Heathrow Air Quality

Together towards sustainability

Air quality at Heathrow Airport

Q4 2013

Headlines

Key information for air quality monitoring data for 2013 is:

- All Q4 data is provisional and will be ratified by the end of March 2014.
- The annual mean for NO_2 fell at most key monitoring sites (see Figs. 1 and 2).
- There were seven breaches of the daily average PM_{10} limit value (see Fig 3) – which is below the EU limit value of 35 breaches per year.
- Annual average PM_{10} concentrations in 2013 remained below the EU limit value (see Fig. 4).
- Annual mean $PM_{2.5}$ concentrations remained at approximately half of the EU target value (see Fig 5).
- Over 91% of aircraft movements were made by more modern CAEP4 or CAEP6 models (see Fig. 7).

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 started replacement of our air quality monitors in 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.

All monitoring data will be ratified by end of March 2013.

Nitrogen dioxide (NO_2 - annual average limit value 40µg/m^3 by 2010)

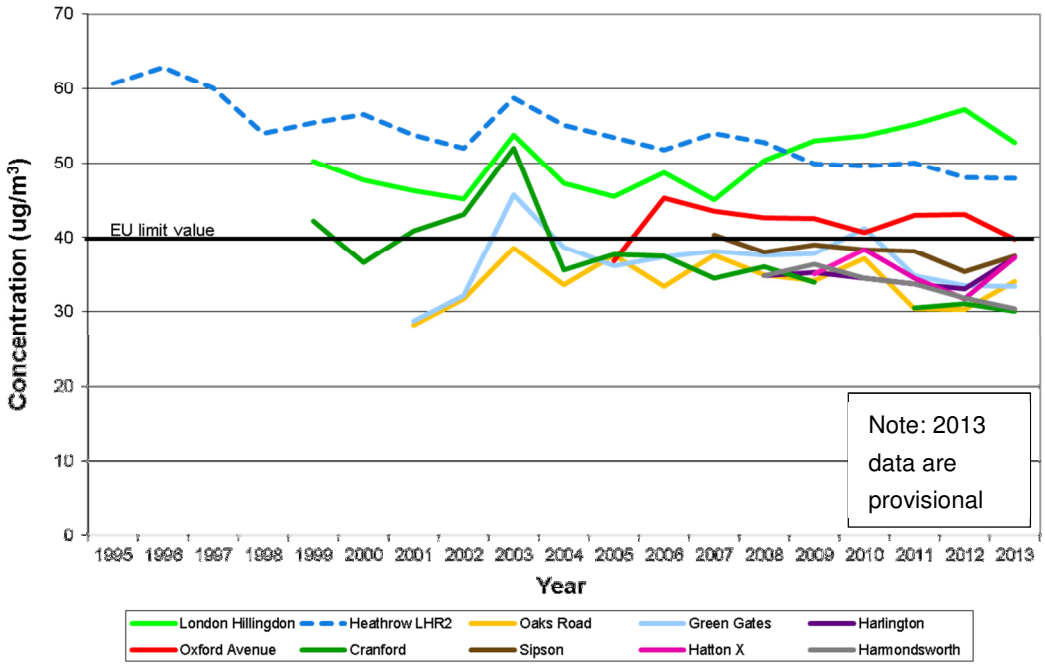
Although all data has not yet been ratified, the annual average EU limit value for NO_2 is expected to be met at the majority of monitoring sites close to Heathrow Airport in 2013 – presented in Fig. 1. Key information is:

- Oxford Avenue (red) is approximately 200m northeast of the airport boundary. Concentrations have exceeded the limit value since installation in 2005 and fluctuate from year to year. They were 43µg/m^3 in 2012, but appear to be below the EU limit value in 2013. 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 mainly affected by emissions from traffic on the M4. Concentrations appear to have decreased in 2013 to approximately 53µg/m^3 (57µg/m^3 in 2012). 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 of 46µg/m^3 appear to have been recorded in 2013, which is similar to 2012. 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 annual average concentrations measured at selected sites around Heathrow Airport since 1995



Approximately 33% of aircraft operations were easterlies in 2013, a higher than average proportion of easterly operations occurred in February and March.

