



South Derbyshire District Council

A Detailed Assessment of Nitrogen Dioxide levels at the
A444/Lullington Road junction in Overseal.

In fulfillment of Part IV of the Environment Act 1995

Local Air Quality Management

June 2010

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Executive Summary

Under the Environment Act 1995, Part IV, local authorities have a duty to review and assess the current and future air quality in their areas.

These predictions are then to be assessed against standards and objectives prescribed in the Air Quality Strategy, published in January 2000 and in The Air Quality (England) Amendment Regulations 2002.

Our Updated Screening Assessment 2009 report highlighted a likelihood of an air quality objective being exceeded, and therefore we are required to undertake a Detailed Assessment for the nitrogen dioxide (NO₂) annual mean objective at the junction of the A444 and Lullington Road in Overseal.

Closer examination of the methods used to monitor air quality at this location, and undertaking additional monitoring using quality-assured monitoring suggests that the air quality objectives are not being breached, and that the levels measured at this location are not representative of the relevant exposure levels.

Introduction

Where the Updating and Screening Assessment has identified a risk that an air quality objective will be exceeded at a location with relevant public exposure, a Detailed Assessment must be undertaken following the guidance set out in Technical Guidance LAQM.TG(09). The aim of the Detailed Assessment is to identify with reasonable certainty whether or not a likely exceedence will occur.

South Derbyshire District Council have undertaken this assessment by conducting additional monitoring of nitrogen dioxide at this location using diffusion tubes.

Assessment method

Diffusion tubes are small plastic tubes containing a media, which upon exposure to pollutants passively absorbs them. Once returned to a laboratory for analysis, a calculation can be made of the mean pollutant concentration in the location of the tube from the duration of exposure and amount of pollutants absorbed. The laboratory uses a 10% TEA in water preparation method, and follows the procedures set out in the Harmonisation Practical Guidance as required by DEFRA and the Devolved Administrations. Some tube locations have been added and others have been changed to ensure that the districts hot spots are covered and to replace stolen or vandalised tubes. The tubes are located at 11 points around the district as listed above and are analysed monthly by the Environmental Services Group (ESG) in Glasgow.

The results from the laboratory need to be bias adjusted to correct for the inherent inaccuracies that occur using this method. This can be done by comparing the results to those obtained from a local real-time NO₂ monitor that was located at the same site as one of the tubes, or from figures derived by the laboratory supplying and analysing the tubes. We use the figure provided by our tube supplier, as we do not have tubes collocated in our district. ESG supplied a bias adjustment value of 0.81 for 2009.

Alison Loader from AEA has confirmed that the Environmental Services Group have demonstrated satisfactory performance in the last round of the WASP scheme which checks laboratory precision for analysis of NO₂ diffusion tubes.

All monitoring methods are subject to limitations. South Derbyshire District Council considered the use of continual automatic analysers to undertake this assessment with. Quotes were obtained for this work, and the benefits considered.

For the full 6 months monitoring recommended in LAQM.TG(09) Bureau Veritas quoted £11,302. This price was dependent upon the monitoring station fitting in the very limited space that was available, and initial discussions with the suppliers indicated that the monitoring station may have to go inside the adjacent building (a public house), in a secure room if possible, which would have resulted in additional costs. On top of this were the costs to connect to and power the unit, the costs and resource implications in training staff to enable them to undertake comprehensive Local Site Operator duties every 4 weeks, (a service the supplier could provide at an extra £2,400 for 6 months). See appendix 5 for further details.

The main justification for the use of a continual analyser over diffusion tubes is improved detail and accuracy. It should be noted however that DEFRA Technical Guidance TG09 confirms continuous analysers are up to 15%, and diffusion tubes up to 25% uncertainty (source A1.36 & A1.40 LAQM TG 09).

