

Air quality bulletin

Northern Queensland

September 2023



Prepared by: Air Quality Monitoring, Department of Environment, Science and Innovation

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Introduction

Air quality monitoring gathers information on the quality of the air environment. The objectives of the monitoring are to check compliance with ambient air quality guidelines, identify long-term trends in air quality, investigate local air quality concerns, and assess the effectiveness of air quality management strategies.

During September 2023, air quality monitoring was carried out by the Queensland Government at two sites in Townsville, one site in Ayr, one site in Cairns and one site in Mount Isa. In addition, monitoring was also conducted by Port of Townsville Limited at Townsville Coast Guard and Lennon Drive and Environment Park in South Townsville.

Air pollutants monitored included nitrogen dioxide, sulfur dioxide, visibility-reducing particles, PM_{2.5} and PM₁₀ (particles less than 2.5 and 10µm in diameter, respectively), TSP (total suspended particulate matter - particles less than 100µm approximately in diameter) and dustfall (particles large enough to settle from the air).

Port of Townsville Limited assumed sole responsibility for air monitoring at the Coast Guard site in August 2023. As a result, one day in six TSP and dustfall (and associated metals in TSP and dustfall) monitoring at the Coast Guard site by the Queensland Government ceased from August 2023. Data for these pollutants can now be accessed through the online Townsville Port Operations air quality dashboards at <https://www.townsville-port.com.au/environment/monitoring/air-monitoring/air-quality-dashboards>.

Reporting protocol

Data presented in this bulletin are based on clock hours. Hourly or other averages are constrained to start and finish on a clock hour.

Air quality summary graphs

Figures 1 to 15 summarise available air quality data for sampling days at Townsville, Ayr and Cairns sites during September. Monthly average dustfall and deposited lead for Townsville sites are shown in figures 16 and 17. Figures 18 to 24 summarise air quality data for sampling days at the Mount Isa site during September. The maximum recorded level for each day is used to show the day-to-day variation in air quality.

Air quality summary tables

Tables 6 to 25 present monthly summaries of air quality data for the preceding 12 months. These tables show the month-to-month variation in air quality. A monthly entry is given when at least three-fifths of the maximum possible number of observations during the month are available. When data is not available for the entire month, due to equipment malfunction, this is indicated by the abbreviation 'n.d.' (no data). A dash is inserted when less than three-fifths of data are available. Where no data is recorded, the reason for the low data availability is summarised in Table 26 at the end of this bulletin.

Table 1. Air pollutants monitored at northern Queensland ambient air quality monitoring sites.

	Nitrogen dioxide	Sulfur dioxide	PM ₁₀	PM _{2.5}	Visibility-reducing particles	TSP	Lead	Copper	Zinc	Nickel	Arsenic	Cadmium	Dustfall	Dustfall lead
Townsville														
North Ward	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Coast Guard (industry)			✓			✓								
Lennon Drive (industry)			✓			✓								
Environment Park (industry)			✓											
Ayr														
Ayr			✓	✓										
Cairns														
Woree			✓	✓										
Mount Isa														
The Gap		✓	✓	✓			✓				✓	✓		

Guidelines

Wherever possible, air quality measurements are compared against Australian air quality standards. In their absence relevant international standards are used for comparison.

Measured concentrations of nitrogen dioxide, sulfur dioxide, visibility-reducing particles, PM_{2.5}, PM₁₀, TSP, lead, nickel, cadmium and arsenic are compared to the air quality objectives contained in the Queensland Environmental Protection (Air) Policy 2019 (EPP (Air)) to assess whether pollutant levels could harm health and wellbeing. Limit values for TSP and dustfall specified in the Department of Environment and Science - (DES) guideline document *Application requirements for activities with impacts to air* (Air Impacts Guideline) are used to assess dust nuisance effects.

Sulfur dioxide, PM₁₀ and arsenic levels in Mount Isa are also compared against the air quality limits specified in the Mount Isa Mines Limited Environmental Authority EPML00977513.

Compliance with air quality guidelines - Townsville and Ayr

During September, measured pollutant levels, with the exception of visibility-reducing particles, did not exceed the relevant air quality guideline at Queensland Government and industry air monitoring sites in Townsville and Ayr.

Visibility at the North Ward monitoring site fell below the EPP (Air) objective of 20km for a one-hour period on 1 September during light southwesterly winds. While a specific source of the particles could not be determined, lower particle levels at the other Townsville monitoring sites at the same time point to smoke from a local fire in close proximity to the North Ward monitoring site as the most likely cause.

Table 2. Number of occasions during September when measured levels exceeded EPP (Air) objectives for nitrogen dioxide, sulfur dioxide, visibility-reducing particles, PM_{2.5}, PM₁₀, TSP, lead, nickel, arsenic and cadmium; Ontario Ministry of Environment air quality criteria for copper and zinc; and DES nuisance dust limits for TSP and dustfall at Queensland Government and industry air monitoring sites in Townsville and Ayr.

Pollutant	Averaging Period	Exceedences
Nitrogen dioxide	<i>EPP (Air)</i> Annual	0
	1-hour	0
Sulfur dioxide	<i>EPP (Air)</i> Annual	0
	24-hour	0
	1-hour	0
Visibility-reducing particles (refers to protecting aesthetic environment, not health and wellbeing).	<i>EPP (Air)</i> 1-hour	1
PM _{2.5}	<i>EPP (Air)</i> Annual	0
	24-hour	0
PM ₁₀	<i>EPP (Air)</i> Annual	0
	24-hour	0
TSP (24-hour period refers to dust nuisance, not health and wellbeing)	<i>EPP (Air)</i> Annual	0
	<i>DES limit</i> 24-hour	0
TSP Lead	<i>EPP (Air)</i> Annual	0
TSP Copper	<i>Ontario</i> 24-hour	0
TSP Zinc	<i>Ontario</i> 24-hour	0
TSP Nickel	<i>EPP (Air)</i> Annual	0
TSP Arsenic	<i>EPP (Air)</i> Annual	0
TSP Cadmium	<i>EPP (Air)</i> Annual	0
Dustfall (30-day period refers to dust nuisance, not health and wellbeing)	<i>DES limit</i> 30-day	0

Compliance with air quality guidelines - Cairns

During September, measured pollutant levels did not exceed the relevant air quality guideline at the Queensland Government air monitoring site in Cairns.

Table 3. Number of occasions during September when measured levels exceeded EPP (Air) objectives for PM_{2.5} and PM₁₀ in Cairns.

Pollutant	Averaging Period	Exceedences
PM _{2.5}	<i>EPP (Air)</i> Annual	0
	24-hour	0
PM ₁₀	<i>EPP (Air)</i> Annual	0
	24-hour	0

Compliance with air quality guidelines - Mount Isa

During September, measured pollutant levels, with the exception of sulfur dioxide and PM₁₀, did not exceed the relevant air quality guideline at the Queensland Government air monitoring site in Mount Isa.

Sulfur dioxide levels exceeded the EPP (Air) 1-hour objective for a single one-hour period at The Gap monitoring site during September due to industry emissions.

PM₁₀ concentrations exceeded the EPP (Air) 24-hour objective at The Gap monitoring site on 8 September due to windblown dust generated by gusty winds associated with the passage of a weather trough during dry conditions. The elevated PM₁₀ concentrations were measured during southeasterly winds, indicating that industry emissions did not contribute to this exceedance.

Table 4. Number of occasions during September when measured levels exceeded EPP (Air) objectives for sulfur dioxide, PM_{2.5}, PM₁₀, lead, arsenic and cadmium at the Queensland Government air monitoring site in Mount Isa.

Pollutant	Averaging Period	Exceedences
Sulfur dioxide	<i>EPP (Air)</i>	
	Annual	0
	24-hour	0
	1-hour	1
PM _{2.5}	<i>EPP (Air)</i>	
	Annual	0
	24-hour	0
PM ₁₀	<i>EPP (Air)</i>	
	Annual	0
	24-hour	1
TSP Lead	<i>EPP (Air)</i>	
	Annual	0
PM ₁₀ Arsenic	<i>EPP (Air)</i>	
	Annual	0
PM ₁₀ Cadmium	<i>EPP (Air)</i>	
	Annual	0

Compliance with smelter air quality limits

From January 2016 smelter operations in Mount Isa have been operating under an amended Environmental Authority (EA) which sets alternative air quality limits for some air pollutants as part of the Copper Smelter Extension Project. Table 5 details the EA air quality limit values applying in 2023 where these differ from the EPP (Air) objectives. Compliance with the EA limits is determined on a calendar year basis.

Since January 2023, 24-hour sulfur dioxide concentrations have not exceed the EA air quality limit value at The Gap monitoring site.

Since January 2023, 1-hour sulfur dioxide concentrations at The Gap monitoring site have exceeded the 0.400ppm limit value for one hour and have exceeded the 0.200ppm limit value for a total of six hours.

Since January 2023, 24-hour PM₁₀ concentrations at The Gap monitoring site have exceeded 50µg/m³ on one day.

The average arsenic concentration at The Gap monitoring site for the 12-month period ending September 2023 was less than the EA air quality limit value.

Table 5. Environmental Authority (EA) air quality limits applying to smelter operations in Mount Isa.

Air Pollutant	Averaging period	Limit value	Assessment criterion ^(a)	Period when limit value applies
Sulfur dioxide	24-hour	230µg/m ³ (=0.080ppm)	<=3 days	1 Jan to 31 Dec 2023
	1-hour	570µg/m ³ (=0.200ppm)	<=175 hours	
	1-hour	1140µg/m ³ (=0.400ppm)	<=35 hours	
PM ₁₀	24-hour	50µg/m ³	<=5 days	1 Jan to 31 Dec 2023
Arsenic	Annual	0.015µg/m ³	Does not exceed	1 Jan to 31 Dec 2023

^(a) Compliance is on an individual monitoring site basis, not across the monitoring network.

Measured ambient concentrations - Townsville, Ayr and Cairns

Nitrogen dioxide

Figure 1. Ambient concentrations of nitrogen dioxide at North Ward site. Daily maximum 1-hour average concentrations (ppm), September 2023.

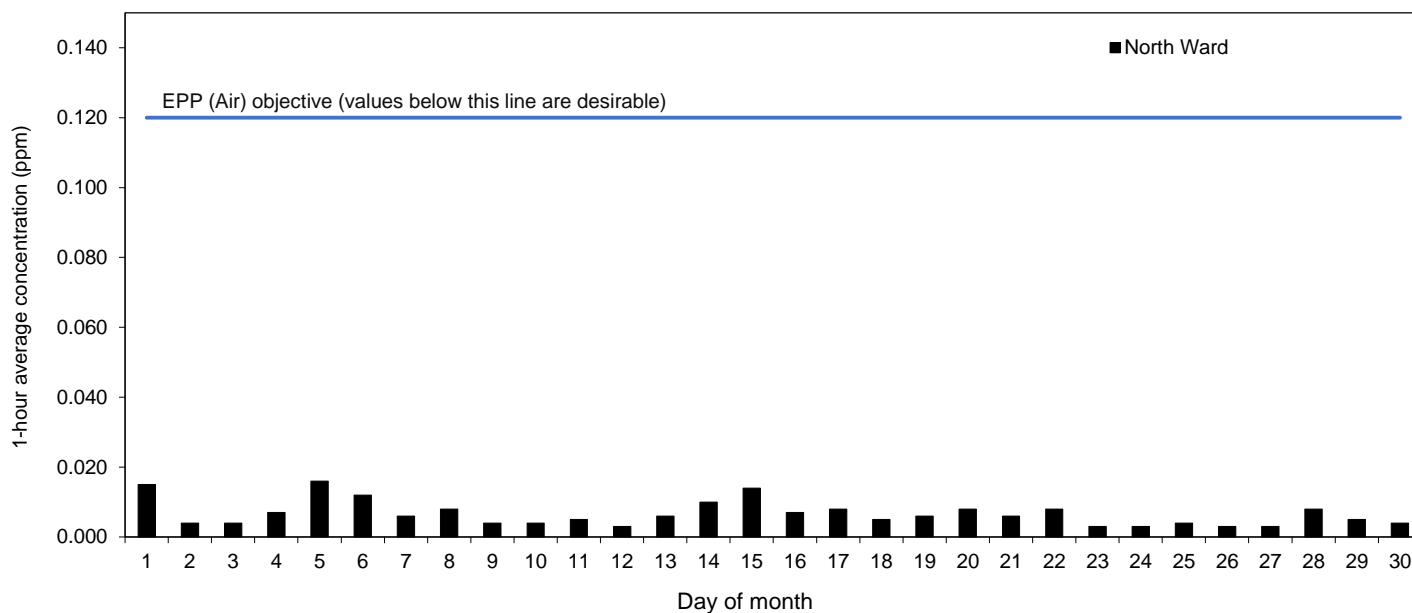


Table 6. Ambient concentrations of nitrogen dioxide. Annual average and monthly maximum 1-hour concentrations (ppm), October 2022 to September 2023.

