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2.0 AIR QUALITY MANAGEMENT ISSUES IN THE GISBORNE DISTRICT

2.1 Introduction to Issues

Air is a very dynamic medium. It provides interfaces with every other receiving environment, including land, sea, freshwater, vegetation and animals, including the human body. The interactions between receiving environments and the chemicals discharged into and transported by air are very complex and do not fall neatly into categories of effect, discharge activity or contaminant. For example, the discharge of smoke may involve many effects associated with the combustion process. However, many of these effects may also be caused by other discharges that are unrelated to combustion. Any discussion of adverse air quality effects will contain areas of overlap and duplication.

Many adverse air quality effects are not particularly relevant to this region. This section focuses on those issues that are significant within the Gisborne Region.

2.2 Tangata Whenua Issues

2.2.1 Discharges of odorous or visual contaminants have the potential to cause adverse effects on sites and resources of significance to Tangata Whenua

Air contaminants may adversely affect waahi tapu. Objectionable odours or visible contaminants may violate the sacredness of these sites or other places or features of significance to Tangata Whenua. The Part-Operative Gisborne District Combined Regional Land and District Plan identifies sites and features of significance to Maori in the Gisborne Region. These will be used for the purposes of air quality management, ensuring consistency between land and air quality management.

Objective 3.2.4[1]

Policy 4.2.1

2.2.2 The air is a taonga and needs to be safeguarded

The air, like other natural and physical resources, is considered by Tangata Whenua to be a taonga, to be valued, used with respect and passed on intact to the next generation. The principle of Kaitiakitanga in environmental terms provides for restoration of ecological systems, restoration of ecological harmony, increased usefulness of resources and reduces risk to present and future generations.

Objective 3.2.4

Policy 4.2.1

2.2.3 Discharges of contaminants to air, particularly hazardous pollutants and particulate matter, have the potential to cause adverse effects to the health of the Tangata Whenua of the Gisborne Region

As outlined in the introduction to the Plan, a series of hui were held in March 1994 to provide for cultural perspectives of local iwi in preparation of the Proposed Regional Air Quality Management Plan. A summary of the issues raised were:

a) Effects of dust, including pollen, on community and individual water supplies;

b) Effects of dust and pollen on the health of Tangata Whenua. A large proportion of the Maori population are affected by asthma and other bronchial ailments;

[1] Cross referencing has been provided within the Plan to give an indication of the linkages between the issues, objectives, policies, methods and rules. It is not intended to be an exhaustive list of all possibilities only a guide and does not override the section 104 requirements of the Resource Management Act 1991.

c) Car exhaust fumes settling on edible vegetation close to roads;

d) Spraying of horticultural blocks and pine plantations and the effects on human health;

e) Incineration of human tissue.

Both natural and human induced discharges to air are of concern to Tangata Whenua.

Objective 3.2.4

Policies 4.2.1, 4.4.4, 4.4.5

2.3 Ambient Air Issues

2.3.1 Discharges to air cause, or have the potential to cause, reduction in the quality of ambient air

Ambient air quality is the general quality of the air that surrounds us. Ambient air quality reflects the cumulative effects of all activities, both from human activities and natural processes.

Air quality is governed by the presence or absence of substances in the air, such as gases and dusts, which may cause adverse effects on the environment. These substances are generally referred to as contaminants. The quantity of contaminants in the air is controlled by the amount discharged from both human and natural activities, the meteorological conditions that control dispersion of the air and the formation of other substances via chemical reactions. There are a number of factors that control the quality of the air and its impacts on the environment.

The Gisborne Region generally enjoys a high standard of air quality. This is partly the result of the Region's geographic position on the East Coast of the North Island and the relatively exposed nature of the landscape to the prevailing winds.

It also reflects the Region's dispersed population and low overall numbers, the absence of heavy industrialisation, relatively low motor vehicle densities and increasing attention to the control of contaminant producing activities.

However, there are activities discharging contaminants to air in the Gisborne Region, that cause, or have the potential to cause, degradation of ambient air quality. The combined effect of discharges from domestic heating appliances can often cause the degradation of urban air quality, particularly in calm weather conditions. Discharges from industrial or trade activities have the potential to degrade ambient air.

This may be as a result of combined emissions or individual discharges of a large-scale nature, such as large-scale timber processing plants. Motor vehicles, particularly in urban areas, can reduce air quality significantly through combined discharges of contaminants.

Objective 3.2.1

Policy 4.3.1

2.3.2 There is a lack of adequate data and information on ambient air quality, contaminants in discharges and climatic effects in the Gisborne Region

Ambient air quality is generally assessed in relation to guidelines or standards that are a measure of the deviation of air quality from "pristine" natural background levels.

It is not feasible to measure all contaminants in the atmosphere. Measurement of air quality is normally restricted to a few "indicator" pollutants that are so widespread that their effects on air quality are apparent over large areas. Indicators are selected with particular air quality objectives in mind.

In the absence of reliable regional-based information or guideline levels, the Ministry for the Environment have adopted the Guidelines developed largely by the World Health Organisation (but supplemented by the United States Environmental Protection Act and the Victorian Environmental Protection Act). These New Zealand Ambient Air Quality Guidelines are used as the primary indicators and levels against which monitoring information can be assessed. The major indicators adopted in the Ministry for the Environment's Ambient Air Quality Guidelines include carbon monoxide (CO), sulphur oxides (SO_x) nitrogen oxides (NO_x), and inhalable particulate (PM_{10})

Each indicator has a maximum level of concentration in the ambient air that should not be exceeded. These are recommended minimum requirements for air quality, rather than maximum permissible concentrations of pollutants in air, and are only a starting point for assessing air quality.

The Guidelines are primarily directed at the protection of community health. At present there is a lack of scientific information relating to the effects of contaminants on flora and fauna and the health and functioning of ecosystems.

