Heathrow Air Quality

Together towards sustainability

Air quality at Heathrow Airport

Q3 2012

Headlines

Key information for air quality monitoring data is:

- Annual average NO_2 concentrations in 2011 at the Green Gates monitoring site in Longford were below the EU limit value, but concentrations measured at Oxford Avenue still exceeded it.
- In Q3 2012, the running annual mean for NO_2 fell at most monitoring sites – the principal exception being the Hillingdon M4 site (see Fig. 1).
- Up to Q3 2012, there were 12 exceedances of the daily average PM_{10} limit value. Thirty five exceedances per year are allowed before the limit value is breached (see Fig 2).
- Over 90% of aircraft movements in 2011 were made by more modern CAEP4 or CAEP6 models (see Fig. 4). This trend continued through Q3 2012 with over 91% of movements made by these aircraft.

Background

Heathrow Airport Ltd (HAL) has monitored air quality since the 1990s at its site located near the northern runway (LHR2). It now monitors air quality at three other sites around the airport – Harlington, Green Gates and Oaks Road (see Fig. 3 for locations of these and other air quality monitoring sites within 2km of Heathrow Airport).

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) breach 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/m^3 by 2010)

The annual average EU limit value for NO_2 was met at the majority of monitoring sites close to Heathrow Airport in 2011. Key information is:

- Oxford Avenue (red) is approximately 200m northeast of the airport boundary. Concentrations have exceeded the limit value since installation in 2005. In 2011, the annual average was 43µg/m^3. Current monitoring data indicates the running annual average to September 2012 has fallen below the limit value; a full year's data is needed to assess against it. 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.
- Concentrations at Green Gates (light blue) have shown a gradually increasing trend since 2005. In 2011, annual average concentrations were less than 35µg/m^3. Current monitoring data indicates the running annual average to September 2012 has remained at this level. Direct airport emissions are approximately 7% of measured NO_X concentrations, 5% is from airport-related road traffic, 21% from non-airport traffic and 67% 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 increased slightly 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. 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

