Part II
Otago's Air Quality Issues

4 Introduction

This part of the Plan outlines the air quality issues in the Otago region. These issues have been identified through:

- Consultation during the development of the Regional Policy Statement for Otago;
- Evaluating issues raised in public comments on the Air Quality Discussion Paper; and
- Assessing the relevance of national and international air quality issues.

4.1 Kai Tahu ki Otago

4.1.1 Discharges into air may adversely affect:

(a) Waahi tapu;
(b) Waahi taoka;
(c) Mahika kai; and
(d) Marae.

Explanation

Kai Tahu ki Otago have a spiritual relationship with the air. Its creation is recognised by Kai Tahu tradition as the dawn of light. The air is an integral part of the environment which must be valued, used with respect, and passed on intact to the next generation.

Kaitiakitanga requires Kai Tahu to be actively engaged in the planning, consenting and monitoring of the air resource to ensure their holistic values are recognised. Because of the importance of the air resource to Kai Tahu, and in order to provide for kaitiakitanga, it is necessary to involve Kai Tahu in the management of the air resource.

When contaminants are discharged into air they may have an adverse effect on customary values and practices including waahi tapu, waahi taoka, mahika kai and marae. For example:

- Discharges into the air may adversely affect traditional sources of mahika kai thereby further reducing the ability to gather food;
- Discharges such as those from a crematorium can, if located in close proximity to waahi tapu or other taoka, be spiritually offensive; and
- Discharges into air can adversely affect health on a marae and can be culturally offensive.

Issues of particular concern, which stem from the Kai Tahu perspectives are:

- **Air quality in Otago**. To ensure the air resource is passed on intact to the next generation, Otago's air resource should be maintained and enhanced where it is degraded.
- **Discharges from industrial or trade premises** adversely affect local and ambient air quality and can affect papakaika and mahika kai.
- **Domestic discharges** are a concern because of their effect on mahika kai and other cultural uses.
- **Dust** can have an adverse effect on traditional Maori rock art and people's health.
- **Odour** may affect marae and waahi taoka.

- **Agrichemical spray drift** has the potential to cause adverse effects on people's health and non-target neighbouring areas. Of particular concern are site specific areas such as marae, waahi tapu, mahika kai, water and indigenous flora.
- **Vegetation burning** can have an adverse effect on waahi tapu, waahi taoka, mahika kai and marae.
- **Transport emissions** can have an adverse effect on public health, mahika kai, and on native flora and fauna used for natural medicines.

Other issues 4.2.1 to 4.10.1
Objectives 6.1.1, 6.1.2, 6.1.3
Policies 7.1.1, 8.2.3

4.2 Air quality in Otago

4.2.1 The discharge of contaminants into air can degrade ambient air quality.

Explanation
Ambient air quality is the general quality of the air that surrounds us and is a reflection of the cumulative impacts of discharges from human activities and natural processes.

There are many benefits of good ambient air quality, including:
- Avoiding costs in the health, recreation, built environment, commerce and natural environment areas;
- Enabling our quality of life to be maintained, and in particular those values relating to amenity and visibility; and
- Maintaining the perception of this country as a clean environment and thus enhancing its attractiveness to visitors.

In 1994, the Ministry for the Environment produced a document entitled *"Ambient Air Quality Guidelines"* (AAQG). The AAQG provides the minimum requirements that ambient air quality should meet in order to protect human health and the environment. These 1994 guidelines were updated in 2002. The updated AAQG contains new ambient air quality guideline values for both existing and newly listed contaminants, revised guidance on how they should be used to manage air quality under the Resource Management Act, and new guidance on assessing the potential impacts of air pollution on ecosystems.

In 2004 the NESAQ was gazetted, as discussed in section 2.1. The NESAQ provides baseline ambient air quality protection for all New Zealanders, the standards of which are based upon those given in the AAQG. Where pollutants are not covered by the NESAQ, those guidelines given in the AAQG still apply. The requirements of the NESAQ also override any less stringent requirements in regional plans.

The Otago Regional Council's ambient air quality monitoring programme, which commenced in 1997, has focused on measuring the levels of PM_{10} (particles smaller than ten microns), oxides of nitrogen, carbon monoxide and sulphur dioxide. A report produced by the Otago Regional Council in 2005 entitled *"Ambient Air Quality in Otago 1997 – 2004, Nitrogen Dioxide, Sulphur Dioxide and Carbon Monoxide"*, summarises the air quality monitoring results for these

pollutants, and concludes that they are not causing a significant problem in Otago's urban areas. However, the monitoring programme is on-going to enable the Council to identify trends and further increase its understanding of air quality, and the effects of discharges of contaminants to air.

