# Nelson
# State of the Environment
# Report




NELSON CITY COUNCIL

# Contents

# Foreword

This is Nelson's third State of the Environment Report. The focus is on our air quality which is one of the most significant environmental issues currently facing the city. As outlined in this report, the monitoring that has been carried out shows there is a need for change if we wish to have clean air in the winter.

In April 2001, the Council adopted the Ministry for the Environment Ambient Air Quality Guidelines (2000) as the target for air quality within the city. This new guideline has lower levels for many pollutants, including particulate material ($PM_{10}$), as a result of ongoing research on the effects of these pollutants on human health.

In addition to Council's regular air quality monitoring, the proposed southern link road led to a need for better information about Nelson's existing air quality. As a result, more intensive and comprehensive air quality monitoring was carried out in 2000 than in previous years. The recent conclusions of the Commissioners who heard and considered submissions to the southern link road application reinforces the need for the Council to address air quality issues.

This report provides an overview of air quality information compiled by the Council, the air quality issues we are facing and points towards possible solutions. It is important that the Nelson community understands the air quality issues facing the city so that we all recognise the impact of our activities, including our home heating, on our air quality and people's health. Some of our habits will have to change if we are to improve our air quality.

A community that understands the issues, and the options for improvement, will be better able to contribute to preparation of our forthcoming Air Quality Plan, and more inclined to give effect to its provisions. Your understanding and participation in this process is vital to a healthy environment for our children and, in turn, their children.

Further information is available through Live Nelson and the Council's website (www.nelsoncitycouncil.co.nz).

This State of the Environment Report also contains information related to noise monitoring in Nelson. To date this work has mainly focused on transport noise but in the future will include noise measurements related to residential, commercial and industrial activity.

**Councillor Derek Shaw**

Chair Environment and Planning Committee
**Nelson City Council**

# Acknowledgements

**Nelson City Council would like to acknowledge the following people for their contributions to environmental monitoring and reporting in Nelson.**

Air Quality part one – Jeff Bluett (NIWA)
Air Quality parts two and three – Emily Wilton

Noise part three (traffic noise) – Stephen Lawrence (Environmental Inspections Ltd) with assistance and traffic data from the Nelson City Council Traffic Engineering Section and Opus.

**Key Nelson City Council contributors**

Paul Sheldon and Debra Bradshaw; also
Fiona McNab and Melanie Baynes.

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# Introduction

## This report – air issues

This report outlines the monitoring the Council has carried out on both air quality and noise levels around the city.

Both of these air-related issues are critical to human health and well being. In both cases, the impact on human health and wellbeing is the most sensitive indicator in the environment.

The hills surrounding Nelson are one of the main influences on the shape of the city. By sheltering Nelson City from the east, south and west, the prevailing wind flow is modified. This creates below average (for New Zealand) wind flow which means smoke and other airborne pollutants do not disperse quickly. These calm conditions, combined with Nelson's frosty winters, have a significant impact on the concentrations of air pollution in Nelson. In combination, the topography and weather conditions may result in temperature inversions, where cold air, along with smoke and vehicle exhaust emissions, become trapped under a layer of warmer air. These temperature inversions mainly occur in winter when smoke production from home heating fires is at a maximum.

For these reasons, Nelson's relatively small population can have a significant polluting impact on air quality.

Excessive noise or unwanted sound can also affect the health and wellbeing of the community. Noise can travel a long distance and one source can affect large areas of the community.

## The structure of this report

The two main sections of this report (section 2 - air quality and section 3 - noise) are structured in terms of:

- Key issues and historic trends which provide background on air quality and noise issues.
- What the Council wants to achieve outlines the commitments the Council has made in the *Nelson Regional Policy Statement* and the *Proposed Nelson Resource Management Plan.* The full text of the objectives and policies referred to in this report is listed in Appendix 4.
- Results to date is an explanation of the monitoring that has recently been carried out, and a summary of the results.
- Where to from here is an outline of the next steps the Council will be taking in response to the issue.

Appendices 1 and 2 provide detail of the performance indicators contained within the Nelson Regional Policy Statement and the Nelson Resource Management Plan. Appendix 3 outlines the proposed work programme for environmental monitoring over the next year.

## Air Plan

The air quality monitoring outlined in this report will contribute to the development of the Air Plan, which will include provisions to improve our air quality.

This report provides information for the public, councillors and staff of our council and other councils. It will be particularly relevant for people involved in the working group and stakeholder groups developing air quality provisions for the Air Plan, and for members of the public who wish to take part in the public consultation process of that Plan.

The Air Plan will form part of the larger Nelson Resource Management Plan (first released in 1996 and last revised in December 1999). A freshwater plan is also being prepared.

The Nelson Resource Management Plan sets objectives, policies and rules for activities in each of the land use zones: residential, inner city, suburban commercial, industrial, open space, rural, the coastal marine area, and the conservation zone.

Above it in the planning hierarchy is the Nelson Regional Policy Statement (RPS), which gives an overview of Nelson's resource management issues and sets a direction on how the Council and community can achieve sustainable management.

Both documents have been prepared under the provisions of the Resource Management Act which was passed in 1991 and is the legal framework for most of the Council's environmental management of Nelson.

## Noise

Noise leads to more complaints to the Council than any other issue. Almost everything we do creates noise to a greater or lesser extent. People vary in their tolerance of noise, and some individuals are particularly sensitive to it.

The Council has set noise limits for residential, commercial, industrial and rural areas of Nelson. Noise from the airport and port is particularly difficult to manage. Monitoring of these noise sources is outlined in this report.

The Council has monitored the before and after noise environment of both the new Whakatu Drive (Stoke Bypass) and Main Rd Stoke and Nayland Rd South which were the main feeder roads used before Whakatu Drive was constructed. This study measured the change in noise levels at different times of the day and night for nearby residents as a result of the change of traffic patterns.

## Monitoring and information

We need to understand the current air quality and noise levels in our environment before we can assess whether it is getting better or worse and where improvement is required. (See Section 35 of the Resource Management Act.) When action is necessary, the Council can use any of the methods available to it under the Act. New provisions in the Act require the Council to maintain a written record of the options it considered and the costs and benefits of those options and the reasons why a particular option is chosen over others. (See Section 32 of the Resource Management Act.)

## The national picture

Local level state of the environment monitoring, such as the information reported here, contributes to New Zealand state of the environment reporting compiled by the Ministry for the Environment (MfE). Consistency between regions is important. For this reason, the Council is guided by MfE on what environmental indicators to measure, and what monitoring methods to use.

## Nelson City Council's approach to state of the environment reporting

This report is the third report on the state of Nelson's environment. The first report was a scene-setter and provided an overview of what we know about the condition of and pressures on the whole environment including our coast, fresh water, land and air. It also reported on what we are doing in relation to amenity values, development and hazards, and the Council's relationship with the Tangata Whenua. The second report focused on land-related monitoring projects. Copies of both of these reports are available from the Council.

The next two topic reports will provide more detailed information on fresh water (2002) and the coast (2003).

In 2004 there will be an assessment of the current state of knowledge of the environment as a whole and the performance of the Proposed Nelson Resource Management Plan (the Plan) to date. This information will provide a stocktake of how well the Council is doing in relation to managing the environment through the policies in the Plan.

Following on from this stocktake, the Council will produce a further set of topic reports on specific environments.

In 2009 the Council will report on the key issues of the whole environment. This detailed information will feed into a review of the performance and effectiveness of the Plan.

## Feedback

Please forward any comments on this report, including the monitoring work programme in Appendix 3, to Paul Sheldon, Monitoring Co-ordinator, Nelson City Council, PO Box 645, Nelson, phone (03) 546-0435, fax (03) 546-0239, email Paul.Sheldon@ncc.govt.nz.

# Iwi perspective on Air Quality issues

## State of the Environment Reporting

Within the origins of Maori culture, Ranginui and Papatuanuku were spiritual beings, while Tane Mahuta (Guardian of the Forest), Tawhirimatea (Guardian of Winds and Airways), and Tangaroa (Guardian of the Seas) were their children.

Ranginui (Sky Father) and Papatuanuku (Earth Mother) were parted by their children which resulted in the tears of Ranginui creating the waterways. Thus are all parts of the environment inter-related.

State of the Environment monitoring and reporting transcends the domains of Tangaroa and Tawhirimatea as well as Tane Mahuta.

Based on their whakapapa[1], Tangata whenua are kaitiaki[2] for these spiritual beings and as such wish to protect the mauri of these areas.

Tangata Whenua take a holistic approach to the management of the environment. Tangata Whenua consider that air, earth, water and flora and fauna are all interconnected elements of the environment. This is the approach advocated by the Resource Management Act under sections 5, 6 and 7.

Involving Tangata Whenua within the Nelson region in State of the Environment monitoring recognises the rangatiratanga[3] that Tangata Whenua hold throughout New Zealand which has been recognised in Te Tiriti o Waitangi (Treaty of Waitangi).

### Iwi Perspective on Air

As a taonga[4], air like all other natural and physical resources, is to be valued, protected and used with respect.

Air quality management is an integral part of an holistic process that recognises and takes into account the inter-relationships between the domains of Ranginui and Papatuanuku and the guarantee of these resources as stated in the Treaty of Waitangi and recognised in section 8 of the Resource Management Act.

Tangata Whenua wish to improve and enhance the best air quality for this region.

[1] Genealogy
[2] Guardian
[3] Maori sovereignty
[4] A highly prized resource

## Issues for Tangata Whenua

1. Discharges of odorous or visual contaminants which have the potential to cause adverse effects on sites and resources of significance to tangata whenua.

The sacredness of Ranginui and the importance of waahi tapu/urupa[5] means that objectionable odours or visible contaminants may violate the wairua[6] and mauri[7] of nga taonga tuku iho[8]. It is of great importance to tangata whenua that these sites and resources are protected and respected.

2. Discharges of contaminants to air, particularly hazardous pollutants and particulate matter have the potential to cause adverse effects on the health of the community and Tangata Whenua of the Nelson region.

Examples of potential health issues for Tangata Whenua include, but are not limited to:
Agricultural spray drift;
Dust pollution;
Vehicle exhaust fumes; and
Industrial/commercial emissions.

Tangata Whenua wish to be involved in relation to the management and monitoring of the above health issues.

Air is a taonga and therefore it is of great importance to Tangata Whenua that they are involved in the maintenance and improvement of the air quality of Nelson.

## Maori Environmental Indicators

Nationally there have been programmes that aimed to develop Maori Environmental Indicators but these are yet to be finalised. The Ministry for the Environment (MfE) is currently working towards the establishment of an agreed process for the development of local Maori Environmental Indicators. This is being done through a number of case studies including fresh water and marine environments. MfE has indicated that until this programme is complete, no funding for local Maori Environmental Indicators will be available. When agreed processes are available Nelson City Council will work with Iwi to consider how the development of monitoring and reporting of local indicators should take place.

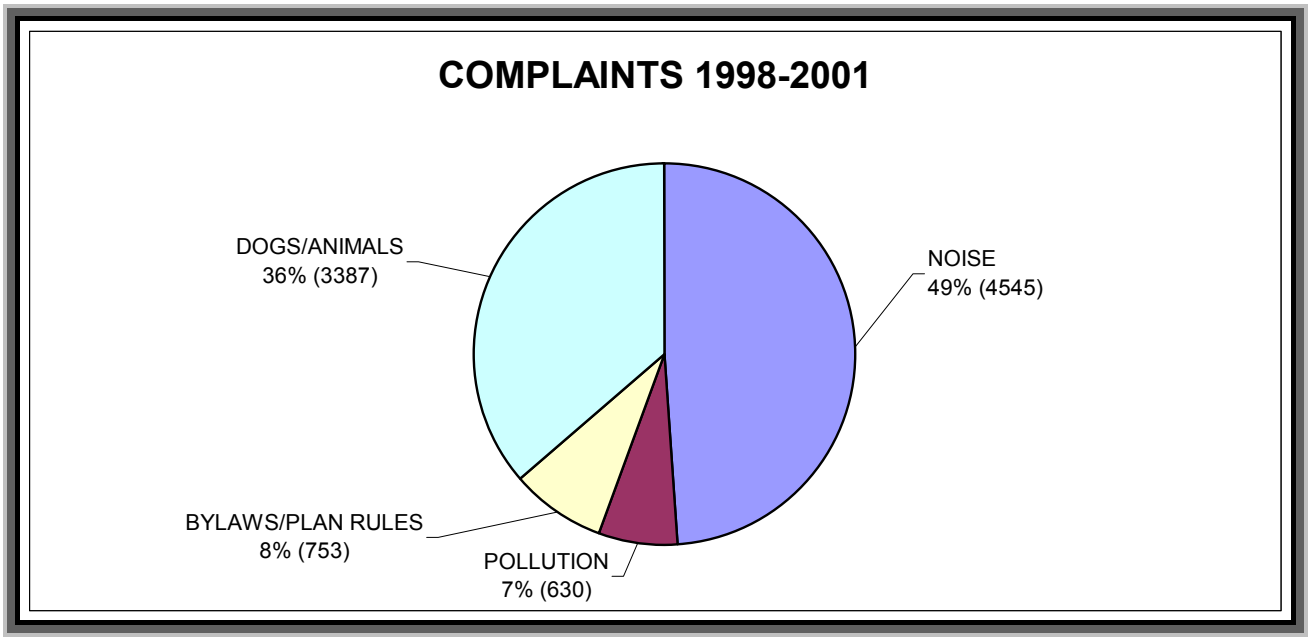
[5] Sacred site/cemetery
[6] Spiritual
[7] Life force
[8] Those things that have been handed down

# COMPLAINTS

The vast majority of complaints made to Nelson City Council relate to noise, and dog and animal control issues. The Council maintains a 24 hour, 30 minute response to all urgent pollution and nuisance noise complaints.

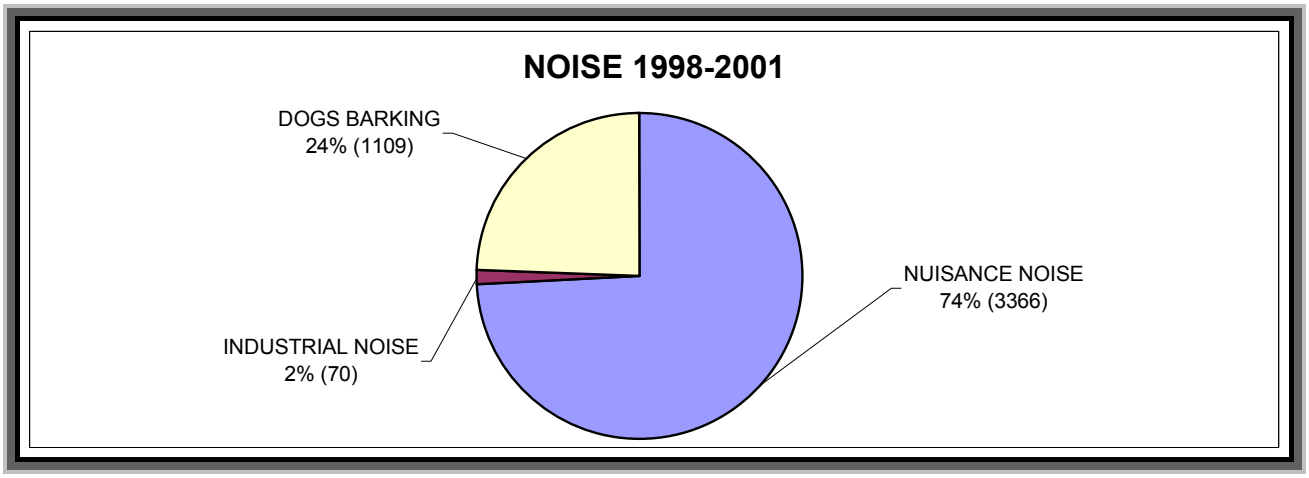
Although noise and animal control issues generate the greater number of complaints and have an immediate effect on the living environment, the pollution complaints and some of the bylaw/plan rule complaints have a greater effect on the physical environment.

**Figure 3: Complaints 1998-2001**




The following 2 charts (figures 3 and 4) further identify the key areas of complaint for noise and air pollution.

