



**MARLBOROUGH  
DISTRICT COUNCIL**

# **Annual Air Quality Monitoring Report – Blenheim 2014**

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Report Prepared for Marlborough District Council by

Emily Wilton Environet Limited

Marlborough District Council  
Seymour Square  
PO Box 443  
Blenheim 7240  
Phone: 520 7400  
Website: [www.marlborough.govt.nz](http://www.marlborough.govt.nz)



## Executive Summary

The main air pollutant of concern in urban areas of New Zealand is particles in the air less than 10 microns in diameter, referred to as PM<sub>10</sub>. Air quality monitoring of PM<sub>10</sub> in Blenheim during 2014 was carried out at the two historical monitoring sites (Redwoodtown and Middle Renwick Road (MRR)). The main source of PM<sub>10</sub> in Blenheim during the winter is solid fuel burning for domestic home heating.

Concentrations of PM<sub>10</sub> at both sites were compared to the National Environmental Standard for Air Quality (NES) of 50 µg m<sup>-3</sup> (24-hour average) and to the Ministry for the Environment's air quality guidelines and indicator categories. Comparisons are made with historical data to determine the likelihood of trends in concentrations.

Concentrations of PM<sub>10</sub> exceeded 50 µg m<sup>-3</sup> (24-hour average) at the Redwoodtown site on one occasion during 2014. However, monitoring was limited to one day in three sampling for the majority of the winter period when breaches normally occur. Statistical extrapolation of data suggest at least two breaches of 50 µg m<sup>-3</sup> were likely for 2014 at this site. The NES specifies one allowable exceedence per year. The maximum measured concentration was 56 µg m<sup>-3</sup>, which is lower than previous recent maximum concentrations which range from 59 µg m<sup>-3</sup> to 82 µg m<sup>-3</sup> for the years 2010-2013.

An evaluation of trends in PM<sub>10</sub> concentrations in Blenheim previously showed a decrease from 2005-2009, an increase in 2010 and 2011 followed by a return to around pre 2010 concentrations for average concentrations the years 2012-2014 and a lesser decrease in upper quartile concentrations. Overall concentrations do not appear to have decreased since 2006.

The annual average PM<sub>10</sub> concentration for the Bowling Club site was 16 µg m<sup>-3</sup> and is consistent with previous years.

The maximum PM<sub>10</sub> concentration measured at the MRR site was 42 µg m<sup>-3</sup> for 2014 and is the highest concentration measured at the site since 2008 when 51 µg m<sup>-3</sup> was recorded. Exceedences of 50 µg m<sup>-3</sup> also occurred in 2000, 2003. The annual average concentration for this site was estimated to be 13 µg m<sup>-3</sup> for 2014. An evaluation of trends at the MRR site suggests a decrease in annual average PM<sub>10</sub> concentrations at this site between 2000 and 2008 but no further reductions are evident since 2009.



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## 1. Introduction

The main air contaminant of concern in urban areas of New Zealand is PM<sub>10</sub>. PM<sub>10</sub> refers to particles in the air less than 10 microns in diameter. Concentrations of PM<sub>10</sub> were measured at two sites in Blenheim during 2014. The main site for reporting PM<sub>10</sub> relative to National Environmental Standards is at the Redwoodtown Bowling Club. A second long term monitoring site in Blenheim is located at Middle Renwick Road (MRR).

Historical air quality monitoring for Marlborough includes monitoring of PM<sub>10</sub> at the MRR monitoring site, intermittent monitoring of PM<sub>10</sub> at the Redwoodtown Bowling Club site, survey PM<sub>10</sub> monitoring in Renwick during 2000 and 2002, monitoring for PM<sub>10</sub> in Picton during 2008 and 2009, visibility surveys and passive sampling for nitrogen oxides and sulphur oxides. From 2007 to early 2008, PM<sub>10</sub> concentrations were measured at the Croquet Club in Redwoodtown in addition to the main monitoring site at the Bowling Club. A site on Brooklyn Street in Redwoodtown was temporarily used to measure PM<sub>10</sub> concentrations during 2004.

In 2004 the Ministry for the Environment introduced National Environmental Standards (NES) for ambient air quality (Ministry for Environment, 2004). Table 1.1 shows the contaminant, the concentration, averaging period and allowable exceedances as required by the NES. The NES for PM<sub>10</sub> is set at 50 µg m<sup>-3</sup> with one allowable exceedance per year. Compliance with this target is required by 2016 in Blenheim. All other areas in Marlborough must remain compliant with the NES.

Air quality monitoring data in other urban areas of New Zealand indicates that it would seem unlikely that concentrations of NES contaminants other than PM<sub>10</sub> would be in breach in Blenheim. Concentrations of other contaminants even in large urban areas are typically within the NES and guideline concentrations. Because emissions of other contaminants in Blenheim are far lower than large urban areas such as Christchurch, it would seem unlikely that concentrations of other key urban air pollutants would be in breach of the NES or air quality guidelines. The exception to this may be benzo(a)pyrene concentrations, which appear to occur well in excess of guideline concentrations in Christchurch.

The Ministry for the Environment also provides guidelines for ambient air quality (Ministry for Environment, 2002). Table 1.2 shows the ambient air quality guidelines and Table 1.3 details the air quality indicator categories to assist in the presentation and management of air quality in New Zealand. Air quality monitoring data in this report are presented relative to air quality guidelines and these indicator categories. These categories provide a useful perspective on the overall air quality and provide a valuable tool for evaluating trends in concentrations over time.

**Table 1.1: National Environmental Standards for Ambient Air Quality (MfE, 2004)**

Contaminant	NES values		
	Concentration	Averaging Period	Allowable exceedences / year
Particles (PM <sub>10</sub> )	50 µg m <sup>-3</sup>	24-hour	1
Nitrogen dioxide	200 µg m <sup>-3</sup>	1-hour	9
Sulphur dioxide	350 µg m <sup>-3</sup>	1-hour	9
Sulphur dioxide	570 µg m <sup>-3</sup>	1-hour	0
Ozone	150 µg m <sup>-3</sup>	1-hour	0

Table 1.2: Ambient Air Quality Guidelines for New Zealand (MfE, 2002)