Site	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Townsville												
North Ward												
Annual average:	0.002											
Maximum 1-hour	0.009	0.009	0.013	0.006	0.008	0.009	0.016	0.027	0.020	0.022	0.022	0.016
% I.A.	100	99	100	100	97	100	99	99	99	100	86	100
% I.A. indicates instrument availability. - indicates less than three-fifths of the data are available. n.d. indicates no data are available. The Environmental Protection (Air) Policy 2019 air quality objectives for nitrogen dioxide are an annual average of 0.030ppm and a 1-hour average of 0.120ppm.												

Sulfur dioxide

Figure 2. Ambient concentrations of sulfur dioxide at North Ward site. Daily 24-hour average concentrations (ppm), September 2023.

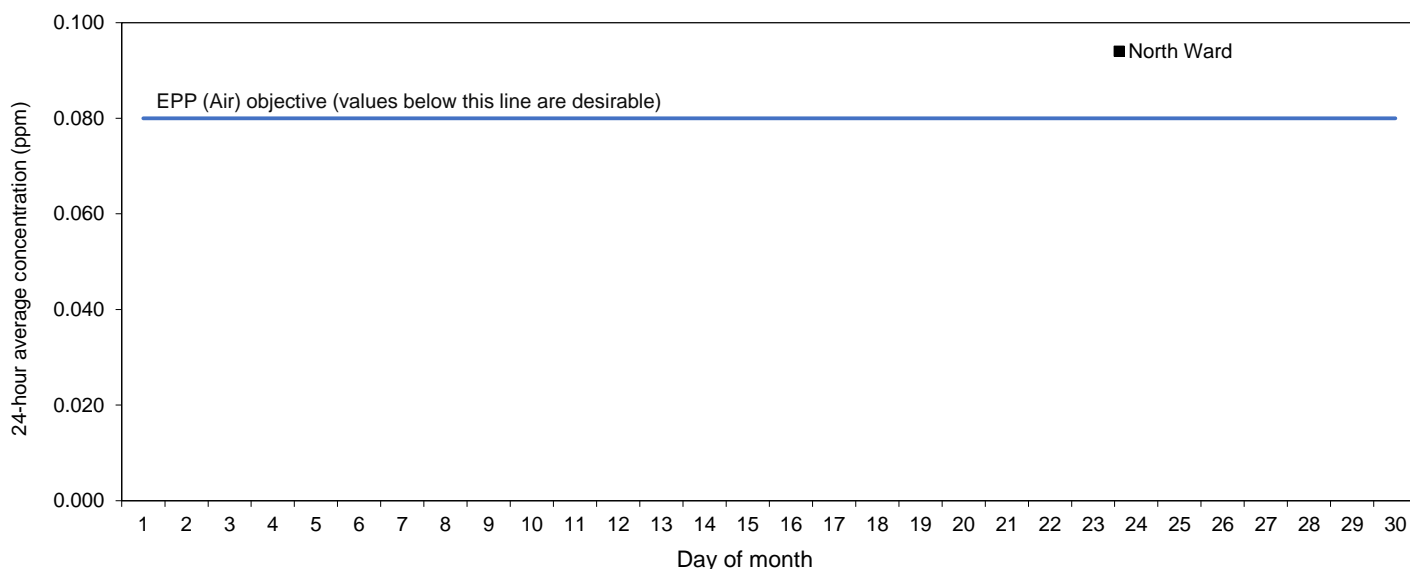


Figure 3. Ambient concentrations of sulfur dioxide at North Ward site. Daily maximum 1-hour average concentrations (ppm), September 2023.

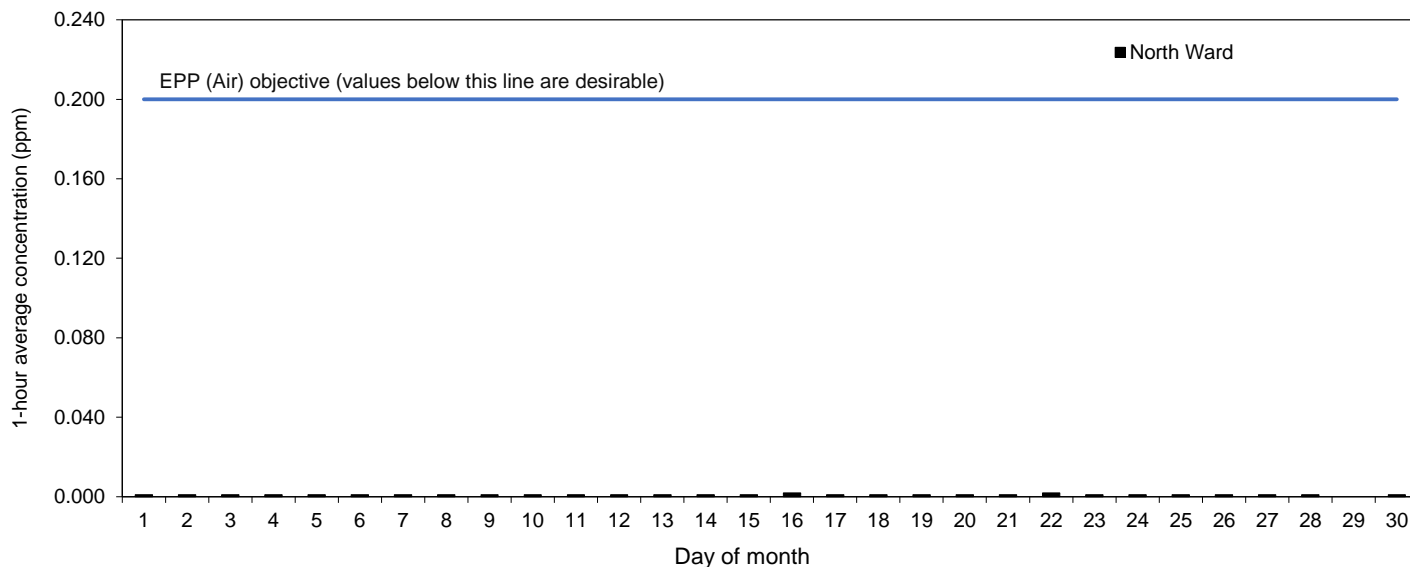


Table 7. Ambient concentrations of sulfur dioxide. Annual average and monthly maximum 24-hour and 1-hour average concentrations (ppm), October 2022 to September 2023.

Site	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Townsville												
North Ward												
Annual average:	<0.001											
Maximum 24-hour	<0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	<0.001
Maximum 1-hour	0.002	0.002	0.002	0.004	0.003	0.005	0.001	0.001	0.001	0.002	0.003	0.002
% I.A.	100	99	99	100	97	100	99	99	99	100	100	100
% I.A. indicates instrument availability. - indicates less than three-fifths of the data are available. n.d. indicates no data are available. The Environmental Protection (Air) Policy 2019 air quality objectives for sulfur dioxide are an annual average of 0.020ppm, a 24-hour average of 0.080ppm (not to be exceeded on more than one day per year) and a 1-hour average of 0.200ppm (not to be exceeded on more than one day per year).												

Visibility-reducing particles

Figure 4. Ambient concentrations of visibility-reducing particle levels at North Ward site. Daily maximum 1-hour average light scattering coefficient (B_{sp}) values (Mm^{-1}), September 2023.

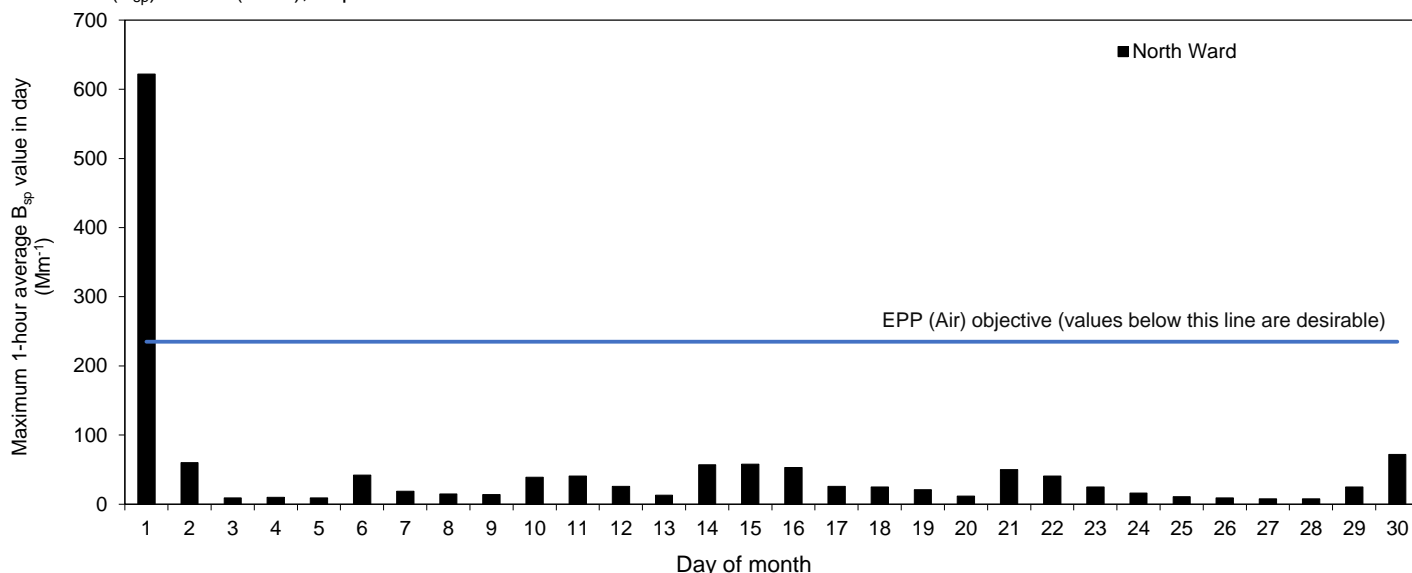


Table 8. Ambient visibility-reducing particle levels. Monthly maximum 1-hour light scattering coefficient (B_{sp}) values (Mm^{-1}), October 2022 to September 2023.

Site	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Townsville												
North Ward												
Maximum 1-hour	23	188	23	21	63	17	102	84	68	115	64	622
% I.A.	100	99	100	100	97	100	99	99	99	100	100	100

% I.A. indicates instrument availability. - indicates less than three-fifths of the data are available. n.d. indicates no data are available.

The Environmental Protection (Air) Policy 2019 air quality objective for visibility-reducing particles is 20km visibility. This equates to light scattering coefficient values of $235Mm^{-1}$ or less.

PM₁₀

Figure 5. Ambient concentrations of PM₁₀ at Coast Guard, Environment Park and Lennon Drive sites. Daily 24-hour average concentrations ($\mu g/m^3$), September 2023.

