2016 Air Quality Annual Status Report (ASR)

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

July 2016

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Overview of Air Quality in Our Area

Air Quality in Darlington

Air pollution is associated with a number of adverse health impacts. It is recognised as a contributing factor in the onset of heart disease and cancer. Additionally, air pollution particularly affects the most vulnerable in society: children and older people, and those with heart and lung conditions. There is also often a strong correlation with equalities issues, because areas with poor air quality are also often the less affluent areas[1,2]

The annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion[3].

Darlington Borough Council has formally reviewed and assessed air quality since year 2000, and has produced statutory annual reports to the UK Government. It has done this in co-operation with neighbouring Tees Valley Councils and the Environment Agency to give as broad a picture of air quality as possible, continuing a long history of joint co-operation between councils which recognised that air pollution transcended local authority boundaries.

Consistently, the annual report has concluded that air quality in areas in the Darlington Borough where the public may be exposed is generally good when compared with Government objectives, and there has been no need to declare any Air Quality Management Areas in which adverse health effects may exist. There is no complacency in this; Darlington Council is committed to improving air quality as policy, but the economic options are limited against this background.

Darlington Borough, in contrast with the four neighbouring Tees Valley Councils, does not have large industrial areas and is not close to those industrial areas nearer the coast. It has a densely populated central area, with main arterial roads radiating out to the rural surround, and as such has always provided a measure of air pollution from traffic sources, which with its primary emissions at ground level, is now the greatest concern for public health. A significant portion of traffic flow has always been through traffic and this has dictated major road improvements over the years. In the 1960s, the A1 Darlington by-pass to the west of the town was completed, and in the 1970s, the Darlington inner ring road was completed which gave protection to the town centre. The A66 Southern bypass was completed in 1985. More recently in 2008, the eastern transport corridor was opened, which besides providing access to new development land also alleviated traffic congestion on two of the busiest road corridors in the town, Haughton Road and Yarm Road.

Actions to improve Air Quality

Road traffic across the UK has increased dramatically this century, most noticeably in respect of car ownership. This is also true within Darlington and neighbouring councils. For Darlington, most through traffic has been channelled onto bypasses; the main impact on public health is along commuter roads, and it is in this area that most action needs to be targeted to alleviate air pollution. Fortunately, most housing along these roads is low rise, and set back from kerbside so that there is good dispersion of air pollutants compared with older UK cities and towns. On the downside, it is recognised that public

[1] Environmental equity, air quality, socioeconomic status and respiratory health, 2010
[2] Defra, DCLG Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006
[3] Defra. Abatement cost guidance for valuing changes in air quality, May 2013

transport limitations have contributed to a higher level of commuter traffic for work purposes than in other large conurbations. In 2004, Darlington was one of three towns selected by the Department of Transport to participate in a national sustainable travel project ('Town on the move'), looking at ways to tackle traffic congestion. In 2007, pedestrianisation of a large part of the town centre was completed.

National action in terms of reducing emissions from vehicles is a crucial factor in reducing air pollution alongside roads. While significant strides have been made in vehicle engine technology, and on reducing harmful emissions from large diesels engines in buses and HGV's, Government policy has tended to concentrate in recent years on reducing carbon emissions, and this has filtered down into local authority policies. There has been a major shift away from petrol engines in small vehicles to diesel, which, while contributing to lower carbon emissions per mile, has inadvertently escalated those pollutants judged to be most harmful to public health, fine particulates and nitrogen dioxide, which cannot easily be reduced as with larger diesel vehicles. This has been compounded by inadequate emission testing regulations, so that actual emissions from small diesel engines in practice can be significantly higher than test. This has meant that the expected benefit of cleaner vehicle technology has not translated into significantly lower air pollution levels, and this has been confirmed by local monitoring. It will now take time for alternative low carbon / low emission technologies such as electric / hydrogen / hybrid vehicles to become economically viable alternatives. Much of the necessary infrastructure at a nationwide scale to facilitate these emerging technologies is currently unavailable.

Darlington Borough Council's Third Local Transport plan (2011-2026) states that a specific outcome it seeks to achieve is that "everyone can play their part in reducing the impact of transport on the environment……"

Local actions to reduce the impact of vehicle emissions within Darlington are principally taken in conjunction with neighbouring councils through Tees Valley Unlimited concentrate in the following areas, with further detail in the Local Transport Plan:

- Reduce traffic congestion at peak times through improved network management and road improvements.
- Encouraging local bus companies to review services with particular emphasis on access to new and emerging employment opportunities, and to renew their fleet on an on-going basis.
- Encourage wider transport choices by improving pedestrian, cycling and public transport, including rail.
- Encourage the provision of a low emission vehicle infrastructure through the planning regime.

Over time, these improvements will all contribute to further reduction in air pollution within Darlington.

Local Priorities and Actions

Although not currently a statutory requirement of the National Air Quality Strategy, Local Air Quality Management Policy Guidance expects local authorities to work towards reducing emissions and / or concentrations of particulate $PM_{2.5}$. The new Public Health Outcomes Framework includes particulate $PM_{2.5}$ as an air pollution indicator under domain 3.1 – 'Fraction of mortality attributed to particulate air pollution'.

Monitoring of particulate $PM_{2.5}$ is carried out within neighbouring Middlesbrough and Stockton-on-Tees Councils through the national network and it is also possible to determine likely levels in all Tees Valley Council areas, including Darlington. Government objectives are easily met where relevant public exposure exists and this is expected to continue. Even so, Darlington Council will continue to co-operate with the four other Tees Valley Councils in trying to identify in more detail sources of fine particles, and see if any local action can cost effectively reduce emissions / concentrations.

How to get Involved

Individuals can help to reduce air pollution by breaking the 'Car Addiction'! Try to avoid using the car for short journeys, or reduce the number of short journeys by better planning. Join a car club, or cycle, or walk. Use public transport when available.

Ensure that the vehicle is well maintained; keep tyre pressures properly inflated to manufacturers' recommendation. Drive more consistently and avoid excessive speed, excessive braking and prolonged idling.

On a wider front, join a car club / car sharing scheme and if changing a car, pay greater attention to engine emission levels, downsize if practicable.

Local Motion promotes and provides information on travelling sustainably in Darlington. It targets all age groups in a number of settings and via a variety of communication platforms. The team looks to educate people into the benefits of different transport choices and provides information on how to get involved.

