

## AIR MONITORING

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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 order to protect our air, the Regional Council 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 authorised.



More recently, the Ministry for the Environment introduced National Environmental Standards (NES) for air quality in October 2004. These include:

- prohibiting certain activities because of the air pollution they generate
- setting maximum concentrations for harmful pollutants in air to protect public health
- setting emission standards and efficiency criteria for wood burners used for home heating.

### Prohibited activities

No person may carry out the following activities (effective 8 October 2004):

- burning of coated wire in the open
- deliberate landfill fires
- burning of tyres in the open
- burning of road tar seal (bitumen burnoff)
- burning of waste oil in the open

In addition, no new high temperature hazardous waste incinerators are allowed to be built, and from October 2006, the use of school and hospital incinerators will be banned unless they obtain a resource consent.

For more information on these standards and guidelines check out the following pdf's on the Ministry of the Environment's website at the following web addresses:

- National Environmental Standards for air quality  
<http://www.mfe.govt.nz/laws/standards/consolidated-nes-aug2005.pdf>

- Ambient Air Quality Guidelines  
<http://www.mfe.govt.nz/publications/air/ambient-air-quality-may02/ambient-guide-may02.pdf>

Five ambient air standards became effective in September 2005. The pollutants covered include, fine particles (PM<sub>10</sub>), nitrogen dioxide (NO<sub>2</sub>), ozone (O<sub>3</sub>), sulphur dioxide (SO<sub>2</sub>), carbon monoxide (CO). Regional councils must monitor air quality for these pollutants and publicly report any exceedances. Northland Regional Council monitored fine **particulate matter (PM<sub>10</sub>)** (refer page 3) and **sulphur dioxide** (refer page 8) in 2005-2006.

There will be future expansion of the Regional Council's air monitoring inline with the requirements of the air standards. To find out about future changes and performance targets for state of the environment monitoring of air quality refer to page 9.

Northland Regional Council has been monitoring air quality since 1996. The main purpose of air quality monitoring is to find out where air pollution might affect people's health. Air pollution monitoring in the Northland region shows that there are some areas with poor air quality, especially during winter or next to busy roads. In winter, there are periods of cold, calm weather when pollutants can build up to levels that may affect human health.

Air quality monitoring to date has shown that Whangarei city is the most likely area to have air pollution episodes during the winter. Air quality around busy roads, especially those subject to traffic congestion, can be degraded by pollutants emitted from motor vehicles. Northland Regional Council also has an ongoing programmes to carry out air quality monitoring in places suspected of having occasional degraded air quality.

Part of the implementation of the National Environmental Standards required Regional Councils to designate areas (airsheds) where air quality had been affected as a result of human activities. Using results of research into airsheds carried out by the National Institute of Water and Atmospheric Research (NIWA), the Northland Regional Council identified five areas in Northland which are suspected of reaching or exceeding the National Environmental Standards (NES).

The five areas include:

- **Whangarei city** - expected to reach or exceed the NES for PM<sub>10</sub>
- **Marsden Point** - expected to reach or exceed the NES for sulphur dioxide
- **Kaitaia** - expected to reach or exceed the NES for PM<sub>10</sub>
- **Kerikeri** - expected to reach or exceed the NES for PM<sub>10</sub>
- **Dargaville** - expected to reach or exceed the NES for PM<sub>10</sub>

Maps of these airsheds are available on the NRC website in the air section of the 2005-2006 Annual Monitoring Report.

## Particulate Matter

Particulate matter is a collective term used to describe very small solid or liquid particles such as dust, fume, smoke and mist or fog. PM<sub>10</sub> is particulate matter that is less than 10 microns in diameter. PM<sub>10</sub> 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 PM<sub>10</sub>, which is easily inhaled and can harm people's health. People most susceptible to the effects of inhaling PM<sub>10</sub> include the elderly; those with existing respiratory disease; those with cardiovascular disease; those with infections such as pneumonia; and children.

