Report

Permitted Activity Thresholds

An evaluation of Permitted Activity Thresholds in the Regional Air Quality Management Plan

Prepared for Greater Wellington Regional Council (Client)

By Beca Infrastructure Ltd (Beca)

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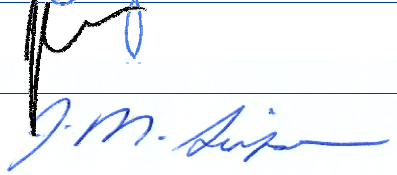
Approved by	Jenny Simpson		03/02/2012
on behalf of	Beca Infrastructure Ltd		

Table of Contents

Supplements and Appendices

Executive Summary

This report provides an analysis of a set of existing provisions of the Greater Wellington Regional Council (GW) operative Regional Air Quality Management Plan (RAQMP).

The RAQMP is a first generation regional plan that was gazetted in 2000. Since that time, a number of other regional plans have been developed to regulate air quality and discharges of contaminants to air across New Zealand, and a greater understanding of air quality issues in the Wellington Region has been developed.

This report has been commissioned by GW to provide a review of the suitability of the existing RAQMP provisions for permitted activities for managing the environmental effects of those activities. This report also provides initial recommendations on potential permitted activity thresholds for discharge activities identified in this investigation as potentially appropriate for control as permitted activities in any subsequent revision of the RAQMP.

The evaluation has been conducted in a number of distinct phases.

The first phase was undertaken to identify a list of relevant activities to identify:

- Existing provisions in the RAQMP that should be refined
- Whether any new provisions should be included in the RAQMP as a permitted activity, subject to appropriate conditions and thresholds

Documents such as other regional plans, the Australia New Zealand Standard Industrial Classification, and the Australian National Pollutant Inventory database were evaluated for possible discharges for which permitted activities could be developed for. A prioritisation and gap analysis was undertaken to highlight provisions of high priority. 'High priority' activities were chosen for further investigation in this report, although lower priority areas were also identified.

The second phase delved further into specific activities to derive thresholds that might be suitable to consider for additional consultation within the context of the new regional air quality plan. Thresholds were derived from evaluating other significant regional council air plans, Australia/New Zealand standards, and some international regulatory documents. A summary list of the sources reviewed in developing the thresholds is:

- The Auckland Council Air, Land, Water Plan
- The Environment Canterbury Natural Resources Regional Plan
- The Waikato Regional Plan
- The Tasman Resource Management Plan
- The Gisborne Air Quality Management Plan
- The Regional Air Quality Plan for Southland
- The Hawkes Bay Regional Resource Management Plan
- Various Australian, New Zealand, and joint standards
- The Department of Environment and Heritage, New South Wales, Australia Chimney Height Guidelines and Part 5 of the Protection of the Environment Operations (Clean Air) Regulations 2010
- Chimney Height guidance from the former New South Wales Environmental Protection Agency and the United Kingdom
- The California Air Resource Board 'Title V – Insignificant Activities' Schedules

At the instruction of GW, particular attention was paid to the thresholds applied to permitted discharges from combustion activities. Guidance on appropriate chimney heights for combustion activities was evaluated in the context of their use of this parameter as a permitted activity threshold. However, it was considered that, in general, the methods used in those guidance documents are overly prescriptive and not suitable in a Wellington region context. Instead, fixed thresholds have been recommended considering aspects including chimney stack height, efflux velocity, clearance of the discharge point from other adjacent obstacles, and requirements for regular maintenance of the equipment.

Atmospheric dispersion modelling using hypothetical scenarios was used to assess the potential impacts of combustion discharges meeting possible permitted activity thresholds for the stack discharge parameters discussed above, as well as based on generation capacity and fuel type.

In order to assess the suitability of those thresholds, predicted off-site concentrations of fine particulate matter (PM_{10}) and nitrogen oxides (NO_X) were compared with assessment criteria including the National Environmental Standard for Air Quality.

A finding of the modelling was that off-site concentrations are highly influenced by building downwash factors, with a significant increase in predicted ground-level concentrations in close proximity to a building, before decreasing rapidly as the effects of the building wake diminish, even at stringent permitted activity thresholds for the stack parameters identified. However, in the theoretical situations, maximum ground-level concentrations are significantly higher than the newly amended National Environmental Standard for Air Quality PM_{10} 'significance' threshold for polluted airsheds of 2.5µg/m^3. It is recommended that further work and discussions with other regional councils and with Ministry for the Environment should be undertaken before strictly applying the 'significance' threshold of 2.5µg/m^3 for permitted combustion activities.

A summary of the evaluated 'high priority' permitted activity thresholds and the recommendations of this report are presented below:

- Combustion activities: Further investigation should be undertaken before committing to the thresholds indicated by dispersion modelling findings
- Processing of animal and plant matter: Altered thresholds and inclusion of further activities
- Crushing, screening, storage, handling and processing of materials within a quarry: Revised activity definition and thresholds
- Crushing, screening, storage, handling and processing of materials outside of a quarry: Revised activity definition and thresholds
- Pneumatic conveyance of bulk materials: Altered thresholds, inclusion of further activities
- Surface coating and spray application of coatings within a booth: Revised activity definition, altered thresholds and inclusion of further activities
- Surface coating and spray application of coatings outside of a booth: Revised activity definition, altered thresholds and inclusion of further activities
- Printing processes using water-based inks Revised activity definition, altered thresholds and inclusion of further activities
- Abrasive blasting (stationary): Revised activity definition, altered thresholds
- Abrasive blasting (mobile): Revised activity definition, altered thresholds
- Gas, water, wastewater reticulated supply and transfer: Altered thresholds, inclusion of further activities
- Ventilation, Cooling Towers and Laboratory Fume Cupboards: Altered thresholds
- Cleanfills: Correlate with Discharges to Land Plan rules
- Drying or Heating of Minerals: Altered thresholds

- Processing of Metals: Altered thresholds, inclusions
- Chemical Processes: Remove permitted activity status
- Closed Landfills: Altered thresholds, inclusions
- Dry Cleaning: Altered thresholds, inclusions

1 Introduction

Greater Wellington Regional Council (GW) has commissioned Beca Infrastructure Limited (Beca) to provide specialist technical advice to gather information on discharges to air from stationary sources to inform their review of the Regional Air Quality Management Plant (RAQMP). This document provides the findings of the research.

The scope of this investigation was broken down into specific phases. A summary of which is detailed as follows:

Phase 1: Identification of Sources

The purpose of this phase was to identify the types of discharge activities that could be appropriately controlled through permitted activity rules, and to encompass as many activities that could potentially be permitted by a regional rule were identified.

In order to generate a list of potentially suitable activities, a number of documents were used:

- The Australia New Zealand Standard Industrial Classification 2006 (ANZSIC)
- The activities for which the Australian government has developed guidelines for reporting to the National Pollution Index (NPI Activities)
- Various Regional Plans in New Zealand, including the GW RAQMP

Each activity has been grouped by their predominant emission type and according to ANZSIC groupings to identify similar discharge activities and to allow a collective consideration of thresholds for those similar discharges.

Phase 2: Prioritisation and Identification of Thresholds

Once the various sources were identified and amalgamated in accordance with the ANZSIC categories, prioritisation process was undertaken with an assessment of the suitability of each activity for a permitted activity rule in accordance with the following factors:

- What is the main non-combustion discharge?
- Are the effects of the discharge well understood?
- Are the engineering controls for mitigating effects well understood?
- Are there significant potential health effects associated with the discharge?
- Are there significant potential amenity effects associated with the discharge?
- Has there been a history of complaints relating to that particular activity/discharge?
- Whether, based on our experience, there was the potential for a permitted activity threshold to be instated where one does not currently exist.

Additionally, a ‘reality check’ via dispersion modelling has been undertaken to assist in determining whether it is appropriate to permit combustion emissions, and the threshold for which they could be required to comply with.

A matrix of the amalgamated activities and their relevant thresholds has been prepared. This is a gap analysis exercise which seeks to identify three key items:

- Whether there are any missing activities in the various regional plans that could be considered as permitted activities (sourced from the NPI activity list and ANZSIC classification)
- Whether the permitted activities in the RAQMP have thresholds and conditions that are consistent with other regional plans (or whether those controls are appropriate when considering the emission type)
- Whether there are activities that are permitted in other regions in New Zealand where it may also be appropriate to have as permitted activities in the Wellington Region

The various gaps in knowledge have been prioritised for evaluation and further research based on their applicability in the GW context.

Phase 3: Research of Thresholds for Prioritised Activities

For each category or activity, the regional plan rules have been tabulated. Additional research was to be conducted into each category to understand if there are other potential guidelines such as industry-specific guidance, emissions control technology, or throughput limitations for activities to comply with.

Combustion activities were given the highest priority. Additionally, GW has specifically requested that chimney height guidance documents be evaluated for their suitability and applicability in the Wellington Regional context.

The research was tabulated and compared with the various existing provisions of the RAQMP and other regional plan documents, and a recommendation for what thresholds would be appropriate were developed for each activity.

Phase 4: Ground-truthing via modelling for combustion processes

In order to ground-truth the thresholds that have been identified, modelling of the thresholds with some theoretical discharge parameters were conducted.

Discharges from combustion activities and various thresholds were modelled with the model suites TAPM and AUSPLUME.

Various model scenarios were run to test the thresholds that were outcomes from the initial collated thresholds, and to assist with evaluating what are the most appropriate thresholds to apply in the Wellington context.

Phase 5: Documentation and Recommendations

This report provides the recommendations relating to the prioritised activities that have been made. Some areas of further research have also been identified.

2 Identification of Relevant Activities

2.1 Existing Permitted Activities and Thresholds

Permitted discharges are those activities that do not require authorisation from a local authority in order to operate, provided certain conditions are met.

The RAQMP contains a number of rules that specifically relate to discharges from industrial or trade processes, or combustion processes. Table 2.1 on the following pages summarises and provides comments on the various permitted activities of the existing RAQMP and their thresholds. At the request of GW, certain permitted activities have been omitted from the scope of this investigation, including:

- Agrichemical discharges
- Fumigation discharges

Table 2.1 - Summary of Existing RAQMP Permitted Activity Provisions

Rule	Activity	Threshold and Condition Basis	Exclusions	Example of Activity	Comments
5	Processing of animal and plant matter	▪ General offensive or objectionable condition ▪ Ventilation condition	▪ Extraction, distillation, purification of animal and vegetable oils or fats ▪ Rendering, reduction, drying, curing through application of heat ▪ Processing of skins such as fellmongery and tanning ▪ Drying of milk/milk products through the application of heat	▪ Fast-food preparation ▪ Café operation ▪ Coffee roasting ▪ Tobacco production	▪ Exclusions appear to be specifically taken from the Clean Air Act 1972 Schedule 2 activities. ▪ However, the Section 3 activities also implement a throughput threshold on the excluded activities before requiring a permit.
6	Combustion engines, heating and electrical generation processes[1]	▪ Generation capacity ▪ Concentration of TSP emission ▪ General offensive or objectionable condition ▪ Ventilation conditions	▪ Emissions from transport such as aircraft and motor vehicles ▪ Burning of materials listed in Rule 19	▪ Emergency generator ▪ Industrial boiler	▪ The generation capacity of 2MW is used in various thresholds in the Clean Air Act 1972 Schedule 2 activities, but not specifically for combustion-only processes (the threshold is 50MW for combustion processes) ▪ The current maximum stack concentration standard will result in a visible plume
8	Processing, storage and transfer and flaring of hydrocarbons and biogas	▪ Biogas production capacity ▪ Heat generation capacity ▪ Concentration of TSP emission	▪ N/A	▪ Petrol stations ▪ Petroleum tank farms (e.g. Ngauranga tank farm) ▪ Small-scale on-site	▪ Enclosed flaring of hydrocarbons and biogas is likely the only discharge where the particulate concentration standard could be applied; however, flaring of those materials is unlikely to result in exceedences of this if well operated

[1] Not restricted to industrial/trade premises

Rule	Activity	Threshold and Condition Basis	Exclusions	Example of Activity	Comments
		■ General offensive or objectionable condition ■ Ventilation conditions		wastewater treatment facilities with biogas flaring ■ Flaring of biogas from a closed landfill	■ There is no maximum threshold (e.g. storage capacity) for storage tanks and their ventilation.
10	Mineral extraction and the sorting of powdered and bulk products[2]	■ Type of activity ■ General offensive or objectionable condition	■ Pneumatic Conveyance	■ Quarrying and screening/sizing of materials	■ Size reduction of bulk materials has the potential to generate dust emissions if not managed well. ■ The Clean Air Act 1972 defines thresholds for this type of activity based on throughput and storage capacity of the site.
11	The drying and heating of minerals	■ Heat generation capacity ■ Concentration of TSP emission ■ General offensive or objectionable condition ■ Ventilation condition	■ Portland cements ■ Pozzolanic materials ■ Metal ores in preparation for smelting ■ Burning of calcium and carbonates etc. ■ Glass manufacture ■ Surface coating to glass fibres ■ Hot mix asphalt paving mixes ■ Emission of HAPs	■ Brick manufacture ■ Ceramics manufacture	■ The restriction on the discharge of HAPs is likely to preclude most, if not all activities from operating as permitted activities ■ The generation capacity threshold for this rule (100kW) differs from that of the combustion activities governed by Rule 6 (2 MW). This could lead to confusion in interpretation
12	Metal production and processing[3]	■ Melting Capacity (lead identified	■ Extraction of metal or metal alloys	■ Sweating of scrap metal	■ There are few known foundries of this kind located in the Wellington Region

