

AIR QUALITY MONITORING

SUMMARY 2007-08

OVERVIEW

- Northland's air is generally of a high quality however urban areas are susceptible to air pollution from human activities, particularly during the winter months.
- In order to protect our air quality, Northland Regional Council (NRC) developed the Regional Air Quality Plan for Northland, which became operative in 2003.
- NRC has been monitoring air quality since 1996. The main objective of monitoring is to find out where air pollution might pose a risk to human health.
- Whangarei city is the most likely area to be affected due to its higher population density.

PERFORMANCE TARGETS

Continue to implement and improve a prioritised State of the Environment monitoring programme based on the Regional Policy Statement and Regional Plans:	Target Achieved:
<ul style="list-style-type: none"> ➤ Monitor ambient air quality in line with the priorities of the National Environmental Standard for Air and the Regional Air Quality Plan, including background levels of dust, carbon monoxide and sulphur dioxide. 	✓
<ul style="list-style-type: none"> ➤ Report to the Council annually on environmental monitoring activities within three months of the end of the financial year. 	Ongoing

SUMMARY OF RESULTS 2007-08

- Particulate matter (PM₁₀) is sampled at three locations in Northland – Water Street and Robert Street in Whangarei and Donald Road in Kaitaia.
- During the 2007-08 financial year, PM₁₀ levels did not exceed the National Environmental Standard at any of the three sites monitored.
- Sulphur dioxide (SO₂) is monitored at one site in Northland – Taurikura Bay, opposite the New Zealand Refining Company Ltd at Marsden Point.
- Peak concentrations recorded in 2007-08 were consistently below the National Environmental Standard and below the current 24 hour ambient air quality standard.

INTRODUCTION

Air is a life supporting resource that needs to be protected. Although Northland's air is generally of a high quality, there is air pollution from human activities – particularly around urban centres such as Whangarei city. Northland, like most other predominantly rural regions in New Zealand, is noted for its clear skies and fresh air. The prevailing south-westerly winds generally move air masses across the region fairly rapidly, although smoke and fog can accumulate during extended periods of cool, still weather in the winter months.

In order to protect our air, Northland Regional Council (NRC) developed the **Regional Air Quality Plan** for Northland, which became operative in March 2003. The plan provides guidance to those using our air resource, in addition to specifying rules on what discharges into the air are permitted, authorised by resource consent, or prohibited.



Photo: Smoke pollution from burning farm waste

NRC has also been monitoring air quality in the region since 1996. The main purpose of air quality monitoring is to find out where air pollution might affect human health. NRC has an ongoing programme of air quality monitoring in places that are suspected of having occasional degraded air quality, or that may be affected by industrial emissions. The main pollutants measured are particulate matter (PM₁₀) and sulphur dioxide (SO₂).

Air quality monitoring in the Northland region shows that some areas do occasionally experience poor air quality, especially areas next to busy roads that are subject to traffic congestion. Air quality issues in these areas can be exacerbated by periods of cold, calm weather during the winter months when pollutants can build up. Monitoring to date has shown that Whangarei city is the most likely area in Northland to have air pollution episodes.

In addition to regular monitoring programmes, NRC staff also undertake monitoring visits for consented activities that involve a discharge to air and attend environmental incidents where the main resource affected is air. The results of these monitoring visits and environmental incidents are discussed in more detail in the sections entitled “Annual Compliance” and “Environmental Incidents” respectively.

PARTICULATE MATTER

Particulate matter (PM₁₀) is a collective term used to describe very small solid or liquid particles less than 10 microns in aerodynamic diameter, such as dust, fumes, smoke and mist or fog. PM₁₀ originates from both natural (wind blown dust, forest fires, volcanic emissions, sea spray or pollen) and anthropogenic activities (including automobile exhausts, solid fuel burning, and industrial emissions).

Smoke has high levels of PM₁₀, which is easily inhaled and can harm people's health. People most susceptible to the effects of inhaling PM₁₀ include the elderly, those with existing respiratory disease, those with cardiovascular disease, those with infections such as pneumonia and children.

