Heathrow Air Quality

Together towards sustainability

Air quality at Heathrow Airport

Q3 2013

Headlines

Key information for this quarter is:

- Running annual mean for NO_2 remained below the EU limit values at most monitoring sites in Q3 2013 (see Fig. 1).
- There were four breaches of the daily average PM_{10} limit value to Q3 2013 (see Fig 2). 35 exceedances are allowed per year before the limit value is breached.
- The number of aircraft movements made by more modern models (from CAEP4 onwards) to Q3 2013 was over 90.5% (see Fig. 4).
- Heathrow has finalised its plans to replace all of its air quality monitors. These will be replaced from Q4 2013.
- Heathrow has updated the Heathrow AirWatch website.

Background

Heathrow Airport Ltd (HAL) has monitored air quality since 1993 at its site located near the northern runway (LHR2). It now monitors air quality at three other sites around the airport – Harlington, Longford (Green Gates) and Stanwell (Oaks Road). Fig. 3 shows the locations of these and other air quality monitoring sites within 2km of the Airport. We aim to replace all thirteen of our air quality monitors from Q4 2013.

Large areas of London exceed the health-based air quality limit values set by the EU, due primarily to emissions from road traffic and from buildings. Every London borough has declared at least one Air Quality Management Area (AQMA).

Air quality management is a key priority for HAL and we will continue to work in partnership with our key stakeholders – especially local authorities and national government - to reduce emissions from all sources in the area in order to meet the EU limit values. The main pollutants of concern at Heathrow are measured at all these sites – oxides of nitrogen (NO_X – made up of nitrogen dioxide and nitrous oxide) and particles (measured as PM_{10} and $PM_{2.5}$). In addition, ozone (O_3) is measured at Harlington.

Measured concentrations

Local air quality

Located on the western edge of London and close to two busy motorways, the Great Western mainline and local industries, Heathrow Airport is within an area of high air pollution.

Of the two pollutants of concern - nitrogen dioxide (NO_2) and particles (measured as PM_{10} and $PM_{2.5}$) - NO_2 has the greatest extent of exceedence and large areas of London (and the rest of the UK) exceed the annual average EU limit value, due mainly to emissions from road traffic and from buildings. This pattern is repeated locally, where the activities that take place at Heathrow Airport are just one source of air emissions in the local area.

Nitrogen dioxide (NO_2 - annual average limit value 40µg/m3 by 2010)

The annual average EU limit value for NO_2 was met at the majority of monitoring sites close to Heathrow Airport in 2012. Key information is:

- Oxford Avenue (red) is approximately 200m northeast of the airport boundary. Concentrations have exceeded the limit value since installation in 2005. Although concentrations fell to their lowest value in 2010, they remained at 43µg/m^3 in 2012. Direct airport emissions are approximately 19% of measured NO_X concentrations, 6% is from airport-related road traffic, 18% from non-airport traffic and 57% from background sources.
- Two other sites exceeded the limit value:

  - London Hillingdon (light green) is affected mainly by emissions from traffic on the M4. Concentrations increased slightly in 2012 to 57µg/m^3 (from 55µg/m^3 in 2011). Direct airport emissions are approximately 4% of measured NO_X concentrations, 13% is from airport-related road traffic, 38% from non-airport traffic and 45% from background sources.

  - LHR2 (blue dotted line), located near the northern runway, has shown a gradual decreasing trend in concentrations, though it is in an area of high emissions. Concentrations were 48µg/m^3 in 2012 (from 50µg/m^3 in 2011). Direct airport emissions are approximately 30% of measured NO_X concentrations, 19% is from airport-related road traffic, 14% from non-airport traffic and 37% from background sources.