Contaminant	2002 guideline values	
	Concentration	Averaging Period
Carbon monoxide	30 mg m <sup>-3</sup>	1-hour
	10 mg m <sup>-3</sup>	8-hour
Particles (PM <sub>10</sub> )	50 µg m <sup>-3</sup>	24-hour
	20 µg m <sup>-3</sup>	Annual
Nitrogen dioxide	200 µg m <sup>-3</sup>	1-hour
	100 µg m <sup>-3</sup>	24-hour
Sulphur dioxide b	350 µg m <sup>-3</sup>	1-hour
	120 µg m <sup>-3</sup>	24-hour
Ozone	150 µg m <sup>-3</sup>	1-hour
	100 µg m <sup>-3</sup>	8-hour
Hydrogen sulphide c	7 µg m <sup>-3</sup>	1-hour
Lead d	0.2 µg m <sup>-3</sup> (lead content of PM <sub>10</sub> )	3-month moving, calculated monthly
Benzene (year 2002)	10 µg m <sup>-3</sup>	Annual
Benzene (year 2010)	3.6 µg m <sup>-3</sup>	Annual
1,3-Butadiene	2.4 µg m <sup>-3</sup>	Annual
Formaldehyde	100 µg m <sup>-3</sup>	30-minutes
Acetaldehyde	30 µg m <sup>-3</sup>	Annual
Benzo(a)pyrene	0.0003 µg m <sup>-3</sup>	Annual
Mercury (inorganic) d	0.33 µg m <sup>-3</sup>	Annual
Mercury (organic)	0.13 µg m <sup>-3</sup>	Annual
Chromium VI d	0.0011 µg m <sup>-3</sup>	Annual
Chromium metal and chromium III	0.11 µg m <sup>-3</sup>	Annual
Arsenic (inorganic) d	0.0055 µg m <sup>-3</sup>	Annual
Arsine	0.055 µg m <sup>-3</sup>	Annual

Notes for Table 1.2:

- <sup>a</sup> All values apply to the gas measured at standard conditions of temperature (0° C) and pressure (1 atmosphere).
- <sup>b</sup> The sulphur dioxide guideline values do not apply to sulphur acid mist.
- <sup>c</sup> The hydrogen sulphide value is based on odour nuisance and may be unsuitable for use in geothermal areas.
- <sup>d</sup> The guideline values for metals are for inhalation exposure only; they do not include exposure from other routes such as ingestion. These other routes should be considered in assessments where appropriate.

**Table 1.3: Environmental Performance Indicator Categories for Air Quality (MfE, 2002)**

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 urgent action
Alert	Between 66% and 100% of the guideline	This is a warning level, which can lead to exceedences if trends are not curbed
Action	More than 100% of the guideline	Exceedences of the guideline are a cause for concern and warrant action, particularly if they occur on a regular basis

In 2012 the emission inventory for Blenheim (Wilton, 2005) was updated to provide a more recent estimate of the sources of PM<sub>10</sub> and other contaminant emissions (Wilton, 2012b). The results of the inventory indicated that domestic home heating was the main source of PM<sub>10</sub> emissions, contributing to around 92% of the daily wintertime PM<sub>10</sub> (Wilton, 2012). Motor vehicles contributed to 2% of PM<sub>10</sub> emissions, outdoor burning contributed to 5% and industry contributed to 1% of total wintertime emissions.

## 2. Methodology

Air quality monitoring of PM<sub>10</sub> in Blenheim during 2014 was carried out at the two historical monitoring sites (Redwoodtown and Middle Renwick Road (MRR)). At the Redwoodtown Bowling Club site in Blenheim, a 5014I beta attenuation monitor (BAM) was used as well as a high volume sampler. The original purpose of the high volume sampler was to determine the relationship of the relatively new sampler to the high volume reference method. However, because of an instrument issue with the BAM which invalidated data from 22 February to late July the comparison was unable to be made and the high volume data were used for reporting purposes. Both methods are NES compliant, although the high volume sampler is not commonly used for NES reporting owing to practical difficulties in obtaining continuous operation (hence the need to use two samplers). The sampling frequency for the high volume sampler at this site was one day in three.

At the MMR site a gravimetric high-volume sampler, a method compliant with the NES reference method specifications, was used. High-volume sampling was carried out on a one day in three sampling regime with samples collected over a 24-hour period from midnight to midnight. Although compliant in terms of the principles of operation, the high volume sampler is difficult to operate continuously because of the requirement for filter change at midnight. Consequently this method as used at the MMR site was not compliant with the NES. The site was historically classified as a residential neighbourhood monitoring site in accordance with the Ministry for the Environment's Good Practice Guide for Air Quality Monitoring (Ministry for the Environment, 2009) but has been revised to traffic peak owing to its proximity to the road.

Meteorological data, including wind speed, wind direction were obtained from a NIWA site on the outskirts of Blenheim. Ambient temperature data was collected at the Bowling Club site in Redwoodtown.

## 2.1. Air Quality Monitoring Sites

Figure 2.1 shows the MRR site, which provides a historical record of PM<sub>10</sub> in Blenheim and is located to the north-west of Blenheim, the Redwoodtown Bowling Club site which has been operational since 2002, and the metrological monitoring site.

In 2007 a site at the Croquet Club was established for the purposes of evaluating the relationship between Brooklyn Street area PM<sub>10</sub> and PM<sub>10</sub> concentrations measured at the Bowling Club. This was considered important because PM<sub>10</sub> concentrations of the magnitude measured during 2004 at Brooklyn Street had not been measured at the Bowling Club and because the reductions required in PM<sub>10</sub> concentrations in Blenheim had been dependent on the Brooklyn Street results. The results from work undertaken in 2007 and reported in the '2007 Air Quality Monitoring Report' (Wilton, 2008) indicated that the Brooklyn Street site was likely to be affected by localised sources of PM<sub>10</sub> and should not be used for air quality management purposes. Details of the Croquet Club site are outlined in '2008 Air Quality Monitoring Report' (Wilton & Baynes, 2009).



Figure 2.1: Location of air quality sites and metrological site in Blenheim.

### 2.1.1. Middle Renwick Road (MRR) Monitoring Site

The MRR air quality monitoring site was established in 2000 at the back yard area of a Council site at 106 Middle Renwick Road. An aerial picture of the MMR site and its surrounds are shown in Figure 2.2 and Figure 2.3 shows the high volume sampler located at the MRR monitoring site. Table 2.1 provides site details for the site.





Figure 2.2: Aerial photo of the MRR air quality monitoring site (red arrow points to monitoring location).



Figure 2.3: PM<sub>10</sub> monitor at the MRR air monitoring site.



**Table 2.1: Site Summary Details for the MRR Air Quality Monitoring Site.**

Site name	Blenheim – 106 Middle Renwick Road
Site contact details	Marlborough District Council
Description of site	Grass lawn near to roadside. Mixed use area with proximity to industrial, residential and high traffic count road.
Site category	Traffic peak
Purpose of site and sources	To measure ambient air concentrations of PM <sub>10</sub> at the historical air quality monitoring site in Blenheim. Main source during the winter months is solid fuel burning for domestic heating.
Proposed duration of monitoring	Ongoing
Contaminants monitored	PM <sub>10</sub>
Site co-ordinates	E1678182 N5404327
Date of site installation	January 2000
Meteorological characteristics of area	Low wind speeds occur regularly during the winter months. Temperature inversions are likely.
Sample frequency	One day in three from May 2005 One day in six prior to this during the summer and one day in three during the winter.
Inlet height	1.5 metres
Averaging period	24-hour

### 2.1.2. Redwoodtown – Bowling Club Monitoring Site

In 2010 air quality monitoring took place at the main air quality monitoring site at the Blenheim Bowling Club on Weld Street in Redwoodtown. Figures 2.4 and 2.5 show the surrounding area and the location of the monitoring site within the Bowling Club grounds. Summary site details are given in Table 2.2.



