Nitrogen dioxide concentrations

This factsheet presents indicators of nitrogen dioxide concentrations at monitoring sites in New Zealand between 2004 and 2016. Concentrations are measured against the National Environmental Standard for Air Quality (NESAQ) and a World Health Organization (WHO) guideline for nitrogen dioxide exposure.

Key facts

Five out of 13 stations exceeded the national standard (one-hour average) for NO2 between 2004 and 2016.

None of the monitoring stations exceeded the national standard (one-hour average) since 2015.

The WHO guideline (annual average) was exceeded by one out of 13 monitoring stations between 2004 and 2016. The Queen Street monitoring station in Auckland exceeded the annual average guideline in nine out of 12 monitored years.

What is nitrogen dioxide?

Nitrogen dioxide (NO2) is a reddish-brown gas that has a strong smell. It can be released directly into the air but the majority of NO2 is formed when nitric oxide (NO) emissions react with other chemicals in the air. The main source of human-generated NO2 is the combustion of fossil fuels such as coal, oil and gas, especially in motor vehicles. Other sources include industrial activities (eg manufacturing and construction, domestic shipping) and home heating emissions (Ministry for the Environment 2011; Ministry for the Environment and Stats NZ 2018).

NO2 easily reacts with other substances (eg water) to form compounds such as acids. It can also react with other air pollutants to form secondary harmful particles (eg particulate matter) and gases (eg ozone) or create poor visibility (Ministry for the Environment 2011; Ministry for the Environment and Stats NZ 2018; WHO 2006).

NO2 increases the risk of respiratory illnesses

NO2 exposure is associated with increases in hospital admissions for respiratory diseases (WHO 2013). NO2 can decrease the lungs' defences against bacteria, making them more susceptible to infections. It can also aggravate asthma. Inhalation of NO2 by children increases their risk of respiratory infection and may lead to poorer lung function in later life (WHO 2006; WHO 2013). Children, asthmatics, and people with chronic lung disease are most at risk of developing these health problems (Ministry for the Environment 2011).

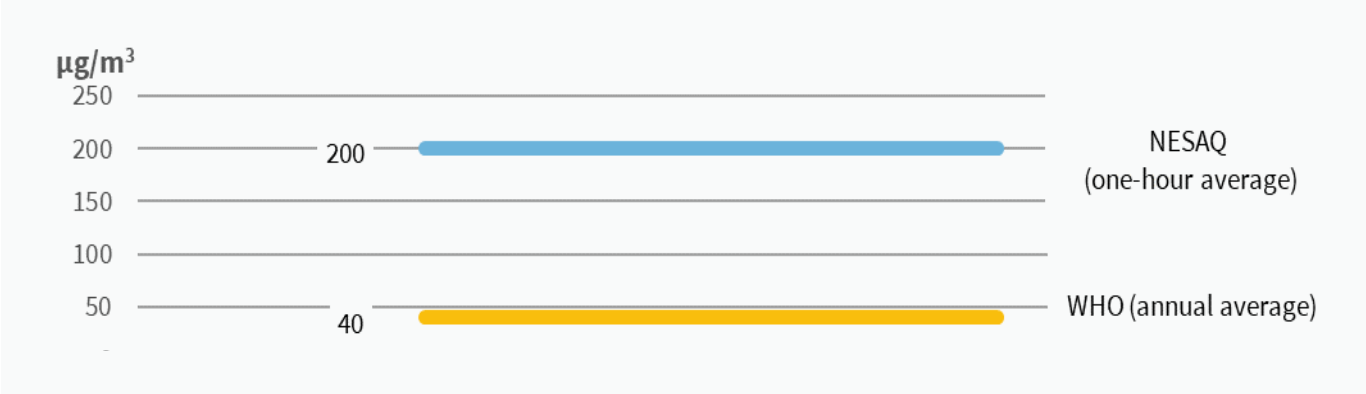
Health effects from NO2 can be difficult to separate from those of other air pollutants such as particulate matter, ultrafine particles or benzene. The majority of these air pollutants come from the same sources (mainly motor vehicles) and are present in the air together (WHO 2013).