Fig. 1 NO_2 running annual average concentrations at selected sites since 1995

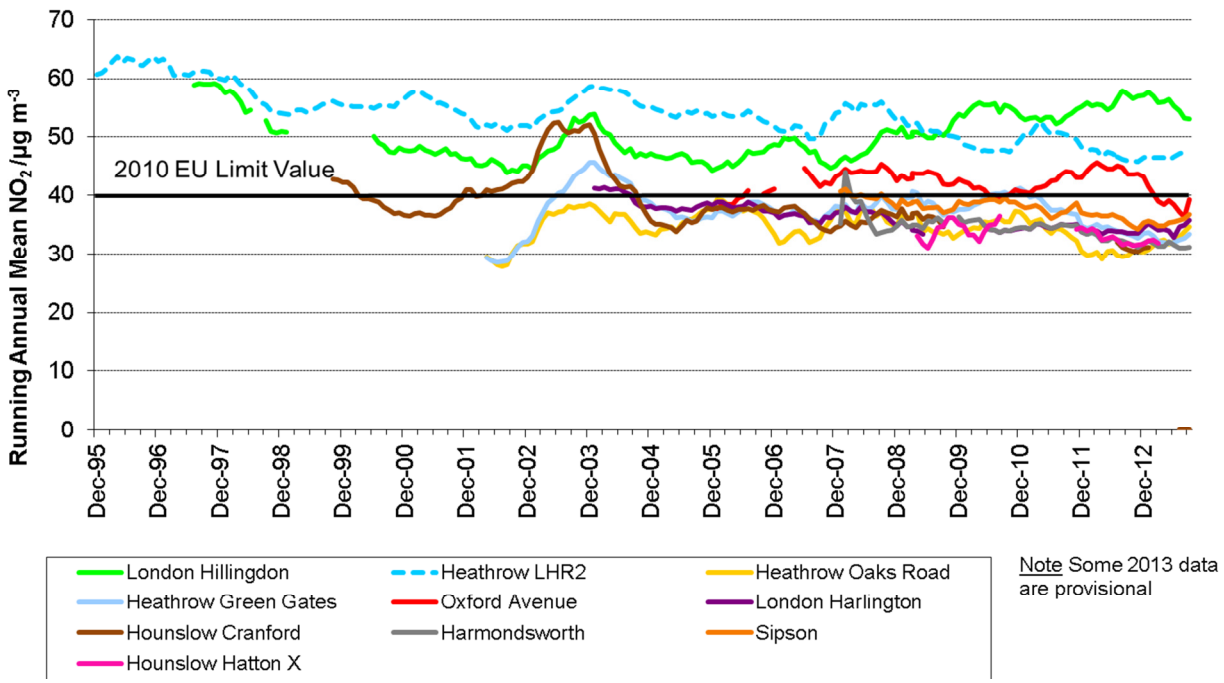


Fig. 1 shows the NO_2 monitoring data expressed as running annual means, which allows us to track changes throughout the year. In general, concentrations of NO_2 have been below the EU limit value, but showed an increasing trend in Q3 2013.

Particles (2005 PM10 EU limit value of 50µg/m3 (35 breaches allowed))

(2020 PM2.5 EU target of 25µg/m3)

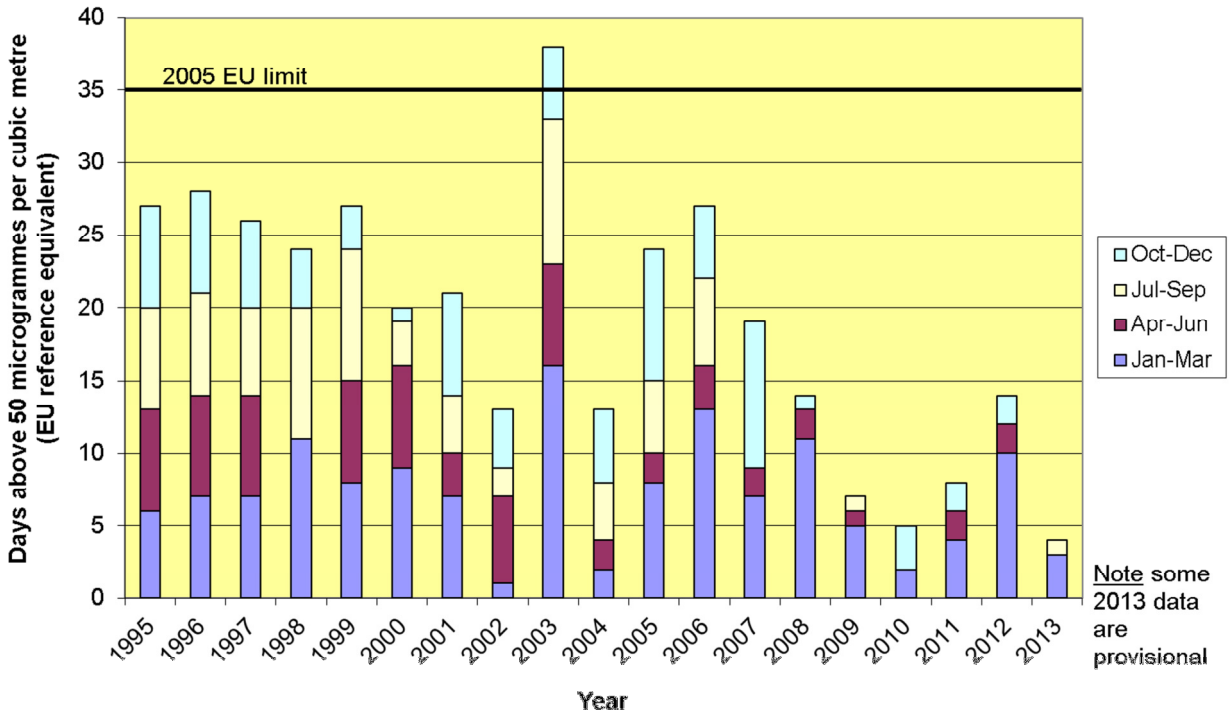
PM_{10} is measured at all four of HAL's monitoring sites and concentrations measured at LHR2 are generally the highest. Results are presented in Fig. 2.