[2] Not restricted to industrial/trade premises

[3] Not restricted to industrial/trade premises

Rule	Activity	Threshold and Condition Basis	Exclusions	Example of Activity	Comments
		separately with a lower capacity) ■ Concentration of TSP emission ■ General offensive or objectionable condition ■ Ventilation condition	■ Making of steel or refining of metal or modification of any alloy in a molten state ■ Hot-dip galvanizing ■ Desulphurisation of a ferrous material ■ Heating in a furnace for the removal of non-metallic contaminants ■ Emission of HAPs	■ Small-scale melting of metal	that would be able to comply with the rule and all relevant conditions ■ Exclusions mainly based on the Clean Air Act 1972 Schedule 2 activities ■ The restriction on the discharge of HAPs is likely to preclude most, if not all activities from operating as permitted activities
13	Chemical Processes	■ Concentration of TSP emission ■ General offensive or objectionable condition ■ Ventilation condition	■ Electroplating processes ■ Bodying of oils, production of synthetic resins, manufacture or reaction of monomers ■ The production of soap, grease, detergents, surfactants ■ Synthesis/extraction of organic chemicals ■ Production of inorganic chemicals ■ Production of synthetic fertilisers ■ Solvent recovery processes ■ Emission of HAPs	■ Mixing and repackaging of chemicals (without the emission of HAPs)	■ Exclusions are mainly based on the Clean Air Act 1972 Schedule 2 activities ■ There may be activity-specific industry standards for individual activities, however, the category is extremely broad and they may not be relevant to other industries. ■ The restriction on the discharge of HAPs is likely to preclude most, if not all activities from operating as permitted activities

Rule	Activity	Threshold and Condition Basis	Exclusions	Example of Activity	Comments
14	Di-isocyanate and organic plasticiser processes[4]	■ Rate of use ■ Concentration of TSP emission ■ General offensive or objectionable condition ■ Ventilation condition	■ N/A	■ Manufacture of plastic playground mats ■ Moulded foam industry	■ Di-isocyanates and plasticisers are identified in the Clean Air Act 1972 Schedule 2 activities; however, the threshold is set at 100kg per hour, as opposed to 3kg per hour. The source of either threshold is unknown. ■ The concentration of TSP emitted is unlikely to have a direct relationship with the specific activity
15	Coating processes (including spray painting)[5]	■ Rate of use and application ■ Heating capacity ■ Concentration of TSP emission ■ General offensive or objectionable condition ■ Ventilation condition	■ Di-isocyanate use (defaults to Rule 14)	■ Automotive panel and pain industry ■ Powder coating applications in manufacturing	■ There are many examples of panel and paint activities in Wellington Region ■ In some areas, the general ventilation condition may not be enough to minimise potential adverse effects relating to odour
16	Abrasive blasting processes (mobile and stationary)	■ General offensive or objectionable condition ■ Controls on discharges to water (minimum separation	■ Dry abrasive blasting	■ Water-blasting (mobile and stationary)	■ Enforcement would be based on complaints and potentially difficult for mobile operations

[4] Not restricted to industrial/trade premises

[5] As above

Rule	Activity	Threshold and Condition Basis	Exclusions	Example of Activity	Comments
		distance) and debris collection ■ Disposal conditions			
17	Cooling towers/ventilation	■ General offensive or objectionable condition ■ Ventilation condition	■ N/A	■ HVAC Exhausts ■ Cooling towers	■ Main discharges would likely be of heat and water ■ Visible steam plumes may be undesirable in certain circumstances
20	Landfilling and composting[6]	■ General offensive or objectionable condition	■ Landfills and composting sites where material is brought from off-site ■ Waste transfer stations	■ Home composting ■ Closed landfills	■ Has interlinkages to rules in the discharge to land ■ On-site landfills can be reasonably large and could also potentially generate odour, particularly if putrescibles are also landfilled ■ Does not permit cleanfills (specifically excluded from the definition of a 'landfill')
21	Sewage and trade waste conveyance and treatment processes[7]	■ Type of activity ■ General offensive or objectionable condition	■ Treatment of sewage or liquid wastes off the site that they were generated on	■ Wastewater Pump stations ■ Sewerage vents ■ On-site home disposal to land wastewater treatment plants	■ There is the potential for some pump stations to potentially release an odour, particularly when sewage is of sufficient age to become anaerobic
22	Miscellaneous processes	■ General offensive or objectionable	■ Manufacture of hot-mix asphalt paving mixes	■ Vehicle engine maintenance and	■ Is an amalgamation of minor activities that could potentially also be controlled

[6] Not restricted to industrial/trade premises

[7] As above

Rule	Activity	Threshold and Condition Basis	Exclusions	Example of Activity	Comments
		condition	▪ Tar burning	servicing ▪ Dry cleaning ▪ Laboratory fume cupboards ▪ Tunnels ▪ Carparks ▪ Welding ▪ Spray painting of roads and bridges ▪ Road construction and paving ▪ Incidental equipment for gas transmission pipe lines	by a general 'permitted activity' rule ▪ Roading tunnels may not qualify as being an 'industrial or trade premises' and the effects can potentially be wide-scale. ▪ There are potential synergies for many miscellaneous activities identified and other permitted activity rules

2.2 Activity Identification Methodology

2.2.1 Activities from Regional Plans

The RAQMP contains a number of activities that are specifically identified as permitted in the Wellington Region, provided the discharge complies with conditions or reference standards relating to that specific activity. However, it is possible that there are other discharge activities could be appropriately controlled as permitted activities.

The activities permitted in the RAQMP were compared with those permitted by rules in other regional plans. These were:

- The Auckland Regional Plan: Air Land and Water (AC:ALWP)

The AC:ALWP is the plan which controls permitted discharges to air for the Auckland Region. The plan services the largest population of the regional plans in New Zealand.

- The Canterbury Natural Resources Regional Plan - Air Quality Chapter (ECan NRRP)

The ECan NRRP and the Air Quality Chapter is the plan which controls permitted discharges to air for the Canterbury Region. It is the most prescriptive (identifies the most number of activities) of the plans in New Zealand.

- The Bay of Plenty Regional Air Plan (BOPAP)

The BOPAP is the plan which controls permitted discharges to air for the Bay of Plenty region. The Bay of Plenty region is of similar size to Wellington region, and is considered less prescriptive than the AC and ECan plans. A number of industries are located in that region and an analysis of the BOPAP could potentially yield additional permitted activity thresholds that were not considered by Auckland or Canterbury councils.

2.2.2 Activities Identified in the Australian NPI Activity List

The activities identified from the three regional plans were also compared with activities identified in the Australian National Pollutant Inventory and for which guidance is available for calculating emissions (NPI Activity List).

The National Pollutant Inventory (NPI) is a programme operated by the Australian Government that seeks to provide information relating to specific industrial emissions in Australia. There are 93 activities that have been identified as being important in the Australian context due to their potential effect on human health or the environment. Therefore, guidelines to assist in determining emissions from those activities have been drafted. While the NPI Activity List is skewed towards Australia-centric activities (in particular mining and metals processing), many of the activities are also relevant to New Zealand.

The NPI defines certain thresholds for reporting of emissions; therefore, if a specific industry does not exceed a certain threshold, then reporting to the NPI is not required. While it can be expected that the NPI thresholds will be reasonably high or in excess of a comparable regional plan's permitted activity thresholds, the grouping of various substances and emissions may provide further confidence in developing general groupings of emissions for this project.

The thresholds are based on an industry's throughput and emissions generated by the process. The hierarchy is defined by Category (1, 1a, 1b, 2a, 2b) for each of the 93 substances.

The NPI requires the reporting of emissions when, within a reporting period (1 year), industry are in excess following thresholds:

- A facility uses 10 tonnes or more of a Category 1 substance
- A facility uses 25 tonnes or more of a Category 1a substance
- A facility uses 5 kilograms or more of a Category 1b substance

And if:

- A facility burns 400 tonnes or more of fuel and/or waste leading to emissions of a Category 2a substance
- A facility burns one tonne or more of fuel and/or waste in any hour leading to emissions of a Category 2a substance
- A facility burns 2,000 tonnes or more of fuel or waste leading to emissions of a Category 2b substance
- Consumes 60,000 MWh or more of electrical energy other than for lighting or motive purposes leading to emissions of a Category 2b substance

  Or

- If the facility has a maximum potential power consumption rated at 20MW or more for other than lightning or motive purposes in a reporting period

And if:

- The facility emits to water, sewer or other mandatory destination, 15 tonnes or more of Total Nitrogen
- The facility emits to water, sewer and/or another mandatory transfer destination, 3 tonnes or more of Total Phosphorus

2.2.3 Categorisation in Australia New Zealand Standard Industrial Classification

ANZSIC is a framework that categorises businesses or production facilities into a nested set of categories.

The primary set of 19 categories is known as 'Divisions'. Within each division is a set of subdivisions, and within each subdivision are groups and classes.

An example of the above nesting can be shown as:

- Division A (Agriculture, Forestry and Fishing)
  - Subdivision 01 (Agriculture)
    - Group 011 (Nursery and Floriculture Production)
      - Class 0111 (Nursery Production (under cover))
      - Class 0112 (Nursery Production (Outdoors)

The ANZSIC classification was also used to classify the existing GW RAQMP rules. Table 2.2 shows that some RAQMP rules have a best fit description at Subdivision level, while others fit at a Class level.

Table 2.2 - Existing GW RAQMP Provisions and their respective ANZSIC Classification

GW RAQMP Rule	ANZSIC Code	ANZSIC Description
Rule 5: Processing of animal and plant matter	C11	Food Product Manufacturing
Rule 6: Small combustion engines, heating and electrical generation processes	N/A	Considered Separately

GW RAQMP Rule	ANZSIC Code	ANZSIC Description
Rule 7: Combustion engines, heating and electrical generation processes	N/A	Considered Separately
Rule 8: Processing, storage and transfer and flaring of hydrocarbons and biogas	B070, C11, I53, G40	Oil and Gas Extraction (but others would be captured by GW rule such as food product manufacture)
Rule 9: Fuel conversion processes	C17	Petroleum and coal product manufacturing
Rule 10: Mineral extraction and the sorting of storage of powdered and bulk products	B, C	Mining and Manufacturing
Rule 11: The drying and heating of minerals	C20	Non-metallic Mineral Product Manufacturing
Rule 12: Metal production and processing	C21	Primary Metal and Metal Product Manufacturing
Rule 13: Chemical Processes	C18	Various chemical manufacturing
Rule 14: Di-isocyanate and organic plasticiser processes	C19	Polymer Product and Rubber Product Manufacturing
Rule 15: Coating processes (including spray painting)	S9412, C2293	Automotive Body, Paint and Interior Repair, Metal Coating and Finishing
Rule 16: Abrasive blasting processes (mobile and stationary)	C2293	Metal Coating and Finishing
Rule 17: Cooling towers/ventilation	N/A	N/A
Rule 20: Landfilling and composting	D2921	Waste Treatment and Disposal Services
Rule 21: Sewage and trade waste conveyance and treatment processes	D2812	Sewerage and Drainage Services
Rule 22: Miscellaneous Processes		
Vehicle Engine maintenance and servicing	S941	Automotive Repair and Maintenance
Dry cleaning	S9531	Laundry and Dry-Cleaning Services
Lab fume cupboard	N/A	N/A
Tunnels and car parks	S9533	Parking Services
Welding	C22	Fabricated Metal Product Manufacturing
Spray painting of roads and bridges	S3244, C2293	Painting and Decorating Services, Metal Coating and Finishing
Road construction and paving other than manufacture	E3101	Road and Bridge Construction
Incidental equipment and compression stations for natural gas	D27	Gas Supply

2.2.4 Gap Analysis to Derive Activities

The resultant list of activities identified in the Plans and NPI Activity List was then considered in the context of the Wellington Region and the main type of non-combustion discharge released from each activity.

The coarse list of activities from the NPI Activity list and RAQMP were analysed to identify those that were likely to be occurring in the Wellington Region.

Out of the original screening for activities that could possibly occur in the Wellington Region, a qualitative analysis matrix was used to further refine the activities for which it was considered appropriate to have a permitted activity for. Additionally, the GW database of consents granted for discharges to air was obtained and activities were also identified based on whether there has been a history of complaints alleging adverse effects in relation to that particular activity.

The aspects considered in the analysis were:

- What is the main non-combustion discharge?
- Are the effects of the discharge well understood?
- Are the engineering controls for mitigating effects well understood?
- Are there significant potential health effects associated with the discharge?
- Are there significant potential amenity effects associated with the discharge?
- Has there been a history of complaints relating to that particular activity/discharge?

2.3 Amalgamated list and comparison with broader regional plan thresholds

The activities that were identified as being potentially suitable for a permitted activity rule were placed into a hierarchal matrix characterised by:

- Broad ANZSIC Division
  - General grouping
    - Relevant ANZSIC Class (from NPI Guidelines)
      - Activity as it would be described in a Regional Plan

The permitted activity thresholds of the GW RAQMP, the AC:ALWP, the ECan NRRP and the BOPAP were aligned with the relevant amalgamated activity or ANZSIC Class. The compiled decision matrix is found in Appendix A of this report.

This allowed a gap analysis and prioritisation exercise to be conducted for:

- Whether the existing thresholds in the RAQMP were very different from those identified in the other three plans
- Whether the GW Activities appeared in the other plans at all
- Whether other plans had permitted activities that the RAQMP lacked; and
- Whether any other activities should be considered for a permitted activity threshold out of the amalgamated ANZSIC classification.

A copy of the gap analysis matrix is found as the spreadsheet Supplement I.

2.4 Other Information Considered

2.4.1 GW Complaints Record

The complaints record held by GW for the years 2003 – 2011 was analysed to determine whether specific permitted activities caused a significant number of complaints. While the complaints have been received regarding both consented and unconsented activities, the predominant activities from which complaints have been made alleging adverse effects is shown in Figure 2.1.

It can be seen that the vast majority of complaints relate to odour. Complains regarding dust and smoke sources have also been received. However, in comparison with odour effects, these are not significant.

