2009 Air Quality Updating and Screening Assessment for Waveney District Council

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

July 2009

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Executive Summary

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

No AQMAs are currently declared in the Waveney District Council area, and this report does not identify the need for any as a result of changes in sources or monitoring. Seven diffusion tubes are located in and around the area of Lowestoft for the purpose of non-automatic nitrogen dioxide monitoring. These are mostly at roadside sites on or near the major A-roads passing through Lowestoft, the A416, A1117 and A12. One such site shows exceedences of the AQS objective for NO_2 at one receptor location near the port of Lowestoft on Mill Road, a residential street with relevant public exposure. The bias adjusted annual mean concentration measured at this site is 43.2 $\mu g \cdot m^{-3}$, however data capture from the site is just 77.8% so this result is not considered reliable. Despite this, it is likely that exceedences of the AQS objective for NO_2 have occurred at the Mill Road site, and it is therefore recommended that monitoring be continued, and possibly expanded.

Waveney District Council has identified a number of biomass boilers installed since the last round of review and assessment. Those with relevant exposure are at Brampton Church Primary School, Edgar Sewter Church Primary School, and Kirkley Middle School, all of which use the same type of boiler. Since no information on rates of NO_2 emission was available, the NO_x emission estimates for this boiler have been used as a stringent upper bound. From this assessment it is concluded that none of the installations are likely to cause exceedences of the air quality objectives for PM_{10} or NO_2.

There is no need for Waveney District Council to proceed to a detailed assessment in 2009 for any pollutants considered in this assessment. However, due to the possible exceedence of air quality objectives in the area of Lowestoft port, it is recommended that continued monitoring be used to assess the need for further action. The next action for Waveney District Council is therefore the submission of an air quality progress report in 2010.

Table of contents

Appendices

Appendix A QA:QC Data

1 Introduction

1.1 Description of Local Authority Area

Waveney District, named after the River Waveney that forms its north-west border, lies on the east coast of Suffolk, on the southern extent of the Norfolk Broads. The district council is based in Lowestoft, the capital of Waveney, which is the only unparished area in the district. Other towns in the district are Beccles, Bungay, Halesworth and Southwold.

In general the countryside within Waveney is lowland, the majority of which is farmed. The north of the District is dominated by the River Waveney itself with most of the river valley designated as a Special Landscape Area and/or an Environmentally Sensitive Area. Much of this part of the District is adjacent to the Broads Authority area. The remainder of the rural area contains nationally and regionally recognised wildlife and landscape designations including the Suffolk Coast and Heaths Area of Outstanding Natural Beauty, Sites of Special Scientific Interest and a substantial number of County Wildlife Sites. The coastline south of Kessingland falls within the Suffolk Heritage Coast, which is possibly the most vulnerable and sensitive part of Waveney's natural environment.

1.2 Purpose of Report

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

1.3 Air Quality Objectives

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

Table 1.1 Air Quality Objectives included in Regulations for the purpose of Local Air Quality Management in England.

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

1.4 Summary of Previous Review and Assessments

No AQMAs have been declared in Waveney District at any time, though it has been suggested that NO_2 concentrations in the vicinity of Lowestoft port may exceed UK air quality objectives.

1.4.1 First Round of Review and Assessment

Waveney District Council completed the first round of air quality review and assessment in 2000, concluding that the risk of any of the UK air quality objectives being exceeded was negligible. No AQMAs were declared as a result of this assessment.

1.4.2 Second Round of Review and Assessment

The Second Round Updating and Screening Assessment for Waveney District Council was published in May 2003. Monitoring data indicated that concentrations of NO_2 were likely to exceed UK annual average objectives in 2005 at two junctions, and that PM_{10} concentrations were likely to exceed 24-hour objectives at a third junction in 2004. The report therefore concluded that a Detailed Assessment was required for NO_2 and PM_{10}.

The 2004 Detailed Assessment for NO_2 concluded that Waveney District Council was not required to declare an AQMA for either location. It was predicted that UK objectives for PM_{10} in 2010 would be exceeded in that year, but since concentrations were not deemed to exceed the 2004 objectives, no AQMAs were declared as a result of the assessment. However, the report recommended that a detailed survey of traffic flow at all three locations be commissioned when the SLRR bypass was opened.

