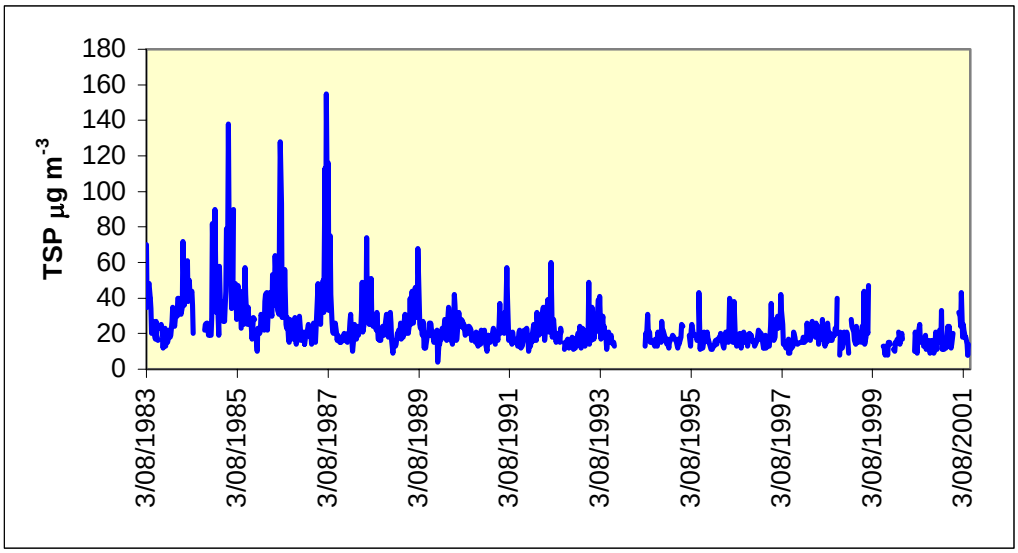
4 Waikato Region

Air quality monitoring for particles in the Hamilton region includes total suspended particulate monitoring since 1983 and since 1998, and PM_{10} monitoring at the Peachgrove Road site. A permanent PM_{10} air quality monitoring site was established in Tokoroa in 2001 following an initial investigation during 1999. Shorter-term PM_{10} monitoring programmes have been undertaken in Taupo in 2001 and 2002 and in Te Kuiti in 1998. Figure 4.1 shows a decline in TSP concentrations measured in Hamilton since 1983. The extent to which this reflects reductions in the PM_{10} component is uncertain.

Figure 4.1: Seven-day average concentrations of TSP measured in Hamilton since 1983



4.1 Monitoring sites and methods

Details of the four ambient air quality PM_{10} monitoring sites in the Waikato region are shown in Table 4.1. In addition to these sites, some PM_{10} monitoring has been carried out by industry. These include continuous PM_{10} monitoring using an Anderson FH62 BAM in Huntly and gravimetric sampling using a high-volume sampler south of Tokoroa.

Table 4.1: Ambient air quality monitoring sites for PM_{10} in the Waikato region

Area	Location	Duration	Site classification	Monitoring method
Hamilton	Peachgrove Road	From June 1998	Residential peak	TEOM
Tokoroa (a)	South Waikato District Council	1999	Residential neighbourhood	MetOne GT640
Tokoroa (b)	Billah Street Reservoir	From January 2001	Residential neighbourhood	Met One 1020 BAM
Te Kuiti	Te Kuiti City Council Offices	April–November 1998	Residential neighbourhood	TEOM
Taupo	Gillies Street Reserve	2001 and 2002	Residential neighbourhood	Gravimetric partisol sampler

4.2 PM_{10} concentrations

Table 4.2 summarises the PM_{10} concentrations measured at each monitoring site in Waikato. The table shows that exceedences of the 24-hour average guideline value occurred at Hamilton, Tokoroa and Taupo in 2001. Extrapolations of this measured data show that if monitoring was undertaken every day during the winter months, more exceedences of the guideline value may have occurred. This table also shows that the annual average guideline value for PM_{10} was exceeded in Tokoroa. Other areas are within the alert (66–100% of the guideline) category for the annual average PM_{10} concentrations although it is possible given the low sampling regime in Taupo, that the annual guideline value was exceeded in this area also. Data for Tokoroa for 1999 are excluded because of uncertainties regarding the accuracy of the optical monitoring method.

Figure 4.2 shows that in the Waikato region, PM_{10} concentrations are within the good and acceptable categories for most of the year. For a few days each year the 24-hour average concentrations approach (alert) or go above (action) the guideline value. This happens mostly in winter when wind speeds are low and temperature inversions restrict the dispersion of PM_{10}.

