MARLBOROUGH DISTRICT COUNCIL

Annual Air Quality Monitoring Report – Blenheim 2015

Technical Report No: 16-002
May 2016

Annual Air Quality Monitoring Report - Blenheim 2015

MDC Technical Report No: 16-002

ISSN 1179-819 (Online)

ISBN 978-1-927159-67-5 (Online)

May 2016

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

Executive Summary

Particulate (PM_{10}) is main air pollutant of concern in urban areas of New Zealand. Air quality monitoring of PM_{10} in Blenheim has been carried out since 2000. In 2015 monitoring of PM_{10} was carried out in Redwoodtown and at the historical monitoring site in Middle Renwick Road (MRR). The main source of PM_{10} in Blenheim during the winter is solid fuel burning for domestic home heating.

To gauge the significance of the measurements, concentrations were compared to the National Environmental Standard for Air Quality (NES) of 50 µg m^{-3} (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_{10} exceeded 50 µg m^{-3} (24-hour average) at the Redwoodtown site on four occasions during 2015. Although the NES specifies one allowable exceedence per year all four exceedences were breaches of the NES owing to there being less than a year between the first breach in May and the 2014 breach in July. The maximum measured concentration was 79 µg m^{-3} and the second highest PM_{10} concentration was 70 µg/m^3.

An evaluation of trends in PM_{10} 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 2012-2015 and a lesser decrease in upper quartile concentrations. In 2015 the 90^{th} and 95^{th} percentile data were higher than for the 2010 and 2011, although other indicators such as the mean were lower. Overall, the higher concentrations do not appear to have decreased since 2006.

The annual average PM_{10} concentration for the Bowling Club site was 17 µg m^{-3} and is consistent with previous years.

The maximum PM_{10} concentration measured at the MRR site was 32 µg m^{-3} for 2015. The annual average concentration for this site was estimated to be 13 µg/m^3 for 2015 and is similar to 2013 and 2014. An evaluation of trends at the MRR site suggests a decrease in annual average PM_{10} concentrations at this site between 2000 and 2008 but no further reductions are evident since 2009.

Contents

Executive Summary i

1. Introduction 1

2. Methodology 3

2.1. Air quality monitoring sites 3

2.1.1. Middle Renwick Road (MRR) monitoring site 4

2.1.2. Redwoodtown – Bowling Club Monitoring Site 7

2.2. Quality assurance 10

3. Air quality monitoring in Blenheim 11

3.1. PM_{10} concentrations at the MRR site 11

3.2. PM_{10} concentrations at Redwoodtown – Bowling Club 16

3.3. PM_{10} and meteorology in Blenheim 20

4. Trends in PM_{10} concentrations in Blenheim 21

5. Summary 22

References 22

List of Figures

Figure 2.1: Location of air quality sites and metrological site in Blenheim 4

Figure 2.2: Aerial photo of the MRR air quality monitoring site (red arrow points to monitoring location). 5

Figure 2.3: PM_{10} monitor at the MRR air monitoring site 6

Figure 2.4: Aerial photo of the Redwoodtown – Bowling Club air quality monitoring site (note: blue arrow depicts monitoring site). 8

Figure 2.5: PM_{10} monitor at the Redwoodtown – Bowling Club air quality monitoring site. 9

Figure 3.1: Daily winter PM_{10} concentrations measured at the MRR site during 2015. 11

Figure 3.2: Relations between daily winter PM_{10} concentrations at the MRR site and at Redwoodtown during 2015. 12

Figure 3.3: Comparison of PM_{10} concentrations measured at the MRR site from 2000 to 2015 to air quality indicator categories. 12

Figure 3.4: Comparison of daily PM_{10} concentrations each month during 2015 to air quality indicator categories at the MRR site. 13

Figure 3.5: Number of days when the NES was exceeded, the maximum concentration and the second highest concentration from 2006 to 2015 at the MRR site. 13

Figure 3.5: Annual average PM_{10} concentration from 2000 to 2015 at the MRR site. 14

Figure 3.7: 24-hour average PM_{10} concentrations measured at the Redwoodtown – Bowling Club site during 2015. 16

Figure 3.8: Comparison of PM_{10} concentrations measured at Redwoodtown – Bowling Club site during 2006 to 2015 to air quality indicator categories. 17

Figure 3.9: Comparison of daily PM_{10} concentrations each month during 2015 to air quality indicator categories. 17

Figure 3.10: Number of days when 50 µg m^{-3} was exceeded, the maximum concentration and the second highest concentration from 2006 to 2015. 18

Figure 3.11: Hourly average PM_{10}, wind direction and temperature on 5 May and 9, 21 and 30 July 2015 when PM_{10} concentrations exceeded 50 µg m^{-3} (24 hour average) at Redwoodtown. 20

Figure 4.1: Trends in PM_{10} concentrations after adjusting for meteorological conditions 21

List of Table

Table 1.1: National Environmental Standards for Ambient Air Quality (MfE, 2004) 1

Table 1.2: Ambient air quality guidelines for New Zealand (MfE, 2002) 2

Table 1.3: Environmental Performance Indicator categories for air quality (MfE, 2002) 2

Table 2.1: Site summary details for the MRR air quality monitoring site. 7

Table 2.2: Site summary details for the Redwoodtown – Bowling Club air quality monitoring site. 9

Table 3.1: Summary of PM_{10} concentrations measured at the MRR monitoring site from 2000 to 2015 15

Table 3.2: Summary of PM_{10} concentrations measured at Redwoodtown – Bowling Club site from 2002-2015 19

1. Introduction

Particulate (PM_{10}) is the main air contaminant of concern in Blenheim and other urban areas of New Zealand. PM_{10} refers to particles in the air less than 10 microns in diameter. Concentrations of PM_{10} were measured at two sites in Blenheim during 2015. The main site for reporting PM_{10} 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).

