



STAFF REPORT

TO: Environment & Planning Committee

FROM: Trevor James, Resource Scientist

REFERENCE: C301

SUBJECT: **RICHMOND AIR QUALITY UPDATE 2007 - REPORT EP07/09/09 -**
Report Prepared for 12 September Meeting

1. INTRODUCTION

The purpose of this report is to present results for air quality monitoring for the 2007 year to date and compare these to previous years and to other monitored air-sheds in New Zealand.

This season we set up two new survey sites, one in Brightwater and one in Richmond North. The Brightwater site was set up as part of a routine screening of other urban areas in Tasman District and in response to calls from the public. The Richmond North site was set up to determine how PM₁₀ concentrations vary across the township.

Additionally an automated camera was set up prior to this winter on the Barnicoat Range in Richmond South. Images from this camera along with the meteorological data from our two stations will be critical in developing a three-dimensional air pollutant dispersion model as it will be able to determine the character of inversion conditions in Richmond and the lower Waimea Plains. The main output of the model will be mapping concentrations of air pollutants (particularly PM₁₀) over the greater Richmond area and testing the effect of various discharges and management scenarios.

2. BACKGROUND

The overall aim of the Tasman District 'State of the Environment' air quality monitoring programme is to determine the condition of ambient air for the purpose of understanding potential effects on human health. More specifically, the programme aims to determine the concentration of fine particulate (PM₁₀) and determine trends over time. We will not be in a position to comment conclusively on trends until we have at least another year of data from our continuous PM₁₀ monitoring equipment.

Over the winter we had approximately 150 visits per month to the "Air Quality Today" pages; down by ~65% on last winter. Information was also picked up by the Nelson Evening Mail from the website to produce their graphs for the newspaper, with Richmond data being displayed alongside data from Nelson City. Additionally as required by national standards, formal reports listing the date and level of exceedence above standards were provided to the media. A 'State of the Environment' report on Air Quality was produced in April 2007 and an electronic copy placed on the website.

3. RESULTS AND DISCUSSION

3.1 Update for Richmond Central

At the Richmond Central site there were 21 measured exceedences of the standard for 24-hour average PM₁₀ (as at 28 August 2007). 24-hour average PM₁₀ concentrations above 50 µg/m³ are termed “exceedences”. Figure 1 shows a plot of 24-hour average PM₁₀ for the year to date. The highest recorded maximum concentration (83 µg/m³) this winter was on 19 June.