Fig. 2 NO_2 running annual average concentrations at selected sites since 1995

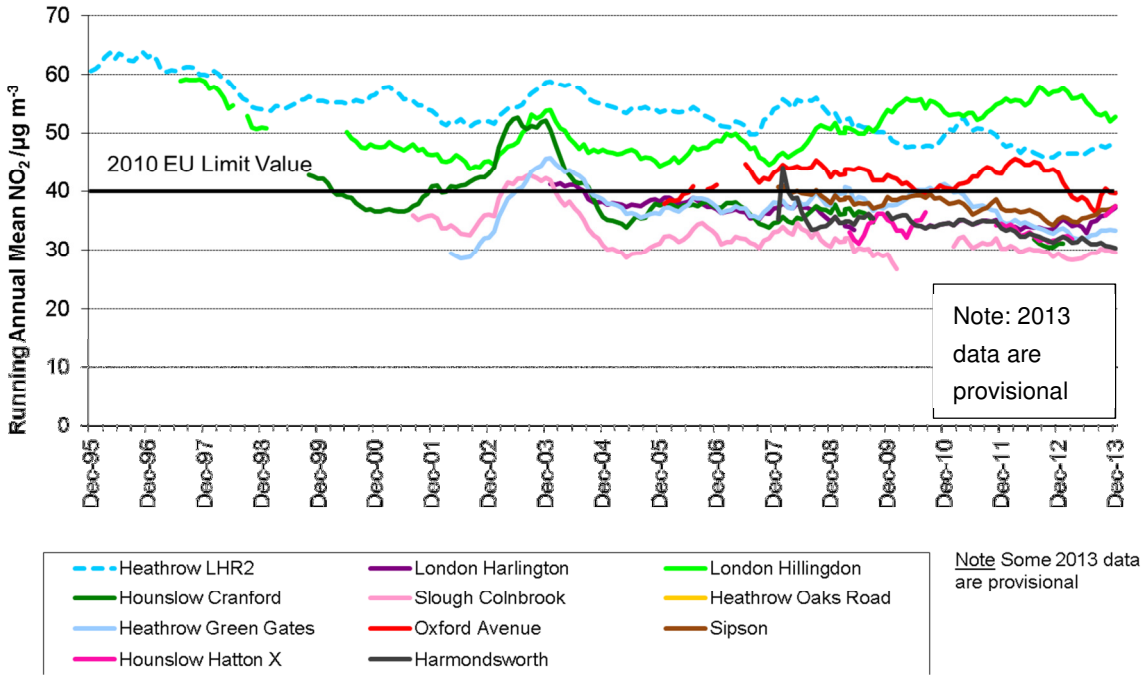


Fig. 2 shows the NO_2 monitoring data expressed as running annual means, which allows us to track changes throughout the year. In general, there was wide variability in concentration trends measured in 2013.

Particles (2005 PM_{10} EU limit value of 50µg/m^3 (35 breaches allowed)) (2020 $PM_{2.5}$ EU target of 25µg/m^3)

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 Figs. 3 and 4.

Only 7 exceedances of the EU limit value were recorded at LHR2 in 2013 – half those that were recorded in 2011.