Air quality monitoring in the Marlborough Region includes monitoring of PM_{10} at the MRR monitoring site, intermittent monitoring of PM_{10} at the Redwoodtown Bowling Club site, survey PM_{10} monitoring in Renwick during 2000 and 2002, monitoring for PM_{10} in Picton during 2008 and 2009, visibility surveys and passive sampling for nitrogen oxides and sulphur oxides. From 2007 to early 2008, PM_{10} 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_{10} 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_{10} is set at 50 µg m^{-3} with one allowable exceedence 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_{10} 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 (PM10)	50 µg m-3	24-hour	1
Nitrogen dioxide	200 µg m-3	1-hour	9
Sulphur dioxide	350 µg m-3	1-hour	9
Sulphur dioxide	570 µg m-3	1-hour	0
Ozone	150 µg m-3	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-3 10 mg m-3	1-hour 8-hour
Particles (PM10)	50 µg m-3 20 µg m-3	24-hour Annual
Nitrogen dioxide	200 µg m-3 100 µg m-3	1-hour 24-hour
Sulphur dioxide b	350 µg m-3 120 µg m-3	1-hour 24-hour
Ozone	150 µg m-3 100 µg m-3	1-hour 8-hour
Hydrogen sulphide c	7 µg m-3	1-hour
Lead d	0.2 µg m-3 (lead content of PM10)	3-month moving, calculated monthly
Benzene (year 2002) Benzene (year 2010)	10 µg m-3 3.6 µg m-3	Annual Annual
1,3-Butadiene	2.4 µg m-3	Annual
Formaldehyde	100 µg m-3	30-minutes
Acetaldehyde	30 µg m-3	Annual
Benzo(a)pyrene	0.0003 µg m-3	Annual
Mercury (inorganic) d Mercury (organic)	0.33 µg m-3 0.13 µg m-3	Annual Annual
Chromium VI d Chromium metal and chromium III	0.0011 µg m-3 0.11 µg m-3	Annual Annual
Arsenic (inorganic) d Arsine	0.0055 µg m-3 0.055 µg m-3	Annual Annual

Notes for Table 1.2:

[a] All values apply to the gas measured at standard conditions of temperature (0° C) and pressure (1 atmosphere).

[b] The sulphur dioxide guideline values do not apply to sulphur acid mist.

[c] The hydrogen sulphide value is based on odour nuisance and may be unsuitable for use in geothermal areas.

[d] 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_{10} and other contaminant emissions (Wilton, 2012b). The results of the inventory indicated that domestic home heating was the main source of PM_{10} emissions, contributing to around 92% of the daily wintertime PM_{10} (Wilton, 2012). Motor vehicles contributed to 2% of PM_{10} emissions, outdoor burning contributed to 5% and industry contributed to 1% of total wintertime emissions.

2. Methodology

Air quality monitoring of PM_{10} in Blenheim during 2015 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, instrument issues for the BAM during the year meant both datasets have been used for reporting purposes, with BAM data being used on days when high volume sampler data were not available. 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. A monitoring enclosure upgrade and replacement BAM is scheduled for early 2016 to address the instrument issues at the Redwooodtown monitoring site.

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 Environments 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_{10} 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_{10} and PM_{10} concentrations measured at the Bowling Club. This was considered important because PM_{10} 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_{10} 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_{10} 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_{10} 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_{10} 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_{10}
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.

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

Figure 2.5: PM_{10} 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_{10} 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_{10}
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_{10} 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_{10} 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 (± 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. Annual calibrations are carried out by Watercare Services.

3. Air quality monitoring in Blenheim

3.1. PM_{10} concentrations at the MRR site

Daily average PM_{10} concentrations measured at the MRR site during 2015 are shown in Figure 3.1. The maximum measured 24-hour average PM_{10} concentration was 33 µg m^{-3} and was measured on 21July. The corresponding concentration at Redwoodtown was 70 µg m^{-3}.

Figure 3.2 shows a reasonable correlation between PM_{10} concentrations measured at MRR with those in Redwoodtown with the latter measuring less than half of the concentrations at Redwoodtown.