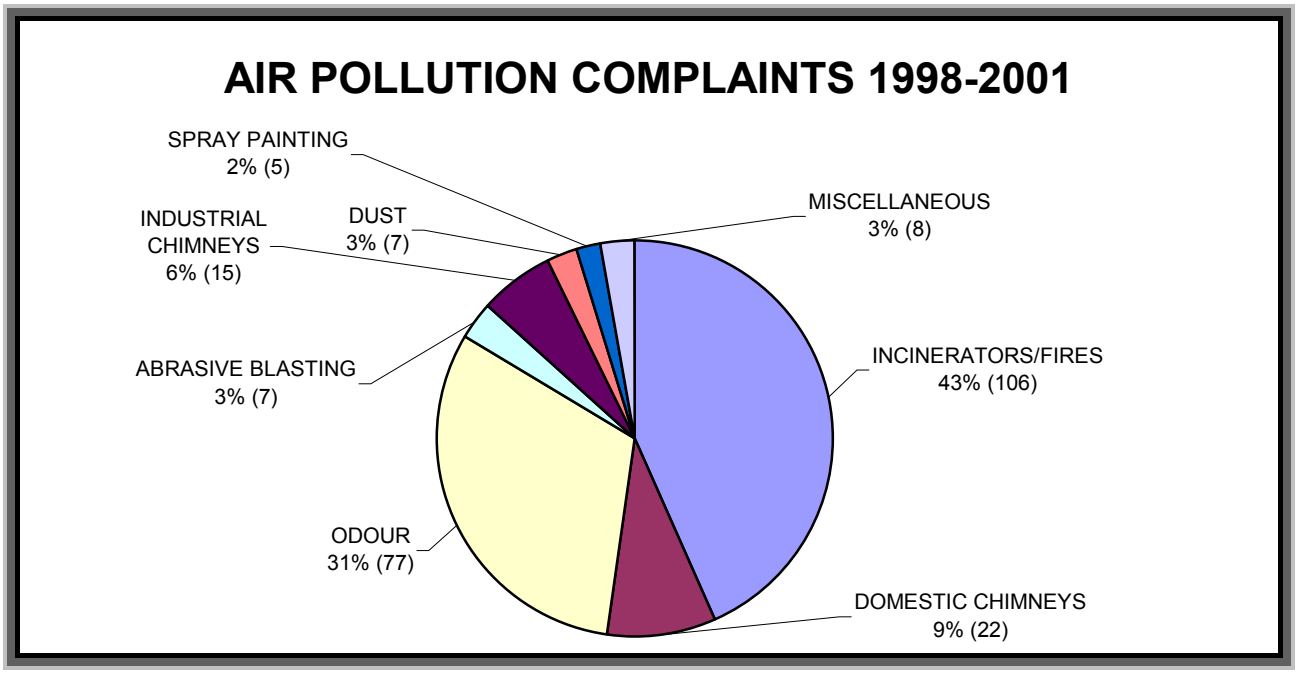
**Figure 4: Noise 1998-2001**



Nuisance noise is predominantly party and stereo noise. The Council is not responsible for controlling noisy vehicles.

Industrial/commercial noise complaints relate mainly to music/activity from hotels and taverns. Where noise complaints concern factories the main sources of problems are compressors and generators. There have been no more than 2 to 4 airport noise complaints per year over the past three years.

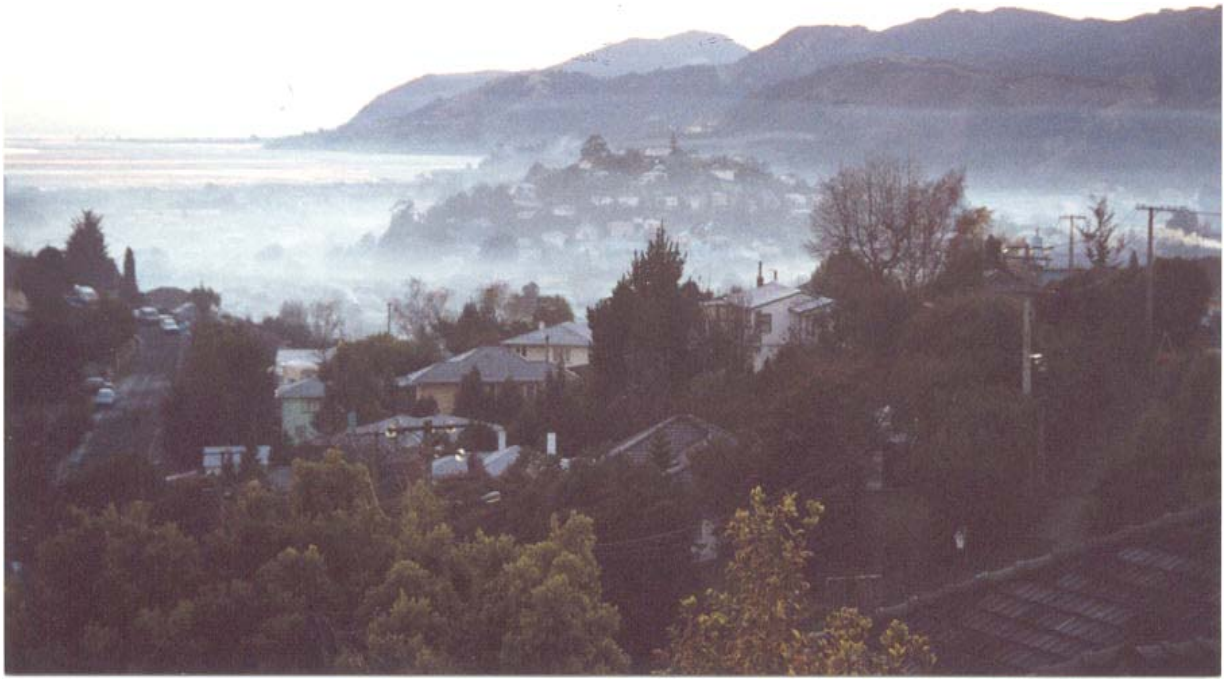
**Figure 5: Air Pollution 1998-2001**




Odour is a significant pollutant within Nelson. Other industrial discharge complaints tend to be localised and while causing immediate nuisance it is unknown what long term effect they have (figure 5).

Incinerators, open burning, and domestic chimneys cause considerable nuisance and give rise to the greatest number of air pollution related complaints. While the level of complaint does not always reflect the environmental severity of the issue, in the case of smoke pollution recent research demonstrates a strong linkage with serious human health problems. The nature and extent of these problems is outlined in the following section of this report.

# AIR QUALITY



***What the Council wants to achieve***

- *an improvement of air quality in Nelson*
- *minimum air quality standards set to avoid harmful impacts of air pollution on human health*
- *no significant decrease in quality where existing air quality is higher than the minimum standard*
- *To control and/or reduce discharges of air pollutants from industrial, commercial, rural and domestic activities*

# Key issues and historic trends

## Human health

The Ministry for the Environment has recently reconsidered the significance of 'smoke' as an air pollutant because of its effects on human health. Smoke contains particles with a diameter smaller than 10 microns, or 0.01mm. Particles this small can penetrate into the lungs, where they cause problems.

These small particles (referred to as $PM_{10}$) can worsen respiratory and related conditions such as asthma and bronchitis. The level of small particles in the air can increase hospital admissions and emergency department visits, and can lead to school absences, lost work days and days of poor health.

The elderly, people with cardiovascular and respiratory disease, asthmatics and children are particularly susceptible to the effects of air pollution.

Poor air quality can also have adverse effects on:

- Amenity values e.g. visibility, odour and dust
- Economic systems e.g. property damage and tourism
- Ecosystems e.g. plant and animal health

## Changing standard

In the light of information from health studies in New Zealand and overseas, the Ministry for the Environment is reducing the maximum recommended level of $PM_{10}$ in the air we breathe from 120 micrograms per cubic metre to 50 micrograms per cubic metre. Research shows a direct relationship between $PM_{10}$ levels and health effects. There is no safe level and therefore it is desirable to keep levels as low as practical.

## Nelson's air quality

The Council began monitoring smoke levels in Nelson in 1983. Initial smoke monitoring was carried out at three locations in Nelson: the inner city, Vanguard Street and Quarantine Road. Results of that monitoring suggested that air quality was acceptable based on the equipment and standards available at that time. Trends from this monitoring indicate that there has been a steady decline in the winter smoke levels in Nelson since monitoring began.

However, in 2000 the monitoring programme was revised and the focus placed on the smaller particles ($PM_{10}$), the indicator now used in national air quality guidelines. The monitoring data for 2000 and 2001 shows regular breaches of the new guideline level.

## Air quality monitoring 2001

Under the Resource Management Act (the Act), Nelson City Council is responsible for managing the quality of the outdoor air we breathe (ambient air). The Act also requires the Council to monitor the state of the environment including air quality.

During 2001 an extensive air quality monitoring programme was undertaken in Nelson City. The collected data has been used to:

- Assess ambient concentrations of airborne contaminants;
- Establish compliance of concentrations with Ministry for the Environment (MfE) air quality guidelines;
- Assess potential health effects on humans;
- Identify the most significant sources of contaminants.

More sophisticated monitoring was carried out during the winter of 2001, to gain a more accurate picture of the nature of Nelson's air pollution, as it relates to pollution sources, weather, traffic, and topography. The conclusions from that monitoring are outlined in this report section.

The ultimate purpose of the monitoring is to collect data that can be used to make informed decisions about how to best manage and improve Nelson's air quality.

## Main source of air pollution

Prior to a detailed air emissions inventory in 2001, the main source of $PM_{10}$ air pollution was believed to be from domestic fires. While this was generally accepted the Council needed to be sure of the facts before it could manage the problem. The inventory has confirmed that domestic heating is the main contributor of both $PM_{10}$ and $PM_{2.5.}$ Domestic heating is also a main contributor to emissions of benzene, carbon monoxide, volatile organic compounds and carbon dioxide emissions.

The results of the emissions inventory include estimates of the relative contribution from motor vehicles, household fires, outdoor burning and industry, and is outlined in this report section, under part two of 'Results to Date'.

## What the Council wants to achieve

The Council wants:

- An improvement of air quality in Nelson.
- Minimum air quality standards set to avoid harmful impacts of air pollution on human health.
- No significant decrease in quality where existing air quality is higher than the minimum standard.
- To control and/or reduce discharges of air pollutants from industrial, commercial, rural and domestic activities.

(See RPS objective DA1.2.2 and RPS policies DA1.3.1, DA1.3.2, DA1.3.3 and DA1.3.4, in Appendix 4.)

# Results to Date Part One – Air Quality Monitoring

## Assessing Ambient Air Quality

MfE has produced guidelines for air pollutants that can be used as indicators of the state of our air environment. The guidelines specify the concentrations and types of contaminants which are, or are likely to be, hazardous to human health and wellbeing (MfE 2001).

Due to the nature and number of sources of air contaminants in Nelson City, carbon monoxide (CO), nitrogen dioxide ($NO_2$), particulate matter smaller than 10 microns ($PM_{10}$) and benzene were identified as the indicator pollutants most likely to cause adverse environmental effects. These particular pollutants are also identified in the National Ambient Air Quality Guidelines (jointly developed and adopted by Ministry of Health and Ministry for the Environment 2000) and were therefore monitored in Nelson City during 2001. The proposed guideline values for these particular pollutants are shown in Table 1.

**Table 1: Proposed Ambient Air Quality Guideline Values (MfE, 2000)**

| Contaminant | Averaging time* | Value |
|---|---|---|
| **CO** | 1-hour | 30 $mg/m^3$ |
| | 8-hour | 10 $mg/m^3$ |
| **$NO_2$** | 1-hour | 200 $\mu g/m^3$ |
| | 24-hour | 100 $\mu g/m^3$ |
| **$PM_{10}$** | 24-hour | 50 $\mu g/m^3$ |
| **Benzene** | Annual | 10 $\mu g/m^3$ |

* Averaging time means the average level of contaminants present during the specified period of time.

### Environmental Performance Indicators

MfE states that "*Guideline values should not be seen as a limit which it is acceptable to pollute up to*". In other words, any contaminant can have harmful impacts, and should be avoided wherever possible. MfE has developed a set of Environmental Performance Indicators (EPI) that can be used as a warning device of possible air pollution problems (MFE, 1998). The EPIs are based on percentage ranges of the guideline value and are shown in Table 2.

**Table 2: Environmental Performance Indicators (MfE, 1998)**

| Category | Maximum Measured Value | Comment |
|---|---|---|
| **Action** | Exceeds guideline | Unacceptable by national and international standards |
| **Alert** | Between 66 % and 100 % of guideline | A warning level, of possible future guideline exceedances |
| **Acceptable** | Between 33 % and 66 % of guideline | Generally a level which does not warrant dramatic action |
| **Good** | Between 33 % and 10 % of guideline | Peak levels unlikely to affect air quality |
| **Excellent** | Less than 10 % of guideline | Of little concern |

## Monitoring Strategy

### Contaminants measured

The most significant sources and a summary of potential adverse human health effects of CO, $NO_2$, $PM_{10}$ and benzene are shown in Table 3.

**Table 3: Sources and potential adverse effects of contaminants monitored in Nelson during 2001**

| Contaminant | Most significant source/s* | Potential adverse human health effects** |
|---|---|---|
| **CO** | Domestic heating (51 %)<br>Transport (46 %) | Reduce the oxygen carrying capacity of the blood |
| **$NO_2$** | Transport (72 %)<br>Industry (20 %) | Increase susceptibility and severity of infections and asthma |
| **PM10** | Domestic heating (78 %)<br>Industry (14 %) | Aggravation of existing respiratory and cardiovascular disease. |
| **Benzene** | Domestic heating (57 %)<br>Transport (39 %) | Haemotoxin and carcinogen. |

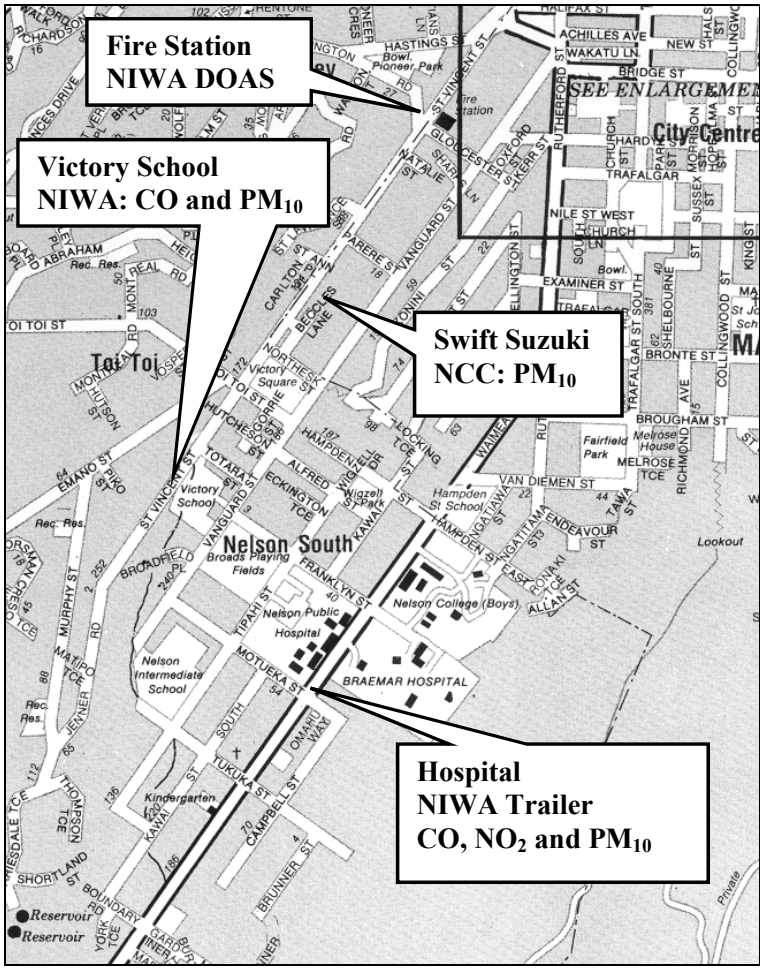
* Information from the Nelson Emission Inventory, (Wilton and Simpson, 2001) See Part 2 of this report section.

** Information from Ambient Air Quality Guidelines (MfE, 1994).

## Where and How was the Air Quality Measured?

The monitoring stations were located within the Victory Square area and were sited to obtain data which is representative of the area being studied. The locations of the monitoring sites and the pollutants that they measured are shown in Figure 6 - location of the ambient air quality monitoring sites. The monitoring sites and reasons for their selection are described in detail in NIWA report number AK011135. This report is available for viewing at Council reception (Civic House) and at the Elma Turner Library.

**Figure 6: Location of the ambient air quality monitoring sites**




CO levels were monitored at Victory School and the Hospital. $NO_2$ levels were monitored at the Fire Station and the Hospital. $PM_{10}$ levels were monitored at the Swift Suzuki site in Vanguard Street, at Victory School and at the Hospital. Benzene levels were measured at the Fire Station.

The measurement methods varied. For more detail, please refer to the NIWA report number AK01182. This report can be viewed at Council reception and the Elma Turner Library. Copies are also available for purchase from Council reception.

## Summary of Monitoring Results

This section presents a brief summary of air quality monitoring data collected during the five months between 1 April and 31 August, 2001. A detailed description and analysis of the monitoring data can be found in NIWA report number AK01182, as mentioned above.

### Guideline Assessment

Table 4 shows the highest maximum and mean measured concentrations recorded during the monitoring campaign.

**Table 4: Maximum and Mean Measured Concentrations**

| Pollutant | Averaging period | Site | Max. Conc. | Mean Conc. | MFE Guideline | Number of exceedances |
|---|---|---|---|---|---|---|
| **CO** | 1-hour | Victory School | 8.7 (mg $m^{-3}$) | 1.4 (mg $m^{-3}$) | 30 (mg $m^{-3}$) | 0 |
| | 8-hour | Hospital | 5.1 (mg $m^{-3}$) | 1.4 (mg $m^{-3}$) | 30 (mg $m^{-3}$) | 0 |
| **NO2** | 1-hour | Fire Station | 138 (µg $m^{-3}$) | 29 (µg $m^{-3}$) | 200 (µg $m^{-3}$) | 0 |
| | 24-hour | Fire Station | 51 (µg $m^{-3}$) | 24.5 (µg $m^{-3}$) | 100 (µg $m^{-3}$) | 0 |
| **PM10** | 24-hour | Swift Suzuki | 165 (µg $m^{-3}$) | 64 (µg $m^{-3}$) | 50 (µg $m^{-3}$) | 81 |
| **Benzene** | Annual | Fire Station | NA | 6.8* (µg $m^{-3}$) | 10 (µg $m^{-3}$) | NA |

*Average benzene concentration over the 5 month monitoring campaign.