Of the large proportion of odour-related complaints, a small number of activity classes stand out as potential sources of odour. The predominant activities with alleged odour effects are:

- Carey's Gully Complex (consented landfill, composting and sludge dewatering)
- Fish Processing (consented sources)
- Industrial manufacturing (various)
- Industrial solvent use (most likely to be panel and paint discharges)
- Landfill Odour (most are likely to have consented sources)
- Meat Works (consented sources)
- Waste Treatment Facilities (possibly a combination of sewage treatment, composting, pump stations and facilities like the hazardous waste treatment facility Interwaste)
- Waste Water Treatment Facilities (consented)

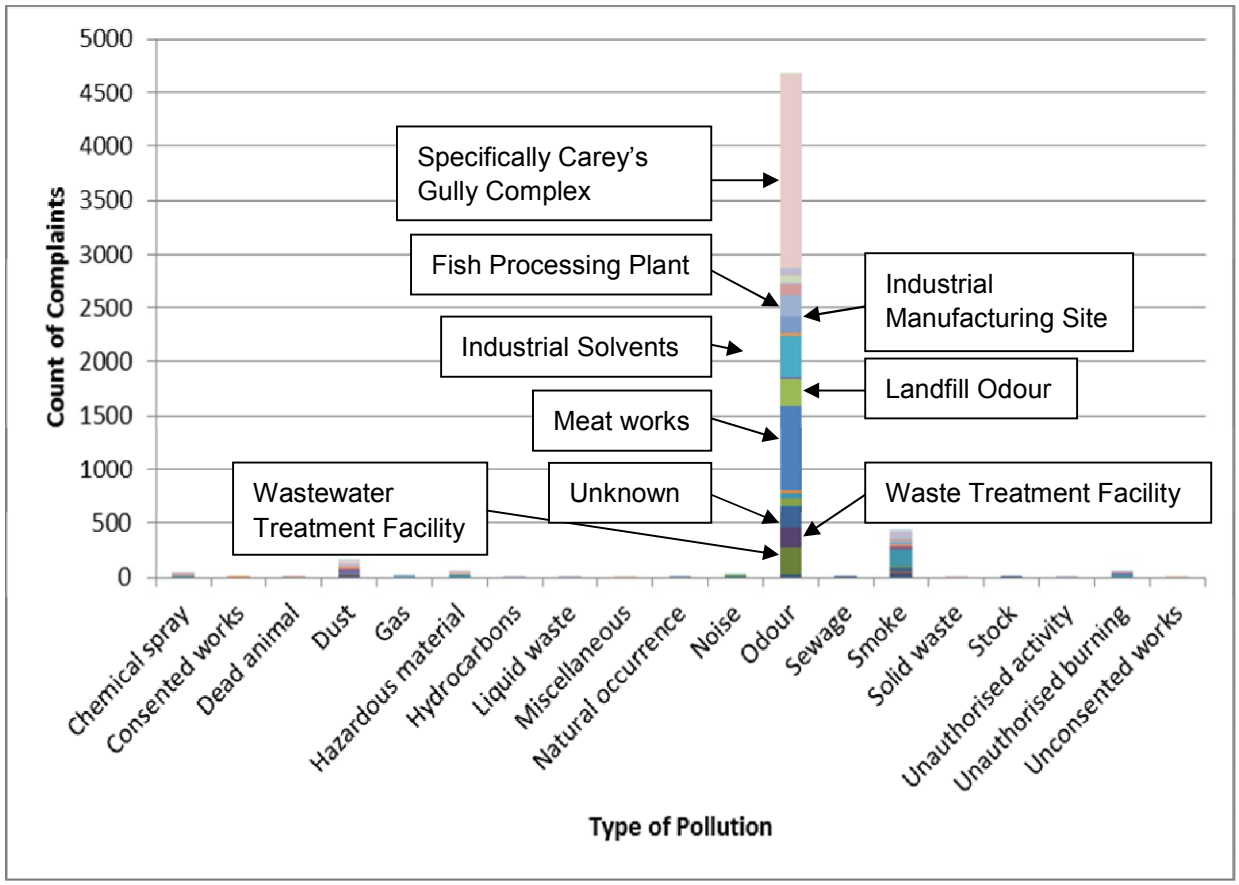


Figure 2.1 - Complaints relating to different emissions to air

Of the industrial activities identified in the complaints record, industrial solvent use and potentially waste treatment facilities are the types of activities that have been identified as being potentially permitted in the RAQMP.

Industrial manufacturing is likely to comprise of a broad range of activities. The GW complaints record indicates that odour related to industrial manufacturing is alleged to occur from industries such as tobacco manufacture (no consent required) and soap powder manufacture (consented). It is considered that coffee roasting could potentially also fall into this category.

The GW complaints record shows that the industrial solvent complaints relate mostly to automotive panel and paint (spray application/coating) shops. Complaints were also recorded for odour from two specific sites. These comprised the majority of alleged effects in the complaints record. A small number of other panel and paint shops contribute to the complaints record in a less significant manner.

A significant number of complaints alleging odour effects from a particular discharge/activity can potentially indicate that the permitted activity rule, that the threshold is not functioning well, or that additional conditions and thresholds are required. However, in the case of the unconsented activities identified in the complaints record, it appears that only a small handful of activities and a few individual sites are potentially causing an adverse odour effect. These individual sites may require further investigation from GW as to whether compliance with the permitted activity threshold is being achieved.

The above information has been used to identify the most sensitive activities and to decide whether it is appropriate to potentially develop a permitted threshold for that activity.

2.4.2 United States Clean Air Act

The United States Clean Air Act requires the United States Environmental Protection Agency (US EPA) to regulate emissions of toxic air contaminants from a published list of industrial sources referred to as "source categories." The list contains 187 contaminants and is mirrored in the existing RAQMP in Appendix 1.

The US EPA as a regulatory body has control over major emitters of toxic air contaminants. It is a higher-level control that is exercised over significant emitters which may have a wide-scale impact. However, the legislation also allows individual state authorities to define and use ‘Title V - Insignificant Activities’, who can identify certain activities for which it is not necessary to assess in a permit application. A point of difference between ‘insignificant activities’ and that of permitted activities in the RMA context is that insignificant activities are still considered on a case-by-case basis by a regulator. They are excluded from a large technical assessment as the emissions have been adjudged to be minimal, but they are still identified in them.

At the level of regulation below the US EPA, individual state-wide air resources boards are tasked with the monitoring and development of air quality guidelines. The CARB is considered to be a more conservative and prescriptive air resource board when compared with other potential boards in the US. However, within the CARB area (California State), the management of whether a particular activity is permitted or not is devolved further to air quality management areas including defining ‘insignificant activities’. Within the CARB-regulated area alone, there are 35 individual air quality management areas.

Different rules and thresholds for activities of note within each air quality management area are identified in the management plans for these areas, and it is within each air quality management area plan that specific thresholds are developed. While there are some consistencies between air quality management areas for the type of activity controlled, it is clear that there are significant differences in the range of activities controlled by the local authorities.

In the case of some activities, it may be appropriate to delve to the air pollution control district or management district level to compare ‘insignificant activities’, thresholds and limits for minimum performance standards based on US EPA AP-42 emissions factors and annual quantities of contaminants emitted. These could then be compared with existing permitted activity thresholds in the RAQMP in certain cases. However, in many cases, permitted activities are not generally concerned with annual mass emission of a contaminant for developing permitted activity thresholds,

and it is therefore considered more relevant to use New Zealand and Australian limits in the first instance.

Therefore, the various thresholds from various Regional Plans in New Zealand and relevant NPI data from the Australian guidelines have been used for the activities identified as higher priority and these are the documents on which the recommendations of this report have relied upon when available.

3 Prioritisation of Activities

3.1 Reasons for Prioritisation

The scope of this investigation was to identify whether the existing permitted activity thresholds of the RAQMP are appropriate, and to identify other activities that could potentially be provided for as permitted.

As the initial gap analysis resulted in a large number of potentially suitable activities, a method of prioritisation was required to rank the activities for which further research was most important to be undertaken. A balance must be struck between identifying as many activities as possible that may be eligible for permitted activity status, and the actual likelihood of each identified activity having a practical application in the Wellington Regional context. This prioritisation is described in Section 2.2 of this report.

3.2 Methodology

As discussed in Section 2.2, a broad cross-section of activities was qualitatively developed from the gap analysis based on the following requirements:

- What is the main non-combustion discharge?
- Are the effects of the discharge well understood?
- Are the engineering controls for mitigating effects well understood?
- Are there significant potential health effects associated with the discharge?
- Are there significant potential amenity effects associated with the discharge?
- Has there been a history of complaints relating to that particular activity/discharge?

This information was also considered in the context that:

- Whether, based on our experience, there was the potential for a permitted activity threshold to be instated where one does not currently exist

The activities that have been identified as being of 'high' priority in this context, and their main potential effect, are identified in Table 3.1.

Table 3.1 - Identified 'High Priority' Activities

Activity	Existing GW Rule (if applicable)	Main Emission	Main Effect
Food (fruit, vegetable, meat) processing	R5	Odour	Amenity
Combustion	R6 (and R7)	PM_{10}, $PM_{2.5}$, NO_X, CO, SO_2, CO_2	Health
Crushers, screening and mobile crushing devices	R10	Dust	Amenity
Storage and handling of bulk materials	R10	Dust	Amenity
Drying/Heating of minerals including ceramic product manufacturing	R11	Non-combustion particulate/Dust	Health

Activity	Existing GW Rule (if applicable)	Main Emission	Main Effect
Metal Processing	R12	Non-combustion particulate, Metals	Health
Chemical Processes	R13	VOCs, Odour, Various	Health
Surface Coating and spray application of coatings including the use of di-isocyanates	R14	Dust, VOCs, Odour	Amenity
Abrasive Blasting	R16	Dust	Amenity
Closed Landfills	R20	Odour, VOCs	Health and Amenity
Gas, water and wastewater reticulated supply and transfer	R21	Odour, VOCs	Amenity
Ventilation, Cooling Towers and Laboratory Fume Cupboards	R22	Non-combustion particulate, VOCs, Dust	Amenity
Dry Cleaning	R22	VOCs	Health
Cleanfills	N/A	Dust	Amenity

4 Evaluation of Thresholds

4.1 Threshold Identification Methodology

Permitted activity rules often stipulate thresholds; if an activity operates at a level which is under that threshold, then the implication is that the discharge is appropriate to be controlled outside of the consent process.

In order to assist in identifying thresholds and production limitations that could be potentially appropriate for each identified activity, a number of regulatory authority documents were consulted. This included literature research in the following areas:

- Other regional council plans, mainly:
  - The AC: ALWP
  - The ECAN NRRP
  - The BOPAP
  - The Waikato Regional Plan
  - The Tasman Resource Management Plan
  - The Gisborne Air Quality Management Plan
  - The Regional Air Quality Plan for Southland
  - The Hawkes Bay Regional Resource Management Plan
- Australian, New Zealand, and joint AS/NZ Standards
- The Department of Environment and Resource Management, Queensland, Australia (DERM) manuals, codes and guidelines for Environmentally Relevant Activities
- Office of Environment and Heritage, New South Wales, Australia Chimney Height Guidelines and Part 5 of the Protection of the Environment Operations (Clean Air) Regulation 2010: air impurities from emitted activities and plant
- Chimney Height guidance from the New South Wales Environmental Protection Agency[8] and the United Kingdom
- The US EPA California Air Resource Board 'Title V - Insignificant Activities' schedules

The thresholds identified in each of the documents were amalgamated, the similarities noted, and a recommendation was developed when considering the merits of the various thresholds, and their scientific background, if known.

4.2 Definition of Appropriate Threshold for Permitted Activity Status

Section 7.3 of the existing RAQMP discusses the principal reasons for adopting the various permitted activity provisions. Throughout the discussion in that section, the threshold for the development of a permitted discharge appears to be based on an assessment that considers that it would be unlikely for that discharge to have 'significant adverse effects'.

Since the RAQMP's development, the Resource Management Act 1991 (RMA) has been amended, and a large body of case law has been produced.

[8] A predecessor to the Office of Environment and Heritage, New South Wales, Australia

This report has used the words 'less than minor' to describe the appropriate threshold for a permitted activity in the context of the RMA. This is consistent with the terminology used to determine whether adverse effects are likely to be more than minor, and whether a person is an affected person pursuant to Section 95E of the RMA, which states:

> *(1) A consent authority must decide that a person is an affected person, in relation to an activity, if the activity's adverse effects on the person are minor or more than minor (but are not less than minor).*

The words 'less than minor' have been used to identify where permitted activities sit in the 'hierarchy' of effects within the definitions used in the RMA. In order from greatest potential effect to least potential effect, this hierarchy is considered to be:

- *Significant*
- *More than Minor*
- *Minor*
- ***Less than Minor***
- *De Minimis*

It is considered that the terminology used to define permitted activity thresholds should be consistent with the provisions of the RMA. Effects that are 'less than minor' do not necessarily require the written approval of a land owner, and it is at this level of effect for which a discharge could be permitted.

When designing or considering thresholds to be implemented for permitted activities, it is important to consider that permitted discharges:

- Should have actual or potential effects that are less than minor as a result of that activity's discharge to air, provided that the conditions of the activity are complied with
- That, even when there are multiple activities discharging the same contaminants to air, when the conditions of the permitted activity are complied with, the cumulative discharges are also likely to have actual or potential effects that are less than minor
- Would form the permitted baseline, that is, any actual or potential effect that is permitted in a plan could potentially be disregarded when considering applications for resource consents for similar discharges

While it is considered that the definition of a permitted activity is for GW to consider and decide as a policy, it is important in the context for where recommendations are being developed to permit discharges to air, up to a certain point. In the context of this report, less than minor discharges could still have a measureable increase to off-site concentrations of a particular contaminant; however, the *effect* of that increase should not be of a concern.

Therefore, for this report, the thresholds have been recommended when considering the above factors – that the threshold has the potential to form the permitted baseline, and that the threshold should seek to provide for a limited, 'less than minor' discharge. If certain conditions are complied with, the effects of that discharge should not be of concern to neighbours, council officers or have a noticeable impact on the wider airshed and community.

