



STAFF REPORT

TO: Environment & Planning Committee

FROM: Trevor James and Thomas Marchant

REFERENCE: C301

SUBJECT: **AIR QUALITY IN RICHMOND – AN UPDATE 2007 - REPORT**
EP08/09/07 – Report prepared for meeting of 16 September

1. INTRODUCTION

The purpose of this report is to present results for air quality monitoring for the 2008 year to date and compare these results to previous years.

The continuous particulate monitor in Richmond Central (the BAM) continues to perform well with only three days in the year with more than 30 minutes of lost record. New this season saw the setup of a temporary survey site in Richmond South and a campaign of mobile monitoring in Richmond, Brightwater, Wakefield and Nelson to determine spatial variation of PM₁₀ concentrations across the townships. This data, in combination with data collected in Richmond North last winter and the images of inversion heights collected from a camera on the Barnicoat Range, will be very useful to help calibrate models that will produce contour plots of PM₁₀.

The 2008 winter period saw the introduction of a compliance monitoring programme relating to the use of small scale solid fuel burning appliances within the Richmond Airshed. Rule 36.3.16B of the TRMP prohibits the discharge of contaminant from non authorised solid fuel burning appliances, if the subject property has undergone a transfer of ownership since 13 January 2007. In order to accurately enforce this rule, a survey was undertaken in order to provide details on the current status of solid fuel burners within the Richmond airshed subject to transfer of ownership. A strategy has been initiated to ensure that compliance with the TRMP rule is met by the beginning of the winter 2009 season.

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. At present we are not in a position to report trends with any confidence as specialists advise us that we will only have sufficient record to undertake trend analysis after another year's worth of data.

The Richmond air emission inventory shows 84% of PM₁₀ is caused by domestic home-heating appliances. Diurnal patterns of PM₁₀ concentration measured in Richmond Central are typical of those in an air-shed dominated by wood smoke with peak PM₁₀ concentrations occurring in the evening (from 7pm to 1am) and morning (a smaller peak about 9am) and very low concentrations from late morning to late

afternoon. The evening peak is most-often bimodal (ie double-crested) with the second peak (usually the highest) occurring at about 10pm when people go to bed and damp down the fire.

Rules requiring upgrading of domestic wood burners at the point of property sale came into effect in January 2007. All owners of houses with a wood burner who have bought from this date to the present have been visited to ensure compliance. No combustion burners other than pellet fires can be installed in Richmond in new houses or existing houses without burners although existing householders are able to upgrade their existing burner to one of the complying burners as listed on the MfE site (www.mfe.govt.nz)

3. 'STATE OF THE ENVIRONMENT' AIR QUALITY MONITORING - 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 (see Figure 1 and 2) this last winter. 24-hour average PM₁₀ concentrations above 50 µg/m³ are termed "exceedences" under the National Environmental Standard. Data above 50.5 µg/m³ was rounded up, but data less than this number was not considered an exceedence. Figure 1 shows a plot of 24-hour average PM₁₀ for the year to date. The highest recorded maximum concentration (79 µg/m³) this winter was on the 12th June. The number of exceedences in June was the highest on record, equal with 2006 (see Appendix One). If the weather pattern that prevailed in June had continued the figure of 21 exceedences could have been quite different. Earlier this decade July had the highest number of exceedences and average PM₁₀ concentrations. For the first time Richmond had no exceedences in August. Since 2004 June has been the month of highest air pollution whereas prior to that July was the highest (see Appendix One).

The mean PM₁₀ 24-hour average for days when there was an exceedence was slightly lower this year than last year (see Figure 3). This analysis includes only those days when there was an exceedence, effectively including only the coldest and most calm conditions. There is a more marked reduction in the highest 24-hour average. Both the maximum and second-highest 24-hour average results appear to have reduced over the years (see Figure 3). Another way of representing the data is shown in Appendix Four where data is grouped into the following categories: good, acceptable, alert and exceeding the NES limit.

Like last winter, the number of exceedences was well down on previous years. Again, like last winter this is most likely to be attributable to warmer, calmer and wetter weather in July (see Figure 4 and Appendix Two and Three). Temperatures over the whole winter were on average 2-3 degrees above the daily averages averaged for the previous 12 years. Wind speeds over 10 km/hr were more common in July than in June. Particularly apparent in July were stronger winds from the NE to ENE.