The recently revised Emission Inventory of the Whangarei airshed has confirmed that the main source of PM₁₀ during the winter months is solid fuel burning for home heating (74%), followed by industry (11%), outdoor burning (9%) and transport (6%). The photograph below shows an inversion layer over Whangarei city formed by cool, calm weather conditions, allowing the build up of air pollution (photo courtesy of Northern Advocate).



Photo: An inversion layer over Whangarei

Sampling PM₁₀

Particulate matter is sampled at three locations in Northland; Water Street and Robert Street in Whangarei and at Donald Road in Kaitaia. PM₁₀ levels at Water Street are monitored using a high volume sampler, as shown in the photograph below. The sampler collects inhaleable particulate matter on a glass fibre filter over a 24 hour period. At the end of the sampling period, the filter is carefully removed, placed in a conditioning chamber and then weighed. A sample is collected every three to six days.

PM₁₀ levels at Robert Street are monitored using a Beta Attenuation Monitor (BAM), which continuously samples the air using a specially prepared filter tape. The BAM is connected to a computer which records a result every ten minutes. The data is periodically downloaded and converted to 24 hour averages (midnight – midnight).

All results collected are compared to the National Environmental Standard for PM₁₀, which is no more than one exceedance of the limit of 50 µg/m³ in a twelve month period.