### Sampling PM<sub>10</sub>

Particulate matter is sampled at three locations in Northland, Water Street and Robert Street in Whangarei City and at Donald Road in Kaitia. PM<sub>10</sub> levels at Water Street, Whangarei and Donald Road, Kaitia are monitored using a high volume sampler as shown in the photograph. 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 3 to 6 days.



While PM<sub>10</sub> levels at Robert Street are monitored using a Beta Attenuation Monitor (BAM), which continuously samples the air onto a specially prepared filter tape. The BAM is connected to a computer which records a result every 10 minutes. The data is periodically downloaded and converted to 24 hour averages (midnight – midnight).

The results are compared to the National Environmental Standard for PM<sub>10</sub>, which is no more than one exceedance in a 12-month period of the limit of 50 µg/m<sup>3</sup>. Another method of reviewing the results is to compare them to the environmental performance criteria developed by the Ministry for the Environment shown in the table below.

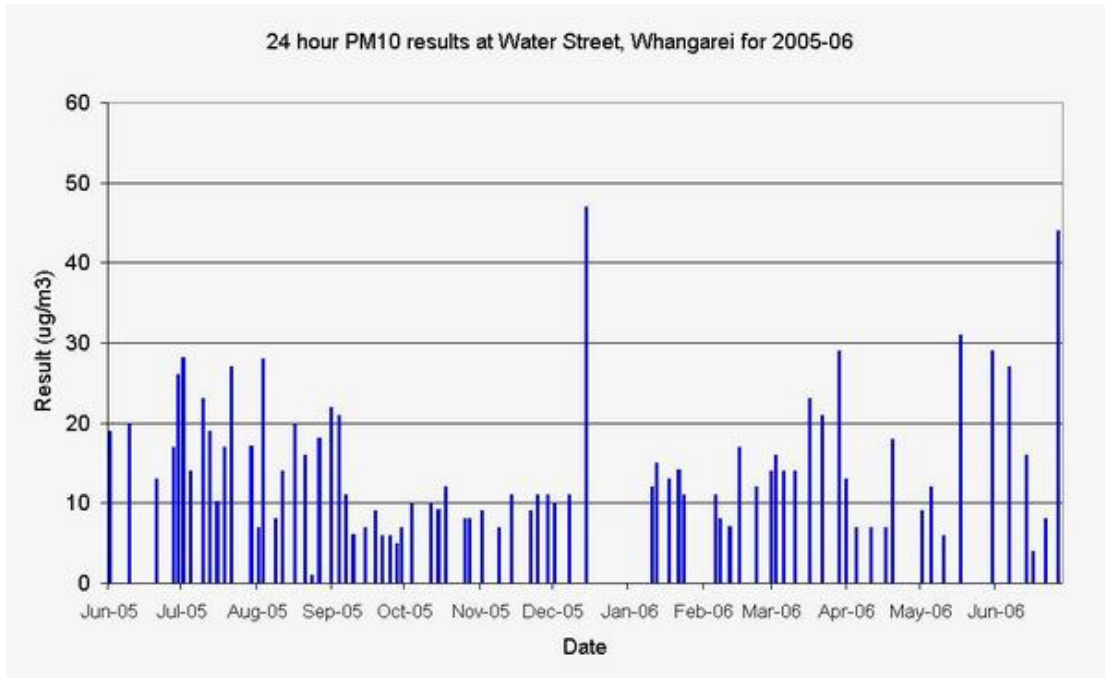
Category	Value relative to guideline	Comment
Excellent	Less than 10% of the guideline	Of little concern, if maximum values are less than a tenth of the guideline, average values are likely to be much less
Good	Between 10% and 33% of the guideline	Peak measurements in this range are unlikely to affect 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

The results are presented in pie graphs where each segment represents the percentage of time that air pollution levels fall into the categories above. As an example, the more green there is in the pie graph, the better the overall air quality with respect to that pollutant. Our aim is that air quality in the region does not fall into