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Redwoodtown BAM and High-Vol

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Figure 2.4: Aerial photo of the Redwoodtown – Bowling Club air quality monitoring site (note: blue arrow depicts monitoring site).



Figure 2.5: PM<sub>10</sub> monitor at the Redwoodtown – Bowling Club air quality monitoring site.

Table 2.2: Site Summary Details for the Redwoodtown – Bowling Club Air Quality Monitoring Site.

Site name	Redwoodtown – Bowling Club
Site contact details	Marlborough District Council
Description of site	The site is located at the Blenheim Bowling Club, which is to the south-east of central Blenheim. The surrounding area includes a bowling green, gravel petanque area and paved areas.
Site category	Residential neighbourhood
Purpose of site and sources	To measure worst-case ambient air concentrations of PM <sub>10</sub> in Blenheim. The main source during the winter months is solid fuel burning for domestic heating. The site is downwind of a large residential area for meteorological conditions conducive to poor air quality.
Proposed duration of monitoring	Ongoing
Contaminants monitored	PM <sub>10</sub>
Site co-ordinates	E1679764 N5402328
Date of site installation	Monitoring from 2000-2003. Permanent site since 2005.
Meteorological characteristics of area	Low wind speeds occur regularly during the winter months. Temperature inversions are likely.
Sample frequency	Continuous
Inlet height	3.5 metres
Averaging period	24-hour and hourly

## 2.2. Quality Assurance

Marlborough District Council staff operated the high volume PM<sub>10</sub> samplers, including filter changing.

Flow calibrations were carried out every month, normally during the morning. Filters were couriered to Hill Laboratories, who undertook filter weighing in accordance with the New Zealand and Australia standard for high volume sampling. Hill Laboratories hold IANZ accreditation, for high volume PM<sub>10</sub> sampling.

Transportation of filters occurs at the end of each month, with filters stored and transported in snaplock bags at ambient temperature. Quality assurance methods include the analysis of one field blank per site per month. Field blanks outside of the “acceptable” range ( $\pm 8$  mg per filter) are noted in a report from Hills Laboratory.

Operation of the BAM is also carried out by MDC staff. Ten minute data is recorded by the instrument and logged by an iQuest iRIS 350 datalogger. Results are telemetered hourly to MDC and stored in the hilltop database.

### 3. Air Quality Monitoring in Blenheim

#### 3.1. PM<sub>10</sub> Concentrations at the MRR Site

Daily average PM<sub>10</sub> concentrations measured at the MRR site during 2014 are shown in Figure 3.1. The maximum measured 24-hour average PM<sub>10</sub> concentration was 42 µg m<sup>-3</sup> and was measured on 17 May. The corresponding concentration at Redwoodtown was 29 µg m<sup>-3</sup>. Figure 3.2 shows a reasonable correlation between PM<sub>10</sub> concentrations measured at MRR with those in Redwoodtown with the latter measuring around half of the concentrations at Redwoodtown.

Concentrations of PM<sub>10</sub> at MRR have exceeded 50 µg m<sup>-3</sup> on only a few years. In 2008 the maximum concentration recorded was 51 µg m<sup>-3</sup>. The only other years that concentrations above 50 µg m<sup>-3</sup> have been recorded at this site are 2000 (56 µg m<sup>-3</sup>), 2003 (75 µg m<sup>-3</sup>) and 2008 (51 µg m<sup>-3</sup>).

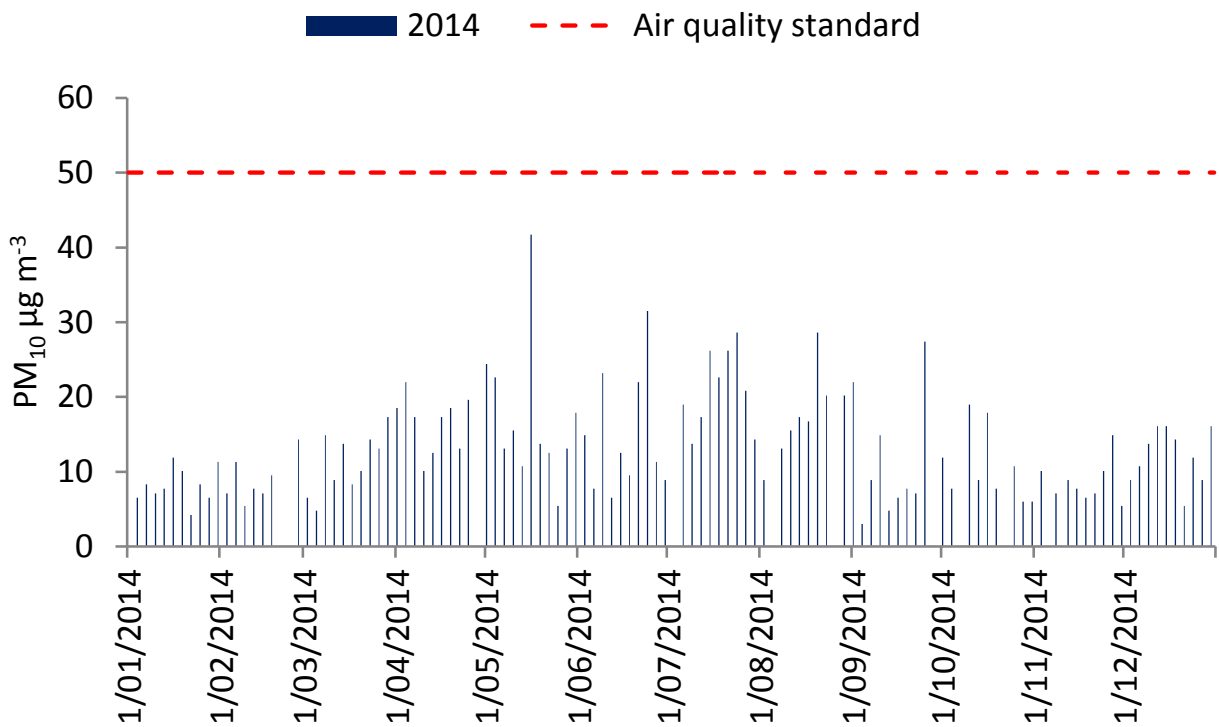


Figure 3.1: Daily winter PM<sub>10</sub> concentrations measured at the MRR site during 2014.

