Chesterfield Borough Council

Update & Screening Assessment

May 2006

Prepared by C Rossall
Reviewed by J Peck

Copies of this report are available from:
Environmental Services
Pollution Control Section
Chesterfield Borough Council
Town Hall
Chesterfield
S40 1LP

EXECUTIVE SUMMARY

Local air quality management was introduced in the Environment Act 1995 and subsequent regulations. It places a statutory duty on Local Authorities to review and assess the air quality in their area with respect to health-based Government Objectives for seven major air pollutants.

The second phase of this review & assessment was initiated in 2003 with an Update & Screening report. The findings for Chesterfield were that two of the seven air pollutants, namely Nitrogen Dioxide and PM_{10}, were at risk of exceeding these health-based Objectives. This led to a Detailed Assessment of these pollutants being conducted in 2004. The results of this Assessment revealed that although these pollutants should remain under close review, due to the marginality of the results and the large confidence error associated with the data, it was recommended that no immediate action be taken. Instead it was advised that improvements in air quality monitoring across the Borough should be implemented and to then review these pollutants in subsequent reports.

A Progress Report was submitted in 2005 detailing all new monitoring data. The results showed that there was little risk of exceedence of the Air Quality Objectives at Whittington Moor as had been previously predicted and that there was only a predicted marginal exceedence of the Provisional 2010 PM_{10} Objective. However, diffusion tube monitoring over the course of 2004 highlighted a new potential hotspot area, Derby Road, which was showing elevated levels of NO_2. Unfortunately over the course of 2005 the data capture was not of sufficient accuracy for immediate action to be taken. As a consequence the Progress Report highlighted recommendations to improve the air quality monitoring strategy in Chesterfield which were actioned over the course of 2005.

The Update & Screening was completed in 2006 and this report reviewed all the air pollutants listed in the Air Quality Regulations 2000. It was found that the majority of the pollutants were not at risk of exceedence of the Air Quality Objectives. It also confirmed that the prediction of Whittington Moor exceeding the 2010 PM_{10} Air Quality Objective remained valid, but since this is only a Provisional Objective, a Detailed Assessment was not required. However three locations were showing exceeedence of the annual Nitrogen Dioxide Air Quality Objective, namely Chatsworth Road (A619) and Derby Road (A61 South) and Chesterfield Road, Staveley (A619).

Both the A619 and A61 are major arterial routes into Chesterfield. They experience high levels of traffic and frequently experience congestion and standing traffic especially at rush hour. Residential properties are positioned within 5-10m of the kerb at numerous points along the length of both roads. In addition there are Major Developments occurring adjacent to both the A61 and A619, which may increase the traffic flows on these roads and introduce new sensitive receptors to an area of elevated Nitrogen Dioxide.

It was therefore decided to proceed to a Detailed Assessment for Nitrogen Dioxide on Derby Road (A61) and Chatsworth (A619) and Chesterfield Road, Staveley (A619).

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1.0 Introduction

Local air quality management was introduced in the Environment Act 1995 and subsequent regulations. It requires a Local Authority to regularly review and assess the air quality in their area with respect to health-based Air Quality Objectives for seven of the main air pollutants. Should any of these Air Quality Objectives not be met by a required date, the Local Authority must declare an Air Quality Management Area (AQMA) and develop an action plan to address the air quality issues. The Air Quality Objectives are listed below:

1.1 Air Quality Objectives

Table 1: Summary of Objectives in the Air Quality Regulations 2000 and (Amendment) Regulations 2002 applicable to Chesterfield Borough Council.

Pollutant	**Concentration**	**Measured as**	**Date to be achieved by**
Benzene	16.25μg/m^3 (5ppb)	Running annual mean	31/12/2003
	5.0 μg/m^3 (1.5ppb)	Annual Mean	21/12/2010
1,3-Butadiene	2.25μg/m^3 (1ppb)	Running annual mean	31/12/2003
Carbon Monoxide	10.0 mg/m^3 (8.6ppm)	Maximum daily running 8-hour mean	31/12/2003
Lead	0.5 μg/m^3	Annual mean	31/12/2004
	0.25μg/m^3	Annual mean	31/12/2008
Nitrogen Dioxide* (NO_2)	200μg/m^3 (105ppb), not to be exceeded more than 18 times a year	1 hour mean	31/12/2005
	40μg/m^3 (21ppb)	Annual mean	31/12/2005
Particles (PM_{10})	50μg/m^3 not to be exceeded more than 35 times a year	24-hour mean	31/12/2004
	40μg/m^3	Annual mean	31/12/2004
Sulphur Dioxide (SO_2)	266μg/m^3 (100ppb), not to be exceeded more than 35 times a year	15 minute mean	31/12/2005
	350μg/m^3 (132ppb), not to be exceeded more than 24 times a year	1 hour mean	31/12/2004
	125μg/m^3 (47ppb), not to be exceeded more than 3 times a year	24 hour mean	31/12/2004
	ppm = parts per million; ppb = parts per billion; μg/m^3 = micrograms per cubic metre *The objectives for nitrogen dioxide are provisional **Assuming NO_x is taken as NO_2		

The first phase of the second round of Review & Assessment of air quality was completed in 2003. This involved an Update & Screening of all the air pollutants identified in the Air Quality Regulations and listed in Table 1 above. Where a Local Authority identified one or more of the Objectives at risk of exceedence they then had to proceed to a Detailed Assessment in 2004, with a Progress Report required from all Local Authorities in 2005. In order to provide a little background to this Update & Screening 2006, a summary of the findings of Chesterfields Update & Screening 2003, Detailed Assessment 2004 and Progress Report 2005 are summarised below:

1.2 Summary of Update & Screening Assessment 2003

The 2003 Update & Screening Assessment identified that only two of the seven pollutants listed in Table 1 showed a risk of exceedence of the Air Quality Objectives, namely Nitrogen Dioxide (NO_2) and Particulate Matter (PM_{10}).

The Update & Screening Assessment 2003 indicated that levels of Nitrogen Dioxide, as monitored with diffusion tubes, had not fallen as quickly as predicted. More detailed traffic data was provided, allowing more comprehensive modelling with DMRB, which identified 7 junctions and 2 main roads at possible risk of exceeding the objective. As a consequence of this assessment, a Detailed Assessment was then conducted in 2004, to investigate the levels of NO_2 at these risk locations in more detail.

The 2003 Assessment used DMRB modelling to identify a road traffic hotspot area, the Whittington Moor Roundabout, where there was risk of possible exceedence of the PM_{10} Air Quality Objective in 2004. A detailed assessment was therefore recommended to validate the modelling and further quantify the risk. The results of this assessment can be found in the following section 1.3 below.

1.3 Conclusions and Recommendations of Detailed Assessment 2004

Chesterfield completed a Detailed Assessment in 2004 to investigate the two pollutants which were at risk of breaching the Air Quality Objectives, namely Nitrogen Dioxide and PM_{10}. The results of this assessment are summarised below:

Nitrogen Dioxide (NO_2)

The detailed assessment highlighted that the conclusions of the Update & Screening 2003 were reached using inadequate data with high level uncertainty. Although the conclusions were indicative that there may be a risk of exceedence in those locations, the evidence was not strong enough to determine with certainty that the 2004 objective would not be met. The Detailed Assessment recommended therefore that further monitoring should be undertaken. The information then provided from future data sets supported by more detailed modelling would afford stronger evidence on which to make a determination.

PM_{10}

Based on the monitoring data available from the Whittington Moor Air Quality Station, 11 days of exceedences of the 50μg/m^3 objective were recorded during the monitoring period. The modelled exposure was compared to the monitored data where the Air Quality Station was situated. The ratio between modelled and monitored data was then applied to the location closest to the road; namely the residential bungalows near the Whittington Moor Roundabout Government Guidance LAQM.TG(03) assumes that the monitored data is more reliable than the model predictions. The monitoring data was therefore used to create a correction factor.

Both the modelling and the monitoring showed a potential breach of the PM_{10} objective close to the residential bungalows. DMRB predicted that there would be 61 days of pollution levels above 50μg/m^3; the Air Quality Objective only allows for 35 days of exceedences. This indicates a possible breach of the objective at this location.

At the monitoring location the extrapolated annual average was 28.5μg/m^3. This is below the PM_{10} objective of 50.0μg/m^3. There is a large discrepancy between the modelled prediction of 9 days above 50μg/m^3 and the extrapolated monitored prediction of 39 days, above the 50μg/m^3 standard. In this instance, the monitored results showed a borderline breach of the objective.

Consequently, it was concluded that the declaration of an Air Quality Management Area (AQMA) would not be pursued for the following reasons:

- (i) the marginality of the results and the large confidence error would require further data,
- (ii) QC/QA analysis of the data and
- (iii) consideration of whether unusual climatic conditions in 2003 were influential in the monitoring figures over this period.

In summary, it was proposed to address these factors further before coming to a definitive conclusion and making a decision. The recommendations of the 2004 Detailed Assessment were addressed over the course of 2005 and the associated actions were highlighted in the Annual Progress Report 2005.

1.4 Conclusions and Recommendations of Progress Report 2005

The Progress Report 2005 analysed the data from the Whittington Moor monitoring station and also from the Nitrogen dioxide diffusion tubes, which were exposed over the course of 2004. The Conclusions and Recommendations of Progress Report are as follows:

Conclusions

- The hourly and annual mean NO_2 concentrations for 2005 and 2010 for Whittington Moor Roadside Air Quality Station did not show any risk of exceedence of the Air Quality Objectives.

- One diffusion tube location, Derby Road; Lincoln Street, may be at risk of potentially breaching the NO_2 Objectives. However since this location did not meet the minimum monitoring period criteria, this result only provides an indication of a possible hotspot. In view of this however, relocation of one of the air quality sites to this area will be investigated so that more thorough monitoring can be conducted (see following section – Recommendations)

- The 1-hour, 24-hour and 15-minute mean Air Quality Objectives for SO_2 do not show any risk of exceedence.

- The 24-hour and annual mean Air Quality Objectives for PM_{10} for 2004 do not show any risk of exceedence. However the provisional 2010 annual mean objective shows a potential marginal exceedence at Whittington Moor.

- The Major Development Site Progress Group will continue to meet on a regular basis; the major developments, which received outline planning permission in the spring 2005, will be kept under close review. Appropriate comments on more detailed application will be made regarding any air quality issues when those applications are received.

- There have been two new industrial process permitted in 2004. The Environment Agency have permitted a metal finishing installation and Chesterfield Borough Council have permitted a waste oil burner. Two installations have been revoked by Chesterfield Borough Council; one was an odourisation plant and the other a surface coating installation. The air quality implications of these installations will be considered in more detail in the next round of Review & Assessment.

- The Local Transport Plan 2 will be put to consultation in autumn 2005 with a view to publishing the final version in 2006.

Recommendations

Having reviewed the data and audited the air quality systems in place at Chesterfield Borough Council the following recommendations were made.

- Since the appointment of the new air quality officer at Chesterfield Borough Council there will also be a review of in-house QA/QC procedures and improvements made where necessary. All QA/QC procedures will be documented and made available upon request.

- The current NO_2 diffusion tube network will be reviewed and extended to target likely problem areas. The majority of the diffusion tubes are located at roadside/kerbside sites but it may be more appropriate to locate the tubes at the façade of properties. In relocating the diffusion tubes, care will also be taken to select sites that should be at a lower risk of theft to provide better data capture over the coming year. The guidance provided by LAQM.TG(03) Annex 1 will be strictly adhered to in the design and selection of new diffusion tube locations.

- Since SO_2 diffusion tubes are unable to detect increases in short-term concentrations and according to LAQM.TG(03) are not of sufficient accuracy to

be used for Review & Assessment purposes, the cessation of SO_2 diffusion tube network is therefore recommended.

- The possibility of conducting additional air quality monitoring in the Borough will be investigated and closer working relationships with neighbouring Local Authorities will be developed over the coming year.

- The possible relocation of the Birdholme Urban Background station to a suitable roadside location will be considered. Currently it is anticipated that the station will be relocated to a site on Derby Road, which is an area of concern with regards potential NO_2 air quality exceedences. The guidance provided by LAQM.TG(03) Annex 1 regarding the siting and operation of an air quality campaign will be strictly followed in the event of relocation of the Air Quality Station.

- The air quality website will be reviewed and updated with a view to providing more relevant information and improve access to recent and historical air quality reports and data.

- The Local Air Quality Strategy and will be reviewed and updated. The aim is to liaise and where possible include other relevant council departments such as Land-Use Planning, Transport, Energy Efficiency and Sustainability Departments in the development of the Strategy.