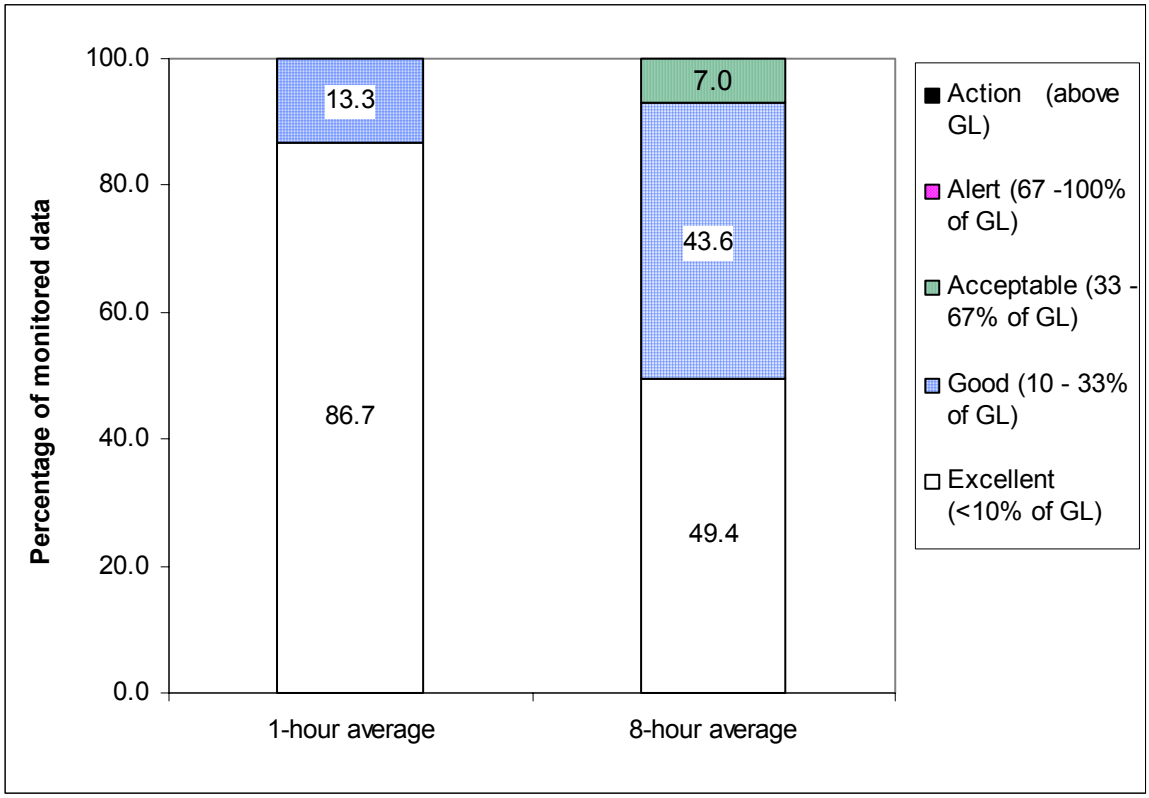
The data in Table 4 shows that the maximum recorded concentrations of:

- CO and $NO_2$ did not exceed the relevant MfE/MoH Guideline.
- $PM_{10}$ concentrations exceeded guideline levels on 81 occasions (51 % of the days that were monitored).

### Environmental Performance Indicators

Figure 7 to Figure 9 show the environmental performance indicator (EPI) classification of CO, $NO_2$ and $PM_{10}$ concentrations respectively. The data displayed in these figures is from the monitoring site which recorded the highest levels of that particular contaminant.

**Figure 7: EPI classification of CO concentrations monitored at Victory School**




Note: GL = guideline level (as established by the National Ambient Air Quality Guidelines 2000).

**Figure 8: EPI classification of $NO_2$ concentrations monitored at the Fire Station**

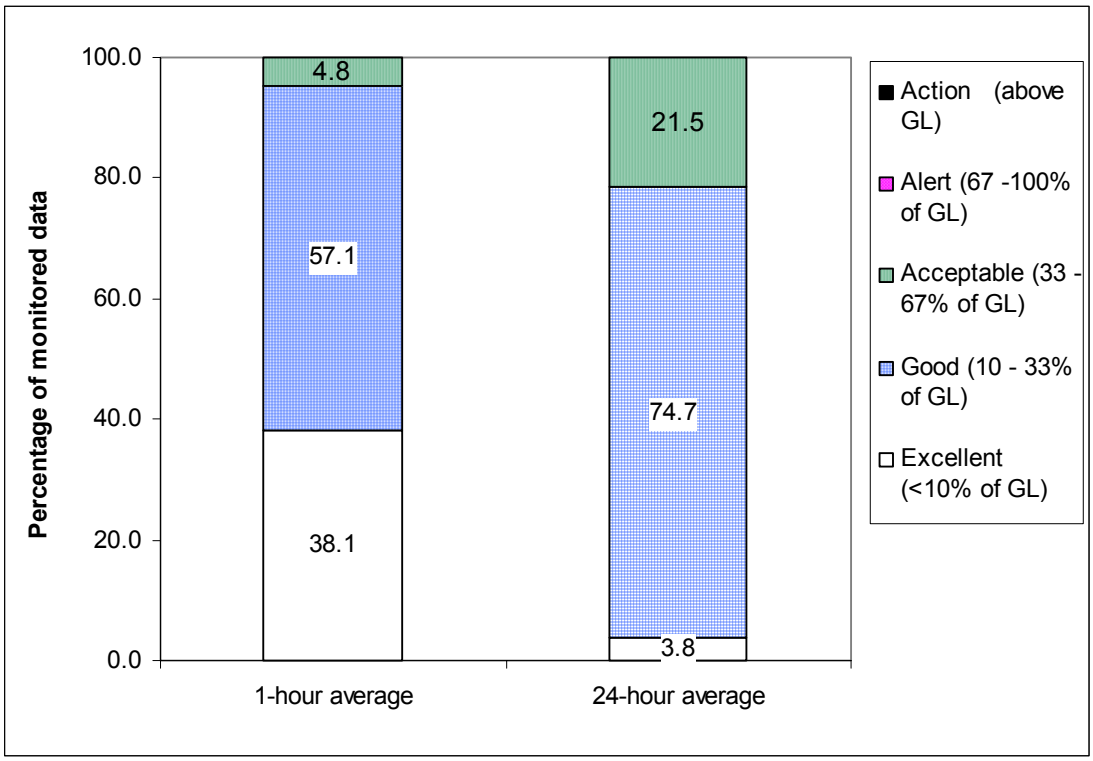



**Figure 9: EPI classification of $PM_{10}$ concentrations monitored at Swift Suzuki (St Vincent Street)**

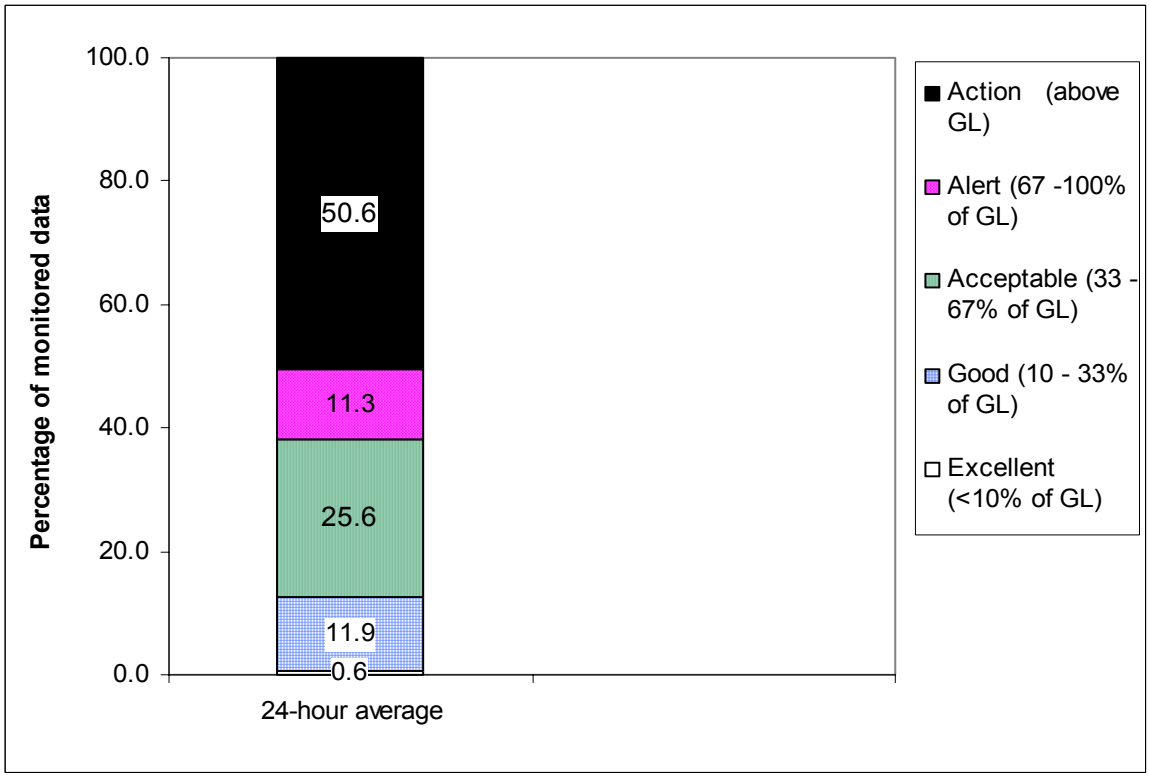


Figure 7 to Figure 9 show that of the maximum recorded concentrations:

- CO reached the good and acceptable EPI for the 1- and 8-hour averaging periods respectively.
- $NO_2$ reached the acceptable EPI for both the 1- and 24-hour averaging periods
- $PM_{10}$ exceeded guideline levels on 81 occasions (51 % of the days that were monitored).

**Seasonal Variation of Contaminant Concentrations**

Figure 10 shows the $PM_{10}$ concentrations recorded at the Swift Suzuki site over the period 23 March to 30 September, 2001.

**Figure 10: $PM_{10}$ concentrations (24-hour average) recorded at Swift Suzuki**

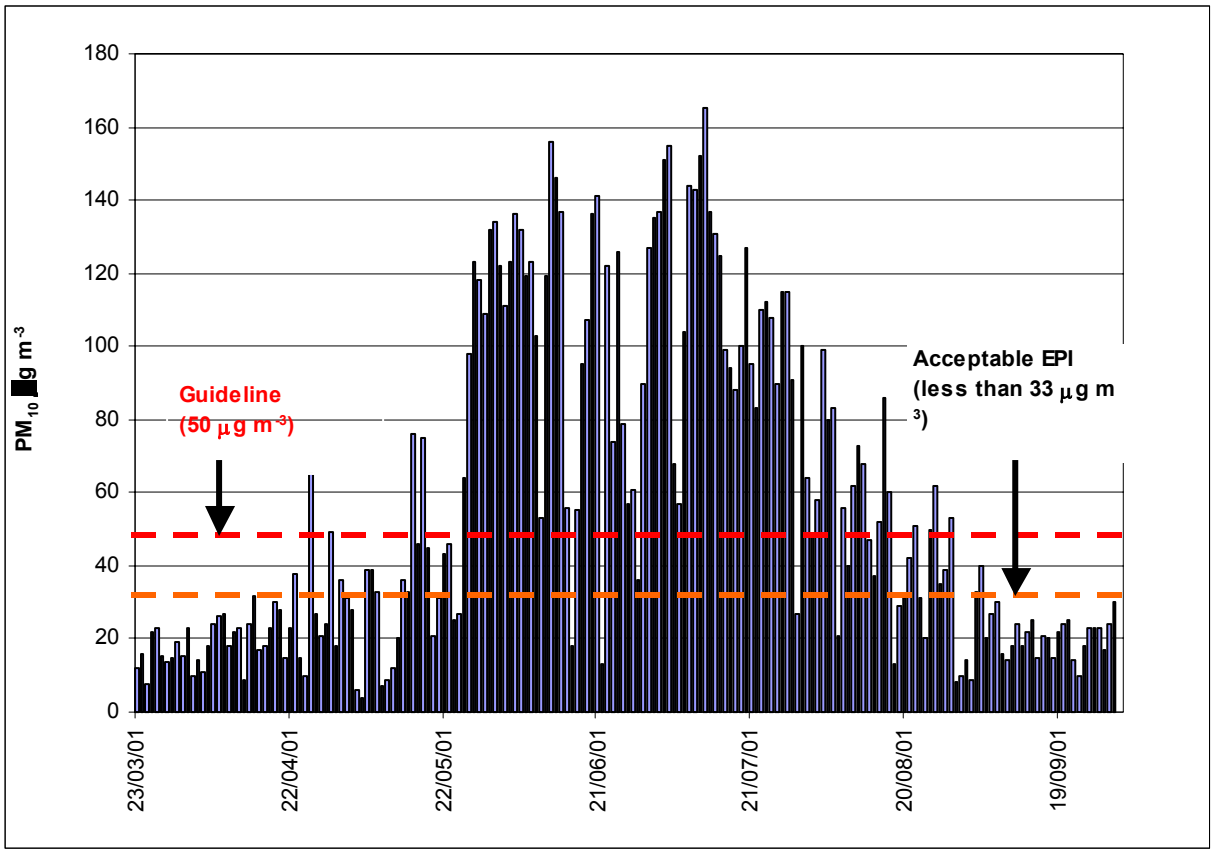



Figure 10 shows that the concentrations of $PM_{10}$ recorded at the Swift Suzuki site vary significantly with changes in season. Levels are observed to increase during autumn, reaching peak concentrations in winter before decreasing again in spring. A very similar pattern of relatively high concentrations occurring in the colder part of the year is observed in the CO, $NO_2$ and benzene data.

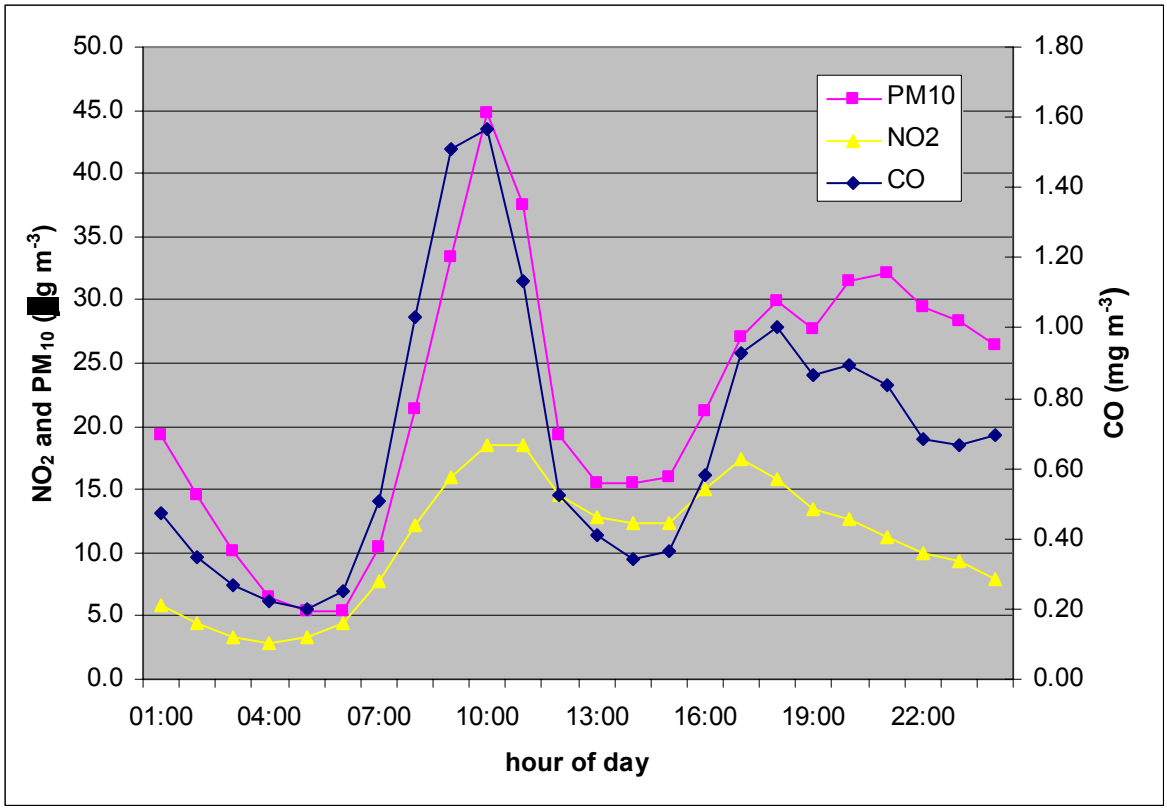
The observed seasonal variation of air quality is most likely to be caused by:

- Relatively poor dispersion occurring in winter due to low wind speeds and cold temperatures.
- Increased emission of pollutants in winter from residential fires.

**Daily Variation of Contaminant Concentrations**

Figure 11 shows the variation of the concentrations of CO, $NO_2$ and $PM_{10}$ on a typical winter week day at the Hospital monitoring site. This site is in close proximity to Waimea Road and is thus heavily influenced by traffic flows.