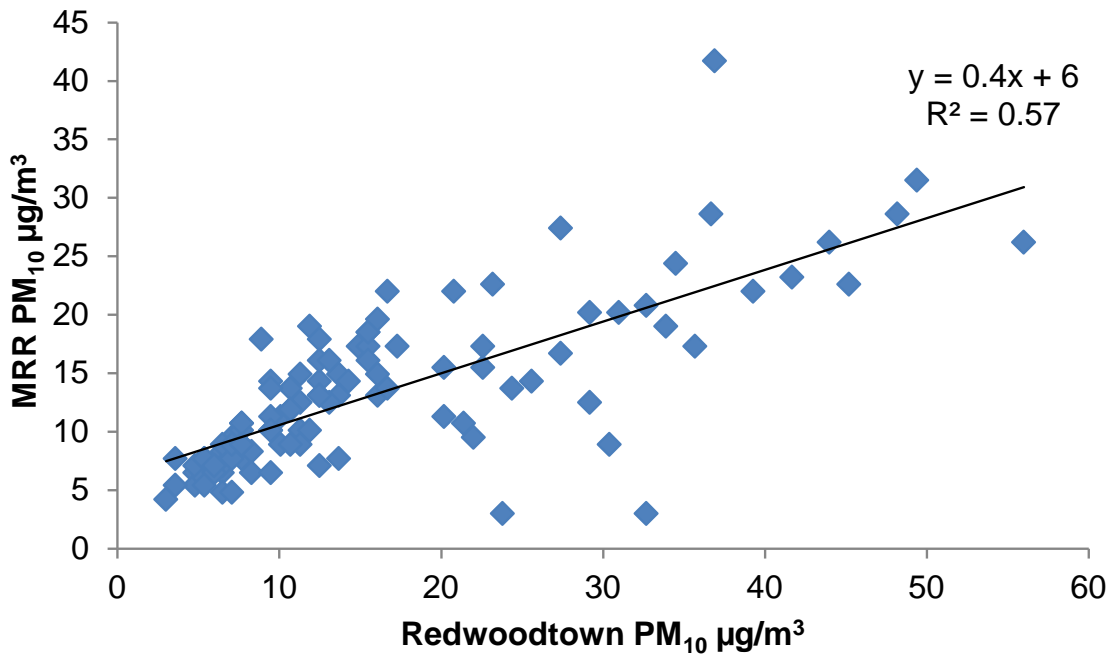


Figure 3.2: Relations between daily winter PM<sub>10</sub> concentrations at the MRR site and at Redwoodtown during 2014.

Figure 3.3 shows changes in PM<sub>10</sub> concentrations relative to MfE air quality indicator categories (shown in Table 1.3) at the MRR site from 2000 to 2014. Data indicate improving PM<sub>10</sub> concentrations at the MRR monitoring site between 2000 and 2009 with no further improvement evident after this time.

Monthly variations in PM<sub>10</sub> concentrations compared to air quality indicators for 2014 are shown in Figure 3.4. Figure 3.5 shows the number of days when the NES was exceeded, the maximum concentration and the second highest concentration for 2014 and for previous years.

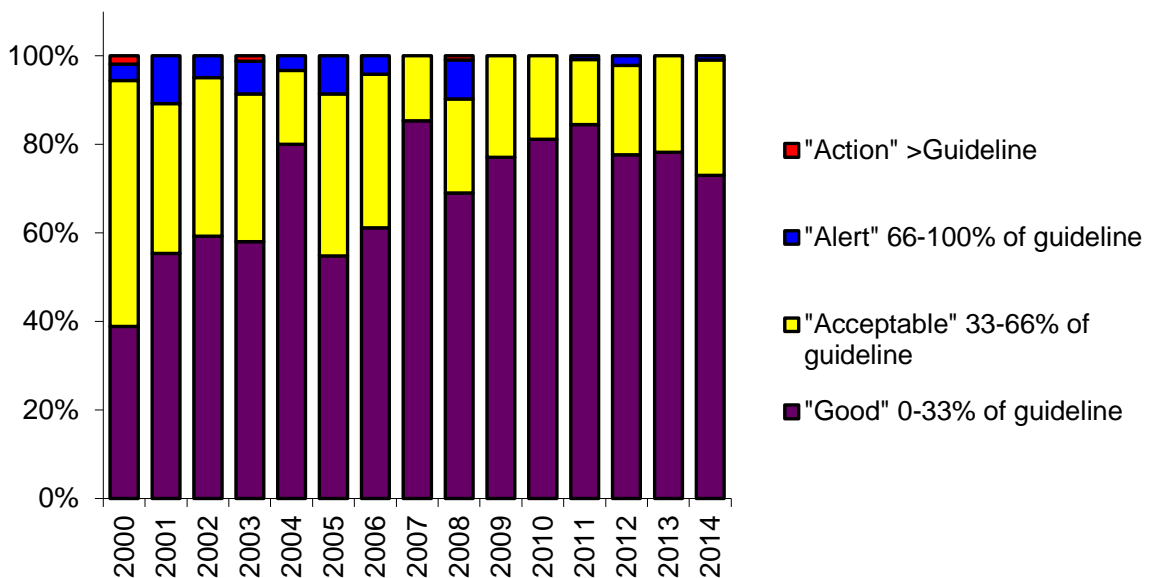


Figure 3.3: Comparison of PM<sub>10</sub> concentrations measured at the MRR site from 2000 to 2014 to air quality indicator categories.



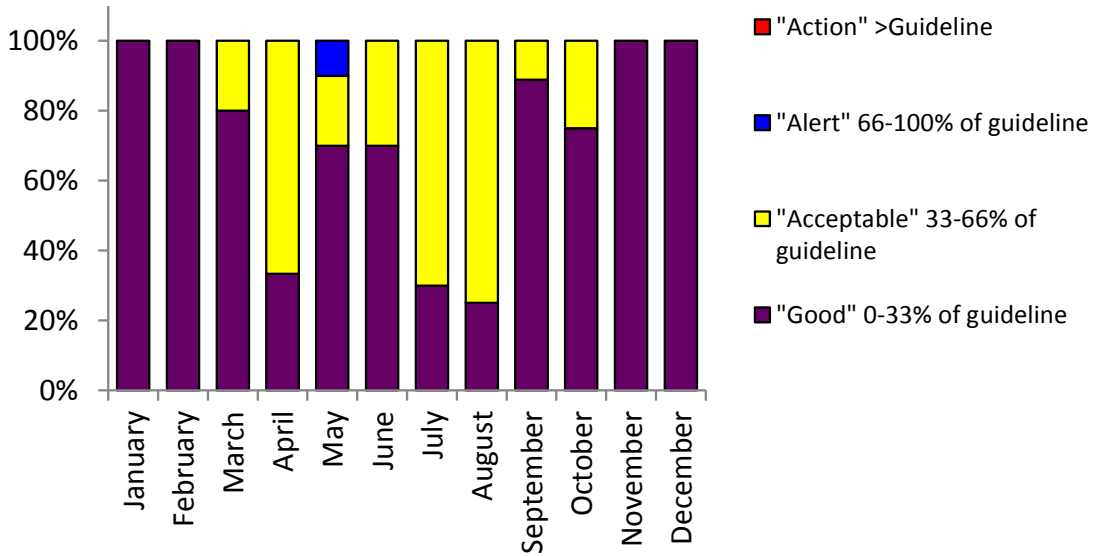


Figure 3.4: Comparison of daily PM<sub>10</sub> concentrations each month during 2014 to air quality indicator categories at the MRR site.

