2011 Air Quality Further Assessment Report for Ryedale District Council

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

January 2011

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Executive Summary

This report sets out the Further Assessment of air quality within the Malton Air Quality Management Area (AQMA). It forms part of the air quality Review and Assessment process prescribed by Defra and the Devolved Administrations. The AQMA, designated by Order on 14 December 2009, was made because of exceedences of the annual mean nitrogen dioxide objective.

This Further Assessment Report follows on from the work reported in the 2009 Detailed Assessment Report (Ryedale DC, 2009a) and the 2010 Progress Report (Ryedale DC, 2010). The Detailed Assessment presented modelling and monitoring evidence showing that exceedence of the national air quality objective (AQO) for annual average nitrogen dioxide was likely to continue at several locations within Malton town centre where there are relevant receptors. The boundary of the Malton AQMA was set so that all locations where exceedence of the AQO was considered likely to occur were included within the area.

In this report further data has been collated from monitoring undertaken within and just outside the AQMA. This data has been used to re-evaluate the evidence for exceedences of the AQO. In addition, the main sources of emissions of nitrogen oxides affecting the AQMA have been identified and an estimate of the percentage reduction in emissions required to achieve the air quality objective has also been determined. Consideration has been given to any new development that has taken place, or has been approved, since the last assessment and which has the potential to affect nitrogen oxides levels in the AQMA.

The main findings of the Further Assessment report are:

The Malton Air Quality Management Area should remain because the latest monitoring data shows that levels of nitrogen dioxide are still likely to exceed the annual mean air quality objective (AQO) at a number of locations within the AQMA where there is public exposure.

The latest monitoring results confirm that the existing extents of the AQMA are appropriate.

Source apportionment shows that local road traffic accounts up to 77% of the total NO_2 annual mean concentration in the AQMA and that approximately 40% of this arises from emissions of NO_x (NO + NO2) from Heavy Duty Vehicles (HDV's).

It is estimated that a reduction in emissions of NO_x from local road traffic of at least 8.25% will be necessary in order for the NO_2 annual mean AQO to be met at all public exposure locations in the AQMA.

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1 Introduction

Ryedale District Council has produced this Further Assessment Report in respect of the Malton Air Quality Management Area (AQMA). This falls within the Councils statutory duties for Local Air Quality Management (LAQM) under Part IV of the Environment Act 1995.

1.1 Purpose of Further Assessment

Section 84(1) of the Environment Act, requires authorities to complete a Further Assessment within 12 months of designating an Air Quality Management Area (AQMA). The Further Assessment is intended to allow the Council to supplement the information already gathered from the earlier Review and Assessment work.

The main aims of the Further Assessment are: to show that the decision to declare the AQMA and the extent of the AQMA remain appropriate; and to identify and quantify the principle pollution sources contributing to the AQO exceedences at locations within the AQMA (source apportionment). This will support the development of an Air Quality Action Plan by determining the improvements in air quality needed and allowing a targeted approach to improving local air quality through measures to be identified by the action plan.

The guidance in LAQM.TG (09) (Defra, 2009) states that the Further Assessment should address the following issues:

- Consider any new guidance issued by Defra and the Devolved Administrations, or any new policy developments that may have come to light since declaration of the AQMA;
- Carry out additional monitoring to support the decision to declare the AQMA;
- Take account of any new local developments that were not fully considered within the earlier Review and Assessment work. This would include, for example, the implications of new transport schemes, commercial or major housing developments etc, that were not committed or known of at the time of preparing the Detailed Assessment;
- Confirm the original assessment, and thus ensure that it was appropriate to designate an AQMA in the first place;
- Corroborate the assumptions on which the AQMA has been based, and to check that the original designation is still valid, and does not need amending in any way;
- Calculate more accurately what improvement in air quality, and corresponding reduction in emissions, are required to satisfy the AQO within the AQMA;

- Refine knowledge of pollutant sources so that the an air quality Action Plan may be appropriately targeted;

- Respond to any comments made by statutory consultees in respect of the Detailed Assessment.

1.2 Summary of Previous Review & Assessments

Local air quality management forms a key part of the Government's strategies to achieve the air quality objectives under the Air Quality (England) Regulations 2000 and 2002. As part of its duties the Council has undertaken reviews and assessments and published reports of local air quality on a regular basis since 1999. A summary of these is given in Table 1.2.

Table 1.2: Previous Reports, Dates of Publication and Outcomes.

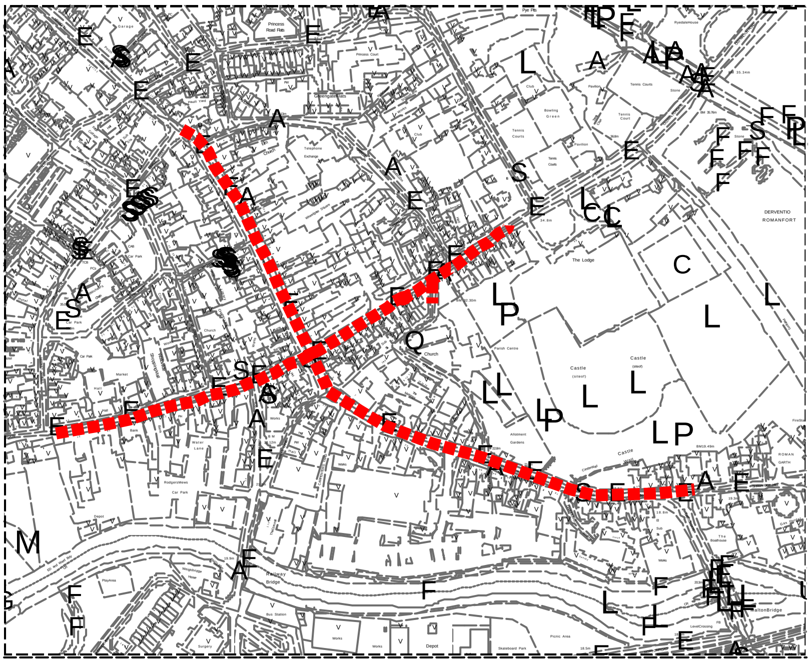
ROUND	***STAGE***	***DATE COMPLETED***	***OUTCOME***
1	1	1999	2nd Stage Assessment Required for Sulphur dioxide; Nitrogen dioxide; and PM_{10}
1	2	2000	No further Action Required
2	USA	2003	Detailed Assessment Required for Nitrogen dioxide; and PM_{10}
2	Detailed Assessment	2004	No further Action Required
2	Progress Report	2005	No further Action Required
3	USA	2006	No further Action Required
3	Progress Report	2007	Detailed Assessment Required for Nitrogen dioxide
3	Detailed Assessment	2009	Air Quality Management Area Designation (Malton AQMA 14 December 2009)
4	USA	2009	No further Action Required
4	Progress Report	2010	No further Action Required

The 2009 Detailed Assessment (Ryedale DC 2009a) concluded that declaration of an AQMA was necessary in parts of Malton because the annual mean concentration of nitrogen dioxide (NO_2) exceeded the relevant AQO at various relevant receptor locations. Consequently, following public consultation, the Council designated an AQMA in part of the town centre.