For schools the Local Motion website includes travel maps showing walking times, cycle routes and bus stops near schools and organises themed walks to school. For workplaces to promote 'greener' commuting Local Motion has worked with Arriva Travel club to provide offers to workplaces to make sustainable ways of commuting more accessible and appealing.

For more information visit the Local Motion webpage at: http://www.dothelocalmotion.co.uk/

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1 Local Air Quality Management

This report provides an overview of air quality in Darlington Borough Council during 2016. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives. This Annual Status Report (ASR) is an annual requirement showing the strategies employed by Darlington Borough Council to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England can be found in Table E.1 in Appendix E.

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority must prepare an Air Quality Action Plan (AQAP) within 12-18 months setting out measures it intends to put in place in pursuit of the objectives.

Darlington Borough Council currently does not have any AQMAs, and can see no requirement for one. Air quality has been shown, since LAQM started in year 2000, to be consistently and generally good and this has been accepted by Defra.

2.2 Progress and Impact of Measures to address Air Quality in Darlington

Darlington Borough Council has had no requirement to declare an Air Quality Management Area, and cannot economically justify a formal action plan to address air quality issues. However, the Council is committed to improving air quality in general, and does that through joint co-operation with the four neighbouring Tees Valley Councils through Tees Valley Combined Authority (April 2016, which includes Tees Valley Unlimited), and at the environmental health level through the Tees Valley Environmental Protection Group, which also includes the Environment Agency. The Council also encourages stand alone measures that may have beneficial impact on air quality.

Measures generally impact on vehicle emission reductions, improving the transport network, changing transport attitudes through encouraging cycling and walking, and improving public transport. Examples are:

- Promoting low emission transport by working with bus companies to improve the vehicle fleet efficiency and routes. Partnership working with bus companies to promote Euro 5 buses and since 2013 Arriva Bus Company has introduced to their fleet 14 gas powered buses. The Arriva Bus Company have recently installed a gas fuelling station at their bus depot at Faverdale, Darlington.
- A Licensing Policy which offers a 25% reduction in licensing fees for vehicles that are fuelled by liquid petroleum gas (LPG), electric, petrol-electric and compressed natural gas (NGV).
- Promotion of electric vehicle charging points for any commercial development and public facilities that creates a car parking area with 50 more spaces.

- Traffic management and strategic highways improvements to improve traffic flows and bus priority. Examples being the improvements to the junction at Albert Road and Whessoe Road as part of the North Road Bus Priority Scheme and the replacement of Stonebridge roundabout on the inner ring road with a traffic light system controlled junction, bus only lanes and creation of extra lanes on the approaches to Freemans Place roundabout.
- Promoting travel alternatives by encouraging use of sustainable transport via Local Motion. The promotion of workplace and school travel planning, use of public transport, smarter driving, car sharing and cycling schemes and to provide a network of cycle ways such as the cycle route through Central Park linking Darlington College, Teesside University and the new housing development to Bank Top Rail Station.
- Address climate change issues and implement a carbon management plan

Most of these schemes have been implemented in part, and the work will continue. The schemes do not address specific air quality issues, but all will have a bearing on improving air quality.

2.3 $PM_{2.5}$ – Local Authority Approach to Reducing Emissions and or Concentrations

As detailed in Policy Guidance LAQM.PG16 (Chapter 7), local authorities are expected to work towards reducing emissions and/or concentrations of $PM_{2.5}$ (particulate matter with an aerodynamic diameter of 2.5µm or less). There is clear evidence that $PM_{2.5}$ has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

Overview

Particulates $PM_{2.5}$ are very fine particulates which are now considered to be a more significant health risk than the larger particulates PM_{10}, as they penetrate further into the respiratory system and are less easily dislodged. Recognising this, the UK Public Health Outcomes Framework (Healthy Lives: Healthy People) includes an indicator relating to fine particulate matter ($PM_{2.5}$). This indicator is 3.01 in Health Protection Domain 3 – 'Fraction of mortality attributed to particulate air pollution' – with the latest factors across the Tees Valley as follows:

	England	North East	Darlington	Hartlepool	Middlesbrough	Redcar & Cleveland	Stockton-on-Tees
Fraction	5.3	4.2	4.0	4.1	4.4	4.2	4.2

These are estimates of the percentage of mortality attributable to long term exposure to particulate air pollution. The general range for the UK is between 2.5 and 4.0 for rural areas, up to 8 and higher in certain city areas.

Particulate $PM_{2.5}$ is not yet incorporated into LAQM regulation within England. As such there is no statutory requirement on local authorities to review and assess $PM_{2.5}$ for LAQM purposes, and while $PM_{2.5}$ monitoring across the UK is desirable given the links to the Public Health Outcomes Framework, it is recognised that monitoring costs can be prohibitive on local authorities. The latest 2016 Technical Guidance suggests local authorities use results from the national network of $PM_{2.5}$ monitors to assess levels, and also provides a nationally derived factor of 0.7 that can be used to estimate $PM_{2.5}$ levels from any particulate PM_{10} monitors that local authorities may have installed.

Within the Tees Valley, there are three $PM_{2.5}$ monitors as part of the national network, Middlesbrough Breckon Hill (urban industrial); Stockton Eaglescliffe (roadside); and, starting February 2016, Stockton A1035 Nelson Terrace (roadside), all giving direct $PM_{2.5}$ annual means. The Breckon Hill and Eaglescliffe stations have PM_{10} monitors alongside so that a locally derived factor of $PM_{2.5}$ to PM_{10} can be calculated and compared with the national factor and used at local PM_{10} monitors with a similar location. Annual means for $PM_{2.5}$ for within the Tees Valley as measured at the two monitors (Middlesbrough Breckon Hill and Stockton Eaglescliffe) have ranged between 9.5 and 13.1 µg/m^3, with variations year on year likely to be due to weather variations.