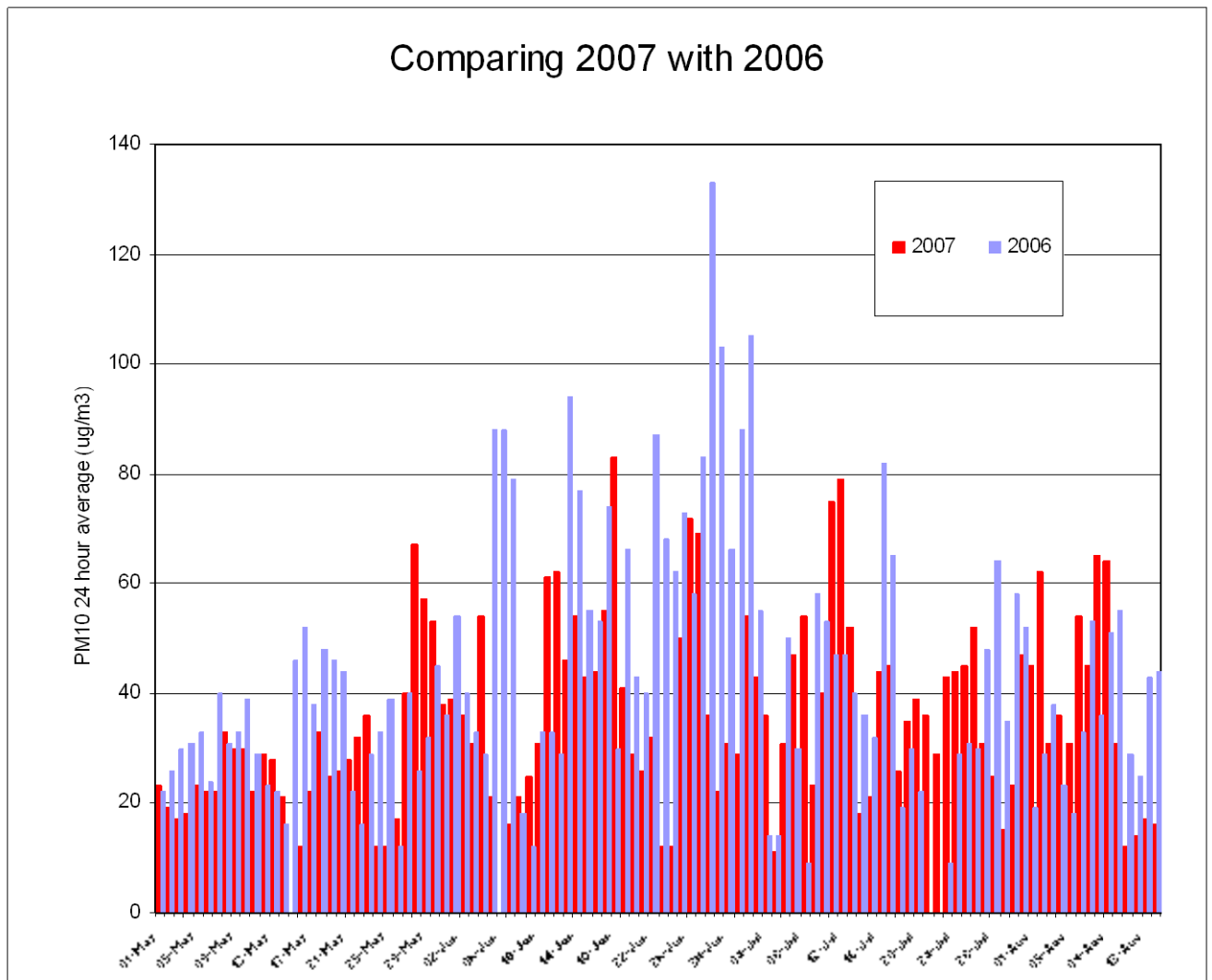


Figure 1: PM₁₀ 24 hour average for Richmond central – Overplot of 2007 (red) and 2006 (blue).

While there was a significant drop in PM₁₀ 24 hour Average for Richmond this year, it is most likely attributable to warmer weather (see Figure 2).

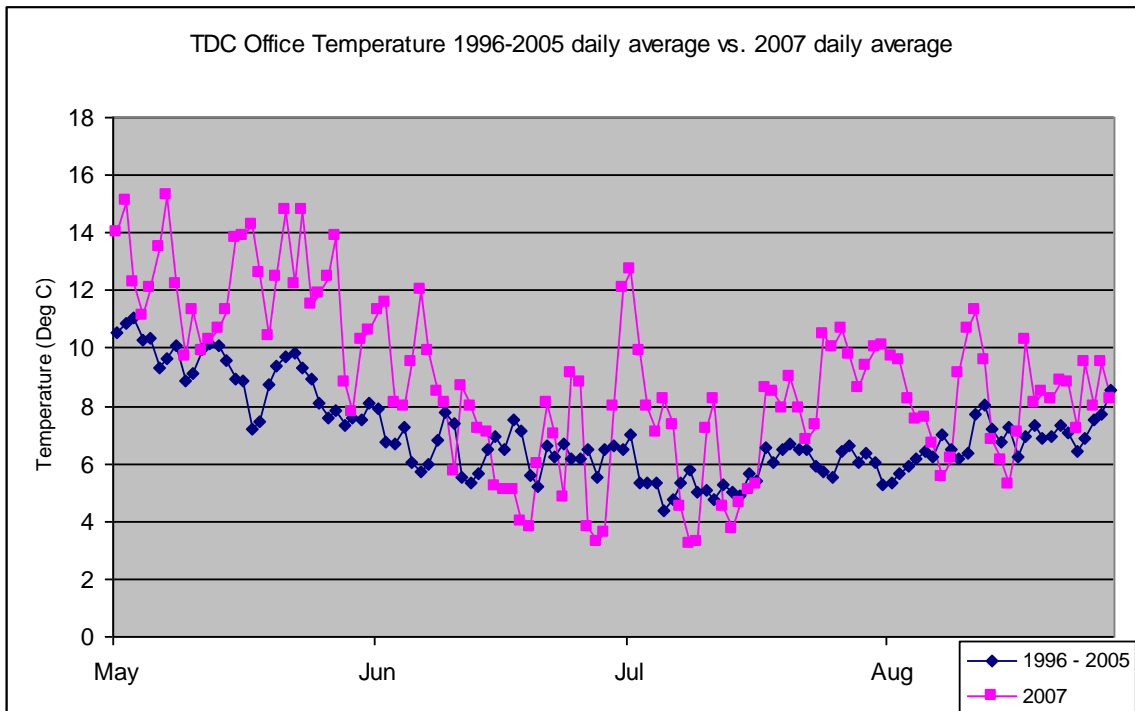


Figure 2: Daily Average Temperatures for 2007 (Pink) Compared To Typical Daily Temperatures (Blue)

Wind direction changes by approximately 180° were responsible for unusual peaks on 28 June. Air pollution from the southwest of Richmond built up as typical until 10.00 am, after which time the wind changed to the east and northeast and the pollution passed back over the monitoring site (see Figure 3). There was a brief interlude of about an hour when higher wind speeds cleared the air before the pollution returned. This can be visually detected in the photos from the Barnicoat Range.