NO2 air quality standards and guidelines

NO2 air quality standards and guidelines have been developed to provide some level of protection against health risks. One-hour average NO2 concentrations are measured against a threshold value of 200µg/m3 in the National Environmental Standards for Air Quality (NESAQ). This value is allowed to be exceeded nine times in a 12-month period.

Additionally, annual average concentrations can be compared against the international WHO guideline of 40µg/m3 (Figure 1) (Ministry for the Environment and Stats NZ 2018).

Figure 1: NO2 standard (one-hour average) and guideline (24-hour average)

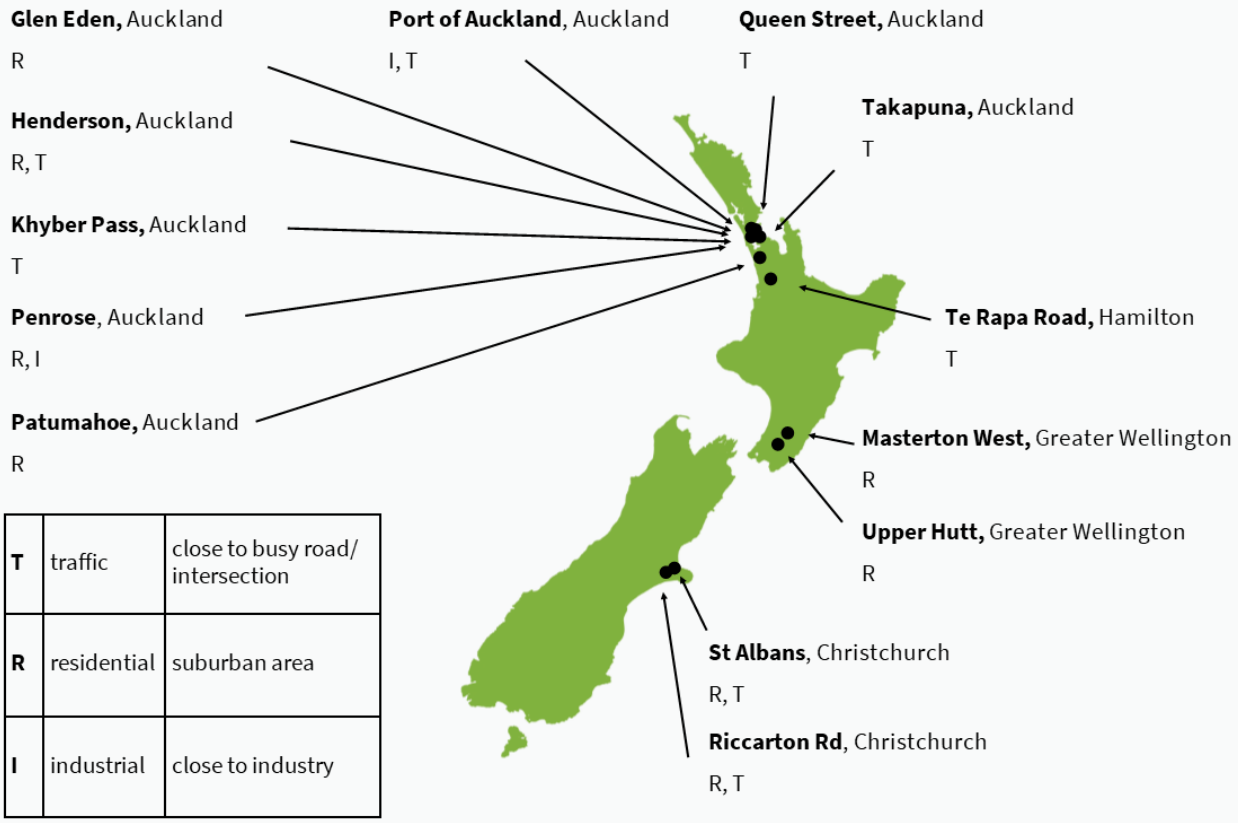


Note: National Environmental Standards for Air Quality (NESAQ), World Health Organization (WHO). Exceedances occur when concentrations are greater than the stated values. Nine exceedances of the NESAQ threshold are allowed in a 12-month period.
Source: Ministry for the Environment and Stats NZ 2018

13 monitoring stations had valid data between 2004 and 2016

Between 2004 and 2016, 13 monitoring stations had valid data for NO2 exposure (Figure 2).