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

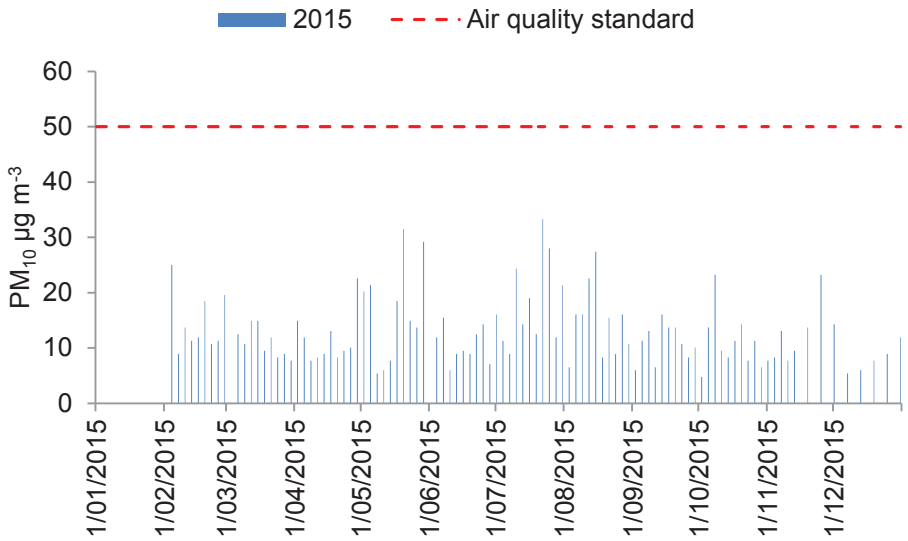

Figure 3.1: Daily winter PM_{10} concentrations measured at the MRR site during 2015.

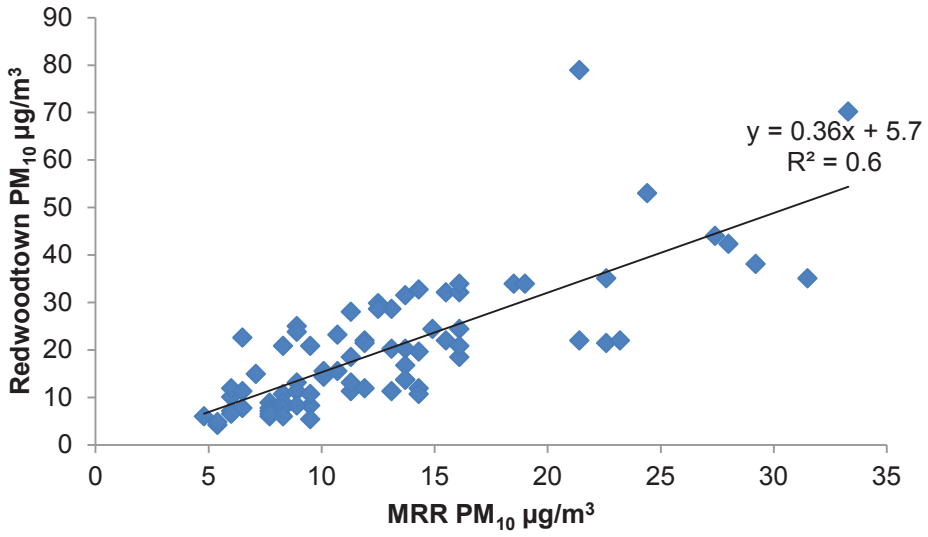

Figure 3.2: Relations between daily winter PM_{10} concentrations at the MRR site and at Redwoodtown during 2015.

Figure 3.3 shows changes in PM_{10} concentrations relative to MfE air quality indicator categories (shown in Table 1.3) at the MRR site from 2000 to 2015. Data indicate improving PM_{10} concentrations at the MRR monitoring site between 2000 and 2011 with no further improvement evident after this time. Data for 2015 are similar to that for 2011.

Monthly variations in PM_{10} concentrations compared to air quality indicators for 2015 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 2015 and for previous years.

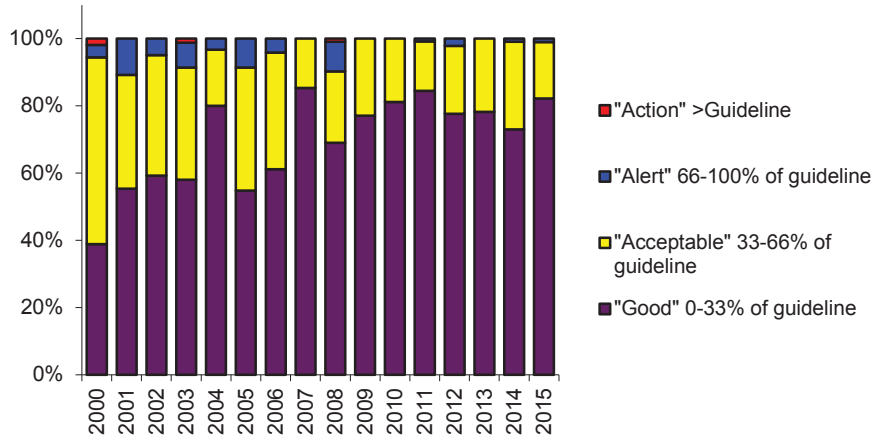

Figure 3.3: Comparison of PM_{10} concentrations measured at the MRR site from 2000 to 2015 to air quality indicator categories.

