Calderdale Council

Environment Act 1995

Calderdale Air Quality Management Area (No 3)

Hebden Bridge Further Assessment Report

September 2007

A Plain Language Guide to the Report

In 2006 Calderdale declared part of Hebden Bridge as an **Air Quality Management Area** (**AQMA**) due to the levels of **nitrogen dioxide**, which has the chemical symbol **NO_2**. This brief guide gives a simple explanation of some of the terms and contents of the report. It is not intended to replace a reading of the report itself.

Justifying the AQMA- Measurement and Modelling of Nitrogen Dioxide

Section 2 of the report examines why the AQMA was necessary by reviewing the monitoring data and discussing a possible change in the AQMA boundary.

The Council uses two different methods to measure nitrogen dioxide. We use an electronic monitor called a 'Romon'. It continuously measures NO_2 and its results can be analysed hourly, monthly etc. We also use 'passive diffusion' test tubes to collect NO_2 from the air for 1 month. They are then analysed afterwards to give an average level of nitrogen dioxide for that month.

We derive average levels for a whole year from the two different sets of data. As the Romon gives more accurate readings than the tube we adjust the results from the tubes by comparing them with the results from the Romon. This is called **bias correction**. If only a part-year of results is available for a tube we adjust those results by comparing them to tubes where a full year of results is available. This is called **period correction.** Sometimes where no data is available we use computer programs to predict or **model** levels of pollution. Modelling offers the best estimate of pollution, and the characteristics of traffic that are contributing most to pollution. However it is subject to several limitations and it cannot replace the value of actual measurement.

What are the likely levels of Nitrogen Dioxide in the future?

Vehicles burn fossil fuels eg petrol and diesel. Some fuels contain nitrogen impurities. Nitrogen also exists in the air we breath. Burning fuel in air allows the nitrogen to combine with oxygen to produce gases called **nitrogen oxides** (**NOx**). Complicated chemical reactions convert the NOx to NO_2. In 2010 the EU expects the UK to have reduced NO_2 pollution to acceptable levels, but work to bring about the reductions will not stop at 2010.

Section 4 discusses **background levels**, ie the levels that would exist were the local A646 traffic not there. Local and distant sources, eg local factories and distant traffic, contribute to this 'background'. Knowing the background levels today allows an assessment of the amount of pollution being caused by the A646 traffic today, and is used to predict the situation to 2010, and beyond.

Constant changes in the numbers and types of vehicles on our roads, speed, driving characteristics etc affect how much fuel is burned. Individual new vehicles are assumed to be more fuel-efficient and less polluting than older vehicles, and so pollution levels should fall. The computer models that we use assume that a certain amount of NOx is converted to NO_2 to reflect this reduction.

However the exhaust systems of modern vehicles use catalytic converters. These trap nitrogen oxides, but allow nitrogen dioxide to escape. This means that the amount of nitrogen dioxide directly emitted by vehicles as a proportion of nitrogen oxides is increasing. Even if individual vehicles emit less pollution, more vehicles on our roads may cause overall levels of NO_2 to rise in some cases. Appendix A3 suggests a different rate of conversion of NOx to NO_2 to that assumed by the computer models, based on local measurements. The combined effect of all these variables makes accurate prediction very difficult. Such predicted levels are not guaranteed, and a prediction cannot replace the value of a measurement. That is why the models are used to highlight the *types* of vehicles that are seen to contribute most to emissions, and the *scale* of that contribution, rather than be relied upon for a definitive measure of pollution levels.

Other Considerations For an Action Plan

This report will be used as the basis for an **Air Quality Action Plan** (**AQAP**) of measures to try to achieve more acceptable levels of NO_2. An AQAP is not just about reducing pollution. Reducing exposure to pollution and avoiding situations that prevent the dispersion of pollution is also important. Section 5 discusses local commuting and recent planning development, and how local and national policy might contribute to better air quality in Hebden Bridge.

If you have any questions about this report, please do not hesitate to contact Environmental Health Services.

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1. Introduction

An Air Quality Management Area (AQMA) covering the A646 corridor in Hebden Bridge came into effect on 1st September 2006.

The AQMA was designated under Section 83 Environment Act 1995. The annual mean air quality objective (AQO) for Nitrogen Dioxide (NO_2) specified in the Air Quality (England) Regulations 2000 is 40µg/m^3. The designation was in part due to a known exceedence of the AQO and in part due to modelled evidence of a likely exceedence of the AQO.

Section 84(2) of the Act now requires further assessment of the AQMA. This further Assessment addresses the following issues

- Confirmation of the original assessment of air quality (Sections 2.1 and 2.2)
- Review of the existing AQMA boundary (Section 2.3)
- Review of Comments made by Statutory Consultees (Section 3)
- Calculation of the extent of improvement in air quality needed (Section 4)
- The impact of recent policy developments upon the AQMA (Section 5)

2 Confirmation of the original assessment of air quality

Essentially this comprises

- a review of the information available leading up to declaration of the AQMA
- assessment of information available post-declaration

Review of information available leading up to declaration of the AQMA

Hebden Bridge air quality had been investigated since the 1990s. There had been passive monitoring using diffusion tubes in the town centre since 1993 and periods of continuous monitoring using the large Groundhog monitor on Bridge Gate in 2000, and close by at West End between 2002 - 2003.

The 2003/04 Detailed Assessment reported measured and forecasted levels within the AQO. However traffic congestion on the A646 in Hebden Bridge had always been an issue and in 2004 further changes to the highway were proposed. Elsewhere in the Borough it was apparent that monitoring locations even a short distance from a highway could be relatively unaffected by road traffic. It was agreed to measure the effect of changes to the A646 by measuring emissions close to the highway. Sites previously used for continuous monitoring at West End and Bridge Gate were no longer available and there were no other suitable sites to locate the Groundhog monitor. Government funding was sought to purchase a smaller Romon continuous monitor, and one was located on Market Street in late 2005 and over subsequent months the deployment of diffusion tubes was revised. The data gathered is summarised in Tables 1 and 2, and the position of the monitors appear in Figure 2 below.

Table 1: NO_2 Diffusion Tube Results (in μg/m^3) Hebden Bridge, 2002-2006							
Tube ref	**Location**	**Position**	**year**				
			02	**03**	**04**	**05**	**06^**
NO1	Bridge Gate/ West Street	kerbside/ roadside	27	26	25	27	
HB1	Market Street (GF)	roadside	41	38	34	36	51
HB5	Market Street (FF)	roadside	38*	30*	24	31	40
HB2	Bridge Lanes	roadside	34*	32	30	32	43
HB3	Central Street School	urban background	23*	22	21	23	24
HB4	New Road	roadside	34*	34	32	26	40

Notes to Table 1: *Not a full set of 12 measurements.
^ January to June, bias corrected B=0.89, period correction factor 0.96-see Table 3C

Table 2: continuous monitoring data (in μg/m^3) Romon 3, Market St, Hebden Bridge			
Period	**Average**	**1-hour exceedences**	**Data capture (%)**
November 2005	55.7	0	97.7
December 2005	54.4	0	97.7
Jan - Jun 2006	49.5	0	97.6

The levels of nitrogen dioxide derived from continuous monitoring in 2005 were considered unrepresentative of the true annual mean given the relatively short period of deployment of Romon 3 and unusually elevated levels of NO_2 being experienced across the region from October 2005. However a crude period correction of the continuous monitored data (to be seen as an indication of the considerations to be applied when more detailed information becomes available) using data from Romon 2 at Huddersfield Road, Halifax, indicated that levels around 40-45μg/m^3 would be more representative of the true situation.

The area west of the junction of the A646 New Road/ West End with Bridge Gate and Holmes Road presents a typical street canyon, with tall terraced buildings separated from the highway by narrow pavements, and with some residential accommodation above and between shops. The area east of this junction is wider, and the buildings not so tall, with some open space on the south side of the highway.

The A646 corridor was modelled using ADMS Urban 2.2 with MapInfo as the visualisation tool, and weather and traffic data inputs to compute pollutant concentrations and distribution. The results of modelling are shown in Figure 1below.

There is always concern about the accuracy of modelling outputs, which arises from

- The use of regional weather data compared to actual local weather. Calderdale possessed weather data sets for Leeds 2000, and for Bingley 2001-2005. Leeds and Bingley weather stations lie 32km and 15km east and northeast respectively of Hebden Bridge. Datasets include data for cloud cover, used to estimate solar radiation and hence the heating of air at ground level and, with wind data, permit modelling of distribution of pollution over the area. Cloud cover is determined at RAF Leeming 70km to the north-northeast.
- How representative modelling is of actual topography and buildings. Reference is made above to the existence of a street canyon. The accuracy of local traffic data,

given a complex highway design with several junctions, peak time congestion, and variable traffic speeds. The council held some 2004 and 2005 data, primarily Annual Average Daily Traffic (AADT) two-way 24-hour flows, and in one case some 2007 data, coupled with a limited breakdown of the use-class gained from visual surveys in separate peak hour flows.

- How accurately modelling predicts production of NO_2 from NOx (See Appendix 2)

In figure 1 below the yellow-shaded areas represent concentrations above the AQO of 40µg/m^3 NO_2. These clearly impact on most of the properties fronting the A646. Orange-shaded areas represent concentrations of 49µg/m^3 and above and blue areas below 40µg/m^3. In Figure 2 below diffusion tube HB5 is located at 1st-floor level where some reduction in NO_2 concentration is expected over the lower placed HB1, albeit the difference is variable and the model calculates emissions at ground level.