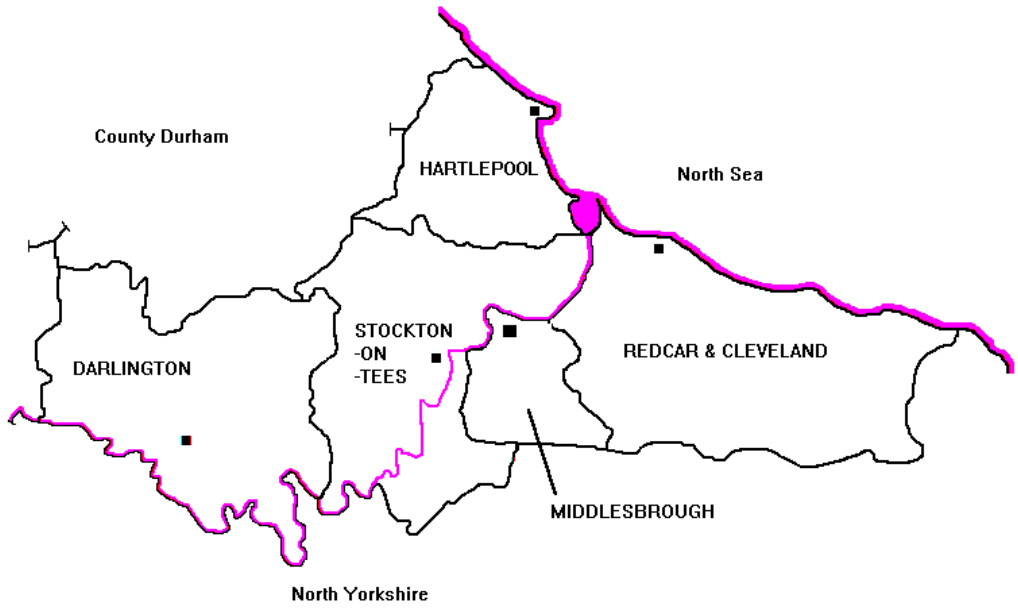
The UK target objective for $PM_{2.5}$ was first introduced in 2008 as an annual mean of 25 µg/m^3 (gravimetric) with no exceedances and a target 15% reduction at urban background sites between 2010 and 2020. This has been consistently met across the Tees Valley. The 2016 Technical Guidance has revised this objective to give local authorities in England a new flexible role in working towards reducing emissions and concentrations of $PM_{2.5}$. This will require local authorities to better

understand local $PM_{2.5}$ sources and emission levels, data which is currently only available through national estimates.

Technical Guidance recognises that due to its extremely small size, $PM_{2.5}$ can travel for long distances in the air and it is estimated that as much as 40% to 50% of the levels found in any given area can be from sources outside a local authority's direct boundary. Around a quarter of concentrations are thought to be secondary sourced, i.e. reactions between other pollutants in the atmosphere. In addition, coastal and rural areas can have higher proportions of natural sources such as salt, fine sand and pollens, the extent of which will be weather dependent. This means that locally emitted $PM_{2.5}$ will tend to be significantly less than 50% of the total burden, with road traffic and industry the principle sources.

Darlington $PM_{2.5}$

Darlington Borough Council is one of five unitary Councils forming the general area known as the Tees Valley. As shown below, it is the most westerly of these Councils and third largest in area, at 198.4 sq. km.



Darlington Borough has a densely populated central area, but is otherwise largely rural. It is a major shopping and commercial centre, and is the main railway centre for the Tees Valley. There is very little heavy industry compared with other Tees Valley Councils, and although some quarrying and other industrial processes lie just outside its boundary, they do not significantly impact on Darlington air quality.

The main A1 motorway (North – South), and the A66 trunk route (East – West) run through the Borough, but are mainly in rural areas, with no areas of relevant exposure. Within the urban area, there are some congested commuter routes, and in the absence of a northern by-pass, some heavy through traffic on the northern outskirts of the town. A major road change, completed in 2008, was the eastern transport corridor, formerly known as the cross-town route (eastern section). The main purpose of this scheme was to provide access to development land to the west of the A66 by-pass, but it has also contributed to significant reductions in traffic on two of the busiest road corridors in the town, Haughton Road and Yarm Road.

The majority of the Darlington urban area is subject to Smoke Control Orders, and natural gas is the main source of heating in all but a few rural villages. This means that air pollution from domestic and commercial sources are low. Industrial emissions are also low, leaving road transport as the most significant air pollution source.

The principle source of fine particulate pollution is likely to be from road transport, but even this is limited. Other than along the main commuter routes into the town centre, road traffic is generally light as the significant through routes are in their own transport corridors. This general view of sources is reflected in the national 1 sq km sector model data maps for Darlington based on 2011 emission source estimates (reference 4). Typical background levels are shown as 8.3 – 11.3 $\mu g/m^3$/sqkm, with over 80% identified as natural or secondary sources. The average $PM_{2.5}$ loading per sqkm in 2011 is shown as 9.1 $\mu g/m^3$, reducing to 8.7 $\mu g/m^3$ in 2020 as a result of planned Government / EU measures.

Therefore, at this stage of understanding of local fine particulate emissions, it is difficult to see what positive action can be economically taken by Darlington Borough Council to reduce $PM_{2.5}$ levels over the coming years, other than those actions already identified in section 2.2 of this report. A more significant impact is likely to be made by changes in Government policy with regard to diesel engines in cars and small vans. Since 1995, the proportion of diesel engine cars has risen from below 10% to over 40% today due to concentration on reducing carbon emissions. Diesel engines emit more fine particulates than petrol engines, and it is difficult to fit effective abatement measures. Of as much concern is the higher levels of nitrogen oxides emitted by diesel engines, which are a key factor in secondary fine particulate formation.

3 Air Quality Monitoring Data and Comparison with Air Quality Objectives and National Compliance

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

Until recently, Darlington Council had two continuous monitoring stations.

St Cuthbert's Way was a Local station monitoring nitrogen oxides and particulate PM_{10} from traffic, and owned and operated by Darlington Council between years 2000 and 2014, when the equipment fell into disrepair. The unit was a kerbside site on a busy inner ring road roundabout, on the edge of the main shopping centre, where traffic is generally slow moving. The unit was in an area of relevant public exposure only for the 1 hour nitrogen dioxide objective, and represented a worst case kerbside site for the whole of the Tees Valley.

The second continuous Local monitoring station for nitrogen oxides and particulate PM_{10} operated at **Cockerton Bridge** from 2004 to early April 2012, when the monitors became unserviceable and could not be economically repaired. The unit was a roadside site on one of the main radial routes into the town centre, with heavy, but relatively free flowing traffic. The monitor location was between kerbside and the nearest building façades, and was a worst-case site for all objectives relating to nitrogen oxides and particulate PM_{10} from traffic. It is noted here that a non-continuous nitrogen dioxide diffusion tube (D5 on the map Appendix D) continues to be operated at a nearby roadside location on Woodland Road to provide an on-going measure of nitrogen dioxide trends.