For the afore mentioned reasons, the installation of an automatic analyser for what could be just an anomaly did not seem justifiable, and so it was decided to measure levels in more detail using additional diffusion tubes. Whilst not recommended, TG09 accepts that diffusion tubes can be the only practicable monitoring method, and are acceptable provided that;

1. Monitoring should be carried out for a full year;
2. Tubes should be deployed at several sites in the vicinity if possible (for example, at several points around a busy junction);
3. The precision of the tubes used should be ascertained: a supplier should be selected whose tubes have demonstrated good precision; and
4. The accuracy of the tubes should be quantified. An appropriate bias adjustment factor should be applied to the annual mean.'

Monitoring was carried out at the 3 locations around the road junction where there is a relevant receptor. A plan of the locations is provided in appendix 3. These locations are as follows:

Description	Site type	Grid reference	Distance to relevant exposure
5. Robin Hood PH, Burton Road, Overseal	Roadside	429450,315450	<1m
7. Road sign adjacent to Robin Hood PH, Lullington Road.	Kerbside	429454,315403	<2m
8. Road sign next to 1 Lullington	Kerbside	429463,315389	<2m

Road			
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Note: location numbering relates to site numbering used for South Derbyshire District Council's diffusion tube monitoring network, further details can be found in the 2010 Progress Report accompanying this document.

Site 7 is within 10m and site 8 within 20m approximately of site 5. Both sites are representative of relevant exposure.

Monitoring Results

Additional monitoring of nitrogen dioxide levels began in August 2009 with the relocation of tubes 7 & 8 to this location. The data has been annualised following the procedures provided in Box 3.2 of TG09 (see appendix 1).

	Site 5	Site 7	Site 8
Jan-09	53		
Feb-09	71		
Mar-09	57		
Apr-09	63		
May-09	42		
Jun-09	48		
Jul-09	50		
Aug-09	54	22	31
Sep-09	62	49	47
Oct-09	40	-	47
Nov-09	50	46	-
Dec-09	55	42	-
Average	54	40	42
Bias corrected	44	32	34
Annualised	44	32	33

All values are in $\mu\text{g}/\text{m}^3$.
 '-' denotes tube missing

Discussion

The results show that site 5 is not recording NO₂ levels which are indicative of the relevant exposure for the area. Site 7 & 8 are exposed to the same volume of traffic, and are closer to the highway than site 5, and yet levels at those locations are considerably lower than those recorded at site 5, which is only a few metres away. Interestingly results for sites 7 and 8 are very close to each other, as would be expected from monitoring in the same area.

The location under assessment is a junction, which is relatively free flowing, and by no means the busiest compared to other areas in South Derbyshire where air quality is also monitored without any exceedence of air quality objectives. Furthermore, upon closer examination of the monitoring location, and consideration of the DEFRA document UK NO₂ Diffusion Tube Network Instruction Manual, several factors were identified which could lead to measurements taken at site 5 reporting exaggerated NO₂ levels.

The manual states that ‘Care must be taken to avoid any very localised sources, or sinks of NO₂’... ‘For example, close proximity (less than 10 m) to the following must be avoided:

- Heater flues (particularly low level balanced flues)

- Trees and other vegetation

- Air conditioning outlets

- Extractor vents

- Underground ventilation shafts’

As the picture in appendix 4 shows, there is a flue, several air conditioning outlets and an extractor all within approximately 5 metres of the diffusion tube, making this location an unsuitable monitoring location and likely to produce results not representative of relevant exposure. It is proposed to continue to monitor at this location, along with the 2 new locations one the same junction, for a twelve-month period, and unless levels at the other locations also indicate a likely exceedence, monitoring at this location will end.

Work was undertaken to model predicted air quality this location using the DMRB screening method. Initial results indicated that NO₂ levels should be well below air quality objectives, however before completing the modelling process, an extensive model verification procedure would have had to be undertaken. To ensure this was done properly the Air Quality Helpdesk was contacted to agree the best way forwards. The Helpdesk confirmed that the DMRB results are regularly found to be inaccurate, and that the model would be replaced soon. The modelling exercise was therefore abandoned in favour of taking actual measurements to form the basis of this detailed assessment.