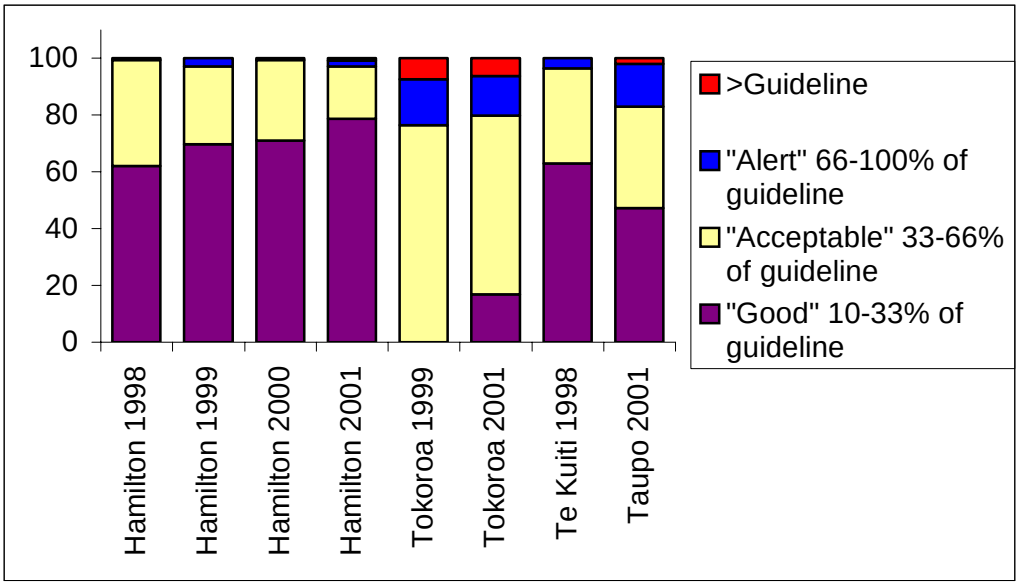
Table 4.2: Summary of PM_{10} concentrations at ambient monitoring sites in the Waikato region

Area	24-hour maximum	24-hour 99.5 percentile	Annual average	% days monitored	Days > 50 μgm^{-3}	% of winter days guideline was exceeded
Hamilton – 1998	35	33	15	47%	0	0
Hamilton – 1999	44	42	16	99%	0	0
Hamilton – 2000	43	33	15	91%	0	0
Hamilton – 2001	**67**	53	14	70%	2 measured 3 equivalent*	3%
Te Kuiti – 1998	42	42	16	53%	0	0
Tokoroa – 2001	**75**	66	**26**	47%	13 measured 24 equivalent*	20%
Taupo – 2001	**57**	54	18	15%	1 measured 2 equivalent*	2%

Note: Guideline value exceedences are highlighted in bold.

* This is an estimate of the number of days PM_{10} concentrations may have exceeded the guideline value if monitoring had been carried out on all days during winter (May to August inclusive). It is extrapolated from the number of measured exceedences and the number of days when monitoring did occur.

Figure 4.2: Percentage of measured 24-hour average PM_{10} concentrations within air quality categories in the Waikato region



5 Bay of Plenty Region

Air quality monitoring for PM_{10} in the Bay of Plenty region commenced in December 1997 with the establishment of monitoring sites in Rotorua, Tauranga, Whakatane and Pongakawa.

5.1 Monitoring sites and methods

Details of the six ambient air quality PM_{10} monitoring sites within the Bay of Plenty region are shown in Table 5.1. These include two traffic-monitoring sites in both Rotorua and Tauranga and one background PM_{10} monitoring site in Pongakawa.

Table 5.1: Ambient air quality monitoring sites for PM_{10} in the Bay of Plenty

Area	Location	Duration	Site classification	Monitoring method
Rotorua	Pererika Street	From December 1997	Residential neighbourhood	TEOM
Rotorua	Fenton Street	December 1998 – February 1999	Traffic peak	TEOM
Tauranga	Otumoetei Road	From December 1997	Residential neighbourhood	TEOM
Tauranga	Marsh Street	March 2000 – February 2001	Traffic peak	TEOM
Whakatane	Quay Street	From December 1997	Residential neighbourhood	Partisol
Pongakawa	Pongakawa Bush Road	From December 1997	Background – special (rural)	Partisol

5.2 PM_{10} concentrations

Figure 5.1 shows that concentrations of PM_{10} (24-hour average) in the Bay of Plenty are typically within the good or acceptable air quality categories with concentrations occasionally reaching the alert category in Rotorua and Whakatane. These towns have each recorded one exceedence of the 24-hour average guideline value, both during 1998 (Table 5.2). With the exception of Whakatane, Table 5.2 shows the annual average PM_{10} concentration in these Bay of Plenty towns ranges from 12 – 14 μgm^{-3}, falling within the acceptable and alert air quality categories. In Whakatane the annual average ranged from 13 to 19 μgm^{-3} indicating some potential for annual average guideline value exceedences in this area.