The locations of the two monitoring sites are shown on the map, Appendix D. Further details on how the monitors were calibrated and how the data has been adjusted are included in Appendix C.

3.1.2 Non-Automatic Monitoring Sites

There are ten non-continuous diffusion tube sites measuring annual mean nitrogen dioxide levels, four of which used to be national survey sites. Apart from the two background sites and one rural site, all are kerbside or roadside sites as a measure of NO_2 concentrations arising from traffic.

These diffusion tubes are 50% TEA in acetone, supplied and analysed by Gradko International Ltd. The results are adjusted for bias using factors from the laboratory (Gradko) overall bias factor, as there is no triple tube location study.

Further QA / QC detail is provided in Appendix C of this report.

The location details are shown on the map Appendix D.

3.2 Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for "annualisation" and bias. Further details on adjustments are provided in Appendix C.

3.2.1 Nitrogen Dioxide (NO_2)

Table A.3 in Appendix A compares the ratified and adjusted monitored NO_2 annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

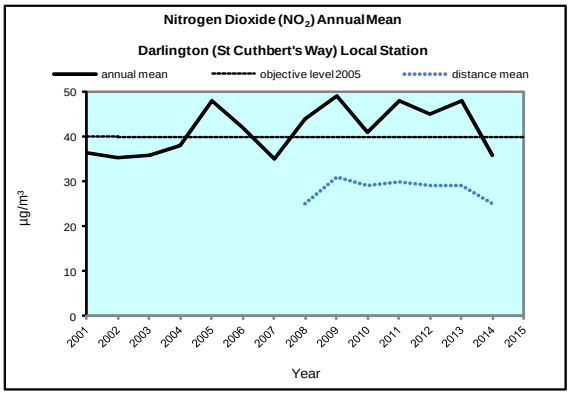
For diffusion tubes, the full 2015 dataset of monthly mean values is provided in Appendix B. Table A.4 in Appendix A compares the ratified continuous monitored NO_2 hourly mean concentrations for the past 5 years with the air quality objective of 200µg/m^3, not to be exceeded more than 18 times per year.

There have been no exceedances of the annual mean (in areas of relevant exposure) or 1 hour mean objectives at any monitoring location.

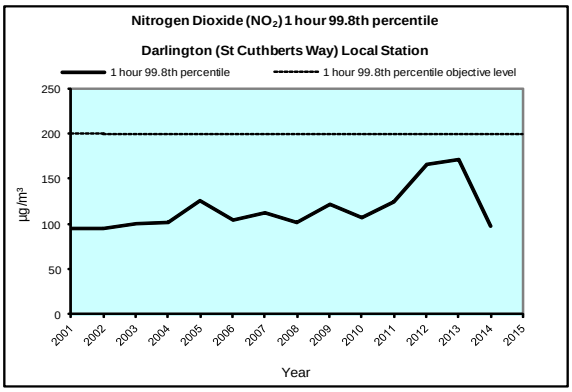
Historical nitrogen dioxide trend graphs at the Darlington St Cuthbert's Way and Cockerton Bridge continuous monitoring stations are shown below, along with the nitrogen dioxide diffusion tube trends.

The blue trend line shown on the St Cuthbert's Way graph is the expected concentration at the nearest point of relevant public exposure 20 metres away, using the fall off with distance method given in the Technical Guidance (reference 2).

St Cuthbert's Way (no relevant exposure of the annual mean)

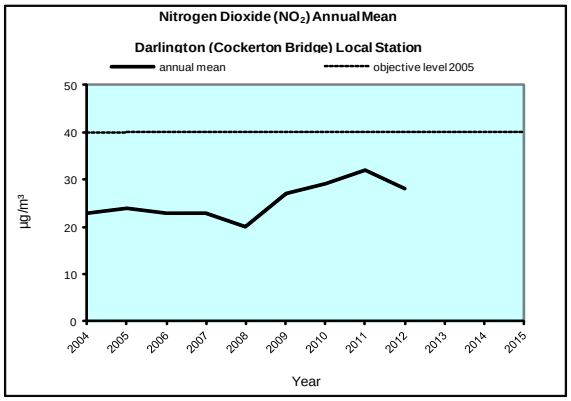


no 2015 data

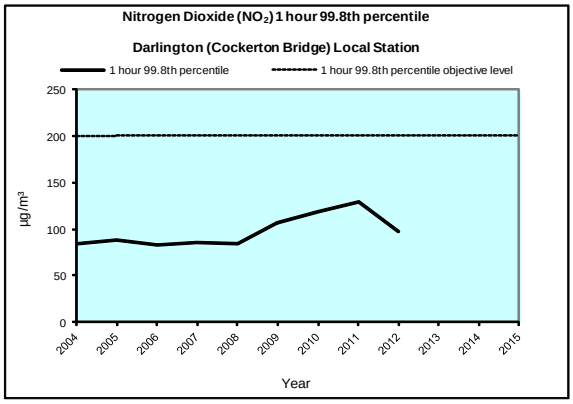


no 2015 data

Cockerton Bridge

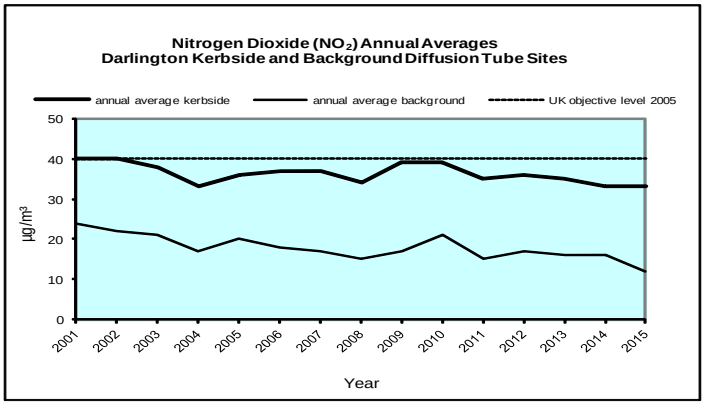


closed April 2012



closed April 2012

Diffusion Tube Annual Average Trends



Diffusion tube annual average for six kerbside / roadside sites and two background sites

2014/5 data annualised using three Tees Valley Continuous Monitor datasets.

