Report

Air Quality Review and Assessment - Detailed

A Report produced for Suffolk Coastal District Council

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Executive Summary

The UK Government published its strategic policy framework for air quality management in 1995 establishing national strategies and policies on air quality which culminated in the Environment Act, 1995. The Air Quality Strategy provides a framework for air quality control through air quality management and air quality standards. These and other air quality standards[1] and their objectives[2] have been enacted through the Air Quality Regulations in 1997 and 2000 and the Air Quality (Amendment) Regulations 2002. The Environment Act 1995 requires Local Authorities to undertake an air quality review. In areas where the air quality objective is not anticipated to be met, Local Authorities are required to establish Air Quality Management Areas to improve air quality.

The intention is that local authorities should only undertake a level of assessment that is appropriate with the risk of air quality objectives being exceeded. The first step in the second round of review and assessment is an Updating and Screening Assessment (USA), which is to be undertaken by all authorities. Where the USA has identified a risk that an air quality objective will be exceeded , the authority is required to undertake a detailed assessment.

This report is a Detailed air quality review for Suffolk Coastal District Council (SCDC). Only nitrogen dioxide and particles (PM_{10}) are considered in this report. This report investigates current and potential future nitrogen dioxide and PM_{10} levels through an examination of the location and size of principal traffic emission sources, emissions modelling exercises and by reference to monitored air quality data.

As part of this report, detailed modelling using ADMS version 3.1 has been undertaken at the following locations:

- Melton junction
- Woodbridge junction

Nitrogen Dioxide

In this report model runs have been carried out using the most recent set of emission factors for road vehicles. The model results have been adjusted to take account of model bias.

Consideration has been given to the possibility of designating Air Quality Management Areas at the locations assessed. Factors to be taken into account include:

- the likelihood that members of the public will be exposed over the relevant averaging time;
- the likelihood that the objective will be met;

The results of the model validation, (which takes into account uncertainty based on model errors and year to year variability) suggests that only areas within the 40 $\mu g\ m^{-3}$ contour will "probably" exceed and only areas within the 47 $\mu g\ m^{-3}$ contour are likely to exceed the objective in 2005. It would be recommended that SCDC only considered declaring an AQMA where the probability of exceedance in 2005 is greater than 50%.

The modelling results showed that it is ***unlikely*** (with a probability between 5% and 20%) that an exceedence of the annual objective would occur at either the Melton or Woodbridge Junctions in 2005. However, diffusion tubes exposed on Melton Hill show an exceedence of the annual mean NO_2 objective. This may be the result of a street canyon effect. It is recommended that further

[1] Refers to standards recommended by the Expert Panel on Air Quality Standards. Recommended standards are set purely with regard to scientific and medical evidence on the effects of the particular pollutants on health, at levels at which risks to public health, including vulnerable groups, are very small or regarded as negligible.
[2] Refers to objectives in the Strategy for each of the eight pollutants. The objectives provide policy targets by outlining what should be achieved in the light of the air quality standards and other relevant factors and are expressed as a given ambient concentration to be achieved within a given timescale.

monitoring is carried out at building façades at a number of locations on both sides of the street for a period of 12 months. Suffolk Coastal District Council should consider declaring an air quality management area in 12 months time if the results of the monitoring campaign at this junction show that the annual mean NO_2 objective will not be met.

It is recommended that Suffolk Coastal District Council do not consider declaring an AQMA for nitrogen dioxide from road transport at either the Melton or Woodbridge Junctions.

PM_{10}

In this report model runs have been carried out using the most recent set of emission factors for road vehicles. Due to their being no PM_{10} monitoring at either the Melton or Woodbridge Junctions, the model results have not been corrected for bias. The results are presented in terms of the daily mean PM10 concentration as this is the most stringent of the 2004 objectives.

Consideration has been given to the possibility of designating Air Quality Management Areas at the locations assessed. Factors to be taken into account include:

- the likelihood that members of the public will be exposed over the relevant averaging time;
- the likelihood that the objective will be met;

The results of our model validation, (which takes into account uncertainty based on model errors and year to year variability) suggests that only areas within the 50 $\mu g\ m^{-3}$ contour are more likely than not to exceed the 24 hour objective in 2004. It would be recommended that SCDC only considered declaring an AQMA where the probability of exceedance in 2004 is greater than 50%.

The modelling results showed that it is ***very unlikely*** (with a probability less than 5%) that an exceedence of the 24 hour PM_{10} objective could occur at either the Melton or Woodbridge Junctions.

It is recommeded that Suffolk Coastal District Council do not consider declaring an AQMA for PM_{10} from road transport at either the Melton or Woodbridge Junctions.

Maps reproduced within this document

Acronyms and definitions

AADTF	annual average daily traffic flow
ADMS	an atmospheric dispersion model
AQDD	Common Position on Air Quality Daughter Directives
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
AURN	Automatic Urban and Rural Network
CNS	central nervous system
d.f.	degrees of freedom
DEFRA	Department for the Environment, Food and Rural Affairs
DETR	Department of the Environment, Transport and the Regions
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
EPA	Environmental Protection Act
EPAQS	Expert Panel on Air Quality Standards
GIS	Geospatial Information System
kerbside	0 to 5 m from the kerb
n	number of pairs of data
NAEI	National Atmospheric Emission Inventory
NAQS	National Air Quality Strategy (now called the Air Quality Strategy)
NETCEN	National Environmental Technology Centre
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
NRTF	National Road Traffic Forecast
ppb	parts per billion
r	the correlation coefficient
roadside	1 to 5 m from the kerb
SCDC	Suffolk Coastal District Council
SD	standard deviation
TEMPRO	A piece of software produced by the DETR used to forecast traffic flow increases

Contents

1 Introduction

1.1 PURPOSE OF THE STUDY

Suffolk Coastal District Council (SCDC) has commissioned Netcen to undertake a Detailed assessment for nitrogen dioxide and PM_{10} around the Melton and Woodbridge junctions.

1.2 GENERAL APPROACH TAKEN

The approach taken in this study was to:

- Collect and interpret additional data to support the detailed assessment, including detailed traffic flow data around the Melton and Woodbridge Junctions;
- Utilise the monitoring data from the Council's monitoring campaign to assess the ambient concentrations produced by the road traffic and to validate the output of the modelling studies;
- Model the concentrations of NO_2 and PM_{10} around the selected roads, concentrating on the locations (receptors) where people might be exposed over the relevant averaging times of the air quality objectives;
- Present the concentrations as contour plots of concentrations and assess the uncertainty in the predicted concentrations.

1.3 VERSION OF THE POLLUTANT SPECIFIC GUIDANCE USED IN THIS ASSESSMENT

This report has used the latest guidance in LAQM.TG(03), published in February 2003.

1.4 NUMBERING OF FIGURES AND TABLES

The numbering scheme is not sequential, and the figures and tables are numbered according to the chapter and section that they relate to.

1.5 UNITS OF CONCENTRATION

The units throughout this report are presented in $\mu g\ m^{-3}$ (which is consistent with the presentation of the new AQS objectives), unless otherwise noted.

1.6 STRUCTURE OF THE REPORT

This document is a detailed Air Quality review for Suffolk Coastal District Council for nitrogen dioxide and particles (PM_{10}). This chapter, Chapter 1 has summarised the need for the work and the approach to completing the study.

Chapter 2 of the report describes developments in the UK's Air Quality Strategy (AQS). In addition, it discusses when implementation of an AQMA is required.

Chapter 3 contains details of the information used to conduct the Detailed Assessment for Suffolk Coastal District Council.

Chapter 4 introduces the latest standards and objectives for nitrogen dioxide and summarises the monitoring of NO_2 that has taken place in Suffolk Coastal in the areas of concern.

Chapter 5 introduces the latest standards and objectives for particulates (PM_{10}).

Chapter 6 describes the results of the assessment and discusses whether the nitrogen dioxide and PM_{10} objectives will be exceeded in Suffolk Coastal in 2004/5. The results of the analysis are displayed in tabular form and as contour plots.

2 The updated Air Quality Strategy

2.1 THE NEED FOR AN AIR QUALITY STRATEGY

The Government published its proposals for review of the National Air Quality Strategy in early 1999 (DETR, 1999). These proposals included revised objectives for many of the regulated pollutants. A key factor in the proposals to revise the objectives was the agreement in June 1998 at the European Union Environment Council of a Common Position on Air Quality Daughter Directives (AQDD).

Following consultation on the Review of the National Air Quality Strategy, the Government prepared the Air Quality Strategy for England, Scotland, Wales and Northern Ireland for consultation in August 1999. It was published in January 2000 (DETR, 2000).

The Environment Act (1995) provides the legal framework for requiring LA's to review air quality and for implementation of an AQMA. The main constituents of this Act are summarised in Table 2.1 below.

Table 2.1 Major elements of the Environment Act 1995

Part IV Air Quality	Commentary
Section 80	Obliges the Secretary of State (SoS) to publish a National Air Quality Strategy as soon as possible.
Section 81	Obliges the Environment Agency to take account of the strategy.
Section 82	Requires local authorities, any unitary or Borough, to review air quality and to assess whether the air quality standards and objectives are being achieved. Areas where standards fall short must be identified.
Section 83	Requires a local authority, for any area where air quality standards are not being met, to issue an order designating it an air quality management area (AQMA).
Section 84	Imposes duties on a local authority with respect to AQMAs. The local authority must carry out further assessments and draw up an action plan specifying the measures to be carried out and the timescale to bring air quality in the area back within limits.
Section 85	Gives reserve powers to cause assessments to be made in any area and to give instructions to a local authority to take specified actions. Authorities have a duty to comply with these instructions.
Section 86	Provides for the role of County Councils to make recommendations to a district on the carrying out of an air quality assessment and the preparation of an action plan.
Section 87	Provides the SoS with wide ranging powers to make regulations concerning air quality. These include standards and objectives, the conferring of powers and duties, the prohibition and restriction of certain activities or vehicles, the obtaining of information, the levying of fines and penalties, the hearing of appeals and other criteria. The regulations must be approved by affirmative resolution of both Houses of Parliament.
Section 88	Provides powers to make guidance which local authorities must have regard to.