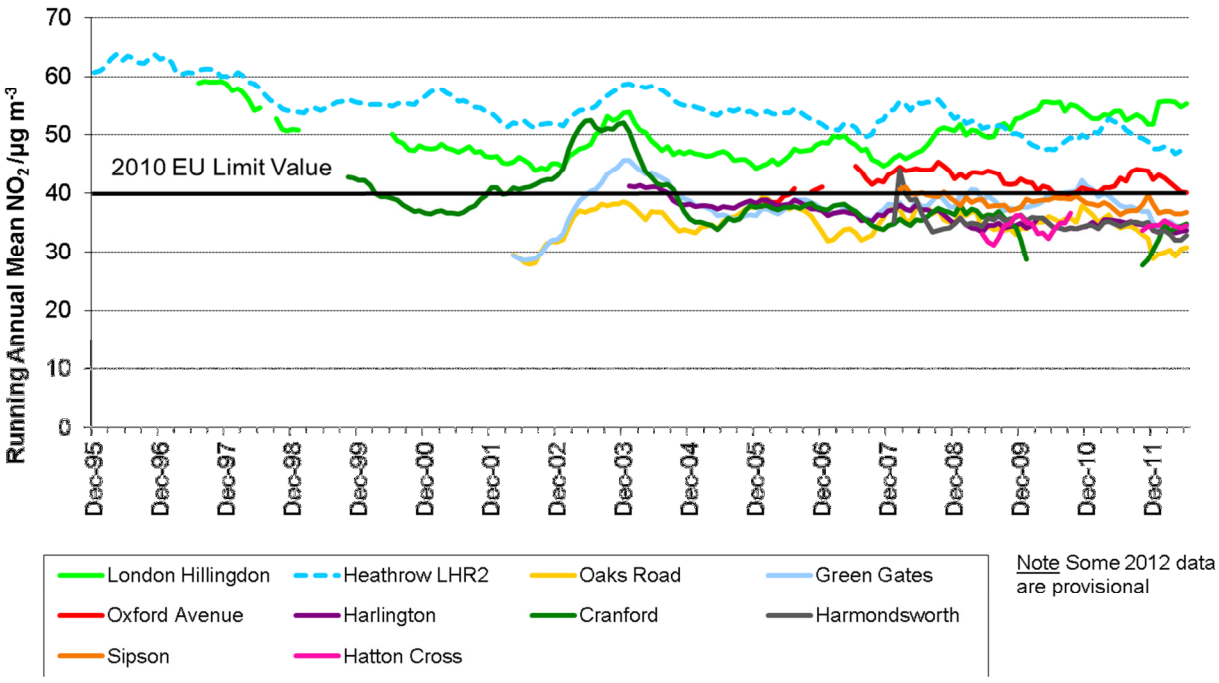


Fig. 1 shows the NO_2 monitoring data expressed as running annual means, which allows us to track changes throughout the year. In general, concentrations of NO_2 have been lower throughout 2012 when compared to 2011. The principal site where an increasing trend has been recorded is the site near the M4 (London Hillingdon).

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

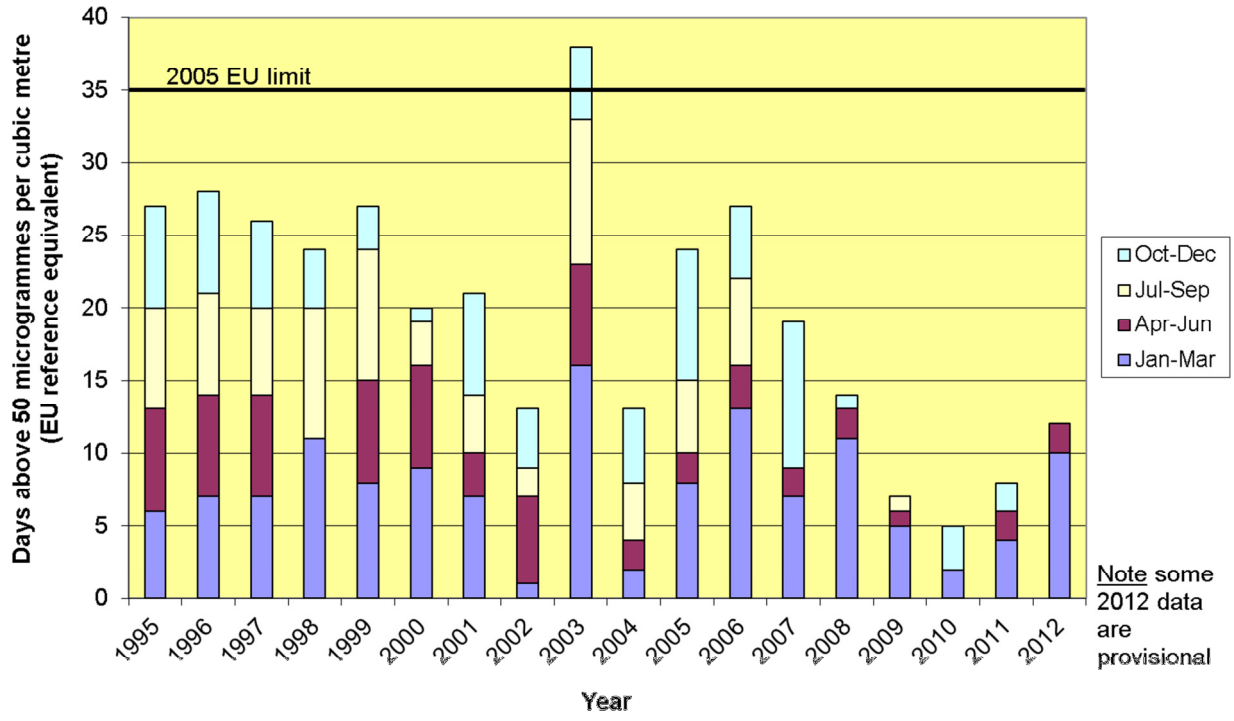
PM_{10} is measured at all four of HAL's monitoring sites and concentrations measured at LHR2 are generally the highest. Results are presented in Fig. 2.

Twelve exceedances have been recorded at LHR2 so far in 2012. Ten occurred in Q1; a higher number than usual, but a pattern seen across London monitoring sites due to weather conditions. Two exceedences occurred in Q2; none occurred in Q3.

