

# Air Pollution Forecasting: Pollution Episode Report (February 2003)

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24/03/2003

## INTRODUCTION

Between the period of 17<sup>th</sup> February and 2<sup>nd</sup> March, elevated PM<sub>10</sub> levels were reported by many sites in the UK Automatic Urban Network. During the period, 29 sites reported 24 hour running mean concentrations in the 'MODERATE' band and 6 sites reported these in the 'HIGH' band.

The purpose of this report is to detail the extent and duration of the AQS Objective exceedances resulting from these elevated levels and to describe the weather situation and other causal factors that may have contributed to the event. As the final data for the period of the event has yet to be ratified all statistics and charts are based on provisional data as used in the actual forecasting process.

## DEVELOPMENT OVER TIME

- **Fri 14<sup>th</sup> to Mon 16<sup>th</sup>**

Over the weekend from Friday 14<sup>th</sup> to Tuesday 18<sup>th</sup> February an area of high pressure to the north east of the UK over Scandinavia was dominating UK weather patterns. The far north west of the UK was receiving clean south westerly winds from the Atlantic. The rest of the UK experienced dry but cold weather with easterly winds originating from the Baltics. Despite the continental air mass (which typically brings in pollutants) affecting most of the UK, pollution levels remained in the Defra 'LOW' band as winds remained strong enough to ensure effective dispersion.

- **Tue 17<sup>th</sup> to 20<sup>th</sup>**

The persisting influence of easterly winds bringing continental air masses to the UK and the effects of decreasing wind speeds became more apparent from 17<sup>th</sup> to 20<sup>th</sup> February. As a result, PM<sub>10</sub> levels across the UK began to rise. On 17<sup>th</sup> February, only two sites (Bury Roadside and Scunthorpe) were reporting 'MODERATE' levels of PM<sub>10</sub>. This increased to 4 sites with the addition of Glasgow Kerbside and Marylebone Road on 18<sup>th</sup> February. By 20<sup>th</sup> February 9 monitoring stations in the Automatic Urban Network were reporting 'MODERATE' concentrations (see table 2). There would have been a greater number of stations reporting 'MODERATE' levels but for erratic data from Glasgow Kerbside which stopped reporting data at 21.00 on 18<sup>th</sup> February.

- **21<sup>st</sup> to 23<sup>rd</sup>**

It was during this period that the episode really developed. On 21<sup>st</sup> February there were 16 network sites reporting 'MODERATE' levels of PM<sub>10</sub> and one site reporting 'HIGH' concentrations. The 'HIGH' concentrations were reported by the Glasgow Kerbside site though they should be treated with suspicion because the site had not been reporting data since 21.00 on 18<sup>th</sup> and had recently undergone a service. It is hard to tell whether these levels were as a result of genuinely elevated concentrations or the result of the preceding service. A further site which should be treated with caution is the Stockton-on-Tees Yarm site which resumed data reporting at 3.00 on the morning of 21<sup>st</sup> after stopping data transmission at 17.00 on 17<sup>th</sup> February. Initially the concentrations reported by this site were just below the 'HIGH' band and dropping - these levels may have been a result of the site being offline for the previous few days rather than an accurate reflection of the ambient air conditions. An LSO visit to the site on 20<sup>th</sup> February revealed that this data gap was caused by an incorrectly connected cable to the logger. Given the PM<sub>10</sub> concentrations of 74  $\mu\text{g m}^{-3}$  (just below the 'HIGH' band) upon resumption of data reporting, it seems possible that concentrations may have entered the 'HIGH' band, although this cannot be confirmed with this provisional data.