**Figure 11: Variation of pollutants recorded at the Hospital monitoring site on a typical winter day**




The data displayed in Figure 11 shows that during the morning (8-11am) and the evening (5-9pm) concentrations are generally higher than over the middle of the day and late at night. The periods of elevated pollution are most likely the result of relatively high emission rates coinciding with a period of poor dispersion. The poor dispersion is caused primarily by two factors: low wind speeds, which limit horizontal dispersion; and an inversion layer (warm air beneath cooler air) which traps pollutants close to the ground.

The most significant source of the pollutants contributing to the morning peak at this site is most likely to be vehicles and to a lesser extent domestic heating (NIWA report AK01182). The morning peak levels are eroded by increasing wind speeds which blow the pollutants away as the day moves toward noon. Emissions from domestic fires appear to be the most significant source of pollutants during the evening (NIWA report AK01182), when increasing numbers of home solid fuel burners are sending smoke into an atmosphere at a time of the day when there is limited air circulation. Other sites elsewhere in Nelson which are less influenced by traffic flows are likely to show different patterns.

## Conclusion

The 2001 ambient air quality monitoring programme has provided data that allows a comparison between the relevant MfE guideline and the maximum recorded concentrations of CO, $NO_2$, $PM_{10}$ and benzene. This comparison suggests that current concentrations of:

- CO and $NO_2$ are unlikely to cause adverse health effects.
- $PM_{10}$ levels are frequently above levels that have been demonstrated as causing adverse human health effects.

Using the EPIs as an assessment tool suggests that it is unlikely that guideline levels for CO and $NO_2$ will be exceeded in Nelson in the near future unless significant new sources of these contaminants are introduced in the City's airshed.

If the autumn-winter average concentration of benzene (6.8 μg $m^{-3}$) was maintained for the whole year the alert EPI (66 % of guideline value) would be reached. However due to decreased home heating emissions and better dispersion during spring and summer, it is likely that the annual average benzene concentration would be lower than 6.8 μg $m^{-3}$ and therefore fall back into the acceptable EPI. It must be noted that MfE have proposed an annual average guideline of 3.6 μg $m^{-3}$ to be introduced in the year 2010 (MfE, 2000). If this guideline is adopted and emission rates of benzene remain constant then this contaminant may become an environmental issue in the Nelson in the near future.

The frequency and magnitude of $PM_{10}$ guideline exceedences clearly demonstrates that Nelson's air environment is significantly degraded by emissions of this particular contaminant.

The pattern of seasonal and diurnal variation of $PM_{10}$ concentrations suggests that the primary cause of the $PM_{10}$ issue is domestic fires during winter. This conclusion is consistent with the information contained in the Nelson Emission Inventory (Wilton and Simpson, 2001).

The $PM_{10}$ data clearly indicates that if the $PM_{10}$ guideline is to be met, some changes will be required to reduce the emissions of this pollutant during winter.

## References

Ministry for the Environment. 1994: ***Ambient air quality guidelines***. New Zealand Ministry for the Environment.

Ministry for the Environment, 1998: ***Environmental performance indicators, confirmed indicators for air, fresh water and land***. New Zealand Ministry for the Environment.

Ministry for the Environment and Ministry of Health, 2000: ***Proposals for revised and new Ambient air quality guidelines for New Zealand, Working draft 1.*** New Zealand Ministry for the Environment and Ministry of Health, Air Quality Technical Report 16.

NIWA report number AK01182. Bluett, J.G. and Petersen, J., 2001***. Ambient air monitoring, Nelson City, autumn – winter 2001***.

NIWA report number AK01135. Bluett, J.G. 2001***. Nelson City Council $PM_{10}$, CO, $NO_2$ and benzene ambient air quality monitoring network site locations.***

Wilton, E. and Simpson, J. 2001. ***Nelson Emission Inventory.*** AD9, 18 October 2001.

# Results to Date Part 2 - Air Emissions Inventory

An air emissions inventory was carried out across Nelson for 2001. The purpose of the study was to assess the types and volumes of air pollution discharged throughout the city. Determining sources of emissions and concentrations of air contaminants are important for air quality management, as the results can be used to help understand what is causing the air pollution and point to ways of improving air quality.

The types of pollutants included in the Nelson assessment were based on air quality indicators identified by the Ministry for the Environment and included suspended particles, carbon monoxide, nitrogen oxides, sulphur oxides, volatile organic compounds, carbon dioxide and benzene. The main focus of the inventory was on sources of suspended particles, in particular those less than 10 micrograms in diameter (referred to as $PM_{10}$), although data on the $PM_{2.5}$ size fraction were also collected. $PM_{10}$ and $PM_{2.5}$ size fractions are of greatest concern because of their ability to penetrate the lungs and cause health problems.

Sources included in the 2001 emission inventory assessment for Nelson were motor vehicles, domestic heating, outdoor burning and industry. Emissions from these sources were estimated by collecting data on the activity resulting in the emissions, for example the quantity of fuel burnt, and using mathematical equations to estimate the amount of emissions that would be produced.

**Home heating methods**

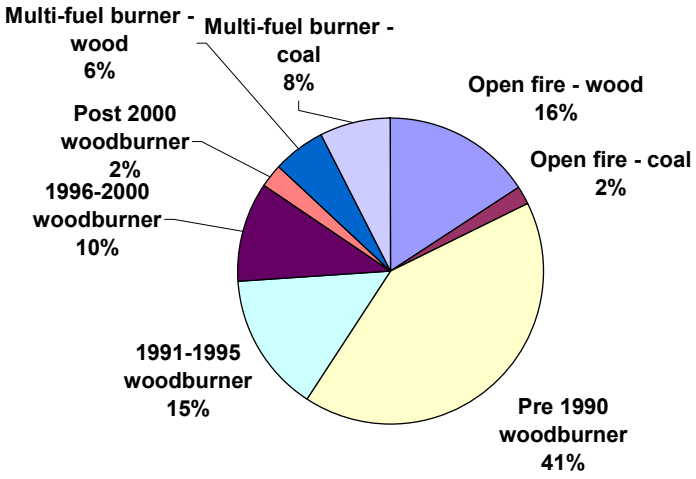
The most commonly used forms of home heating in Nelson are electricity and woodburners, with 68% of households using electricity and 40% relying on woodburners. About 26% of households rely on gas to heat their living area on a typical winter's night. (The percentages add up to more than 100% because many households use more than one method to heat their homes.)

Most households use wood (94%) in their fires, with less than 3% using coal.

For domestic heating and outdoor burning emissions, up to 10% of households in Nelson were surveyed to determine what type of fires they used and how often. The results were then used to estimate the types and daily quantities of emissions produced by Nelson households during the winter. Figure 12 shows how different domestic heating methods contribute to $PM_{10}$ emissions across the whole of Nelson.

Information on the average number of vehicle kilometres travelled (VKT) within Nelson was used for the motor vehicle assessment. This data was obtained using the Nelson City road transport model and was combined with emission rates from a national database, adjusted for types of motor vehicles in Nelson, to estimate emissions from vehicles.

**Figure 12: Domestic heating methods in Nelson**

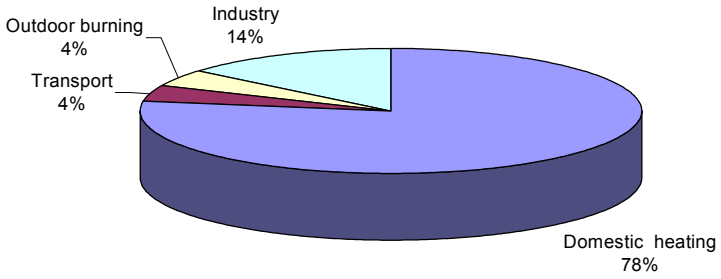



Emissions from industry were estimated by applying emission rates for different process types to industries in the area. As an example of how emissions are estimated, if a local sawmill burnt five tonnes of wood per day during the winter at an emission rate of 3.25 kg $PM_{10}$ per tonne of wood, the total emissions from that activity would be 16.25 kg per day. Emissions from all industrial and commercial processes, including schools, within Nelson were collated to give an estimate of emissions from industry.

## Conclusion

The combination of emission estimates from all sources indicates that domestic heating is the main contributor to $PM_{10}$ and $PM_{2.5}$ emissions across Nelson (see figure 13). Almost two tonnes of $PM_{10}$ is produced in Nelson per day and 78% of this comes from domestic heating. Of this, 18% come from open fires, 41% from burners installed prior to 1990 and the remainder from other wood and multi-fuel burners.

**Figure 13: Relative contribution of different sources to $PM_{10}$ emissions across Nelson**




Note: these proportions vary across different parts (airsheds) of Nelson.

Domestic heating is also a major contributor to emissions of other contaminants across Nelson. In particular, benzene, carbon monoxide, volatile organic compounds and carbon dioxide emissions have a strong domestic heating contribution (figure 14).

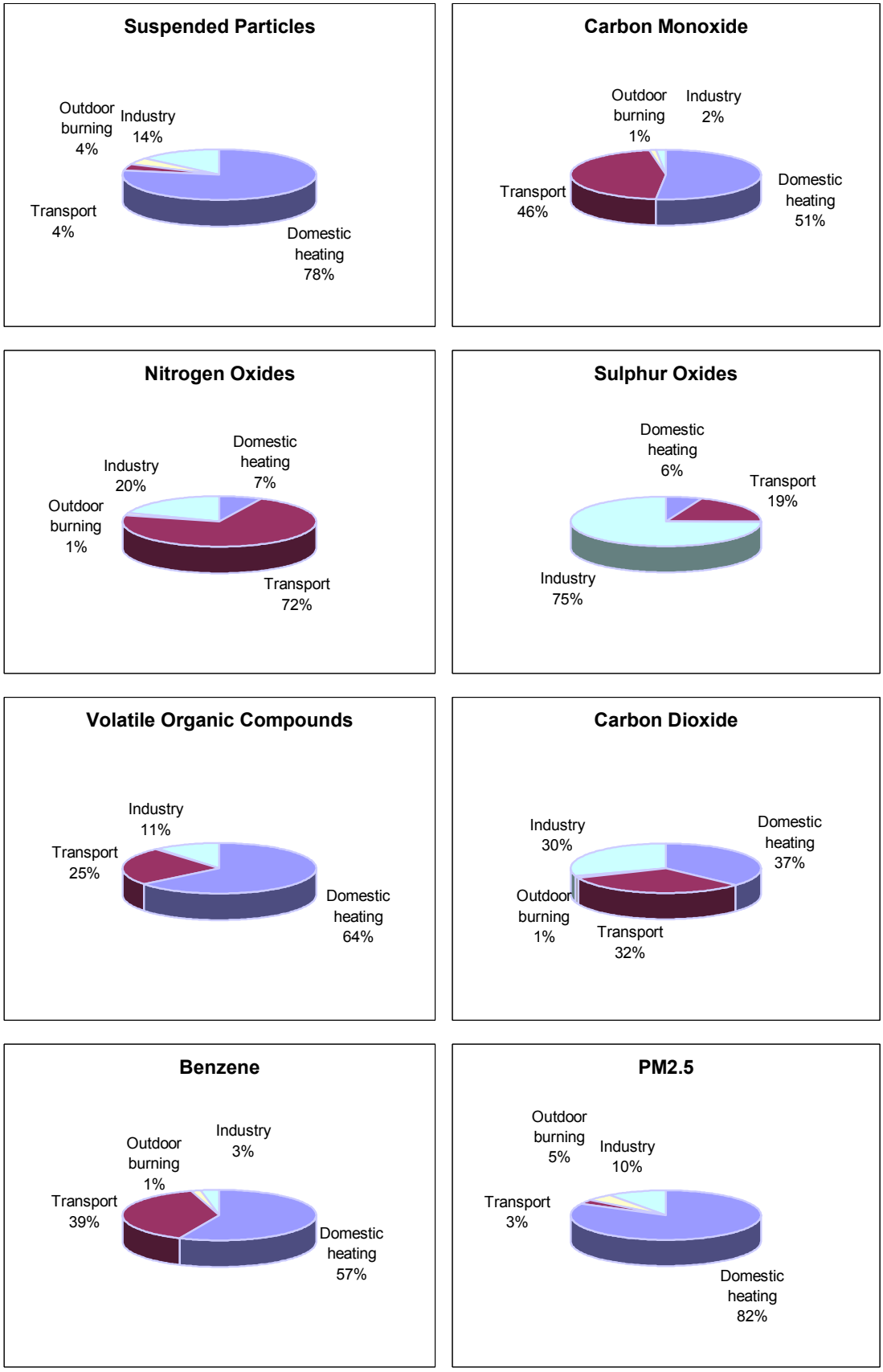
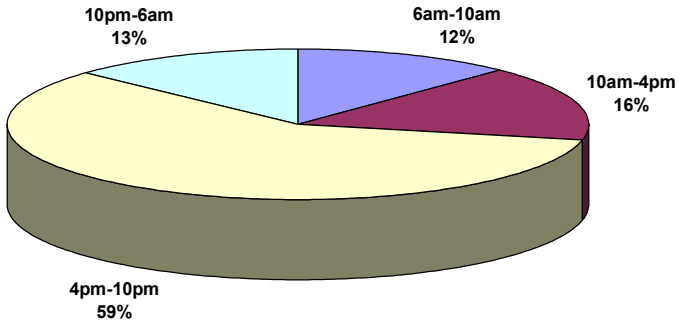



**Figure 14.** Note: different air sheds receive different amounts of pollution which is not reflected in these graphs.

A breakdown of $PM_{10}$ emissions across the whole city by time of day indicates that the majority of emissions occur during the evening (4-10pm), reflecting the dominance of the domestic heating source (figure 15). Typically this time of day is most conducive to high concentrations of pollution because of temperature inversions (cold air near the ground which does not mix with the upper air) and low wind speeds.

**Figure15: Emissions of $PM_{10}$ by time of day for Nelson**



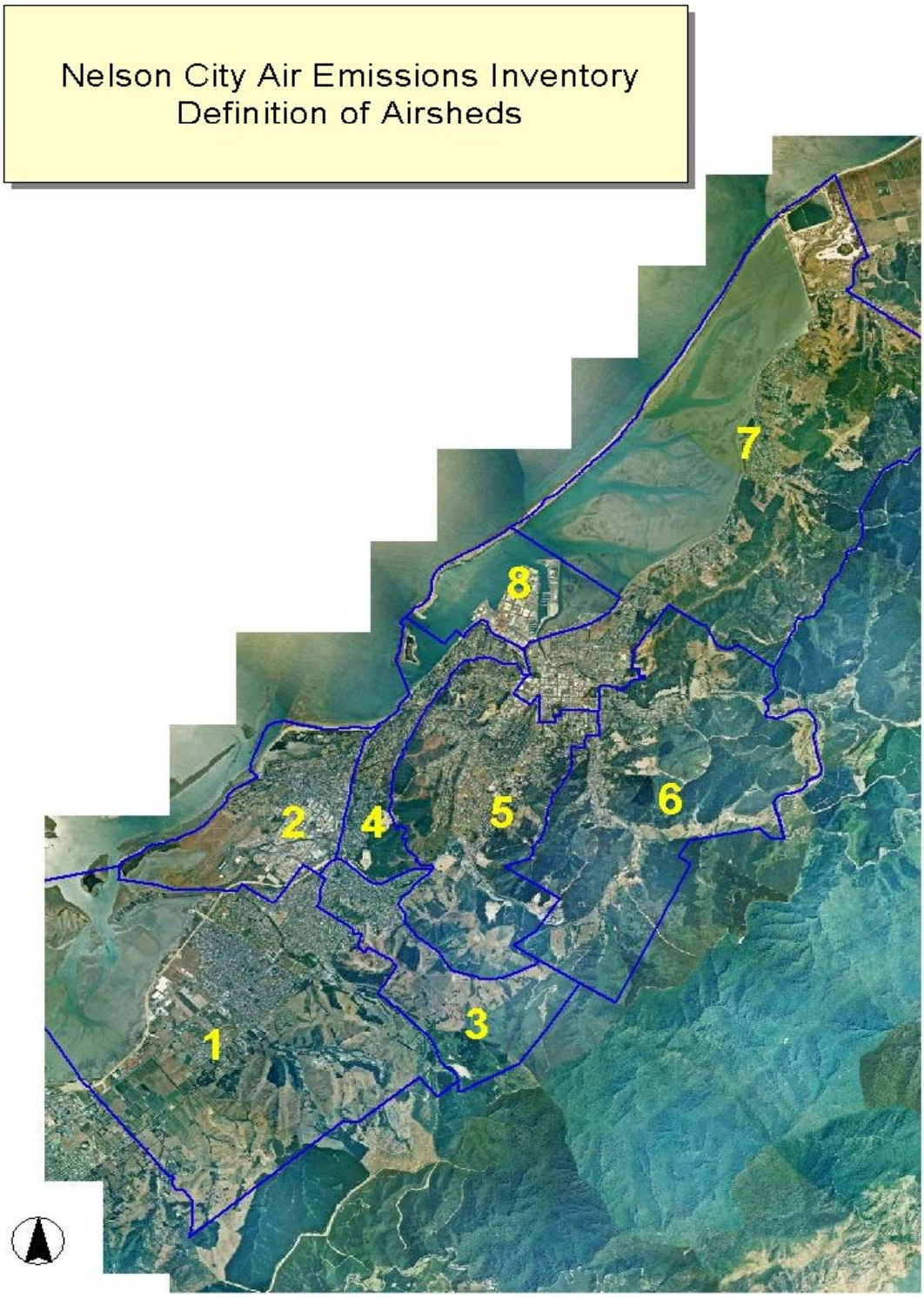

Emission estimates for Nelson were also collected based on geographical location. The Nelson area was divided into eight separate areas referred to as airsheds and emissions estimates were made for each of these airsheds. Figure 16 illustrates the different airsheds and the sources of $PM_{10}$ emissions in each airshed.

