

Monitoring SO₂ and NO₂ Levels

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During the industrial revolution of the 19th century, large amounts of coal were burnt to provide power for factories and their machines. Vast quantities of carbon dioxide and sulfur dioxide poured into the air. Iron smelters generated large volumes of sulfur dioxide as they produced the growing quantities of steel required for industry. The atmosphere of large industrialised cities in Europe and the USA became highly polluted with acidic gases. The increased use of motor vehicles in the 20th century (particularly after 1945) increased oil consumption. Emissions of sulfur dioxide doubled in the 25-year period following World War II. Adding to this pollution burden on the atmosphere was the increasing production of nitrogen oxides in internal combustion engines. Following numerous deaths (about 4000) in London in 1952 due to heavy acidic smogs, pollution controls began to be introduced to clean up the air of these large cities. High levels of photochemical smog (produced by the action of sunlight on air containing moisture, ozone, hydrocarbons and NO_x) in cities such as Los Angeles and Tokyo in the 1960s accelerated the push for emission controls on motor vehicles. In the 1970s the development of more sensitive gas analysis technologies allowed chemists to monitor the global increase in sulfur dioxide emissions due to the expansion of industries in Asia.

In recent years the air quality has improved in most westernized countries. In Europe, the sulfur dioxide emissions dropped by about 45% in the 1990s. In the same period, nitrogen dioxide emissions dropped by about 20%. However, due to increasing population and usage of motor vehicles, the levels of pollutants have stabilised rather than continuing to decrease. The rapid industrialisation of Asia (particularly China) has led to huge increases in sulfur dioxide emissions. It is predicted that sulfur dioxide emissions in Asia will triple in the 20-year period from 1990. The Environmental Protection Agency of NSW (EPA) monitors the levels of pollutant gases in the atmosphere in many regions across NSW. The 2003 report reveals the following information.

- The peak 1-hour measurements of sulfur dioxide in Sydney air are now less than 25% of the National Environmental Protection Council (NEPC) standard (0.20 ppm).
- NO₂ concentrations have remained fairly stable over the last decade, with concentrations rarely above the NEPC 1-hour peak standard of 0.12 ppm. In Sydney, typical levels have been much lower than 0.08 ppm over the last decade. This compares favourably to the 1980s when the standard was exceeded over many days in the winter.

Table 7.4 shows EPA data for various suburbs of Sydney in winter (June 2005). The data shows how the heavy traffic in the central-west suburbs of Sydney contributes to NO₂ pollution.

Maximum 1-hour levels of SO₂ and NO₂ in various monitoring sites in Sydney on 24 June 2005 (winter) - *Source:* <http://www2.nsw.epa.gov.au>

Monitoring site	Maximum 1-hour concentration of SO ₂ (ppm)	Maximum 1-hour concentration of NO ₂ (ppm)
Randwick (east)	0.06	0.13
Chullora (central west)	0.01	0.23
Richmond (north-west)	0	0.12
Bringelly (south west)	0.01	0.06

The NSW Department of Environment and Conservation prepares quarterly reports on air quality. The data in Table 7.5 compares information for June in the reports for the years 2000, 2002 and 2004. This data confirms that the air quality in Sydney with respect to SO₂ and NO₂ is high when compared with NEPC standards. The data shows no discernible trends overall across the 5-year period.

Average SO₂ and NO₂ concentrations at various sites during June in 2000, 2002 and 2004 (1-hour averages) - *Source:* Quarterly reports on air quality from the NSW Department of Environment and Conservation for June in 2000, 2002 and 2004

(a) Sulfur dioxide (NEPC standard = 0.20 ppm)			
Monitoring site	2000	2002	2004
Randwick (east)	0.04	0.02	0.08
Wooloware (south)	0.03	0.02	0.03
Richmond (north-west)	0.02	0.01	0.03
Bringelly (south-west)	0.01	0.02	0.01

(b) Nitrogen dioxide (NEPC standard = 0.12 ppm)

Monitoring site	2000	2002	2004
Randwick (east)	0.032	0.030	0.031
Woolooware (south)	0.024	0.026	0.026
Richmond (north-west)	0.016	0.015	0.017
Bringelly (south-west)	0.016	0.016	0.016

The air in Sydney compares favourably with that of much larger cities overseas. The large industrialised cities of China, the USA and Europe have much higher levels of atmospheric NO₂ and SO₂ than Sydney's. Peak 1-hour levels of NO₂ of 0.13 ppm to 0.46 ppm in London, and 0.24 ppm to 0.47 ppm in Los Angeles, have been recorded. In most major centres in Europe and the USA the emission controls that have been instituted by government environmental agencies have improved air quality since the 1950s.