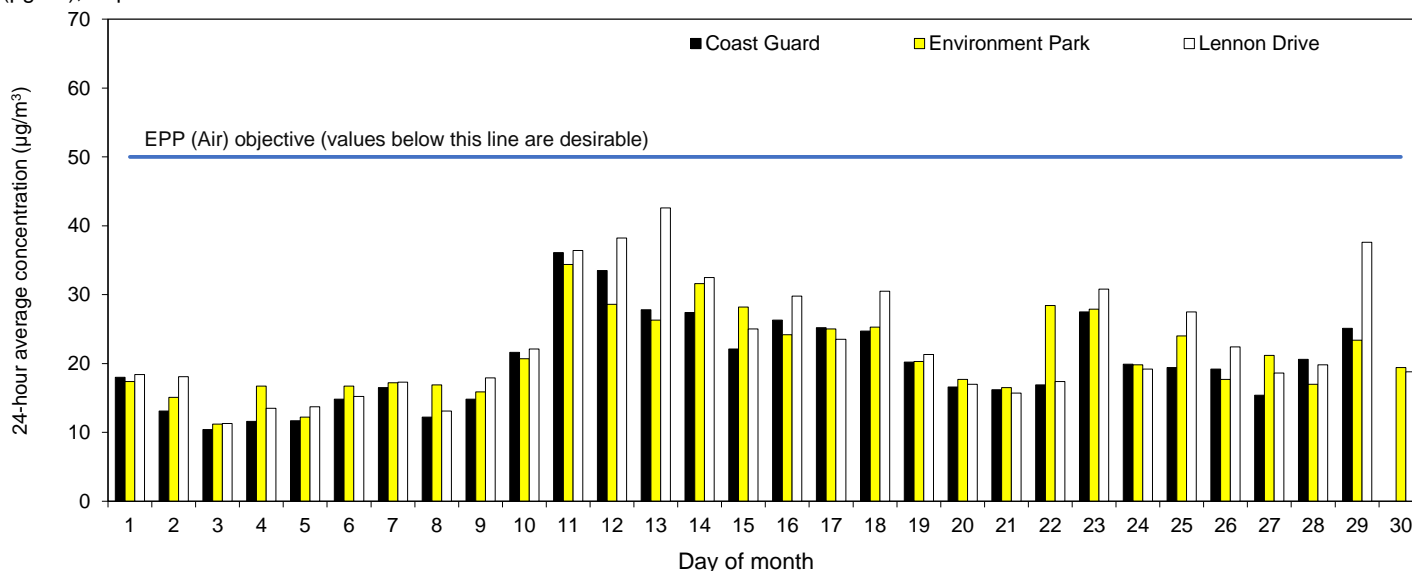


Figure 6. Ambient concentrations of PM₁₀ at North Ward, Ayr and Woree sites. Daily 24-hour average concentrations (µg/m³), September 2022

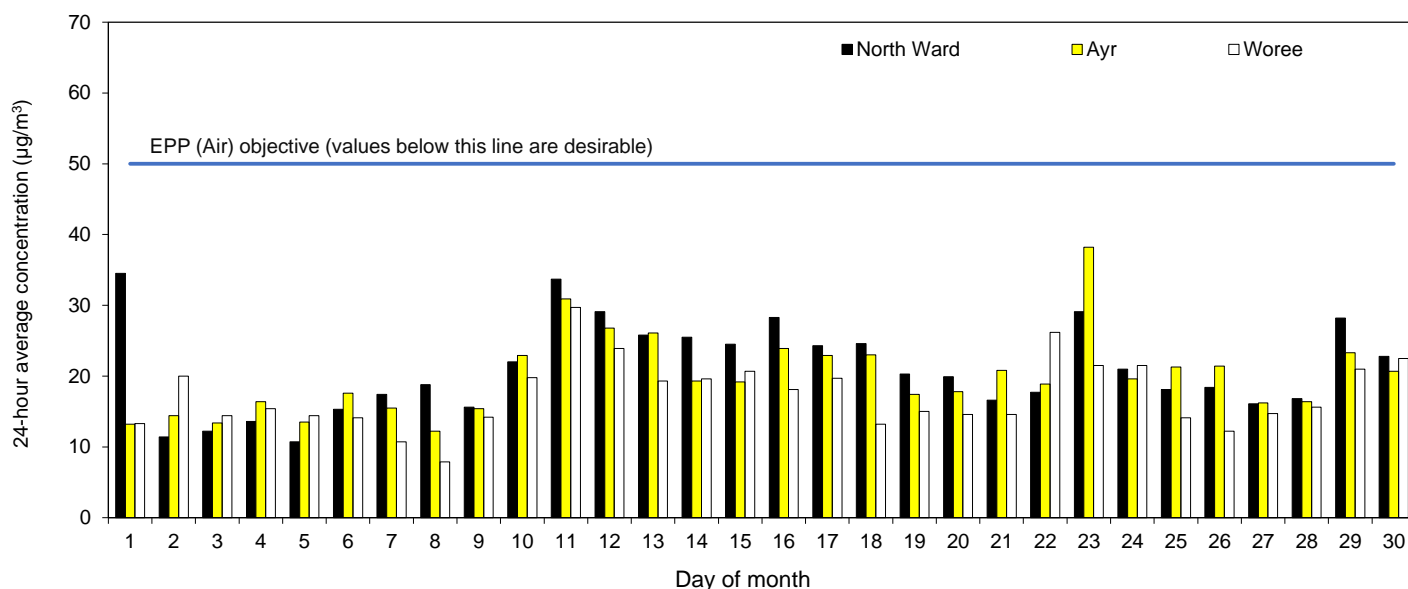


Table 9. Ambient concentrations of PM₁₀. Annual average and monthly maximum 24-hour concentrations (µg/m³), October 2022 to September 2023.

Site	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Townsville												
Coast Guard (industry-operated site)												
Annual average:	15.6											
Maximum 24-hour	25.6	30.8	26.2	22.9	21.9	20.3	24.2	29.9	22.8	25.2	-	36.1
% I.A.	100	100	100	99	84	92	100	98	98	88	20	97
Environment Park (industry-operated site)												
Annual average:	15.5											
Maximum 24-hour	31.0	36.6	30.2	22.4	22.6	19.5	21.0	26.5	23.7	27.2	31.3	34.4
% I.A.	100	75	63	99	100	96	100	95	79	100	96	100
Lennon Drive (industry-operated site)												
Annual average:	16.0											
Maximum 24-hour	34.0	36.1	34.6	20.5	20.7	27.6	23.5	36.3	26.3	29.1	32.3	42.6
% I.A.	100	97	100	99	100	98	100	100	100	100	97	100
North Ward												
Annual average:	15.9											
Maximum 24-hour	26.9	31.5	25.5	22.8	22.2	20.3	22.4	27.2	23.7	27.9	23.2	34.5
% I.A.	100	100	100	100	98	100	100	99	100	100	100	100
Ayr												
Ayr												
Annual average:	16.0											
Maximum 24-hour	17	26.2	25.1	25.5	21.8	22.1	22.9	24.5	34.6	25.1	26.0	38.2
% I.A.	100	100	100	100	100	100	100	100	100	99	99	100
Cairns												
Woree[‡]												
Annual average:	-											
Maximum 24-hour	n.d.	n.d.	n.d.	n.d.	n.d.	18.1	19.3	19.7	22.2	18.3	19.8	29.7
% I.A.	0	0	0	0	0	76	100	100	100	91	89	100
% I.A. indicates instrument availability. - indicates less than three-fifths of the data are available. n.d. indicates no data are available.												
[‡] PM ₁₀ monitoring commenced at Woree in March 2023.												
The Environmental Protection (Air) Policy 2019 air quality objectives for PM ₁₀ are an annual average of 25µg/m ³ and a 24-hour average of 50µg/m ³ .												

PM_{2.5}

Figure 7. Ambient concentrations of PM_{2.5} at North Ward, Ayr and Woree sites. Daily 24-hour average concentrations (µg/m³), September 2023.

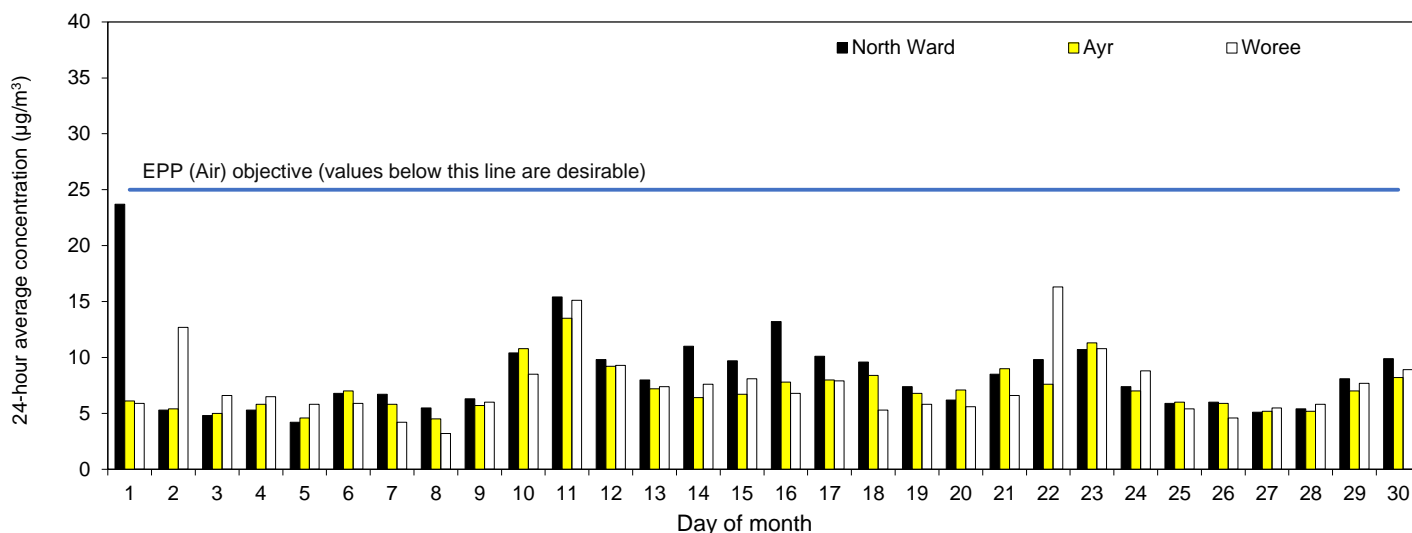


Table 10. Ambient concentrations of PM_{2.5}. Annual average and monthly maximum 24-hour concentrations (µg/m³), October 2022 to September 2023.

Site	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Townsville												
North Ward												
Annual average:	6.0											
Maximum 24-hour	9.8	18.0	8.9	8.6	7.9	7.5	12.6	14.0	13.2	13.0	8.4	23.7
% I.A.	100	100	100	100	98	100	100	99	100	100	100	100
Ayr												
Ayr												
Annual average:	5.6											
Maximum 24-hour	8	8.5	8.7	8.7	7.3	7.1	7.8	9.8	15.2	10.0	8.4	13.5
% I.A.	100	100	100	100	100	100	100	100	100	99	99	100
Cairns												
Woree[‡]												
Annual average:	-											
Maximum 24-hour	n.d.	n.d.	n.d.	n.d.	n.d.	6.5	7.2	10.4	12.0	8.1	11.1	16.3
% I.A.	0	0	0	0	0	76	100	100	100	91	89	100
% I.A. indicates instrument availability. - indicates less than three-fifths of the data are available. n.d. indicates no data are available.												
[‡] PM _{2.5} monitoring commenced at Woree in March 2023.												
The Environmental Protection (Air) Policy 2019 air quality objectives for PM _{2.5} are an annual average of 8µg/m ³ and a 24-hour average of 25µg/m ³ .												

TSP

Figure 8. Ambient concentrations of TSP at Coast Guard and Lennon Drive sites. Daily 24-hour average concentrations ($\mu\text{g}/\text{m}^3$), September 2023.

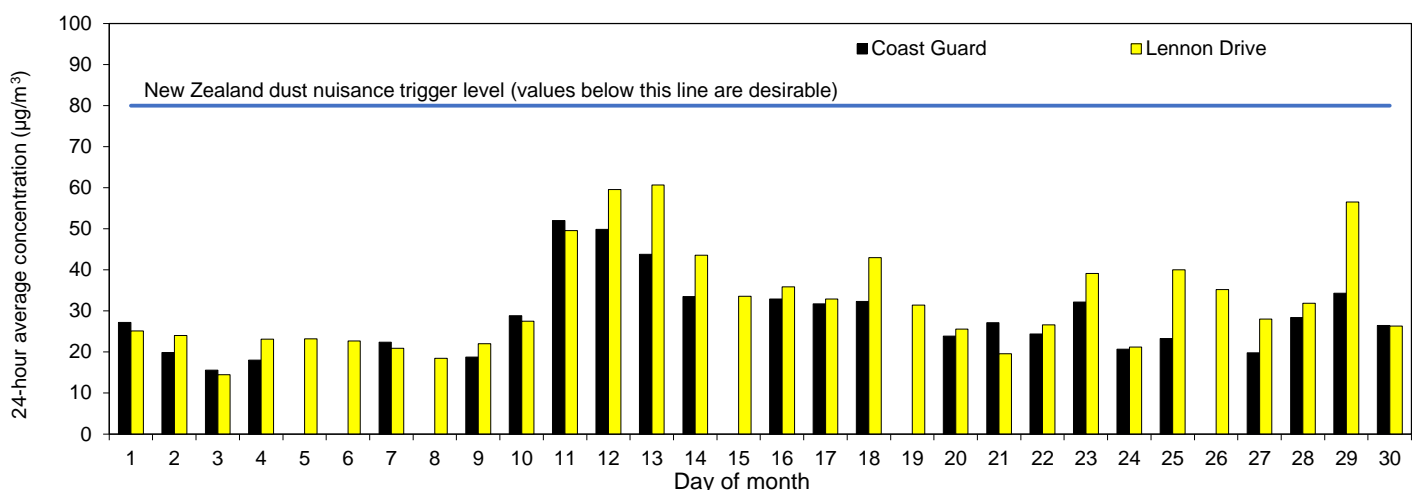


Figure 9. Ambient concentrations of TSP (one day in six monitoring) at North Ward site. Daily 24-hour average concentrations ($\mu\text{g}/\text{m}^3$), September 2023.