Although national data provides this region with measurable guidelines against which air quality may be assessed, these Guidelines are often not completely relevant to the circumstances in the Gisborne Region.

Some of the limitations of the Ambient Air Quality Guidelines include:

a) Many of the levels set in the Guidelines are well above probable existing levels in the Region, and may not be appropriate to ensuring the maintenance, and where necessary, enhancement of air quality;

b) The guideline levels are primarily set to protect against adverse effects on human health. They do not provide for chronic effects, that is, long-term exposure to low levels of pollutants, often because such effects are not known;

c) It is unknown how much of the available air quality in an area can be allocated to an individual discharge in a sustainable manner (that is, without resulting in adverse effects and without limiting further development, including urban growth and its associated/subsequent emissions, that will also emit contaminants into the air);

d) As knowledge of the effects of pollutants grows, the recommended safe levels are reviewed and often decreased;

e) Some emissions of air pollutants in the Region are often associated with specific industrial discharges and contain contaminants that are not included in the national Guidelines;

f) There are some discharges of contaminants for which there are no appropriate air quality standards or guidelines and it may be impractical to determine the effects of those discharges; and

g) Setting a guideline or standard for any indicator implies that the effect this indicator has on ambient air quality should be monitored. Practical considerations and costs of monitoring also influence the air quality indicators selected.

h) Measures are also being taken at the regional level to gather and analyse information and improve knowledge about the air quality in the Gisborne Region and the processes and factors that affect it.

i) The Council's current monitoring programme has been designed to cover most of the common pollutants with short periods of monitoring at the time of year when conditions might be expected to be at their worst. A more intensive programme would only be called for if initial results were found to be much higher than expected. If this is not found, the aim is to carry out repeat exercises at 4-yearly intervals to ensure that the situation does not deteriorate.

j) The only significant exception to the above is particulate matter. The potential sources for this are many and varied and spread throughout the Region. A regional particulate monitoring programme was started in Gisborne in 1993.

k) A regional emissions inventory was also completed in 1996, which identified the major sources of air discharges in the Region. Since this time sources of contaminants may have changed and the emissions inventory may be outdated.

l) Because the information currently available is limited, effective and meaningful air quality management is difficult. There is a need to further expand the information gathering and monitoring programme in the Gisborne Region. This could include the following:

m) Updated regional emissions inventory;

n) Comprehensive monitoring in order to develop regionally applicable indicators and guideline levels; and

o) Information gathering on meteorology, topography etc. of the Gisborne Region.

Objective 3.2.1

Policy 4.3.2

2.4 General Air Quality Management Issues

There are a number of regionally significant air quality management issues in the Gisborne Region that do not relate specifically to the sources of the discharge but focus on the contaminants contained in the discharge or certain areas of the Region that are particularly sensitive to discharges. These issues are described below.

HAZARDOUS AIR CONTAMINANTS

2.4.1 Hazardous air contaminants have the potential to cause serious and significant adverse effects on human, flora and fauna health and ecosystem integrity

Hazardous contaminants discharged to air can have serious impacts on the health of humans, plants and animals and on the functioning of ecosystems. To provide certainty about what comprises a hazardous air contaminant, the list of hazardous air contaminants proposed by the Ministry for the Environment in the Ambient Air Quality Guidelines have been adopted in the Plan.

The list includes substances that are known or suspected to cause: acute human health effects; cancer or teratogenic (birth defect) effects; or serious or irreversible effects - reproductive dysfunctions, neurological disorders, inheritable genetic mutations or other chronic health effects. The list also includes substances known or suspected to cause significant adverse effects on the environment due to their toxicity, persistence in the environment, tendency to bioaccumulate or any combination of these. The effects of many hazardous air contaminants are not known. The list may not be an exhaustive list for New Zealand. There may be additional substances in use in New Zealand that pose health and environmental concerns that are not included in the list.

Some sources of hazardous air contaminants in the Gisborne Region include:

Combustion/incineration sources: Can emit toxic and hazardous materials such as poly aromatic hydrocarbons (PAHs), metals, dioxins and furans;

Timber processes: Can emit hazardous aldehyde gases;

Asbestos removal;

Sand blasting: Can emit toxic materials such as lead, copper, mercury, zinc, arsenic, cadmium or tributyltin from surfaces, as well as silica dust; and

Agrichemical application (refer to 2.5.1).

The Gisborne Region will need to determine which of these pollutants will require management and at what level depending on their presence and potential for adverse effects in the Gisborne Region. As stated in the Ambient Air Quality Guidelines, in the interim, the Ministry for the Environment recommends that a precautionary approach of minimising the generation of emissions of these pollutants be adopted.

Objective 3.2.2

Policies 4.4.1 - 4.4.5, 4.4.11, 4.5.2, 4.5.3

ODOUR

2.4.2 Odorous discharges to air can result in temporary or prolonged adverse effects on human health and wellbeing, amenity values and the natural character of the coastal environment, wetlands, rivers, lakes and their margins

The human nose, in many instances, is unsurpassed as a detection system for many odorous gases, able to detect compounds at levels far below the limits of sensitivity of sophisticated technical equipment. It is this same sensitivity that makes odour a contentious issue. The possibility that odour is life threatening is remote, yet the strength of human reaction to unpleasant odours is almost universal.

Odours are caused by mixtures of chemical compounds in the air that stimulate the receptors on olfactory nerve cells in the nose.

Smells are perceived subjectively, although there are a few smells that most people would agree are unpleasant, for example sewage.

Odour nuisances are the most common source of air quality complaint in the Region. Noxious, offensive or objectionable odours can have significant adverse effects on amenity values, but also on human health and wellbeing. Adverse effects of odour can include nausea, loss of appetite, sleep disturbance, depression, stress and loss of enjoyment of the home environment. Even pleasant odours can become objectionable when exposed to them over a long period of time (e.g. strong perfumes, commercial food preparation).

