OPEN COUNTRY DAIRY LIMITED

WAHAROA MILK PROCESSING PLANT

Resource Management Act 1991

Assessment of Effects on the Environment

Application for a Consent to Discharge Contaminants to Air

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Contents

Tables & Figures

1 Executive Summary

This Assessment of Environment Effects (AEE) is prepared to support the consent application for the expansion of the Open Country Dairy Limited Waharoa milk processing facility. The expansion will include an additional coal fired boiler, a possible 10 tonne per hour milk drying plant plus expansion of the dairy products facility. Bag filtration systems will be install to minimise the emissions of fine particulate. The design processing capacity of the upgraded facility is expected to be 5,000 cubic metres of milk per day.

Open Country Dairy Company Limited (OCD) commenced operations in Waharoa as Open Country Cheese Limited at Factory Road in October 2004. In 2005/06 Open Country constructed and now operates an integrated whey processing factory alongside the cheese factory to convert the whey by-product from the company's cheese factory into marketable powder. The whey powder plant has a capacity of 3 tonnes per hour.

Currently OCD operate 2 boilers, a whey dryer and WMP dryer, these are covered under Waikato Regional Council (WRC) consents 111948 and 117296 expiring 30 August 2023. A copy of these consents is included in the Appendices to this Assessment of Environmental Effects (AEE).

OCD has indicated its intention to expand the dairy products and milk powder processing plant on the same site immediately adjacent to the existing cheese and whey plants. The whole site is on industrial zoned land to the west of the railway line and State Highway at the northern end of the township. The land has for many years been zoned industrial. The proposal fits well within this zoning and present plant.

Energy for the additional powder plant will be provided by the combustion of coal in an additional boiler, the present boiler capacity it totally utilised with the present cheese, whey and WMP plants. The additional boiler capacity will be about 25 megawatts or 109 gigajoules output. At maximum load the additional boiler will burn up to 4 tonnes per hour of Huntley Coal, giving a maximum on-site use of about 8.5 tonnes per hour. The proposed powder plant will be similar in design and emissions to the existing milk plant.

Discharges to air from the processes on site include:

- Discharge to air from the combustion of coal — boiler stack (2)
- Discharge to air from the processing of dairy products (3)

The operation of the dairy plant and associated boiler plant is a discretionary activity under the Waikato Regional Council Air Quality Plan.

The plant will be design to meet the criteria of Section 5 of Resource Management Act 1991 and operated to ensure the "best practicable option" is met.

The effects of the discharges to air have been assessed in association with the proposed operating and control measures. The actual and potential effects of the completed plant will be minor or less under all normal operating conditions.

1. Combustion products from the boiler plants will be discharged from stacks of minimum height 45 metres.
2. Ventilation air from the dairy plant processes will be fully contained and passed through a filtration system before discharge.

3. The plant will not generate offensive or objectionable odours outside of the site boundary

Table 1: Steam demand and boiler capacity

Steam Demand							
Description	Current		Additional		Combined		
	Average (T/h)	Peak (T/h)	Average (T/h)	Peak (T/h)	Average (T/h)	Peak (T/h)	Peak MW
Cheese			5	7	5	7	5
Cheese/Liquids/AMF	5	7			5	7	5
Dryer 1/Tanker CIP/RO CIP	5	7			5	7	5
Tanker CIP			0.5	2	0.5	2	1
Lactose			5	7	5	7	5
Dryer 2	14	16			14	16	11
Dryer 3			15	18	15	18	12
TOTALS	24	30	25.5	34	49.5	64	43
Total MJ	58	72	61	82	119	154	
Total MW	16	20	17	23	33	43	
Steam Supply							
Description	Current		Additional		Combined		
	MCR Observed (T/h)	MCR Name Plate (T/h)	MCR Observed (T/h)	MCR Name Plate (T/h)	Average (T/h)	Peak (T/h) MCR	Peak MW
Boiler 1	13	15			13	15	10
Boiler 2	19	21.2			19	21	14
Boiler 3			30	35	30	35	23
TOTALS	32	36.2	30	35	62	71	47
Total MJ	77	87	72	84	149	171	
Total MW	21	24	20	23	41	47	
Site input GJ					198	228	63

1. T/h — Tonnes per hour

Table 1 is based on a survey of the energy demands of the present and proposed manufacturing facilities. The installed capacity must always exceed the maximum demand. Effects have been determined based all plant operating at the indicated peak demand, this is a highly conservative approach and one unlikely to occur in practice, however, it indicates a potential but remote maximum effect. The maximum effect could only occur during peak milk input — this is limited to the period September to February.

The effects of the cheese and whey plants have been assessed in combination with the milk drying plant and boiler(s).

The whey dryer and WMP dryers are fitted with a modern highly effective bagfilter unit – the new milk dryer will be fitted with similar bagfilter technology. The discharges from both operations will be controlled to a point where effects can be classed as “de Minimis”. The bagfilters are continuously monitored to ensure high efficiency continued operation. Any failure is quickly identified by sensitive detecting equipment - warnings are automatically issued to the control desk and operator, this allows quick correcting action to be taken.

The exhausts from the existing 11 MW and 14 MW boilers are discharged through a common 45-metre-high chimney. A new chimney 45 metres in height will service the additional boiler.

The discharge of sulphur dioxide and particulate as PM-10 through the two 45 metre chimneys has been modelled to determine ground level concentrations. In addition, levels of nitrogen oxides and carbon monoxide have been assessed. Modelling was carried out with receptors in the general airshed surrounding the plant and at the point where maximum concentration of PM-10 and sulphur dioxide occur in the village.

Levels from the dispersion modelling indicate that the plant will meet the New Zealand National Environmental Standards and the Environment Waikato guidelines for all contaminants.

Open Country submits that given the relatively minor effects of the proposal it is appropriate for this application to be processed on a non-notified basis. Open Country offers two points for consideration in support of this particular submission.

- Both in absolute terms and relative to the thresholds set in the Waikato Regional Plan, the effects of the additional operations on the environment are minor. The general context of the development is industrial.
- The site is remote from sensitive sources, 500 metres from main housing area of the village.

As part of the original land use consent application to Matamata-Piako District Council, Mansergh Graham (landscape architects) prepared a report. The Mansergh Graham Report concluded that the introduction of the proposed powder plant represents only a minor cumulative increase in built form of the existing factory site, due to the context provided by the existing large scale industrial factory buildings onsite, and surrounding warehouse type buildings within the immediate vicinity.

In addition, it considered that the powder plants will not result in any significant loss of amenity values, or result in a change to surrounding landscape values or the existing industrial character. The powder plants will not affect the key landscape attributes of the surrounding landscape.

This application is for resource consent for an air discharge for a milk products processing facility and an air discharge for the burning of coal in a boiler. Taken as a whole, these activities are consistent with, indeed, an integral part of, a cheese/whey processing factory development. The cheese factory went through a full resource consent process in 2003. The addition of the whey plant was processed on a non-notified basis. The public notification at the time of the original cheese plant elicited little response - only two submissions were received (Waikato Freshwater Anglers Club, Waikato District Health Board). The Waikato Freshwater Anglers Club was not relevant as the proposal included no application to discharge to water - Waikato District Health Board just called for health effects to be considered. Neither party sought to make further submissions).

A further consent was processed in 2015 for the current manufacturing facility.

OCD submits that this application for further development can be processed on a non-notified basis. In preparing the land use consent application to Matamata-Piako District Council, Open Country (in agreement with the Council as to who should be consulted) consulted with the two parties on adjoining boundaries, Fonterra (being the owner of the Waharoa Cool store) and Waharoa Industrial Park Limited. Waharoa Industrial Park Limited provided written advice that not only that it does not object to the proposal, it positively supports the development.

Other neighbours are a considerable distance away. The closest residential properties are in Hawes Street and Casey Streets. These are on the opposite of the railway line, and a minimum of 350 metres from the plant. The dryer towers will be on the western side of the large storage buildings on Factory Road and be visible from the residential properties.

Open Country is of the view that apart from the two immediate neighbours mentioned above it is unaware of any other person with a relevant interest in terms of the Act that could be considered to be potentially adversely affected by the proposed activity.

This Assessment of Effects on the Environment (AEE) itemises discharges of contaminants to the atmosphere and discusses the actual and potential effects on the environment from the discharges.

This Assessment of Effects on the Environment has been prepared in accordance with the requirements of S88 (6), the 4th Schedule to the Resource Management Act (ACT) and the Waikato Regional Plan.

RMA Clause 88

> **88 Making an application**
>
> (1) A person may apply to the relevant consent authority for a resource consent.
>
> (2) An application must—
>
> (a) be made in the prescribed form and manner; and
>
> (b) include, in accordance with Schedule 4, an assessment of environmental effects in such detail as corresponds with the scale and significance of the effects that the activity may have on the environment.

Figure 1: Location of milk processing facility at Waharoa

Open Country Dairy Company Limited applies for resource consent to discharge contaminants to air as described below:

1. Land:

   The land to which the application relates is located at Lot 1 DP 333824 and DP 415727;

   2. The location of the proposed activity:

   Factory Road Waharoa 3441 and is within the Waharoa industrial zone.

   The site is located at or about NZTM 50 reference BD35 426 373.

   3. The activity to which this application relates is as follows:

   Processing of milk into milk products and associated plant including boilers;

   4. Resource consent sought:

   Discharge to Air Consent – To authorise the discharge of contaminants to air from milk powder dryers (3) and associated coal fired boilers (3);

   5. Consent duration:

   A duration of 35 years is sought for the resource consent.

   6. Plant

   The plant includes:

   2 x nominal ten tonne per hour milk powder dryers;

   1 x three tonne per hour whey dryer

   1 x eleven megawatt output coal fired boiler;

   1 x fourteen megawatt output coal fired boiler;

   1 x twenty five megawatt output coal fired boiler;

   The combined boilers will use up to a maximum of 8.5 tonnes of coal per hour.

   The plant will be able to process up to 5,000 cubic metres of milk.

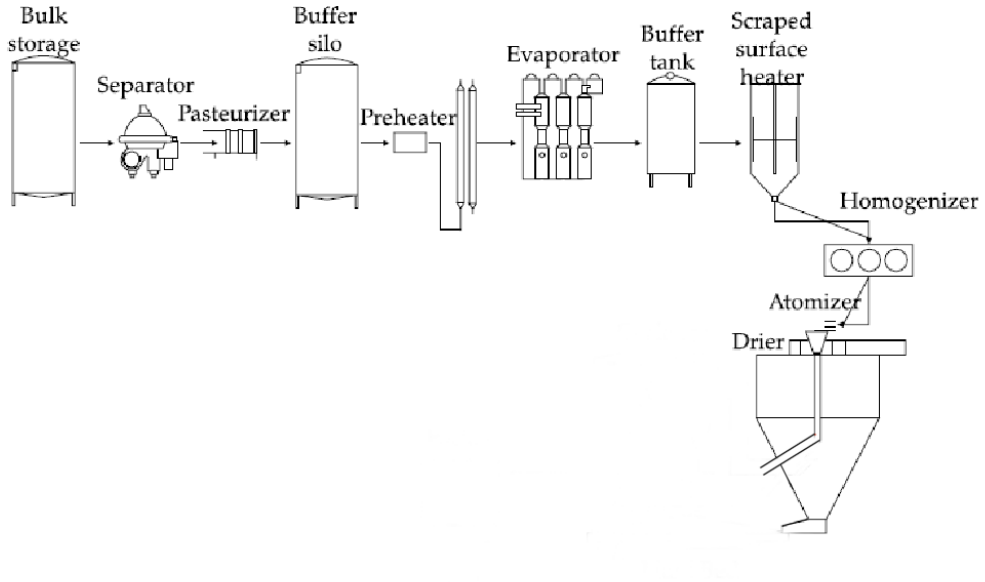
The discharge to air is a discretionary activity.

2 Introduction

Milk Powder

Milk powder manufacture is a simple process now carried out on a large scale. It involves the gentle removal of water at the lowest possible cost under stringent hygiene conditions while retaining all the desirable natural properties of the milk - colour, flavour, solubility, nutritional value. Whole (full cream) milk contains, typically, about 87% water and skim milk contains about 91% water.

During milk powder manufacture this water is removed by boiling the milk under reduced pressure at low temperature in a process known as evaporation. The resulting concentrated milk is then sprayed in a fine mist into hot air to remove further moisture and so give a powder. Approximately 13 kilograms of whole milk powder (WMP) or 9 kilograms of skim milk powder (SMP) can be made from 100 litres of whole milk. The milk powder manufacturing process is shown in the following schematic.



Water vapour and air is discharged from the dryer after passing through a bag filter unit to remove fine particulate from the discharge.

Separation / Standardization

The conventional process for the production of milk powders starts with taking the raw milk received at the dairy factory and pasteurising and separating it into skim milk and cream using a centrifugal cream separator. If WMP is to be manufactured, a portion of the cream is added back to the skim milk to produce a milk with a standardised fat content (typically 26- 30% fat in the powder).

Preheating

The next step in the process is "preheating" during which the standardised milk is heated to temperatures between 75 and 120°C and held for a specified time from a few seconds up to several minutes (*cf.* pasteurisation: 72°C for 15 seconds). Preheating causes a controlled denaturation of the whey proteins in the milk and it destroys bacteria, inactivates enzymes, generates natural antioxidants and imparts heat stability. The exact heating/holding regime depends on the type of product and its intended end-use.

Evaporation

In the evaporator the preheated milk is concentrated in stages or "effects" from around 9.0% total solids content for skim milk and 13% for whole milk, up to 45-52% total solids. This is achieved by boiling the milk under a vacuum at temperatures below 72°C in a falling film on the inside of vertical tubes, and removing the water as vapour.

This vapour, which may be mechanically or thermally compressed, is then used to heat the milk in the next effect of the evaporator which may be operated at a lower pressure and temperature than the preceding effect.

Modern plants may have up to seven effects for maximum energy efficiency. More than 85% of the water in the milk may be removed in the evaporator. Evaporators are extremely noisy because of the large quantity of water vapour travelling at very high speeds inside the tubes.

Spray Drying

Spray drying involves atomising the milk concentrate from the evaporator into fine droplets. This is done inside a large drying chamber in a flow of hot air (up to 200°C) using either a spinning disk atomiser or a series of high pressure nozzles. The milk droplets are cooled by evaporation and they never reach the temperature of the air. The concentrate may be heated prior to atomisation to reduce its viscosity and to increase the energy available for drying.

Much of the remaining water is evaporated in the drying chamber, leaving a fine powder of around 6% moisture content with a mean particle size typically of < 0.1 mm diameter. Final or "secondary" drying takes place in a fluid bed, or in a series of such beds, in which hot air is blown through a layer of fluidised powder removing water to give product with a moisture content of 2-4%. Precautions must be taken to prevent fires and to vent dust explosions should they occur in the drying chamber or elsewhere. Such explosions can be extremely dangerous to life, property and markets.

Energy and Environmental Considerations

Large amounts of energy are expended in the process of removing water and so plants developed over the years have become increasingly more energy efficient. Evaporators are much more energy efficient than dryers, using only a fraction of a kilogram of steam (or the energy equivalent) per kilogram of water removed. Dryers on the other hand use several kilograms of steam (or steam equivalent) per kilogram of water evaporated.

Spray drying provides a means of rapidly and gently removing the bulk of the remaining water but, ideally, spray dryers have short residence times. Hence fluid beds may be used for the final stages of drying. The powder remains for several minutes in fluid beds allowing time for the last of the water to be removed. Milk powder manufacturing plants tend to be very large, few in number and located in rural areas. If modern and well managed, they have only relatively small effects on the environment. They are moderately energy intensive, burning coal and consuming substantial electricity.

There are strong economic pressures to reduce energy consumption but there is little scope for further major improvement. Milk storage silos, cream separators and the evaporators and associated plant must be cleaned daily, and dryers less often. Sodium hydroxide and nitric acid are used as cleaning agents. The spent cleaning fluids must be disposed of by suitable means. There can be emission of milk powder dust into the local environment during plant malfunctions but this is rare. Noise is a problem mainly within the plant buildings but fans can affect close neighbours.

The energy input for a 1,000 cubic metre per day milk input plant is about 60 Gigajoules per hour.

Original Article Written by Dr K. N. Pearce (Food Science Section, New Zealand Dairy Research Institute).

3 Waharoa Milk Processing Plant

The Waharoa milk processing plant is of similar design to that built by OCD at Wanganui. Additional operations on this site include dairy manufacture and a whey dryer

The milk processing or drying plant operate up to 22-hours per day. The operation of the plant is dependent on the availability of milk; the plant will operate on minimum throughput during the May to August period.

Milk processing plants operate on an OFF or ON basis, there is no low load option. In a 24-hour period 2 hours are reserved for cleaning (CIP), there is no discharge during this period. In peak season it is normal practice to run all plants, as milk availability decreases operating hours are reduced until a point is reached when one plant will not operate.

To maintain a conservative approach to the assessment of environmental effects it has been assumed that the plants may operate on a 24/7/365 basis at the rated capacity. This is an extremely conservative approach and will over predict any effects, however all eventualities will be covered. Table 2 illustrates the average variation in milk availability throughout the year. Availability varies with location and individual farm.

Table 2: Monthly milk availability as a percentage of yearly throughput.

Month	% of annual total
August	6
September	12
October	15
November	15
December	12
January	12
February	8
March	8
April	6
May	4
June	1
July	1
Year	100

4 Legislative Framework

4.1 Resource Management Act 1991

The premises as occupied by the OCD Processing Plant will be an "industrial and trade" premise as defined in the Act. Section 15(1)(c) prohibits the discharge of any contaminant from such premises into air unless the discharge is allowed by a rule of a regional plan or relevant proposed plan, resource consent, or by regulations.

National Air Quality Standards and the rules in the Waikato Regional Council Plan govern the requirements for the operation. The Matamata-Piako Council plan governs the land use and any implied restrictions within that plan.

The application conforms to the requirements of the 4th schedule and Section 88 of The Act; the assessment of environmental effects is in such detail as corresponds with the scale and significance of the effects that the activity may have on the environment.

4.2 Purpose of the RMA

Section 5

1. The purpose of this Act is to promote the sustainable management of natural and physical resources.
2. In the Act, “sustainable management” means managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural wellbeing and for their health and safety

while –

Sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and

Safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and

Avoiding, remedying, or mitigating any adverse effects of activities on the environment.

The primary facet of the Act is “sustainable management” of natural and physical resources, Sections 6 – 8 of Part 2 of the Act are conditional on Section 5.

The proposal recognises those matters required by Section 5 by the control of effects and implementation of “the best practicable option”.

Section 6. Matters of national importance

In achieving the purpose of this Act, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall recognise and provide for matters of national importance.

The proposal recognises matters that are included in Section 6, however it is considered that there are no outstanding matters of national importance associated with the proposal.

Section 7 Other matters

All persons exercising functions and powers the Act, in relation to managing the use, development, and protection of natural and physical resources, shall have particular regard to those matters set out in Section 7.

The relevance of each of the matters in Section 7 has been reviewed and it is considered that following may have a bearing on the proposal —

(b) The efficient use and development of natural and physical resources — the conversion of milk to milk products to provide food to people throughout New Zealand and the world;

(ba) The efficiency of the end use of energy — energy is provided from local coal and utilized in high efficiency combustion systems to provide energy;

(c) The maintenance and enhancement of amenity values — effect on amenity values in the area is considered to be neutral;

(f) Maintenance and enhancement of the quality of the environment — the assessment of effects of the activity on the environment indicates that whilst effects will be present, the nature and extent of such effects is minor or less;

(g) The effects of climate change — the dairy industry as whole, cows through to milk products produces by-products designated as “greenhouse gases”. An effect attributable to a single processing plant cannot be extracted from that of the industry. To control effects from this industry will require legislation and policies outside of the terms of the Resource Management Act 1991.

Section 8 Treaty of Waitangi

The proposal recognises the treaty and it is considered that there no matters arising in achieving the purpose of this Act that may be impacted upon by the activity.

The plant meets the criteria of sections 5 – 8 of the Act.

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

Discharges to air, dispersion modelling and assessment of effects are discussed in Sections 6 and 7 of the report.

4.4 Resource Management (National Environmental Standards for Air Quality) Regulations 2004

The regulations were amended, on 1 June 2011, by regulation 4(2) of the Resource Management (National Environmental Standards for Air Quality) Amendment Regulations 2011.

Ambient air quality standards for contaminants.

(1) The ambient air quality standard for a contaminant specified in the first column of the table in Schedule 1 is that the contaminant must not exceed its threshold concentration in an airshed unless the exceedance is a permissible exceedance.

(2) The ambient air quality standard for a contaminant is breached if the contaminant exceeds its threshold concentration in an airshed and the exceedance is not a permissible exceedance.

(3) In these regulations,—

Exceedance, for a contaminant, means an instance where the contaminant exceeds its threshold concentration in an airshed

Permissible exceedance, for a contaminant, means 1 of the number of exceedances allowed for the contaminant in an airshed as specified in the third column of the table in Schedule 1

threshold concentration, for a contaminant, means the concentration of the contaminant specified in the second column of the table in Schedule 1 calculated as a mean for the time period specified in that column.

The ambient air quality standard for a contaminant applies at any place—

(a) that is in an airshed; and

(b) that is in the open air; and

(c) where people are likely to be exposed to the contaminant.

However, if the discharge of a contaminant is expressly allowed by a resource consent, the ambient air quality standard for the contaminant does not apply to the site on which the resource consent is exercised.

The ambient air quality standard for a contaminant listed in the first column of the table in Schedule 1 of the regulations is that the concentration of the contaminant must not exceed its threshold concentration except to the extent and in the circumstances (if any) listed in the third column of that table.

For the purposes of the regulations, an ambient air quality standard is breached if the concentration of the contaminant concerned exceeds its threshold concentration otherwise than to the extent and in the circumstances (if any) listed in the third column of the table in Schedule 1.

For the purposes of the regulation and Schedule 1, threshold concentration means the concentration of the contaminant listed in the second column of the table in Schedule 1 of the regulations calculated over the time interval specified in that column.

Ambient air quality standards for contaminants in the following Table 3.

1-hour mean---

is a mean value calculated every hour on the hour for the preceding hour; and in relation to a contaminant at a particular location for a particular hour, means the mean of not more than 10-minute means, collected not less than once every 10 seconds, for the contaminant at that location during that hour

24-hour mean---

is a mean calculated every 24 hours at midnight for the preceding 24 hours; and in relation to a contaminant at a particular location for a particular 24-hour period,

(i) the mean level at which the contaminant is recorded in the air, by continuous sampling of the air at that location, throughout that 24-hour period; or

(ii) the mean of the 1-hour means for that contaminant at that location for the preceding 24 hours

Running 8-hour mean---

is a mean calculated every hour on the hour for that hour and the preceding 7 hours to give 1 running 8-hour mean per hour; and in relation to a contaminant at a particular location for a particular hour, means the mean of the 1-hour means for that contaminant at that location for that hour and the preceding 7 hours.

Other Relevant Guidelines

The World Health Organisation published new guidelines for sulphur dioxide in 2005. The significant change being a new 24-hour guideline of 20 µg/m³. This would be approached in two stages, an initial guideline of 50 µg/m³ followed by the reduction to 20 µg/m³. The New Zealand Ministry for the Environment is currently evaluating the implications of this guideline. The operation comp[lies with a guideline of 50 µg/m³.

Application to this consent —

The Waharoa industrial zone is within the general New Zealand Air Shed and is not classified as polluted in the Waikato Regional Council air plan. Providing that the discharges do not result in the National Environmental Standards being exceeded consent can be granted.

Modelling confirms that the standards are not exceeded.