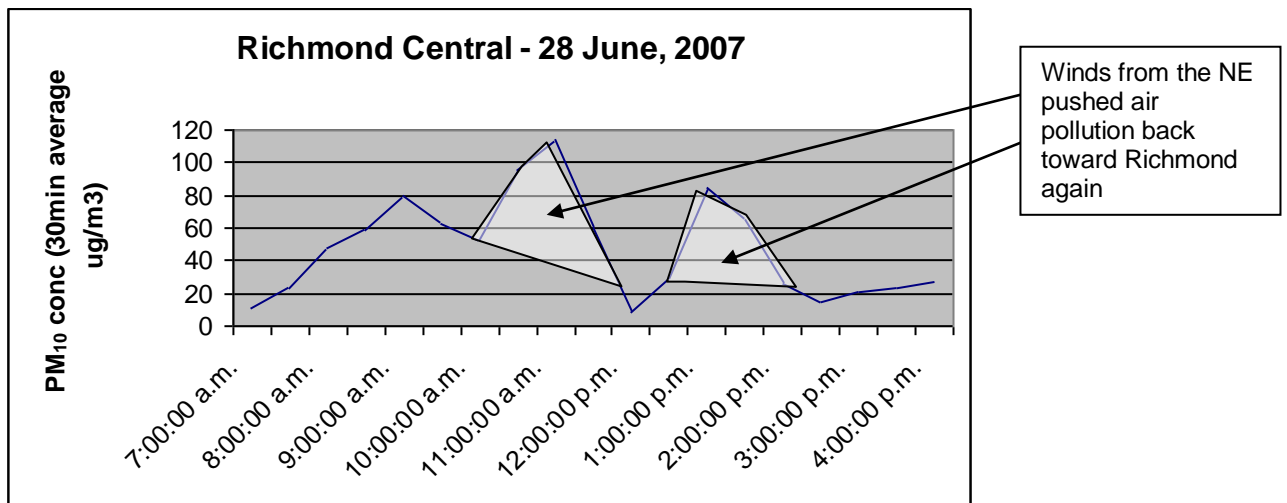


Figure 3: PM₁₀ concentrations in Central Richmond on 28 June, 2007 with alternating SW and NE winds

The total number of days when the PM₁₀ 24 hour standard was breached was significantly lower this winter than any previous winter of monitoring (see Figure 4).

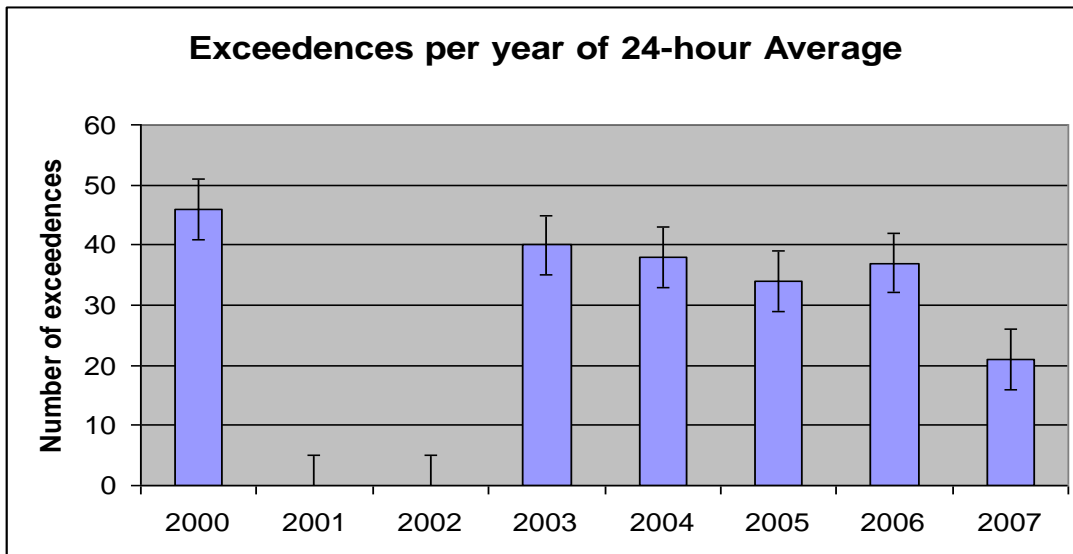


Figure 4: Total number of days the PM₁₀ standard was breached

Other South Island air sheds also experienced much a lower number of exceedences for the winter of 2007. Nelson’s St Vincent Street site recorded 25 exceedences whilst Christchurch’s St Albans site had 13. For both these locations this number is less than half than that typically recorded.

The average magnitude of exceedence above national standard (measured 24 hour average concentration minus the standard of 50 µg/m³) has not changed significantly since records began (see Figure 5).

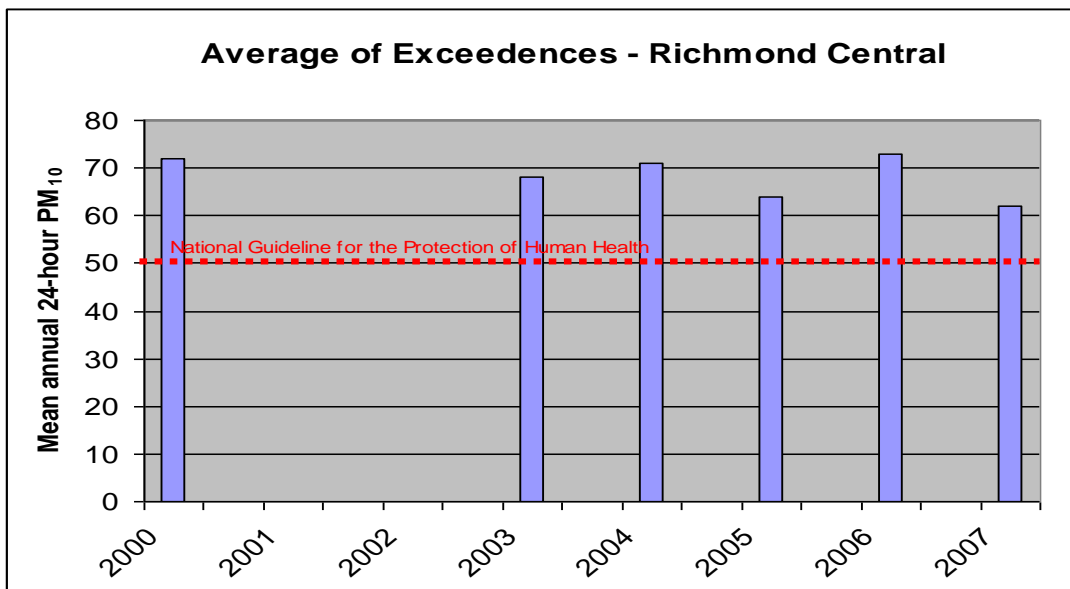


Figure 5: Average level of exceedence for each year

With respect to annual average of 24-hour average concentrations over the five years of record, there appears to be a slight downward trend (see Figure 6), although this is not statistically significant. While annual averages are not part of the national standard for assessing PM₁₀ condition the Ministry for the Environment provides a guideline for annual average PM₁₀ at 20 µg/m³.