At other sites, PM<sub>10</sub> concentrations fluctuated around in the 'MODERATE' band until the middle of 22<sup>nd</sup> February when levels began to rise again. This might be due to the slight change in wind direction over 22<sup>nd</sup> which became more south easterly than on the previous day (see fig. 3 and fig. 4). These rising levels culminated in another peak, just within the 'HIGH' band during the early hours of 23<sup>rd</sup> February. During this time, 3 sites entered the 'HIGH' band and 18 sites were seeing levels in the 'MODERATE' band

(table 2). London Marylebone Road reported the highest concentrations and recorded a 24 hour running mean of  $77 \mu\text{g m}^{-3}$  between 23.00 on 22<sup>nd</sup> and 5.00 on 23<sup>rd</sup> February. Scunthorpe only just entered the 'HIGH' band, reporting a 24 hour running mean of 75 from 4.00 to 6.00 on 23<sup>rd</sup> February. TEOM equivalent data from the Belfast Clara Street site showed that concentrations here also just tipped the 'HIGH' band with a 24 hour running mean of 75 at 6.00 on 23<sup>rd</sup> February only.

- **23<sup>rd</sup> to 24<sup>th</sup>**

As the back trajectory map (fig. 5 shows), the wind direction on 23<sup>rd</sup> February changed – trajectories originated over the Atlantic Ocean or over the Mediterranean Sea. In both cases, air masses brought in to the UK would be typically cleaner than the previous few days. Consequently, immediately following the peak in concentrations in the early hours of 23<sup>rd</sup> February, levels across the UK dropped significantly over 23<sup>rd</sup> February as shown in fig. 1. By the morning of 24<sup>th</sup> February all sites in the Automatic Urban Network were reporting PM<sub>10</sub> concentrations in the Defra 'LOW' band where they remained for the duration of the day.

- **25<sup>th</sup> to 26<sup>th</sup>**

Another change in the wind direction (see fig. 6) to southerly over the following days again subjected the UK to air with a secondary PM<sub>10</sub> component. This resulted in further period of building PM<sub>10</sub> concentrations as shown in fig. 1. Concentrations were in the 'MODERATE' band at 7 sites on 25<sup>th</sup> February and this increased to 15 sites the following day. Scunthorpe was recording PM<sub>10</sub> in the 'HIGH' band on both days, reaching a 24 hour running mean of  $80 \mu\text{g m}^{-3}$  on 25<sup>th</sup>. Scunthorpe was the only site that rose significantly enough to enter the 'HIGH' band – this may have been caused by local sources in the industrial area that surrounds it.

- **27<sup>th</sup> onwards**

On 27<sup>th</sup> February there were 18 sites recording concentrations in the 'MODERATE' band and 3 sites (Scunthorpe, Stockton-on-Tees Yarm and Sheffield) with concentrations in the 'HIGH' band. The number of sites reporting 'MODERATE' concentrations fell on 28<sup>th</sup> February to 11 but sites with 'HIGH' concentrations remained at 3 – Sheffield, Scunthorpe and Aberdeen. Scunthorpe and Sheffield stations were well into the 'HIGH' band over these 2 days, reporting 24 hour running mean concentrations of up to  $84 \mu\text{g m}^{-3}$  and  $90 \mu\text{g m}^{-3}$  respectively.

A final change in the wind direction over the episode period (see fig. 7) resulted in clean air influencing the UK again from 28<sup>th</sup> February onwards. As fig. 1 shows, this produced a significant drop in PM<sub>10</sub> levels and by March 1<sup>st</sup> all monitoring sites in the network were reporting 24 hour running means in the 'LOW' band.

## CONCLUSION

- It is likely that the episode was caused by contributions from a secondary PM<sub>10</sub> component originating from continental Europe. This component probably compounded levels at sites in the network where, in a low wind speed situation, local sources such as roads or industry also provide a significant PM<sub>10</sub> contribution.
- The importance of wind direction and strength are apparent during the episode in determining the degree of dispersion of concentrations and the influence of European emission sources.

