

Air Pollution Forecasting Ad-hoc report: Bonfire night, 2002

Andrew Kent
netcen November 2002

Introduction

This report examines the extent of PM₁₀ pollution over the 2002 bonfire night period. It covers Friday 1st November to Monday 11th November which includes the weekends either side of bonfire night because these are likely to have been when major fireworks displays and celebrations will have taken place.

Generally, PM₁₀ levels remained a lot lower than previous years with elevated measured concentrations being confined to a few small areas, often at sites which have comparatively high background levels of PM₁₀. The uncharacteristically low concentrations of PM₁₀ were almost certainly attributable to meteorological. The weather over the period was extremely unsettled with moderate to strong westerly winds bringing clean Atlantic air masses and providing effective dispersion at all areas of the UK. Heavy rain showers may also have helped to remove particulate components from the air as well as discouraging fireworks displays and bonfire night celebrations. Figure 2 shows the average UK concentrations compared with previous years.

Development over time

- The weather during the weekend preceding bonfire night was typical of the weather that would dominate through the entire period. Winds were strong and south westerly to westerly in direction. Air masses from the Atlantic were passing over the Atlantic bringing heavy rain showers with each weather front. As a result, the 24 hour running mean concentrations of PM₁₀ (on which the bandings are based) did not become significantly elevated, remaining in the LOW band (index 1-3) at all sites with the exception of London Marylebone Road. The Marylebone Road site recorded 24 hour running mean concentrations of 50 $\mu\text{g m}^{-3}$ for several hours from 8.00 to midday on Friday 1st November (as shown in Figure 1). The kerbside nature of this site means that it frequently records elevated levels even when dispersion conditions are favourable.
- The winds dropped on Monday 4th and Tuesday 5th resulting in calm conditions preceding bonfire night which reduced atmospheric dispersion. Consequently concentrations rose into the MODERATE band at 6 sites (see table 2). The majority of these sites remained in the lower end of the MODERATE band (index 4 and 5) until the early hours of the 6th November. However, Haringey Roadside recorded concentrations rising to the upper end of the MODERATE band (74 $\mu\text{g m}^{-3}$, index 6), just below the lower limit of the HIGH band. During these calm conditions on the evening of bonfire night, London Brent recorded levels that rose into the HIGH band between the hours of 10.00 and 11.00. The following hour levels at the site moved into the VERY HIGH band. This was because from 20.00 on 4th to 3.00 on 5th there were consecutive hours of concentrations over 100 $\mu\text{g m}^{-3}$, reaching an hourly maximum of 664 $\mu\text{g m}^{-3}$ at 23.00 on 4th. The result was that the 24 hour running mean rose rapidly - levels entered the MODERATE band between 21.00 and 22.00 and moved into the HIGH band between 22.00 and 23.00. By midnight, levels were in the VERY HIGH band (112 $\mu\text{g m}^{-3}$, index 10). However, it was not until 11.00 on 5th that the 24 hour running mean reached a maximum of 135 $\mu\text{g m}^{-3}$. In the early evening of bonfire night the winds became strong as forecast and the VERY HIGH concentrations dropped significantly in a very short space of time from 19.00 onwards (see Figure 1). It is likely that a bonfire was located very close to the Brent site, given that concentrations recorded here were much higher than anywhere else in the UK.
- By mid-morning on 6th November all sites were measuring concentrations in the LOW band again where they remained through the remainder of the week and the following weekend.

Belfast Clara Street measured a 24 hour running mean of $51 \mu\text{g m}^{-3}$ on 1st November. This cannot be counted as an exceedence of the MODERATE band because the bandings are based on TEOM data and the Clara Street instrument is a BAM. However, if this data is converted to an equivalent of TEOM data in the same way as gravimetric equivalent data is derived from TEOM data (i.e. by *dividing* the Clara Street data by 1.3) then the values should be comparable. In this case, the maximum 24 hour running mean (TEOM equivalent) becomes $39 \mu\text{g m}^{-3}$ and so remains in the LOW band. Similarly, TEOM equivalent data for maximum daily average was $31.2 \mu\text{g m}^{-3}$ so the daily AQS Objective value was not exceeded at this site.

Table 1 Sites exceeding AQS Objective ($50 \mu\text{g m}^{-3}$ daily mean based on gravimetric equivalent data) – Friday November 1st to Monday November 11th.

Site	Number of exceedences	Number of days	Maximum exceedence ($\mu\text{g m}^{-3}$)
London Marylebone Road	5	5	71
Glasgow Kerbside	2	2	59
Haringey Roadside	2	2	73
London Brent	2	2	129
Bolton	1	1	61
Bradford Centre	1	1	53
Leeds Centre	1	1	78
Port Talbot	1	1	56
Southampton Centre	1	1	62

Table 2 Number of days of MODERATE and above PM_{10} (TEOM data) pollution, by site – Friday November 1st to Monday November 11th.