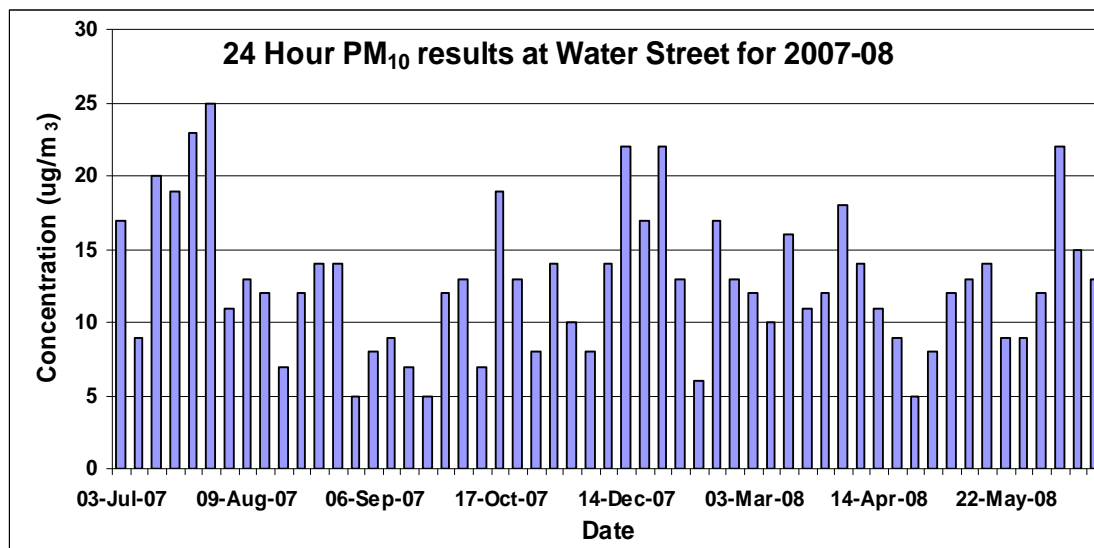


Photo: High volume sampler for particulate matter

Results for 2007-08

Water Street

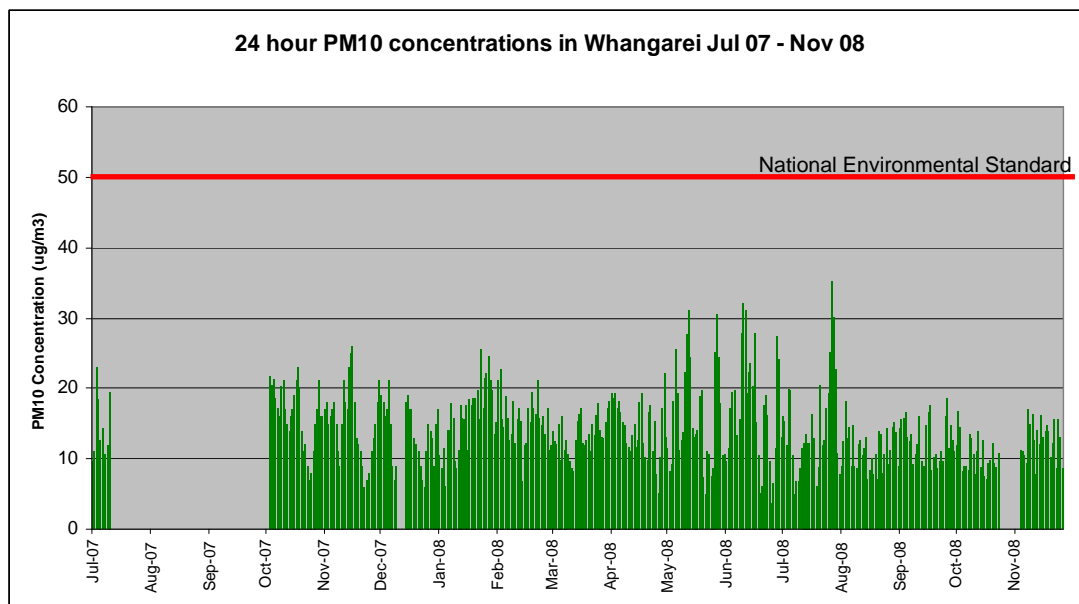
Monitoring results from the PM₁₀ high volume sampler in Water Street indicate that the standard was not exceeded at this site during the 2007-08 sampling period. The 24 hour period results are shown in the graph below.



Robert Street

In previous years, results from the Robert Street site in Whangarei have shown the occasional elevated result during the winter months, when emissions from domestic wood-fired heaters have accumulated under atmospheric inversions. However, during the 2007-08 sampling period, the winter months were warmer and windier than in previous years and peak concentrations did not exceed the National

Environmental Standard on any occasion. The three month data gap evident in the graph below occurred following water damage to the air quality analyser during a severe storm in July 2007.

