



Ambient PM₁₀ monitoring adjacent to five unsealed roads in Northland 2019/20

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Introduction

Each year during the dry periods Northland Regional Council (council) receives several complaints about dust nuisance produced by vehicles travelling on unsealed roads in Northland. This is an ongoing issue for council, particularly during summer months. Council monitors PM₁₀ concentrations adjacent to unsealed roads during summer in order to investigate concerns raised by residents.

Council initiated unsealed road PM₁₀ monitoring in 2013. PM₁₀ monitoring is generally undertaken between December and March/April each summer, depending on weather conditions. The results of the monitoring are published in an annual report and distributed to residents who reported the nuisance. The results are also distributed to the relevant district council.

This report provides details of PM₁₀ monitoring carried out during summer 2019/20.

PM₁₀

Particulate matter is a collective term used to describe very small solid or liquid particles such as dust, fumes, smoke and mist or fog. Particulate material, which has an aerodynamic diameter of less than 10 microns, is referred to as PM₁₀. PM₁₀ in the atmosphere originates from both natural and anthropogenic activities. It is estimated that unsealed road dust contributes 12 percent of PM₁₀ and 2 percent of PM_{2.5} in New Zealand (MfE & Stats NZ, 2018).

PM₁₀ is small enough to be inhaled. Research has shown that fine particles are more responsible for specific health effects. The National Environmental Standard (NES) for air quality set by the Ministry for the Environment (MfE) for PM₁₀ in order to protect human health is 50 µg/m³ averaged over a 24-hour period (MfE 2004).

Purpose

The main purpose of this monitoring is to identify sites adjacent to unsealed roads which experience high levels of dust as a result of traffic. This information assists district councils in prioritising mitigation measures.

To investigate dust nuisance incidents reported to council's environmental hotline.

Method

A Met One Environmental Beta Attenuation Monitor (E-BAM) with a PM₁₀ inlet was used for PM₁₀ monitoring. This instrument draws 16.7 litres ambient air per minute and measures the mass concentration of PM₁₀ by use of beta attenuation. This instrument is designed to draw PM₁₀ via a vacuum pump on to a filter tape. The filter tape is located between a C¹⁴ source and a detector. As the mass of PM₁₀ increases on the filter tape, the beta count is reduced. The relationship between the decrease in beta count and particulate mass is computed and a continuous “real time” concentration (in µg/m³) of particulate is measured.

Site selection

Monitoring sites are selected by using one of the following criteria;

- Roads referenced in “Regional Dust from Unsealed Roads Mitigation Framework” 2014.
- Road names recommended by district councils prior to each monitoring season.
- Investigation of dust nuisance complaints reported to council’s environmental hotline.

All monitoring sites in 2019/20 were selected from council’s dust nuisance complaints list. No site recommendations were provided by district councils. Unsealed road PM₁₀ monitoring site locations in 2019/20 are presented in Figure 1.



Figure 1: PM₁₀ monitoring locations in Northland during summer 2019/20.

Results and Discussions

PM₁₀ monitoring was undertaken at five sites around Northland. The sites were monitored for one to two weeks at a time from January until the end of March.

Results of the PM₁₀ monitoring is presented in the following paragraphs.

Table 1 shows the highest and the second highest 24-hour PM₁₀ concentrations recorded at the monitoring sites as well as the total rainfall recorded during the monitoring period at a nearby rainfall station.

The graphs present the daily average of PM₁₀ concentrations for each monitoring site.

Table 1: Summary of PM₁₀ monitoring results

Monitoring site location	Monitoring period	PM ₁₀ concentration (µg/m ³)		Total rainfall at nearby rainfall station (mm)
		Highest	Second highest	
Valley Road	22 Jan to 5 Feb	37	36	0
Settlement Road	5 to 18 Feb	170	166	0
Lawrence Road	18 to 26 Feb	54	46	0
Prescott Road	28 Feb to 6 Mar	36	24	21
Rawhiti Road	9 to 23 March	20	18	43

Results presented in Table 1 are 24-hour averages of PM₁₀ obtained from the data collected at 10-minute intervals by the EBAM. Data analysis is based on the Good Practice Guide for Air Quality Monitoring and Data Management 2009 (MfE, 2009).

Kaiwaka and Mangawhai

Valley Road, Settlement Road and Lawrence Road were monitoring sites selected in the Kaiwaka and Mangawhai area. All three roads were observed to be dusty during site visits.

