Auckland Air Quality Report

Monthly update

Research and Evaluation Unit | RIMU | Auckland Council — Te Kaunihera o Tāmaki Makaurau

Introduction

Auckland Council continuously collects air quality data to assess compliance with national standards and provide information to aid policy development and evaluation. The data the council collects enables us to quantify ambient air quality in the region and note spatial and temporal variations. This report presents a monthly update on air quality in Auckland. It has three sections: sections A and B present tables and graphics illustrating air quality status in the Auckland region based on the data collected from continuous monitoring sites across the region. For this edition, section C focuses on one monitoring site – Penrose. The monthly update is prepared using validated data which is generally available one month after raw data is collected. This update covers data to 30th June 2022.

Summary

- Customs Street site recorded 94 exceedances of the National Environmental Standard for Air Quality (NESAQ) for Nitrogen Dioxide (NO_2) (1-hour average) between 09/06/2022 and 17/06/2022. An ambient air quality concentration limit of 200 µg/m³ (one hour average) for NO_2 must be met for all but nine hours each year. An investigation found that a mobile diesel power generator had been located next to the monitoring station whilst some repair work in the area was being carried out. The exceedances stopped immediately after the power generator was removed from the premises on 18th June 2022. As per the regulations, Auckland Council has given a public notification within one month of the breach.
- All monitoring sites recorded particulate matter (PM_{10}) concentrations higher than the same period of the previous year (January to June).
- All monitoring sites (except Penrose) recorded particulate matter ($PM_{2.5}$) concentrations higher than same period of the previous year.
- Although the highest NO_2 levels were measured at the city centre sites, the concentrations are lower than the same period of the previous year.

Glossary of terms

Term	Meaning
Aerodynamic diameter	Used to describe the behaviour of a particle as it moves around in the air; it compares the behaviour with that of a spherical particle of unit density.
Air pollutant/contaminant	Any substance in the air that could harm humans, animals, vegetation, or other parts of the environment when present in high enough concentrations.
Air pollution	The presence of one or more air pollutants in high enough concentrations to cause harm.
Air quality	Is the degree to which air is suitable or clean enough for humans, animals, or plants to remain healthy.
Air quality index (AQI)	Score out of 100, based on dividing a pollutant concentration by a relevant standard. It can be used to approximate relative impact of different pollutants.
Ambient air	The external air environment (does not include the air environment inside buildings or structures)
Black carbon (BC)	Is an air pollutant made up of tiny soot-like particles discharged into the atmosphere from combustion processes.
CO	Carbon monoxide, a type of air pollutant.
Exceedance	An exceedance defines a period of time during which the concentration of a pollutant is greater than the appropriate air quality criteria.
Ground-level ozone (O_3)	At ground level, ozone is considered an air pollutant that can seriously affect the human respiratory system. It is a major component of photochemical smog.
Monitoring site	A facility for measuring the concentration of one or more pollutants in the ambient air; also referred to as 'monitoring station'
NESAQ	National Environmental Standard for Air Quality.
NO_2	Nitrogen dioxide, a type of air pollutant
PM	Particulate matter is made up of a mixture of various sizes of solid and liquid particles suspended in air.
PM_{10}	Particulate matter with an aerodynamic diameter of 10 micrometres or less; a type of air pollutant.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of 2.5 micrometres or less; a type of air pollutant.
SO_2	Sulphur dioxide, a type of air pollutant
$\mu g/m^3$	Microgram of pollutant (1 millionth of a gram) per cubic metre of air, referenced to temperature of 0°C (273.15 K) and absolute pressure of 101.325 kilopascals (kPa)
n/a	Not applicable

Data can be viewed on the environmental data portal , LAWA or requested from environmentaldata@aucklandcouncil.govt.nz. Full state and trends analyses and reports are prepared every few years (last report; Trends in Auckland's air quality 2006-2018).

See the frequently asked questions about the Auckland air quality monitoring programme.

Section A – Data tables

Table 1. Summary information about Auckland air quality monitoring programme 1 January 2022 to 30 June 2022		
Number of Continuous Monitoring Sites	10	
Location of Monitoring Sites	Queen Street, Customs Street, Khyber Pass Road, Penrose, Henderson, Takapuna, Glen Eden, Pakuranga, Papatoetoe, and Patumahoe	
Standard Contaminants Monitored	PM_{10}, CO, NO_2, O_3, and SO_2	
Other Key Contaminants Monitored	$PM_{2.5}$, and Black Carbon	
Number of Exceedances Of NESAQ In 2022	94 (1-hour average)	
Number of Exceedances of Auckland Ambient Air Quality Targets In 2022	10 (24-hour average)	
Maximum PM_{10} 24-Hours Mean (Jan - June 2022)	37.0 µg/m^3 (74.0% of NESAQ)	*Recorded at Queen Street on 25 March 2022*
Maximum $PM_{2.5}$ 24-Hours Mean (Jan - June 2022)	19.3 µg/m^3 (77.2% of Auckland target)	*Recorded at Patumahoe on 13 June 2022*
Maximum NO_2 1-Hour Mean (Jan - June 2022)	399.0 µg/m^3 (199.5% of NESAQ)	*Recorded at Customs Street on 9 June 2022*
Maximum SO_2 1-Hour Mean (Jan - June 2022)	51.0 µg/m^3 (14.6% of NESAQ)	*Recorded at Customs Street on 10 June 2022*
Maximum O_3 1-Hour Mean (Jan - June 2022)	67.0 µg/m^3 (44.7% of NESAQ)	*Recorded at Patumahoe on 14 June 2022*
Maximum CO Running 8-Hour Mean (Jan - June 2022)	2.05 mg/m^3 (20.5% of NESAQ)	*Recorded at Khyber Pass Rd on 13 May 2022*
Written Reports Framework	Monthly Updates, Annual Report, Trends Report, and State of the Environment Report	

Table 2. General changes in concentration of key contaminants monitored for the last 18, 30 and 42 months.