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

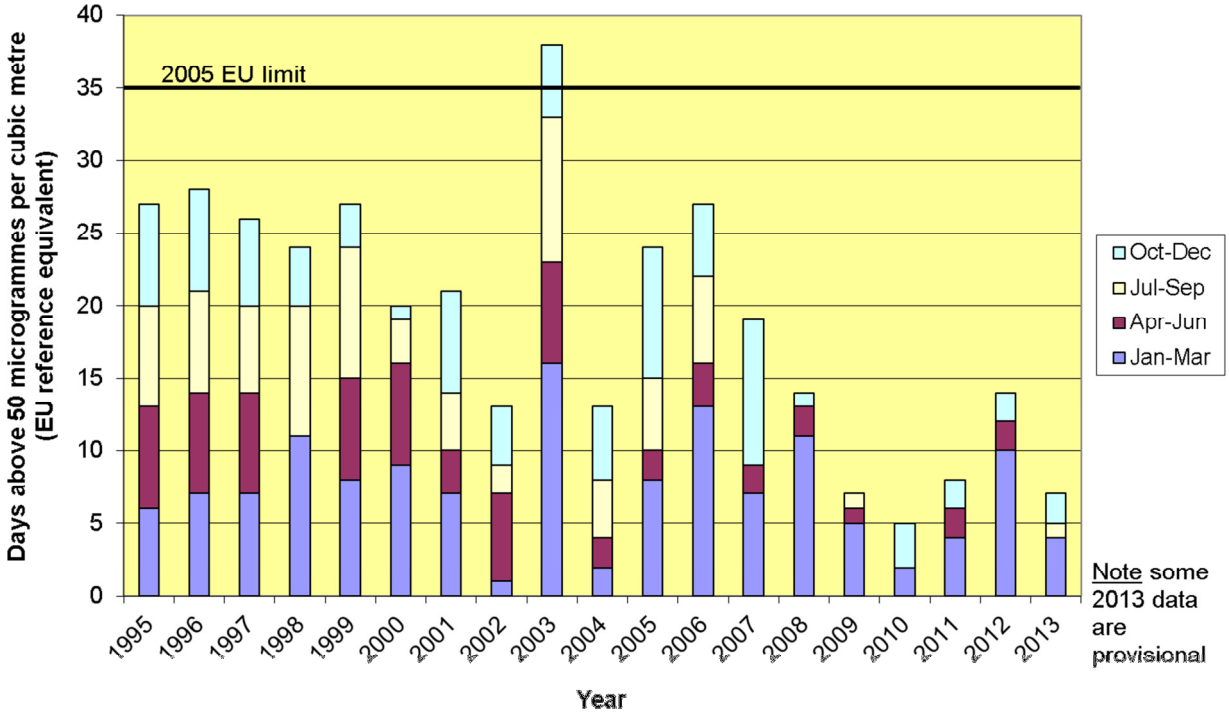