Site	Number of days MODERATE	Number of days HIGH	Number of days VERY HIGH	Maximum exceedence ($\mu\text{g m}^{-3}$)
London Brent	2	2	1	135
London Marylebone Road	3	-----	-----	60
Haringey Roadside	2	-----	-----	74
Leeds Centre	2	-----	-----	61
Southampton Centre	1	-----	-----	56
Camden Kerbside	1	-----	-----	50

Table 3 Number of days of MODERATE and above PM_{10} (TEOM data) pollution, by date – Friday November 1st to Monday November 11th.

Date	Number sites measuring MODERATE	Number sites measuring HIGH	Number sites measuring VERY HIGH	highest 24-hr running mean
01/11/02	1	0	0	50
02/11/02	0	0	0	-----
03/11/02	0	0	0	-----
04/11/02	1	1	0	99
05/11/02	6	1	1	135
06/11/02	3	0	0	58

* N.B. London Brent is included in the MODERATE **and** the HIGH/ VERY HIGH columns in Table 3 as it recorded concentrations moving through the bands during the day.

Figure 1 - Time series chart of 24 hour running mean concentrations, sites that recorded MODERATE or higher levels during bonfire night 2002

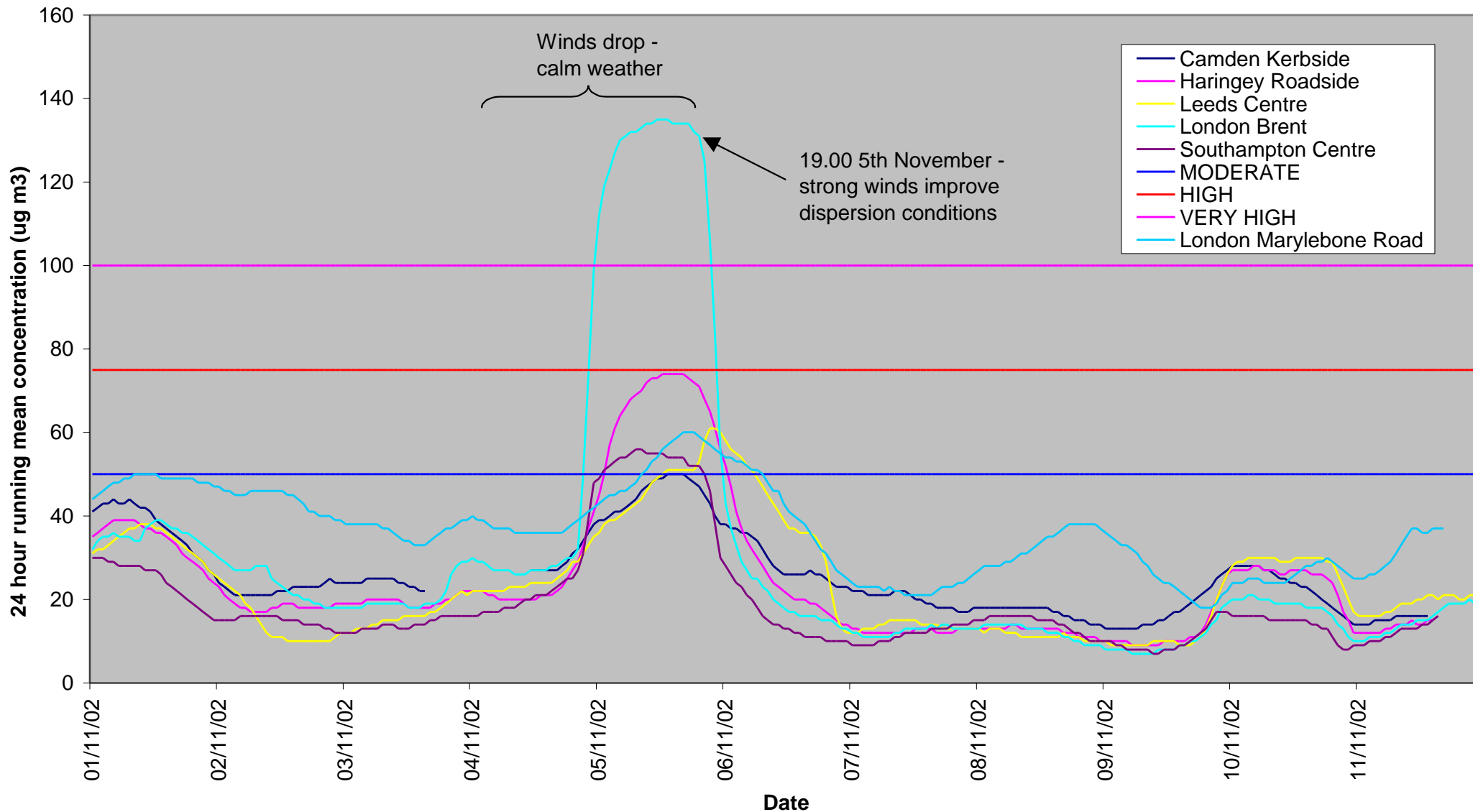


Figure 2 - Bonfire Night PM₁₀ Air Pollution Episodes 1994 to 2001
Running 24-Hour Mean Network Averaged TEOM Data (all sites)