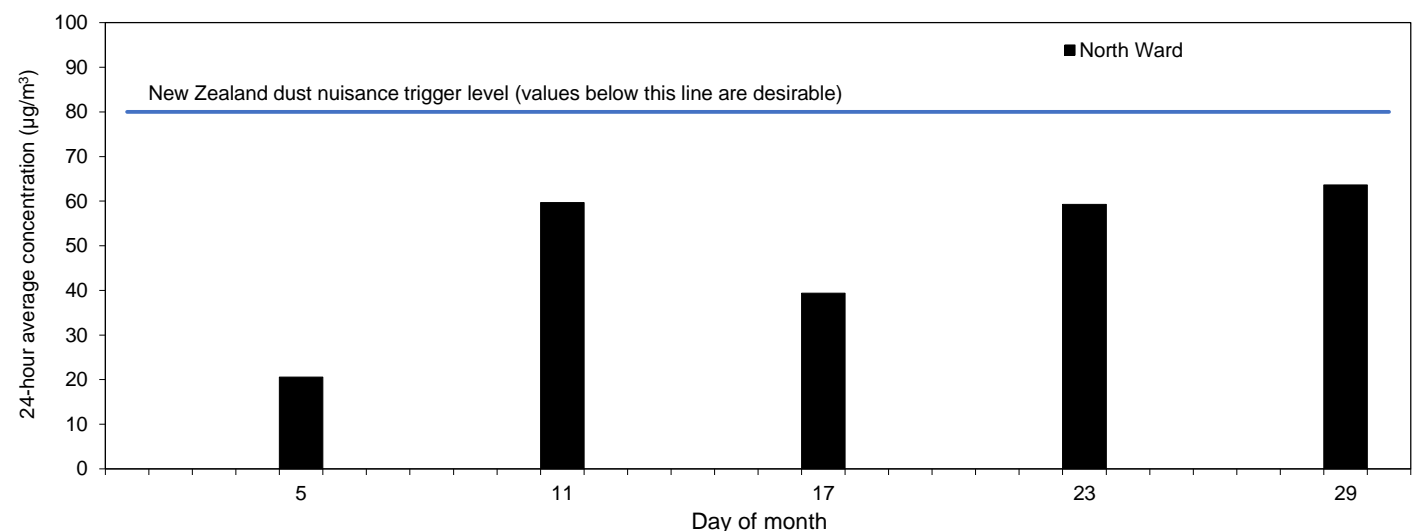


Table 11. Ambient concentrations of TSP. Annual average and monthly maximum 24-hour concentrations ($\mu\text{g}/\text{m}^3$), October 2022 to September 2023.

Site	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Townsville												
Coast Guard (industry-operated site, continuous monitoring)												
Annual average:	21.1											
Maximum 24-hour	29.5	47.5	37.5	28.6	27.0	27.0	31.0	35.2	31.6	29.8	-	52.0
% I.A.	89	97	97	97	83	88	98	98	98	82	20	81
Lennon Drive (industry-operated site, continuous monitoring)												
Annual average:	24.6											
Maximum 24-hour	46.0	64.3	-	-	27.9	38.2	-	59.5	39.2	43.6	46.5	60.7
% I.A.	94	96	43	59	95	100	38	100	100	99	97	99
North Ward (one day in six monitoring)												
Annual average:	25.5											
Maximum 24-hour	42.1	39.4	36.8	19.5	29.1	20.1	28.3	28.3	29.9	44.5	35.1	63.6
% I.A.	100	100	100	80	100	100	100	100	100	100	100	100

% I.A. indicates instrument availability. - indicates less than three-fifths of the data are available. n.d. indicates no data are available.

The Environmental Protection (Air) Policy 2019 air quality objective for TSP is an annual average of $90\mu\text{g}/\text{m}^3$.

The Department of Environment and Science Air Impacts Guideline recommends that short-term (24-hour) TSP concentrations be compared against the trigger levels provided in the New Zealand Ministry for the Environment's "Good Practice Guide for Assessing and Managing Dust (2016)" to assess dust nuisance impacts. The New Zealand dust nuisance trigger level for areas of moderate sensitivity is a 24-hour average of $80\mu\text{g}/\text{m}^3$.

TSP lead

Figure 10. Ambient concentrations of lead (one day in six monitoring) at North Ward site. Annual average concentrations ($\mu\text{g}/\text{m}^3$), October 2022 to September 2023.

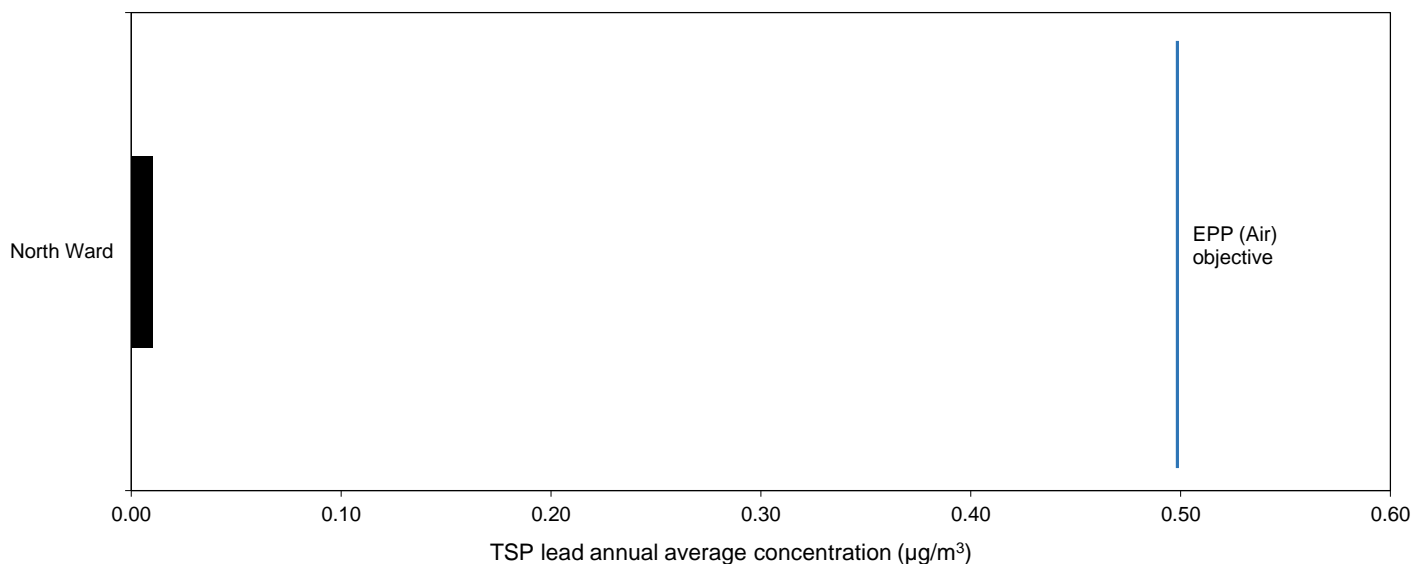


Table 12. Ambient concentrations of TSP lead. Annual average and monthly maximum 24-hour concentrations ($\mu\text{g}/\text{m}^3$) for one day in six monitoring, October 2022 to September 2023.

Site	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Townsville												
North Ward												
Annual average:	0.01											
Maximum 24-hour	0.03	0.01	0.03	0.02	0.02	0.01	0.01	0.08	0.01	0.02	0.03	0.03
% I.A.	100	100	80	80	100	100	100	100	100	100	100	100
% I.A. indicates instrument availability. - indicates less than three-fifths of the data are available. n.d. indicates no data are available. The Environmental Protection (Air) Policy 2019 air quality objective for lead is an annual average of $0.5\mu\text{g}/\text{m}^3$. The limit of reporting is the minimum measured lead concentration that can be determined with the sampling equipment and laboratory method used. Lead concentrations below this limit are preceded by a "<" sign in the table.												

TSP copper

Figure 11. Ambient concentrations of copper (one day in six monitoring) at North Ward site. Annual average concentrations ($\mu\text{g}/\text{m}^3$), October 2022 to September 2023.

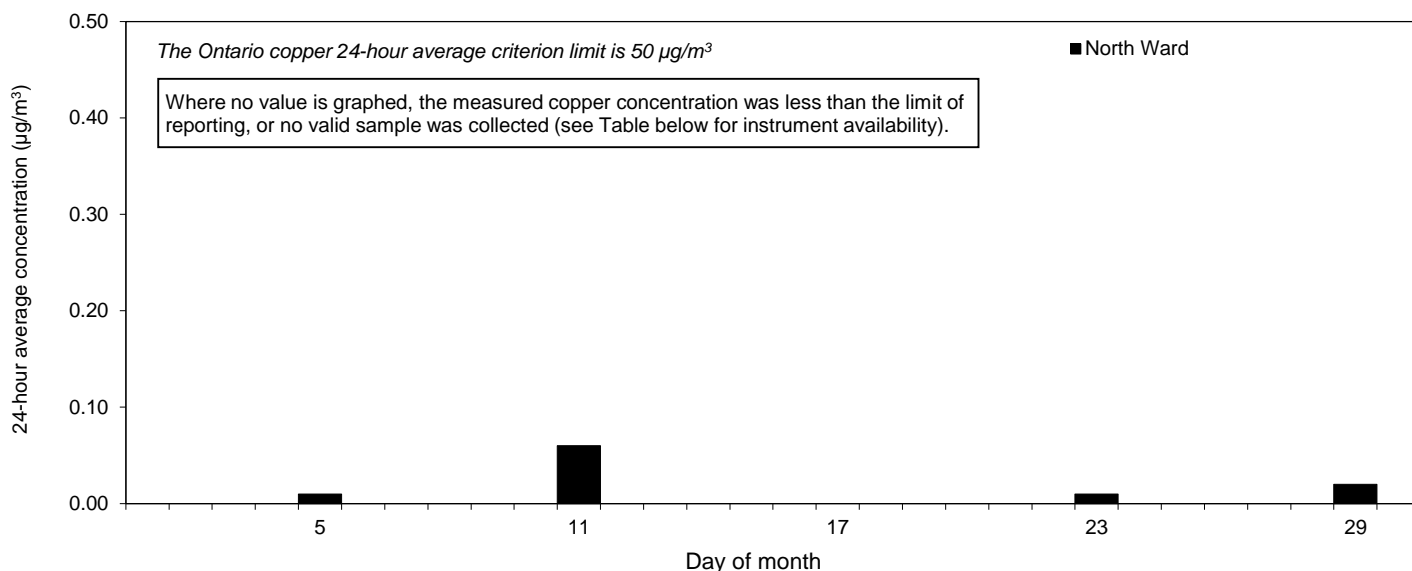


Table 13. Ambient concentrations of TSP copper. Monthly maximum 24-hour concentrations ($\mu\text{g}/\text{m}^3$) for one day in six monitoring, October 2022 to September 2023.

Site	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Townsville												
North Ward												
Maximum 24-hour	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.06
% I.A.	100	100	80	80	100	100	100	100	100	100	100	100

% I.A. indicates instrument availability. - indicates less than three-fifths of the data are available. n.d. indicates no data are available.

The Ontario Ministry of Environment ambient air quality criterion for copper is a 24-hour average of $50\mu\text{g}/\text{m}^3$.

The limit of reporting is the minimum measured copper concentration that can be determined with the sampling equipment and laboratory method used. Copper concentrations below this limit are preceded by a "<" sign in the table.

TSP zinc

Figure 12. Ambient concentrations of zinc (one day in six monitoring) at North Ward site. Annual average concentrations ($\mu\text{g}/\text{m}^3$), October 2022 to September 2023.