Although less of an issue, odour can also adversely affect the natural character of the coastal environment, wetlands, lakes and rivers and their margins.

The predominant causes of odour in the Gisborne Region are industrial processing, waste disposal activities, combustion, agricultural activities and transport. Examples of these include:

a) Ethylamines from animal and plant processing activities;

b) Turpines from timber processes;

c) Ammonia, methane gases and hydrogen sulphides from landfills, refuse burning (including vegetation), sewage reticulation and the sewage outfall station or large scale composting operations;

d) Oily fumes from the operation of mobile asphalt plant or from tar seal and pavement burning;

e) Burning of some fossil fuels such as coal or diesel (nuisance from vehicle exhausts, particularly diesel vehicles, may be a problem on Gisborne's heavy traffic route); and

f) Amines, hydrogen sulphides and mercaptans from agricultural activities such as silage or the keeping of livestock, pigs or poultry.

Responses to an issues and options paper in 1994 varied in the level of recognition of odour issues. Concerns regarding odour associated with urban sewage were common, along with backyard burning and solid fuel burning in the winter season. Most of the odour issues expressed were in relation to specific emissions such as the seasonal animal processing industry, premises used for manufacturing animal or vegetable products and intensive animal farming operations (e.g. pigs and poultry).

It is important to note that there have been substantial changes to Gisborne City's sewerage infrastructure and that some of the larger contributors to odorous discharges (i.e. meat processing activities and pet food manufacturing) have all but disappeared from the Region in recent times. While these odour issues may have lessened in significance , the situation could easily change again over time.

With a few exceptions, the odour management issues in Gisborne seem to be perceived as temporary, or occurring in limited and localised sites. There are few receiving environments particularly sensitive to odorous discharges, although individual residences and places of high public use can be adversely affected. Odour can also have detrimental effects on the coastal environment, wetlands, lakes, rivers and their margins and preservation of these areas is required as a matter of national importance.

The subjectivity associated with odour makes it difficult to measure odour objectively and to assess its effects. The management of odour is often contentious and difficult. The factors that influence the significance of adverse odour effects are referred to as the FIDO factors, that is, the frequency, intensity, duration of exposure or offensiveness of the odour discharge. The location of the odour is also seen to be of significance.

When odour causes, or has the potential to cause, adverse effects on the environment, there are a variety of options available for the management of odour.

Odour Management Under the Resource Management Act is a document prepared by the Ministry for the Environment that explains options for odour management. 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 that can be implemented to minimise adverse effects.

Objective 3.2.2

Policies 4.4.3, 4.4.4, 4.4.5, 4.4.7, 4.4.8, 4.5.1, 4.5.3, 4.5.4

SMOKE, DUST AND OTHER PARTICULATE MATTER

2.4.3 Discharges of smoke, dust and other particulate into the air have the potential to cause adverse effects on human health and on amenity values in localised areas of the Region

There are several related and overlapping terms for particulates associated with adverse effects on human health, amenity and the natural and physical environment. *Total suspended particulate* refers to all airborne particulates, including aerosols. Of these, the coarse particles (generally over 20 micrometers in size) fall rapidly out of the air following discharge and settle as *dust* or *deposited particulate*.

The smaller solid or liquid particles (less than 10 micrometers in size) can penetrate the upper respiratory defences and enter the lungs as *inhalable particulate,* measured as PM_{10}.

Particulates occur naturally in the environment (dry riverbeds, pollens and salt seaspray for example). They can also arise from natural phenomenon exacerbated by human action (e.g. windblown soils exposed by previous vegetation clearance, pollens from production forest).

Some particulates are completely human induced such as those generated from the operation of machinery, quarrying, chimney emissions, controlled bushfires and the use of chemical sprays for example.

The burning of materials for heat, energy, waste disposal or as part of industrial processes results in various products of combustion including discharges of smoke, odour, incompletely burnt matter and a wide range of airborne chemical contaminants. The contents of the discharge depend on the nature of the material burnt (smoke is used in this Plan as a general term for the airborne products of combustion). These products of combustion can be in the form of gases, suspended and inhalable particulate or deposited particulate.

Dust (or particulate over 20 micrometres in size) is commonly perceived as an amenity issue, centring on the nuisance impacts of airborne dust and subsequent deposition on surfaces such as on gardens, cars, in households and on roof water supply areas. Dust can also impede the operation of machinery and reduce the useful life of components, particularly if the dust contains corrosive chemicals. Breathing in airborne dust is uncomfortable and irritates eyes and nasal passages.

While dust particles are generally too large to be a significant respiratory health risk, they may present other risks through ingestion or skin contact, depending on the material (e.g. lead and formaldehyde). Dust can also cause adverse effects on the environment through deposition in waterways and on plants.

Solid or liquid particulate other than dust have the potential for adverse effects on human health when the particles are small enough to be inhaled, that is, particles smaller than 10 micrometers.

The inhalable particulate transported into the lungs could include hazardous substances and can also present respiratory problems independent of the chemical composition of the particles. These include loss of lung function, damage to respiratory system and a loss of capacity to resist infection. Children, the elderly and asthmatics are particularly sensitive to inhalable particulate, greatly magnifying the adverse effects. Inhalable particulate, or PM_{10}, can have adverse effects on the environment such as ingestion by animals and effects on ecosystems. However scientific evidence is not well established.

The 1996 Emissions Inventory for the Gisborne Region calculated *total annual suspended particulate* (including both deposited and inhalable particulate or PM_{10}) at 759 tonnes per year. Further analysis and monitoring has been undertaken at representative sites in the Region and has shown that discharges of *deposited particulate* are often significant, exceeding 27 $g/m^2/30$ days. However the mean in all but extremely unusual cases is well below the guideline for deposited particulate of 4.0 $g/m^2/30$ days proposed by the Ministry for the Environment in the 1992 discussion document on air quality guidelines.

