Research and Evaluation Unit | RIMU

Auckland Air Quality Report

Monthly update – April

Introduction

Auckland Council's Research and Evaluation Unit (RIMU) collects air quality data to ensure compliance with national standards and inform policy development and evaluation. The data we collect provides a better understanding of ambient air quality in the region, including spatial and temporal variations.

This monthly update is prepared using validated data that is available about one month after raw data collection. This report covers data up to 31 March 2024. This regular update on air quality aims to promote awareness and encourage actions to improve air quality in the region.

This update is divided into four sections, with sections A and B featuring tables and graphics that illustrate air quality status in Tāmaki Makaurau / Auckland, and is based on data collected from continuous monitoring sites across the region.

For this edition, section C focuses on one monitoring site – Patumahoe. Section D provides monthly averages for 2024 and the past four to five years of pollutant concentrations (when data is available).

Summary

- No breach of national air quality standards occurred in March 2024.
- Most monitoring sites recorded particulate matter levels slightly higher than those of the same period in the previous year.
- The Customs Street site recorded the highest levels of NO_2 and SO_2 concentrations in March 2024.

It is important to note that air quality at a monitoring site can vary from year to year due to weather and other influences (See *Auckland air quality report, October 2021*). For a brief analysis of short-term concentration changes of key pollutants, please see Table 2.

Where to view our data

Data can be viewed on the council's environmental data portal, the LAWA website LAWA or requested from environmentaldata@aucklandcouncil.govt.nz

Full state and trends analyses and reports are prepared every few years (the most recent report is *Trends in Auckland's air quality 2006-2018*).

The *2022 Annual data report* is available on the Knowledge Auckland website.

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

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.
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

What we monitor		Why we monitor
Air	Particulate matter (PM) – PM_{10} and $PM_{2.5}$	Tiny particles (particulate matter) from polluting sources such as vehicles and smoke get into the air. Breathing them may cause health problems.
	Nitrogen dioxide (NO_2)	Vehicles are the main source of NO_2 in Auckland. It can irritate the lungs, increasing susceptibility to asthma and lowering resistance to respiratory infections.
	Other pollutants	Air pollutants ozone, sulphur dioxide, carbon monoxide, black carbon and volatile organic compounds (VOCs) like benzene cause adverse health effects at elevated concentrations.
Greenhouse gas emissions	Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3)	The climate is warming due to increased greenhouse gas (GHG) levels in the atmosphere caused by human activities. Reducing GHG emissions will limit temperature rise.

Section A – Data tables

Table 1. Summary information about Auckland air quality monitoring programme 1 January to 31 March 2024

Number of exceedances of NESAQ in 2024	0	
Number of exceedances of Auckland ambient air quality targets in 2024	0	
Maximum PM_{10} 24-hours mean	29.9 µg/m³ (59.8% of NESAQ)	Recorded at Papatoetoe on 4 February 2024
Maximum $PM_{2.5}$ 24-hour mean	9.8 µg/m³ (39.2% of Auckland target)	Recorded at Takapuna on 20 January 2024
Maximum NO_2 1-hour mean	148.0 µg/m³ (74.0% of NESAQ)	Recorded at Khyber Pass Rd on 22 March 2024
Maximum SO_2 1-hour mean	19.0 µg/m³ (5.4% of NESAQ)	Recorded at Penrose on 4 January 2024
Maximum O_3 1-hour mean	68.0 µg/m³ (45.3% of NESAQ)	Recorded at Patumahoe on 23 January 2024
Maximum CO running 8-hour mean	0.54 mg/m³ (5.4% of NESAQ)	Recorded at Khyber Pass Rd on 12 March 2024
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	

Table 2. Short-term trends in concentration of key air pollutants monitored for the past three, four, and five years

↑ indicates an upward   ↓ indicates a downward   ↗ upward but not significant   ↘ downward but not significant

Legend for arrows below: ↑ = upward significant (red), ↓ = downward significant (green), ↗ = upward not significant (orange), ↘ = downward not significant (blue).

Site	PM_{10} Past 3 years	Past 4 years	Past 5 years	$PM_{2.5}$ Past 3 years	Past 4 years	Past 5 years	NO_2 Past 3 years	Past 4 years	Past 5 years	Black carbon Past 3 years	Past 4 years	Past 5 years	Ozone Past 3 years	Past 4 years	Past 5 years	CO Past 3 years	Past 4 years	Past 5 years	SO_2 Past 3 years	Past 4 years	Past 5 years	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	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	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	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	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*
	PM_{10}			$PM_{2.5}$			NO_2			Black carbon			Ozone			CO			SO_2			

Notes

Trend significance was determined using the Theil-Sen method (deseasonalised): ↑ and ↓ arrows indicate trends are statistically significant at the 0.05 level, 95% confidence intervals. n/a means not applicable.