1. 3 Malton Air Quality Management Area

The Malton Air Quality Management Area Order was made by the Council on 14 December 2009 (Ryedale DC, 2009b). The Order relates to current and projected levels of nitrogen dioxide, which breach, or are likely to breach, the nitrogen dioxide (annual mean) air quality objective of 40 µg/m^3, as prescribed by the Air Quality (England) Regulations 2000 (as amended). A map of the AQMA is shown below in Figure 1.3.

Figure 1.3: Map of Malton Air Quality Management Area.



The Order identifies the area designated as an AQMA, which is described as the roads or stretches of roads listed in the Order and shown marked on the map. It includes all the properties, whether residential or commercial, with facades on these roads. The designated area includes the whole of these properties, i.e. buildings and associated open space within the same cartilage.

Although the Detailed Assessment indicated that the annual mean objective was not breached throughout the AQMA, it was considered that declaring a single area encompassing all the required locations was preferable to declaring multiple smaller AQMA's. As well as being more complex administratively, the designation of multiple smaller AQMA's would have increases the risk of missing out areas of exceedence.

2 New Monitoring Data

2.1 Non-Automatic Monitoring Sites

Monthly average nitrogen dioxide concentrations are currently measured using diffusion tubes at ten sites within, and in close proximity to, the AQMA. Diffusion tubes are a type of passive sampler. They work by absorbing NO_x from the surrounding air and are inexpensive and simple to use.

Site locations are shown in Figure 2.4.2 and details of all the sites are set out in Table 2.1.

Table 2.1. Details of Non- Automatic NO_2 Monitoring Sites

Site Name	Site Type	OS Grid Ref	In AQMA?	Relevant Exposure? *(Y/N with distance (m) to relevant exposure)*	Distance to kerb of nearest road
1 - Yorkersgate – Castlegate, Butcher Corner, Malton	Roadside	X 478739 Y 471654	Y	Y(5m)	3m
2 – Wheelgate (1), Malton	Roadside	X 478703 Y 471729	Y	Y (1m)	2m
3 – Wheelgate (2), Malton	Roadside	X 478609 Y 471880	N	Y (m)	2m
4 - Old Malton Gate (1), Malton	Kerbside	X 478847 Y 471732	Y	Y (1m)	1m
5 - Old Malton Gate (2), Malton	Roadside	X 478896 Y 471755	Y	Y (1m)	3m
6 – Castlegate (1), Malton	Roadside	X 478844 Y 471594	Y	Y (2m)	2m
7 – Castlegate (2), Malton	Roadside	X 479027 Y 471538	Y	Y (1m)	2m
8 – Castlegate (3), Malton	Roadside	X 478922 Y 471557	Y	Y (1m)	3m
9 – Yorkersgate (1), Malton	Kerbside	X 478664 Y 471628	Y	Y (1m)	1m
10 – Yorkersgate (2), Malton	Roadside	X 478544 Y 471605	Y	Y (1m)	2m

2.2 Quality Assurance

Nitrogen dioxide diffusion tubes are supplied by Harwell Scientifics. Exposed tubes are analysed in accordance with Harwell Scientifics standard operating procedure HS/GWI/1015 issue 14. The tubes are prepared by spiking acetone-triethanolamine (50:50) onto the grids prior to the tubes being assembled. The tubes are desorbed with distilled water and the extract analysed using a segmented flow autoanalyser with ultraviolet detection. The laboratory is UKAS accredited for the preparation and testing of NO_2 diffusion tubes.

The Workplace Analysis Scheme for Proficiency (WASP) is an independent analytical performance testing scheme, operated by the Health and Safety Laboratory (HSL). Quarterly summaries of participating laboratories' performance in the WASP scheme over the preceding 12 months are prepared by AEA on behalf of Defra. The summaries are available via links on the Defra Local Authority Air Quality Support Website at http://laqm1.defra.gov.uk/review/tools/no2/qa-qc.php.

The performance summary covering the period January 2009 to December 2009 states that the performance of Harwell Scientifics' in the analysis of NO_2 diffusion tubes was good (AEA 2010).

2.3 Diffusion Tube Bias Adjustment and Ratification of Monitoring Data

The accuracy of measurements obtained using diffusion tubes is expressed as percentage bias relative to the measurements made using a chemiluminescence analyser (the European reference method for measuring nitrogen dioxide concentrations).

Generally diffusion tubes tend to overestimate nitrogen dioxide levels. In order to compensate for this, the results obtained using diffusion tubes must be corrected by applying a bias adjustment factor. Bias adjustment factors are determined by means of co-location studies. This involves exposing diffusion tubes alongside an automatic analyser. A bias adjustment factor can then be determined by dividing the annual mean concentration (measured by the automatic analyser) by the annual mean concentration, as measured using co-located diffusion tubes.

Local authorities must decide whether to use the result of a local co-location study (if available) or an overall national bias factor derived from the results of all co-location studies for the relevant laboratory and year. In making a choice of which bias adjustment factor to use, local authorities must consider a number of points. These are set out in the Technical Guidance LAQM. TG (09) – Box 3.3.

All of the data presented in this report have been adjusted to account for diffusion tube bias using the appropriate national bias factor provided by The Defra Local Authority Air Quality Support website: http://laqm1.defra.gov.uk/review/tools/no2/baf.php, which has links to the latest version of the '*Nitrogen Dioxide Diffusion Tube Bias Adjustment*' tool.