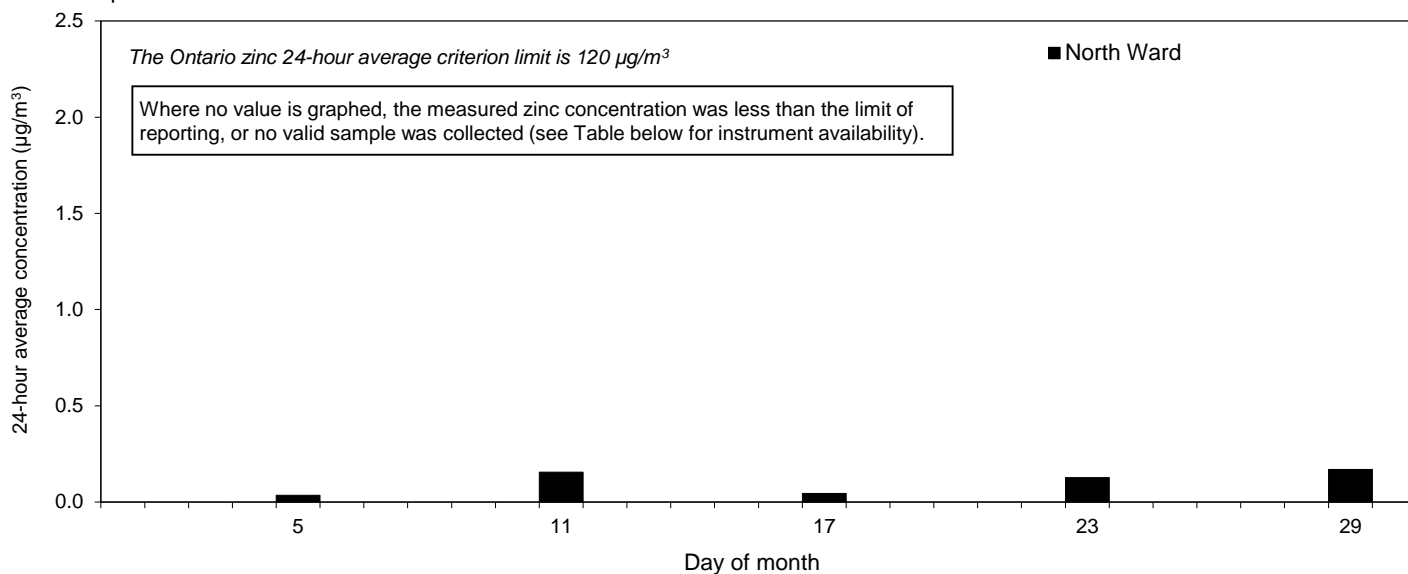


Table 14. Ambient concentrations of TSP zinc. Monthly maximum 24-hour concentrations ($\mu\text{g}/\text{m}^3$) for one day in six monitoring, October 2022 to September 2023.

Site	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Townsville												
North Ward												
Maximum 24-hour	0.26	0.12	0.10	0.15	0.22	0.14	0.08	0.22	0.14	0.14	0.16	0.17
% I.A.	100	100	80	80	100	100	100	100	100	100	100	100

% I.A. indicates instrument availability. - indicates less than three-fifths of the data are available. n.d. indicates no data are available.

The Ontario Ministry of Environment ambient air quality criterion for zinc is a 24-hour average of $120\mu\text{g}/\text{m}^3$.

The limit of reporting is the minimum measured zinc concentration that can be determined with the sampling equipment and laboratory method used. Zinc concentrations below this limit are preceded by a "<" sign in the table.

TSP nickel

Figure 13. Ambient concentrations of nickel (one day in six monitoring) at North Ward site. Annual average concentrations ($\mu\text{g}/\text{m}^3$), October 2022 to September 2023.

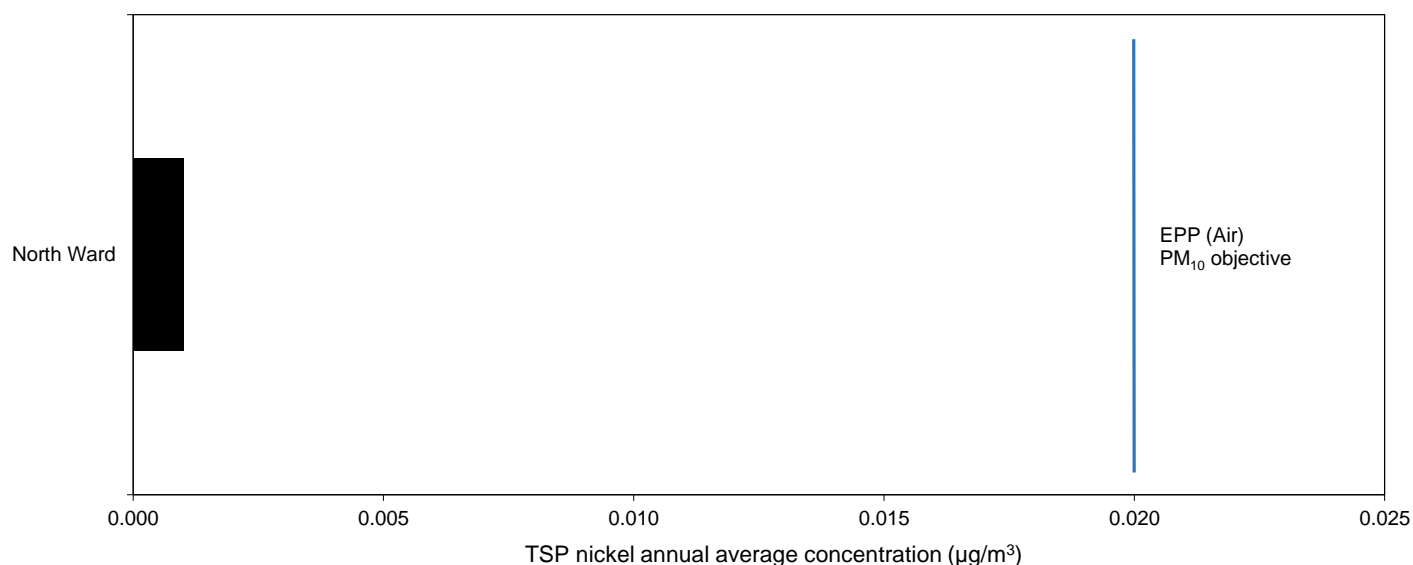


Table 15. Ambient concentrations of TSP nickel. Annual average and monthly maximum 24-hour concentrations ($\mu\text{g}/\text{m}^3$) for one day in six monitoring, October 2022 to September 2023.

Site	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Townsville												
North Ward												
Annual average:	0.001											
Maximum 24-hour	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002
% I.A.	100	100	80	80	100	100	100	100	100	100	100	100
% I.A. indicates instrument availability. - indicates less than three-fifths of the data are available. n.d. indicates no data are available. The Environmental Protection (Air) Policy 2019 air quality objective for nickel is an annual average of $0.020\mu\text{g}/\text{m}^3$ (measured as the total metal content in PM_{10} particles). Monitoring conducted by the Queensland Government measures the amount of nickel present in the TSP fraction. As PM_{10} is a subset of TSP, if the TSP nickel concentration is less than the EPP (Air) PM_{10} objective value, it follows that the PM_{10} nickel concentration complies with the EPP (Air) objective. The limit of reporting is the minimum measured nickel concentration that can be determined with the sampling equipment and laboratory method used. Nickel concentrations below this limit are preceded by a "<" sign in the table.												

TSP arsenic

Figure 14. Ambient concentrations of arsenic (one day in six monitoring) at North Ward site. Annual average concentrations ($\mu\text{g}/\text{m}^3$), October 2022 to September 2023.

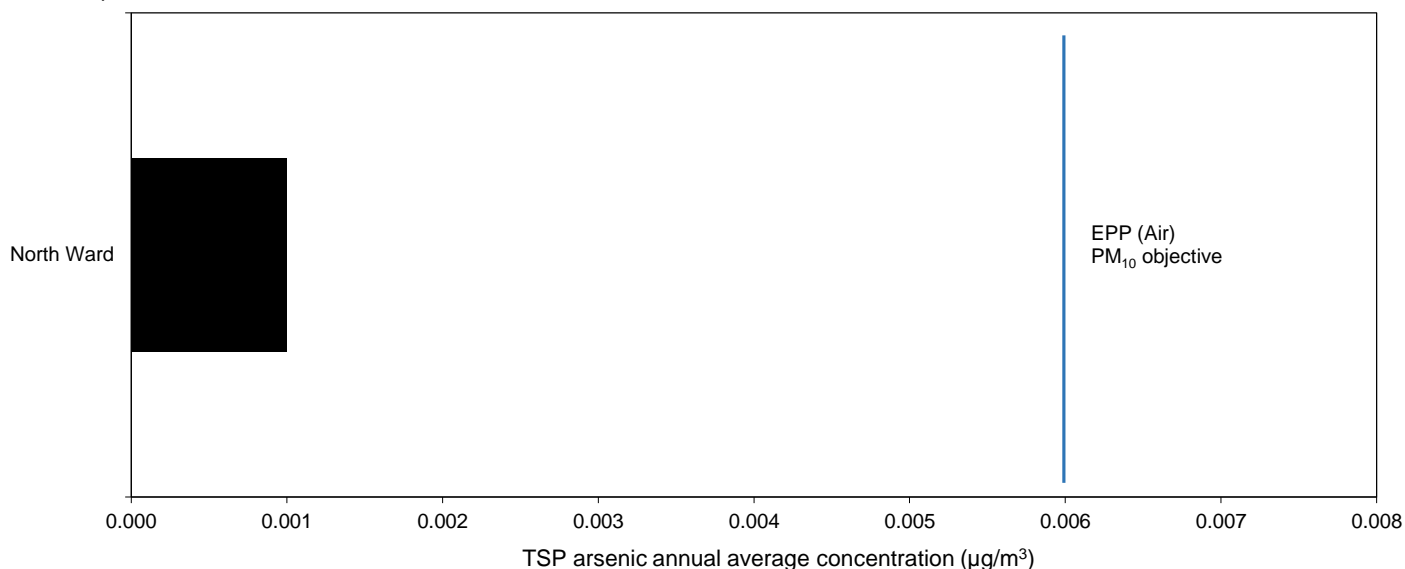


Table 16. Ambient concentrations of TSP arsenic. Annual average and monthly maximum 24-hour concentrations ($\mu\text{g}/\text{m}^3$) for one day in six monitoring, October 2022 to September 2023.

Site	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Townsville												
North Ward												
Annual average:	0.001											
Maximum 24-hour	0.013	0.004	0.001	0.001	0.002	0.001	0.001	0.003	0.002	0.001	0.003	0.002
% I.A.	100	100	80	80	100	100	100	100	100	100	100	100

% I.A. indicates instrument availability. - indicates less than three-fifths of the data are available. n.d. indicates no data are available.

The Environmental Protection (Air) Policy 2019 air quality objective for arsenic is an annual average of $0.006\mu\text{g}/\text{m}^3$ (measured as the total metal content in PM_{10} particles).

Monitoring conducted by the Queensland Government measures the amount of arsenic present in the TSP fraction. As PM_{10} is a subset of TSP, if the TSP arsenic concentration is less than the EPP (Air) PM_{10} objective value, it follows that the PM_{10} arsenic concentration complies with the EPP (Air) objective.

The limit of reporting is the minimum measured arsenic concentration that can be determined with the sampling equipment and laboratory method used. Arsenic concentrations below this limit are preceded by a "<" sign in the table.

TSP cadmium

Figure 15. Ambient concentrations of cadmium (one day in six monitoring) at North Ward site. Annual average concentrations ($\mu\text{g}/\text{m}^3$), October 2022 to September 2023.