Table 3: National Environmental Standards – Schedule 1

Contaminant	Threshold concentration	Permissible excess
Carbon monoxide	10 milligrams per cubic metre expressed as a running 8-hour mean	One 8-hour period in a 12-month period
Nitrogen dioxide	200 micrograms per cubic metre expressed as a 1-hour mean	9 hours in a 12-month period
Ozone	150 micrograms per cubic metre expressed as a 1-hour mean	Not to be exceeded at any time
PM-10	50 micrograms per cubic metre expressed as a 24-hour mean	One 24-hour period in a 12-month period
Sulphur dioxide	350 micrograms per cubic metre expressed as a 1-hour mean	9 hours in a 12-month period
Sulphur dioxide	570 micrograms per cubic metre expressed as a 1-hour mean	Not to be exceeded at any time
Sulphur dioxide	125 micrograms per cubic metre expressed as a 24-hour mean	One 24-hour period in a 12-month period (Environment Southland criteria)

4.5 Regional Policy and Air Quality Plan for Waikato Regional Council

The Waikato in general has a good level of air quality, however, urban areas show impairment due to particulate from domestic space heating plus elevated levels of carbon monoxide and nitrogen oxides due to traffic.

The objectives of the plan are —

Objective 1:

Significant characteristics of air quality are:

a) protected where they are high

b) enhanced where they are degraded

c) otherwise maintained.

Objective 2:

No significant adverse effects from individual site sources on the characteristics of air quality beyond property boundary.

Objective 3:

Cumulative effects of discharges on ambient air quality do not:

a) present more than a minor threat to the health of humans, flora and fauna

b) cause odour that is objectionable to the extent that it causes an adverse effect

c) result in levels of suspended or deposited particulate matter that are objectionable to the extent that they cause adverse effects

d) have a significant adverse effect on visibility

e) cause accelerated corrosion of structures

f) cause significant adverse effects on the relationship tangata whenua as Kaitiaki have with their identified taonga such as air, ancestral lands, water and waahi tapu.

The policies to achieve these objectives are —

Policy 1: Low Risk Discharges to Air Enabled

Enable the discharge of contaminants into air through permitted and controlled activity rules where:

a) there are no significant adverse effects on human health and the health of flora and fauna from discharges of hazardous air pollutants,

b) there is no odour that is objectionable to the extent that it causes an adverse effect beyond the property boundary,

c) suspended or deposited particulate matter are not objectionable to the extent that they cause adverse effects beyond the property boundary,

d) significant adverse effects on, or changes to, visibility beyond the property boundary are avoided or remedied,

e) air quality beyond the property boundary does not cause accelerated corrosion or accelerated deterioration.

Policy 2: Managing Effects of Other Discharges

Manage other discharges of contaminants to air through controlled and discretionary activity rules having particular regard to the effects of the discharge on:

a) ambient air quality compared to the Regional Ambient Air Quality Guidelines (RAAQG) levels provided in Chapter 6.3,

b) ambient air quality compared to internationally accepted air quality guidelines or standards for managing and understanding the effects of contaminants on human health, the health of flora and fauna and amenity values,

c) ambient odour and particulate matter levels compared to the guidelines for assessment provided in Chapter 6.4 of the Plan for odour and particulate matter

d) adverse effects from contaminants that are hazardous in ambient air, particularly with respect to human health,

e) the significant characteristics of air quality within an area,

f) significant adverse effects of the discharge on the identified values of tangata whenua as Kaitiaki,

g) the sensitivity of the receiving environment,

h) existing ambient air quality and any cumulative effects as a result of the discharge on the receiving environment,

i) nationally accepted codes of practice for the relevant activity.

Policy 3: Air Shed Management

Adopt an air shed management approach that takes into account the relative contributions of all contaminant sources in the area in accordance with the Ministry for the Environment's Ambient Air Quality Guidelines (May 2002). Priority for development of air quality management plans is to be given to areas where air quality is degraded as defined in Table 6-2 or where such a plan is necessary to prevent air quality becoming further degraded.

An assessment based on Section 8.1.5.1 of the Waikato Regional Plan is included in Appendix 1, similarly Section 8.1.5.3 is included in Appendix 2.

Table 6-2 Regional Ambient Air Quality Categories and Designated Response

Category	Measured Value	Response
Degraded	Exceeds the Regional Ambient Air Quality Guideline value in Chapter 6.3.	Enhance
	Between 66% and 100% of the Regional Ambient Air Quality Guideline value in Chapter 6.3.	Maintain or Enhance
Acceptable	Between 33% and 66% of the Regional Ambient Air Quality Guideline value in Chapter 6.3.	Maintain
High	Between 10% and 33% of the Regional Ambient Air Quality Guideline value in Chapter 6.3.	Maintain / Protect
	Less than 10% of the Regional Ambient Air Quality Guideline value in Chapter 6.3.	Protect

Policy 4: Best Practicable Option*

While having regard to the provisions in Policies 1, 2 and 3, and the likely effects of activities on ambient air quality, Waikato Regional Council will promote the best practicable option to prevent or minimise the discharge of contaminants to air where:

a) numerical guidelines or standards establishing a level of protection for a receiving environment are not available or cannot easily be established,

b) the maintenance or enhancement of the existing air quality is desirable or there is uncertainty over existing air quality,

c) the known adverse effects and costs associated with adopting the best practicable option for an operation are small and the costs of investigating the effect on air quality is large in comparison to the potential effects.

Policy 5: Positive Benefits of Resource Use

Recognise the positive benefits to people and communities arising from activities that affect air quality by enabling a range of activities to use the air (including existing activities) whilst ensuring that:

a) high quality air resources are protected,

b) degraded air quality is enhanced,

c) adverse effects on air quality are avoided, remedied or mitigated.

Each of the above policies has been considered in determining the best options for the proposed plant, these include —

- Location in an area set aside for heavy industrial activities;
- Design of the proposed plant;
- Incorporation of the “best practical option” into the design and operation of the plant and the limitation of effects from the discharge of contaminants.

4.6 Rules

The following rules have been considered in this Assessment of Environmental Effects (AEE) —

Rule 6.1.12.1

Permitted Activity Rule – Combustion of Fuel for Heat Release

The discharge of contaminants into air from burning the following fuels for the purpose of generating useful heat, steam, power or electricity:

1. Natural gas and liquefied petroleum gas with a rate of heat release not exceeding 10 megawatts

2. Wood and wood products (with the exception of wood that has been treated), paper and paper products with a rate of heat release not exceeding:

i) five megawatts from activities lawfully established or authorised before the date of notification of this Plan

ii) two megawatts from activities lawfully established or authorised after the date of notification of this Plan

3. Diesel, kerosene, petroleum, coke, coal, charcoal, oil (excluding waste oil) or non-chlorinated alcohols with a rate of heat release not exceeding five megawatts.*

The activity fails the test of Rule 6.1.12.1 and is therefore discretionary.

Permitted Activity Rule – Miscellaneous

Unless restricted by any other rule in this Plan, the discharge of contaminants into air from the following industrial or trade premises or processes:

> *The drying of milk or milk products that singly or together has a raw material capacity not exceeding of 2 tonnes per hour,*

The installed processing capacity of the plant exceeds 2 tonnes per hour, therefore fails the permitted activity test and is therefore discretionary.

Discretionary Activity Rule – General Rule

Except as provided for in any other rule in this Plan, the discharge of contaminants into air from:

> *1. Any process or activity that is on an industrial or trade premises and is not permitted by or does not comply with Rules 6.1.9.1, 6.1.10.1 to 6.1.19.1; or*
>
> *2. A mobile source or premises that are not industrial or trade premises, and does not comply with Rules 6.1.9.1, 6.1.10.1 to 6.1.19.1*

is a discretionary activity (requiring resource consent).

The activity is classified as discretionary under the Waikato Regional Plan.

The discharge of work place ventilation air and steam are permitted activities.

Environmental Results Anticipated

The Waikato plan anticipates the following results —

1. Ambient air quality within regional guideline levels.

2. Early detection of degradation of air quality in specific locations.

3. Reduction in instances of reverse sensitivity effects.

4. Adequate data to support the adoption of an Air Quality Management approach.

5. No discharges of particulate matter that are objectionable to the extent that they cause adverse effects beyond the property boundary.

6. No discharges of odour that are objectionable to the extent that they cause adverse effects beyond the property boundary.

7. Discharges of hazardous contaminants at a level where there is a low risk of causing adverse effects on human health and the health of flora and fauna beyond the boundary of the subject property.

8. Discharges to air that do not significantly change visibility on a local or regional scale.

9. Discharges to air that do not cause accelerated corrosion or corrosive effects on structures beyond the boundary of the subject property.

10. Minimisation of short and long term contamination of soil and water as a result of the discharge of contaminants to air.

11. Air management outcomes that are consistent with the values held by tangata whenua as Kaitiaki.

Each of the above has been considered in relation to the discharges to air from the proposed milk processing facility. No adverse effects are considered to occur that transgress the above.

Duration of Consent

The application is made for a consent period of 35 years. The effects of the plant have been determined as minor or less.

Summary

- The proposed plant will meet national and local standards for ambient air quality;
- The plant will comply with current source emission limits and performance criteria for discharges to air from combustion sources and industrial processes;
- The proposed plant will incorporate the best practicable options for environmental controls;
- The activity will not impact on air quality in areas where it has been degraded, — Waharoa industrial area.
- The operation of the plant will not be detrimental to the life supporting capacity of the global atmosphere.
- The applicant recognises Maori culture and traditions in relation to air by way of incorporation in the plant design control technologies to minimise any adverse effects.

Furthermore, it should be noted that Section 17 of the Resource Management Act imposes a duty on all persons to avoid, remedy or mitigate adverse effects, including those relating to odour, dust and smoke, regardless of any rules in plans or conditions of resource consents.

The OCD operation meets the terms of the Act.

Duration of Consent

The applicant is seeking a discharge permit of 35 years duration. Section 123(a) of the Act provides for issuing discharge permits for a period not exceeding 35 years. Section 128 provides for reviewing of conditions of a resource consent to deal with any adverse effect on the environment that may arise from the exercise of the consent that is appropriate to deal with at a later stage.

Therefore, conditions can be reviewed at any time irrespective of the duration of the consent. The principal advantages for the Company for a discharge permit of at least 30 years are:

- Security in future planning and investment;
- Ability to enter into long term contracts for the supply of materials, and
- Substantial savings in the cost of preparing any application and supporting documentation on a more frequent basis.

General terms of the Environment Waikato Plan

The location and nature of the activity has been reviewed and it is considered that it meets the general terms of the Environment Waikato plans.

5 Site Description

Waharoa is located on State Highway 27 seven kilometres north of Matamata. Factory Road, Waharoa, runs parallel to State Highway 27 (the main street of Waharoa) on the west of the railway line that runs through Waharoa. Factory Road is accessed from State Highway 27 via Hawes Street at the northern end of Waharoa and Link Road at the southern end of the village. The western side of the railway line in Waharoa is occupied with various industrial activities.

Waharoa township (village) has commercial activity on the main street (State Highway 27) consisting of small food service businesses, a small general store (with post office facilities), second hand items shop and a dairy industry cleaning products manufacturing business.

The broader area surrounding Waharoa is predominantly dairy farm, with a significant component of cropping (onions, potatoes, and asparagus). The area has an almost completely flat gradient

The site has two distinct levels; a flat terrace on top with a lower area running to the Waitoa River. These levels are divided by a bank approximately 6 to 8 metres high. The terrace has an almost completely flat gradient.

The Open Country dairy factory is located on the upper terrace. In the original layout of the factory provision was made for locating the whey plant and future expansion on the site.

Waharoa is dissected by the Kinleith Branch railway line and State Highway 27.

- Land to the east is zoned Residential and Business.
- Land between the railway line and the state highway is comprised of:
- Residentially zoned and occupied sites with access from Casey and Hawes Streets (these are the closest residential properties to the Open Country site);
- Unoccupied Business zoned land to the south of Hawes Street; and,
- Land designated for reserve purposes and owned by MPDC.
- Land to the west of the railway line is zoned Industrial and is known as the Waharoa Industrial Park.

Between Factory Road and the railway line are the original dairy factory (currently used for storage), the unused Anchor dairy factory (derelict) together with newer buildings which are predominately used for storage activities. To the west of Factory Road there are buildings occupied by a number of activities including potato and onion packing, storage and Waharoa Transport Ltd.

Land to the south of the site is a closed landfill that was operated in association with the Anchor dairy factory.

To the west is the Waitoa River, a relatively small watercourse with vegetated margins including native riparian and lowland indigenous species. Between the river and the site is a strip of land vested in the Matamata-Piako District Council. On the certificates of title this area is shown as road reserve however it is likely that it is an esplanade reserve of some description.

The District Plan has no historic or waahi tapu sites, no key landmarks and no significant wetlands wildlife habitats in the vicinity identified on the site. The applicant has no knowledge of any such sites. Part of the continuous stand of kahikatea running along the Waitoa River is a distinguishing feature on the neighbouring property to the west of the site.

The site is contained within an area generally referred to as the Waharoa Industrial Park, which is located to the west of State Highway 27 and the Kinleith Branch railway line.

Historically the site was used for the dairy factory workers village, housing staff and families of the Waharoa Dairy Factory (owned by New Zealand Cooperative Dairy Group now part of Fonterra). The original Anchor dairy factory building (formerly a butter factory to the north and milk powder dryer plant to the south) is located between Factory Road and the railway line. It is now unused.

At the time of the resource consent applications for the cheese factory in 2003, research in Environment Waikato records showed the Anchor dairy factory closed in 1995 after obtaining one year extensions to the relevant regional council consents.

Since the closure of the NZ Dairy Group (Anchor) dairy factory and until the construction and opening in 2004 of the Open Country Cheese Company cheese factory, the site was used for general purposes including grazing, storage of equipment, and other such relatively low value purposes.

5.1 Meteorology

The site shows typical weather patterns associated with the inland Waikato area. An abstract of weather data from the Hamilton Station is presented in Table 4. This data has been compiled from the National Institute of Water and Air database.

Frosts can be expected on most clear mornings during winter, approximately half of these days have screen frost indicated by air a metre above the ground also being below 0°C, these are typically very cold days.

Table 4: Weather data for the period 1969-1998 where available

Station	Rain mm mean annual	Wet days 1.0mm	Sun hours mean annual	Temp Mean Annual	Frost days	Wind mean speed km/h	Gale Days >63 km/h
Hamilton	1190	129	2009	13.7	63	12	2

5.2 Wind

Wind speed has been measured at Hamilton Airport and Ruakura Research Centre for many years. A frequency distribution analysis for Ruakura is presented in Table 5

Table 5: Frequency distribution of wind speed and direction at Ruakura

	Speed m/s					
Direction	0.5 - 1	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	>= 10.0	Total
N	0.9%	2.1%	1.6%	0.3%	0.0%	4.9%
NNE	1.1%	2.9%	1.7%	0.2%	0.0%	5.9%
NE	1.6%	3.9%	2.9%	0.7%	0.0%	9.1%
ENE	1.2%	2.0%	1.7%	0.6%	0.0%	5.5%
E	0.9%	1.3%	0.7%	0.1%	0.0%	3.1%
ESE	0.8%	1.3%	0.6%	0.1%	0.0%	2.8%
SE	0.9%	1.9%	1.1%	0.0%	0.0%	4.0%
SSE	1.0%	2.3%	0.4%	0.0%	0.0%	3.7%
S	1.5%	3.9%	0.9%	0.0%	0.0%	6.3%
SSW	1.3%	2.4%	1.4%	0.2%	0.0%	5.2%
SW	0.7%	1.4%	2.1%	1.3%	0.0%	5.6%
WSW	0.5%	2.1%	6.0%	4.4%	0.0%	13.0%
W	0.5%	3.0%	5.5%	2.3%	0.0%	11.2%
WNW	0.4%	2.0%	2.3%	1.1%	0.0%	5.8%
NW	0.5%	1.8%	1.6%	0.5%	0.0%	4.4%
NNW	0.6%	1.7%	1.4%	0.4%	0.0%	4.0%
Sub total	14.3%	36.1%	31.8%	12.2%	0.1%	94.5%
Calms						5.5%
Frequency calm winds		5.48%				
Average Wind speed		2.57 m/s				

The distribution of wind speeds and directions is also presented in the Wind roses for Ruakura and Hamilton Airport. This data is considered to represent general wind patterns in the Waikato.

Stable conditions (E and F) occur for about 34% of the time. The most common situation is Stability D — this may occur day or night and is usually accompanied by cloud cover.

The predominant wind directions are from the "north-east", 20% of the time and the "west" to “west-south-west”, 25% of the time. Strong winds, greater than 10 metres/second occur are rare and generally occur from the “west”. Light winds of less than 2.5 metres/second occur for about 50% of the time. Winter nights with clear skies are characterised by temperature inversions and stable atmospheric conditions. Wind speeds are low with limited dispersion during these periods.

Figure 2: Windrose Ruakura Research Centre

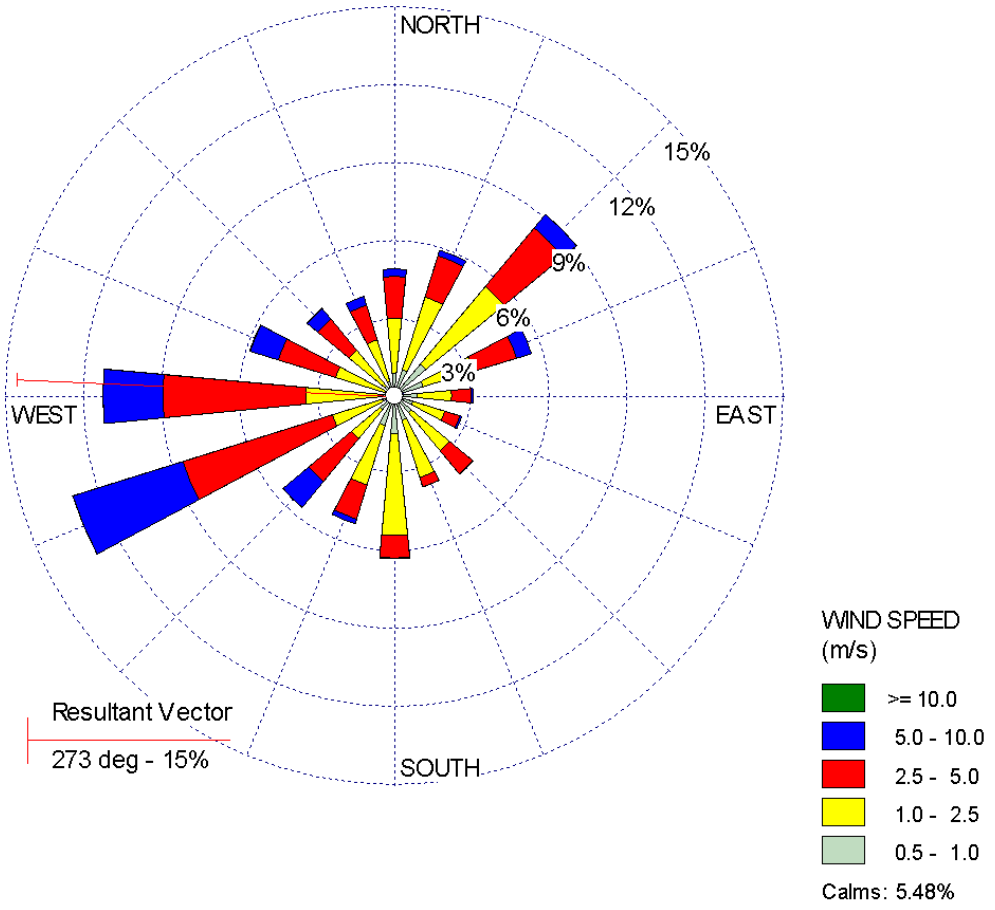


Figure 3: Windrose Hamilton Airport

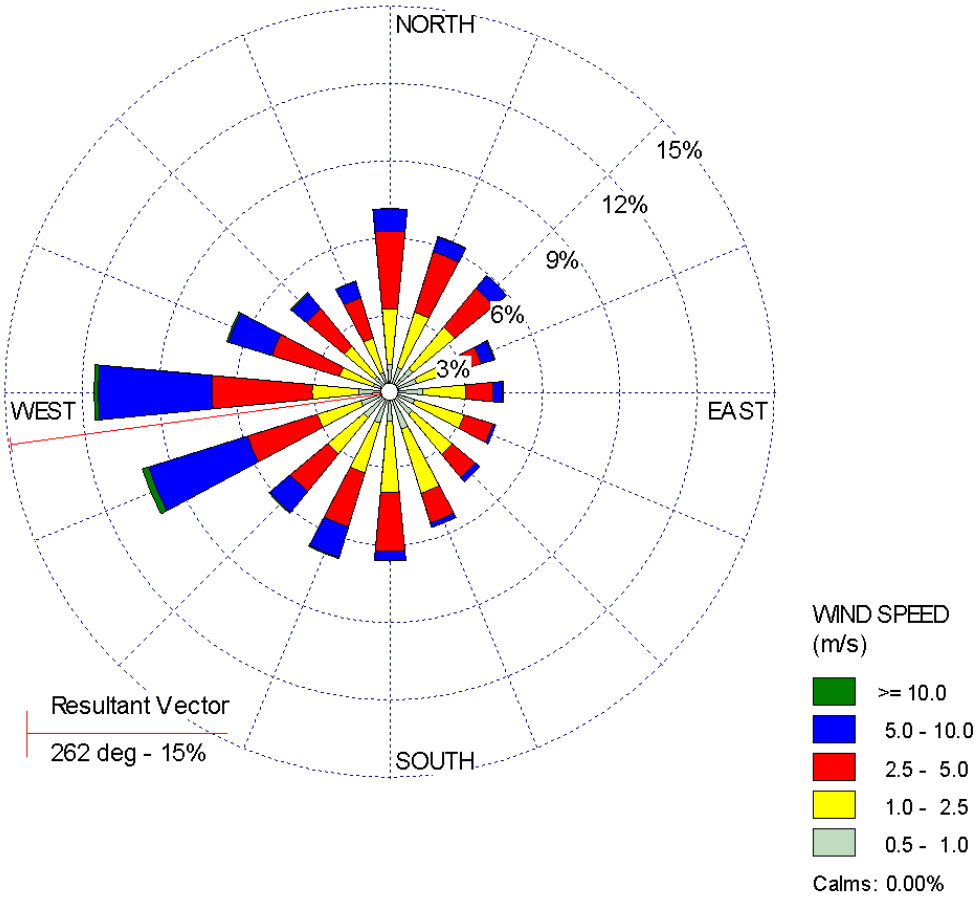
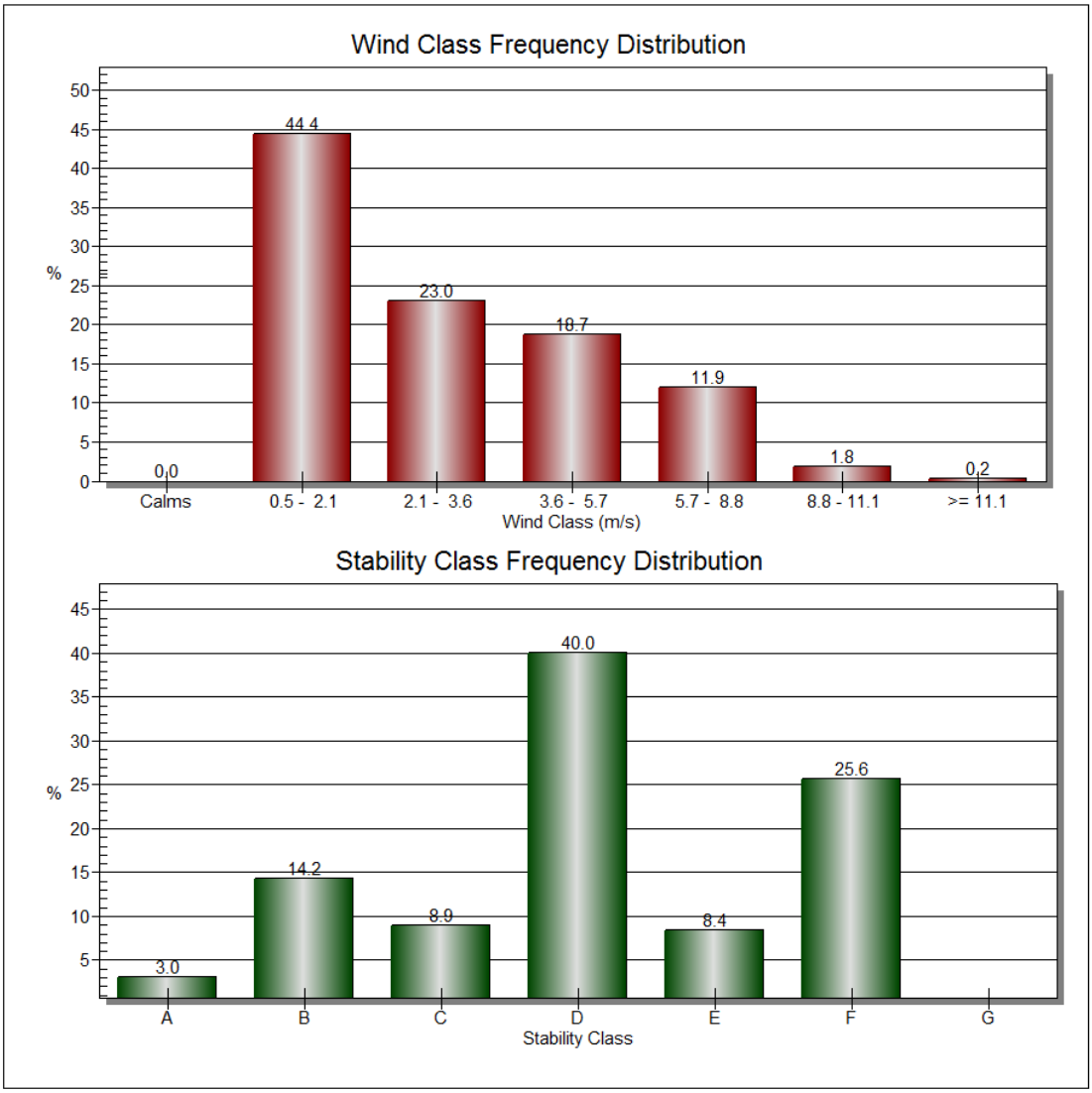


Figure 4: Wind frequency and stability



5.3 Meteorological Data for Modelling

A meteorological data set was developed from the NIWA automatic weather station at Hamilton Airport with solar radiation values measured on site. The data was transformed into an AUSPLUME modelling form using the Solar Radiation method[1] as prescribed by the USEPA[2].