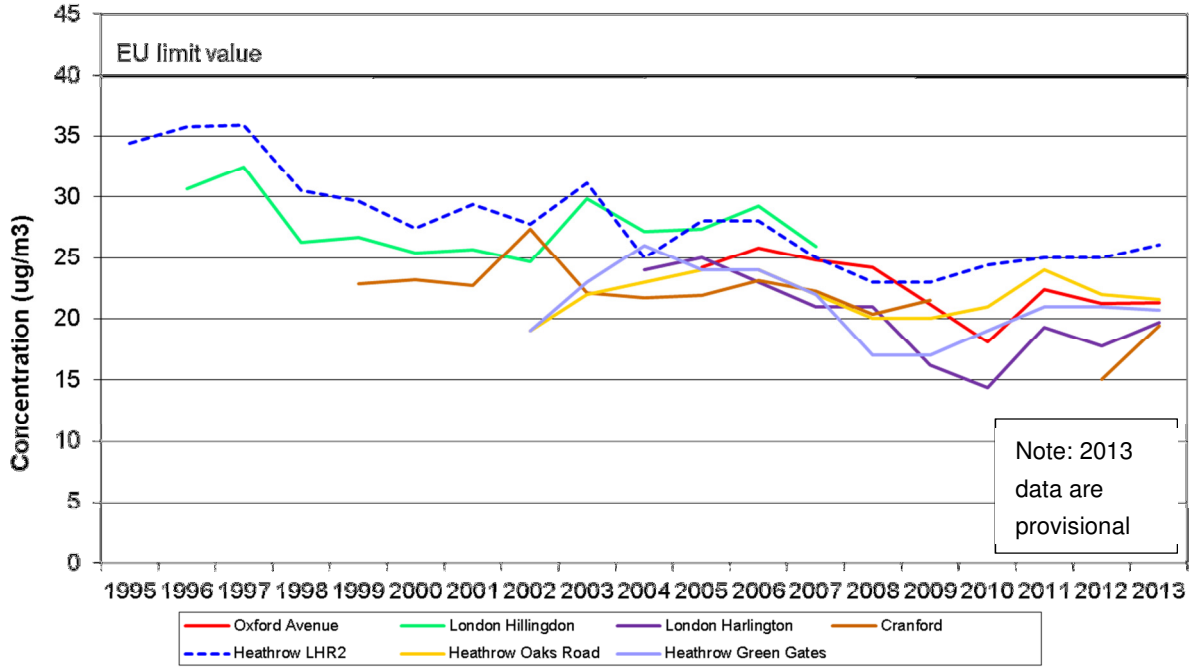
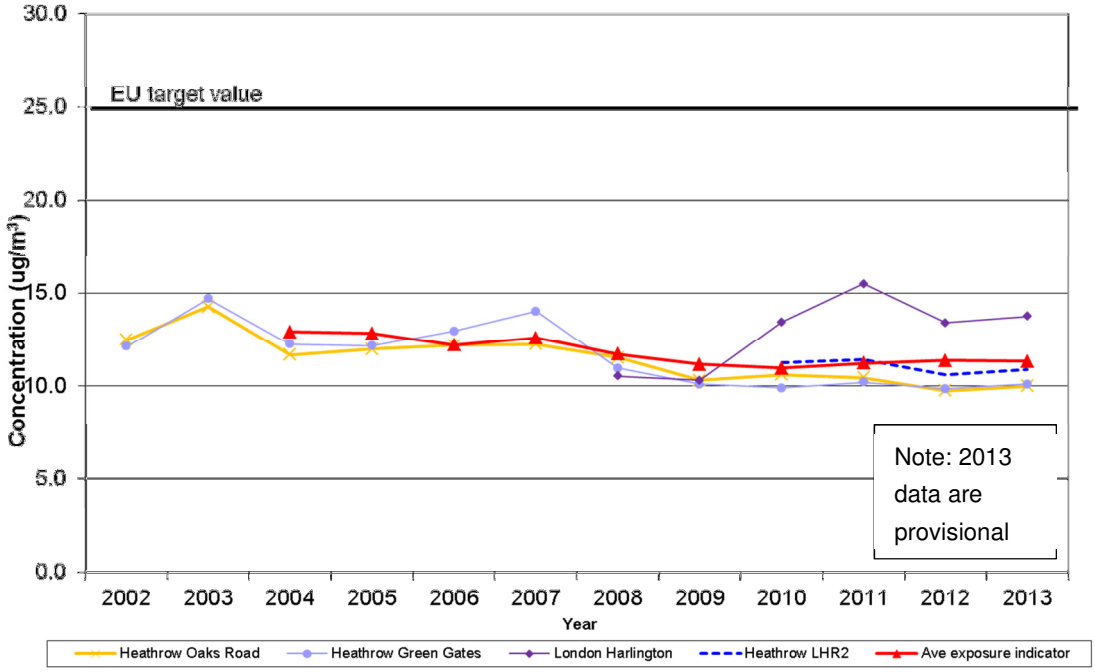