The EU limit value for PM_{10} has been met here 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. It also includes the trend in NO_2 concentrations measured at each site since 2001, putting the data into 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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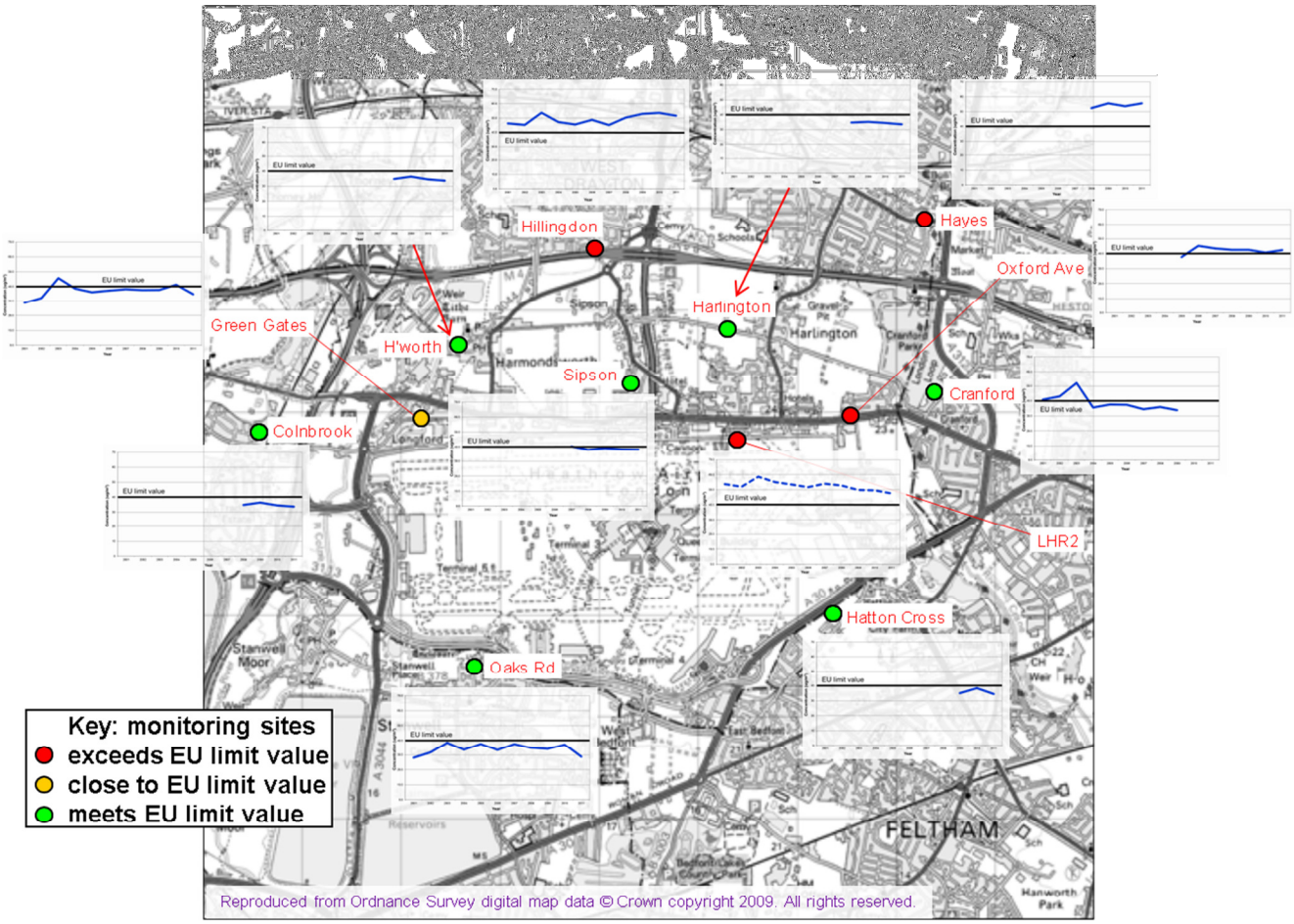
Fig. 3 - Nitrogen dioxide monitoring sites and annual mean measurements since 2001