In 2005, the Progress Report commissioned by Waveney District Council recommended that, although there had been no exceedences of the air quality objectives in 2004, significant developments in Lowestoft town centre warranted monitoring of NO_2 and traffic flow to assess the effects on air quality.

1.4.3 Third Round of Review and Assessment

The Updating and Screening Assessment completed for Waveney District Council in May 2006 predicted that no exceedences of the air quality objectives for the UK would occur in Waveney. However, the report recommended that further modelling based on reassessment of traffic flows may be necessary following completion of the major road building schemes in Waveney.

Following this, the 2007 Progress Report concluded that NO_2 concentrations were below relevant objectives at all monitoring locations in 2006. Hence it was deemed unnecessary for Waveney District Council to proceed to a Detailed Assessment. Similarly the 2008 progress report identified no definite exceedences of NO_2 objectives in 2007, and concluded that there was no necessity for Waveney District Council to proceed to a Detailed Assessment. However, incomplete monitoring data at Mill Road showed possible exceedences of NO_2 objectives, and the report consequently recommended further monitoring by diffusion tubes and traffic counts at this location.

2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

Waveney District Council operates one automatic monitoring station at Belvedere road, which is routinely calibrated on a bi-weekly basis by the local authority. No diffusion tubes are co-located with the automatic monitor, and no data was available for 2008 at the time of writing.

Table 2.1 Details of Automatic Monitoring Sites

Site Name	Site Type	OS Grid Ref	Pollutants Monitored	In AQMA ?	Relevant Exposure? *(Y/N with distance (m) to relevant exposure)*	Distance to kerb of nearest road *(N/A if not applicable)*	Worst-case Location ?
Belvedere Road	Roadside	X 654651 Y 292619	N/A	N	Y (2m)	N/A	Y