↑ indicates an increase   ↓ indicates a decrease   ↗ Increase but not significant   ↘ Decrease but not significant

Site	PM$_{10}$ Last 18 months	Last 30 months	Last 42 months	PM$_{2.5}$ Last 18 months	Last 30 months	Last 42 months	NO$_2$ Last 18 months	Last 30 months	Last 42 months	Black carbon Last 18 months	Last 30 months	Last 42 months	Ozone Last 18 months	Last 30 months	Last 42 months	CO Last 18 months	Last 30 months	Last 42 months	SO$_2$ Last 18 months	Last 30 months	Last 42 months	AQI Last 18 months	Last 30 months	Last 42 months	Site
Customs Street*	n/a	n/a	n/a	↗	↓	n/a	↘	↓	n/a	↘	↘	n/a	n/a	n/a	n/a	n/a	n/a	n/a	↑	↑	n/a	n/a	n/a	n/a	Customs Street*
Glen Eden*	↗	↘	↘	↑	↗	↘	↗	↗	↗	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	↗	↘	↓	Glen Eden*
Henderson	↗	↗	↘	n/a	n/a	n/a	↗	↗	↘	↗	↗	↘	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	↗	↘	↘	Henderson
Khyber Pass Road	↑	↗	↗	n/a	n/a	n/a	↘	↘	↘	n/a	n/a	n/a	n/a	n/a	n/a	↘	↘	↘	n/a	n/a	n/a	n/a	n/a	n/a	Khyber Pass Road
Pakuranga*	↗	↑	↘	↗	↗	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Pakuranga*
Papatoetoe	↘	↗	↘	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Papatoetoe
Patumahoe	↘	↘	↓	↗	↗	↘	↑	↗	↗	n/a	n/a	n/a	↗	↘	↘	n/a	n/a	n/a	n/a	n/a	n/a	↗	↘	↓	Patumahoe
Penrose	↗	↗	↘	↗	↘	↓	↗	↘	↘	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	↑	↑	↗	↗	↗	↓	Penrose
Queen Street	↗	↑	↑	↗	↑	↑	↓	↓	↓	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	↘	↗	↗	Queen Street
Takapuna	↗	↗	↘	↗	↗	↘	↗	↗	↘	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	↗	↗	↓	Takapuna

Notes

Effective dates: 18 months (1 Jan 2021 to 30 June 2022), 30 months (1 Jan 2020 to 30 June 2022), and 42 months (1 Jan 2019 to 30 June 2022)

PM$_{10}$ is monitored at Glen Eden, Henderson, Khyber Pass Rd, Pakuranga, Papatoetoe, Patumahoe, Penrose, Takapuna, and Queen St.

PM$_{2.5}$ is monitored at Customs St, Glen Eden, Pakuranga, Patumahoe, Penrose, Takapuna, and Queen St.

NO$_2$ is monitored at Customs St, Glen Eden, Henderson, Khyber Pass Rd, Patumahoe, Penrose, Takapuna, and Queen St.

Black carbon is monitored at Customs St, and Henderson.

CO is monitored at Khyber Pass Rd.

Ozone is monitored at Patumahoe.

SO$_2$ is monitored at Customs St, and Penrose.

*PM$_{2.5}$ data coverage for Glen Eden, Customs Street and Pakuranga is less than 75% due to instrument failure between Sep 2021 and Jan 2022. Weather changes significantly affect concentrations of air contaminants (see this report)
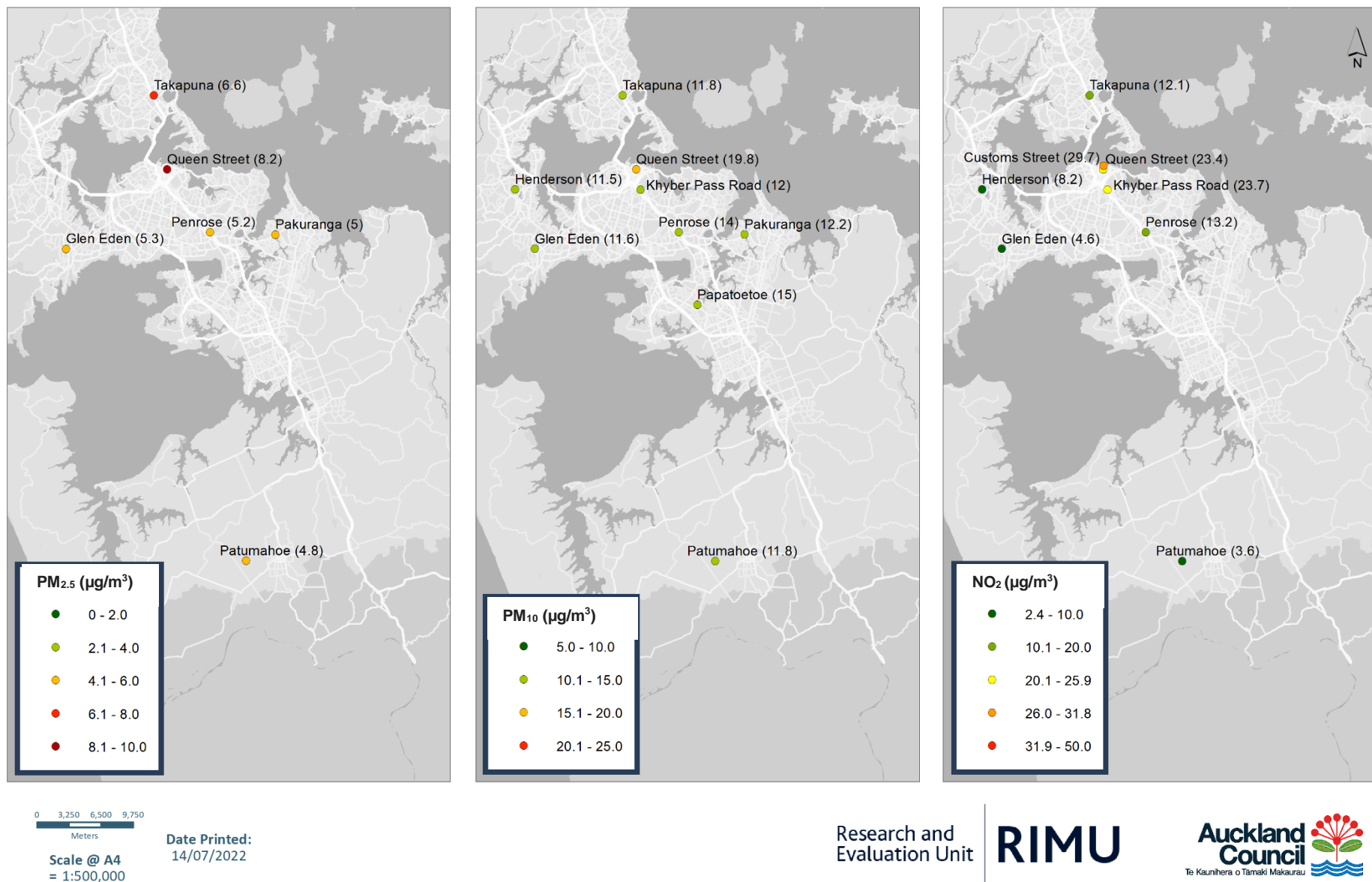
Figure 1. Maps a, b and c show the air quality monitoring sites and their last 12- months (1 July 2021 to 30 June 2022) average PM and NO₂ concentrations in brackets. Auckland city centre monitoring sites recorded the highest PM and NO₂ concentrations.