This tool consists of a spreadsheet containing details of local authority co-location study results from around the UK. The spreadsheet shows annual bias factors for each study and each laboratory, together with a combined annual 'national' bias adjustment factor for each particular laboratory. The spreadsheet was last updated in September 2010. For Harwell Scientifics, the spreadsheet gives an overall bias adjustment factor for 2009 of 0.82, based on 27 studies. As no locally derived bias factor is available for 2009, it is appropriate to use this factor.

Table 2.3 Diffusion Tube Bias Adjustment Factors

Source of Factor	*Bias Adjustment Factor*
UWE LAQM Tool (Combination of 27 Studies in 2009)	0.82

Triplicate diffusion tubes are exposed at one of the sites in the AQMA to allow an indication of the precision of the diffusion tubes to be calculated. Overall, the tubes were found to have good precision. Precision is an indication of reproducibility of results, and tubes are said to have good precision when the coefficient of variation between the triplicate tubes for eight or more months (during a twelve month period) is less than 20%, and the average coefficient of variation for all periods is less than 10%.

As reported in the 2010 Progress Report, In 2009 the average coefficient of variation (CV) during the 9 month period for which tubes were exposed in triplicate was 7% and the CV was less than 20% for each monthly period (Ryedale DC 2010).

2.4 Diffusion Tube Monitoring Data 2009

Bias adjusted 2009 annual mean NO_2 concentrations are detailed in Table 2.4.1. Exceedences of the annual mean objective level (40 µg/m^3) are shown in emboldened text. Where monitoring was undertaken for less than the full calendar year, or if data capture was less than 100%, the annual mean has been annualised using the methodology in Box 3.2 of TG (09). All the results have been adjusted using the overall 2009 national bias factor for co-location studies that use diffusion tubes prepared and analysed by Harwell Scientifics.

All the monthly results were detailed in Appendix A of the 2010 Progress Report (Ryedale DC 2010), together with details of the adjustments made to annualise data for those sites where monitoring was for less than 12 months or data capture was less than 100%.

Table 2.4.1 Bias Adjusted NO_2 Diffusion Tube Measurements at Sites in Ryedale 2009

Site ID	Location	Within AQMA?	Monitoring Period	Data Capture 2009 %	Annual Mean Concentration (Bias Adjusted using combined national factor – 0.81)
1	Yorkersgate – Castlegate, Butcher Corner, Malton	Yes	Jan - Dec	100	40
2	Wheelgate (1), Malton	Yes	Jan - Dec	100	**42**
3	Wheelgate (2), Malton	No	May - Dec	100	27*
4	Old Malton Gate (1), Malton	Yes	Jan - Dec	100	37
5	Old Malton Gate (2), Mallton	Yes	May - Dec	100	38*
6	Castlegate (1), Malton	Yes	Jan - Dec	100	31
7	Castlegate (2), Malton	Yes	Jan - Dec	83	**41***
8	Castlegate (3), Malton	Yes	May - Dec	100	**42***
9	Yorkersgate (1), Malton	Yes	Jan - Dec	75	**42***
10	Yorkersgate (2), Malton	Yes	May - Dec	100	29*

* Result has been annualised using methodology in Box 3.2 of TG (09)

Comparison of Monitoring Results with Air Quality Objectives

Sites where AQO Exceeded

The results show that in 2009 the annual mean AQO was exceeded at four monitoring sites (Sites 2, 7, 8 & 9), each of which lies within the Malton AQMA. All the sites are representative of public exposure. Sites 2, 7 & 9 are long term sites where annual mean NO_2 concentrations have consistently exceeded the AQO. Site 8 is a relatively new site, which is well within the AQMA, at a location where modelling undertaken as part of the 2009 Detailed Assessment indicated that exceedence of the AQO was likely.

Sites where AQO not Exceeded

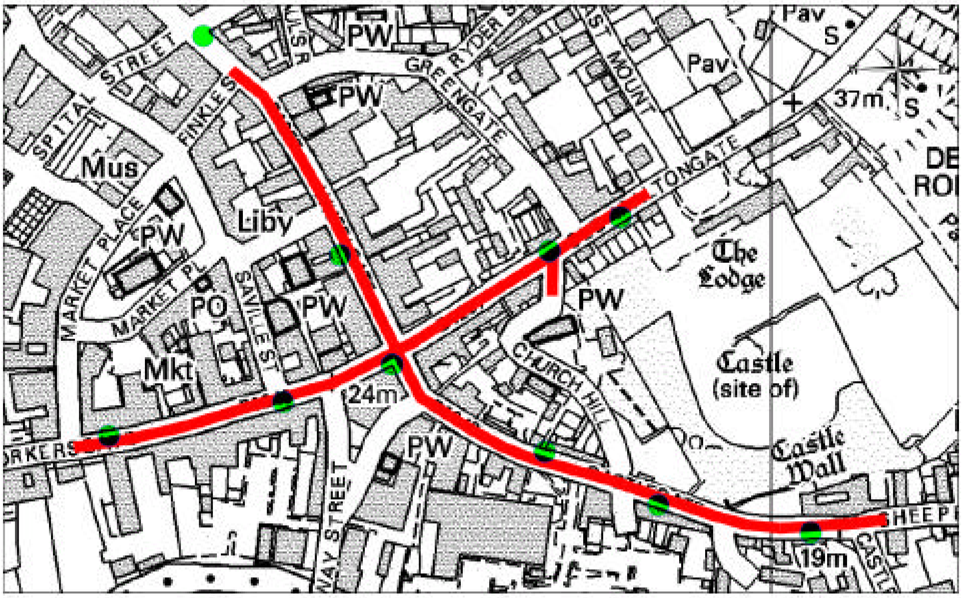
Five of the six monitoring sites where in 2009 levels did not exceed the AQO are within the AQMA. The 2009 annual mean NO_2 concentration at one of these (Site 1) was equal to the AQO level. Levels of NO_2 at Site 1 had exceeded the AQO in each of the previous seven years. This is illustrated in Figure 2.4.4 below.

Sites 5 and 10 are new sites established since the AQMA designation. They are within the AQMA but situated relatively close to the limits of the area. These sites were selected to provide an indication of whether the boundaries of the area extended far enough to ensure that all areas of likely exceedence had been included in the AQMA. Site 6 is a long term site within the AQMA in, a relatively open and exposed location. No annual mean concentration measured at the site has exceeded the AQO over the 10 years during which the site has been in use.

