

Determining PM₁₀ compliance timeframes for Nelson's A and B airsheds

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Executive summary

The National Environmental Standards (NES) for air quality were amended in 2011 to, among other things, change the timeframes for compliance with the PM₁₀ standard.

Regulation 16B of the amended regulations introduced the new timeframes for compliance, with the PM₁₀ standard depending on the number of exceedances an airshed experienced in the period leading up to 1 September 2011.

Nelson City Council began monitoring air pollution in 1986 and currently has three airsheds gazetted under the NES: A, B and C. Airshed C does not breach the NES for PM₁₀.

Nelson City Council (NCC) commissioned NIWA to analyse the air quality monitoring data from airsheds A and B to determine the number of exceedances that have been experienced in those two airsheds.

The aim of this report is to present the outcomes from the analysis of data from airsheds A and B and to conclude which new NES compliance timeframe NCC must meet to fulfil its air quality management responsibilities.

The analysis of air quality monitoring data undertaken for this report shows that airsheds A and B have meaningful PM₁₀ data for five and four years respectively over the period 2006 to 2011. The PM₁₀ data shows that both airshed A and B have a history of multiple NES PM₁₀ exceedances for each of the 12 month periods analysed. The average number of exceedances experienced in airsheds A and B is 21.4 and 7.5 per year respectively.

Therefore under NES Regulation 16B(3) both Airsheds qualify for an extended timeframe to fully comply with the PM₁₀ standard. The number of historical exceedances within these two airshed determine that:

- Airshed A is subject to a 'dual target' under Regulation 16B(3). By 1 September 2016 not more than three exceedances over a 12 month period must be achieved, and by 1 September 2020 onwards, a maximum of only one exceedance over a 12-month period.
- Airshed B is subject to a 'single target under Regulation 16B(3). By 1 September 2016 onwards not more than 1 exceedance in a 12-month period must be achieved.

1 Introduction

1.1 Background

On a national level, the management of air quality in New Zealand is governed by the Resource Management (National Standards for Air Quality) Regulations (2004). The NES sets out ambient air quality standards for a number of contaminants including particulate matter (PM₁₀).

Regulation 13 and Schedule 1 of the NES set the standard for PM₁₀ at not more than one exceedance of 50 µg-m⁻³ (24-hour mean) in a 12-month period.

The NES was amended in 2011 to, among other things, change the timeframes for compliance with the PM₁₀ standard, and to provide a process to apply to the Minister for the Environment to have an exceedance of the standard excluded from the record if it were caused by “exceptional circumstances”.

Regulation 16B of the amended regulations introduced the new timeframes for compliance with the PM₁₀ standard depending on the number of exceedances an airshed had in the period leading up to 1 September 2011. In order to be able to assess the new timeframes, an airshed must have at least one 12 month period of “meaningful” PM₁₀ monitoring data in the previous five years. “Meaningful” data is defined in regulation 16C, described in section 4.6.1 of the MfE User’s Guide to the revised Standards (MfE, 2011) and covered briefly in section 2.3 of this report.

The timeframe by which an airshed must fully or partially attain the Standard depends upon the average number of historical exceedances recorded there, as set out in Regulation 16B(3) and shown in Table 1-1.

Table 1-1: Compliance with PM₁₀ standard for airsheds based on historical exceedances

Average exceedances/year (in 5 year period prior to 1 Sept 2011)	Required compliance with PM10 standard		
Airsheds with 1 or fewer exceedance	1 Sept 2011 onwards - 1 or fewer exceedances in a 12 month period		
Airsheds with 2 to 9 exceedances	1 Sept 2011 to 31 Aug 2016 – Unlimited exceedances allowed	1 Sept 2016 onwards - 1 or fewer in a 12 month period	
Airsheds with 10 or more exceedances	1 Sept 2011 to 31 Aug 2016 – Unlimited exceedances allowed	1 Sept 2016 to 31 Aug 2020 - 3 or fewer in a 12 month period	1 Sept 2020 onwards - 1 or fewer in a 12 month period

Airsheds which have a history of multiple exceedances now have extended time to fully meet the standard (Regulation 16B3).

Determining which deadline an airshed is required to meet is based on monitoring data from the five years leading up to the new regulations coming into force (Regulation 16B4). Thus data is drawn from the eligible period of 1st September 2006 to 31st August 2011.