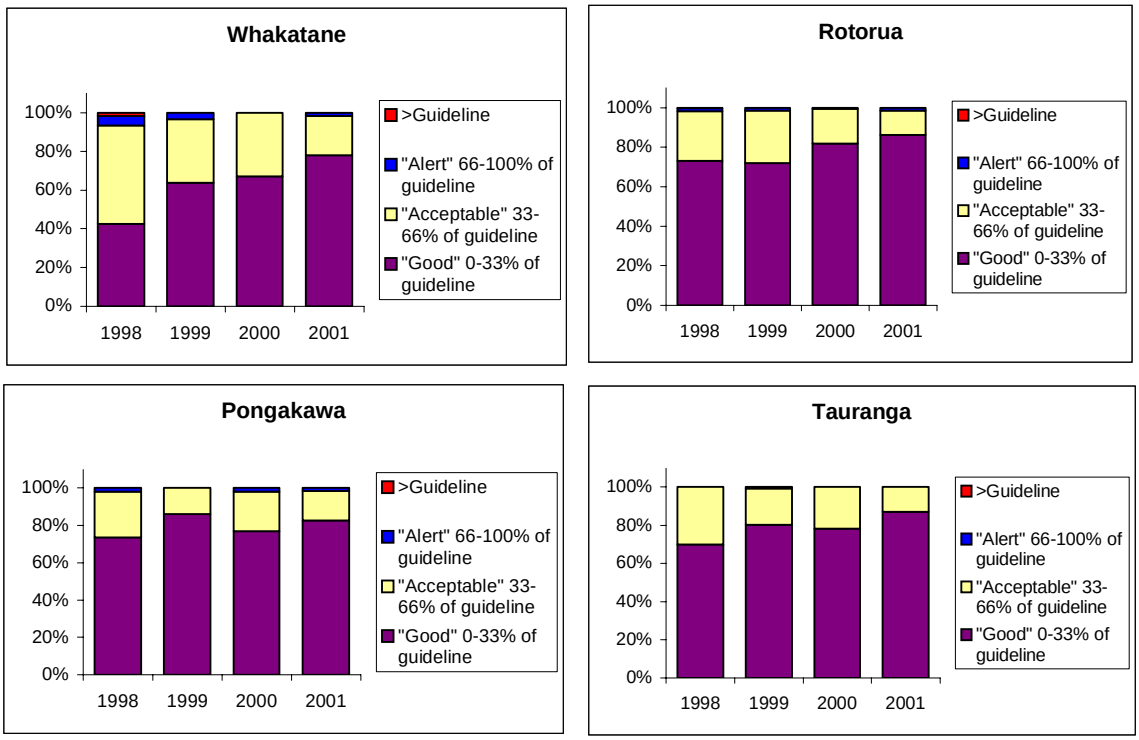
Table 5.2: Summary of PM_{10} concentrations at ambient monitoring sites (24-hour average)

Area	24-hour maximum	24-hour 99.5 percentile	Annual average	% days monitored	Days > 50 μgm^{-3}	% of winter days guideline was exceeded
Rotorua 1998	**52**	40	14	100%	1	0.8%
Rotorua 1999	43	35	14	99%	0	0
Rotorua 2000	36	32	12	98%	0	0
Rotorua 2001	38	37	12	98%	0	0
Tauranga 1998	32	29	14	100%	0	0
Tauranga 1999	34	31	13	100%	0	0
Tauranga 2000	29	26	13	97%	0	0
Tauranga 2001	28	23	12	89%	0	0
Whakatane 1998	**53**	48	19	17%	1 measured 6 equivalent*	5%
Whakatane 1999	38	37	16	17%	0	0
Whakatane 2000	31	31	14	17%	0	0
Whakatane 2001	45	41	13	16%	0	0
Pongakawa 1998	44	41	12	15%	0	0
Pongakawa 1999	28	26	11	16%	0	0
Pongakawa 2000	45	41	13	15%	0	0
Pongakawa 2001	49	42	11	16%	0	0

Note: Guideline value exceedences are highlighted in bold.

* This is an estimate of the number of days PM_{10} concentrations may have exceeded the guideline value if monitoring had been carried out on all days during winter (May to August inclusive). It is extrapolated from the number of measured exceedences and the number of days when monitoring did occur.

Figure 5.1: Percentage of measured 24-hour average PM_{10} concentrations within air quality categories in the Bay of Plenty region



6 Taranaki and Northland Regions

Air quality monitoring for PM_{10} in the Taranaki and Northland regions is limited to monitoring of PM_{10} in Whangarei and Kaitaia and some screening monitoring in New Plymouth. The Kaitaia monitoring site was located near State Highway One and was limited to three samples only. Because of the low sampling frequency, results are not reported. Further monitoring in Kaitaia was also carried out during 2002. The New Plymouth monitoring was carried out using the GRIMM optical sampling method. No results for the latter site have been reported because of the limited period of monitoring and uncertainties associated with the monitoring method.