Effective dates: 3 years (1 January 2021 to 31 December 2023), 4 years (1 January 2020 to 31 December 2023), and 5 years (1 January 2019 to 31 December 2023)

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 September 2021 and January 2022. No data for Takapuna in January and February 2023 due to the Auckland floods. Queen St data is up to 22 August due to power outage at the site.
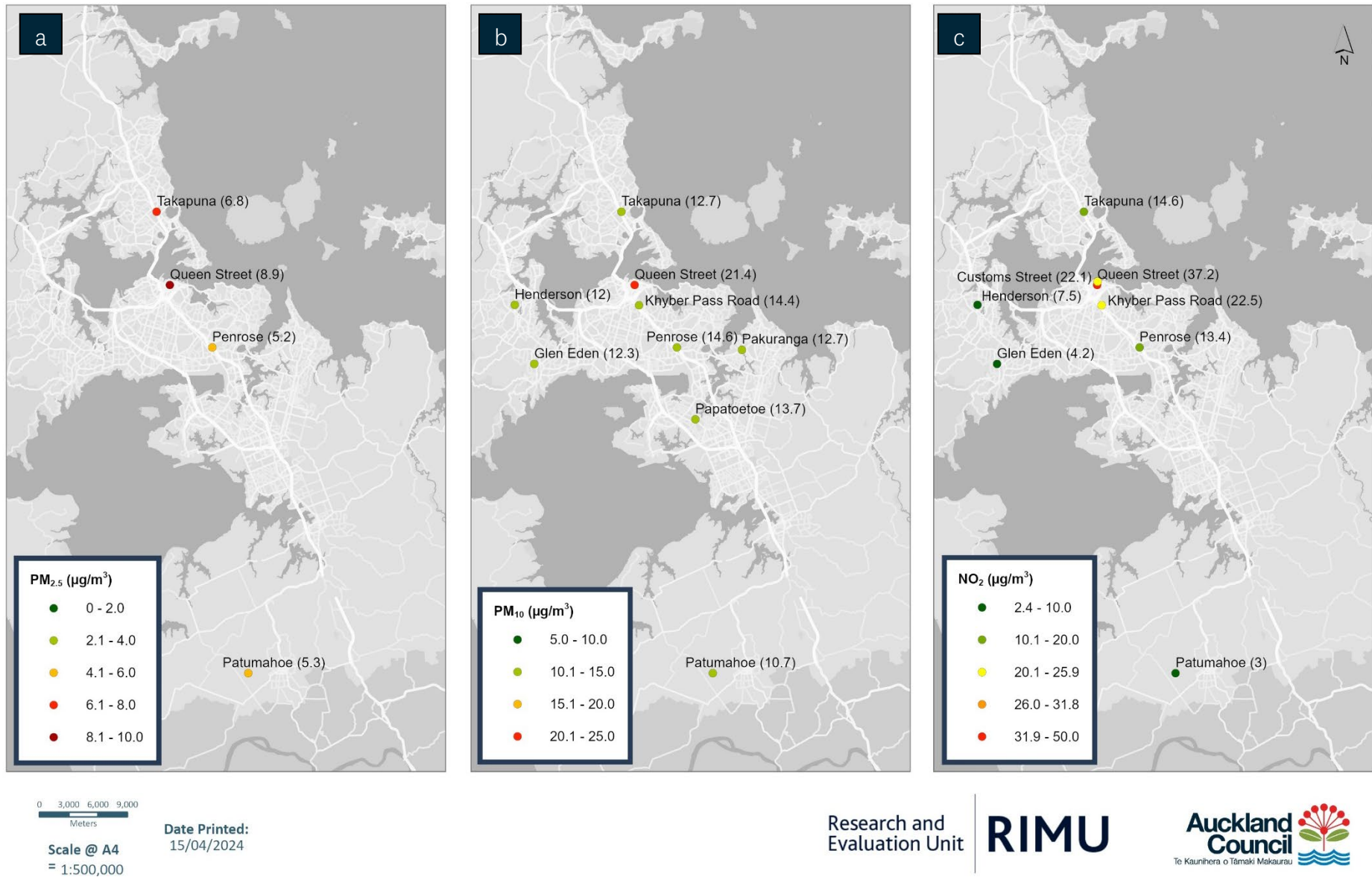
Figure 1. Maps a, b and c show the air quality monitoring sites and their last 12 months (1 April 2023 to 31 March 2024) average PM and NO$_2$ concentrations in brackets. Auckland city centre monitoring sites recorded the highest PM and NO$_2$ concentrations.
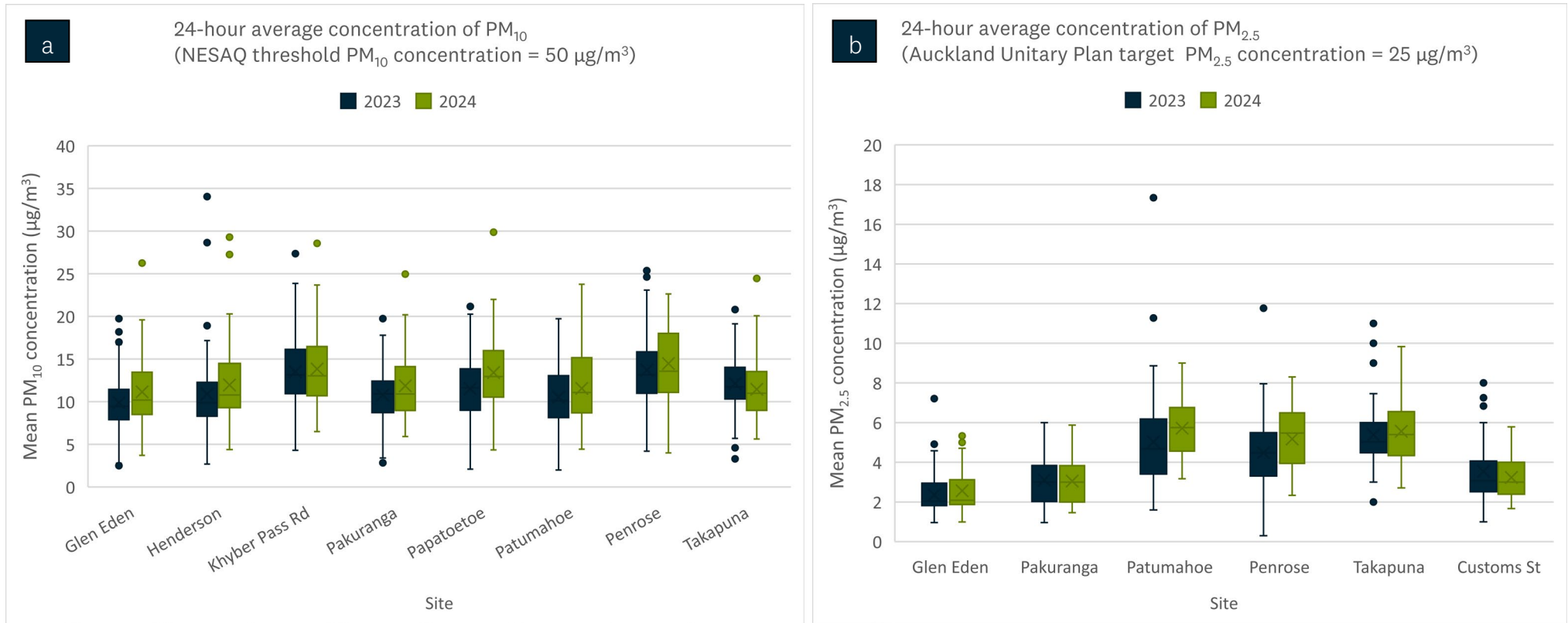
Figure 2. Boxplot of PM mean concentration – Jan to Feb between 2024 and 2023. The highest 24-hour average concentrations of PM_{10} and $PM_{2.5}$ were recorded at the Papatoetoe and Takapuna sites, respectively. Plots 'a' and 'b' represent PM_{10} and $PM_{2.5}$, respectively. PM_{10} and $PM_{2.5}$ have multiple sources including home heating, motor vehicles, sea salt, marine diesel, and soils (windblown soil, road dust, and dust generated by earthworks, construction, and road works).

