



Thurrock Council

Detailed Assessment for NO₂ Tilbury, Calcutta Road

August 2011

Executive Summary

This is the 2011 Detailed Assessment for NO_2 . This assessment fulfils the Council's next step of the Local Air Quality Management (LAQM) process and is required as a result of the findings of the Council's 2009 Updating and Screening Assessment (USA) report. The report examines the pollutant nitrogen dioxide (NO_2) which is summarised below.

Nitrogen dioxide

The Previous Updating Screening Assessment in 2009 showed there to be an exceedence of NO_2 , the area identified was for Tilbury, along Calcutta Road, as Thurrock Council's NO_2 diffusion tube located along the roadside was found to be above the annual mean air quality objective. For the purpose of the Detailed Assessment, a more in depth approach is required, and for this reason, Thurrock Council has more detailed monitoring data, by means of a continuous monitoring station which was setup in January 2010 along Calcutta Road. In addition more NO_2 diffusion tube locations were setup around where the original diffusion tube location, in order to assess whether the exceedence goes beyond this location.

The new monitoring results and predictions have been used in this report. The report thus meets the requirements of the technical guidance LAQM. TG (09) produced by the Department of Environment, Food and Rural Affairs (DEFRA).

The Council will from the finding of this report, continue to investigate further using continuous and non-continuous monitoring at the same locations, to assess whether concentrations of NO_2 will change and to trace long-term trends

This Report has identified an area of exceedence of NO₂, based on the monitored results for 2008 to 2010. The automatic monitoring station Thurrock 4 along Calcutta Road was found to be above the annual mean objective limit at 40.2 μ g m⁻³. The area which is exceeding the objective limit for NO₂ is along Calcutta Road and Dock Road Tilbury. Based on the monitoring data gathered, it will declare an Air Quality Management Area (AQMA).

The report also investigated where the likely sources of NO_2 may be coming from. It indicates that the road traffic along Calcutta Road and Dock Road is the predominant source but also points to the Tilbury Docks as being a secondary source of NO_2 .

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1 Introduction to Detailed Assessment

This is the Detailed Assessment of air quality for Thurrock Council for NO_2 in Tilbury along Calcutta Road. This assessment fulfils the Council's next step of the Local Air Quality Management (LAQM) process and is required as a result of the findings of the Council's 2009 Updating & Screening Assessment (USA) Report. The report examines the pollutant nitrogen dioxide (NO_2).

The screening assessment examined air quality across the whole of the Council's area in accordance with the Department for Food and Rural Affairs (DEFRA) guidance. The report concluded that NO_2 and PM_{10} was widely being exceeded within the Council's current Air Quality Management Areas (AQMA's) but in addition to this one area outside of the current AQMA's Tilbury, Calcutta Road was above the air quality annual mean objective for NO_2 . No other pollutants will be covered in this report. They will be reported on in the Council's 2011 Progress Report.

The new technical guidance (LAQM.TG09) was produced by DEFRA to aid local authorities with their duties. This guidance replaces an earlier version produced in 2003 (LAQM.TG03). The revised guidance is designed to support local authorities in carrying out their duties under the Environment Act 1995. It confirms that LAQM forms a key part of the government's strategies to achieve the air quality objectives.

The guidance provides advice to local authorities for the purposes of undertaking their statutory review and assessments and on factors that need to be taken into account when assessing exposure. The standards from which the objectives derive are based on a potential risk to health, thus a single exposure of an individual above the standards is to be avoided. The objectives however also allow a number of occurrences where the standards might be exceeded for reasons of feasibility and practicality.

This report considers that only the long-term objective for NO_2 or annual mean objective is relevant when considering public exposure in this location. Supplementary evidence is included in this report for 1-hour NO_2 objective which rules out any further consideration.

The aim of the detailed assessment is thus to identify with reasonable certainty whether or not a likely exceedence of an AQS objective will arise. The assumptions used need to be considered in depth and the data used should be of a high standard. This is to ensure confidence in the decisions that need to be made. Where a likely exceedence is identified the detailed assessment shall provide detail of both its magnitude and geographical extent.