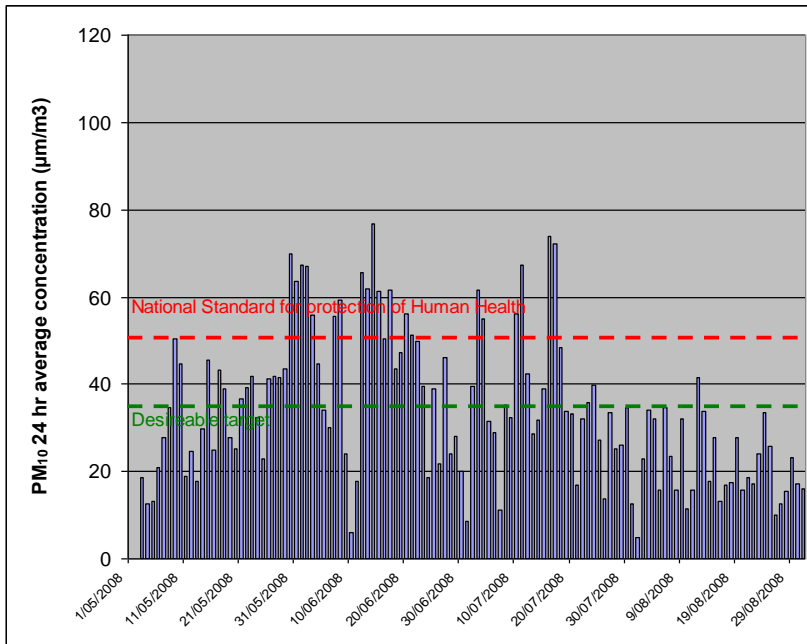


Figure 1: PM₁₀ 24-hour Average for Richmond Central

The total number of days when the PM₁₀ 24-hour standard was breached was significantly lower for the last two winters than any previous winter of monitoring (see Figure 2).

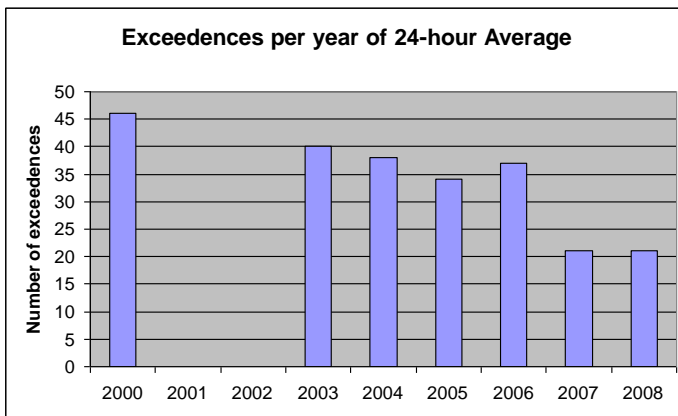


Figure 2: Total number of days per year that the NES was exceeded

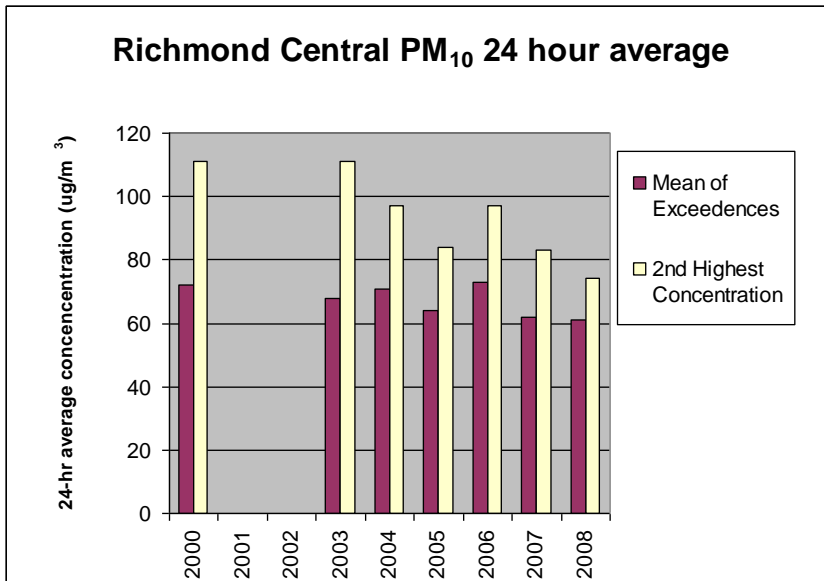


Figure 3: Annual mean of days when there was an exceedence (red) and second-highest concentration (yellow). The second-highest value is used because one exceedence is allowed under the NES rules.