Conclusions and proposed actions

South Derbyshire District Council are confident that the air quality objectives are not being breached at this location. Site 5 has reported unexpectedly high readings in the past (see 2005 Progress Report), unfortunately at this stage the error of measuring NO₂ at an unsuitable location was not identified.

The main source of NO₂ at this location is from road traffic. TG09 states that the unexpected increase in primary emissions from this source is as a result in recent increase of diesel fleet cars and catalytically regenerative particle traps on some heavy-duty vehicles. It also reports that this source is expected to resume its downward trend in coming years. This combined with an expect decrease in background levels of nitrogen dioxide means that an exceedence is not expected at this location in the near future, although the site will be closely monitored.

References

1. DEFRA. (2008) *Diffusion Tubes for Ambient NO₂ Monitoring: Practical Guidance for Laboratories and Users*. DEFRA Publications.
2. DEFRA. (2008) *NO₂ Diffusion Tubes for LAQM: Guidance Note for Local Authorities*. AEA Energy & Environment on behalf of DEFRA.
3. DEFRA (2010). *WASP – Annual Performance Criteria for NO₂ Diffusion Tubes used in Local Air Quality Management (LAQM), 2008 onwards, and Summary of Laboratory Performance in Rounds 103-107*. Prepared by AEA on behalf of Defra and the Devolved Administrations. 2010
4. DEFRA. (2009). *Technical Guidance LAQM.TG(09)*. DEFRA Publications.
5. DEFRA (2003) *UK NO₂ Diffusion Tube Network Instruction Manual*. DEFRA Publication.

Appendices

1. Annualised data

Sites 7 & 8 In Overseal must be annualised as they cover the period August 2009 – December 2009.

This has been done as follows:

Annualise locations 6,7 & 8 following Box 3.2 of TG(09),

(Background Data from AURN)

	Annual Mean (AM) 2009	Period Mean (PM)	AM/PM Ratio
Chesterfield Urban	19	18.2	1.043956
Birmingham Tyburn	32	33.9	0.9439528
Sandwell West Bromich	27.1	27.5	0.9854545
		Average	0.991
		Site 7	Site 8
Average		39.75	41.667
Bias adjustment		32.2	33.75
Annualised		32	33