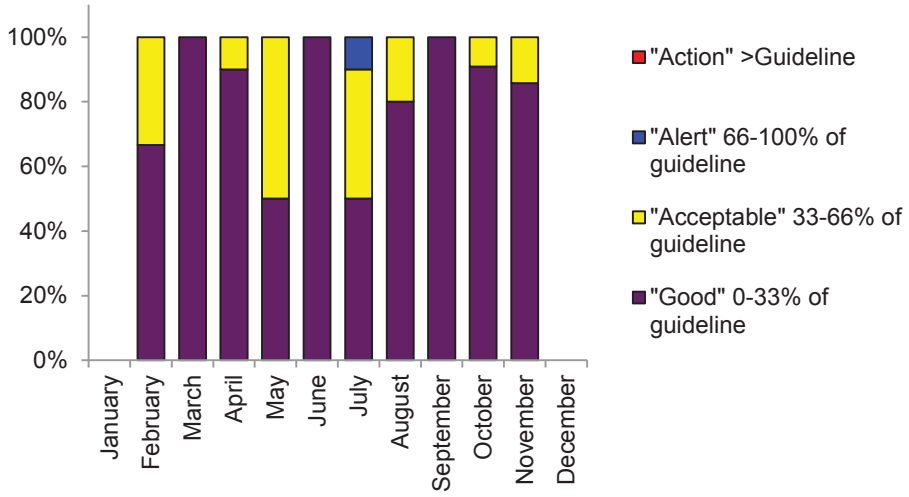

Figure 3.4: Comparison of daily PM_{10} concentrations each month during 2015 to air quality indicator categories at the MRR site.

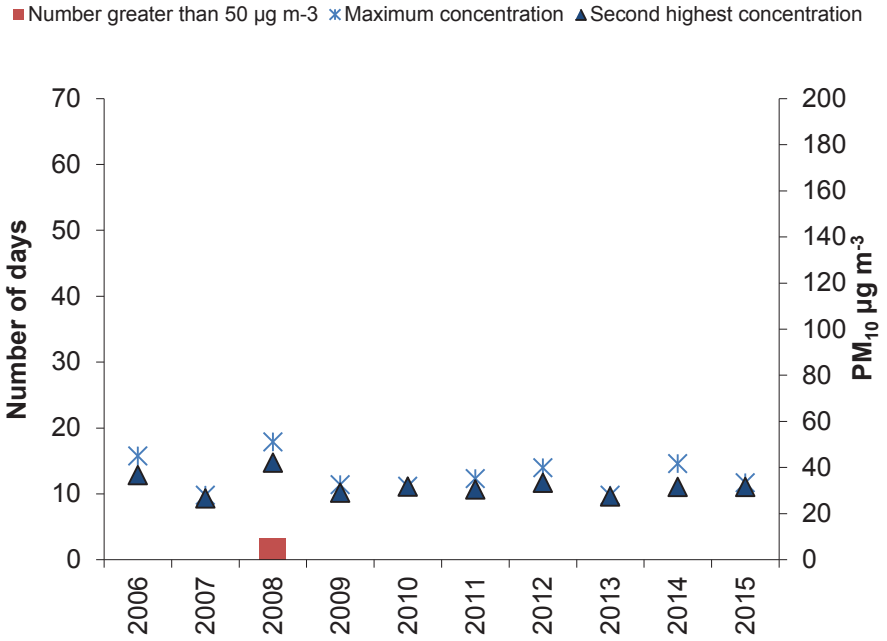

Figure 3.5: Number of days when the NES was exceeded, the maximum concentration and the second highest concentration from 2006 to 2015 at the MRR site.

The estimated annual average PM_{10} concentration for the MRR site for 2015 is 13 µg $m^{-3,}$ which is similar to the 2014 and 2013 annual averages. Figure 3.6 shows a downward trend in annual average PM_{10} 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_{10} since 2009. The Ministry for the Environments annual average PM_{10} guideline is 20 µg m^{-3}. There is currently no NES for annual average PM_{10} concentrations.

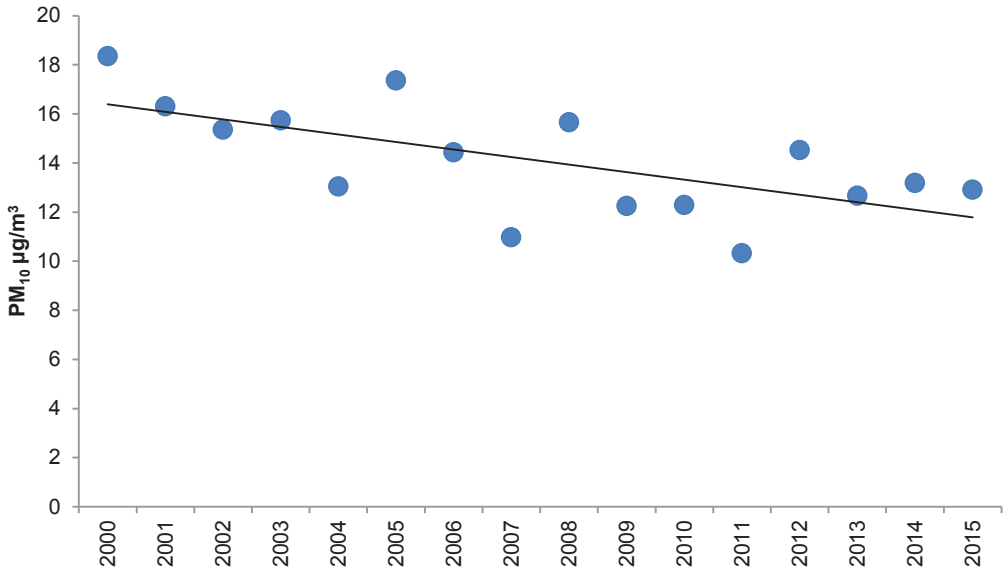

Figure 3.6: Annual average PM_{10} concentration from 2000 to 2015 at the MRR site.

