

SWINDON BOROUGH COUNCIL

LOCAL AIR QUALITY PROGRESS REPORT 2004

Compiled in accordance with DEFRA Progress Report Guidance
document LAQM.PRG(03)

Swindon Borough Council

Local Air Quality Management 2004 Progress Report

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1. Executive Summary:

The Local Air Quality Management process requires Local Authorities to continuously assess the levels of 7 pollutants within their districts for which are prescribed objective standards and compliance dates. A timetable for the submission of progress reports is also established.

This 2004 Progress Report identifies Swindon's monitoring activities in this regard and tabulates data recorded.

In contrast to the Updating & Screening Report produced in Spring 2003, which indicated that all objective standards were expected to be met by the compliance dates, monitoring of Nitrogen Dioxide levels at **one site in Kingshill Road throughout 2003 has now identified a risk of an exceedence of the annual mean standard for this pollutant occurring** in the vicinity of the site.

The significance of this latest data is currently under assessment and further detailed studies will now be undertaken to determine the accuracy of the diffusion tube data. **The need to declare an Air Quality Management Area and thereby implement traffic management measures in Kingshill Road, to reduce NO₂ levels, is a distinct possibility.**

In this regard a Detailed Assessment report is required to be submitted to the Department of Environment, Food & Rural Affairs (DEFRA) in April 2005.

2. Overview of Air Pollution Monitoring activities:

Swindon's Local Air Quality Management activities currently entail continual monitoring in accordance with the Department of Environment, Food and Rural Affairs (DEFRA) policy & technical guidance.

Previous screening & assessment exercises, undertaken in 2000 & 2003, have not indicated a need to establish any Air Quality Management Areas in the Borough to date, but in line with requirements, a watching brief is being kept on the developing situation with particular regard to Nitrogen Dioxide levels, particularly in close proximity to busy roads.

Monitoring of Smoke & Sulphur Dioxide and Particulate Matter is also continuing.

2.1 Nitrogen Dioxide:

Nitrogen Dioxide (NO₂) has to be considered as part of the group of Nitrogen Oxides (NO_x) comprising Nitric Oxide (NO) & Nitrogen Dioxide (NO₂). All combustion processes produce some NO_x but only NO₂ is associated with adverse effects on human health. The main source of NO_x in the UK is road transport which accounted for approx.47% of emissions and this figure is considerably higher in urban areas where traffic congestion is often prevalent.

NO₂ is produced by the oxidation of Nitric Oxide in the atmosphere and there is a complex relationship between emissions of NO_x and the resulting concentration of NO₂ which is dependant upon the proportions of NO₂ in the primary emission and the availability of atmospheric oxidant, especially Ozone.

The Air Quality standard for NO₂ is:

40ug/m³ measured as an Annual Mean, to be achieved by end of 2005

200ug/m³ not to be exceeded more than 18 times/year measured a 1-hour mean, to be achieved by end of 2005

In 1993 Central Government initiated the establishment, in conjunction with Local Authorities, of a national network of sites to monitor ambient Nitrogen Dioxide levels deploying passive diffusion tubes. Monitoring of Nitrogen Dioxide levels, using passive diffusion tubes, has been carried out at a number of sites across the Borough since 1993.

The tubes, which are prepared by pipetting 30ml of a solution of 20% triethanolamine in water onto metal grids in the end cap, are exposed for a period of one month in accordance with the national survey protocol.

Bristol City Council Scientific Services unit has been contracted to supply and analyse the tubes since the start of the exercise. The laboratory does not hold UKAS accreditation for NO₂ tube analysis, but does participate in the Workplace Analysis Scheme for Proficiency (WASP) for NO₂ tubes. At the last round of performance assessment (round 46 – March 2003) the laboratory recorded a 'good' classification.

The laboratory participates in a Quality Control programme operated by the National Environmental Technology Centre (NETCEN) for which they recorded 'good' classification for 11 of the monthly assessments in the year 2002.

They also participate in a field inter-comparison scheme that started in November 2002, controlled by NETCEN and organised by the Health & Safety Laboratory, in which 3 tubes are co-located with a continuous analyser which provides a reference value. Three sets of results have been returned to date and these show an average positive bias for the tubes of 11% , 16% and 34%.

A total of 17 sites are now being operated in Swindon, data from 4 of which is contributed to the National data-base. Results for all sites are tabulated at Appendix 2.

No continuous, real-time, monitoring of NO₂ is currently being undertaken within Swindon.

2.2 Smoke & Sulphur Dioxide:

The main source of sulphur dioxide (SO₂) in the UK is power stations, with other industrial combustion processes also generating significant emissions. Domestic sources now only account for 4% of emissions, although these can be locally significant if concentrated in a particular locality.

The Air Quality standard for SO₂ is:

350ug/m³ measured as a 1-hour mean not to be exceeded more than 24 times/year, to be achieved by end 2004

125ug/m³ measured as a 24-hour mean not to be exceeded more than 3 times/year, to be achieved by end 2004

266ug/m³ measured as a 15-minute mean not to be exceeded more than 35 times/year, to be achieved by end 2005

Local exceedences of the objectives (principally the 15-minute mean) may occur in the vicinity of small combustion plant burning coal or oil.

Neither of the above scenarios is known, or believed, to exist or occur at any location within Swindon.

Daily monitoring of Smoke and Sulphur Dioxide levels have continued at a site in the Ferndale Road area of Swindon (Grid Ref: SU 4147 1858), as they have done since 1963. The progressive reduction in levels of these pollutants over the past 30+ years has already been confirmed by this monitoring exercise.