In respect of inhalable particulate, the Ministry for the Environment has determined that PM_{10} measurements should not exceed an annual mean of $40\mu/m^3$.

Monitoring of PM_{10} at one permanent and several short term sites in the Region since 1994 show levels under half the Ministry for the Environment's standard mean. The results to April 1998 for the PM_{10} range over 24 hours are also well below the 24 hour mean of 120µ/m3, at 0.8 -70.6µ/m3.

Given the geography, population and industry characteristics of the Region it is not surprising that the results are consistently superior to the standard. This is not to state that there are no issues regarding inhalable particulate.

Because the population of the East Coast is largely Maori (who have a high incidence of respiratory illness), the issue of minimising the adverse effects of discharges on respiratory health has significance in the Gisborne Region. Working from national averages for asthma prevalence, there are between 2500-3800 youth with asthma in this Region.

Smoke is discharged to air as a product of combustion. Visible smoke results from poor combustion (either low temperatures and/or lack of sufficient oxygen). Smoke usually contains both inhalable and deposited particulate matter. Visible smoke particles are typically very fine (less than 5 micrometers) and can have a major impact on visual air quality and other amenity values (e.g. odour). Combustion may also cause a variety of other contaminants to be discharged to air including carbon dioxide, sulphur oxides, nitrogen oxides, carbon monoxide and hydrocarbons.

Examples of major combustion discharge sources include natural fires and volcanic activity, energy and heat generation for a range of purposes (including industrial processes, mobile asphalt plants and pavement burning), municipal, commercial, industrial or residential waste incineration; rural vegetation clearance; and the use of motor vehicles.

Combustion resulting from domestic heating, water burning and transport sources are addressed more fully as specific issues in the Plan.

Next to odour, smoke emissions are the most common cause of public complaint to the Council. Monitoring for smoke was undertaken during winter months in 1993 at a residential site in the city. Generally, levels were half that of Auckland or Huntly.

There are a number of different approaches to ensure the adverse effects of dust, particulate or smoke are avoided, remedied or mitigated. Dust from non-point sources may be dealt with through good management or containment.

Smaller particulate from combustion sources, abrasive blasting and other sources may be controlled through reduction at source, control technologies of combustion sources (appropriate chimney heights etc), "end-of pipe technologies" (e.g. scrubbers, filters), efficient operation of processes or land-use measures that reduce the effects of the discharge on surrounding sensitive areas.

Objective 3.2.2

Policies 4.3.1, 4.4.3 - 4.4.7, 4.4.9, 4.4.10, 4.5.1 - 4.5.5

SENSITIVE AREAS

2.4.4 Discharges to air have the potential to cause adverse effects on receiving environments within the Gisborne Region that are potentially sensitive to those discharges

Section 6 of the Resource Management Act sets out matters of national importance that must be recognised and provided for. These include:

(a) The preservation of the natural character of the coastal environment (including the coastal marine area), wetlands and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use and development;

(c) The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna;

(e) The relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga.

These areas and values have the potential to be compromised by the discharge of contaminants to air and they must be afforded special protection and consideration when managing discharges.

There are also other areas and resources of the Gisborne Region that may be sensitive to the effects of discharges to air. These include:

a) Residences and places of public and private assembly (including amenity areas, early childhood education centres, schools, hospitals, health care or medical centres);

b) Public roads and airports;

c) Domestic and community water supplies; and

d) Sensitive crops or farming systems.

Although these receiving environments are not specifically provided for under the Resource Management Act, they have been identified as being potentially sensitive to some types or volumes of discharges in terms of the effects on human health, amenity values, visibility, flora and fauna and ecosystems.

Discharges of contaminants to air that may cause adverse effects should be avoided in close proximity to these areas. When this is not possible or practicable, options such as buffer distances, control technology and notification requirements may prevent or reduce adverse effects. These methods may also be appropriate to manage reverse sensitivity effects that can arise when sensitive activities locate in proximity to existing rural activities.

Objective 3.2.2

Policy 4.4.1, 4.4.5, 4.4.8, 4.4.9.

2.5 Spray Application of Agrichemicals

2.5.1 Discharges to air from the application of agrichemicals, particularly when resulting in off target spray drift, have the potential to cause adverse effects on human health, flora and fauna health, ecosystem integrity and on sensitive receiving environments in the Region

Agrichemical sprays are particulates existing in the form of airborne droplets, solids or vapour. Agrichemical sprays are used routinely in both the domestic and primary production sectors, including viticulture, forestry, agriculture and horticulture. The indirect and perceived effects of agrichemical spray drift are issues of concern to the Gisborne Region.

Agrichemical spray drift is the airborne movement of agrichemicals onto a non-target area and has the potential to cause injury or damage to humans, plants, animals, the environment or property. However, there are also issues associated with the application, storage and disposal of agrichemicals that must be addressed under other plans.

The definition of agrichemicals centres on products used to eradicate, modify or control flora and fauna. While fertilisers would come under the definition of 'agrichemical', the agrichemicals of issue to the Gisborne Region are those that have fungicidal, herbicidal, insecticidal or other pesticidal properties, that is they are usually inherently toxic to target organisms. So fertilisers have been excluded from this definition.

The effects of sprayed agrichemicals on human health are not well established outside of acute toxicity effects from direct and inappropriate contact (such as spillage). Concentrated levels of agrichemicals can have significant adverse effects on human health. Organophosphates, for example, interfere with the nerve cells of pests and if taken in sufficient amounts could result in serious (and potentially fatal) effects on the human nervous system.