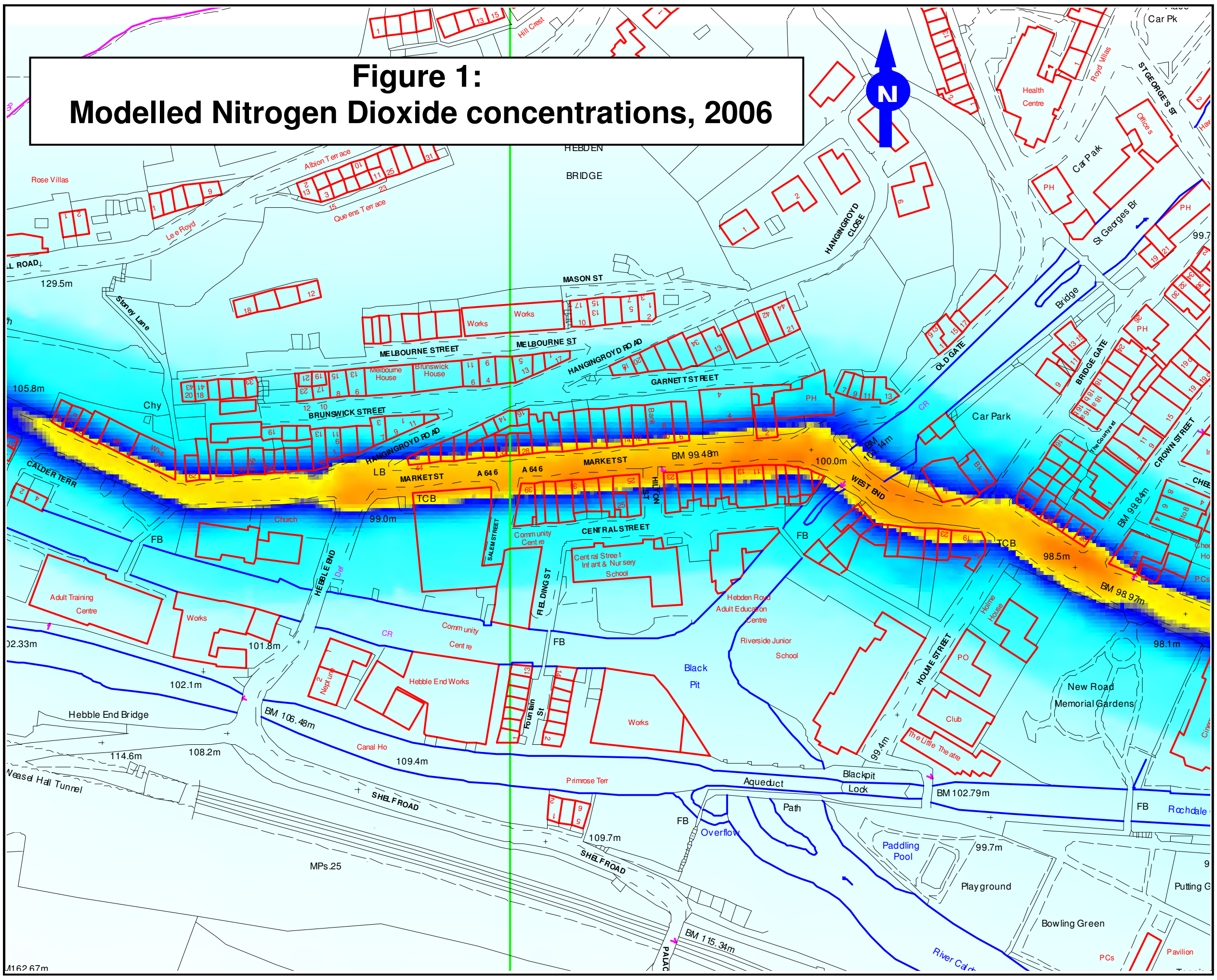


Figure 1: Modelled Nitrogen Dioxide concentrations, 2006

Model outputs were comparable with the measured data and it was considered that sufficient information existed to show that NO_2 levels in this corridor were likely to exceed the AQO of 40µg/m^3. The Updating and Screening Assessment 2005 (reported in 2006) concluded that NO_2 at the A646 at Hebden Bridge was likely to exceed, if not already exceeding, an annual average AQO of 40µg/m^3. In determining a boundary Statutory Guidance LAQM.PG(03) promoted inclusion of areas in the AQMA where modelling indicated poor air quality, and pointed to not sub-dividing blocks of terraced residential property, or of houses from their gardens. The AQMA boundary was drawn accordingly, as portrayed in Figure 2 below. An AQMA covering the A646 corridor was declared, taking effect 1 September 2006.

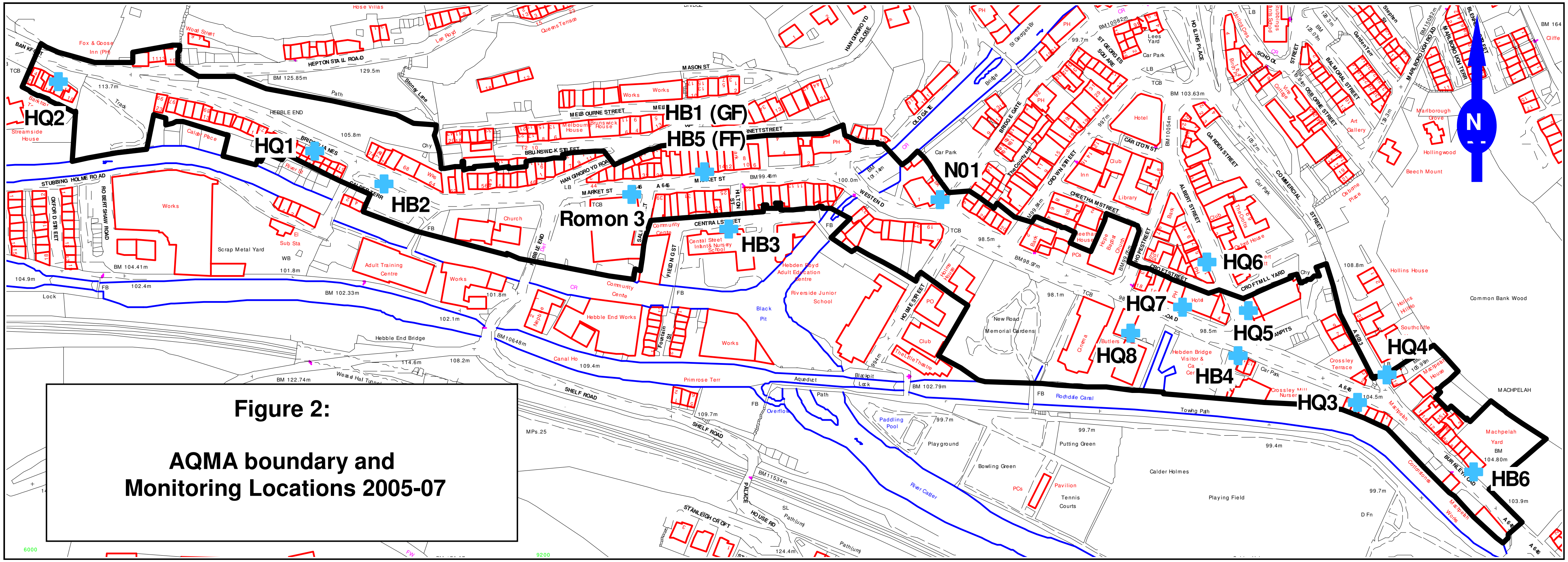


Figure 2:

AQMA boundary and Monitoring Locations 2005-07

Assessment of information available post-declaration

Tube NO1 was discontinued. Additional diffusion tubes designated HB6 and HQ1 to HQ8 were located in the AQMA, often at first floor level as much of the existing and potential residential accommodation was "living above the shop". This made a total of 14 diffusion tubes and the continuous monitor 'Romon 3' deployed in the AQMA (see Figure 2 above).

Monitoring data to December 2005 has been published in the Updating and Screening Assessment 2005. Data to June 2006, ie pre-declaration, is given in Tables 1 and 2 above. Data in respect of tubes for the whole of 2006 and to July 2007 is given in Table 3 below. Data from Romon 3 for the whole of 2006 and to June 2007 is given in Table 4.

Table 3: Diffusion Tube Measurements (µg/m^3) [Period and Bias Corrected] January 2006 – August 2007			
Tube	**January-December, 2006***	**September-December, 2006^**	**January-August, 2007#**
HB1	52		57
HB2	42		45
HB3	26		26
HB4	40		44
HB5	38		42
HB6	42		48
HQ1		69	65
HQ2		31	32
HQ3		44	48
HQ4		42	41
HQ5		35	44
HQ6		39	35
HQ7		44	47
HQ8		33	30

Notes on Table 3:
*January – December 2006 Bias Correction 0.89
^September– December 2006 Period correction 0.97, Bias Correction 0.89-see table 3B
#January– August 2007 Period correction 1.14, Bias Correction 0.89-see table 3A

Tables 3A, 3B and 3C show the calculation of the period correction factors used in Table 3. Table 3B utilises the full 2006 set of results from the relevant tubes, and reflects a period corrected mean for 2006. The factor for January to August 2007 (Table 3A) is derived from the results for 2006 and so Table 3 represents a mean for 2006 (as if the tubes had been exposed for a full year in 2006).