**Table 1 – PM<sub>10</sub> site concentrations by band and duration**

Site	Number days 'moderate'	Number days 'high'	Number days 'very high'	Maximum 24 hour running mean (µg m <sup>-3</sup> )
Scunthorpe	11	5	---	84
Sheffield Centre	7	2	---	90
Glasgow Kerbside	8	1	---	98
Stockton-on-Tees Yarm	7	1	---	78
Aberdeen	3	1	---	77
Belfast Clara St *	7	1	---	75
Bury Roadside	11	---	---	66
London Bloomsbury	8	---	---	67
London A3 Roadside	7	---	---	63
Hull Freetown	6	---	---	59
London Marylebone Road	6	---	---	74
Leeds Centre	5	---	---	67
London Bexley	5	---	---	59
Manchester Piccadilly	5	---	---	56
Bradford Centre	4	---	---	62
London Brent	4	---	---	63
Haringey Roadside	4	---	---	55
Wolverhampton Centre	3	---	---	53
Birmingham Centre	3	---	---	57
Redcar	2	---	---	67
London Eltham	2	---	---	59
Middlesbrough	2	---	---	56
Canterbury	2	---	---	55
Bristol Centre	2	---	---	58
Thurrock	1	---	---	52
Northampton	1	---	---	50
Camden Kerbside	1	---	---	51
Nottingham Centre	1	---	---	51
Leicester Centre	1	---	---	50

\* Belfast Clara Street uses a gravimetric analyser (BAM) – for the purpose of this report, data has been converted to TEOM equivalent to allow comparisons with the other sites in the network.

**Table 2 – changing PM<sub>10</sub> concentrations over time**

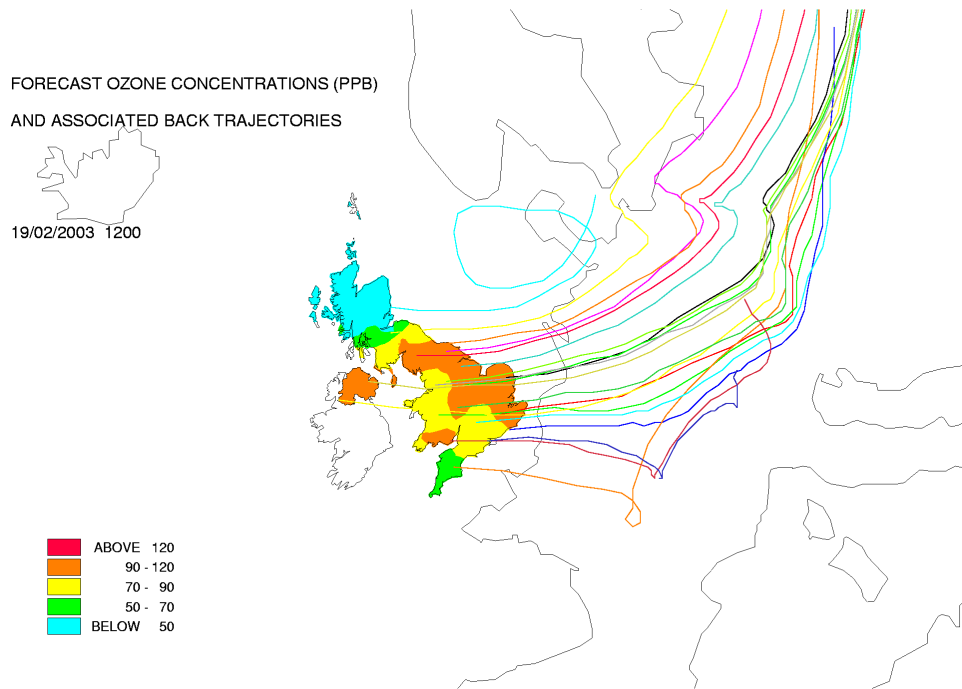
Date	Number sites in 'moderate' band	Number sites in 'high' band	Number sites in 'v high' band	Maximum exceedance, 24 hour running mean (µg m <sup>-3</sup> )
17/02/03	2	---	---	58
18/02/03	4	---	---	61
19/02/03	6	---	---	63
20/02/03	9	---	---	66
21/02/03	16	1	---	98
22/02/03	17	---	---	---
23/02/03	18	3	---	98
24/02/03	---	---	---	---
25/02/03	7	1	---	80
26/02/03	15	1	---	84
27/02/03	18	3	---	84
28/02/03	11	3	---	90
1/03/03	---	---	---	---
2/03/03	---	---	---	---