In airsheds where there are multiple monitoring sites, data from only one site determines whether the 12 month period in question meets the minimum requirements for meaningful data. However, data from all sites in the airshed are used to establish the number of exceedances, with multiple sites exceeding the threshold on the same day counting as a single exceedance.

1.2 Aim of this report

Nelson City Council (NCC) commissioned NIWA to analyse the air quality monitoring data from airsheds A and B and to determine the number of PM₁₀ NES exceedances that have been experienced in those two airsheds. No exceedances of the PM₁₀ NES have been monitored in Airshed C.

The aim of this report is to present the outcomes from the analysis of data from airshed A and B and conclude which new NES compliance timeframe NCC must meet to fulfil its air quality management responsibilities.

2 Method

The method for verifying the new compliance timeframes NCC's airsheds must meet under the revised Regulations is clearly described in Section 4 (Ambient Air Quality Standard for PM₁₀) of the 2011 Users' guide to the revised NES for air quality (MfE, 2011) and is described below in section 2.4.

2.1 NCC air quality monitoring in Airsheds A and B

Nelson City Council began monitoring air pollution in 1986 and currently has three airsheds gazetted under the NES: A, B and C. Figure 2-1 shows a map of Nelson city, outlines the boundaries of its three airsheds and indicates the location of the two air quality monitoring sites within airsheds A and B (the two airsheds that breach the PM₁₀ standard).