6.1 Monitoring sites

Details of the ambient air quality PM_{10} monitoring sites within the Northland and Taranaki regions until December 2001 are shown in Table 6.1.

Table 6.1: Ambient air quality monitoring sites for PM_{10} in Taranaki and Northland

Area	Location	Duration	Site classification	Monitoring method
New Plymouth	New Plymouth Central	30 May 2000 – 1 May 2000	Residential neighbourhood	GRIMM (optical)
New Plymouth	New Plymouth Central	20 February 2000 – 20 March 2000	Residential neighbourhood	GRIMM (optical)
New Plymouth	New Plymouth Central	13 November 2000 – 30 December 2000	Residential neighbourhood	GRIMM (optical)
Whangarei	Robert St Boat Garage	October 2000 – August 2001	Residential neighbourhood	High volume
Kaitaia	State Highway One	November–December 2001 – three samples only	Traffic peak	High volume

6.2 PM_{10} concentrations

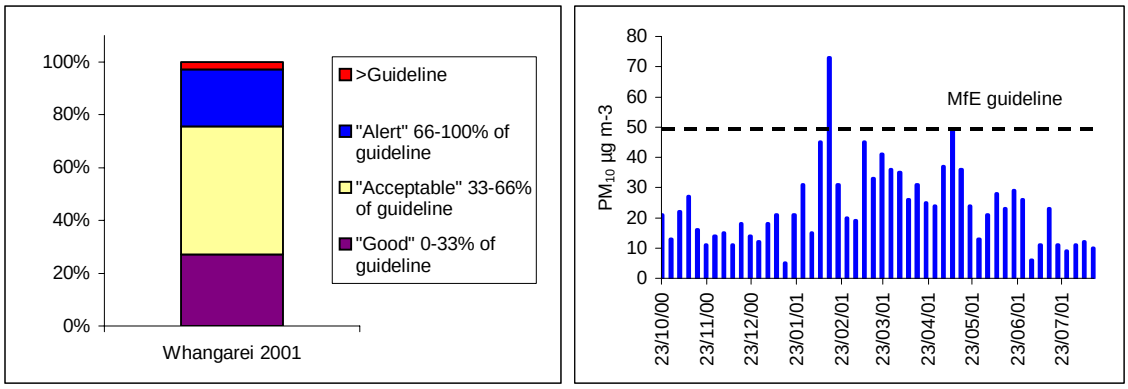
Air quality monitoring in Whangarei (Northland) for 2000 and 2001 shows one exceedence of the 24-hour average ambient air quality guideline value for PM_{10} on the 14 February 2001 (Figure 6.1 and Table 6.2). This exceedence is unlike those at most other locations in New Zealand where high PM_{10} concentrations typically occur during the winter months. Other elevated concentrations also occur during the summer months and may be attributed to a local industrial source of PM_{10}. Elevated PM_{10} concentrations during the winter months are also apparent with a near guideline value exceedence of 49 μgm^{-3} on 9 May 2001.

Table 6.2: Summary of PM_{10} concentrations at ambient monitoring site in Whangarei, Northland

Area	Maximum	99.5 percentile	Annual average	% of days monitored	Days > 50 μgm^{-3}	% of winter days guideline was exceeded
Whangarei 2001	**73**	69	n/a	10%	1 measured	0%

Note: Guideline value exceedences are highlighted in bold.

Figure 6.1: The percentage of measured 24-hour average PM_{10} concentrations for Whangarei within air quality categories (left) and measured concentrations (right)



7 Gisborne and Hawkes Bay Regions

Air quality monitoring for PM_{10} in the Gisborne and Hawkes Bay regions is limited to the towns of Gisborne and Napier. In each of these areas data are available for one ambient air quality monitoring site and one background air quality monitoring site.

7.1 Monitoring sites

Details of the four ambient air quality PM_{10} monitoring sites within the Gisborne and Hawkes Bay regions are shown in Table 7.1. These include one background PM_{10} monitoring site in Gisborne and one regional monitoring site in Napier.