Settlement Road recorded the highest PM₁₀ concentrations out of the three sites with several exceedances recorded above NES (50 µg/m³) over a 24-hour period (Figure 2). The PM₁₀ concentration at Settlement Road fell below the NES only in the last three days of monitoring as a result of change in wind direction from south westerly to easterly-north easterly. Wind direction was obtained from council's Ruakaka meteorological monitoring station. Easterly to north easterly wind made the location of the deployed monitor upwind from the road. Settlement Road had a higher traffic volume than the other two roads and the monitor was located at a property close to the road. There was no rain recorded during the monitoring period at all three sites.

All PM₁₀ concentrations recorded at Valley Road fell below NES and one exceedance was recorded at Lawrence Road.

Daily concentrations of PM₁₀ for each monitoring site is presented in Figure 2 below.

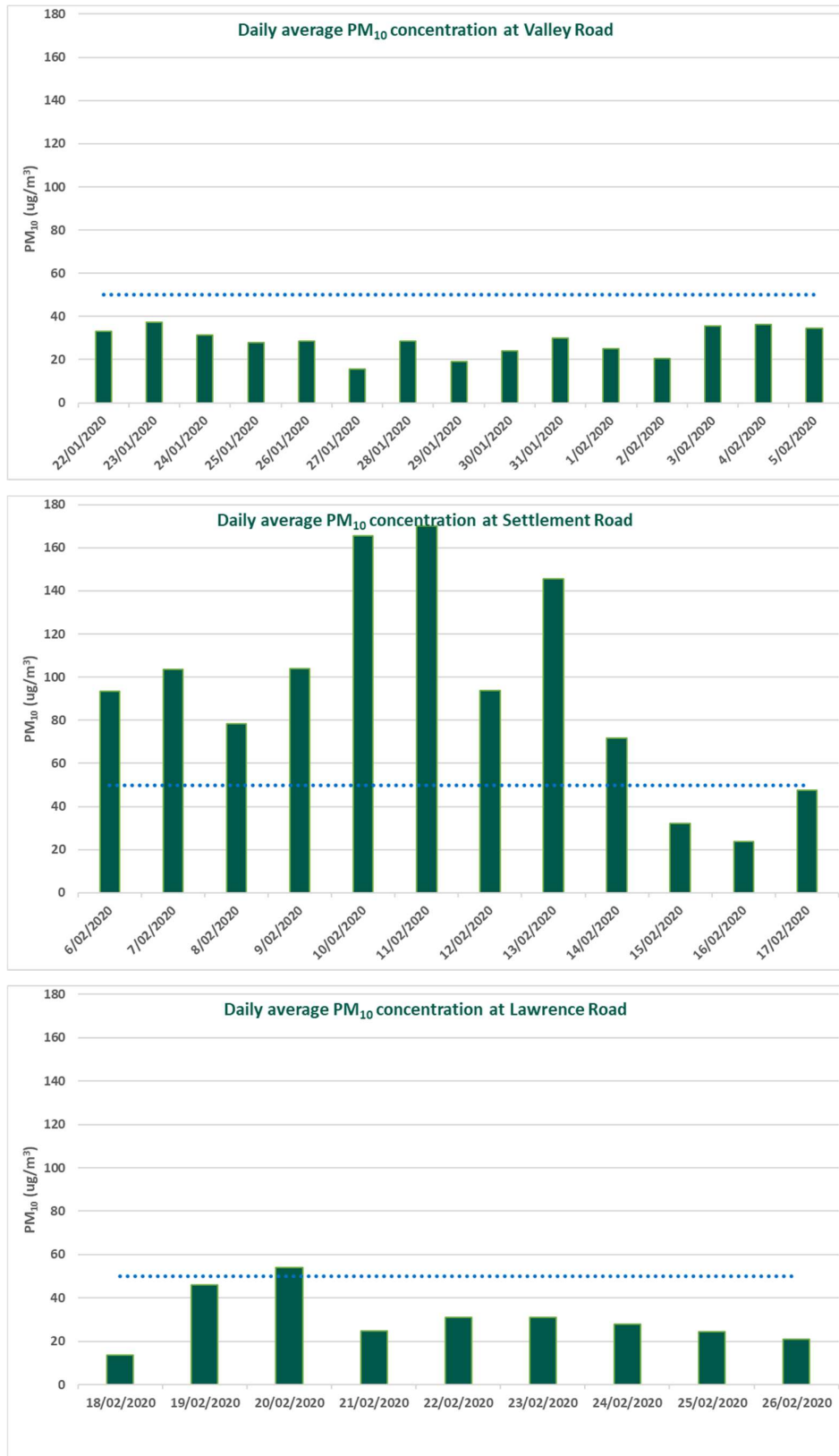


Figure 2: Daily PM₁₀ concentrations at monitored sites. Blue dotted line represents NES air quality standard for PM₁₀.