2.2 OVERVIEW OF THE PRINCIPLES AND MAIN ELEMENTS OF THE NATIONAL AIR QUALITY STRATEGY

The main elements of the AQS can be summarised as follows:

- The use of a health effects based approach using national air quality standards and objectives.
- The use of policies by which the objectives can be achieved and which include the input of important actors such as industry, transportation bodies and local authorities.
- The predetermination of timescales with a target dates of 2003, 2004, 2005, 2008 and 2010 for the achievement of objectives and a commitment to review the Strategy every three years.

It is intended that the AQS will provide a framework for the improvement of air quality that is both clear and workable. In order to achieve this, the Strategy is based on several principles which include:

- the provision of a statement of the Government's general aims regarding air quality;
- clear and measurable targets;
- a balance between local and national action and
- a transparent and flexible framework.

Co-operation and participation by different economic and governmental sectors is also encouraged within the context of existing and potential future international policy commitments.

2.2.1 National Air Quality Standards

At the centre of the AQS is the use of national air quality standards to enable air quality to be measured and assessed. These also provide the means by which objectives and timescales for the achievement of objectives can be set. Most of the proposed standards have been based on the available information concerning the health effects resulting from different ambient concentrations of selected pollutants and are the consensus view of medical experts on the Expert Panel on Air Quality Standards (EPAQS). These standards and associated specific objectives to be achieved between 2003 and 2010 are shown in Table 2.2. The table shows the standards in ppb and $\mu g\ m^{-3}$ with the number of exceedences that are permitted (where applicable) and the equivalent percentile.

Specific objectives relate either to achieving the full standard or, where use has been made of a short averaging period, objectives are sometimes expressed in terms of percentile compliance. The use of percentiles means that a limited number of exceedences of the air quality standard over a particular timescale, usually a year, are permitted. This is to account for unusual meteorological conditions or particular events such as November 5th. For example, if an objective is to be complied with at the 99.9th percentile, then 99.9% of measurements at each location must be at or below the level specified.

Table 2.2 Air Quality Objectives in the Air Quality Regulations (2000) and (Amendment) Regulations 2002 for the purpose of Local Air Quality Management.

Pollutant	Concentration limits		**Averaging period**	**Objective** [number of permitted exceedences a year and equivalent percentile]	
	($\mu g\ m^{-3}$)	(ppb)		(**$\mu g\ m^{-3}$**)	date for objective
Benzene	16.25	5	**running annual** mean	**16.25**	by 31.12.2003
	5	1.5	**Annual mean**	**5**	by 31.12.2010
1,3-butadiene	2.25	1	**running annual** mean	**2.25**	by 31.12.2003
CO	10,000	8,600	**running 8-hour** mean	**10,000**	by 31.12.2003
Pb	0.5	-	**annual** mean	**0.5**	by 31.12.2004
	0.25	-	**annual** mean	**0.25**	by 31.12.2008
NO_2 (see note)	200	105	**1 hour** mean	**200** [maximum of 18 exceedences a year or equivalent to the 99.8th percentile]	by 31.12.2005
	40	21	**annual** mean	**40**	by 31.12.2005
PM_{10} gravimetric (see note)	50	-	**24-hour** mean	**50** [maximum of 35 exceedences a year or ~ equivalent to the 90th percentile]	by 31.12.2004
	40	-	**annual** mean	**40**	by 31.12.2004
SO_2	266	100	**15 minute** mean	**266** [maximum of 35 exceedences a year or equivalent to the 99.9th percentile]	by 31.12.2005
	350	132	**1 hour** mean	**350** [maximum of 24 exceedences a year or equivalent to the 99.7th percentile]	by 31.12.2004
	125	47	**24 hour** mean	**125** [maximum of 3 exceedences a year or equivalent to the 99th percentile]	by 31.12.2004

Notes

1. Conversions of ppb and ppm to ($\mu g\ m^{-3}$) correct at 20°C and 1013 mb.
2. The objectives for nitrogen dioxide are provisional.

PM_{10} measured using the European gravimetric transfer standard or equivalent.

2.2.2 Relationship between the UK National Air Quality Standards and EU air quality Limit Values

As a member state of the EU, the UK must comply with EU Directives.

There are three EU ambient air quality directives that the UK has transposed in to UK law. These are:

- **96/62/EC** Council Directive of 27 September 1996 on ambient air quality assessment and management. (the Ambient Air Framework Directive)
- **1999/30/EC** Council Directive of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide, oxides of nitrogen, particulate matter and lead in ambient air. (the First Daughter Directive)
- **2000/69/EC** Directive of the European Parliament and the Council of 16 Nov 2000 relating to limit values for benzene and carbon monoxide in ambient air. (the Second Daughter Directive)

The first and second daughter directives contain air quality Limit Values for the pollutants that are listed in the directives. The United Kingdom (i.e. Great Britain and Northern Ireland) must comply with these Limit Values. The UK air quality strategy should allow the UK to comply with the EU Air Quality Daughter Directives, but the UK air quality strategy also includes some stricter national objectives for some pollutants, for example, the 15-minute sulphur dioxide objective.

The Government is ultimately responsibility for achieving the EU limit values. However, it is important that Local Air Quality Management is used as a tool to ensure that the necessary action is taken at local level to work towards achieving the EU limit values by the dates specified in those EU Directives.

2.2.3 New particle objectives (not included in Regulations[3])

For particulates (as PM10) new objectives are proposed.

- For all parts of the UK, except London and Scotland, a 24 hour mean of 50 $\mu g/m^3$ not to be exceeded more than 7 times a year and an annual mean of 20 $\mu g/m^3$, both to be achieved by the end of 2010;
- For London, a 24 hour mean of 50 $\mu g/m^3$ not to be exceeded more than 10 times a year and an annual mean of 23 $\mu g/m^3$, both to be achieved by the end of 2010;
- For scotland, a 24 hour mean of 50 $\mu g/m^3$ not to be exceeded more than 7 times a year and an annual mean of 18 $\mu g/m^3$, both to be achieved by the end of 2010.

2.2.4 Policies in place to allow the objectives for the pollutants in AQS to be achieved

The policy framework to allow these objectives to be achieved is one that that takes a local air quality management approach. This is superimposed upon existing national and international regulations in order to effectively tackle local air quality issues as well as issues relating to wider spatial scales. National and EC policies that already exist provide a good basis for progress towards the air quality objectives set for 2003 to 2008. For example, the Environmental Protection Act 1990 allows for the monitoring and control of emissions from industrial processes and various EC Directives have ensured that road transport emission and fuel standards are in place. These policies are being developed to include more stringent controls. Recent developments in the UK include the announcement by the Environment Agency in January 2000 on controls on emissions of SO_2 from coal and oil fired power stations. This system of controls means that by the end of 2005 coal and oil fired power stations will meet the air quality standards set out in the AQS.

Local air quality management provides a strategic role for local authorities in response to particular air quality problems experienced at a local level. This builds upon current air quality control responsibilities and places an emphasis on bringing together issues relating to transport, waste,

[3] The exception is the Scottish Executive which has incorporated the new PM10 objectives in their Regulations.

energy and planning in an integrated way. This integrated approach involves a number of different aspects. It includes the development of an appropriate local framework that allows air quality issues to be considered alongside other issues relating to polluting activity. It should also enable co-operation with and participation by the general public in addition to other transport, industrial and governmental authorities.

An important part of the Strategy is the requirement for local authorities to carry out air quality reviews and assessments of their area against which current and future compliance with air quality standards can be measured. Over the longer term, these will also enable the effects of policies to be studied and therefore help in the development of future policy. The Government has prepared guidance to help local authorities to use the most appropriate tools and methods for conducting a review and assessment of air quality in their District. This is part of a package of guidance being prepared to assist with the practicalities of implementing the AQS. Other guidance covers air quality and land use planning, air quality and traffic management and the development of local air quality action plans and strategies.

2.2.5 Timescales to achieve the objectives

In most local authorities in the UK, objectives will be met for most of the pollutants within the timescale of the objectives shown in Table 2.2. It is important to note that the objectives for NO_2 remain provisional. The Government has recognised the problems associated with achieving the standard for ozone and this will not therefore be a statutory requirement. Ozone is a secondary pollutant and transboundary in nature and it is recognised that local authorities themselves can exert little influence on concentrations when they are the result of regional primary emission patterns.

2.3 AIR QUALITY REVIEWS

A range of Technical Guidance has been issued to enable air quality to be monitored, modelled, reviewed and assessed in an appropriate and consistent fashion. This includes LAQM.TG(03), on 'Local Air Quality Management: Technical Guidance, February 2003. This review and assessment has considered the procedures set out in the guidance.

The primary objective of undertaking a review of air quality is to identify any areas that are unlikely to meet national air quality objectives and ensure that air quality is considered in local authority decision making processes. The complexity and detail required in a review depends on the risk of failing to achieve air quality objectives and it has been proposed in the second round that reviews should be carried out in two stages. Every authority is expected to undertake at least a first stage Updating and screening Assessment (USA) of air quality in their authority area. Where the USA has identified a risk than an air quality objective will be exceeded at a location with relevant public exposure, the authority will be required to undertake a detailed assessment. The Stages are briefly described in the following table, Table 2.3.

Table 2.3: The phased approach to review and assessment.

Level of assessment	Objective	Approach
Updating and screening assessment (USA)	To identify those matters that have changed since the last review and assessment, which might lead to a risk of the air quality objective being exceeded.	Use a check list to identify significant changes that require further consideration. Where such changes are identified, apply simple screening tools to decide whether there is sufficient risk of an exceedence of an objective to justify a detailed assessment
Detailed assessment	To provide an accurate assessment of the likelihood of an air quality objective being exceeded at locations with relevant exposure. This should be sufficiently detailed to allow the designation or amendment or any necessary AQMAs.	Use quality-assured monitoring and validated modelling methods to determine current and future pollutant concentrations in areas where there is a significant risk of exceeding an air quality objective.

2.4 LOCATIONS THAT THE REVIEW AND ASSESSMENT MUST CONCENTRATE ON

For the purpose of review and assessment, the authority should focus their work on locations where members of the public are likely to be exposed over the averaging period of the objective. Table 2.4 summarises the locations where the objectives should and should not apply.