Agrichemicals also have the potential to cause adverse effects on the natural and physical environment. Contamination of waterways can cause destruction of aquatic ecosystems and could pose risks to drinking or irrigation supplies. Some crops are particularly susceptible to agrichemicals at various stages of growth (e.g. grapes to hormone sprays), while other vegetation is susceptible because of the economic value attached to their freedom from agrichemicals (e.g. organically grown produce). Agrichemicals can also cause damage to benevolent insects such as bees, ladybirds and some mites, however, this is difficult to measure.

The risk of agrichemical spray drift affecting human health and the natural and physical environment in non-target areas depends on a number of factors:

a) Timing, frequency and duration of spraying;

b) Proximity to sensitive areas (e.g. parks, school grounds, residential areas, aquatic ecosystems etc);

c) Weather conditions (wind speed, wind direction, humidity);

d) Method of application (e.g. use by inexperienced applicators can result in "overkill", incorrect storage and disposal etc); and

e) The chemical used, particularly its propensity to volatilise.

Improvements over recent years have resulted in agrichemicals that are generally better suited to their uses requiring less quantity to be applied and using better application technologies.

They are better understood in terms of effects and are being designed and used in an environment where the general public demands a relatively high level of accountability (particularly regarding human and environmental health issues).

Moreover, some of the particularly noxious chemicals have been phased out altogether (e.g. 2,4-D butyl ester or DDT). Use of the New Zealand Standard GROWSAFE and integrated wine production and integrated fruit production management programmes in New Zealand have resulted in better management of agrichemical use and a reduction in the amount of spray used.

Spray drift can occur through droplet drift occurring some time after the application. Vapour drift is caused by volatilisation of the agrichemical. Chemicals that have a high vapour pressure have a higher propensity to volatilise. Volatilisation is unpredictable and may take place after the application has been complete. If wind direction and wind intensity change and air temperature increases after application, the risk of vapour drift increases. The most appropriate way to avoid vapour drift is to use chemicals with low volatile formulations. Further details of drift hazard are included in Appendix Y of NZS8409:2004 Code of Practice for the Management of Agrichemicals.

The ability for the community to be able to protect themselves, their property and the environment from unwanted agrichemicals arose as a significant issue in the development of the Plan. Strong views were also expressed by agrichemical users, contractors and suppliers emphasising that it is the issue of spray drift to non-target areas that is the problem rather than the use of agrichemicals *per se*.

It is difficult to measure the amount of agrichemical used in the Region, not least because the areas planted in crop and species of produce vary from year to year. The diversity of spray types, water application methods, spray frequencies etc. compound the difficulty.

A report on agriculture statistics commissioned for the Gisborne District Council in 1994 noted over 531,500 hectares in grazing, arable, fodder and fallow land and just over 7,500 hectares in horticulture. Spray usage can be broken down as follows:

a) **Agriculture:** The hormonal agrichemical sprays typically used in the hill country for broadleaf and other weed control in farming would usually be applied by helicopter biennially;

b) **Forestry:** Spray is largely used in the land preparation stage. Further spot weed control spraying occurs in the first year of planting as required and applications to combat pine blight occur between years 5-15. Other forestry applications may occur in response to biosecurity crises such as tussock moth release;

c) **Horticulture:** Sprays applied to horticulture and commercial vegetable production are largely associated with the prime soils of the Poverty Bay Flats (an area of approximately 16,000 hectares) along with another 3000 hectares further inland along the Waipaoa River and pockets in the Tolaga Bay area. These crops vary in the amount, frequency and duration of spraying undertaken, ranging from bi-annual passes for maize and sweetcorn through to approximately 4 passes per year for squash, broccoli, kiwifruit and citrus, up to 10 passes for tomato crops and 12-15 passes seasonally for grapes and apples; and

d) **Public and Roading:** Municipal spraying occurs on overgrown road verges and drains, reserves and where noxious plant infestations occur. The extent of agrichemical use in residential situations, glasshouses, nursery work and municipal situations throughout the Region is unknown.

When managing the use of agrichemical spraying, it is necessary to allow for the continued use of agrichemicals, as they are essential for the functioning of many activities (particularly rural activities), while ensuring human health and ecosystems are protected.

There are a variety of mechanisms with which to achieve this objective including regulation, education and the provision of information both to the public and to the user.

Advocacy of alternatives to agrichemical spraying, liaison with industry and implementation of GROWSAFE under the NZS8409:2004 Code of Practice for the management of agrichemicals provide other invaluable methods for achieving the objectives of the Plan.

Objective 3.2.2

Policies 4.4.5, 4.4.9, 4.5.6, 4.5.7

2.6 Discharge of Contaminants from Transport Sources

2.6.1 Engine emissions can result in adverse effects on human health flora and fauna health and ecosystem integrity and are a major contributor to global warming

New Zealand has a relatively low population density so New Zealanders tend to travel a lot by private vehicle. Vehicles are the largest source of air pollution in metropolitan areas and transport contributes 40 percent of New Zealand's carbon dioxide emissions. Exhaust gases are the primary source of air pollutants from motor vehicles. Emissions from petrol fuelled engines include carbon dioxide, carbon monoxide (particularly from badly tuned vehicles or vehicles operating at low speeds), aromatic hydrocarbons (including toluene and benzene), particulate material, water vapour, nitrogen oxides, dioxins, 1.3 butadiene and sulphur dioxide. Investigation of emission rates for several major transport pollutants has revealed that all increase with interruption to traffic flow so the management of traffic to avoid congested conditions appears to be a crucial component of the emissions issue in New Zealand.