Table 3A: Derivation of Period Correction Factor (Jan-Aug 2007) for Table 3 using the Method set out in Paragraph 6.26/ Box 6.5 of TG(03)			
Tube ref	Am (2006)	Pm (2007)	Factor
HB1	58	56	1.03
HB2	47	44	1.07
HB3	29	25	1.15
GH1	57	43	1.33
		Mean	1.14

Table 3B: Derivation of Period Correction Factor (Sep-Dec 2006) for Table 3 using the Method set out in Paragraph 6.26/ Box 6.5 of TG(03)			
Tube ref	Am (2006)	Pm (2006)	Factor
HB1	58	60	0.97
HB2	47	47	1.00
HB3	29	33	0.86
GH1	57	55	1.04
		Mean	0.97
Table 3C: Derivation of Period Correction Factor (Jan-Jun 2006) for Table 3 using the Method set out in Paragraph 6.26/ Box 6.5 of TG(03)			
Tube ref	Am (2005)	Pm	Factor
HB1	51	60	0.85
HB2	46	50	0.92
HB3	33	28	1.18
GH1	55	61	0.90
		Mean	0.96

Table 4: Continuous Monitoring Results in (µg/m3) 2006-2007				
Monitor	Monitoring Period	Period average NO_2 concentration	No. of exceedences of 200µg/m^3 hourly average	Percentage data capture
Romon 3	January–December 2006	48.4	0	87.7
	January-August 2007	44.1	2	96.7

Data capture for 2006 was below desired levels. In July 2006 flooding occurred in Hebden Bridge, affecting Romon 3. Although it was dried out and restarted 1 week later Romon 3's air-conditioning failed in early September, in turn causing the NOx analyser to fail. The unit was unserviceable until late September and this downtime accounts for most of the data loss. However there is no indication of any potential to exceed the hourly average NO_2 AQO and so the Romon 3 and the passive diffusion tube data largely support the AQMA boundary as drawn, with few locations that might warrant removal from the AQMA.

Re-consideration of the AQMA boundary

Monitoring data shows levels of NO_2 in excess of the annual mean AQO at most monitoring locations in the AQMA as presently defined. However there are a small number of locations where levels are lower than originally expected.

HQ2 is located on a terraced house facade facing the traffic light-controlled junction of the A646 Bankfoot and Heptonstall Road. It is set back some 10m back from the roadside, whereas other houses in the terrace are as close as 6.5m. The bias-corrected and period-corrected mean for the period September-December 2006 at HQ2 was 27µg/m^3 and 29µg/m^3 for the period January-August 2007. The traffic on Heptonstall Road is lighter still in comparison to that on Bankfoot and there is an argument for removing Bankfoot Terrace and the properties at 9-15 Heptonstall Road from the AQMA, whilst retaining the land between Bankfoot Terrace and Calder Place / Bridge Lanes.

HQ8 is on the façade of the Tourist Information building, set back some 15m from the A646. The location is more open there, and not enclosed by tall terraced buildings as it is elsewhere in the AQMA . The bias-corrected and period-corrected means at HQ8 are 28µg/m^3 for the period September-December 2006 and 27µg/m^3 for the period January-August 2007. HQ8 can be contrasted with HQ7 positioned only 3m from the same stretch of road. The bias-corrected and period-corrected means for HQ7 are 38µg/m^3 for the period September-December 2006 and 43µg/m^3 for the period January-August 2007.

HQ8 suggests that the tourist information office could be removed from the AQMA, along with the memorial gardens to the west. However Hebden Bridge cinema, and to the east 13 and 14 New Road and Crossley Mill nursery present relevant exposure and HQ7, HB4 and HQ3 point to NO_2 levels close to the AQO in those locations. Some buildings in the AQMA are used as dwellings, being originally designed as such. Other properties include churches, the library, pubs, café/restaurants and shops. Although the public is 'exposed' the exposure may not be seen as relevant if it is not regularly and significantly in excess of 1 hour. However existing planning policy does encourage conversion of unused space above a shop to a dwelling as a way of supporting town centre life, yet this might then create new relevant exposure. Hence whilst HQ2 and HQ8 suggest that some discrete locations could be removed from the AQMA (see figure 3 below) it may be that refining planning policy (see paragraph 5.3 below) to discourage the creation of new relevant exposure in an AQMA could lead to a more significant revision still.

It is possible that there may exist an argument at a future date to extend the AQMA in the vicinity of Garden Street. The bias-corrected and period-corrected mean for HQ6 for the period September-December 2006 is 33µg/m^3 and for the period January-August 2007 it is 32µg/m^3, ie well within the air quality objective. However there is a proposal, as yet to be determined, to build a multi-storey car park off Garden Street north of HQ6. Such a development might attract more traffic in general and cause a rise in local levels around the town centre, which has a degree of one-way traffic.

A reduction in the maximum permitted road speed from 30mph to 20mph along the A646 in Hebden Bridge is due for implementation by December 2007. Clearly this may affect emissions in the AQMA. It is therefore considered prudent not to alter the AQMA boundary at this time, but to await the impact of the change to permitted road speed.

3 Review of Comments made by statutory consultees

The intention to declare the A646 corridor was featured in the Updating and Screening Assessment 2005. Subsequent investigations at Hebden Bridge were also featured in the Detailed Assessment 2006 published April 2007. No response was received from any of the statutory consultees relating to the content of the 2005 or 2006 reports, in respects of Hebden Bridge.

4 Calculation of the extent of improvement in air quality needed

This section concentrates on

- determination of a background concentration of NO_2 for Hebden Bridge for 2006 and projection of same to 2010
- establishing local traffic data source apportionment and model projections for 2006 and 2010

4.1 Background NO_2 concentration

In determining a representative background NO_2 concentration for the AQMA reference was had to diffusion tubes. HB3 at Central School is connected to the A646 Market Street by the short (26m long) highway of Hilton Street, but otherwise it is shielded by terraced property on Market Street outside the AQMA itself. HQ6 is just outside the AQMA on Albert Street, a well-used road that affords access to the town centre. HQ8 is at the tourist information office some 20m from the A646, but within the AQMA and in a slightly more open environment. In the absence of suitable other monitoring locations regard was had to the background emissions published in August 2007 on the National Atmospheric Emissions Inventory (NAEI) (www.airquality.co.uk/archive/laqm/tools/43_2004.csv), to projections of data using ADMS Urban software, and to projections using the NAEI and LAQM.TG(03). [see Figure 3 and Table 5 below]

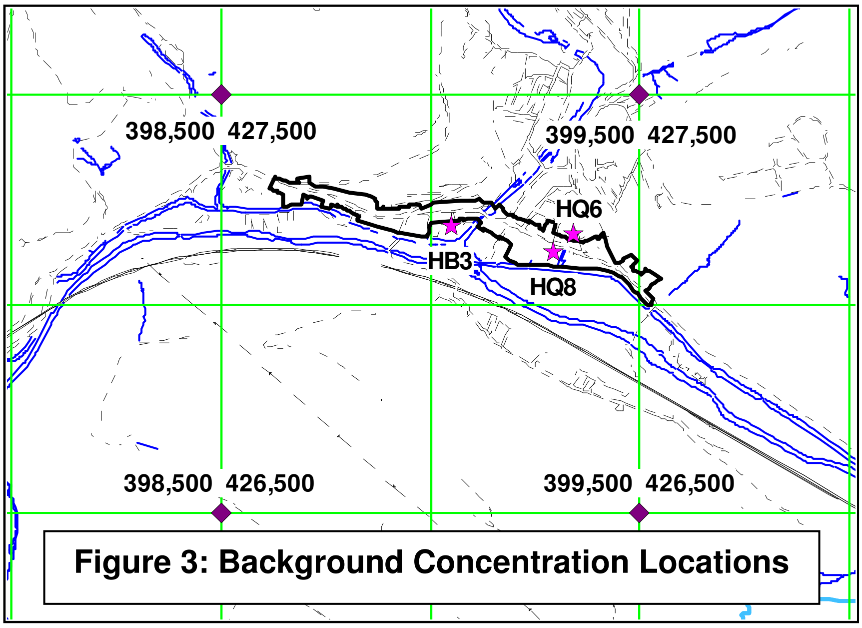


Figure 3: Background Concentration Locations

The determination of a representative background NO_2 concentration for the AQMA has proven difficult. The predominant wind direction is from the west along the Calder valley and there will be local wind flows created by Hebden Water. There is little by way of industrial emissions in the area, with most sources being in the west. The distinctive built-environment of Hebden Bridge of tall terraced buildings close to the roadside might well shield receptors that are otherwise positioned only a short distance from the highway. The reference points in Table 5 present the most appropriate points available to determine a background concentration.

Table 5: Ambient NO_2 concentrations (μg/m^3) and projections to 2010							
Code	**Location**	**Type**	**2005**	**2006**	**Projection method from 2005/2006 to 2010**		
					NAEI	**LAQM. TG(03)**	**UKA-YAC 2010$^{\$}$**
HB3	Central School	urban background		26		22.9	23.2
HB3	Central School	urban background		23.6$^{\#}$		21.4$^{\#}$	21.7$^{\#}$
HQ6	Albert Street	urban roadside		33		29.0	29.6^
HQ8	New Road	urban background		28		24.6	25.1
NAEI*	NGR 389500, 426500 (Bents hamlet, on hillside south of Hebden Bridge)	rural background	11		8.9		9.6
	NGR 389500, 427500 (east of Hebden Royd primary school)	suburban background	11		9		9.6
	NGR 399500, 426500 (on hillside above Crow Nest Wood)	rural background	11.5		9.3		10.1
	NGR 399500, 427500 (Eiffel Street, Birchcliffe, hillside to north of AQMA)	urban background	11.3		9.2		9.9

Notes to Table 5
* Source from UK air quality archive (www.airquality.co.uk/archive/laqm/tools/43_2004.csv)
^ Projection is for 'NO_2 background'. Projection using NO_2 roadside gives an estimate of 28.6μg/m3
$ Projections using the UK archive year adjustment calculator v 2.2a [www.airquality.co.uk/archive/laqm/tools/Year_Adjustment_Calculator22a.xls] are seen as preferable to those using Box 6.7 of LAQM.TG(03)
# Represents period September 2006-August 2007. Bias correction factor 0.847 derived from Romon 2 at Salterhebble, Halifax. Projections to 2010 assume a base year of 2007.