Table 2.4 Typical locations where the objectives should and should not apply

Averaging Period	Pollutants	Objectives *should* apply at …	Objectives should *not* generally apply at …
Annual mean	• 1,3 Butadiene • Benzene • Lead • Nitrogen dioxide • Particulate Matter (PM_{10})	• All background locations where members of the public might be regularly exposed.	• Building facades of offices or other places of work where members of the public do not have regular access.
		• Building facades of residential properties, schools, hospitals, libraries etc.	• Gardens of residential properties.
			• Kerbside sites (as opposed to locations at the building facade), or any other location where public exposure is expected to be short term
24 hour mean and 8-hour mean	• Carbon monoxide • Particulate Matter (PM_{10}) • Sulphur dioxide	• All locations where the annual mean objective would apply.	• Kerbside sites (as opposed to locations at the building facade), or any other location where public exposure is expected to be short term.
		• Gardens of residential properties.	

Table 2.4 (contd.) Typical locations where the objectives should and should not apply

Averaging Period	Pollutants	Objectives should apply at …	Objectives should generally not apply at …
1 hour mean	• Nitrogen dioxide • Sulphur dioxide	• All locations where the annual mean and 24 and 8-hour mean objectives apply.	• Kerbside sites where the public would not be expected to have regular access.
		• Kerbside sites (e.g. pavements of busy shopping streets).	
		• Those parts of car parks and railway stations etc. which are not fully enclosed.	
		• Any outdoor locations to which the public might reasonably expected to have access.	
15 minute mean	• Sulphur dioxide	• All locations where members of the public might reasonably be exposed for a period of 15 minutes or longer.	

It is unnecessary to consider exceedences of the objectives at any location where public exposure over the relevant averaging period would be unrealistic, and the locations should represent non-occupational exposure.

Key Points

- The Environment Act 1995 has required the development of a National Air Quality Strategy for the control of air quality.
- A central element in the Strategy is the use of air quality standards and associated objectives based on human health effects that have been included in the Air Quality Regulations.
- The Strategy uses a local air quality management approach in addition to existing national and international legislation. It promotes an integrated approach to air quality control by the various actors and agencies involved.
- Air quality objectives, with the exception of ozone, are to be achieved by specified dates up to the end of 2010.
- A number of air quality reviews are required in order to assess compliance with air quality objectives. The number of reviews necessary depends on the likelihood of achieving the objectives.

3 Information used to support this assessment

This Chapter presents the information used to support this review and assessment.

3.1 MAPS

Suffolk Coastal District Council provided GIS maps of the two road junctions to be modelled. This enabled accurate road widths and the distance of the housing to the kerb to be determined.

3.2 ROAD TRAFFIC DATA

3.2.1 Average flow, hourly fluctuations in flow, speed and fraction of HDV's.

Traffic count data were provided by SCDC for the roads of concern. To determine the hourly fluctuations in traffic flow the DETR's diurnal traffic variation default figures were used (DETR 1999b).

Data on the percentage of HDVs in the traffic and free flowing traffic speeds were available from traffic counts.

Appendix 1 provides details of the information.

3.2.2 Traffic Growth

The traffic counts provided by SCDC were made in 2002. These have been converted to 2004/5 figures using the Defra's TEMPRO traffic flow forecasts provided by SCDC. Tempro provides regional traffic growth statistics. In addition, traffic growth due to housing and commercial developments have been provided by SCDC. Details of TEMPRO and the predicted flows in Suffolk Coastal in 2004/5 are given in Appendix 1.

3.3 METEOROLOGICAL DATA USED IN THE DISPERSION MODELLING

Hourly data for Wattisham was obtained for 2002 from the Meteorological Office for input into the ADMS v3.1 dispersion model.

3.4 AMBIENT MONITORING

3.4.1 Nitrogen dioxide

Nitrogen dioxide concentrations were monitored:

- By diffusion tubes. In 2002 there were diffusion tubes exposed at 4 locations in Melton and at 3 locations in Woodbridge. To provide a reasonable estimate of the annual mean concentration, concentrations for at least 6 months of the year are needed. Therefore, annual means have not been presented where there are less than 6 months of data.

- By continuous monitoring since February 2002 at the Melton Junction

Details of the type, locations, and concentrations recorded by the monitors (diffusion tubes and continuous monitors) are given in Appendix 2.

3.4.2 Particulates (PM_{10})

No monitoring of PM_{10} has taken place at either the Melton or Woodbridge Junctions.

4 Nitrogen dioxide

4.1 INTRODUCTION

Nitrogen oxides are formed during high temperature combustion processes from the oxidation of nitrogen in the air or fuel. The principal source of nitrogen oxides, nitric oxide (NO) and nitrogen dioxide (NO_2), collectively known as NO_x, is road traffic, which is responsible for approximately half the emissions in Europe. NO and NO_2 concentrations are therefore greatest in urban areas where traffic is heaviest. Other important sources are power stations, heating plant and industrial processes.

Nitrogen oxides are released into the atmosphere mainly in the form of NO, which is then readily oxidised to NO_2 by reaction with ozone. Elevated levels of NO_x occur in urban environments under stable meteorological conditions, when the air mass is unable to disperse.

Nitrogen dioxide has a variety of environmental and health impacts. It is a respiratory irritant, may exacerbate asthma and possibly increase susceptibility to infections. In the presence of sunlight, it reacts with hydrocarbons to produce photochemical pollutants such as ozone. In addition, nitrogen oxides have a lifetime of approximately 1-day with respect to conversion to nitric acid. This nitric acid is in turn removed from the atmosphere by direct deposition to the ground, or transfer to aqueous droplets (e.g. cloud or rainwater), thereby contributing to acid deposition.

4.2 LATEST STANDARDS AND OBJECTIVES FOR NITROGEN DIOXIDE

The National Air Quality Regulations (1997), set two provisional objectives to be achieved by 2005 for nitrogen dioxide:

- An annual average concentration of 40 $\mu g\ m^{-3}$ (21 ppb);
- A maximum hourly concentration of 286 $\mu g\ m^{-3}$ (150 ppb).

In June 1998, the Common Position on Air Quality Daughter Directives (AQDD) agreed at Environment Council included the following objectives to be achieved by 31 December 2005 for nitrogen dioxide:

- An annual average concentration of 40 $\mu g\ m^{-3}$ (21 ppb);
- 200 $\mu g\ m^{-3}$ (100 ppb) as an hourly average with a maximum of 18 exceedences in a year.

The National Air Quality Strategy was reviewed in 1999 (DETR, 1999). The Government proposed that the annual objective of 40 $\mu g\ m^{-3}$ be retained as a provisional objective and that the original hourly average be replaced with the AQDD objective. The revised Air Quality Strategy for England, Scotland, Wales and Northern Ireland (DETR, 1999; 2000) included the proposed changes.

The new hourly objective is slightly more stringent than the original hourly objective. Modelling studies suggest that in general achieving the annual mean of 40 $\mu g\ m^{-3}$ is more demanding than achieving either the former or current hourly objective. If the annual mean is achieved, the modelling suggests the hourly objectives will also be achieved.

4.3 THE NATIONAL PERSPECTIVE

The main source of NO_x in the United Kingdom is road transport, which, in 2000 accounted for approximately 42% of emissions. Power generation contributed approximately 29% and domestic

sources 5%. In urban areas, the proportion of local emissions due to road transport sources is larger (NAEI, 2000).

National measures are expected to produce reductions in NO_x emissions and achieve the objectives for NO_2 in many parts of the country. However, the results of the analysis set out in the National Air Quality Strategy suggest that for NO_2 a reduction in NO_x emissions over and above that achievable by national measures will be required to ensure that air quality objectives are achieved everywhere by the end of 2005. Local authorities with major roads, or highly congested roads, which have the potential to result in elevated levels of NO_2 in relevant locations, are expected to identify a need to progress to a detailed assessment for this pollutant.

4.4 SUMMARY OF AIR QUALITY REVIEW (ROUND 1)

The results of the SCDC Stage 3 air quality review and assessment suggested that there was no significant risk of exceedences of the annual mean or hourly NO_2 objective at relevant receptors adjacent to the Melton and Woodbridge Junctions. Suffolk Coastal did not declare an air quality management area.

4.5 MONITORING DATA

Nitrogen dioxide concentrations were monitored at one site within Suffolk Coastal by continuous monitoring and by diffusion tubes at further sites.

4.5.1 Continuous monitoring

Location of the continuous monitor

Nitrogen dioxide has been measured by ozone chemiluminescence since February 2002 at a site (OS Grid Reference 628146, 250420) adjacent to the Melton Junction.

Measurement technique and QA/QC

Ozone chemiluminescence is the reference method specified by the EC NO_2 Directives. Calibration methods employed included primary calibration by permeation tube, gravimetric cylinder and static dilution and transfer calibration by cylinder audit during a fortnightly site visit. The expected accuracy of the method for nitrogen dioxide is ±10-11% with a precision of ±3.5 ppb. Netcen undertook installation of the equipment, site audits, checking of calibration data and quality control and scaling of the real-time results.

Summary statistics

Table 4.5 shows the daily average measured concentrations throughout the latest year of monitoring. The average concentration for the Melton site is below the annual objective for nitrogen dioxide. The original values in ppb have been converted to $\mu g\ m^{-3}$ using a factor of 1.91.

Table 4.5 Summary of continuous nitrogen dioxide ratified data from February 22nd 2002 to February 10th 2003.

	Concentration, $\mu g\ m^{-3}$	
	Nitrogen dioxide	Oxides of nitrogen
Average	32.5	74.5
Maximum daily	59	229
Data capture	94.9%	94.9

4.5.2 Diffusion tubes

Monthly average concentrations of nitrogen dioxide are measured by diffusion tubes at 4 locations in Melton and at 3 locations in Woodbridge. The measurement data for 2002 is summarised in Table 4.5.2A & B below. Appendix 2 provides data for other years where available and a breakdown on a monthly basis.

Diffusion tubes can under or over-read and if possible should be referred to the results of continuous monitoring. This may be done in two ways: either by using results from tubes co-located with a continuous analyser or by using the results of the UK National Diffusion Tube Survey Field Intercomparison Exercise. Three diffusion tubes have been co-located with the continuous monitor in Melton since March 2002. The diffusion tubes exposed at this site recorded an average concentration of 36 $\mu g/m^3$ in 2002 whereas the continuous monitor recorded an average concentration of 32.5 $\mu g/m^3$ over the same time period. This provides a bias adjustment factor of 0.9. The diffusion tube results have been multiplied by this adjustment factor.

It should be taken into account that diffusion tubes are spot measurements and may be very sensitive to distance from the road as concentrations change rapidly with distance from the road when comparing them with modelled results.