**A description of each airshed, based on census area units, follows:**

| | |
|---|---|
| Airshed one: | Maitlands, Nayland, Saxton, Langbein, Isel Park, Ngawhatu |
| Airshed two: | Airport and Tahunanui |
| Airshed three: | Enner Glynn |
| Airshed four: | Tahuna Hills and part of Britania Heights |
| Airshed five: | Toi Toi, Broads, Kirks, Bronte, Grampians and part of Britannia Heights |
| Airshed six: | The Brook, Atmore, Maitai |
| Airshed seven: | Clifton, The Wood, Trafalgar |
| Airshed eight: | Port Nelson |

These airsheds are shown on figure 16 on the following page.

**Figure 16: Nelson City Air Emissions Inventory**



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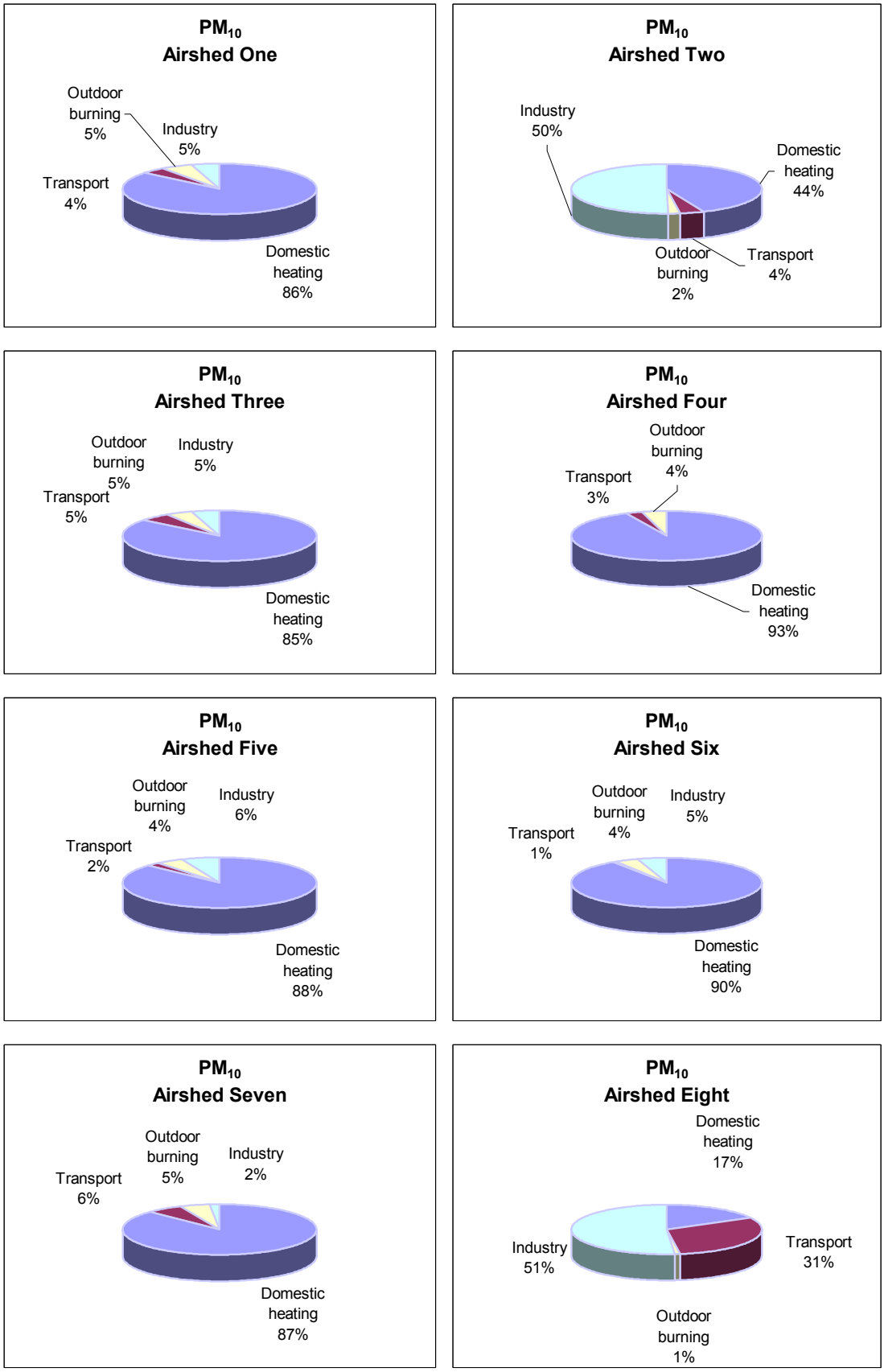
## Figure 17: the sources of $PM_{10}$ emissions in each airshed



Air quality monitoring results show $PM_{10}$ concentrations in parts of Nelson exceed acceptable levels regularly during the winter months. Health studies carried out overseas and in New Zealand show that these particles can result in health problems. Types of health effects associated with these concentrations of $PM_{10}$ range from throat irritation, bronchitis, asthma symptoms and respiratory illness to death. Other effects of $PM_{10}$ pollution include soiling of buildings, odour, smoke nuisance and reduced visibility.

The emission inventory is a useful tool for identifying potential management options to reduce $PM_{10}$ concentrations in Nelson and for assessing their effectiveness.

A range of management options exist to address Nelson's air pollution including:

- Raising awareness about domestic fires and suggesting options for reducing air pollution
- Help people to use more efficient types of heating or to insulate their houses.
- Encourage people to use less polluting forms of heating, such as electricity or gas, or woodburners with low emission levels.
- Help people to use less polluting forms of heating by providing grants or low interest loans.
- Require people buying new fire places to only buy those that are low emitting burners.
- Regulate the most polluting household fires, such as open fires and backyard burning.
- Reduce the number of household fires.
- Introduce high standards for all industrial discharges.

The extent to which specific measures will be adopted to address Nelson's air pollution issues has yet to be determined. It is likely that in order to achieve good air quality that a mix of measures will be required.

Any air quality plan must include a rigorous assessment of the relative costs and benefits of each measure sufficient to justify its adoption. A number of social and economic issues also arise where people are unable to afford to upgrade their heating or where they are tenants in rental housing.

Any air quality plan must have the support of the wider community. This is vital in terms of implementing the plan's provisions but is also required by the Resource Management Act (RMA). The RMA specifies that there must be a full public process including the right to contribute ideas to the plan and to challenge the Council's decisions if these ideas are rejected.

## Results to Date Part 3 – Health Impacts of Nelson Air Pollution

The Ministry for the Environment suggests a guideline value for $PM_{10}$ of 50 $\mu gm^{-3}$ (24-hour average). This value was exceeded at a monitoring site in St Vincent Street (Swift Suzuki) on 81 days during winter 2001. Historical monitoring in other areas of Nelson suggests that the St Vincent Street site is more representative of worst case air pollution in Nelson. However, elevated concentrations of particles are experienced in most parts of Nelson.

Health impacts associated with concentrations of $PM_{10}$ range from effects such as coughs, asthma symptoms, bronchitis, respiratory illness to premature death. Health studies over a 10 year period show that for every 10 $\mu gm^{-3}$ increase in 24-hour average $PM_{10}$ concentrations, mortality increases by 1%. This statistical calculation is based on international research by the World Health Organisation and is supported by studies in Europe, the United States and Christchurch.

An assessment of the potential impact of existing $PM_{10}$ concentrations in Nelson on health was carried out during 2001. Results of air quality monitoring for 2000 and 2001, historical smoke monitoring data and an assessment of the likely impacts of topography and meteorology were used to estimate average exposure for the whole of Nelson. Health statistics for mortality and hospital admissions for respiratory and cardiac illnesses and asthma were obtained from the Ministry of Health. Exposure and health statistics data were used in conjunction with dose-response relationships from health studies to assess the potential impact of $PM_{10}$ in Nelson.

Based on the statistic calculation of 1% mortality increase for every10 $\mu gm^{-3}$ increase average $PM_{10}$ concentrations mentioned above, in Nelson existing $PM_{10}$ concentrations are likely to result in around eight deaths per year and around 14 hospital admissions for respiratory or cardiac related illnesses. Two of these hospital admissions are likely to be asthma related.

A less severe measure of the potential impact of $PM_{10}$ concentrations is the restriction on activities that occurs as a result of health impacts of $PM_{10}$. This is referred to as Restricted Activity Days (RAD) and includes days spent in bed, days missed from work or days when activities are partially restricted due to illness. The American Lung Association[9] indicates an increase in RAD of approximately 91,200 RAD each year per million of population for every 1 $\mu gm^{-3}$ increase in annual average $PM_{2.5}$. Based on this relationship, around 58,000 RAD could be expected to occur each year as a result of concentrations of particles in Nelson.

The costs of these health impacts vary depending on the severity of effect and include costs of treatments, costs of loss of workdays and the cost to the person of loss of enjoyment of life. Some information on the latter is available for New Zealand based on a survey of people's "willingness to pay" (WTP) to avoid the health impact. This is based on a road safety study carried out in New Zealand which indicated the value of a statistical life was $2.49 million. This was used to establish a statistical life year

[9] American Lung Association, 1995, *Dollars and cents: The economic and health benefits of potential particulate matter reduction in the United States*. 1740 Broadway, New York.

value of $172,000 based on a life expectancy of 35 years and an annual discount rate of 6%. (The statistics were prepared for road deaths, for which the average age of death is 35. The 6% discount for future years is the standard approach used by economists.)

Death by road accident is an active risk. Death by pollution is a passive risk that people cannot protect themselves against, for example by driving more slowly or more skilfully, or purchasing a car with more safety features. The willingness to pay to avoid the impact of road accidents may be higher for this reason.

The life-year approach recognises that people dying of pollution related illnesses would have a shorter life expectancy than the average working age adult. The average value of a male or female life lost to respiratory or cardiopulmonary disease can then be assessed by comparing the average age of death for males and females dying of these causes, to average age profiles for New Zealand.

Cost estimates for different health impacts of $PM_{10}$ have been assessed by Bicknell and Greer[10] and are presented in table 5. Estimates for hospital admissions and RAD are based on costs of treatment and loss of work and do not include WTP to avoid the impact.

**Table 5: Value of health impacts**

| | |
|---|---|
| Value of statistical life | $2,489,655 |
| Value of statistical life year | $171,721 |
| Average value of male life lost to respiratory or cardiopulmonary disease (relates to the number of years that the pollution brings the death forward) | $1,368,780 |
| Average value of female life lost to respiratory or cardiopulmonary disease (relates to the number of years that the pollution brings the death forward) | $1,689,595 |
| Average value of life based on one-month mortality advancement | $14,196 |
| Average daily wage at May 2001 | $139.67 |
| Average cost of hospital admission of average length 3.96 days including lost wages | $3,647.77 |
| Average cost of a RAD | $76.82 |

These data suggest that costs associated with $PM_{10}$ related deaths in Nelson are likely to be in the order of $6 -12 million per year depending on the extent of mortality advancement. Mortality advancement refers to the extent to which the $PM_{10}$ concentrations bring the death forward. For example, if it is only by a few weeks (ie they would have died anyway within a few weeks) then it is only a small

[10] Bicknell, K., & Greer, G., Updated Economic Analysis of Option to Reduce Suspended Particulate from Domestic Burning in Christchurch. Environment Canterbury Report U01/88.

advancement (and therefore is valued much less) than if they would have lived for longer.

An additional $4.5 million dollars per year may be associated with the cost of restricted activity days and $50,000 for hospital admissions. This gives a total cost in the order of $10.5 - $16.5 million dollars per year.

# Air Quality – Where to from here

## Guideline accepted

In March 2001 the Council acknowledged the Ministry for the Environment's intention to change the air quality guideline levels for small particles ($PM_{10}$) from 120 to 50 micrograms per cubic metre. The Council resolved that:

- Where air quality is worse than the 'acceptable' category, the aim will be to enhance air quality, and
- Where air quality is 'acceptable' or better, the aim will be to maintain existing air quality.

Councillors also concluded that the major improvements required in air quality will require the removal or upgrade of very large numbers of domestic heating installations. Although Council's public opinion survey conducted in January 2000 revealed support for strong action with respect to domestic fires, rules requiring such upgrades are likely to be unpopular and the cost of replacing existing fires with alternative heating is also likely to be high. The residents survey revealed that the majority of residents support greater controls on fires used to heat homes (63%) and backyard burning (76%).

Similar stringent controls would be needed on backyard rubbish fires, and on commercial and industrial boilers or combustion processes.

Rules alone are unlikely to solve the smoke problem, and Council faces some significant and ongoing expenditure to raise public awareness and promote solutions to the public, to implement the phasing out of the most polluting domestic installations, and to address some of the social and economic impacts to individual households of changing their type of home heating.

## Air Quality Plan

The Nelson Air Quality Plan is currently being prepared. The process will require a comprehensive analysis of management options and their costs and benefits.

There are many difficult issues that will need to be addressed before the Air Quality Plan's provisions are ready to be publicly notified. A working party of Councillors, staff, public health officials, an iwi representative and two scientists will meet to make decisions on key issues related to air quality. In addition, a stakeholders group including representatives from key community groups will be established to discuss the proposed provisions of the air plan.

The proposed plan will present the Council's preferred methods to improve air quality. This Plan will then be made available for the community to comment and contribute ideas through a consultation process.

# NOISE


*High density city living leads to situations where multiple noise sources exist in close proximity to each other and result in a constant background of noise. The control of noise pollution is complex especially where a number of sources exist close to each other. Each source may be at a level where the effects created are acceptable, but when the various noises are added together they jointly exceed an acceptable level.*

## Key issues and historic trends

Noise leads to more complaints to Nelson City Council than any other issue (see Section 1 - Complaints). Almost everything we do creates noise to a greater or lesser extent. People vary in their tolerance of noise with some individuals particularly sensitive to it. Noise is a widespread pollutant. It can travel long distances and one source can affect large areas of the community.

High density city living leads to situations where multiple noise sources exist in close proximity to each other and result in a constant background of noise. The control of noise pollution is complex especially where a number of sources exist close to each other. Each source may be at a level where the effects created are acceptable, but when the various noises are added together they jointly exceed an acceptable level.

Excessive and prolonged noise can lead to sleep disorders and severe stress, and in extreme cases it can lead to hearing damage or even deafness.

The Resource Management Act makes the control of commercial, industrial and domestic noise a function of both district and regional councils. Nelson City Council as a unitary authority (combined district and regional council) has this responsibility for Nelson's noise levels. While the Council is responsible for the management of most forms of noise it is not responsible for noise emitted from motor vehicles or from over flying aircraft, which are the responsibility of Central Government agencies. Noise from constructing new roads or from operation of existing ports or airports is managed by the Council.

The Proposed Nelson Resource Management Plan defines noise limits for specific areas. In most cases residential areas have lower noise limits than commercial or industrial areas.

Noise associated with Nelson Airport and Port Nelson is particularly difficult to manage. Both facilities are very important to Nelson's economy. They operate seven days a week, including evenings and are associated with a range of noise producing activities. In the ideal world they would be well separated from noise sensitive activities, but in reality both are located in the main urban centre, adjoin residential and other noise sensitive uses and give rise to noise related complaints from some residents.

The special characteristics of port and airport noise have led to the development of New Zealand Standards for managing noise generated from these activities. These standards take into account projected increases in activities in the future and then use a computer based model to predict the future noise intensity in the surrounding area. Using these predictions it is then possible to prepare noise contours showing the noise exposure at particular properties.

The Nelson Resource Management Plan then uses the noise contours to introduce land use planning controls designed to avoid, remedy or reduce the adverse effects of the noise. As an example the Nelson Airport overlay is shown in Figure 18.