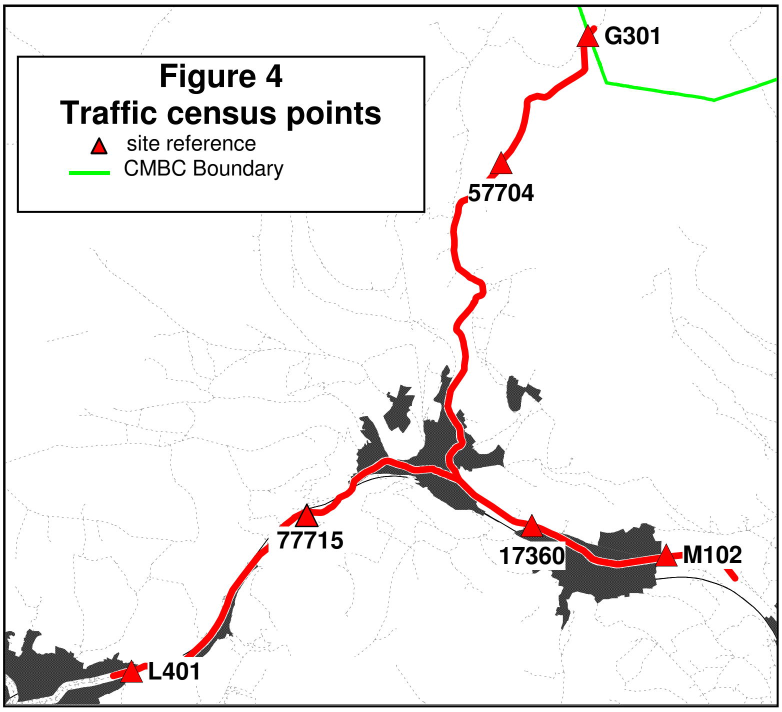
However whilst measured levels are preferred to NAEI estimates, the disparity between the two sets of data for Hebden Bridge does not offer an easy compromise in choosing a background location. Central Street serves a school, a community centre and an adult education centre, but offers little parking facility. Even when the school is closed the other two facilities are open and clearly there is some daily traffic component here. Choosing HB3 and hence 26μg/m^3 as a background level appears high when A646 roadside levels at HQ2 are 27μg/m^3 (although 52 μg/m^3 at HB1 near the junction of Market Street and Hilton Street). It is also 'high' when compared to the background levels of 20μg/m^3 and 18.3μg/m^3 determined for the AQMAs at Salterhebble, Halifax and Sowerby Bridge. It was not feasible to correct this figure, based on an average ratio of levels experienced at HB3 for summer holidays (August) compared to annual levels. Table 1 above suggests an increase in annual levels in 2006 over that experienced for 2002-05, which were in the range 21-23μg/m^3 per year. Provisional readings for 2007 in Table 3 suggest a slight fall for the high of 2006 back to 23μg/m^3, but this not the case for each tube, and those projections unavoidably incorporate period and bias correction factors.

A 12-month mean of 23.6µg/m^3 was calculated for HB3 for the period September 2006-August 2007, and projected to 2010 using 2007 as the base year. In the absence of another figure that may appear more appropriate to use it was decided to select 23.6µg/m^3 as the current background level. The UK archive data and year adjustment tools were revised recently to account for current thought on the levels of NO_2 and NOx to be expected in 2010. However LAQM.TG(03) does not incorporate such revision. The projection of a background NO_2 level in 2010 is 21.7µg/m^3.

4.2 Local Traffic data

Traffic survey locations are depicted on Figure 4 below and the data obtained in Tables 6 to 11 below. The following sources were considered

- National Traffic Surveys (link census counts) –measured 12 hour and estimated 24-hour flows, together with breakdown of vehicle use-class.
- Automatic traffic data (long term monitoring programme, 24hr AADT flows)



Tables 6, 8 and 10 below detail the results of a 12-hour Peak time (7am –7pm) National Traffic Survey. 24-hour AADTs are estimated from the 12-hour data.

Table 6: Traffic census site 17360- A646 Burnley Road, E of Hebden Bridge, Wednesday 5 May 2004									
Direction of Count Eastbound/Westbound	Pedal Cycle	Motor Cycle	Cars & Taxis	PSV	Light Goods	Rigid Axle vehicles	Articulated Axle vehicles	TOTAL	%age vehicles > 1.5t
Measured 12hr WB count	28	35	5559	158	1113	282	42	7217	6.7%
Estimated 24hr WB count								7936	
Measured 12hr EB count	36	34	5833	163	1165	199	55	7485	5.6%
Estimated 24hr EB count								8230	
Estimated AADT 24hr 2-way count								16166	6.1%

Table 7: Traffic census site M102 - A646 Burnley Rd (East of Mytholmroyd) 2005			
Direction	total vehicles		
	08:00-09:00 weekday	17:00-18:00 weekday	24hour weekday
Westbound	546	727	8409
Eastbound	678	593	8218
2-way count			16627

Table 8: Traffic census site 57704- A6033 Keighley Road Pecket Well, Thursday 26 May 2005									
Direction of Count Northbound/Southbound	Pedal Cycle	Motor Cycle	Cars & Taxis	PSV	Light Goods	Rigid Axle vehicles	Articulated Axle vehicles	TOTAL	%age vehicles > 1.5t
Measured 12hr NB count	2	17	876	22	144	17	1	1080	3.7%
Estimated 24hr NB count								1188	
Measured 12hr SB count	5	13	819	20	147	26	2	1032	4.7%
Estimated 24hr SB count								1135	
Estimated AADT 24hr 2-way count								2323	4.2%

Table 9: Traffic census site G301- A6033 Keighley Rd, Cock Hill 2005			
Direction	total vehicles		
	08:00-09:00 weekday	17:00-18:00 weekday	24hour weekday
Southbound	80	140	1320
Northbound	90	110	1300
2-way count			2620

Table 10: Traffic census site 77715- A646 Halifax Road Charlestown, Hebden Bridge, Friday 25 May 2007									
Direction of Count Eastbound/Westbound	Pedal Cycle	Motor Cycle	Cars & Taxis	PSV	Light Goods	Rigid Axle vehicles	Articulated Axle vehicles	TOTAL	%age vehicles > 1.5t
Measured 12hr WB count	31	82	4239	87	773	143	26	5401	5.1%
Estimated 24hr WB count								5939	
Measured 12hr EB count	25	62	3778	82	702	229	41	4919	7.2%
Estimated 24hr EB count								5409	
Estimated AADT 24hr 2-way count								11348	6.2%

Table 11: Traffic census site L401 -A646 Halifax Rd (East of Todmorden) 2005			
Direction	total vehicles		
	08:00-09:00 weekday	17:00-18:00 weekday	24hour weekday
Westbound	344	497	5870
Eastbound	398	407	5827
2-way count			11697

Sites 17360 and M102 (Tables 6 and 7) show similar overall traffic numbers between the 2004 and 2005 censuses, but site M102 is east of Mytholmroyd where some of the recorded vehicles may start or end their journeys, or may travel via the B6138 Cragg Vale rather than Hebden Bridge, albeit that road primarily serves local traffic.

Westbound traffic from the direction of Halifax and Sowerby Bridge to Hebden Bridge may have increased slightly to 8409 vehicles AADT-24 hours, and eastbound traffic from Hebden Bridge fallen slightly from the 8218 vehicles AADT 24 hours between 2004 and 2005.

Sites 77715 and L401 (Tables 8 and 9) are west of Hebden Bridge. Their data shows a marked similarity in overall traffic numbers between 2005 and 2007. Between 2005 and 2007 typical eastbound traffic from the direction of Todmorden to Hebden Bridge has fallen from 5827 to 5409 vehicles AADT-24 hours and westbound traffic from Hebden Bridge has increased slightly from 5870 to 5939 vehicles AADT-24 hours.

The A646 represents the main east-west route between Halifax and Todmorden, via Hebden Bridge. Many of the aforementioned vehicle movements will be through-traffic, including the 6.1% of vehicles that are public service and HGVs. The A6033 between Hebden Bridge and Haworth primarily serves local traffic. Sites 57704 and G301 (Tables 10 and 11) were both surveyed in 2005 on the same stretch of road. Typical southbound traffic to Hebden Bridge ranges from 1135 to 1320 vehicles AADT-24 hours and north-bound traffic from Hebden Bridge ranges from 1188 to 1300 vehicles AADT-24 hours. The majority of local residents who commute to the east will likely join the A646 at its junction with Commercial Street at the eastern point of the AQMA. Hence for the purpose of any modelling within the AQMA the data for site 77715 will be assumed.

The Council also referred to the Department for Transport's "Transport Statistics Bulletin – Road Traffic Statistics for Great Britain 2005 – Statistics Report SB (06)28" of July 2006. This document would describe the A646 as a principal urban 'A' road, maintainable by the local authority, and offers the following in respect of such roads

- some 80% of all motor traffic is cars and taxis
- typically between 18700 and 20000 vehicles a day would be a typical motor vehicle flow for the Yorkshire and Humberside region.
- goods vehicle traffic peaks slightly during the autumn period and mid week (Wednesdays/ Thursdays). Goods vehicle traffic is concentrated between 6am and 5pm, tailing off outside normal working hours
- car traffic on urban roads is more evenly distributed throughout the year and rises slowly from Mondays, peaking on Fridays.

In 2005 the A646 AADT 24-hour flow (site 11348) was well below this regional average at 11348 vehicles (see tables 6-11). The proportion of cars and taxis to all motor vehicles was also below the regional 80% average – typically 71%.