Section B. Key air contaminants across the 10 air quality monitoring sites (1 January 2022 to 30 June 2022)
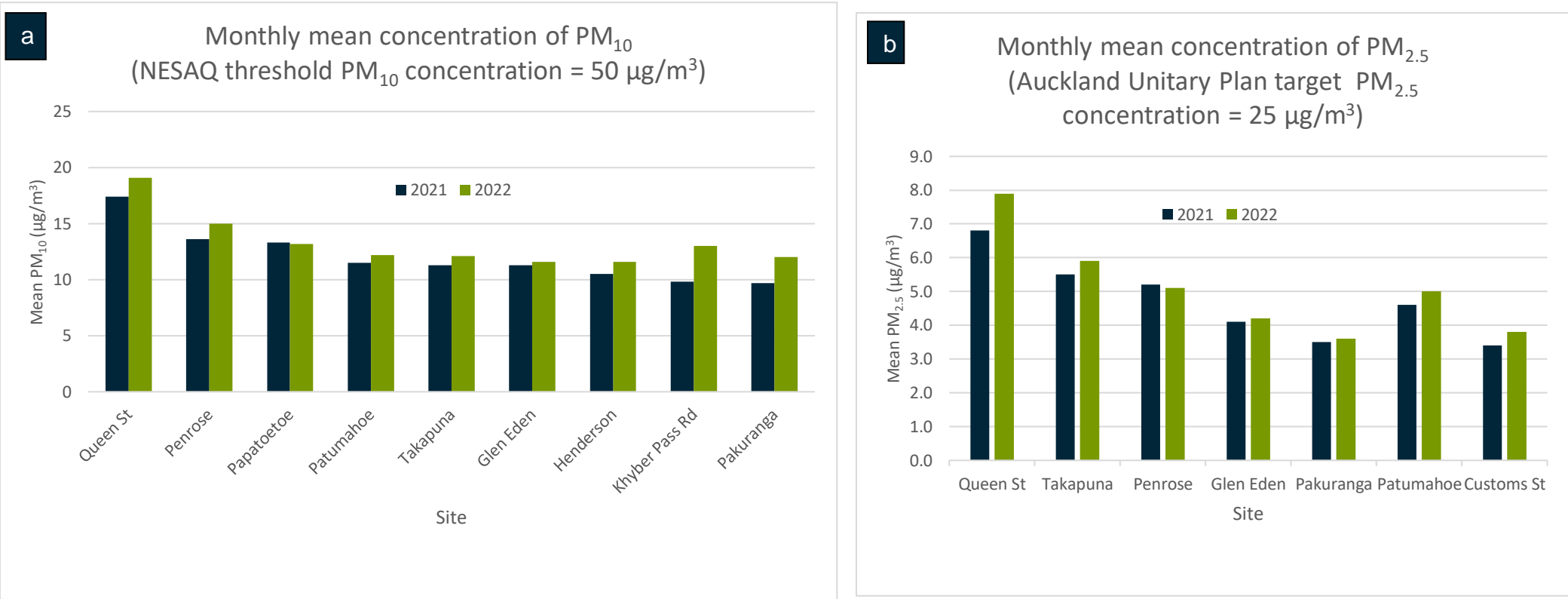
Figure 2. Monthly mean concentration of particulate matter. As in the previous year, the highest concentrations of both PM_{10} and $PM_{2.5}$ were recorded at Queen St. Plots a and b represent PM_{10} and $PM_{2.5}$, respectively. The average PM_{10} concentration in all the monitoring sites is higher than the same period of the previous year. PM_{10} and $PM_{2.5}$ have multiple sources including motor vehicles, home heating, sea salt, marine diesel, and soils (windblown soil, road dust, and dust generated by earthworks, construction, and road works).
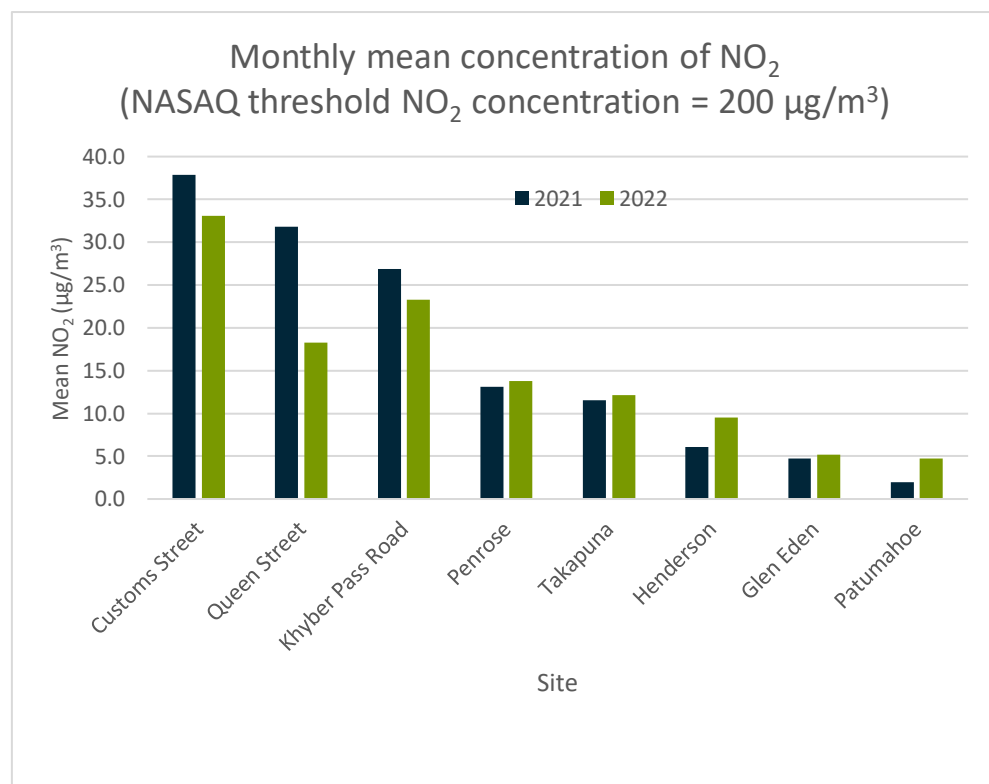
Figure 3. Monthly mean concentration of NO_2 across monitoring sites. Auckland city centre monitoring sites recorded the highest concentrations. All monitoring sites, except Queen St, Customs St, and Khyber Pass Rd, recorded higher average NO_2 concentrations compared to 2021. The main source of NO_2 is motor vehicles.
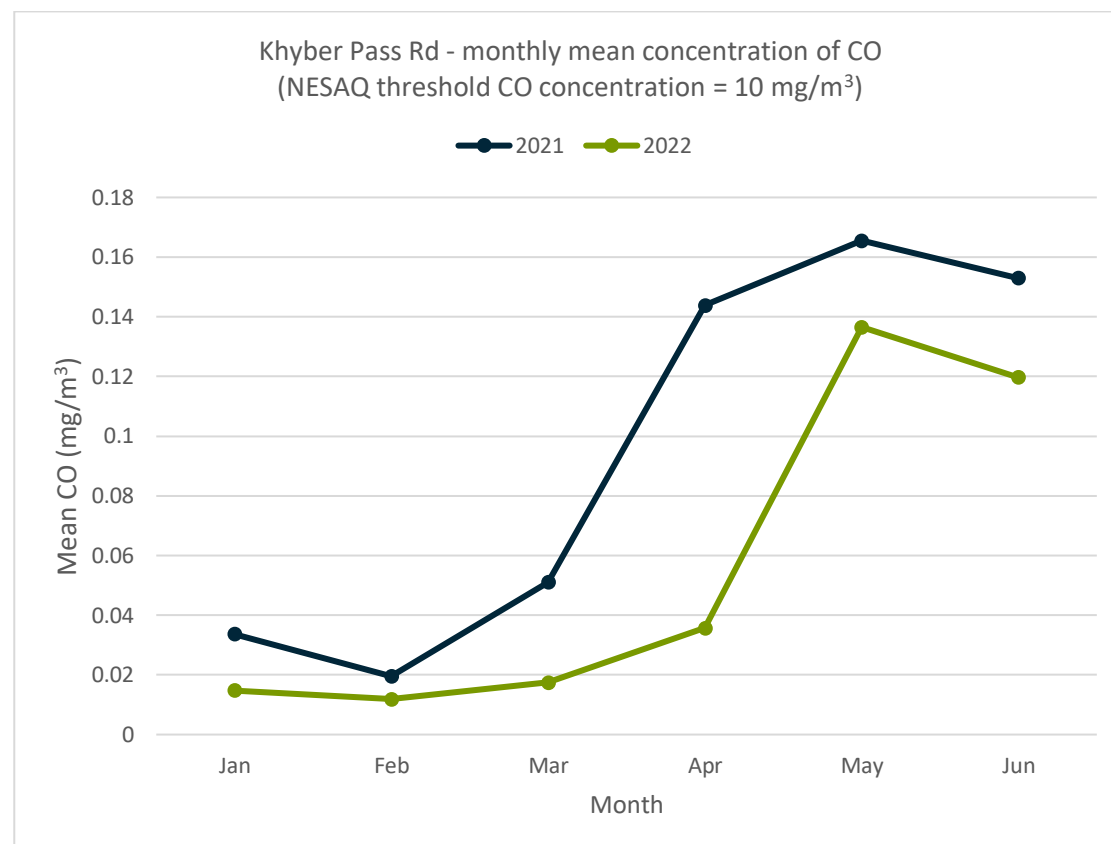
Figure 4. Monthly mean concentration of CO. The mean CO concentration for each month is less than the previous year. The main source of CO is motor vehicles. Note: currently, CO is only monitored at Khyber Pass Road. There is 40% decrease in CO average concentration (from 0.094 mg/m^3 to 0.056 mg/m^3)