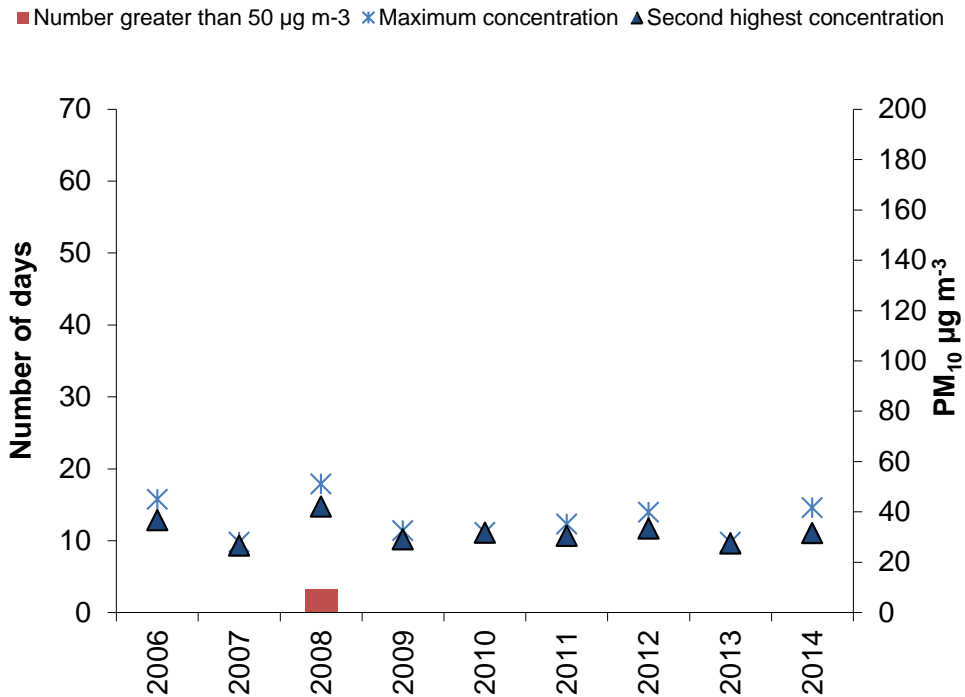


Figure 3.5: Number of days when the NES was exceeded, the maximum concentration and the second highest concentration from 2006 to 2014 at the MRR site.

The estimated annual average PM<sub>10</sub> concentration for the MRR site for 2014 is 13 µg m<sup>-3</sup>, which is similar to the 2013 annual average. Figure 3.6 shows a downward trend in annual average PM<sub>10</sub> concentrations at MRR since 2000. However, the reduction is dominated by trends between 2000 and 2008 with data suggesting no changes in annual average PM<sub>10</sub> since 2009. The Ministry for the Environment's annual average PM<sub>10</sub> guideline is 20 µg m<sup>-3</sup>. There is currently no NES for annual average PM<sub>10</sub> concentrations.

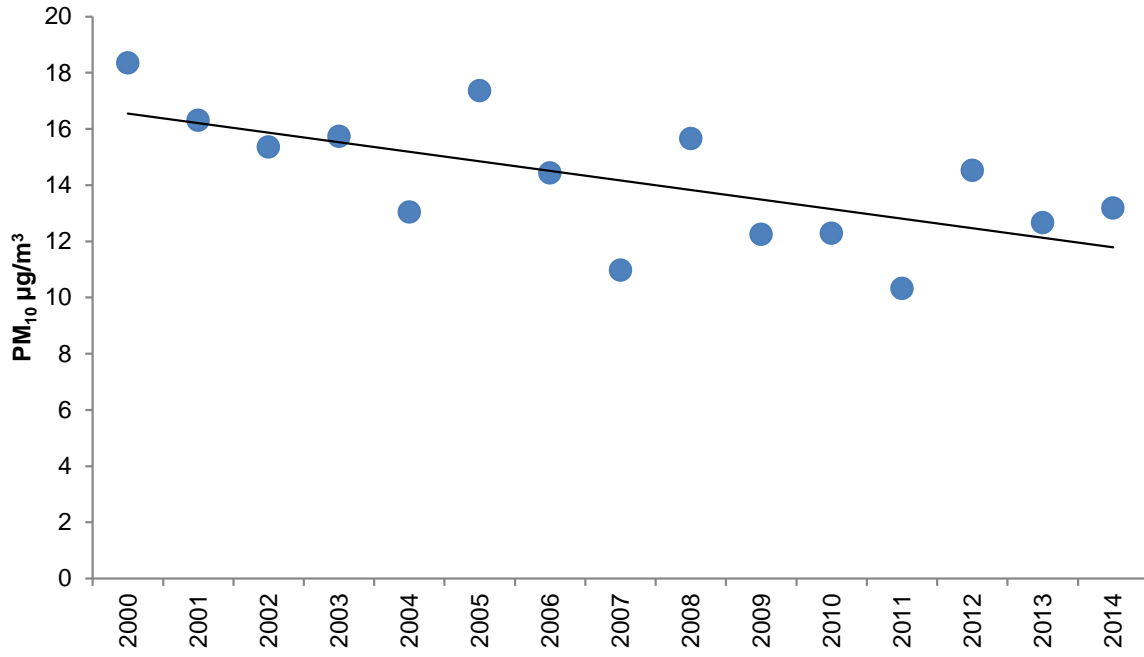


Figure 3.6: Annual average PM<sub>10</sub> concentration from 2000 to 2014 at the MRR site.