Table 7.1: Ambient air quality monitoring sites for PM_{10} in Gisborne and Hawkes Bay

Area	Location	Duration	Site classification	Monitoring method
Gisborne	Oates Road	From April 1993 to December 2000	Residential neighbourhood	High-volume
Gisborne	McDonalds Road	From November 1993	Background – special (rural)	High-volume
Napier	Nelson Park	From July 2001	Residential neighbourhood	High-volume
Napier	Guppy Road	February 1996 to June 1999	Residential Regional	High-volume

7.2 PM_{10} concentrations

Concentrations of PM_{10} measured in Napier suggest that 24-hour average PM_{10} concentrations may exceed the air quality guideline values on around 13% of the winter days (Table 7.2). In Gisborne one exceedence of the guideline value was measured on 28 October 1998 and coincided with northwest winds and elevated wind speeds of around 8 ms^{-1} on average. Dusts and/ or sea spray are potential sources under these types of conditions. Extrapolations of this measured data show that if monitoring was undertaken every day during the winter months, it is likely that more exceedences of the guideline value may have occurred. For Napier, this extrapolation was based on the proportion of the amount of data available for the period from May to August inclusive, but for Gisborne because the exceedence was not seasonal, the extrapolation was based on the data available for the whole year.

Figures 7.1 and 7.2 show the percentage of measured 24-hour average PM_{10} concentrations within the air categories at the sites in Gisborne and Napier. These graphs show that the majority of concentrations were within the good air quality categories for all sites.

Table 7.2: Summary of PM_{10} concentrations at ambient monitoring sites in Gisborne and Napier

Area	24-hour maximum	24-hour 99.5 percentile	Annual average	% of days monitored	Days > 50 μgm^{-3}	% of winter days guideline was exceeded
Gisborne (Oates Road) 1993	35	35	n/a	11%	0	0
Gisborne (Oates Road) 1994	24	24	9	15%	0	0
Gisborne (Oates Road) 1995	20	19	8	16%	0	0
Gisborne (Oates Road) 1996	25	25	9	15%	0	0
Gisborne (Oates Road) 1997	26	25	9	15%	0	0
Gisborne (Oates Road) 1998	**70**	61	12	15%	1 measured 7 equivalent*	Exceedence occurred during summer
Gisborne (Oates Road) 2000	16	16	n/a	10	0	0
Napier (Guppy Road) 1998	24	23	n/a	10%	0	0
Napier (Guppy Road) 1999	17	17	n/a	6%	0	0
Napier (Nelson Park) 2000	**64**	64	n/a	7%	2 measured 15 equivalent*	13%
Napier (Nelson Park) 2001	33	33	n/a	7%	0	0

Note: Guideline value exceedences are highlighted in bold.

* This is an estimate of the number of days PM_{10} concentrations may have exceeded the guideline value if monitoring had been carried out on all days during winter (May to August inclusive). It is extrapolated from the number of measured exceedences and the number of days when monitoring did occur.

Figure 7.1: The percentage of measured 24-hour average PM_{10} concentrations within air quality categories in Gisborne

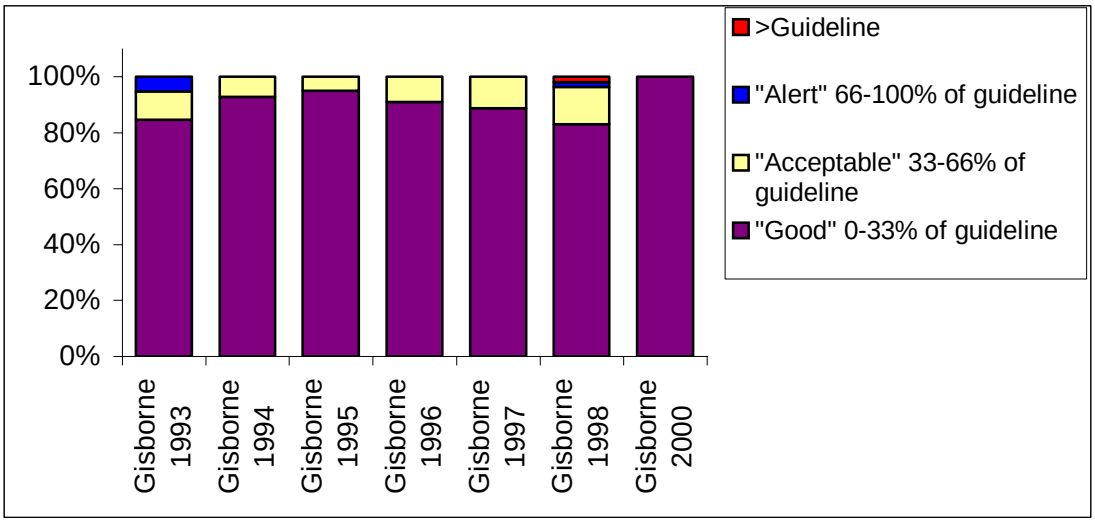
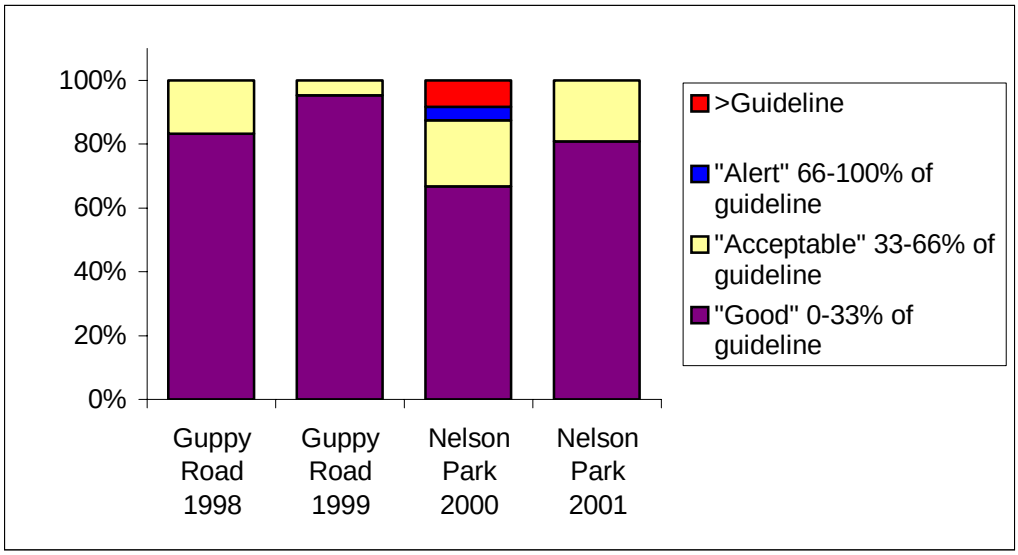