The Council is also required to confirm that there is the likelihood of relevant public exposure in the identified area. The Air Quality (England) Regulations as amended, refer to "the quality of air at locations which are situated outside of buildings or other natural or man made structures, above or below ground, and where members of the public are regularly present."

2 Introduction for nitrogen dioxide (NO₂)

2.1 Overview to Detailed Assessment of Nitrogen Dioxide

This section provides the Detailed Assessment for Thurrock Council, which fulfils the statutory requirement for this, the Council's next step, of the Local Air Quality Management (LAQM) process for nitrogen dioxide (NO2). The main purpose of this section is to assess whether or not the Council needs to declare a new Air Quality Management Area (AQMA).

2.2 Background

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 completed its Updating and Screening Assessment of the seven LAQM pollutants. The conclusion for NO2 was that the Council needed to undertake a Detailed Assessment for one area only, specifically the area where monitoring has indicated that the annual mean objective (see Table 1) will not be met. The opportunity is taken in this report to formally prove the need to declare another AQMA for NO_2 .

	<u>Objective</u>	Date to be		
Pollutant	Concentration	Measured as	achieved by	
Nitrogen Dioxide	200 μg m ⁻³ not to be exceeded more than 18 times a year	1 hour mean	31 Dec 2005	
	40 μg m⁻³	Annual Mean	31 Dec 2005	

Table 1 Air Quality Obje	ectives for nitrogen dioxide ((NO_2)
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(It should be noted that the 1-hour mean (which is less stringent than the annual mean objective) also did not need to be assessed further in this report) as in accordance with the TG(09) Guidance any annual mean below 60 μ g m⁻³ is most likely to be below the 1-hour objective for NO₂. This argument is further bolstered by the fact that the maximum 1-hour NO₂ results from the Thurrock 4 continuous monitoring station in 2010 fell considerably short of the 200 μ g m⁻³ concentration.

The Council's current AQMA's are listed in Table 2 and shown in Figure 3 below

AQMA	Pollutant Description of AQMA			
No.				
1	NO ₂	Grays town centre and London Road Grays		
2	NO ₂	London Road South Stifford and adjoining roads		
3	NO ₂	East side of Hogg Lane and Elizabeth Road		
4	NO ₂	West of Chafford Hundred Visitor Centre		
5	NO ₂ & PM ₁₀	Warren Terrace, A13 and A1306		
7	NO ₂ & PM ₁₀	Hotels next to M25		
8	NO ₂ & PM ₁₀	Hotel next to Junction 31 of the M25		
9	NO ₂	Hotel next to Junction 31 of the M25		
10	NO ₂ & PM ₁₀	London Road Purfleet near to Jarrah Cottages		
12	NO ₂	Watts Wood estate next to A1306		
13	NO ₂	London Road Aveley next to A1306		
15	NO_2	Near to M25 on edge of Irvine Gardens, South Ockendon		
16	NO ₂	Next to M25 off Dennis Road		
21	NO ₂	Hotel on Stonehouse Lane		
23	NO ₂	London Road West Thurrock		

Table 2 Summary of existing Thurrock AQMA's

Figure 1 Map of Thurrock's AQMA's



2.3 Monitoring of NO₂

2.3.1 Continuous Monitoring

In 2010 the Council decided to undertake further more detailed monitoring, it commissioned a new continuous monitoring station, located within the grounds at St Mary's Catholic Primary School along Calcutta Road, Tilbury, which is approximately 38 metres east of the long running Calcutta Road (TL) diffusion tube monitoring site, which first flagged up the NO_2 exceedence back in 2007.

Table 3 Thurrock 4	continuous monitored NO ₂ results	
Sito	Baramotor	

Site	Parameter	2010
Thurrock 4 (Calcutta Road, Tilbury)	Annual mean (µg m ⁻³)	40.2
	Max 1-hour (μg m ⁻³)	157
	No of 1-hour exceedences	0
	Data Capture	99.39%

(Bold indicates was above air quality objective limit)

The NO₂ data from 2010 was found to be above the annual mean objective limit for NO₂, at 40.2 μ g m⁻³, this reinforces the diffusion tube monitoring which was also above the objective. The 1-hour mean objective of 200 μ g m⁻³ was not breached with the highest 1-hour concentration measured at 157 μ g m⁻³, this objective will not any further consideration in this report.