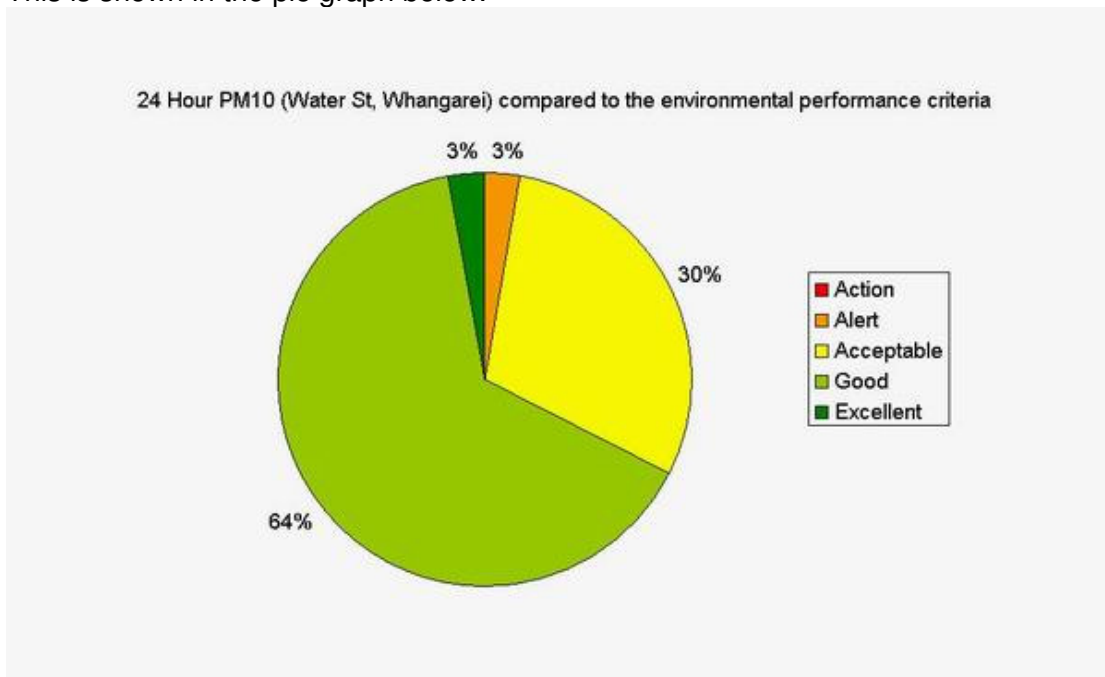
the 'Action' (red) category at any time and that pollution levels rarely fall into the 'Alert' (orange) category.

**Results for Water Street**

Monitoring results from the PM<sub>10</sub> high volume sampler indicate that the standard was not exceeded at the Water Street site during 2005-06, although one result in December 2005 (47 µg/m<sup>3</sup>) and another in June 2006 (44 µg/m<sup>3</sup>) came reasonably close to the limit. The 24 hour period results are shown in the graph below.