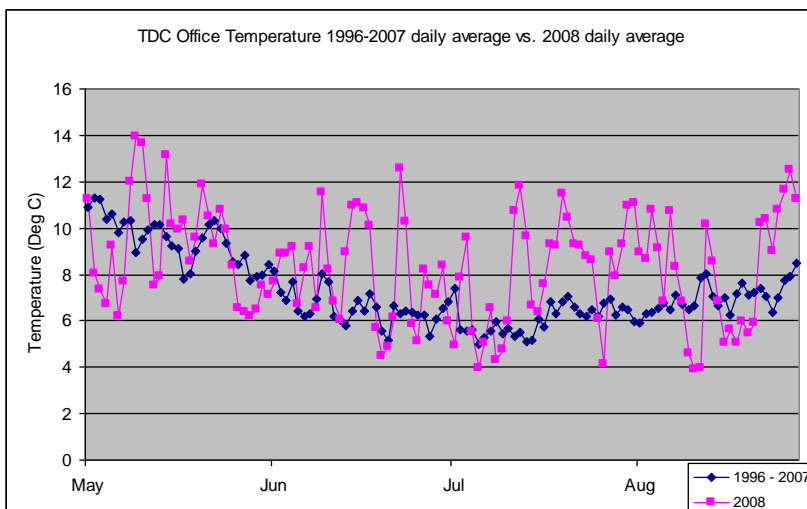


Figure 4 Daily Average Temperatures for 2007 (Pink) Compared To Typical Daily Temperatures (Blue)

Other South Island airsheds also experienced relatively low numbers of exceedences for the winter of 2008. Nelson's St Vincent Street and Tahunanui sites recorded 23 and 10 exceedences, respectively, whilst Christchurch's St Albans site had 19. For each of these locations this number is low compared to the average for the last few years.

With respect to annual average for the 24-hour average concentrations over the six years of record, there appears to be a slight downward trend (see Figure 5), 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.

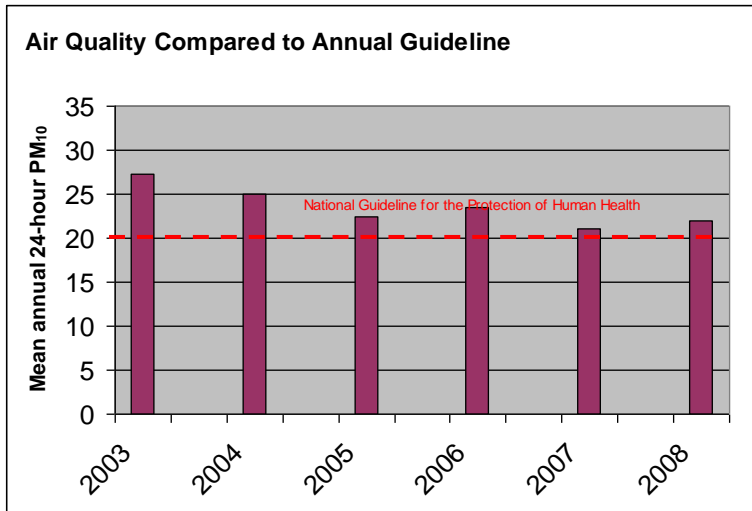


Figure 5 Year-round daily average PM₁₀ concentration

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 PM₁₀ 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 each year. For the Richmond Central site all results were below the straight line path (see Figure 8).

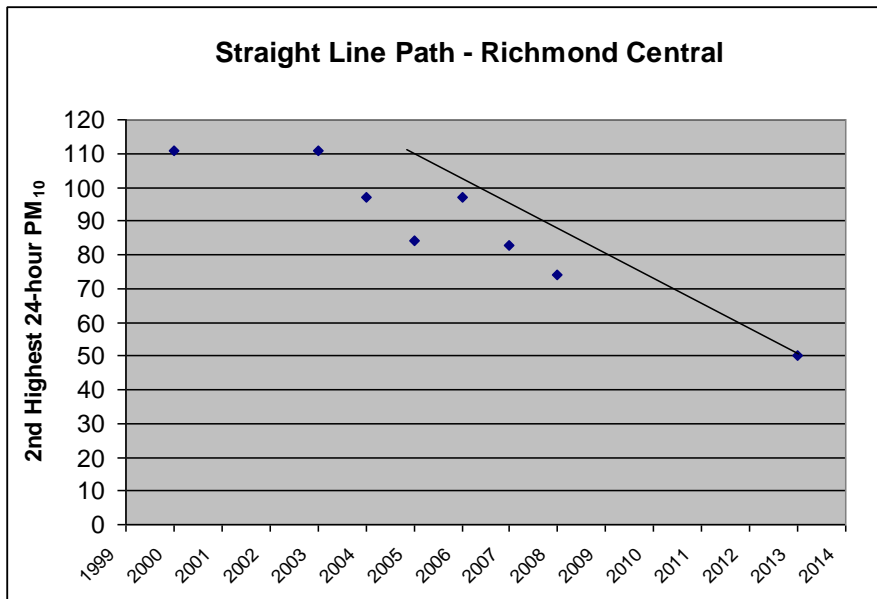


Figure 6 Maximum 24-hour concentrations as plotted on the straight line path set down by the NES