Figure 7.2: The percentage of measured 24-hour average PM_{10} concentrations within air quality categories in Napier



8 Wellington Region

Air quality monitoring for PM_{10} has been carried out in the Wellington region since at least 1998. The main monitoring sites are located outside Wellington City, in areas such as Lower and Upper Hutt, because PM_{10} concentrations in these areas are elevated during the winter months.

8.1 Monitoring sites and methods

Details of the five ambient air quality PM_{10} monitoring sites within the Wellington region are shown in Table 8.1. These are all residential neighbourhood air quality monitoring sites using either the TEOM operating at a temperature setting of 40°C or high-volume sampling.

Table 8.1: Ambient air quality monitoring site for PM_{10} in the Wellington region

Area	Location	Duration	Site classification	Monitoring method
Wellington	Drummond Road, Newtown	March to October 1998	Residential neighbourhood	High-volume sampler
Rural Otaki		October 1998 to February 2000	Background rural	High-volume sampler
Lower Hutt	Birch Lane	From April to June 2001	Residential neighbourhood	TEOM
Lower Hutt	Huia Street	May 1998 to June 1999	Residential neighbourhood	TEOM
Upper Hutt	Trentham Fire Station	From May 2000	Residential neighbourhood	TEOM
Wainuiomata	Moohan Street	From September 2000	Residential neighbourhood	High-volume sampler
Masterton	Memorial Park	1999	Residential neighbourhood	TEOM

8.2 PM_{10} concentrations

The main method of monitoring for PM_{10} in the Wellington region is continuous monitoring using the TEOM. In Wellington, a moving 24-hour average is calculated from these data and results are reported based on the moving average. As indicated previously, this method is consistent with the *Good Practice Guide for Air Quality Monitoring and Data Management* (MfE, 2000), although tends to measure concentrations less than the gravimetric method recommended in the air quality guidelines. Table 8.2 shows a summary of the PM_{10} concentrations based on moving PM_{10} averages.

While no data are available for Wellington on the relationship between the TEOM monitoring method and the high volume sampling method specified in the Guidelines document (MfE and MoH, 2002), data for other areas indicates the TEOM underestimates PM_{10} concentrations relative to the high volume sampler. For example, studies in Christchurch and Auckland show differences of around 20–30%. Consequently the PM_{10} data reported for Lower and Upper Hutt are likely to underestimate PM_{10} concentrations relative to the method specified in the guidelines (MfE and MoH, 2002).

Unlike PM_{10} concentrations in most of New Zealand, the exceedence of the guideline value at the Otaki air quality monitoring site occurred during the summer months. This site is located near the sea and it is likely that the cause of elevated concentrations during the summer months is a combination of sea spray and wind blown dusts. Further work on the filter samples is being carried out by Greater Wellington to characterise the source of elevated PM_{10} concentrations in rural Otaki.

As well as showing the number of 24-hour average guideline value exceedences, Table 8.2 also shows extrapolations of the data for Rural Otaki (1999), Wainuiomata (2001) and Masterton (1999). For Wainuiomata and Masterton, this shows that if monitoring was undertaken every day during May to August inclusive, and for Otaki during the summer months, it is likely that more exceedences of the guideline value may have occurred.