To predict the diffusion tube concentrations at roadside sites in 2005 from the 2002 results a factor of 0.92 as provided in Box 6.6 TG(03) has been used. For background sites a factor of 0.933 has been used as provided in Box 6.7 in TG(03).

Table 4.5.2A Nitrogen dioxide diffusion tube survey 2002 results for Melton corrected for co-located bias and predictions for 2005 ($\mu g/m^3$).

Site	Location	Annual average 2002 uncorrected for bias	Annual average 2002 corrected for bias	Predicted conc. In 2005 ($\mu g/m^3$)
MEL 2 (UB)	Hall Farm Rd	19	17	16
Average MEL 3 A,B,C (R)	Wilford Bridge Rd	52.5	47	43
Average MEL 4 A,B,C (R)	Woods Lane	41.3	37	34
Average MEL 5 A,B,C (R)	The Street	36.1	32	30

Note: UB - urban background site
R = roadside
Site MEL 3,4 & 5 are triplicate sites. Mel 5 is co-located with the continuous monitor. Site MEL3 has now been discontinued.

Table 4.5.2B Nitrogen dioxide diffusion tube survey 2002 results for Woodbridge corrected for co-located bias and predictions for 2005 ($\mu g/m^3$).

Site	Location	Annual average 2002 uncorrected for bias	Annual average 2002 corrected for bias	Predicted conc. In 2005 ($\mu g/m^3$)
Average WBG 1 A,B,C (R)	Melton Hill	57.7	52	48
WBG 3 (UB)	Kingston Farm Rd	23.1	21	19
Average WBG 5 A,B,C (R)	Suffolk Place, Lime Kiln Quay Rd	39.2	35	32

Note: UB - urban background
R - roadside
WBG 1 & 5 are triplicate sites.

4.5.3 Comparison of monitoring data with AQ objectives

The continuous monitoring shows that the nitrogen dioxide concentrations at the Melton Junction site are below the annual mean NO_2 objective.

Three diffusion tubes have been co-located with the continuous monitor at the Melton junction site. Therefore co-located bias has been used to correct the diffusion tubes at the sites of concern. MEL 2, MEL 4 and MEL 5 do not show an exceedence of the annual mean NO_2 objective. However, MEL 3 located on Wilford Bridge Road is predicted to record an annual average NO_2 concentration of 43 $\mu g/m^3$ in 2005. This site is a kerbside site and does not represent relevant exposure and has now been discontinued.

Concentrations recorded by diffusion tubes in Woodbridge at WBG3 and WBG 5 do not show an exceedence of the objective when corrected for co-lcoated bias. However, concentrations at WBG 1 - the Thoroughfare are predicted to exceed the annual mean NO_2 objective in 2005. All three tubes displayed high concentrations throughout the year 2002. The tubes are located less than 1 metre from the kerb at relevant receptor locations. The vehicle flow on Melton Hill is less than 11,000 vehicles per day in 2002 and the nearby Lime Kiln Quay Road is estimated to have less than 10,500 vehicles travelling on it a day. The concentrations recorded by the diffusion tubes are therefore unexpectedly high for the traffic flow. On consultation with Suffolk Coastal District Council it has been suggested that the high concentrations may result from a street canyon effect. The Local Authority has visually inspected the area for previously unidentified sources of NOx and no obvious sources were found. There are no dispersion models specifically developed for predicting concentrations in street canyon environments. However, the screening model DMRB can be used. DMRB has therefore been run with the street canyon option so that the NO_2 concentrations expected in a street canyon with the vehicle flows experienced in Woodbridge can be assessed.

4.6 DMRB MODEL RUN

As outlined above, DMRB has been run to assess whether an exceedence of the annual mean NO_2 objective would be expected in a street canyon environment in Woodbridge. As suggested in TG(03), the contribution from roads has been doubled to take account of the street canyon environment.

Table 4.6. Annual mean NO_2 concentrations as predicted by DMRB at the Woodbridge junction in a street canyon environment.

Receptor location	Background concentration NOx ($\mu g/m^3$)	Background concentration NO_2 ($\mu g/m^3$)	Predicted total NO_2 concentration (roads + background) in 2002 ($\mu g/m^3$)	Predicted total NO_2 concentration (roads + background) in 2005 ($\mu g/m^3$)
House on Melton Hill near junction	29.6	20	50	45

The DMRB model run shows that in a street canyon environment, NO_2 concentrations at the Woodbridge junction could be in exceedence of the annual mean NO_2 objective. However, the concentrations predicted by DMRB are below that recorded by the diffusion tubes.

The dispersion in a street canyon depends on:

- The orientation of the street with respect to wind direction
- Wind speed
- The height of the buildings on either side of the street

- The variation in the height of the buildings
- Volume and speed of the traffic
- The distance from the roadside to the buildings
- Whether there are any gaps in buildings or road junctions along sections of the street
- Atmospheric conditions such as temperature.

In street canyons, the direction of the wind at street level is opposite to the flow above roof level. This usually causes higher pollutant concentrations on the leeward (up-wind) side of the street and lower concentrations on the windward (down-wind) side, which is the opposite of what is expected in flat terrain.

Where the gap in a street canyon is a road junction (as in Woodbridge, at Lime Kiln Quay Road), emissions from traffic can be carried into the canyon and the result can be higher concentrations at junctions.

It is recommended that additional monitoring by diffusion tubes is carried out for a period of 12 months at a number of locations on either side of Melton Hill (as recommended in TG(03)). If after 12 months, the diffusion tubes show an exceedence of the annual mean NO_2 objective, then SCDC should consider declaring an Air Quality Management Area.

5 PM10

5.1 INTRODUCTION

PM_{10} in the atmosphere arises from two main sources. The first is the direct emission of particulate matter into the atmosphere from a wide range of sources such as fuel combustion, surface erosion and wind blown dusts, for example from quarrying and construction sites. The second source is the formation of particulate matter in the atmosphere through the reactions of other pollutants such as sulphur dioxide, nitrogen oxides and ammonia to form solid sulphates and nitrates, as well as organic aerosols formed from the oxidation of VOCs. These are called secondary particulates.

The main source of PM_{10} in the UK is combustion in the residential sector, which contributed 41% of the total emissions in 2000. The next biggest source was road transport (18%) (NAEI, 2000).

5.2 LATEST STANDARDS AND OBJECTIVES FOR PM10

The government and the devolved administrations have adopted two air quality objectives for fine particles (PM_{10}), which are the equivalent to the EU Stage 1 limit values in the first Air Quality Daughter Directive. The objectives are:

- An annual mean of 40 $\mu g/m^3$.
- A 24 hour mean of 50 $\mu g/m^3$ not to be exceeded more than 35 days per year.

The EU has also set indicative limit values for PM_{10} which are to be achieved by 1st January 2010. These stage 2 limit values for England and Wales are considerably more stringent and are:

- For England and Wales (except London), a 24 hour mean of 50 $\mu g/m^3$ not to be exceeded more than 7 days per year and an annual mean of 20 $\mu g/m^3$ to be achieved by the end of 2010;
- For London, a 24 hour mean of 50 $\mu g/m^3$ not to be exceeded more than 10 days per year and an annual mean of 23$\mu g/m^3$ to be achieved by the end of 2010. An annual mean objective of 20$\mu g/m^3$ to be achieved by the end of 2015 has also been set.

The 24 hour objective is more stringent than the annual mean objective in 2004. However, the opposite is true in 2010, and the annual mean objective is more stringent than the 24 hour objective.

5.3 SUMMARY OF AIR QUALITY REVIEW (ROUND 1)

The results of the Stage 3 air quality review and assessment (NETCEN, 2001) suggested that there was no significant risk of exceedences of the annual mean or 24 hour mean PM_{10} objective at relevant receptors adjacent to the Melton and Woodbridge Junctions. Suffolk Coastal did not declare an air quality management area for PM_{10} from road traffic at these locations.

5.4 MONITORING OF PM10

No monitoring of PM_{10} has been carried out at either the Melton or Woodbridge Junctions.

6 Detailed modelling of NO_2 and PM_{10}

The locations at which detailed modelling was carried out (at the request of SCDC) are as follows:

- Melton Road Junction (cross-roads of the A1152 and B1438)
- Woodbridge Road Junction (the junction of the Lime Kiln Quay Road, the Thoroughfare and St. John's Street, Woodbridge).

These are further referred to in this report as the Melton junction and the Woodbridge junction.

Predictions of traffic flow in 2004 and 2005 were obtained from the TEMPRO database and were provided by Suffolk County Council. In addition, information was provided on traffic growth arising from planned developments at both the Melton and Woodbridge Junctions.
The following developments are planned:

- Annington devlopment;
- Rendlesham Enterprise Park and New Rendlesham development;
- St. Audry's development; and
- Deben Mill development

6.1 METEOROLOGICAL DATA

Hourly sequential meteorological data for the nearest suitable meteorological station, Wattisham was obtained from the Meteorological Office for 2002. The meteorological data provided information on wind speed and direction and the extent of cloud cover for each hour of 2002.

6.2 TRAFFIC MODELLING SUMMARY

In this study, the concentrations of NO_2 and PM10 at receptors close to junctions have been modelled.

The roads were defined as volume sources, 3m deep, and were broken up in to a series of adjoining segments. The length of these segments was dictated by the way in which the OS LandLine data was digitised and varied from one or two metres in length (where the road rapidly changed direction) to hundreds of metres in length (where the road was essentially straight). The OS LandLine data was used to provide the co-ordinates of the centre line of the road, and the road widths. Therefore, the position of the volume sources (here the roads) were accurate to within a few centimetres.

The NETCEN proprietary LADSUrban model has then been used to predict the NO_2 and PM10 levels at the Melton and Woodbridge Junctions. It has been specially developed for Review and Assessments by NETCEN. The model has made use of ADMS-3.1 to provide dispersion kernels over a grid. The model cannot accurately predict concentrations within street canyons due to the complex nature of dispersion in these environments. Please see Section 4.6

6.3 SOURCES OF BACKGROUND (NON-TRAFFIC) EMISSIONS DATA

Background concentration of oxides of nitrogen (NOx), nitrogen dioxide (NO_2) and particulates (PM_{10}) have been taken from the UK National Atmospheric Emissions Inventory (www.naei.org.uk) and scaled to the year of interest where necessary following the recommended procedure in LAQM. TG(03). The contribution from roads to the background concentrations has been omitted.