Figure 2 Thurrock 4 rolling monthly mean for NOx, NO & NO2 using hourly average data over 2010

Figure 2 shows how concentration of oxides of nitrogen (NOx), nitric oxide (NO) and nitrogen dioxide (NO₂) varied from Thurrock 4 over 2010. There were typically higher concentrations over the early and end part of 2010 with the lowest concentrations observed over the summer period. Concentrations over November and December displayed a rapid upward step change in NOx and NO but less so for NO₂ but over this period NO₂ was well above 40 μ g m⁻³.



Figure 3 24-hour temporal pollution plots over 2010 for Thurrock 4

Figure 3 shows how nitrogen dioxide concentrations over a 24-hour period for all of 2010 at Thurrock 4. Typically the highest concentrations of NOx and NO2 were over the rush hour periods between 6:00am to 9:00am and 16:00pm to 19:00pm, with the morning rush hour showing a higher peak period, as would be expected due to more stable stagnant conditions

leading to a lack of mixing in the air. Also weekday (5 day) NOx and NO_2 is slightly higher than the whole week (7 day), and the week end only was considerably lower than both.

2.3.2 Sources of NOx & NO₂



Figure 4 Thurrock 4 wind rose plot using hourly average met data from Bexley 2 for all of 2010

Figure 5 Thurrock 4 wind rose plot using hourly average met data from Bexley 2 for 2010 at times when NO₂ concentrations were above 40 μ g m⁻³





Figure 6 Thurrock 4 wind rose plot using hourly average met data from Bexley 2 for 2010 at times when NO₂ concentrations were above 60 μ g m⁻³





Figures 4 to 7 show the wind direction and wind speeds over 2010 from Thurrock 4 with time varying pollution episode events. Figure 4 shows the wind direction over all of 2010, and

shows that most of the wind comes from the north-west to south-west and to a lesser extent from the east. Figure 5 shows all the times when NO₂ was above 40 μ g m⁻³, most of the wind is coming from the west, between 0.5-2.1 m/s, this direction follows the line of Calcutta Road, and to a lesser extent the Port of Tilbury, may have some influence. Figure 6 shows all the times when NO₂ was above 60 μ g m⁻³, so moderately high levels, the predominant wind direction for these events were westerly's and at 0.5-2.1 m/s. Figure 7 shows all the times when NO₂ was above 100 μ g m⁻³, so high levels of pollution, the wind plots are more varied with north-westerly and south-westerly being the main direction, but also some from the south, which may that indicate shipping was contributing to these high concentrations, also the wind speed is typically lower between 0.2-2.1 m/s.

Figure 8 Pollution Polar Plot for NOx in 2010 from Thurrock 4 using met data from Bexley 3 (μ g m⁻³)



The Pollution Polar Plot in (Figure 8) gives an indication of where the sources of NOx are originating from around Thurrock 4. The main source is very localised but there are some influences from the west and north-west but also to the south-west, however it looks clear that the traffic travelling along Calcutta Road is contributing the majority of NOx



Figure 9 Pollution Polar Plot for NO in 2010 from Thurrock 4 using met data from Bexley 3 (μ g m⁻³)

The Pollution Polar Plot in (Figure 9) gives an indication of where the sources of NO are originating from around Thurrock 4. Again this trend is similar to the one in figure 8 for NOx but seems in this case be more localised and not influenced as much from sources further away as for NOx, the westerly and south-westerly source is more diminished.



Figure 10 Pollution Polar Plot for NO₂ in 2010 from Thurrock 4 using met data from Bexley 3 (μ g m⁻³)

The Pollution Polar Plot in (Figure 10) gives an indication of where the sources of NO_2 are originating from around Thurrock 4. The sources are more varied than for NOx and NO. Again the main source appears to be originating very locally, from the traffic along Calcutta Road immediately to the north-west, but there also appears to be another source originating further away from a west-north-west direction, it is not entirely clear where this source could be originating from. Another source but to a lesser extent is coming from the south-west, possibly arising from the Port of Tilbury.