Boxes represent 25th (bottom of the box) and 75th (top of box) percentile, central line through the box is the median, bars outside the box (whiskers) represent the 1.5× interquartile range, × markers are the means, and circles are outliers.
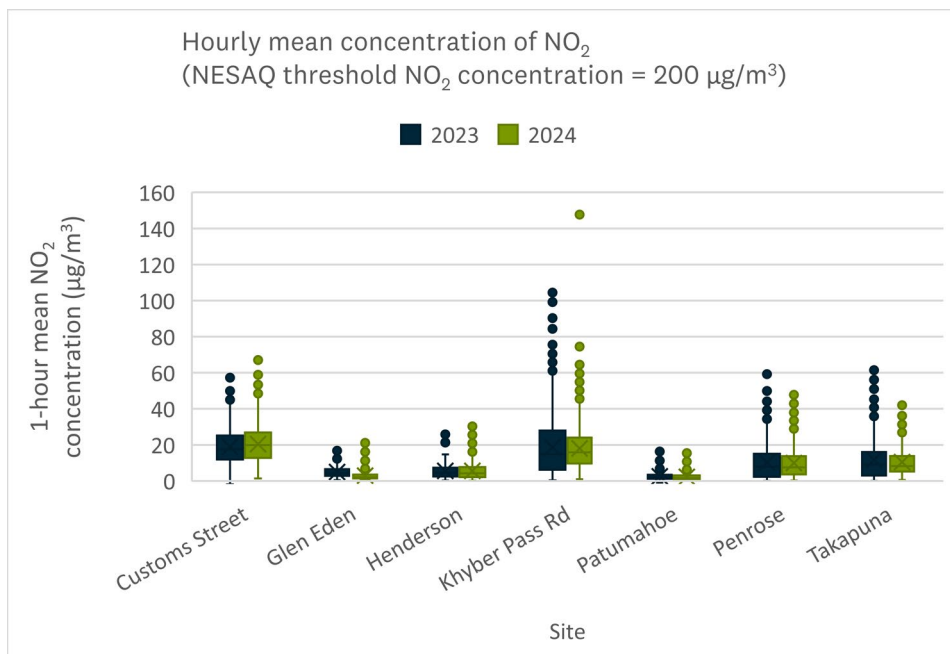
Figure 3. Boxplot of NO_2 1- hour mean concentration: Jan-Feb between 2024 and 2023. The highest concentrations were recorded at the Customs Street monitoring site in the city centre. Motor vehicles are the primary source of NO_2.

Figure 4. Boxplot of SO_2 1-hour mean concentration: Jan -Mar 2024 compared to 2023. The highest average concentration in March was recorded at the Customs St site. SO_2 is produced from the combustion of fossil fuels that contain sulphur, such as coal and oil (used for home heating, industry, and shipping). Motor vehicles also contribute to SO_2 levels in urban air.

Boxes represent 25th (bottom of the box) and 75th (top of box) percentile, central line through the box is the median, bars outside the box (whiskers) represent the 1.5× interquartile range, × markers are the means, and circles are outliers.

Section C. Focus on a monitoring site: Patumahoe

Figure 5. The Patumahoe air quality monitoring site is located within the Plant and Food Research Station at Cronin Rd, Patumahoe. Image 'a' shows the air quality monitoring shed. Image b is an aerial view of the monitoring site and surroundings taken in April 2024 (Source: Google Earth). Air quality monitoring at this site commenced on 21 October 1996. PM_{10}, $PM_{2.5}$, NO_2, and ground level ozone concentrations are monitored at this site. This site represents Auckland regional background air quality. The main sources of air contaminants are motor vehicles, home heating, and agricultural activities such as fertiliser application, crop tilling and green waste burning.