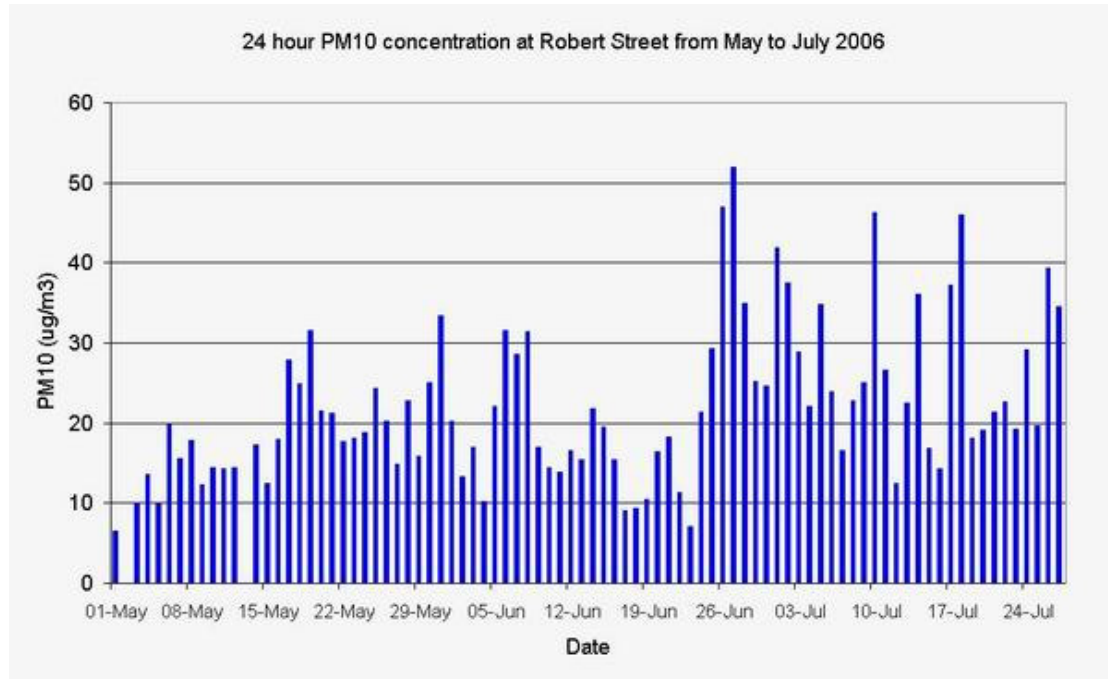


When compared to the environmental performance criteria developed by the Ministry for the Environment the results indicate that air quality in relation to PM<sub>10</sub> at Water street in Whangarei is (on average) good or excellent for two out of every three days. This is shown in the pie graph below.