1.5 Introduction to Update and Screening Assessment 2006

The Update & Screening Assessment 2006 is to be undertaken by all Local Authorities. This is based on a checklist to identify those matters that have changed since the first and second round of Review & Assessment and which may now require further assessment. The Updating & Screening should cover: new monitoring data; new Objectives, new sources or significant changes to existing sources, either locally or in neighbouring Authorities and other local changes that may effect local air quality etc. If there is a risk that these changes may be significant, then a simple screening assessment should be carried out.

This document forms the Update & Screening Report 2006 for Chesterfield Borough Council. In writing this report, the Council has had regard to the Governments published guidance in Technical Guidance LAQM.TG(03). It assesses the levels of

each of the pollutants outlined in the Air Quality Objectives. It details new monitoring data for 2005 and also makes predictions of future levels of Nitrogen Dioxide (NO_2) and PM_{10} in the Borough.

1.6 Consultation

The 1995 Act provides the statutory basis for consultation and liaison in respect of local air quality management. Schedule 11 of the Act requires Local Authorities to consult:

- The Secretary of State
- The Environment Agency
- The Highways Agency
- Derbyshire County Council
- All neighbouring Local Authorities
    - Amber Valley Borough Council
    - Bolsover District Council
    - Derbyshire Dales District Council
    - Derby City Council
    - Erewash Borough Council
    - High Peak Borough Council
    - North East Derbyshire District Council
- Peak District National Park

Copies of this report will also be made available at the Town Hall, all local libraries and will also be made available on the Council website at http://www.chesterfield.gov.uk

1.7 Methodology

This assessment shall adopt the format and follow the guidance as specified in LAQM.TG(03). Each relevant section shall explain in detail how the information was collated and data calculated. Additional information can also be found in the Appendices, which will be clearly referred to in the text. To date, Chesterfield has not declared any AQMA's for any of theAir Quality Objectives, therefore all monitroing data has been generated outside an AQMA.

2.0 Carbon Monoxide

The Government and Devolved Administrations have adopted one Air Quality Objective for Carbon Monoxide (CO). This are listed in Table 2 below.

2.1 Objective

Table 2: Carbon Monoxide Air Quality Objective applicable to Chesterfield Borough Council.

Pollutant	**Concentration**	**Measured as**	**Date to be achieved by**
Carbon Monoxide (CO)	10.0 mg/m^3 (8.6ppm)	Maximum daily running 8-hour mean	31/12/2003

2.2 Introduction

Carbon Monoxide (CO) is a gas that prevents the normal transport of oxygen by the blood. It can lead to a significant reduction in the supply of oxygen to the heart, particularly in those people suffering from heart disease. The main source for Carbon Monoxide (CO) in the UK is road transport, which accounted for 59% of UK emissions in 2002. There has been a steady reduction in annual emissions of CO from the transport sector since the 1970's due to increased use of catalytic converters in cars. Current projections indicate that these trends are likely to continue and that existing policies are sufficient in order to meet the Air Quality Objective for CO in 2003 and subsequent years.

The 2003 Update & Screening Assessment for Chesterfield did not identify any risk of the CO Air Quality Objective being exceeded. However as part of the Review & Assessment Process, the levels of CO in the Borough should be re-assessed to ensure that risk of the exceedence of the objective remains low.

2.3 Assessment

This assessment shall adopt the format and follow the guidance as specified in LAQM.TG(03) Box 2.2

2.3.1 Monitoring Data

As a result of previous Review & Assessments, Carbon Monoxide is not monitored at any of Chesterfield Borough Council's Air Quality Stations. Geographically the closest national network monitoring station is Sheffield Centre which represents the worst case scenario for Chesterfield as Sheffield's traffic flows are considerably higher than those in Chesterfield. The maximum daily running 8-hour mean for 2005 for Sheffield Centre is 3mg/m^3. This is well below the Air Quality Objective for Carbon monoxide and therefore the risk of the Air Quality Objective being exceeded at Chesterfield is low, therefore no further assessment is required.

2.3.2 Very Busy Roads and Junctions

As part of Review & Assessment, very busy roads and junctions where current background concentration is expected to be above 1mg/m3 must be screened to ensure they are not posing a threat to the Air Quality Objective for Carbon monoxide. To identify 'very busy roads and junctions' the following criteria should be used:

- Single carriageway roads with daily average traffic flows, which exceed 80,000 vehicles per day.
- Dual carriageway (2 or 3 lane) roads with daily average traffic flows, which exceed 120,000 vehicles per day.
- Motorways with daily average traffic flows, which exceed 140,000 vehicles per day.
- Background concentration >1mg/m^3.
- Relevant exposure within 10m of the kerb.

There are no roads or junctions in Chesterfield that meet the above criteria, therefore no further assessment is required.

2.3.3 Neighbouring Authorities

There are no sources in neighbouring Authorities that could have an adverse effect on levels of carbon monoxide within Chesterfield Borough Council's area, therefore no further assessment is required.

2.4 Conclusion

The exceedence of the Air Quality Objective for carbon monoxide is unlikely and a Detailed Assessment is therefore not required.

3.0 Benzene

The Government and Devolved Administrations have adopted two Air Quality Objectives for Benzene. These are listed in Table 3 below.

3.1 Objectives

Table 3: Benzene Air Quality Objectives applicable to Chesterfield Borough Council.

Pollutant	**Concentration**	**Measured as**	**Date to be achieved by**
Benzene	16.25μg/m^3 (5ppb)	Running annual mean	31/12/2003
	5.0 μg/m^3 (1.5ppb)	Annual Mean	21/12/2010

3.2 Introduction

Benzene is a known genotoxic carcinogen and long-term exposure has been linked to various forms of leukaemia and can damage the immune system and cell chromosomes. In light of the health effects and advice from APAQs and the Department of Health's Committee on Carcinogenity of Chemicals in Food, Consumer Products and the Environment, to reduce the concentrations of benzene in air to as low a level as possible, the much more stringent Air Quality Objective of 2010 was implemented.

The main sources of benzene in the UK are petrol engine vehicles, petrol refining and the distribution and uncontrolled emissions from petrol station forecourts without vapour recovery systems. Since benzene is a constituent of petrol, emissions arise from the evaporation and combustion of petrol. In 2002, fuel combustion in the road transport sector accounted for 32% of UK emissions. Benzene is also used in the chemical industry as an intermediate chemical in the production of foams, fibres, coatings, detergents, solvents and pesticides. The use of benzene in the chemical industry gives rise to stack and fugitive emissions, however these emissions sum to contribute only 4% of total emissions.

A number of policies are in place that aim to reduce emissions of benzene. Since January 2000, EU legislation has reduced the maximum benzene content of petrol from 5% to 1%. The European Auto-oil Programme will further reduce emissions from cars and light-duty vehicles, and emissions from the storage and distribution of

petrol are controlled by vapour recovery systems. Indeed benzene emissions in the UK have decreased by 75% between 1990 and 2002. Forecasts based on national mapping suggest that these policies will achieve the 2003 objective and the majority of locations will also achieve the 2010 objective.

The 2003 Update & Screening Assessment for Chesterfield did not identify any risk of the benzene Air Quality Objectives being exceeded. However as part of the Review & Assessment Process, the levels of benzene in Chesterfield should be re-assessed to ensure that risk of exceedence of the benzene Objectives remains low.

3.3 Assessment

This assessment shall adopt the format and follow the guidance as specified in LAQM.TG(03) Box 3.2.

3.3.1 Monitoring Data

As a result of previous Review & Assessments benzene is not monitored at any of Chesterfield Borough Council's Air Quality Stations.The nearest national network monitoring sites do not monitor for benzene so local monitoring data is currently unavailable. Maps of estimated UK background air pollution concentrations have been used to calculate the background concentration for 2010. These maps can be found at http://www.airquality.co.uk. The maximum concentration has been calculated to be 0.55µg/$m^{3,}$ which is well below the Air Quality Objective of 5.0µg/m^3, therefore no further assessment is required.

3.3.2 Very Busy Roads and Junctions

Locations close to busy roads in areas with high background concentrations may be at risk of exceeding the benzene Air Quality Objectives. To identify 'very busy' roads and junctions the following criteria should be used:

- Single carriageway roads with daily average traffic flows, which exceed 80,000 vehicles per day.
- Dual carriageway (2 or 3 lane) roads with daily average traffic flows, which exceed 120,000 vehicles per day.
- Motorways with daily average traffic flows, which exceed 140,000 vehicles per day.
- Relevant exposure within 10m of the kerb
- Background concentration >2µg/m^3.

There are no roads or junctions in Chesterfield that meet the above criteria, therefore no further assessment is required.

3.3.3 Industrial Sources

There may be a few petrochemical works that emit sufficient benzene to put the 2010 Air Quality Objective at risk of being exceeded. However no industrial sources were identified during previous rounds of Review & Assessment as likely to give rise to exceedence of the running annual mean for benzene. There are no new industrial sources, new relevant exposure or sources with substantially increased emissions, therefore no further assessment is required.

3.3.4 Petrol Stations

There is some evidence that petrol stations could emit sufficient benzene to put the 2010 objective at risk of being exceeded, especially combined with higher levels from busy nearby roads and relevant exposure in close proximity to the pumps. To identify those locations the following criteria should be used:

- Annual throughput of more than 2000m^3 of petrol
- Nearby busy road of more than 30,000 vehicles per day
- Relevant exposure within 10m of the pumps.

Chesterfield Borough Council regulates a total of 12 petrol stations with a petrol throughput of more than 2000m^3 of petrol. However they do not fulfil the remaining criteria, therefore no further assessment is required.

3.3.5 Major Fuel Storage Depots

There are no major fuel storage depots in the Chesterfield area, therefore no further assessment is required.

3.3.6 Neighbouring Authorities

There are no sources in neighbouring Authorities that could have an adverse effect on levels of benzene within Chesterfield Borough Council's area, therefore no further assessment is required.

3.4 Conclusion

The exceedence of the Air Quality Objective for benzene is unlikely and a Detailed Assessment is therefore not required.

4.0 1,3-butadiene

The Government and Devolved Administrations have adopted one Air Quality Objective for 1,3-butadiene. This is listed in Table 4 below.

4.1 Objective

Table 4: 1,3-Butadiene Air Quality Objectives applicable to Chesterfield Borough Council.

Pollutant	**Concentration**	**Measured as**	**Date to be achieved by**
1,3-Butadiene	2.25μg/m^3 (1ppb)	Running annual mean	31/12/2003

4.2 Introduction

1,3-butadiene is a known genotoxic carcinogen. It arises as stack and fugitive emissions from its manufacture and use in the chemical industry where it is used in the production of various forms of rubber. However the main source of 1,3-butadiene in the UK, 75% of total UK emissions in 2002, is as a by-product of combustion in vehicle exhausts. Due to the increasing number of cars being equipped with catalytic converters, there have been significant reductions in emissions of this pollutant. Between 1990 and 2002 emission of 1,3 butadiene had reduced by 73%. Further reductions in vehicle emissions and improvements in fuel quality, including those as part of the Auto Oil Programme, are expected to reduce these levels further.

Studies on a national level, based on modelling and measured data, suggest that there is little likelihood of the objective for 1,3-butadiene being exceeded in future years. Indeed, the 2003 Update & Screening Assessment for Chesterfield did not identify any risk of the 1,3-butadiene Air Quality Objective being exceeded. However as part of the Review & Assessment Process, the levels of this pollutant in Chesterfield should be re-assessed to ensure that risk of exceedence of the Objectives remains low.

4.3 Assessment

This assessment shall adopt the format and follow the guidance as specified in LAQM.TG(03) Box 4.2.

4.3.1 Monitoring Data

As a result previous Review & Assessments, 1,3-butadiene is not monitored at any of Chesterfield Borough Council's Air Quality Stations. The nearest national network monitoring sites do not monitor for 1,3 butadiene so local monitoring data is currently unavailable. Maps of estimated UK background air pollution concentrations have been used to calculate the background concentration for 2005. These maps can be found at http://www.airquality.co.uk. The maximum concentration has been calculated to be 0.23µg/$m^{3,}$ which is well below the Air Quality Objective of 2.25µg/m^3, therefore no further assessment is required.

4.3.2 Industrial Sources

No industrial sources were identified during previous rounds of Review & Assessment as likely to give rise to exceedence of the running annual mean for 1,3-butadiene. There are no new industrial sources, new relevant exposure or sources with substantially increased emissions, therefore no further assessment is required.

4.3.3 Neighbouring Authorities

There are no sources in neighbouring Authorities that could have an adverse effect on levels of 1,3-butadiene within Chesterfield Borough Council's area, therefore no further assessment is required.