Night time stabilities E and F were determined from the degree of change of the daily average temperature to the hourly night time temperature as measure of heat loss.

[1] Data transformation using proprietary software by Terry Brady Consulting Ltd

[2] Meteorological Program Guidance for Regulatory Modeling Applications. EPA-450/4-87-013

This data set would be considered to be second degree screening data, but since the source is small, and the plume height low at a few tens of metres, no significant errors arise from not having on site meteorological data available. A wind rose is provided.

The meteorological data used for modelling is prepared from 2 years of actual data gathered over the period 1999 - 2000. The site is about 38 kilometres east-north-east from Hamilton Airport. The land is predominantly flat with both the site and Hamilton airport about 50 metres ASL low hills rising to about 340 metres lie in between. The presence of the river may influence the formation and break-up of inversion conditions. The data is based on real-time measurements; an indication of 24-hour averages is permissible. The data may be used to determine frequency of events or percentile distributions.

Limited local meteorological data is available from a site in Matamata[3].

The predominance of Stability D conditions should be noted. In addition nearly 80% of wind speeds are less than 5 metres/second.

6 Matamata – Piako District plan

The land is zoned “Industrial” within the Matamata-Piako District Plan.

The proposed development is a discretionary activity under that plan requiring resource consent.

The buildings exceeds the 20 metre height limit applicable in the industrial area. The activity is included in the industry definitions for discretionary activities.

Clause 5.4 — Industry including activities involving the extraction, processing and packaging of meat, milk, poultry, fish, seafood, animal by-products, beverages, produce, and pulped paper — discretionary activity

[3] https://www.wunderground.com/personal-weather-station/dashboard?ID=IWAIKATO77#history/tdata/s20150420/e20160421/myear

Figure 5: Matamata – Piako zoning for Waharoa

7 Environmental Setting and Sensitivity

The surrounding environment is rural with influence from the proximity to the Waharoa village and state highway. The Industrial area extends to the north and south on the west of the state highway. The residential area is located to the east of the highway.

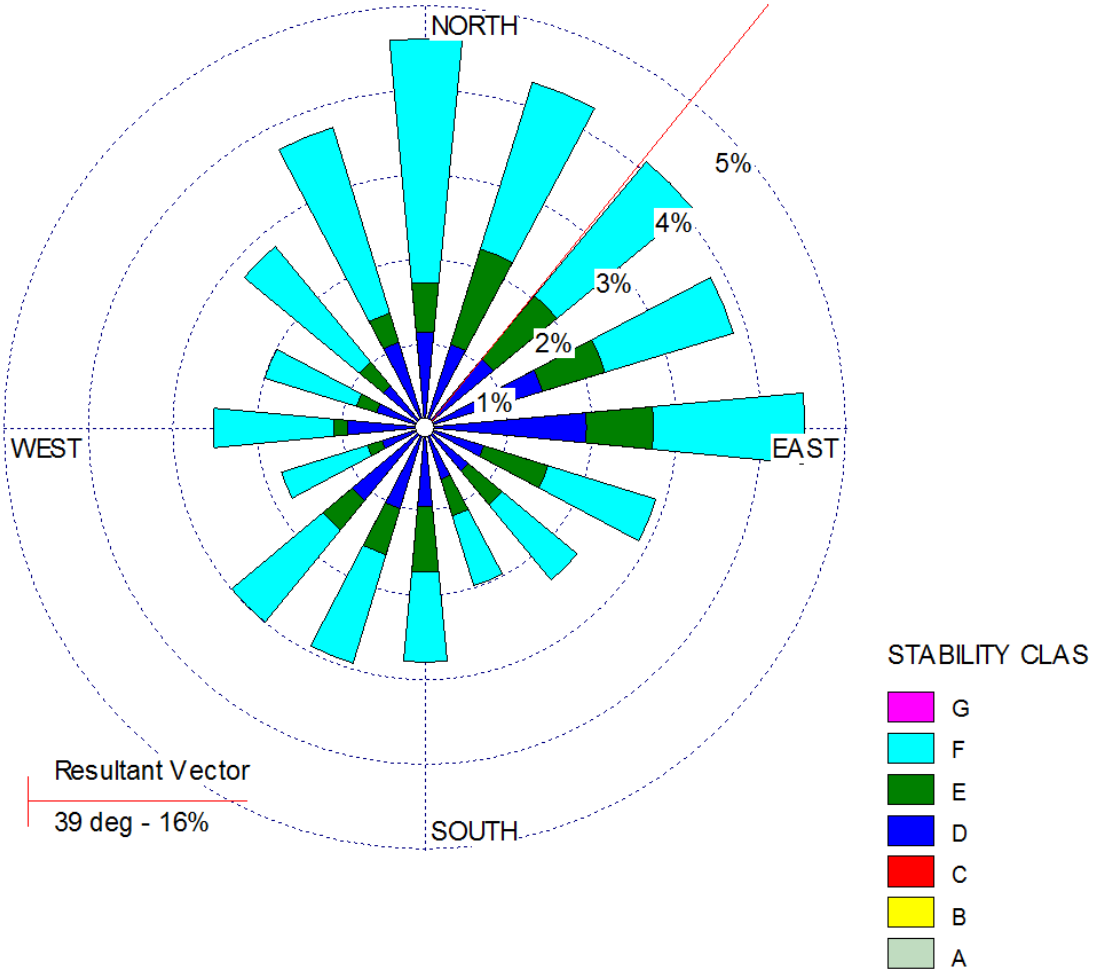
The air environment is not pristine and is modified due to the existing industrial presence, highway and residential area. The population of Waharoa is about 110 persons. There are two primary schools, Waharoa School and Te Kura O Waharoa, a service station, general store and café. The surrounding area is rural.

Emissions from the existing industrial area may occur on a 24/7 basis. Seasonal variation is indicated with discharges being lower during the winter period or off-season.

Emissions from residential sources can generate particulate in particular PM_{10} from winter heating.

Air movement on stable nights may be in any direction, the night wind rose for winter months shows a predominance of wind from the south.

Figure 6: Night wind vector 7 pm to 7 am showing stability.



The only air contaminants of significance are particulate, sulphur dioxide and nitrogen oxides from the boiler plant and particulate from the powder plant.

There are no locations of high sensitivity on adjacent properties. In the vicinity there are residential properties and schools, these being 500+ metres from the site.

The drying towers and stacks are visible from the surrounding areas.

7.1 Existing background pollution levels.

Ambient air monitoring has taken place in Hamilton. No monitoring has taken place outside of the urban limits.

Background levels will be similar to those in inland small towns in the north island; particulate will be similar to that found in the rural environment, levels of nitrogen oxides and carbon monoxide may be slightly above rural background due to highway traffic and residential heating.

Health and Air Pollution in New Zealand, 5 June 2007, Appendices — indicated annual average concentrations of pollutants in New Zealand cities and towns. The context of these averages is contained in the report[4]. The concentrations are likely to represent the upper bound of the Waharoa environment and include the contribution from the existing dairy factory.

Table 6: Indicative annual average background

Particulate as PM-10, µg/m³	13
Sulphur dioxide, µg/m³	5
Nitrogen dioxide (NO_2) µg/m³	15
Carbon monoxide (CO) mg/m³	1

Background levels can only be applied spatially and in time as they relate to the emissions and concentrations predicted from the source. Background levels are not simply added.

The Ministry for the Environment – Good practice guide for Assessing Discharges to Air from Industry indicates background levels for rural areas with low population density. Values are included in Table 7.

[4] Health and Air Pollution in New Zealand — A Research Project Funded by Health Research Council of New Zealand, Ministry for the Environment, Ministry of Transport. 5 June 2007.

Table 7: MfE examples of existing NOx, PM10 and CO concentrations without project

Pollutant	Value to assume	Comment
NO2 1-hour average	15 µg/m³	No results for rural neighborhood, Masterton 2-year average = 13.5, worst case assumption for a rural area.
PM10 24-hour average	15 µg/m³	Typical maximum, no obvious sources
Sulphur dioxide		No value quoted
CO 8-hour average	0 mg/m³	No local sources

A UK Environment Agency study[5] has investigated some alternative approaches. A simpler approach, which gave better accuracy than some and equal accuracy to the best alternative statistical approach, was to add the predicted short-term average concentration to twice the annual average background concentration.

This approach is valid for hourly or short term averages but is not directly applicable to daily or 24 hour averages.

Table 8: Assessed background levels for Waharoa – present dairy factory excluded

Contaminant	Background Concentration (µg/m³)
PM10 24 hour	15
PM10 annual	5
Sulphur dioxide 1 hour	5
NO2 1 hour	15
NO2 24 hour	6
NO2 annual	4
CO 1 hour rural town	5,000
CO 8 hour rural town	2,000

These values have been assessed, no information is available to assess their validity in the Waikato. However, local values are likely to be similar. Use with care – warning.

5 Ministry for the Environment – Good Practice Guide for Assessing Discharges to Air from Industry.

Short term averages are unlikely to be additive whereas annual averages may be more representative.

The use or addition of background levels in this case must be done with care. A dairy factory currently exists on the site, the emissions will add to the concentrations without project. An expansion of the existing dairy factory is proposed, the emissions and modelled concentrations for the new combined facility have been determined for the assessment of effects.

To determine the total effects the background without project levels must be added to the expanded facility levels. The background levels without project used are those quoted in Table 8.

8 Plant and Processing

Open Country Dairy Company Limited commenced operations at its cheese factory on its site at Factory Road, Waharoa on 1 October 2004. OCD has established and operates a whey processing factory alongside the cheese factory.

The whey factory converts whey by-product from the cheese factory into powder.

A second dryer to manufacture whole milk and associated powders has been added to the processing plant. This proposal is to add a third boiler and powder dryer.

8.1 Cheese making

In very simple terms, the age old cheese making process involves first, the action of a culture ("starter") on milk which converts a small portion the naturally occurring sugar in milk (lactose) to lactic acid ("souring") after which a coagulant (rennet) is added to separate curd (the basic cheese) from whey. Various different recipes using different starters and different approaches to curd cooking and maturation make for different cheeses. The range of products that come under the general of being a product of the 'cheese making' process is huge.

8.2 Whey

Whey constitutes about 88% of the volume of milk and half the total solids (TS) in milk (6% TS). The solids in whey generally consist of about 1% protein and 4.8%-5% lactose with the balance of solids – less than ½% - being a small amount of minerals (generally referred to as 'ash'). In years past whey was seen as a disposal (waste) by-product (fed to animals, spray irrigated on pastures, etc.). Modern technologies allow whey to be economically manufactured into market useful products, including powder.

8.3 Processing Capacity

The Open Country cheese factory is currently processing around 500,000 litres of milk per day. The cheese making process (the time a drop of milk enters until it exits as raw cheese) is about 7 hours.

A full run (the time it takes to complete the processing of the milk) takes approximately 10 hours. Four hours per day must be set aside for plant cleaning. The maximum time a plant can produce cheese therefore is about 20 hours.

By adding operating shifts, factory utilisation could be expanded. For OCD a significant constraint on increasing the volume of milk processed per day is satisfactorily managing the whey being produced.

8.4 Whey Processing

The whey powder making process involves evaporation, crystallisation, drying to manufacture a stable non hygroscopic human grade powder (4% moisture). Finished product is packaged and stored on site before being transported to markets. Generally transport to market occurs relatively soon after packing; no maturation or any holding time is required for whey powder.

8.5 The Open Country Whey Processing Factory

There are a variety of ways in which the capacities of powder plants are rated. The dairy industry in New Zealand often refers to the tonnage of whole milk powder a plant they can produce per hour. Were this factory a whole milk powder plant, its production capacity would be 2 tonnes/hour. Whey concentrate for drying is more concentrated than whole milk concentrate. Given the feedstock concentration, it is expected that this plant will produce 3 tonnes of whey powder per hour[6].

The floor area of the whey processing factory is 400 m^2. An area of 430 m^2 is used for storage area including a load out canopy area (roofed to cover loading trucks but without walls).

8.6 Energy Centre

The proposed expansion will include the addition of a third boiler of similar design to the present 14 MW boiler. This boiler will be fitted with a bagfilter unit for the control of particulate emissions and discharge through a separate 45 metre high chimney stack. Boiler and bag filter will be monitored by a PLC system with visual and audible alarms to indicate any malfunction of bag failure.

Energy for the process is currently provided by steam generated in a 11 megawatt John Thompson coal fired boiler plus a 14 megawatt coal fired boiler. The boilers are water tube type units fitted with a mass feed system stokers.

The boiler are be designed for unattended operation. A PLC based system provides continuous monitoring of all operational parameters, adjustment of load, adjustment of fuel/air control and optimisation of combustion.

[6] Modern milk product drying plants like the proposed Open Country plant can dry a range of milk products – whole milk powder, skim milk powder, whey powder. The constant between plants is the volume of moisture/water [H_2O] they remove per hour. A more concentrated feedstock with higher solids will give a higher output per hour of powder.

Instrumentation monitors all boiler functions including steam load, pressures, temperatures, flue gas oxygen/carbon dioxide content and opacity. Emission control is by high efficiency multicyclone. The boilers are fitted with an economiser to recover additional heat from the flue gases and improve efficiency. Estimated efficiency is 77%.

Coal is supplied from the Huntly East coal field. Boiler and stoker design is optimised for the combustion of sub-bituminous coal. A mass feed coal system coupled to a chain grate stoker is environmental friendly, giving a high level of control and a low level of emissions.

The boiler can also operate successfully on Spring Creek or Indonesian coals. The mass feed/chain grate combination is highly versatile and clean combustion system.

Thee prosed design will feed steam to common header enabling boiler operation to be closely matched to milk input. It is expected that under general operation load will be matched to the combined output of the 14 and 25 MW boilers, the 11 MW being available in support capacity.

As milk input reduces steam demand decreases and boiler operation is balance to the load. A conservative approach has been used in the preparation of this AEE and effects have been determined for three boilers operating at up to their nominal operating load or 80% of maximum rating. This is the normal sustained load factor.

The boiler operating parameters are set out in Table 10. The parameters for the stack discharge for the combined boilers is set out in Table 11.

8.7 Milk Powder Plant

This AEE is based on the installation of an additional 10 tonne per hour WMP powder plant. The new plant will be similar in design to the existing WMP unit and operate in a similar manner. Emission control will be by bag filtration.

A typical milk powder plant is where liquid milk is transformed into a powder form by spraying the liquid into a hot drying medium inside a drying chamber in one continuous process. The dried powder will conform to single particles or agglomerates, depending on the physical and chemical composition of the liquid feed.

Dried powder particles, along with moisture-laden exhaust air from the drying chamber, are processed through cyclone separators then bagfilters to separate the powder from the exhaust air.

The dairy plants incorporate state of the art technology for the production of milk products. Capacity of the plants is about 5,000+ m^3/day of raw milk.

Filtered ventilation air from within the plant will be discharged directly to atmosphere, process air will be discharged through a bag filter unit located on the top of the plant above ground. For dispersion modelling the building heights are as included in Table 9.

Table 9: Dryer buildings discharges.

Dryer	Height of building metres	Height of discharge metres	Velocity metres/second
Whey	21	25	22
WMP 1	34.5	45	14
WMP 2 (new)	34.5	45	18

8.8 Nature of the Discharge to Air

To determine the discharge rate of contaminants from combustion sources it is necessary to understand the operation and management of the source. The following criteria apply at all times.

The energy supplied by the fuel is equal to the energy removed in the steam or hot water plus the energy lost in the flue gas, ash, and boiler surfaces etc.

Energy input = energy output + energy losses

The boiler output = system energy demand

If these criteria are not met either the boiler will lose pressure and be unable to meet demand or the steam pressure will rise to the point that the safe working pressure is exceeded and the safety valves open.

The boiler and the combustion processes must always be in a state of balance. The boiler controls sense the rate of change in demand and proportionally adjust the fuel and air supply.

8.8.1 Nature of the fuel and combustion system

The nature of the fuel ultimately determines the composition of the contaminants discharged from the process. Coal may vary for each delivery and does not have a stable composition. The average properties are more clearly specified and used as the basis for the combustion calculations and calculation of emissions.

An energy system is set up to provide a balance between the demand and the available input; in general the input should always be able to exceed the demand. Maximum demand from the system should not exceed an average of about 80% of the manufacturers specified maximum output for the boilers — these being averages over about an hour or so of operation. Short-term peaks and troughs will occur in any system and are accommodated by the boilers with little change in load (changes in water level within the boiler, fluctuation in boiler pressure etc. allow these to happen).

The fractional efficiency may normally be taken as 0.8 and may vary from about 0.75 to 0.9 for coal fired boilers (equivalent to efficiency in the range 75 – 90%).

The energy input to the boiler may be determined by a simple calculation from the steam flow meter fitted to the boiler and the calorific value of the fuel.

The fuel feed rate can be determined from the energy input if the gross specific energy is known (simple analysis data).

The Resource Management Act 1991 is effects based, therefore, the effects must be determined from the discharge rate at the chimney stack. The factors meaningful to this are:

- Energy input (GJ/hr) specified in consent
- Coal feed rate (kg/hr) calculated not specified in consent
- Nitrogen oxides discharge rate (kg/hr) specified in consent
- Total particulate discharge (kg/hr) specified in consent

8.9 Process inclusions

The Act defines an "Industrial or trade process" to include every part of a process from the receipt of raw material to the dispatch or use in another process or disposal of any product or waste material, and any intervening storage of the raw material, partly processed matter, or product. Discharges of ventilation air from the work place and ancillary areas are consider to be integral with the processing of milk or milk products and are part of this application.

8.10 Combustion Sources

The discharges from the proposed boiler(s) are included in Table 10.

The demand steaming rate of the existing boilers is 13,000 and 19,000 kg/hr. The new boiler has a design capacity of 35,000 kg/hr.

8.11 Dispersion Modelling Input Data

Operating and Contaminant Discharges (g/s). These are set out in the following the following tables.

Chimney, Heights and Diameters. The locations of the discharges are set out in the site plan (Appendix 1). Vent heights, dimensions where applicable are listed.

Site Elevation. The terrain input is set to zero — the surrounding land is taken as flat.

Building Heights. Maximum building height = 21 and 34.5 metres meters. The stack height does not exceed average roof height by a factor greater than 2.5, wake correction is required.

Receptor Location. Grid; with receptor locations every 50 metres.

Averaging Times and Compliance Guidelines Criteria. Output averaging times are set to correspond to the most appropriate contaminant guideline concentration averaging times, 1-hour and 24-hour, and annual.

Hamilton Meteorological Data. Compiled 2-year met-data set to give true hourly and daily averages.

Table 10: Boiler design parameters

	Existing 11 MW	Existing 14 MW	Existing stack combined 11+14	New 25 MW	Combined existing +new
Load Factor	0.87	0.91	1.00	0.86	
Peak Steaming Capacity kg/hr	15000	21000	36000	35000	71000
Peak energy output GJ/hr	36	50	86	84	170
Peak fuel energy input GJ/hr	48	65	113	109	223
Boiler size (Manufacturers rated output from nameplate) MW	10.0	14.0	24	23.3	47
Boiler size (Gross) MW	13	18	32	30	62
Boiler efficiency %	75	77	76	77	76
Operating Steam Capacity kg/hr	13000	19000	32000	30000	62000
Operating energy output GJ/hr	31	46	77	72	149
Operating fuel energy input GJ/hr	42	60	101	94	195
Fuel	Coal blend	Coal blend	Coal blend	Coal blend	Coal Blend
Energy content, gross MJ/kg	23.0	23.0	23.0	23.0	23.0
Sulphur content %	0.5	0.5	0.5	0.5	0.5
Ash content %	5	5	5	5	5
Fuel consumption kg/hour	1816	2590	4405	4079	8484

Table 11: Boiler stack contaminant discharge rates

	Existing 11 MW	Existing 14 MW	Existing stack combined 11+14	New 25 MW	Combined existing +new
Contaminant emission factors (NPI Emission Factors)	Emission factor kg/tonne	Emission factor kg/tonne		Emission factor kg/tonne	Emission factor kg/tonne
Sub-bituminous coal 23MJ/kg					
Total particulate	2.78	2.78	2.78	2.78	2.78
Particulate PM-10 as % of Total particulate	90	90	90	90	90
Particulate PM-10	2.50	2.50	2.50	2.50	2.50
Sulphur oxides (calculated from 20*%S)	10.00	10.00	10.00	10.00	10.00
Nitrogen oxides	3.75	3.75	3.75	3.75	3.75
Carbon monoxide	3.00	3.00	3.00	3.00	3.00
Total organics (TOC)	0.03	0.03	0.03	0.03	0.03
Flue gas analysis					
Excess Air Factor	1.57	1.57	1.57	1.57	1.57
Water vapour %	8.6	8.6	8.6	8.6	8.6
Carbon dioxide % dry	12.0	12.0	12.0	12.0	12.0
Oxygen % dry	7.7	7.7	7.7	7.7	7.7
Flue gas discharge -dry at 12% carbon dioxide (Nm^3/s)	4.33	6.17	10.5	9.72	20

Table 12: Boiler stack discharge parameters

	Existing 11 MW	Existing 14 MW	Existing stack combined 11+14	New 25 MW
Stack Discharge rates				
Flue Gas actual m^3/s, wet	8.2	11.7	19.9	18.4
Flue gas temperature °C	180	180	180	180
Stack diameter m	1.05	1.05	1.05	1.05
Stack exit area m^2	0.87	0.87	0.87	0.87
Stack exit velocity m/s	9.5	13.5	23.0	21.3

Table 13: Dryer operating parameters

Dryer discharge	Whey dryer	WMP plant 1	WMP plant 2 (new)	
Stack actual	69,840	205,000	205,000	m³/hr specification
Humidity RH % at 70°	17	16	16	%
Humidity Absolute	0.0590	0.0590	0.0590	kg/m³
Water	41,000	41,000	41,000	ppmw
Temperature	70	70	70	°C
Density	0.993	0.993	0.993	kg/m³
Air discharge	54,953	161,301	161,301	0°C moist
Water content of air (tables)	39.1	38.2	38.2	g/Nm³
Volume of water	0.049	0.048	0.048	Nm³/Nm³
Air discharge	52,279	153,633	153,633	m³/hr 0°C dry
Particulate discharge	10	10	10	mg/m³
Particulate discharge	0.15	0.43	0.43	g/sec

Table 14: Dryer discharges

Dryer discharge	Whey dryer	WMP plant 1	WMP plant 2 (new)	
Stack Discharge rates				
Flue gas temperature °C	74	74	74	°C
Flue gas discharge m³/s actual	19.4	56.9	56.9	m³/sec
Stack diameter metres	1.05	2.25	2.00	metres
Stack exit area m²	0.87	3.98	3.14	m²
Stack exit velocity m/s	22.4	14.3	18.1	m/s
Particulate mg/m³	10	10	10	mg/m³
Particulate g/s	0.15	0.43	0.43	g/s
Particulate kg/hr	0.52	1.54	1.54	kg/hr
Test emission TSP	0.03	0.11	0.11	g/s

Table 15: Dispersion modelling input data

Parameter	Whey	WMP 1	WMP 2	Combined Boiler stack	New Boiler Stack
Height (m)	25	45	45	45	45
Temperature °C	70	70	70	180	180
Diameter (m)	1.05	2.25	2.0	1.05	1.05
Velocity (m/s)	22.4	14.3	18.1	23.0	21.3
Discharges (g/s)					
PM-10	0.15	0.43	0.43	2.6	0.5
CO_2 %				12	12
O_2 %				7.7	7.7
SO_2 g/s				11.0	10.2
NO_2 g/s				4.6	4.2
CO g/s				3.7	3.4

9 Assessment of Actual or Potential Effects

9.1 Actual Effects

Actual effects attributable to the operation of the activity would arise from

- The discharge of contaminants generated from the operation of three coal fired boilers;
- The discharge of any contaminants associated with the processing of milk-products;
- The discharge of low level odours associated with the processing of milk products.