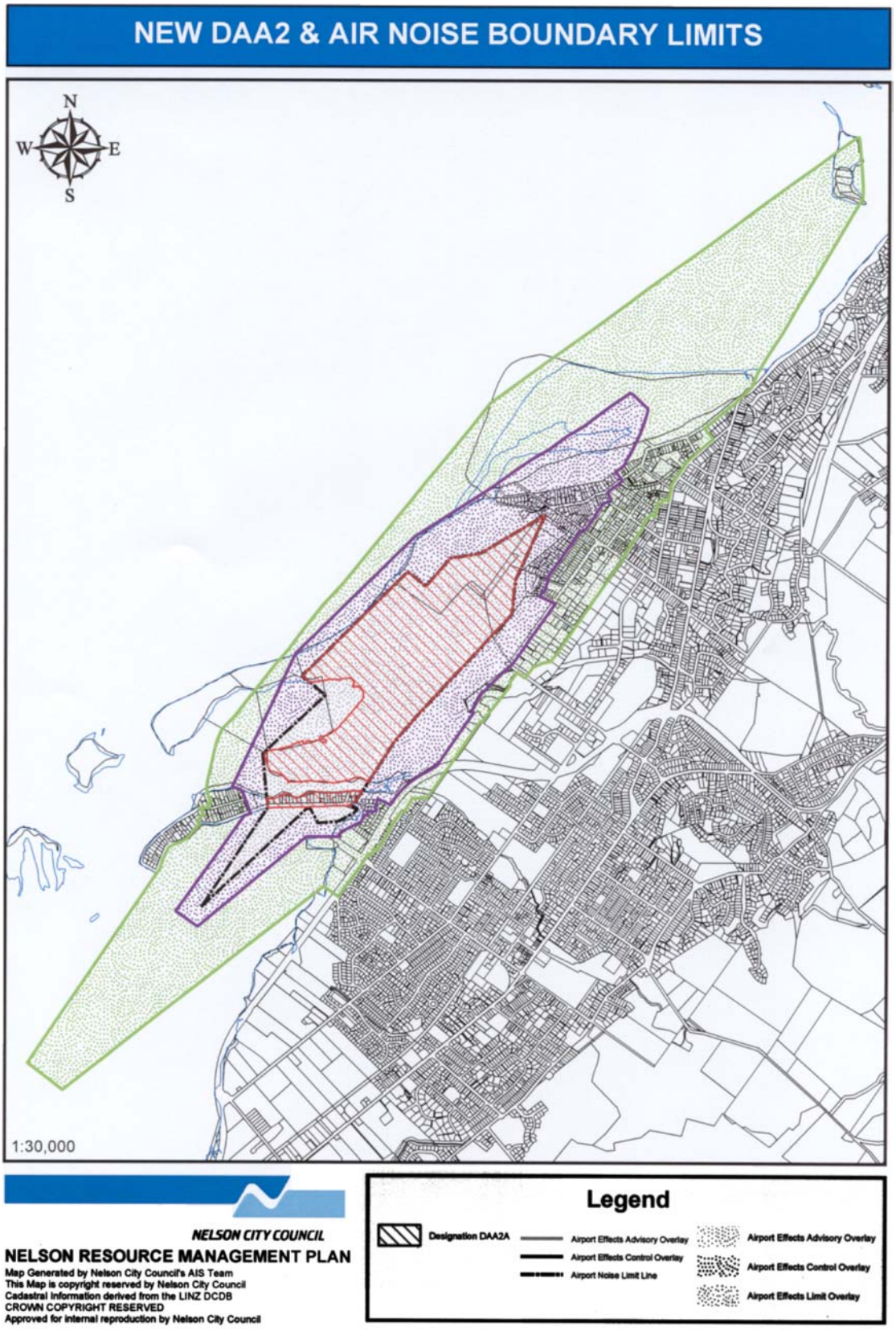

NEW DAA2 & AIR NOISE BOUNDARY LIMITS
N
W
E
S
1:30,000
NELSON CITY COUNCIL
NELSON RESOURCE MANAGEMENT PLAN
Map Generated by Nelson City Council's AIS Team
This Map is copyright reserved by Nelson City Council
Cadastral Information derived from the LINZ DCDB
CROWN COPYRIGHT RESERVED
Approved for internal reproduction by Nelson City Council
Legend
Designation DAA2A
Airport Effects Advisory Overlay
Airport Effects Control Overlay
Airport Noise Limit Line
Airport Effects Advisory Overlay
Airport Effects Control Overlay
Airport Effects Limit Overlay

**Figure 18**

Generally the areas of greatest noise intensity are restricted to land owned or controlled by the port or airport. Surrounding this central area is a lower noise intensity area (Control Overlay) where controls are placed on further development and requirements are placed on those properties requiring noise insulation of bedrooms and living areas in new or extended dwellings. Surrounding the control overlay is an advisory overlay where no special rules apply but the public is advised that the area may be subject to some noise increase associated with the port or airport.

In order to confirm that the computer modelling is accurate, and that the port and airport are complying with the Proposed Nelson Resource Management Plan's provisions, both organisations undertake self monitoring and keep a register of complaints.

While there are still issues remaining which include accuracy of some noise contours and how representative the various measuring sites are, this approach provides a better, more workable, easier to monitor, and more enforceable method than setting a single event upper noise limit at a site boundary as is done in other zones.

## What the Council wants to achieve

The Council wants:

- To avoid exposure to unreasonable noise. Where this is not possible, the Council wants to reduce noise levels or reduce the impact of the noise.
- To protect existing and future residents from noise caused by industrial, commercial, transportation, community and recreational activities.
- To prevent noise from commercial and industrial activities from affecting those people in neighbouring premises.
- The airport to be able to continue operating at its existing site, allowing for a controlled increase in aircraft movements while managing the effects of the noise on the community.

Noise policies in the Plan set the following standards:

- Noise from the airport should not exceed the levels forecast in the Plan.
- The operating needs of both the airport and the port should be balanced against the pleasantness and wellbeing of neighbouring communities.
- A noise management plan for airport activities will be established.
- Residential Zone noise levels at boundaries should be reasonable for a residential area.
- Inner City Zone activities should not cause noise levels which detract from the character of the area.
- Suburban Commercial Zone activities should not cause any more noise than would be normal for such an area, or at times other than would normally be expected.

- Industrial Zone activities should not produce noise to a level that detracts, or has potential to detract, from nearby activities and the surrounding area.
- Rural Zone activities should not cause noise levels which compromise the pleasantness of neighbouring properties.
- Coastal Marine Area activities should not cause noise levels which have a significant negative impact on pleasantness, human health, or wildlife.

(See Regional Policy Statement (RPS) objective DA2.2.1, RPS policies DA2.3.1, DA2.3.2, DA2.3.3 and Resource Management Plan (Plan) objective DO10.1 and Plan policies DO10.1.2, DO10.1.3, DO10.1.5, DO10A.1.3, DO10A.1.4, RE2.1, IC4.2, SC2.3, IN2.1, RU3.3 and CM3.5, in Appendix 4.)

## Results to Date Part 1 - Port Noise

During the Christmas period of 2000-2001 Port Nelson Ltd employed an engineering student (Daniel Cain) to undertake a validation of the port noise contours. This exercise involved noise monitoring at six sites. Four of the sites were monitored for five consecutive days including observers on site to identify the actual sources of the noise recorded. The fifth site was monitored for five days with observers on site for two days, and three days unattended monitoring was carried out at the sixth site. An example of the results of this monitoring is given in Figure 19 below which shows the noise levels recorded at one of the recording sites at various time of the day and the activities associated with the noise.

**Figure 19: 5-day noise summary at 66 Queens Road.**

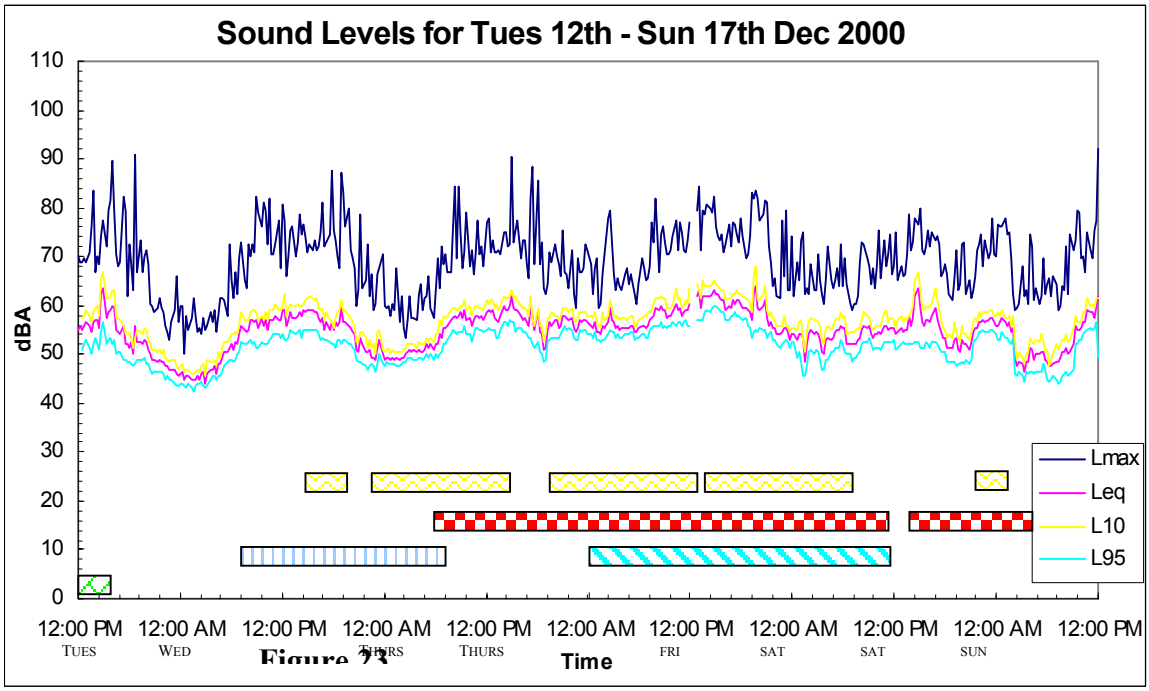



Figure 73

- Containers
- Logs
- MDF (Roll on Roll off)
- Petrol
- Fish

## Results to Date Part 2 – Airport noise

Nelson Airport Ltd continually monitors aircraft movements. The airport then uses this data, along with published noise levels from landing and takeoff for particular types of aircraft, to derive the total amount of aircraft noise at various reference sites around the airport. This allows the airport to assess how well it is complying with the provisions of the Proposed Nelson Resource Management Plan. It periodically audits this data by placing noise meters at the various reference points and comparing the measured and derived values. An example of the Nelson Airport Noise Report is given in Figure 20 on the following page.

### Complaints Registers and Advisory Committees

Both Port Nelson and Nelson Airport convene environmental committees which include representatives of users and nearby residents. Both companies maintain complaints registers and actively investigate and report on any complaints received.

Like the complaints received by Nelson City Council a large number of complaints received by the port and airport relate to noise. Many of these can be addressed through raising awareness and suggesting alternatives to users and through good practice. In the case of Port Nelson innovations such as the use of a warning light rather than reversing beepers on forklifts during the hours of darkness, and locating vessels so that generator noises face away from residential areas, have helped reduce the disturbance of residents.

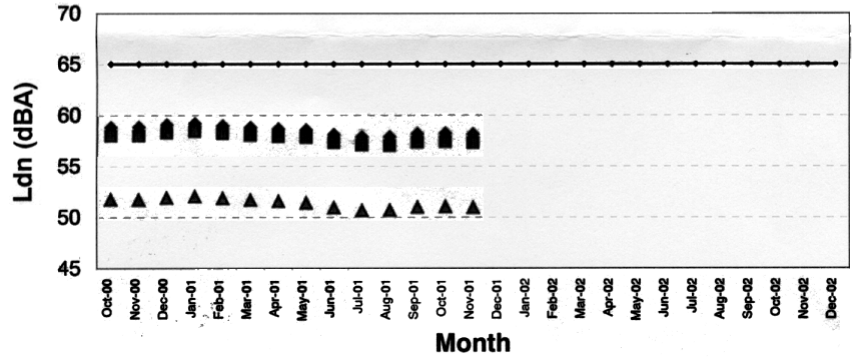
**Figure 20**

# NELSON AIRPORT NOISE REPORT

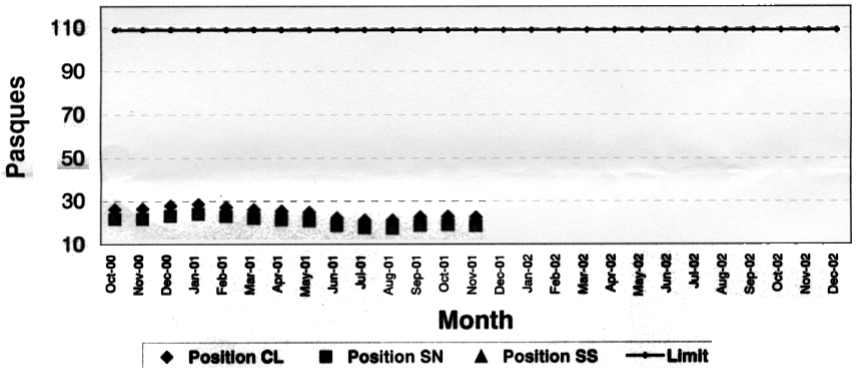
For 3 Months to end of **Nov-01**

| | Current 3 Month Noise Levels | | | Noise Limit | |
|---|---|---|---|---|---|
| | Position CL | Position SN | Position SS | | |
| Ldn | 58.2 | 57.3 | 50.9 | 65 | dBA |
| Sound Exposure | 23 | 19 | 4 | 109 | Pasque |

**Ldn (3 month rolling average)**




**Sound Exposure (3 month rolling average)**




Number of Aircraft Movements

| | Total | Day | Night |
|---|---|---|---|
| Sep-01 | 4500 | 4412 | 88 |
| Oct-01 | 4604 | 4542 | 62 |
| Nov-01 | 3816 | 3747 | 69 |

Report Prepared: 18-Dec-01

Note: This figure shows the airport is operating well under its noise projections, which would be expected as those projections extend out to 2020.

# Results to Date Part 3 – Traffic noise

## Background

During 1999 Whakatu Drive, between Richmond to Nelson, was constructed.

The Council decided as part of the environmental monitoring programme to assess the before and after noise environment of both the new Whakatu Drive and also Main Rd Stoke and Nayland Rd South which were the main feeder roads used before the motorway was constructed.

Initial monitoring was carried out from November 1999 to January 2000, before the motorway was in operation. Each site was re-surveyed between November 2000 and July 2001. A year to 18 months between surveys allowed time for new patterns and driver habits to be established.

## Sites

Six sites were chosen. Three sites on the line of the new motorway, two sites on Main Rd Stoke and one site on Nayland Rd.

Site 1 – Saxton (Corner Saxton Rd and Main Rd Stoke. 793 Main Rd Stoke)
Site 2 – Main Rd (389 Main Rd, Stoke)
Site 3 – Nayland (319 Nayland Rd)
Site 4 – Aldinga (67 Aldinga Avenue)
Site 5 – Rosebank (10 Rosebank)
Site 6 – Cawthron (46 Cawthron Crescent)

Each site has different characteristics and was chosen to provide data on various factors.

## Methodology and Sampling Parameters

The intention was to sample each site for seven continuous days. However continuous sampling was not possible at some sites due to intense rain events. In addition, unexplained excessive peaks (localised sources of noise such as motor mowers) were eliminated from the results. Overall, sufficient measurement took place at all sites to provide adequate data for the purposes of the survey. The raw data has been archived and is available on request.

Measurements were made using a Rion NL 60 Integrating Sound Level Monitor. The sampling period for each measurement was five minutes with Leq, minimum, maximum and standard exceedence levels being recorded.

The 12 sets of five minute Leq measurements for each hour were then used to calculate the 1 hour and 24 hour Leqs.

While this range of measurements is broader than is required to assess traffic noise it does provide additional background information.

The Leq measurement criteria is the normal method used in assessing and reporting traffic noise. Leq in its very simplest form is the average noise level over a set time period.

> Leq: (TIME AVERAGE SOUND LEVEL) is the value of the steady continuous A-weighted sound pressure level that, within a measurement time interval, has the same mean square sound pressure as the sound under consideration whose level varies with time.

When interpreting results it should be noted that, in general terms, a 3 dBA increase in the measured noise level is a doubling of the noise level. A 3 dBA reduction is a halving of the noise level. However it takes a 10 dBA increase for a person to perceive a doubling of the noise level.

Results are reported as follows:

*Graph type 1*
Graphing the 1-hour Leq for each and every hour of a week (Monday – Sunday) against the traffic flow data for each hour. Each graph contains noise and traffic data for both survey rounds. This graph clearly shows the relationship between noise level and traffic flow.

*Graph type 2*
Graphing the difference between the 24-hour Leq before and after the Motorway was constructed. This graph shows clearly the overall noise received in a 24-hour period for each site.

In combination with the noise levels, traffic flow data was gathered for each site as follows:

Traffic flow measurements were taken at Sites 1-4 during the first survey round. Traffic Data for Rosebank and Cawthron was not collected, as there would have been negligible traffic to record. On the second round Traffic Data was collected for Sites 1-5 on the second round but data was not available for Cawthron.

Where possible the Traffic Data was for the same day as the noise measuring. However where same day data was not available, traffic data for the closest available day was used (i.e. Monday for a Monday etc). This is not considered critical, as small fluctuations in traffic flow are not critical - and do not significantly influence the final results.

**Results and Analysis**

This report focuses on two key sites, Saxton Rd and Aldinga Avenue, which are the two sites most directly influenced by the construction of the motorway.

## Site 1 – Saxton Rd

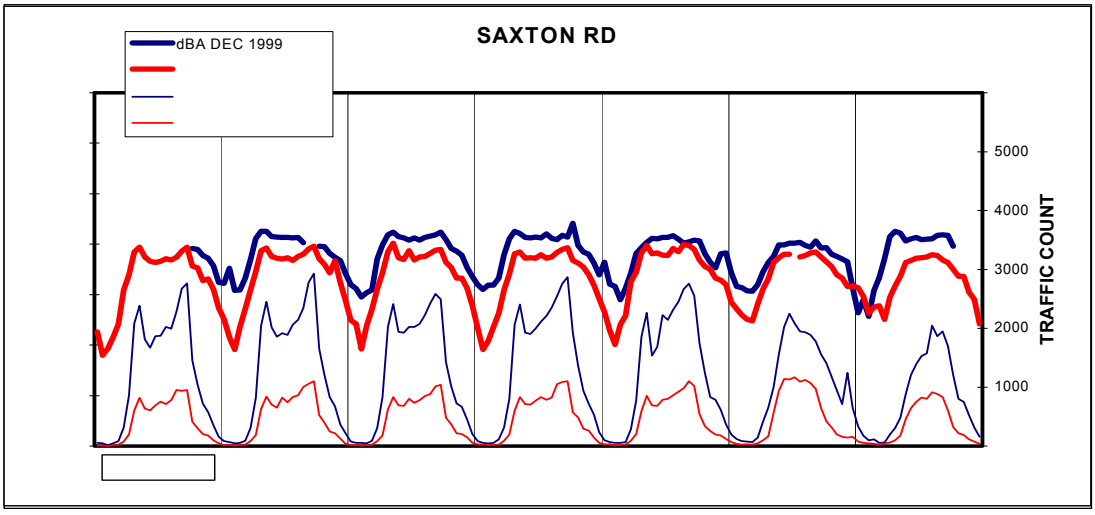
This site was situated at 793 Main Rd Stoke, (South-East Corner of Saxton Rd and Main Rd Stoke). The measuring point was 3 metres from the front corner of the site (figure 21).