Section C. Focus on a monitoring site: Penrose
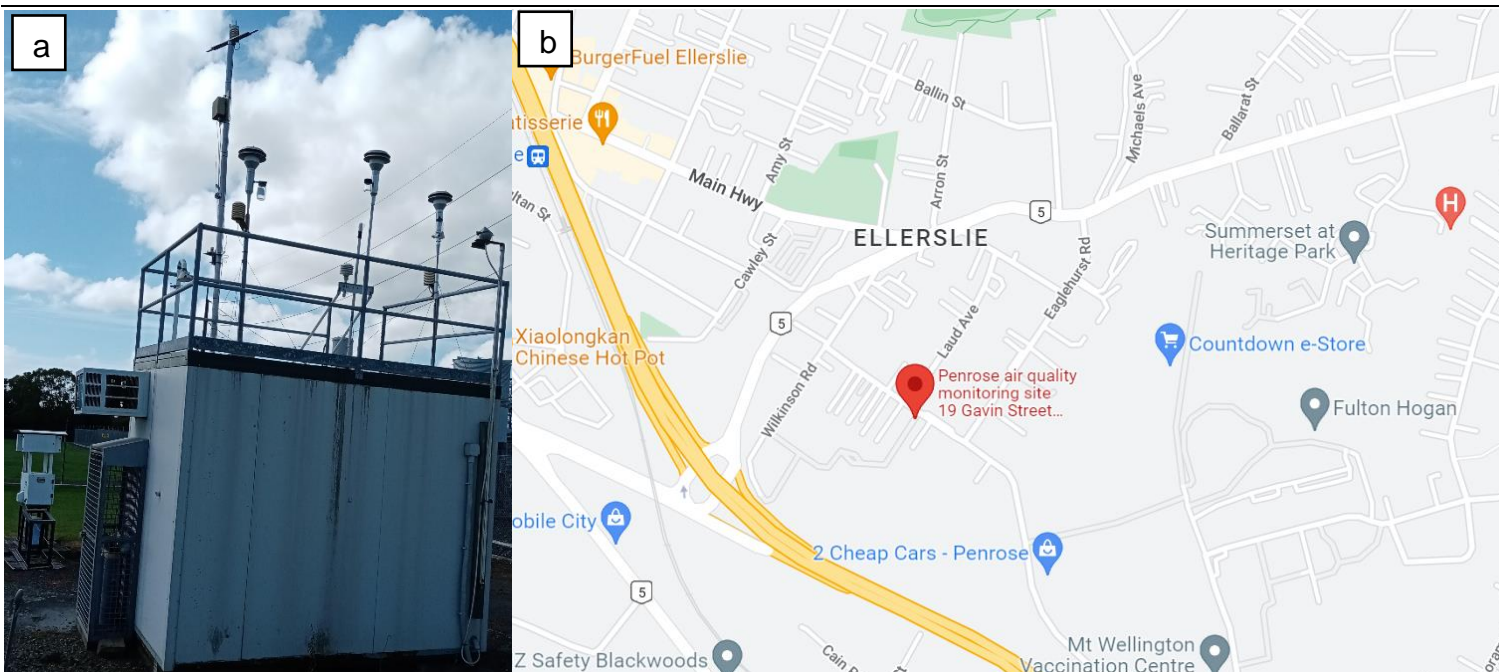
Figure 5. The Penrose air quality monitoring site is located at 19 Gavin Street. Image a shows the air quality monitoring shed. Image b is an aerial view of the monitoring site and surroundings taken in June 2022 (Source: Google Maps). Air quality monitoring at this site commenced on November 2000. PM_{10}, $PM_{2.5}$, NO_2, SO_2, and ambient meteorological parameters are monitored at this site. The main sources of air contaminants are motor vehicles, home heating (during winter) and industrial activities.