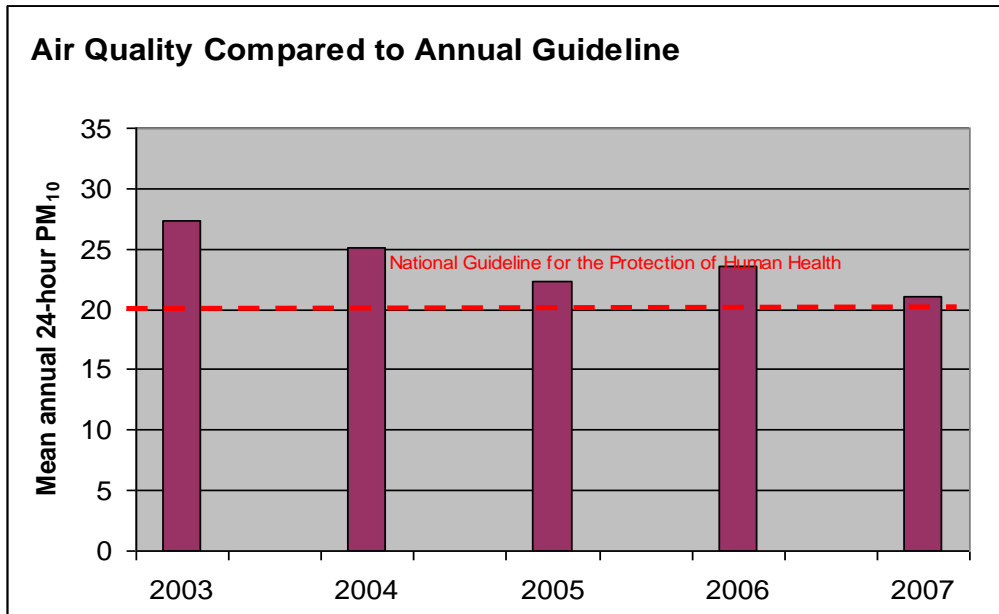


Figure 6: Year-round daily average PM₁₀ concentration

3.2 Daily Variation in PM₁₀ at Richmond Central

An appreciation of the variation within each 24 hour period can be gleaned from the graph of 30 minute averages for each day during the season as measured by the Beta Gauge (see Figure 7a & b).

The daily variation in PM₁₀ concentration shows repeating patterns appear to correlate with the use of domestic fires for home heating. On the high pollution days PM₁₀ concentrations start to rise dramatically after 5.00 pm. This coincides with the time people return home from work and begin lighting their fires. This builds up in the air-shed producing an initial peak concentration around 7.00 pm to 8.00 pm. The concentration then typically falls, presumably from the burners being hot and working at optimum efficiency. It is likely that the peak around 11.00 pm to 12.00 pm is caused by fires being stoked up to keep the house warm over the night. This practice of stoking up a fire and dampening down the air flow to make the heat output last over a longer period is known to cause much higher emission rates from a burner. In the morning there is usually a lower peak around 9.00 am, presumably caused by fires being restarted.

It is notable how quickly the concentration returns to almost background in the period from late morning to early evening on most days, with the exception of slightly elevated concentrations extending toward midday on some weekends (see the highest purple line).