3.4 Spatial Variation of PM₁₀ within Richmond

Generally lower 24-hour average concentrations of PM₁₀ were found in south Richmond than at Richmond Central (see Figure 7). PM₁₀ concentrations at the Richmond south site averaged 5.6% lower on the days when there were exceedences. The only significant exception to this pattern was on 24 June when the wind was relatively light and blowing from the north-north-east. To have this wind direction over almost 24 hours is unusual and resulted in air pollution from the north side of town accumulating in south Richmond.

This compares to last winter's monitoring at Richmond north where 24-hour average concentrations were 45% higher than Richmond central. This is due to the predominant south to south-west winds diluting the contaminants on the upwind (south to south-west) side of town and accumulating contaminants at the downwind (north to north-east) side of town.

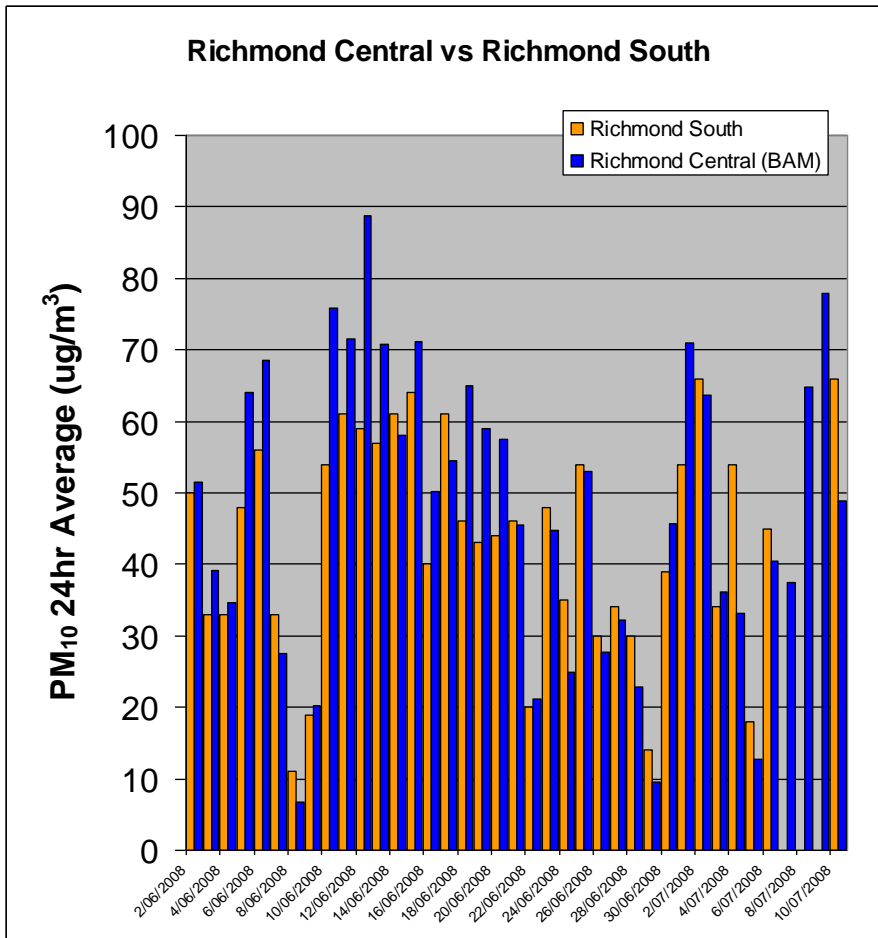
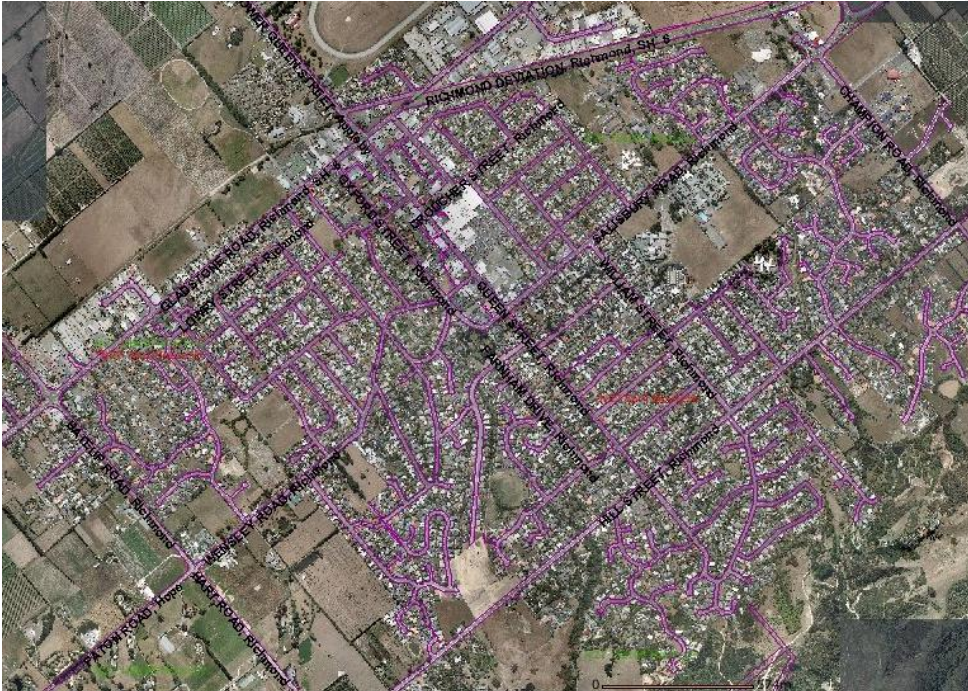