Fourteen exceedances were recorded at LHR2 in 2011, and four have occurred so far to Q3 2013.

The EU limit value for PM_{10} has been met at the LHR2 site since 2003, when unfavourable weather conditions produced 38 breaches at LHR2 and affected sites throughout the UK.

It is not unusual for daily mean PM_{10} levels to exceed 50µg/m^3, though the EU limit value allows 35 exceedances (equal to 35 days) per year before the limit value is breached.

Fig. 2. PM_{10} at LHR2 since 1995 – Comparison with the 2005 EU limit value (number of days above 50µg/m^3)



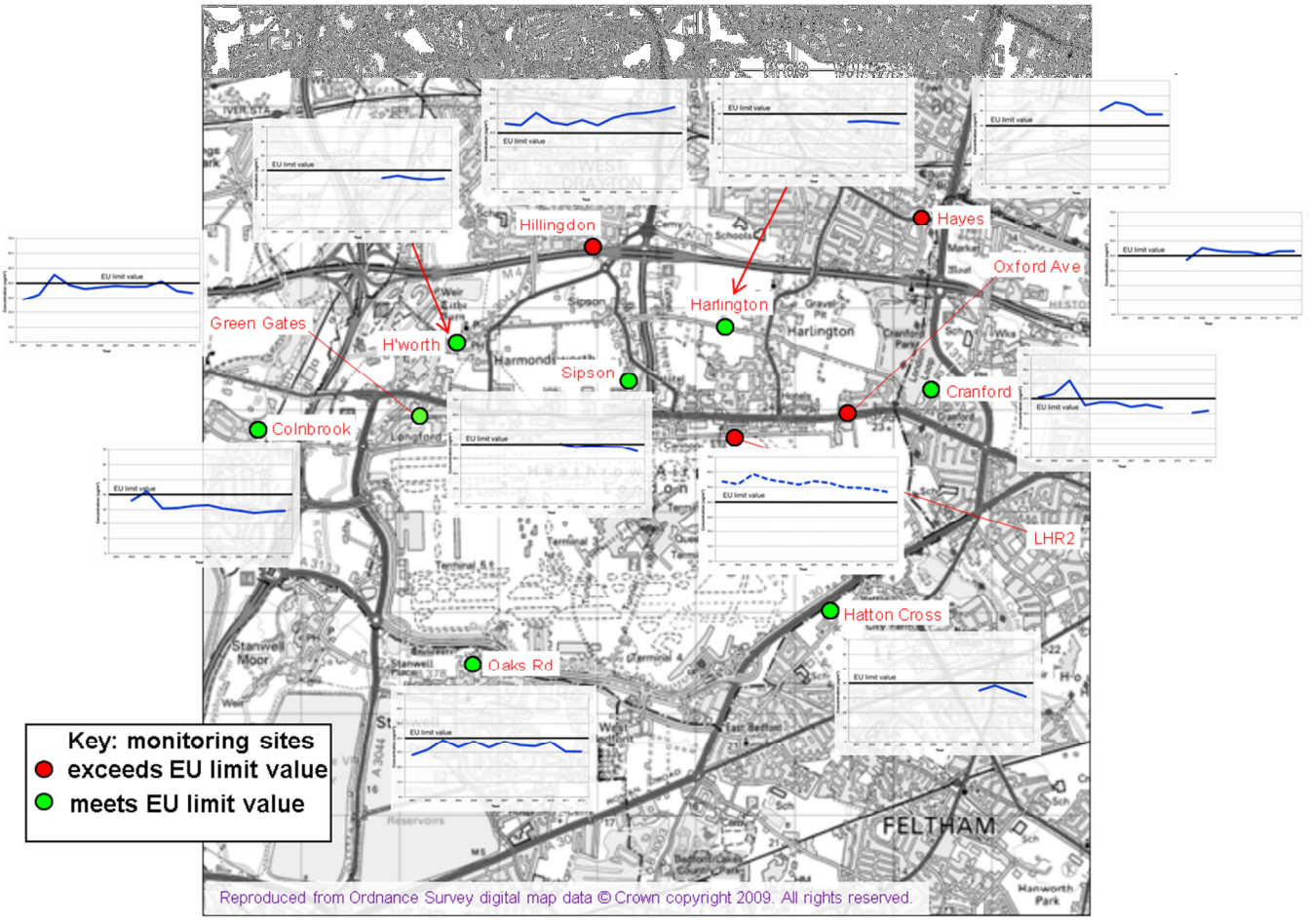
Locations of the air quality monitoring sites at Heathrow and their individual NO_2 monitoring history.