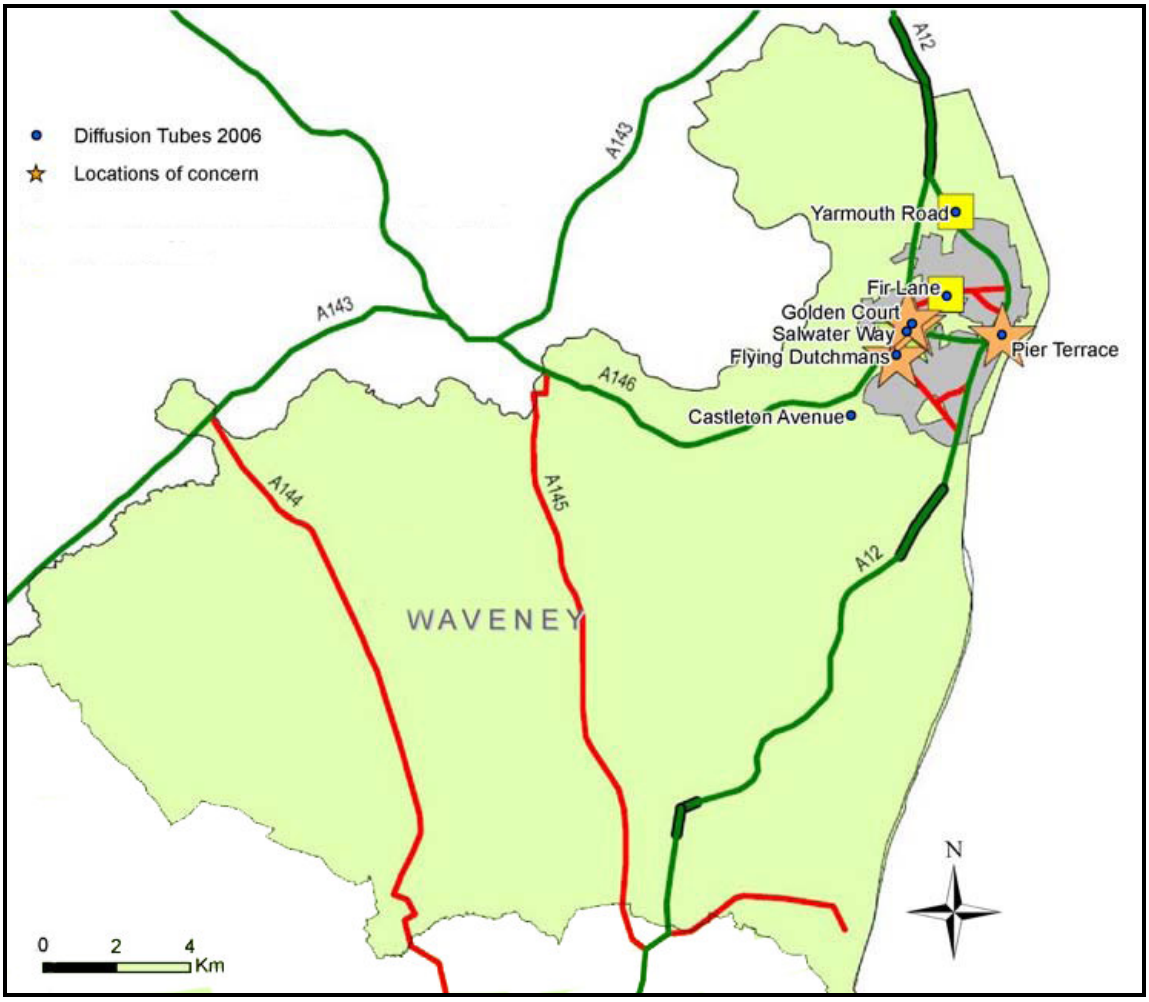
2.1.2 Non-Automatic Monitoring

Seven diffusion tubes are located in and around the area of Lowestoft for the purpose of non-automatic nitrogen dioxide monitoring. These are mostly at roadside sites on or near the major A-roads passing through Lowestoft, the A416, A1117 and A12.

Samples have been analysed in accordance with Harwell Scientifics' standard operating procedure HS/GWI/1015 issue 11. The tubes were prepared by spiking acetone:triethanolamine (50:50) onto the grids prior to the tubes being assembled. Following exposure, tubes were desorbed with distilled water and the extract analysed using a segmented flow autoanalyser with ultraviolet detection. In the WASP intercomparison scheme for comparing spiked Nitrogen Dioxide diffusion tubes, Harwell Scientifics is currently ranked as a Category Good laboratory.

Table 2.2 Details of Non- Automatic Monitoring Sites

Site Name	Site Type	OS Grid Ref	Pollutants Monitored	In AQMA?	Relevant Exposure? *(Y/N with distance (m) to relevant exposure)*	Distance to kerb of nearest road *(N/A if not applicable)*	Worst-case Location?
Castleton Ave.	Roadside	X 650617 Y 290470	NO_2	N	Y	N/A	Y
Fir Lane	Roadside	X 653223 Y 293721	NO_2	N	Y	N/A	Y
Dutchmans Court	Roadside	X 651853 Y 292106	NO_2	N	Y	N/A	Y
Golden Court	Roadside	X 652272 Y 292960	NO_2	N	Y	N/A	Y
Pier Terrace	Roadside	X 654724 Y 292658	NO_2	N	Y	N/A	Y
Saltwater Way	Roadside	X 652137 Y 292751	NO_2	N	Y	N/A	Y
Yarmouth Road	Roadside	X 653465 Y 295997	NO_2	N	Y	N/A	Y



NO_2 monitoring sites in Waveney district

Waveney District Council

No co-location study data has been provided for Waveney District Council in 2008. A bias adjustment factor of 0.80 has therefore been taken from tables published on the UWE Review and Assessment website. This has been deduced from 7 co-location studies by Harwell Scientifics in 2008.

2.2 Comparison of Monitoring Results with AQ Objectives

2.2.1 Nitrogen Dioxide

Automatic Monitoring Data

No automatic monitoring data for any pollutants is available from 2008.

Diffusion Tube Monitoring Data

Data capture is given for the period 5th March 2008 to 5th March 2009, no data was available for January, February, March, July, August or November 2008. For all sites, data capture in 2008 was lower than 90%.