4.4 Conclusion

The exceedence of the Air Quality Objective for 1,3-butadiene is unlikely and a Detailed Assessment is therefore not required.

5.0 Lead

The Government and Devolved Administrations have adopted two Air Quality Objectives for Lead. These are listed in Table 5 below.

5.1 Objectives

Table 5: Lead Air Quality Objectives applicable to Chesterfield Borough Council.

Pollutant	**Concentration**	**Measured as**	**Date to be achieved by**
Lead	0.5µg/m^3	Annual mean	31/12/2004
	0.25µg/m^3	Annual mean	31/12/2008

5.2 Introduction

The long-term health effects of lead are caused by its accumulation in the body which can cause kidney and reproductive damage, loss of cognitive function, poor aptitude and can damage the peripheral and central nervous system.

UK emissions of lead have declined considerably since 1990 primarily due to reductions in the lead content of leaded petrol and the increased use of unleaded and lead replacement petrol. The agreement reached between the European Parliament and the Environment Council on the Directive on the Quality of Petrol and Diesel fuels (part of the Auto-Oil Programme) has led to a ban on sales of leaded petrol in the UK with effect from 1 January 2000. This has resulted with road transport contributing only 1% to the total UK emissions in 2002, the predominant sources of lead in the UK are now from a variety of industrial activities.

The main industrial sectors which are responsible for UK emissions of lead include battery manufacture, pigments in paints and glazes, alloys, radiation-shielding, tank lining and piping. Detailed assessments of the impacts of these industrial processes have been undertaken by the Government and Devolved Administrations and the results of monitoring have generally indicated no exceedences of the 2004 or 2008 Objectives. Similarly there have been no AQMAs declared in the UK in respect of the 2004 and 2008 Objectives.

The 2003 Update & Screening Assessment for Chesterfield did not identify any risk of the lead Air Quality Objective being exceeded. However as part of the Review & Assessment Process, the levels of lead in Chesterfield should be re-assessed to ensure that risk of the exceedence of the objective remains low.

5.3 Assessment

This assessment shall adopt the format and follow the guidance as specified in LAQM.TG(03) Box 5.1.

5.3.1 Monitoring Data

As a result of previous Reviews & Assessments, lead is not monitored at any of Chesterfield Borough Council's Air Quality Stations. The nearest monitoring site that monitors for lead are two locations at Manchester, one at an urban background location (St Paul's School, Wythenshawe), and one at an urban central location (Piccadilly Gardens), the latest data available is for 2004 with an annual mean of 0.02μg/m^3 and 0.05μg/m^3 respectively. Both locations are below the objective for both 2004 and 2008. Manchester, being a larger conurbation, represents a worst case scenario for Chesterfield. It is therefore unlikely that the Air Quality Objective is at risk of exceedence and consequently no further assessment is required.

5.3.2 Industrial Sources

No industrial sources were identified during previous rounds of Review & Assessment as likely to give rise to the exceedences of the annual mean objective for lead. There are no new industrial sources, new relevant exposure or sources with substantially increased emissions, therefore no further assessment is required.

5.3.3 Neighbouring Authorities

There are no sources in neighbouring Authorities that could have an adverse effect on levels of lead within Chesterfield Borough Council's area, therefore no further assessment is required.

5.4 Conclusion

The exceedence of the Air Quality Objective for lead is unlikely and a Detailed Assessment is therefore not required

6.0 Nitrogen Dioxide

6.1 Objectives

The Government and Devolved Administrations have adopted two Air Quality Objectives for Nitrogen Dioxide (NO_2). These are listed in Table 6 below.

Table 6: Nitrogen Dioxide Air Quality Objectives applicable to Chesterfield Borough Council.

Pollutant	Concentration	Measured as	Date to be achieved by
Nitrogen Dioxide* (NO_2)	200µg/m^3 (105ppb), not to be exceeded more than 18 times a year	1 hour mean	31/12/2005
	40µg/m^3 (21ppb)	Annual mean	31/12/2005

6.2 Introduction

Nitrogen dioxide is a respiratory irritant affecting lung function and bronchial reactivity. It has also been shown to increase the susceptibility of respiratory tracts to infections in children and may increase the response of sensitive individuals to allergens. It can also increase the frequency and intensity of asthma and heart attacks.

Nitrogen Dioxide (NO_2) and Nitric Oxides (NO) are both oxides of nitrogen and are collectively referred to as nitrogen oxides (NOx). It is only the NO_2 that is subject to health based air quality standards. High temperature combustion processes produce these oxides. During the combustion process, the principal constituent of NOx is NO, which is converted into NO_2 in the atmosphere mostly by reacting with Ozone (O_3). However there are also primary sources of NO_2 that can also play a considerable role. There is evidence of significant amounts of NO_2 emitted directly in diesel vehicle exhausts, especially in slow moving traffic. This is due to technologies designed to reduce particulate emissions in their exhausts. An increase in diesel car sales in 2010 from 22% of new car sales (current rate) to 30% could increase urban UK road transport emissions of NOx in 2010 by 0.7% and NO_2 emissions by 3%.

Road transport is the predominant source of NOx emissions in the UK, accounting for 49% of total UK emissions in 2000, although the impact of road transport to local emissions may be much higher. However this contribution has declined over recent

years due to various policy measures including improvements in engine design and the fitting of three-way catalysts to petrol cars. This decline is expected to continue through improved technologies and emissions standards, with an expected reduction of 46% between 2000 and 2010.

Other sources of nitrogen oxides include the electricity supply industry and the industrial/commercial sector involved in the combustion of fossil fuels. Emissions from these sources have also declined over recent years due to abatement measures in coal-fired power stations and increased use of other fuels for power generation.

The annual mean objective of 40μgm^3 is currently widely exceeded at roadside sites across the UK with exceedences also reported at urban background locations in major conurbations. The vast majority of Air Quality Management Areas, which have been declared for NO_2, are related specifically to road traffic emissions. Analysis of monitoring data in the vicinity of roads has shown that exceedences are likely to occur within approximately 10m of the kerbside of single carriageway roads. This includes roads with relatively low traffic flows if they are within congested town centres. This is particularly significant for Chesterfield, as being a market town, it has narrow streets with some residential properties within 5m of the kerb.

The Update & Screening for Chesterfield in 2003 identified several locations across the Borough at risk of exceedence of the annual Air Quality Objective. This conclusion was reached however with inadequate data and high levels of uncertainty. It was recommended therefore that further monitoring undertaken before any action was taken. The issues that were raised were also highlighted as recommendations in the Progress Report 2005 and have since been implemented. These recommendations are listed in more detail in Section 1.4 of the Introduction of this report. The locations which were identified as at risk of breaching the annual Air Quality Objective for NO_2 shall be reassessed as part of this Update & Screening 2006.

6.3 Assessment

This assessment shall adopt the format and follow the guidance as specified in LAQM.TG(03) Box 6.2.

6.3.1 Monitoring Data

Methodology

Over the course of 2005, Chesterfield Borough Council monitored Nitrogen Dioxide within the Borough using automatic analysers housed in two-air quality monitoring stations. Further NO_2 monitoring was achieved using passive diffusion tubes distributed across the Borough. Since Chesterfield Borough Council has not declared any Air Quality Management Areas to date, during 2005 the monitoring was conducted outside an AQMA.

Automatic Monitoring Stations

There are two mobile automatic monitoring stations in Chesterfield, both monitor Nitrogen Dioxide using Monitor Labs chemiluminescence Analysers housed in secure air-conditioned cabins.

Both stations undergo a routine maintenance service every six months by Casella ETI and are also audited on a six monthly basis by Netcen. A Local Site Operator, who performs calibrations and equipment checks in accordance with the Site Operators Manual AEAT/ENV/R1595, visits the stations every two weeks. The results are submitted to Netcen for verification after each calibration.

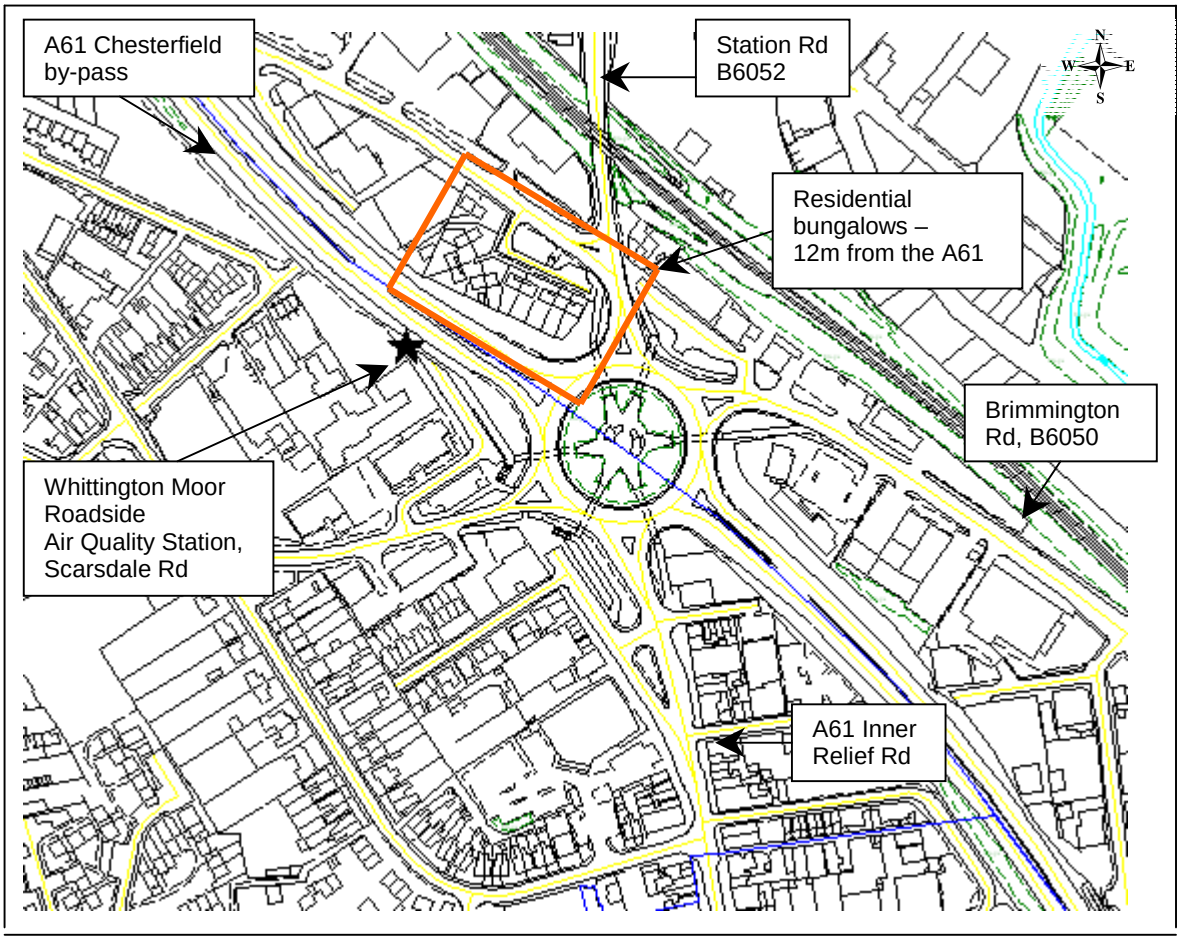
The data is downloaded by GSM modem from both stations every 24 hours directly to a standalone PC in the Environmental Health Department at Chesterfield Borough Council. The data is also downloaded on a daily basis by Netcen, who then validate and ratify the raw data and provide the ratified reports on a bi-annual basis to Chesterfield Borough Council.

Whittington Moor Air Quality Station

The Air Quality Station at Whittington Moor was first commissioned on the 14th April 2004. This location is adjacent to the A61, Northwest of Chesterfield, adjacent to Scarsdale Road and opposite Gilbert-Heathcote Primary School. It is within 50m of the busy roundabout linking the A61, B6050 and the B6057. The location of the Whittington Moor Air Quality Station was chosen to reflect the local air quality that is experienced by the nearest sensitive receptors to the busy roundabout. These sensitive receptors are the residential bungalows highlighted in the orange box on

Figure 1 below. The property which is nearest the A61 is approximately 12m from the kerb.

Figure1: Map showing location of Whittington Moor Air Quality Station.