The NESAQ requires the ambient concentration of PM_{10} in all parts of New Zealand to meet 50 $\mu g/m^3$ (24-hour mean) by 1 September 2013, with only one excedence of this standard allowed in a 12-month period. With regard to PM_{10}, a report produced by the Otago Regional Council in 2005 entitled *"Ambient Air Quality in Otago 1997 – 2004, Particulate Matter"* summarises air quality monitoring undertaken. Monitoring data has shown breaches of the NESAQ requirements for PM_{10} in a number of urban areas throughout the region, including Alexandra, Arrowtown, Cromwell, Dunedin, Milton, Mosgiel, Oamaru, and Palmerston.

The relative contributions of domestic, industrial, commercial and transport sources on air quality were investigated in 1999 and 2006 through an inventory of emissions for Otago's main urban areas. The results of the inventory show that during winter when measured PM_{10} concentrations have been high, emissions from domestic sources are the largest source of PM_{10}.

Outside of urban areas, ambient air quality in Otago is generally considered to be good.

Other issues 4.3.1 to 4.10.1
Objective 6.1.1
Policies 8.1.1, 8.1.2, 8.2.3, 8.2.4, 8.2.6, 8.2.8, 9.1.1, 9.1.2, 9.1.3, 9.1.4, 13.1.1, 14.1.1

4.3 Discharges from industrial or trade premises

4.3.1 Discharges into air from industrial or trade premises can adversely affect air quality.

Explanation
Discharges from industrial or trade premises may be point source (e.g., a chimney) or from an area source such as a storage yard. These discharges can adversely affect human health, amenity and heritage values and the physical and biological environments surrounding the discharges. The main factors giving rise to these effects include the presence of:

- Dust (area source discharges are addressed in Issue 4.5.1);
- Hazardous or toxic contaminants;
- Particulates; and
- Odour, which is a significant effect resulting from discharges from some industrial or trade premises and is addressed in Issue 4.6.1.

In terms of this Plan, discharges on industrial or trade premises do not include those from the engines of motor vehicles, trains or aircraft on these premises.

While most, if not all discharges of contaminants into air from industrial or trade premises will have some effect on air quality, the effects will vary, and therefore

the level of control necessary to avoid, remedy or mitigate adverse effects will vary. It is therefore important to establish a level of control that is appropriate to the actual or potential effects of the discharge, and one which is at a similar level to the controls established for non industrial or trade discharges which have similar effects on the environment.

Other issues 4.5.1, 4.6.1, 4.9.1
Objectives 6.1.1, 6.1.2, 6.1.3
Policies 8.1.1 to 8.2.6, 8.2.8, 9.1.1, 9.1.2, 10.1.1, 11.1.1

4.4 Domestic heating and burning of waste

4.4.1 Domestic heating using wood and fossil fuel produces emissions that have the potential to adversely affect human health and amenity values in Otago's urban areas.

Explanation
The burning of wood and fossil fuels produces smoke, water vapour, carbon dioxide, carbon monoxide, nitrogen oxides, hydrocarbons and other volatile organic compounds. Sulphur oxides (primarily sulphur dioxide and sulphur trioxide) are also discharged from the burning of fuels containing sulphur, such as coal. Monitoring of levels of nitrogen, carbon monoxide and sulphur dioxide in ambient air in urban areas of Otago has been undertaken, and is documented in the 2005 report "*Ambient Air Quality in Otago 1997 – 2004, Nitrogen Dioxide, Sulphur Dioxide and Carbon Monoxide"*. The report concludes that they are not causing a significant problem in Otago's urban areas.

In terms of the burning of wood and fossil fuels for domestic heating, the most significant effect of discharges in Otago is the accumulation of fine particles (smaller than 10 microns (PM_{10})) in the air that we breathe (ambient air). This is an issue because these particles can adversely affect human health as they enter the respiratory system and can cause loss of lung function, onset or aggravation of respiratory illness, and a loss of capacity to resist infection.

Monitoring of PM_{10} in ambient air in urban areas has been undertaken, and is documented in the 2005 report *"Ambient Air Quality in Otago 1997 – 2004, Particulate Matter"*. This monitoring has shown that PM_{10} concentrations have reached or exceeded levels where adverse health effects may occur in many of Otago's urban areas. Emissions inventories undertaken in 1999 and 2006 for Otago's urban areas indicate that the majority of this PM_{10} comes from domestic heating discharges. In 1999, many urban areas were surveyed and such discharges were found to contribute an average of 75% of winter PM_{10} emissions, with contributions for individual urban areas ranging from 52% to 92%. In 2006, an emissions inventory was undertaken for Dunedin, Mosgiel and Alexandra. The main source of PM_{10} emissions in all areas during the winter was domestic home heating, which accounted for 90% of total PM_{10} emissions in Dunedin and Mosgiel, and 99% of total PM_{10} emissions in Alexandra.