Diurnal variation at Settlement Road

To investigate the elevated PM₁₀ concentrations recorded at Settlement Road, diurnal PM₁₀ averages were calculated and the results presented in Figure 3. The pattern shows the lowest PM₁₀ concentration was recorded during early hours of the day and late in the evening. PM₁₀ concentration increased from 0600 hours and reached its peak at 0800 hours in the morning. This indicates the PM₁₀ contribution from morning rush hour traffic on Settlement Road. Concentration of PM₁₀ decreased slowly and increased again between 1300 and 1600 hours in the afternoon.

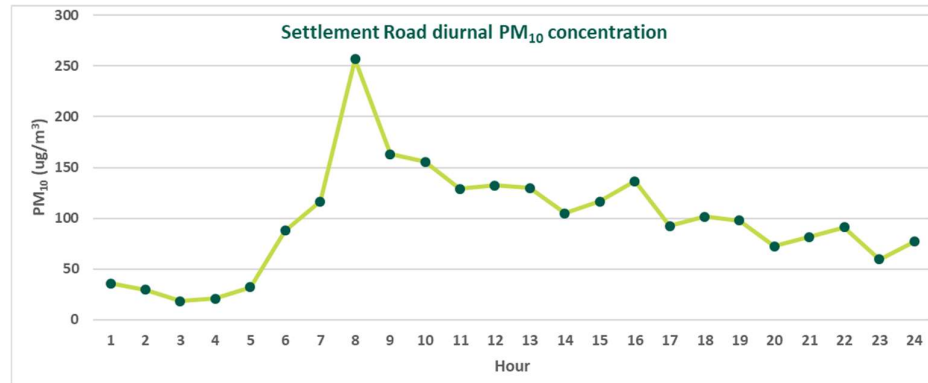


Figure 3: Diurnal variation of PM₁₀ at Settlement Road, Kaiwaka.

Ruakaka

Prescott Road was selected as a monitoring site in the Ruakaka area. Sections of the road were observed to be dusty during council site visits. The monitor was located towards the end of Prescott road.

Monitoring results collected at Prescott Road are shown in Figure 4. PM_{10} concentrations were well below the NES for air quality of $50 \mu\text{g}/\text{m}^3$ over 24-hour period. This was due to the low traffic volume and high rainfall recorded during the monitoring period. Daily rainfall was obtained from council's rainfall station located at Wilson Dam. The total rainfall recorded during the monitoring period was 21mm.

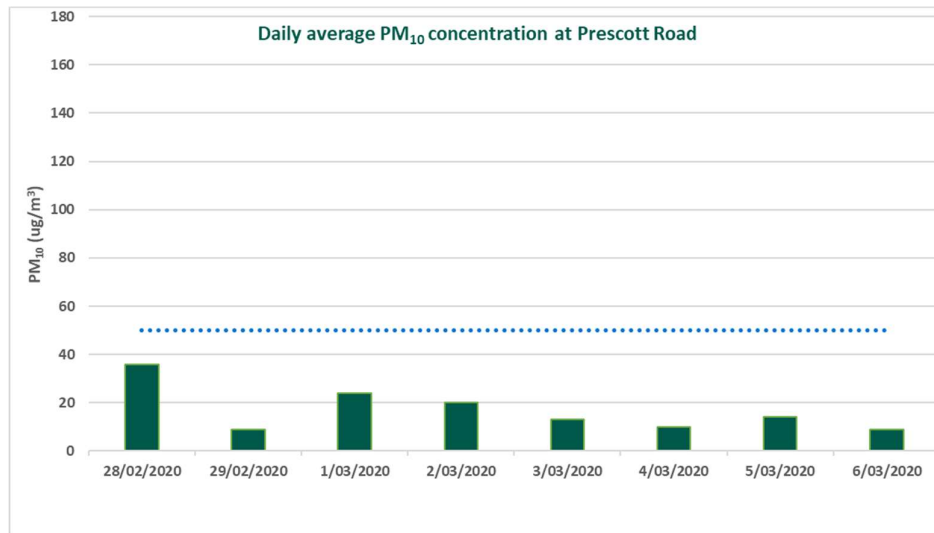


Figure 4: Daily PM_{10} concentration at Prescott Road, Ruakaka.