Bias adjusted results are scaled to represent a full year's exposure; the ratio of results from the monitoring period to those from a full year is calculated using the ratio of similar results from an AURN monitor in Cambridgeshire[1]. This has the effect of reducing concentration estimates by around 3.5% on average, to give those shown in table 2.4a below:

Table 2.4a Results of Nitrogen Dioxide Diffusion Tubes

Site ID	Location	Within AQMA?	Data Capture 2008 %	Annual mean concentrations 2008 (μg/m^3) Adjusted for bias
S1	Dutchman Court	N	**55.6**	26.4
S2	Castleton Ave.	N	**77.8**	22.3
S3	Saltwater Way	N	**66.7**	29.0
S4	Golden Court	N	**77.8**	33.5
S5	Pier Terrace	N	**77.8**	38.4
S6	Tesco Yarmouth Rd	N	**77.8**	27.6
S7	Fir Lane	N	**66.7**	29.9
S8	Mill Rd	N	**77.8**	**42.3**

[1] No other AURN background monitors were considered close enough to provide suitable data

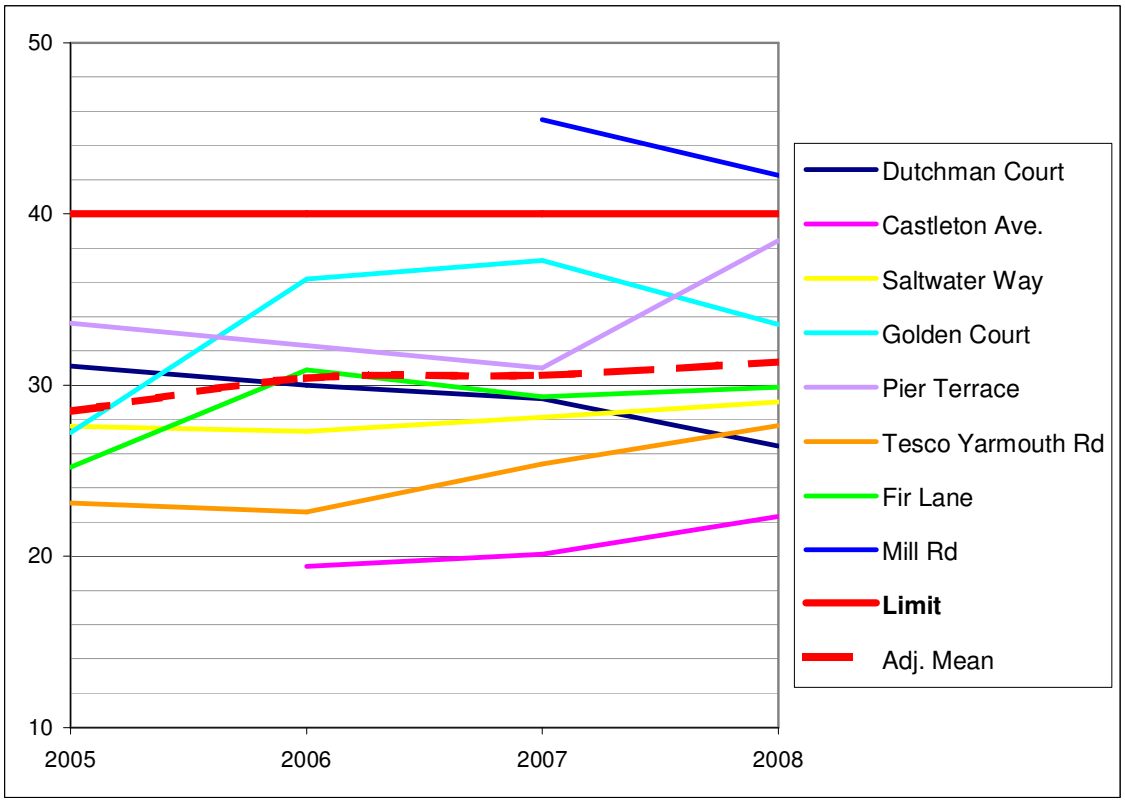
Table 2.4b Historical Results of Nitrogen Dioxide Diffusion Tubes