Discharges from domestic heating can also result in adverse effects on amenity values in terms of odour, nuisance and visibility.

The adverse effects of discharges from domestic heating are caused, or exacerbated by, inefficient heating appliances, incorrect use of appliances and poor quality fuels. For example, open fires discharge more PM_{10} than multifuel or woodburners, which in turn discharge more PM_{10} than pellet fires, gas heaters or electricity. Poor quality fuels, such as coal with a high sulphur content or wood with a high moisture content, will produce more adverse effects than low sulphur coal or dry wood, which in turn produce more adverse effects than wood pellets or gas.

Objectives 6.1.1, 6.1.2, 6.1.3
Policies 8.1.1, 8.1.2, 8.2.7, 8.2.8, 9.1.1, 9.1.3, 9.1.4

4.4.2 Burning waste outdoors can produce emissions which have adverse localised effects beyond the boundary of the property where the burning occurs.

Explanation
The Otago Regional Council receives a significant number of complaints about outdoor burning. These are typically associated with burning in drums or on the open ground in backyard situations. In the three years to 30 June 1999 these accounted for 23% of air pollution complaints with the majority being made within the Dunedin City area.

The main effects from the burning of waste on residential properties are adverse localised effects which occur mostly in areas which have a higher density of settlement. These effects include:

- The generation of smoke which can cause a nuisance to neighbours by soiling property and reducing visibility;
- The emission of odours which can reduce the pleasantness and general amenity value of an area;
- Exposure to high concentrations of various combustion products which may cause adverse health effects such as respiratory irritation, an issue which can be significant for people with asthma or other respiratory illness; and
- The potential for hazardous air contaminants to be discharged. These contaminants commonly result from the burning of materials such as plastics, chemically treated wood and fabrics.

Discharges from the outdoor burning of waste can also accumulate in the ambient air and increase contaminant concentrations (along with contaminants from other sources) to levels where adverse human health effects occur. An emissions inventory undertaken for Otago's urban areas in 1999 has shown that only a small proportion (less than 1%) of contaminants originate from the burning of waste on residential properties. Because of this, their cumulative effects are considered to be relatively insignificant. Instead, it is the adverse localised effects that occur from such burning, rather than its effects on ambient air quality, that are the significant concern.

Such effects can result from both open burning and incineration. Outside the main urban areas, a more dispersed population and good management practices can assist in mitigating any adverse effects.

Note that Otago's city and district councils may also implement bylaw controls on the burning of waste for the purpose of reducing fire risk.

Objectives 6.1.1, 6.1.2, 6.1.3
Policies 8.2.6, 8.2.7, 8.2.8

4.5 Dust from area sources

4.5.1 Dust emissions from area sources can be a nuisance.

Explanation
Area sources of dust are those where the dust is not emitted from a particular point such as a chimney. The main area sources of dust in the Otago region are:

- Land and soil disturbance associated with subdivision development, construction activities, land clearance and cultivation;
- Unsealed roads, driveways or yards;
- Gravel extraction and mining; and
- Natural sources such as dry river and lake beds.

The adverse environmental effects of dust from these sources are primarily associated with nuisance and can include unwanted deposition of dust on property, reduced visibility and diminished amenity values. Health impairment may also occur, particularly when small particles are present.

Once emitted, dust from area sources is difficult to control because the emissions are generally intermittent and difficult to contain. Managing the adverse effects of dust discharges is therefore best achieved through avoiding dust emissions by using appropriate land management practices. Thus, while this Plan advocates the use of appropriate land management practices to avoid dust emissions, and contains rules to control activities on industrial or trade premises that have the potential to result in significant dust emissions, it is envisaged that the two primary means by which such controls will be implemented will be via the district plans of Otago's city and district councils and by conditions on land use consents granted by city and district councils. Dust controls may also form part of industry codes of practice or other mechanisms which promote good management practices.

Dust emissions from point sources are commonly related to specific activities undertaken on domestic, industrial or trade premises. As such, the effects of point source discharges are addressed via other issues in this Plan.