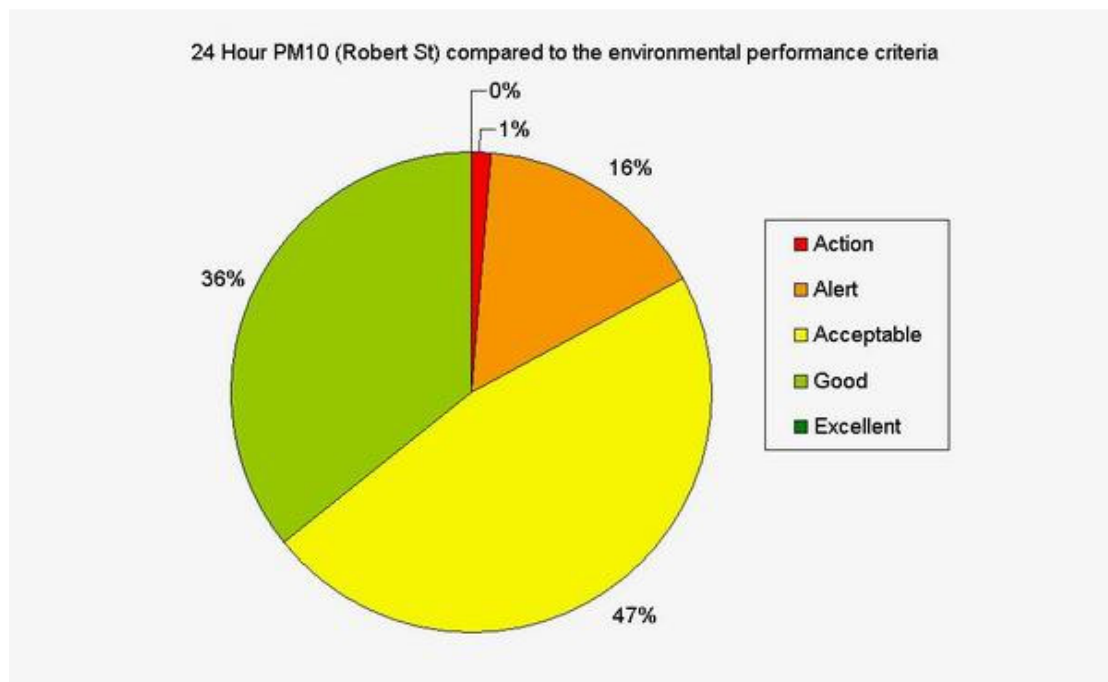


**Results for Robert Street**

Results from the Robert Street site indicate occasional elevated readings and one exceedance of the National Environmental Standard of 50 µg/m<sup>3</sup> on 27 June 2006, reaching 52 µg/m<sup>3</sup> (shown in the graph below). The standard allows one such exceedance in a 12 month period. This means if the air quality exceeds the standard again before 27 June 2007, the Northland Regional Council will need to formally notify the public about the details of the exceedance, in a local paper.



While the air quality within the central Whangarei city area is acceptable or good more than 80% of the time, there can be periods where cool calm conditions enable the concentration of air pollution to build up.

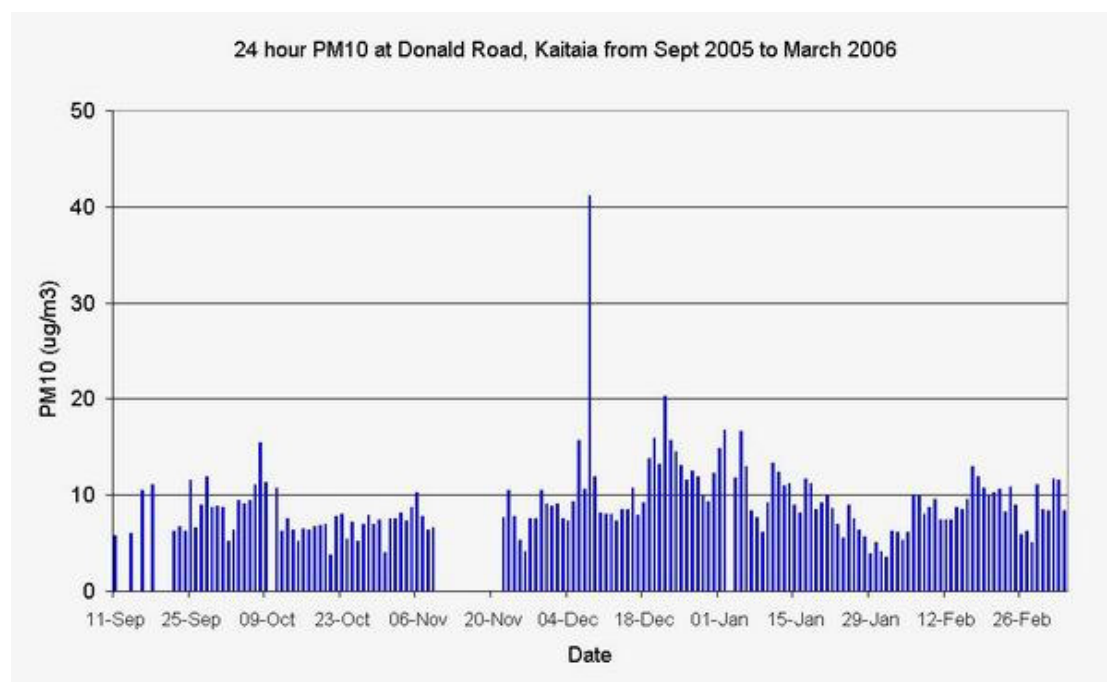


During cool calm inversion conditions smoke becomes trapped in a layer above the ground. Previous studies (2001) have revealed that the majority of winter time PM<sub>10</sub> in Whangarei city is sourced from domestic fires. The photograph below shows an inversion layer over Whangarei city formed from cool calm weather conditions, allowing the build up of air pollution.