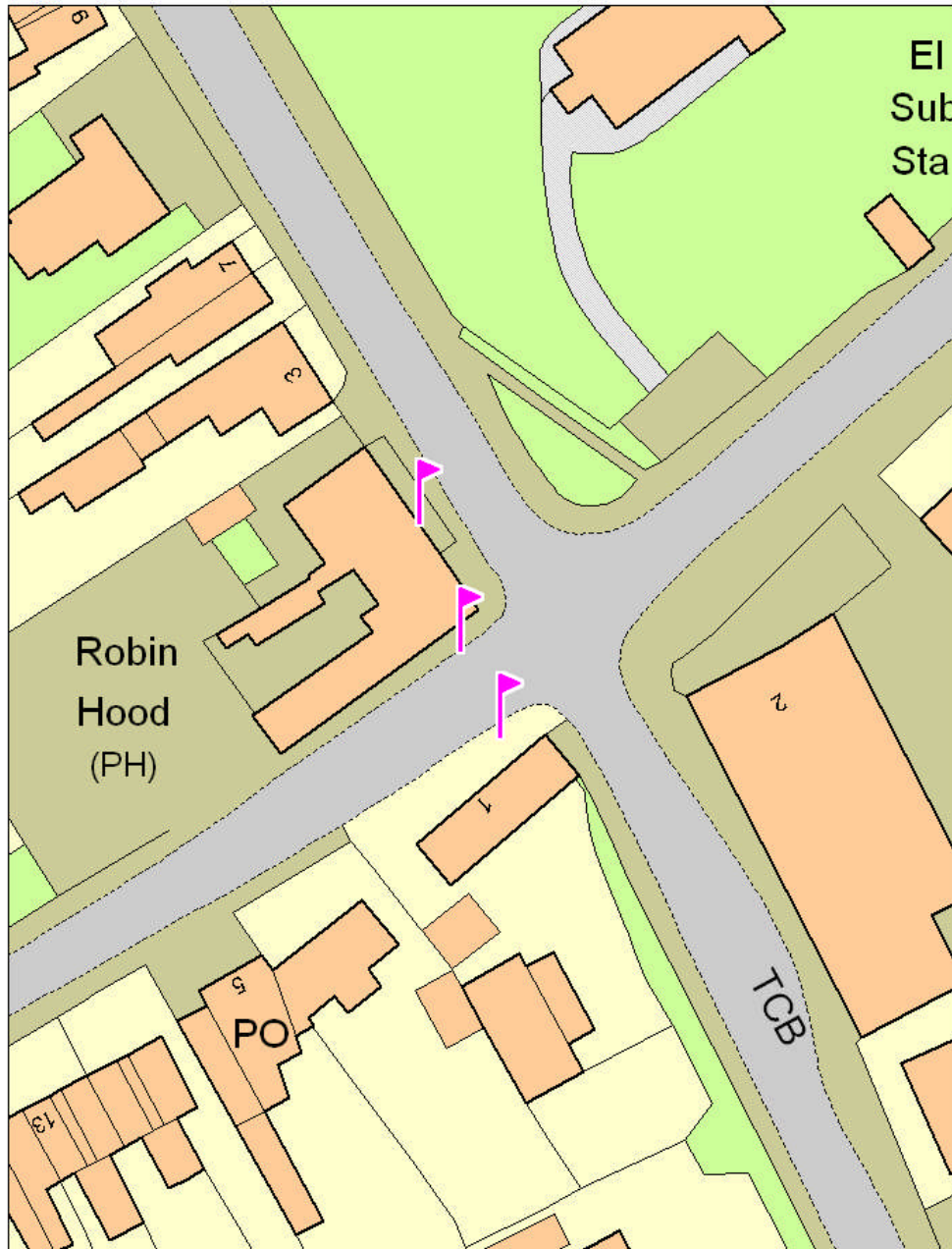
2. Plan of Overseal, South Derbyshire.



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3. Plan of NO₂ monitoring locations A444 Junction with B5004 in Overseal, South Derbyshire



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4. Image of monitoring location



Approximate location of diffusion tube, which is over reading

5. Bureau Veritas quote



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27th May 2009

Or Ref: 10GG.0589192

Dear John,

Re: NO₂ Monitoring at Overseal

In continuation of our recent communication, I am pleased to submit Bureau Veritas' fee proposal to undertake Air Quality monitoring in Overseal.

ABOUT BUREAU VERITAS

Bureau Veritas has extensive experience in setting up, running, collating and provision of quality data from automatic and non-automatic monitoring networks. The company has been the Central Management and Coordination Network (CMCU) for Defra's Automatic Urban and Rural Network (AURN) for more than 16 years. In addition, Bureau Veritas manage and operate networks for a number of power generators. These networks provide quality assured data on ambient pollutant levels.

SCOPE OF WORKS

You have expressed an interest in undertaking a programme of ambient air monitoring (primarily for NO₂). Bureau Veritas have sought competitive quotes from four instrument suppliers with which we have a considerable amount of experience and strong existing relationships. There was a significant range in costs (particularly for 6 month monitoring) and the costs for the cheapest supplier are provided within. Local Air Quality Technical Guidance (LAQM.TG(09)) recommends that monitoring should be carried out for 6 months, ideally split between winter and summer periods. However, 3 months, may be acceptable in circumstances where suitable monitoring stations can be identified for the determination of annualised data.

An initial site survey would be undertaken and is included in the quote. The quote assumes that the smallest suitable cabinet available is used. However, should this not be possible based on the site survey then a suitable alternative may be required to be sought, which may include the installation of equipment inside a secure room within the pub. This could potentially result in a contract variation.

The methodology and costs for undertaking the proposed monitoring are provided below.