5 Chimney Stack and Point Source Discharge Parameter Thresholds

5.1 Reasons for Consideration

An area specifically identified by GW in the terms of reference as requiring more in-depth research has been in the development of chimney height thresholds for discharge activities (including, but not limited to combustion discharges).

Chimneys or stacks provide a relatively simple measure to mitigate the impacts of a discharge by promoting or augmenting the dispersion of the contaminants discharged. The discharge or dispersion parameters associated with a stack are important in the context of permitted activity thresholds as those parameters can be observed and assessed relatively easily.

Stack design parameters have a significant influence on dispersion of contaminants and the potential environmental effects of point source discharges. Relevant design parameters include:

- **Height of the Discharge Point Above Ground Level**

  The height of the stack tip above ground level influences dispersion in a number of ways. An increase in height increases the distance that the plume must travel to reach ground level where, in general, people are more likely to be exposed. In the case of hot emission sources (such as combustion activities or exothermic chemical processes) increases in stack height increase natural draught effects and improve dispersion. Minimum stack tip heights are the most commonly applied permitted activity thresholds for stack dispersion parameters

- **Clearance of the Discharge Point Above Adjacent Obstacles**

  Airflow over obstacles (buildings, solid structures, etc.) can create eddies that can drag all or part of a contaminant emission plume from an adjacent stack to ground level. This can lead to higher concentrations in the wake of buildings in comparison to those experienced on flat, open ground. This effect is generally termed a “building downwash” effect.

  In order to decrease the influence of these downwash effects, permitted activity thresholds often include a minimum vertical height clearance of the stack tip over adjacent building or structures within a certain radial distance of the stack.

  Increased clearance above nearby elevated areas where people may be exposed can also reduce the potential impingement of an emission plume and any associated high contaminant concentrations. The effectiveness of clearance height in reducing the potential impingement effects rapidly diminishes with distance from the discharge point however.

- **Discharge Temperature**

  A heated discharge will generally have greater buoyancy relative to atmosphere, providing for increased plume rise and better dispersion of contaminants. Although not common in regional plans in New Zealand, discharge temperature thresholds may provide a potential measure for assessing the suitability of a discharge as a permitted activity.

- **Vertical Efflux Velocity**

  In addition to building downwash effects, eddies created by air movement over the stack itself can provide a downward influence on an emission plume. Greater vertical efflux velocities reduce the impact of these "stack tip downwash" effects and allow for greater dispersion.

  An increase in the vertical momentum of a discharge increases the point at which an emission plume diffuses horizontally in atmosphere. As the mass of a discharge is generally constant, momentum may be increased with an increase in discharge (efflux) velocity. However, guidance on air quality management published by the NSW Office of Environment and Heritage (NSW OEH) states that "*the physical momentum of the plume due to its discharge velocity usually adds little to the plume rise. The main effect of a high velocity of discharge from a stack in most situations is to escape the stack's own downwas*h"[9].

  Given the identified benefits to contaminant dispersion associated with increased efflux velocity, permitted activity thresholds are occasionally stipulated to require a minimum efflux velocity.

  In order to prevent in the ingress of water (rain) into stacks, caps or hats are often placed over or above the aperture of the stack. Such devices impede the discharge and greatly reduce vertical momentum and plume rise. Permitted activity rules often exclude discharges that are subject to an impedance of vertical discharge.

5.2 Existing GW RAQMP Stack/Discharge Parameter Thresholds

Chimney height thresholds are stipulated in the GW RAQMP for stationary point discharges associated with a variety of activities in the following rules:

- Rule 6: Small internal or external combustion engines, heating appliances and electrical generation plants
- Rule 8: Small scale production and collection (including the refining, purification, and reforming) of biogas and the storage, transfer, and small scale flaring of hydrocarbons and biogas)
- Rule 11: Mineral drying and heating (including glass and mineral fibre manufacture)
- Rule 12: Metallurgical processes
- Rule 13: Chemical processes
- Rule 14: Use of small quantities of di-isocyanates, or organic plasticisers
- Rule 15: Coating processes, including spray painting

These rules govern discharges that largely involve emissions of either combustion contaminants or VOCs generated from the use, storage or handling or solvents (or both).

Rules 6, 11 and 12 are associated with combustion activities; Rules 14 and 15 involve the discharge of VOCs. Rule 8 governs activities including both of these types of discharge. Rule 13 covers a range of discharges activities associated with various chemical processes which discharge a variety of contaminants.

The listed rules do not stipulate a fixed minimum stack height but instead provide a general threshold for the clearance of the stack tip above the level of any adjacent area that can be accessed. The inclusion of the "access" provision in the threshold indicates that its primary purpose is to control impingement of the discharge rather than building downwash effects.

[9] NSW Office of Environment and Heritage (NSW OEH). 2011. *Local Government Air Quality Toolkit - Module 3 Part 1: Air Pollution Control Techniques*.

Rule 6 (for generation capacities of greater than 100 kW), Rule 8 (anaerobic biogas production and biogas/hydrocarbon flaring only) and Rules 11-15 contain conditions that stipulate that the chimney or vent *discharges at a point which terminates at least 3 metres above the level of any adjacent area to which there is general access.*

"*Adjacent area to which there is general access*" is defined in Rules 13, 14 and 15 as "*i.e., ground level, roof areas or adjacent openable windows*" but not defined in any of the other rules.

Rule 6 (for generation capacities of 100 kW or less) outlines a less tangible requirement that *the discharge be made at a point which as far as practicable avoids the adverse effects.*

Rules 6 and 8 include requirements that the discharge be vertical and uninterrupted or unimpeded. None of the other rules that include stack height requirements include such a stipulation, despite an impedance of the discharge potentially having a more detrimental effect on dispersion than a limited stack height.

Although not directly related to permitted activity thresholds, Rule 7 governs discharges from "*medium sized*" combustion appliances (generation capacity of 2-5 MW) as controlled activities subject to standards. Appendix 3 of the RAQMP sets guideline criteria for the consideration of chimney heights for discharges requiring consent under Rule 7. Those minimum height criteria are fixed for discharges of less than 2 kg/h SO_2 and less than 0.5 kg/h NO_x (at 8 m above ground level and 3 m above any area that can be accessed). Guidance documents are referenced for consideration:

- Her Majesty's Stationery Office (UK) 1981. "'*Chimney Heights'. Third Edition of the 1956 Clean Air Act Memorandum*". (UK Chimney Height Memorandum)
- K. Rolfe. 1978. "*NZ Guidelines for Determining Chimney Heights*"
- Environment Protection Authority of New South Wales Wales. 1993. "*Guidelines for Estimating Chimney Heights for Small to Medium Size Fuel Burning Equipment*" (NSW EPA Chimney Height Guidelines)

The UK Chimney Height Memorandum and the NSW EPA Chimney Height Guidelines are discussed in the following section. The NZ Guidelines were modified for New Zealand conditions from a previous version of the UK Chimney Height Memorandum but are no longer in circulation.

5.3 Other Regional Plan Thresholds

The majority of regional plans in New Zealand set fixed chimney height thresholds for stationary point source discharges. Those fixed thresholds comprise either a fixed minimum height, a fixed minimum clearance above an adjacent building, vent or access area (as in the GW RAQMP) or, most commonly, a requirement to comply with both. Those fixed thresholds are detailed in Supplement 1 to this report.

A number of other regional plans specify more complex methods for determining minimum stack heights. The AC:ALWP includes perhaps the most complex stack height thresholds for permitted activity air discharge rules in New Zealand. Stacks discharging contaminants from natural gas, diesel and fuel oil combustion are required to comply with the NSW EPA Guidelines in order for the discharge to be considered as permitted. The specific reference to the NSW EPA Guidelines in the conditions of a permitted activity rule differs from the approach of the GW RAQMP, which is to use that document for the purposes of general consideration of controlled activity applications.

As the NSW EPA guidelines are based on efflux velocities of 15 m/s, this velocity is placed as a condition to the Auckland permitted activity combustion rules. However, such velocities may be difficult to achieve in natural draught combustion activities.

The Southland Regional Air Quality Plan includes excerpts from the UK Chimney Height Memorandum, which is discussed in section 5.5.

5.4 NSW EPA Chimney Height Guidelines

The NSW EPA Chimney Height Guidelines are used to determine minimum stack heights using a series of empirical equations. These guidelines are referenced in a number of regional plans, including the GW RAQMP.

Uncorrected minimum stack heights are first calculated for the following fuels based on emissions on what has been determined to be the principal contaminant of interest:

- Sulphur-bearing fuels (based on SO_2 emission rates)
- Natural gas (based on NO_X emission rates)
- Hydrogen fluoride (from brick making or coal fired boilers)

Given the low sulphur content of modern diesel supplies, SO_2 is unlikely to be the most relevant contaminant emitted from diesel combustion in the Wellington region context when compared to particulate or NO_X.

The uncorrected minimum stack height is then modified to account for terrain if local terrain is elevated in relation to the stack location. Building downwash effects are also accounted for, whereby the height, dimensions and orientation of a nearby building or cluster of buildings are taken into account to develop final minimum stack height for the discharge.

A number of assumptions are used in the calculations including an assumed gas velocity of 15 m/s and temperature of 165°C on discharge and a local wind speed of 6 m/s at chimney height.

The Auckland plan, which specifically references the guidelines in determining minimum stack heights for permitted discharges, also includes a minimum efflux velocity of 15 m/s. While a discharge velocity of this magnitude will assist in avoiding building downwash effects, natural draught boiler discharges are unlikely to be able to generate such velocities without the assistance of fans.

Overall the guidelines are complicated and variable interpretations of building characteristics such as orientation can have a significant bearing on the results. Advances in dispersion modelling and the computers used to run those models mean that it is now likely to be more efficient and more accurate to use screening modelling investigations to determine effective stack heights.

The guidelines are no longer used as a stand-alone document, and are incorporated into other guidelines such as the guidance[10] of NSW Office of Environment and Heritage which refers instead to dispersion modelling for the determination of appropriate stack heights[11].

5.5 UK Chimney Height Guidelines

The determination of effective chimney heights for small to medium scale point source discharges in the UK are generally based on two guidance documents:

[10] NSW OEH. 2011. *Local Government Air Quality Toolkit. Module 3: Guidelines for Managing Air Pollution*.

[11] NSW EPA. 2005. *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*.

- The UK Chimney Height Memorandum
- The Local Air Quality Management Technical Guidance LAQM.TG(09) published by the UK Department for Environment, Food and Rural Affairs (DEFRA) in 2009

The UK Chimney Height Memorandum was last updated in 1981. It provides guidance on effective chimney heights for combustion appliances burning sulphur bearing fuels. SO_2 emissions from the combustion of sulphur-containing fuels are generally of lesser relevance in the Wellington Region than PM_{10} and NO_X. Additionally, the SO_2 concentrations thresholds on which the memorandum has been based have been superseded in the UK and do not relate to New Zealand criteria. Therefore, the memorandum is not considered to provide useful guidance in the Wellington region context.

The UK Chimney Height Memorandum was modified for use in New Zealand in 1978 (Rolfe, 1978), specifically to convert the calculations to metric units and incorporate NO_X emissions into calculations. However, the relevant air quality assessment criteria have changed in New Zealand since publication of those guidelines and they are no longer in circulation.

Under the UK Environment Protection Act, industrial processes are divided into two parts with larger scale Part A operations controlled by the UK Environment Agency and smaller scale Part B operations controlled by local authorities (in a similar fashion to New Zealand's superseded Clean Air Act 1972). Local authorities are therefore responsible for controlling discharges that would equate to permitted activities in the Wellington region.

The LAQM TG(09) is a guide prepared for local authorities in reviewing and assessing air quality within their jurisdiction, including the control of local discharges. A screening level assessment of the activity and associated discharges is initially undertaken, which includes determination of effective stack heights for point source discharges. Effective stack heights (which in the document begin at 10m in height) required to meet specified levels of air quality (in terms of a maximum percentile exceedance of defined contaminant concentration thresholds) are determined. That determination is made from annual mass emission of contaminants (including NO_X, PM_{10}, SO_2, lead and benzene) and stack diameter using nomograms. However, the contaminant concentration thresholds and percentiles on which the nomograms are based not match the criteria used in this investigation (which are derived from the New Zealand NESAQ and AAQG).

Overall, the air quality issues relevant to the Wellington region differ from those encountered in the UK. The relevant air quality assessment criteria also differ between the UK and New Zealand. As such the UK guidance documents are not considered to provide chimney height guidance that is relevant in the Wellington regional context, particularly for small boilers that may not have stacks or discharge points that are greater than 10m in height. Those documents would require significant modification in order to be relevant in context.

5.6 District Plan Restrictions on Building Heights

The various district plans in the region set restrictions on the height of buildings and structures within particular zones as permitted activity standards. Thresholds that require minimum stack heights exceeding those standards may lead to a requirement for land use consents.

Industrial zone height restrictions are most likely to be applicable to point source discharges from industrial and trade premises and a summary of relevant industrial zone height restrictions is provided in Table 5.1.

Table 5.1: District Plan Industrial Zone Height Restrictions

District Plan	Industrial Zone Height Restriction*
Hutt City (Lower Hutt)	20 m
Kapiti	10 m
Porirua	10 m
Upper Hutt	12 m/15 m
Wairarapa Combined	15 m
Wellington	N/A – no specific industrial zone

*Restrictions in specifically identified areas or at locations adjacent to other zones may differ.

A stack of up to 10 m in height is therefore likely to comply with most district plan industrial zone permitted activity standards in the region. Conversely, a stack of over 20 m in height is likely to require land use consent throughout the majority of the region.

5.7 Consideration of Stack Design Thresholds

When considering the various ways to determination appropriate stack heights, empirical calculations and nomograms are considered to provide an unnecessarily complex means of determination for permitted activities. If this approach were to be taken, it is likely that a similar level of effort could instead be expended in undertaking a simple screening dispersion modelling study, which should provide more accurate results.

Further, given the differing air quality issues and assessment criteria present overseas, the UK and NSW guidelines for determining effective stack heights are considered to be of limited relevance in the context of the Wellington region.