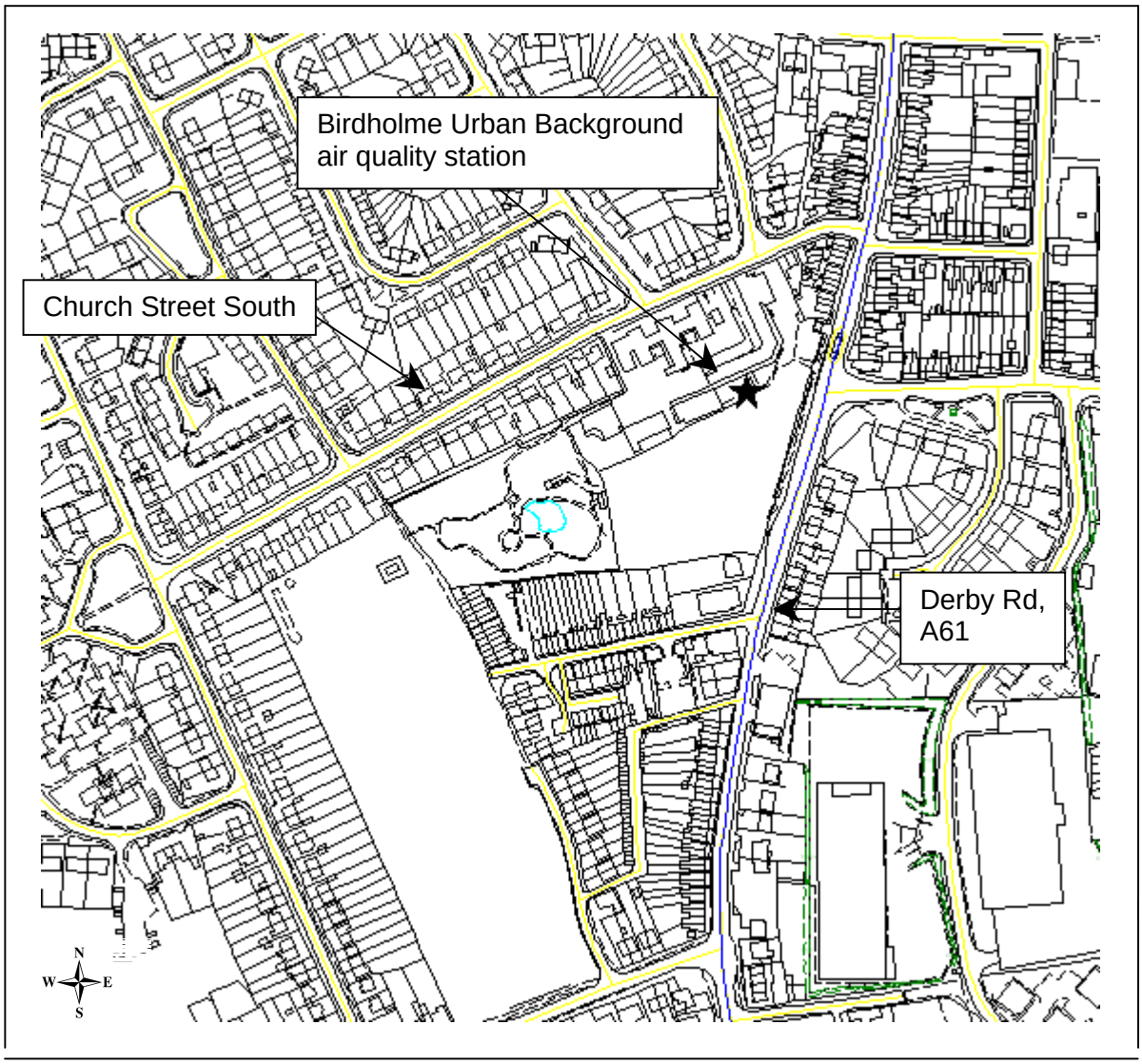


Birdholme School Air Quality Station

The second mobile Air Quality Station is located at Birdholme Primary School and was commissioned in October 2004. It is positioned >30m from Derby Road (A61) to the south of Chesterfield and is representative of the residential properties set-back from the A61 where the predominant source of pollutants in the area is generated by traffic. This school in particular was chosen due to an increasing number of complaints of asthma amongst the children that attended the school. A detailed map

showing the location of the Birdholme Air Quality Station can be found on Figure 2 below.

Figure 2: Map showing location of Birdholme Air Quality Station.



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Monitoring Data- Results

Automatic Monitoring Data

The data provided by the Whittington Moor and Birdholme Air Quality Stations were both for a period of twelve months. The data for both sites have been ratified from 1st January 2005 to 31st October 2005. The data for the period 01st November 2005

through 31st December 2005 remains provisional, although it has been screened and scaled and as such is validated and is suitable for the purposes of Review & Assessment. The data capture rates during this monitoring period for Whittington Moor and Birdholme was 88% and 88.8% respectively. Advice was sought and provided by the Review & Assessment Helpdesk regarding these data capture rates, although the minimum rate should be 90%, the data loss was considered so marginal, that the capture rate was deemed acceptable for comparison with the annual and hourly mean NO_2 Objectives. Table 7 below provides the annual means and the maximum hourly mean for 2005 with associated predicted concentrations for 2010 for both Air Quality Stations.

Table 7: Hourly and Annual mean NO_2 concentrations for Whittington Moor and Birdholme Air Quality Stations.

Air Quality Station Name	Monitoring Period	Data Capture Rate (%)	Maximum Hourly Mean 2005 NO_2 ($\mu g/m^3$)	Hourly Mean 2010 NO_2 ($\mu g/m^3$)	Annual Mean 2005 NO_2 ($\mu g/m^3$)	Annual Mean 2010 NO_2 ($\mu g/m^3$)
Whittington Moor	01/01/05 – 31/12/05	88.0	191	160.6	30.0	25.2
Birdholme	01/01/05 – 31/12/05	88.8	132	115.4	23.0	20.1

The annual Air Quality Objective for NO_2 for 2005 and 2010 is 40$\mu g/m^3$. The annual mean at Whittington Moor in 2005 and projected to 2010 is 30.0$\mu g/m^3$ and 25.23$\mu g/m^3$ respectively. The annual mean at Birdholme in 2005 and projected to 2010 is 23.0$\mu g/m^3$ and 20.11$\mu g/m^3$ respectively.

Therefore **THE ANNUAL AIR QUALITY OBJECTIVE FOR NO_2 FOR 2005 HAS BEEN MET. THE 2010 IS ALSO EXPECTED TO BE MET AT THESE LOCATIONS.**

The hourly Air Quality Objective for NO_2 for 2005 and 2010 is 200$\mu g/m^3$ with 18 exceedences. The maximum hourly mean at Birdholme in 2005 and projected to 2010 is 191.0$\mu g/m^3$ and 160.6$\mu g/m^3$ respectively. The maximum hourly mean at Birdholme in 2005 and projected to 2010 is 132.0$\mu g/m^3$ and 115.4$\mu g/m^3$ respectively. These values are all below the Air Quality Objective.

Therefore **THE ANNUAL AIR QUALITY OBJECTIVE FOR NO_2 FOR 2005 HAS BEEN MET. THE 2010 OBJECTIVE IS ALSO EXPECTED TO BE MET AT THESE LOCATIONS.**

Therefore no further assessment is required at these locations.

Nitrogen Dioxide Diffusion Tubes

There are a total of 25 diffusion tubes distributed across the Borough, each being exposed for a four-week period. The diffusion tubes are supplied and analysed by South Yorkshire Laboratories. They purchase the tubes uncoated from Gradko, treat with 50% acetone and 50% triethanolamine, allow to evaporate and then mount into tubes. Analysis of the tubes is by colourimetric determination. South Yorkshire laboratories are members of WASP, InterLaboratory Field Comparison and Standard Solution Checks associated with NO_2 monitoring with satisfactory results. It is the intention of South Yorkshire laboratory to obtain UKAS accreditation for its NO_2 tube analysis in 2006.

Travel blanks are not used. South Yorkshire Laboratories retain co-prepared samplers to determine the preparation and storage blank concentrations for each batch prepared and automatically correct results for this blank. This system was adopted due to elevated travel blanks consistently being associated with inappropriate handling of the diffusion tubes and therefore the elevated values were rarely used to correct their associated diffusion tube results. This new system of co-prepared samplers was therefore agreed with all the users of South Yorkshire Laboratories in February 2004.

Over the course of 2005, there were two locations with triplicate collocated diffusion tubes. The first set were located at Whittington Moor Air Quality Station. The second set were located at Brimington, North Chesterfield for the first half of 2005. They were initially located at Brimington as historically there had been an Air Quality Station at that location and the collocation results had been used for the purpose of bias adjustment. Since that station had been decommissioned at that location in 2003, the triple exposure was relocated to Birdholme Air Quality Station from July to December 2005.

According to LAQM.TG(03), the minimum monitoring period using diffusion tubes should encompass at least three summer and three winter months consecutively where comparison with an annual mean objective for NO_2 is required. Unfortunately over the course of 2005 a number of diffusion tubes were lost which has been attributed to theft. The triplicate diffusion tubes located at the Whittington Moor Air Quality Station suffered considerable loss, culminating in only seven results in twelve months of tube exposure with a maximum consecutive exposure period of two

months. The triplicate diffusion tubes located at Brimington also suffered from theft resulting in only five months data. Therefore these locations do not fulfil the minimum monitoring criteria and the results cannot be used for comparison with the annual mean objective for NO_2.

In light of the theft problems at Whittington Moor Air Quality Station, new procedures have been implemented in 2006, which will considerably reduce the risk of theft in future years. Relocating the triplicate diffusion tubes from Brimington to Birdholme School also reduced the risk of theft, as this Station is located within secure school grounds. Since January 2006 all diffusion tubes locations have been reassessed and more secure mounts and locations have been developed so as to ensure minimum loss in future years.

The remaining locations do meet the minimum period of data capture and therefore can be used for comparison with the annual mean objective for NO_2. A table listing the diffusion tube locations and the months successfully exposed and returned to the South Yorkshire Laboratories for analysis can be found in Appendix 1.

Bias Adjustment

According to LAQM.TG(03) a recent report revealed that the results from diffusion tube collocation studies varied considerably between the different laboratories responsible for analysing the tubes. It is recommended therefore that this bias should be taken into account when using diffusion tube data.

Ideally each local authority should be able to calculate their own bias correction factor by collocating NO_2 diffusion tubes with a chemiluminescence analyser for a period of at least nine months. However, in the case of Chesterfield, since the co-location study only successfully occurred for seven non-consecutive months at Whittington Moor and only six months at Birdholme it was thought appropriate to use a correction factor provided by the Air Quality Consultants which is available via the Air Quality Review & Assessment website at http://www.uwe.ac.uk/aqm/review. According to the database provided, the correction factor to use for the laboratory that analyses Chesterfields NO_2 diffusion tubes is 0.96.

The Table in Appendix 1 shows the bias corrected monthly mean for all the NO_2 diffusion tube locations. It also shows the period of data capture for each location. The locations that did not fulfil the minimum monitoring criteria and so therefore

cannot be used for comparison with the annual mean objective for NO_2 are Brimington and Whittington Moor.

Extrapolated Annual Means

The remaining locations do meet the minimum period of data capture and therefore can be used but must be extrapolated to provide an annual mean. According the LAQM.TG(03) Box 6.5, this requires calculation of a correction factor based on data provided by two to four nearby long-term Air Quality Stations, which are preferably part of the national network. The Air Quality Stations which meet these criteria and which have been used to extrapolate Chesterfield's data is Sheffield Tinsley, Leicester Centre and Rotherham Centre as recommended by Netcen. The extrapolated NO_2 annual means for those diffusion tube locations in Chesterfield which met the minimum monitoring criteria in 2005 can be found in Table 8.

Kerbside Adjustment

As can be seen in Table 8 several of the diffusion tube locations are kerbside sites and since the nearest sensitive receptors are set back from the kerb, these values have also been adjusted to reflect the relevant exposure levels of NO_2 at those locations. Guidance provided by the Review & Assessment website gives correction factors for kerbside mounted diffusion tubes. The correction factors and calculations showing the adjustment for each kerbside site can be found in Appendix 2.

Table 8 below therefore provides the annual mean for 2005 for each diffusion tube location. It also details the predicted annual means at each diffusion tube location for 2010 using the technique detailed in LAQM.TG(03) and the adjustment factors in boxes 6.6 of the Guidance. The calculations can be found in Appendix 3. The locations highlighted in the table below are those results that are near or above the annual mean objective for NO_2 for 2005 and the provisional objective for 2010.

Table 8: Annual mean NO_2 diffusion tube results for all tube locations in Chesterfield.