**Table 3 - PM<sub>10</sub> Episode summary**

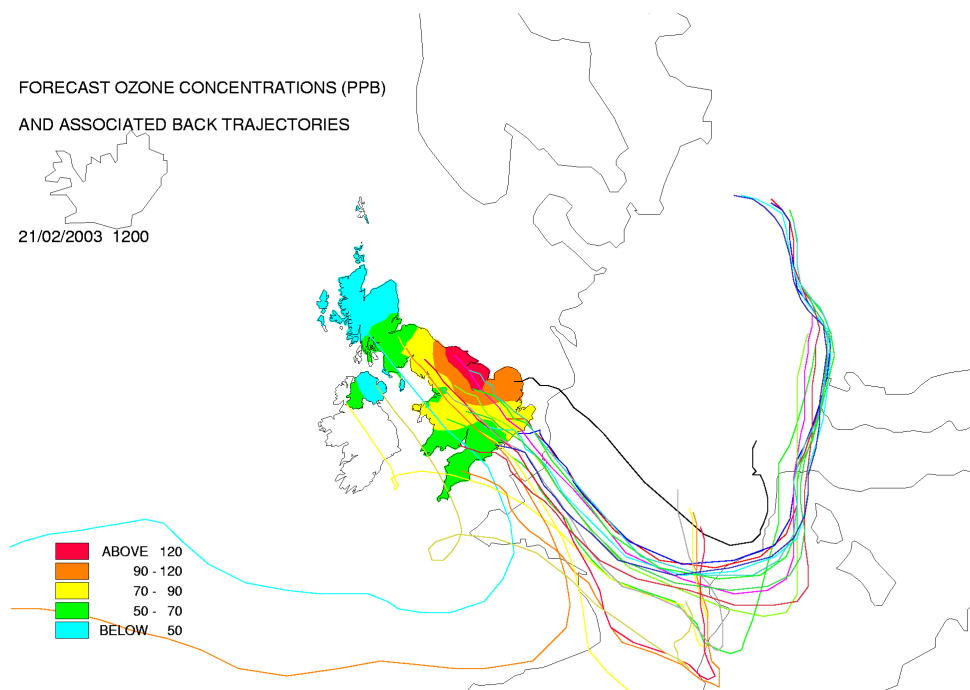
Band (index)	Number of days
Very high (index 10)	0
High (index 7-9)	7
Moderate (index 4-6)	5