As such, simpler guidelines based on fixed minimum values for stack heights and clearances above neighbouring buildings are considered more appropriate. Such thresholds can be readily assessed by both Council officers and discharge operators and stack height thresholds of this type are most commonly stipulated regional plans in New Zealand.

An initial recommendation on minimum stack height of 9.5 m has been made to comply with most industrial zone district planning restrictions. The existing clearance threshold of 3 m has been retained though it is recommended that the radius of influence be defined (as approximately five times the minimum stack height).

Although discharge temperature will influence dispersion through thermal buoyancy, given the variability of discharge temperatures likely to be encountered, it is not considered appropriate to define a threshold for this discharge parameter.

The efflux velocity of a discharge will also influence stack-tip downwash effects and dispersion overall. However, given the variability of unassisted natural draught discharges, no minimum threshold for this parameter is recommended. If a threshold is required for efflux velocity, it is recommended that this is set at no greater than 6 m/s to provide for natural draught discharges.

It is recommended that the requirement that the discharge be vertical and unimpeded (by rain caps or other devices) should be retained.

5.8 Initial Recommendations on Permitted Activity Thresholds for Discharge Parameters

Table 5.2 summarises the initial recommendation on thresholds for permitted activity rules for stack/point source discharge parameters. The recommended thresholds are assessed in Section 9 where a final recommendation is provided for thresholds for combustion processes.

A requirement of the ECan NRRP has been to ensure that the fuel burning equipment be maintained at least once a year by a person competent the maintenance of that equipment. Given the importance of regular upkeep to maintain efficiency and to minimise emissions to air, it is recommended that a similar provision also be applied to any permitted activity for combustion processes.

Table 5.2: Summary of Initial Recommendations on Permitted Activities Thresholds for Point Source Discharge Parameters

Discharge Parameter	Initial Recommendation on Threshold
Height of the Discharge Point Above Ground Level	Minimum of 9.5 m above local ground level
Minimum Clearance of the Discharge Point Above Adjacent Obstacles	Minimum of 3 m above any building or structure within a 50 m radius of the stack
Discharge Temperature	No minimum temperature specified
Vertical Efflux Velocity	Discharge must be vertical and unimpeded – no minimum velocity specified*.
Regular Maintenance of Equipment	Fuel-burning equipment to be maintained by a suitably qualified or experienced person at least once a year, with a copy of the maintenance report held by the operator and presented to GW on request.

*If a minimum velocity is required, a threshold of 6 m/s is recommended to cater for natural draught boiler discharges.

6 Combustion Activity Thresholds

6.1 Overview of Combustion Activities and Emissions

Fuel combustion is widely used in industrial or trade processes to raise heat and energy and is one of the most common activities leading to the discharge of contaminants to air in New Zealand. All regional plans in New Zealand contain rules providing for certain combustion discharges as permitted activities.

The principal contaminants emitted from fuel combustion are:

- Particulate matter (primarily composed of finer particulate fractions of PM_{10} and smaller)
- Oxides of nitrogen (NO_X)
- Carbon monoxide (CO)
- Sulphur dioxide (SO_2)
- Volatile organic compounds (VOCs)

Discharges of the above contaminants are regulated by NESAQ. Carbon dioxide (CO_2) is also emitted, although CO_2 emissions are not directly regulated by the RMA. Hazardous air pollutants such as metal compounds and persistent organic pollutants (e.g. dioxins and furans) may also be emitted in trace quantities.

Given the widespread nature of combustion activities, the environmental effects of combustion contaminants are generally well understood and permitted activity thresholds for discharges from combustion activities in New Zealand are generally more prescriptive than for other permitted discharges.

6.2 Overview of Potential Combustion Activity Thresholds

Permitted activity thresholds for combustion activities generally relate to one or more of the following factors:

- **Scale and Nature of Emissions**

  Combustion exhaust analysis (including measurement of CO, CO_2 and O_2 content) is often carried out on boilers in order to determine the operational efficiency of the appliance as part of routine maintenance. However, direct measurement of emission rates and concentrations of other contaminants from small combustion appliances is not widely undertaken.

  Permitted activity thresholds relating to the scale of emissions from combustion appliances are therefore usually based on heat or energy generation capacity (e.g. heat output in kW) or fuel usage rates (e.g. fuel usage in kg/h), from which emission rates may be inferred.

  The scale of emissions discharged will vary depending on fuel type (e.g. coal, natural gas etc.) and on fuel quality (e.g. moisture content of wood fuel). Thresholds relating to the scale of emissions may vary depending on fuel type. Further thresholds may also be specified defining a minimum standard of fuel quality.

  The concentrations of particulate in the emissions is often used as an indicator of both the scale of emissions (though this is also related to overall gas discharge flowrate) and of the efficiency of

the discharge. However, as stated above, particulate emissions from small-scale combustion appliances are not often measured.

A method of inferring particulate emission concentrations is through quantification of the opacity of a discharge. It is possible to measure the opacity instrumentally within a stack (e.g. through light scattering measurements) or opacity may be approximately gauged through visual observation of plume opacity (e.g. through comparison with Ringelmann shades).

Opacity is related to a number of factors including size and composition of particles emitted and may not directly correlate with particulate emission concentrations. Visual observations may also lead to inaccuracies as those observations are influenced by other factors such as background lighting conditions and the level of experience of the observer.

The nature of the combustion contaminants listed above have varying potential for environmental effects, based on their toxicity to humans and biota or their potential to cause nuisance, degrade amenity or damage property.

The presence of contaminants in the emissions may, in some circumstances, be inferred from the presence of contaminants or precursors in the fuel. As emissions of most contaminants from small combustion appliances are not regularly measured, permitted activity rules can include thresholds for the content of contaminants or precursors in fuels.

The most common example of such a threshold is a threshold for sulphur content (sulphur oxidises to SO_2). Combustion of certain materials, such as waste oil, that can contain a variable amount of potential hazardous contaminants may also be specifically excluded from permitted activity rules.

- **Dispersion of Emissions**

  Augmentation of contaminant dispersion (e.g. through the use of chimneys or stacks) provides a relatively simple engineering measure for the mitigation of environmental impacts of point source discharges. Thresholds relating to chimney design parameters and the dispersion of contaminants are discussed in section 5 of this report.

- **Emissions Control Measures and Maintenance and Testing Requirements.**

  Thresholds may be stipulated specifying a minimum standard of control of emissions (e.g. the use of fabric filtration meeting a certain standard of performance). As the use of dedicated control measures (e.g. baghouses, scrubbers, electrostatic precipitator) is not widespread for small-scale combustion appliances, such thresholds are not common for permitted combustion activity thresholds.

- **End Use of the Energy Produced**

  Although the not directly related to the potential adverse environmental effects of a combustion discharge, the end use of the energy produced may potentially mitigate those effects to some degree if it provides some benefit to the wider environment or community. For instance, the combustion discharges associated with emergency back-up electricity generators is at times considered separately from other point source combustion discharges.

6.3 Existing Thresholds in the GW RAQMP

The existing thresholds for permitted combustion processes are found in Rules 6 of the RAQMP. Those thresholds consist of:

- A maximum generation capacity of 2MW (based on the higher heating value of the input fuel). Separate provisions apply to discharges from combustion activities with a capacity of 100kW or less
- A maximum particulate emission concentration (as total suspended particulate) of 250 mg/Nm^3 (whereby concentrations are standardised to 0° C (273.15K), 1 atmosphere in pressure on a dry gas basis)
- A minimum stack tip clearance above adjacent buildings of 3 m (does not apply to combustion activities with a capacity of 100kW or less)

However, Rule 6 contains no distinction between:

- The type or quality of the fuel combusted
- The end use of the energy produced (e.g. as a stand-by electricity supply in case of network supply interruptions or to additionally supply the electricity network during times of peak network demand).

6.4 Thresholds in other Regional Plans

6.4.1 Generation Capacity

The emissions from different types of fuels can vary and most regional plans contain different permitted activity thresholds for different fuel types. The various thresholds contained in regional plans throughout the country are contained in Supplement 1 to this report.

In plans such as the ECan NRRP, the generation capacity may be based on the net heat or energy output. While net energy output may be a relatively simple measure to determine, it does not account take account of the efficiency of conversion of heat into energy. The ECan NRRP counters this to a certain degree by separating internal combustion (which is generally used to generate electricity and has relatively low overall conversion efficiency) from external combustion (which is generally used to raise heat and has a much higher conversion efficiency). The basis of generation capacity thresholds in regional plans such as the AC: ALWP is not defined.

Generation capacities thresholds specified for permitted combustion activities in regional plans are summarised in Table 6.1.

Table 6.1: Generation Capacity Thresholds for Permitted Combustion Activities in Regional Plans by Fuel Type

Fuel Type	Thresholds from other Regional Plans
Natural gas and liquefied petroleum gas	5 MW$^{\#}$ (ECan), 10 MW (Waikato), 22 MW* (Auckland)
Biogas/landfill gas	2 MW^{+} (GW)
Diesel	2 MW$^{\#}$ (ECan), 5 MW* (Auckland)
Coal	1 MW$^{\#}$ (ECan), 5 MW* (Auckland)
Light fuel oil	1 MW$^{\#}$ (ECan), 5 MW* (Auckland)
Untreated wood/wood pellets	2 MW (Waikato), 5 MW* (Auckland), 5 MW$^{\#}$ (ECan)

$^{\#}$ Generation capacity based on net heat or energy output
$^{+}$ Generation capacity based on gross energy input (higher heating value of input fuel)
* Basis of generation capacity not specified or defined

6.4.2 Emissions Concentration

Fine particulate is a common combustion contaminant of concern in most regions of New Zealand and regional plan rules for combustion discharges often contain thresholds for particulate emissions concentration. As particulate emissions are not often measured, some regional plans such as the Auckland plan do not stipulate a maximum emissions concentration.

On behalf of ECan, Wilton et al (2007) investigated the potential financial impacts of different particulate emissions concentration limits on industrial sectors featuring boiler usage in Christchurch. The purpose of this ECan investigation was to determine the maximum allowable particulate emissions concentrations for all combustion discharge, including not only permitted discharges but those requiring consent as well. The potential particulate emissions concentration limits that were investigated were 300 mg/Nm^3, 250 mg/Nm^3, 150 mg/Nm^3 and 50 mg/Nm^3.

Despite the differences in the circumstances of the ECan investigation and this investigation, the former investigation provides some useful insights into the relative limitations of combustion of different fuel types in appliances of different configurations with respect to particulate emissions.

Diesel and natural gas-fired appliances were expected to be able to comply with an emission limit of 50 mg/Nm^3 without the use of emissions abatement. The reticulated gas supply available in most industrial areas of the Wellington region (outside of the Wairarapa) provides a clean and relatively cheap combustion source in those areas and its use is likely to be widespread where a continuous or regular heat or energy supply is required. Diesel provides a readily stored fuel supply in the Wellington Region for intermittent combustion sources such as emergency electrical generators.

The use of coal as a combustion fuel is much more widespread in Christchurch, where there is no reticulated gas supply, than it is in the Wellington Region. The lack of a reticulated gas supply in the Wairarapa is likely to mean that coal use is more prevalent there; however, it is unlikely to be of the scale of coal use in Christchurch.

The particulate emissions concentrations measured from coal-fired appliances varied with coal feed/stoker configuration, with drop feed systems emissions of well in excess of 300 mg/Nm^3. Other configurations of coal boilers emissions (without emissions control) generally produced emissions concentrations of over 250 mg/Nm^3. Test results indicated that multi-cyclones would reduce emissions concentrations to below 200-250 mg/Nm^3 depending on stoker/feed configuration. Wet scrubbing/absorption control methods reduced emissions to below 100-120 mg/Nm^3 depending on stoker/feed configuration. Fabric filtration provides the greatest level of control of methods usually employed and reduced emissions concentrations to below 5 mg/Nm^3.

Appliances fired by Light Fuel Oil (LFO) were anticipated to achieve particulate emissions concentrations of less than 100 mg/Nm^3. However, while LFO is supplied in bulk in Christchurch, it is not currently supplied in bulk in the Wellington Region. As such, while LFO combustion is important to consider as a potential permitted activity in Canterbury it unlikely to have the same significance in the Wellington region.

Wood is a fuel source that is likely to be more widely used in the Wellington region now and in the future, both in pellet form and as a waste product from forest product industries (e.g. saw dust or hog fuel).

Although there was a small sample size of emissions testing data for wood pellet combustion available for the ECan study, measured emissions of particulate were substantially lower than those from similar coal combustion devices. The test results indicated that a ceiling for particulate emissions concentrations from wood pellet combustion of 100 mg/Nm^3 or at most 120 mg/Nm^3 is likely to be achievable if the plant is well operated.

Due to the relative lack of control over moisture content and surface area, emissions of particulate from wood waste combustion are more variable and generally of a greater scale than combustion of

wood pellets. Depending on the configuration of the appliance, testing indicated that combustion of wood waste could potentially exceed 250 mg/Nm^3 without emissions control. If the current particulate emissions concentration threshold for permitted combustion activities is to be reduced, emissions control would therefore likely be required for wood waste combustion appliances in order to comply.

6.4.3 Fuel Composition

Sulphur present in fuel is readily oxidised to SO_2 and other oxides of sulphur when combusted. Control of the sulphur content of fuels therefore provides a relatively simple and measureable means of controlling SO_2 emissions from combustion activities.

Limits on the sulphur content of fuel stipulated in regional plans vary from 0.35% (ECan) to 0.5% (Auckland) to 1% (various other plans). The fuels with the highest potential sulphur contents are generally coal, fuel oil and waste oil and the sulphur content of these fuels can exceed 2%. Table Table 6.2 provides a summary of sulphur content in fuel restrictions found in other regional plans.