Tube Location	Site Type	Annual Mean 2005 NO_2 ($\mu g/m^3$)	Annual Mean 2010 NO_2 ($\mu g/m^3$)
Staveley High Street	Roadside	28.1	23.6
Staveley Stables	Background	23.2	18.7
Travel Lodge	Roadside	37.8	31.8
Derby Rd, St Augustines	**Kerbside**	**42.4**	35.7
Derby Rd, Lincoln St	**Kerbside**	**47.4**	39.9
Jawbones Hill	**Kerbside**	**40.7**	34.2
St Augustines Rain Pipe	Roadside	25.0	21.3
St Augustines Church	Roadside	26.0	21.9
St Augustines Rd	Kerbside	30.8	25.9
Station Road, Barrow Hill	Kerbside	28.7	24.4
Chesterfield Rd, Staveley	**Roadside**	**42.4**	35.7
Chesterfield Rd, Brimington	Kerbside	38.2	32.2
Middlecroft Road	Roadside	20.8	17.5
Triple Exposure; Birdholme	Background	22.3	19.5
		22.0	19.2
		23.4	20.5
Walton Road	Roadside	29.1	24.5
Hasland By-Pass	Roadside	29.6	25.0
Bell House Lane	Roadside	28.3	24.0
Chatsworth Road	**Kerbside**	**51.4**	**43.3**
Queen Mary Road	Kerbside	23.9	20.1
Vincent Crescent	Kerbside	33.3	28.0

It can be seen from the table above that five of the locations breached the annual mean objective for NO_2 for 2005 and one is projected to breach the 2010 objective. A more detailed discussion of each of the breach locations can be found below.

Chesterfield Road – A619

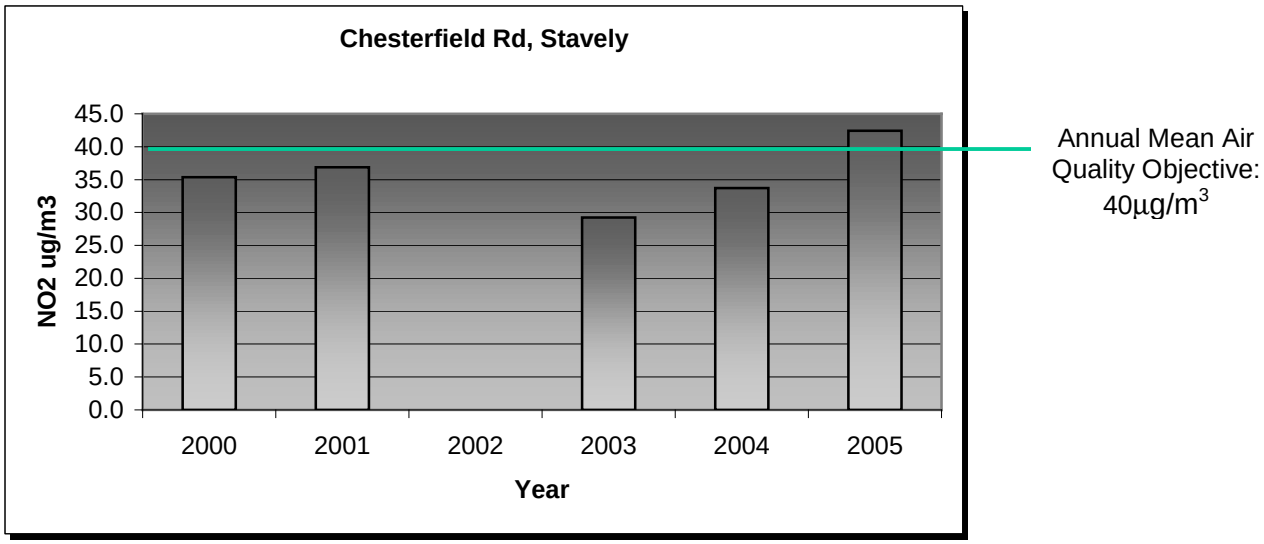
The result for the diffusion tube at this location was rather unexpected. This is a location on Chesterfield Road, Staveley. The A619 (Chesterfield Road) leads from the town centre to Staveley, which is a town in the Northeast of Chesterfield near the border of Chesterfield Borough Council and Bolsover District Council. It has one lane for traffic each way, which accommodates a 24hr annual average daily traffic flow of 15955 with 6% comprising HDV's. The majority of properties adjacent to the A619 are positioned more than 10m from the road, however this diffusion tube location is at

a section of the road where the houses are located 3.6m from the kerb and therefore represents a worst-case scenario. The houses at this point are only on one side of the road however with an open aspect on the other and there are no traffic lights near the diffusion tube location which may lead to slow-moving vehicles in the location of the tube. Since there is open aspect and ordinarily flowing traffic at this location the Air Quality Objective exceedence was unexpected. The only potential cause could be the slight incline on this stretch of road in combination with HDV traffic.

The audit of diffusion tubes in 2005 revealed that the diffusion tube was mounted directly onto the building façade, a spacer block was absent and it was attached to an area that was slightly recessed. As such there were concerns that the diffusion tube was therefore not sampling a representative sample of air, since there may not be adequate dispersion, there was the possibility that it has been sampling stagnant air. The diffusion tube was relocated in January 2006 adjacent to its original location but was correctly mounted using spacer blocks in an area of adequate dispersion.

To provide further understanding of the levels of NO_2 at this location it is appropriate, since this diffusion tube location has been in operation since 2000, to make an assessment of any trends in the data. Unfortunately data for 2002 is unavailable but there remains, however, five years of data available so it may be possible to investigate any trends in the data on Figure 3 below.

Figure 3: Graph showing diffusion tube annual mean concentrations of NO_2 at Chesterfield Road, Staveley 2000-2005.



The trend graph shown on Figure 4 could be interpreted in two ways. Either 2005 appears to be an exceptionally high year for NO_2 or there appears to be an upward trend of NO_2 concentrations at that location from 2003 to 2005. Since either view could be valid, this trend graph unfortunately does not provide a conclusive pattern to make an assessment of trends over the past five years. To further assess the levels of NO_2 at that location, DMRB modelling was employed. The results of which gave an annual mean of 25.79µg/$m^{3,}$ which is well below the NO_2 Air Quality Objective and is more comparable to the lower diffusion tube results produced over recent years.

Nevertheless, the 2005 annual mean diffusion tube result for Chesterfield Road, Staveley requires Chesterfield Borough Council to proceed to a Detailed Assessment for NO_2 at this location. However, it must be noted, that the results of the DMRB modelling, the issues associated with the mounting and location of the diffusion tube, and the uncertainties associated with the trend graph for the past five years of data suggest that the diffusion tube exceedence at this location could be an anomaly. A Detailed Assessment therefore is necessary in order to clarify the levels of NO_2 in that area.

Derby Road – A61

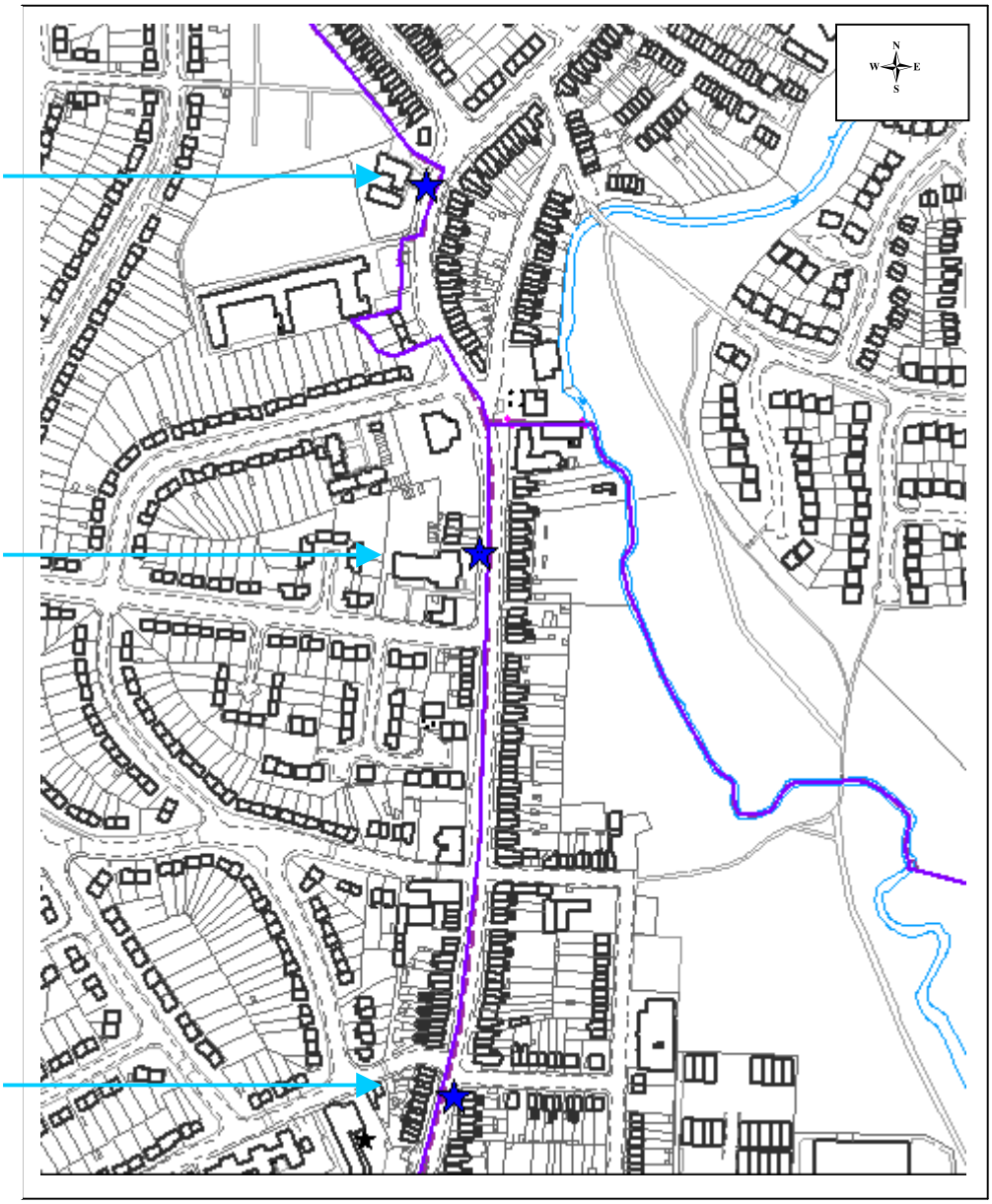
Derby Road - Lincoln Street, Derby Road -St Augustines and Jawbones Hill are all locations on the A61 (Derby Road) south of Chesterfield. Each location being progressively closer to the town centre. A map showing the diffusion tube locations can be found on Figure 4 below. The A61 is a very busy road, being the main arterial route from the South of the town and beyond to the town centre. It hosts 3 traffic lights and two pedestrian lights along approximately 1.6km length of road, which interrupts the flow of traffic and the A61 frequently experiences standing traffic at rush hour. It has one lane for traffic each way, which accommodates a 24-hour annual average daily traffic flow (AADT) of 20332 with 4% comprising HDV's.There are residential properties adjacent to the length of the A61 on both sides of the road, at Jawbones Hill; the properties lie within 1-2m of the roadside.

Figure 4: Map showing location of Diffusion Tubes along Derby Road, A61, South of Chesterfield.

1) The tube furthest north along Derby Road is Jawbones Hill.

2) Approx 200m South is Derby Road, St Augustines diffusion tube location.

3) The diffusion tube location furthest south, approx 550m from Jawbones is Derby Road, Lincoln Street.