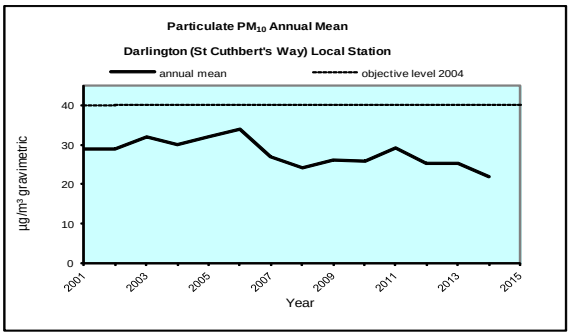
3.2.2 Particulate Matter (PM10)

Table A.5 in Appendix A compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past 5 years with the air quality objective of 40 µg/m^3.

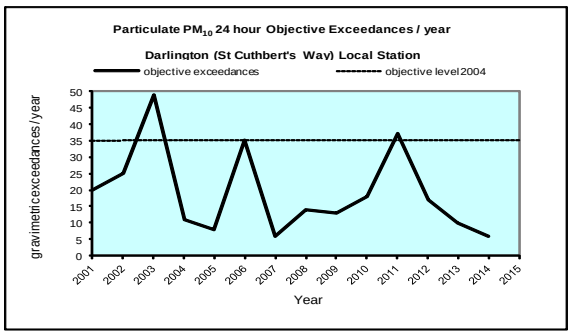
Table A.6 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past 5 years with the air quality objective of 50 µg/m^3, not to be exceeded more than 35 times per year.

There have been no exceedances of the annual mean or daily mean objective in areas of relevant public exposure. The exceedance variations year on year at the St Cuthbert's Way site are due to weather conditions, with high pressure episodes in winter months causing rapid particulate build-up. Particulate PM_{10} trend graphs at the Darlington St Cuthbert's Way and Cockerton Bridge continuous monitoring stations are shown below.

St Cuthbert's Way (no relevant public exposure of the annual mean or daily mean)

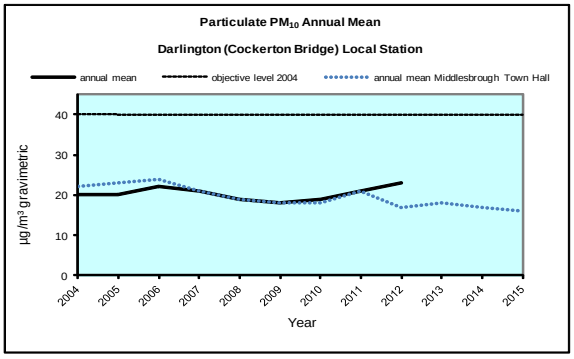


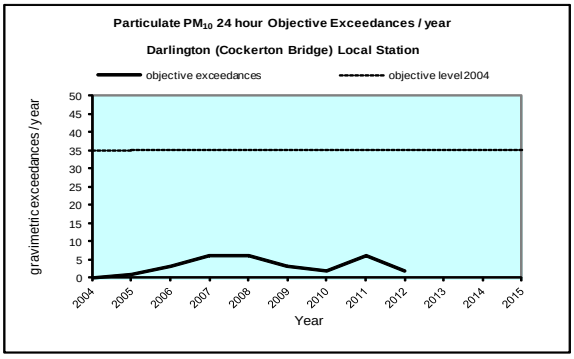
no 2015 data



no 2015 data

Cockerton Bridge





Middlesbrough Town Hall data added to indicate probable trend 2011 - 2015

3.2.3 Particulate Matter ($PM_{2.5}$)

Table A.7 in Appendix A presents the derived $PM_{2.5}$ annual mean concentrations as available for the past 5 years using the nationally derived factor of 0.7 applied to the particulate PM_{10} results at the St Cuthbert's and Cockerton Bridge sites. Also shown are the annual means recorded at the Middlesbrough and Stockton AURN sites, which are located in areas of relevant public exposure, and indicative of Darlington locations.

The derived annual mean for St Cuthbert's has fallen from 20.5 µg/m^3 in 2011 to 15.6 µg/m^3 in 2014. This site is a kerbside site, and fully reflects road traffic emissions. There is insufficient data at the Cockerton Bridge site. The actual monitored levels at the Middlesbrough and Stockton sites range between 10.1 and 13.1 µg/m^3 over the same period. These stations are more representative of urban traffic and of relevant public exposure. Weather conditions are thought to be the major influence on year by year variations.

3.2.4 Sulphur Dioxide (SO_2)

Darlington Council no longer monitors sulphur dioxide concentrations, and there is no requirement in the absence of industrial sources or significant domestic coal burning. For many years, Darlington did monitor sulphur dioxide concentrations in the town centre using an 8 port sampler, but this site was closed in 2004 when sulphur dioxide concentrations fell below the limit of detection.

Sulphur dioxide monitoring results from other Tees Valley Councils (shown for 2015 in Table A.8 in Appendix A) with significant emissions from the chemical and steel industries, consistently show the objectives being met, and this will be the case within the Darlington Council area.

3.2.5 Other Pollutants – Lead, Benzene, 1,3-Butadiene

There are no air quality issues within Darlington involving these pollutants.

3.2.6 Other (Unregulated) Pollutants – PAH and Ozone

There are no air quality issues within Darlington involving PAH.

Regarding Ozone, this is a more complex pollutant. It is a secondary pollutant, formed by the action of strong sunlight on other air pollutants, and tends to have higher levels next to coastal regions. Darlington is well inland, and has relatively high ozone-scavenging nitrogen oxide emissions from traffic. This makes it less likely that urban areas will have ozone exceedances, but they cannot be entirely ruled out in times of hot summer weather.

Ozone is monitored in the Redcar & Cleveland Council area to the east, which has an extensive coastline, and there has been no recorded exceedance of the objective since 2012.