The site is one of approx 165 operating across the country for which data is collated by NETCEN, on behalf of DEFRA, to produce National Annual statistics.

Results for Swindon's site are tabulated at Appendix 1.

2.3 Particulate Matter (PM₁₀)

There is a wide range of emission sources which contribute to PM₁₀ concentrations in the UK, which are generally divided into the categories of *Primary, Secondary & Coarse Particles*.

The expected reduction in particle emission in future years is different for each source type. Emissions from road transport will be influenced by new legislation on vehicle emission standards; emissions from secondary sources will be largely governed by controls on power generation, industrial and transport SO₂ and NO_x emissions, both in Europe and the UK; emissions of coarse particles are largely uncontrolled, and in general are not expected to decline.

The Air Quality standard for PM₁₀ is:

40ug/m³ measured as an Annual Mean, to be achieved by end of 2004

50ug/m³ measured as a 24-hour mean not to be exceeded more than 35 times/year, to be achieved by end of 2004

Continuous monitoring equipment, which uses a light-scattering technique, (Osiris monitor, Serial No. TNO 2171) was installed in mid-August 2001 at a site in Bridge End Road, Swindon with the specific objective of gauging the daily variations and the average values of particulate matter in the locality. The site was chosen to represent a probable 'worse-case' scenario within the Swindon urban area, on the basis that the immediate locality contains both a scrap metal recycling plant and a stone crushing\aggregate handling plant. Additionally, the monitor is, sited on a lamp-post which is within 0.5m of the kerbside of a busy arterial road.

Results for this site are tabulated at Appendix 3.

3. Commentary:

This report arises from the requirement, embodied in Part IV of the Environment Act 1995, for local authorities to continually review and assess air quality within their area, and to establish a system of local air quality management (LAQM) within their area, in support of the UK Government's strategy to achieve the air quality objectives. The formal framework for the process was originally shaped with the issue of prescriptive review and assessment guidance by DEFRA (then Department of Transport, Local Government and the Regions [DTLR]) in 2000.

The first round of the process required the production of a detailed report on existing ambient levels of the following 7 specified pollutants:

- ◆ Benzene
- ◆ 1,3 Butadiene
- ◆ Carbon Monoxide
- ◆ Lead
- ◆ Nitrogen Dioxide
- ◆ Particulate Matter
- ◆ Sulphur Dioxide

Accordingly, the authority conducted a screening exercise to assess the impact of these pollutants and likelihood, or otherwise, of levels existing, or arising in the future, which would exceed the objective standards prescribed by the Air Quality Regulations 2000 which were adopted at the inception of the process.

Swindon's Stage 3 review and assessment report of January 2001 confirmed the determination that there was no likelihood of any of the pollutants exceeding the objective standards, within the relevant timescale, at 'relevant locations' within the district. 'Relevant locations' are described as places where members of the public are regularly present outside of buildings or other natural or man-made structures and are likely to be exposed over the averaging period of the objective.

No Air Quality Management Areas were therefore required or established. The report was submitted to DEFRA for appraisal and the conclusions were accepted.

In 2003 all local authorities were required to conduct a further, second round, review and assessment of the same 7 pollutants against the slightly revised

requirements of the Air Quality (Amendment) Regulations 2002. (tabulated in Appendix 4.)

The methodology of assessment was slightly modified to streamline the process, eliminating one of the reporting stages which were required in 2000. The requirement in 2003 was to conduct an initial updating and screening assessment (USA) with the objective of establishing the likelihood of all objective standards being met, or otherwise. This was to be followed by a Detailed Assessment if confirmed as being necessary at the USA stage.

Swindon Borough Council's updating & screening exercise again confirmed that there was no identified likelihood of exceedence of the objective standards for any of the pollutants occurring, within the respective timescales. It was not, therefore, necessary to conduct a further Detailed Assessment, and consequently no Air Quality Management Areas, as referred to in Section 83 of the Environment Act 1995, are required to be established.

4. Monitoring Activities:

Predictably, as in many urban areas, the traffic generated pollutants Nitrogen Dioxide and Particulate Matter give the greatest cause for continuing concern and present the strongest potential for the declaration of Air Quality Management areas in Swindon in the future.

During the succeeding year Swindon's air pollution monitoring programme has continued unchanged with Nitrogen Dioxide levels being constantly monitored at 17 locations throughout the Borough using the diffusion tube technique with a creditable 96.75% data capture rate being secured. As in previous years Bristol City Council Scientific Services unit have provided the diffusion tube analysis service.

In 2002 no sites recorded values exceeding the annual mean objective (40ug/m³) based upon the uncorrected data, which was reported in the 2003 Updating & Screening Assessment document. However, the application of appropriate bias correction factors suggests that sites 5 (bottom of Kingshill Road), 12 (Swindon Bus Station) & 14 (top of Kingshill Road) should be considered to have had marginal exceedences (approx 5%) in 2002. Similarly, sites 12 and 14 both recorded bias corrected values some 25% above the objective in 2003.

The Bus Station monitoring site was established as a 'worst case scenario' site in response to a local community council request. Whilst the second round review and assessment guidance required the assessment of nitrogen dioxide levels at bus stations, the criteria determined that this should only apply to bus stations that are not enclosed, and which had a flow of greater than 1000/day. Swindon's Bus Station may be classified as partially enclosed (with the tube being sited beneath the peripheral canopy) and bus throughput rates were determined as being in the region of 920/day. Additionally, no 'relevant exposure' within 10 metres of the station is considered to occur. Hence no detailed further assessment was proposed.