Table 3.1: Summary of PM_{10} concentrations measured at the MRR monitoring site from 2000 to 2015

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
"Good" 0-33% of guideline	39%	55%	59%	58%	80%	55%	61%	85%	69%	77%	81%	84%	78%	76%	73%	82%
"Acceptable" 33-66% of guideline	56%	34%	36%	33%	17%	37%	35%	15%	21%	23%	19%	15%	20%	21%	26%	17%
"Alert" 66-100% of guideline	4%	11%	5%	7%	3%	9%	4%	0%	8%	0%	0%	1%	2%	0%	1%	1%
"Action" >Guideline	2%	0%	0%	1%	0%	0%	0%	0%	1%	0%	0%	0%	0%	1%	0%	0%
Percentage of valid data	15%	20%	22%	22%	16%	25%	33%	32%	31%	32%	29%	32%	26%	32%	30%	28%
Annual average (µg m^{-3})	18	16	15	16	13	17	14	11	16	12	12	10	15	13	13	13
Measured PM_{10} concentrations above 50 µg m^{-3}	1	-	-	1	-	-			1						0	0
Extrapolated PM_{10} concentrations above 50 µg m^{-3}									3						0	0
99.7 %ile concentration (µg m^{-3})	53	46	40	67	46	47	42	27	48	31	32	34	38	28	38	33
Annual maximum (µg m^{-3})	56	48	41	75	49	49	45	28	51	32	32	35	40	28	42	33
Number of records	54	74	81	81	60	93	121	116	113	118	106	116	97	115	111	101

3.2. PM_{10} concentrations at Redwoodtown – Bowling Club

During 2015 four exceedences of 50 µg m^{-3} were recorded at the Redwoodtown air quality monitoring site (Figure 3.7). The NES allows one exceedence of 50 µg m^{-3} per year before a breach occurs. Because the 2014 exceedence of 50 µg/m^3 occurred on 20 July and the first exceedance for 2015 on 5 May, the 5 May value constitutes a breach of the NES[1]. Thus the NES was breached on four occasions at Redwoodtown during 2015. 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_{10} concentration for 2015 was 79 µg/m^3 and occurred on 30 June. The second highest PM_{10} concentration was 70 µg/m^3 and as recorded on 21 July. Previous recent maximum concentrations at Redwoodtown have ranged from 59 - 82 µg m^{-3}.

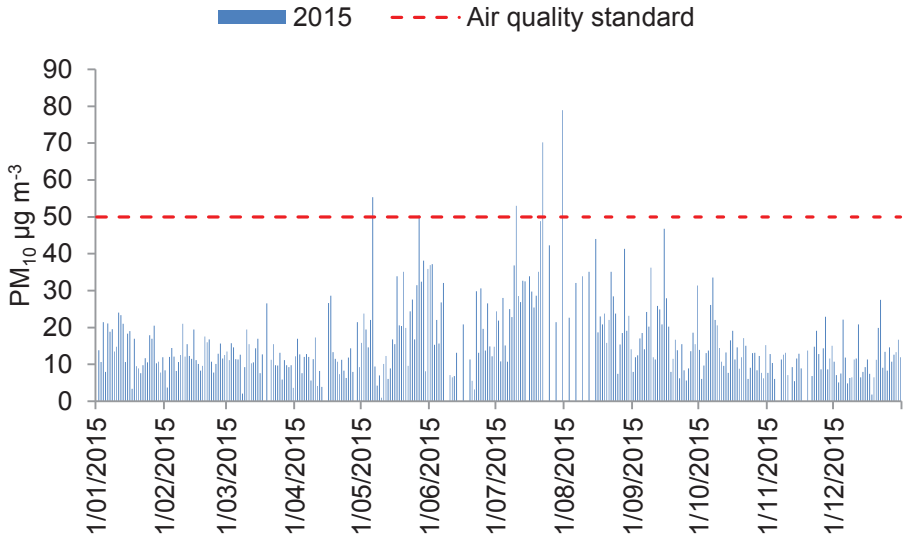

Figure 3.7: 24-hour average PM_{10} concentrations measured at the Redwoodtown – Bowling Club site during 2015.

Daily PM_{10} concentrations measured from 2006 to 2015 relative to the MfE air quality indicator categories (shown in Table 1.3) are illustrated in Figure 3.8. Similarly, monthly variations in the distribution of PM_{10} concentrations for 2015 are shown in Figure 3.9. No data are reported for the months of July and August owing to insufficient data collected during these months to be able to report a representative distribution. It is likely, however, that data would be similar in distribution 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 2015 to previous years along with the maximum concentration and the second highest concentration. It is 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.

[1] Because it occurred within a year of the 20 July 2014 exceedance.