The locations of relevant air quality monitoring sites are shown in Fig. 3, which also shows the trend in NO_2 concentrations measured at each site since 2001.

Previous Air Quality Briefings described the proportions of emissions calculated for each monitoring site when the HAL Emissions Inventory 2008/9 was compiled. Fig. 3 shows the trend in measured NO_2 concentration at each site as well as providing the geographical context for the data presented in Fig.1.

- The only site not previously mentioned is Hayes, to the northeast of Heathrow. Direct airport emissions are approximately 4% of measured NO_X concentrations, 2% is from airport-related road traffic, 33% from non-airport traffic and 61% from background sources.

Fig. 3. Nitrogen dioxide monitoring sites and annual mean measurements since 2001

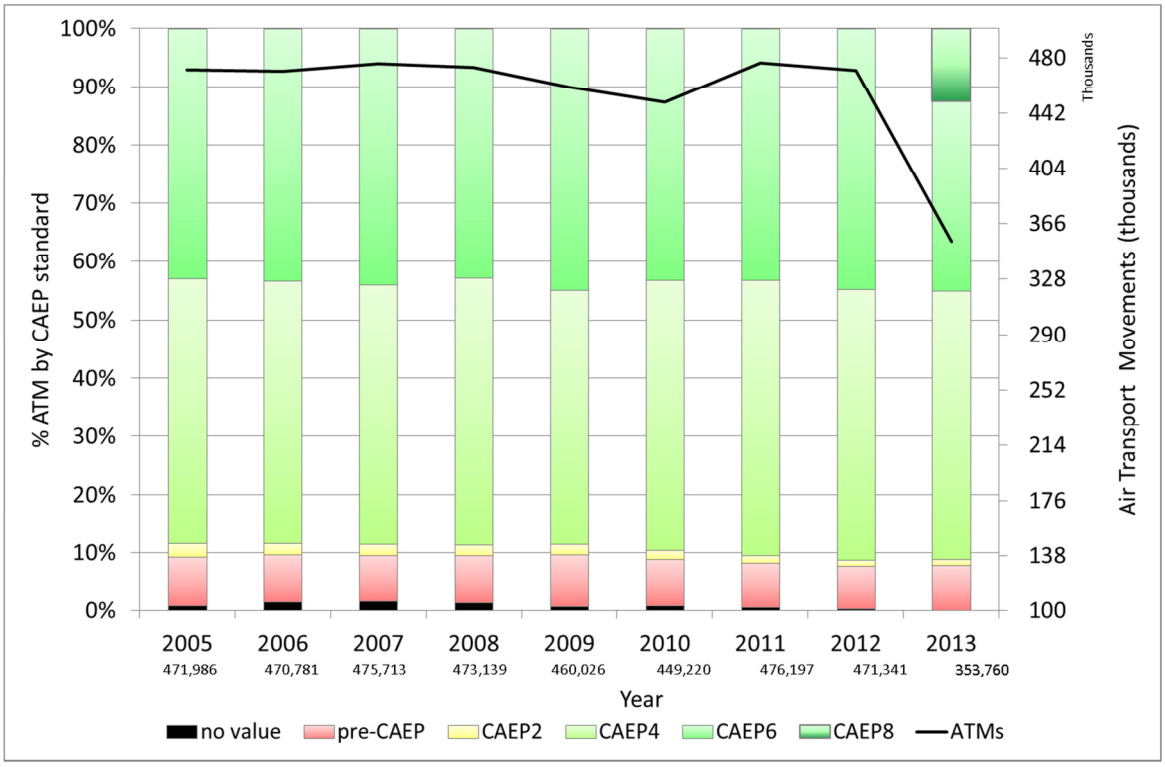


CAEP value of air transport movements

Through its Committee on Aviation Environmental Protection (CAEP), the International Civil Aviation Organization (ICAO) sets new emissions standards for aircraft engines – including for NO_X. CAEP6 is the latest standard and came into force in 2008. The more stringent CAEP 8 comes into force on 31/12/13 and is included for the first time.