This AEE presents the effects as they are seen to occur from the combustion sources and the milk processing plant. Odour is not a significant source and would only be detected on site. Measurements made at the property boundary confirm that under normal operation odour levels are not offensive.

Table 16: Odour concentrations measured at the main gate to the premises

Sample description	Sampling date	Temperature (°C)	Odour concentration (OU)
Near main gate, sample point 1	13 November 2014	18.0	<LOD
Near treatment pond, sample point 2	13 November 2014	18.5	<LOD

*The limit of detection of the olfactometer is 36 OU.

The basic parameters used in the determination of effects are:

Comparison of predicted ground level concentrations of nitrogen oxides, particulate as PM_{10}, and carbon monoxide attributable to the combustion sources plus particulate from the milk powder plant to air quality guidelines.

The nature and composition of the discharges from the proposed activities is discussed in Sections 6 and 7. The information presented has been used to determine input data suitable for use in the commercial model Ausplume Version 6 (Prime variation as approved by the Ministry for the Environment, New Zealand). The model has been used to determine averages for a range of receptors around the plant and in the general area.

The Hamilton Aerodrome meteorological dataset for 1996 - 1997 is representative of Hamilton and surrounding area and includes all conditions that are relative to this site. Concentrations determined using this meteorological information will predict actual concentrations. These will be representative concentrations both spatially and in time. The model has been used with a surface roughness factor of 0.6, to cover the mixed uses surrounding the site.

The use of this prediction method is considered to represent the best method available without having access to onsite meteorological information.

It is common practice to apply a background concentration to modelling for industrial emissions. These must be determined by appropriate statistical means; it is not merely adding a value to the predictions of peak values.

9.2 Air Quality Guidelines

Air quality standards[7] for New Zealand were introduced by way of regulations under the Resource Management Act 1991. The Ministry for the Environment published its New Ambient Air Quality Guidelines in 2005. Data from this source is included where relevant.

Effects may be analysed by comparison of the results predicted by dispersion modelling with published air quality standards or guidelines for general exposure or point of impingement for maximum exposure. Standards are set out in Table 17.

Table 17: Air Quality Guidelines (National Environmental Standards)

	Concentration Limit and Averaging Period	Number of allowable exceedances per year	Maximum Limit for Exceedances	66% Level to maintain air quality
Particles as PM_{10}	50 µg/m³ (1 day average)	1	120 µg/m³ (1 day average)	33 µg/m³ (1 day average)
Carbon monoxide	10 mg/m³ (8 hour average)	1		7 mg/m³ (8 hour average)
Nitrogen dioxide	200 µg/m³ (1 hour average)	9	300 µg/m³ (1 hour average)	132 µg/m³ (1 hour average)
Sulphur dioxide	350 µg/m³ (1 hour average)	9	570 µg/m³ (1 hour average)	231 µg/m³ (1 hour average)

[7] Resource Management (National Environmental Standards Relating to Certain Air Pollutants, Dioxins, and Other Toxics) Regulations 2004 SR 2004/309

Table 18: Air Quality Guidelines (Waikato regional Council)

Contaminant	Averaging Time	Waikato Region Levels
Carbon monoxide (CO)	1 hour	30 mg/m^3
	8 hours	10 mg/m^3
Nitrogen dioxide (NO_2)	1 hour	200 µg/m^3
	24 hours	100 µg/m^3
	Annual	30 µg/m^3
Particulate matter (PM_{10})	24 hours	50 µg/m^3
	Annual	20 µg/m^3
Sulphur dioxide (SO_2)	1 hour	350 µg/m^3
	24 hour	120 µg/m^3

The modelled concentrations in this AEE have been compared with the relevant guideline — indicated in the evaluation of the results.

9.3 Accuracy of Predictions

The accuracy of predictions depends on the quality of the input data and assumptions and on the inherent limitations in the model in respect to predicting plume rise at any point downwind; ability to predict plume dispersion coefficients (plume spread); the assumption that meteorological conditions remain constant between the source and receptor; that varying terrain can be accounted for; and the assumed averaging times etc.

Accuracy is also strongly affected by the sophistication of predictions required and how real-time meteorological data (if available) is used. It is common to see statements to the effect that a difference of a factor of two between dispersion modelling predicted concentrations and actual concentrations is the best that can be expected - that is predictions could be between ½ and twice actual concentrations. This, however, is an over simplification and if such accuracy or better is assumed then special assumptions and conditions apply.

If modelling is used to estimate (over flat terrain) the highest 1 hour and 24 hour concentration that could occur during a year (to compare with ambient air quality standards) but is not asked to predict when and where these would occur, then, according to Turner (1992), EPA studies indicate that predicted concentrations are typically within 10 to 40% of observed concentrations. If modelling is used to predict theoretical concentrations downwind at specified distances over flat terrain for a specified rate and temperature of contaminant discharge using screening meteorological data the predicted concentrations should be within 50% of reality for those stability classes and wind speeds nominated. Such accuracy cannot be expected for receptors in complex terrain (terrain which rises above the plume centre line). For such situations predicted concentrations are indicative only.

9.4 Effects – Contaminant concentrations

The predicted contaminant levels have been determined on the basis of three boilers operating at a combined input rating of up to 138 Gigajoules. The modelling presumes that the boiler may operate twenty four hours a day, seven days a week for 365 days per year. This is a realistic estimate as far as the plant operates continuously but conservative as regards load as this presumes continuous operation at maximum rating. The modelling results for the predicted concentrations are presented below.

Dispersion modelling indicates full compliance with the National Air Quality Standards and compliance with the Waikato regional Council Air Plan.

The predicted levels must be considered conservative in that they indicate the situation with the boiler at maximum rated capacity under a worst case scenario — there is no reasonable indication that this will occur in practice.

Background levels as indicated in Section 5.1 and Table 6 may be applied.

A source input file was prepared based on the daily operating hours, both plants were presumed to be operating at rated capacity for those hours when cleaning was not taking place. This is a conservative option and does not take into consideration those periods when only one plant is operating.

The source input file includes the option that the plant is shut down in June and July, this being the off season.

The predicted results are considered to be the maximum values likely to occur.

Table 19: Indicative concentrations in Waharoa - present dairy factory excluded

Contaminant	Background Concentration (µg/m³)
PM10 24 hour	15
PM10 annual	5
Sulphur dioxide 1 hour	5
NO2 1 hour	15
NO2 24 hour	6
NO2 annual	4
CO 1 hour rural town	5,000
CO 8 hour rural town	2,000

9.5 Dispersion modelling output data.

Tables and discussion on predicted results are included in Section 9.5. The results are presented graphically in Appendix 3.

9.5.1 Particulate

Particulate concentrations have been modelled for 1-hour, 24-hour and annual averaging periods. The National Environmental Standard (NES) is 50 µg/m³ based on a 24 hour averaging period. An annual guideline of 20 µg/m³ is reference by the WHO and in the Waikato Plan.

The predicted maximum annual average is 4 µg/m³. If an annual background of 5 µg/m³ is included the predicted annual concentration is 9 µg/m³. The controlling factor being the existing background concentration.

The predicted 24-hour average is 14 µg/m³. If a background of 15 µg/m³ is included the predicted concentration is 29 µg/m³. The controlling factor being the existing background concentration. The operation of the plant will not cause the NES of 50 µg/m³ for particulate to be exceeded.

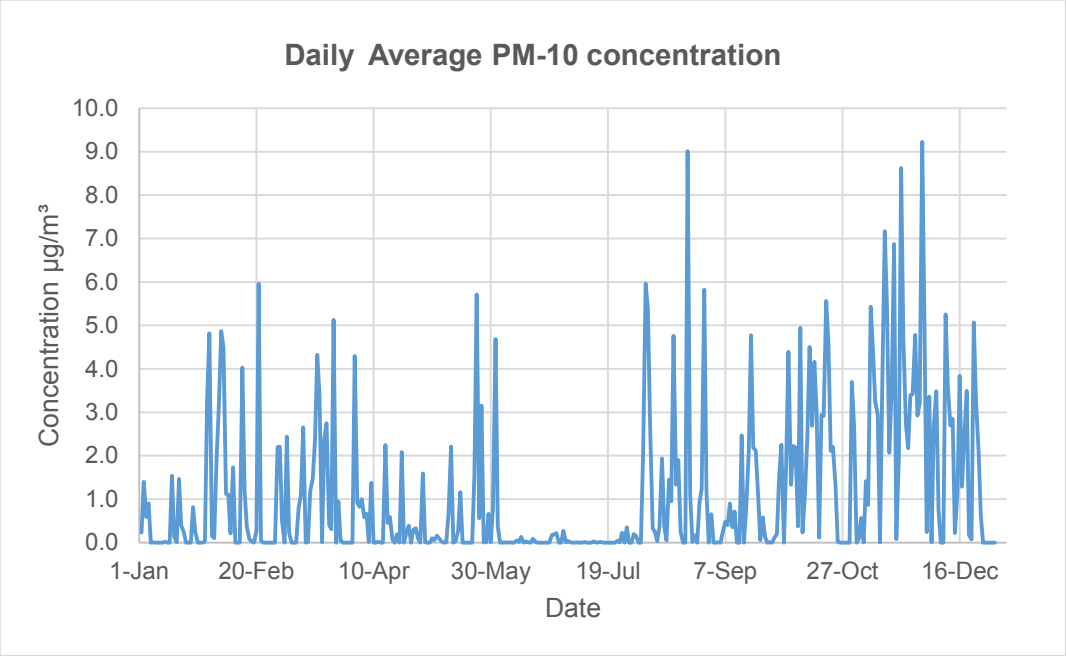
Peak values do not coincide with domestic heating, the background concentration is very conservative. In all predicted worst case situations, the NES will not be exceeded.

The area of maximum concentration in the residential area has been determined the particulate and sulphur dioxide plots. A single receptor at the maximum location has been modelled to assess concentrations in the village.

The particulate (PM-10) concentration as a 24 hour average is 14 µg/m³ or 29 µg/m³ including background. Maxima occur during November and do not coincide with the domestic heating peaks.

A plot of the daily values is shown in Figure 7.

Figure 7: Daily average 24-hour PM-10 concentrations in the village in µg/m³.



9.5.2 Nitrogen dioxide

Given the low concentrations a conservative presumption is that all nitrogen oxides is present as nitrogen dioxide (NO_2); this is the case in the analysis of effects.

The maximum 99.9 percentile 1- hour value of nitrogen dioxide plus the background concentration is 50 +15 = 65 µg/m³. Given the conservative calculations used to determine this concentration; the effects are minor.

The 24-hour maximum value of nitrogen dioxide plus the background concentration is 33 µg/m³ or less than one third of the NES. Given the conservative calculations used to determine this concentration; the effects are minor.

9.5.3 Sulphur dioxide

The maximum 99.9 percentile 1- hour value of sulphur dioxide plus the background concentration is 120 + 5 = 125 µg/m³. Given the conservative calculations used to determine this concentration; the effects are minor.

The 24-hour maximum value of sulphur dioxide plus the background concentration is 66 µg/m³. Given the conservative calculations used to determine this concentration; the effects are minor.

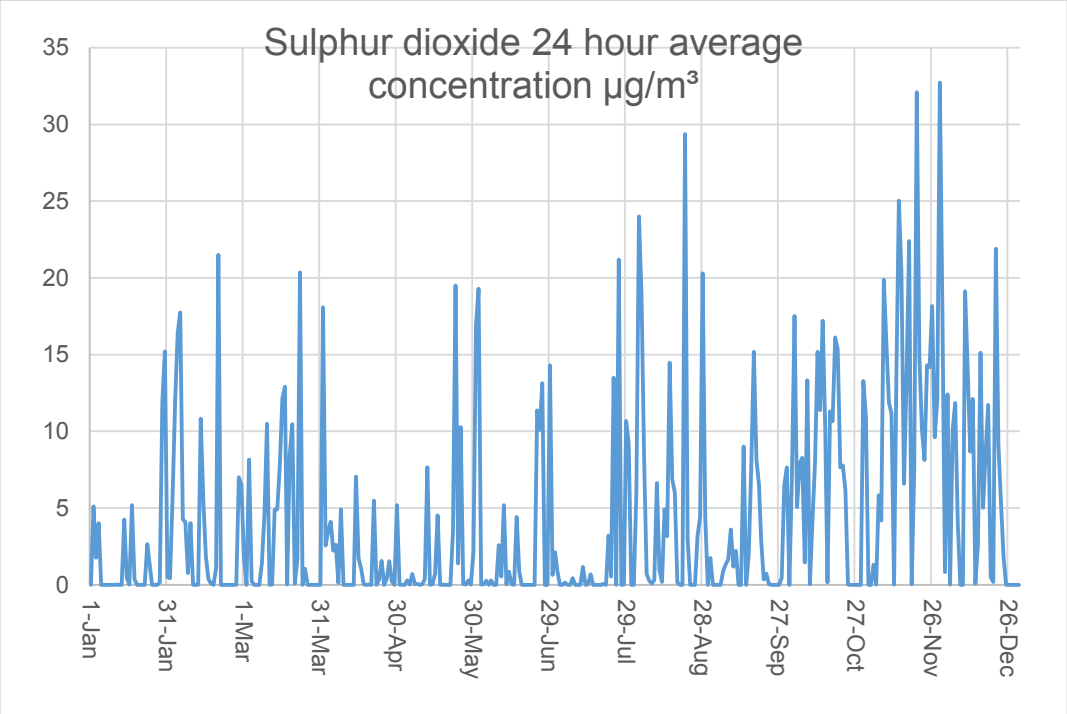
The elevated levels are based on a sulphur content in the coal of 0.5%

The area of maximum concentration in the residential area has been determined the particulate and sulphur dioxide plots. A single receptor at the maximum location has been modelled to assess concentrations in the village.

The sulphur dioxide concentration in the village as a 24 hour average is 32 µg/m³ or 34 µg/m³ including background. Maxima occur during November and do not coincide with the domestic heating peaks.

A plot of the daily values is shown in Figure 8.

Figure 8: Daily average 24-hour sulphur dioxide concentrations in the village in µg/m³.



9.5.4 Summary

An analysis of the predicted modelling values is presented in Table 20. The distribution and site locations for particulate includes emissions from both the boilers and dryers, whereas the other contaminants are solely from the boilers. There is a significant difference in the distribution, this is indicated in the figures containing the isopleths.

Table 20: Concentrations excluding background

Contaminant	Modelled concentration µg/m³	Village µg/m³	NES standard µg/m³
PM-10 24 hour average	14	10	50
PM-10 annual average	4	3	20
Nitrogen dioxide 1 hour	50	33	200
Nitrogen dioxide 24hour	27	13	100
Sulphur dioxide 1 hour	120	78	350
Sulphur dioxide 24 hour	64	32	
Carbon monoxide 8 hour	40		10,000

Further results are indicated in the following graphs.

Figure 9: Particulate (PM10) concentrations, at 2nd highest level for 24 hour averages in µg/m³. Existing boilers + dryers and new boiler and dryer

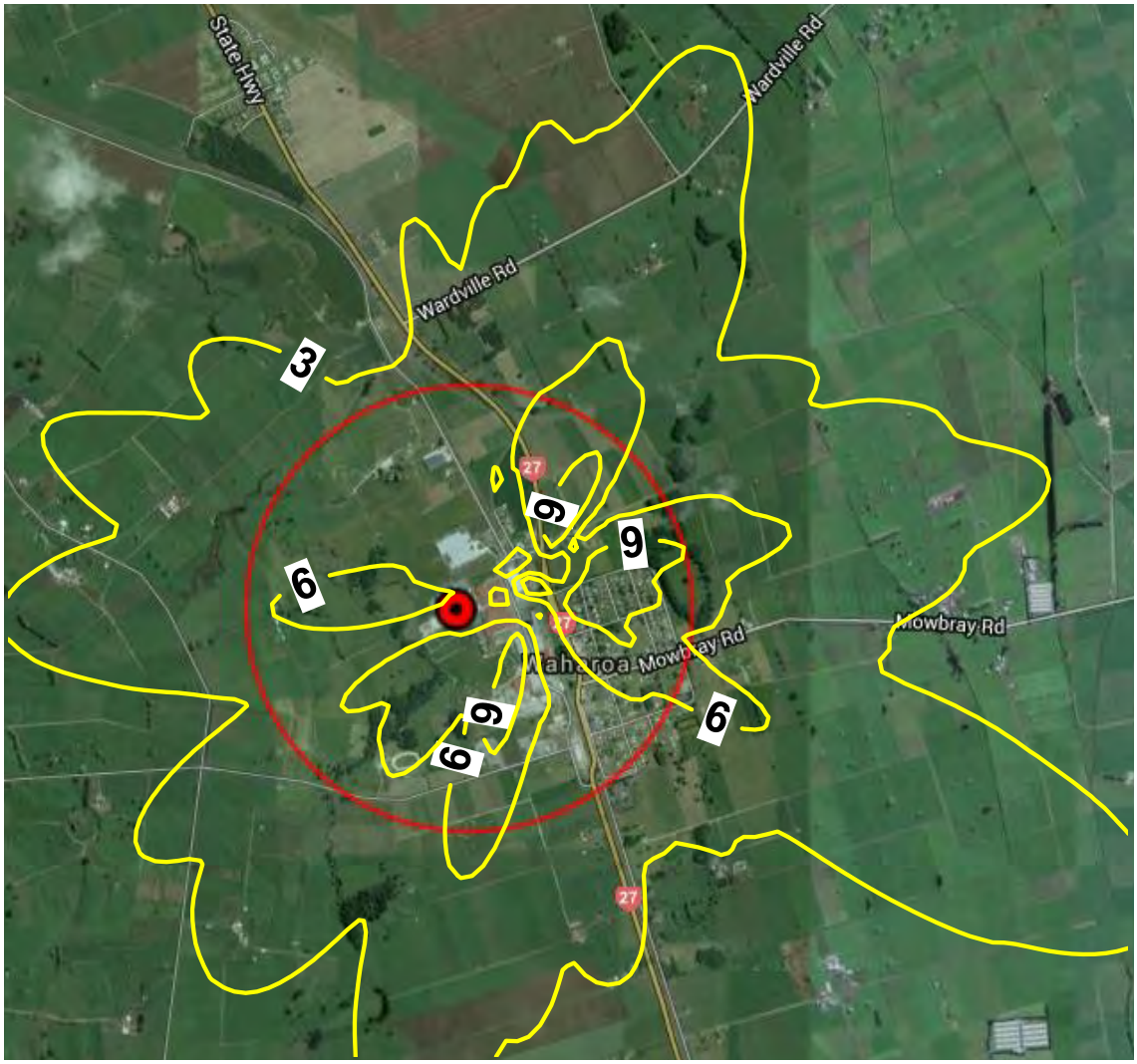
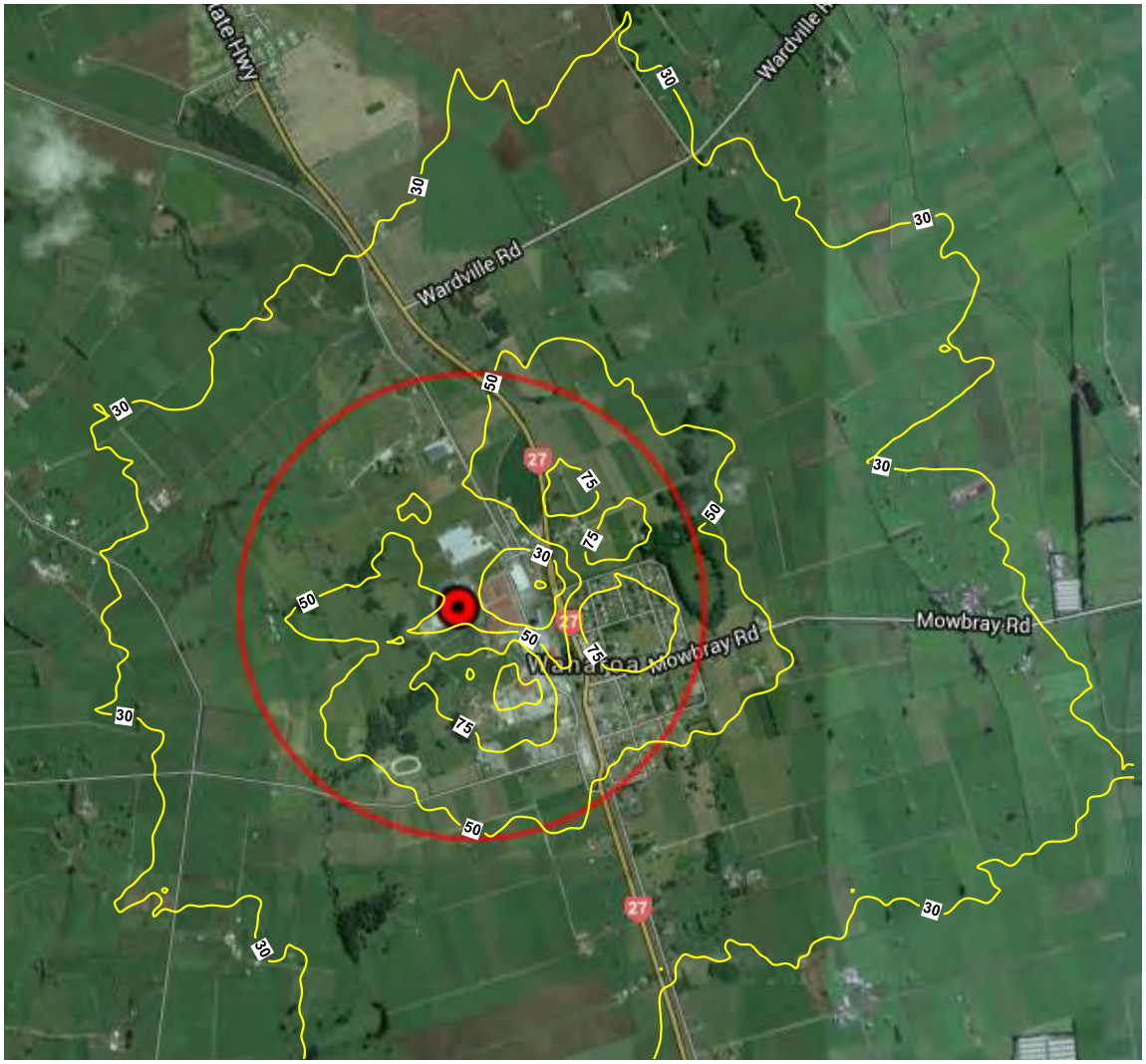


Figure 10: Sulphur dioxide concentrations, at 99.9 percentile level for 1 hour averages in µg/m³. Existing boilers and new boiler



Red circle at 1,000 metres from existing stack base

9.6 Effects other contaminants

The effects are mitigated to the point that although there is some degradation in the environment — the consent conditions ensure that the process meets the requirements of the Resource Management Act 1991, in that effects remain minor for all contaminants.