Site ID	Location	Within AQMA?	Annual mean concentrations ($\mu g/m^3$) Adjusted for bias			
			2005	2006	2007	2008
S1	Dutchman Court	N	31.1	30.0	29.2	26.4
S2	Castleton Ave.	N	-	19.4	20.1	22.3
S3	Saltwater Way	N	27.6	27.3	28.1	29.0
S4	Golden Court	N	27.2	36.2	37.3	33.5
S5	Pier Terrace	N	33.6	32.3	31.0	38.4
S6	Tesco Yarmouth Rd	N	23.1	22.6	25.4	27.6
S7	Fir Lane	N	25.2	30.9	29.3	29.9
S8	Mill Rd	N	-	-	**45.5**	**42.3**

Diffusion tube monitoring data indicates that annual average concentrations of NO_2 at the Mill Road site have exceeded Air Quality Objectives for two consecutive years since the commencement of monitoring. However in 2007 and 2008 data capture for the site was 16.7% and 77.8% respectively, and hence results from the site are not considered sufficiently reliable to determine exceedence of AQ objectives.

The standard error on the 2008 Mill Road result is approximately ±1.8 $\mu g/m^3$, and consequently the 80% confidence range is 40.0 – 44.5 $\mu g/m^3$; it is therefore possible to say with 80% certainty that the monitoring results are indicative of an exceedence of the AQS objective for annual mean NO_2 concentrations. Similarly, whilst historical monitoring at the Pier Terrace site indicates no exceedence of AQS objectives, the standard error on the mean of the 2008 monitoring result is approximately ±2.4 $\mu g/m^3$. Thus it is only possible to say with 50% confidence that the result is not indicative of an exceedence of the AQS objectives for NO_2 in 2008.

Fig 2.4b Historical Results of Nitrogen Dioxide Diffusion Tubes



Sites with four years consecutive monitoring data show an average trend of NO_2 concentrations increasing by around 1.35 $\mu g/m^3$ per year. Therefore, since in 2008 levels of NO_2 at two sites (S4 & S5) seem to be at

risk of exceeding the Air Quality objectives, it is recommended that monitoring is continued, and possibly expanded, at these locations.

2.2.2 PM_{10}

No monitoring of PM_{10} has been undertaken by Waveney District Council in 2008.

2.2.3 Sulphur Dioxide

No monitoring of SO_2 has been undertaken by Waveney District Council in 2008.

2.2.4 Benzene

No monitoring of C_6H_6 has been undertaken by Waveney District Council in 2008.

2.2.5 Other pollutants monitored

No monitoring of other pollutants has been undertaken by Waveney District Council in 2008.

3 Road Traffic Sources

3.1 Narrow Congested Streets with Residential Properties Close to the Kerb

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

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

Waveney District Council confirms that there are no new/newly identified busy streets where people may spend 1 hour or more close to traffic.

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

Waveney District Council confirms that there are no new/newly identified roads with high flows of buses/HDVs.

3.4 Junctions

Waveney District Council confirms that there are no new/newly identified busy junctions/busy roads.

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

The South Lowestoft Relief Road (SLRR) is not open at the time of writing, and therefore will not be considered in this assessment, however it will need to be considered in the next review.

Waveney District Council confirms that there are no new/proposed roads.

3.6 Roads with Significantly Changed Traffic Flows

Waveney District Council confirms that there are no new/newly identified roads with significantly changed traffic flows.

3.7 Bus and Coach Stations

Waveney District Council confirms that there are no relevant bus stations in the Local Authority area.

4 Other Transport Sources

4.1 Airports

Waveney District Council confirms that there are no airports in the Local Authority area.

4.2 Railways (Diesel and Steam Trains)

Emissions from diesel trains were reviewed in the 2003 USA and subsequently assessed in the 2004 Detailed Assessment. It was concluded that they were unlikely to cause exceedence of the AQ objectives. No significant changes to train services or relevant exposure have been reported since this assessment.

4.2.1 Stationary Trains

New evidence has come to light that NO_2 concentrations alongside busy rail lines carrying coal or diesel locomotives can be elevated to a similar extent as on a busy road. Where background NO_2 concentrations exceed 25 $\mu g/m^3$, and there is relevant exposure within 15 m of the tracks, an assessment may be necessary if volumes of rail traffic are considered large enough. However since the highest background NO_2 concentration in the Council area is 18.2 $\mu g/m^3$, no assessment of this source is necessary in the Waveney District.