The Kingshill Road site is an equivalent 'kerbside' site with the tube being sited on a lamp post set back 1 metre from the kerb. This site, too, was determined as being a likely 'hot-spot', being towards the top of a relatively steep hill on a principle arterial road where traffic often labours up the hill at slow speed, with consequently elevated NO_x emissions likely to occur. This site does represent 'relevant exposure' with a terrace of 14 residential properties lying just 1.3 metres from the kerb edge, some 35 metres down hill from the monitoring location. The properties would necessarily fall within an Air Quality Management Area should future recorded levels continue to exceed the NO₂ objective value.

Of interest is a comparison of annual mean results between site 5 (situated at the bottom of Kingshill Road) and site 14 (situated at the top of Kingshill Road), both of which are situated 1 metre from the kerb. During the years 2000 & 2002 the correlation between the sites was fairly close, whereas in the

years 2001 & 2003 site 14 recorded significantly higher values. Precise conclusions are difficult to establish.

The application of the specified correction factor for estimating the 2005 NO₂ from the bias corrected 2002 data at site 14 [Box 6.6, LAQM. TG(03)] (0.892/0.969) i.e. 42.05×0.920537 , suggests a likely concentration of 38.71ug/m³ will pertain in that year, but the application of the correction factor for the year 2003 (0.892/0.941) i.e. 49.59×0.947928 indicates that a concentration of 47.01ug/m³ (117.5%) will pertain. The projected concentration for 2010 is (0.734/0.941, i.e. 49.59×0.780021) 38.68ug/m³

It is therefore recognised that there is a risk of an exceedence of the Annual Mean objective standard for NO₂ occurring in this locality by the end of 2005, and guidance is being sought on the need to proceed to conduct a detailed assessment of the situation in this locality.

Monitoring will continue at this, and all other sites, with the objective of plotting trends in Nitrogen Dioxide levels.

The continuous 'Osiris' Particulate monitor sited at Bridge End Road has functioned dependably since July (following a prolonged idle period due to power disruption). This site was selected as a likely 'hot-spot' for fugitive emissions in the knowledge that a long established scrap metal recycling plant and a stone crushing/aggregate transfer site exist on opposite sides of the road. The road itself is a significant arterial road which carries a relatively high proportion of heavy goods vehicles (11%). In recent months the extent of stone crushing/aggregate handling has substantially reduced in line with the operator's changing commercial plans.

The relative contributions to the measured PM₁₀ values at this site are difficult to establish with accuracy, but the Design Manual for Roads and Bridges (DMRB) assessed road traffic component is of the order of 6ug/m³, which, when added to the estimated background concentration gives a predicted value of the order of 25ug/m³ for road traffic sourced PM₁₀

The number of recorded daily exceedences of the 24hour mean objective, (50ug/m³, to be exceeded not more than 35 times/year), has, as expected, shown a marked downward trend during the past 4 months. (Results are tabulated at Appendix 3.)

DEFRA's commentary on the conclusions of the Updating & Screening assessment made reference to the Osiris data, suggesting that this indicated a possible issue of concern regarding PM₁₀ values in this locality and sought confirmation that there are no locations of 'relevant exposure' in the vicinity.

The closest residential property, which constitutes a 'relevant location', stands 150 metres to the west of the monitoring site. Being to the west, it is upwind of the prevailing south-westerly wind. During the summer months of 2003 several residents of properties with gardens adjacent to the scrap metal

recycling plant registered complaints of excessive dust impact (and also noise impact).

Investigations were undertaken and, following discussions with management, improved mitigation measures were devised and implemented, which involved the erection of a 6 metre high solid fence at the boundary between the plant site and the gardens of the properties concerned (completed at the end of September, and erected principally as a noise barrier) and greater frequency of yard sweeping together with appropriate water spray application measures.

Complaints about both dust and noise from the site have now ceased.

The continuous smoke & sulphur dioxide monitoring station, sited at Ferndale Road, Swindon has been maintained and continues to provide confirmation that the concentration of these pollutants remains at a very low level. (Results are tabulated at Appendix 1.)

5. Local Developments:

Industrial sources of pollution within the Swindon locality have remained stable during the past year with no new significant industrial processes having been established during the past year, and no complaints concerning pollution events arising from any existing authorised processes having been received.

The re-location of the town's main hospital, from Okus to Commonhead, at the south-eastern extremity of the town, occurred from the beginning of 2002, with an inevitable impact upon traffic flow patterns within the town. No detectable impact upon localised traffic generated pollution levels has occurred however, and indeed the site at Kingshill Road might have been expected to be returning lower values given that Kingshill Road was a significant feeder road to the old hospital at Okus.

Studies are taking place into the provision of a new feeder road to link the northern expansion zone with the main west to east arterial road (Great Western Way).

Several individual routes are presently under consideration, and a primary factor for determination is the potential impact upon pollution levels in the vicinity of any residential premises which will border the new route. Consultants are charged with modelling the potential impact of each of the route options.

The proposed development of the 'front garden', to the south of the town, has recently received approval in principle. Traffic flow and air quality impacts due to arise from this large development have been modelled by consultants who predict no exceedences of the traffic generated pollutants within the next 10 years.