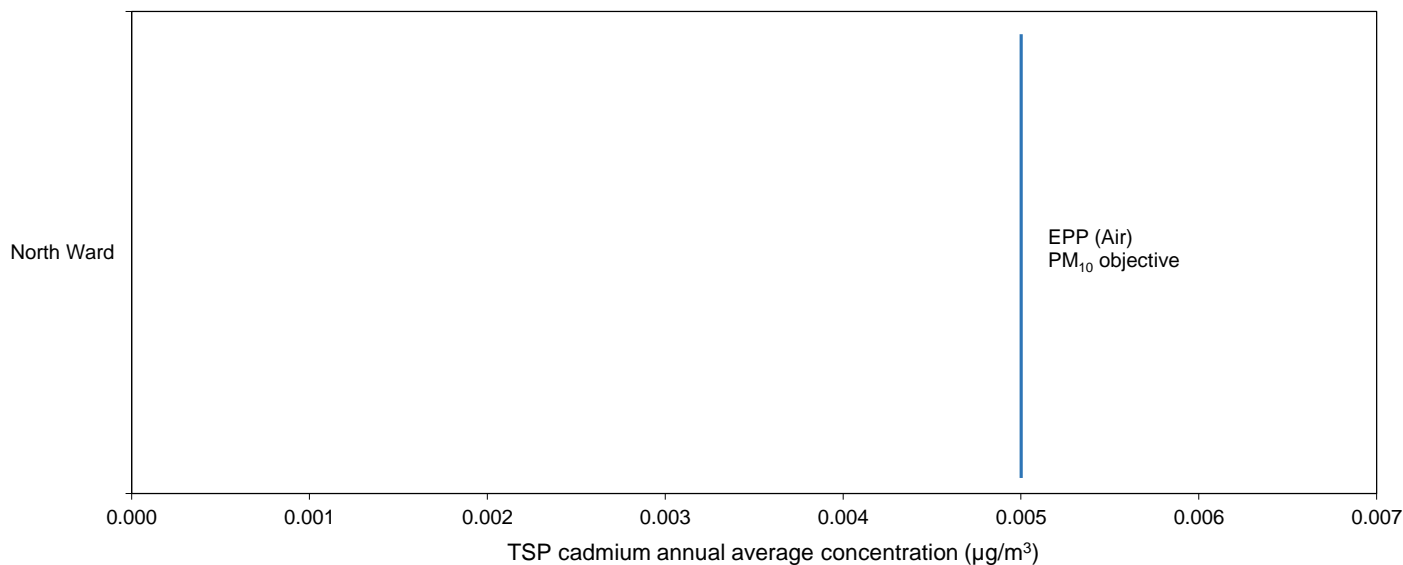


Table 17. Ambient concentrations of TSP cadmium. Annual average and monthly maximum 24-hour concentrations ($\mu\text{g}/\text{m}^3$) for one day in six monitoring, October 2022 to September 2023.

Site	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Townsville												
North Ward												
Annual average:	<0.001											
Maximum 24-hour	0.001	<0.001	<0.001	0.001	0.001	0.001	<0.001	0.001	<0.001	0.001	0.001	0.001
% I.A.	100	100	80	80	100	100	100	100	100	100	100	100
% I.A. indicates instrument availability. - indicates less than three-fifths of the data are available. n.d. indicates no data are available. The Environmental Protection (Air) Policy 2019 air quality objective for cadmium is an annual average of $0.005\mu\text{g}/\text{m}^3$ (measured as the total metal content in PM_{10} particles). Monitoring conducted by the Queensland Government measures the amount of cadmium present in the TSP fraction. As PM_{10} is a subset of TSP, if the TSP cadmium concentration is less than the EPP (Air) PM_{10} objective value, it follows that the PM_{10} cadmium concentration complies with the EPP (Air) objective. The limit of reporting is the minimum measured cadmium concentration that can be determined with the sampling equipment and laboratory method used. Cadmium concentrations below this limit are preceded by a "<" sign in the table.												

Dustfall

Figure 16. Dust deposition rates at North Ward site. Daily dust (insoluble solids fraction) deposition rate (mg/m²/day), for month of September 2023.

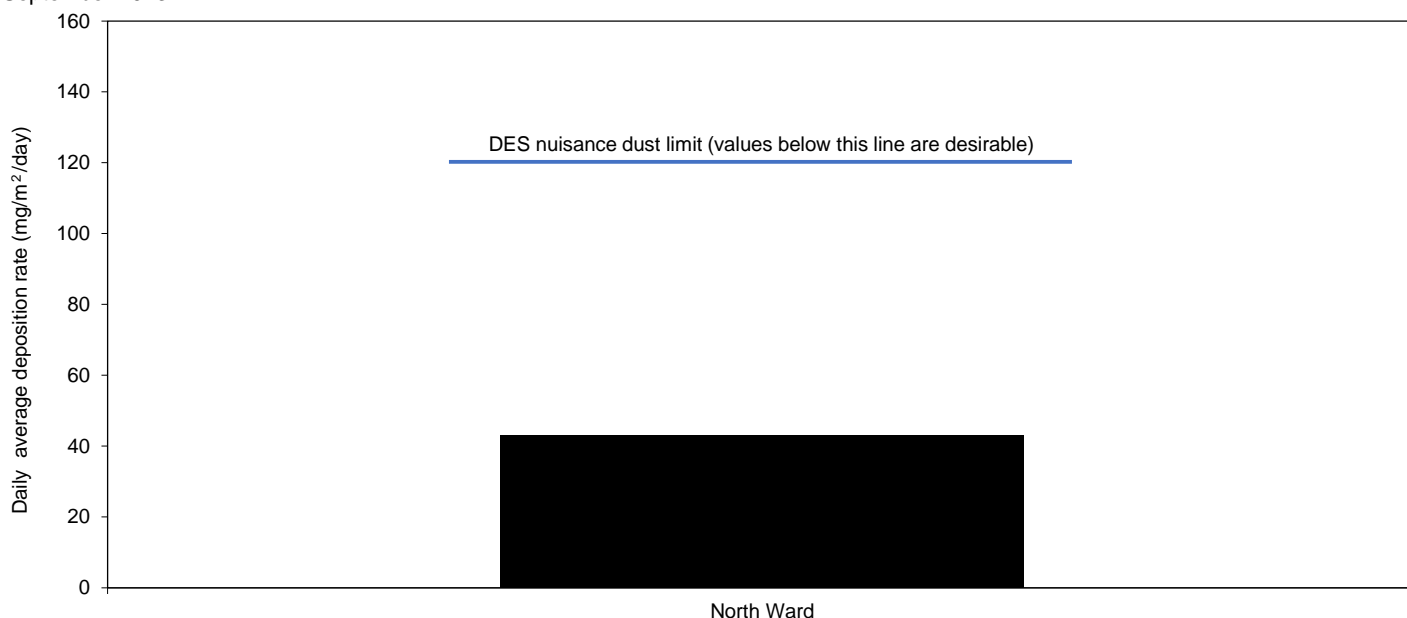


Table 18. Monthly average dust (insoluble fraction) deposition rate (mg/m²/day), October 2022 to September 2023.

Site	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Townsville												
North Ward												
Daily average	40	43	20	7	10	10	7	27	20	30	40	43
n.d. indicates no data are available.												
There is no national guideline for dust deposition.												
The Department of Environment and Science Air Impacts Guideline recommends a dust deposition limit of 120mg/m ² /day, averaged over one month, be used to assess dust nuisance.												
There is a minimum dust deposition rate that can be determined with the sampling equipment and laboratory method used. Dust deposition rates below this minimum reporting value are preceded by a "<" sign in this table.												

Dustfall lead

Figure 17. Dustfall lead monitoring at North Ward site. Daily average lead deposition rate ($\mu\text{g}/\text{m}^2/\text{day}$) for month of September, 2023.

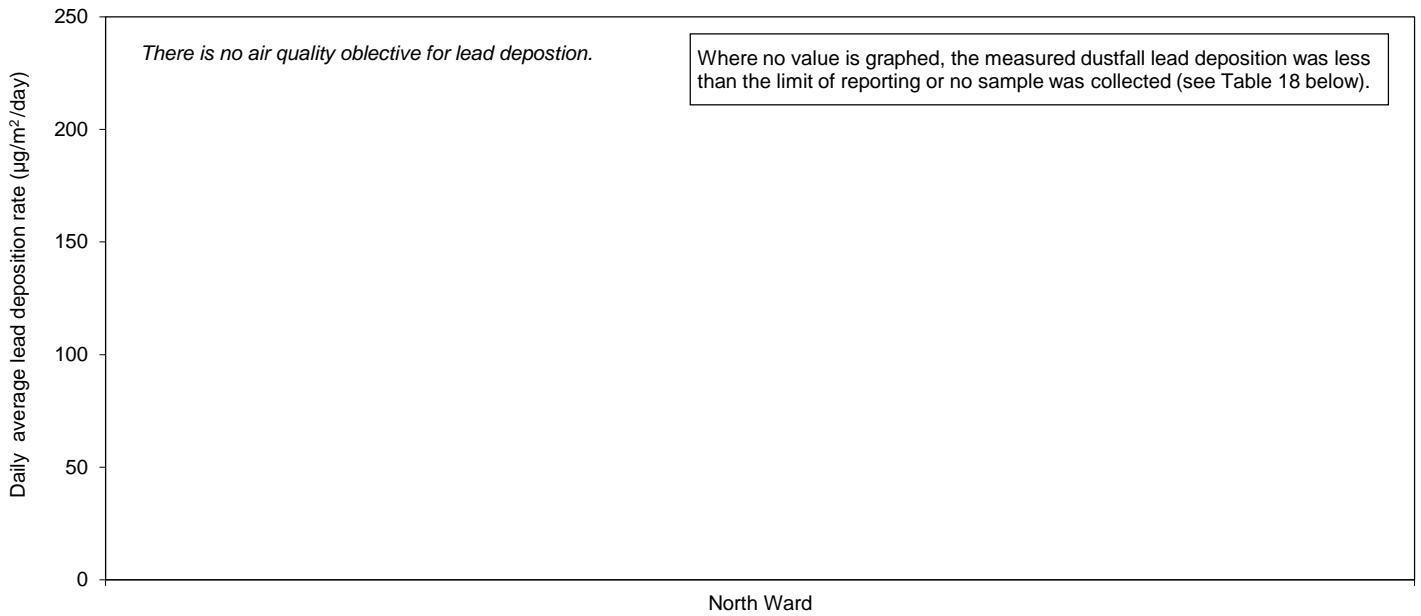


Table 19. Daily average lead deposition rate ($\mu\text{g}/\text{m}^2/\text{day}$), October 2022 to September 2023.

Site	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Townsville												
North Ward												
Annual average:	<33											
Lead	<33	<33	<33	<33	<33	<33	<33	<33	<33	<33	<33	<33
n.d. indicates no data are available.												
There is no air quality objective for ambient lead deposition. Some data indicate that lead fallout levels between 250 and 750 $\mu\text{g}/\text{m}^2/\text{day}$ (averaged over a 12-month period) are associated with a slight increase in blood lead levels (Air Quality Guidelines for Europe, Second Edition, World Health Organization, 2000).												
The limit of reporting is the minimum measured lead deposition rate that can be determined with the sampling equipment and laboratory method used. Lead deposition rates below this limit are preceded by a "<" sign in the table.												

Measured ambient concentrations - Mount Isa

Sulfur dioxide

Figure 18. Ambient concentrations of sulfur dioxide at The Gap site. Daily 24-hour average concentrations (ppm), September 2023.

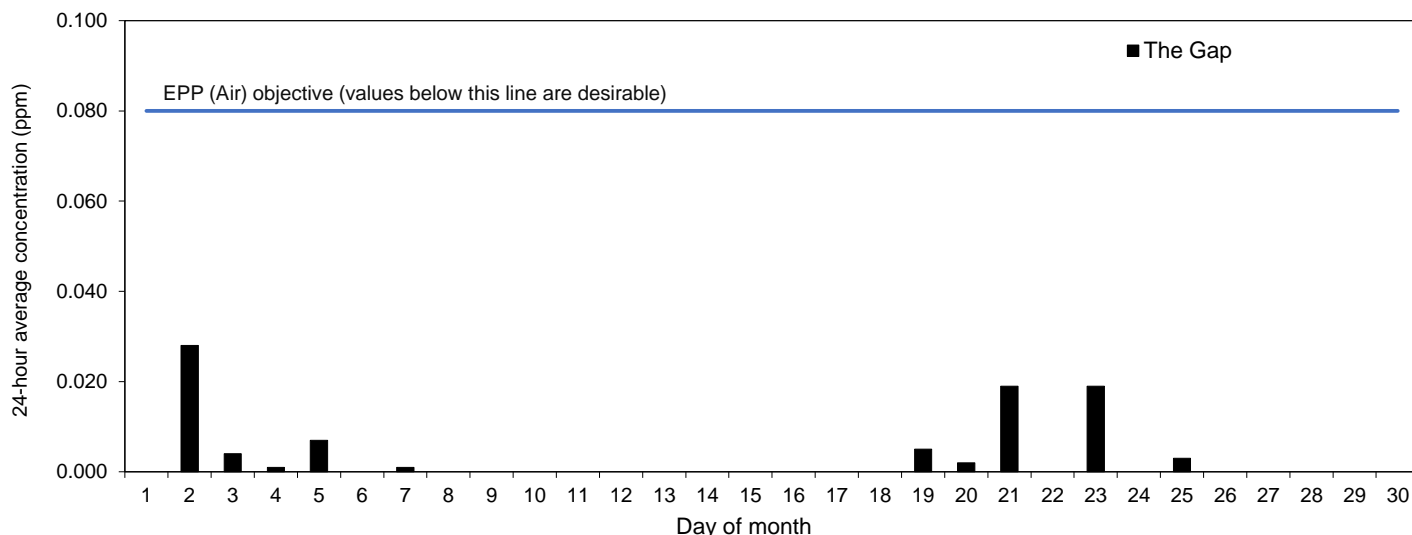


Figure 19. Ambient concentrations of sulfur dioxide at The Gap site. Daily maximum 1-hour average concentrations (ppm), September 2023.