Figure 7 PM₁₀ 24-hour average for Richmond Central (blue) and Richmond South (gold) sites

This winter Tasman and Nelson Councils engaged NIWA (using Envirolink funding) to undertake a campaign of air quality monitoring across the airshed using a mobile sampling system. Air quality and meteorological instruments were installed in a vehicle driven around the airsheds of Nelson, Richmond, Brightwater and Wakefield. The following information was collected continuously: wind speed, wind direction, relative humidity, temperature, PM₁₀, PM_{2.5} and PM₁ (these particulate fractions were measured using a GRIMM). The campaign ran from 6pm until after midnight between 19 and 27 July. On three evenings this monitoring was called off due to wet weather and the possible damage to the instruments that would create. Over this period there were no exceedences of the 24-hour average PM₁₀ standard, but there were several evenings when instantaneous PM₁₀ over parts of the airshed was high (consistently over 100 µg/m³ and sometimes over 200 µg/m³). This level of pollution was easily sufficient to make the monitoring campaign a success. One of the reasons the 24-hour average PM₁₀ was so low over this period was that the morning peak pollution was often very low or absent. All except one of the evenings when

monitoring was successful the vehicle was driven over a set route from Three Brothers corner and through Richmond-Stoke-Tahunanui airshed as well as the other airsheds of Nelson. Staff from the two councils were involved in driving the vehicle, while a NIWA technician operated the instruments.



While a report presenting results from this campaign is not yet available, there was a very consistent pattern of fine particulate pollution over Richmond. The patterns that stood out the most were the high air pollution in the area around Hunt Street and the catabatic drainage (cold air flow off the hill) from the valley around Churchill Ave. Low levels of pollution were found in the Templemore Drive-Champion Road area and South Hill St to Otia Drive area. These areas contain mainly relatively new housing. Apart from these general areas, moderate-high, and relatively uniform, air pollution was present around much of the older housing areas of Richmond from the Richmond Deviation in the north-west to Hill St in the south-east and D'Arcy Street in the north-east to King Street in the South-west.