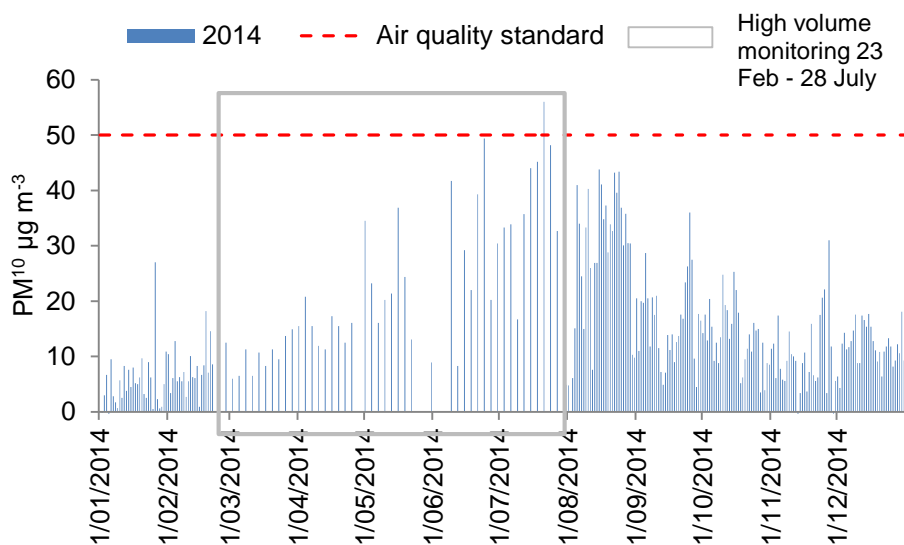
**Table 3.1: Summary of PM<sub>10</sub> Concentrations Measured at the MRR Monitoring Site from 2000 to 2014.**

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
"Good" 0-33% of guideline	39%	55%	59%	58%	80%	55%	61%	85%	69%	77%	81%	84%	78%	76%	73%
"Acceptable" 33-66% of guideline	56%	34%	36%	33%	17%	37%	35%	15%	21%	23%	19%	15%	20%	21%	26%
"Alert" 66-100% of guideline	4%	11%	5%	7%	3%	9%	4%	0%	8%	0%	0%	1%	2%	0%	1%
"Action" >Guideline	2%	0%	0%	1%	0%	0%	0%	0%	1%	0%	0%	0%	0%	1%	0%
Percentage of valid data	15%	20%	22%	22%	16%	25%	33%	32%	31%	32%	29%	32%	26%	32%	30%
Annual average ( $\mu\text{g m}^{-3}$ )	18	16	15	16	13	17	14	11	16	12	12	10	15	13	13
Measured PM <sub>10</sub> concentrations above 50 $\mu\text{g m}^{-3}$	1	-	-	1	-	-			1						0
Extrapolated PM <sub>10</sub> concentrations above 50 $\mu\text{g m}^{-3}$									3						0
99.7 %ile concentration ( $\mu\text{g m}^{-3}$ )	53	46	40	67	46	47	42	27	48	31	32	34	38	28	38
Annual maximum ( $\mu\text{g m}^{-3}$ )	56	48	41	75	49	49	45	28	51	32	32	35	40	28	42
Number of records	54	74	81	81	60	93	121	116	113	118	106	116	97	115	111

### 3.2. PM<sub>10</sub> Concentrations at Redwoodtown – Bowling Club

During 2014 only one exceedence of 50  $\mu\text{g m}^{-3}$  was measured at the Redwoodtown air quality monitoring site (Figure 3.7). However, data collection over the winter period was limited with valid data only available for 59 days from May to August (48%). The NES allows one exceedence of 50  $\mu\text{g m}^{-3}$  per year before a breach occurs. If data are extrapolated statistically for missing days the result would be two exceedences of 50  $\mu\text{g m}^{-3}$  and one breach of the NES. However, there is uncertainty on the extent of non-compliance because of missing data. The Blenheim airshed was compliant with the NES during 2009 but prior to this it had been non-compliant since the NES was introduced.

The maximum measured PM<sub>10</sub> concentration for 2014 was 56  $\mu\text{g m}^{-3}$  and occurred on 20 July. Previous recent maximum concentrations at Redwoodtown have ranged from 59 - 82  $\mu\text{g m}^{-3}$ .



**Figure 3.7: 24-hour average PM<sub>10</sub> concentrations measured at the Redwoodtown – Bowling Club site during 2014.**

Figure 3.8 compares daily PM<sub>10</sub> concentrations measured from 2006 to 2014 to the MfE air quality indicator categories (shown in Table 1.3). Monthly variations in the distribution of PM<sub>10</sub> concentrations for 2014 are shown in Figure 3.9. No values are reported for the months March to July owing to the limited data collected during this period. However, it is likely that the distribution of data would be similar to other years with the winter months showing the greatest proportion of days in the “acceptable”, “alert” and “action” categories and fewer days in the “good” category.

Figure 3.10 compares the number of days when the NES was exceeded in 2014 to previous years along with the maximum concentration and the second highest concentration. Interpretation of the 2014 data relative to other years is limited by the infrequent sampling regime during 2014. It is also important to note, that comparisons between years does not take into account year to year variations in the impact of meteorology. This issue is examined further in section 4 of this report.

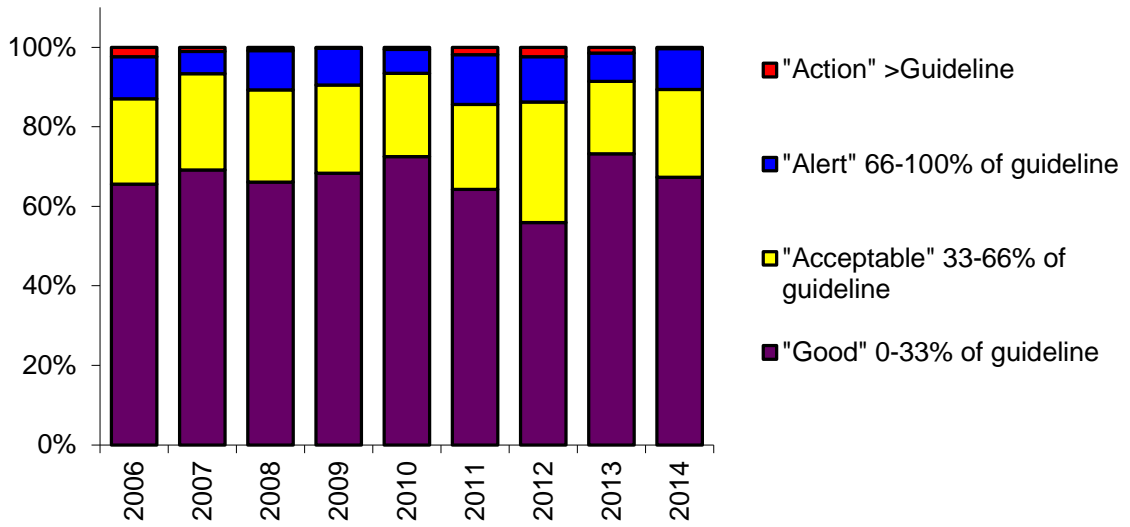


Figure 3.8: Comparison of PM<sub>10</sub> concentrations measured at Redwoodtown – Bowling Club site during 2006 to 2014 to air quality indicator categories.