The usage of Swindon's two Park-and-Ride schemes continues to increase with average town centre traffic volumes consequently reduced. The development of a third site, to the east of the town, has now won planning approval and development works are due to commence in the near future.

Appendix 1

Sulphur Dioxide Monitoring Data

Ferndale Road Monitoring site, Swindon [Grid ref: SU 147 858]
(Urban Background classification - Site code 3220002)

This continuous monitoring station, measuring Smoke & Sulphur Dioxide levels has been established on the site at the ex-Ferndale Road Secondary school (now occupied by Oxford Brookes university) since 1963 and has confirmed the progressive reduction in levels of these pollutants since the decline of the railway workshops in this locality, the phasing out of coal burning steam locomotive power in the late 1960's and the progressive move away from coal as a staple fuel for home heating.

	Annual Mean value ug/m3	Equivalent annual mean p.p.b.
1990/91	20	8
1991/92	18	7
1992/93	14	5
1993/94	12	5
1994/95	13	5
1995/96	13	5
1996/97	11	4
1997/98	10	4
1998/99	10	4
2000	9	3
2001	9	3
2002	7	3

Guidance advises that measured daily mean concentrations should be multiplied by a factor of 1.25 to take account of a general tendency for bubbler samplers to under-read at high concentrations.

In the year 2002 the highest recorded daily concentration at this site was 13 ug/m³, which was recorded on a total of 32 days during the year. Applying the correction factor produces a figure of 16.25ug/m³. During 2001 the highest figure was 24ug/m³ [recorded on 3 days] (30ug/m³ corrected).

Appendix 2

2000 Nitrogen Dioxide diffusion tube results: ug/m3

site 1:	GWR Museum , Faringdon Road, Swindon	<i>(Roadside site - 2.7m from kerbside at Emlyn Square)</i>
site 2:	Pipers Way, Swindon	<i>(Intermediate site – 30m from Pipers roundabout)</i>
Site 3:	Roussel Laboratory, Kingfisher Drive, Swindon	<i>(Urban background site – 123m from Dorcan Way)</i>
Site 4:	Crowdys Hill School, Jefferies Avenue, Swindon	<i>(Urban background site – 170m from Cricklade Road)</i>
Site 5:	F/O 186 Kingshill Road, Swindon	<i>(1m from Kingshill Road, at bottom of hill)</i>
Site 6	Chalet School, Queens Drive, Swindon	<i>(14.3m from Queens Drive)</i>
Site 7:	Link Centre, Tewkesbury Way, Swindon	<i>(61m from Tewksbury Way)</i>
Site 8:	Thornhill, South Marston	<i>(on Thornhill roundabout)</i>
Site 9:	Village Hall, South Marston	<i>(10m from Old Vicarage Lane)</i>
Site 10:	Ermin Street, Blunsdon	<i>(on dual-carriageway central reservation)</i>
Site 11:	South Street, Swindon	<i>(Established Nov.1999) (1m from kerbside in South Street)</i>
Site 12:	Swindon Bus Station	<i>(Established Nov.1999) (within Bus Station)</i>
Site 13:	Meadow Way, Badbury Wick	<i>(Established Dec.1999) (74m from M4 Motorway kerbside)</i>
Site 14:	Kingshill Road/Clifton Street, Swindon	<i>(Established Dec.1999) (1m from kerbside of Kingshill Road, towards top of hill)</i>
Site 15:	Westcott Place, Swindon	<i>(Established Dec.1999) (1.4m from kerbside of Westcott Place)</i>
Site 16:	F/O 483 Cricklade Road, Swindon	<i>(Established Dec.1999) (5.5m from kerbside of Cricklade Road)</i>
Site 17:	Bruce Street Bridges, Swindon	<i>(Established Dec.1999) (5.5m from kerbside of Bruce Street roundabouts)</i>
Site 18:	Validation sample	<i>(*located at site 5)</i>

site no.	Jan.	Feb.	Mar.	Apr.	May	June.	July	Aug	Sept	Oct	Nov	Dec
1	44.1	36.6	41.3	36.1	19.5	34.8	27.9	25.9	35	23.8	38.5	33.2
2	29.5	24.9	22.6	23.1	22.8	20.2	12.4	20.3	19.9	20.5	22	25.6
3	31.5	26.3	26.4	18.3	18.9	15.5	16.2	18.4	22.4	18.9	20.1	30
4	34.2	n/r	22.9	19.7	15.6	18	10.4	21.6	20.4	38.9	31.9	26.5
5	54.7	39.6	43.3	43.5	43.8	43.7	31.7	42.1	40.2	31.9	40.5	49.8
6	49.7	46.8	43.2	30.5	32.6	33.4	24.2	34.3	32.7	26.4	49.8	39.4
7	34.6	29.9	32.9	23.9	n/r	18.9	16.3	18.6	17	20.8	24.9	25.9
8	44.2	41.7	29.1	30.3	19.8	29.1	14.6	26.2	36.2	35.4	49.8	36.7
9	36	27.7	23.4	14.5	13.1	15.3	8.9	15.3	15.7	19.1	26.6	27.3
10	42.3	29.8	41.1	37.4	28	35.4	29.7	32.5	28.6	30.8	30.9	36.4
11	39.6	32.7	33.9	27.6	22.1	16.6	15.2	20.1	24.1	25.2	30.5	34.7
12	43.6	45.9	49	41.9	37.5	50.4	35.2	35.8	36.4	44	58	47.7
13	46.5	42.6	43.2	25.1	27.4	34.6	21	31.1	26.5	30.5	39.5	42.7
14	49.9	59.1	55.1	42.7	51.4	63.1	38.5	54.1	39.8	39.9	49.6	41.5
15	47.8	46.7	53	53.6	48.8	33.7	30.8	37	44.8	n/r	n/r	48.3
16	51	44.9	48.9	35.1	38.8	33.7	29.2	39.6	34.8	40.8	42.6	37.1
17	42.7	28.9	39.7	42.3	50.1	29.9	22.5	33	27.8	20.3	31.5	42

18*	32.1	46.5								36.1	40.8	50.9
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Sites **1,2,3 & 4** contribute to the National Survey and are classified accordingly.