Waveney District Council confirms that there are no locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m.

4.2.2 Moving Trains

Waveney District Council confirms that there are no locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m.

4.3 Ports (Shipping)

The port of Lowestoft, located in the east of the district, has fewer than 5000 shipping movements per year and is therefore not busy enough to merit assessment.

Waveney District Council confirms that there are no ports or shipping that meet the specified criteria within the Local Authority area.

5 Industrial Sources

5.1 Industrial Installations

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

Waveney District Council confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

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

Waveney District Council confirms that there are no industrial installations with substantially increased emissions or new relevant exposure in their vicinity within its area or nearby in a neighbouring authority.

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

Waveney District Council confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

5.2 Major Fuel (Petrol) Storage Depots

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

5.3 Petrol Stations

Only one petrol station in the Waveney District has daily throughput exceeding 2,000 m^3. This was assessed in the last Updating and Screening Assessment (2006) and it was concluded that there was no relevant exposure within 10 m of the pumps.

Waveney District Council confirms that there are no petrol stations meeting the specified criteria**.**

5.4 Poultry Farms

Waveney District Council indicates that there are 4 poultry farms in the district of sufficient size to merit consideration, however none of these have relevant exposure within 100 m, and therefore none require assessment.

Waveney District Council confirms that there are no poultry farms meeting the specified criteria.

6 Commercial and Domestic Sources

6.1 Biomass Combustion – Individual Installations

Waveney District Council has identified a number of biomass boilers installed since the last round of review and assessment. Those with relevant exposure are at Brampton Church Primary School, Edgar Sewter Church Primary School, and Kirkley Middle School, all of which use the same type of boiler. Since no information on rates of NO_2 emission was available for this boiler, the NO_x emission estimates have been used as a stringent upper bound. From this assessment it is concluded that none of the boilers are likely to cause exceedences of the air quality objectives for PM_{10} or NO_2.

Kirkley Middle School

Pollutant	Objective	Max. permissible ground level concentration / µg/m^3	Max. permissible emission rate / g/s	Maximum expected emission rate / g/s
PM_{10}	90th percentile of 24-hr mean	1	0.2150	0.0054
NO_2	99.8th percentile of 1-hr mean	200	0.4240	0.0281
NO_2	Annual mean	1	0.9916	0.0281

Edgar Sewter Church Primary School

Pollutant	Objective	Max. permissible ground level concentration / µg/m^3	Max. permissible emission rate / g/s	Maximum expected emission rate / g/s
PM_{10}	90th percentile of 24-hr mean	1	0.2180	0.0068
NO_2	99.8th percentile of 1-hr mean	200	0.4382	0.0351
NO_2	Annual mean	1	1.1056	0.0351

Brampton Church Primary School

Pollutant	Objective	Max. permissible ground level concentration / µg/m^3	Max. permissible emission rate / g/s	Maximum expected emission rate / g/s
PM_{10}	90th percentile of 24-hr mean	1	0.0235	0.0013
NO_2	99.8th percentile of 1-hr mean	200	0.0891	0.0066
NO_2	Annual mean	1	0.1453	0.0066

Waveney District Council has assessed the biomass combustion plants, and concluded that it will not be necessary to proceed to a Detailed Assessment.

6.2 Biomass Combustion – Combined Impacts

Waveney District Council confirms that there are no biomass combustion plants in the Local Authority area.

6.3 Domestic Solid-Fuel Burning

Waveney District Council confirms that there are no areas of significant domestic fuel use in the Local Authority area.

7 Fugitive or Uncontrolled Sources

The maximum annual mean background PM_{10} concentration in the district is 24 $\mu g \cdot m^{-3}$, in an area near the village of Holton. Relevant exposure is therefore assessed within 200 m of sources in accordance with chapter 5 of LAQM.TG(09). An ash process located in the port of Lowestoft may be a potential source of fugitive dust emission, however there is no relevant exposure within 200 m, and so the process has not been assessed in this, or any previous, round of review and assessment.

Waveney District Council confirms that there are no potential sources of fugitive particulate matter emissions in the Local Authority area.