6.4 MODEL BIAS

The monitoring site at the Melton Junction site was used as a reference site: e.g. NO_2 model concentrations were adjusted by adding the difference between the modelled concentration at the monitoring site and the measured value on to the modelled values at other locations. The purpose of this adjustment was to ensure that the modelled concentrations equalled the measured values at the monitoring site. Table 6.4 shows the main elements of the calculation.

No bias adjustment has been carried out for PM_{10} as only NO_2 has been measured at the Melton Junction monitoring site.

Table 6.4 Main elements of the reference calculation for NO_2.

Element	NO_x concentration ($\mu g\ m^{-3}$)	Factor used	NO_2 concentration (1dp) ($\mu g\ m^{-3}$)	Source of factor or Model used
Measured concentration				
Measured concentration at the Melton Junction site (2002)			32.5	
Background concentration at the monitoring site (NOx)	29			NAEI
Background concentration at the monitoring site (NO2)			19.6	NAEI
Modelled contribution of traffic emissions at the Water St. site	27.6	Box 6.3 in TG(03)	7.1	LADSUrban
Model bias correction				
NO2 road plus NO2 background		=(7.1+19.6)	**26.6**	
Measured concentration at the Melton site (includes background & roads)			**32.5**	Monitoring data
Difference (bias in the model)		(32.5 – 26.6) =	**5.9**	Model under predicting at the Melton site

Notes : Totals may not necessarily agree with the sum of their components due to rounding.
Dp = decimal place

As recommended the model bias applied in 2004/5 has been multiplied by conversion factors provided in TG(03).

6.5 MODEL VALIDATION

Statistical techniques have been used to assess the likelihood that there will be an exceedence of the air quality objectives given the modelled concentration.
Confidence limits for the predicted concentrations were calculated based on the validation studies by applying statistical techniques based on Student's t distribution. The confidence limits took account of uncertainties resulting from:

- Model errors at the receptor site;
- Model errors at the reference site;
- Uncertainty resulting from year to year variations in atmospheric conditions.

The confidence limits have been used to estimate the likelihood of exceeding the objectives at locations close to the roads. The following descriptions have been assigned to levels of risk of exceeding the objectives.

It would be recommended that SCDC consider declaring an AQMA where the probability of exceedence in 2004/5 is greater than 50% ("Probable").

Table 6.5A: Uncertainties in the modelled concentrations for NO_2.

Description	Chance of exceeding objective	Modelled annual average concentrations, $\mu g/m^3$	
		Annual average objective	Hourly average objective
Very unlikely	Less than 5%	<27	<38
Unlikely	5-20%	27-33	38-52
Possible	20-50%	33-40	52-67
Probable	50-80%	40-47	67-82
Likely	80-95%	47-53	82-95
Very likely	More than 95%	>53	>95

The confidence limits for the 'probable' and 'likely' annual average and hourly objective concentrations have been set equal to those for 'possible' and 'unlikely', respectively. In reality, the intervals of concentration increase as the probability of exceeding the annual and hourly objective increases from 'unlikely' to 'likely'. The advantage to setting symmetrical concentration intervals is that the concentration contours on the maps become simpler to interpret. This is a mildly conservative approach to assessing the likelihood of exceedences of the NO_2 objectives since a greater geographical area will be included using the smaller confidence intervals.

A simple linear relationship can be used to predict the 99.8th hourly percentile concentration of NO_2 from the annual concentration: the 99.8th percentile is three times the annual mean at kerbside/roadside locations. Therefore, plots of the modelled annual mean NO_2 concentrations can be used to show exceedences of both the annual and hourly NO_2 objectives. However, the magnitude of the concentrations used to judge exceedences of the hourly objective need to be adjusted so they may be used directly with the plots of annual concentration. This has been performed by simply dividing the concentrations of the confidence limits by three.

Table 6.5B: Uncertainties in the modelled concentrations for PM_{10}.

Description	Chance of exceeding objective	90th percentile of 24 hour mean ($\mu g/m^3$)
Very unlikely	Less than 5%	< 36
Unlikely	5-20%	36 - 44
Possible	20-50%	44 - 50
Probable	50-80%	50 - 56
Likely	80-95%	56 - 64
Very likely	More than 95%	> 64

The above table provides the modelling uncertainty bands for the 90th percentile of the 24 hour mean PM_{10} objective. The 24 hour mean is the most stringent of the PM_{10} objectives in 2004 and therefore this has been used to show compliance with the PM10 objectives.

To convert annual average PM_{10} concentrations to an approximate figure for the 90th percentile of the 24 hour mean, the annual average concentration has been multiplied by 1.68 as recommended in the PSG (TG00).

6.6 RESULTS OF MODELLING

6.6.1 Melton Junction - NO_2

Figure 6.6.1A shows modelled nitrogen dioxide concentrations at the Melton Junction in 2002. The model predicts that the annual average objective for nitrogen dioxide is not exceeded anywhere at this junction.

Figure 6.6.1B shows modelled annual average concentrations for 2005. The model predicts that the annual average concentration will not exceed the standard of 40 $\mu g\ m^{-3}$ anywhere at this road junction. Table 6.6.1 below shows the risk of exceeding the objectives for nitrogen dioxide at the nearest houses to the area assessed. At most it is "unlikely" that the annual objective will be exceeded.

Table 6.6.1 Probability of exceeding the objectives for nitrogen dioxide in 2005 at the Melton Junction.

Location	Probability of exceedence, P	
	Annual average objective	99.8th %ile hourly average
Buildings adjacent to the Street.	5% <P< 20% Unlikely	P < 5% Very Unlikely
Buildings adjacent to the Woods Lane.	5% <P< 20% Unlikely	P < 5% Very Unlikely
Buildings adjacent to Wilford Bridge Road	5% <P< 20% Unlikely	P < 5% Very Unlikely
Buildings adjacent to Melton Road	5% <P< 20% Unlikely	P < 5% Very Unlikely

6.6.2 Melton Junction - PM_{10}

Please note that due to their being no PM_{10} monitoring data at the Melton Junction site, the model results have not been corrected for bias. However, even if the model was under predicting by 15 $\mu g/m^3$ there would still be no exceedence of the daily mean objective.

Figure 6.6.2A shows modelled 90th percentile daily mean PM_{10} concentrations at the Melton Junction in 2002. The model predicts that the daily mean objective for PM10 is not exceeded anywhere at this junction.

Figure 6.6.2B shows modelled 90th percentile daily mean PM_{10} concentrations for 2004. The model predicts that the objective will not be exceeded anywhere at this road junction. Table 6.6.2 below shows the risk of exceeding the objectives for PM_{10} at the nearest houses to the area assessed. At most it is "very unlikely" that the 2004 daily mean objective will be exceeded.

Table 6.6.2 Probability of exceeding the 24 hour objective for PM_{10} in 2004 at the Melton Junction.

Location	Probability of exceedence, P
Buildings adjacent to the Street.	P < 5% Very Unlikely
Buildings adjacent to the Woods Lane.	P < 5% Very Unlikely
Buildings adjacent to Wilford Bridge Road	P < 5% Very Unlikely
Buildings adjacent to Melton Road	P < 5% Very Unlikely

6.6.3 Woodbridge Junction - NO_2

Figure 6.6.3A shows modelled nitrogen dioxide concentrations around the Woodbridge Junctions for 2002. The model predicts that the annual average objective for nitrogen dioxide is not exceeded outside buildings close to the road.

Figures 6.6.3B shows modelled annual average concentrations for 2005. The model predicts that the annual average concentration will not exceed the standard of 40 $\mu g/m^3$ at any locations assessed. At most it is "unlikely" that the annual objective will be exceeded.

Table 6.6.3A Probability of exceeding the objectives for nitrogen dioxide in 2005 at the Woodbridge Junction.

Location	Probability of exceedence, P	
	Annual average objective	99.8th %ile hourly average
Buildings adjacent to Melton Hill	5% <P< 20% Unlikely	P < 5% Very Unlikely
Buildings adjacent to Lime Kiln Quay Road	5% <P< 20% Unlikely	P < 5% Very Unlikely
Buildings adjacent to St. John's Street	5% <P< 20% Unlikely	P < 5% Very Unlikely
Buildings adjacent to the Thoroughfare	5% <P< 20% Unlikely	P < 5% Very Unlikely

6.6.4 Woodbridge Junction - PM_{10}

Please note that due to their being no PM_{10} monitoring data at the Melton Junction site, the model results have not been corrected for bias.

Figure 6.6.4A shows modelled 90th percentile daily mean PM_{10} concentrations at the Woodbridge Junction in 2002. The model predicts that the daily mean objective for PM_{10} is not exceeded anywhere at this junction.

Figure 6.6.4B shows modelled 90th percentile daily mean PM_{10} concentrations for 2004. The model predicts that the objective will not be exceeded anywhere at this road junction. Table 6.6.4 below shows the risk of exceeding the objectives for PM_{10} at the nearest houses to the area assessed. At most it is “very unlikely” that the annual objective will be exceeded.

Table 6.6.4 Probability of exceeding the 24 hour objective for PM_{10} in 2004 at the Woodbridge Junction.

Location	Probability of exceedence, P
Buildings adjacent to Melton Hill	P < 5% Very Unlikely
Buildings adjacent to Lime Kiln Quay Road	P < 5% Very Unlikely
Buildings adjacent to St. John's Street	P < 5% Very Unlikely
Buildings adjacent to the Thoroughfare	P < 5% Very Unlikely

Figure 6.6.1A. Predicted annual mean nitrogen dioxide concentrations in Melton corrected for model bias in 2002.

Figure 6.6.1B. Predicted annual mean nitrogen dioxide concentrations in Melton corrected for model bias in 2005.

Figure 6.6.2A. Predicted 90th percentile daily mean PM10 concentrations uncorrected for model bias in Melton in 2002.