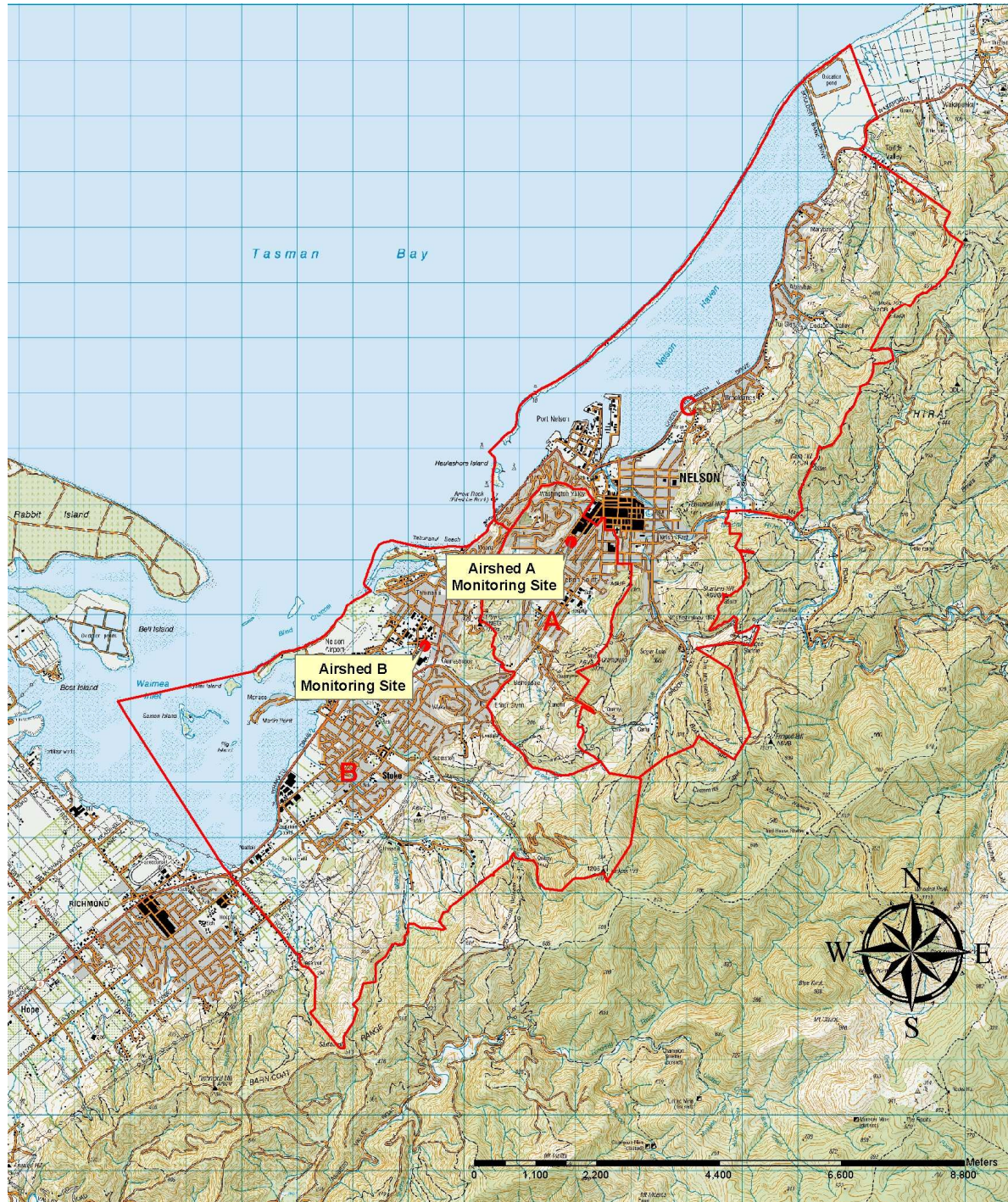


Figure 2-1: Nelson City Council airshed boundaries and ambient air quality monitoring sites

Airshed A is known as Nelson South. Within this airshed, air quality monitoring has been on-going for 11 years, at the St. Vincent Street site. The current instrumentation used is a beta attenuation monitor (BAM) Thermo FH62-C14 monitor, which took over from a Partisol 2000 monitor in mid-February 2006. The Partisol monitor still runs concurrently on a one day in six cycle, while the FH62 records concentrations every 30 minutes.

Airshed B's first permanent monitoring site was located in Vivian Place, but monitoring ceased at this site in 2006 due to its unrepresentative exposure to industrial emissions. Airshed B currently has a monitoring site in the northern, more industrial zone of the airshed, at the Blackwood Street site. Both a BAM (a Thermo FH62-C14) and a Partisol 2000 instrument are operated at this monitoring site. The southern half of Airshed B is more residential in nature, but monitoring here is not on-going. A short period of monitoring with a Partisol 2000 was undertaken over the winter of 2010.

2.2 Review of air quality monitoring data from airsheds A and B

A review of the air quality data from Airsheds A and B was undertaken to define what data were available and to determine the quality assurance status of those data. Data were supplied to NIWA by NCC in the form of an Excel spreadsheet with multiple summary tables and plots. The spread sheets also contained the 'raw' 24-hour monitoring data for all Nelson airsheds. Table 2.1 presents a summary of the PM₁₀ air quality data supplied.

Table 2-1: Summary of the PM₁₀ air quality data supplied by NCC

Airshed	Site name	Years Covered	Instrumentation
A	St Vincent Street	23 March 2001 – present	Partisol 2000 & FH62
B1	Roto Street	14 May – 7 July 2002 14 August 2004 – 13 April 2005	Partisol 2000
	Vivian Street	11 June 2005 – 2 August 2006	Partisol 2000 & FH62
	Blackwood Street	4 August 2006 - present	Partisol 2000 & FH62
B2	Marsden	14 April – 31 August 2010	Partisol 2000

The instruments and processes used by NCC to monitor PM₁₀ concentrations comply with the data collection requirements as set out in the NES.

NCC staff post-process and quality assure the air quality data. The main PM₁₀ record for each site is based on the 30 minute BAM data and is reported via a telemetry system which can introduce minor errors. The data is therefore also downloaded about every 4 months via RS232 downloads directly from the instrument logger and cross-checked with the telemetry data-feed to identify these errors. A further cross-check is undertaken against the co-located Partisol monitor which runs one day in six. These co-location comparisons show that the BAM is performing well against the gravimetric method of monitoring PM₁₀.

Data from the telemetry system BAMs and the RS232 downloads are entered into Hilltop software where they are checked for anomalous data and obvious errors including date corruption, missing data, spikes or negative data. The data are then compiled into 24 hour data using Hilltop Hydro. The day begins at 12.30 AM which is when the BAM logs the 0000

to 0030 result. Telemetered data is loaded into the 24 hour spreadsheet record but is treated as provisional data until it has been cross-checked with the physically downloaded data every four months. Further details of NCC's QA procedures may be found in Appendix A.

The quality assurance undertaken by NCC on these two data sets to date, does not meet all the recommendations set out in MfE's Good Practice Guide for Air Quality Monitoring and Data Management (MfE, 2009). However, the quality of the data is considered sufficient to meet the purposes of this report, because any additional QA refinements that may be made to the data set are unlikely to change the high level conclusions reached in the report.