Key findings:

- Overall, Penrose site average $PM_{2.5}$ concentration is 17.0 % higher than Auckland's average and 36.0 % more than Patumahoe (a rural site).
- Customs Street average SO_2 concentration is 85.7 % more than Penrose average.
- In general, Penrose average NO_2 concentration is 58.3 % higher than Auckland's average and 13-fold more than Patumahoe site.
- Overall, Penrose site average PM_{10} concentration is 6.0 % higher than Auckland's average and 26.3 % more than Patumahoe site.
- Deseasonalised long-term trend analysis results at the Penrose site show there is a downward trend in PM_{10}, $PM_{2.5}$, NO_2 and SO_2 average concentrations.
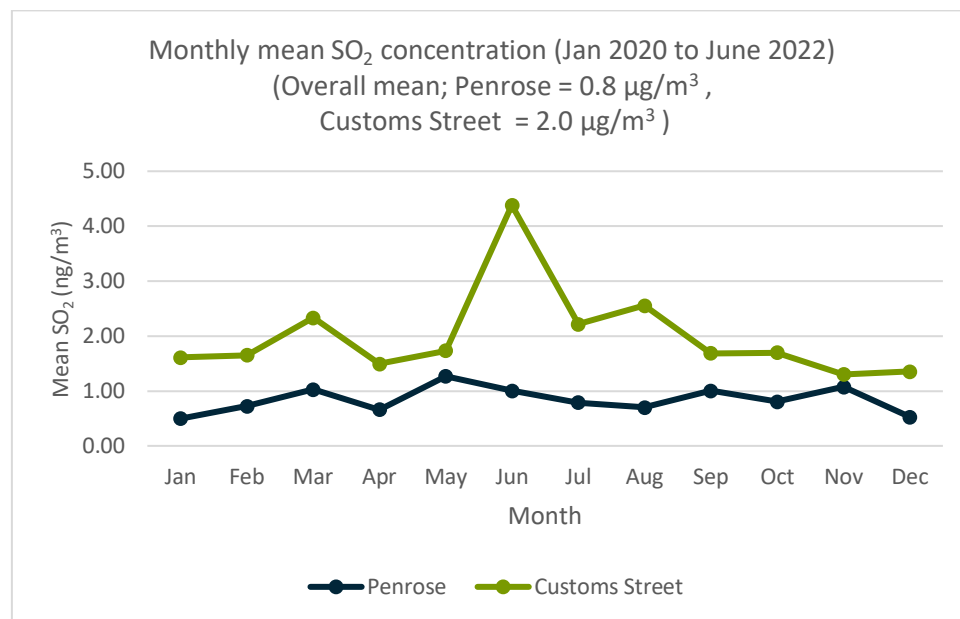
Figure 6. Temporal variation in monthly SO_2 concentrations – Penrose site compared to Customs Street site. Overall, Customs Street average SO_2 concentration is 85.7 % more than Penrose average.