Emissions from diesel fuelled vehicles consist largely of particulate matter, unburnt and oxygenated hydrocarbons (including carcinogens) and inorganic compounds such as sulphur and nitrogen oxides. Trains, aircraft and ships are also sources of air pollution. Motor vehicles, rail, aviation and marine transport are estimated as contributing 8% of the total suspended particulate emissions in the Region, assumed to comprise inhalable particulate.

A key aspect of transport emission issues is the difficulty in effectively addressing vehicle emissions on a regional basis, given the mobility of people in the Region and in the rest of the country. New Zealand's vehicle fleet is gradually becoming 'cleaner' through the gradual decrease in the older vehicle fleet and their replacement with imported vehicles that comply with the emission standards of the originating country. Nationally applied solutions such as phasing the lead out of petrol have also proven effective. National policy initiatives are being developed to address issues such as vehicle emissions control, climate change and national road management.

The Gisborne Region is a relatively large, sparsely populated and isolated Region. Transport options are limited. Most travel and transport within and out of the Region is by motor vehicle. The number of motor vehicles in the Region reflects a high rate of vehicle ownership with 23,928 licensed motor vehicles (October 1998) for a population of 45,780 (1996 Census figures). The proportion of heavy vehicles is also relatively high at between 13% and 19%. As the forestry industry in the Region develops, heavy vehicle numbers are likely to increase. The Region is experiencing growth in traffic volumes and this is expected to continue for the next 10 years due to increasing mobility and increasing primary production.

Gisborne Region residents' opinions on local issues were surveyed in 1994. 69% of residents surveyed expressed concern with motor vehicle emissions, with just under 40% being very concerned about the issue.

The low population density and rural character of the Region has meant that the overall increased per capita use of cars and the consequential increase in emissions is likely to have little significance at a national level. However the build-up of emissions (e.g. particulate from diesel engines) within the central business district and alongside heavy traffic routes has possibly reached the point where it presents a concern at peak times or where wind speeds are low and traffic density is high.

Total transport emissions of carbon monoxide (CO) in the Gisborne Region were measured at just under 2700 tonnes per annum. Monitoring of CO was carried out in 1993/1994 in Gisborne's central business district. Results revealed that CO levels are not a critical problem in the city at present, although levels exceeded the AAQG levels at one kerbside (peak) site.

Motor vehicles are the primary source of nitrogen oxide, however monitoring data from other areas of New Zealand indicate nitrogen dioxide levels are unlikely to exceed the Ambient Air Quality Guideline. Total emissions from transport in the Region are calculated at approximately 1250 tonnes per annum.

Road pavement burning is another transport-related activity of particular concern. It is carried out on roads as an option for restoring skid resistance qualities and enhancing traffic safety. It results in voluminous, dark smoke and low but potent emissions of carbon monoxide, sulphuric acid and polycyclic aromatic hydrocarbons (carcinogens) in addition to typical products of combustion.

Asphalt manufacture is a mobile industrial process involving significant emissions of smoke, however very few mobile plants operate in the Region as priorities for new sealed roads are relatively low. Pavement burning and re-chipping is carried out extensively on the state highways of the Region as a cost-effective means of repairing worn seal. The rural nature of most of the surrounding land means that there is the potential for significant adverse impact on nearby stock, water supplies and aquatic habitat from toxic, carcinogenic or acidic compounds. The activity also results in localised smoke and odour effects to nearby people, residences and public places.

Dust from the use of both public and private unsealed roads is another transport-related issue of concern in the Gisborne Region. Of the 1822km of Council managed local roads, approximately 1200km are unsealed. The forestry industry is a major user of unsealed roads for log haulage. As the forestry industry develops further in the Region, the usage of heavy vehicles on unsealed roads is likely to increase.

Given the Region's topography and low population, management of emissions from transport might favour low key options that focus on maintaining ambient air quality and improving it at localised problem areas. Vehicle emissions are not regulated under this Plan.

National initiatives and legislation are currently at the level at which management is most appropriate. However, there is scope for regional input at present of a non-regulatory, minor nature.

Objective 3.2.2

Policies 4.3.1, 4.3.2, 4.5.4, 4.5.5, 4.5.8

2.7 Discharge of Contaminants from Domestic Sources

2.7.1 Discharges to air from domestic sources, including home heating appliances, open fires and backyard burning, can adversely affect human health and reduce amenity of adjoining properties and present a health risk

There are two primary sources of contaminants discharged to air from private domestic sources – the use of domestic heating appliances that consume fuel at the point of heat generation (open fires, chip heaters, natural gas heaters) and the use of backyard incinerators or fires to dispose of domestic wastes.

Electricity, oil and natural gas are common means of home heating in the Region. Up to about 55% of households use solid fuel appliances in combination with the above means and nearly all solid fuel appliances in the Region use wood. Approximately 25% of households use only wood as a fuel for heating. Very little coal is burnt - probably less than 50 households. The Emissions Inventory for the Gisborne Region estimates that just under 130 tonnes of total suspended particulate is emitted from domestic fuel consumption per year.

Emissions from solid fuel burners can cause local nuisance conditions and human health effects, especially in people sensitive to respiratory irritants. The main constituents of wood-burner emissions are a variety of polycyclic organic compounds, carbon monoxide and particulate.

As about 80% of the particulate in smoke is very small, it can remain suspended for weeks and may drift many kilometres from the source. Smoke emissions increase when wood-burners are not operated properly, the main causes being: using wood with a high moisture content (> 25%); overloading the burner and causing oxygen starvation; burning other materials - household rubbish etc; and banking overnight to the extent that the fire smoulders.

The effect of smoke from wood-burners on neighbouring properties is often exacerbated by inadequate chimney height in relation to roof height or adjoining roof height. Inadequate chimney insulation can also result in similar nuisance effects.

Open "backyard" burning and the use of domestic incinerators for burning household rubbish and green vegetation are responsible for a significant proportion of complaints regarding air pollution. The incineration device used may aggravate the issue by not allowing air into the centre of the fire, making it produce copious amounts of smoke and particulate matter such as fly ash.