Table 6.2: Sulphur Content Thresholds for Permitted Combustion Activities in Regional Plans by Fuel Type

Fuel Type	Sulphur Content Thresholds from other Regional Plans (by weight)
Generic fuels	1% (Tasman)
Natural gas and liquefied petroleum gas	0.35% (ECan), 1% (Waikato)
Diesel	0.35% (ECan), 1% (Waikato)
Coal	0.5% (Auckland), 1% (Waikato), 2% (ECan)
Light fuel oil	1% (Waikato), 2% (ECan)
Untreated wood/wood pellets	1% (Waikato), 2% (ECan)

The World Health Organisation (WHO) reduced the air quality guideline for ambient SO_2 concentrations to 20 µg/m^3 as a 24-hour average in 2006. This is significantly lower than current 2002 MfE AAQG of 120 µg/m^3. Although no changes to the MfE AAQG have been proposed, the potential reduction in the MfE AAQG (or NESAQ) for SO_2 should be taken into consideration in determining controls on sulphur emissions from combustion.

The Engine Fuel Specifications Regulations 2008 require that diesel (and biodiesel) retailed in New Zealand has a sulphur content (by weight) of 10 ppm or less. This specification provides an effective control over SO_2 emissions from stationary diesel combustion and further limits on diesel sulphur content placed through permitted activity rules are likely to be redundant. Controls over sulphur content will be required on other fuels, however.

Combustion of waste, used or recycled oil can lead to emissions of metal and ionic compounds and polycyclic-aromatic hydrocarbons (PaHs), many of which are classified as hazardous air pollutants that can have adverse health effects at relatively low concentrations or doses. Given the variable quality of waste/used oil available and the associated potential for environmental effects, combustion of this fuel is excluded from permitted activity combustion rules in most regional plans.

Biogas from solid waste disposal can also lead to the discharge of hazardous contaminants and is also considered separately in regional plans such as the Waikato plan (and the GW RAQMP).

6.4.4 End Use of Energy

Some regional plans stipulate different permitted activity thresholds for combustion activities with certain end uses of electricity, such as back-up emergency electricity generation.

Stationary internal combustion of readily stored fuels (e.g. diesel) is often used to provide a back-up or standby supply of electricity during black-outs or failure of reticulated grid supply. Such emergency back-up generators are reasonably common in the commercial areas of the Wellington regional and at hospitals or other locations where a continuous supply of electricity is vital.

In addition to providing a back-up electricity supply, generators that are used for that purpose may also be used to supply the national electrical grid at times where high national or local electricity demand places strain on reticulated electricity supply and spot electricity prices are high. This is referred to as peak electricity network load management or peak lopping.

The ECan plan considers external and internal combustion discharges separately. The internal combustion permitted activity rules include operating period thresholds for back-up generation and other related activities such as peak electricity network load management.

As an example, Rule AQL16A of the ECan plan, which governs internal combustion of diesel, petrol or gas with a net output of 300 kW or less in the Christchurch Clean Air Zone 1 and 2 as a permitted activity, includes the following condition:

7. The use of internal combustion equipment to generate electricity shall not exceed the following:

Circumstance	***Limit***
(a) When the electricity supply is not available, or its unavailability is imminent (including circumstances where a Grid Emergency Event is declared by the System Operator under the Electricity Governance Rules or Regulations):	*No Limit*
(b) When used for peak electricity network load management:	*No more than 300 hours per calendar year*
(c) During a period within which:	
(i) the Electricity Commission (or any statutory body exercising like powers and functions to the Electricity Commission) determines that reserve generation capacity (for example, Whirinaki Power Station) should generate electricity; or	*No Limit*
(ii) the South Island Minzone, as derived by the Electricity Commission (or any statutory body exercising like powers and functions to the Electricity Commission) has been breached.	*No Limit*
(iii) the Emergency Zone as derived by the Electricity Commission (or any statutory body exercising like powers and functions to the Electricity Commission) has been breached.	*No Limit*
(d) In all other circumstances, including testing and maintenance.	*No more than 150 hours per calendar year*

It would be worthwhile to consider the suitability of similar thresholds for electricity generation through internal combustion in the Wellington region. However, this would require a wider

consideration of the benefits that the end use of energy can provide to other aspect of the environment (other than air quality), which is beyond the scope of this investigation.

6.5 Clean Air Act Thresholds

Some regional plans, particularly those that were among the earlier plans proposed and made operative (e.g. the GW RAQMP and the Gisborne Air Plan) used the thresholds contain in the Clean Air Act 1972 as a basis of many thresholds

The second schedule of Clean Air Act defined industrial processes in three parts, each with separate activity thresholds:

- Part A – Processes subject to licensing by the Department of Health after application to the local authority
- Part B – Processes subject to licensing by local authorities
- Part C – Processes requiring notification to local authorities and subject to licence pursuant to bylaws

Except for separate thresholds for sulphur bearing fuels (sulphur combustion rate) no distinction is made between fuel types in the thresholds for combustion activities.

In general, combustion processes governed under Part A were defined as any combustion process with a potential rate of heat release in excess of 50 MW. Part B combustion processes were defined as those with a potential rate of heat release between 5 MW and 50 MW with the remainder (<5MW) governed under Part C.

6.6 Assessment of Suitability

Generic thresholds covering all fuels are not considered to account for the variation in the nature and scale of effects of combustion emissions from different fuel types. Separate thresholds for different fuel types are therefore considered more appropriate for the control of small-scale combustion emission sources.

It is recommended that the following fuel groupings be considered separately:

- Natural gas and liquid petroleum gas
- Diesel (including biodiesel and blends) and kerosene
- Biogas generated from solid or liquid waste sources
- Untreated wood (including pellets)
- Coal, LFO and petroleum distillates of higher viscosity

Given the variability in quality of waste/used/recycled oil and the resulting emissions, it is recommended that combustion of fuels of this type is excluded from permitted activity rules and that those activities are assessed through the consent process.

Given that gross generation capacity based on combustion rates of the input fuel more accurately reflects the resulting emissions than net generation capacity, it is considered that thresholds based on gross generation capacity (as exist in the current GW RAQMP) are more appropriate.

The rules governing combustion activities in the ECan plan are generally the most comprehensive regional plans combustion rules in New Zealand. However, the air quality issues in Christchurch differ somewhat from those in the Wellington region. As such the ECan plan permitted activity external combustion thresholds that apply to areas outside of the Christchurch and Rangiora air quality zones have been chosen as a basis for the generation capacity recommendation. As the

ECan plan thresholds are based on net generation capacity, the generation capacity thresholds for the (higher efficiency) external combustion activities from that plan have been applied as gross capacity values.

The Wilton report (2007) considered that particulate emissions concentrations resulting from the combustion of natural gas, diesel and kerosene (where this is used) should comply with a limit of 50 mg/Nm^3, if plant is well operated. Combustion of solid fuels generally leads to substantially higher particulate emissions and a higher limit of 100 mg/Nm^3 has been recommended for those sources. Emissions control measures may be required to meet that threshold.

Thresholds based on visual assessment of opacity of a discharge plume (e.g. through the use of Ringlemann shades) are not recommended due to the difficulties in providing accurate observations.

A threshold for sulphur content in fuels should provide an effective means of limiting SO_2 emission produced from permitted combustion activities. Given the likely low regional usage of sulphur-bearing fuels compared to South Island locations and the 2006 reduction in WHO AQG for ambient SO_2 concentrations, the lower sulphur content threshold (0.5%) of the Auckland plan are considered appropriate for solid fuels and fuel oil. Given the low sulphur content of natural gas and the current national fuel specification for diesel sulphur content, no sulphur content threshold for those fuels is recommended. Although the fuel specification does not include kerosene, it is de-sulphurised and should meet a sulphur content threshold of 0.05% (500 ppm). Usage of this fuel for stationary combustion purposes is also likely to be limited in the Wellington Region.

Moisture content in wood fuel is generally limited to 25% in permitted activity rules that specify this type of threshold. It is recommended that this threshold is adopted for permitted wood combustion discharges in the GW RAQMP. It should be noted that wood fuels of a certain moisture grade or pre-drying of fuel may be required to meet this threshold.

End-uses of energy such as back-up generation and emergency peak electricity network load management may provide other benefits to aspects of the environment or community other than air quality. It is recommended that those benefits are furthered investigated and, if it is deemed appropriate, separate or additional provisions along the lines of those stipulated in the relevant ECan plan rules are placed on discharges of that nature.

6.7 Initial Recommendations for Permitted Activity Thresholds

Table 6.3 summarises the initial recommendation on thresholds for permitted activity rules for combustion activities. The recommended thresholds are assessed in Section 9 where a final recommendation is provided for thresholds for combustion processes.

It should be noted that the maximum PM emissions concentrations for some of the fuels are unlikely to be complied without some additional control technology being implemented.

Table 6.3: Summary of Initial Recommendations on Permitted Activities Thresholds for Combustion Activities

Fuel type	Maximum Generation Capacity	Maximum PM Emissions Concentration*	Other Thresholds or Stipulations
Natural gas and liquid petroleum gas	5 MW	50 mg/Nm^3	-
Diesel and kerosene	2 MW	50 mg/Nm^3	Kerosene sulphur content of ≤ 0.05% (diesel sulphur content is limited in regulations)**
Biogas generated from waste sources	2 MW	50 mg/Nm^3	Sulphur content ≤ 0.5%**
Untreated wood (including pellets)	1 MW	100 mg/Nm^3	Moisture content ≤ 25%**; Paint or extraneous materials excluded
Coal, LFO and petroleum distillates of higher viscosity	500 kW	100 mg/Nm^3	Sulphur content ≤ 0.5%**
Waste, used or recycled oil	Excluded		

*At a temperature of 0°C, pressure of 1 atmosphere and on a dry gas basis.
**Content by weight

It is also recommended that the suitability of separate or additional provisions for combustion discharges associated with back-up electricity generation and/or similar activities such as peak electricity network load management be investigated.

7 Non-Combustion Activities with Potential Amenity Effects

7.1 Overview

A number of activities where the engineering or mitigation controls were well understood, and where there were existing permitted activity thresholds which either required a more comprehensive review were identified from the prioritisation process.

Those activities that were identified as having a 'high' priority for evaluation were:

- The processing of animal and plant matter
- Crushing, screening, storage and handling of bulk materials
- Pneumatic conveyance of bulk materials
- Surface coating processes including spray application of coatings and use of di-isocyanates
- Abrasive Blasting (Mobile and Stationary)
- Gas, water and wastewater reticulated transfer
- Ventilation, Cooling towers and Fume cupboards
- Cleanfills

The following sections explore the reasons for the prioritisation for each activity, and any potential thresholds that could be implemented as permitted activity rules and conditions.

7.2 Processing of Animal and Plant Matter (Food Product Manufacturing)

7.2.1 Introduction

This activity was prioritised due to its potential for adverse effects on amenity due to odour discharges.

Rule 5, the "processing of animal and plant matter" typically includes processes undertaken in abattoirs, meat packaging plants, food manufacturing plants, fast food outlets and commercial kitchens. Clauses (a) to (d) are designed to exclude the parts of these activities which commonly emit offensive or objectionable odour and are difficult to manage. (i.e rendering) and are sourced from Schedule 2 of the Clean Air Act 1972.

Rule 5 also contains a clause relating to the method of dispersion which requires that the discharge of contaminants to air is vented through a chimney(s) or vent(s). The intention of this clause is to minimise the discharge of fugitive emissions and make for greater ease in monitoring discharges.

The primary discharges to air from these activities are odour from cooking or curing processes and also handling of waste material from such processes. Food processing operations often also include combustion processes for heating or drying but these are sufficiently covered under the combustion rules.

7.2.2 Authorities and documents queried

The following documents and authorities were queried for relevant thresholds for this activity. Table 7.1 summarises the documents and the findings:

Table 7.1 - Summary of Research for Food Processing

Document/Search term	Contains reference to activity?	Relevant threshold?
AS/NZS standards	No	N/A
NPI Guidelines	Yes	No
ARC Plan	Yes	Yes
BOPC Plan	No[1]	N/A
ECan Plan	Yes	No
EW Plan	Yes	Yes

1. While the BOPRC Plan has no specific reference or thresholds relevant to food processing activities, these could be permitted under the 'general activities' rule in that plan.

7.2.3 Discussion

Unlike some other regional plans, the GW Plan does not impose any limit on the scale of food processing activities covered by Rule 5. An appropriate permitted activity threshold could be drawn from the relevant rules in the AC:ALWP for food processing. The AC: ALWP contains one rule (4.5.91) for discretionary activities that address the effects of odour and hazardous air pollutants, as follows:

4.5.91 The discharge of contaminants into air from any of the following processes:

- *Flour or grain milling*
- *Deep fat or oil frying*
- *Curing by smoking*
- *Roasting or drying of berries, grains or plant matter*
- *The refining of sugar*

at a rate exceeding 250 kg per hour of product is a Discretionary Activity

This Rule implies that activities below this threshold are permitted subject to the general permitted activity Rule 4.5.1.

The EW Plan proposes two thresholds:

- A production capacity of 250 kg (dry basis) per hour for food, vegetable and meat processing, similar to the AC: ALWP. The basis for the threshold of 250 kg per hour production capacity appears to have been taken from Schedule 2 of the Clean Air Act 1972 and in most cases would provide for small-scale activities (e.g. domestic or boutique-scale production and small-scale industry)
- A maximum raw material capacity of 0.5 tonnes per hour for meat rendering, reduction or drying processes. This threshold is based on the Clean Act 1972 and would limit permitted rendering or drying operations only to very small or boutique operations

It is noted that Rule 5 would also cover the operation of breweries, with no limitations on scale of production. In the AC: ALWP breweries are specifically allowed for in Rule 4.5.90:

"The discharge of contaminants into air from the fermentation of plant matter for the purpose of producing alcoholic beverages at a rate that exceeds 25 million litres per year is a Restricted Discretionary Activity"

At least two large scale breweries operate in Auckland, however smaller operations also exist in the Wellington region.

From the GW complaints database, significant complaints relate to fish processing and meat works operations. While there are also intermittent complaints relating to odours from other activities, the bulk of odour complaints are consented processes, and it is unlikely a change to the permitted activity rules would significantly reduce these complaint levels.