4.3 Source apportionment for 2006, and modelling projections for 2010

The AQMA lies at the junction of the River Calder and Hebden Water valleys. The predominant wind direction along is from the west. Paragraph 6.05 LAQM.TG(03) holds that the main sources of NOx are transport and electricity generation. Although there are several large mills most of these have been converted from single industrial uses to multiple smaller industrial/ commercial uses and to residential use, and some sites are currently vacant. Assessment was made of major boiler plant or other activity that might affect NOx levels, either by direct emissions or indirectly (eg traffic attending the site). Within 1km of the AQMA boundary, are

- Hebden Royd Primary School, Eaves Road, Mytholm
- Calder Mill, Stubbing Holme Road
- Supermarket, Market Street, including a small car park
- Hebble End Works, Hebble End
- Beehive Works Hebble End
- Bond Street Works, Hangingroyd Lane
- Salem Community Centre Central Street
- Central Street Infant and Junior School, Central Street
- Hebden Royd adult education centre, Central Street
- Riverside Junior School, Holme Street
- Pennine Industrial Park, Valley Road
- Victoria Works, Victoria Road
- The Packing Centre Victoria Road
- Nutclough Mill Victoria Road
- Birchcliffe Centre, Birchcliffe Road
- Railway Station, Station Road

There are no significant power generation plants within the AQMA. Emissions from smaller industrial units are presumed to either dissipate to the east or to contribute to the background concentration, measured at HB3 as 23.6$\mu g/m^3$ for 2006.

The A646 and A6033 are the main road transportation routes in the AQMA. The Leeds-Halifax -Manchester / Blackpool / Preston railway and the Hebden Bridge railway station lie just outside the AQMA. The rail line is lightly trafficked. Paragraph 6.50 of LAQM.TG(03) does not suggest it would be a significant local contributor to NO_2. There is also the Rochdale canal, primarily used by leisure traffic. The canal is not considered to be a major contributor to local NO_2 levels. The main source of nitrogen dioxide in this AQMA is from traffic using A646 and its contributory roads.

Paragraph 6.71 and Box 6.9 of LAQM.TG(03) offer a mechanism to derive NO_2 from NOx for road traffic sources. Normally I ppb of NOx is held as the simple sum of 1ppb NO and 1ppb NO_2, with most NO_2 arising from conversion of NOx in the atmosphere and a small amount from direct emissions. Paragraph 6.06 of LAQM.TG(03) holds that nitrogen oxides emissions from road transport are expected to fall to 2010 and beyond, with urban traffic NOx falling by some 20% between 2000 and 2005, and by 46% between 2000 and 2010. However, notwithstanding the dynamics of actual traffic conditions and driving patterns, no two vehicles of identical age, make and model, emit identical levels of pollution. Engine exhaust catalytic converters are intended to reduce emissions of NOx but it is now believed that they are less effective at controlling direct emissions of NO_2. Together with an expected increase in the overall numbers of vehicles on our roads there is an argument to say that the formula of Box 6.9 and contained within the model poorly represent actual conditions and a reappraisal of the envisaged reduction in NOx and NO_2 levels in the coming years is required. The UK air quality archive's year adjustment calculator attempts to provide a more realistic estimate of the reduction in NOx and NO_2 emissions that can be expected. This is used to supplement the TG(03) method used in Figures 5A and 5B below to show the extent of reduction of NOx and NO_2 needed at Hebden Bridge to bring NO_2 within the air quality objective by 2010.

Although it is a valid method concern persists about TG(03)'s assumptions regarding the production of NO_2 from NOx (see Appendix 2). The method is as Figures 5A and 5B.

Figure 5A:
Apportionment of NO_2 and NO_x emissions, Romon 3, Hebden Bridge

This applies the method of Box 6.9 of LAQM.TG(03) to determine the road traffic contribution to the total NO_2 concentrations measured at Market Street, Hebden Bridge, and projects the reduction needed in road traffic NOx to achieve the air quality objective of a maximum annual mean concentration of NO_2 of 40µg/m^3 by 2010.

The contributors to NO_x levels at Romon 3 in Hebden Bridge are road traffic and the background. No measurements have been made of the background NOx for Hebden Bridge. Romon 3 does measure NOx but it is located at the kerbside rather than in a background location, and the NAEI data (see Figure 3 above) appears to seriously underestimate the background NOx and NO_2 levels. Hence in using the TG(03) method the following information is relevant:

- diffusion tube HB3 (Central Street School) is used to represent a local annual mean background NO_2 for 2006 of 23.6µg/m^3
- measured total NOx at Romon 3 at Market Street, Hebden Bridge for 2006 of 164µg/m^3
- Barnsley Gawber AURN (automatic urban and rural network) monitoring station measures urban background concentrations of NOx and NO_2. It is one of a number of strategically located sites across the UK to assist the government in monitoring air quality. This site gives annual mean background levels for 2006 of 28µg/m^3 NOx (as NO_2) and of 19µg/m^3 NO_2. Its ratio of NOx to NO_2 is used to define the ratio of NOx to NO_2 at the local background tube HB3.

Using the measured background NO_2 concentration of 23.6µg/m^3 at HB3 (see paragraph 4.1 above) and the ratio of background NOx to NO_2 at Barnsley Gawber AURN site, the following are derived:

- the **mean background NOx level at HB3** is estimated as **34.8µg/m^3**
  [ie 23.6 x 28/19 $_{(\text{Barnsley NOx/NO}_2\text{ ratio})}$= 34.8]
- the **road traffic NOx contribution at Romon 3** is calculated as **129.2µg/m^3**
  [ie 164 $NOx_{(total,\ Romon\ 3)}$ -34.8 background $NOx_{(HB3)}$ = 129.2]
- the **NO_2 road traffic contribution at Romon 3** is **23.7µg/m^3**,
  [from Box 6.9, TG(03) where $NO_{2(road)}$=((-0.068 x Ln($NOx_{(total)}$))+0.53) x $NOx_{(road)}$]
  [where $NOx_{(total)}$ = 164µg/m^3 and $NOx_{(road)}$ = 129.2µg/m^3]
- the calculated **total NO_2 at Romon 3 is 47.3 µg/m^3**
  [ie 23.7 $NO_{2(road)}$+ 23.6 $NO_{2(background)}$ = 47.3].
  This value is close to the 2006 measured annual mean at Romon 3 of 48.4 µg/m^3.
- in 2006 the calculated **A646 road traffic contribution at Romon 3** of 23.7µg/m^3 represents **50.1% of the** recorded **total NO_2** and **21.2% of the total NOx**
  [ie=23.7/47.3 x 100 for NO_2] and [(164-129.2)/164 x 100) for NOx].

Figure 5A shows that road traffic contributed 23.7µg/m^3 of the annual mean NO_2 for 2006 at Romon 3. When added to the calculated background contribution of 23.6µg/m^3 NO_2 (giving 47.3µg/m^3) this corresponded well to the mean level of NO_2 48.4µg/m^3 measured by Romon 3 during 2006.

Figure 5B uses the year adjustment calculator to project some of the background levels from 2006 to 2010. The methodology of Box 6.9 can be used to see what reductions in levels are necessary if we are to achieve the air quality objective of 40µg/m^3. The calculation shows that overall NOx levels being recorded at Romon 3 in 2006 need to fall by 42µg/m^3, ie by 26% by 2010, and the contribution from road traffic itself by 36µg/m^3, ie 28%. This calculation assumes that the multiple small industrial and commercial emitters will also achieve reductions in the emissions that contribute to the background levels.

Figure 5B:
Projection of NO_2 and NO_x emissions to year 2010, Romon 3, Hebden Bridge

2006 background levels are projected to 2010 using the year-adjustment calculator at: www.airquality.co.uk/archive/laqm/tools/Year_Adjustment_Calculator22a.xls.

- the **forecast annual mean background NO_2 at diffusion tube HB3** (Central Street School) for 2010 is **21.1µg/m^3**.
- the **forecast annual mean background levels for 2010 for Barnsley Gawber** AURN monitoring station are **23.5µg/m^3 NOx** (as NO_2) and of **17µg/m^3 NO_2**.

From this

- the **forecast annual mean background NOx level at HB3** (Central Street School) in 2010 is **29.2µg/m^3**
  [ie 21.1 x 23.5/17$_{\text{(Barnsley NOx/NO2 ratio)}}$ = 29.2].

The estimated reduction in total NOx needed for NO_2 in the AQMA to fall from 47.3µg/m^3 in 2006 to no more than the AQO of 40µg/m^3 in 2010 can be derived as follows

- 23.7µg/m^3 NO_2 **road traffic contribution** at Romon 3 in 2006 **must reduce to 18.9µg/m^3** by 2010 to achieve the AQO of 40µg/m^3
  [ie 40 $NO_{2(total)}$ - 21.1 $NO_{2(background)}$ = 18.9 $NO_{2(road)}$].
- the value of **total NOx** at Romon 3 in 2010 equating to 18.9µg/m^3 NO_2 is **122µg/m^3**.
  [from Box 6.9 LAQM.TG(03) where $NO_{2(road)}$=((-0.068 x Ln($NOx_{(total)}$))+0.53) x $NOx_{(road)}$)]
  [ie ((-0.068 x Ln(122))+0.53) x (122-29.2) = 18.9]
  This in turn gives a **road traffic contribution to the total NOx at Romon 3 of 92.8µg/m^3**
  [122-29.2 = 92.8]
- the **reduction needed** for **total NOx** at Romon 3 to fall 42µg/m^3 from 164µg/m^3 to 122µg/m^3 in 2010 and comply with the AQO is **25.6%** of the 2006 level.
  [ie (164-122)/164 x 100]
- the **reduction needed** for **A646 road traffic contribution to total NOx at Romon 3** to fall from 129.2µg/m^3 to 92.8µg/m^3 to achieve the AQO in 2010 (ie 36.4µg/m^3) is **28.2%** of the 2006 level.
  [ie (129.2-92.8)/129.2 x 100]

In 2010 a **road traffic NO_2 contribution at Romon 3** of 18.9 µg/m^3 would represent **47.2% of the** AQO of 40µg/m^3 **NO_2** and **21.2% of the total NOx**
[ie=18.9/40 x 100 for NO_2] and [(164-129.2)/164 x 100) for NOx].