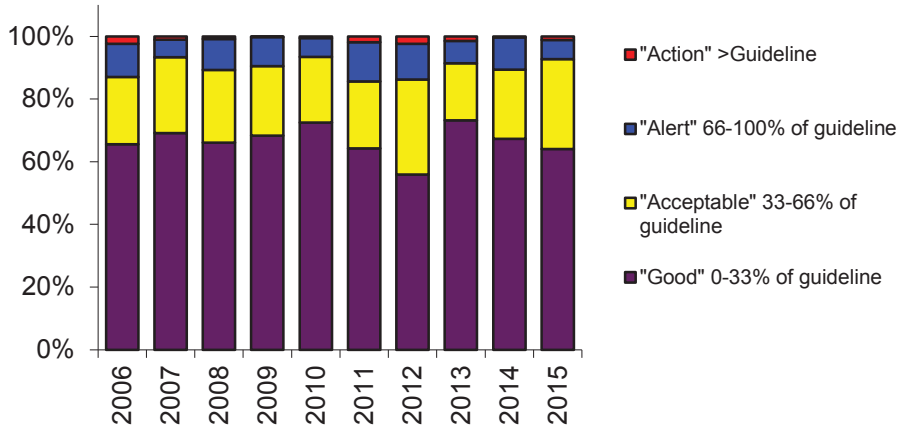

Figure 3.8: Comparison of PM_{10} concentrations measured at Redwoodtown – Bowling Club site during 2006 to 2015 to air quality indicator categories.

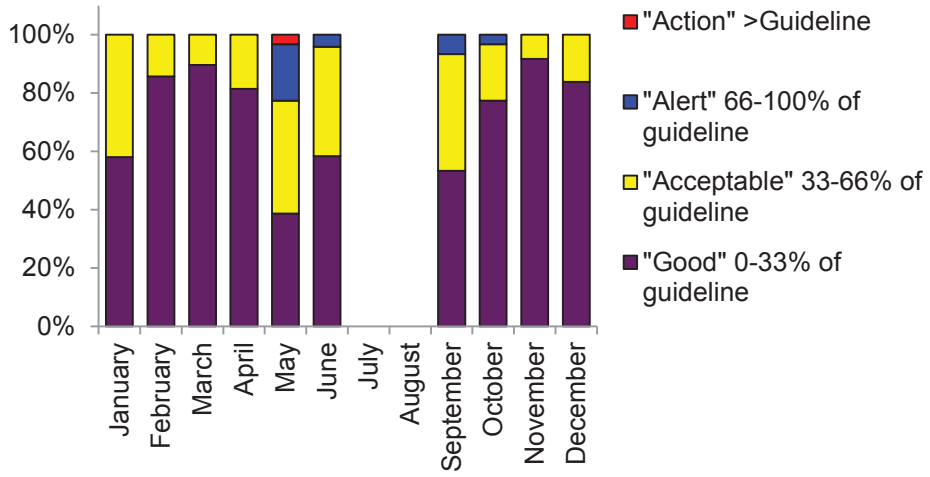

Figure 3.9: Comparison of daily PM_{10} concentrations each month during 2015 to air quality indicator categories.

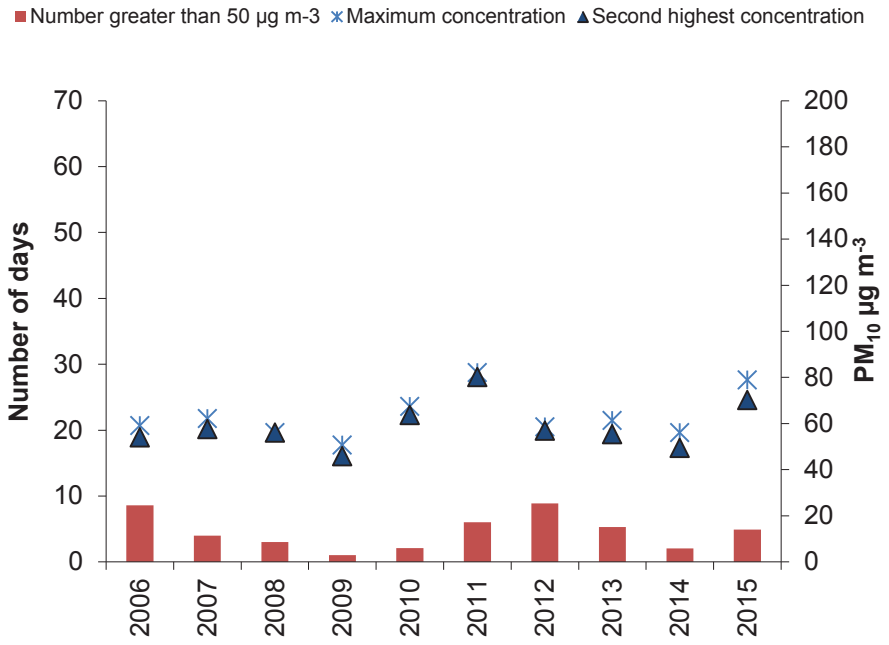

Figure 3.10: Number of days when 50 µg m^{-3} was exceeded, the maximum concentration and the second highest concentration from 2006 to 2015.

The annual average PM_{10} concentration for 2015 was 17 µg m^{-3}. This is within the normal range for this monitoring site (14-19 µg/m^3). The Ministry for the Environment specifies an annual average guideline for PM_{10} of 20 µg m^{-3}. The NES does not currently include an annual average concentration for PM_{10}.