From our review of other regional plans, discharge concentration thresholds are not applied to permitted activity rules for odour discharges from food processing activities. This is likely to be due to the complexities of olfactometry measurements, and a discharge concentration threshold would therefore not be a practical or workable tool for managing permitted activities.

7.2.4 Recommendations

A permitted activity criterion for processing of animal and plant matter could be specified as follows:

- Any processing of animal or plant matter (including any process incidental to the cooking of food such as deep fat frying, oil frying, roasting, drying, curing by smoking, and the slaughter or skinning of animals), with a total on-site production capacity of less than 250 kg per hour
- Consider also specifying a permitted activity threshold for fermentation of plant matter for alcoholic beverages

The activity should also comply with relevant combustion-related rules if applicable.

7.3 Crushers, Screeners and the storage, handling and processing of materials

7.3.1 Introduction

This activity classification is based on the existing RAQMP Rule 10 and this section focuses on both provisions 1 and 2 of the permitted activity rule, which provided for discharges to air from the extraction, quarrying, mining of minerals and the size reduction and screening of wood products and minerals, and storage of various bulk products that have the potential to generate dust.

The pneumatic conveyance of bulk materials is specifically excluded from this rule; however, this is discussed in detail in Section 7.4. A throughput threshold could potentially be imposed in the future specifically for activities involving pneumatic conveyance.

The main intent of this activity classification is to cover all aspects involved in quarrying and mining raw materials, their storage and general handling, their classification into size cohorts (screening), their reduction in size from large blocks into smaller aggregate (size reduction/crushing), and their storage.

'Handling' within this section is defined as activities involved in the movement of bulk materials that are **not** pneumatic conveyance.

7.3.2 Authorities and documents queried

The following documents and authorities were queried for relevant thresholds for this activity. Table 7.2 summarises the documents and the findings:

Table 7.2 - Summary of Research - Crushing and Screening Processes

Document/Search term	Contains reference to activity?	Relevant threshold?
NPI Guidelines	Yes	No
US EPA	Yes	No
NSW EPA	No	N/A
DERM	No	N/A
ARC Plan	Yes	Yes
BOPRC Plan	No	N/A
ECAN plan	Yes	Yes
Ministry for the Environment Guideline	Yes	No

7.3.3 Discussion

The existing provisions within the RAQMP permit the discharges to air from various processes involved with extraction, quarrying and mining of materials, in addition to the screening and size reduction of wood and minerals. While activities such as extraction, quarrying and mining are likely to be undertaken in areas where sensitive receptors are unlikely to be located, stockpiling, handling, screening and size reduction activities such as crushing of shingle, wood and concrete can be undertaken outside of mines and quarries.

It is inferred from the explanation in Rule 10 that an exclusion specifically relating to industrial and trade premises was deleted by a plan change. There is now only a specific exclusion for pneumatic conveyance of bulk materials.

Both the AC:ALWP and the ECan NRRP contain throughput thresholds that industrial and trade premises must comply with in order to be a permitted activity. They relate both to crushing/screening sites and to general quarrying sites.

The AC:ALWP provides a minimum threshold for open cast extraction, quarrying, screening and crushing activities of:

- 5 tonnes per hour (anywhere)
- 5 to 200 tonnes per hour when located outside an Urban Air Quality Management Area and the closest dwelling on a neighbouring property or residentially zoned area is greater than 200m away from the site

A ‘temporary’ activity of 60 tonnes per hour threshold is also included in the AC:ALWP for the *crushing* of concrete, masonry products, minerals, ores or aggregates.

ECan also identifies throughput thresholds that are permitted. The maximum rates for activities undertaken in conjunction with a quarrying or mining activity (extraction, size reduction, screening, pneumatic conveyance and storage) not undertaken within a permanent, fully enclosed structure are:

- 100 tonnes per hour (continuous)
- A permitted acceptance of 250 tonnes per hour and 1250 tonnes per day, provided the activity is conducted no more than 21 days per calendar year

- A minimum distance to a sensitive activity located on a different property must also be maintained if the reduction, screening, processing or pneumatic conveyance exceeds 50 tonnes per hour in any one hour of 200m (or 500m if blasting is involved)
- No more than 1000 tonnes to be stored when the material is a particle size of <3.5mm

For activities that are not associated with mining and quarrying areas – i.e for activities that could potentially be located in non-quarry and mine environments, the threshold is reduced to 100 tonnes per hour for size reduction, screening or pneumatic conveyance.

The predominant potential adverse effect is that of dust released from uncontrolled stockpiles and crushing/screening equipment. However, the engineering and mitigation options are well understood, and are generally easily applied in smaller activity situations. It should be noted that the AC:ALWP threshold of 5 tonnes per hour would be less than a typical 'medium sized truck' load per hour and is thus very low in comparison to the existing GW threshold (no limit).

A direct control to minimise dust propagation from the site is that of the particle size of <3.5mm threshold. At higher wind velocities (5m/s and higher), the probability of entrainment by wind into the air without other mitigation measures rises significantly[12]. Particles that are smaller in size can remain in a column of air for a longer period, and can travel farther from a stockpile and source. A particle size of 3.5mm (sand grain) is considered to be conservative when considering the distance that typical wind conditions could transport stockpiles.

It is not known how the other AC:ALWP and ECan NRRP thresholds were developed.

Outside of smaller situations, the management and capital expenditure to manage larger stockpiles and screening and crushing operations can potentially result in increasing the risk of fugitive dust emissions having an adverse amenity effect off-site. However, it should be noted that even large sites can be managed adequately to ensure that dust beyond the boundary of a site has an adverse effect that is less than minor.

Aside from the potential dust emissions, another consideration is for the site-wide combustion processes from potentially large engines required to power crushing, screening and mining equipment. It is proposed that any such equipment (as a total site-wide emission) would also need to comply with the combustion activities thresholds and conditions.

The primary issue for consideration is to balance the existing GW threshold (no throughput limitation) with implementing a reasonable throughput rate for which smaller operators will be able to comply with, provided appropriate mitigation practices are in place.

7.3.4 Recommendations

The research indicates that there are two different thresholds that should be considered. They are for activities that are conducted within a quarry or mining site, and for activities that are conducted elsewhere.

[12] Ministry for the Environment, Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions 2001

For activities that are conducted on-site and located with a quarry, mine or similar area, potential thresholds could be:

- A throughput for mining, quarrying, crushing, screening, processing, stockpiling and handling of X tonnes per hour, to a maximum of Y tonnes per day
- A setback distance to the nearest sensitive receptor of 200m
- No more than a total of 1000 tonnes to be stored on site when the material is of a particle size less than 3.5mm

Where X equates to a threshold of 200 – 250 tonnes per hour; an Y equates to a maximum based on the total number of tonnes to be stored on site and when evaluating the GW consent database and what activities are permitted

For activities that are conducted elsewhere, potential thresholds could be:

- A throughput for crushing, screening, processing, stockpiling and handling of X tonnes per hour, to a maximum of Y tonnes per day
- A setback distance to the nearest off-site sensitive receptor of 200m if the activity exceeds Z tonnes per hour
- No more than a total of a day's worth production at Z tonnes to be stored uncovered on site when the material is of a particle size less than 3.5mm.

Where X equates to a threshold of between 100 and 200 tonnes per hour; where Y equates to a maximum of 800 tonnes per day (equivalent to 100 tonnes per hour for a working day); and where Z equates to a percentage of X (for instance, ECan has used 50% in their threshold).

As the control on throughput for processes located in industrial/trade zones, throughput could be limited by the 'Z' variable, consultation with stakeholders and evaluation of the consented thresholds in the GW region would assist in determining the correct thresholds to implement.

The definition of "Sensitive Receptors" is likely to require additional refinement and should be defined in any revision of the RAQMP if the recommended setback provisions are adopted. It is considered that using notional boundary interpretations that are similar to existing District Plan provisions could be useful in defining the extent of neighbouring sensitive receptors. The use of notional boundaries would therefore change in accordance with land use zone. For example, in a residential zone, the notional boundary may be 10m from the house footprint. In a business zone, it may be the actual building footprint that is defined as a notional boundary.

If correlation with District Plans is considered overly complex in determining separation distance thresholds, a more conservative approach would be to define sensitive receptors as owner/occupiers of land parcels within the same 200m buffer zone.

7.4 Pneumatic conveyance of bulk materials

7.4.1 Introduction

This activity is a continuation of the handling processes discussed in Section 7.3 and is an activity specifically excluded from Rule 10 of the GW RAQMP.

The measures that could be employed to mitigate discharges to air from pneumatic conveyance processes are well-known. However, there can be significant capital costs that are related to installing and maintaining pneumatic conveyance emissions control technology. The predominant potential discharge is that of TSP and particulate matter as a result of the vacuum movement of the material.

Pneumatic conveyance is used to move a variety of bulk materials, and is not limited to just natural minerals, aggregate and wood products as discussed in Section 7.3. Many types of industrial and trade processes that convert raw materials into a processed product could potentially use pneumatic conveyance techniques to move product around a factory.

Examples of industries which commonly employ pneumatic conveyance include:

- Wood working and carpentry shops to remove sawdust
- Manufacture or processing of a pelletised raw material (such as plastic beads) into a product (such as plastic matting)
- Concrete batching plants

7.4.2 Authorities and documents queried

Table 7.3 summarises the documents and authorities were queried for relevant thresholds for this activity – note that the research found in Table 7.2 contained information for both pneumatic conveyance/handling and for storage/processing of bulk materials.

Table 7.3 - Summary of Research for Pneumatic Conveyance and Handling of Bulk materials

Document/Search term	Contains reference to activity?	Relevant threshold?
NPI Guidelines	Yes	No
US EPA	Yes	No
NSW EPA	No	N/A
DERM	No	N/A
ARC Plan	Yes	Yes
BOPRC Plan	No	N/A
ECAN plan	Yes	Yes

7.4.3 Discussion

Pneumatic conveyance of material is specifically excluded from the existing permitted activity rule in the RAQMP. The AC:ALWP does not provide a permitted activity threshold for the pneumatic conveyance of materials, however, the ECan NRRP provides the same thresholds for pneumatic conveyance as for bulk materials handling, being a threshold of 100 tonnes per hour. Activities that handle between 50 to 100 tonnes per hour of materials also need to have a buffer of 200m to the nearest sensitive receptor.

The main contaminant of concern generated from pneumatic conveyance processes is TSP and PM_{10}. There are many mitigation options available, ranging from an uncontrolled emission through to fabric filtration devices.

Currently, all pneumatic conveyance systems in the Wellington Region are discretionary activities, and as such, any permitted activity rule implemented would provide some smaller pneumatic conveyance systems without the need for additional compliance costs related to resource consents.

Additionally, because of the potential effects of a particulate-related discharge for PM_{10}, it is also important to minimise the mass emission of these particle sizes to ensure that any potential adverse effects are minimised.

It should be noted that, the current requirement to authorise any pneumatic conveyance process would require many activities with pneumatic conveyance associated with them to apply for resource consents. It is likely that a significant number of small pneumatic conveyance activities associated with industry or trade are currently unconsented, and that they may also have adverse effects that are less than minor. Examples of this could be small carpentry shops with multi-cyclones to evacuate saw dust to air.

Examples of how pneumatic conveyance is provided for in other plans are limited, and given the variety of industries that use pneumatic conveyance, industry guidance on best approach to mitigation of potential discharges is also limited.

Instead, relating pneumatic conveyance to best practice guidelines for emissions control technology for particulate matter could be a starting point for discussion. Bag and cartridge filtration techniques can achieve good particulate matter removal efficiencies, and good bag filters typically release concentrations of 20mg/Nm^3 at the point of discharge, although most conservative estimates (for modelling purposes) usually assume concentrations of 50mg/Nm^3.

7.4.4 Recommendations

It is considered that two thresholds could be implemented for pneumatic conveyance processes. These would be:

- A throughput of product of less than X tonnes per hour
- A throughput of product of between X to Y tonnes per hour which also requires compliance with
  - An emission concentration of no more than 50mg/Nm^3 at the point of discharge (equivalent to many existing bag and cartridge filter efficiencies)

Where X is a minimal throughput rate that could be developed on consultation with small-scale stakeholders such as carpentry shops – say 1/100th of Y.

Where Y is a throughput rate that could be developed with an evaluation of existing throughputs experienced by consented pneumatic conveyance sites; but no more than 50 tonnes per hour as required in the ECan provisions.

Further work could also evaluate whether there are other methods such as defining beta filter efficiencies based on PM_{10}, which would be easier to determine compliance with than a stack concentration.

Additional refinement could also be given to identifying certain individual activities for which the use of a bag filter would be potentially unnecessary, which would lead to the permitting of activities such as wood working and carpentry shops. Currently, small-scale discharges from the activities could potentially have adverse effects that are less than minor, but would not be in compliance with the existing or proposed thresholds. This may be unnecessary if the “X” threshold is developed for small activities such as woodworking/carpentry shops or in consultation with industry, as opposed to applying the ‘minimal throughput rate’ threshold.

7.5 Surface coating and spray application of coatings including the use of di-isocyanates

7.5.1 Introduction

The RAQMP currently provides for some surface coating activities as a permitted activity subject to conditions. Surface coating has been prioritised as industrial solvent use (mainly from “panel and paint” type activities) has been associated with a number of complaints in the Region. It has also

been identified as a priority because it is a single rule that covers a wide range of activities, and thresholds exist for many of the activities that fall within this broad grouping.