Site 3, which is just outside the AQMA, is a new site selected to provide an indication of whether the AQMA boundary is appropriate.

All the sites (marked in green) are shown in relation to the AQMA in Figure 2.4.2.

Figure 2.4.2: Malton AQMA and NO2 Monitoring Site Locations



Exceedences of the 1-hour objective may occur at roadside sites if the annual mean exceeds 60 µg/m^3. There were no sites where the annual mean exceeded or approached this level.

The results show that levels of NO_2 within the AQMA exceeded the AQO at a number of relevant receptor locations. Although levels were slightly lower than those recorded in 2008 (see Table 2.4.3), the results support the AQMA designation. Levels at new monitoring sites indicate that the AQMA boundaries are appropriate and that the requirement to seek to include within the AQMA all locations where there is likely to be relevant exposure to elevated NO_2 has been achieved.

The results do not indicate that revocation or amendment of the Malton AQMA Order would be justified.

Trends

Table 2.4.3 shows bias adjusted annual mean NO_2 levels at various sites for the five years from 2005 to 2009. The measured concentrations have been adjusted using the overall bias factor for the particular year in question, as published in the latest version of the national '*Nitrogen Dioxide Diffusion Tube Bias Adjustment*' tool.

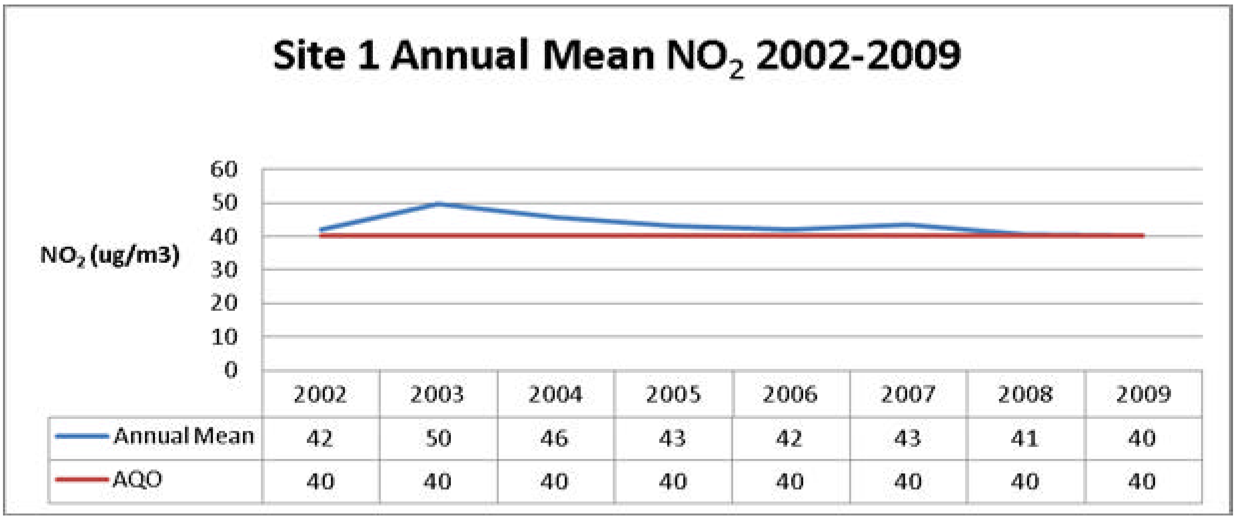
Comparison of the results in Table 2.4.3 indicates that at most sites annual mean levels in 2009 were slightly less than in the previous 12 months. Over the five-year period the results indicate a small decrease in levels at all sites for which the complete data set is available. The decreases are all within the range of 5 - 13%.

Table 2.4.3 Results of Nitrogen Dioxide Diffusion Tubes 2005 - 2009

Site ID	Location	**2009 Annual Mean Concentration (ug/m^3)** Bias Adjusted using combined national factor – 0.82	**2008 Annual Mean Concentration (ug/m^3)** Bias Adjusted using combined national factor – 0.78	**2007 Annual Mean Concentration (ug/m^3)** Bias Adjusted using combined national factor – 0.82	**2006 Annual Mean Concentration (ug/m^3)** Bias Adjusted using combined national factor – 0.79	**2005 Annual Mean Concentration (ug/m^3)** Bias Adjusted using combined national factor – 0.88
1	Yorkersgate – Castlegate, Butcher Corner, Malton	40	**41**	**43**	**42**	**43**
2	Wheelgate (1), Malton	**42**	**45**	**45**	**45**	**46**
3	Wheelgate (2), Malton	27	-	-	-	-
4	Old Malton Gate (1): Malton	37	37	**44**	36	39
5	Old Malton Gate (2): Malton	37	-	-		
6	6 - Castlegate (1): Malton	31	31	32	32	36
7	Castlegate (2): Malton	**42**	**43**	**47**	**47**	**46**
8	Castlegate (3): Malton	**41**	-	-		
9	Yorkersgate (1): Malton	**42**	**43**	**45**	**45**	**46**
10	Yorkersgate (2): Malton	29	-	-		

Figure 2.4.4 below shows the annual mean the concentration at Site 1 for each year from 2002 to 2009. After a relatively sharp increase in 2003, the plot shows a downward trend, interrupted in 2007 by a slight increase. Whilst indicating an overall, albeit slight decline in levels over the eight year period, the plot illustrates the unpredictability of changes in annual mean levels on a year to year basis.

Figure 2.4.4: Site 1 Annual Mean NO2 and AQO



Nitrogen Dioxide Levels in 2010 and Beyond

Annual mean NO_2 concentrations for 2010 are not available because the diffusion tube monitoring dataset is not yet complete, with results for the last quarter still to be reported by the laboratory. The complete data set for 2010 will be considered in the Councils next Progress report, due for completion in April 2011.

A preliminary comparison of unadjusted results for January to September 2010 with results for the same period in 2009 appears to indicate that NO_2 levels may have increased at all the diffusion tube monitoring sites. However, until the full dataset and bias adjustment factors are available it would not be appropriate to draw any conclusions.