Appendix A: Monitoring Results

Table A.1 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Monitoring Technique	Distance to Relevant Exposure (m)	Distance to kerb of nearest road (m)	Inlet Height (m)
StC	St Cuthbert's Way (Local)	kerbside	429032	514818	NO_2, PM_{10}	N	NO_2 - Chemiluminescence PM_{10} - TEOM (vcm correction)	20m	0.5m	NO_x 1.9 TEOM 2.0
Co **(closed April 2012)**	Cockerton Bridge (Local)	urban	427528	515309	NO_2, PM_{10}	N	NO_2 - Chemiluminescence PM_{10} - TEOM (vcm correction)	20m	10m	2.9

Table A.2 – Details of Non-Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA ?	Distance to Relevant Exposure (m)	Distance to kerb of nearest road (m)	Tube collocated with a Continuous Analyser?	Height (m)
D1	Northgate	kerbside	429026	514898	NO_2	N	N/A	<1 metre	N	2.6
D2	Darlington College	background	429857	515168	NO_2	N	N/A	5 metres	N	2.0
D3	Arts centre	background	428250	514684	NO_2	N	50m	10 metres	N	2.1
D4	Salters Lane	roadside	429478	517375	NO_2	N	5m	1 metre	N	2.8
D5	Woodland Rd	roadside	428152	514966	NO_2	N	20m	1 metre	N	2.9
D6	Blackwell Bridge	roadside	427734	512591	NO_2	N	10m	1 metre	N	2.6
D7	North Rd Station	kerbside	429007	515504	NO_2	N	N/A	<1 metre	N	3.0
D8	Haughton Green	kerbside	430905	515918	NO_2	N	20m	<1 metre	N	2.5
D9	Yarm Road	roadside	431299	514137	NO_2	N	20m	1 metre	N	2.6
D10	Middleton-one-Row	rural	435431	512030	NO_2	N	10m	1 metre	N	2.6

Table A.3 – Annual Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2015 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
					2011	2012	2013	2014	2015
StC	kerbside	Automatic	100	N/A	**48.0**(30.2) [a]	**44.6**(28.8) [a]	**48.4**(28.8) [a]	35.7(24.8) [a]	-
Co **(closed April 2012)**	urban	Automatic	100	N/A	33.4	27.8	-	-	-
				Bias factor	0.94	1.02	1.01	0.98	0.96
D1	kerbside	Diffusion Tube	100	83	36.7	39.9	36.3	34.4	32.8
D2	background	Diffusion Tube	100	67	16.9	19.3	18.3	17.5	12.9
D3	background	Diffusion Tube	100	83	13.4	14.4	14.2	13.6	10.8
D4	roadside	Diffusion Tube	100	92	32.3	36.6	34.2	30.6	29.8
D5	roadside	Diffusion Tube	100	75	33.5	33.1	29.1	29.5	24.9
D6	roadside	Diffusion Tube	100	100	28.6	32.4	36.9	37.7	38.0
D7	kerbside	Diffusion Tube	100	42	32.2	32.8	33.4	31.0	35.4
D8	kerbside	Diffusion Tube	100	100	37.0	37.7	36.3	35.8	33.2
D9	roadside	Diffusion Tube	100	83	26.4	29.4	26.2	27.0	24.2
D10	rural	Diffusion Tube	100	100	9.9	10.1	10.3	9.3	8.3

a Figures in brackets for St Cuthbert's Way are the projected public exposure concentration annual means derived from the NO_2 fall off with distance calculator at 20 metres, the nearest point of relevant public exposure.

Notes: Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**.

NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective if exists are shown in **bold and underlined.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per Technical Guidance LAQM.TG16. See Appendix C for details.

Table A.4 – 1-Hour Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2015 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
					2011	2012	2013	2014	2015
StC	kerbside	Automatic	100	N/A	1 (125)	1 (166)	4 (172)	0 (98)	-
Co **(closed April 2012)**	urban	Automatic	100	N/A	1 (129)	0 (97)	-	-	-

Notes: Exceedances of the NO_2 1-hour mean objective (200µg/m^3 not to be exceeded more than 18 times/year) if exists are shown in **bold.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 90%, the 99.8th percentile of 1-hour means is provided in brackets.

Table A.5 – Annual Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2015 (%) (2)	PM_{10} Annual Mean Concentration ($\mu g/m^3$) (3)				
				2011	2012	2013	2014	2015
StC	kerbside	100	N/A	29.2	25.2	25.3	22.8	-
Co **(closed April 2012)**	urban	100	N/A	21.4	22.8	-	-	-

All results unmodified TEOM, adjusted to gravimetric using the vcm method

Notes: Exceedances of the PM_{10} annual mean objective of 40$\mu g/m^3$ if exists are shown in **bold.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) All means have been "annualised" as per Technical Guidance LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Table A.6 – 24-Hour Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2015 (%) (2)	PM_{10} 24-Hour Means > 50µg/m^3 (3) (90.4th percentile shown in brackets)				
				2011	2012	2013	2014	2015
StC	kerbside	100	N/A	**37** (51)	17 (43)	10 (40)	6 (37)	-
Co **(closed April 2012)**	urban	100	N/A	6 (38)	2 (39)	-	-	-

All results unmodified TEOM, adjusted to gravimetric using the vcm method

Notes: Exceedances of the PM_{10} 24-hour mean objective (50µg/m^3 not to be exceeded more than 35 times/year) if exists are shown in **bold.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 90%, the 90.4th percentile of 24-hour means is provided in brackets.

Table A.7 – $PM_{2.5}$ Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2015 (%) (2)	$PM_{2.5}$ Annual Mean Concentration (µg/m^3) (3)				
				2011	2012	2013	2014	2015
StC	kerbside	100	N/A	20.4	17.6	17.7	16.0	-
Co **(closed April 2012)**	urban	100	N/A	15.0	16.0	-	-	-
Stockton-on-Tees Eaglescliffe	roadside	100	97	12.0	11.4	10.1	10.9	10.7
Middlesbrough Breckon Hill	urban industrial	100	78	10.6	10.2	10.8	13.1	10.5

The Stockton-on-Tees Eaglescliffe and Middlesbrough Breckon Hill sites are national network AURN stations within Tees Valley council areas. The stations are at locations of relevant public exposure and will be representative of such locations in Darlington.