Maximum concentration: 98 µg m<sup>-3</sup>

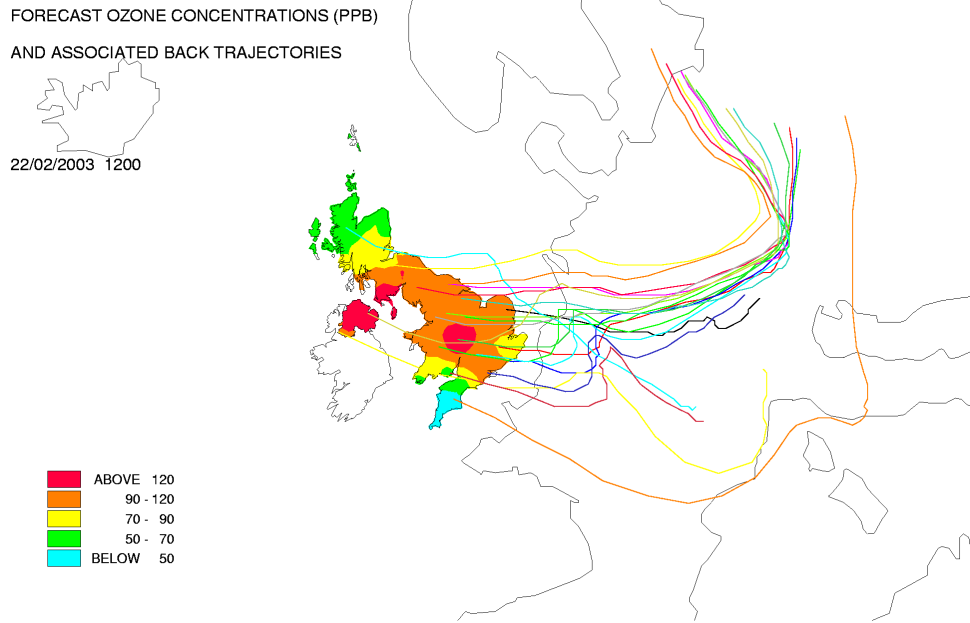




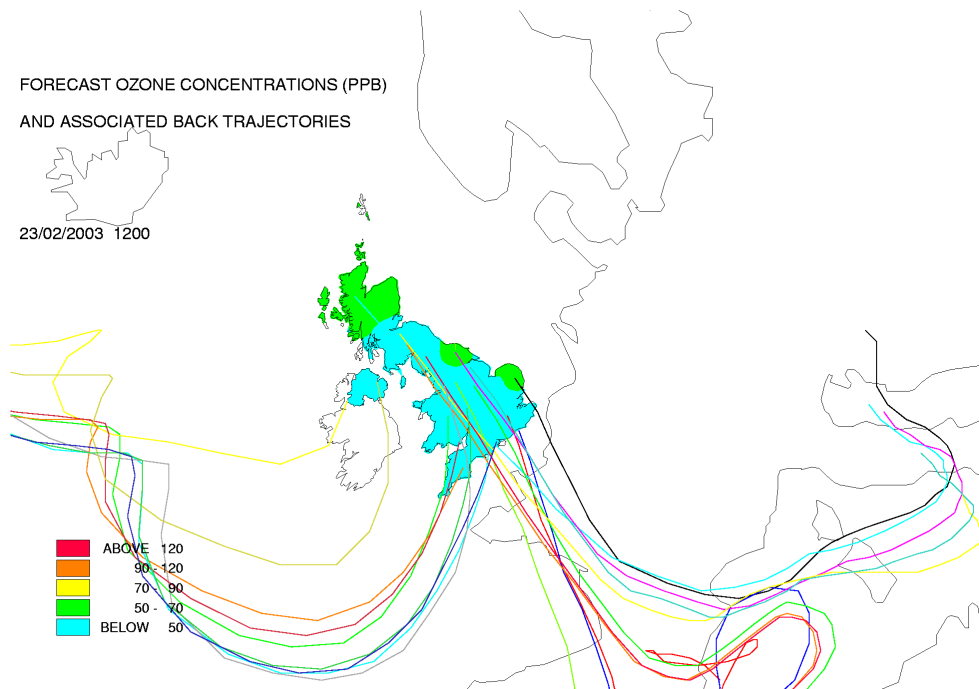
**Figure 2 – Four day forecast back trajectories UK, 19<sup>th</sup> February 2003**