Using data from Table 3 with 2007 as base year and the NAEI year adjustment calculator for roadside reduction, NO_2 levels are projected to 2010 and shown in Table 12 below. In 2010 Table 12 suggests the annual mean NO_2 concentration at Romon 3 would be 44.4µg/m^3. The background concentration is projected at around 15µg/m^3 (See Table 5 above).

Table 12 suggests that NO_2 concentrations in the far western area of the AQMA in 2010 (tube HQ2) will continue to exist well below the Air Quality Objective. However tubes HQ1, HB1, HQ7, HQ3 and HB6 continue to project exceedence.

Whilst the reductions in NO_2 assumed by TG(03) and the revisions relied upon by the year adjustment calculator have been used in this report they may yet be viewed as optimistic in light of concerns that newer vehicles are now suspected of creating more primary NO_2 emissions than previously thought. Appendix 2 offers a different way of determining NO_2 from NOx. As the national vehicle fleet is constantly being renewed it is yet to be seen how the findings from modelling will correlate to actual measurement.

Table 12: Continuous Monitoring and Passive Diffusion Tube Measurements of NO_2 Estimate of reading as at 2010 (µg/m^3)		
	Period and Bias-corrected data (µg/m^3) January –August 2007**	Projected reading 2010 (Netcen)
Romon 3*	44	40
HB1	57	51
HB2	45	40
HB3#	26	23
HB4	44	39
HB5	42	38
HB6	48	43
HQ1	65	58
HQ2	32	29
HQ3	48	43
HQ4	41	37
HQ5	44	39
HQ6	35	31
HQ7	47	42
HQ8	30	27

Notes to Table 12 (all data rounded to nearest whole number)
*see Table 4 above **see Table 3 above #See Table 5 above

NOx concentrations were projected for receptor positions within the AQMA. The model was then re-run to represent various scenarios eg no HGV component, changes in speed, no congestion, reduced traffic volume etc. This allowed individual contributions to overall emissions to be estimated.

This model uses spatial calculation to project pollution levels in notional grid squares, which can be of any size from 10m x 10m. The size of the grid squares is important. Clearly traffic does not instantly achieve a different speed and maintain it between adjacent squares. In reality acceleration is recognised as a highly polluting event. Smaller grids that might better reflect changes in speed require a greater data input to populate the model and make for a greater computational load, but offer a more “accurate” output.

The model can account for topography but this greatly increases the computational load, and experience suggests it has little effect on computed results. No modelling tool can account for all sources of nitrogen impacting in the area modelled. Many smaller sources are simply assumed in the “background” or other data input. This model only distinguishes between Heavy Goods Vehicles and Light Vehicles and sub-divisions within such groups are not recognised. In any event large amounts of *local* traffic and weather data often simply do not exist. An alternative approach using 500m x 500m grid squares or focusing on specified key receptors requires much less computational load. Barriers to dispersion as presented by buildings and walls are only factored into calculations where they form part of a street canyon. Relationships are still suggested by model outputs and hence the extent of dispersion to be indicated in the outputs, this offers the best use of the model. The results are presented in Table 13 below.

Table 13: Estimate of Emissions of NO_2 from A646 traffic in $\mu g/m^3$ (%age component of all traffic)															
Receptor points	Measured 2006, bias and period corrected	All Traffic (modelled)	No HGVs		Reduction in traffic by 50%, with congestion factor unchanged		Reduction in traffic by 75%with congestion factor unchanged		No congestion		No congestion and traffic speeds increased by $10kmh^{-1}$		No HGV and No congestion	
HB1	48.7	100%	36.7	76%	39.8	82%	33.1	68%	38.4	79%	37.5	77%	31.2	64%
HB2	37.7	100%	30.8	82%	31.9	85%	28.0	74%	35.9	95%	35.2	93%	30.0	80%
HB3	30.2	100%	26.0	86%	26.9	89%	24.9	83%	26.9	89%	26.6	88%	24.7	82%
HB4	37.9	100%	31.1	82%	32.1	85%	28.2	74%	34.6	91%	34.0	90%	29.1	77%
HB5	35.6	100%	28.6	80%	30.2	85%	26.8	75%	29.7	84%	29.2	82%	26.1	73%
HB6	43.2	100%	34.0	79%	35.5	82%	30.1	70%	39.8	92%	38.8	90%	32.0	74%
HQ 1	44.4	100%	34.4	78%	37.2	84%	31.6	71%	34.8	78%	34.2	77%	29.3	66%
HQ 2	29.7	100%	26.2	88%	26.7	90%	24.8	84%	29.3	99%	28.9	97%	26.0	88%
HQ 3	40.2	100%	32.4	81%	33.8	84%	29.3	73%	34.5	86%	33.9	84%	29.1	72%
HQ 4	36.2	100%	31.2	86%	30.5	84%	27.0	75%	30.4	84%	29.9	83%	26.5	73%
HQ 5	36.4	100%	31.8	87%	30.6	84%	27.0	74%	30.3	83%	29.8	82%	26.4	72%
HQ 6	30.6	100%	26.9	88%	27.0	88%	25.0	82%	26.9	88%	26.6	87%	24.6	81%
HQ 7	43.2	100%	33.6	78%	35.3	82%	30.1	70%	36.1	84%	35.3	82%	29.7	69%
HQ 8	32.1	100%	27.3	85%	28.2	88%	25.7	80%	28.7	89%	28.3	88%	25.6	80%

Several scenarios were modelled with results expressed as a percentage of the 2006 base model predictions.

Table 13 suggests that the 6% of traffic that constitutes PSVs and HGVs accounts for 12-24% of NO_2 emissions. Whilst the kerbside HB1, HQ1 and HQ7 show maximum saving other kerbside locations of HB2, HQ3, HQ4 and HQ5 less so. The latter locations are arguably more open. However 7-21% of emissions appear to be associated with traffic congestion, with an additional 1-2% saving to be made by increasing traffic speeds by 10km/hr. The greater savings would appear to be possible where the A646 narrows, traffic slows here partly because of that and partly because of on-street parking, and the buildings here create a street canyon. It has been noted that congestion in Hebden Bridge can be severe throughout the day, more so when traffic diverts from the M62 should there be an incident between junctions 21 and 24 (particularly 21 and 22). Tackling HGVs and congestion together would appear to offer the most significant savings of 12-36% over

2006 levels. Overall volumes of traffic would appear to be least influential on NO_2 levels in comparison to other factors of congestion, road speed and amount of HGV/PSV traffic, yet nevertheless they contribute to congestion and to average road speed.

There is no suggestion that this set of scenarios is complete or comprehensive. More complex models could be set up to vary several parameters together, but it is clear that the major contributions have been identified and potential savings indicatively quantified.

5 The impact of recent policy developments upon the AQMA

5.1 National Policy (NO_2 and NOx)

The Government published its revised Air Quality Strategy in July 2007.

It states that NO_2 is associated with adverse effects on human health but accepts that there is debate as to the extent of some of those effects. It maintains that at high levels NO_2 causes inflammation of the airways and that over the long term it may affect lung function and (other existing) respiratory ailments. It also enhances allergic responses in sensitive individuals. It advises that high levels of NOx can adversely affect vegetation, and contribute to the acidification (making environments more acid) and eutrophication (excess nitrogen in soil) of sensitive habitats, which leads to loss of biodiversity. NOx also contributes to ground level ozone production which can affect human and plant health.

The government expects NO_2 levels to continue to fall, but not as fast as previously expected, nor as fast as levels of nitric oxide (NO). It believes that an increase in road traffic NOx emissions directly emitted as NO_2 is due to an increasing number of light duty diesel vans and cars fitted with oxidation catalysts to meet Euro 3 emission standards. It predicts that there will be exceedences of NO_2 above the AQO alongside some busy major roads well beyond 2010.

No change is proposed to the air quality objectives for NO_2, although the World Health Organisation may yet argue for a lowering of the annual mean objective of $40\mu g/m^3$. The government strongly advocates that air quality issues should be dealt with in a holistic, multi-disciplinary and multi-agency way. It sees it as vital that all those organisations, groups and individuals that have an impact upon local air quality, should work towards the objectives of an adopted action plan.