8 Conclusions and Proposed Actions

8.1 Conclusions from New Monitoring Data

Non-automatic monitoring in the Waveney District shows exceedences of the AQS objective for NO_2 at one receptor location near the port of Lowestoft on Mill Road, a residential street with relevant public exposure. The bias adjusted annual mean concentration measured at this site is 43.2 $\mu g \cdot m^{-3}$, however data capture from the site is just 77.8% so this result is not considered reliable. Despite this, it is likely that exceedences of the AQS objective for NO_2 have occurred at the Mill Road site, and it is therefore recommended that monitoring be continued, and possibly expanded.

8.2 Conclusions from Assessment of Sources

There are no developments in the Waveney District Council that are likely to significantly affect air quality in locations with relevant exposure.

8.2.1 Road Traffic Sources

The results of the USA carried out for road traffic sources concluded that there is no requirement to proceed to a Detailed Assessment for the following sources:

- Narrow Congested Streets with Residential Properties Close to the Kerb;
- Busy Streets Where People May Spend 1-hour or More Close to Traffic;
- Roads with a High Flow of Buses and/or HGVs;
- Junctions;
- New Roads Constructed or Proposed Since the Last Round of Review and Assessment;
- Roads with Significantly Changed Traffic Flows; and
- Bus and Coach Stations.

8.2.2 Other Transport Sources

There is no requirement to proceed to a Detailed Assessment for the following sources:

- Airports;
- Railways (Diesel and Steam Trains); and
- Ports (Shipping).

8.2.3 Industrial Sources

There is no requirement to proceed to a Detailed Assessment for the following sources:

- Industrial Installations;
- New or Significantly Changed Installations with No Previous Air Quality Assessment;
- Major Fuel (Petrol) Storage Depots;
- Petrol Stations; and
- Poultry Farms.

8.2.4 Commercial and Domestic Sources

There is no requirement to proceed to a Detailed Assessment for the following sources:

- Biomass Combustion – Individual Installations
- Biomass Combustion – Combined Impacts; and
- Domestic Solid-Fuel Burning.

8.2.5 Fugitive or Uncontrolled Sources

There is no new, or newly identified, source or potential sources of fugitive particulate matter, therefore there is no requirement to proceed to a Detailed Assessment.

8.3 Proposed Actions

There is no need for Waveney District Council to proceed to a detailed assessment in 2009 for any pollutants considered in this assessment. However, due to the possible exceedence of air quality objectives in the area of Lowestoft port, it is recommended that continued monitoring be used to assess the need for further action. The next action for Waveney District Council is therefore the submission of an air quality progress report in 2010.

9 References

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Appendices

Appendix A: QA/QC Data

Appendix A: QA:QC Data

Diffusion Tube Bias Adjustment Factors

Diffusion tubes may systematically under or over-read NO_2 concentrations when compared to the reference chemiluminescence analyser. This is described as bias and can be corrected for to improve the accuracy of the diffusion tube results using a suitable bias adjustment factor.

Waveney District Council's diffusion tubes are prepared and analysed in accordance with Harwell Scientifics' standard operating procedure HS/GWI/1015 issue 11. The tubes were prepared by spiking acetone:triethanolamine (50:50) onto the grids prior to the tubes being assembled. Following exposure, tubes were desorbed with distilled water and the extract analysed using a segmented flow autoanalyser with ultraviolet detection. In the WASP intercomparison scheme for comparing spiked Nitrogen Dioxide diffusion tubes, Harwell Scientifics is currently ranked as a Category Good laboratory.

As no co-location study data has been provided for Waveney District Council in 2008. A bias adjustment factor of 0.80 has therefore been taken from tables published on the UWE Review and Assessment website. This has been deduced from 7 co-location studies by Harwell Scientifics in 2008. Results are also adjusted to account for poor data capture to represent a full year's exposure; the ratio of results from the monitoring period to those from a full year is calculated using the ratio of similar results from an AURN monitor in Cambridgeshire. This has the effect of reducing concentration estimates by around 3.5% on average, and is included in the stated bias factor for each site.

Fig. A1 – Derivation of bias adjustment factor

Spreadsheet Version Number: 03/09

Follow the steps below **in the correct order** to show the results of **relevant** co-location studies

This spreadsheet will be updated in late September 2009 on the R&A website

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

This spreadhseet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.