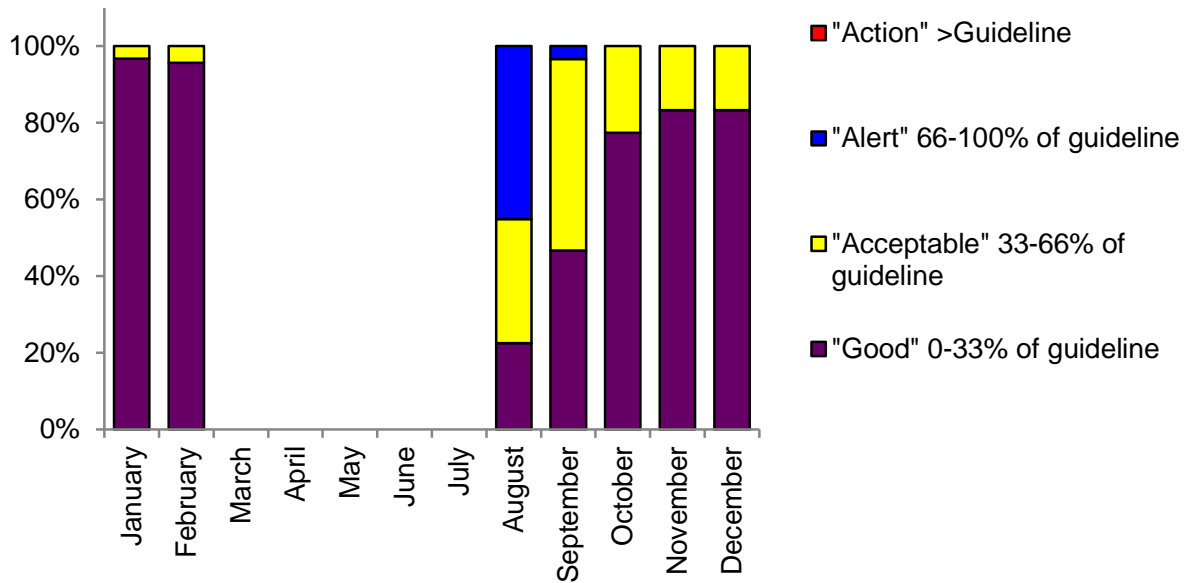


Figure 3.9: Comparison of daily PM<sub>10</sub> concentrations each month during 2014 to air quality indicator categories.

■ Number greater than 50  $\mu\text{g m}^{-3}$  × Maximum concentration ▲ Second highest concentration



Figure 3.10: Number of days when 50  $\mu\text{g m}^{-3}$  was exceeded, the maximum concentration and the second highest concentration from 2006 to 2014.

The annual average PM<sub>10</sub> concentration for 2014 was 16  $\mu\text{g m}^{-3}$ . This is within the normal range for this monitoring site (14-17  $\mu\text{g m}^{-3}$ ). The Ministry for the Environment specifies an annual average guideline for PM<sub>10</sub> of 20  $\mu\text{g m}^{-3}$ . The NES does not currently include an annual average concentration for PM<sub>10</sub>.

Summary statistics for PM<sub>10</sub> monitoring results from the Redwoodtown Bowling Club site from 2002 to 2014 are provided in Table 3.2. From 2005 monitoring was conducted from January to December and in 2004 air quality monitoring took place at a site in Brooklyn Street.

**Table 3.2: Summary of PM<sub>10</sub> Concentrations Measured at Redwoodtown – Bowling Club Site from 2002-2014**

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Monitoring method	Hi-vol	Hi-vol	Hi-vol	Hi-vol	BAM	BAM	BAM	BAM	BAM	BAM	BAM/High vol	BAM	BAM/High vol
"Good" 0-33% of guideline	18%	22%	46%	63%	66%	69%	66%	68%	72%	64%	56%	72%	67%
"Acceptable" 33-66% of guideline	62%	30%	22%	17%	21%	24%	23%	22%	21%	21%	31%	18%	22%
"Alert" 66-100% of guideline	10%	26%	20%	17%	10%	6%	10%	9%	6%	13%	11%	7%	10%
"Action" >Guideline	10%	22%	12%	3%	3%	1%	1%	0%	1%	2%	2%	1%	0%
Percentage of valid data	14%	7%	22%	32%	68%	99%	99%	98%	96%	87%	91%	98%	70%
Annual average ( $\mu\text{g m}^{-3}$ )	-	-	22	18	17	15	17	15	14	16	19	14	16
Measured PM <sub>10</sub> concentrations above 50 $\mu\text{g m}^{-3}$	5	6	10	3	6	5	3	1	2	6	8	5	1
Extrapolated PM <sub>10</sub> concentrations above 50 $\mu\text{g m}^{-3}$	16	34	31	9	10	4	3	1	2	6	9	5	2
Second highest PM <sub>10</sub> concentration ( $\mu\text{g m}^{-3}$ )					54	58	56	46	64	80	57	55	51
Annual maximum ( $\mu\text{g m}^{-3}$ )	58	60	81	58	59	62	56	46	67	82	59	61	56
Number of records	50	27	82	115	247	360	363	357	352	319	331	351	254

### 3.3. PM<sub>10</sub> and Meteorology in Blenheim

Figure 3.11 shows variations in meteorological conditions on the 20 July when the 24-hour average exceeded 50 µg m<sup>-3</sup> at the Redwoodtown air quality monitoring site. The high pollution episode is characterised by low wind speeds throughout the day, a south east wind direction and PM<sub>10</sub> concentrations peaking in the early evening.