Rawhiti

Rawhiti Road was selected as a monitoring site in the Rawhiti area. The monitor was located towards the end of Rawhiti Road.

Monitoring results collected at Rawhiti Road are shown in Figure 5. PM_{10} concentrations were well below the NES air quality of $50 \mu\text{g}/\text{m}^3$ over 24-hour period. This was due to the low traffic volume and high rainfall recorded during the monitoring period. Daily rainfall was obtained from council's rainfall station located at Opuha Wharf. The total rainfall recorded during the monitoring period was 43mm.

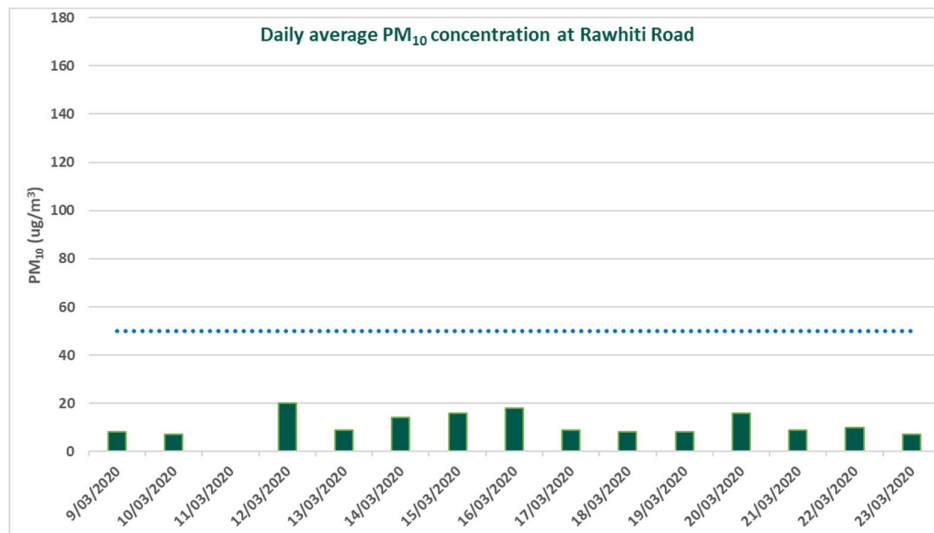


Figure 5: Daily PM_{10} concentration at Rawhiti Road, Rawhiti.

Limitation of unsealed road PM₁₀ monitoring

- The PM₁₀ EBAM monitor used for this monitoring is not a Ministry for the Environment NES for Air Quality approved instrument.
- While it is likely that the majority of PM₁₀ measured by the EBAM originated from unsealed roads, it is important to note that PM₁₀ can also originate from other sources such as fires, sea spray, pollen and vehicle exhausts.
- The PM₁₀ EBAM monitor was situated near the road and therefore results obtained represent PM₁₀ levels occurring at this location and may not be representative of actual ambient PM₁₀ levels in the area.
- PM₁₀ concentration may vary depending on weather conditions such as rainfall, wind speed and direction.

Conclusion

- Northland Regional Council used an EBAM to monitor PM₁₀ at or near residential dwellings adjacent to five different roads in Northland during summer 2019/20.
- The main purpose of this monitoring was to identify unsealed roads which experience high levels of dust as a result of traffic and to assist district councils in prioritising mitigation measures.
- All monitoring sites during this monitoring were to investigate dust nuisance incidents reported to council's environmental hotline.
- Out of five sites monitored the site located at Settlement Road, Kaiwaka recorded highest PM₁₀ concentrations, with several exceedances recorded above 50 µg/m³ over a 24-hour averaging period.

References

- Ministry for the Environment & Stats NZ (2018).
New Zealand's Environmental Reporting Series: Our air 2018. Retrieved from www.mfe.govt.nz and www.stats.govt.nz
- Ministry for the Environment 2009.
Good Practice Guide for Air Quality Monitoring and Data Management 2009.
Wellington: Ministry for the Environment.
- Ministry for the Environment (2004).
Resource Management (National Environmental Standards for Air Quality) Regulations 2004. <http://www.mfe.govt.nz/laws/standards/air-quality-standards.html>