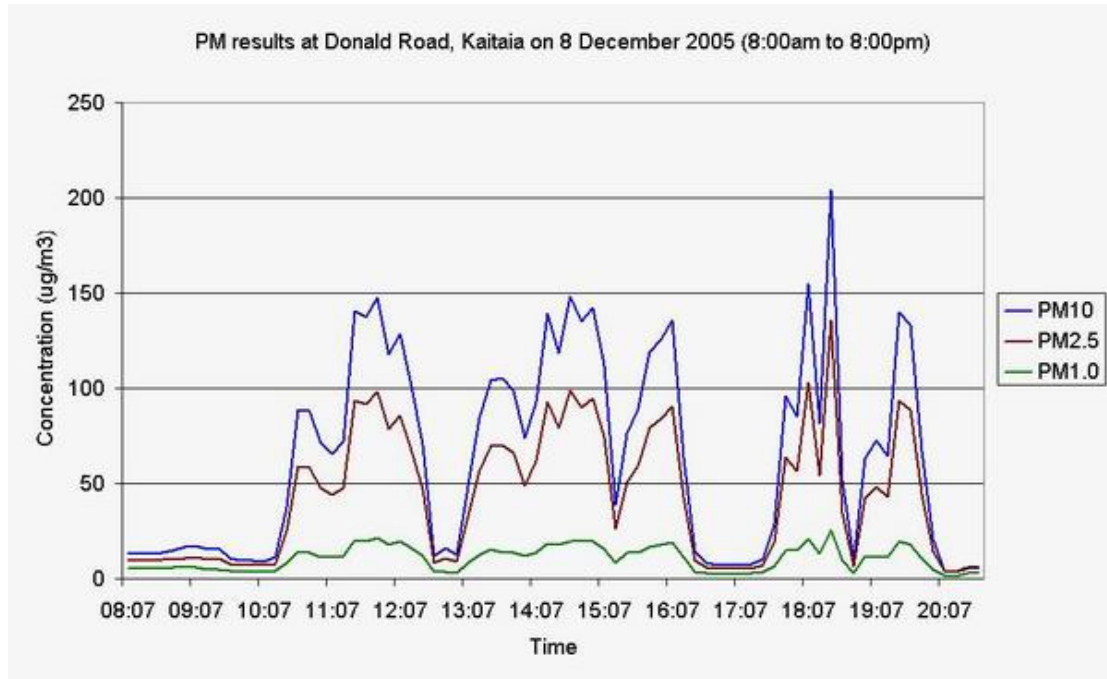


**Results for Donald Road**

The results at Donald Road, show that the PM<sub>10</sub> results for the Kaitaia airshed are much lower compared to Whangarei. This is reflected in the annual average PM<sub>10</sub> results, with a much lower 9 µg/m<sup>3</sup> in Kaitaia compared to 21 µg/m<sup>3</sup> in Whangarei city. There is one elevated result as shown on the graph below, which occurred on 8 December 2005. This resulted from the burning of waste vegetation on a nearby property.