2.3 Method for determining meaningful data

To qualify for a dual target date an airshed must have at least one 12 month period of meaningful PM₁₀ monitoring data in the previous five years. The use of meaningful data is intended to ensure that sufficient and appropriate data is available to determine compliance with the Regulations. Meaningful data is defined in Regulation 16C(2) as:

(a) when the concentration of PM₁₀ in the airshed was measured during that period, it was measured in a way that allowed 24-hour mean concentrations to be calculated under Schedule 1; and

(b) the measurements captured data for at least 95% of the 12-month period, after deducting from the duration of the 12-month period any periods of time that were not covered by measurements because of maintenance or calibration; and

(c) at least 75% of the data captured was valid data.

2.4 Determining new compliance timeframes

The methodology used for this analysis is drawn from Regulation 16C for determining an airshed's meaningful data and Regulation 16D for determining an airshed's annual average number of exceedances. The Regulatory methods 16C and 16D are detailed in the NES User's Guide in Sections 4.6.1 and 4.7, respectively, which provide clear instructions and examples (MfE, 2011). In summary, five simple steps are taken here to determine what targets an airshed should meet:

1. Define the 12 month periods for airsheds A and B.
2. Calculate the data capture rate and data validity rate for each 12 month period
3. Determine if each 12 month period qualifies as meaningful data
4. For each period with meaningful data, record the number of exceedances.
5. Average the number of exceedances over the number of periods, as set out in Regulation 16(D2).
6. Refer to Regulation 16B3 or section 4.4 of the User's Guide to the revised standards (MfE, 2011) to determine which targets the airshed should reach.

3 Results: Number of exceedances

3.1 Airshed A

Monitoring at the St. Vincent Street site began in March 2001 and continues to this day. Thus data for this site is available for the full eligible period of 1 Sep 2006 to 31 Aug 2011.

The data can be divided into five consecutive periods of 12 months (1 September to 31 August). The data capture and number of exceedances for each period are outlined in Table 3-1. All five of these periods qualify as having meaningful data for the purpose of this analysis.

Table 3-1: Data summary for each 12 month monitoring period in airshed A

Period	Start and end dates	Total number days monitored ¹	Data capture rate ² (%)	Valid data ³ (%)	Meaningful data ⁴	Number of Exceedances
1	1 st September 2006 31 st August 2007	365	97.5	356/365 days (97.5)	Y	27
2	1 st September 2007 31 st August 2008	366	98.9	362/366 days (98.9)	Y	24
3	1 st September 2008 31 st August 2009	364	100	364/365 days (99.7)	Y	34
4	1 st September 2009 31 st August 2010	363	99.7	362/365 days (99.2)	Y	7
5	1 st September 2010 31 st August 2011	365	100	365/365 days (100)	Y	15

1. 365 minus no. of days out for calibration and maintenance

2. Days of data/days monitored

3. Days of data/365

4. Capture >=95% and Valid >=75%

Over the five 12 month periods the average number of exceedances is 21.4. Therefore as defined in 16B(3), Airshed A has a dual target under the NES: a) from present to 31 August 2016 there are no limits on the number of exceedances allowed in this airshed, b) from 1 September 2016 to 31 August 2020 there must be only three or fewer in a 12 month period, and c) from 1 September 2020 onwards, a maximum of one exceedance per 12 month period.

3.2 Airshed B

Monitoring for airshed B has been undertaken at a number of different sites, with the eligible period covered by monitoring at Vivian Place and Blackwood Street consecutively. The eligible period was again divided into five consecutive 12 month periods as shown in table 3-2. There were relatively large gaps in two of the years of monitoring undertaken within this airshed; 2006/7 and 2009/2010. These gaps were associated with scheduled maintenance or calibration. These gaps did not result in less meaningful data of themselves, but the 2009/2010 period also had enough missing data due to system failures and unverified data spikes to fall short of the 95% requirement for data capture. In summary NCC has meaningful data for four of the five years monitoring has been undertaken in airshed B.

Table 3-2: Data summary for each 12 month monitoring period in airshed B

Period	Start and end dates	Total number days monitored ¹	Data capture rate ² (%)	Valid data ³ (%)	Meaningful data ⁴	Number of Exceedances
1	1 st September 2006 31 st August 2007	298	96.3	287/365 days (78.6)	Y	9
2	1 st September 2007 31 st August 2008	365	99.7	364/366 days (99.7)	Y	11
3	1 st September 2008 31 st August 2009	364	98.6	359/365 days (98.4)	Y	8
4	1 st September 2009 31 st August 2010	365-37	94.2	309/365 days (84.6)	N	1
5	31 st August 2011 1 st September 2010	364	100	364/365 days (99.7)	Y	2

1. 365 minus no. of days out for calibration and maintenance

2. Days of data/days monitored

3. Days of data/365

4. Capture >=95% and Valid >=75%

The four eligible periods of meaningful data give an average of 7.5 exceedances per year. Therefore as defined in 16B(3), Airshed B falls within the second band of targets and must record a maximum of one exceedance per 12 month period by 1 September 2016. Allowable exceedances until then are unlimited.

