Air Quality in London 2004 – Summary of Provisional Measurements

Introduction

The purpose of this document is to summarise provisional measurements of air pollution in London during 2004 with respect to the Air Quality Strategy Objectives.

London Air Quality Network (LAQN) measurements are subject to two quality assurance processes. Initially, measurements are validated using the best calibration and instrument performance information available at the time. Measurements are retrospectively examined during the ratification process, using long-term instrument histories and the results of further quality checks. Hence the measurements in this summary will differ from those initially published. The measurements in this summary are largely unratified. Further revisions are therefore likely before final measurements are published in the 2004 annual report.

Results from each monitoring site can be found on the LAQN web pages;

www.londonair.org.uk

Carbon Monoxide

CO emissions within the LAQN area are dominated by road transport sources. The AQS Objective of 8.6 ppm (10mgm⁻³) as a rolling 8 hour mean (DEFRA 2002) was met at all LAQN monitoring sites.

Nitrogen Dioxide

 NO_2 is largely a secondary pollutant formed by the oxidation of NO. In the LAQN area, road transport is the dominant source of NO_X . This is reflected in the general distribution of NO_2 , with the greatest annual mean concentrations being measured near roads and in central London locations. Lower concentrations are observed in background and suburban areas.

The AQS stipulates two Objectives for NO₂: an annual mean of 21 ppb (40 μ gm⁻³) and an incidentbased Objective of 104.6 ppb (200 μ gm⁻³), as an hourly mean, not to be exceeded more than 18 times per year.

The annual mean NO_2 Objective was exceeded at all kerbside monitoring sites and the majority of roadside monitoring sites. Preliminary measurements suggest that three roadside monitoring sites in outer London (Enfield 2, Havering 1 and Havering 3) achieved the Objective. This represents an improvement on the situation reported for 2003 when all kerbside and roadside sites exceeded this Objective.

The annual mean NO₂ Objective was exceeded at background sites in inner London. Background and suburban sites in outer London and the home counties achieved the Objective with the exception of two sites in West London; Heathrow Airport and Ealing 1.

The incident-based Objective for NO₂ was exceeded at the kerbside sites Barnet 1, Lambeth 4, Marylebone Road, and Sutton 4. The Objective was also exceeded at the roadside sites Brent 3, Ealing 6, Greenwich 8, Hounslow 4, Kensington & Chelsea 3 and Kensington & Chelsea 4. The highest number of hourly means above 105 ppb was measured at the new Lambeth 4 site, which measured 3513. During 2004, 100 hours or more above 105 ppb were also measured at Ealing 6 (174), Kensington & Chelsea 3 (235) and Marylebone Road (497).

Ozone

 O_3 is a seasonal pollutant with the highest concentrations being measured during the summer months. It is also a regional pollutant, with episodes extending over many hundreds of kilometres. O_3 exhibits local variation caused by the scavenging effect of NO close to NO_X emission sources, for example at the roadside. Health-based standards are rarely exceeded at roadside and kerbside sites and O_3 monitoring is not generally undertaken in these locations. However, roadside monitoring of O_3

can lead to a better understanding of the mechanisms that determine roadside NO_2 concentrations and for this reason further O_3 monitoring at roadside sites in London would be encouraged.

The AQS has an Objective of 100 μ gm⁻³ (50 ppb), measured as a rolling 8 hour mean, which should not be exceeded on more than 10 days per year. The greatest concentrations of Q₈ are generally measured at sites in outer London and in the Home Counties. During the 3 years 2000 to 2002, the majority of sites in outer London and the Home Counties exceeded the Objective whilst many sites in inner and west London met the Objective. During 2000 to 2002, outer London sites typically experienced around 20 to 30 days per year with peak concentrations above 100 μ gm⁻³, measured as a rolling 8 hour mean. During the summer of 2003, several sites measured over 40 days above 100 μ gm⁻³, expressed as a rolling 8 hour mean; almost double the number of days measured annually during 2000 to 2002. During 2004, the AQS Objective was exceeded at all permanent background O₃ measurement sites in outer London and the home counties except Brent 1, Hounslow 2 and the Harlington AURN site. Sites in inner London achieved the Objective with the exception of Kensington & Chelsea 1 and Tower Hamlets 1.

PM 10 particulate

There are two AQS Objectives for PM_{10} . These are in line with the EU Daughter Directive Stage 1 Limit Value for PM_{10} . The AQS has an incident-based Objective of 50 µgm⁻³, measured as a daily mean not to be exceeded on more than 35 days per year, and an annual mean Objective of 40 µgm⁻³.

 PM_{10} poses many measurement challenges. Rather than comprising a single, defined chemical compound, like CO or SO₂ for example, the composition of PM_{10} varies with location, time of year and during episodes. PM_{10} can be considered to comprise primary particulates (mainly emitted from local sources), secondary particulates (mainly from distant sources), and coarse particulates whose origin can be local or further afield. The variation in composition affects each measurement technique differently and therefore each measurement technique produces systematically different results. The EU Daughter Directive is based on a 'gravimetric' method where PM_{10} is collected on a filter that is then weighed in a laboratory (CEN, 1998). There is ample evidence to suggest that the most common measurement methodology employed in the UK, the Tapered Element Oscillating Microbalance (TEOM), produces a result lower than the 'gravimetric' method. DEFRA suggest that a correction factor of 1.3 be applied to TEOM results for comparison to the AQS Objective.

Beta Attenuation Monitors (BAM) are also used to measure PM_{10} in the LAQN. Research at Marylebone Road sought to compare the results from TEOM, 'gravimetric' and BAM instruments. The BAM instrument tested produced higher results than the 'gravimetric' method at this location during the test period. However, no correction factor has been applied to the BAM measurements.

 PM_{10} measurements during 2003 were affected by the series of PM_{10} incidents, which are discussed in ERG (2004). Such PM_{10} incidents were not repeated during 2004.

The incident-based PM_{10} AQS Objective was exceeded in inner and central London at the kerbside TEOM sites Marylebone Road and Camden 1. In outer London, the incident-based PM_{10} Objective was exceeded at 3 TEOM sites situated alongside major arterial roads; Brent 4 (North Circular), Greenwich 8 (Woolwich Flyover), Hounslow 5 (M4 and A4 at Brentford) and Bexley 7 (A206 at Crayford). The 2 TEOM sites situated near the entrances to waste management facilities (Bexley 4 and Brent 5) also exceeded the incident-based PM_{10} Objective. All background and suburban TEOM sites met the incident-based Objective. The annual mean Objective of 40 µgm⁻³ was exceeded at the industrial roadside TEOM sites Bexley 4 and Brent 5, and at the kerbside TEOM site Marylebone Road.

The incident-based Objective was exceeded at all kerbside and roadside BAM sites. The background BAM site Haringey 2 also exceeded the incident-based PM_{10} Objective. The annual mean Objective was exceeded at the Lambeth 4 kerbside BAM site.

Sulphur Dioxide

The distribution of SO₂ concentrations is influenced by both road traffic and industrial point sources. Road traffic sources are the main factor influencing annual mean concentrations, whereas industrial point sources produce short-term high values due to plume grounding. The annual mean concentrations of SO_2 do not vary to any large degree over the network.

The AQS incident-based Objective for SO₂ is based on a 15 minute mean concentration of 266 μ gm⁻³ (100 ppb) which must not be exceeded more than 35 times per year. This Objective was not approached at any LAQN site, although Brent 3, Castle Point 1, Enfield 3, Hammersmith and Fulham 1, Thurrock 1, Waltham Forest 1 and the Westminster AURN site measured 15 minute means in excess of 266 μ gm⁻³.

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