Deposited particulates borne in smoke can be a major nuisance, and the likelihood of this is increased by open burning, the inefficient use of incinerators and burning when combustion is at low temperatures and/or lacking sufficient oxygen for complete combustion of the fuel.

Backyard incinerators are prolific throughout the Region.

The Regional Emissions Inventory calculates an annual emission of 11 tonnes of total suspended particulate from domestic waste combustion (being 8% of the combined TSP emissions from domestic heating and waste burning). A 1994 survey on air quality issues showed 50% of residents to be concerned with smoke and odour from backyard fires with 20% being very concerned.

Discharges to air from domestic waste burning and home heating appliances are not usually significant on an individual basis but may give rise to adverse effects on adjoining properties if not carried out in a proper manner. The cumulative effects of many domestic sources may give rise to more widespread effects. However, because of the Gisborne Region's location on the coast, and its topography and climate, these effects are infrequent and relatively minor on a region wide basis.

Providing information on available technology, efficient burning practices, the effects of burning inappropriate materials and alternative methods of energy or heat production will be suitable management options in many cases. For example, the average heat output of wood-burners under low burn conditions is 4.6 kW. Encouraging the correct matching of the burner's heat output to the size of the area to be heated would be constructive in increasing the efficiency of wood-burners.

Advocacy for 'cleaner' forms of heating or more efficient insulation may also be appropriate. Liaison and information sharing with industry on best practices, new technology and alternative processes should contribute positively to air quality management.

Management of the adverse effects associated with burning waste tends to emphasise regulation, as section 15 of the RMA restricts discharges of contaminants from burning waste unless by consent or as otherwise allowed by a regional plan (e.g. permitted activities subject to environmental standards).

Avoiding the adverse effects of backyard waste burning other than by prohibiting the activity is difficult and the scale of the issue may not warrant such intervention. However plan rules can also work to restrict the type of waste that may be burned, the burning conditions, the location or timing of burning etc. In addition Fire Permits are required in rural areas during restricted fire seasons and all year round for open burning in city and residential areas. Alternatives exist to burning waste. Integrated planning for waste management could take into account appropriate goals for minimising the amount of waste that is burned. Advocacy and education also have a role to play in minimising waste and diverting it away from the incinerator. Examples include liaison with organisations about alternatives (such as waste minimisation and recycling at schools), industry codes of practice, publicity regarding the effects of burning waste, recycling options and their benefits and municipal refuse collection services.

Objective 3.2.2

Policy 4.3.1, 4.4.3, 4.4.4, 4.4.9, 4.5.3, 4.5.8

2.8 Industrial or Trade Sources

2.8.1 Discharges of contaminants to air from industrial or trade premises can reduce amenity and adversely affect human health and flora and fauna

Section 15 of the Resource Management Act recognises that industrial or trade premises have the potential to cause significant adverse effects on the environment. Emissions from these sources are not permitted unless expressly allowed by a rule in a regional plan, resource consent or regulations.

Industry is important in the Region as it enables people and communities to provide for their economic wellbeing by adding value to the primary produce of the Region through further processing, together with other manufacturing and service industries.

Established industrial activities operate in the Region. This activity is mainly focused in and around the Gisborne urban area. The Gisborne urban area contains mainly smaller industries although some larger processing industries have historically been located around the port and railway area. More recently, a rural industrial area for larger operations has been established in the Willows and McDonalds Road area of Matawhero.

It is expected there will be further industrial growth, particularly in relation to the forestry industry, meaning greater emissions to air from these sources.

The definition of industrial and trade premises provided in the Act also includes activities that are not 'traditional' industrial or trade activities, such as premises used for storage, transfer, treatment or disposal of wastes, including incineration devices in schools and hospitals etc.

Some of the predominant sources in the Gisborne Region include:

a) Animal and plant matter processing: e.g. meatworks, wool scourers, milk processing, wine making, fishmeal production and smoke houses. Emissions from these can include particulate matter, odorous gases such as ammonia, ethalymines and hydrogen sulphide;

b) Combustion/incineration sources: e.g. small boilers, incinerators and furnaces. Emissions from these sources can include carbon dioxide, sulphur oxides, nitrogen oxides, carbon monoxide, hydrocarbons, particulate matter, visible smoke and hazardous air contaminants;

c) Timber processes: e.g. preparation of plywood and fibreboard. Emissions can include odorous and potentially hazardous aldehyde gases, wood dust and hazardous air contaminants;

d) Asbestos removal;

e) Abrasive Blasting: Emissions can include sand with a high free silica and toxic materials such as lead, copper, mercury, zinc, arsenic, cadmium or tributyltin; and

f) Air conditioning, refrigeration and dry-cleaning: These can result in emissions of ozone depleting substances.

The effects of discharges from industrial or trade premises can vary according to the nature of the process, emission controls, locality, local topography and climatic conditions. These activities can result in a number of adverse effects on the environment, including:

a) Reduction of amenity from odorous gases, discharge of visible smoke and nuisance from dust;

b) Health effects on humans. Such effects may include respiratory problems from particulate matter and risk to life from some hazardous pollutants causing cancers and other illnesses;

c) Damage to waterways from dust deposition and contaminants from hazardous pollutants in overspray; and

d) Effects on plant and animal health and functioning from particulate and hazardous pollutants.

As discharges from industrial activities arise from an easily identifiable source, and are readily regulated, options for management are generally wide. They may include:

a) Control technologies such as liquid scrubbing, biofliters, venting odorous gases, good housekeeping;

b) Maintenance procedures such as keeping the site clean of particulate matter, enclosing processes; and

c) Restricting types of materials used or burnt; landuse measures such as buffer zones for the protection of sensitive areas and many others. Non-regulatory management methods such as liaison and advocacy are also relevant.