Estimates of concentrations for 2010 and future years may be made by applying roadside NO_2 future years projection factors (provided in the Technical Guidance LAQM.TG(09)) to 2009 measured concentrations. The projection factors are based on pollution modelling studies which take account of expected changes to primary NO_2 emissions. However, guidance issued in September 2010 on the Defra LAQM Review and Assessment Helpdesk indicates that such projections are likely to be unreliable. This is because of the disparity recently identified between measured concentrations at urban roadside sites (which show little evidence of a downward trend in NO_x and NO_2 concentrations) and the forecasted decline in NO_2 concentrations (Defra, 2010a).

3 Source Apportionment of NO_2 in Malton AQMA

3.1 Purpose of Apportionment

In order to draw up an air quality action plan it is necessary to identify the principle sources of emissions and their contribution to the AQO exceedence within the AQMA. The purpose of apportioning pollution sources is to allow the required improvement (i.e. the required reduction in emissions) to be determined. Following on from this the Air Quality Action Plan will focus on targeted measures to reduce pollution and achieve the AQO for NO_2 by selecting the most cost effective actions.

In the Malton AQMA the elevated levels of NO_2 arise primarily as a result of high volumes of road traffic and congestion along the roads leading to the junction of the B1257 and B1248 (Butchers Corner) in the town centre and traffic backing up along the B1257 (Castlegate) towards this junction from the railway level crossing in Norton.

3.2 Background Contributions

The measured levels of NO_2 identified by the Councils monitoring programme consist of background NO_2 and NO_2 from local sources. Values for background pollutant concentrations, including NO_2, are provided by Defra to assist local authorities with the review and assessment process. These are published in the form of downloadable data tables for each 1km by 1km Ordnance Survey grid square for the entire UK. The data tables list a background concentration against the co-ordinates for the centre of each OS grid square (Defra, 2010b). Tables of background data, based on projections of base year (2008) estimates, can be downloaded for each year up to 2020. The 2009 background NO_2 data table gives a concentration of 9.574289 μgm^{-3} for the 1 km grid square in which the AQMA is situated (grid square co-ordinates 478500 471500).

3.3 Local Contributions and Required Reduction in Pollutant Emissions

There are not considered to be any significant local sources of NO_2 except for emissions from road traffic. Actions to reduce the background concentrations will have a negligible effect, therefore, the percentage reduction in nitrogen dioxide concentrations required relates to the road traffic component only. Measures to reduce NO_2 levels so that there are no breaches of the air quality standard in the AQMA will therefore need to be targeted at road traffic emissions in the AQMA and the immediate vicinity.

Assessment of the air quality impacts of emissions from road traffic relies upon the application of air quality models which predict the dispersion and dilution of primary pollutants. Vehicle emissions, in grams per second, are converted to concentrations in micrograms per cubic metre. These road traffic concentrations are then added to the local background concentrations to give the total concentrations, which decline as a function of distance from the road.

The principal interest when assessing NO_x ($NO+NO_2$) emissions from road traffic is the concentration of NO_2 at the roadside, as it is the NO_2, not the NO_x, that is associated with adverse health effects. It is therefore necessary to predict the transformation of NO to NO_2.

For the assessment of NO_2 alongside roads, the required reduction should be reported in terms of µg/m^3 of NO_2. However, the required %age reduction of local emissions should be expressed in terms of NO_x arising from local road traffic 'road traffic nitrogen oxides (NO_x)'. This is because the relationship between the primary emission NO_x, which is predominantly emitted into the atmosphere in the form of nitric oxide (NO), and NO_2 is non-linear. In the atmosphere NO is converted to NO_2 through various chemical reactions. Under most atmospheric conditions, the main pathway for NO_2 formation is by the reaction of NO with ozone (O_3). The reaction with ozone changes the proportion of NO_2 and this has to be allowed for in the modelling. There is the added complexity of background NO and NO_2 mixing with freshly emitted NO and NO_2. Prediction of NO_2 concentrations is thus not straightforward.

The minimum NO_2 reduction required may be identified by determining the reduction in NO_2 required to achieve the AQO at the worst-case receptors within the AQMA.

A method to convert modelled road nitrogen oxides (NO_x) concentration values to equivalent nitrogen dioxide (NO_2) concentrations was provided with the previous Local Air Quality Management Technical Guidance LAQM.TG(03). The method was updated in 2007. A calculator (version 1.1) was issued in Dec 2008 based on a new approach that takes account of ozone (O_3) concentration and changes in the proportions of primary NO_2 and regional NO_x and NO_2 in future years. Defra released the latest version of the calculator (version 2.1) on 22 January 2010. The calculator may be downloaded from the Defra LAQM support web page at http://www.defra.gov.uk/environment/quality/air/airquality/local/support/index.htm

The calculator has been used in this assessment to convert measured NO_2 concentrations to equivalent road NO_x concentrations.

The calculator provides updated values for the fraction of NO_x emitted as primary NO_2. This is referred to as f-NO_2. The new values for f-NO_2 are based on the latest information about emissions from various vehicle classes, such as petrol cars, diesel cars & buses, and the traffic mix (fleet composition) data for the UK, London and other urban and non-urban areas of the UK.

The f-NO_2 values are provided for the years 2008-2025. The new f-NO_2 values are relatively higher compared to those in the previous version of the calculator. The f-NO_2 values for the future years take into account the expected changes in the NO_2 fraction of NO_x emissions from traffic, in addition to changes in regional concentrations of NO_x, NO_2 and ozone (O_3).

The spreadsheet may be used to calculate road NOx by inputting measured values of NO_2 and the local background NO_2 value. The other inputs are: the regional concentrations of O_3, NO_x and NO_2 above the surface layer (these are automatically entered when the local authority name is selected); the assessment year; and traffic mix.

The most appropriate traffic mix must be selected from a menu of six choices and this determines the input value of the estimated overall mix fraction of f-NO_2 in exhaust emissions. In the case of the Malton AQMA the appropriate traffic mix is ‘all other UK urban traffic’. For the purposes of the model, the descriptor ‘urban’ is based upon the Department for Transport’s definition, ‘an urban road is a road within an urban area with a population of 10,000 or more’ (Defra 2010c).

As the diffusion tube sites in the Malton AQMA are relevant receptor locations, the calculator was run to determine the road NO_x concentration that is equivalent to the highest measured annual mean NO_2 concentration in 2009, as detailed in Table 2.4.1.