Figure 2: Monitoring stations with valid data, 2004-2016



T	traffic	close to busy road/ intersection
R	residential	suburban area
I	industrial	close to industry

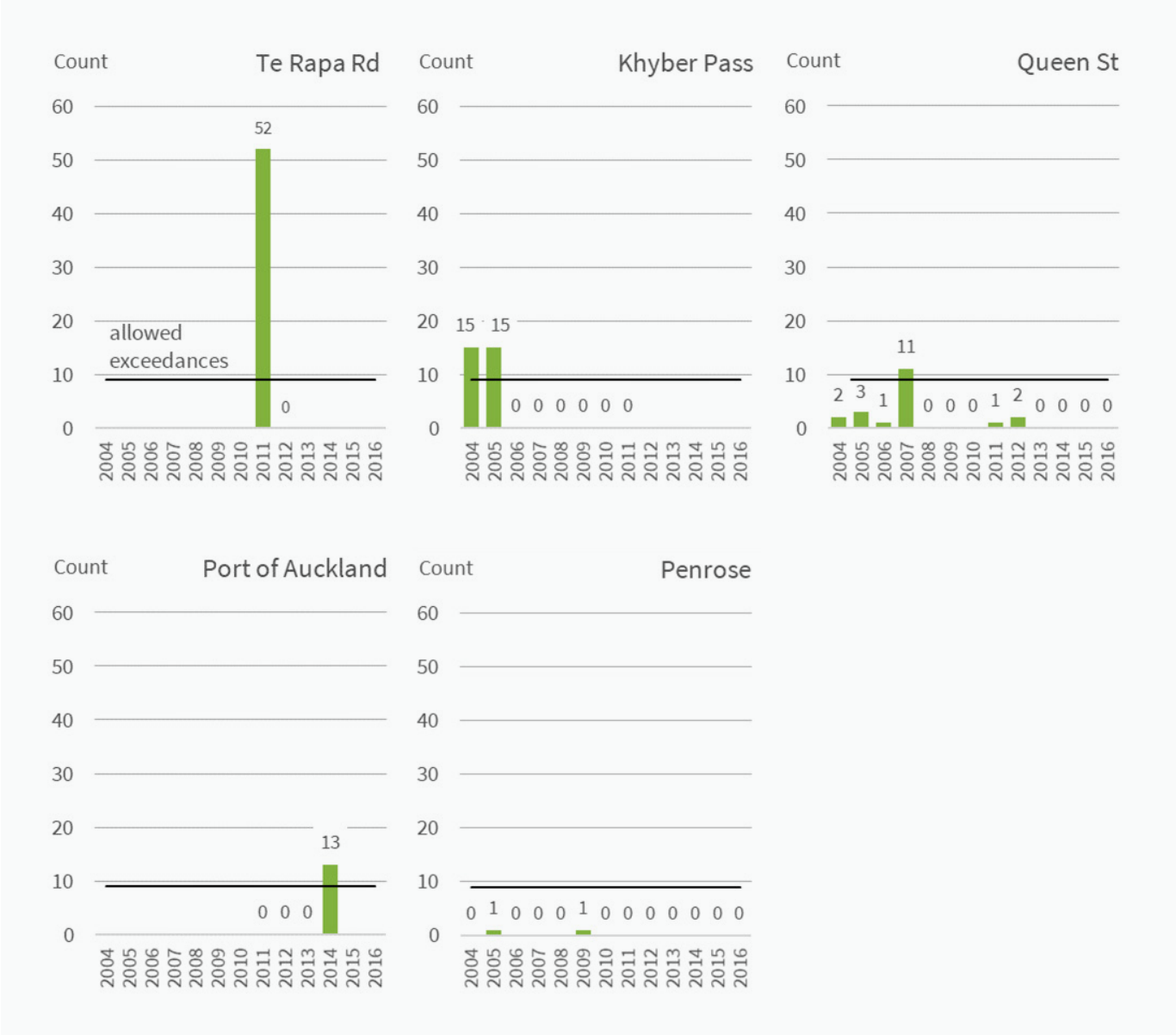
Source: Ministry for the Environment and Stats NZ 2018

Five monitoring sites exceeded the NESAQ threshold

Between 2004 and 2016, five out of 13 monitoring stations exceeded the national one-hour average standard (Figure 3). All five monitoring stations had a traffic- and/or industrial-focus.