The assessment of effects must be based on the predicted concentrations and the degree to which these are acceptable in any location in the area, in that significant adverse effects do not occur. Each of the predicted concentrations compares with the presented air quality guidelines. The National Standards are not exceeded.

The risk associated with predicted maximum levels actually occurring is considered low; given that it requires each source on the site to be generating worst case or near to worst case emission levels co-incident with minimal dispersion in the area.

9.7 Effects – processing

The discharge from the dryer will be controlled by a bag filter unit, an emission concentration of 10 mg/m³ based on corrected gas volume has been used to determine Total Particulate (TSP) and fine particulate (PM-10). Modelling of the predicted PM-10 concentrations includes the discharge from both the boiler and dryer discharge.

The work areas within the plant are air conditioned and circulated air is filtered. Any powder discharge from these sources is minimal.

The plant design is such that any odour or particulate at the plant boundary is neither offensive nor objectionable. The expectation is that during plant operation odour will not be detected beyond the boundary of the plant — this has been found to be the case with currently operating plants.

9.8 Local Air Shed

The analysis of actual and potential effects has been extended to determine if any effects from the operation of the plant will cause National Environmental Standards or Guidelines within the Local Air Shed to be exceeded.

The predicted effects within the Air Shed boundary, are less than minor, being near the lower limit of detection with currently available analytical methods.

9.9 Potential Effects

9.9.1 Energy Centre

An assessment of the activity has been carried out to determine if there are factors that may contribute to the generation of potential effects.

The commonly considered factors being power failure, earthquake, storm, flood, or equipment failure. In all cases there is no evidence to indicate that the activity would generate “potential effects” on the air environment. In general terms, if there is a power failure all electric motors will stop and the process basically moves into a dormant stage with combustion activity ceasing.

The only area considered to have relevance, is the possibility of a fan failure associated with the boiler. Elevated levels of carbon monoxide and hydrocarbons may occur 1-2 minutes while control systems shut off the coal supply and close the boiler down, combustion air will continue to be supplied by natural draft from the chimneys.

The potential for complete fan failure, not associated with electrical failure in the district, is considered to be extremely remote.

9.9.2 Milk Processing Plant

An assessment of the activity has been carried to determine if there are factors that may contribute to the generation of potential effects.

The commonly considered factors being power failure, earthquake, storm, flood, or equipment failure. In all cases there is no evidence to indicate that the activity would generate “potential effects” on the air environment. In general terms, if there is a power failure all electric motors will stop and the process basically moves into a dormant stage with activity ceasing.

The assessment of effects must be based on the predicted concentrations and the degree to which these are acceptable in any location in the area, in that significant adverse effects do not occur. Each of the predicted concentrations compares favourably with the presented air quality guidelines. The National Standards are not exceeded. At maximum predicted levels there is no intrusion into the “alert zone”.

Emissions from the powder plant are controlled by a bag filter system, excessive emissions would result if failure of the bags within the filter unit occurred. The particulate level within the exhaust is monitored to ensure any bag failure is detected and the situation rectified as soon as practicable. Failure of one or two bags will increase the emission but should not result in objectionable levels outside of the property.

10 Mitigation

The operation of the plant is controlled and monitored within the plant operational and maintenance programme.

The design and operation of the plants meets the best practicable option criteria.

The new boiler will be fitted with a bagfilter based emission control system. Each of the powder dryers use a bagfilter based control system.

The plant will comply with operating requirements of the New Zealand Food Safety division of MAF. A risk management plan with HAACP analysis is required.

Testing will be carried out as required by the consent conditions.

11 Monitoring

11.1 Boiler

Combustion conditions are monitored and adjusted by a PLC based control system to maintain optimum conditions. Monitoring and adjustments will ensure minimal environmental effects. Emission of smoke will not be a factor due to the use of high technology combustion monitoring and control.

Properties of current coal supply are included in Table 21.

11.2 Powder production

The discharge from the powder plant is monitored on a continuous basis by a Particulate Monitoring System. The Systems employ a technology based on induction. A sensor probe is mounted in the stack. As particulate flows near and over the sensing element, minute electrical currents are induced in the sensor and transferred to the control unit. A microprocessor filters and processes the signal into a normalized, absolute output that is linear to the mass concentration of particulate.

The instrument is sensitive down to the expected discharge from the bag filter under normal operation and if leakage occurs due to bag deterioration.

Table 21: Properties of current coal supply

East Mine Monthly Graded Product (0-50mm Slack)
Performance Records 'As Received Results'
Dec-2014

Sample ID	Date	LOAD (%)	Moist (%)	VM (%)	Ash (%)	FC (%)	Sul (%)	CV (Mj/kg)
	8-Dec-14	3.85	19.2	34.85	3.84	42.13	0.393	23.12
	15-Dec-14	5.16	19.46	34.96	3.41	42.18	0.254	23.1
	22-Dec-14	5.05	20.37	34.59	3.52	41.52	0.379	23
	30-Dec-14	5.91	19.55	35.04	3.7	41.71	0.375	23.22

12 Alternative Location and Method of Discharge

Resource Management Act, Schedule 4 (b) and (f)(ii)

Resource Management Act, Schedule 4, 1(b) and (f)(ii) state —

1(b) where it is likely that an activity will result in any significant adverse effect on the environment, a description of any possible alternative locations or methods for undertaking the activity:

1(f) where the activity includes the discharge of any contaminant, a description of…….

(ii) Any possible alternative methods of discharge, including discharge into any other receiving environment:

As the potential for significant adverse effects is low, only Section *1(f)* applies.

The consent application relates to an expansion of an existing process. Matters relating to the consent have been considered in relation to the full operation of the processing facility.

The site provides space for the combined operation. The location is appropriately zoned under the Waikato District Scheme. A local labour force is available.

Conversion of milk to milk powder requires significant energy. Use of combustion processes to provide the energy input is the only practicable method for plants of this size. Combustion of solid or other fuels requires the discharge of combustion products to air.

The discharges to air from the boilers and milk powder ventilation systems are the only practicable options for the discharges.

13 Consultation

Resource Management Act, Schedule 4 (h)

At this stage the expansion is in the planning and consent stages. Consultation will take place prior to filing of the application. This will be as informal discussion with the residents. Given the number of person formal sign is not considered a practical option except for parties on adjacent properties.

14 Term of Consent

The term of consent requested is 35 years.

15 Consent Conditions

15.1 Energy Centre

The maximum energy input to the boiler system shall not exceed 180 GJ/hour;

The maximum nitrogen dioxide emission shall not exceed 8 kg/hr

The maximum particulate emission shall not exceed 7 kg/hr (when measured as PM-10).

The maximum coal consumption shall not exceed 8,500 kg/hour

15.2 Powder Plant

The maximum particulate emission shall not exceed 4 kg/hour (when measured as PM-10).

Appendix 1
Waikato Regional council Plan
Section 8.1.5.1

8.1.5.1 – Discretionary and Non Complying Activity Rules

a. The extent to which the Regional Ambient Air Quality Guidelines are complied with.

The activity meets both the National and regional air quality guidelines.

b. The extent to which the discharge will have an adverse effect on ambient air quality.

The effect of the activity is evaluated as less than minor.

c. The extent to which the discharge will have an actual or potential adverse effect on the existing air quality characteristics of an area.

The discharge will generate a low level of actual effects – less than minor. Potential effects are controlled by strict limitations on processing and hygiene requirements within the plant.

d. The extent to which the discharge will have an adverse effect on human health and the health of flora and fauna.

There is no indication of adverse effects on human or plant, concentrations are below those indicated in **Air Pollution Injury on Tomato and Pepper by** Janice LeBoeuf - Vegetable Specialist/OMAF Ontario Canada

e. The extent to which the discharge will have an adverse effect on amenity values, including any objectionable effects as a result of an odour or particulate discharge (refer also to Guidelines for Assessment in Chapter 6.4).

The values determined from dispersion modelling for particulate, nitrogen dioxide and carbon monoxide indicate less than minor impact on amenity values. Objectionable effects are not considered to occur.

f. The extent to which the frequency, intensity, duration, offensiveness and location of the discharge causes adverse effects.

The discharge effects are less than minor and do not impact on the above

g. The extent to which the discharge will be reduced at source.

The activity will use natural coal as an energy source and particulate emissions from the processing plant will be controlled by bag filtration. The plant meets the terms of the BPO for milk processing.

h. The nature of the discharge and the extent to which it is hazardous (refer Hazardous Air Contaminants List in Chapter 6.7).
i. The existing air discharge sources in the area (point and non-point).

Domestic space heating – small residential area, effects likely to be minor.

Motor vehicle exhaust from traffic on State Highway 27.

j. The influence of meteorology and topography on the discharge.

The area is basically flat – topography will have minimal effects

Meteorology is included in the dispersion modelling, analysis of the wind rose indicates no untoward effects are expected.

k. The extent to which the method of discharge is the most efficient and effective means of carrying out an activity.

The discharge is from the combustion of coal and processing of milk products — it is the only practical option.

l. The extent to which any alternative location or method(s) of discharging any contaminant, such as into a different medium, was considered.

The location provides for access both for raw material in and product out, local labour, flat land suitable for structures. The there is no alternative medium for discharge.

m. Whether the option minimises any adverse effects on the environment.

The option selected is based on the control and minimisation of effects

n. The extent to which tangata whenua as Kaitiaki concerns have been recognised and provided for.

As far as has been indicated to OCD in discussions there are no concerns.

o. The extent to which the activity will have the potential to affect significant heritage sites[1] or areas of historic and cultural significance.

General effects are less than minor; no potential effects for heritage sites or areas of historic and cultural significance.

p. The extent to which the discharge creates actual or potential effects on other receiving environments (i.e. land or water).

No effects greater than minor on any other receiving environments.

q. The extent of any consultation undertaken (as per the reporting requirements in Schedule Four of the RMA).

Effects are minor, consulting is not a mandatory requirement. However consultation has taken place with local Iwi. Local people are aware of the proposal.

r. The extent to which the discharge creates actual or potential effects on the global atmosphere (within the scope of central government policy).

Combustion of coal will generate carbon dioxide.

s. The extent to which to which the discharge creates cumulative effect which may arise over time or in combination with other effects.

There is no indication of cumulative effects generated over time.

t. Any effects of low probability but high potential impact.

There are no effects of low probability with high impact.

u. Whether management plans and contingency plans have been provided.

A management plan is included in the Appendices

v. The risk of abnormal emissions and the level of control employed.

Control with the plant is fully automated, operators are in place to oversee all of the systems. The plant is of international design and incorporates all necessary safeguards to minimise the risk of adverse effects be they environmental or other.

w. The extent to which relevant codes of practice or other guidelines are adhered to.

The plant will meet all relevant codes of practice and statutory requirements.

x. The extent to which the discharge may affect aircraft safety.

The activity complies with the requirements of the Civil Aviation Act.

y. Any other relevant matters.

There are no other relevant matters

Appendix 2
Waikato Regional council Plan
Section 8.1.5.3

8.1.5.3 Further Information – Modelling For Consent Applicants

a. A discussion of the model and the justification for the use of the particular model.

EPA Victoria developed AUSPLUME (V6.0 used) for predicting the effects of industrial emissions on air quality. The model is approved for use in New Zealand by the Ministry for the Environment.

The model is a steady-state Gaussian plume model; with the ability to model a variety of sources including point, area, line and volume sources. It is able to account for building downwash and includes plume rise as a function of downwind distance.

A steady-state Gaussian model is suitable to use in this modelling exercise providing that representative meteorological data is available. The Hamilton airport and Ruakura data are suitable and have been prepared from real time data.

b. How particular model settings were used and other model assumptions were made.

The model was run with the default settings. Building wake settings were activated.

c. The influence of terrain and other local effects such as sea breezes.

No terrain or sea breezes influenced the site.

d. A description of the contaminants in the discharge.

Basic combustion originated contaminants plus milk powder

e. The source emission data used in the model and other model input data such as stack and building dimensions.

Full details are given in the text of this AEE

f. A description of the meteorological data used.

Hamilton airport and Ruakura data download from the NIWA CLIDB data base and processed by Terry Brady Consulting Limited.

g. Tables and graphical presentations of the predicted maximum ground level concentrations for each contaminant at regular and appropriate intervals from the discharge points.

Tables and Figures are included in the text and appendices

h. Model output tables.

Tables and Figures are included in the text and appendices

i. A comparison of the predicted maximum ground level concentrations with the appropriate guideline or other criteria.

Tables and Figures are included in the text and appendices

j. Model interpretation including a discussion and conclusions on the likely effects on the environment taking into account background levels of contaminants and other sources in the vicinity as appropriate and a discussion on model uncertainties.

Discussion, Tables and Figures are included in the text and appendices

Appendix 3
Location and Site Plan

Figure 11: OCD site showing plant layout

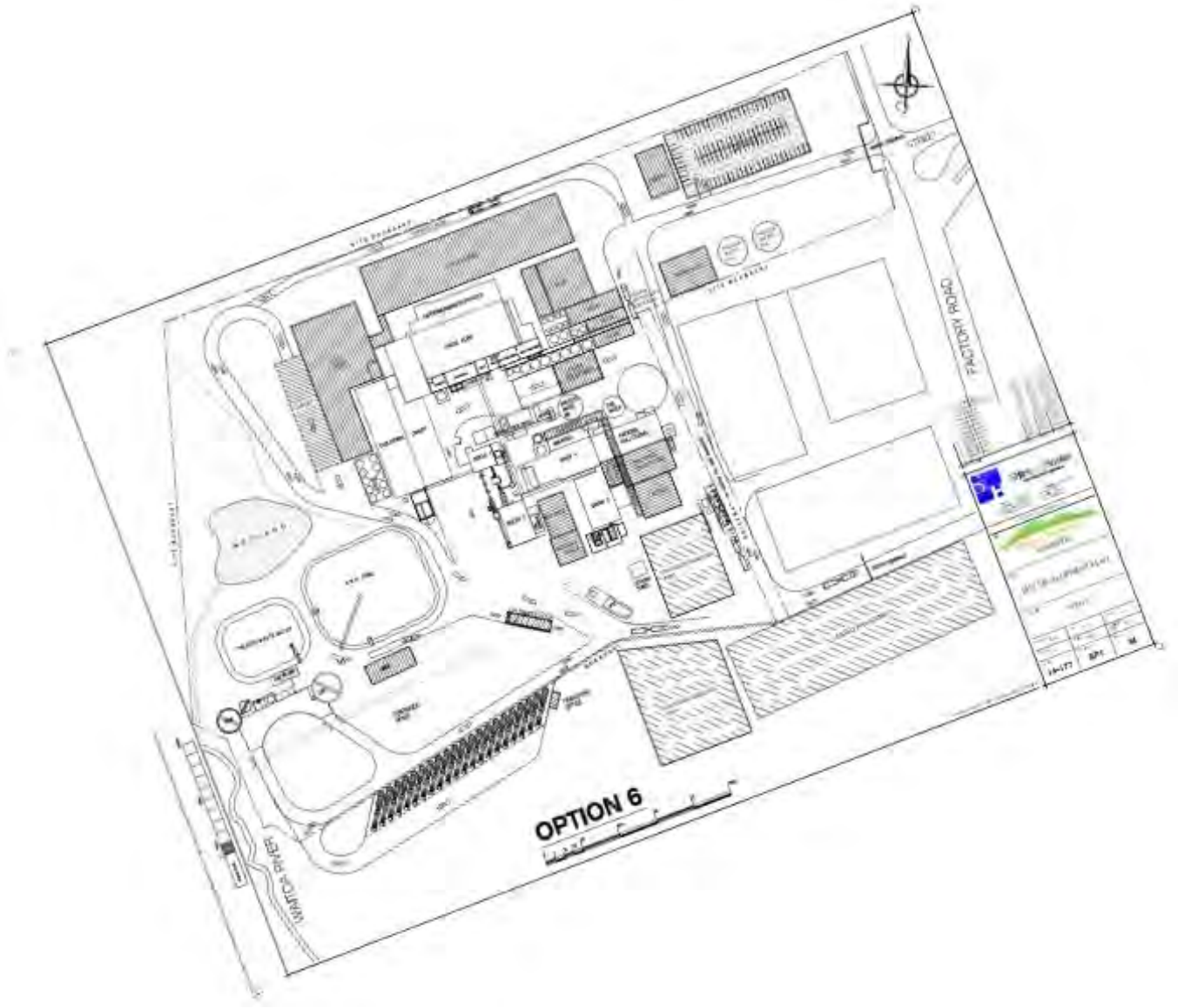
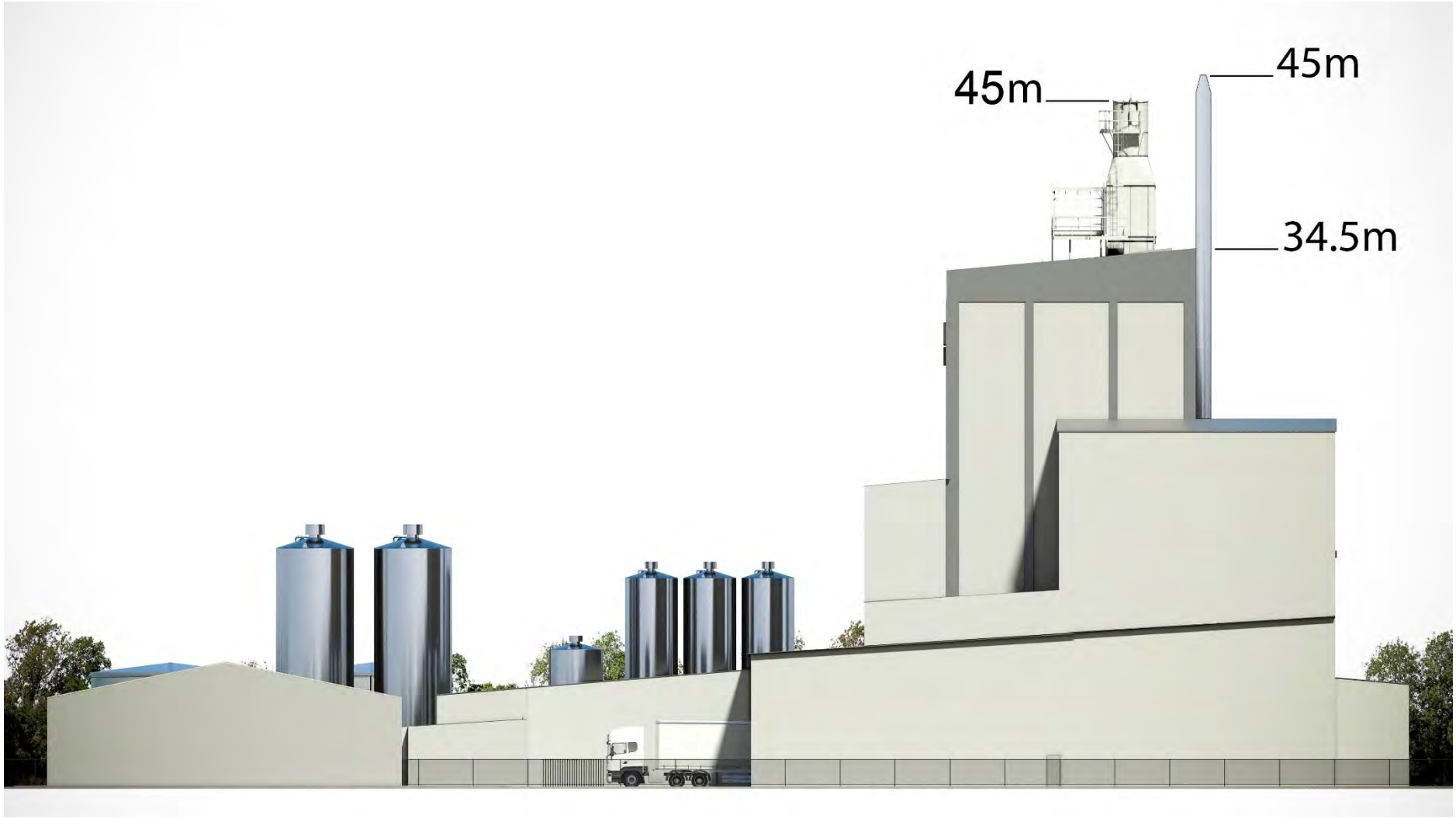


Figure 12: Proposed OCD plant showing discharge heights



Appendix 4

Ministry for the Environment Air Contaminants

Ambient Air Quality Guidelines

Air Quality Report No 32

Prepared by the Ministry for the Environment and the Ministry of Health

Published in May 2002 by the Ministry for the Environment

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2 Health-based Guideline Values

2.1 Introduction

The revised and new guideline values listed in Table 1 should be used to direct air-shed management and evaluate ambient air quality monitoring results. Guidance on how to apply the guideline values is given in Chapter 3.

The health-based guideline values aim to protect people's health and well-being. They are generally designed to protect those who are most susceptible to experiencing health effects when a particular contaminant is inhaled. All the values are based on health effects, except the one for hydrogen sulphide, which is based on odour nuisance. They have been derived from epidemiological studies, international guidelines and, in some cases, laboratory research. The economic benefits and costs associated with achieving the values have not been taken into account. These must be considered when specific reduction strategies are developed (discussed further in section 3.3).

Potential health effects caused by inhaling contaminants range from relatively minor impacts, such as respiratory irritation, headaches and cough, to more serious health impacts, including asthma, cancer and advanced mortality in those already suffering serious illness. The following sections contain only brief descriptions of the human health effects of each contaminant (as opposed to the results of animal or laboratory research) and limited references. The reader is strongly advised to seek more detailed information and references in Chiodo and Rolfe (2000) and Denison et al. (2000).

The new contaminants (also referred to as 'hazardous air pollutants') were selected by prioritising those that are of greatest concern, are most likely to exist in New Zealand, and that should be monitored, assessed and, where necessary, reduced. The ranking method considered each contaminant's hazard to human health, toxicity, likelihood of being discharged, potential to cause public exposure, and ultimate fate in the environment (Chiodo and Rolfe, 2000). In most cases the guideline value is based on the 'no observable adverse effect level' or 'lowest observable adverse effect level' of the contaminant, as determined through research studies. A safety factor may also be applied. Where research has been unable to determine such a threshold, a judgement has been made as to what constitutes an 'acceptable' health risk, taking into account the level of uncertainty in our understanding of the health effects caused by the contaminant. Given these different considerations, the result is inevitably a range of risk values, which are specified in Appendix 4.

Fluoride guideline values are now covered under Chapter 4 on ecosystem protection.