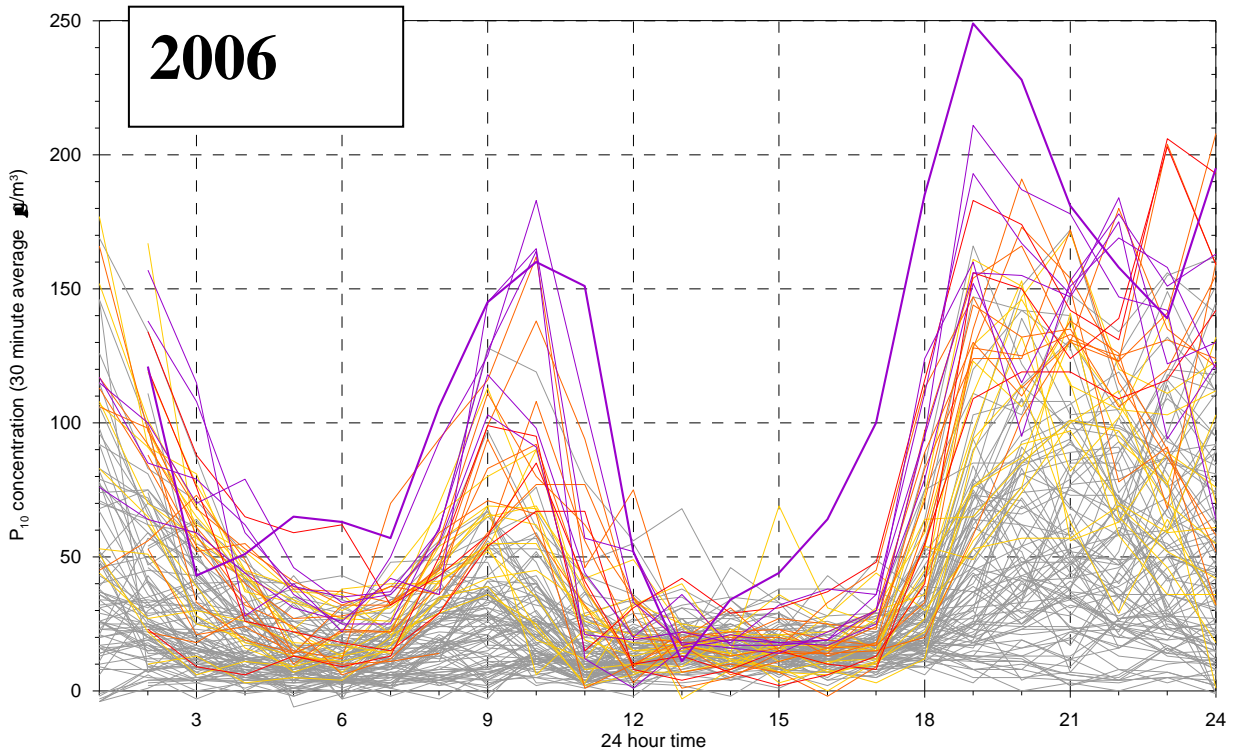


Figure 7a: PM₁₀ 30 minute average values for Richmond Central 2006 season. Coloured lines indicate exceedences of the national standard (yellow 50-60, orange: 61-75, red: 76-90, purple: >91)

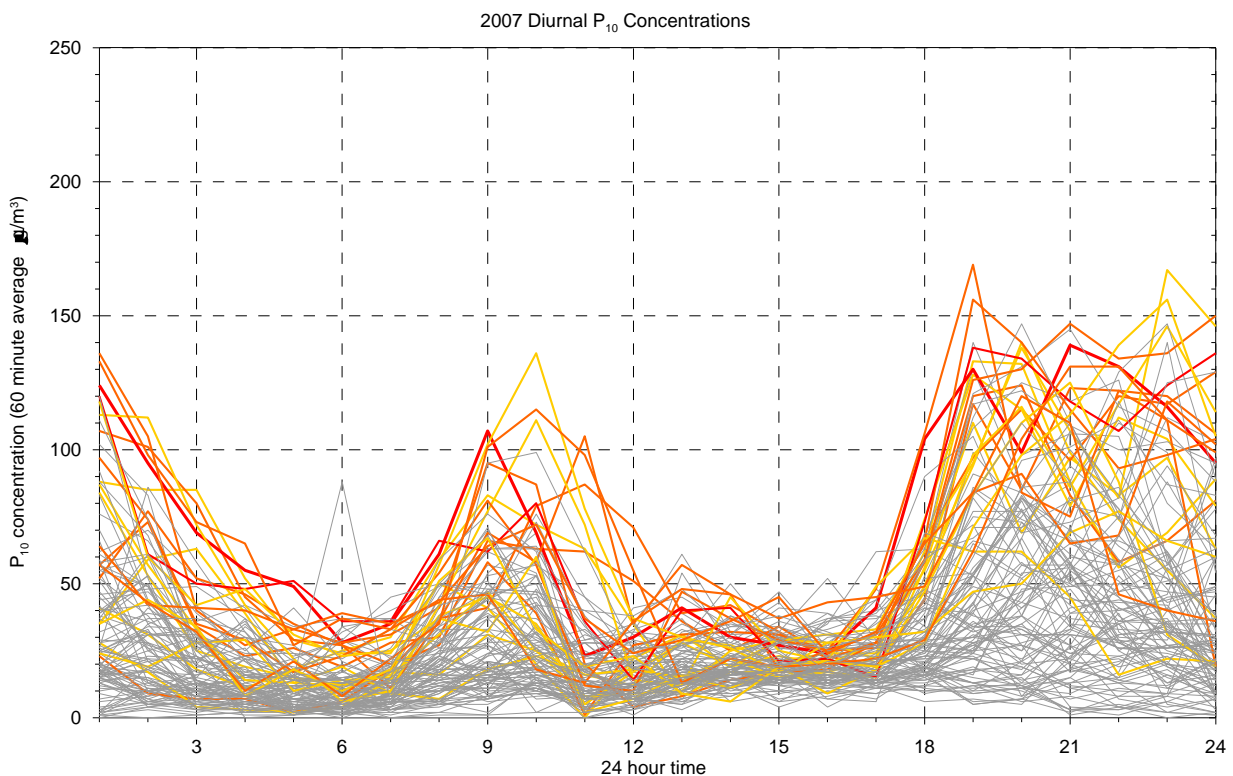


Figure 7b: PM₁₀ 30 minute average values for Richmond Central 2007 season. Coloured lines indicate exceedences of the national standard (yellow 50-60, orange: 61-75, red: >75)

76-90)

3.3 Deviations from the National Standard Straight Line Path for Richmond

In September 2005 the National Environmental Standard (NES) for air quality was introduced. This sets out a path for compliance with the standard by 2013. Any of the second-highest 24 hour average PM_{10} results above this line after 2005 must be highlighted. The second-highest value is plotted in respect of this standard because the NES allows for one breach. For the Richmond Central site all results were below the straight line path (see Figure 8).