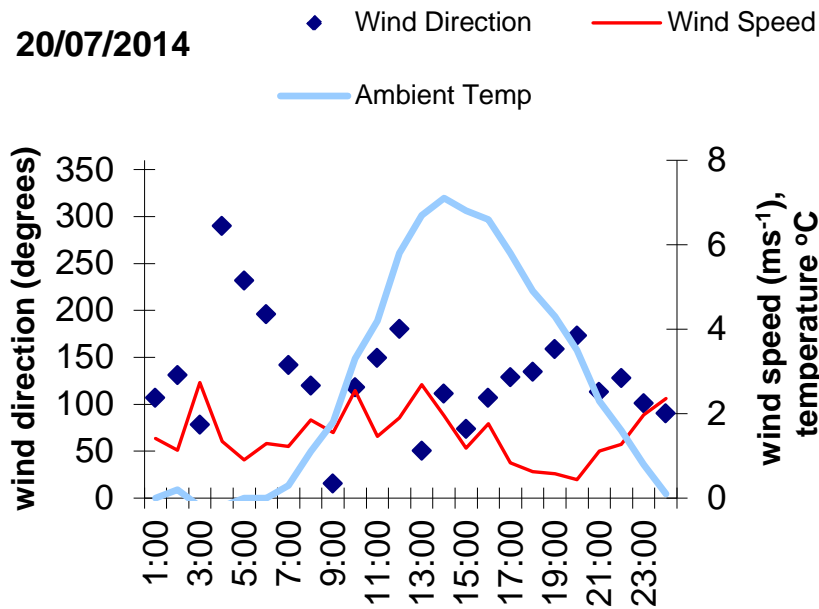


Figure 3.11: Hourly average wind speed, wind direction and temperature on 20 July 2014 when PM<sub>10</sub> concentrations exceeded 50 µg m<sup>-3</sup> (24 hour average) at Redwoodtown.

## 4. Trends in PM<sub>10</sub> Concentrations in Blenheim

To quantify the impact of meteorological conditions and therefore further assess the likelihood of changes in PM<sub>10</sub> concentrations since 2005, a trends assessment was updated in 2012 (Wilton, 2012a). The objective of that work was to identify meteorological conditions giving rise to concentrations of PM<sub>10</sub> in excess of the NES and to provide a tool for comparing year to year PM<sub>10</sub> concentrations whilst minimising the impact of variability in meteorological conditions. The trends assessment provided a tool for updating the trends analysis with time. The Figure 4.1 shows trends in PM<sub>10</sub> concentrations updated with the 2014 PM<sub>10</sub> data adjusted for the impact of meteorological conditions. Results suggest a decrease in concentrations from 2006 to 2009 and an increase in upper quartile concentrations in 2010 and 2011 and average concentrations just slightly. Since 2012 average concentrations have been similar to 2009 and upper quartile concentrations appear to have decreased. However, overall results suggest concentrations of PM<sub>10</sub> in Blenheim have not decreased since 2006. It is uncertain whether changes in emissions, the spatial distribution of emissions or meteorological conditions not quantified in the trends assessment are responsible for the changes in PM<sub>10</sub> illustrated in Figure 4.1 from 2010 – 2014.

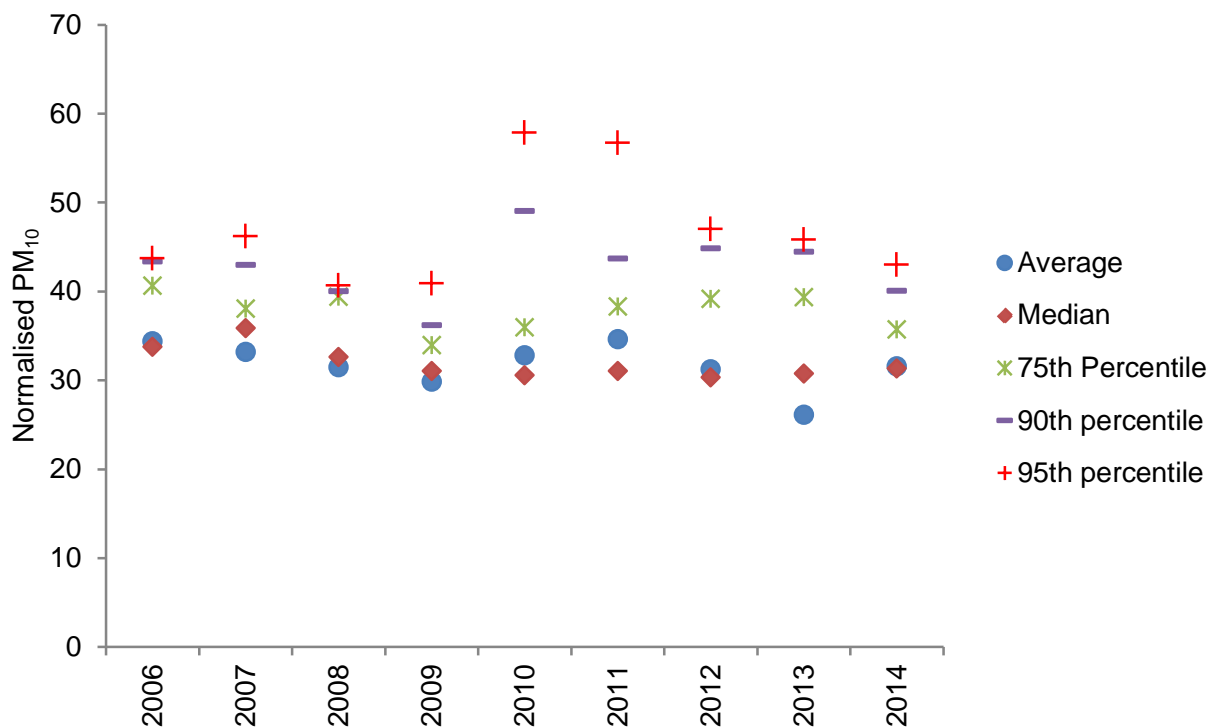


Figure 4.1: Trends in PM<sub>10</sub> concentrations after adjusting for meteorological conditions.

## 5. Summary

Sampling for PM<sub>10</sub> at Redwoodtown was limited during 2014 owing to an instrument issue with the BAM which invalidated data from February to July. High volume sampling was carried out on a one day in three sampling frequency over this period and these data was used for reporting purposes. Results found one measured exceedence of 50 µg m<sup>-3</sup>, although further exceedences may have occurred on days when sampling wasn't undertaken. This is a low number of exceedences for this site relative to other years.

Concentrations of PM<sub>10</sub> were also measured at the historical Middle Renwick Road monitoring site. In 2014 there were no exceedences of 50 µg m<sup>-3</sup> at this site. The maximum daily PM<sub>10</sub> concentration at this site was 42 µg m<sup>-3</sup>. An evaluation of annual average concentrations measured at this site since 2000 has previously indicated a downward trend in concentrations. With the inclusion of 2014 data the trend appears to have tapered since 2009. Concentrations at this site are less than half those measured at Redwoodtown on average.

The NES for PM<sub>10</sub> was reviewed by the Ministry for the Environment in 2011. A new date of 2016 was given for compliance with 50 µg m<sup>-3</sup> (24-hour average, one allowable exceedence) for areas with fewer than 10 breaches. Blenheim is required to meet this target date. Prior to 2010 PM<sub>10</sub> concentrations appeared to be reducing. However, increases in the frequency of exceedences and the magnitude of concentrations were observed around 2009 and 2010 and it now appears unlikely that any reductions in concentrations have occurred since 2006. Management intervention is required to ensure the NES for PM<sub>10</sub> is met by 2016.

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