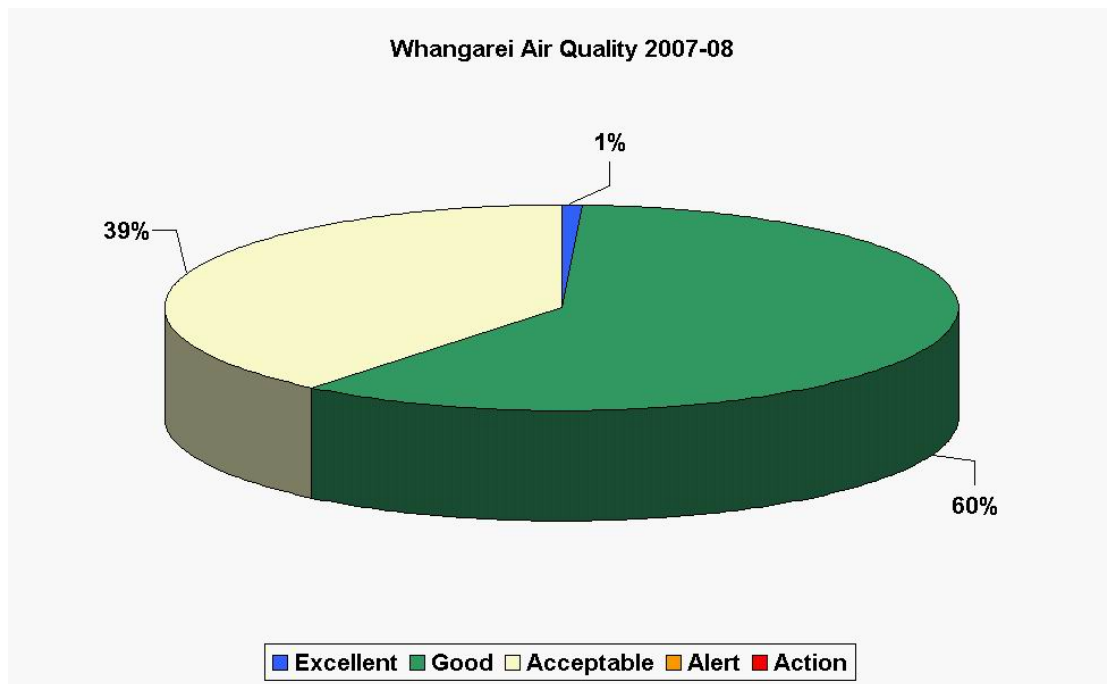


Summary of Whangarei City

In addition to comparing results to the National Environmental Standard for PM₁₀, another method of reviewing the results obtained from air quality monitoring is to compare them to the environmental performance criteria developed by the Ministry for the Environment, as shown in the table below.

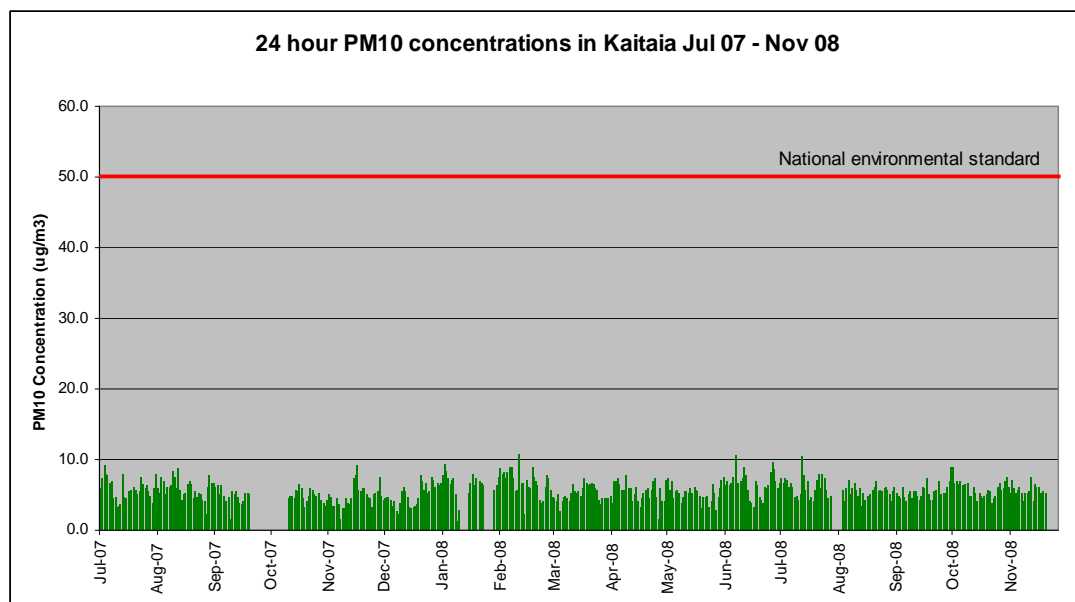
Category	Value relative to guideline	Comment
Excellent	Less than 10% of the guideline	Of little concern, if maximum values are less than a tenth of the guideline, average values are likely to be much less
Good	Between 10% and 33% of the guideline	Peak measurements in this range are unlikely to affect air quality
Acceptable	Between 33% and 66% of the guideline	A broad category, where maximum values might be of concern in some sensitive locations but generally they are at a level which does not warrant dramatic action
Alert	Between 66% and 100% of the guideline	A warning level, which can lead to the guideline being exceeded if trends are not curbed
Action	More than 100% of the guideline	Exceeding the guideline is a cause for concern and warrants action if it occurs regularly

Results for central Whangarei for the 2007-08 sampling period show that air quality is excellent, good or acceptable for almost 100% of the time, however there can be periods where cool, calm conditions allow the concentration of pollutants to build up. These results can be seen in the graph below.