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Step 1: Select the Laboratory that Analyses Your Tubes from the Drop-Down List. If a laboratory is not shown, we have no data for this laboratory.

Step 2: Select a Preparation Method from the Drop-Down List. If a preparation method is not shown, we have no data for this method at this laboratory.

Step 3: Select a Year from the Drop-Down List. If a year is not shown, we have no data[2]

Step 4: 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 you have your own co-location study then see footnote[4]. If uncertain what to do then contact the Review and Assessment Helpdesk 0117 328 3668 aqm-review@uwe.ac.uk.

Analysed By[1]	Method (To undo your selection, choose (All) from the pop-up list)	Year[5] (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[6]	Bias Adjustment Factor (A) (Cm/Dm)
Harwell Scientific Services	50% TEA in Acetone	2008	R	Cambridge CC	12	52	43	20.8%	G	**0.83**
Harwell Scientific Services	50% TEA in Acetone	2008	UB	Falkirk Council	9	30	26	13.0%	G	**0.89**
Harwell Scientific Services	50% TEA in Acetone	2008	R	Falkirk Council	11	43	32	35.0%	G	**0.74**
Harwell Scientific Services	50% TEA in Acetone	2008	R	Hambleton DC	12	28	21	33.4%	G	**0.75**
Harwell Scientific Services	50% TEA in Acetone	2008	R	Canterbury CC	10	48	40	21.6%	G	**0.82**
Harwell Scientific Services	50% TEA in Acetone	2008	B	Canterbury CC	12	22	17	34.6%	G	**0.74**
Harwell Scientific Services	50% TEA in Acetone	2008	K	AEA Tech Intercomparison	12	138	116	19.3%	G	**0.84**
Harwell Scientific Services	50% TEA in Acetone	2008		**Overall Factor[3] (7 studies)**				**Use**		**0.80**

[1] For Casella Stanger/Bureau Veritas (NOT Bureau Veritas Labs) use Gradko 50% TEA in Acetone; for Bureau Veritas Labs and Eurofins use Casella Seal/GMSS/Casella CRE/Bureau Veritas Labs/Eurofins; for Staffordshire County Analyst use Staffordshire CC SS; for Bodycote Health Sciences use Clyde Analytical Laboratories. From 2008 Dundee CC are Tayside SS.

[2] In this situation it would be reasonable to use data from the nearest year.

[3] Overall factors have been calculated using orthogonal regression to allow for uncertainty in both the automatic monitor and diffusion tube. The uncertainty of the diffusion tube has been assumed to be double that of the automatic monitor.

[4] If you have your own co-location study, please send your data to us, so that it can be included here. If this is not possible, but you wish to combine these factors with your own, select and copy the relevant data from this spreadsheet and paste them into a new one (otherwise your calculations will include hidden data). Then add your own data and calculate the bias. To obtain a new correction factor that includes your data, average the bias (B) values, expressed as a factor, i.e. -16% is -0.16. Next add 1 to this value, e.g. -0.16 + 1.00 = 0.84 in this example, then take the inverse to give the bias adjustment factor 1/0.84 = 1.19. (This will not be exactly the same as the correction factor calculated using orthogonal regression as used in this spreadsheet, but will be reasonably close).

[5] Where an annual data set falls into two years it has been ascribed to the year in which most of the data fall.

[6] Tube precision is determined as follows: G = Good precision - coefficient of variation (CV) of diffusion tube replicates is considered good when the CV of eight or more periods is less than 20%, and the average CV of all monitoring periods is less than 10%; P = Poor precision - CV of four or more periods >20% and/or average CV >10%; S = Single tube, therefore not applicable; na = not available.

To add data download a questionnaire
or contact: KiriBrown@aqconsultants.co.uk

Waveney District Council

Adjusted means and raw means from all sites are shown in the table below:

Site ID	Raw mean	Bias adjustment factor	Adjusted mean
S1	34.7	0.76	26.4
S2	28.9	0.77	22.3
S3	37.8	0.77	29.0
S4	43.4	0.77	33.5
S5	49.8	0.77	38.4
S6	35.8	0.77	27.6
S7	38.7	0.77	29.9
S8	54.1	0.78	**42.3**