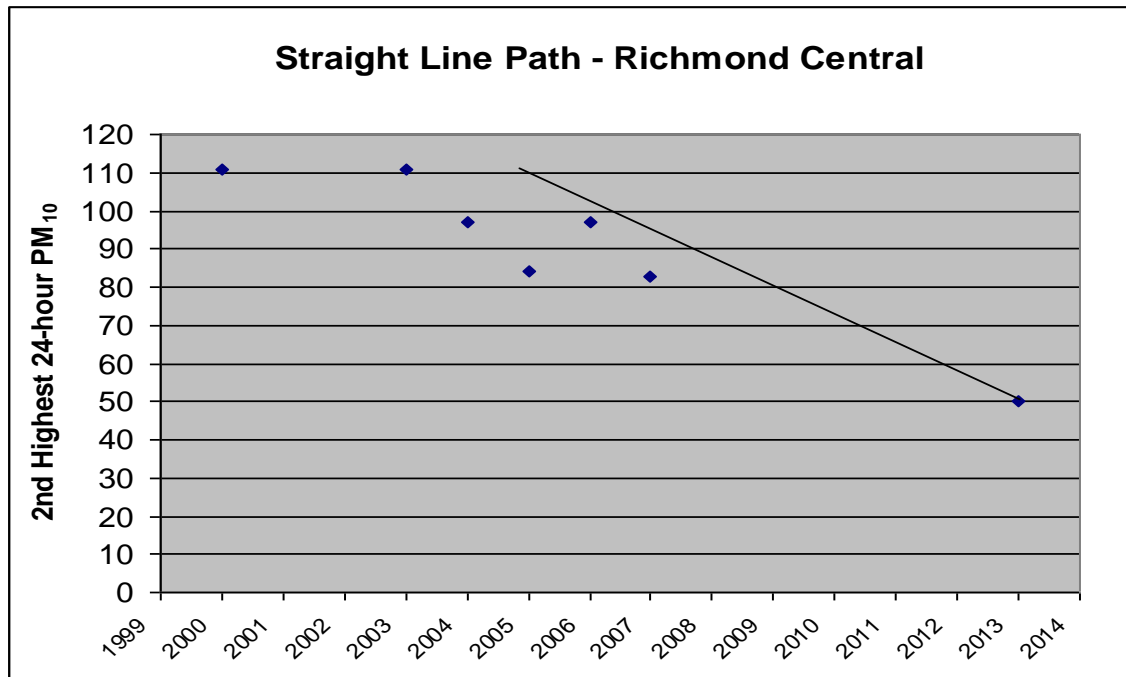


Figure 8: Maximum 24 hour concentrations as plotted on the straight line path set down by the NES

3.4 Spatial Variation of PM_{10} within Richmond

PM_{10} concentrations at the Richmond North site averaged 45% higher on the days when there were exceedences (see Figure 9). Averaged over the whole period of monitoring (15 June to 4 August) the Richmond North site was 28% higher. Higher temperatures and/or higher wind speeds accounted for days when air pollution at Richmond north was lower or similar to at Richmond Central.