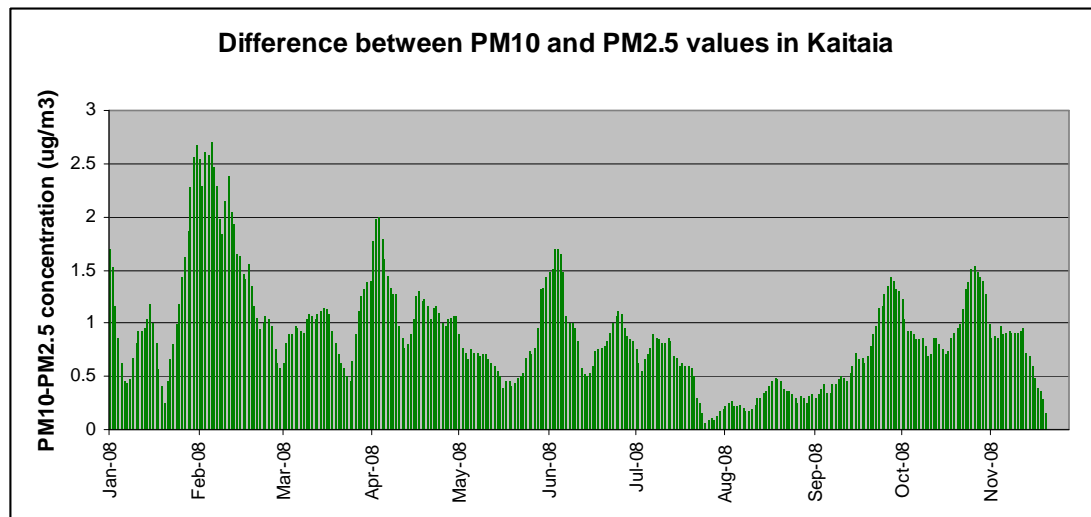
Results for Donald Road

Results obtained from the monitoring station at Donald Road in Kaitaia show that levels of PM₁₀ in the Kaitaia airshed are much lower than levels recorded in the Whangarei airshed. The annual average PM₁₀ results for Kaitaia were 6 µg/m³ in 2007-08, compared to 16 µg/m³ in Whangarei city.



The sampler at Donald Road also measures PM_{2.5} (particulate matter of 2.5 microns diameter). PM₁₀ is derived from a variety of sources including combustion, wind blown dusts and some sea salt and pollens whereas PM_{2.5} is almost exclusively sourced from combustion sources. By subtracting PM_{2.5} from PM₁₀, it is possible to gain some insight into possible sources of PM₁₀ at different times of the year within the Kaitaia airshed.