Fig. 4 Annual average gravimetric PM_{10} measurements around Heathrow Airport since 1995



Annual average PM_{10} concentrations at all sites were below the EU limit value in 2013.

Fig. 5 Annual average gravimetric $PM_{2.5}$ measurements around Heathrow Airport since 2005 – Comparison with the EU limit value (2020 $PM_{2.5}$ EU target of 25µg/m^3)



Annual mean concentrations of $PM_{2.5}$ measured at Green Gates, Oaks Road, Harlington and LHR2 for 2013 are presented in Fig 5. It also includes the average exposure indicator, which is a three year average for all monitoring sites.

Concentrations measured at three of the sites have not changed substantially since 2008, whereas those measured at Harlington have been higher since 2010. We installed a different monitor at Harlington in 2010 which captures a greater proportion of the volatile fraction of particles – it uses a TEOM FDMS, as opposed to TEOM instruments at the other three sites. Unfortunately the TEOM FDMS is more prone to breakdown and the data capture at Harlington has been below the minimum EU requirement (90%) since the instrument was installed. This situation has improved, and we achieved data capture of over 90% since 2012.

HAL is investigating what monitors should replace all its TEOM and TEOM FDMS particle monitors to reduce data loss as well as provide the most robust monitoring data.

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. 6, which also shows the trend in NO_2 concentrations measured at each site since 2001, putting the data presented in Fig.1into a geographical context.

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.

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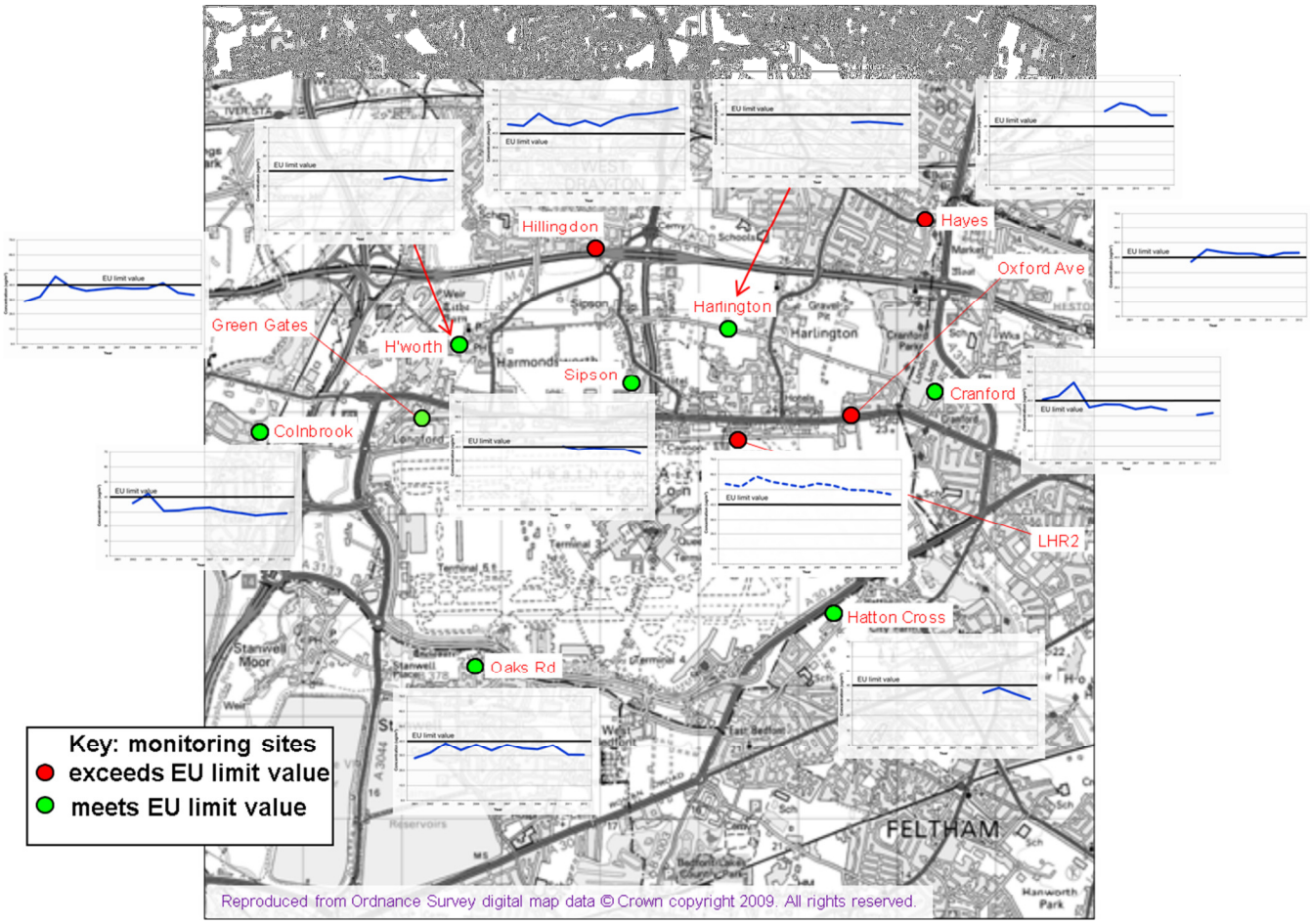
Fig. 6. Nitrogen dioxide monitoring sites and annual mean measurements since 2001