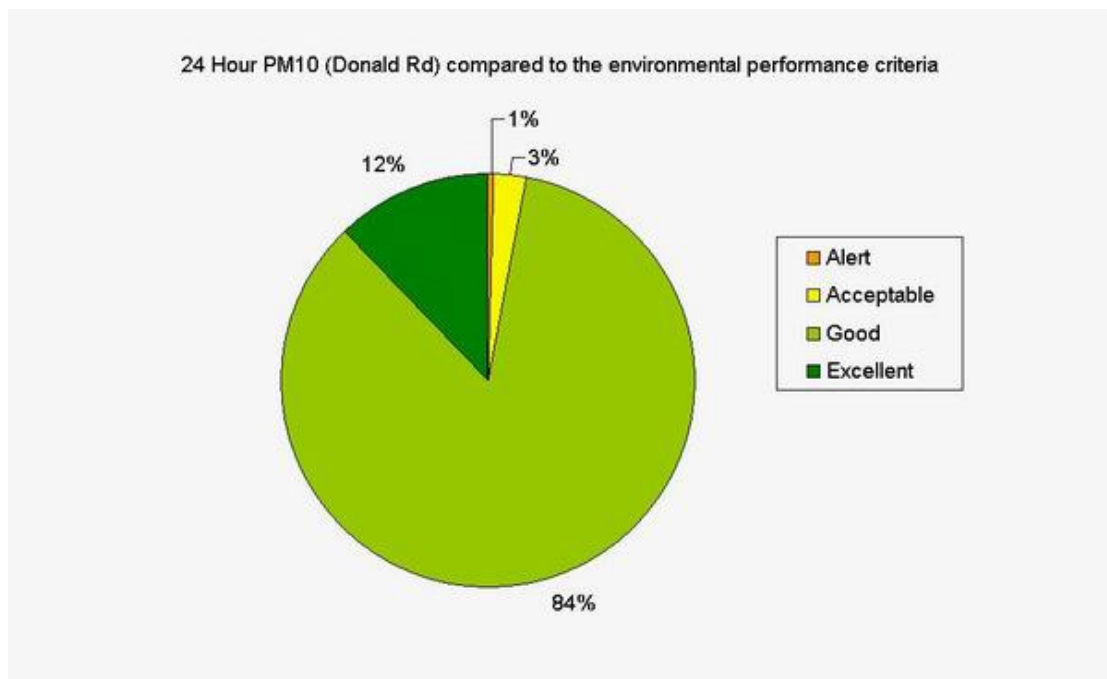


The sampler at Donald Road also measures PM<sub>2.5</sub> and PM<sub>1.0</sub> (2.5 and 1 microns diameter respectively). The impact of the fire on the concentrations of different sized particulate matter is shown in the graph below.



Both PM<sub>10</sub> and PM<sub>2.5</sub> display significant increases while the fire was burning, while PM<sub>1.0</sub> shows some variation, but not to the same order of magnitude. Despite the impact of the nearby fire, the average 24 hour PM<sub>10</sub> was 41 µg/m<sup>3</sup>, still below the National Environmental Standard of 50 µg/m<sup>3</sup>.

The better air quality in Kaitia is apparent in the pie graph below, where PM<sub>10</sub> levels are good or excellent for approximately 96% of the time.



## Sulphur Dioxide

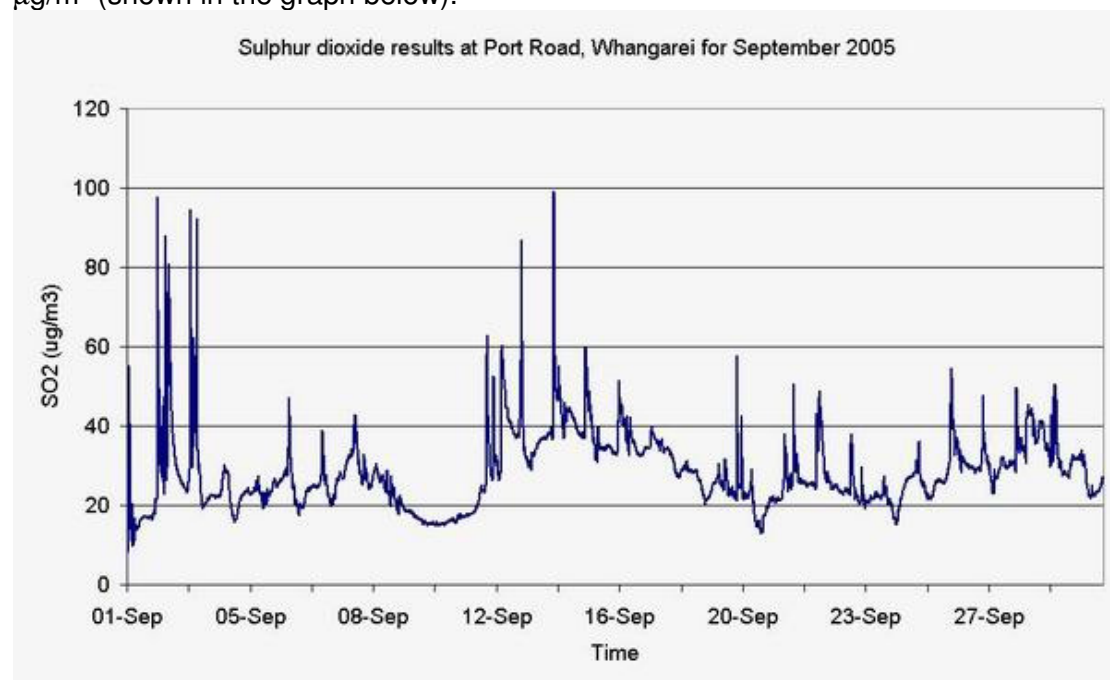
Sulphur dioxide (SO<sub>2</sub>) is a colourless, soluble gas with a characteristic pungent smell. It is mainly produced by the combustion of fossil fuels containing sulphur and some industrial processes.