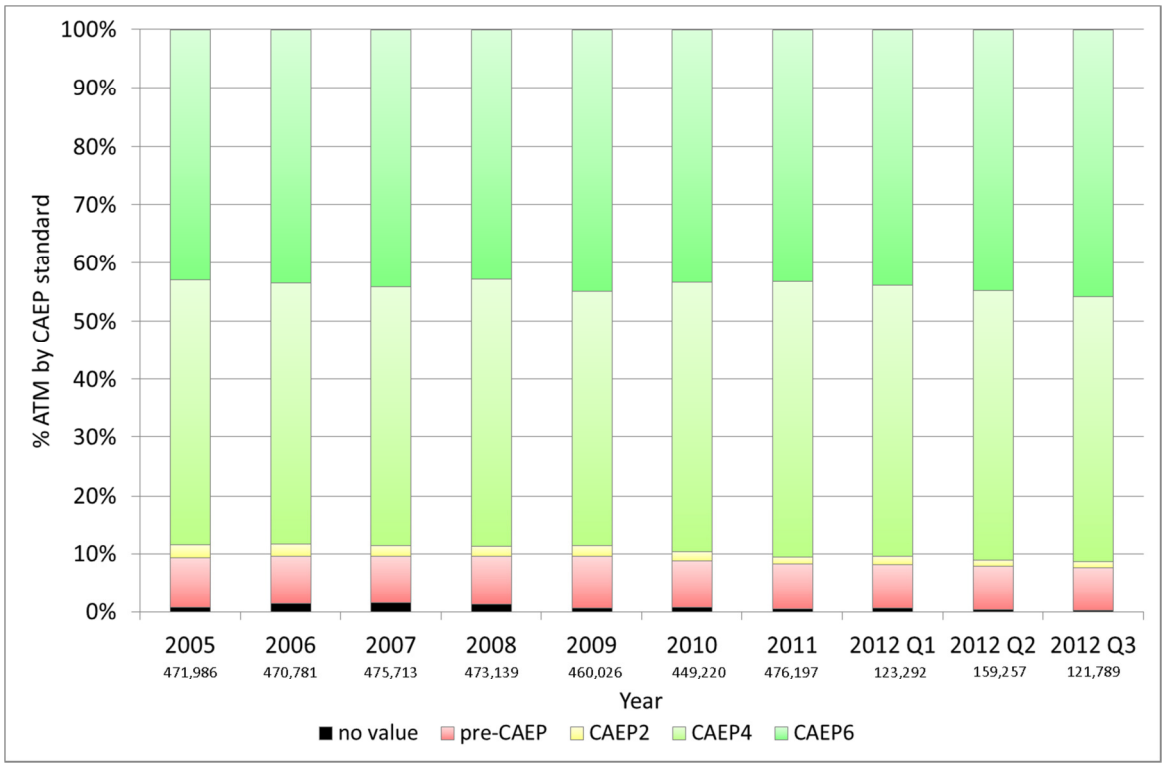


CAEP value of air traffic movements

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.

Fig. 4 shows the proportion air traffic movements (ATMs) based on their relationship to the CAEP NO_X emissions standards. The number of ATMs each year is also presented. It shows the relative proportion of flights made by newer, cleaner aircraft (those defined as CAEP4 or better) has risen to its highest ever point. Over 90% of flights were made by these aircraft in 2011, although ATMs were similar to those in 2007. This pattern has continued into 2012. In Q3, over 91% of ATMs were made by CAEP4 aircraft or better.