Table 1: Guideline values and the key health effects

Contaminant	Guideline values[a]		Key health effects
	Value	Averaging time	
Carbon monoxide	30 mg/m^3 10 mg/m^3	1-hour 8-hour	Reduced birth weight (non-smoking mothers), decreased work capacity, increased duration of angina (for those with ischaemic heart disease), decrease in visual perception, decreased manual dexterity, and decreased ability to learn.
Fine particles (PM_{10})	**50 µg/m^3** **20 µg/m^3**	24-hour Annual	Mortality, morbidity, hospitalisation, work-affected days, increased use of medication. There is no evidence of a threshold below which adverse health effects will not be observed.
Nitrogen dioxide	**200 µg/m^3** 100 µg/m^3	1-hour 24-hour	Apparent contribution to morbidity and mortality, especially in susceptible subgroups, including young children, asthmatics and those with chronic inflammatory airway disease.
Sulphur dioxide[b]	350 µg/m^3 **120 µg/m^3**	1-hour 24-hour	Daily mortality, hospital admissions and emergency room attendances for respiratory and cardiovascular disease, increases in respiratory symptoms and decreases in lung function.
Ozone	150 µg/m^3 100 µg/m^3	1-hour 8-hour	Increased daily mortality, respiratory and cardiovascular disease; decreases in lung function; increases in hospitalisations, and in respiratory illnesses such as cough, phlegm and wheeze.
Hydrogen sulphide[c]	7 µg/m^3	1-hour	Nuisance and unpleasant odour – sensitivity is reduced through continuous exposure. Higher concentrations lead to eye irritation, eye damage, and over-stimulation of the nervous system, causing rapid breathing, cessation of breathing, convulsions and unconsciousness.
Lead[d]	**0.2 µg/m^3**	3-month moving average, calculated monthly	At low levels: impairment of hearing, effects on intelligence, effects on CNS, reductions in nerve condition.
Benzene (year 2002) Benzene (year 2010)	**10 µg/m^3** **3.6 µg/m^3**	Annual Annual	Decreased white blood cell counts, genotoxic and carcinogenic (group 1 carcinogen). Short-term exposure to high levels causes drowsiness, dizziness, headaches and unconsciousness.
1,3-Butadiene	**2.4 µg/m^3**	Annual	Carcinogenic effects on humans. Acute exposure causes: irritation of eyes, throat, lungs and nasal passages; blurred vision; fatigue; headache and vertigo.
Formaldehyde	**100 µg/m^3**	30 minutes	Eye, nose and throat irritation; coughing, wheezing, chest pains and bronchitis.
Acetaldehyde	**30 µg/m^3**	Annual	Odour; eye, nose and throat irritation; coughing. Carcinogen of low potency.
Benzo(a)pyrene	**0.0003 µg/m^3**	Annual	At high levels: dermatitis, photosensitisation, eye irritation and cataracts. Animal studies note effects on blood and liver. Potential increases in lung cancer.
Mercury (inorganic)[d] Mercury (organic)	**0.33 µg/m^3** **0.13 µg/m^3**	Annual Annual	CNS effects such as hallucinations, delirium and suicidal tendencies; gastrointestinal effects, and respiratory effects such as chest pains, cough, pulmonary function impairment.
Chromium VI[d] Chromium metal and chromium III[d]	**0.0011 µg/m^3** **0.11 µg/m^3**	Annual Annual	High levels cause coughing and wheezing and gastrointestinal and neurological effects; chronic inhalation causes effects on the respiratory tract, such as bronchitis, pneumonia, asthma and nasal itching; and potentially effects on the liver, kidney, and gastrointestinal and immune systems.
Arsenic (inorganic)[d] Arsine[d]	**0.0055 µg/m^3** **0.055 µg/m^3**	Annual Annual	May cause gastrointestinal effects, haemolysis, and CNS disorders. High levels lead to kidney failure.

Notes:

[a] All values apply to the gas measured at standard conditions of temperature (0º C) and pressure (1 atmosphere).

[b] The sulphur dioxide guideline values do not apply to sulphur acid mist.

[c] The hydrogen sulphide value is based on odour nuisance and may be unsuitable for use in geothermal areas.

[d] The guideline values for metals are for inhalation exposure only; they do not include exposure from other routes such as ingestion. These other routes should be considered in assessments where appropriate.

2.2 Carbon monoxide

2.2.1 Guideline values

The guideline values are 30 mg/m³ (1-hour average) and

10 mg/m³ (8-hour average).

The guideline values aim to ensure that nobody will be exposed to levels of ambient carbon monoxide (CO) that would result in blood carboxyhaemoglobin (COHb) levels greater than 2.5%, at any level of physical activity. They are set to protect the more susceptible population sub-groups, including those with ischaemic heart disease, other forms of cardiac disease (including cyanotic heart disease), hypoxaemic lung disease, cerebrovascular disease, peripheral vascular disease, those with anaemia and haemoglobin abnormalities, children, and developing foetuses.

2.2.2 Health effects

When inhaled, CO combines with haemoglobin (Hb), the blood's oxygen-carrying protein, to form COHb. In this state the Hb is unable to carry oxygen (O2). It takes about 4 to 12 hours for CO concentrations in the blood to reach equilibrium with the CO concentration in air, so any fluctuations in the ambient CO concentrations are only slowly reflected in the COHb levels in humans.

High exposures to CO can cause acute poisoning, with coma and collapse occurring at COHb levels of over 40%. Ambient exposures to CO are several orders of magnitude lower than those associated with acute poisoning. However, some exposures in urban settings have been shown to adversely affect the heart, brain and central nervous system.

Adverse cardiovascular effects of CO inhalation include decreased O2 uptake and decreased work capacity. Those with angina may suffer decreased exercise capacity at onset of angina, and increased duration of angina. Adverse neurobehavioural effects of CO include a decrease in vigilance, visual perception, manual dexterity, ability to learn and perform complex sensorimotor tasks in healthy individuals, and reduced birth weight in non-smoking mothers.

Recent epidemiological studies have found effects in susceptible groups at levels lower than previously thought to be of concern. The Ministry therefore intends to review the CO guideline values within the next two years.

2.2.3 Description and sources

CO is a colourless, odourless and tasteless gas. It is a trace constituent of the atmosphere, with background levels normally ranging between 0.01 and 0.2 mg/m³. CO is formed from burning fuels, especially during incomplete combustion. It is produced both by natural processes (for example, from volcanoes) and by human activities (for example, the incomplete combustion of carbon-containing fuels, especially from motor vehicles). Industrial processes may also produce CO.

2.3 Particles (PM10 and PM2.5)

2.3.1 Guideline values

The PM10 guideline values are 50 µg/m³ (24-hour average) and 20 µg/m³ (annual average).

Research has been unable to determine a threshold for PM10 below which there are no adverse effects (WHO, 1999). Consequently, these guideline values are associated with a higher level of health risks than for many of the other contaminants. The values for PM10 are designed to be the first step in reducing the health effects caused by particles in areas where concentrations breach the guideline values. Where PM10 levels are within the guideline values, efforts should still be made to maintain and, where possible, further reduce levels (see also discussion in section 3.3).

The 1994 24-hour average guideline value of 120 µg/m³ is no longer appropriate given recent evidence of the acute (short-term) health effects of PM10, and the annual average value has been amended to take account of recent evidence of the chronic (long-term) health effects of PM10. The values are consistent with several current international guideline values and standards.

Recent research has shown that particles less than 2.5 microns in diameter (PM2.5) may responsible for specific health effects caused by fine particles. We therefore need to increase our understanding of PM2.5 in New Zealand and to promote monitoring and source assessments. A monitoring value of 25 µg/m³ (24-hour average) can be used for assessing monitoring results and to judge whether further investigations are needed to quantify PM2.5 sources. In suggesting this value, the Ministry aims to promote PM2.5 monitoring and assessment. It is premature to use PM2.5 as a target for air-shed management until further research can accurately determine its specific health effects and its sources. The Ministry will commence an investigation into PM2.5 in 2002 with the aim of establishing an appropriate guideline value by 2004.

2.3.2 Health effects

The major health effects from airborne particles are:

1. increased mortality
2. aggravation of existing respiratory and cardiovascular disease
3. hospital admissions and emergency department visits
4. school absences
5. lost work days
6. restricted activity days.

People most susceptible to the effects of particles include the elderly; those with existing respiratory disease such as asthma, chronic obstructive pulmonary disease and bronchitis; those with cardiovascular disease; those with infections such as pneumonia; and children. As discussed above, the results of epidemiological studies have provided no evidence for the existence of a threshold value below which no adverse health effects are observed.

2.3.3 Description and sources

Particles are diverse in their chemical and physical characteristics and can span several orders of magnitude in size. Particles derive from many sources, including motor vehicles (especially diesels), solid-fuel burning for domestic heating, industry, photochemical processes, and natural sources such as dust, pollens and sea spray.

2.4 Nitrogen dioxide

2.4.1 Guideline values

The nitrogen dioxide guideline values are 200 µg/m³ (1-hour average) and

100 µg/m³ (24-hour average).

The guideline values are based on a safety factor of 50% applied to the lowest observable adverse effect level in order to ensure adequate protection of the more vulnerable sub-groups in the population, including children, asthmatics of all ages (but especially children), and compromised adults with chronic respiratory and cardiac disorders. This value is consistent with the WHO guideline value of 200 µg/m³ (1-hour average) and the 1994 New Zealand 24-hour guideline value of 100 µg/m³.

2.4.2 Health effects

Exposure to nitrogen dioxide (NO2) has been shown to cause reversible effects on lung function and airway responsiveness. It may also increase reactivity to natural allergens. Inhalation of NO2 by children increases their risk of respiratory infection and may lead to poorer lung function in later life. Recent epidemiological studies have shown an association between ambient NO2 exposure and increases in daily mortality and hospital admissions for respiratory disease. NO2 has also been shown to potentiate the effects of exposure to other known irritants, such as ozone and respirable particles.

There is some evidence that acute exposure to NO2 may cause an increase in airway responsiveness in asthmatic individuals. This response has been observed only at relatively low NO2 concentrations, mostly in the range of 400–600 µg/m³. However, the findings of both clinical and epidemiological studies do not provide any clear quantitative conclusions about the health effects of short-term exposures to NO2. The adverse health effects at low levels of NO2 remain equivocal, with conflicting patterns of results obtained in both controlled exposure studies and in epidemiological studies. The contribution of NO2 as one of a mixture of pollutants in the ambient environment has yet to be clearly defined.

2.4.3 Description and sources

NO2 is a pungent, acidic gas. Corrosive and strongly oxidising, it is one of several oxides of nitrogen (NOx) that can be produced as a result of combustion processes. Combustion of fossil fuels converts atmospheric nitrogen and any nitrogen in the fuel into its oxides, mainly nitric oxide (NO) but with small amounts (5–10%) of NO2. NO slowly oxidises to NO2 in the atmosphere. This reaction is catalysed in the presence of O3. In the presence of sunlight, NOx, including NO2, react with volatile organic compounds to form photochemical smog.

The main source of NO2 resulting from human activities is the combustion of fossil fuels (coal, gas and oil). In cities, about 80% of ambient NO2 comes from motor vehicles. Other sources include the refining of petrol and metals, commercial manufacturing, and food manufacturing. Electricity generation using fossil fuels can also produce significant amounts.

2.5 Sulphur dioxide

2.5.1 Guideline values

The guideline values for sulphur dioxide are 350 µg/m³ (1-hour average) and 120 µg/m³ (24-hour average).

These values are set to provide protection of lung function and prevent other respiratory symptoms of vulnerable sub-groups in the population, including asthmatics and those with chronic obstructive lung disease. They are in line with current international guideline values and standards. The annual guideline value for sulphur dioxide is now discussed in Chapter 4 on ecosystem-based guidelines. The short-term guideline value has been removed, as it is not appropriate for managing air quality in large air sheds, however, shorter-term criteria for sulphur dioxide may be appropriate for assessing industrial discharges.

2.5.2 Health effects

Sulphur dioxide (SO2) is a potent respiratory irritant when inhaled. Asthmatics are particularly susceptible. SO2 acts directly on the upper airways (nose, throat, trachea and major bronchi), producing rapid responses within minutes. It achieves maximum effect in 10 to 15 minutes, particularly in individuals with significant airway reactivity, such as asthmatics and those suffering similar bronchospastic conditions.

The symptoms of SO2 inhalation may include wheezing, chest tightness, shortness of breath or coughing, which are related to reductions in ventilatory capacity (for example, reduction in forced expiratory volume in one second, or FEV1), and increased specific airway resistance. If exposure occurs during exercise, the observed response may be accentuated because of an increased breathing rate associated with exercise. A wide range of sensitivity is evident in both healthy individuals and more susceptible people, such as asthmatics, the latter being the most sensitive to irritants.

Epidemiological studies have shown significant associations between daily average SO2 levels and mortality from respiratory and cardiovascular causes. Increases in hospital admissions and emergency room visits for asthma, COPD and respiratory disease have also been associated with ambient SO2 levels. These associations were observed with up to a two-day lag period. Long-term exposure to SO2 and fine particle sulphates (SO4) has been associated with an increase in mortality from lung cancer and development of asthma and cardio-pulmonary obstructive disease. Increases in respiratory symptoms have also been associated with SO2 levels.

2.5.3 Description and sources

SO2 is a colourless, soluble gas with a characteristic pungent smell. It is mainly produced by the combustion of fossil fuels containing sulphur and some industrial processes.

The WHO indicated in their 2005 Revision of Guidelines that there is a basis for revising the 24-hour guideline for sulphur dioxide downwards, adopting a prudent precautionary approach. Since the recommended 24-hour guideline may be quite difficult for some countries to achieve in the short term, they suggest a stepped approach using interim goals, as shown in Table 2. An annual guideline is not needed, since compliance with the 24-hour level will assure low levels for the annual average.

Table 2. Sulfur dioxide air quality guidelines and interim targets to be achieved in improving air quality

	24-hour average	10-minute average
WHO interim target 1 (IT-1) (2000 guideline level)	125 µg/m^3	–
WHO interim target 2 (IT-2)	50 µg/m^3 Intermediate goal based on controlling either (*a*) motor vehicle (*b*) industrial emissions and/or (*c*) power production; this would be a reasonable and feasible goal to be achieved within a few years for some developing countries and lead to significant health improvements that would justify further improvements (such as aiming for the guideline).	–
WHO air quality guidelines	20 µg/m^3	500 µg/m^3

Intermediate goal based on controlling either

(a) motor vehicle

(b) industrial emissions and/or

(c) power production;

this would be a reasonable and feasible goal to be achieved within a few years for some developing countries and lead to significant health improvements that would justify further improvements (such as aiming for the guideline).

Table 7.1: Examples of existing NO_2, PM_{10} and CO concentration 'without project'

Area where estimate of background air quality is required	Pollutant	Value to assume	Justification for worst-case assumption, based on review of data to 2004 (extracted from various council monitoring reports and web site data in mid-2005)
An urban area with a significant wood- or coal- burning problem (eg, a gazetted airshed)	NO_2 1 hr	150 ($\mu g/m^3$)	10-year average of maxima, Packe Street, Christchurch = 124. 3-year average of maxima, Coles Place, Christchurch = 110. 1-year maximum, fire station, Nelson = 148. *Christchurch and Nelson represent the worst case for areas with significant domestic heating pollution.*
	PM_{10} 24 hr	100 ($\mu g/m^3$)	Christchurch, Nelson, Timaru, Masterton, Mosgiel, Arrowtown, Richmond and Kaiapoi have all recorded peaks of over 100 (the highest is 252 in Christchurch in 2002).
	CO 8 hr	8 (mg/m^3)	The highest values recorded in Christchurch have been slightly above 8.
Area with poor dispersion (eg, urban canyon) within 5 m of a busy intersection or congested area (with over 10,000 vehicles per day and/or wood or coal burning)	NO_2 1 hr	340 ($\mu g/m^3$)	4-year average of maxima Khyber Pass = 343. *Khyber Pass is a peak traffic monitoring data for NO_2 (traffic approx 30,000 vehicles/day, air quality monitoring < 5 m from roadside)*
	PM_{10} 24 hr	80 ($\mu g/m^3$)	Even smaller centres that have poor dispersion can record high values (Reefton 55, Nelson 165, Wainuiomata 57, Upper Hutt 60).
	CO 8 hr	10 (mg/m^3)	The highest values recorded in Auckland have been slightly above 10.
Area within 20 m of vehicle routes of over 10,000 per day, or within 100 m of a motorway	NO_2 1 hr	140 ($\mu g/m^3$)	10-year average of maxima, Auckland Penrose = 139. 2-year average of maxima, Peachgrove Road, Hamilton = 133. *Penrose and Peachgrove Road have the highest maximum NO_2 levels of all data reviewed except for Khyber Pass.*
	PM_{10} 24 hr	70 ($\mu g/m^3$)	There are not many sites in this category with monitoring results, but Auckland's Khyber Pass has recorded 81, almost certainly largely due to traffic.
	CO 8 hr	5 (mg/m^3)	4-year average of maxima, Peachgrove Road, Hamilton = 4.75. Maxima at peak traffic sites in Rotorua and Tauranga are also less than 5.
Urban area that doesn't have significant wood-burning problem and no vehicle routes of over 10,000 vehicles per day within 20 m, or motorways within 100 m	NO_2 1 hr	50 ($\mu g/m^3$)	Hastings, less than 1 year of data, maximum = 36. Napier, less than 1 year of data, maximum = 66. Wellington, all sites, all years, maximum = 53. *These sites have some traffic influence, so represent a worst-case assumption for urban areas without significant traffic.*
	PM_{10} 24 hr	40 ($\mu g/m^3$)	Residential neighbourhood monitoring sites in Hawke's Bay and Bay of Plenty have recorded occasional exceedances of the PM_{10} standard, although averages of maxima taken over several years tend to be lower than 40.
	CO 8 hr	2 (mg/m^3)	Maximum concentrations measured at neighbourhood sites in Upper Hutt, Lower Hutt and Masterton are typically 2 or less.
Rural area, or urban area that is very open with low population density	NO_2 1 hr	15 ($\mu g/m^3$)	Masterton 2-year average of maxima = 13.5. *There are no results available from rural monitoring sites. Masterton is the lowest result for a 'residential neighbourhood' site, so this is a worst-case assumption for a rural area.*
	PM_{10} 24 hr	15 ($\mu g/m^3$)	This is a typical maximum concentration when no obvious sources occur upwind.
	CO 8 hr	0 (mg/m^3)	With no local sources, CO concentrations are generally very low, and can be taken as effectively zero.

Good Practice Guide for Assessing Discharges to Air from Industry

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World Health Organisation — Global Update 2005

Air Quality Guidelines for Particulate matter, ozone, nitrogen dioxide and sulphur dioxide

Appendix 5
Dispersion Modelling Files

```
Ausplume 6.0 version input data file for PM-10
************************************************************
* WARNING - WARNING - WARNING - WARNING - WARNING - WARNING *
*                                                          *
* This is a generated file. Please do not edit it manually. *
* If  editing  is  required, under any circumstances do not *
* edit information enclosed in curly braces.  Corruption of *
* this information or changed order of data blocks enclosed *
* in curly braces may render the file unusable.             *
*                                                          *
************************************************************

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Terrain influence tag, 0-ignore, 1 - include
{0}
Egan coefficients
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Total number of sources (Stack + Area + Volume sources)
{5}
Source Group information
Total Number of Sources in Group 1
{5}
Sources in Source Group 1
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Total number of buildings
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Y coordinates
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Height, Number of sides
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Y coordinates
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Y coordinates
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Stack height and diameter
{45 1.05 }
Stack temperature, Velocity, Cross, Height
{473 23 -1 -1 }
Emission type (1-constant, 2-monthly, 3-hours of the day, 4-wind and stability, 5-hour and
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Monthly emission rate
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Building width
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47.14354 51.50467 54.30087 33.12442 30.60187 30.43225 34.99783 26.10001 29.5585 32.11884
33.70328 34.26366 42.68188 34.4703 27.88156 29.70694 34.30001 41.34999 47.14354 51.50468
54.30087 33.12439 30.60187 30.43225 34.99783 26.10001 }
Building height
{25 25 25 25 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 25 25 25 25 25 25 25 25 25 34.5 34.5
34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 25 25 25 25 25 }
Building BPIP parameter1
{-31.835 -27.20271 -21.74391 -15.6244 18.76694 25.86328 30.4046 31.12512 30.89999 29.73596
27.66843 24.76016 21.09961 5.281219 7.511936 7.728624 4.53318 1.199997 -2.169647 -5.473373 -
8.610794 -11.48657 -74.21411 -80.772 -85.93045 -52.50388 -91.70001 -90.42844 -86.40921 -
79.76454 -70.69621 -42.89808 -41.31115 -39.51545 -38.08633 -35.49999 }
Building BPIP parameter2
{-21.54443 -23.78425 -25.30138 -26.04976 -38.1389 -29.22105 -19.75547 -12.57621 -3.349991
7.727562 18.57032 28.84885 38.25081 -2.548874 0.813385 4.516785 8.614273 18.65001 21.54445
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27.11095 55.44717 54.90872 55.52585 21.37872 60.80002 60.69247 58.7408 55.00436 49.5966
37.61685 33.79921 31.78683 33.55316 34.3 }

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Stack height and diameter
{25 1.05 }
Stack temperature, Velocity, Cross, Height
{343 22.4 -1 -1 }
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{0.15 0.15 0.15 0.15 0.15 0 0 0.15 0.15 0.15 0.15 0.15 }
Building width
{29.55847 32.11882 33.70326 34.26364 33.78295 34.47033 27.88157 29.70694 34.3 41.34996
47.14354 51.50467 54.30087 55.44714 54.90872 55.52585 34.99783 26.10001 29.5585 32.11884
33.70328 34.26366 33.78294 34.4703 27.88156 29.70694 34.30001 41.34999 47.14354 51.50468
54.30087 55.44717 54.90869 55.52585 34.99783 26.10001 }
Building height
```

{25 25 25 25 25 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 25 25 25 25 25 25 25
34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 25 25 }

Building BPIP parameter1

{-44.89083 -41.61766 -37.07999 -31.41563 -24.79675 10.6004 16.10916 18.23154 19.79999 20.76682
21.10266 20.79729 19.86002 18.31931 16.22197 12.63677 13.73401 12.49999 10.88617 8.941589
6.725296 4.304688 1.753265 -65.50912 -71.63501 -39.61029 -80.60001 -81.45929 -79.84344 -
75.80165 -69.45662 -61.00118 -50.69226 -40.51832 -47.28717 -46.8 }

Building BPIP parameter2

{-12.57529 -17.21847 -21.33849 -24.81015 -27.52797 -33.45714 -26.57756 -21.77704 -14.64999 -
5.328255 4.155373 13.51276 22.45955 30.72391 38.05473 43.87209 -4.279343 7.550003 12.5753
17.21848 21.3385 24.81016 27.52797 33.45712 26.57755 21.77703 14.64997 5.328239 -4.155388 -
13.51276 -22.45955 -30.72392 -38.05478 -43.87209 4.279312 -7.550003 }

Building BPIP parameter3

{34.00465 32.67609 30.35468 27.11095 23.04349 54.90872 55.52582 21.37872 60.80002 60.69247
58.74081 55.00435 49.5966 42.68191 34.47032 27.88156 33.55316 34.3 34.00465 32.67609 30.35468
27.11095 23.04346 54.90872 55.52585 21.37872 60.80002 60.69247 58.7408 55.00436 49.5966
42.68188 34.47029 27.88156 33.55316 34.3 }

Source ID, Source Type (1 - stack, 2 - area, 3- volume) and X, Y, Z coordinates

{Dryer2 1 323 83.8 0 }

Stack height and diameter

{45 2.25 }

Stack temperature, Velocity, Cross, Height

{343 14.3 -1 -1 }

Emission type (1-constant, 2-monthly, 3-hours of the day, 4-wind and stability, 5-hour and
season, 6-temperarture), Number of particle fractions

{2 0 }

Monthly emission rate

{0.43 0.43 0.43 0.43 0.43 0 0 0.43 0.43 0.43 0.43 0.43 }

Building width

{60.69247 58.74081 55.00435 49.59662 42.68191 34.47033 27.88157 29.70694 34.3 41.34996
47.14354 51.50467 54.30087 55.44714 54.90872 55.52585 59.06018 60.80002 60.69247 58.74083
55.00435 49.5966 42.68188 34.4703 27.88156 29.70694 34.30001 41.34999 47.14354 51.50468
54.30087 55.44717 54.90869 55.52585 59.06018 60.80002 }