Key findings:

On average, the PM_{10} and $PM_{2.5}$ concentrations at Patumahoe are respectively, 18.1% and 24.2% lower than the average levels observed across Auckland.
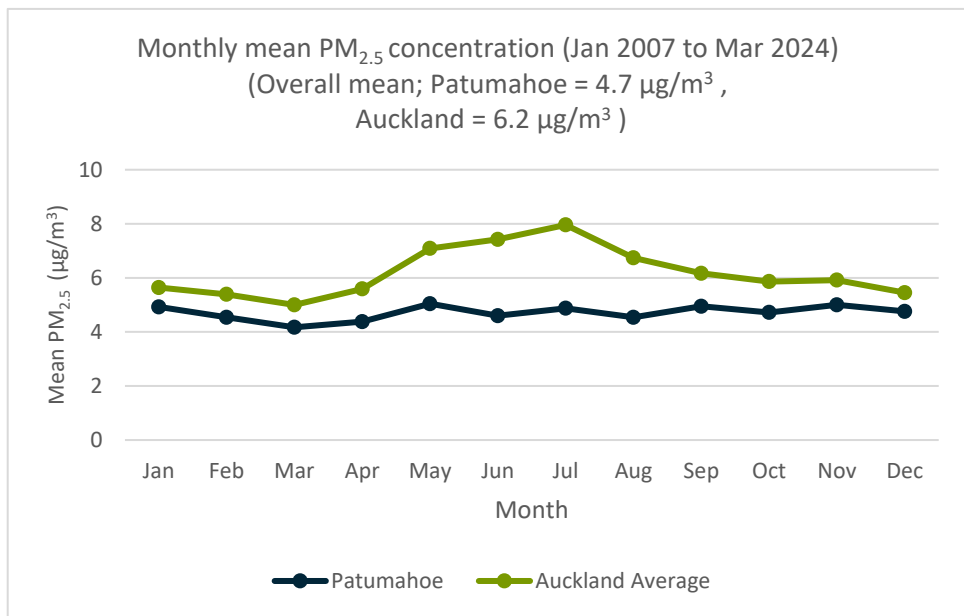
• On average, the concentration of NO_2 at Patumahoe is 82.4% lower than the average concentration measured across Auckland.

• It is worth noting that the Patumahoe monitoring site is located in a rural area and is representative of Auckland's regional background air quality. Thus, lower air pollutant concentrations are expected at this site compared to Auckland's urban areas.

• The results of trend analysis reveal a long-term decrease in NO_2 concentration over the monitoring period. On the contrary, $PM_{2.5}$ is trending upwards, which is most likely due to increased biomass burning. Further studies are needed.

• No significant trends were observed in PM_{10} and ground-level ozone concentrations.
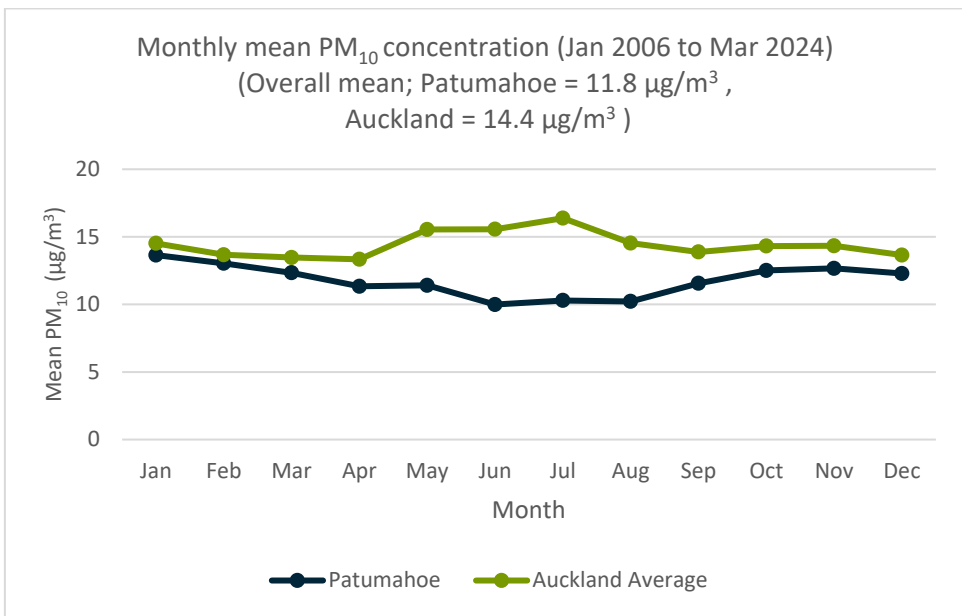
Figure 6. Temporal variation in monthly PM_{10} concentrations – Patumahoe (rural site) compared to Auckland's average. The average PM_{10} concentration at Patumahoe site is 18.1% lower than Auckland's average.
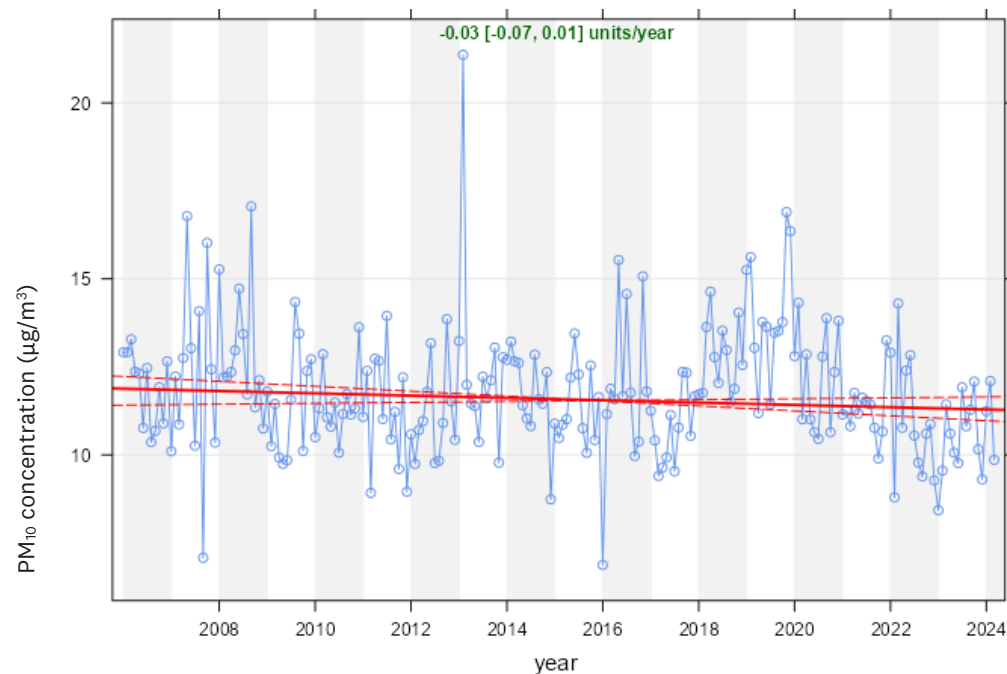
Figure 7. Trends in PM_{10} at Patumahoe site – January 2006 to March 2024. The plot shows the deseasonalised monthly mean concentrations of PM_{10}. The solid red line shows the trend estimate and the dashed red lines show the 95% confidence intervals for the trend based on resampling methods. The overall trend is shown at the top-left as – 0.03 ($\mu g/m^3$) per year (not statistically significant at the 0.05 level)