2000 Annual Mean Values:

Site 1:	<i>(2.7m from kerbside at Emlyn Square)</i>	33.1 ug/m3 (82.75%)	12 samples
Site 2:	<i>(30m from Pipers Roundabout)</i>	22.0 ug/m3 (55.00%)	12 samples
Site 3:	<i>(123 m from Dorcan Way)</i>	21.9 ug/m3 (54.75%)	12 samples
Site 4:	<i>(170m from Cricklade Road)</i>	23.7 ug/m3 (59.25%)	11 samples
Site 5:	(1m from kerbside at bottom of Kingshill Road)	42.1 ug/m3 (105.25%)	12 samples
Site 6:	(14.3m from Queens Drive)	36.9 ug/m3 (92.25%)	12 samples
Site 7:	(61m from Tewksbury Way)	24.0 ug/m3 (60.00%)	11 samples
Site 8:	(on Thornhill Roundabout)	32.8 ug/m3 (82.00%)	12 samples
Site 9:	(10 m from Old Vicarage Lane)	20.2 ug/m3 (50.50%)	12 samples
Site 10:	(on dual-carriageway central reservation)	33.6 ug/m3 (84.00%)	12 samples
Site 11:	(1m from kerbside at South Street)	26.9 ug/m3 (67.25%)	12 samples
Site 12:	(within Bus Station)	43.8 ug/m3 (109.50%)	12 samples
Site 13:	(74m from M4 Motorway)	34.2 ug/m3 (85.50%)	12 samples
Site 14:	(1m from kerbside at top of Kingshill Road)	48.7 ug/m3 (121.75%)	12 samples
Site 15:	(1.4m from kerbside at Westcott Place)	44.5 ug/m3 (111.25%)	10 samples
Site 16:	(5.5 m from Cricklade Road)	39.7 ug/m3 (99.25%)	12 samples
Site 17:	(5.5 m from Bruce Street Roundabout)	34.2 ug/m3 (85.50%)	12 samples
Site 18:	Validation sample for Site 5	41.3 ug/m3 (103.25%)	5 samples

2001 Nitrogen Dioxide diffusion tube results - ug/m3

Site Nos 1 & 3 > 18 details as 2000

NOTE: Beginning January 2001, the classifications of sites contributing to the National survey were altered by NETCEN with the effect that Site Nos 1 & 16 are now 'Roadside' sites, (being sites 1 – 5 metres from a busy road, but may be up to 15metres) with sites 3 & 4 'Urban Background' sites,(being sites >50 metres from a busy road and typically in a residential area).

Site No. 2 now re-located at Leamington Grove, Swindon [Grid Ref: SU 166 827] from 01/01/01 and deleted from National Survey.

Site No.16 classified as a 'Roadside' Site contributing to National Survey from 01/01/01 - Due to repeated loss of tubes, this site re-located to F/O 461 Cricklade Road with effect from 02/10/2001; due to further repeated loss of tubes, this site re-located again to opposite side of Cricklade Road, F/O No. 422 (lamp-post 124, 2.6m from kerbside) with effect from 04/03/2003.

site no.	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1	n/r	42.3	28.5	33.9	34.7	25.2	23.9	23.2	29.3	30.8	35.5	n/r
2	35.5	31.7	30.6	20.2	15.6	8.8	9.7	13.5	17.7	14.5	30.3	21.5
3	30.3	36.3	24.3	19.2	23.3	12.3	16.8	15.7	13.6	17.2	32.6	28.7
4	n/r	29.4	26.2	20.7	19.5	10	14.1	16.9	15.6	24.6	34.4	26.5
5	25.9	50.4	37.3	35.6	18.9	28.9	n/r	33.6	29.9	39	56.6	35.9
6	39.1	47	31.9	41.1	28.8	24.5	27.8	29.8	21.4	21.4	45.5	28.9
7	28.3	36.3	26.3	18.6	23.1	12.7	n/r	17.8	n/r	23.4	34.6	26.3
8	36.8	33.9	32.9	21.9	20.5	16.2	25.4	15.2	21.4	27.7	47.6	25.8
9	21	26.7	22.4	18.5	14.3	11.8	14.6	12.5	18.3	15.5	34.4	25.5
10	28.2	42.8	33	28.6	44.7	20.3	26.4	24	32.8	28.8	41.1	38.8
11	44.9	n/r	33.3	26.3	25.7	11.3	15.3	17.7	19	25.2	35.4	19.2
12	50.5	56.3	52.2	57.9	50.3	23.6	35.5	35.5	33.7	37.1	57.7	n/r
13	38.5	46	39.7	36.1	25.4	14.7	22.6	21.6	13.8	31.3	52.8	n/r
14	44.9	61.65	55.7	43.6	49.1	28.3	40.6	37.9	29.1	37.4	44.8	46.9
15	n/r	52.6	n/r	39.2	28	23.4	n/r	32.8	37	42	n/r	n/r
16	34	48.9	n/r	n/r	n/r	22.1	n/r	n/r	n/r	23.1	n/r	29.5
17	56.9	46.2	43.2	28.8	40.5	19.7	17.2	22.1	24.2	30.5	42.3	40.8
*18	37.3	49.9	47.2	32	31.4	15	n/r	33.5	35.2	36.8	34.7	29.8