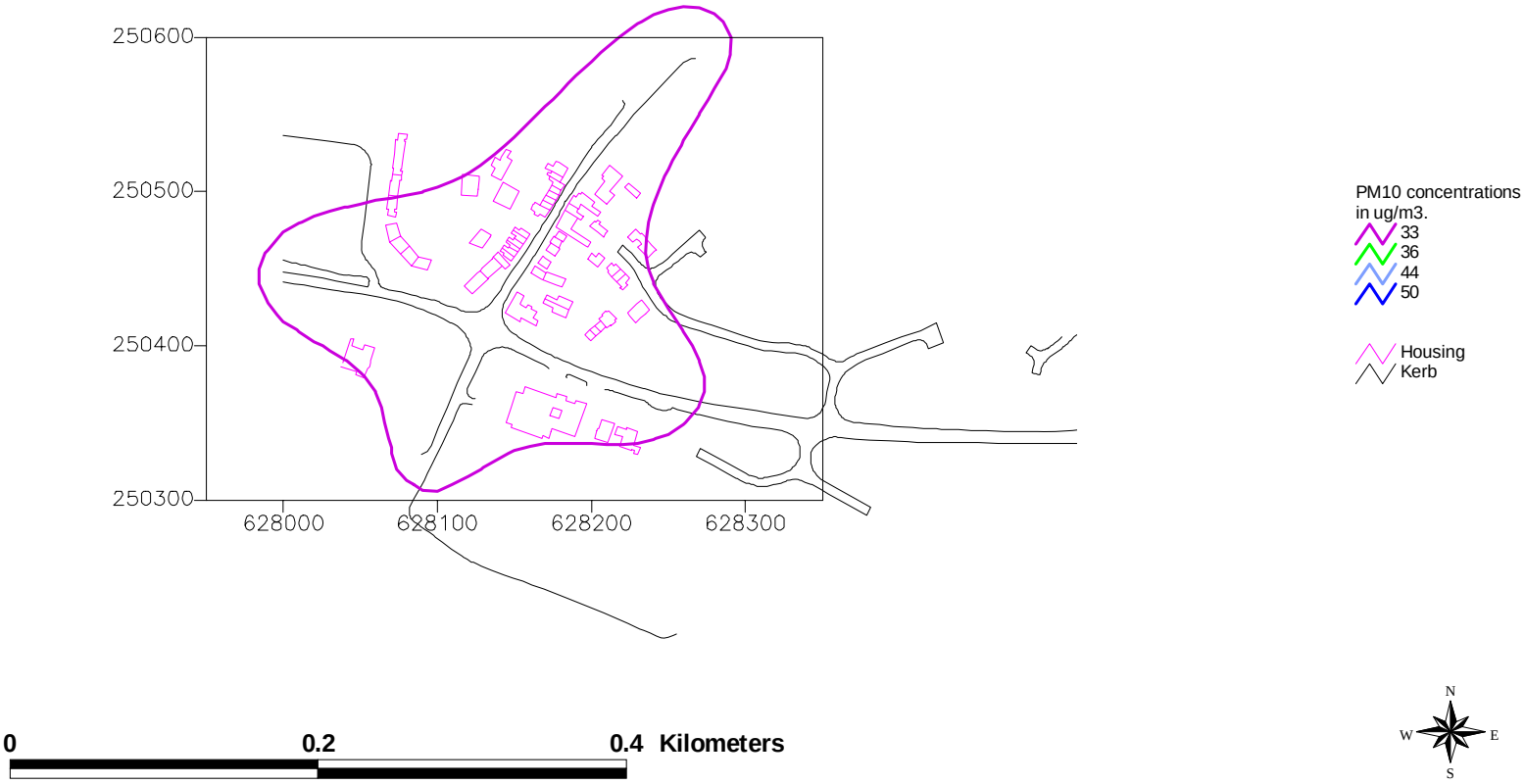


Figure 6.6.2B. Predicted 90th percentile daily mean PM10 concentrations uncorrected for model bias in Melton in 2004.

Figure 6.6.3A. Predicted annual mean nitrogen dioxide concentrations in Woodbridge corrected for model bias in 2002.

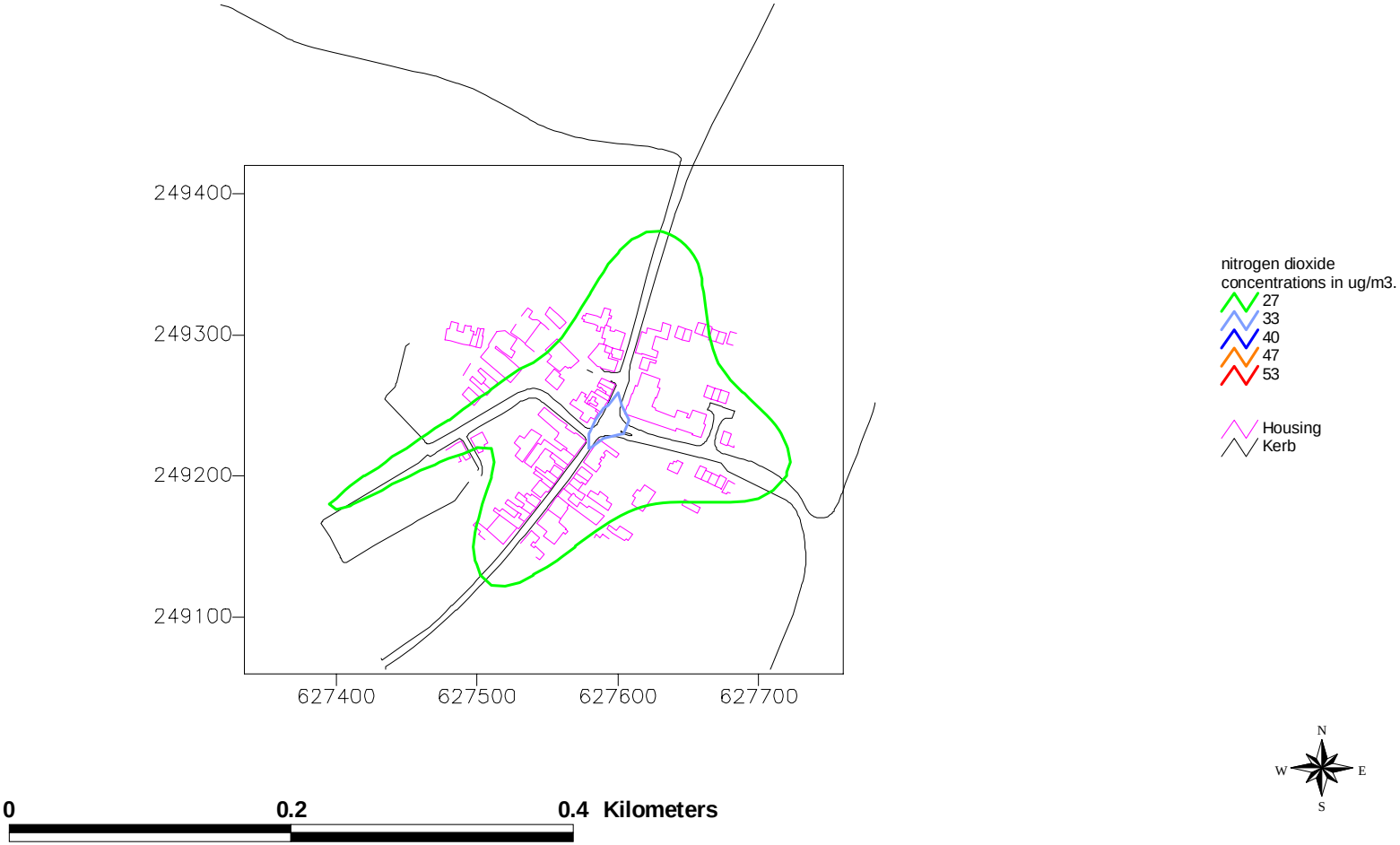


Figure 6.6.3B. Predicted annual mean nitrogen dioxide concentrations in Woodbridge corrected for model bias in 2005.

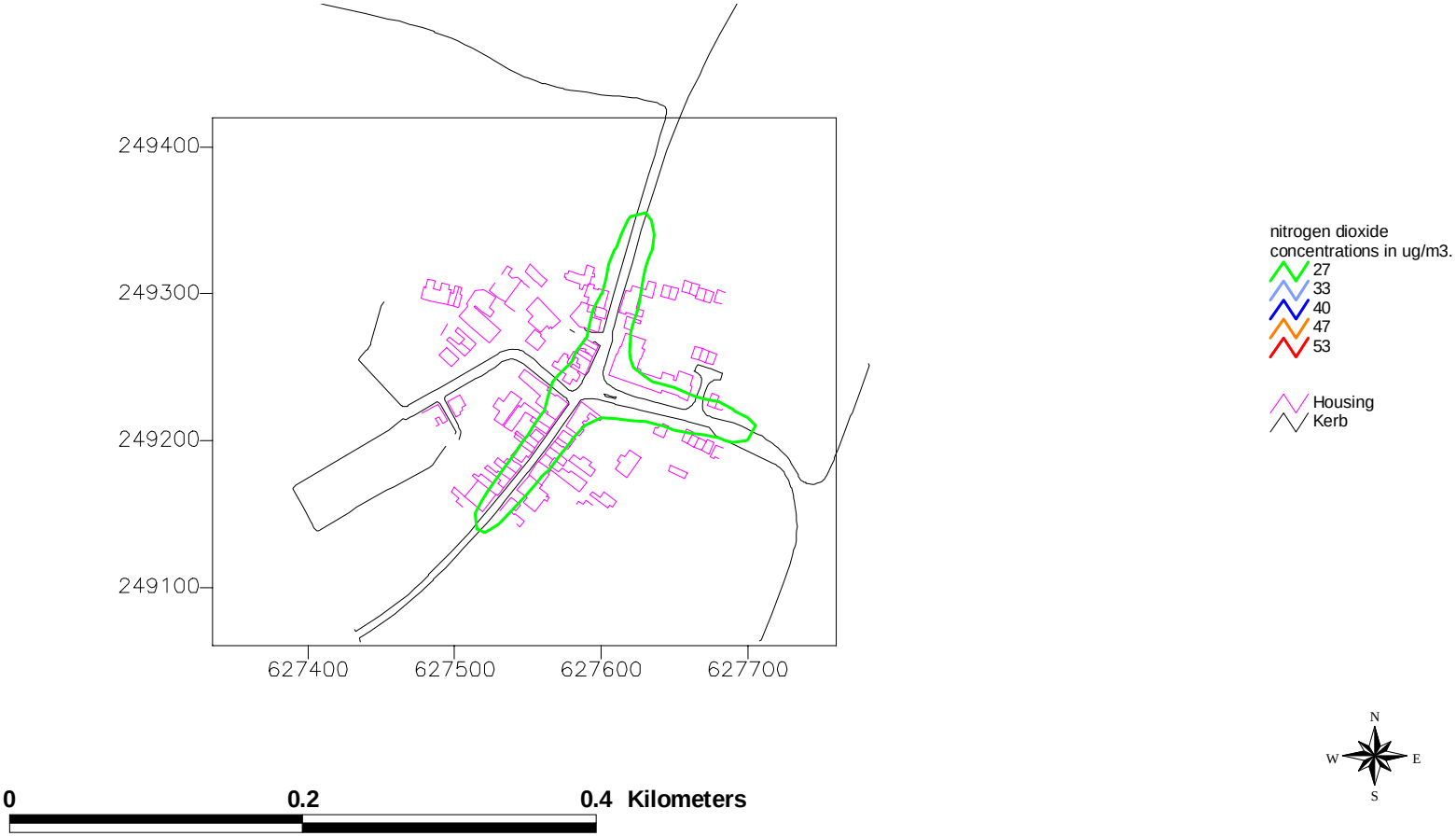
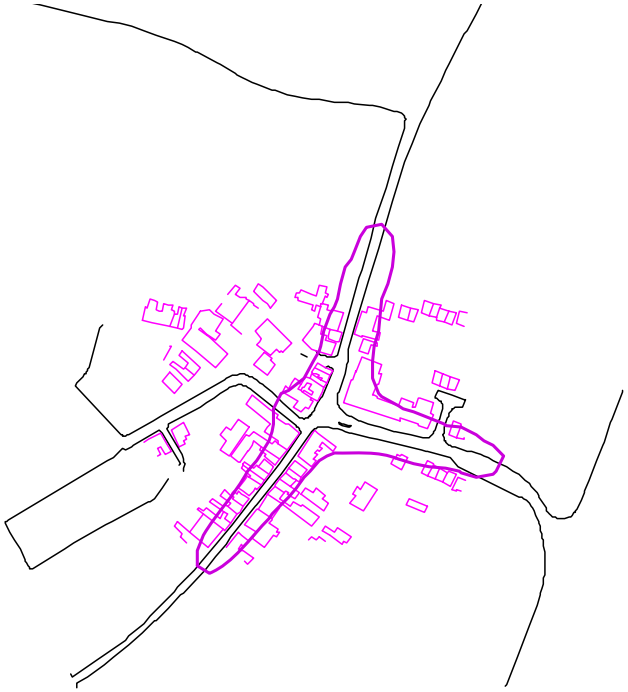