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



Aircraft ground emissions in 2011

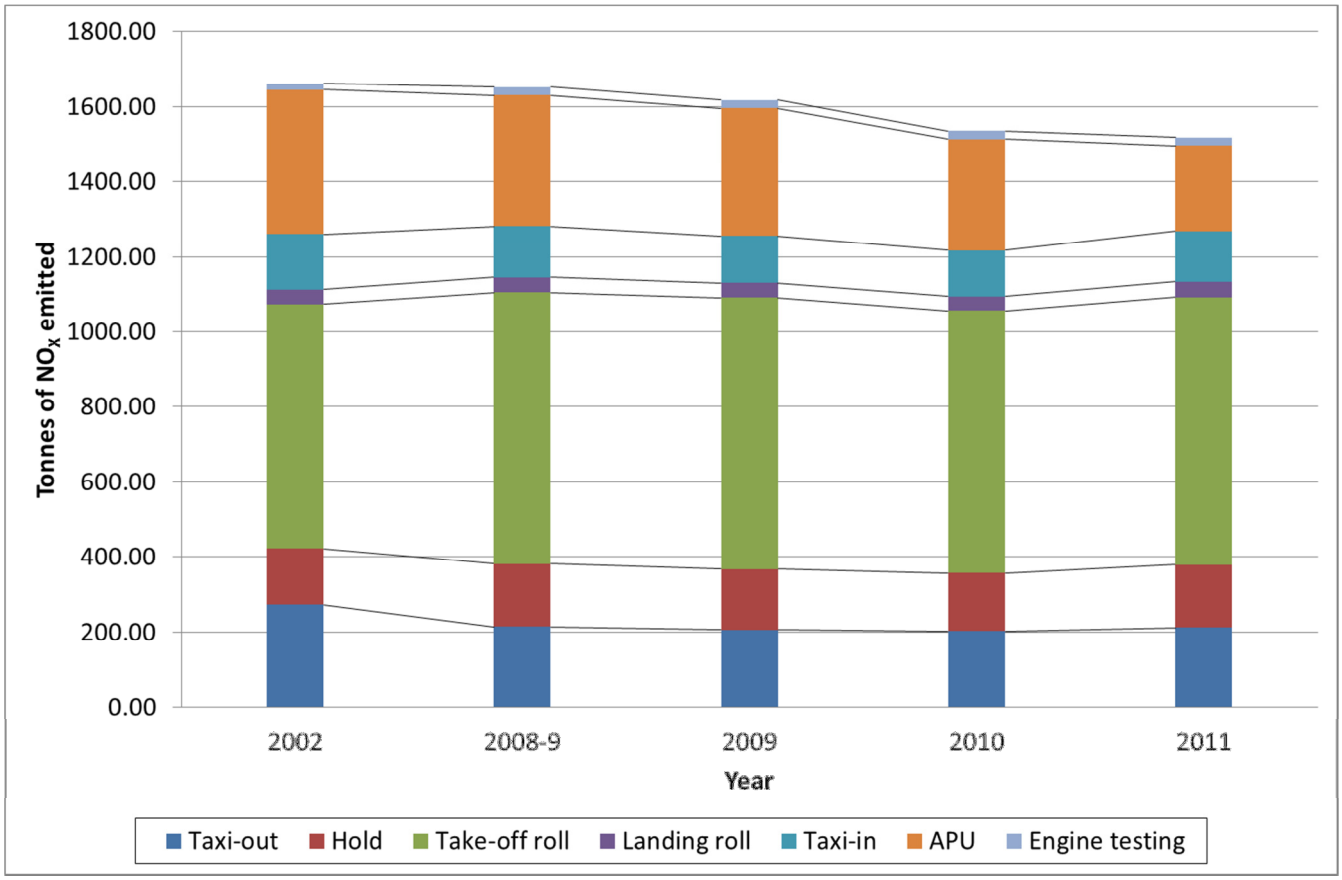
Since 2009 HAL has commissioned an annual inventory of aircraft emissions to assess how these are changing over time. The results of the latest NO_X assessment, for 2011, are shown in Fig 5.

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 unit (APU) use on the airport. Manual survey data indicates APU emissions have fallen by approximately 120 tonnes (35%) since 2008/9.

Fewer aircraft movements in 2009 and 2010 reduced emissions too. In 2011, movements increased by approximately 15,500 to 476,197, but ground level emissions still fell to 1,518 tonnes; a fall of 8% since 2008/9.

Fig. 5 - Comparison of total annual ground level aircraft NO_X emissions at Heathrow airport



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 traffic movements (ATMs) were almost up to the cap of 480,000 in 2011.
- The proportion of flights by narrow bodied aircraft remained at approximately 66% of the total, but produced approximately 30% of total ground level NO_X.
- Passenger loading increased again – and was approximately 146 passengers per flight.

NO_X emission per passenger fell again and was approximately 62 grams, whilst NOx emission per aircraft movement increased slightly to 2.66kg; reflecting subtle changes to the aircraft fleet mix.

Table. 1 - Assessment of normalised annual NO_X emissions

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

Note:

1. Excludes APU and engine testing emissions