Figure 7. Long-term trends in SO_2 at Penrose site. The plot shows the deseasonalised monthly mean concentrations of SO_2. The solid red line shows the trend estimate and the dashed red lines show the 95% confidence intervals for the trend based on resampling methods. The overall trend is shown at the top-left as -0.61 ($\mu g/m^3$) per year and the 95% confidence intervals in the slope from -0.18 – (-0.13) $\mu g/m^3$/year. The '***' show that the trend is significant to the 0.001 level.

Figure 8. Temporal variation in monthly PM$_{2.5}$ concentrations – Penrose site compared to Patumahoe (rural site) and Auckland average. Overall, Penrose site average PM$_{2.5}$ concentration is 17.0 % higher than Auckland's average and 36.0 % more than Patumahoe site.

Figure 9. Long-term trends in PM$_{2.5}$ at Penrose site. The plot shows the deseasonalised monthly mean concentrations of PM$_{2.5}$. The solid red line shows the trend estimate and the dashed red lines show the 95% confidence intervals for the trend based on resampling methods. The overall trend is shown at the top-left as -0.07 (µg/m^3) per year and the 95% confidence intervals in the slope from -0.11 – (-0.03) µg/m^3/year. The '**' shows that the trend is significant to the 0.01 level.

Monthly mean NO$_2$ concentration (Jan 2006 to June 2022)
(Overall mean; Penrose = 45.4 µg/m^3 ,
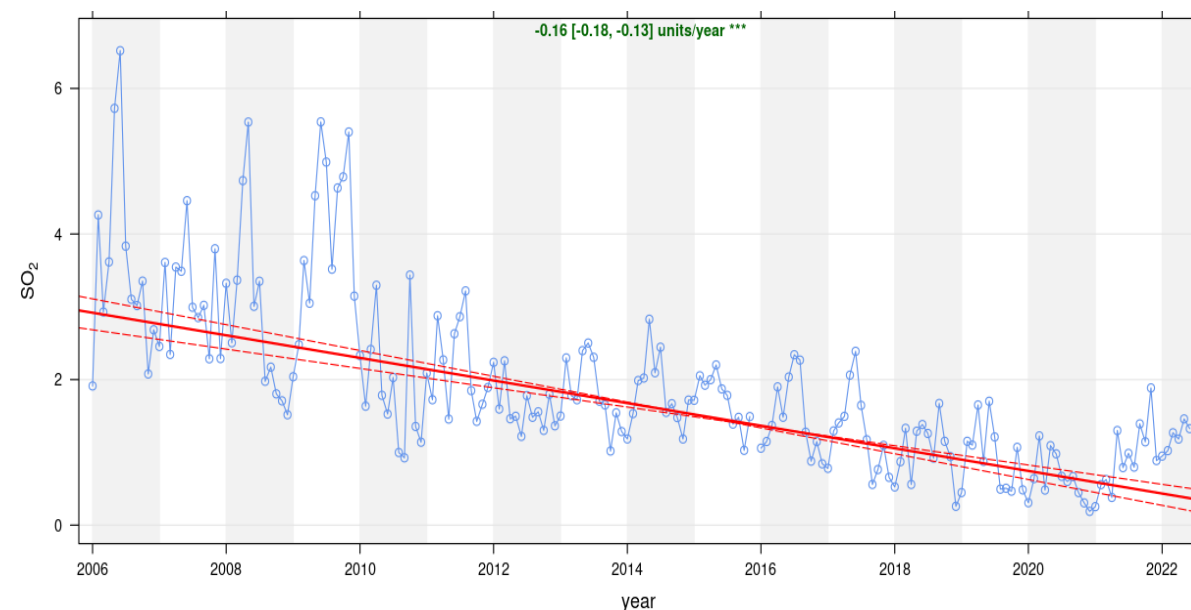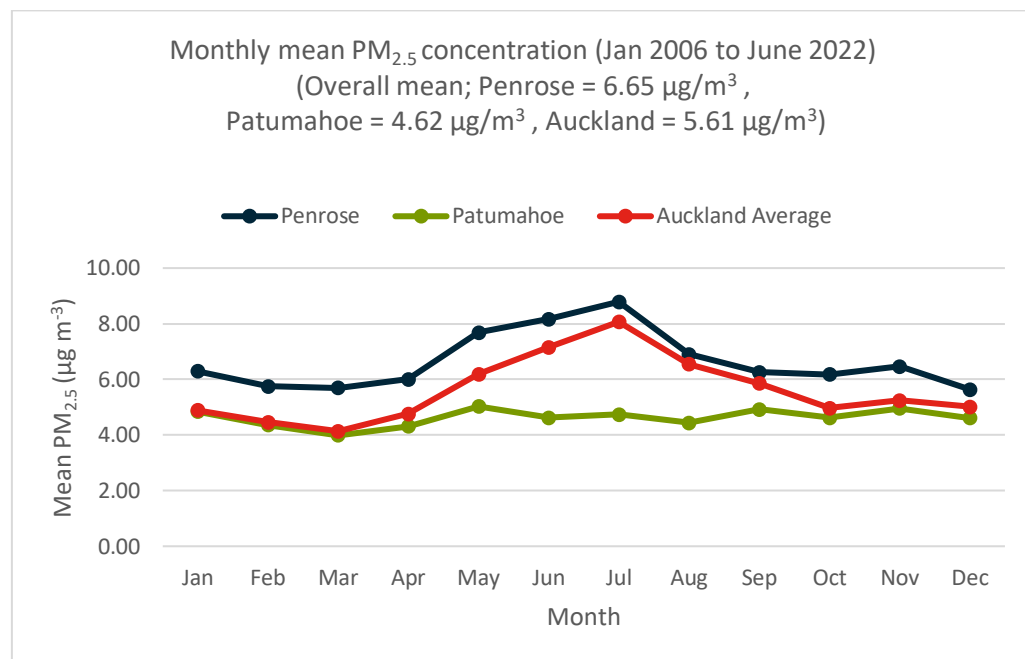Patumahoe= 3.4 µg/m^3 , Auckland = 24.9 µg/m^3)

Figure 10. Temporal variation in monthly NO$_2$ concentrations – Penrose site compared to Patumahoe (rural site) and Auckland average. Overall, Penrose average NO$_2$ concentration is 58.3 % higher than Auckland's average and 13-fold more than Patumahoe site.