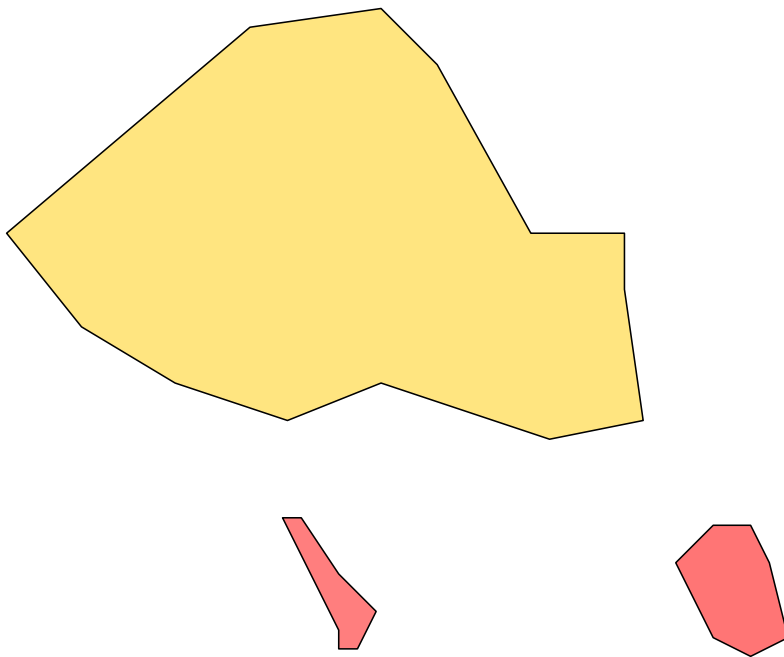


Figure 8 Approximate area of air pollution hotspots in Richmond. Red shading indicates the approximate area where the highest air pollution was found and yellow shading the approximate area where exceedences are likely to occur. Please note that this representation is based on preliminary analysis and that a more accurate map will be provided within a few months.

On the one evening that Brightwater and Wakefield area was also monitored which showed little issue for Wakefield but some older housing areas of Brightwater (around Starveall Street) showed air pollution levels only slightly less than that of the older housing areas of Richmond (i.e. moderate pollution). It is likely that the Starveall Street area of Brightwater will have a few days each year where there are breaches of the NES.

Information from this mobile monitoring, as well as data from all the monitoring sites used in Richmond, Wakefield and Brightwater, meteorological data and the camera on the Barnicoat Range, will be used to develop a three-dimensional air dispersion model in 2009. This model will provide information which will enable more targeted and effective policies and methods to protect people's health and comply with the air quality National Environmental Standard (NES). More specifically this information will assist with the following:

- A. Reviewing the appropriateness of current airshed boundaries.
- B. Consider reviewing progress to achieve the NES - the models will forecast particulate matter out to 2013 when we must be compliant with the NES. If the forecast says we will not meet the NES then we may have to consider further options.

- C. Provide applicants of resource consents for discharge to air with a standard and high quality meteorology model which can be used to model the effects of their emissions.
- D. "State of the Environment" reporting.
- E. Review appropriateness of the location of current monitoring sites (for both compliance and 'State of the Environment' Monitoring).
- F. Better targeted controls on emissions. A cross-check on our emissions inventory will give us more confidence to target specific sources.
- G. Better coordinate management of the issue across the Council borders (Tasman District Council and Nelson City Council boundary runs right through an airshed)

3.5 Reporting On Air Quality

This June and July saw 241 and 220 visits (respectively) to the "Air Quality Today" pages. This is up by a third on last winter. Richmond air quality data was reported in Hubbub to fulfil Council's legal obligations to report under the National Environmental Standard (NES). Nelson Evening Mail have not published a graph of the week's data (like the graph in the Press) as they have in previous years. This was partly because Nelson City stopped presenting the data to the Nelson Evening Mail in favour of the Council newspaper. A 'State of the Environment' report on Air Quality was produced in April 2007 and an electronic copy placed on the website.

3.6 Further Monitoring and Analysis

The following initiatives are planned:

1. Measure PM_{2.5} using the Partisol monitor at the central Richmond alongside the continuous PM₁₀ monitor (the BAM) to determine ratio of these fine particle size classes. It has been found that the PM_{2.5} fraction is the more significant fraction for human health, even though the national standard is PM₁₀.
2. Subject to the 2009 / 2010 budget undertake 3D fine particulate dispersion modelling in October 2009 for the Richmond air shed in cooperation with Nelson City Council. For the purpose of determining spatial distribution of PM₁₀ and to 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.
4. Review location of monitoring sites and airshed boundaries.

4. COUNCIL RESPONSE TO IMPROVE AIR QUALITY

4.1 Summary of The Level of Compliance With Respect to Wood Burners

Information from the Air Quality Monitoring database was utilised in order to undertake a programme of door knocking and telephone interviews during the period June-August 2008. The following information was gathered by Compliance Officers for each property that had registered a change of ownership since the rule came into effect:

- Presence of a chimney stack;
- The primary heat source for the dwelling;
- Make and model of the solid fuel burning appliance (if applicable);
- Compliance pursuant to rule 36.3.16B (if determined on site/phone; see Table 1);

Table 1: Results of compliance monitoring with respect to Rule 36.3.16B. The number of properties investigation were those that had undergone a 'transfer of ownership' between 13 Jan 07 to 30 June 08.

Number of properties investigated	Number of Authorised wood burners	Wood burners replaced with 'Clean Heat' alternative	Number of confirmed non-compliant wood burners	Properties not subject to rule:
550	22	60 (approx)	64	404

In addition to this, the results from the survey have shown a large number of dwellings have converted the primary heat source from solid fuel burners, to a 'clean heat' source such as a heat pump or gas fire. This information is not currently held on the Council property files, as a Building Consent is not required to undertake this work. The number of properties that had applied for a building consent to install an authorised wood burner was low when compared to the number of houses that have installed a heat pump or gas fire.