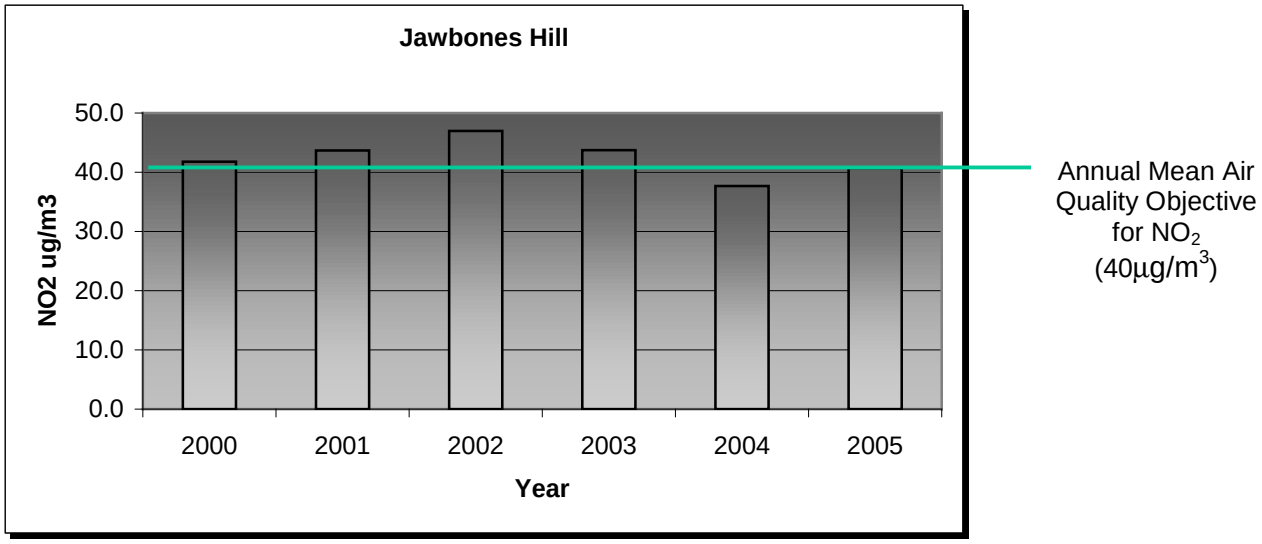


Planning consent has recently been granted for a mixed-use development on currently derelict land adjacent to Derby Road (A61), 600m south of Chesterfield near the Hornsbridge A61/A617 roundabout and 200m north of Jawbones Hill. The development comprises a non-food retail outlet, 8 new office buildings, an urban

park, residential development of 280 units, provision of a health facility, community rooms and local shopping and associated car parking and landscaping. There will be 453 car-parking spaces assigned to short stay retail use and 594 for offices. This will impact on local air quality by generating additional traffic onto an already busy, and at times congested, road. It will also introduce new sensitive receptors to an area that is currently experiencing elevated levels of NO_2.

Unfortunately there is insufficient data to explore any trends in the data over the past five years for St Augustines and Lincoln Street. However there is adequate data to look at trends at Jawbones Hill.

Figure 5: Graph showing diffusion tube annual mean concentrations of NO_2 at Jawbones Hill, Chesterfield 2000-2005.



This graph clearly shows that with the exception of 2004, the concentration at Jawbones Hill has been consistently near the annual mean NO_2 Air Quality Objective. The values depicted on the graph do not necessarily mean that this area had been consistently breaching the Objectives as it is unknown whether these values, prior to 2004, have been adjusted to reflect the diffusion tubes kerbside location. However the trend graph clearly shows that the Jawbones Hill area is currently an air quality hotspot, which was highlighted in the Progress Report 2005. A Detailed Assessment of the A61, Derby Road, is therefore required.

Chatsworth Road – A619

The area showing exceedence of both the annual mean NO_2 for 2005 and 2010 is Chatsworth Road. It is the main arterial route East from Derbyshire and the Northwest (including cities such as Manchester and Stockport) into Chesterfield town centre and West from the M1. It has one lane for traffic each way, which accommodates an AADT of 15162 with 8% comprising HDV's. Closer to the town centre, the 24hr AADT increases to 21658. Chatsworth Road is approximately 2.5km and hosts 3 traffic lights, 8 pedestrian lights and a roundabout, which interrupt the flow of traffic with congestion frequently occurring on the A619 at rush hour. There are residential properties adjacent to the length of the A619 on both sides of the road, at several locations the properties lie within 1-2m of the roadside.

Planning consent is being sought for a development on the old Bradbury Hall site, adjacent to Chatsworth Road, which will comprise 97 residential units in total. This development will introduce new sensitive receptors to an area that is already experiencing elevated levels of NO_2. In addition there is a major mixed-use development at the pre-application stage for the old Walton Works site adjacent to Chatsworth Road, stretching from Boythorpe Road to Walton Road. This development will impact on local air quality by generating additional traffic onto an already busy, and at times congested, road. Diffusion tube results show levels of NO_2 in that area are already breaching the 2005 NO_2 annual mean Air Quality Objective.

Unfortunately there is insufficient data to make an assessment of air quality trends at this location. However taking into consideration the levels of NO_2 measured at this location and the major developments to be completed in that area, a Detailed Assessment of the A619, Chatsworth Road is required.

6.3.2 Narrow Congested Streets

Concentration of NO_2 is often higher where traffic is slow moving with stop/start driving and where buildings on either side reduce dispersion. These locations are often referred to as 'street canyons'. To identify 'narrow congested' streets the following criteria should be used:

- Relevant exposure within 5m of the kerb
- Flow greater than 10,000 vehicles per day
- Roads where the average speed is 50kph or less

Chesterfield is a traditional market town and as such is particularly vulnerable to the street canyon effect influencing the air quality on some of its roads. Five locations have been identified as potential problem areas, namely:

1) Saltergate
2) Rutland Road
3) Foljambe Road
4) Old Hall Road
5) Chesterfield Road Roundabout

However these locations only partially fulfil the above criteria and with the exception of Old Hall Road, there is currently no traffic flow data available. Consequently, as part of the diffusion tube audit in 2005, diffusion tubes have been located on these roads since January 2006 and the results shall be closely observed over the next 6-12 months. Should they show any risk of exceedence a more detailed assessment of these locations shall be undertaken, including liaison with Derbyshire County Council to obtain traffic flow data.

The two roads that do meet the above criteria are Chatsworth Road and Derby Road and, as discussed in the preceding Section 6.3.1 - Monitoring Data, will be investigated further in a Detailed Assessment.

6.3.3 Junctions

Hotspot areas may also be at busy junctions where there is relevant exposure. To identify 'busy' junctions the following criteria should be used:

- Flow greater than 10,000 vehicles per day
- Relevant exposure within 10m of the kerb

There are six junctions in Chesterfield that fulfil these criteria, namely:

1) Markham Road roundabout
2) West Bars Roundabout
3) Holywell Cross Roundabout
4) Derby Road/Langer Lane
5) Chatsworth Road/Walton Road/Old Hall Road Roundabout
6) Chatsworth Road/Somersall Lane

DMRB modelling was conducted to assess the levels of NO_2 at these locations. The results of this modelling can be found in Table 9 below.

Table 9: Results of the DMRB modelling, detailing annual mean for NO_2 and NOx at each busy junction.

Junction Name	Annual Mean NO_x ($\mu g/m^3$)	Annual Mean NO_2 ($\mu g/m^3$)
Markham Rd Roundabout	88.1	33.0
West Bars Roundabout	93.3	33.9
Holywell Cross Roundabout	86.4	32.7
Derby Rd / Langer Ln	66.1	28.8
Walton Roundabout	61.5	27.8
Chatsworth Rd/ Somersall Ln	69.0	29.5

It can be seen from the above Table 9 that none of the locations are at risk of breaching the annual Air Quality Objective for NO_2 of 40$\mu g/m^3$, therefore no further assessment is required.

6.3.4 Busy Streets

There will be some locations in towns where members of the public may regularly spend 1-hour or more E.g. streets with many shops, outdoor cafes/bars. To identify these areas the roads must meet the following criteria:

- Flow greater than 10,000 vehicles per day
- Relevant exposure within 5m of the kerb for 1 hour or more.

Since the main town centre shopping area in Chesterfield is pedestrianised there are no roads that fall into this category, therefore no further assessment is required.

6.3.5 Roads with high flow of HGV's, buses

There will be some locations where traffic flows are not too high but there is an unusually high proportion of buses or HGV's. These can be major sources of nitrogen oxides. In order to identify such roads, the following criteria should be used:

- Roads where HDV's comprise more than 25% of traffic flow.
- Relevant exposure within 10m of these roads
- The flow of HDV's is greater than 2,500 vehicles per day

There is one road in Chesterfield that partially fulfils these criteria, namely New Beetwell Street. It runs through the centre of the town, parallel to Markham Road. The majority of cars and HDV's which pass through Chesterfield use this adjacent Markham Road, leaving New Beetwell Street to be used predominantly by buses. It also hosts the highest concentration of bus stops in Chesterfield Town Centre. As such it is used somewhat as a bus station and the vehicle flow would undoubtedly comprise more than 25% HDV's although exact traffic proportion data is currently unavailable. There are two residential properties within 10m of New Beetwell Street. However the number of bus movements on this road per day is approximately 700 which is below the 2500 trigger criteria triggered as outlined above.

Continuous monitoring using a mobile Air Quality Station was conducted adjacent to the residential property on New Beetwell Street from 1st April to 1st September 2002 and was reported in the Update & Screening 2003. The extrapolated annual mean for 2003 was calculated to be 37.4μg/m^3, which projected to 2005, is 34.0μg/m^3. This is below the annual mean Air Quality Objective of 40μg/m^3. The number of bus routes via New Beetwell Street remains comparable to those in 2003 and as such the Air Quality Objective at this location should not be at risk of exceedence. Nevertheless, as part of the diffusion tube re-assessment in 2005, a new diffusion tube location was mounted near the residential development on New Beetwell Street to ensure the levels continue to remain below the objective.

Taking into consideration the low number of bus movements along this road coupled with the projected annual mean NO_2 at this location, there is no need for further assessment at this time. However the results of the diffusion tube monitoring will be discussed in future reports and further assessment shall be conducted if required.

6.3.6 New roads

There have been no new roads constructed or proposed since the previous round of Review & Assessment, therefore no further assessment is required.

6.3.7 Roads with significantly changed traffic flows

There may be roads, which have experienced a large increase in traffic since the last Review & Assessment, or there may be existing roads that have new relevant exposure. In order to identify these roads, the following criteria should be used:

- Flow greater than 10,000 vehicles per day

- 25% increase in traffic flows on these roads since the last Review & Assessment or new relevant exposure.
- Have these roads been previously identified as being at risk of exceeding the Objectives (i.e. >36μg/m^3)

There are no roads that fall into this category in Chesterfield therefore no further assessment is required.

6.3.8 Bus stations

As part of the screening process bus stations that are not enclosed must be identified and an assessment should be made as to their impact on any relevant receptors. There is one coach station in Chesterfield, built in 2004, which is located on Beckingham Way and is not enclosed. However there is no relevant exposure within 10m of the coach station and the flow of buses is less than 1000 per day, therefore no further assessment is required.

6.3.9 Roads close to the Objectives during 2nd round of R&A

Nine roads/junctions were identified in the Update & Screening 2003 as close to the Air Quality Objectives for PM_{10}. These were:

1) Markham Roundabout
2) Holywell Cross Roundabout
3) West Bars
4) Whittington Moor Roundabout
5) Sheffield Road
6) Hornsbridge Roundabout
7) Netto Roundabout
8) Chatsworth Road
9) Whittington Hill

The first three junctions have already been discussed in the preceding 'Section 6.33 Junctions' and Chatsworth Road has been discussed at length in the preceding Section 'Nitrogen Dioxide Diffusion Tubes'. The remaining junctions/roads have been modelled again using DMRB, the results of which can be found in Table 10 below: The DMRB output can be found in Appendix 6

Table 10: Results of the DMRB modelling, giving annual mean for NO_2 and NOx at each busy junction

Junction Name	Annual Mean NO_x ($\mu g/m^3$)	Annual Mean NO_2 ($\mu g/m^3$)
Whittington Moor Roundabout	89.4	33.2
Sheffield Road	56.0	26.6
Hornsbridge Roundabout	93.5	34.0
Netto Roundabout	61.1	27.7
Whittington Hill	52.7	25.9

As can be seen from the above table, none of these roads/junctions are at risk of breaching the Objectives for 2005 or 2010. The reasons for the apparent air quality improvement can be attributed to a variety of measures. The most important is due to the use of updated background pollutant levels, particularly PM_{10}, NO_2 and NOx, which are available to download from www.airquality.co.uk/archive/laqm.tools. In addition, Chesterfield is experiencing a high level of redevelopment and as such, some receptors/traffic flows which would have influenced previous DMRB modelling have altered since the last Update & Screening Assessment 2003. An example of this is the old Dema Glass site, which was a major industry, located between the Tesco and Netto roundabout, highlighted in previous reports. This industry has been closed for the past two years and at the time of this report was being demolished.

Particular attention should be given to the Whittington Moor roundabout, which was highlighted in the Detailed Assessment 2004 and the Progress Report 2005. This junction was modelled again using DMRB, inputting the updated background levels and exercising conservative speeds at the junction itself, in order to ensure modelling of worst case scenario. The DMRB output gave a result of 33.2$\mu g/m^3$ which is comparable to the monitored results at the Whittington Moor roundabout of 30.0ug/m3, therefore there is little risk of exceedence of the Air Quality Objective at this location. However the Air Quality Station shall remain at Whittington Moor for the foreseeable future and all results shall be detailed in any future reports.