Building height

{34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5
34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 }

Building BPIP parameter1

{-2.212723 -2.358215 -2.432053 -2.431976 -2.358032 -2.212433 -3.768799 -8.107605 -12.20004 -
15.92175 -19.1597 -21.81554 -23.80847 -25.07801 -25.58558 -26.3107 -27.98043 -32.30001 -
39.13725 -44.78532 -49.07262 -51.8689 -53.08914 -52.69629 -51.75702 -13.27112 -48.59998 -
44.77069 -39.58109 -33.18884 -25.78813 -17.60387 -8.884712 -1.570852 -1.726509 -2.000008 }

Building BPIP parameter2

{-14.42451 -10.21071 -5.686653 -0.9898376 3.737072 8.350412 12.36991 13.12696 15.15 18.46226
21.21355 23.3203 24.71846 25.36554 25.24193 23.99413 21.42249 18.2 14.42448 10.2107 5.686653
0.98983 -3.737072 -8.35043 -12.36992 -13.12696 -15.15001 -18.46227 -21.21355 -23.32029 -
24.71843 -25.36555 -25.24191 -23.99409 -21.42252 -18.2 }

Building BPIP parameter3

{41.34996 47.14354 51.50467 54.30084 55.44714 54.90872 55.52582 21.37872 60.80002 60.69247
58.74081 55.00435 49.5966 42.68191 34.47032 27.88156 29.70695 34.30001 41.34998 47.14354
51.50467 54.30087 55.44717 54.90872 55.52585 21.37872 60.80002 60.69247 58.7408 55.00436
49.5966 42.68188 34.47029 27.88156 29.70695 34.30003 }

Source ID, Source Type (1 - stack, 2 - area, 3- volume) and X, Y, Z coordinates

{Dryer3 1 343.7 104 0 }

Stack height and diameter

{45 2 }

Stack temperature, Velocity, Cross, Height

{343 18.1 -1 -1 }

Emission type (1-constant, 2-monthly, 3-hours of the day, 4-wind and stability, 5-hour and
season, 6-temperarture), Number of particle fractions

{2 0 }

Monthly emission rate

{0.43 0.43 0.43 0.43 0.43 0 0 0.43 0.43 0.43 0.43 0.43 }

Building width

{60.69247 58.74081 55.00435 49.59662 42.68191 34.47033 27.88157 29.70694 34.3 41.34996
47.14354 51.50467 54.30087 55.44714 54.90872 55.52585 59.06018 60.80002 60.69247 58.74083
55.00435 49.5966 42.68188 34.4703 27.88156 29.70694 34.30001 41.34999 47.14354 51.50468
54.30087 55.44717 54.90869 55.52585 59.06018 60.80002 }

Building height

{34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5
34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 }

Building BPIP parameter1

{-25.70035 -28.41983 -30.27576 -31.21179 -31.19946 -30.23917 -30.12924 -32.00082 -32.90002 -
32.79959 -31.70255 -29.64226 -26.68129 -22.90963 -18.44186 -14.40872 -11.68183 -12.10001 -
15.64961 -18.72372 -21.22891 -23.08908 -24.24768 -24.66956 -25.39658 10.62207 -27.89999 -
27.89288 -27.03824 -25.36211 -22.91531 -19.77226 -16.02844 -13.47284 -18.02512 -22.20001 }

Building BPIP parameter2

{2.453354 2.332138 2.140083 1.88298 1.568676 1.206705 0.4679441 -3.171639 -5.049995 -5.025368
-4.848061 -4.523422 -4.061356 -3.475891 -2.784805 -2.366348 -2.470734 -2.500015 -2.453354 -
2.332146 -2.140068 -1.882973 -1.568676 -1.206707 -0.4679413 3.171644 5.049999 5.025368
4.848061 4.52343 4.061356 3.475876 2.784821 2.366348 2.470703 2.500015 }

Building BPIP parameter3

{41.34996 47.14354 51.50467 54.30084 55.44714 54.90872 55.52582 21.37872 60.80002 60.69247
58.74081 55.00435 49.5966 42.68191 34.47032 27.88156 29.70695 34.30001 41.34998 47.14354
51.50467 54.30087 55.44717 54.90872 55.52585 21.37872 60.80002 60.69247 58.7408 55.00436
49.5966 42.68188 34.47029 27.88156 29.70695 34.30003 }

Source ID, Source Type (1 - stack, 2 - area, 3- volume) and X, Y, Z coordinates

{Stack2 1 306.8 64.7 0 }

Stack height and diameter

{45 1.1 }

Stack temperature, Velocity, Cross, Height

{473 21.3 -1 -1 }

Emission type (1-constant, 2-monthly, 3-hours of the day, 4-wind and stability, 5-hour and
season, 6-temperarture), Number of particle fractions

{1 0 }

Constant emission rate

{0.49}

Building width

{60.69247 58.74081 55.00435 49.59662 42.68191 34.47033 27.88157 29.70694 34.3 34.00465
32.67609 30.35466 27.11095 33.12442 30.60187 30.43225 59.06018 60.80002 60.69247 58.74083
55.00435 49.5966 42.68188 34.4703 27.88156 29.70694 34.30001 34.00465 32.67609 30.35468
27.11093 33.12439 30.60187 30.43225 59.06018 60.80002 }

Building height

{34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 34.5 25 25 25 25 25 25 25 34.5 34.5 34.5 34.5 34.5
34.5 34.5 34.5 34.5 34.5 34.5 25 25 25 25 25 25 25 34.5 34.5 }

Building BPIP parameter1

{19.41022 21.13065 22.20905 22.61264 22.32916 21.36719 17.98682 11.16296 3.999969 -26.25531 -
30.41286 -33.64635 -35.85748 -40.81303 -38.50062 -36.80416 -43.97717 -51.40002 -60.76019 -
68.2742 -73.71371 -76.91351 -77.77631 -76.27591 -73.51263 -32.54172 -64.79999 -3.303162 -
1.705963 -0.05693054 1.593842 3.196182 4.701408 5.01733 14.27024 17.10001 }

Building BPIP parameter2

{-27.06172 -18.90114 -10.16627 -1.122513 7.955349 16.79151 24.77732 29.1237 34.25001 17.52496
15.26743 12.546 9.443367 1.013351 -3.682709 -7.901001 40.69305 34.40001 27.06169 18.90113
10.16627 1.122505 -7.955379 -16.79152 -24.77734 -29.1237 -34.25002 -17.52496 -15.26743 -
12.54599 -9.443359 -1.013336 3.682739 7.901031 -40.69308 -34.39998 }

Building BPIP parameter3

{41.34996 47.14354 51.50467 54.30084 55.44714 54.90872 55.52582 21.37872 60.80002 29.55847
32.11882 33.70328 34.26364 37.61687 33.79922 31.78682 29.70695 34.30001 41.34998 47.14354
51.50467 54.30087 55.44717 54.90872 55.52585 21.37872 60.80002 29.55847 32.11884 33.70328
34.26366 37.61685 33.79921 31.78683 29.70695 34.30003 }

Receptor information

Discrete receptors

Receptor coordinates type (1-Cartesian,0-Polar),Number of Receptors

{1 1 }

X, Y coordinates and Elevation

{655 108 0 }

Gridded receptors

Receptor coordinates type (1-Cartesian, 0-Polar), Number of X and Y coordinates, Receptor
height

{1 101 101 0 }

X grid coordinates

{-2000 -1950 -1900 -1850 -1800 -1750 -1700 -1650 -1600 -1550 -1500 -1450 -1400 -1350 -1300 -1250 -1200 -1150 -1100 -1050 -1000 -950 -900 -850 -800 -750 -700 -650 -600 -550 -500 -450 -400 -350 -300 -250 -200 -150 -100 -50 0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050 1100 1150 1200 1250 1300 1350 1400 1450 1500 1550 1600 1650 1700 1750 1800 1850 1900 1950 2000 2050 2100 2150 2200 2250 2300 2350 2400 2450 2500 2550 2600 2650 2700 2750 2800 2850 2900 2950 3000 }

Y grid coordinates

{-2000 -1950 -1900 -1850 -1800 -1750 -1700 -1650 -1600 -1550 -1500 -1450 -1400 -1350 -1300 -1250 -1200 -1150 -1100 -1050 -1000 -950 -900 -850 -800 -750 -700 -650 -600 -550 -500 -450 -400 -350 -300 -250 -200 -150 -100 -50 0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050 1100 1150 1200 1250 1300 1350 1400 1450 1500 1550 1600 1650 1700 1750 1800 1850 1900 1950 2000 2050 2100 2150 2200 2250 2300 2350 2400 2450 2500 2550 2600 2650 2700 2750 2800 2850 2900 2950 3000 }

Model settings and parameters

Emission conversion factor, Averaging Time

{1000000 0 }

Land use (surface roughness)

{0.4}

Averaging time flags (1,2,3,4,6,8,12,24 hrs, 7, 90 days, 3 month, All hrs

{1 0 0 0 0 0 0 1 0 0 0 0 }

Statistical output options

{7 0 }

Output options (All meteodata, Every concentration/deposition, Highest/2nd highest, 100 worst case table, Save all calculations

{0 0 0 1 1 0 }

Write concentration (1-yes, 0-no), Concentration rank, Write frequency, Frequency Level

{1 2 0 -1 }

Disregard exponents (1-yes, 0-no), Exponent Scheme (1-Irvin urban, 2-Irvin rural, 3-ISCST, 4-User Defined

{1 2 }

Dispersion exponents

{0.15 0.15 0.15 0.15 0.15 0.15 0.15 0.15 0.15 0.15 0.15 0.15 0.2 0.2 0.2 0.2 0.2 0.2 0.25 0.25 0.25 0.25 0.25 0.25 0.4 0.4 0.4 0.4 0.4 0.4 0.6 0.6 0.6 0.6 0.6 0.6 }

Building wake effects (1-include,0-not) , Default decay coefficient, Anemometr height, Sigma-theta averaging period, Roughness at vane site, Smooth stability changes, ConvectivePDF)

{1 0 10 60 0.3 0 0 }

Deposition options, Depletion options

{False False False False False False }

Stability class adjustments (0-None, 1-Urban1, 2-Urban2)

{0}

Building wake algorithms (1-Huber-Sneider, 2-Hybrid, 3-Schulman-Scire)

{4}

Gradual plume rise (1-yes,0-no), Stack tip downwash (1-yes,0-no), Disregard Temperature Gradient (1-yes,0-no), Partial Penetration, Temp Gradient, Adiabatic Entrainment, Stable Entrainment

{1 1 0 0 0.004 0.6 0.6 }

Temperature Gradients for Wind and Stability categories

{0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.02 0.02 0.02 0.02 0.02 0.02 0.035 0.035 0.035 0.035 0.035 0.035 }

Dispersion curves (1-Pasquill Gifford, 2- Briggs rural, 3-Sigma theta) horizontal < 100 m, ditto vertical < 100 m, ditto horizontal > 100 m, ditto vertical > 100 m

{1 1 1 1 }

Adjust PG curves for roughness - Horizontal, Vertical (1-yes,0-no)

{1 1 }

Enhance plume for buyoancy - Horizontal, Vertical (1-yes,0-no)

{1 1 }

Adjust for wind direction shear

{1}

Shear rates

{0.005 0.01 0.015 0.02 0.025 0.035 }

Wind Speed categories

{1.54 3.09 5.14 8.23 10.8 }

Output file

{'C:\Ausplume\Ausplume data\Waharoa 2016\PM-all-B.txt'}

Meteorological file

{'C:\Ausplume\Ausplume data\Waharoa\HAML96B.met'}

```
Concentration file
{'C:\Ausplume\Ausplume data\Waharoa 2016\PM-all-B.dat'}
Save All file
{'C:\Ausplume\Ausplume data\Waharoa 2016\PM-all-B.cal'}

                        OCD  Waharoa - 2016  1 PM-10

 Concentration or deposition                          Concentration
 Emission rate units                                  grams/second
 Concentration units                                  microgram/m3
 Units conversion factor                              1.00E+06
 Constant background concentration                            0.00E+00
 Terrain effects                                      None
 Smooth stability class changes?                      No
 Other stability class adjustments ("urban modes")    None
 Ignore building wake effects?                        No
 Decay coefficient (unless overridden by met. file)   0.000
 Anemometer height                                    10 m
 Roughness height at the wind vane site               0.300 m
 Use the convective PDF algorithm?                    No

                   DISPERSION CURVES
 Horizontal dispersion curves for sources <100m high  Pasquill-Gifford
 Vertical  dispersion  curves for sources <100m high  Pasquill-Gifford
 Horizontal dispersion curves for sources >100m high  Pasquill-Gifford
 Vertical  dispersion  curves for sources >100m high  Pasquill-Gifford
 Enhance horizontal plume spreads for buoyancy?       Yes
 Enhance  vertical  plume spreads for buoyancy?       Yes
 Adjust horizontal P-G formulae for roughness height? Yes
 Adjust  vertical  P-G formulae for roughness height? Yes
 Roughness height                                     0.400m

 Horizontal plume spreads will be adjusted taking into account
 the default wind directional shear values.

                    PLUME RISE OPTIONS
 Gradual plume rise?                                  Yes
 Stack-tip downwash included?                         Yes
 Building downwash algorithm:                        PRIME method.
 Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
 Partial penetration of elevated inversions?          No
 Disregard temp. gradients in the hourly met. file?   No

 and in the absence of boundary-layer potential temperature gradients
 given by the hourly met. file, a value from the following table
 (in K/m) is used:

    Wind Speed               Stability Class
     Category       A      B      C      D      E      F
   ------------------------------------------------------
        1         0.000  0.000  0.000  0.000  0.020  0.035
        2         0.000  0.000  0.000  0.000  0.020  0.035
        3         0.000  0.000  0.000  0.000  0.020  0.035
        4         0.000  0.000  0.000  0.000  0.020  0.035
        5         0.000  0.000  0.000  0.000  0.020  0.035
        6         0.000  0.000  0.000  0.000  0.020  0.035

 WIND SPEED CATEGORIES
 Boundaries between categories (in m/s) are:  1.54,  3.09,  5.14,  8.23, 10.80

 WIND PROFILE EXPONENTS: "Irwin Rural" values (hourly met. file values IGNORED)

 AVERAGING TIMES
```

1 hour
24 hours

SOURCE CHARACTERISTICS

STACK SOURCE: STACK1

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
280	102	0m	45m	1.05m	200C	23.0m/s

Effective building dimensions (in metres)

Flow direction	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°
Effective building width	30	32	34	34	43	34	28	30	34	41	47	52
Effective building height	25	25	25	25	35	35	35	35	35	35	35	35
Along-flow building length	34	33	30	27	55	55	56	21	61	61	59	55
Along-flow distance from stack	-32	-27	-22	-16	19	26	30	31	31	30	28	25
Across-flow distance from stack	-22	-24	-25	-26	-38	-29	-20	-13	-3	8	19	29

Flow direction	130°	140°	150°	160°	170°	180°	190°	200°	210°	220°	230°	240°
Effective building width	54	33	31	30	35	26	30	32	34	34	43	34
Effective building height	35	25	25	25	25	25	25	25	25	25	35	35
Along-flow building length	50	38	34	32	34	34	34	33	30	27	55	55
Along-flow distance from stack	21	5	8	8	5	1	-2	-5	-9	-11	-74	-81
Across-flow distance from stack	38	-3	1	5	9	19	22	24	25	26	38	29

Flow direction	250°	260°	270°	280°	290°	300°	310°	320°	330°	340°	350°	360°
Effective building width	28	30	34	41	47	52	54	33	31	30	35	26
Effective building height	35	35	35	35	35	35	35	25	25	25	25	25
Along-flow building length	56	21	61	61	59	55	50	38	34	32	34	34
Along-flow distance from stack	-86	-53	-92	-90	-86	-80	-71	-43	-41	-40	-38	-35
Across-flow distance from stack	20	13	3	-8	-19	-29	-38	3	-1	-5	-9	-19

Emission rates by month in grams/second:

Jan 2.60E+00	Feb 2.60E+00	Mar 2.60E+00	Apr 2.60E+00
May 2.60E+00	Jun 0.00E+00	Jul 0.00E+00	Aug 2.60E+00
Sep 2.60E+00	Oct 2.60E+00	Nov 2.60E+00	Dec 2.60E+00

No gravitational settling or scavenging.

STACK SOURCE: DRYER1

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
291	114	0m	25m	1.05m	70C	22.4m/s

Effective building dimensions (in metres)

Flow direction	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°
Effective building width	30	32	34	34	34	34	28	30	34	41	47	52
Effective building height	25	25	25	25	25	35	35	35	35	35	35	35
Along-flow building length	34	33	30	27	23	55	56	21	61	61	59	55
Along-flow distance from stack	-45	-42	-37	-31	-25	11	16	18	20	21	21	21
Across-flow distance from stack	-13	-17	-21	-25	-28	-33	-27	-22	-15	-5	4	14

Flow direction	130°	140°	150°	160°	170°	180°	190°	200°	210°	220°	230°	240°
Effective building width	54	55	55	56	35	26	30	32	34	34	34	34
Effective building height	35	35	35	35	25	25	25	25	25	25	25	35
Along-flow building length	50	43	34	28	34	34	34	33	30	27	23	55
Along-flow distance from stack	20	18	16	13	14	12	11	9	7	4	2	-66
Across-flow distance from stack	22	31	38	44	-4	8	13	17	21	25	28	33

Flow direction	250°	260°	270°	280°	290°	300°	310°	320°	330°	340°	350°	360°
Effective building width	28	30	34	41	47	52	54	55	55	56	35	26

Effective building height	35	35	35	35	35	35	35	35	35	35	25	25
Along-flow building length	56	21	61	61	59	55	50	43	34	28	34	34
Along-flow distance from stack	-72	-40	-81	-81	-80	-76	-69	-61	-51	-41	-47	-47
Across-flow distance from stack	27	22	15	5	-4	-14	-22	-31	-38	-44	4	-8

Emission rates by month in grams/second:

Jan 1.50E-01	Feb 1.50E-01	Mar 1.50E-01	Apr 1.50E-01
May 1.50E-01	Jun 0.00E+00	Jul 0.00E+00	Aug 1.50E-01
Sep 1.50E-01	Oct 1.50E-01	Nov 1.50E-01	Dec 1.50E-01

No gravitational settling or scavenging.

STACK SOURCE: DRYER2

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
323	84	0m	45m	2.25m	70C	14.3m/s

Effective building dimensions (in metres)

Flow direction	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°
Effective building width	61	59	55	50	43	34	28	30	34	41	47	52
Effective building height	35	35	35	35	35	35	35	35	35	35	35	35
Along-flow building length	41	47	52	54	55	55	56	21	61	61	59	55
Along-flow distance from stack	-2	-2	-2	-2	-2	-2	-4	-8	-12	-16	-19	-22
Across-flow distance from stack	-14	-10	-6	-1	4	8	12	13	15	18	21	23

Flow direction	130°	140°	150°	160°	170°	180°	190°	200°	210°	220°	230°	240°
Effective building width	54	55	55	56	59	61	61	59	55	50	43	34
Effective building height	35	35	35	35	35	35	35	35	35	35	35	35
Along-flow building length	50	43	34	28	30	34	41	47	52	54	55	55
Along-flow distance from stack	-24	-25	-26	-26	-28	-32	-39	-45	-49	-52	-53	-53
Across-flow distance from stack	25	25	25	24	21	18	14	10	6	1	-4	-8

Flow direction	250°	260°	270°	280°	290°	300°	310°	320°	330°	340°	350°	360°
Effective building width	28	30	34	41	47	52	54	55	55	56	59	61
Effective building height	35	35	35	35	35	35	35	35	35	35	35	35
Along-flow building length	56	21	61	61	59	55	50	43	34	28	30	34
Along-flow distance from stack	-52	-13	-49	-45	-40	-33	-26	-18	-9	-2	-2	-2
Across-flow distance from stack	-12	-13	-15	-18	-21	-23	-25	-25	-25	-24	-21	-18

Emission rates by month in grams/second:

Jan 4.30E-01	Feb 4.30E-01	Mar 4.30E-01	Apr 4.30E-01
May 4.30E-01	Jun 0.00E+00	Jul 0.00E+00	Aug 4.30E-01
Sep 4.30E-01	Oct 4.30E-01	Nov 4.30E-01	Dec 4.30E-01

No gravitational settling or scavenging.

STACK SOURCE: DRYER3

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
344	104	0m	45m	2.00m	70C	18.1m/s

Effective building dimensions (in metres)

Flow direction	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°
Effective building width	61	59	55	50	43	34	28	30	34	41	47	52
Effective building height	35	35	35	35	35	35	35	35	35	35	35	35
Along-flow building length	41	47	52	54	55	55	56	21	61	61	59	55
Along-flow distance from stack	-26	-28	-30	-31	-31	-30	-30	-32	-33	-33	-32	-30
Across-flow distance from stack	2	2	2	2	2	1	0	-3	-5	-5	-5	-5

Flow direction	130°	140°	150°	160°	170°	180°	190°	200°	210°	220°	230°	240°

Effective building width	54	55	55	56	59	61	61	59	55	50	43	34
Effective building height	35	35	35	35	35	35	35	35	35	35	35	35
Along-flow building length	50	43	34	28	30	34	41	47	52	54	55	55
Along-flow distance from stack	-27	-23	-18	-14	-12	-12	-16	-19	-21	-23	-24	-25
Across-flow distance from stack	-4	-3	-3	-2	-2	-3	-2	-2	-2	-2	-2	-1

Flow direction	250°	260°	270°	280°	290°	300°	310°	320°	330°	340°	350°	360°
Effective building width	28	30	34	41	47	52	54	55	55	56	59	61
Effective building height	35	35	35	35	35	35	35	35	35	35	35	35
Along-flow building length	56	21	61	61	59	55	50	43	34	28	30	34
Along-flow distance from stack	-25	11	-28	-28	-27	-25	-23	-20	-16	-13	-18	-22
Across-flow distance from stack	0	3	5	5	5	5	4	3	3	2	2	3

Emission rates by month in grams/second:

Jan 4.30E-01	Feb 4.30E-01	Mar 4.30E-01	Apr 4.30E-01
May 4.30E-01	Jun 0.00E+00	Jul 0.00E+00	Aug 4.30E-01
Sep 4.30E-01	Oct 4.30E-01	Nov 4.30E-01	Dec 4.30E-01

No gravitational settling or scavenging.

STACK SOURCE: STACK2

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
307	65	0m	45m	1.10m	200C	21.3m/s

Effective building dimensions (in metres)

Flow direction	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°
Effective building width	61	59	55	50	43	34	28	30	34	34	33	30
Effective building height	35	35	35	35	35	35	35	35	35	25	25	25
Along-flow building length	41	47	52	54	55	55	56	21	61	30	32	34
Along-flow distance from stack	19	21	22	23	22	21	18	11	4	-26	-30	-34
Across-flow distance from stack	-27	-19	-10	-1	8	17	25	29	34	18	15	13

Flow direction	130°	140°	150°	160°	170°	180°	190°	200°	210°	220°	230°	240°
Effective building width	27	33	31	30	59	61	61	59	55	50	43	34
Effective building height	25	25	25	25	35	35	35	35	35	35	35	35
Along-flow building length	34	38	34	32	30	34	41	47	52	54	55	55
Along-flow distance from stack	-36	-41	-39	-37	-44	-51	-61	-68	-74	-77	-78	-76
Across-flow distance from stack	9	1	-4	-8	41	34	27	19	10	1	-8	-17

Flow direction	250°	260°	270°	280°	290°	300°	310°	320°	330°	340°	350°	360°
Effective building width	28	30	34	34	33	30	27	33	31	30	59	61
Effective building height	35	35	35	25	25	25	25	25	25	25	35	35
Along-flow building length	56	21	61	30	32	34	34	38	34	32	30	34
Along-flow distance from stack	-74	-33	-65	-3	-2	0	2	3	5	5	14	17
Across-flow distance from stack	-25	-29	-34	-18	-15	-13	-9	-1	4	8	-41	-34

(Constant) emission rate = 4.90E-01 grams/second
No gravitational settling or scavenging.