Having calculated the worst case road NO_x concentration for 2009, the reduction in pollution required in the AQMA can be defined as:

Road NO_x Reduction = (Current Road-NO_x) - (Road-NO_x Required), where:

(Current Road-NO_x) is the current NO_x concentration due to road traffic emissions;

(Road-NO_x Required) is the level of road NO_x equivalent to an overall annual mean NO_2 concentration of 40µg/m^3. (This is determined by running the calculator with an NO_2 concentration of 40µg/m^3)

This calculation, based on the methodology described in Box 7.2 of the Technical Guidance LAQM.TG(09), is shown in Table 3.3.1.

The calculator was also run using appropriate inputs to determine the required reduction in road NO_x emissions based on the highest measured NO_2 concentrations for 2008.

Table 3.3.1: Calculation of Required Road Traffic NOx Reduction

Year	Relevant Exposure Location Site ID	Total NO_2 (µg/m3) Annual Mean	Total Background NO_2 (ug/m3)	Road NOx (µg/m3) (from $N0_2$ to NOx Conversion Spreadsheet)	Road NOx (µg/m3) Equivalent to Total NO_2 Concentration of 40 µg/m3 (From NO_2 to NOx conversion Spreadsheet)	Required Reduction in Road NOx (µg/m3)	Required %age Reduction in Road NOx
2009	2	42	9.574289	85.86	78.78	7.08	8.25
2008	2	45	10.2469	100.4	80.54	19.86	19.78

The required reduction in road NO_x emissions of 8.25% is based on the highest measured level in 2009. Using the calculator with the worst case measured concentration for 2008 and the appropriate background NO_2 concentration gives a required road NO_x reduction of 19.78%. This suggests that there is a significant degree of uncertainty as to the reduction in road traffic emissions required to ensure that the NO_2 annual mean AQO is met throughout the AQMQ. Primary emissions of NO_2 from road traffic may increase over the next few years and it is not safe to assume that NO_2 levels will fall without measures being taken to reduce traffic emissions in the AQMA.

The required reduction will be considered again on the basis of measured NO_2 concentrations for 2010 in the Councils next Progress Report, which is due to be completed in April 2011.

As stated in Section 2 of this report, measured NO_2 concentrations have not declined as expected in recent years, particularly at roadside sites, and have increased at some locations. On the whole, U.K. urban roadside NO_x concentrations have declined very weakly over the past 6 – 8 years and there is little evidence of a consistent downward trend in either NO_x or NO_2 concentrations. This is thought to be related to the actual on-road performance of diesel road vehicles when compared with calculations based on the Euro standards. This discrepancy is likely to be the result of an increase in the proportion of direct (or primary) NO_2 emission from road traffic, f-NO2, associated with an increase in the proportion of diesel cars in the vehicle fleet, and the use of catalytically regenerative particle traps on some heavy duty vehicles. The proportion of primary NO_2 emissions has been steadily increasing over recent years, and is expected to continue rising up to 2015.

In the case of the Malton AQMA, monitoring results have shown that there was a fall in NO_2 levels of approximately 10% over the five year period from 2005 to 2009. This was much less than had been projected using the reduction factors provided in the Defra technical guidance.

3.4 Apportionment of Road Traffic NOx Emissions

Defra and the Devolved Administrations provided an updated Emission Factors Toolkit (Version 4) based on new (released in 2009) vehicle emissions factors. The toolkit allows users to calculate vehicle emissions for multiple road links based on vehicle fleet composition, traffic speeds and road type. The toolkit produces link by link source apportionment covering vehicle exhaust emissions. The latest version of the toolkit, Version 4.2.2, was released in November 2010. It supersedes all previous versions and can be downloaded from:
http://www.defra.gov.uk/environment/quality/air/airquality/local/support/index.htm

Using Version 4.2.2 of the Emissions Factor Toolkit and following the user guide provided at:
http://laqm1.defra.gov.uk/documents/tools/Guidance_on_using_EFT_V4_2_300710.pdf

Emissions of road traffic NO_x may be apportioned to the following vehicle group categories:

- Heavy Duty Vehicles – HDV's - (rigid and articulated heavy goods vehicles and buses/coaches)
- Light Duty Vehicles – LDV's - (cars, vans and motorcycles)

For the purposes of this assessment the toolkit has been run using traffic flow data for roads in Malton town centre. The traffic data has been provided by North Yorkshire County, The Local Transport Planning Authority and is derived from their Malton Traffic Model. The model has been developed over a number of years using various traffic counts and data from permanent counters situated around Malton.

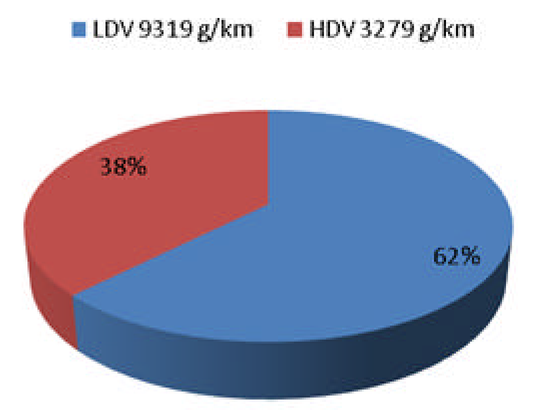
Table 3.4.1: Malton Traffic Data

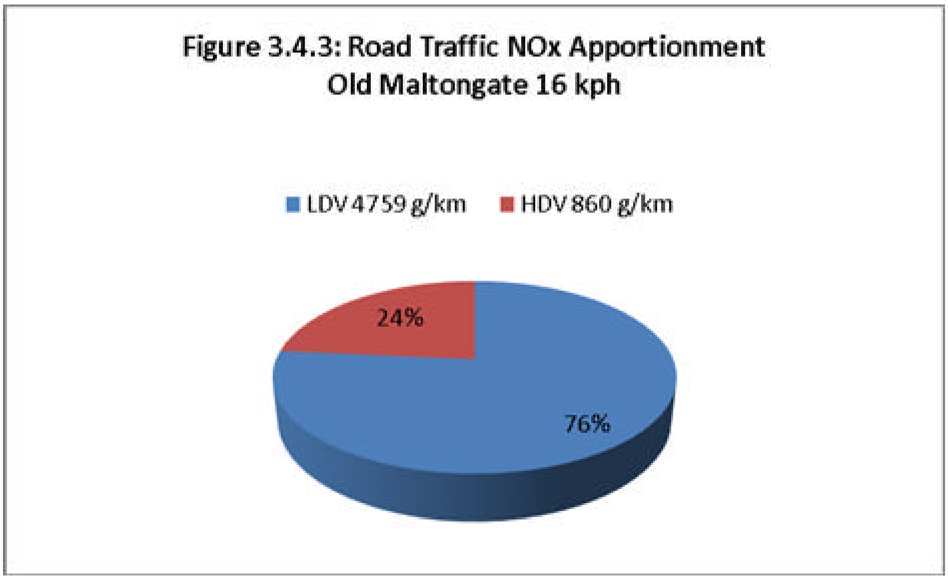
Road	%HDV	Annual Average Daily Traffic (AADT) Flows 2009
Yorkersgate B1248	2.1	12926
Castlegate B1248	2.5	14650
Wheelgate B1257	2.9	10432
Old Maltongate B1257	1.3	7390