6.3.10 Industrial Sources

Although industrial sources are unlikely to make a significant contribution to annual mean concentrations, they could be significant in terms of the 1-hour NO_2 Air Quality Objective. However no industrial sources were identified during previous rounds of Review & Assessment as likely to give rise to exceedence of the 1-hour Objective. There are currently no industrial sources, new relevant exposure or sources with substantially increased emissions, therefore no further assessment is required.

6.3.11 Neighbouring Authorities

There are no sources in neighbouring Authorities that could have an adverse effect on levels of Nitrogen Dioxide within Chesterfield Borough Council's area.

6.3.12 Aircraft

Aircraft are significant sources of nitrogen oxide emissions, especially during takeoff. However emissions from aircraft once they are above 200m will make a negligible contribution to ground level concentrations, therefore the criteria to screen for impact from airports is relevant exposure within 1000m of the airport boundary. The nearest airport to Chesterfield is Sheffield Airport, which is approximately 24km, therefore no further assessment if required.

6.4 Conclusions

A Detailed Assessment for NO_2 annual mean objective shall be progressed for three locations in Chesterfield; Derby Road (A61), Chatsworth Road (A619) and Chesterfield Road, Staveley (A619).

7.0 Sulphur Dioxide

The Government and Devolved Administrations have adopted three Air Quality Objectives for Sulphur Dioxide (SO_2). These are listed in Table 11 below:

7.1 Objectives

Table 11: Sulphur Dioxide Air Quality Objectives applicable to Chesterfield Borough Council.

Pollutant	Concentration	Measured as	Date to be achieved by
Sulphur Dioxide (SO_2)	266μg/m^3 (100ppb), not to be exceeded more than 35 times a year	15 minute mean	31/12/2005
	350μg/m^3 (132ppb), not to be exceeded more than 24 times a year	1 hour mean	31/12/2004
	125μg/m^3 (47ppb), not to be exceeded more than 3 times a year	24 hour mean	31/12/2004

7.2 Introduction

SO_2 has a penetrating odour and is a strong respiratory irritant. It can cause narrowing of the airways, known as bronchoconstriction and long-term exposure can severely impair respiratory defences. Children, the elderly, people suffering with chronic lung diseases and asthmatics are particularly vulnerable.

The most common sources of SO_2 in the UK includes fossil fuel combustion at power stations, smelting, manufacture of sulphuric acid, conversion of wood pulp to paper, incineration of refuse and production of elemental sulphur. Emissions of SO_2 in the UK have reduced by 79% since 1990 due to reduced emissions from industrial and public power sectors, decreased use of coal and increased use of abatement equipment.

However local exceedences of the SO_2 Air Quality Objective have been recorded in areas where solid fuels are the predominant forms of domestic heating, in the vicinity of ports or in the vicinity of small combustion plants burning coal or oil. A small number of AQMAs have been declared since the last round of Review & Assessment due to coal-fired boilers, domestic coal burning and shipping at a major port.

The 2003 Update & Screening for Chesterfield did not identify any risk of the Sulphur Dioxide Air Quality Objective being exceeded. However as part of the Review & Assessment process, the levels of SO_2 in Chesterfield should be re-assessed to ensure that risk of the exceedence of the objective remains low.

7.3 Assessment

This assessment shall adopt the format and follow the guidance as specified in LAQM.TG(03) Box 7.2.

7.3.1 Monitoring Data

Over the course of 2005, Chesterfield Borough Council monitored SO_2 within the Borough using Monitor Labs UV Fluorescence automatic analysers housed in two Air Quality Stations; one located at Birdholme, the other at Whittington Moor. Further details regarding these Air Quality Stations can be found in the preceding chapter 6.3.1 Monitoring Data – Automatic Stations.

The data provided by the Whittington Moor and Birdholme Air Quality Stations were both for a period of twelve months. The data for both sites have been ratified from 1st January 2005 to 31st October 2005. The data for the period 01st November 2005 through 31st December 2005 remains provisional, although it has been screened and scaled and as such is validated and is suitable for the purposes of Review & Assessment.

The data capture rates during this monitoring period for Whittington Moor and Birdholme was 85.4% and 77.8% respectively. Advice was sought and provided by the Review & Assessment Helpdesk regarding these data capture rates, although the minimum rate should be 90%, the data capture was considered acceptable for comparison with the 1-hour, 24-hour and 15-minute SO_2 Objectives. Table 12 provides the 15-minute, 1-hour and 24-hour mean SO_2 concentrations at Whittington Moor and Birdholme Air Quality Station.

Table 12: 15-minute, 1-hour and 24-hour mean SO_2 concentrations at Whittington Moor and Birdholme Air Quality Station.

Air Quality Station Name	Monitoring Period	Data Capture Rate (%)	Maximum 15-minute mean 2005 SO_2 ($\mu g/m^3$)	Maximum 1-hour mean 2005 SO_2 ($\mu g/m^3$)	Maximum 24-hour mean 2005 SO_2 ($\mu g/m^3$)
Whittington Moor	01/01/05 – 31/12/05	85.4	61	53	19
Birdholme	01/01/05 – 31/12/05	77.8	146	120	30

The 1-hour mean Air Quality Objective for SO_2 for 2004 is 350$\mu g/m^3$ with 24 exceedences. The maximum result for the monitoring period at Whittington Moor and Birdholme is 53$\mu g/m^3$ and 120$\mu g/m^3$ respectively which is well below this objective.

The 24-hour mean Air Quality Objective for SO_2 for 2004 is 125$\mu g/m^3$ with 3 exceedences. The maximum result for the monitoring period at Whittington Moor and Birdholme is 19$\mu g/m^3$ and 30$\mu g/m^3$ respectively which is well below this objective.

The 15-minute mean Air Quality Objective for SO_2 for 2005 is 266$\mu g/m^3$ with 35 exceedences. The maximum result for the monitoring period at Whittington Moor and Birdholme is 61$\mu g/m^3$ and 146$\mu g/m^3$ respectively which is well below this objective.

therefore **THE 1-HOUR, 24-HOUR AND 15-MINUTE AIR QUALITY OBJECTIVES FOR SO_2 HAVE BEEN MET AT THESE LOCATIONS.**

7.3.2 Industrial Sources

No industrial sources were identified during previous rounds of Review & Assessment as likely to give rise to exceedence of Air Quality Objectives for SO_2. There are no new industrial sources, new relevant exposure or sources with substantially increased emissions; therefore no further assessment is required.

7.4.3 Neighbouring Authorities

There are no sources in neighbouring Authorities that could have an adverse effect on levels of sulphur dioxide within Chesterfield Borough Council; therefore no further assessment is required.

7.4.4 Areas of Domestic Coal Burning

Areas of domestic coal burning could be a significant local source of SO_2. Areas of significance are deemed to be approximately 500m x 500m with more than 100 houses burning solid fuel as their primary source of heating. Previous rounds of Review & Assessment did not identify any areas of domestic coal burning fulfilling these criteria and so were not likely to give rise to exceedence of the Air Quality Objective for SO_2. There are no new sources or any areas of new exposure, therefore o further assessment is required.

7.4.4 Boilers

Larger boiler plants can cause high short-term concentrations of SO_2, which could cause an exceedence of the 15-minute Air Quality Objective. However new regulations limiting the sulphur content of fuel oil to less than 1% from 01/01/03 means that boilers using fuel oil are unlikely to be significant. Previous rounds of Review & Assessment did not identify any boiler plant >5MW (Thermal) that burn coal or fuel oil in Chesterfield. There are no new sources or any areas of new exposure; therefore no further assessment is required.

7.4.5 Shipping

The fuels used in the transport sector contain varying amounts of sulphur; larger ships generally burn oils with high sulphur content in their main engines, whereas the auxiliary engines, used when berthed, tend to use a lower sulphur fuel. Since Chesterfield is positioned centrally in the country, shipping is not an issue for Chesterfield BC and so no further assessment is required.

7.4.6 Railway Locomotives

Both diesel and coal-fired locomotives emit SO_2, and could contribute significantly to exceedence of the short-term 15-minute Air Quality Objective if they are stationary and idling for 15-minute periods. Areas that may be at risk of exceedence of this

objective require relevant exposure and may include railway depots or stations, goods loops or signals. Previous Review & Assessments did not identify any locations that fulfil these criteria, there are no new sources or any areas of new exposure; therefore no further assessment is required.

7.5 Conclusion

The exceedence of the Air Quality Objective for SO_2 is unlikely and a Detailed Assessment is therefore not required.

8.0 Particulate Matter

The Government and Devolved Administrations have adopted two Air Quality Objectives for Particulate Matter (PM_{10}). These are listed in Table 13 below:

8.1 Objectives

Table 13: PM_{10} Air Quality Objectives applicable to Chesterfield Borough Council.

Pollutant	Concentration	Measured as	Date to be achieved by
Particles (PM_{10})	50µg/m^3 not to be exceeded more than 35 times a year	24-hour mean	31/12/2004
	40µg/m^3	Annual mean	31/12/2004

In addition to the Objectives listed above there are also more stringent provisional Objectives to be achieved by the end of 2010. For all parts of England (except London), Wales and Northern Ireland, a 24-hour mean of 50µg/m^3 not to be exceeded more than 7 times per year and an annual mean of 20ug/m3.

8.2 Introduction

Particulate matter (PM_{10}) consists of solid or liquid droplets with an aerodynamic diameter smaller than 10um. They are suspended in air and if inhaled can penetrate deep into the lungs which can lead to a variety of health problems including increased respiratory symptoms, aggravated asthma and premature deaths in people with heart or lung disease.

PM_{10} has a wide range of sources in the UK and the emissions are divided into three main groups; primary particle, secondary particle and course particle emissions. Primary Particle emissions are those directly produced by combustion process, such as road transport, power generation and industrial processes. Secondary particle emissions are formed by chemical reactions in the atmosphere and comprise mainly of sulphates and nitrates. Coarse emissions have a wide range of sources including surface erosion and wind blown dusts and mechanical break-up, for example, quarrying and construction sites.

Emissions of PM_{10} from road transport arise from vehicle exhausts with diesel vehicles emitting a greater mass of particulate per vehicle kilometre than petrol-engine vehicles. Emissions from road transport also occurs from brake and tyre wear and from the re-entrainment of dust on the road surface.

Combustion of coal used to be the predominant source of particulate emissions in the UK. Since the Clean Air Act, the use of coal for domestic combustion has been restricted, vastly reducing this emission source. Domestic emissions have fallen from 222 ktonnes (41% of the total emission) in 1970 to 28 ktonnes (17%) in 2002. Industrial Processes are also a source of PM_{10}, these sources include production of metals, cement, lime, coke, chemicals and bulk handling of dusty materials, construction, mining and quarrying.

UK emissions of PM_{10} from both the transport and industrial sectors have reduced significantly over recent years, with a total national annual UK emissions reduction of 48% between 1990 and 2002. Further reductions are also predicted in future years due to tightening of emission controls on road transport, reduction of sulphur content of diesel fuels, tighter control of the industrial sector through IPPC, EU Waste Incineration Directive and EU legislation in the Acidification Strategy.

Concentrations of PM_{10} across the UK are generally well below the 2004 annual mean objective, however the 24-hour objective for 2004 has been exceeded at a small number of sites in the vicinity of busy roads or close to industrial activities. Projections of PM_{10} levels in 2010 indicate that, except for London and some parts of the SE, dependent on meteorological conditions, background locations are unlikely to exceed the Objectives. However, exceedences of the annual mean objective are expected at some busy roadside sites throughout the UK.

The Update & Screening for Chesterfield in 2003 identified several locations across the Borough at risk of exceedence of the annual Air Quality Objective. This conclusion was reached however with inadequate data and high levels of uncertainty. It was recommended therefore that further monitoring undertaken before any action was taken. The issues that were raised were also highlighted as recommendations in the Progress Report 2005 and have since been implemented. These recommendations are listed in more detail in Section 1.4 of the Introduction of this report. The locations which were identified as at risk of breaching the annual Air

Quality Objective for PM_{10} shall be reassessed as part of this Update & Screening 2006.