5.2 Car Ownership and Commuter Statistics

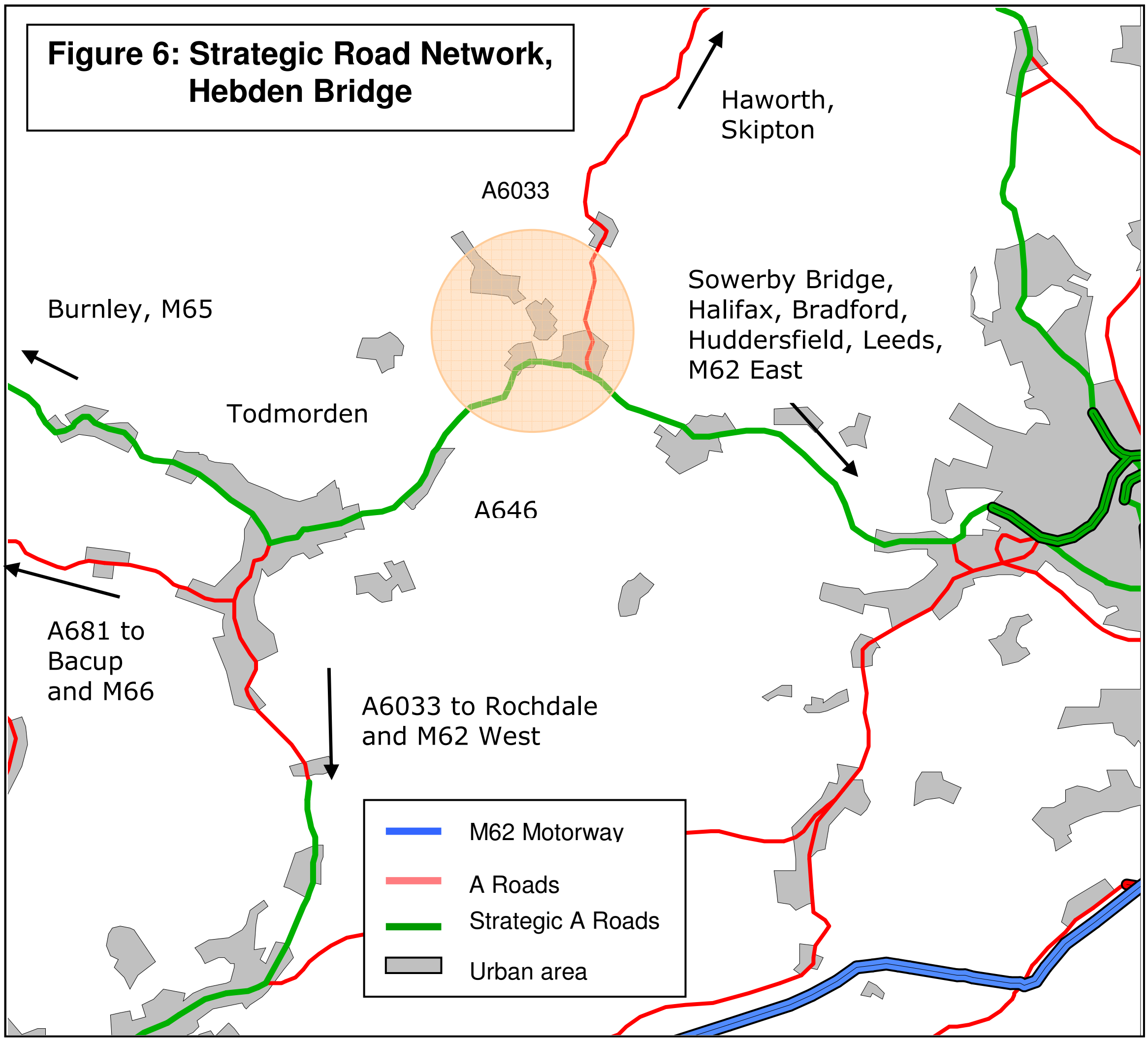
The Department for Transports' document "Focus on Personal Travel Statistics 2005" charts national and regional trends in car ownership for the period 1980-2002. Together with data extrapolated from the 2001 and 1991 UK national census Calderdale shows an increasing trend in car ownership, with fewer households without cars, and an increase in households with 2 or more cars.

Households with no car or van fell from 39% in Calderdale in 1991 to 31% in 2001. The national average dropped from 41% to 26% and in 2002/03 the average in the Yorkshire and Humberside region was 31%.

Households with 1 car or van increased from 42% to 44% between 1991 and 2001 in Calderdale. Nationally and regionally 45% households have 1 car. Nationally this figure has remained constant over 1980-2002.

Households with 2 or more cars or vans in Calderdale increased from 19% in 1991 to 25% in 2001 in Calderdale. Nationally the rise was from 15% in 1980 to 29% in 2002. Regionally for the year 2002/03 24% households had two or more cars.

Figure 6 shows the strategic road traffic network available to Hebden Bridge. The A646 is the main east-west commuter route between Halifax, Hebden Bridge and Todmorden. To the west Todmorden offers connections with Rochdale, Burnley, Bacup, the M62 west and the communities of Greater Manchester and Lancashire. The A6033 connects with Howarth and from there onward to Skipton. Sowerby Bridge to the east offers connections to Elland, Huddersfield and Ripponden, and via the M62 east to Leeds. Halifax offers connections to Bradford and Brighouse.



Some data exists regarding commuting (see Table 14 below) but it is difficult to determine exact figures for travel via the A646 at Hebden Bridge as it involves both origins and destinations that are inside and outside of Hebden Bridge and inside and outside Calderdale.

Table 14: Modes of Travel for Calderdale Residents and All People working in Calderdale				
Mode of Travel	Calderdale Residents in Employment		All people working in Calderdale, inc non-residents	
	1991	2001	1991	2001
Car driver	57.3%	62.8%	56.4%	62.2%
Car Passenger	8.3%	8.1%	8.3%	8.6%
Train	1.6%	2.3%	0.7%	0.9%
Bus	17.3%	12.3%	18.4%	13.0%
Foot	13.6%	11.8%	14.3%	12.5%
Cycle / Motorcycle	2.0%	1.8%	2.0%	1.9%
Other		0.8%		0.9%

Other data has been derived from a comparison of the 1991 and 2001 censuses. What can be discerned from the census data and Table 14 is that

- In-commuters to Calderdale as a whole rose by 21.2 % and out-commuting by 25.5% over that decade. In simple terms about 45,000 people travel into or out of the Borough to go to work each day. The mode of transport is given in Table 14 above.

- Commuting to work from Hebden Bridge to other parts of Calderdale increased from 4472 in 1991 to 7368 in 2001 (ie 65%)

- Commuting to work from other parts of Calderdale to Hebden Bridge increased from 2307 in 1991 to 3958 in 2001 (ie 72%)

- Travel to work journeys between Calderdale and Greater Manchester / the North-west increased substantially between 1991 and 2001, with a 60% outbound rise to 4281 and a 54% inbound rise to 2274

- Eastbound through-journeys from Todmorden, Cornholme and Walsden via Hebden Bridge in 2001, were 1400. This will include some journeys originating within Greater Manchester and Lancashire. Eastbound journeys from Hebden Bridge itself were 2150, although that figure may include 550 journeys that start and finish or simply stop within Hebden Bridge.

- Westbound through-journeys to Todmorden, Cornholme and Walsden via Hebden Bridge in 2001, were 1090. This will include some journeys originating within West Yorkshire. Westbound journeys from Hebden Bridge itself were 366. In addition to these 1456 there is a suggestion that a further 750 persons travel from the east of the Borough to work in Hebden Bridge.

These statistics should be seen as indicators only. Paragraph 4.3 points to the importance of minimising all journeys because of their contribution to NOx emissions, which in turn points to a need for a greater understanding of the number, type of and need for journeys to and from Hebden Bridge. The Action Plan should address this.

5.3 Local policy

At the time of declaring the AQMA the main planning development controls lay in the 2004 replacement Urban Development Plan which was adopted by Calderdale MBC as the Local Planning Authority in August 2006. This provides the following planning polices EP1 and EP2:

EP1 "Protection of Air Quality" states *Development which might cause air pollution (including that from modes of transport) will only be permitted if: -* i) *it would not harm the health and safety of users of the site and surrounding area; and* ii) *it would not harm the quality and enjoyment of the environment.*

EP2 "Development within an Air Quality Management Area" states *Within a declared Air Quality Management Area, development will be permitted provided it can be demonstrated that the pollution levels, if any, would be consistent with the objectives /and or targets of an Action Plan and would not lead to unacceptable pollution levels.*

EP1 and EP2 were conceived before any AQMAs were declared in Calderdale. They envisaged that new pollution rather than new exposure to existing pollution would present the main concern to planning development in an AQMA. Invocation of EP2 is also restricted to the objectives of an action plan (AQAP). LAQM.PG(03) recommends such plans be created within 12-18 months of declaring an AQMA, which means that EP2 cannot apply until an AQAP is in place.

Other development control policies are also pertinent. Housing policies H1 (separation of housing and industry), H2 (primary housing areas), H9 (non-allocated sites) and H13 (affordable housing) all seek to avoid the creation of significant traffic, amenity and environmental problems, albeit air quality is not specifically mentioned. T18 specifies maximum parking allowances and T21 promotes car free and low car ownership housing. There may be no need to provide parking within designated town centre areas.

An AQMA has areas where pollution levels exceed or are likely to exceed the air quality objective. It may also include areas where there is currently no relevant exposure, or only part of a plot of land is so exposed. The Calderdale AQMA (No 3) is a well-defined area with minimum opportunity for new development, but with a potential to convert existing buildings to a use that precludes relevant exposure, or indeed to present it, eg 'living above the shop', new cafes etc. Since AQMA (No 3) was declared in September 2006 several applications for planning permission for developments in or near the AQMA have been considered. These are discussed below.

06/00721/FUL: Extension to Moyles Bar, New Road- Approved

06/01882/COU: Change of use Croft Mill, Albert Street, to Retail outlet- Approved

06/02152/LAA: Continuance of Hebden Vale Adult Training Centre, Bridge Lanes , as temporary library for 2 years- Approved

07/00135/HSE: extension to house at Mayroyd Hall, Burnley Road – Approved

07/00188/OUT: Construction of 3 houses off Stubbing Holme Road- Refused

07/00284/HSE: Alterations to house at 2 New Road - Approved

07/01452/FUL: Demolition of workshop at 19 Old Gate, replace with offices shops and 6 apartments- Refused

07/01708/CUR: Change of use of first floor office to residential at 18 New Road-Refused

Excepting 07/01708/CUR none of the above affected or were affected by the AQMA. 18 New Road seeks to create a first floor dwelling fronting the A646 where none has existed previously. Earlier in 2007 the Council as Local Planning Authority refused a planning application on air quality grounds in similar circumstances in Sowerby Bridge. The refusal was overturned on appeal to the Planning Inspectorate (PINS). A High Court challenge against PINS's decision was not pursued but Calderdale made representations to DEFRA as to whether or not the guidance had been applied correctly in this instance.