Summary statistics for PM_{10} monitoring results from the Redwoodtown Bowling Club site from 2002 to 2015 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_{10} concentrations measured at Redwoodtown – Bowling Club site from 2002-2015

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Monitoring method	Hi-vol	Hi-vol	Hi-vol	Hi-vol	BAM	BAM	BAM	BAM	BAM	BAM	BAM/Hi-vol	BAM	BAM/Hi-vol	BAM/Hi-vol
"Good" 0-33% of guideline	18%	22%	46%	63%	66%	69%	66%	68%	72%	64%	56%	72%	67%	64%
"Acceptable" 33-66% of guideline	62%	30%	22%	17%	21%	24%	23%	22%	21%	21%	31%	18%	22%	29%
"Alert" 66-100% of guideline	10%	26%	20%	17%	10%	6%	10%	9%	6%	13%	11%	7%	10%	6%
"Action" >Guideline	10%	22%	12%	3%	3%	1%	1%	0%	1%	2%	2%	1%	0%	1%
Percentage of valid data	14%	7%	22%	32%	68%	99%	99%	98%	96%	87%	91%	98%	70%	91%
Annual average (µg m^{-3})	-	-	22	18	17	15	17	15	14	16	19	14	16	17
Measured PM_{10} concentrations above 50 µg m^{-3}	5	6	10	3	6	5	3	1	2	6	8	5	1	4
Extrapolated PM_{10} concentrations above 50 µg m^{-3}	16	34	31	9	10	4	3	1	2	6	9	5	2	5
Second highest PM_{10} concentration (µg m^{-3})					54	58	56	46	64	80	57	55	51	70
Annual maximum (µg m^{-3})	58	60	81	58	59	62	56	46	67	82	59	61	56	79
Number of records	50	27	82	115	247	360	363	357	352	319	331	351	254	331

3.3. PM_{10} and meteorology in Blenheim

Figure 3.11 shows variations in meteorological conditions on the 5 May, and 9, 21 and 30 July when the 24-hour average PM_{10} concentrations exceeded 50 µg m^{-3} at the Redwoodtown air quality monitoring site. No wind speed data are available for the pollution episodes. The high pollution episode on 5 May does not follow the typical diurnal variations associated with elevated PM_{10} concentrations in Blenheim. In particular elevated concentrations do not return to baseline following a morning peak but remain slightly elevated. Wind direction during this episode is easterly and temperatures are around 17 degrees. It is possible that other sources such as outdoor burning may be contributing to this pollution event. Pollution events on the 9 and 21 July are more typical although the evening peak is not as high as would be expected relative to the morning peak on 9 July. No hourly PM_{10} data were available for the 30 July when the highest PM_{10} concentration of 79 µg/m^3 was recorded.

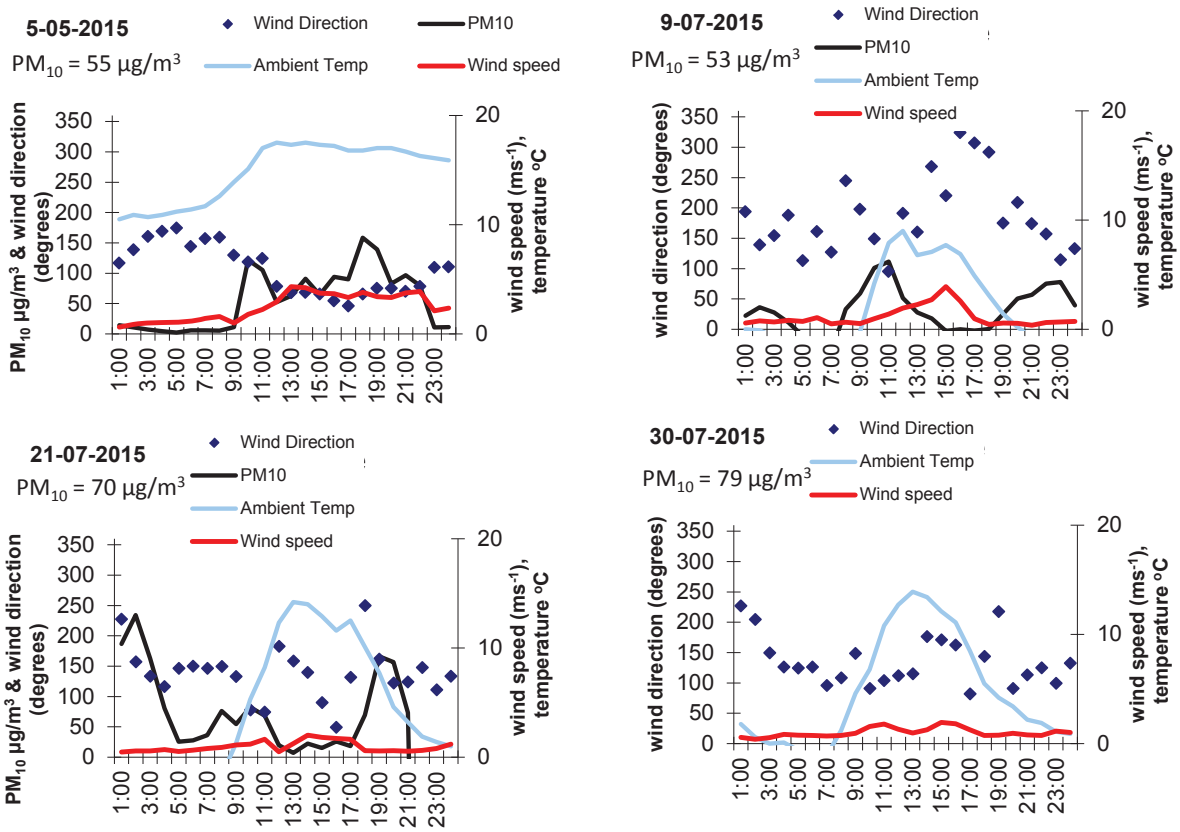

Figure 3.11: Hourly average PM_{10}, wind direction and temperature on 5 May and 9, 21 and 30 July 2015 when PM_{10} concentrations exceeded 50 µg m^{-3} (24 hour average) at Redwoodtown.