METHODOLOGY

Automatic monitoring for NO₂ will be undertaken using a chemiluminescence NO_x analyser. The analyser provides accurate, reliable and efficient monitoring for NO, NO₂ and NO_x. The continuous NO_x /NO₂ analyser provides hourly measurements.

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The gas cylinder, along with the analyser, would be stored within a weatherproof housing which includes an air conditioning unit. Depending on site layout and available space the housing may be placed on a supporting plinth which must be secured into the ground by bolting into the pavement or placed on suitable stable ground.

We would recommend that the council take up the option for Bureau Veritas performing LSO (Local Site Operator) duties. Should the council wish to act as LSO, then the Council nominated personnel will be trained and material provided for the routine maintenance of the monitoring equipment and site in accordance with the high standards that we currently employ in running the National Air Quality Network.

Every 4 weeks a comprehensive site visit has to be undertaken by the LSO to do the following:

- pre-calibration checks
- routine functional and calibration checks using on-site sources
- sample inlet filter replacement
- post calibration checks
- site infrastructure checks

In order to maintain operational effectiveness of the data management it is imperative that the information from the routine calibration visits be provided to Bureau Veritas as soon as possible after site attendance (and no later than 48 hours).

Bureau Veritas will retrieve data from the monitoring instrument using the modem based software allowing connection to the analyser. The collected data, daily auto-calibration responses and analyser status outputs will be examined to establish that no instrument faults had developed. The data will be checked week days and should there be any problems you as LSO will be notified and asked to visit the site. Should it be deemed necessary, an emergency call-out will be issued and the equipment supplier will attend site in the event that all aspects of local intervention have been explored.

Data will be collected as hourly averages for NO_x , NO and NO_2 .

Measurement data will be scaled by applying fixed zero and span factors relevant to the calibration sources. When either the zero or span response falls outside of pre-defined limits these will be examined and the instrument responses adjusted as appropriate. Subsequent data validation and ratification will take account of the actual calibration responses obtained each day to ensure data quality objectives are met.

The scaled hourly minute data will be supplied monthly in an electronic format. Should the option for independent audits be undertaken, then finalised validated data will be provided after the audit at the end of the monitoring period.

PRICING

The cost for a monitoring project with a duration of three months is £8557. The cost for a monitoring project with a duration of six months is £9652. In addition, we strongly recommend that independent audits are carried out at the beginning and end of the monitoring period in line with the procedures of the National networks. This allows for greater tractability of the measurements, and adds more credibility to the data collected. This option would cost approximately £1650. As previously discussed, we recommend that 3 diffusion tubes are collocated with the analyser.

The costs include:

- Initial Site Visit
- Delivery, Installation and decommissioning;
- Hire of analysers and cabinet;
- Provision of calibrations gases;
- Hire of GSM modem and SIM card;
- 48-hour call out for servicing;
- Daily data management and data ratification;



- Project Management;
- Provision of ratified data on a monthly basis.

The above costs do not include:

- Local Site operator Duties;
- Provision of suitable power supply (to be 220-240 V 50 Hz 10 Amp minimum);
- The client will be responsible to provide a site without requiring a planning permission and with suitable access, ground conditions and power supply;
- VAT (at prevailing rate).

We are able to offer Local Site Operator services for an additional £400 per month.

The costs provided here are for the scope of the monitoring provided above, any addition or change to this scope may result in the revision of the costs. Any additional meetings or site visits, apart from the site visits due to problems with the operation of the monitoring equipment mentioned above, can be attended at extra cost. The hourly rates vary from £65 to £90 depending upon the grade of consultant attending the meeting. The travel expenses will be charged at cost.

Bureau Veritas terms and conditions apply, a copy of which is available on request.

INVOICING

We propose to submit an invoice for the costs of the hire of the equipment at the time of installation and commissioning. Thereafter, monthly invoices will be submitted for the work carried out within the month.

I trust the above provides you with the detailed information you require. Should you wish to discuss any aspect of the above, please do not hesitate to contact me.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'D Harrison'.

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