In addition enquiries have been made to create a multi-storey car park, offices, shops and dwellings at Garden Street bordering the AQMA. The location of the car park may impact upon the AQMA and the developers have been asked to submit and air quality assessment.

The replacement UDP was lodged in 2004 and confirmed in 2006. It will run in parallel with a nascent Local Development Framework (LDF), the creation of which is due to commence in 2008. An LDF comprises a core strategy, Local Development Documents (LDDs) and Development Plan Documents (DPDs) to form the basis of the Council's policies. LDFs were envisaged as dynamic and flexible tools that allow the planning system to respond quickly to any need for change. Accordingly the preparation, monitoring, and review of the LDF is a continuous process. Experience has now shown that Calderdale's UDP cannot offer sufficient support to resolve AQ concerns in respect of development control. The LDF will ultimately replace the UDP, but the UDP itself will need to be extended in life in 2009 pending completion of the LDF. Experience of other local planning authorities suggests that the extension process will see a significant number of policies removed from the UDP. Amidst these processes the government is presently considering further changes still to the planning system and the final shape and scope of the LDF is unclear. As yet we do not know if or how the LDF will account for AQ concerns. This means that there is a very uncertain future as to the role planning development can play or will play in air quality management, and particularly in contributing to an effective AQAP.

Meanwhile independent of planning development control traffic management measures have been proposed, introduced or extended in recent years. These include

- The Calderdale Car club- a scheme that offers discounted car parking for those sharing cars for their journeys.

- Metrocard – a scheme offering discounted public transport.

The likely costs and benefits of these and other measures will be discussed in the air quality action plan.

6 Summary and Conclusions

This report estimates that the background concentration of Nitrogen Dioxide (NO_2) in the Hebden Bridge area in 2006 is 23.6µg/m^3, and that this background level is presently projected to fall to about 21.7µg/m^3 in 2010.

It notes that in 2006 real-time measured annual mean levels of NO_2 at Romon 3 are in the region of 48µg/m^3. Such levels are clearly in excess of the Air Quality Objective (AQO), but a projection suggests that real time measurements might fall to around 40µg/m^3 by 2010, although similar projections for the diffusion tubes placed throughout the AQMA are not so optimistic. The overall projection is that in 2010 and beyond there will still be need to have an AQMA in the A646 corridor at Hebden Bridge.

It is further estimated that in 2006 road traffic produced nearly 24µg/m^3 of the NO_2 being recorded at Romon 3, representing 50% of the NO_2 and 21% of the NOx measured there. If the AQO of 40µg/m^3 is to be achieved in 2010 the road traffic contribution must fall below 18.9µg/m^3.

As with other areas the small proportion of HGV/PSV traffic is seen as a major contributor to $NO_{2,}$ albeit in Hebden Bridge congestion particularly in the street canyon area also appears as a significant factor. There remains a need to gain an accurate traffic breakdown with a view to minimising all road journeys and to improving traffic flow through the A646 corridor by minimising congestion.

Equally attention must be given to careful consideration of planning development in or near to the AQMA and to strengthening the council's current policy in this respect.

At the time of writing this report changes to traffic flow and speed are underway within the AQMA. Although there is argument to reduce the AQMA at its western boundary no changes are proposed until the overall effect of these changes can be assessed. The Council's intention is to maintain the existing NO_2 monitoring network in the AQMA for the near future, and to review the monitoring network to facilitate the assessment of measures yet to be introduced under the AQAP.

These matters will be more fully explored in the Air Quality Action Plan (AQAP), due in 2008.

Environmental Health Services
Calderdale Metropolitan Borough Council

This Assessment is open to public comment until 31st January 2008.

Comments should be made to
Head of Service, Environmental Health Services, Calderdale MBC,

Appendix 1: Quality Control

Equipment

The Romon automatic monitoring stations are operated under a maintenance contract with the supplier, Casella covering six-monthly servicing and callout to emergencies. The analysers are ML9841Bs, which operate by splitting an air sample, analysing one subsample for NO and the other for total NOx. This largely avoids problems associated with taking serial samples.

Calderdale staff who are familiar with the equipment carry out weekly manual span and zero checks according to written procedures based on training from the supplier. In-line filters are checked and changed as required. This means that the Romons are physically checked for vandalism or obvious faults (such as impending pump / air conditioning failure) weekly. The results of the span and zero checks are recorded for use in the calculation of NO_2 concentrations.

Diffusion Tubes are supplied and analysed by West Yorkshire Analytical Services. They are prepared using 50% TEA in acetone and are exposed for approximately 1 month.

Raw Data

The Romons are polled every day and the data is stored in a database on a standalone PC. The data is checked every working morning as a means of spotting problems with the analysers. If no data has been received there is a system of remote checking (on demand polling) which is followed up if necessary by a site visit. Unusual results are followed up either by Casella, who can retrieve data from the Romons, or by a site visit.

The database is backed up to the Calderdale network every week.

Calculated Data

The mean NO_2 concentrations are calculated in Excel every month using the factors calculated from the span and zero measurements. The calculated values are graphed to quickly identify any unusual patterns or negative values. These are investigated and, where appropriate, unexplained suspect data is rejected.

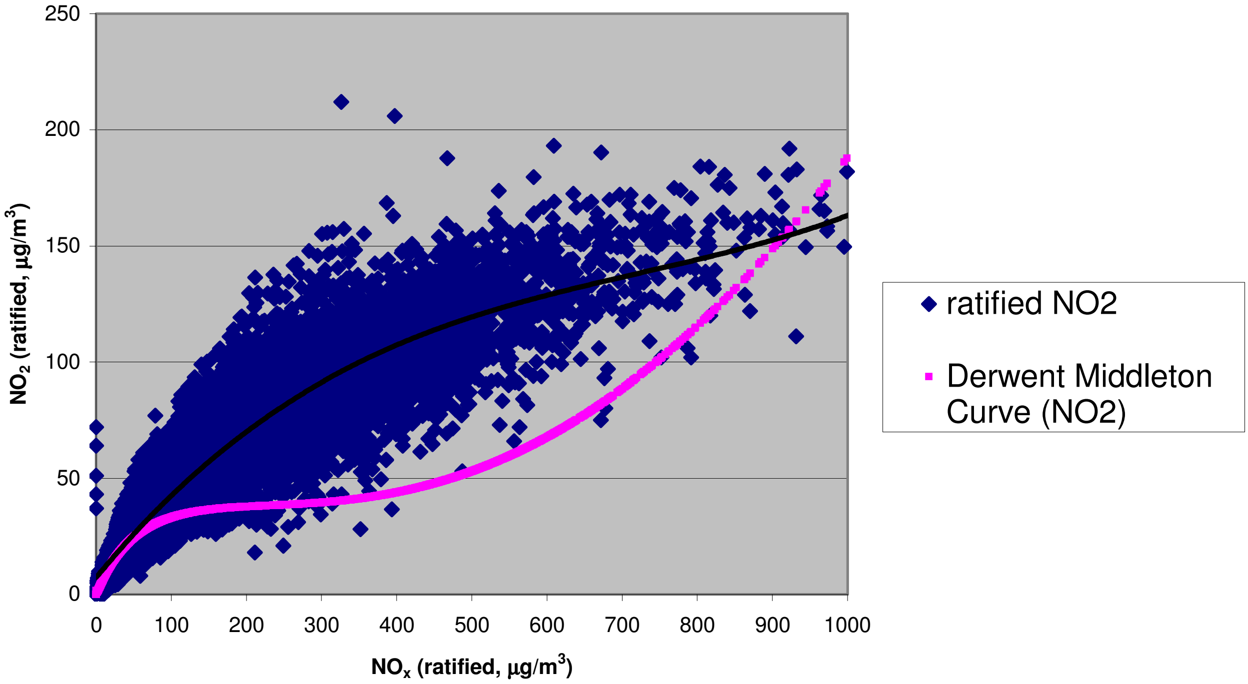
The raw data is retained so that if it comes to light that the analysis is suspect we can always go back and recalculate.

There is a gradual drift in the analyser response and it has been necessary on several occasions to have the analysers serviced before the six months are up in order to improve confidence in the calculated concentrations.

Appendix 2: Determination of NOx from NO_2

"Measured" NO_2 is determined by subtracting measured NO from measured NOx. Box 6.9 of LAQM TG(03) offers one method for calculating NO_2 from NOx which assumes a certain production of NOx and a certain relationship between NO_2 and NOx. However the values being measured in Hebden Bridge reflect the actual vehicle fleet, actual driving characteristics and actual vehicle emissions (and other environmental emissions) at any given time at Romon 3. In the case of vehicle emissions the amount of NO_2 emitted directly as a primary pollutant, as opposed to primary NOx emissions which then evolve in the atmosphere into NO_2, is constantly varying. For the period January to September 2006 for Romon 1 at Salterhebble, Halifax, a range of NO_2 concentrations were determined from measured NOx values, and a line of best fit drawn (see Figure A2 below).

Figure A2: Correlation between measured and projected NO_2 and NO_x emissions, Romon 1, January - September 2006.



Computer models assume a certain relationship of direct to indirect emissions of NO_2 from vehicle engines, such an assumption represented by the Derwent-Middleton Curve, and the same fleet composition for the period modelled. Figure A2 shows that projected NO_2 levels based on those assumptions do not compare well to those derived from measurement.

For the purpose of the calculations throughout the main report predictions have been determined in accordance with TG(03). Figure A2 requires one to bear in mind that the predicted reductions may yet be viewed as optimistic.

Calderdale Council

If you would like this information in another format or language, please contact:
Halifax (01422) 392373

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তাহলে দয়া করে যোগাযোগ করুন ঃ

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