Figure 8. Temporal variation in monthly PM$_{2.5}$ concentrations – Patumahoe site compared to Auckland's average. The average PM$_{2.5}$ concentration at Patumahoe site is 24.2% lower than Auckland's average.
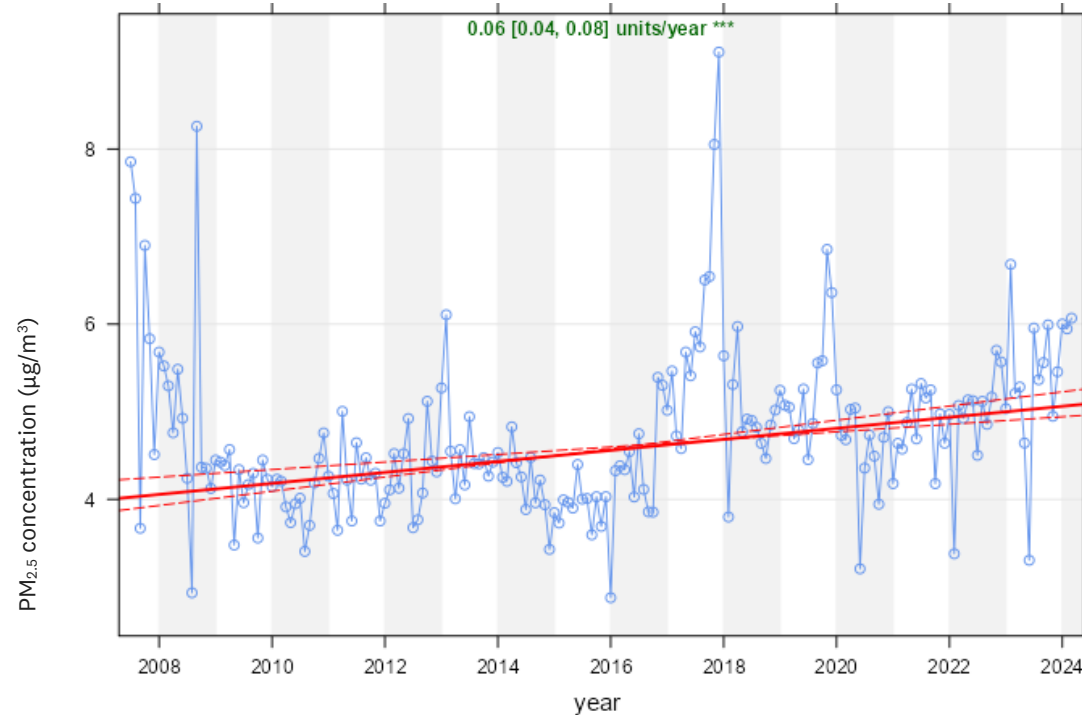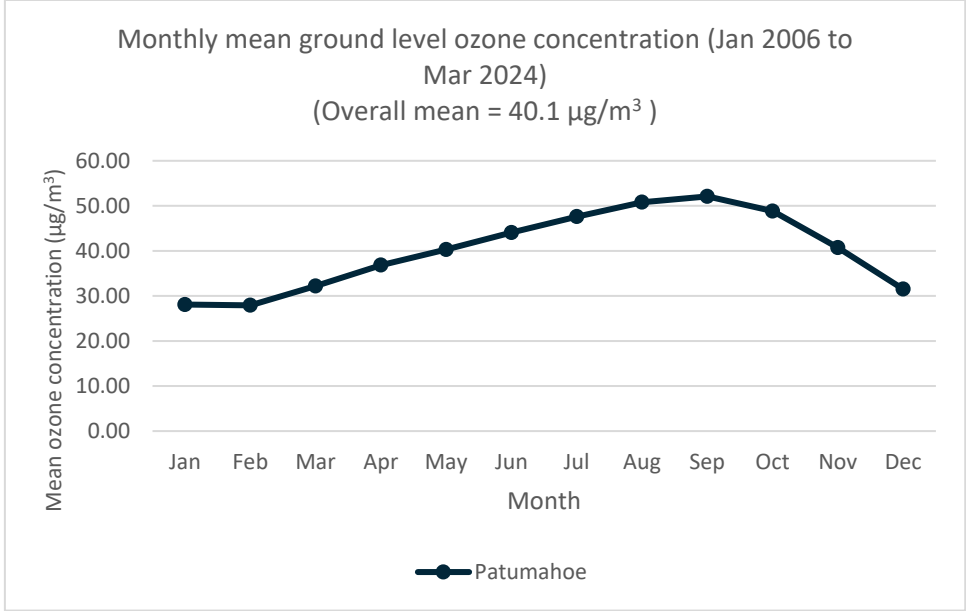