Notes: (1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) All means have been "annualised" as per Technical Guidance LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Table A.8 – SO_2 Monitoring Results

Site ID	Site Type	Valid Data Capture for monitoring Period (%) (1)	Valid Data Capture 2015 (%) (2)	Number of Exceedances (percentile in bracket) (3)		
				15-minute Objective (266 µg/m^3)	1-hour Objective (350 µg/m^3)	24-hour Objective (125 µg/m^3)
Middlesbrough Breckon Hill	urban industrial	100	92	0 (49)	0 (36)	0 (13)
Redcar & Cleveland Dormanstown	suburban industrial	100	92	0 (43)	0 (27)	0 (11)

Darlington Council no longer monitors sulphur dioxide concentrations, and there is no requirement in the absence of industrial sources or significant domestic coal burning. For many years, Darlington did monitor sulphur dioxide concentrations in the town centre using an 8 port sampler, but this site was closed in 2004 when sulphur dioxide concentrations fell below the limit of detection.
The Middlesbrough Breckon Hill and Redcar & Cleveland sites are stations within Tees Valley council areas to the east, close to the main concentrations of the chemical and steel industries and results from these stations are shown above for reference, and are well below the objective level. Darlington sulphur dioxide levels will be lower than these.

Notes: Exceedances of the SO_2 objectives are shown if exists in **bold** (15-min mean = 35 allowed a year, 1-hour mean = 24 allowed a year, 24-hour mean = 3 allowed a year)

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%)

(3) If the period of valid data is less than 90%, the relevant percentiles are provided in brackets.

Appendix B: Full Monthly Diffusion Tube Results for 2015

Table B.1 – NO_2 Monthly Diffusion Tube Results - 2015

Site ID	NO_2 Mean Concentrations ($\mu g/m^3$)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean	
													Raw Data annualised	Bias Adjusted 0.96
D1	30.5	31.6	31.2	29.2	24.3	30.3	34.0	34.6	36.2	53.1	-	-	34.1	32.8
D2	19.3	18.5	17.0	12.2	9.5	10.0	6.4	-	14.2	-	-	-	13.4	12.9
D3	13.0	14.8	11.5	9.9	-	6.5	8.2	9.1	12.5	19.5	12.6	-	11.3	10.8
D4	34.1	39.2	29.1	31.0	23.7	27.4	26.0	30.4	28.8	35.4	37.6	-	31.1	29.8
D5	29.0	41.9	28.1	-	-	23.8	22.2	-	-	25.6	28.7	24.2	26.0	24.9
D6	44.9	41.1	38.7	37.2	38.1	37.8	38.1	39.3	38.7	48.0	38.8	34.0	39.6	38.0
D7	-	-	-	-	-	-	30.0	32.8	33.8	42.4	40.7	-	36.8	35.4
D8	39.4	36.9	35.7	36.2	27.9	29.3	26.4	31.6	32.6	43.7	42.1	32.7	34.5	33.2
D9	23.4	27.5	24.3	24.0	24.1	22.2	24.1	24.3	-	30.3	28.1	-	25.2	24.2
D10	9.4	9.1	9.6	7.7	5.1	5.2	5.3	7.3	8.2	13.1	12.3	11.3	8.6	8.3

Note: See Appendix C for details on bias adjustment. Bias adjustment of 0.96 used is for Gradko International Ltd version 06/16 of the National bias factor spreadsheet covering 15 studies

Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC

There is no additional supporting information required.

Air Quality Monitoring Data QA/QC

Diffusion Tube Bias Adjustment Factors

Gradko International Ltd supply and analyse nitrogen dioxide diffusion tubes for Darlington Borough Council. Tube preparation is 50% TEA in acetone. The bias adjustment factor for 2015 has been obtained from the R&A helpdesk database, and as at June 2016, was 0.96. Darlington does not have a co-location study.

PM Monitoring Adjustment

All measurements for PM_{10} at the Local stations are TEOM based. Results since 2008 have been adjusted by the vcm method to provide gravimetric equivalence.

Short-term to Long-term Data adjustment

The St Cuthbert's continuous monitoring station had 10 months data only in 2014 (the last monitoring year). The nitrogen dioxide and particulate PM10 annual means were annualised using three Tees Valley continuous monitor datasets. Calculations were included with the Darlington 2015 Updating and Screening report.
Seven of the ten diffusion tubes had between 1 and 6 months data missing. The data has been annualised using the results at three Tees Valley continuous monitoring sites. Calculations are shown below in table C1.

QA/QC of automatic monitoring

The two Darlington fixed continuous Local monitoring stations (both NO_x and PM_{10}), were modern installations, operated under a comprehensive service contract with the supplier, in both cases Enviro Technology. Operators of the site received supplier training.

The Council is committed to achieving accuracy, precision, data capture, traceability and long term consistency to ensure that data is representative of ambient air quality. In common with other Tees Valley Councils, Darlington had a documented quality assurance and control programme, which includes an established schedule of regular site calibrations, validation of data, and documentation of all procedures. Details are summarised as follows:

Calibration	daily 'automatic' calibration with frequent (usually fortnightly) manual checks.
	Calibration gas obtained from approved gas standard suppliers.
Equipment	a comprehensive service agreement with the supplier.
Data capture	site operators were experienced and trained personnel, monitoring data capture on a daily basis where possible to ensure that faults are detected and corrected quickly.
Ratification	data was screened, where possible on a daily basis, to check for unusual measurements. Suspicious data was investigated fully, and if found to be faulty, was deleted from the records. Particular attention is paid to possible environmental changes in the vicinity of the analyser.
	Data was recorded monthly and compared with earlier results.

QA/QC of diffusion tube monitoring

The Darlington Borough Council nitrogen dioxide diffusion tube programme is operated through an approved laboratory (Gradko International Ltd) with formal accreditation to BS standards, and one that participates in the AIR-PT programme. Particular attention is paid to proper installation of the tubes at the site, and reliable exposure duration.

Tube precision for this laboratory is consistently shown as good for 2015 for tube preparation 50% TEA in acetone. Gradko International Ltd also demonstrated 100% satisfactory performance in the AIR-PT scheme for 2015.