2001 Annual Mean Values:

Site 1: (2.7m from kerbside at Emlyn Square)	30.73ug/m ³ (76.83%)	10 samples
Site 2: (0.5m from kerbside at Leamington Grove)	20.80ug/m ³ (52.00%)	12 samples
Site 3: (123m from Dorcan Way)	22.53ug/m ³ (56.33%)	12 samples
Site 4: (170m from Cricklade Road)	21.63ug/m ³ (54.08%)	11 samples
Site 5: (1m from kerbside at bottom of Kingshill Road)	35.64ug/m ³ (89.10%)	11 samples
Site 6: (14.3m from Queens Drive)	32.27ug/m ³ (80.68%)	12 samples
Site 7: (61m from Tewksbury Way)	24.74ug/m ³ (61.85%)	10 samples
Site 8: (on Thornhill Roundabout)	27.19ug/m ³ (67.98%)	12 samples
Site 9: (10m from Old Vicarage Lane)	19.63ug/m ³ (49.08%)	12 samples
Site 10: (on dual-carriageway central reservation)	32.46ug/m ³ (81.15%)	12 samples
Site 11: (1m from kerbside at South Street)	24.85ug/m ³ (62.13%)	11 samples
Site 12: (within Bus Station)	44.57ug/m³ (111.43%)	11 samples
Site 13: (74m from M4 Motorway)	31.14ug/m ³ (77.85%)	11 samples
Site 14: (1m from kerbside at top of Kingshill Road)	43.33ug/m³ (108.33%)	12 samples
Site 15: (1.4m from kerbside at Westcott Place)	36.43ug/m ³ (91.08%)	7 samples
Site 16: (5.5m from kerbside at Cricklade Rd.)*	31.52ug/m ³ (78.80%)	5 samples
Site 17: (5.5m from Bruce Street roundabout)	34.37ug/m ³ (85.93%)	12 samples
Site 18: (Validation sample for Site 5)	34.80ug/m ³ (87.00%)	11 samples

* Note: site re-located to within 2.5m from kerbside of Cricklade Road (F/O No. 461) from October 2001 due to repeated tube loss.

2002 Nitrogen Dioxide diffusion tube results - ug/m3

All sites as 2001

site no.	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1	34.8	24.4	34.7	38.7	n/r	21.1	29.4	29	28.7	29.3	19.5	20.9
2	20.3	19.8	19.1	n/r	11.5	11.5	10.2	7.9	22.2	20.3	25	29.6
3	26.9	n/r	n/r	16.4	19.5	7.9	18.2	16.9	20.7	24.8	25.9	39.7
4	31	22.7	17.5	18.2	12.2	15.6	14.5	13.4	23.1	24.5	26.9	10.6
5	n/r	38.9	60.1	40.2	44.7	n/r	18.8	28.9	35	37.5	44	41.3
6	31.4	30.3	42.4	29.5	28.9	22.2	12.9	13.5	24	37.4	34.4	26.7
7	25.6	29.9	36.5	18.9	n/r	n/r	17.6	14.7	17.7	14.8	18.5	29.4
8	32.4	21.7	27.8	23.2	n/r	13.2	26.9	16	17.6	32.2	26.9	20.8
9	44.8	21.7	36.1	13.2	13.1	18.5	17.4	8.9	12.7	22.2	12.2	27.3
10	26.9	23.6	31.3	20.6	20.6	19.7	27.1	26.5	45.7	37.7	28.6	23.3
11	31.6	27.1	33.5	20.5	19	n/r	13.4	n/r	23.4	11.2	8.2	31.3
12	41.7	14.4	44.8	47.9	46	30.5	40.8	30.2	45.7	46.7	47.3	30.6
13	31.8	26.8	37.7	31.5	40.4	45.1	35.4	19	31.6	34.4	21.7	17.4
14	47.4	31	44.3	34.5	39.7	n/r	n/r	35.3	48.2	47.4	20.8	37.2
15	33.1	n/r	30.3	n/r	n/r	15.2	40.9	28.7	48	45.6	53.1	29.8
16	44	18.7	36.2	23.8	22.5	15.9	n/r	22.7	n/r	n/r	n/r	n/r
17	28.5	21.2	33.1	30	28.5	15.5	22.2	17.8	43.6	38.1	37.8	42.0
*18	n/r	33.6	46.4	n/r	32.1	n/r	29.4	29.4	32	26.8	41.8	38.3