**Figure 3 – Four day forecast back trajectories UK, 21<sup>st</sup> February 2003**



**Figure 4 – Four day forecast back trajectories UK, 22<sup>nd</sup> February 2003**



**Figure 5 – Four day forecast back trajectories UK, 23<sup>rd</sup> February 2003**

FORECAST OZONE CONCENTRATIONS (PPB)  
AND ASSOCIATED BACK TRAJECTORIES

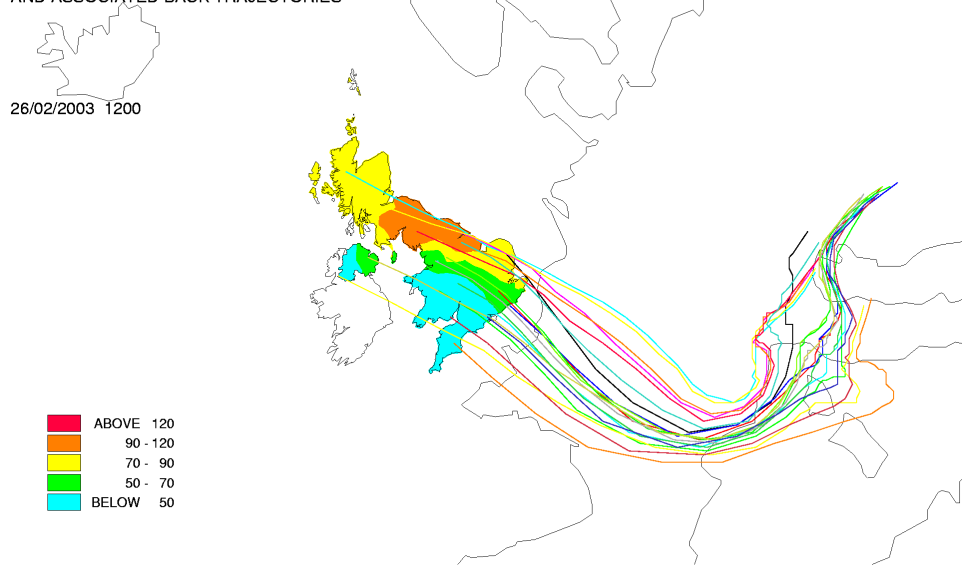


Figure 6 – Four day forecast back trajectories UK, 26<sup>th</sup> February 2003

FORECAST OZONE CONCENTRATIONS (PPB)  
AND ASSOCIATED BACK TRAJECTORIES

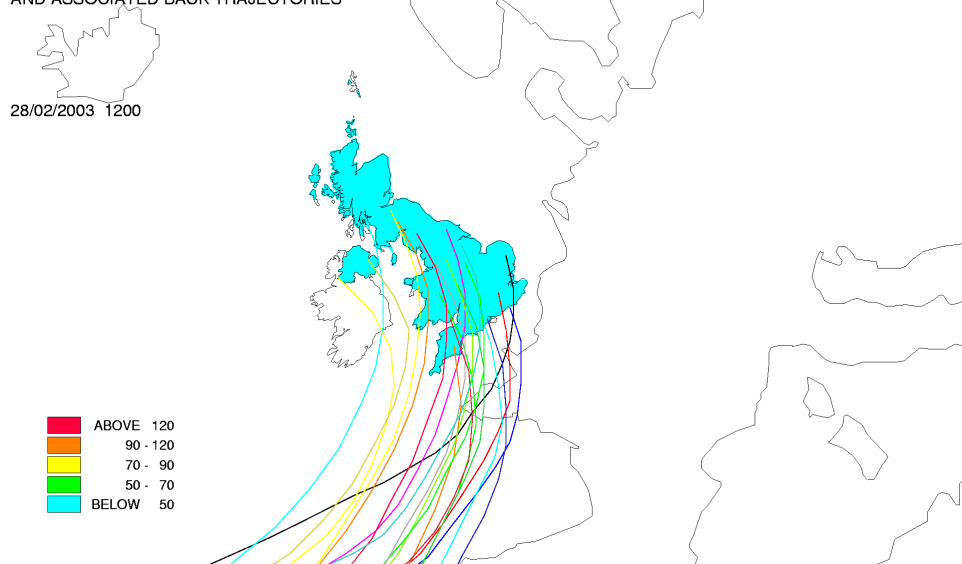


Figure 7 – Four day forecast back trajectories UK, 28<sup>th</sup> February 2003