8.3 Assessment

This assessment shall adopt the format and follow the guidance as specified in LAQM.TG(03) Box 8.4

8.3.1 Monitoring Data

Over the course of 2005, Chesterfield Borough Council monitored PM_{10} within the Borough using R&P Teom analysers housed in air quality monitoring stations located at Whittington Moor and Birdholme. Since Chesterfield Borough Council has not declared any Air Quality Management Areas to date, during 2005 the monitoring was conducted outside an AQMA.

The monitoring period was for twelve months at both sites. The data capture during this period at Whittington Moor was 89.6%. Unfortunately there were technical problems with the R&P Teom analyser housed at Birdholme, which meant it was offline for a significant period during the summer months, with a data capture rate of 59.9%. Table 14 provides the annual means for PM_{10} for both Whittington Moor and Birdholme, the annual mean for the latter Station being an extrapolated annual mean. This was calculated using data provided by Sheffield Tinsley, Rotherham Centre and Leicester Centre AURN sites. The technique described in LAQM.TG(03) Box 8.5 was applied and the calculations can be found in Appendix 2. Since there is less than 12 months data for Birdholme it is appropriate to present the result for the 24-hour mean as the 90^{th} percentile, which is presented in Table 14 below. Concentrations for PM_{10} at both Whittington Moor and Birdholme were predicted for the year 2010 using the technique detailed in the Updated 2006 Guidance Note for the use of year adjustment factors available on the Local Air Quality Management Website. The calculations can also be found in Appendix 2.

The current EU Limits and UK Objectives are based upon measurements carried out using the European Transfer Reference Sampler or equivalent and therefore the results from the Teom need to be adjusted so they can be compared with the UK Objectives. The reason for this is because the Teom instrument houses the filter at a temperature of 50ºc in order to minimise errors associated with the evaporation and

condensation of water vapour. This can lead to a loss of the more volatile particles (such as ammonium nitrate etc). Whilst there will also be some losses of volatile species from the filter of the Transfer Reference Sampler, it will be less than that from the Teom. To compensate for this difference there is a default adjustment factor of 1.3 to estimate the gravimetric equivalent concentrations. This adjustment is discussed in more detail in LAQM.TG(03) Box 8.2.

Table 14: 24-hour and annual mean PM_{10} concentrations at Whittington Moor and Birdholme Air Quality Stations.

Air Quality Station Name	Data Capture (%)	Maximum 24-hour mean GRAV EQ (µg/m^3)& number of exceedences	Annual Mean 2004 GRAV EQ (µg/m^3)	Annual Mean 2010 GRAV EQ (µg/m^3)
Whittington Moor	89.6	89.7 16 exceedences	26.0	25.1
Birdholme	59.9	90th Percentile is 37.7	20.8	19.1

The 24-hour mean Air Quality Objective for PM_{10} for 2004 is 50µg/m^3 with 35 exceedences. The maximum result for the monitoring period at Whittington Moor is 89.7µg/m^3 and there were only 16 exceedences of the objective. The 90th percentile for Birdholme was 37.7µg/m^3.

Therefore **THE 24-HOUR AIR QUALITY OBJECTIVE FOR PM_{10} HAS BEEN MET AT THESE LOCATIONS.**

The annual mean Air Quality Objective for PM_{10} for 2004 is 40µg/m^3. The result for the monitoring period at Whittington Moor is 26.0µg/m^3 and for Birdholme 20.8µg/m^3

Therefore **THE ANNUAL AIR QUALITY OBJECTIVE FOR PM_{10} HAS BEEN MET AT THESE LOCATIONS.**

The provisional Air Quality Objective for PM_{10} in 2010 is 20.0µg/m^3. The projected result for the monitoring period at Whittington Moor in 2004 is 25.1µg/m^3 which is a potential breach of the provisional 2010 objective. The result for Birdholme is 19.1µg/m^3.

Therefore **THE PROVISIONAL ANNUAL AIR QUALITY OBJECTIVE FOR PM_{10} IN 2010 AT WHITTINGTON MOOR ONLY IS AT RISK OF EXCEEDENCE.**

The 2010 objective is provisional and as such, despite a predicted exceedence of the objective in 2010, a Detailed Assessment is not required at this time. However the result does provide valuable information and should be used as a tool to guide the longer-term air quality management strategy at Chesterfield; especially in the event the provisional 2010 objective becomes regulation.

8.3.2 Busy Roads and Junctions

Hotspot areas may also be at busy junctions where there is relevant exposure. To identify 'busy' junctions the following criteria should be used:

- Those roads identified above that have a flow greater than 10,000 vehicles per day
- Relevant exposure within 10m of the kerb

There are six junctions in Chesterfield which fulfil these criteria, namely:

1) Markham Road roundabout
2) West Bars Roundabout
3) Holywell Cross Roundabout
4) Derby Road/Langer Lane
5) Chatsworth Road/Walton Road/Old Hall Road Roundabout
6) Chatsworth Road/Somersall Lane

DMRB modelling was conducted to assess the levels of NO_2 at these locations. The results of this modelling can be found in Table 15 below.

Table 15: Results of the DMRB modelling, detailing annual mean for NO_2 and number of days of exceedences of 24-hour mean PM_{10} Objectives at busy junctions.

Junction Name	Annual Mean PM_{10} ($\mu g/m^3$)	Days >50$\mu g/m^3$
Markham Rd Roundabout	29.1	24
West Bars Roundabout	30.6	30
Holywell Cross Roundabout	29.0	24
Derby Rd / Langer Ln	26.6	16
Walton Roundabout	26.0	15
Chatsworth Rd/ Somersall Ln	26.5	16

The annual mean objective for PM_{10} for 2005 is 40µg/m^3 and the 24-hour mean is 50µg/m^3 with 35 exceedences. It can be seen from the above table that none of the locations are at risk of breaching the annual or daily Air Quality Objective for PM_{10} therefore no further assessment is required.

8.3.3 Roads with high flow of HGV's, buses

There will be some locations where there is an unusually high proportion of buses and/or HGV's which can be an important source of PM_{10}. In order to identify such roads, the following criteria should be used:

- Roads where HDV's comprise more than 20% of traffic flow.
- Relevant exposure within 10m of these roads
- The flow of HDV's is greater than 2,000 vehicles per day

Similar to the preceding section 6.3.5-'Nitrogen Dioxide', there is one road in Chesterfield that partially fulfils these criteria, namely New Beetwell Street. It runs through the centre of the town and is predominantly used by buses. However the number of bus movements on this road per day is approximately 700 which is below the 2000 trigger criteria triggered as outlined above.

Continuous monitoring using a mobile Air Quality Station was conducted on Beetwell Street from 1st April to 1st September 2002, the results of which were reported in the Update & Screening 2003 as showing no risk of exceedence of either of the Air Quality Objectives for PM_{10}. Since the number of bus routes via New Beetwell Street remains comparable to those in 2003 it is reasonable to assume that the Air Quality Objective at this location should not be at risk of exceedence.

Taking into consideration the low number of bus movements along this road coupled with the previous monitoring results at this location, further assessment is not required.

8.3.4 New roads

There have been no new roads constructed or proposed since the previous round of Review & Assessment; therefore no further assessment is required.

8.3.5 Roads with significantly changed traffic flows

There may be roads, which have experienced a large increase in traffic since the last Review & Assessment, or there may be existing roads that have new relevant exposure. In order to identify these roads, the following criteria should be used:

- Flow greater than 10,000 vehicles per day
- 25% increase in traffic flows on these roads since the last Review & Assessment or new relevant exposure.
- Had these roads been previously identified as being at risk of exceeding the Objectives (i.e. >30 24-hour concentrations above 50ug/m^3)

There are no roads that fall into this category in Chesterfield therefore no further assessment is required.

8.3.6 Roads close to the Objectives during 2nd round of R&A

Six roads/junctions were identified in the Update & Screening 2003 as at risk of exceedence of the Air Quality Objectives for PM_{10}. These were:

1) Markham Roundabout
2) Holywell Cross Roundabout
3) Whittington Moor Roundabout
4) Sheffield Road
5) Hornsbridge Roundabout
6) Netto Roundabout

All of these junctions and roads have been remodelled and the results can be found in Table 16 below: The DMRB output can be found in Appendix 6

Table 16: Results of the DMRB modelling, re-assessing the annual mean for NO_2 and the number of days of exceedence of PM_{10} at roads close to the Objectives during the 2nd round of Review & Assessment.

Junction Name	Annual Mean PM_{10} ($\mu g/m^3$)	Days >50$\mu g/m^3$
Markham Road	29.1	24
Holywell Cross Roundabout	29.0	23
Whittington Moor Roundabout	29.6	26
Sheffield Road	24.8	12
Hornsbridge Roundabout	30.2	28
Netto Roundabout	25.8	14.5

As can be seen from the above table, none of these roads/junctions are at risk of breaching the Objectives for 2005 or 2010. The reasons for the apparent air quality improvement can be attributed to a variety of measures. The most important is due to the use of updated background pollutant levels, particularly PM_{10}, NO_2 and NOx, which are available to download from www.co.uk/archive/laqm.tools. In addition, Chesterfield is experiencing a high level of redevelopment and as such, some receptors which would have influenced previous DMRB modelling are currently being demolished and re-landscaped. An example of this is the old Dema Glass site, which was a major industry, located between the Tesco and Netto roundabout, highlighted in previous report. This has been closed for the past two years and at the time of this report is being demolished.

Particular attention should be given to the Whittington Moor roundabout, which was highlighted in the Detailed Assessment 2004 and the Progress Report 2005. This junction was modelled again using DMRB, inputting the updated background levels and exercising conservative speeds at the junction itself, in order to ensure worst case scenario was being modelled. The DMRB output gave a result of 29.6$\mu g/m^3$ which is comparable to the monitored results at the Whittington Moor roundabout of 26.0$\mu g/m^3$, therefore there is little risk of exceedence of the Air Quality Objective at this location. However the Air Quality Station shall remain at Whittington Moor for the foreseeable future and all results shall be detailed in any future reports.

8.3.7 Industrial Sources

Although industrial sources are unlikely to make a significant contribution to annual mean concentrations, they could make be significant in terms of the 24-hour PM_{10} Air Quality Objective. However no industrial sources were identified during previous rounds of Review & Assessment as likely to give rise to exceedence of the PM_{10} Air Quality Objectives. There are no new industrial sources, new relevant exposure or sources with substantially increased emissions; therefore no further assessment is required.

8.3.8 Neighbouring Authorities

There are no sources in neighbouring Authorities that could have an adverse effect on levels of PM_{10} within Chesterfield Borough Council; therefore no further assessment is required.

8.3.9 Areas of domestic solid fuel burning

Areas of domestic coal burning could be a significant local source of PM_{10}. Areas of significance are deemed to be approximately 500m x 500m with more than 50 houses burning solid fuel. Previous rounds of Review & Assessment did not identify any areas of domestic coal burning fulfilling these criteria and so were not likely to give rise to exceedence of the Air Quality Objective for PM_{10}. There are no new sources or any areas of new exposure; therefore no further assessment is required.

8.3.10 Quarries/landfill sites

There may also be a number of sources, not already listed, in an area that are significant for PM_{10} as they generate fugitive dust. These sources include quarries/landfill sites/opencast coal and handling of dusty cargoes at ports etc. The only sources within Chesterfield Borough Council's area are two landfill sites; one is the Staveley Landfill Site and Erin road landfill site. The 2005 background levels of PM_{10} across the Chesterfield Borough Council area is $<26\mu g/m^{3,}$ and there is no relevant exposure within 200m of either landfill site, therefore no further assessment is required.

8.3.11 Aircraft

Aircraft are not significant sources of PM_{10} emissions, but may make a contribution close to the source. However emissions from aircraft once they are above 200m will make a negligible contribution to ground level concentrations, therefore the criteria to screen for impact from airports is relevant exposure within 500m of the airport boundary. The nearest airport to Chesterfield is Sheffield Airport, which is approximately 24km, therefore no further assessment if required.

8.4 Conclusions

The provisional annual 2010 objective for PM_{10} is at risk of marginal exceedence at Whittington Moor however a Detailed Assessment is not required at this time.

The exceedence of the Air Quality Objectives for 2004 and subsequent years is unlikely and a Detailed Assessment is therefore not required.

9.0 Conclusions and Recommendations

- A Detailed Assessment of NO_2 annual mean Air Quality Objective shall be progressed for three locations in Chesterfield; Derby Road (A61) and Chatsworth Road (A619) and Chesterfield Road, Staveley.

- The new diffusion tube locations shall be monitored closely over the next 6-12 months and the results shall be detailed in subsequent reports.

- The remaining six pollutants listed in the Air Quality Regulations 2000 are not at risk of exceedence of any of the Objectives and therefore a Detailed Assessment is not required.

10.0 References

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