Figure 9. Trends in PM$_{2.5}$ at Patumahoe site – January 2006 to March 2024. The plot shows the deseasonalised monthly mean concentrations of PM$_{2.5}$. The solid red line shows the trend estimate and the dashed red lines show the 95% confidence intervals for the trend based on resampling methods. The overall trend is shown at the top-left as 0.06 (µg/m³) per year and the 95% confidence intervals in the slope from 0.04 - (0.08) µg/m³/year. The '∗∗∗' show that the trend is significant to the 0.001 level.

Figure 10. Temporal variation in monthly ground level ozone concentrations. The highest concentrations tend to occur in September.

Figure 11. Trends in ozone at Patumahoe site – January 2006 to March 2024. The plot shows the deseasonalised monthly mean concentrations of ozone. 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 – 0.05 ($\mu g/m^3$) per year (not statistically significant at the 0.05 level)
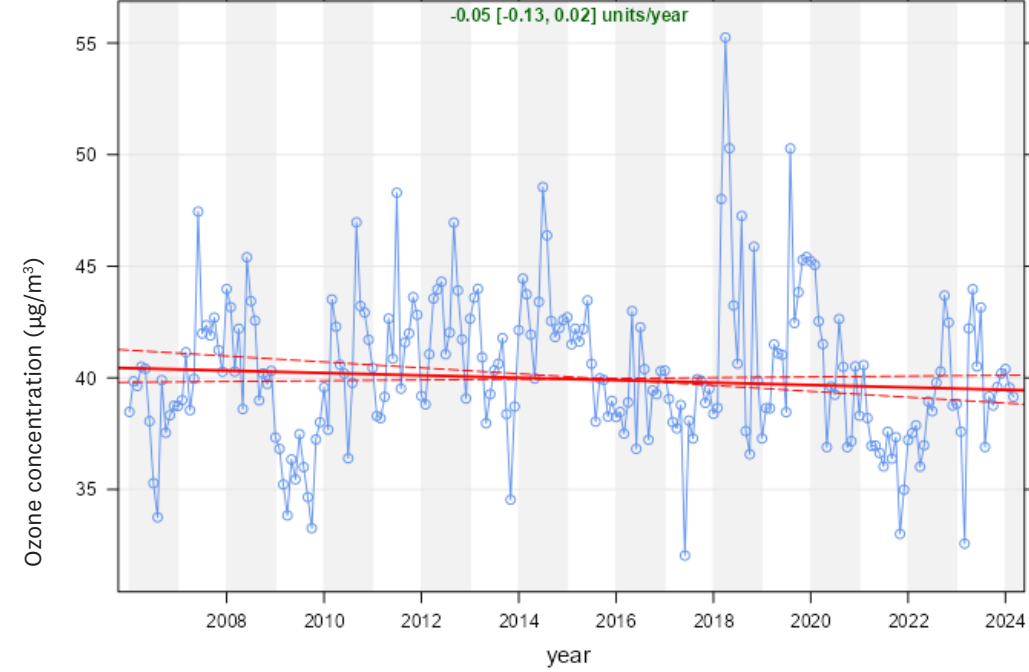
Figure 12. Temporal variation in monthly NO_2 concentrations – Patumahoe site compared to Auckland's average. The average NO_2 concentration at Patumahoe site is 82.4% lower than Auckland's average.
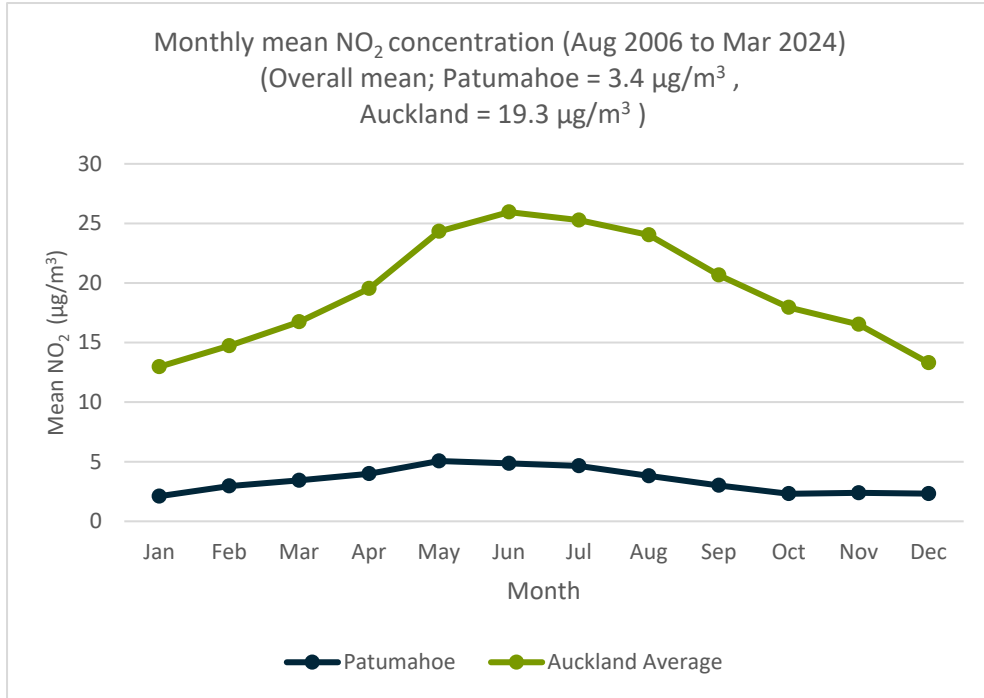