The monitoring station Te Rapa Road in Hamilton, a traffic-focussed station, had the most exceedances (52 exceedances) in 2011. These exceedances coincided with roadworks in the area, which increased traffic congestion and truck movements (Waikato Regional Council 2014).

Figure 3: Number of exceedances of the NESAQ's threshold (one-hour average), 2004-2016



Note: Nine exceedances of the NESAQ one-hour average standard (200µg/m3) per 12-month period are allowed. Only stations with valid data are displayed. Missing data labels indicate that there was no monitoring data available for that year.
Source: Ministry for the Environment and Stats NZ 2018

The annual average WHO guideline was exceeded by one out of ten monitoring stations

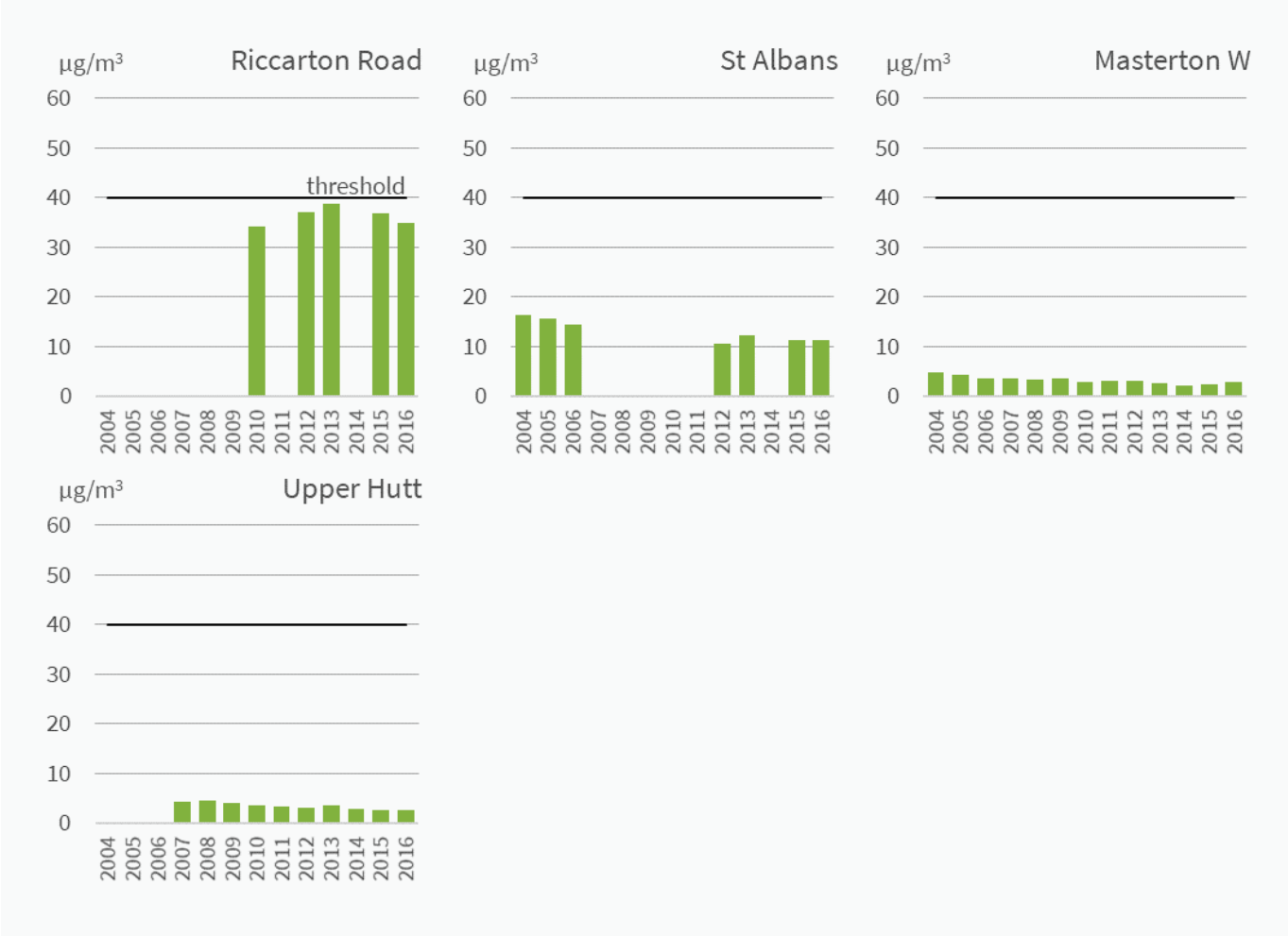
Only one monitoring station exceeded the WHO annual average guideline between 2004 and 2016 (Figure 4). The monitoring station Queen Street in Auckland, a traffic-focussed station, exceeded the guideline in nine out of 12 monitored years. Queen Street is a high-traffic, inner city monitoring station surrounded by tall buildings enabling the accumulation of motor vehicle emissions (Ministry for the Environment and Stats NZ 2018).