Figure 11. Long-term trends in NO$_2$ at Penrose site. The plot shows the deseasonalised monthly mean concentrations of NO$_2$. The solid red line shows the trend estimate and the dashed red lines show the 95% confidence intervals for the trend based on resampling methods. The overall trend is shown at the top-left as – 0.91 (µg/m^3) per year and the 95% confidence intervals in the slope from -0.17 – (- 0.65) µg/m^3/year. The '∗∗∗' show that the trend is significant to the 0.001 level.

Monthly mean PM_{10} concentration (Jan 2007 to June 2022)
(Overall mean; Penrose = 15.5 µg/m³ ,
Patumahoe = 11.9 µg/m³ , Auckland = 14.6 µg/m³)

Figure 12. Temporal variation in monthly PM_{10} concentrations – Penrose site compared to Patumahoe (rural site) and Auckland average. Overall, Penrose site average PM_{10} concentration is   6.0 % higher than Auckland's average and 26.3 % more than Patumahoe site.
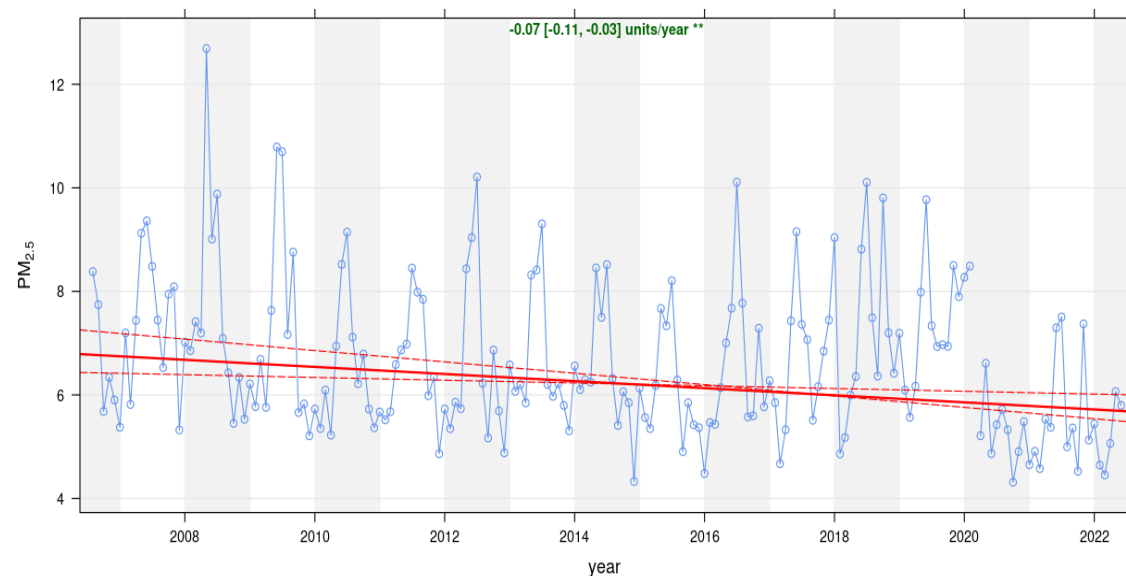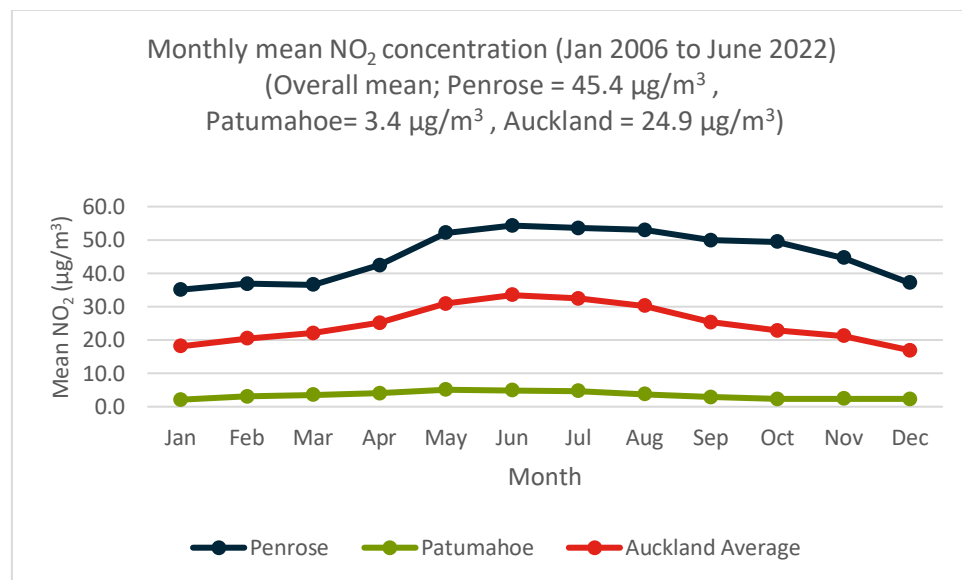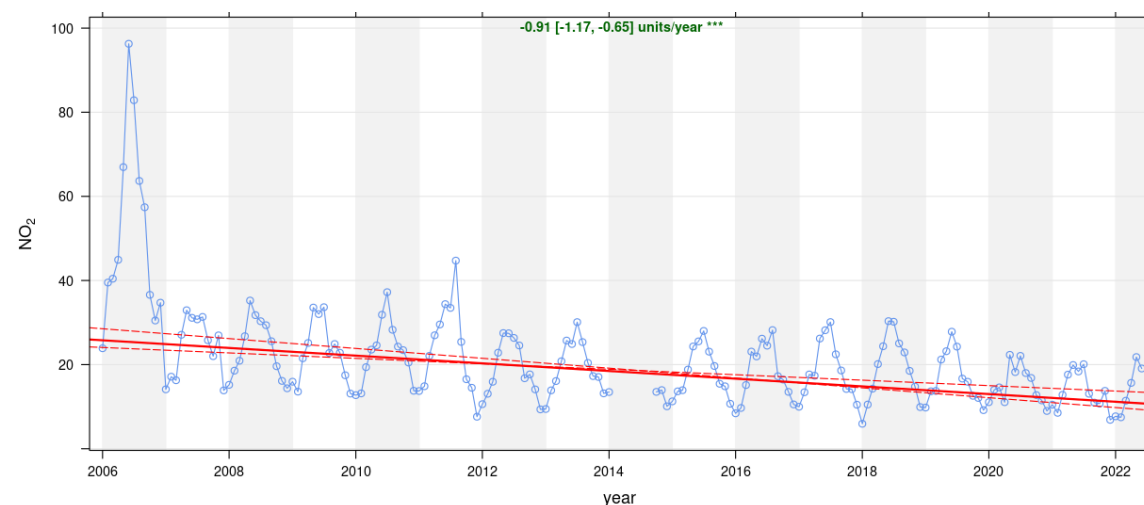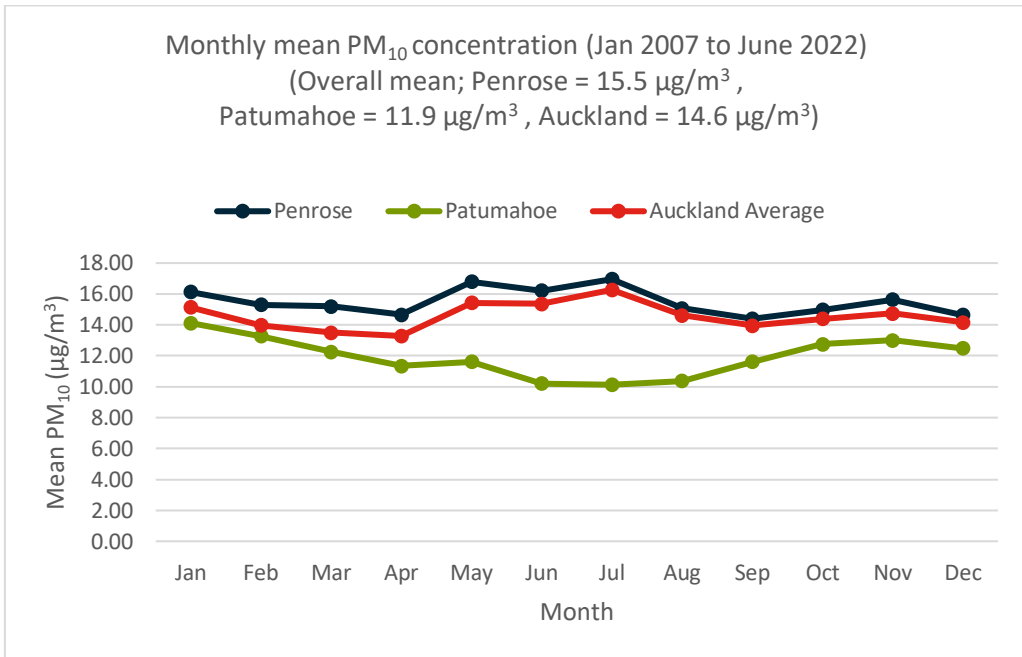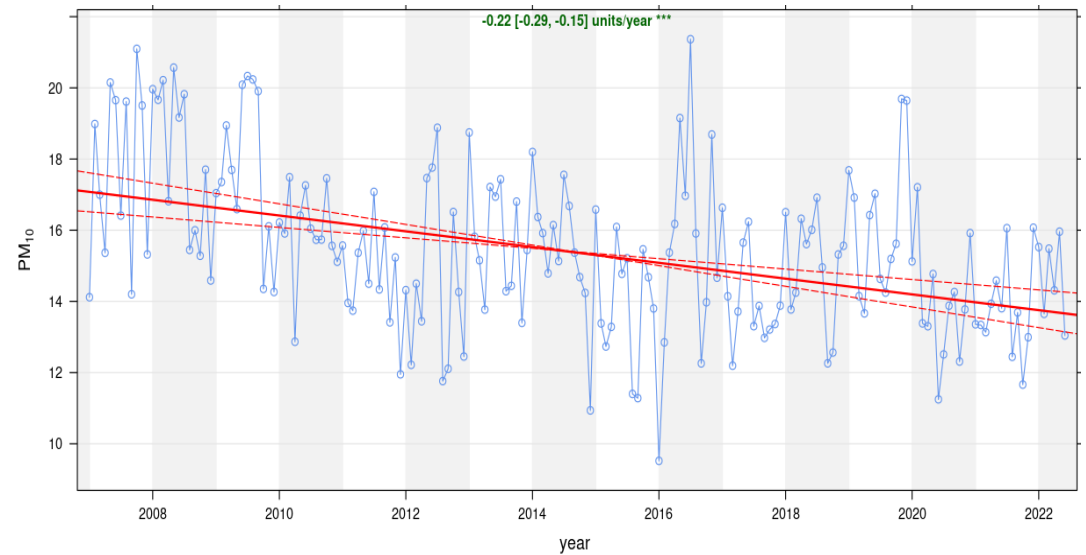
Figure 13. Long-term trends in PM_{10} at Penrose site. The plot shows the deseasonalised monthly mean concentrations of PM_{10}. The solid red line shows the trend estimate and the dashed red lines show the 95% confidence intervals for the trend based on resampling methods. The overall trend is shown at the top-left as – 0.22 (µg/m³) per year and the 95% confidence intervals in the slope from -0.29 – (- 0.15) µg/m³/year. The '∗∗∗' show that the trend is significant to the 0.001 level.

Find out more: EnvironmentAuckland.org.nz

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