Objectives 6.1.1, 6.1.2, 6.1.3
Policy 10.1.1

4.6 Odour

4.6.1 The discharge of odorous compounds can have significant adverse effects on amenity values and human health.

Explanation

Odour is a high profile air quality issue in the Otago region, accounting for 33% of air pollution complaints received by the Otago Regional Council in the year ending 31 December 1997. The main sources giving rise to these complaints are:

- Abattoirs, fellmongers and rendering plants;
- Solid waste disposal, e.g., landfills and transfer stations;
- Fish processing plants;
- Sewage and waste water treatment systems;
- Commercial food processing operations; and
- Farming activities such as dairy shed effluent treatment and disposal, silage making and intensive farming.

Over 80% of odour complaints relate to activities in the Dunedin and Mosgiel areas. This appears to be because of the concentration of industry in these areas and the intensive nature of development which often produces situations where incompatible land uses are located in close proximity to one another. Incompatible land uses can exacerbate the effects of odour discharges by permitting the establishment of activities that produce odorous discharges and odour-sensitive activities in the same area.

The main effects of odour are on amenity values and effects on human health. At its extreme, on-going exposure to an offensive odour can create tensions between the producers of the odour and people exposed to the odour.

Odour, possibly more than any other contaminant discharge, directly affects the amenity values of an area. These amenity values are often described in subjective terms by communities and this can make it difficult to identify the effects that odour may have on them.

Odour itself is also subjectively defined. People respond to smells differently. While one person may detect an odour associated with a contaminant at a low concentration, others may not be able to detect it until it is much stronger. Once detected, people make judgements on the pleasantness or otherwise of an odour based on their individual experience.

While there are a small number of odours that almost all people would agree are offensive, there are a wide range of responses within the population. For example, silage may be considered by some to have a 'sweet' or 'nice' odour, while others may consider the odour to be quite offensive.

It is this subjectivity which makes it both difficult to measure odour objectively and to assess its effects. This means that the management of odour is often contentious and difficult. Odour management should initially concentrate on avoiding the occurrence of odour problems through effective planning, good process design and control, and general site management. Where it is not possible to avoid odour problems, a variety of management options exist and the most

to avoid odour problems, a variety of management options exist and the most appropriate option, given the characteristics of the site and the odour, can be implemented to minimise the adverse effects. The Ministry for the Environment has produced a report entitled *"Odour Management Under the Resource Management Act"* (1995), which sets out considerations for regional, city and district councils for the management of odour.

Objectives 6.1.1, 6.1.2, 6.1.3
Policies 8.2.1, 8.2.3, 8.2.4, 8.2.5, 11.1.1

4.7 Agrichemical spray drift

4.7.1 The application of agrichemicals has the potential to cause adverse effects on non target areas or species as a result of spray drift.

Explanation
The use of agrichemicals to control plant pests, insect pests and fungal diseases is common throughout Otago. Such chemicals are used in horticulture, agriculture, arable farming, forestry and fruit production. Agrichemicals are also used in the management of public amenity areas and in residential gardens.

While problems associated with the application of agrichemicals are not widespread in Otago, there is the potential for adverse effects to occur as a result of sprays drifting onto non-target areas and onto neighbouring properties, thus creating conflict amongst neighbours. Changing land use patterns in some areas of Otago, due to the development of rural residential living and viticulture, may also increase the potential for such conflict to occur. Spray drift may have adverse effects on amenity values, natural resources, human health, economic well being and sensitive areas or places.

Areas or places can be sensitive for two main reasons. Firstly, the area or place may contain something that is particularly susceptible to damage from the agrichemicals being used. Secondly, the area or place might be sensitive because people consider agrichemical use to be inappropriate in that location.

The main factors influencing the occurrence of agrichemical spray drift are weather conditions, whether buffer zones exist between the intended spray area and non-target areas, the application method, and the frequency and duration over which agrichemicals are applied.

Many users of agrichemicals have recognised the need for better management of agrichemical application and control over the use of agrichemicals. In particular, the New Zealand Agrichemical Education Trust runs "Growsafe" courses to certify users of agrichemicals, and has produced the *"Code of Practice for the Management of Agrichemicals"* as a New Zealand Standard (NZS 8409:1999).

Objectives 6.1.2, 6.1.3
Policies 8.2.1, 8.2.2, 8.2.3, 8.2.4, 8.2.5, 8.2.8, 12.1.1

4.8 Vegetation burning on production land

4.8.1 Smoke generated by the burning of vegetative matter on production land can reduce visibility and cause adverse effects including nuisance.