Fig. 4 shows the proportion air transport movements (ATMs) based on their relationship to the CAEP NO_X emissions standards. The number of ATMs each year is presented below each bar as well as on the chart itself. The relative proportion of flights made by newer, cleaner aircraft (those defined as CAEP4 or better) has risen to its highest ever point. Over 91% of flights were made by aircraft of CAEP4 standard or better in 2012 – a 0.9% increase over 2011. Although the percentage is slightly lower up to Q3, the trend is expected to continue. ATMs have been reasonably stable, though 2009 and 2010 showed a fall of 2.7% and 5% respectively when compared to 2008.

Fig. 4. - CAEP4 compliance of ATMs (air transport movements) since 2005



2012 aircraft emissions

Since 2009 HAL has commissioned an annual inventory of aircraft emissions to assess how they change over time. The results of the latest NO_X assessment, for 2012, are shown in Fig 5.

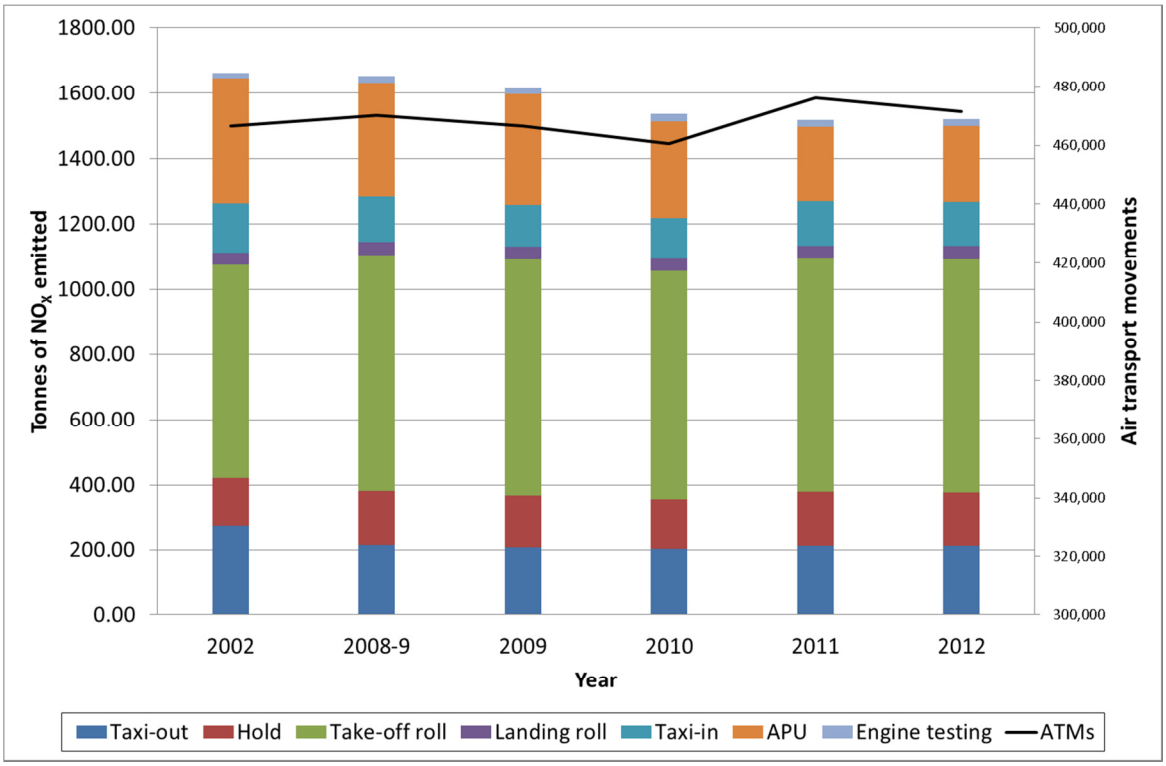
Emissions from aircraft have declined for three reasons:

- the opening of Terminal 5 in 2008 enabled more efficient aircraft movements on the airport - cutting NO_X emissions by approximately 75 tonnes in 2008/9
- the use of cleaner aircraft, partly encouraged by NO_X landing charges, has reduced emissions from main engines by approximately 30 tonnes since 2008/9.
- limiting the use of auxiliary power units (APUs) on the airport. Manual survey data indicates APU emissions have fallen by approximately 120 tonnes (35%) since 2008/9.

There were slightly fewer aircraft movements in 2012 than 2011 (471,341 compared to 476,187). However, NO_X emissions remained relatively unchanged, being 0.1% lower in 2012, which equates to a fall of 8% compared to 2008/9.

In comparison, PM_{10} and $PM_{2.5}$ emissions fell by 0.9% and 1.3% respectively in 2012 – which equates to a corresponding fall of 6.7% and 8.6% from 2008/9 levels.

Fig. 5. – Calculated Ground level aircraft emissions since 2008/09



Further trends can be observed by looking at the relationship between emissions and aircraft and between emissions and passenger numbers. Table 1 summarises these normalised data and shows:

- Air transport movements (ATMs) were 1% lower in 2012 than in 2011 (or within 1.8% of the ATM cap of 480,000).
- The proportion of flights by narrow bodied aircraft fell slightly below 66% of the total, but produced approximately 27% of total ground level NO_X.
- Passenger loading increased by 0.9% – equating to an average of approximately 148 passengers per flight. This is an increasing trend at the airport.

NO_X emission per passenger fell again and was approximately 61 grams, whilst NOx emission per aircraft movement increased slightly to 2.69kg; reflecting subtle changes to the aircraft fleet mix. The proportion of movements of wide bodied aircraft is increasing slowly at Heathrow, particularly of the A380.

Table. 1 - Assessment of normalised annual NO_X emissions

	Year					
	2002	**2008/9**	**2009**	**2010**	**2011**	**2012**
ATMs	466,554	470,029	466,393	460,546	476,197	471,341
Proportion of movements by narrow bodied aircraft (%)	72.8	65.0	65.1	65.7	65.9	65.3
Proportion of movements by wide bodied aircraft (%)	27.2	35.0	34.9	34.3	34.1	34.7
Ground level aircraft NOx emissions (tonnes)	1,662	1,652	1,618	1,536	1,518	1,520
Proportion of NOx emissions by narrow bodied aircraft (%)	33.9	28.1	27.9	28.1	29.0	27.5
Proportion of NOx emissions by wide bodied aircraft (%)	66.1	71.9	72.1	71.9	71.0	72.5
passengers (mppa)	63.01	65.93	66.04	65.88	69.43	70.05
passengers per movement	135.1	140.3	141.6	143.0	145.8	148.6
Ground level NOx emission per passenger (g/passenger)[1]	65.78	68.00	66.88	64.75	62.43	61.22
Ground level NOx emission per movement (kg/ATM)[1]	2.70	2.73	2.69	2.64	2.66	2.69

Note:

1. Excludes APU and engine testing emissions

Heathrow AirWatch website

We have updated the Heathrow Airwatch website. It can be viewed at: www.heathrowairwatch.org.uk and has been brought up to date with a fresh, modern design. It is interactive and shows up to the minute air quality concentrations across the network – see below – it also includes an area aimed at children to help them understand the sources and affects of air pollution.

All the partners involved in Heathrow Airwatch (LB Hillingdon, LB Hounslow, Slough BC, Spelthorne BC, BA and the Environment Agency) have links to their respective websites.