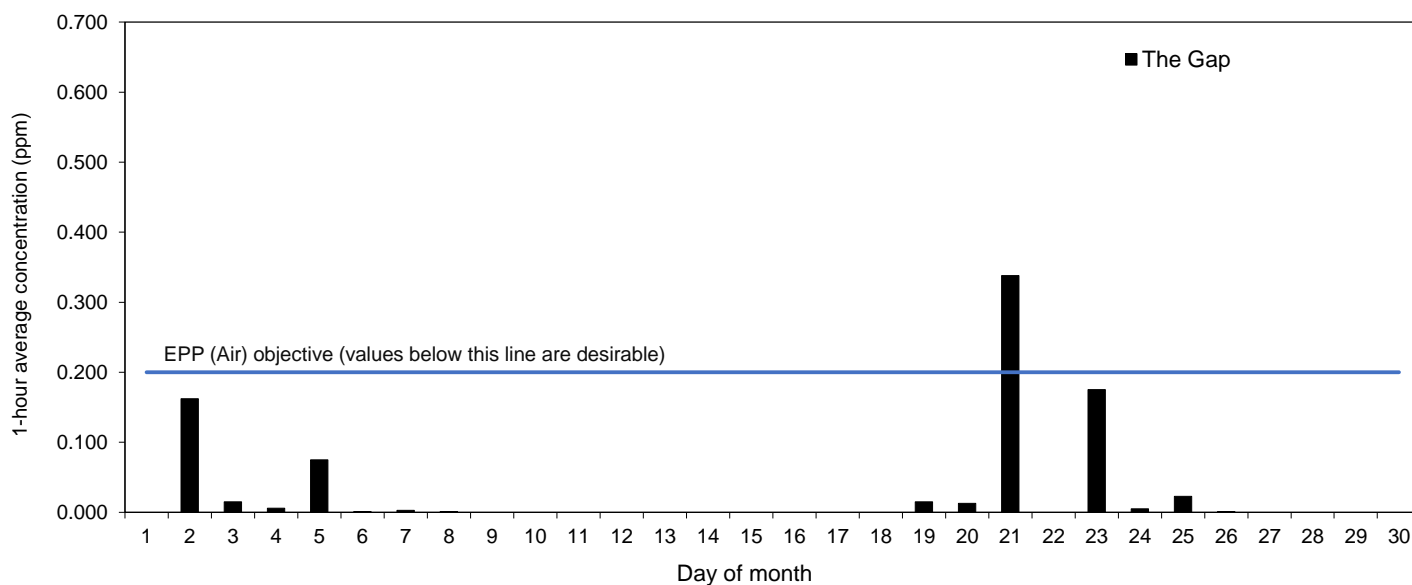


Table 20. Ambient concentrations of sulfur dioxide. Annual average and monthly maximum 24-hour and 1-hour average concentrations (ppm), October 2022 to September 2023.

Site	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mount Isa												
The Gap												
Annual average:	0.004											
Maximum 24-hour	0.051	0.029	0.027	0.039	-	n.d.	-	0.001	0.011	0.027	0.008	0.028
Maximum 1-hour	0.311	0.125	0.185	0.546	-	n.d.	-	0.012	0.119	0.232	0.091	0.338
% I.A.	99	98	86	100	27	0	11	99	99	100	97	98
% I.A. indicates instrument availability. - indicates less than three-fifths of the data are available. n.d. indicates no data are available.												
The Environmental Protection (Air) Policy 2019 air quality objectives for sulfur dioxide are an annual average of 0.020ppm, a 24-hour average of 0.080ppm (not to be exceeded on more than one day per year) and a 1-hour average of 0.200ppm (not to be exceeded on more than one day per year).												

PM₁₀

Figure 20. Ambient concentrations of PM₁₀ at The Gap site. Daily 24-hour average concentrations (µg/m³), September 2023.

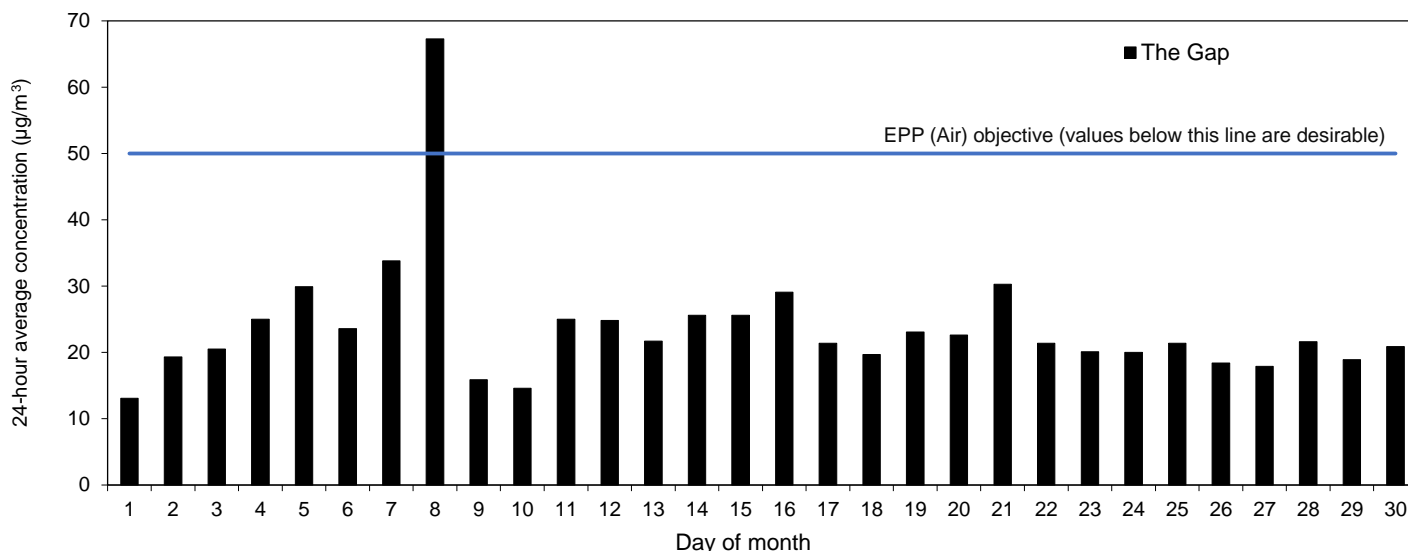


Table 21. Ambient concentrations of PM₁₀. Annual average and monthly maximum 24-hour and 1-hour average concentrations (µg/m³), October 2022 to September 2023.

Site	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mount Isa												
The Gap												
Annual average:	14.0											
Maximum 24-hour	34.7	27.6	27.0	17.2	16.8	19.0	25.1	24.1	28.5	25.8	26.4	67.3
% I.A.	100	100	100	100	100	100	100	100	100	100	100	99
% I.A. indicates instrument availability. - indicates less than three-fifths of the data are available. n.d. indicates no data are available.												
The Environmental Protection (Air) Policy 2019 air quality objectives for PM ₁₀ are an annual average of 25µg/m ³ and a 24-hour average of 50µg/m ³ .												

PM_{2.5}

Figure 21. Ambient concentrations of PM_{2.5} at The Gap site. Daily 24-hour average concentrations (µg/m³), September 2023.

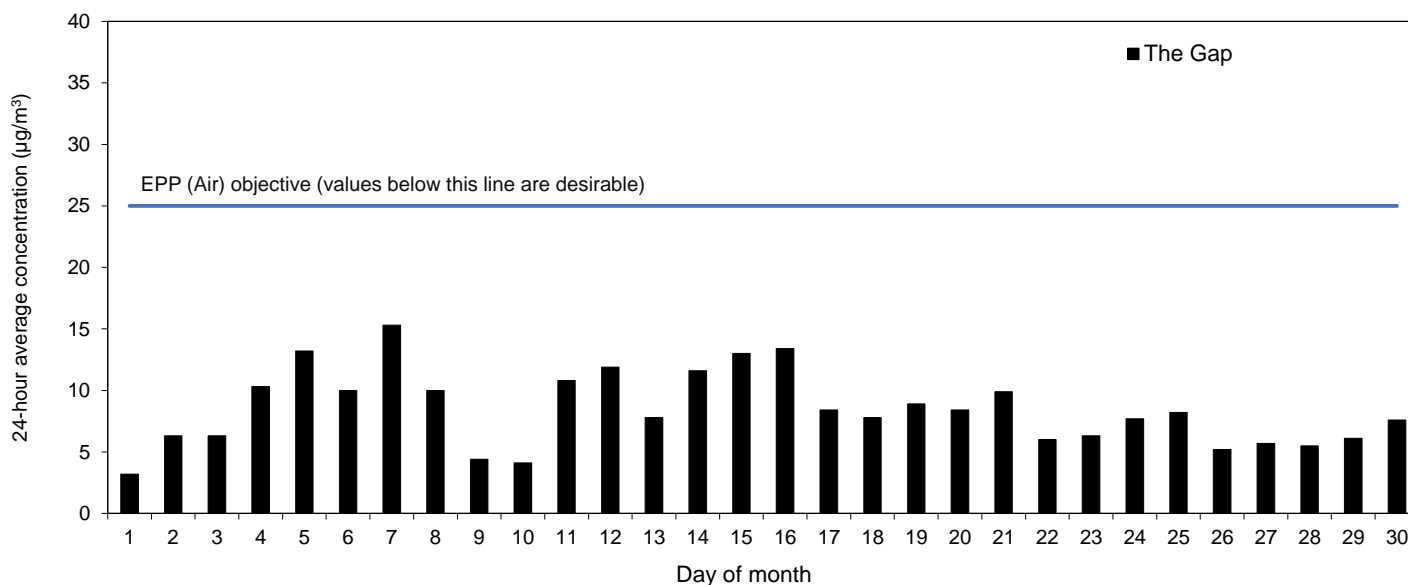


Table 22. Ambient concentrations of PM_{2.5}. Annual average and monthly maximum 24-hour concentrations (µg/m³), October 2022 to September 2023.

Site	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mount Isa												
The Gap												
Annual average:	4.7											
Maximum 24-hour	14.6	12.2	10.8	7.0	6.5	6.3	7.4	6.1	10.0	6.0	9.2	15.3
% I.A.	100	100	100	100	100	100	100	100	100	100	100	99
% I.A. indicates instrument availability. - indicates less than three-fifths of the data are available. n.d. indicates no data are available.												
The Environmental Protection (Air) Policy 2019 air quality objectives for PM _{2.5} are an annual average of 8µg/m ³ and a 24-hour average of 25µg/m ³ .												

TSP lead

Figure 22. Ambient concentrations of TSP lead (one day in six monitoring) at The Gap site. Annual average concentrations (µg/m³), October 2022 to September 2023.