4.2 Feedback from Affected Householders

The feedback from the affected landowners ranged from a keen desire to actively change to a 'Clean Heat' alternative heat source, to serious discontent with the TRMP rules regarding air quality.

Many residents are aware that the air quality of the Richmond area is generally poor during the winter period, and wished to know what TDC was doing to achieve the requirements of the National Environmental Standard for air quality. Those who have changed to an authorised wood burner, or a clean heat alternative were encouraged by, and felt that it was desirable to see, a Council representative out in the community discussing air quality.

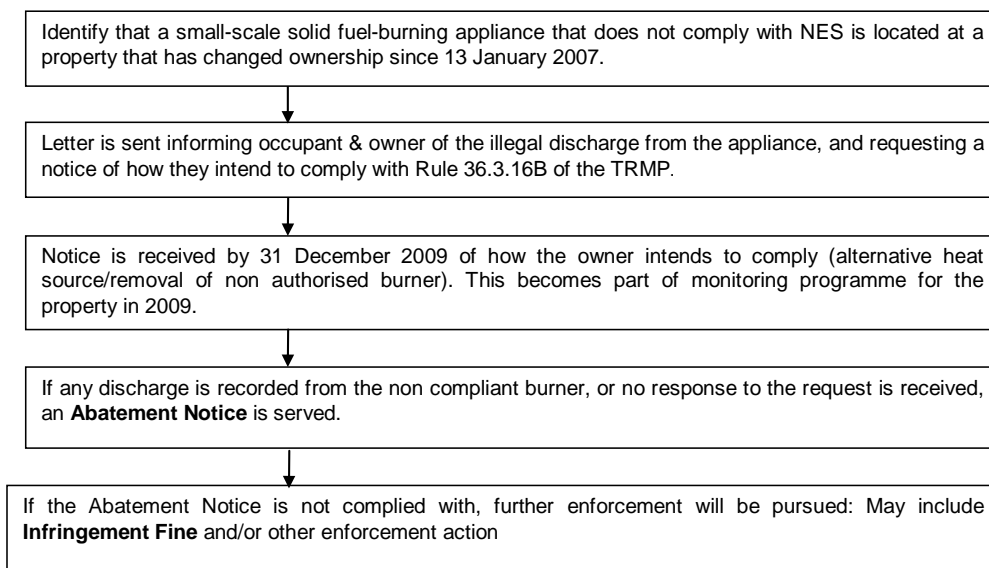
Negative feedback was common, with a high proportion of property owners not informed of how the transfer of ownership would affect them. Information was either not given by the real estate agent, or was given in a way that the intent of the rule was unable to be realised. It is also worth noting that not all purchasers obtained LIMs. Reference was also made to the activity of outdoor burning in the rural area occurring throughout the winter period. Some residents could not see the point in TDC enforcing a residential rule when the smoke from consented and permitted outdoor burns was often thick over the district.

There has been an understandable resistance from property owners who have been issued a Code Compliance Certificate for non-authorised burners up to the date that Rule 36.3.16B came into effect to change. From their perspective TDC has given written approval to the installation of a wood burner, and then reversed the approval

by way of the current enforcement programme within a short time period. This is an unfortunate situation for a few property owners. However, consistent enforcement of the TRMP rules is appropriate.

4.3 Enforcement Programme

The following flow diagram illustrates the proposed framework of the enforcement programme for the next 12 months.



5. CONCLUSION

Air quality in Richmond for the last winter continued to exceed national standards but the number of times this occurred was no worse than last year and a great improvement on the past. The 24-hour average standard for PM₁₀ was exceeded 21 times. This result is also below the straight-line path required under the NES. It is too early to determine if this marks a trend towards improved air quality as July's warmer and windier conditions are likely to have had a large influence on this result. The average rate of exceedence (magnitude above the NES) of the NES appears to have reduced over the last few years. Any statistically valid trends in PM₁₀ (number of exceedences or other statistic) will be able to be confirmed in 2009 when there will be enough data from our continuous monitor. The annual average also exceeded guidelines but by only a small amount.

After this winter's mobile monitoring campaign and installation of a temporary site in Richmond south, as well as last year's monitoring at a temporary site in Richmond north, Council has a greatly increased understanding of spatial variability in PM₁₀ concentrations across Richmond. Two areas with considerably higher concentrations than Richmond central were identified. However, the concentrations at the Richmond central monitoring site are representative of the largest residential area which are likely to experience exceedences of the NES. Generally lower concentrations of 24-hour average PM₁₀ were found at the south Richmond than at Richmond Central. Higher 24-hour average concentrations were found last winter at Richmond north.