There are no physical barriers between the road and the measuring point.

The traffic data was collected at a measuring point 200 metres to the south of the intersection on Main Rd Stoke.

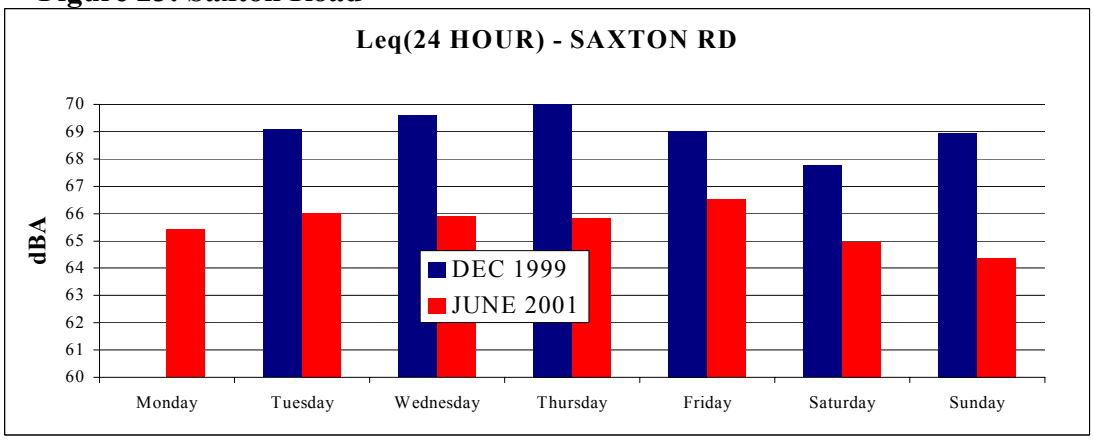

**Figure 21 – Saxton Road site**

**Figure 22: Saxton Road**




*Note: Each day on graph represents a 24 hr period Midnight to Midnight (applies to all graphs)

**Figure 23: Saxton Road**




The key point from this site (figures 22 and 23) is that although the total traffic flow has reduced by between 50% and 75% the 24-Hour Leq has only reduced by between 2 and 4 dBA.

However between midnight and 3 am (except for Friday and Saturday nights) the level of noise has dropped by 5-10 dBA, yet the traffic flow has reduced from a low figure of 80-120 vehicles/hour to 10-40 vehicles/hour (see conclusions).

**Data Graphs Type 1 for the remaining sites are found grouped below:**

**Figure 24: Main Road Stoke**

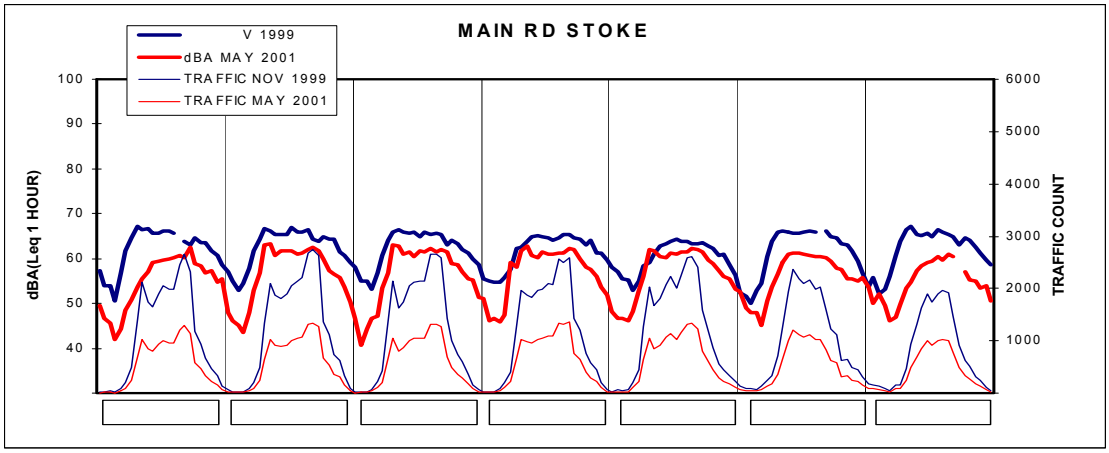



**Figure 25: Nayland Road**

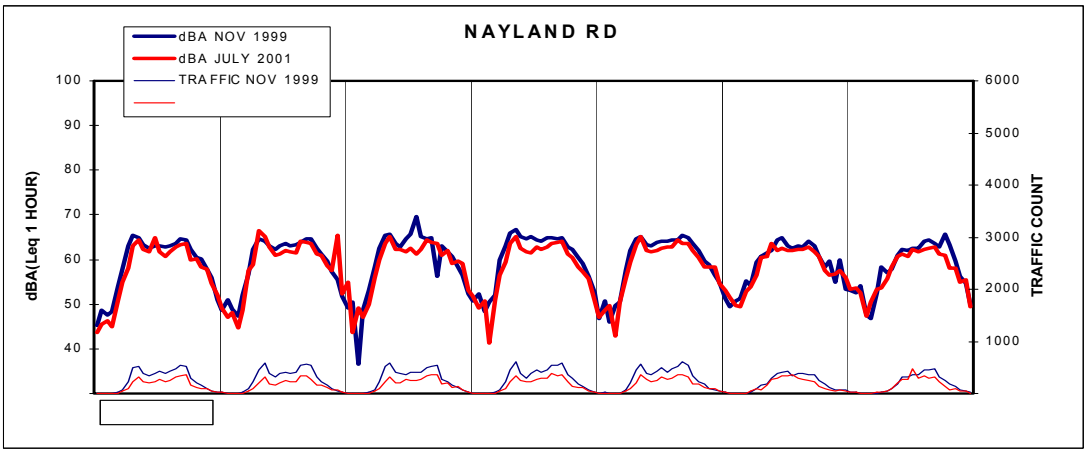
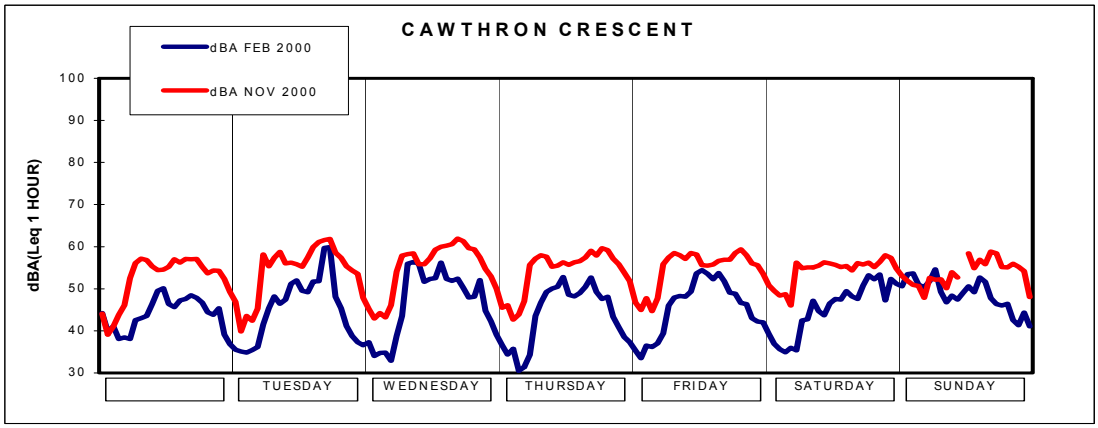



**Figure 26: Cawthron Crescent**




(Figure 27: Rosebank is shown on page 52)

## Other sites

### Site 2 – Main Rd Stoke (figures 24 and 28)

This site is situated at 389 Main Rd Stoke. The measuring point was approximately 10 metres from the front boundary and 15 metres from the road. There are no barriers or noise reducing factors between the road and the measurement point.

Traffic data was collected from the Opus site approximately 100 metres to the north on Main Rd Stoke.

The traffic flow reduced by almost exactly 50% at this site with a 2-8 dBA decrease in the 24-hour Leq. A similar effect occurred as found at the Saxton site where between midnight and 3 am (except for Friday and Saturday nights) the level reduced more markedly than during the day.

### Site 3 - Nayland Rd (figures 25 and 29)

This site is situated at 319 Nayland Rd. The measuring point was approximately 2 metres from the front boundary and 6 metres from the road. There are no barriers or noise reducing factors between the road and the measurement point.

Traffic data was collected from a measurement point approximately 150 metres to the north on Nayland Rd. The traffic flow at this site dropped by 30-35% with a slight reduction in the 24-hour Leq by 1-2 dBA.

**Figure 28: Main Road Stoke**

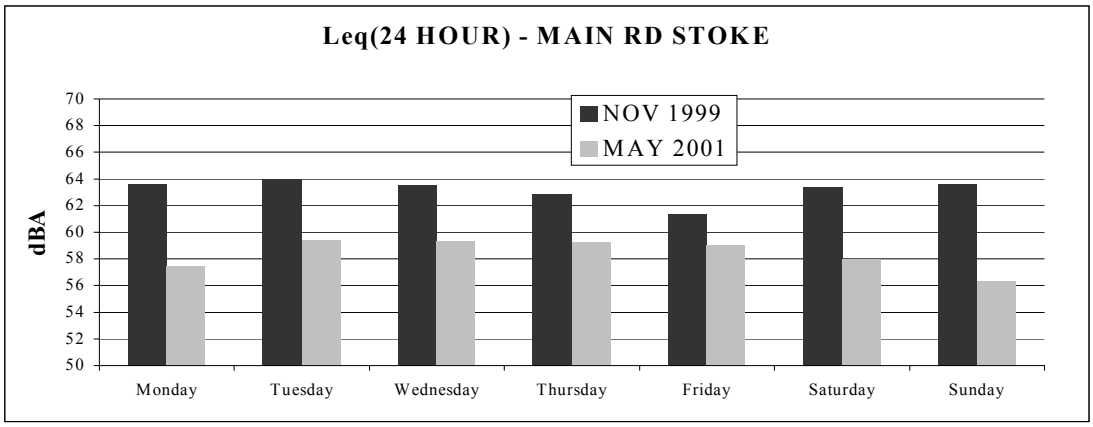



**Figure 29: Nayland Road**

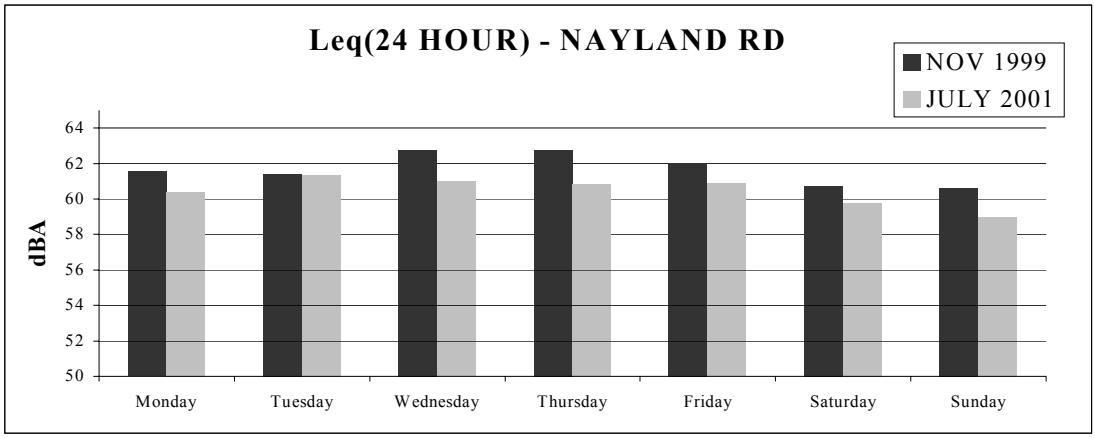
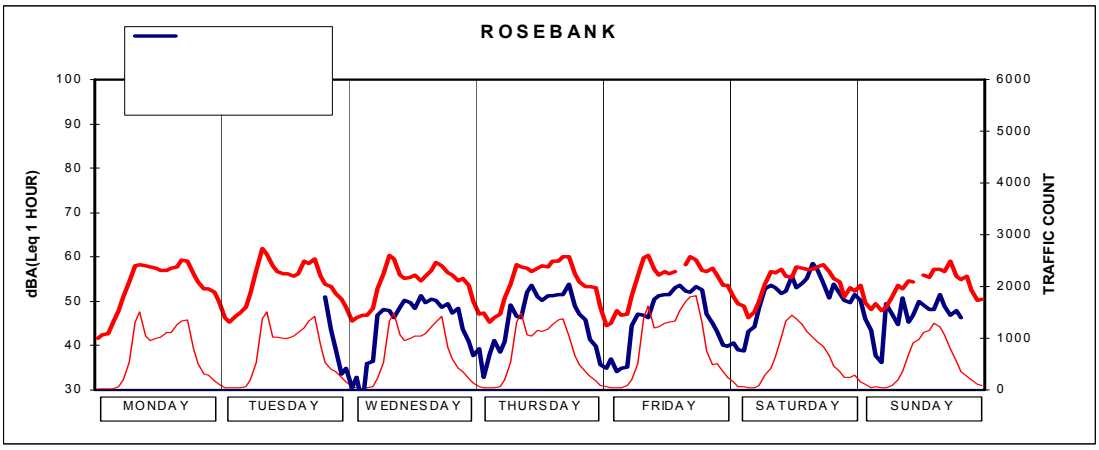


**Figure 27: Rosebank**



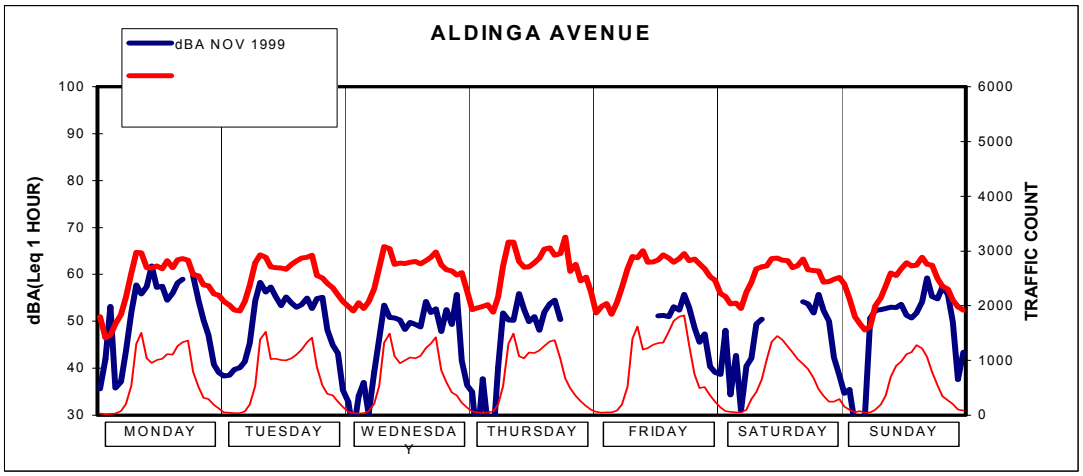

## Site 4 – Aldinga Avenue (figures 30, 31 and 32)

**Figure 30**


This site was situated at 67 Aldinga Avenue. The measuring point is approximately 80 metres from Whakatu Drive and is separated from the Motorway by an earth bund 2 – 2.5 metres high.

The traffic data (pre motorway) was collected on Aldinga Avenue immediately opposite 67 Aldinga Avenue. The traffic data (after motorway) was collected on Whakatu Drive almost directly opposite this site.

**Figure 31: Aldinga Avenue**

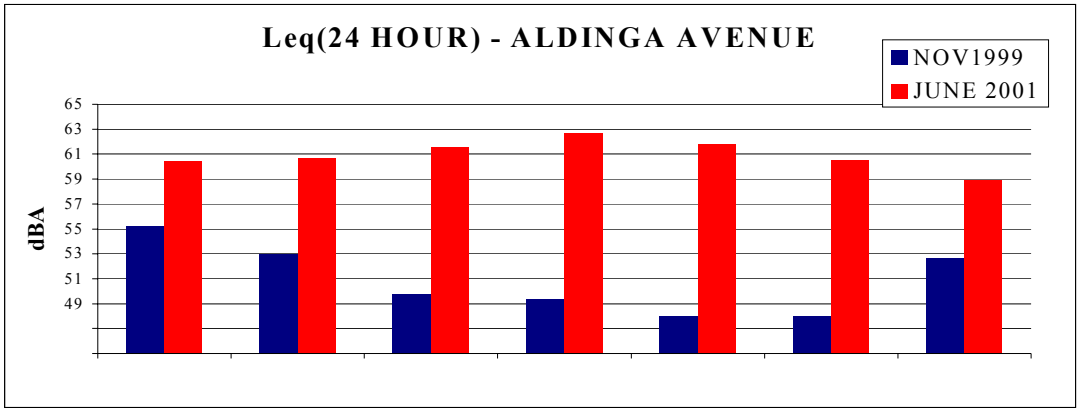



The increase in the general noise environment is significant. The 24-hour Leq has increased by between 8 and 14 dBA. It has gone from being a quiet suburban street to one adjacent to a busy and noisy highway. The noise levels here are 4 to 5 dBA less than at Saxton Road despite a rougher road surface, more vehicles and a higher speed.