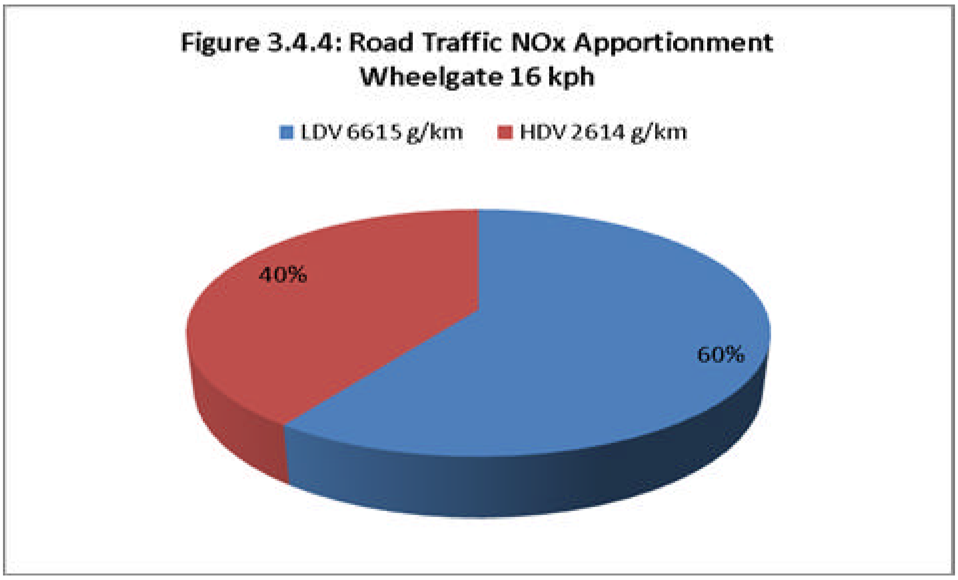
Road speeds along the town centre roads vary considerably during the day. During peak hours congestion often results in standing traffic. Railway level crossing closures also increase congestion and reduce traffic speed between the B1257/B1248 junction and the crossing on a regular basis during the day. Running the software using various road speed scenarios provides an indication of how speed affects overall NO_x emissions from vehicles using these roads and what if any effect speed has on apportionment of NOx emissions between HDV's and LDV's.

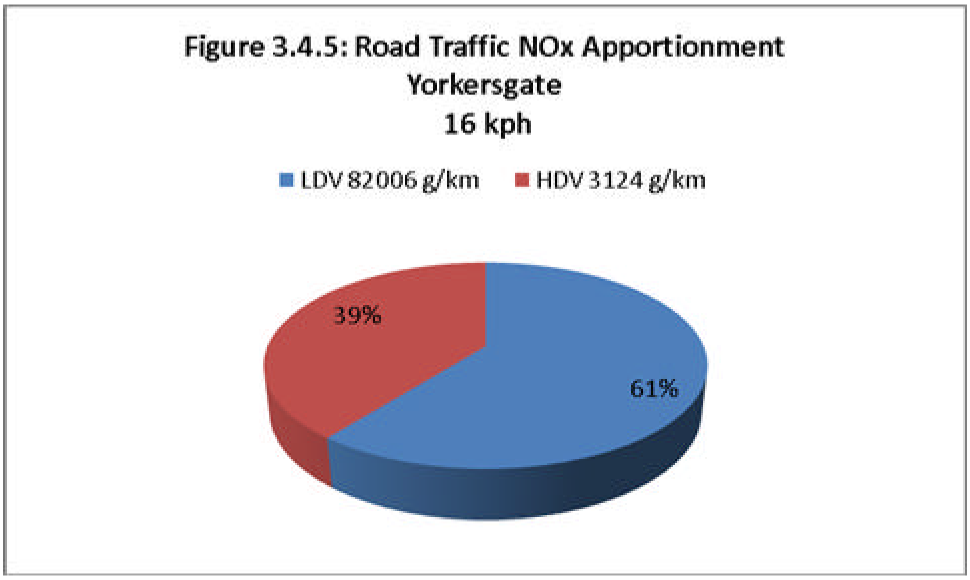
The following series of Pie Charts show the apportionment of NO_x emissions arising from road traffic within the AQMA on each of the four roads at an average speed of 16 kph.

Figure 3.4.2: Road Traffic NOx Apportionment Castlegate 16 kph









Although HDV's make up between just 1.3% and 2.9% of traffic in the AQMA, the above charts indicate that according to the model, at an average speed of 16 kph