2002 Annual Mean Values:

Bias correction factor = 1.09: values indicated in [] brackets

Site 1:	28.23 ug/m3 (70.58%)	[30.77ug/m3]	[76.93%]	11 samples
Site 2:	17.95 ug/m3 (44.88%)	[19.57ug/m3]	[48.93%]	11 samples
Site 3:	21.69 ug/m3 (54.23%)	[23.64ug/m3]	[59.10%]	10 samples
Site 4:	19.18 ug/m3 (47.95%)	[20.91ug/m3]	[52.73%]	12 samples
Site 5:	38.94 ug/m3 (97.35%)	[42.44ug/m3]	[106.10%]	10 samples
Site 6:	27.80 ug/m3 (69.50%)	[30.30ug/m3]	[75.75%]	12 samples
Site 7:	22.36 ug/m3 (55.90%)	[24.37ug/m3]	[60.93%]	10 samples
Site 8:	23.52 ug/m3 (58.80%)	[25.64ug/m3]	[64.10%]	11 samples
Site 9:	20.68 ug/m3 (51.70%)	[22.54ug/m3]	[56.35%]	12 samples
Site 10:	27.63 ug/m3 (69.08%)	[30.12ug/m3]	[75.30%]	12 samples
Site 11:	21.92 ug/m3 (54.80%)	[23.89ug/m3]	[59.73%]	10 samples
Site 12:	38.88 ug/m3 (97.20%)	[42.38ug/m3]	[105.95%]	12 samples
Site 13:	31.07 ug/m3 (77.68%)	[33.87ug/m3]	[84.68%]	12 samples
Site 14:	38.58 ug/m3 (96.45%)	[42.05ug/m3]	[105.13%]	10 samples
Site 15:	36.07 ug/m3 (90.18%)	[39.32ug/m3]	[98.30%]	9 samples
Site 16:	26.43 ug/m3 (66.08%)	[28.81ug/m3]	[72.03%]	7 samples
Site 17:	29.86 ug/m3 (74.65%)	[32.55ug/m3]	[81.38%]	12 samples
Site 18*:	34.42 ug/m3 (86.05%)	[37.52ug/m3]	[93.80%]	9 samples

2003 Nitrogen Dioxide diffusion tube results – ug/m3

All sites as 2002 excepting Site 16, which was re-located, due to repeated tube loss, to opposite side of road, F/O 422 Cricklade Road, 2.6m from kerbside, with effect from 04/03/03

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	37.0	44.7	35.3	32.9	26.4	38.8	24.9	30.3	32.5	41.0	40.0	40.8
2	27.7	29.4	25.3	20.5	10.5	13.9	11.6	18.7	17.6	26.3	25.9	31.6
3	30.9	34.8	30.5	25.2	5.8	18.0	13.9	22.1	25.1	30.5	36.4	33.2
4	26.5	24.7	28.8	22.7	14.4	18.3	11.9	16.1	24.5	25.0	N/r	27.8
5	45.6	34.9	44.8	40.6	21.0	39.8	33.0	33.0	46.8	34.9	39.6	44.5
6	41.7	42.4	31.3	34.6	25.9	41.2	30.6	29.6	35.4	38.8	38.0	37.3
7	30.5	33.0	32.2	26.1	16.1	16.8	17.5	23.6	23.3	25.4	31.1	32.2
8	36.6	44.2	16.4	31.8	21.5	18.0	27.2	N/r	N/r	34.5	50.4	44.9
9	27.5	34.3	23.6	18.4	9.9	16.1	12.9	15.6	19.8	23.6	29.5	30.5
10	38.7	47.7	33.0	44.0	30.7	25.4	25.6	49.6	42.5	36.2	36.1	46.4
11	31.8	39.9	34.0	28.0	15.0	15.7	17.6	17.4	21.6	32.5	41.3	40.3
12	52.5	50.4	61.6	45.9	49.8	52.9	43.1	45.9	53.7	51.4	61.5	58.3
13	42.0	48.0	42.8	39.2	24.9	36.9	36.3	33.2	45.7	31.8	42.5	39.7
14	53.4	63.9	50.6	48.9	35.7	57.1	51.1	50.8	59.1	44.2	52.9	52.2
15	47.3	n/r	n/r	39.0	29.9	31.1	27.1	33.2	36.3	42.9	42.1	51.9
16	n/r	n/r	42.8	40.2	23.8	30.7	27.8	38.6	45.2	37.2	41.5	49.3
17	35.5	56.8	60.8	48.1	19.9	27.8	21.7	38.2	30.6	43.8	38.6	46.0
18*	45.5	50.8	58.6	36.5	28.5	37.5	34.0	40.8	38.9	35.5	43.5	48.4

2003 Annual Mean Values:

Bias correction factor = 0.92: values indicated in [] brackets

Site 1:	35.38ug/m3 (88.45%)	[32.55ug/m3] [81.38%]	12 samples
Site 2:	21.58ug/m3 (53.95%)	[19.85ug/m3] [49.63%]	12 samples
Site 3:	25.53ug/m3 (63.83%)	[23.49ug/m3] [58.73%]	12 samples
Site 4:	21.88ug/m3 (54.70%)	[20.13ug/m3] [50.33%]	11 samples
Site 5:	38.21ug/m3 (95.53%)	[35.15ug/m3] [87.88%]	12 samples
Site 6:	35.57ug/m3 (88.93%)	[32.72ug/m3] [81.80%]	12 samples
Site 7:	25.65ug/m3 (64.13%)	[23.60ug/m3] [59.00%]	12 samples
Site 8:	32.55ug/m3 (81.38%)	[29.95ug/m3] [74.88%]	10 samples
Site 9:	21.80ug/m3 (54.50%)	[20.06ug/m3] [50.15%]	12 samples
Site 10:	37.99ug/m3 (94.98%)	[34.95ug/m3] [87.38%]	12 samples
Site 11:	27.93ug/m3 (69.83%)	[25.70ug/m3] [64.25%]	12 samples
Site 12:	52.25ug/m3 (130.63%)	[48.07ug/m3][120.18%]	12 samples
Site 13:	38.58ug/m3 (96.45%)	[35.49ug/m3] [88.73%]	12 samples
Site 14:	51.66ug/m3 (129.15%)	[47.53ug/m3][118.83%]	12 samples
Site 15:	38.08ug/m3 (95.20%)	[35.03ug/m3] [87.58%]	10 samples
Site 16:	37.71ug/m3 (94.28%)	[34.69ug/m3] [86.73%]	10 samples
Site 17:	38.98ug/m3 (97.45%)	[35.86ug/m3] [89.65%]	12 samples
Site 18:	41.54ug/m3(103.85%)	[38.22ug/m3] [95.55%]	12 samples