It would appear the bund has reduced the noise effects but not enough to prevent a significant increase in the long term noise environment.

Of particular interest is the period between midnight and 3 am where in contrast to the Saxton Site the noise level has increased by up to 20 dBA. This is significantly greater than the day time noise increase of 5-10 dBA.

**Figure 32: Aldinga Avenue**

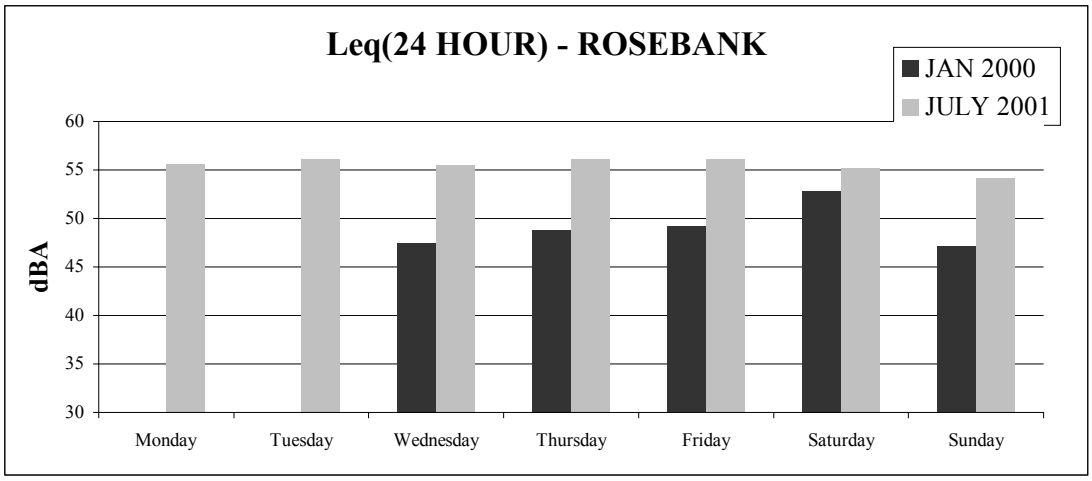



**Site 5 – Rosebank (figures 27 and 33)**

This site is situated at 10 Rosebank. The measuring point was approximately 5 metres from the boundary with Whakatu Drive with another 15 metres to the motorway. The site is elevated above the motorway with a solid fence on top of a bank blocking direct line of sight to the motorway from the measurement point.

No traffic data was collected before the motorway was built (no traffic). The traffic data (after motorway) was collected on Whakatu Drive 300 metres south of Songer St (same data as used for the Aldinga Site).

**Figure 33: Rosebank**




This site is similar to the Aldinga site in that the motorway has had a significant effect on the noise environment. However the increase is slightly less than that at Aldinga due to the measurement point being further away and protected to a greater degree by physical barriers. Noise levels are 8 to 9 dBA less than the Saxton Road site.

## Site 6 – Cawthron (figures 26 and 34)

This site is situated at 46 Cawthron Crescent. The measuring point was approximately 40 metres from the boundary with Whakatu Drive with another 30 metres to the actual motorway. The site is elevated above the motorway with a solid fence on top of an earth bund wall blocking direct line of sight from the measurement point with the motorway.

No traffic data was collected pre motorway (no traffic). No traffic data is yet available for this stretch of Whakatu Drive. When data is collected it can be plotted against the noise data gathered. The 24-hour Leq has risen between 4 and 9 dBA. Noise levels are 7 to 8 dBA less than the Saxton Road site.

**Figure 34: Cawthron Crescent**

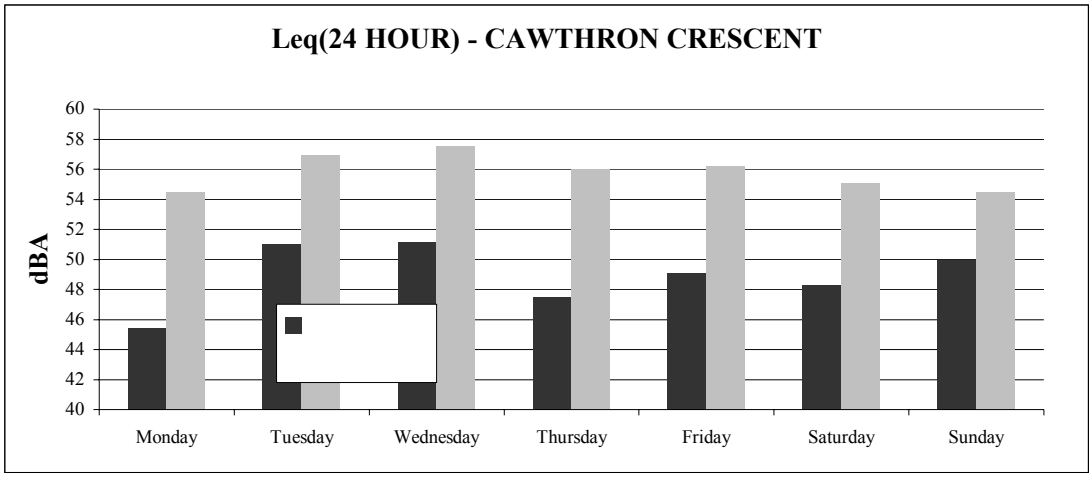



Table 6 shows 24-hour Leq for comparison purposes.

**Table 6: 24-Hour Leq**

| TABLE OF 24-HOUR Leq | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CAWTHRON | | MAIN RD | | NAYLAND | | SAXTON | | ROSEBANK | | ALDINGA | |
| | FEB 2000 | NOV 2000 | NOV 1999 | MAY 2001 | NOV 1999 | JULY 2001 | DEC 1999 | JUNE 2001 | JAN 2000 | JULY 2001 | NOV 1999 | JUNE 2001 |
| Monday | 45 | 54 | 64 | 57 | 62 | 60 | | 65 | | 56 | 55 | 60 |
| Tuesday | 51 | 57 | 64 | 59 | 61 | 61 | 69 | 66 | | 56 | 53 | 61 |
| Wednesday | 51 | 58 | 64 | 59 | 63 | 61 | 70 | 66 | 47 | 56 | 50 | 62 |
| Thursday | 47 | 56 | 63 | 59 | 63 | 61 | 70 | 66 | 49 | 56 | 49 | 63 |
| Friday | 49 | 56 | 61 | 59 | 62 | 61 | 69 | 67 | 49 | 56 | 48 | 62 |
| Saturday | 48 | 55 | 63 | 58 | 61 | 60 | 68 | 65 | 53 | 55 | 48 | 60 |
| Sunday | 50 | 54 | 64 | 56 | 61 | 59 | 69 | 64 | 47 | 54 | 53 | 59 |

## Conclusion

Traffic strongly affects the noise environment adjoining roads. The level of noise is generally logarithmically (exponentially) proportional to the traffic flow. However there are a number of other factors such as frequency/density of traffic, speed of traffic, and road conditions, particularly road surface, that influence the final results for each site.

Where a major road is constructed adjacent to an environment previously unaffected by a large traffic flow, a significant degradation of its noise environment occurs.

This degradation is more pronounced between midnight and 3 am. This is because the previously unaffected area would have had a low background noise (very quiet) at night compared with during the day. Even though the increase in traffic flow at night is less than during the day the increase in the noise level compared with the previous background is higher at night.

In considering the effects of this it is important to understand that the community generally considers it is affected by noise when the existing background is exceeded. Complaints are usually received once there has been a 5-10 dBA increase. The actual noise level is not the most important factor, it is the difference between the old and the new levels that is the determining factor.

On existing roads a marked reduction in traffic flows did not significantly reduce the daytime noise levels. However there was significant reduction in the night time levels. It is probable that residents on Main Rd Stoke have not perceived a major improvement during the day but consider their night time noise environment markedly better.

## Noise issues - Where to from here

The noise provisions of the Proposed Nelson Resource Management Plan were based on a limited number of noise recordings which were undertaken over a comparatively short period of time. During the next year it is hoped to undertake additional measurements within each zone and along zone boundaries to confirm and expand on the findings of previous work. It is expected that such work would provide a greater level of detail regarding local noise environments and between zones themselves.

Additional monitoring work is also planned in and around the port and airport area to independently confirm the results of self monitoring undertaken by these organisations and to improve our understanding of the noise environments in these areas.

If additional noise monitoring work identifies problems or inconsistencies with the current plan provisions these can be amended at the time of normal plan review. In the unlikely event that urgent changes are needed, then a plan change could be initiated.

# Appendix 1 Regional Policy Statement Indicators

## Air Quality

DA1.8.1 The air quality monitoring programme showing a decline in mid winter particulate matter levels.

DA1.8.2 Monitoring of industrial and commercial emissions showing compliance with standards and/or consent conditions being met.

### Noise

DA2.8.1 A reduction in the frequency of noise levels exceeding specified levels at specified locations.

# Appendix 2 Proposed Nelson Resource Management Plan Indicators

**Air quality** (Air Plan not yet written.)

## Noise

| Anticipated environmental results | Indicators | Data source |
|---|---|---|
| **DO10e.1**<br>Airport remaining viable at future levels of aircraft movements. | **DO10e.1.1**<br>Level of noise complaints from residents around airport. | Council records |
| **DO10e.2**<br>Low density development in vicinity of airport. Insulated residential units. | **DO10e.2.1**<br>Consistent approach to applications. | Council records, building consent information |
| **DO10e.3**<br>Aircraft operations do not exceed noise limits. | **DO10e.3.1**<br>Regular noise monitoring**.**<br>Level of noise complaints from residents around airport. | Audit of Airport Authority monitoring data. |
| **DO10Ae.3**<br>Port operations do not exceed noise limits. | **DO10Ae.3.1**<br>Level of noise complaints from residents around port. | Regular noise monitoring**.**<br>Audit of Port monitoring data.<br>Council records |
| **ICe.5**<br>Control of adverse effects of activities and development in the City Centre to within acceptable levels of environmental quality | **ICe.5.1**<br>Changes in ambient noise levels and other environmental effects at selected locations<br><br>Complaints received about adverse effects | Data collected at selected sites<br><br>Council complaints register |
| **SCe.1**<br>Control of adverse effects to acceptable levels of environmental quality | **SCe.1.1**<br>Complaints about adverse effects<br><br>Changes in ambient noise levels and other environmental effects | Council's complaints register<br><br>Data collected at selected sites |
| **INe.3**<br>Adverse effects of use and development in the industrial zones which are controlled to acceptable levels of environmental quality | **INe.3.1**<br>Changes in ambient noise levels and other environmental effects at selected locations<br><br>Complaints received about adverse effects | Data collected at selected sites<br><br>Council's Complaints Register |
| **RUe.3**<br>Adverse effects of use and development in the Rural Zone which are controlled to acceptable levels of environmental quality | **RUe.3.1**<br>Changes in ambient noise levels and other environmental effects at selected locations<br><br>Complaints received about adverse effects | Data collected at selected sites<br><br>Council's complaints register |
| **CMe.7**<br>A quiet coastal environment | **CMe.7.1**<br>Consistent application of standards and enforcement<br>Complaints, media reports | Council records |

# Appendix 3 Monitoring the State of the Environment - Proposed Work Programme 2002

- **Rivers Hydrology.** Maintain river and rainfall stations throughout the Nelson City area.
- **River Ecology Monitoring of up to 40 sites four times per year. Provides** base line data on the state of our rivers and streams so that appropriate Resource Management Plan provisions can be drafted and changes in river health recognised and quantified.
- **Particulate air quality.** Operation of two $PM_{10}$ monitors. One in St Vincent St and the other a roving station. Analysis and reporting of the data.
- **Recreational water quality monitoring (swimming and shellfish gathering).** Maintain a network of monitoring sites and a response strategy if elevated results are detected.
- **Noise monitoring of zone centres and boundaries.** In order to confirm compliance with the Resource Management Plan and if required identify any change required to the Plan. Further monitoring along the proposed southern link route is also possible.
- **Undaria survey of Nelson Haven and Nelson Marina area** to evaluate the extent and intensity of the Undaria infestation.
- **Preparation of a Nelson specific Met Data Set** to provide a basis for using a computer based model to assess the effect of discharge of pollutants to air in Nelson.
- **Contribution to national projects** which include development of a monitoring protocol for estuaries, promotion of integrated catchment management in NZ, and assessment of the environmental effects of river abstraction.
- **Development of a monitoring database** to house NCC monitoring data and allow easy analysis and retrieval. Also commencement of data capture.
- **Survey of the coastal marine area** to establish ecological, social and commercial values. This will also provide a basis for an aquaculture variation to the Nelson Resource Management Plan.
- **Work with iwi to develop environmental indicators** specific to Tangata Whenua of Nelson.
- **Monitoring of hazard events and hazardous situations** including survey of Tahunanui Landslide, Tahunanui Beach, Flooding and landslide events.
- **Extending survey of significant conservation areas** to include potentially important areas not previously surveyed.
- **Heritage and amenity surveys** to record the state of various heritage and amenity items listed in the Nelson Resource Mangement Plan and to assess changes in their state (houses, trees, views etc)
- **State of the Environment Report** preparation and printing. The 2002 SOE report to deal with freshwater issues.

# Appendix 4 Nelson Regional Policy Statement and Resource Management Plan Objectives and Policies Referred to in this Document

## AIR QUALITY POLICIES

### RPS Objective

DA1.2.1 Improvement in Nelson's ambient air quality.

### RPS Policies

DA1.3.1 To set minimum ambient air quality standards that are at levels which ensure that adverse effects on people or ecosystems at ground level are avoided or mitigated.

DA1.3.2 Where existing air quality is higher than the standards set under the above policy, no significant degradation to existing ambient air quality shall be permitted.

DA1.3.3 To control and/or reduce the volume or concentration of point source discharges so that the adverse effects on people or ecosystems at ground level are avoided or mitigated.

DA1.3.4 To ensure industrial, commercial, rural and domestic discharges avoid significant adverse effect on the environment, including people, plants or animals.

## NOISE POLICIES

### RPS Objective

DA2.2.1 An environment in which unreasonable noise is avoided, remedied or mitigated.

### RPS Policies

DA2.3.1 To the extent that it is within Council's statutory power to do so, to protect existing and proposed residents and other noise sensitive land uses from the adverse effects of excessive and unreasonable noise from industrial, commercial, transportation (including land, sea and air), community or recreational activities.

DA2.3.2 Where it is within Council's power to do so, to prevent adjacent activities within commercial and industrial areas from being adversely affected by excessive and unreasonable noise including that generated by transport.

DA2.3.3 To acknowledge that there are noise sensitive activities which may not be compatible with existing facilities which are sources of noise.

RE2.1 Noise levels received at adjacent site boundaries should be consistent with a predominantly residential environment.

IC4.2 Activities should not give rise to levels of noise, smell, dust, and smoke, or traffic, landscape, aesthetic or other adverse effects which will detract from the character being sought for the City Centre and City Fringe areas.

SC2.3 Activities should not give rise to odour, dust, glare, or noise:
a) in any neighbouring zone, inconsistent with levels or times that can reasonably be expected in such a zone, or
b) at levels, or times which would adversely affect the character and function of the centre.

IN2.1 Activities should not produce, beyond the boundaries of the site and in particular on any zone boundary, levels of adverse effects such as noise, dust, and other discharges to air, shading, and glare, which detract (or have potential to detract) from adjacent activities and the surrounding environment.

RU3.3 Activities should not give rise to unreasonable adverse effects which compromise the amenity of adjacent properties, services and zones such as undue levels of noise, smell, traffic and dust.

CM3.5 Activities should not produce unreasonable noise or noise sufficient to have a significant adverse effect on amenity values, human health, animals or wildlife.

**RM Plan Objective**

DO10.1 The long term continuation of Nelson Airport at its present location, with provision for controlled growth in aircraft movements, whilst managing the effects of noise and other potential adverse effects on the community.

**RM Plan Policies**

DO10.1.2 Noise effects of aircraft should be reasonable, in the context of the neighbourhoods surrounding Nelson Airport, and in any case should not exceed levels projected for the year 2020.

DO10.1.3 The potential exposure of communities to airport noise should be managed to ensure that a reasonable balance is achieved between the operational needs of the airport over time, and the amenities and well being of the community.

DO10.1.5 The Airport Authority, in association with the "Nelson Airport Noise Environment Advisory Committee" will establish a noise management plan for airport activities, including a regular noise monitoring programme and regular review. In particular, the Airport Authority will adopt the noise management plan no later than six months after this Resource Management Plan becomes operative, and review it at two yearly intervals or more frequently.

DO10A.1.3 Noise effects arising from port-related activities should be managed in a way that is not incompatible with the neighbourhoods surrounding Port Nelson.

DO10A.1.4 The potential exposure of communities to port noise should be managed to ensure that a reasonable balance is achieved between the operational needs of the port, and the amenities and well being of the community.

# The Air and Noise Report - 2001