Sulphur dioxide is a potent respiratory irritant when inhaled at high concentrations. Asthmatics are particularly susceptible. SO<sub>2</sub> acts directly on the upper airways (nose, throat, trachea and major bronchi) producing rapid responses within minutes. It achieves maximum effect in 10 to 15 minutes, particularly in individuals with significant airway reactivity, such as asthmatics and those suffering similar bronchospastic conditions.

The symptoms of SO<sub>2</sub> inhalation include wheezing, chest tightness, shortness of breath or coughing, which are related to reductions in ventilatory capacity (for example, reduction in forced expiratory volume in one second, or FEV<sub>1</sub>), and increased specific airway resistance. If exposure occurs during exercise, the observed response may be accentuated because of an increased breathing rate associated with exercise.

In Northland, the most significant industrial source of sulphur dioxide 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. To ensure that emissions from the refinery do not pose any health risk to the local community, permanent sulphur dioxide monitors were located at Urquhart's Bay, Mcleod's Bay and Manaia School.

In previous years SO<sub>2</sub> monitoring has not identified any occasions during which the ambient concentration of sulphur dioxide has equalled or exceeded either the current Ambient Air Quality Guidelines or the new National Environmental Standards for Air Quality. Monitoring was carried at Port Road in Whangarei in 2005-06. The results show that peak concentrations are well below the National Environmental Standard of 350 µg/m<sup>3</sup> and also below the current 24 hour ambient air quality standard of 120 µg/m<sup>3</sup> (shown in the graph below).





## Future monitoring

During 2006-2007, it is planned to commission a new monitoring site at Marsden Point. This site will monitor PM<sub>10</sub> and sulphur dioxide levels and will be established late 2006.

A new monitor will be installed in the Bank Street area to monitor concentrations of carbon monoxide. It is anticipated that this monitor will be established late 2006/early 2007.

### 2006 Emissions Inventory

In order to demonstrate compliance with the National Environmental Standards, the Northland Regional Council is revising the emission inventory for the Whangarei Airshed. An emission inventory is a list of all known sources of PM<sub>10</sub> in an area and includes contributions from transport, industrial and domestic sectors. Statistical projections based on future population growth scenarios will then enable an estimate of likely future concentrations of PM<sub>10</sub> within an airshed.

The emission inventory is planned to be finished early 2007, at which point it will be integrated with the ambient monitoring data to estimate future concentrations of PM<sub>10</sub>.

## Performance target relating to air quality

Continue to develop and implement a prioritised State of Environment Monitoring programme based on the Regional Policy Statement and Regional Plans, by:

- Monitoring ambient air quality; including monitoring background levels of dust and sulphur dioxide in the Whangarei urban area.