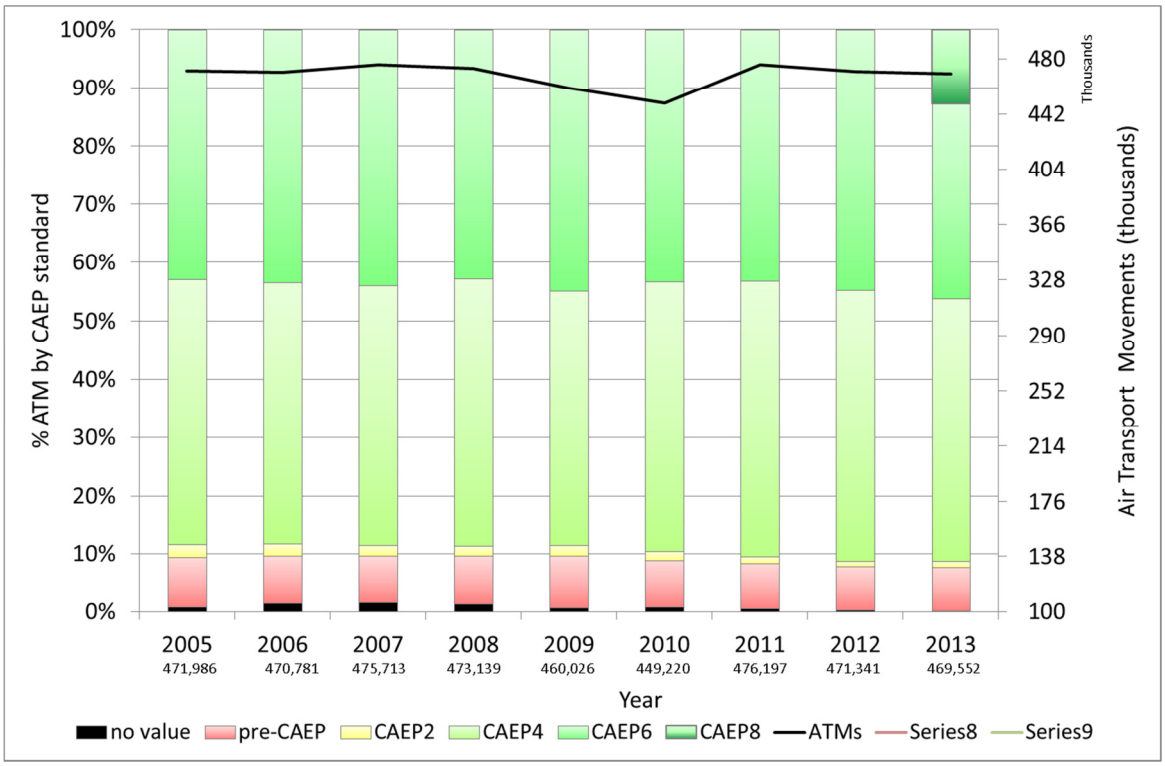


CAEP value of air traffic movements

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; to over 91%. The trend is expected to continue as airlines replace their older aircraft and Heathrow's NO_X emissions landing charge encourages their use. ATMs have been reasonably stable, though 2009 and 2010 showed a fall of 2.7% and 5% respectively.

Fig. 7. - CAEP4 compliance of ATMs (air traffic movements) since 2005



We will investigate 2013 aircraft emissions and report them later in 2014.