Figure 11 Pollution Polar Plots for NO₂ in 2010 from Thurrock 4 using met data from Bexley 3, measuring upper and lower uncertainty values ($\mu g m^{-3}$)



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The Pollution Polar Plots in (Figure 11) gives an indication of where the sources of NO_2 are originating from around Thurrock 4 showing the upper and lower uncertainties. This just illustrates more clearly in the case of the upper uncertainty of where the sources are originating, again it shows the locally generated source along Calcutta Road, but shows more prominently the secondary source occurring further to the west-north-west.



Figure 13 Overlay Map of Tilbury showing the Sources of NO₂ from Thurrock 4

Figure 13 illustrates where the sources of NO_2 are originating in and around Tilbury, although not entirely to scale, it gives an indication of the likely source areas, i.e. the main trunk roads, Dock Road, St Andrews Road and Calcutta Road, and also to a lesser extent the Port of Tilbury.

2.3.3 Diffusion Tube Monitoring

Thurrock Council currently has 7 diffusion tube monitoring locations within Tilbury. These monitoring sites were setup to determine the spatial extent of the NO_2 exceedence. 1 site designated (TL) on Calcutta Road is a long running site operating since 1999. It was this site that flagged up the initial exceedence of NO_2 , back in 2008. In June 2009 the Council decided to set up 5 additional monitoring sites TILA, TILB, TILC, TILD & TILE, to see if the exceedence covered a wider area. In September 2010 an additional site was setup a duplicated diffusion tube site (TK4 A&B) which was co-located with the Thurrock 4 continuous monitoring station, in order to calculate a local bias correction factor.



Figure 12 Map of diffusion tube locations in Tilbury and the proposed boundary of the AQMA

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Site	Designation	Bias Factor	2005	2006	2007	2008	2009	2010
Calcutta Road Tilbury (R)	TL	TK3	32.24	33.32	42.53	43.24	39.61	40.50
Dock Road (Tilbury) (R)	TILA	TK3					36.21	41.16
Broadway Intersection (Tilbury) (R)	TILB	TK3					39.17	41.80
St Andrews Road (Tilbury) (R)	TILC	TK3					35.95	42.71
Calcutta Road East (Tilbury) (R)	TILD	TK3					34.42	39.31
Calcutta Road North (Tilbury) (R)	TILE	TK3					28.65	34.04
Duplicate Tube Thurrock 4 (R)	TK4 A	TK3						35.79
Duplicate Tube Thurrock 4 (R)	TK4 B	TK3						32.72

(Bold indicates was above the objective limit for NO₂)

(Green indicates only 7 months data capture, Yellow indicates only 4 months data capture)

Table 4 shows that most of the bias adjusted diffusion tube results for the Tilbury monitoring sites were above the objective in 2010, The Dock Road site (TILA), and Broadway Intersection site (TILB) were above 40 μ g m⁻³ represent public exposure so this would suggest that most of Dock Road and Calcutta Road are above the NO₂ annual mean objective. St Andrews Road site (TILC) was also above 40 μ g m⁻³, this site however does not represent public exposure as there are no houses nearby, this site was setup to assess pollution from St Andrews Road and the Port of Tilbury. (TILE) which is further east along Calcutta Road was just under 40 μ g m⁻³ at 39.31 μ g m⁻³ this is well inside the margin of uncertainty, so any declared AQMA would have to stretch beyond this point.



Figure 13 All of the Tilbury Diffusion Tube sites results from 2003 to 2010

Figure 13 shows that NO₂ concentrations along Calcutta Road Tilbury site have remained over recent years above the NO₂ annual mean objective along with three other sites (Dock Road, Broadway Intersection and St Andrews Road). The two duplicate sites co-located with Thurrock 4 continuous monitoring station were below 40 μ g m⁻³, although the data capture was for only 4 months late in 2010. Comparing these results to that of Thurrock 4 means that the diffusion tubes are under-reading the continuous analyser so this would suggest that NO₂ concentrations are actually a bit higher from the diffusion tube sites than they state at present, which are based on a bias correction factor from Thurrock 3 Stanford-Ie-Hope roadside site, which for 2010 has a bias correction factor of 0.95. From 2011 a Thurrock 4 bias correction factor will be applied to these diffusion tube locations, which is more representative than the bias correction factor from Thurrock 3.