Figure 6.6.4A. Predicted 90th percentile daily mean PM10 concentrations uncorrected for model bias in Woodbridge in 2002.



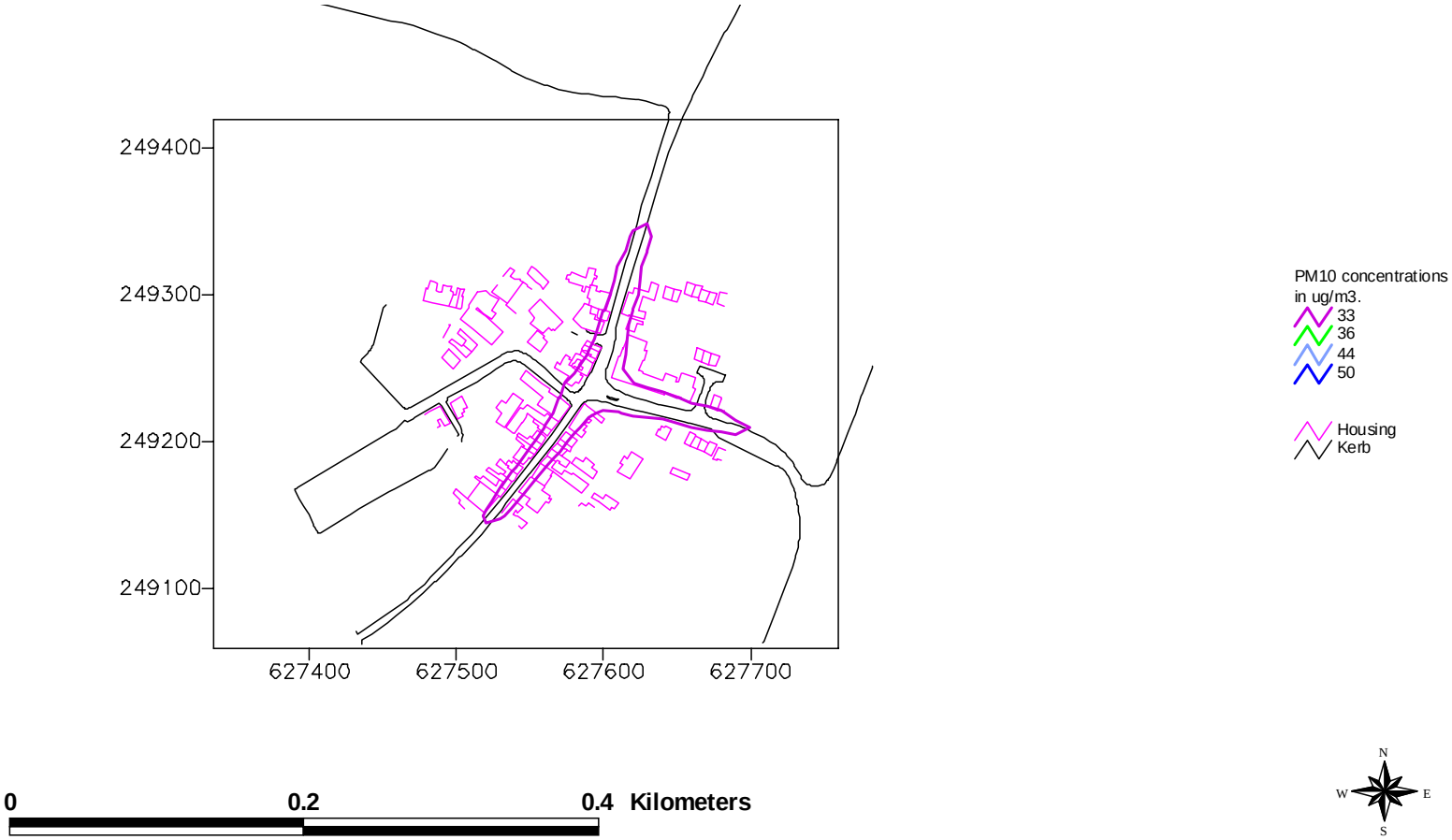
PM10 concentrations in ug/m3.
33
36
44
50

Housing
Kerb

0 0.2 0.4 Kilometers

N
W E
S

Figure 6.6.4B. Predicted 90th percentile daily mean PM10 concentrations uncorrected for model bias in Woodbridge in 2004.



6.7 SUMMARY OF THE LIKELIHOOD OF EXCEEDING THE OBJECTIVES FOR NITROGEN DIOXIDE

The modelling results showed that it is ***unlikely*** (with probability between 20% and 50%) that an exceedence of the annual objective would occur at any of the locations modelled

At all locations the hourly objective is very unlikely to be exceeded.

However, monitoring in 2002 by diffusion tubes on Melton Hill at the Woodbridge junction showed an exceedence of the NO_2 objective (See Section 4.6).

6.8 SUMMARY OF THE LIKELIHOOD OF EXCEEDING THE OBJECTIVES FOR PM_{10}

The model has not been corrected for bias due to their being no monitoring data available at either of the locations modelled. The modelling results (without being corrected for bias) showed that it is ***very unlikely*** (with probability less than 5%) that an exceedence of the 24 hour objective would occur at any of the locations modelled

6.9 RECOMMENDATIONS

It is recommended that Suffolk Coastal District Council do not consider declaring an AQMA for NO_2 at either the Melton or Woodbridge Junctions. However, monitoring by diffusion tubes should be continued at the Melton Hill site (WBG 1) due to the high concentrations recorded. In addition it is recommended that further diffusion tubes should be exposed at a number of locations on both sides of Melton Hill for a period of 12 months. If after a further 12 months of monitoring, exceedences of the NO_2 annual mean objective are shown, then Suffolk Coastal District Council should consider declaring an AQMA.

It is recommended that Suffolk Coastal District Council do not consider declaring an AQMA for PM_{10} at either the Melton or Woodbridge Junctions.

7 References

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Appendices

Appendix 1 - Road Traffic Data

Appendix 2 - nitrogen dioxide monitoring data

Appendix 1

Contents:

Traffic data for Suffolk Coastal District Council at the Melton and Woodbridge Junctions.

Melton Junctions:

Name of Road	Flow in 2002	% HDV	Predicted flow in 2004	Predicted flow in 2005
The Street	5,683	7.3	6,119	6,179
Wilford Bridge Road	12,366	6.1	13,315	13,444
Melton Road	9,026	6	9,719	9,813
Woods Lane	11,973	7	12,892	13,017

Woodbridge Junctions:

Name of Road	Flow in 2002	% HDV	Predicted flow in 2004	Predicted flow in 2005
Melton Hill	10,549	4.7	11,242	11,308
Lime Kiln Quay	10,040	5.3	10,700	10,763
The Thoroughfare	762	0.5	812	817
St. John's Street	3,213	0.9	3,424	3,444

Appendix 2

Contents:

- Continuous monitoring data
- Diffusion Tube Data

Air Pollution Report

Produced by netcen on behalf of Suffolk Coastal District Council

SUFFOLK COASTAL MELTON
22 February 2002 to 10 February 2003

These data have been fully ratified by netcen

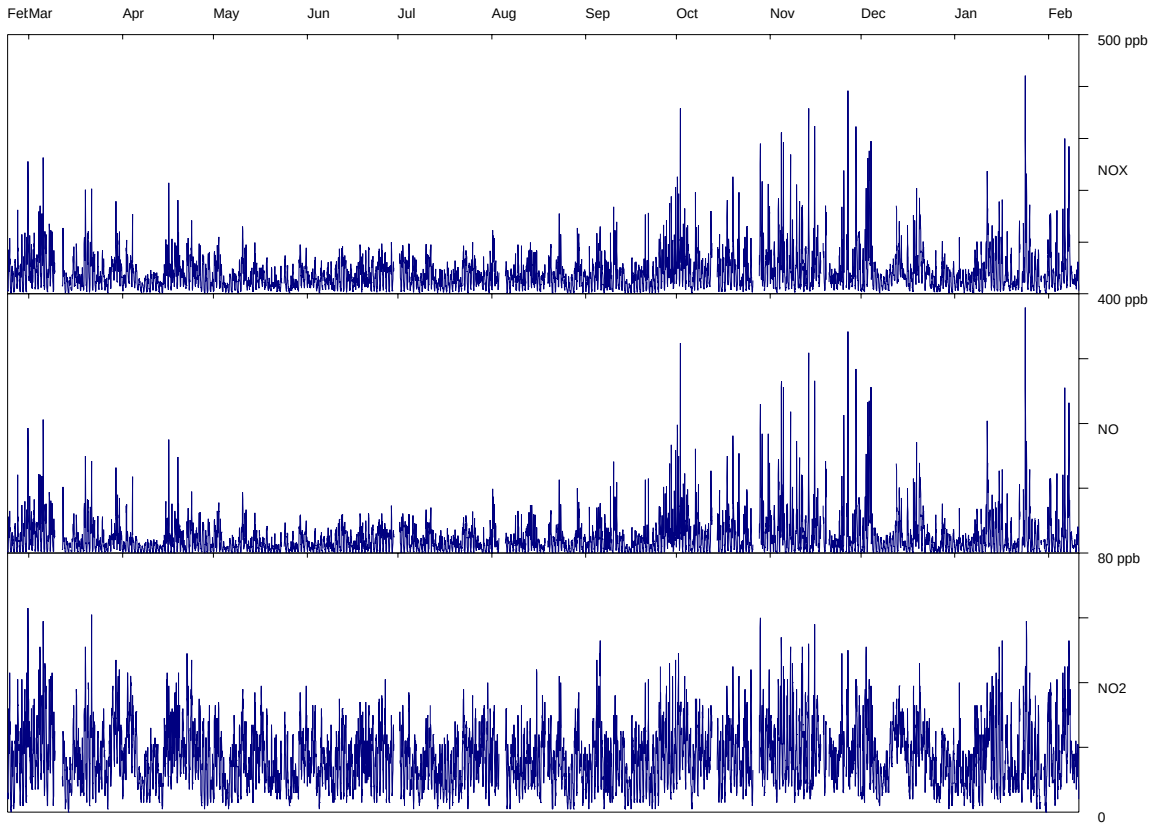
POLLUTANT	NO_X	NO	NO_2
Number Very High	-	-	0
Number High	-	-	0
Number Moderate	-	-	0
Number Low	-	-	8066
Maximum 15-minute mean	494 ppb	430 ppb	78 ppb
Maximum hourly mean	421 ppb	379 ppb	63 ppb
Maximum running 8-hour mean	201 ppb	160 ppb	46 ppb
Maximum running 24-hour mean	123 ppb	102 ppb	34 ppb
Maximum daily mean	120 ppb	89 ppb	31 ppb
Average of hourly means	39 ppb	22 ppb	17 ppb
Data capture of hourly means	94.9 %	94.9 %	94.9 %

Pollutant	Air Quality Regulations (2000)	Exceedences	Days
Nitrogen Dioxide	Annual mean > 21 ppb	0	-
Nitrogen Dioxide	Hourly mean > 105 ppb	0	0

Air Pollution Report

Produced by netcen on behalf of Suffolk Coastal District Council

Suffolk Coastal Melton Air Monitoring
Hourly Mean Data for 22 February 2002 to 10 February 2003



For further information on air pollution in your area please contact:
Sean Christiansen Direct line 01235 463521
Environmental Quality Direct facsimile 01235 463011
AEA Technology plc e-mail sean.christiansen@aeat.co.uk
Culham
Abingdon
Oxon OX14 3ED

Monthly Average Nitrogen Dioxide Concentrations Recorded at Sites in Woodbridge 2002 (Figures in μ/m3)

						TIME IN MONTHS							ANNUAL
SITE	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**AVERAGE**
WBG 1	50.8	**End**	~	~	~	~	~	~	~	~	~	~	n/a
WBG 1a	65.1	55.7	60.0	50.0	54.5	56.8	53.4	56.9	65.1	57.5	65.7	60.5	n/a
WBG 1b	54.0	51.9	60.7	53.5	56.3	53.0	51.0	55.7	65.2	54.2	64.6	58.9	n/a
WBG 1c	59.9	58.1	59.4	62.5	no data	57.2	52.8	57.7	no data	49.6	66.1	53.6	n/a
Average WBG 1a,b,c	59.7	55.2	60.0	55.3	55.4	55.7	52.4	56.8	65.2	53.8	65.5	57.7	**57.7**
WBG 3	32.9	19.3	23.2	18.2	16.0	14.3	10.8	16.3	no data	28.4	34.2	40.5	**23.1**
WBG 4	35.5	22.3	25.4	**End**	~	~	~	~	~	~	~	~	**27.7**
WBG 5a	45.4	29.7	44.8	41.7	36.3	27.5	31.0	34.2	48.0	35.8	47.1	45.6	n/a
WBG 5b	42.3	37.9	34.5	45.7	no data	29.4	31.8	37.7	47.3	24.9	42.6	46.2	n/a
WBG 5c	44.8	35.4	45.3	42.6	36.4	30.4	33.2	36.9	no data	39.6	47.0	47.7	n/a
Average WBG 5a,b,c	44.2	34.3	41.5	43.3	36.4	29.1	32.0	36.3	47.7	33.4	45.6	46.5	**39.2**

KEY:	**WBG 1**	Roadside site, signpost outside 93 Thoroughfare. **SITE DISCONTINUED FROM FEB 2002**
	WBG 1a	Roadside site, signpost outside 93 Thoroughfare. NEW TRIPLICATE SITE FROM FEB 2002
	WBG 1b	Roadside site, signpost outside 93 Thoroughfare. NEW TRIPLICATE SITE FROM FEB 2002
	WBG 1c	Roadside site, signpost outside 93 Thoroughfare. NEW TRIPLICATE SITE FROM FEB 2002
	WBG 3	Urban Background site, lampost outside 8 Kingston Farm Road
	WBG 4	Urban Background site, Farlingaye High School, Ransom Road. **SITE DISCONTINUED FROM APRIL 2002**
	WBG 5a	Roadside site, drainpipe on Suffolk Place, Lime Kiln Quay Road. NEW TRIPLICATE SITE FROM FEB 2002
	WBG 5b	Roadside site, drainpipe on Suffolk Place, Lime Kiln Quay Road. NEW TRIPLICATE SITE FROM FEB 2002
	WBG 5c	Roadside site, drainpipe on Suffolk Place, Lime Kiln Quay Road. NEW TRIPLICATE SITE FROM FEB 2002

						TIME IN MONTHS							ANNUAL
SITE	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**AVERAGE**
MEL 1	57.8	25.8	54.8	**End**	~	~	~	~	~	~	~	~	**46.1**
MEL 2	34.2	9.4	20.3	16	10.7	15.1	9.6	13.6	15.3	23.7	30.6	29.1	**19.0**
MEL 3	49.3	**End**	~	~	~	~	~	~	~	~	~	~	n/a
MEL 3a	57.2	50.9	53.0	49.5	47.3	46.6	46.5	51.5	55.6	55.8	66.4	49.3	n/a
MEL 3b	60.7	52.0	60.7	51.9	50.7	50	44.1	51.7	58.0	59.8	64.0	48.0	n/a
MEL 3c	56.4	48.0	55.7	49.2	44.6	45.7	45.1	48.0	53.4	53.0	58.4	50.6	n/a
Average MEL 3a,b,c	58.1	50.3	56.5	50.2	47.5	47.4	45.2	50.4	55.7	56.2	62.9	49.3	**52.5**
MEL 4a	49.0	42.1	48.2	38.3	32.8	28.9	31.5	38.8	40.8	42.1	47.2	56.1	n/a
MEL 4b	49.0	39.9	47.7	36.3	32.9	30.7	33.7	40.1	40.6	42.9	49.1	54.5	n/a
MEL 4c	44.7	39.8	49.4	40.6	31.7	28.6	33.1	39.9	43.4	43.3	48.5	50.8	n/a
Average MEL 4a,b,c	47.6	40.6	48.4	38.4	32.5	29.4	32.8	39.6	41.6	42.8	48.3	53.8	**41.3**
MEL 5a	~	~	40.8	no data	31.2	36.4	28.7	30.3	35.4	39.1	46.3	38.6	n/a
MEL 5b	~	~	41.3	37.7	32.1	38.1	29.4	29.1	33.1	38.4	49.2	33.9	n/a
MEL 5c	~	~	43.5	19.6	30.3	34.6	23.3	29.5	36.2	38.4	47.6	39.7	n/a
Average MEL 5a,b,c	~	~	41.9	n/a	31.2	36.4	27.1	29.6	34.9	38.6	47.7	37.4	**36.1**

KEY:	**MEL 1**	Roadside site, traffic lights, Melton crossroads. **SITE DISCONTINUED FROM APRIL 2002**
	MEL 2	Urban Background site, drainpipe on 106 hall Farm Road
	MEL 3	Roadside site, lampost opposite Melton CPS, Wilford Bridge Road. **SITE DISCONTINUED FROM FEB 2002**
	MEL 3a	Roadside site, lampost opposite Melton CPS, Wilford Bridge Road. TRIPLICATE SITE FROM FEB 2002
	MEL 3b	Roadside site, lampost opposite Melton CPS, Wilford Bridge Road. TRIPLICATE SITE FROM FEB 2002
	MEL 3c	Roadside site, lampost opposite Melton CPS, Wilford Bridge Road. TRIPLICATE SITE FROM FEB 2002
	MEL 4a	Roadside site, lampost sited at Woods Lane, Melton. NEW TRIPLICATE SITE FROM FEB 2002
	MEL 4b	Roadside site, lampost sited at Woods Lane, Melton. NEW TRIPLICATE SITE FROM FEB 2002
	MEL 4c	Roadside site, lampost sited at Woods Lane, Melton. NEW TRIPLICATE SITE FROM FEB 2002
	MEL 5a	Roadside site, 6 The Street, Melton (co-location with continuous monitor). NEW TRIPLICATE SITE FROM MARCH 2002
	MEL 5b	Roadside site, 6 The Street, Melton (co-location with continuous monitor). NEW TRIPLICATE SITE FROM MARCH 2002
	MEL 5c	Roadside site, 6 The Street, Melton (co-location with continuous monitor). NEW TRIPLICATE SITE FROM MARCH 2002