11	48	36	32.3%	G	0.76
ESG Didcot	20% TEA in water	2012		**Overall Factor[3] (2 studies)**				Use		0.69
ESG Didcot	50% TEA in acetone	2012		**Overall Factor[3] (38 studies)**				Use		0.79