Figure 13. Trends in NO_2 at Patumahoe site – January 2006 to March 2024. The plot shows the deseasonalised monthly mean concentrations of NO_2. The solid red line shows the trend estimate and the dashed red lines show the 95% confidence intervals for the trend based on resampling methods. The overall trend is shown at the top-left as -0.08 ($\mu g/m^3$) per year and the 95% confidence intervals in the slope from -0.1 - (-0.06) $\mu g/m^3$/year. The '∗∗∗' show that the trend is significant to the 0.001 level.
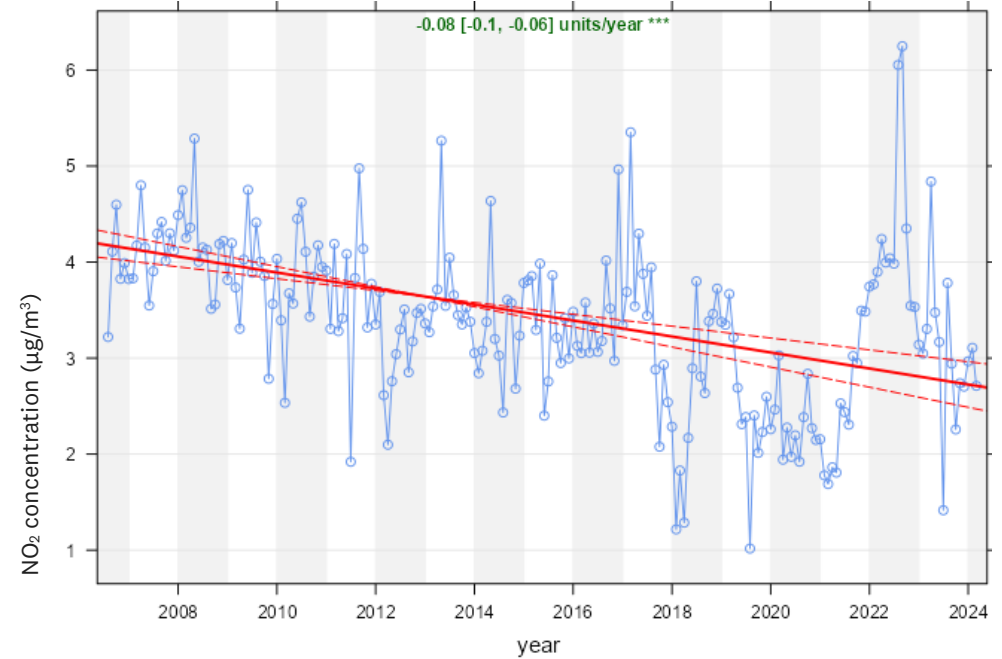
Section D. Table 3. Monthly averages: 2024 and past four to five years (when data is available)