Explanation
Land clearance and vegetation control by burning is a common practice on production land where activities such as horticulture, agriculture, arable farming, forestry and fruit production are undertaken. Where good burning practices are followed, any adverse effects are usually short lived, however when they are not followed, smoke may be discharged over a prolonged period of time. This can reduce visibility and cause adverse effects. It is of particular concern when the burning occurs in the vicinity of urban areas, lifestyle properties or areas where people participate in recreational activities such as on ski fields, and within national parks and reserves.

Discharges from the burning of vegetative matter in backyards can also have adverse effects but, as these effects are different, they are dealt with in Issue 4.4.2 in the Plan.

The burning of vegetative matter may also have effects on land and water resources. These effects will be addressed in other regional plans. The fire risk associated with land clearance is controlled by the Forest and Rural Fires Act 1977. This act is primarily administered by Otago's city and district councils, however the Commissioner for Crown Lands and the Department of Conservation administer the act in relation to Crown land.

Objectives 6.1.1, 6.1.2, 6.1.3
Policy 8.2.8, 13.1.1

4.9 Transport emissions

4.9.1 Emissions from transport sources have the potential to adversely affect human health and amenity values.

Explanation
Within Otago, emissions from motor vehicles such as cars, buses and trucks are the most dominant form of air pollution from transport sources. Emissions from ships and aircraft, however, can have intermittent and localised effects in and around Port Chalmers, the Port of Dunedin and Dunedin and Queenstown airports. It is impractical to manage the emissions from ships and aircraft on a regional basis because they only visit the Otago region for short periods and cause very localised effects. Integrated management of these emissions on a national and international basis is more effective, and as such they are not controlled by this Plan.

In 1996 there were 68,748 motor vehicles recorded as being available for private use in Otago, with 62 % (or 43,014) of these in Dunedin City (Statistics New Zealand, 1996 Census).

Motor vehicles discharge large quantities of contaminants into the air as exhaust fumes. These emissions include nitrogen oxides, carbon monoxide, carbon dioxide, unburned hydrocarbons, and volatile organic compounds such as benzene and formaldehyde. The nature and rate of emissions depends on: the type of fuel used; the efficiency of the engine or state-of-tune; whether or not emission treatment technologies are employed; driving style; the types of vehicles on the road; traffic levels and measures adopted to manage traffic flows.

Discharges from motor vehicles can:

- Have cumulative adverse effects on the global air resource since motor vehicle emissions are one of the main sources of "greenhouse" gases;
- Contribute to the creation of a brown haze or smog in urban areas which has the effect of reducing visibility and amenity values; and
- Contribute to high concentrations of contaminants in urban areas, particularly within "traffic corridors". In some circumstances the concentrations can reach levels where human health can be adversely affected.

Dunedin's central shopping area is the area most susceptible to adverse effects arising from motor vehicle emissions. This is because it has the highest levels of traffic congestion in Otago combined with a complex topography of poorly ventilated street canyons (tall buildings), a proximity to heavily trafficked roads (such as the state highways) and adverse meteorological conditions, such as the evening temperature inversion in the winter.

Objective 6.1.1, 6.1.2, 6.1.3
Policy 14.1.1

4.10 Global issues

4.10.1 The discharge of contaminants into air in Otago may have global effects.

Explanation
Air movement is not constrained by physical boundaries. The discharge of contaminants into air in Otago can therefore have effects on global air quality. Similarly global air quality can have regional effects.

Global issues of most significance for Otago are:

- The depletion of the ozone layer by substances such as chlorofluorocarbons (typically used in refrigeration), halons (used in fire fighting equipment) and methyl bromide (a fumigant); and
- Climate change through the emission of 'greenhouse gases' such as carbon dioxide, methane and water vapour from activities such as the burning of fossil fuels, motor vehicle emissions and methane gas from agricultural production.

Depletion of the ozone layer increases the levels of ultra violet radiation. This radiation is potentially harmful to human health and living tissue. It can lead to an increased incidence of skin cancer and eye damage, and may also affect plant growth and animal health.

Greenhouse gases insulate the earth and maintain global temperatures at constant levels. These gases have increased in concentration over the last 130 years. While there is still uncertainty about the consequences that increased concentrations may have, it is expected that sea level will rise and weather patterns will be modified.

The New Zealand Government is a signatory to international agreements including the Kyoto Protocol, the Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer. The government has primary responsibility for developing and implementing national responses to global air quality issues.

In the Regional Policy Statement for Otago, the Council adopted policies to support initiatives aimed at avoiding, remedying and mitigating the production and discharge of greenhouse gases and ozone depleting substances.

While global effects are the primary responsibility of central government, the policies, methods and rules in this Plan will assist in achieving national objectives, through controlling the discharge of contaminants into air.

Objectives 6.1.1, 6.1.3
Policy 15.1.1