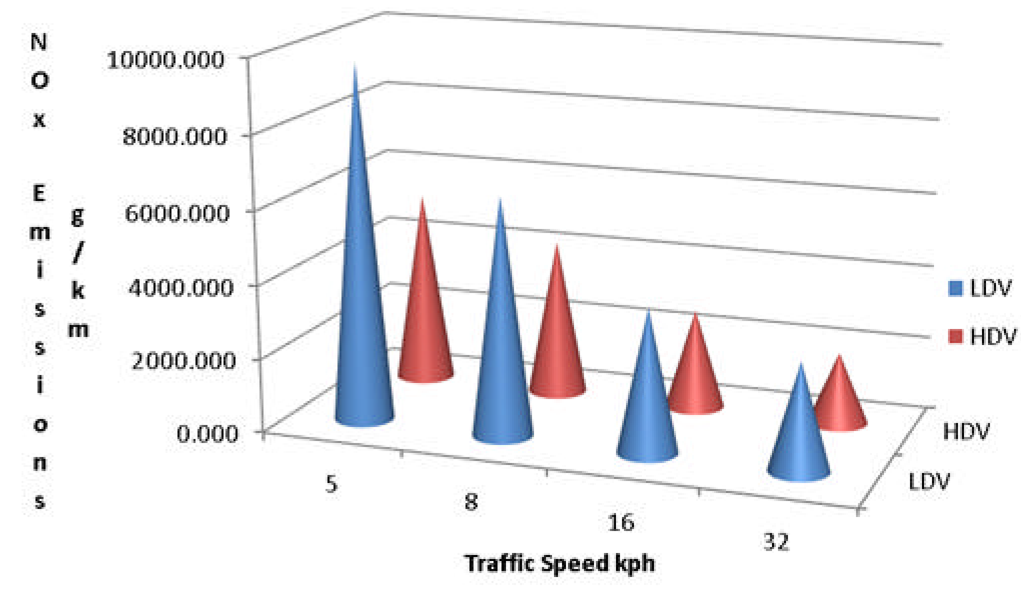
HDV's account for up to 40% of traffic NO_x emissions in the AQMA. At lower speeds the model shows that relative contribution from HDV's is reduced, falling to between 19% and 30% at an average speed of 5 kph. At speeds above 16 kph there is very little change in the apportionment of emissions between HDV's and LDV's.

The model results indicate that because of the disproportionately high levels of NO_x emissions from HDV's, any measures identified in the Air Quality Action Plan that target reductions in the number of HDV's would be particularly beneficial in reducing NOx. For example, a 25% reduction in HDV's (a reduction of just ~0.5% of the AADT flows) may result in a reduction in total road traffic NO_x emissions of approximately 10%. In the case of the AADT figures detailed above in Table 3.4.1, this would equate to a reduction of 68 HDV's a day on Yorkersgate (B1248) and 91 HDV's a day on Castlegate (B1248).

Were it to prove to be not possible to target HDV's, much greater overall reduction in numbers of vehicles would be required to achieve a comparable reduction in emissions. In the event that traffic reduction was largely confined to LDV's then a reduction in total vehicle numbers of about 15% would be required to achieve a 10% reduction in emissions.

Although the model indicates that changes in traffic speed will have a relatively minor impact on source apportionment, it does indicate that total NO_x emissions increase sharply as traffic speed falls. The effect of traffic speed on source apportionment and total NO_x emissions is illustrated by the chart in Figure 3.4.6 below. The chart shows modeled road NO_x emissions from traffic on Wheelgate (B1257) at various traffic speeds.

Figure 3.4.6: NOx Emissions, Apportionment and Traffic Speeds



These model outputs indicate that besides traffic volume and fleet profile, traffic speed is an important factor in determining road traffic NO_x emissions levels. There are conceivable scenarios where the impact on traffic NO_x emissions of reductions in traffic levels could be negated by a decrease in traffic speed. Therefore in developing an Air Quality Action Planning, as well as identifying the impact of any measures on traffic levels and composition, consideration will also need to be given to the potential impact on traffic speeds.

4 New Local Developments

Since the May 2010 when the Council issued its latest Air Quality progress report no planning application approvals have been approved that it was considered could have a significant impact on air quality.

A64 Brambling Field Interchange

Proposals for the development of a new interchange at Brambling Fields on the A64 are at an advanced stage. The new interchange would allow access to and from Norton from the eastern side of the Malton by-pass for traffic travelling to and from the west. The scheme, which is to be jointly funded by North Yorkshire County Council, Ryedale District Council and developer contributions, is intended to allow a significant volume of through traffic to avoid Malton town centre. Supplementary measures including are also being considered

A supplementary traffic management scheme is under development to complement the new interchange. The measures under consideration include restrictions on the movement of HDV's through the town centre. An Air Quality Impact Assessment of the proposals with particular emphasis on the impact within and in close proximity to the Malton AQMA has been undertaken and is currently being considered.

5 Conclusions

In fulfilment of its duty under the Local Air Quality Management (LAQM) regime, the Council has undertaken a Further Assessment of air quality in Malton following the declaration of an Air Quality Management Area for NO_2 in December 2009.

The Further Assessment, which is required to supplement information provided in previous assessments, was based on modelling of NO_x traffic emissions, using updated background pollutant concentrations, monitoring results, and traffic data for the year 2009, and based on the methodology described in the Technical Guidance LAQM.TG(09) issued by Defra.

Source apportionment of NO_2 contribution was carried out based on the following vehicle categories: Light Duty Vehicles (cars, light goods vehicles and motor cycles) and Heavy Duty Vehicles (coaches, buses, and heavy goods vehicles).

The road traffic NO_x reduction required to meet the NO_2 annual mean Air Quality objective in the AQMA was calculated on the basis of the highest concentration measured at locations representative of public exposure (facades of properties).

The latest monitoring results show that there continue to be exceedences of the NO_2 annual mean air quality objective occurring in Malton at locations where there is relevant exposure as defined by guidance (principally residential properties)·

These exceedences are occurring entirely within the current Malton Air Quality Management Area (AQMA). The results indicate there is no need to increase or decrease the extent of the AQMA.

At the various monitoring locations within the AQMA where NO_2 levels have been found to exceed 40µg/m^3, estimates suggest that emissions of nitrogen oxides from local road traffic would need to be reduced by at least ~8% in order to meet the AQO.

Although Heavy Duty Vehicles less than 5% of traffic flows on the roads in the AQMQ, HDV's account for up to 40% of total NO_x emissions from local road traffic. Measures considered in the action plan that could reduce the number of HDV's travelling through Malton town centre would be likely to make a large contribution towards reducing NO_2 levels in the AQMA and meeting the AQO.

Modelling of vehicle emissions indicates that traffic speed has a major impact on vehicle NO_x emissions, emissions increasing sharply as average speed falls. The impact on traffic speeds of measures identified in the action plan should therefore be considered carefully.

Following submission of the Further Assessment the Council is required to produce an Air Quality Action Plan, by 13 June 2011, the deadline for submission of the Action Plan being 18 months from when the AQMA Order was made.

The next Progress Report will be produced and submitted to Defra by 30 April 2011.

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