2004 Nitrogen Dioxide diffusion tube results – ug/m3

All sites as 2003

Site No.	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1	26.3	37.7	28.8	33.0	30.1	26.2						
2	21.4	25.6	19.7	15.9	16.4	10.1						
3	27.3	28.2	21.2	25.5	19.9	13.9						
4	28.0	28.9	23.4	19.6	14.1	14.2						
5	40.3	39.1	N/r	38.6	29.6	26.6						
6	41.3	36.7	28.2	28.7	29.1	32.0						
7	18.1	32.2	19.3	20.0	18.2	15.5						
8	38.4	39.1	29.9	32.3	N/r	21.0						
9	23.6	23.3	18.3	16.4	15.4	15.0						
10	33.6	41.4	29.3	32.7	40.4	20.8						
11	25.2	31.1	23.9	23.4	21.9	12.0						
12	49.1	58.4	43.3	42.1	44.9	47.9						
13	36.8	37.4	32.5	35.5	27.4	29.8						
14	46.0	53.7	33.0	46.2	32.8	30.4						
15	30.5	42.3	28.4	26.7	38.1	28.4						
16	30.0	44.9	32.4	34.5	35.4	21.1						
17	27.3	39.1	29.1	31.6	33.5	18.2						
18	40.4	40.6	N/r	30.7	32.2	31.2						

Appendix 3

PARTICULATE MATTER MONITORING DATA

Bridge End Road Site, Swindon (Grid Ref: SU 167 861)

The continuous monitoring station was established in mid-August 2001 with the objective of gauging the daily variations and the average values of particulate matter pollution in the locality, which contains both a scrap metal recycling plant and a stone crushing/aggregate handling plant.

(Data continuity has been impaired by intermittent and prolonged power disruption)

<u>2001</u>	<u>Max.daily reading</u>	<u>No.of days exceeding 50ug/m3</u>
August (from 15.08)	83	9
September	54	1
October	63	3
November	83	8
December	55	2
<u>2002</u>		
January (to 31.01)	58	3
April (from 16.04)	64	4
May (to 31.05)	76	6
December (from 13.12)	90	1
<u>2003</u>		
January	71	2
February (to 02.02)	79	1
April (from 01.04 to 10.04)	69	2
July	91	11
August	103	12
September	112	14
October	79	4
November	83	1
December	56	1
<u>2004</u>		
January	65	1
February	80	5

The Osiris monitor has not been calibrated for direct comparison of results with the Air Quality objective for PM₁₀ because the purpose of selection of this site was targeted investigation of the locality.

Appendix 4

Objectives included in the Air Quality Regulations 2000 and (Amendment) Regulations 2002 for the purpose of Local Air Quality Management:

<u>Pollutant</u>	<u>Air Quality Objectives</u>		<u>Achievement</u>
	Concentration	Measured As	<u>Date</u>
Benzene <i>All authorities</i>	16.25 ug/m ³	Running Annual Mean	31.12.2003
<i>Authorities in England & Wales only</i>	5 ug/m ³	Annual Mean	31.12.2010
1,3 Butadiene	2.25 ug/m ³	Running Annual Mean	31.12.2003
Carbon Monoxide	10.0 mg/m ³	Maximum Daily running 8-hour Mean	31.12.2003
Lead	0.5 ug/m ³	Annual Mean	31.12.2004
	0.25 ug/m ³	Annual Mean	31.12.2008
Nitrogen Dioxide	200 ug/m ³ not to be exceeded more than 18 times per year	1-hour Mean	31.12.2005
	40 ug/m ³	Annual Mean	31.12.2005
Particles (PM ₁₀) (gravimetric)	50 ug/m ³ not to be exceeded more than 35 times	24-hour Mean	31.12.2004
	40 ug/m ³	Annual Mean	31.12.2004
Sulphur Dioxide	350 ug/m ³ not to be exceeded more than 24 times per year	1-hour Mean	31.12.2004
	125 ug/m ³ not to be exceeded more than 3 times per year	24-hour Mean	31.12.2004
	266 ug/m ³ not to	15-minute Mean	31.12.2005

Appendix 5

Glossary of Terms:

SO ₂	Sulphur Dioxide
NO ₂	Nitrogen Dioxide
NO _x	collective term to describe Nitric Oxide & Nitrogen Dioxide
PM ₁₀	Particulate Matter less than 10 microns in diameter
ug/m ³	Micrograms / cubic metre (i.e. one-millionth of a gram of pollutant per cubic metre)
DEFRA	Department of Environment, Food & Rural Affairs
DTLR	Department of Transport, Local Government and the Regions
DMRB	Design Manual for Roads & Bridges