Objective 3.2.2

Policies 4.4.1 - 4.4.11, 4.5.1, 4.5.2, 4.5.8

2.9 Global Issues

2.9.1 Discharges of certain contaminants to air in the Gisborne Region have the potential to contribute to the greenhouse effect and ozone depletion

Air movement is not constrained by physical boundaries. The discharge of contaminants into air in the Gisborne Region can have effects on global air quality. Similarly global air quality can have regional effects. Depletion of the ozone layer and the greenhouse effect are significant issues for air quality management in the region.

THE GREENHOUSE EFFECT

The greenhouse effect refers to the trapping of heat in the lower atmosphere caused by greenhouse gases such as carbon dioxide (CO_2), methane (CH_4) and water vapour. These gases insulate the earth and maintain global temperatures at constant levels.

Greenhouse gases let energy from the sun travel down to the ground relatively freely, but trap some of the heat radiation emitted by the Earth.

Though the greenhouse effect occurs naturally, when it is enhanced by human activities it causes concern. Increased concentrations of greenhouse gases over the last 130 years and future increases have the potential to cause problems including:

a) Increase in the frequency and severity of storms, floods and droughts;

b) More frequent invasions by tropical pests, weeds and diseases;

c) Land encroachment and coastal erosion from rising seas;

d) Disappearance of some types of ecosystems, agricultural crops and fisheries;

e) Rising temperatures; and

f) Changing weather patterns.

New Zealand produces between 0.15 - 0.3% of the world's human induced greenhouse gases, despite only having 0.07% of the world's population (2-4 times the world average). Despite the small impact the Gisborne Region has on a global scale with regards to emissions, the contribution to the greenhouse effect by New Zealand is a national and global issue of significance to each region of New Zealand.

The Gisborne Region contributes to the emission of greenhouse gases from industry, agriculture, households and transport in the following ways:

a) Motor vehicles emit CO2, N2O and hydrocarbons;

b) Burning fossil fuels emits CO2, N2O and energy production;

c) Domestic fuel fired heating appliances that burn fossil fuels;

d) Livestock, landfills, seepage and agricultural waste water treatment facilities emit methane;

e) Certain industrial practices in addition to fossil fuel burning;

f) Removal of vegetation for agriculture, forestry harvesting and other land development, where the material is left to rot once removed, releases stored carbon as CO2 and methane; and

g) Biomass burning and some industrial processes increase nitrous oxide concentrations.

The considerable vegetation cover (36.3%, including exotic and indigenous vegetation) in the Region constitutes a significant carbon sink, providing Gisborne with a carbon surplus. Gisborne's small, dispersed population means that the level of emissions from industry, vehicle usage and other combustion sources is not high. However, this does not mean there is no issue for the Region. Gisborne's high energy usage per person and industrial processes require improvement to complement efforts made in the rest of New Zealand.

Because of Gisborne's location on the coast and relatively flat topography near populated areas, both global and regional contributions to the greenhouse effect could result in serious consequences to both urban and rural areas of the Region.

Potential sea level rise and other implications of increasing temperatures may require greater irrigation of agricultural and horticultural produce, which is vital to this region, meaning higher costs and possible crop losses.

OZONE DEPLETION

One of the many gases in the atmosphere is ozone (O_3). Ozone is a molecule containing three oxygen atoms instead of the usual two. It is most concentrated in a band in the lower stratosphere.

This band, about 25km above the earth, is called the ozone layer. Ozone performs the very important function of screening out most of the sun's dangerous ultraviolet (UV) rays particularly UV-B rays.

New Zealand receives 10-15% more ultraviolet light than similar latitudes in the Northern Hemisphere. This is partly due to the elliptical orbit of the earth and partly due to this country's less polluted atmosphere. Although UV-B radiation has some beneficial effects, including the production of Vitamin D in humans, the harmful effects on both humans and the environment can be serious, and include:

a) Increased human and animal health problems e.g. skin cancer, eye cataracts, suppression of immune system;

b) Reduced growth, function and quality in plants and aquatic organisms;

c) Possible climatic implications;

d) Possible destruction of vital links in some important food chains; and

e) Degradation of materials such as plastics, textiles and dyes.

Ozone concentrations in the upper atmosphere have been significantly depleted over the past 20 years by manufactured gases that contain chlorine (such as CFCs). Above the Antarctic, a 'hole' in the ozone layer has occurred every spring since the 1980s.

The Gisborne Region contributes to the depletion of the ozone layer through the following sources:

a) Use of refrigerants and air conditioning emitting CFCs; and

b) Agricultural pre and post harvest fumigant and soil sterilant emitting methyl bromide.

There are currently a number of national and international obligations and legislation that aim to reduce the global issues of ozone depletion and global warming.

New Zealand is signatory to international conventions that aim to eliminate the use and emissions of ozone depleting substances, principally chlorofluorocarbons (CFCs) but also other substances such as halons used for fire extinguishing and carbon tetrachloride used for dry cleaning. The Ozone Layer Protection Act 1990 is a means of implementing these conventions at a national level by providing for the phasing out of imports into New Zealand of ozone depleting substances.

In ratifying the UN Framework Convention on Climate Change, New Zealand accepted a commitment to enhance greenhouse gas sinks, as well as reduce greenhouse gas emissions, and to promote other greenhouse gas emissions.

The primary responsibility for managing the issue of ozone depletion and the greenhouse effect in New Zealand rests with national government at present. However, regional initiatives should be implemented in the Gisborne Region where appropriate, including land use decisions relating to transport infrastructure. The general control of discharges of contaminants to air also assists in reducing the emission of greenhouse gases and ozone depleting substances.

Objective 3.2.2

Policy 4.5.8