3 Estimated Population Exposure

An area has been defined along Calcutta Road and Dock Road, where the public might be expected to be exposed to concentrations above the annual mean objective limit for NO2. This area will form the basis of a new Air Quality Management Area (AQMA) for Tilbury. The size of area has been determined from the monitored NO₂ data. The northern edge of the area along Dock Road goes beyond the TILA diffusion tube site which is just above the annual mean objective limit for NO₂. This site does not represent public exposure, as it is not at the façade level, it is approximately 14 metres from the nearest building, but the distance between the line of the property and the diffusion tube from Dock Road is approximately 5.5 metres. As no monitoring has occurred at the façade level here, all properties within 30 metres of Dock Road have been incorporated into the new AQMA. It is unlikely that these properties are above the annual mean objective limit for NO₂, but those properties closest may be, hence a precautionary approach has been adopted incorporating a larger area. The rest of the AQMA includes all buildings with public exposure to with a minimum of 10 metres from Calcutta Road, this has been based on the other diffusion tube monitoring sites results. TILD which represents the furthest monitoring site to the east which is located on Calcutta Road is below the annual mean objective for NO₂ so all buildings beyond this point to the east have not been included in the AQMA. TILE is also below the objective limit but the 10 metre distance from the road will still apply. It must be noted that all the diffusion tube sites are

⁽Yellow outline on the bars indicates less than 9 months data capture)

roadside sites within 2 metres of the road and are nearer to the road than any of the buildings running along Calcutta Road and Dock Road. The diffusion tube concentrations are either just below or just above the annual mean objective limit of 40 μ g m⁻³ for NO₂, so a 10 metre buffer zone from the road will incorporate all those places where the public might be expected to be exposed to NO₂ above the annual mean limit. This is outlined below in Figure 14.



Figure 14 New Tilbury AQMA map showing all buildings which represent public exposure

In accordance with the LAQM TG 09 Technical Guidance the total number buildings which represent public exposure within the designated AQMA area is 52. Of which 49 of these are made up of residential blocks within the AQMA, with an additional 2 blocks which are both Primary Schools, and also 1 other block which represent a health based medical facility. It must be noted that some of these residential blocks are made up of more than 1 property as they are either apartment buildings or retirement homes made up of many properties.

4 Conclusion for NO₂

Based on the monitoring data which has been gathered over the last two years at various locations within Tilbury. Specifically from the automating monitoring station for NO₂ at Thurrock 4 for 2010 which was above the annual mean air quality objective at 40.2 μ g m⁻³. It will be necessary to designate a new Air Quality Management Area (AQMA) for NO₂ along Dock Road and Calcutta Road, Tilbury incorporating a suitable region around specific air quality monitoring locations, referred to in (Section 3 Estimated Public Exposure). A minimum of distance of 10 metres from Calcutta Road and a minimum distance of 30 metres from Dock Road is to mark the boundary of the AQMA, and incorporating all buildings within the area which represent relevant public exposure. The report also investigated where the likely sources of NO₂ may be coming from. It indicates that the road traffic along Calcutta Road and Dock Road is the predominant source but also points to the Tilbury Docks as being a secondary source of NO₂.

5 Recommendations For NO₂

- 1) Undertake consultation on the findings arising from this report with statutory and other consultees as required
- 2) Designate a new Air Quality Management Area (AQMA) in Tilbury along Dock Road and Calcutta Road based on the annual mean air quality objective for NO₂
- 3) Continue to monitor at all locations within Tilbury both automatic and non automatic monitoring sites
- 4) Produce a Further Assessment for NO2 in Tilbury for 2012 / 2013

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