Figure 4: Annual average NO2 concentrations at monitoring stations, Auckland Region, 2004-2016

Note: WHO annual average guideline is 40µg/m3. Missing data are associated with no data for that year, i.e. no monitoring data available or data not valid for that year.
Source: Ministry for the Environment and Stats NZ 2018

None of the four monitoring stations (two stations in the Greater Wellington Region and two in Christchurch) exceeded the WHO annual average guideline between 2004 and 2016 (Figure 5). In general, monitoring stations with a traffic-focus (such as St Albans and Riccarton Road) had higher annual average NO2 concentrations than monitoring stations with a residential focus (such as Masterton West and Upper Hutt). This reflects the high contribution of motor vehicle emissions to NO2 concentrations, and highlights the localised nature of NO2 emissions (Ministry for the Environment and Stats NZ 2018).

Figure 5: Annual average NO2 concentrations at monitoring stations, Christchurch Region and Greater Wellington Region, 2004-2016



Note: WHO annual average guideline is 40µg/m3. Missing data labels are associated with no data for that year, i.e. no monitoring data available or data not valid for that year.
Source: Ministry for the Environment and Stats NZ 2018

Data for these indicators

Monitoring sites exceeding the national environmental standard (one-hour average) for nitrogen dioxide
One-hour average nitrogen dioxide concentration data comes from the Ministry for the Environment and Stats NZ (Ministry for the Environment and Stats NZ 2018) as part of New Zealand's Environmental Reporting Series. One-hour average nitrogen dioxide concentrations (in µg/m3) are compared with the National Environmental Standard for Air Quality for nitrogen dioxide. The threshold is exceeded when concentrations are above 200µg/m3. Nine exceedances in a 12-month period are allowed. For additional information, see the metadata link below.

Monitoring sites exceeding the WHO annual average guideline for nitrogen dioxide
One-hour average nitrogen dioxide concentration data comes from the Ministry for the Environment and Stats NZ (Ministry for the Environment and Stats NZ 2018) as part of New Zealand's Environmental Reporting Series. 24-hour averages are calculated and measured against the WHO annual average guideline. Exceedances occur when concentrations are above 40µg/m3. For additional information, see the metadata link below.

References

Ministry for the Environment. 2011. 2011 *User's Guide to the revised National Environmental Standards for Air Quality. Updated 2014.* Wellington: Ministry for the Environment.

Ministry for the Environment and Stats NZ. 2018. *Our air 2018. Data to 2017*. Wellington: Ministry for the Environment.

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URL: **https://www.waikatoregion.govt.nz/environment/environmental-information/environmental-indicators/air/nitrogen-dioxide-report-card/** (accessed 11/02/2020)

WHO. 2006. *Air quality guidelines. Global update 2005.* Geneva: World Health Organization.

WHO. 2013. *Review of evidence on health aspects of air pollution – REVIHAAP Project.* Copenhagen: WHO Regional Office for Europe.

Other air quality topics include:

Wood and coal fires

Particulate matter

Motor vehicles

Health effects of air pollution

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Further information

One-hour average concentrations **Metadata Sheet**

Annual average concentrations **Metadata Sheet**

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