4. Trends in PM_{10} concentrations in Blenheim

To quantify the impact of meteorological conditions and therefore further assess the likelihood of changes in PM_{10} 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_{10} in excess of the NES and to provide a tool for comparing year to year PM_{10} 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_{10} concentrations updated with the 2015 PM_{10} data adjusted for the impact of meteorological conditions. Results suggest an increase in the 95th percentile concentrations since 2012 with 2015 results more similar to 2010 and 2011. Overall results suggest the top 10 percentile concentrations of PM_{10} in Blenheim have not decreased since 2006, although mean and median concentrations may have reduced slightly. 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_{10} illustrated in Figure 4.1 from 2010 – 2015.

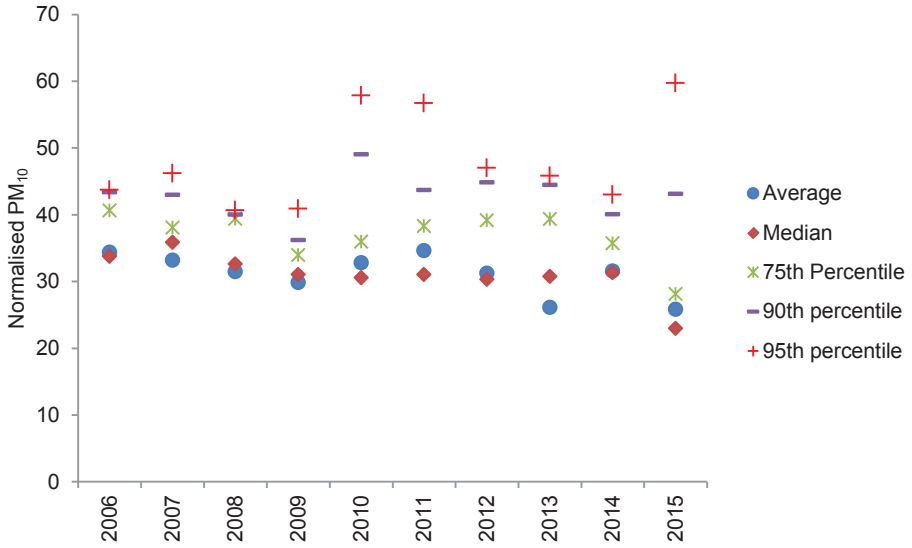

Figure 4.1: Trends in PM_{10} concentrations after adjusting for meteorological conditions

5. Summary

There were some issues with the BAM PM_{10} monitoring at Redwoodtown during 2015. 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 where available. Where high volume sampler data were not available BAM data were used. Four exceedences of 50 µg m^{-3} were recorded, three of which were from the high volume sampler. All four exceedences are considered breaches because of the timing of the 2014 exceedence. The magnitude of the worst and second worst PM_{10} concentrations was the highest since 2011 when concentrations of 82 and 80 µg/m^3 were recorded.

Concentrations of PM_{10} were also measured at the historical Middle Renwick Road monitoring site. In 2015 there were no exceedences of 50 µg m^{-3} at this site. The maximum daily PM_{10} concentration at this site was 32 µg/m^3. An evaluation of annual average concentrations measured at this site since 2000 has previously indicated a downward trend in concentrations. 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_{10} was reviewed by the Ministry for the Environment in 2011. A new date of September 2016 was given for compliance with 50 µg m^{-3} (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_{10} 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_{10} is met. This would need to implemented and effective before winter 2017 for Blenheim to meet the timeframe specified in the NES.

References

Ministry for Environment. (2002). Ambient Air Quality Guidelines – 2002. Ministry for Environment.

Ministry for Environment. (2004). Resource Management (National Environmental Standards for Air Quality) Regulations 2004. New Zealand Government. Retrieved from http://www.legislation.govt.nz/regulation/public/2004/0309/latest/DLM286835.html?search=ts_regulation_air+quality_resel&p=1&sr=1

Ministry for the Environment. (2009). *Good practice guide for air quality monitoring and data management 2009*. Wellington, N.Z.: Ministry for the Environment. Retrieved from http://www.mfe.govt.nz/publications/air/good-practice-guide-air-quality-2009/good-practice-guide-for-air-quality.pdf

Wilton, E. (2005). Blenheim Air Emission Inventory 2005. Marlborough District Council Report.

Wilton, E. (2008). Annual air quality monitoring report 2007. Marlborough District Council Report.

Wilton, E. (2012a). Assessing trends in PM10 concentrations in Blenheim - 2011. Marlborough District Council Report.

Wilton, E. (2012b). Blenheim Emission Inventory - 2012. Marlborough District Council Report.

Wilton, E., & Baynes, M. (2009). Annaul air quality monitoring report for Blenheim and Picton - 2008. Marlborough District Council Report.