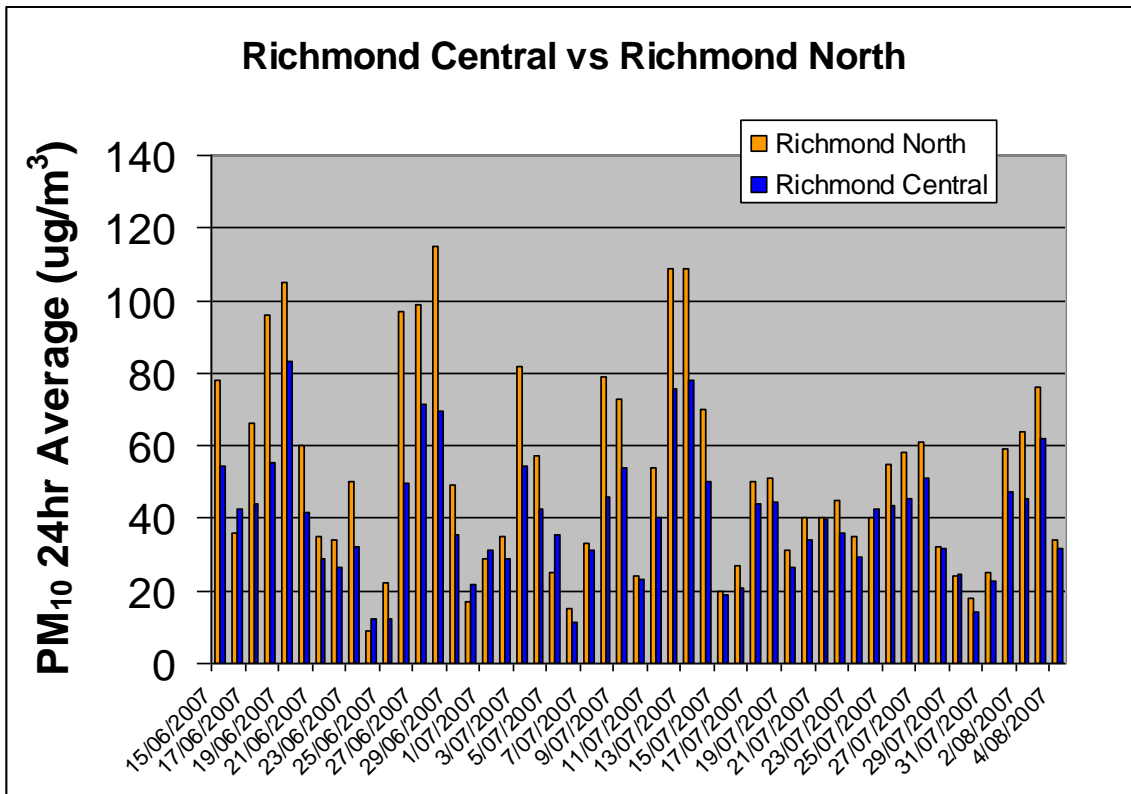


Figure 9: PM₁₀ 24 hour average for Richmond Central and Richmond North sites

This information suggests that Council will have to locate a monitor at another location within Richmond to be compliant with the national standard which says: “Council must monitor air quality in that part of the airshed where the standard is breached by the greatest margin or the standard is breached the most frequently, whichever is the most likely (section 15(i) National Environmental Standard)¹. We will only know definitively where the standard will be breached to the greatest margin after conducting modeling that is intended for 2009. After that point a decision will be made as to where to locate the monitor with respect to this standard. This means that it may be more difficult than previously thought to meet the standard with more needing to be done to meet it by 2013, remembering we will only be able to grant discharge to air consents (releasing PM₁₀) if we meet the standard. A new Straight-Line-Path would need to be drawn for the new site and new models developed to determine the management options needed to meet the requirements of the standard by 2013.

3.6 Results for Brightwater

Early results from the Brightwater site show no exceedences.

¹ Resource Management (National Environmental Standards Relating to Certain Air Pollutants, Dioxins, and Other Toxics) Regulations 2004

4. CONCLUSION

Air quality in Richmond for the past year continued to exceed national standards. The 24-hour average standard for PM₁₀ was exceeded 21 times. This concentration is below the straight-line path required under the NES. The annual average also exceeded guidelines but by only a small amount. Any trend in PM₁₀ concentrations is likely to be due, in part, to warmer and windier conditions. Any statistically valid trends in PM₁₀ will be able to be confirmed in 2009 when there is enough data from our continuous monitor. Diurnal patterns of PM₁₀ concentration were typical of those in an air-shed dominated by wood smoke with peaks in the evening and smaller peaks about 9.00 am. Higher concentrations of PM₁₀ were found in north Richmond than at Richmond Central. This has implications for meeting the requirements of the National Environmental Standard. Orchard fires around Hope are likely to cause elevated levels of PM₁₀ in Richmond and could lead to breaches of the standard.

5. FURTHER MONITORING AND ANALYSIS

The following initiatives are planned:

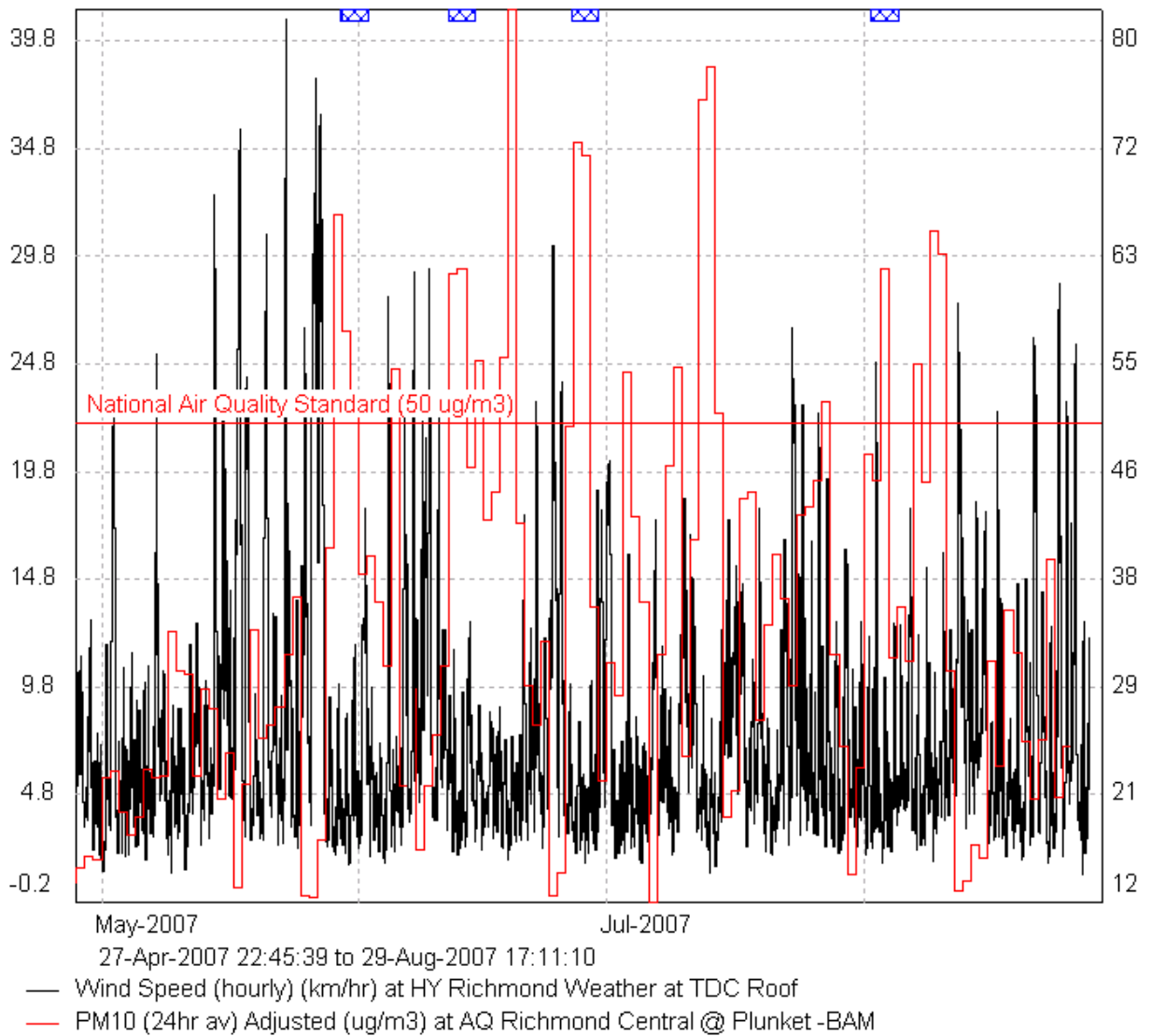
1. Locate the Partisol monitor at a location in south Richmond or Hope to determine how PM₁₀ concentrations vary across the town. It is suspected that concentrations will be lower in this area.
2. Subject to inclusion in the 2008 / 2009 Annual Plan undertake 3D fine particulate dispersion modeling in 2009 for the Richmond air shed in cooperation with Nelson City Council. The model will assist in determining the spatial distribution of PM₁₀ and support decisions regarding the siting of various landuse activities including industries with PM₁₀ emissions.
3. Undertake trend analysis in 2010 using four years of continuous monitoring data.