4 Conclusions: New compliance timeframes

The analysis of air quality monitoring data undertaken for this report shows that Airsheds A and B have a history of multiple NES PM₁₀ exceedances over the years 2006 to 2011. Therefore under Regulation 16B(3) both these airsheds qualify for an extended timeframe to fully comply with the PM₁₀ NES.

4.1 Airshed A

Airshed A is subject to a 'dual target' under Regulation 16B(3). By 1 September 2016 not more than three exceedances over a 12 month period must be achieved, and by 1 September 2020 onwards, a maximum of only one exceedance over a 12-month period.

4.2 Airshed B

Airshed B is subject to a single target under Regulation 16B(3). By 1 September 2016 onwards not more than 1 exceedance in a 12-month period must be achieved.

The conclusions on airsheds A and B presented above should be considered provisional, as the data used is still not fully verified, as noted in Section 2.2. It is also possible that concentrations in the final data may vary a little from the raw data, but it is anticipated that any changes will be minor and not affect the outcome of this analysis.

When the data has been finalised it is possible that airshed B will have five 12-month periods of meaningful data. If the 5th year of meaningful data were included in the analysis of Airshed B it would reduce the average number of exceedances experienced in that airshed down from 7.5 to approximately 6.2 per year. This result would more firmly cement Airshed B into the single target compliance timeframe and therefore not change the conclusions reached in this report.

4.3 Future monitoring

As neither airshed currently meets the standard for ambient PM₁₀ concentrations, NCC is required to continue monitoring as set out under Regulation 15 and the airsheds will be considered polluted until there have been no exceedances of the maximum 24 hour limit for five continuous years (MfE,2011).

References

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Acknowledgements

Thanks to Paul Sheldon at NCC for supplying maps of Nelson's airsheds and a detailed description of the data QA processes.

Appendix A: Full description of data QA/QC as supplied by NCC

Airshed A (St Vincent St) and B1 (Blackwood St) both have permanent monitoring sites.

At each monitoring site there is a BAM (Thermo FH62-C14), a Partisol 2000, and a Met Station.

The BAM runs continuously and is the main PM10 record. It reports 30 minute data via a telemetry system which introduces a bit of noise. It is also downloaded about every 4 months via RS232 downloads directly from the instrument logger

The Partisol's run one day in 6 to provide a cross check on the BAMs. In airshed A the Partisol also runs one day in 6 on PM 2.5.

Data from the telemetry system BAMs is entered into Hilltop software where it is checked for anomalous data and obvious errors this include any date corruption, missing data, spikes or negative data.

The data is then compiled into 24 hour data using Hilltop Hydro. The day begins at 12.30 AM which is when the BAM logs the 0000 to 0030 result.

Telemetered data is loaded into the 24 hour spreadsheet record but is treated as provisional data as there is some noise from the data conversion in the telemetry system.

Approximately every 4 months a physical download from the BAM logger is undertaken via RS232 connection and HyperTerminal software.

As it downloads instrument status codes are checked for errors, warnings and abnormal values. Any strange results are followed up and a call is made to accept or invalidate the data involved. As a general rule there are almost no error codes and very little need to invalidate data.

Download txt files are loaded into excel, converted to .csv files and uploaded into Hilltop. They are then checked for anomalous data and obvious errors this include any date corruption, missing data, spikes or negative data They are compiled into 24 hour data and saved into the 24 hour average spreadsheet as final data.

We have found when BAM inlets are disturbed or when calibration take place the instruments tend to spike and where this is clearly associated with maintenance and is prolonged the spike is removed from the record.

Comparison of provisional and final data is undertaken to ensure the notified NES breach requirements are complied with. Very occasionally we have to withdraw a breach notice or add a new one as the 1 microgram can make all the difference.

BAM and Partisol data are compared to ensure that the instruments are tracking closely. Any major divergence is checked to see if there is an explanation such as an instrument error or abnormal event.