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):

-2000.m	-1950.m	-1900.m	-1850.m	-1800.m	-1750.m	-1700.m
-1650.m	-1600.m	-1550.m	-1500.m	-1450.m	-1400.m	-1350.m
-1300.m	-1250.m	-1200.m	-1150.m	-1100.m	-1050.m	-1000.m
-950.m	-900.m	-850.m	-800.m	-750.m	-700.m	-650.m
-600.m	-550.m	-500.m	-450.m	-400.m	-350.m	-300.m
-250.m	-200.m	-150.m	-100.m	-50.m	0.m	50.m
100.m	150.m	200.m	250.m	300.m	350.m	400.m
450.m	500.m	550.m	600.m	650.m	700.m	750.m
800.m	850.m	900.m	950.m	1000.m	1050.m	1100.m
1150.m	1200.m	1250.m	1300.m	1350.m	1400.m	1450.m

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   1500.m    1550.m    1600.m    1650.m    1700.m    1750.m    1800.m
   1850.m    1900.m    1950.m    2000.m    2050.m    2100.m    2150.m
   2200.m    2250.m    2300.m    2350.m    2400.m    2450.m    2500.m
   2550.m    2600.m    2650.m    2700.m    2750.m    2800.m    2850.m
   2900.m    2950.m    3000.m

 and these y-values (or northings):
  -2000.m   -1950.m   -1900.m   -1850.m   -1800.m   -1750.m   -1700.m
  -1650.m   -1600.m   -1550.m   -1500.m   -1450.m   -1400.m   -1350.m
  -1300.m   -1250.m   -1200.m   -1150.m   -1100.m   -1050.m   -1000.m
   -950.m    -900.m    -850.m    -800.m    -750.m    -700.m    -650.m
   -600.m    -550.m    -500.m    -450.m    -400.m    -350.m    -300.m
   -250.m    -200.m    -150.m    -100.m     -50.m       0.m      50.m
    100.m     150.m     200.m     250.m     300.m     350.m     400.m
    450.m     500.m     550.m     600.m     650.m     700.m     750.m
    800.m     850.m     900.m     950.m    1000.m    1050.m    1100.m
   1150.m    1200.m    1250.m    1300.m    1350.m    1400.m    1450.m
   1500.m    1550.m    1600.m    1650.m    1700.m    1750.m    1800.m
   1850.m    1900.m    1950.m    2000.m    2050.m    2100.m    2150.m
   2200.m    2250.m    2300.m    2350.m    2400.m    2450.m    2500.m
   2550.m    2600.m    2650.m    2700.m    2750.m    2800.m    2850.m
   2900.m    2950.m    3000.m


 DISCRETE RECEPTOR LOCATIONS (in metres)

 No.     X       Y    ELEVN  HEIGHT       No.     X       Y    ELEVN  HEIGHT
  1     655     108     0.0    0.0

        METEOROLOGICAL DATA : Hamilton 1996 Net Radiation Mthd TJBrady

1           Peak values for the 100 worst cases  (in microgram/m3)
                  Averaging time = 1 hour

  Rank     Value   Time Recorded         Coordinates
                     hour,date        (* denotes polar)

     1   3.04E+01   17,06/03/96   (   -50,     350,    0.0)
     2   3.04E+01   14,30/12/96   (  -100,     200,    0.0)
     3   2.88E+01   14,29/11/96   (   400,     100,    0.0)
     4   2.87E+01   03,02/08/96   (   -50,      50,    0.0)
     5   2.85E+01   06,30/12/96   (   300,     100,    0.0)
     6   2.82E+01   23,30/05/96   (   850,    -200,    0.0)
     7   2.81E+01   11,25/09/96   (   300,     100,    0.0)
     8   2.78E+01   18,07/02/96   (   650,    -150,    0.0)
     9   2.77E+01   01,23/11/96   (   800,     -50,    0.0)
    10   2.77E+01   22,09/12/96   (   800,    -100,    0.0)
    11   2.77E+01   15,29/12/96   (   300,     100,    0.0)
    12   2.77E+01   22,13/08/96   (   900,    -150,    0.0)
    13   2.77E+01   12,20/01/96   (   300,     100,    0.0)
    14   2.75E+01   23,27/10/96   (   300,     100,    0.0)
    15   2.74E+01   15,28/10/96   (   300,     100,    0.0)
    16   2.74E+01   13,07/02/96   (   600,    -100,    0.0)
    17   2.74E+01   15,14/03/96   (   750,     -50,    0.0)
    18   2.74E+01   17,25/05/96   (   700,     -50,    0.0)
    19   2.74E+01   15,30/04/96   (   700,    -100,    0.0)
    20   2.73E+01   05,02/08/96   (  -100,       0,    0.0)
    21   2.73E+01   18,25/05/96   (   700,    -100,    0.0)
    22   2.73E+01   13,29/11/96   (   400,     100,    0.0)
    23   2.73E+01   08,30/12/96   (   300,     100,    0.0)
    24   2.73E+01   16,07/10/96   (   650,    -100,    0.0)
    25   2.72E+01   08,02/08/96   (   300,     100,    0.0)
    26   2.72E+01   15,07/10/96   (   750,    -100,    0.0)
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27   2.72E+01   24,21/12/96   (   900,    -100,    0.0)
28   2.72E+01   16,25/05/96   (   700,     -50,    0.0)
29   2.72E+01   16,03/04/96   (   650,       0,    0.0)
30   2.71E+01   02,04/12/96   (   800,    -250,    0.0)
31   2.71E+01   12,21/12/96   (   400,     100,    0.0)
32   2.71E+01   09,21/08/96   (   700,     -50,    0.0)
33   2.71E+01   11,15/11/96   (   700,    -150,    0.0)
34   2.71E+01   12,27/11/96   (   700,     -50,    0.0)
35   2.71E+01   09,15/11/96   (   700,     -50,    0.0)
36   2.71E+01   17,22/10/96   (   650,     -50,    0.0)
37   2.71E+01   21,25/05/96   (   850,    -250,    0.0)
38   2.71E+01   18,29/12/96   (   -50,      50,    0.0)
39   2.71E+01   14,07/02/96   (   650,    -150,    0.0)
40   2.71E+01   06,12/09/96   (   850,    -200,    0.0)
41   2.71E+01   13,03/04/96   (   650,    -150,    0.0)
42   2.71E+01   02,02/08/96   (   300,     100,    0.0)
43   2.70E+01   14,27/11/96   (   650,     -50,    0.0)
44   2.70E+01   13,25/05/96   (   700,    -150,    0.0)
45   2.70E+01   16,09/09/96   (   700,     -50,    0.0)
46   2.70E+01   17,05/08/96   (   650,       0,    0.0)
47   2.69E+01   20,10/12/96   (   850,     -50,    0.0)
48   2.69E+01   15,18/03/96   (   650,    -150,    0.0)
49   2.69E+01   09,25/09/96   (   300,     100,    0.0)
50   2.69E+01   01,17/03/96   (   900,    -100,    0.0)
51   2.69E+01   15,13/11/96   (   400,     100,    0.0)
52   2.69E+01   19,02/04/96   (   800,    -250,    0.0)
53   2.68E+01   16,22/10/96   (   650,     -50,    0.0)
54   2.68E+01   16,31/10/96   (   750,    -100,    0.0)
55   2.68E+01   06,20/02/96   (   900,    -100,    0.0)
56   2.68E+01   05,12/11/96   (   750,    -100,    0.0)
57   2.68E+01   14,14/01/96   (   750,      50,    0.0)
58   2.67E+01   17,28/10/96   (   300,     100,    0.0)
59   2.67E+01   15,03/04/96   (   650,     -50,    0.0)
60   2.67E+01   02,28/08/96   (   900,    -200,    0.0)
61   2.67E+01   15,15/03/96   (   750,       0,    0.0)
62   2.67E+01   04,12/11/96   (   900,    -150,    0.0)
63   2.67E+01   19,14/12/96   (   750,     -50,    0.0)
64   2.66E+01   05,28/08/96   (   900,    -100,    0.0)
65   2.66E+01   09,30/12/96   (   300,     100,    0.0)
66   2.66E+01   14,25/05/96   (   650,     -50,    0.0)
67   2.66E+01   13,27/11/96   (   650,    -150,    0.0)
68   2.66E+01   06,30/11/96   (   900,       0,    0.0)
69   2.65E+01   16,12/10/96   (   650,       0,    0.0)
70   2.65E+01   14,22/11/96   (   750,      50,    0.0)
71   2.65E+01   11,02/04/96   (   750,    -150,    0.0)
72   2.65E+01   14,13/09/96   (   750,      50,    0.0)
73   2.65E+01   20,11/11/96   (   750,    -150,    0.0)
74   2.65E+01   16,30/04/96   (   700,    -150,    0.0)
75   2.65E+01   17,02/10/96   (   700,    -100,    0.0)
76   2.65E+01   11,24/09/96   (   300,     100,    0.0)
77   2.65E+01   16,18/03/96   (   750,    -150,    0.0)
78   2.65E+01   14,03/02/96   (   650,       0,    0.0)
79   2.64E+01   20,29/01/96   (   950,    -100,    0.0)
80   2.64E+01   14,19/10/96   (   750,      50,    0.0)
81   2.64E+01   17,18/03/96   (   650,    -200,    0.0)
82   2.64E+01   13,03/03/96   (   650,     -50,    0.0)
83   2.64E+01   24,04/12/96   (   900,    -100,    0.0)
84   2.64E+01   14,03/04/96   (   600,    -100,    0.0)
85   2.64E+01   23,28/08/96   (   850,    -200,    0.0)
86   2.63E+01   16,13/09/96   (   750,       0,    0.0)
87   2.63E+01   12,15/11/96   (   750,    -150,    0.0)
88   2.63E+01   18,03/04/96   (   600,    -200,    0.0)
89   2.63E+01   15,27/11/96   (   750,       0,    0.0)
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90	2.63E+01	11,27/11/96	(	600,	0,	0.0)
91	2.63E+01	18,02/12/96	(	700,	0,	0.0)
92	2.63E+01	18,22/10/96	(	750,	50,	0.0)
93	2.63E+01	10,19/11/96	(	550,	-100,	0.0)
94	2.63E+01	17,03/04/96	(	600,	-200,	0.0)
95	2.63E+01	15,05/08/96	(	750,	-150,	0.0)
96	2.63E+01	15,04/08/96	(	750,	50,	0.0)
97	2.63E+01	23,31/05/96	(	750,	50,	0.0)
98	2.63E+01	20,03/01/96	(	850,	-300,	0.0)
99	2.62E+01	16,04/08/96	(	750,	0,	0.0)
100	2.62E+01	18,11/10/96	(	750,	0,	0.0)

1 Peak values for the 100 worst cases (in microgram/m3)
Averaging time = 24 hours

Rank	Value	Time Recorded hour,date	Coordinates (* denotes polar)			
1	1.23E+01	24,30/12/96	(	300,	100,	0.0)
2	1.16E+01	24,31/03/96	(	450,	350,	0.0)
3	1.15E+01	24,19/11/96	(	350,	100,	0.0)
4	1.13E+01	24,03/08/96	(	700,	200,	0.0)
5	1.10E+01	24,21/08/96	(	700,	50,	0.0)
6	1.04E+01	24,13/10/96	(	350,	100,	0.0)
7	1.02E+01	24,12/11/96	(	350,	100,	0.0)
8	1.01E+01	24,20/11/96	(	700,	150,	0.0)
9	9.73E+00	24,29/11/96	(	650,	100,	0.0)
10	9.36E+00	24,14/09/96	(	250,	-250,	0.0)
11	9.09E+00	24,04/08/96	(	350,	100,	0.0)
12	8.84E+00	24,25/05/96	(	350,	100,	0.0)
13	8.54E+00	24,15/11/96	(	750,	-150,	0.0)
14	8.46E+00	24,28/08/96	(	350,	100,	0.0)
15	8.35E+00	24,24/11/96	(	350,	100,	0.0)
16	8.31E+00	24,22/11/96	(	350,	100,	0.0)
17	7.95E+00	24,11/03/96	(	500,	600,	0.0)
18	7.84E+00	24,21/12/96	(	350,	100,	0.0)
19	7.69E+00	24,12/10/96	(	750,	0,	0.0)
20	7.67E+00	24,25/11/96	(	700,	250,	0.0)
21	7.59E+00	24,16/08/96	(	750,	300,	0.0)
22	7.48E+00	24,14/10/96	(	700,	250,	0.0)
23	7.44E+00	24,03/04/96	(	350,	100,	0.0)
24	7.44E+00	24,26/01/96	(	350,	600,	0.0)
25	7.43E+00	24,21/05/96	(	-150,	-200,	0.0)
26	7.39E+00	24,01/04/96	(	350,	100,	0.0)
27	7.37E+00	24,28/01/96	(	400,	550,	0.0)
28	7.33E+00	24,14/11/96	(	350,	100,	0.0)
29	7.30E+00	24,13/11/96	(	650,	100,	0.0)
30	7.28E+00	24,07/11/96	(	700,	150,	0.0)
31	7.23E+00	24,28/10/96	(	300,	100,	0.0)
32	7.14E+00	24,20/08/96	(	100,	-200,	0.0)
33	7.08E+00	24,04/09/96	(	50,	-300,	0.0)
34	7.01E+00	24,27/11/96	(	350,	100,	0.0)
35	6.97E+00	24,31/05/96	(	350,	100,	0.0)
36	6.95E+00	24,15/09/96	(	250,	-250,	0.0)
37	6.87E+00	24,17/11/96	(	750,	100,	0.0)
38	6.84E+00	24,23/03/96	(	750,	200,	0.0)
39	6.82E+00	24,23/11/96	(	650,	250,	0.0)
40	6.81E+00	24,19/10/96	(	750,	50,	0.0)
41	6.74E+00	24,23/05/96	(	350,	100,	0.0)
42	6.62E+00	24,22/10/96	(	350,	100,	0.0)
43	6.56E+00	24,29/12/96	(	300,	100,	0.0)
44	6.55E+00	24,02/03/96	(	50,	-250,	0.0)

45	6.46E+00	24,30/11/96	(	350,	100,	0.0)
46	6.43E+00	24,02/04/96	(	350,	100,	0.0)
47	6.42E+00	24,27/01/96	(	350,	550,	0.0)
48	6.40E+00	24,13/01/96	(	0,	-250,	0.0)
49	6.36E+00	24,05/02/96	(	800,	200,	0.0)
50	6.36E+00	24,04/12/96	(	350,	100,	0.0)
51	6.17E+00	24,20/02/96	(	350,	100,	0.0)
52	6.15E+00	24,22/04/96	(	400,	400,	0.0)
53	6.14E+00	24,18/03/96	(	600,	-150,	0.0)
54	6.13E+00	24,02/10/96	(	350,	100,	0.0)
55	6.10E+00	24,19/09/96	(	450,	450,	0.0)
56	6.10E+00	24,26/11/96	(	350,	100,	0.0)
57	6.10E+00	24,15/08/96	(	350,	100,	0.0)
58	6.05E+00	24,02/08/96	(	300,	100,	0.0)
59	6.02E+00	24,03/10/96	(	350,	100,	0.0)
60	5.98E+00	24,08/10/96	(	350,	100,	0.0)
61	5.89E+00	24,03/02/96	(	350,	100,	0.0)
62	5.82E+00	24,07/08/96	(	700,	400,	0.0)
63	5.78E+00	24,01/10/96	(	250,	-250,	0.0)
64	5.74E+00	24,29/09/96	(	700,	300,	0.0)
65	5.71E+00	24,16/03/96	(	350,	100,	0.0)
66	5.69E+00	24,18/12/96	(	650,	0,	0.0)
67	5.67E+00	24,09/05/96	(	500,	450,	0.0)
68	5.65E+00	24,03/03/96	(	350,	100,	0.0)
69	5.61E+00	24,07/02/96	(	650,	-100,	0.0)
70	5.57E+00	24,08/09/96	(	650,	-50,	0.0)
71	5.52E+00	24,04/10/96	(	350,	100,	0.0)
72	5.52E+00	24,25/01/96	(	150,	600,	0.0)
73	5.50E+00	24,26/05/96	(	650,	450,	0.0)
74	5.49E+00	24,12/03/96	(	450,	550,	0.0)
75	5.49E+00	24,29/01/96	(	750,	0,	0.0)
76	5.47E+00	24,17/03/96	(	350,	100,	0.0)
77	5.42E+00	24,06/03/96	(	300,	150,	0.0)
78	5.42E+00	24,06/09/96	(	800,	-250,	0.0)
79	5.26E+00	24,09/12/96	(	750,	100,	0.0)
80	5.22E+00	24,20/10/96	(	750,	50,	0.0)
81	5.16E+00	24,04/02/96	(	350,	100,	0.0)
82	5.05E+00	24,21/11/96	(	350,	100,	0.0)
83	4.97E+00	24,16/11/96	(	700,	300,	0.0)
84	4.96E+00	24,10/12/96	(	750,	0,	0.0)
85	4.96E+00	24,30/08/96	(	500,	550,	0.0)
86	4.96E+00	24,15/10/96	(	350,	100,	0.0)
87	4.94E+00	24,05/12/96	(	350,	100,	0.0)
88	4.90E+00	24,05/08/96	(	350,	100,	0.0)
89	4.85E+00	24,07/09/96	(	200,	-450,	0.0)
90	4.82E+00	24,30/01/96	(	750,	100,	0.0)
91	4.81E+00	24,09/10/96	(	450,	450,	0.0)
92	4.79E+00	24,16/05/96	(	800,	300,	0.0)
93	4.77E+00	24,17/09/96	(	750,	100,	0.0)
94	4.77E+00	24,07/04/96	(	450,	600,	0.0)
95	4.76E+00	24,02/09/96	(	-500,	350,	0.0)
96	4.73E+00	24,30/03/96	(	150,	700,	0.0)
97	4.72E+00	24,15/12/96	(	350,	100,	0.0)
98	4.69E+00	24,12/12/96	(	350,	100,	0.0)
99	4.53E+00	24,10/10/96	(	750,	300,	0.0)
100	4.53E+00	24,08/11/96	(	750,	150,	0.0)

Appendix 6
Management plan

Open Country Dairy Limited

Air Discharges

Management Plan

June 2015

Open Country Dairy Limited

Air Discharge Operations and Management

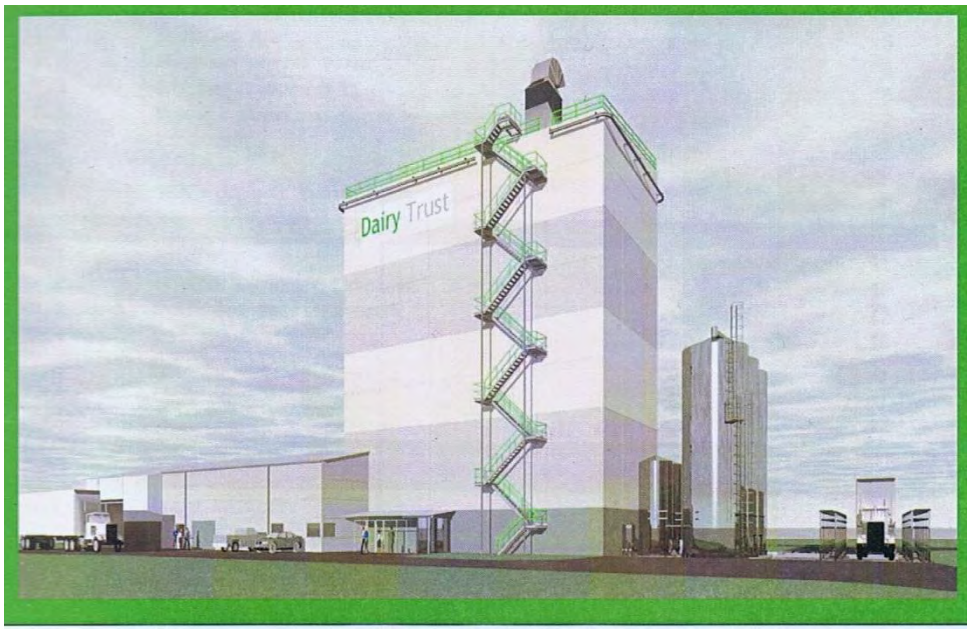
Document No.	**16 Date of Issue**	Version	**17 Pages**
OCDOM 1.201560506	1 July 2015	20150701	12

Reference number	Details
0	Contents
1	Company Policy
2	Consents Terms and Conditions
3	Records and Log sheets
4	Complaint Forms
5	Management and contingency plans

Open Country Dairy Limited

AIR DISCHARGE

OPERATIONS MANUAL



Open Country Dairy Limited

Air Discharge Operations Manual

Subject Contents	Document No. OCDOM 1.201560506	**18 Date of Issue** 6 May 2015	Version 1	**19 Page** 1 of 12

Company Policy, Responsibilities
Consents Terms and Conditions
Boiler
Milk Powder Plant
Operating logs
Complaints
Management and Contingency Plan
Company Policy

Open Country Dairy Limited is committed to effective management of discharges to air from the manufacturing site based in Waharoa.

Operation of the Milk Powder Plant, Steam Boiler, and services will be such that the risk of excessive emissions will at all times be minimised.

Adequate systems, service, resources, staff training, plant inspection and measurement will be provided to achieve this goal.

This manual outlines the checks and procedures imposed on the operation to ensure compliance with the Resource Management Act 1991 and the Discharge Permit issued by Environment Waikato on 2015

The Plant Manager is responsible for the management of Air discharge compliance.

Consent Terms and Conditions

Boilers

General Conditions	Control
Maximum energy output	Log
No discharge of odour or particulate matter deemed offensive	1. Visual 2. Complaint
Emission control processes	WRC Report
Coal burning rate kg/day	Log
Maximum gross energy output is limited to 3,500 gigajoules per 24 hours	Log
Steam production measurement	Log
Opacity no darker than Ringleman shade 1(exception 30min at start)	Log
Opacity no darker than Ringleman shade 1 (exception 2 min/hr)	Log
Annual service is required by a competent person. Summary of report to WRC.	WRC Report
Obscuration meter calibrated.	Log
Monthly — gross energy input rates to be calculated	Log

Milk Powder Plant

General Conditions	Control
Discharges — cyclones and bagfilter units	Fixed control
Stack sampling ports clean and accessible 6 monthly inspection	Fixed control

Measurement of suspended particulate matter every 12 months.	WRC report
The volumetric flow and temperature in the dryer stack shall be determined and results presented as part of the particulate emissions report.	WRC report
The results of emission testing and other information shall be reported within 20 working days following receipt.	WRC report

20 Plant Operating Logs

Daily Operation Record

Date : _____

Time	Powder 1 Bag filter Differential pressure kPa	Powder 2 Bag filter Differential pressure kPa	Coal Usage Boilers m³	Milk litres/day	Operator

Read total steam flow for hour – read integrated flow at beginning and end of hour, difference is steam flow for the hour.

Prepare annual report for the Waikato Regional Council by September each year;
shall include:

Boilers

Report Information	Annually
Plant operational reports	

Plant maintenance Report	
Report on Monthly - coal usage - plant utilisation - plant discharges to air (calculate from emission factors)	
Any abnormal conditions or events	√

Milk Powder Plant:

Report Information	Annually
Concentration and emission rate measurement of suspended particle matter in the dryer stack. Plant to be operating at continuous rating.	
The volumetric flow and temperature in the in the dryer stack.	
Reports to be delivered to the Waikato Regional Council within 20 days of generation	
Any abnormal conditions or events	

General

Attached details of non-compliance and corrective actions □

Summary of Plan annual review □

Copy of any amendments to the plan □

Complaints

Complainant or complaint location	
Date and time	
Contact phone number	
Contact address	
Nature of complaint	
Odour/particulate/other	
Description	
Investigation	
Date and Time	
Wind speed and direction	
Weather	
Investigated by	
Findings	
Signed – plant manager	
Corrective Action	

Figure 13: Waharoa industrial land and owners (2014)