Table 8.2: Summary of PM_{10} concentrations at ambient monitoring sites in the Wellington region

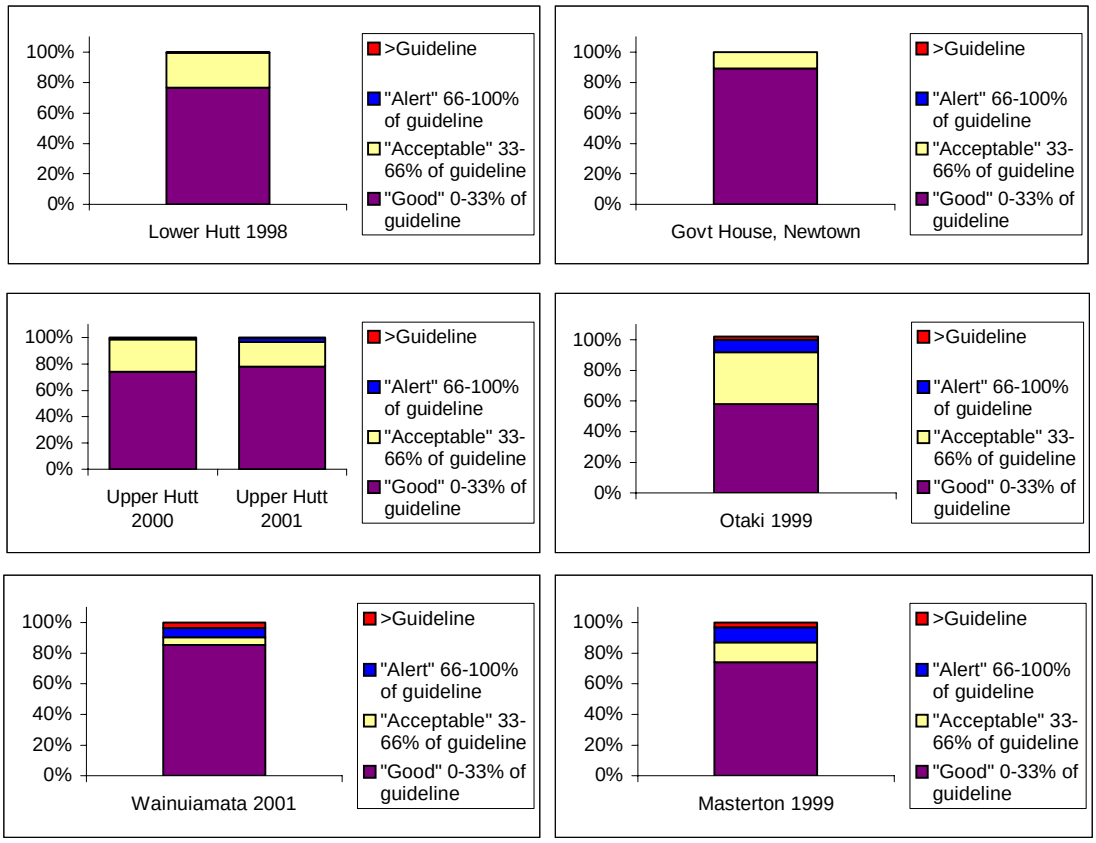
Area	24-hour maximum	24-hour 99.5 percentile	Annual average	% days monitored	Days > 50 μgm^{-3}	% of winter days guideline was exceeded
Newtown, Wellington 1998	18	18	n/a	10%	0	
Rural Otaki 1999	**50**	48	n/a	14%	1 measured 9 equivalent[2]	
Lower Hutt Huia Street 1998	38	33	13	65%	0	
Lower Hutt Huia Street 1999	20	19	11	40%	0	
Lower Hutt Birch Lane 2001	30	26	n/a[1]	17%	0	
Upper Hutt 2000	**52**	49	14	57%	2 measured	2%
Upper Hutt 2001	**61**	57	14	56%	4 measured	3%
Wainuiomata 2001	**57**	57	13	22%	3 measured 10 equivalent[2]	10%
Masterton 1999	**87**	74	16	87%	8 measured 11 equivalent[2]	9%

Note: Guideline value exceedences are highlighted in bold.

1 Although more than 15% of data were available, all data were for winter months.

2 This is an estimate of the number of days PM_{10} concentrations may have exceeded the guideline value if monitoring had been carried out on all days during winter (May to August inclusive). It is extrapolated from the number of measured exceedences and the number of days when monitoring did occur.

Figure 8.1: Percentage of measured 24-hour average PM_{10} concentrations within air quality categories in the Wellington region



9 Nelson, Tasman and Marlborough Districts

Historically, air quality monitoring in Nelson and Tasman was based on measurements of black smoke (BS) and dates back to around 1983. The monitoring programme was initially set up by the then Department of Health, which was in part responsible for air quality. Monitoring was carried out at three locations in Nelson: the inner city, Vanguard Street and Quarantine Road during the months May to August inclusive from 1983, and at one location in Richmond (Tasman).