The promulgation of Rule 36.3.16B of the TRMP has initiated a compliance programme that aims to remove approximately 64 solid fuel burning appliances that currently discharge into the Richmond airshed. Further monitoring of the airshed during the winter 2009 period will indicate whether this is an effective method of achieving the requirements of the National Environmental Standards for Air Quality. Please note that a detailed compliance report will be provided at a later stage. This will focus on the outcomes of the proposed compliance programme.

6. RECOMMENDATIONS:

1. The Committee receives this report.

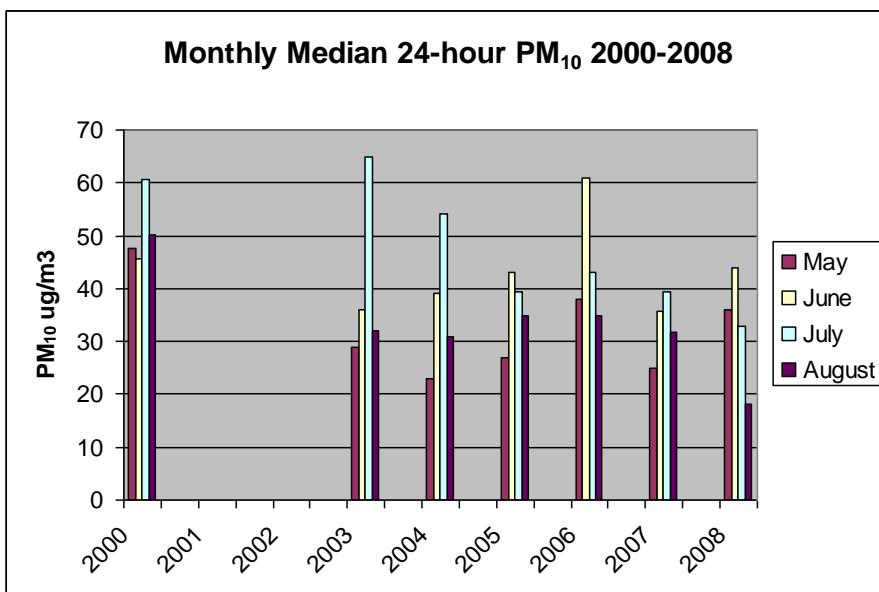
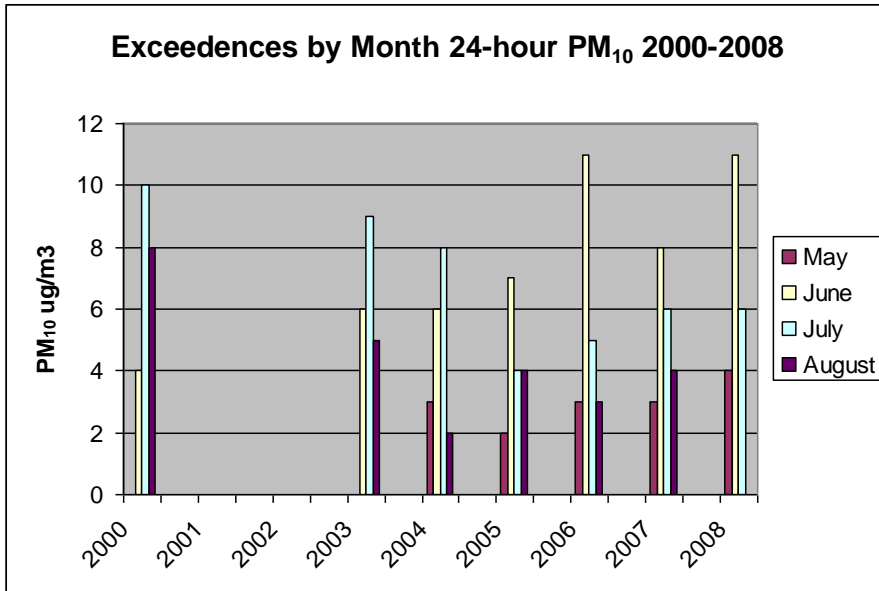
Trevor James
Resource Scientist

Thomas Marchant
Compliance Officer

Appendix 1:

Monthly Variation in PM₁₀. The top graph is the total number of exceedences of the NES by month and the lower graph is the monthly average (median).

Comment [r1]: the y-axis for plot #1 needs correcting to "number of days the NES was exceeded"



Wind roses for Richmond (TDC Building) for May-June and July-August
(to be tabled)

Appendix 2:

Appendix 3:

Pollution Rose for Richmond Central. This is the proportion of pollution coming from various directions.