6. RECOMMENDATIONS:

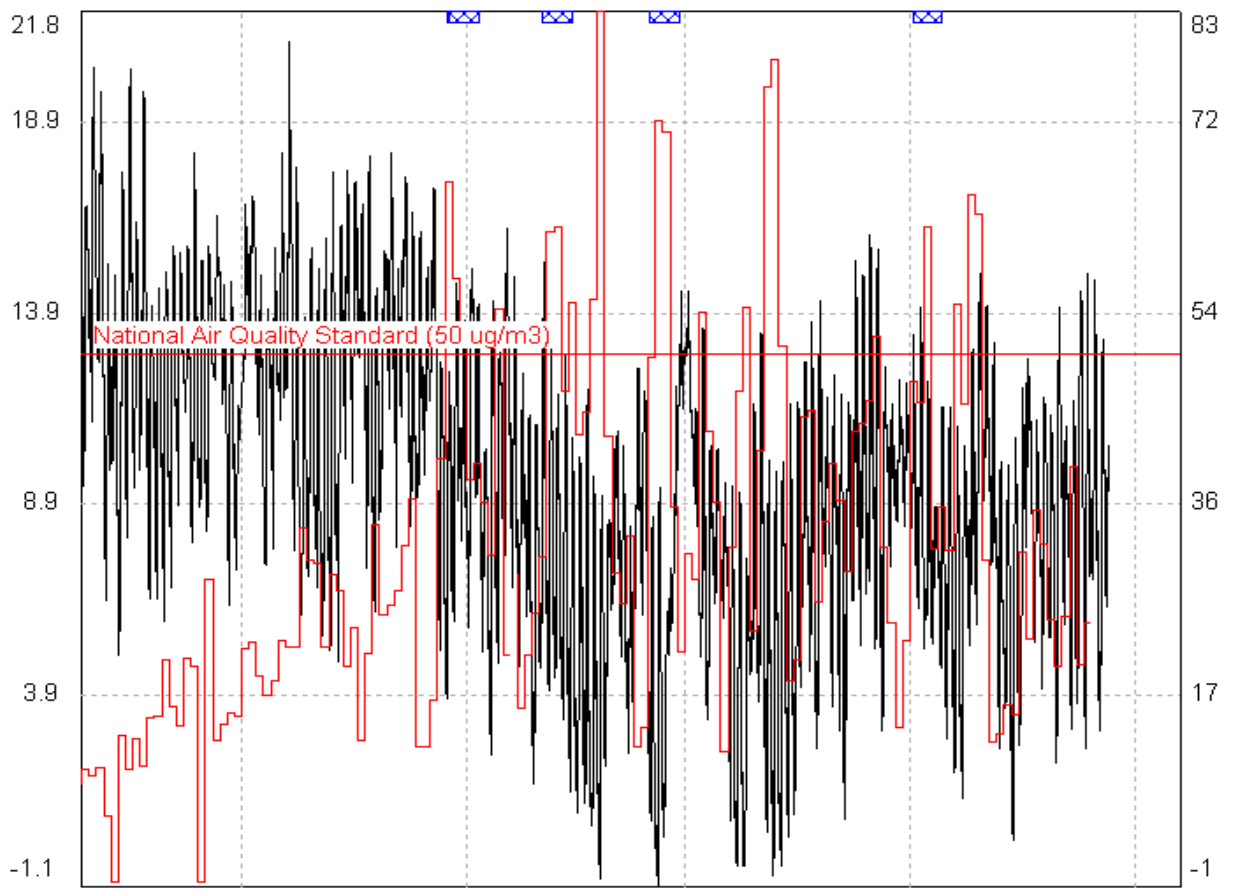
That the Committee receives this report.

Trevor James
Resource Scientist

APPENDIX 1:
Correlation of Wind Speed and 24 hr Average PM₁₀



APPENDIX 2: Correlation of Wind Speed and 24 hour Average PM₁₀



8-Apr-2007 23:38:51 to 7-Sep-2007 06:24:59

- Temperature (10min) (Deg C) at HY Richmond Weather at TDC Roof
- PM10 (24hr av) Adjusted (ug/m3) at AQ Richmond Central @ Plunket -BAM