The 98th percentile smoke concentrations (seventh highest reading) in Nelson per year were typically within 50–120 μgm^{-3} for the Vanguard Street site, between 40 and 80 μgm^{-3} for the Quarantine Road site and less than 60 μgm^{-3} for the inner city site.

The first PM_{10} monitoring programme for Nelson commenced in May 2000 using a high volume gravimetric sampler which was situated at the Nelson fire station. A similar sampler was located in Tasman in the urban area of Richmond. Further PM_{10} monitoring was carried out in Nelson in 2001 using a gravimetric partisol sampler located at a monitoring site at Swift Suzuki.

The air quality monitoring programme in Marlborough, which included PM_{10} monitoring, commenced during 2000. This initially involved monitoring using a gravimetric high-volume sampler in Picton and Blenheim.

9.1 Monitoring sites and methods

Details of the seven ambient air quality PM_{10} monitoring sites within the Nelson, Tasman and Marlborough Districts are shown in Table 9.1. These are all residential neighbourhood monitoring sites and use predominantly gravimetric high and low volume sampling methods.

Table 9.1: Ambient air quality monitoring site for PM_{10} in Nelson, Tasman and Marlborough

Area	Location	Duration	Site classification	Monitoring method
Nelson	Fire Station	May – September 2000	Residential neighbourhood	High-volume sampler
Nelson	117 St Vincent Street	From March 2001	Residential neighbourhood	Partisol
Nelson	Vincent Street	April to September 2001	Residential neighbourhood	High-volume
Nelson	Waimea Road	March to December 2001	Residential peak	TEOM
Tasman	Richmond	May–September 2000	Residential neighbourhood	High-volume sampler
Blenheim	106 Middle Renwick Road	From February 2000	Residential neighbourhood	High-volume sampler
Picton	High Street Fire Station	March to September 2000	Residential neighbourhood	High-volume sampler

9.2 PM_{10} concentrations

Concentrations of PM_{10} have exceeded the 24-hour ambient air quality guideline value in Nelson, Richmond and Blenheim (Table 9.2 and Figure 9.1). Of these areas, the highest concentrations and greatest number of guideline value exceedences have occurred in Nelson. Only one guideline value exceedence has been measured in Blenheim. Extrapolations of this measured data show that if monitoring was undertaken every day during the winter months, it is likely that more exceedences of the guideline value may have occurred at these monitoring sites.

Monitoring data for Nelson for 2001 also indicates that PM_{10} concentrations exceeded the annual average PM_{10} guideline value, with an annual average value of 36 μgm^{-3} being measured. This was estimated based on combining a summer and winter average to remove seasonal bias associated with the commencement of monitoring in March 2001.

Table 9.2: Summary of PM_{10} concentrations at ambient monitoring sites in Nelson, Tasman and Marlborough

Area	24-hour maximum	24-hour 99.5 percentile	Annual average	% days monitored	Days > 50 μgm^{-3}	% of winter days guideline was exceeded
Nelson Fire Station 2000	**142**	139	n/a[1]	15%	27 measured 66 equivalent[2]	54%
Nelson Swift Suzuki 2001	**165**	156	**36**	70%	81	66%
Richmond 2000	**111**	111	n/a[1]	15%	23 measured 60 equivalent[2]	49%
Nelson Vincent Street Kindergarten 2001	**94**	91	n/a	14%	10 measured 35 equivalent[2]	29%
Nelson Waimea Road 2001	**81**	65	**26**	59%	12 measured	10%
Blenheim 2000	**56**	51	19	15%	1 measured 6 equivalent[2]	5%
Blenheim 2001	38	38	17	20%	0	0
Picton 2000	27	27	n/a	10%	0	0

Note: Guideline value exceedences are highlighted in bold.

1 Although more than 15% of data were available, all data were for winter months.

2 This is an estimate of the number of days PM_{10} concentrations may have exceeded the guideline value if monitoring had been carried out on all days during winter (May to August inclusive). It is extrapolated from the number of measured exceedences and the number of days when monitoring did occur.

Figure 9.1 shows the percentage of measured PM_{10} concentrations in Nelson, Richmond, Blenheim and Picton within the air quality categories. This shows a large percentage of the concentrations fall within the alert and action categories for the Nelson and Richmond sites. For the sites in Blenheim and Picton the majority of concentrations are within the good and acceptable categories. Although concentrations in Nelson and Richmond during 2000 appear worse than during 2001, the former monitoring periods included primarily the winter months (i.e. from May to September), whereas monitoring during 2001 was for the period March to December.

Figure 9.1: Percentage of measured 24-hour average PM_{10} concentrations within air quality categories in Nelson, Tasman and Marlborough