Pollutant	Site	Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
PM$_{10}$ (µg/m^3)	Glen Eden	2024	11.3	12.0	10.1	-	-	-	-	-	-	-	-	-
		Past 5 years	11.4	11.0	9.7	11.3	13.0	14.4	14.7	13.6	12.1	11.1	11.5	12.6
	Henderson	2024	11.4	13.2	11.5	-	-	-	-	-	-	-	-	-
		Past 5 years	11.6	11.6	11.0	11.4	12.5	12.3	12.8	11.5	11.7	11.1	11.9	12.3
	Khyber Pass Road	2024	13.3	14.4	13.5	-	-	-	-	-	-	-	-	-
		Past 5 years	11.8	12.2	11.6	12.5	12.3	11.3	12.9	12.1	12.3	11.9	12.8	13.6
	Pakuranga	2024	11.1	13.2	11.4	-	-	-	-	-	-	-	-	-
		Past 5 years	11.6	11.3	10.2	10.6	12.7	12.4	14.0	13.1	11.9	11.2	11.9	12.3
	Papatoetoe	2024	13.0	15.2	12.2	-	-	-	-	-	-	-	-	-
		Past 5 years	14.0	13.5	12.4	12.7	14.0	13.0	14.9	14.2	14.5	13.6	13.8	14.5
	Patumahoe	2024	11.1	13.1	10.6	-	-	-	-	-	-	-	-	-
		Past 5 years	13.7	13.0	12.3	11.6	11.2	9.3	10.5	10.5	11.7	11.0	12.3	14.0
	Penrose	2024	14.3	15.3	14.2	-	-	-	-	-	-	-	-	-
		Past 5 years	14.8	15.1	14.2	14.4	15.6	13.5	14.8	13.8	14.3	13.3	14.2	15.4
	Queen Street	2024	ND	ND	ND	-	-	-	-	-	-	-	-	-
		Past 5 years	17.4	17.3	16.7	17.0	18.0	17.2	19.9	19.1	18.6	18.4	19.6	20.1
	Takapuna	2024	10.5	12.6	11.4	-	-	-	-	-	-	-	-	-
		Past 5 years	12.3	11.9	10.8	12.2	13.1	12.5	13.7	12.5	12.8	11.6	12.3	12.9
PM$_{2.5}$ (µg/m^3)	Customs Street	2024	3.1	3.4	3.1	-	-	-	-	-	-	-	-	-
		Past 4 years	4.1	3.8	3.2	4.1	4.3	4.4	4.8	5.3	5.3	4.0	3.5	3.6
	Glen Eden	2024	2.5	2.8	2.4	-	-	-	-	-	-	-	-	-
		Past 5 years	2.5	2.6	2.1	3.1	5.8	9.0	9.2	7.8	4.8	3.3	3.2	3.1
	Pakuranga	2024	2.8	3.3	2.3	-	-	-	-	-	-	-	-	-
		Past 5 years	2.9	2.9	2.6	3.7	5.5	6.4	7.8	5.8	4.3	3.3	3.6	3.4
	Patumahoe	2024	5.7	5.8	5.8	-	-	-	-	-	-	-	-	-
		Past 5 years	5.1	4.8	4.4	4.9	5.3	4.8	4.9	5.0	5.0	4.7	5.2	5.3
	Penrose	2024	4.9	5.5	5.3	-	-	-	-	-	-	-	-	-
		Past 5 years	6.0	5.8	4.8	5.4	6.2	6.6	6.6	5.9	5.4	5.0	6.0	5.6
	Queen Street	2024	ND	ND	ND	-	-	-	-	-	-	-	-	-
		Past 5 years	7.1	6.8	6.4	7.0	7.7	7.5	8.5	8.1	7.5	7.6	8.0	8.2
	Takapuna	2024	5.8	5.7	5.2	-	-	-	-	-	-	-	-	-
		Past 5 years	5.9	5.4	4.9	5.9	7.0	7.4	8.3	7.5	6.8	6.2	6.8	6.3
NO$_2$ (µg/m^3)	Customs Street	2024	17.0	22.2	22.3	-	-	-	-	-	-	-	-	-
		Past 4 years	30.8	31.9	34.3	28.5	33.7	46.7	33.7	34.4	28.7	27.6	23.5	22.1
	Glen Eden	2024	2.5	3.1	3.3	-	-	-	-	-	-	-	-	-
		Past 5 years	2.7	3.4	4.0	4.6	7.2	7.8	7.0	6.1	4.6	4.4	3.7	2.9
	Henderson	2024	4.2	6.2	6.3	-	-	-	-	-	-	-	-	-
		Past 5 years	4.0	6.8	8.1	8.7	11.6	12.9	10.7	9.4	7.7	6.4	6.1	4.5
	Khyber Pass Road	2024	14.2	18.6	21.4	-	-	-	-	-	-	-	-	-
		Past 5 years	19.0	19.2	23.3	22.4	30.4	33.2	33.2	32.5	28.7	23.9	28.2	19.0
	Patumahoe	2024	1.9	2.5	2.5	-	-	-	-	-	-	-	-	-
		Past 5 years	1.6	2.3	3.1	3.3	4.1	4.3	3.9	3.6	2.6	2.3	2.3	1.9
	Penrose	2024	7.0	10.8	12.0	-	-	-	-	-	-	-	-	-
		Past 5 years	9.1	10.6	13.6	15.4	20.2	21.4	20.5	18.2	14.6	11.3	12.2	7.9
	Queen Street	2024	ND	ND	ND	-	-	-	-	-	-	-	-	-
		Past 5 years	25.1	24.8	30.4	30.7	33.3	36.2	40.5	41.2	34.9	33.1	30.2	26.3
	Takapuna	2024	7.7	11.0	12.6	-	-	-	-	-	-	-	-	-
		Past 5 years	6.6	8.4	12.2	13.8	18.9	20.6	20.3	18.8	14.4	11.5	12.2	8.1
SO$_2$ (µg/m^3)	Customs Street	2024	2.0	2.3	2.7	-	-	-	-	-	-	-	-	-
		Past 4 years	1.8	1.8	2.4	1.9	2.0	4.1	2.5	2.9	2.5	2.2	2.0	1.9
	Penrose	2024	2.5	2.1	2.5	-	-	-	-	-	-	-	-	-
		Past 5 years	0.6	1.0	1.2	0.9	1.2	1.3	1.1	0.9	0.9	0.9	1.2	0.9
O$_3$ (µg/m^3)	Patumahoe	2024	27.6	27.4	33.3	-	-	-	-	-	-	-	-	-
		Past 5 years	26.7	28.3	30.5	36.6	39.7	42.1	47.6	50.5	51.9	47.3	39.6	31.1
CO (mg/m^3)	Khyber Pass Road	2024	0.006	0.007	0.050	-	-	-	-	-	-	-	-	-
		Past 5 years	0.032	0.039	0.044	0.058	0.126	0.134	0.167	0.119	0.056	0.023	0.021	0.011
Black carbon (ng/m^3)	Customs Street	2024	1160	1248	1208	-	-	-	-	-	-	-	-	-
		Past 4 years	1365	1437	1426	1178	1381	3075	1317	1481	1090	1070	1205	1088
	Henderson	2024	186	281	254	-	-	-	-	-	-	-	-	-
		Past 5 years	244	406	523	524	906	1084	912	700	458	334	339	286

ND = No data: station has been temporarily closed due to the renovation of the building hosting the site.

Find out more:
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