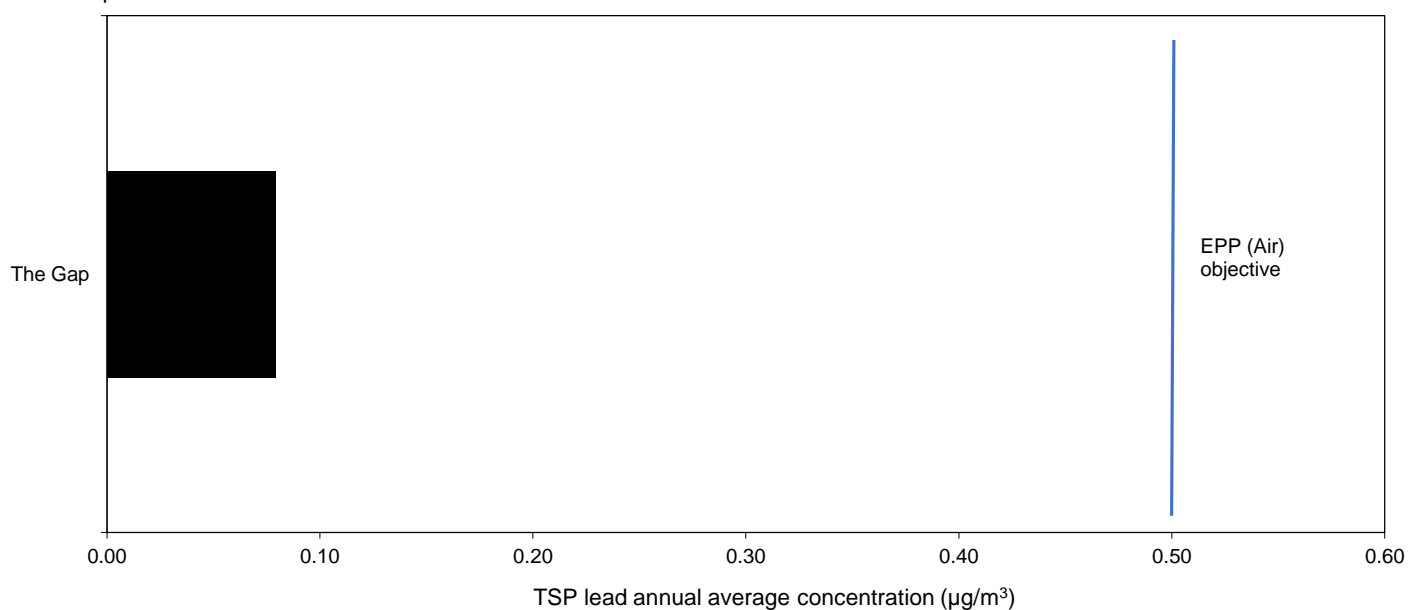


Table 23. Ambient concentrations of TSP lead. Annual average and monthly maximum 24-hour concentrations (µg/m³) for one day in six monitoring, October 2022 to September 2023.

Site	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mount Isa												
The Gap												
Annual average:	0.08											
Maximum 24-hour	0.87	0.17	0.10	0.11	0.10	0.39	0.07	0.01	0.05	0.02	0.63	-
% I.A.	100	100	100	80	100	100	100	100	100	100	100	20
% I.A. indicates instrument availability. - indicates less than three-fifths of the data are available. n.d. indicates no data are available.												
The Environmental Protection (Air) Policy 2019 air quality objective for lead is an annual average of 0.5µg/m ³ .												
The limit of reporting is the minimum measured lead concentration that can be determined with the sampling equipment and laboratory method used. Lead concentrations below this limit are preceded by a "<" sign in the table.												

PM₁₀ arsenic

Figure 23. Ambient concentrations of PM₁₀ arsenic (one day in six monitoring) at The Gap site. Annual average concentrations (µg/m³), October 2022 to September 2023.

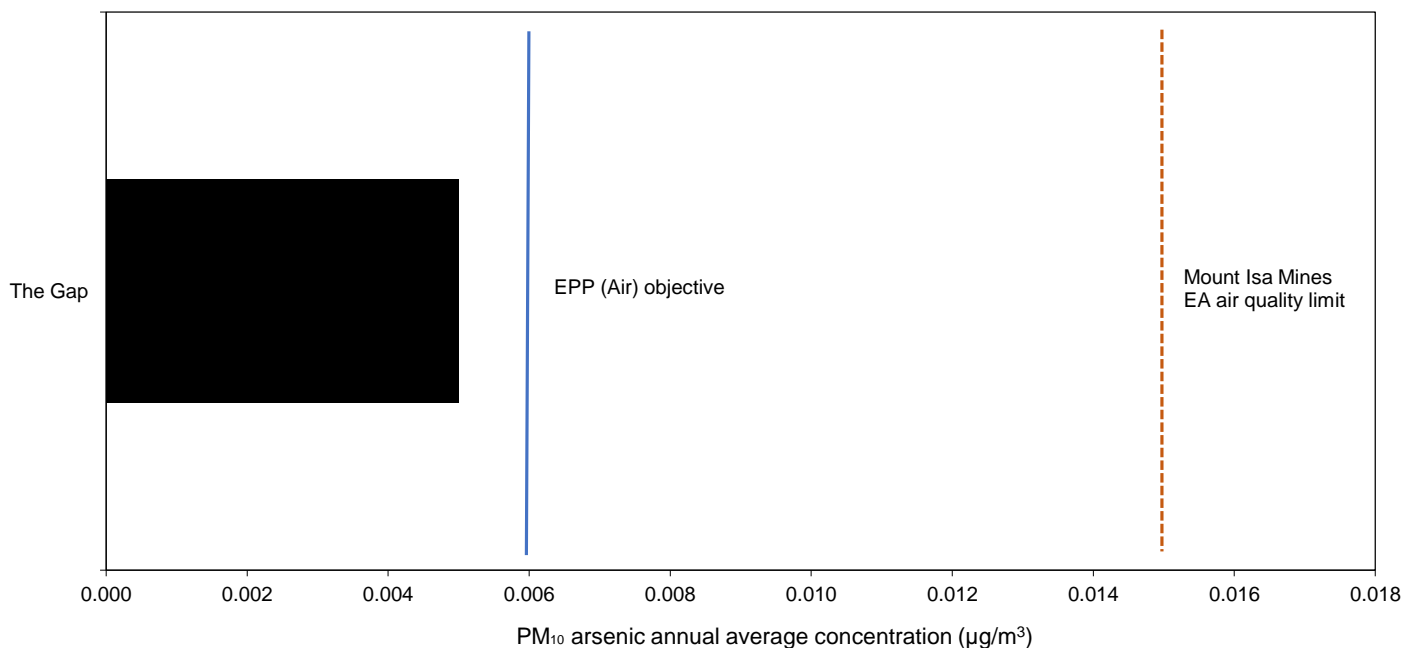


Table 24. Ambient concentrations of PM₁₀ arsenic. Annual average and monthly maximum 24-hour concentrations (µg/m³) for one day in six monitoring, October 2022 to September 2023.

Site	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mount Isa												
The Gap												
Annual average:	0.005											
Maximum 24-hour	0.070	0.012	0.010	0.011	0.005	0.027	0.003	<0.001	0.002	0.002	0.027	-
% I.A.	100	100	100	80	100	100	100	100	100	100	100	20
% I.A. indicates instrument availability. - indicates less than three-fifths of the data are available. n.d. indicates no data are available. The Environmental Protection (Air) Policy 2019 air quality objective for arsenic is an annual average of 0.006µg/m ³ (measured as the total metal content in PM ₁₀ particles). The Mount Isa Mines Environmental Authority air quality limit for arsenic is an annual average of 0.015µg/m ³ (measured as the total metal content in PM ₁₀ particles between 1 January and 31 December 2023). Monitoring conducted by the Queensland Government measures the amount of arsenic present in the TSP fraction (the TSP fraction is collected so lead levels can be compared against the EPP (Air) objective). Monitoring using co-located TSP and PM ₁₀ high volume samplers has determined that the ratio of PM ₁₀ arsenic to TSP arsenic is 0.88:1 in Mount Isa. The PM ₁₀ arsenic values presented in this table have been generated by applying this factor to the measured TSP arsenic concentrations. The limit of reporting is the minimum measured arsenic concentration that can be determined with the sampling equipment and laboratory method used. Arsenic concentrations below this limit are preceded by a "<" sign in the table.												

PM₁₀ cadmium

Figure 24. Ambient concentrations of PM₁₀ cadmium (one day in six monitoring) at The Gap site. Annual average concentrations (µg/m³), October 2022 to September 2023.

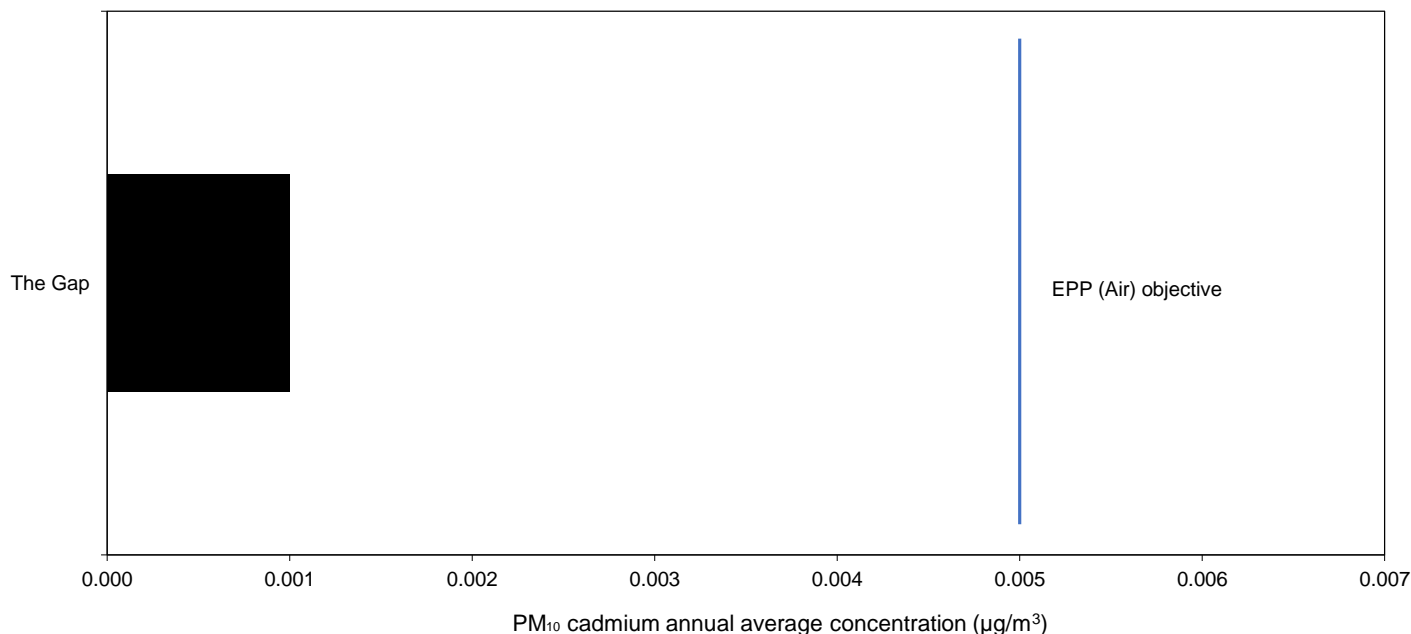


Table 25. Ambient concentrations of PM₁₀ cadmium. Annual average and monthly maximum 24-hour concentrations (µg/m³) for one day in six monitoring, October 2022 to September 2023.

Site	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mount Isa												
The Gap												
Annual average:	0.001											
Maximum 24-hour	0.008	0.002	0.001	0.001	0.001	0.005	0.001	<0.001	0.001	<0.001	0.004	-
% I.A.	100	100	100	80	100	100	100	100	100	100	100	20
% I.A. indicates instrument availability. - indicates less than three-fifths of the data are available. n.d. indicates no data are available.												
The Environmental Protection (Air) Policy 2019 air quality objective for cadmium is an annual average of 0.005µg/m ³ (measured as the total metal content in PM ₁₀ particles).												
Monitoring conducted by the Queensland Government measures the amount of cadmium present in the TSP fraction (the TSP fraction is collected so lead levels can be compared against the EPP(Air) objective). Monitoring using co-located TSP and PM ₁₀ high volume samplers has determined that the ratio of PM ₁₀ cadmium to TSP cadmium is 0.76:1 in Mount Isa. The PM ₁₀ cadmium values presented in this table have been generated by applying this factor to the measured TSP cadmium concentrations.												
The limit of reporting is the minimum measured cadmium concentration that can be determined with the sampling equipment and laboratory method used. Cadmium concentrations below this limit are preceded by a "<" sign in the table.												

Data availability

When required, Table 26 summarises the reasons for data availability below the minimum criteria for reporting at northern Queensland monitoring sites.

Table 26. Reasons for low data availability at northern Queensland ambient air monitoring sites during September 2023.

Station	Air Pollutant	Cause
The Gap	TSP metals (lead, arsenic, cadmium)	Sampler programming faults, power failure during sample run

Related air quality information

Current hourly air quality data is available online at <https://apps.des.qld.gov.au/air-quality/>.

Additional information on air quality monitoring and related issues is also available from the above website.

Further information

For further information about the data presented in this bulletin or related publications, contact:

Air Quality Monitoring
 Coastal and Air Unit
 Science Division
 Department of Environment, Science and Innovation
 Ecosciences Precinct
 41 Boggo Rd
 DUTTON PARK QLD 4102
 Telephone (07) 3170 5477
 Email: air.sciences@des.qld.gov.au

Figure 25. Northern Queensland ambient air quality monitoring site locations.