Table C1 - Data Adjustment for NO_2 Diffusion Tubes

Darlington Diffusion Tube Annualisation 2015

	Stockton Eaglescliffe Year	R&C Dormanstown Year	Middlesbrough Breckon Hill Year	Tube	Period means	Ratios am/pm	Average
J	12.7	16.6	17.2	D1 (10 mths)	14.4; 12.3; 15.2	0.993; 1.030; 1.033	1.019
F	20.7	20.1	20.9				
M	15.6	14.6	17.1	D2 (8 mths)	14.7; 12.7; 15.2	0.975; 0.997; 1.038	1.003
A	16.3	13.4	18.3				
M	8.1	9.0	9.4	D3 (10 mths)	15.0; 12.9; 16.5	0.951; 0.984; 0.952	0.962
J	10.3	9.0	10.8				
J	10.5	8.6	11.1	D4 (1 mth)	14.4; 12.6; 15.9	0.992; 1.012; 0.991	0.998
A	9.2	9.1	9.3				
S	16.5	10.6	16.4	D5 (8 mths)	15.2; 13.8; 16.9	0.942; 0.921; 0.930	0.931
O	24.0	12.3	21.8				
N	14.5	14.8	22.2	D7 (5 mths)	14.9; 11.1; 16.2	0.957; 1.146; 0.973	1.025
D	13.1	14.3	14.2				
				D9 (10 mths)	14.2; 12.8; 15.8	1.007; 0.996; 0.995	0.999
Y	14.3	12.7	15.7				

Appendix D: Map(s) of Monitoring Locations

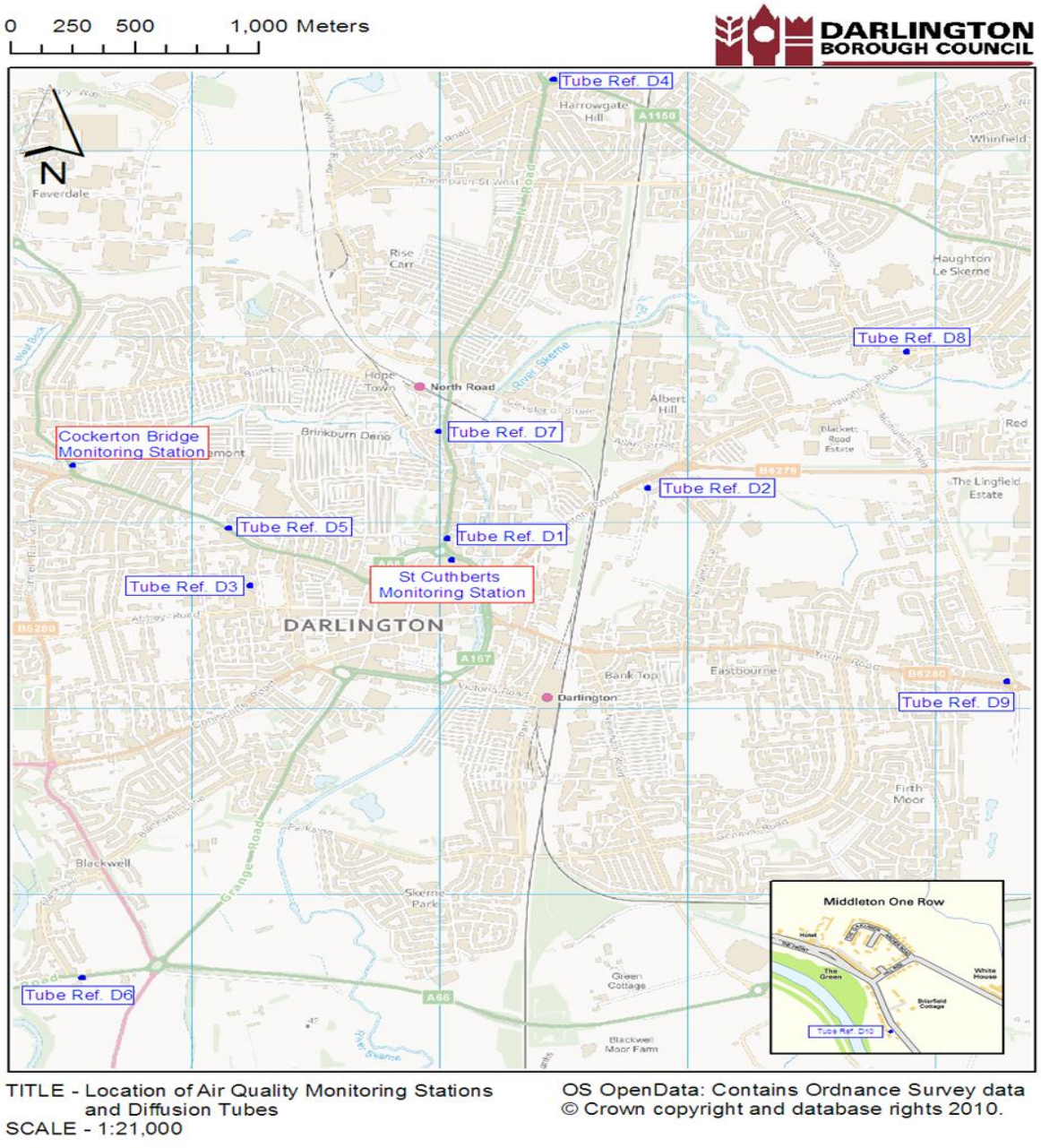
Figure D.1 Map of Automatic and Non-Automatic Monitoring Sites

DARLINGTON COUNCIL AREA

showing locations of the two automatic monitoring stations
and the ten nitrogen dioxide diffusion tube locations

Diffusion Tube Locations

D1	Northgate	D5	Woodland Road	D9	Yarm Road
D2	Darlington College	D6	Blackwell Bridge	D10	Middleton-One-Row
D3	Arts Centre	D7	North Rd Station		
D4	Salters Lane	D8	Haughton Green		



TITLE - Location of Air Quality Monitoring Stations and Diffusion Tubes
SCALE - 1:21,000

Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective[4]	
	Concentration	Measured as
Nitrogen Dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
	40 µg/m^3	Annual mean
Particulate Matter (PM_{10})	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean
	40 µg/m^3	Annual mean
Sulphur Dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean

[4] The units are in microgrammes of pollutant per cubic metre of air (µg/m^3).

Appendix F: Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
ASR	Air quality Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
EU	European Union
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide

Appendix G: References

1. Annual Air Quality Report for the Tees Valley

   Published by the Tees Valley Environmental Protection Group, July 2016

2. LAQM Technical Guidance 2016

   Published by the Department of Environment, Food and Rural Affairs, April 2016

3. LAQM Policy Guidance

   Published by the Department of Environment, Food and Rural Affairs, April 2016

4 2011 Particulate PM2.5 Background Data for Darlington

   Published by the Department of Environment, Food and Rural Affairs, Data Archive