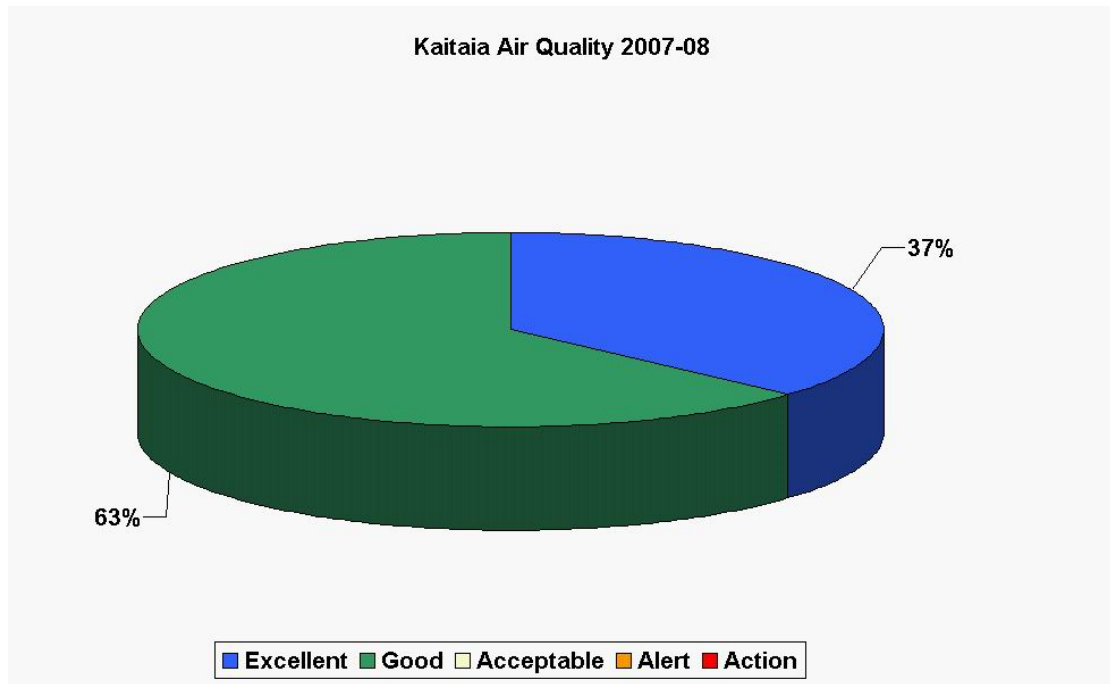
The plot below shows the difference between the two measurements. From the plot, it can be seen that the highest values of PM_{10} occur in late summer. This is because the dry, windy conditions towards the end of summer correspond with an increase in wind blown dusts and pollens, while major combustion sources including domestic home heating are virtually non-existent during this time. Conversely, during the winter (particularly August) the difference between PM_{10} and $PM_{2.5}$ is very small – this is because most of the fine particles in the air at this time of the year are derived from domestic home heating, which consists almost entirely of particles below 2.5 microns in diameter.



This sort of information can be very useful for air resource managers as it assists with targeting policies or strategies towards specific problem areas. This enables NRC to maximise the use of limited resources to improve air quality and therefore the health and wellbeing of residents in local communities.

Summary of Kaitaia

When categorised according to the environmental performance criteria developed by the Ministry for the Environment, it is easy to see the relatively better air quality in Kaitaia compared to Whangarei during 2007-08. In Kaitaia, PM_{10} levels are good or excellent for approximately 96% of the time, compared to Whangarei. The graph below displays the results for Kaitaia from the 2007-08 sampling period.



SULPHUR DIOXIDE

Sulphur dioxide (SO₂) is a colourless, soluble gas with a characteristic pungent smell. It is mainly produced by the combustion of fossil fuels containing sulphur however can also be the product of some industrial processes.

SO₂ is a potent respiratory irritant when inhaled at high concentrations and acts directly on the upper airways (nose, throat, trachea and major bronchi) producing a rapid response within minutes. It achieves maximum effect within 10 to 15 minutes, particularly in individuals with significant airway reactivity, such as asthmatics and those suffering similar bronchospastic conditions.

The symptoms of SO₂ inhalation include wheezing, chest tightness, shortness of breath or coughing. These symptoms are related to a reduction in ventilatory capacity (for example, reduction in forced expiratory volume in one second, or FEV1) and increased specific airway resistance. If exposure occurs during exercise, the observed response may be accentuated because of an increased breathing rate.

Results from SO₂ Monitoring

In Northland, the most significant industrial source of SO₂ is the New Zealand Refining Company Limited, located at Marsden Point. The prevailing wind in this area frequently disperses emissions from the refinery towards the Whangarei Heads, a predominantly rural, residential area. In May 2008, NRC began to monitor SO₂ levels using a continuous monitoring station based at Taurikura Bay.

SO₂ results from this site show that peak concentrations are well below the National Environmental Standard of 350 µg/m³, and also below the current 24 hour ambient air quality standard of 120 µg/m³. These results are shown in the chart below.