Surface coating encapsulates a wide variety of activities, such as:

- Automotive refinishing
- Application of adhesives and sealants
- Printing (heat set web offset, lithographic, rotogravure, etc.)
- Commercial and industrial painting (maintenance painting of steel)
- Wood furniture manufacture

7.5.2 Authorities and documents queried

There are a wide range of regulatory and industry codes of practice and guidelines, which include criteria that could be incorporated in permitted activity rules. Examples include:

- Best Available Techniques for the Surface Treatment using Organic Solvents (August 2007)
- Environmental Code of Practice for the Reduction of VOC Emissions from the Commercial/Industrial Printing Industry, CCME, August 1999
- AS/ NZS 4114.1:2003 Design, construction and testing of spray-booths and AS/NZS 4114.2:2003 Selection, installation and maintenance of spray-booths
- Standards and Guidelines for the Reduction of VOC Emissions from Canadian Industrial Maintenance Coatings, CCME , October 2001
- National Standards and Guidelines for the Reduction of VOC from Canadian Commercial/Industrial Surface Coating Operations - Automotive Refinishing, CCME , October 1998
- Guidelines for the Reduction of VOC Emissions in the Wood Furniture Manufacturing Sector, CCME , 2004
- Best Practices for Auto Refinishers when Spray Painting, US EPA, June 2000

In addition to the above texts, Table 7.4 provides a summary of other documents researched:

Table 7.4 - Summary of Research for Spray Coating Processes

Document/Search term	Contains reference to activity?	Relevant threshold?
ARC Plan	Yes	Yes
ECAN Plan	Yes	Yes
Waikato Regional Council Plan	Yes	Yes

7.5.3 Discussion

Surface coating activities all emit volatile organic compounds from the use of solvents in the surface coating materials. In most cases, the solvent is intended to evaporate, either at ambient temperatures or through the application of heat, leaving a protective or decorative coating on the substrate.

The key environmental effects of VOCs can be broadly categorised as:

- Odour;
- Toxic effects; and
- Photochemical smog formation.

Most overseas controls on VOC emissions are primarily intended to minimise photochemical smog formation by reducing concentrations of VOCs in ambient air. This is unlikely to be an issue in Wellington, where the primary environmental effect associated with surface coating is localised effects of odour. In practice, this means that thresholds adopted overseas may not be appropriate for Wellington (as they will be based on local emissions inventories and a judgement about "significant" emitters). However, the codes of practice and guidelines developed overseas to minimise VOC emissions from these activities are relevant and may be useful for setting permitted activity criteria.

For spray application, the current PA thresholds in the RAQMP are a rate of consumption not exceeding 30 litres (or 30 kg) per day and also not exceeding 3 litres (or 3 kg) per hour on a coating premises. The same daily limit is adopted as a threshold in the Waikato Regional Plan. For comparison, the AC:ALWP uses a solvent emission limit of 20 kg/hour as a threshold for requiring a restricted discretionary consent. Solvent emissions can generally be calculated based on the usage of the coating material and the percentage solvent content from Safety Data Sheets. Therefore, limits based on solvent emission rates are not considered overly difficult to enforce provided that records are maintained of usage rates.

The ECan NRRP includes separate permitted activity rules for

- Small scale spray coating not within a spray booth
- Small scale spray coating within a spray booth
- Printing processes using water-based inks

These rules are comprehensive and could be used as the basis for modified PA criteria for specific activities in Wellington.

7.5.4 Recommendations

Permitted activity criteria could be developed for certain surface coating activities, as follows:

a. Spray application within a spray booth

Spray application of coating materials (including paint, paint solvents, varnish, lacquer, dyes, metal oxide coatings, adhesive coatings, elastomer coatings, stains, and polishes) within a spray booth:

- At a rate of consumption not exceeding 30 litres (or 30 kg) per day and also not exceeding 3 litres (or 3 kg) per hour on a coating premises
- The spray booth shall be fitted with an air extraction system and the discharge shall be via a filtration system that is designed to removes at least 95% of particulate matter from the discharge
- The filtration system shall be maintained to ensure that this particulate removal efficiency is achieved at all times
- The discharge of contaminants to air is vented with an unimpeded vertical flow, through a chimney(s) or vent(s) which terminates at least three metres above the level of any adjacent area to which there is general access (i.e. ground level, roof areas or adjacent openable windows) within 35 metres of the stack and as far as practicable from the boundary of any residential property

For comparison, the equivalent thresholds in the ECan NRRP are not more than 2 litres per hour of coating material; not more than 10 litres per day of coating material; and not more than 100 litres per month of coating material.

b. Spray application not within a spray booth

Spray application of coating materials (paint or adhesive coatings) not within a spray booth:

- Using not more than 0.5 litre of coating material per hour and not more than 5 litres of coating material per month
- Using not more than 5 litres of coating material per hour and not more than 20 litres of coating material per month, at a location at least 100 metres from any sensitive activity beyond the boundary of the property where the spray coating is undertaken

Subject to the following conditions:

- The discharge shall occur at least 10 metres from any sensitive activity beyond the boundary of the property where spray coating is undertaken

These rules for spray painting would need to be cross-referenced to the rule relating to use of di-isocyanates and organic plasticisers.

c. Printing processes using water-based inks

The discharge of contaminants into air from printing processes using only water based inks, dyes and additives, subject to:

- The undiluted water based inks, dyes and additives used shall contain less than 5% volatile organic compounds by weight
- The total quantity of hydrocarbon solvents discharged shall not exceed the 5 kilograms per day or 50 kilograms per month
- Controls on stack discharge parameters
- Records are maintained of ink and solvent use

This is significantly more restrictive than the solvent emission threshold in the AC: ALWP of 20 kg/hour. However, this is an activity that is not identified in the existing RAQMP and thus the suggested threshold is less onerous than the status quo. It may warrant further investigation (such as dispersion modelling if robust emissions factors can be gathered) to consider whether a higher threshold than 5 kg per day would be appropriate. It is noted that this may prove a complex exercise due to the differing odour threshold and health-based air quality criteria for VOCs.

The discharge to air from photocopying, photographic development and printers serving computers can be provide for as a permitted activity due to the low potential for effects.

“Sensitive receptor” definitions have previously been discussed in Section 7.3.4.

7.6 Abrasive Blasting

7.6.1 Introduction

This rule was prioritised as it is an existing rule in the GW RAQMP, and because there is the potential that if good engineering controls are included in the conditions, the adverse effects of those discharges could potentially be minimised.

Rule 16 currently controls abrasive blasting processes, but specifically excludes dry abrasive blasting. Both stationary and mobile abrasive blasting processes are controlled by this rule. It is noted that a TSP emission concentration condition is not implemented in this Rule, one of the instances where the TSP emission ‘standard’ of 250mg/Nm^3 in the RAQMP could be applicable.

On evaluation of other rules and regulatory authorities, it is considered that permitting some discharges relating to dry abrasive blasting is possible.

7.6.2 Authorities and documents queried

A summary of the documents and authorities that were queried for relevant thresholds for this activity is found in Table 7.5.

Table 7.5 - Summary of Research for Abrasive Blasting Processes

Document/Search term	Contains reference to activity?	Relevant threshold?
AS/NZS Standards	Yes	Yes
Australian EPA	Yes	Yes
DERM	Yes	Yes
ARC Plan	Yes	Yes
BOPRC Plan	Yes	Yes
ECAN plan	Yes	Yes

7.6.3 Discussion

As can be seen, many authorities identify various thresholds that could be implemented or refined for the purposes of new thresholds and conditions.

Table 7.6 provides a summary of the standards and their regulatory sources.

Table 7.6 - Relevant Thresholds for Abrasive Blasting

Standard	Description	Comment	Source
Material type	Material used for abrasive blasting must not contain more than **5%** free silica on a dry weight basis	Free silica has potential health effects	AS/NZS 2243.8:2006
	Free silica content of a representative sample of material to be less than **5%** by weight		ECan NRRP and AC: ALWP
	Abrasive material used for the blasting shall contain less than **2 %** by dry weight dust able to pass a **0.15 mm** sieve.	Blasting material of very small size should not be used	AC: ALWP
Emission parameters	**100 mg/Nm^3** (0°C, 1atm, dry gas) Maximum particulate matter concentration allowed at the point of discharge from the enclosure	In order to comply with this stack concentration, it is likely that some emissions control technology would be required. Therefore, it is considered that the more stringent 50mg/Nm^3 standard would be more conservative and should be applied.	Waikato Regional Plan

Standard	Description	Comment	Source
	250 mg/Nm^3 of residual gases after completion of the process and before amalgamation with air, smoke or other gases Maximum level of concentration of solid particles, measured at testing points determined by the Air Policy	It is possible that this could be achieved by an uncontrolled stack discharge	Environment Protection Authority Australia
	Emissions pass through fabric filter, or dry filtration to achieve **30mg/Nm^3** (0°C, 1atm, dry gas)	As indicated, a bag house or cartridge filter would need to be used to achieve this efficiency	AC: ALWP
	Minimum exhaust ducts height **3 m** above the highest structure within a **30 m radius** of the exhaust	This is a requirement based on 250 mg/Nm^3	Environment Protection Authority Australia
	Minimum discharge velocity **10 m/s** from the dust collector to the atmosphere		Environment Protection Authority Australia
	Discharge to be filtered by an extraction system that removes at least 95% of particulate matter from the discharge	The basis for this threshold is unknown	ECan NRRP
Setback distances	**500 m** Minimum separation distance required around the dry blast cleaning site	To ensure that the potential effects are mitigated with a buffer zone	Environment Protection Authority Australia
	100m Minimum zone to be provided for a wet cleaning site. If a minimum separation distance of 100 metres cannot be met, wet blasting must be used		Environment Protection Authority Australia
	No over-spray, dust, odour, gas or vapour from the process which is noxious, dangerous, offensive or objectionable at or beyond the boundary of the property, or beyond **50 metres** of the discharge when sited on public land		GW RAQMP
	Minimum required height above the structure or item being blasted fully screened (sides only) to a height of **2 metres**	To assist in controlling potential emissions at the source	Environment Protection Authority Australia
Notification threshold	**200 m** Notification for mobile sites **2 weeks to 24 hours** before blasting, shall include date, time, duration of abrasive blasting Mobile dry abrasive blasting: owner/occupier or agent must notify the occupier of any adjoining property when the abrasive blasting will be undertaken within **200** metres of that adjoining property	For mobile processes, local stakeholders require a notification	Bay Of Plenty Regional Air Plan

Standard	Description	Comment	Source
	24 hr Minimum notification time before commencing the activity at each new work location (mobile sites)		Department of Environment and Resource Management (Queensland Government)

It is proposed for consideration that abrasive blasting processes be split into those that are stationary, and those that are mobile. This would permit stationary processes, provided that certain emission control measures were in place to mitigate the potential adverse effects of particulate discharge and include dry abrasive blasting processes. Mobile abrasive blasting processes could potentially be developed on a restricted discretionary basis. This would make the implementation of global/region-wide consents for mobile abrasive blasting easier for operators who can demonstrate acceptable mitigation measures within set matters for discretion. This approach is generally in keeping with other regional authorities such as ECan (AQL51 – AQL52A) and ARC (Rules 4.5.52 – 4.5.54 and 4.5.61).

7.6.4 Recommendations

Abrasive blasting processes should be split into two activity classifications – stationary abrasive blasting (including dry abrasive blasting) and mobile abrasive blasting. Mobile abrasive blasting could potentially only restrict dry abrasive blasting processes and the matters for discretion could be limited and mobile dry abrasive blasting could potentially be a restricted discretionary activity.

The thresholds for stationary abrasive blasting (including dry abrasive blasting) could potentially be:

- Materials used for dry abrasive blasting to not contain more than 5% free silica on a dry weight basis
- The abrasive blasting shall be undertaken within an enclosed booth in order to minimise over-spray of blast debris (applies to wet and dry processes)
- The emission from dry abrasive blasting shall be extracted and filtered booth for which the concentration at point of discharge is no greater than 50mg/Nm^3 at STP (this would relate to a bag filter or cartridge filter as a minimum)
- Minimum chimney height from dry abrasive blasting would comply with general chimney height guidelines

For mobile dry abrasive blasting, a number of matters of discretion and thresholds could be:

- The distance of notification of potentially affected parties
- Working hours
- Minimum period prior to and after notification for works to begin
- Separation distances to waterways
- Separation distances to sensitive receptors
- General amenity provisions
- Type of coating to be blasted (e.g. no lead-based paints to be removed)
- Types of mitigation measures to be installed at the site

7.7 Gas, water and wastewater reticulated supply and transfer

7.7.1 Introduction

This activity class seeks to amalgamate some processes identified in the RAQMP Rules 21 and 22. It was originally considered that the general activity could be described as 'Discharges from facilities where the primary purpose is for the storage, conveyance, transfer and pumping of gas, water and wastewater.

The intent of this activity classification would be to permit the minor discharges to air that may be associated with pumping stations and like infrastructure, provided there is no adverse effect being caused by that activity.

For instance, it is known that some sewage pump stations in the Wellington Region have had intermittent odour-related nuisance discharges in the past. These stations would still either require consent, or could potentially need to be improved with filtration in order to comply with the requirements of this rule.

Rule 21 specifically excludes the discharges related to *treatment* of sewage and liquid-borne wastes. It is not proposed to alter this exclusion.

7.7.2 Authorities and documents queried

The following documents and authorities were queried for relevant thresholds for this activity. Table 7.7 summarises the documents and the findings:

Table 7.7 - Summary of Research for Network Utility Reticulated Supply Systems

Document/Search term	Contains reference to activity?	Relevant threshold?
AS/NZS Standards	Yes	No
AS Standards	Yes	No
ISO Standards	Yes	No
ARC Plan	Yes	Yes
BOPRC Plan	No	N/A
ECAN plan	No	N/A

7.7.3 Discussion

From an analysis of the existing GW complaints database, it can be noted that sewerage pump stations are a potential source of odour related complaints. However, locating individual pump stations and determining compliance with the 'general' odour condition can be problematic. The circumstances for the emission of odour from individual pump stations can be complex and vary in accordance with age of sewage, season (ambient temperature), amount of influent arriving at the station, and whether there has been recent wet weather.

Only one plan has developed fixed thresholds based on "best practice" for the design of pump stations. The AC: ALWP permits a threshold of up to 10,000m^3 of a facility used for pumping, transfer or storage of sewage, with the requirement that tanks between 4,000m^3 and 10,000m^3 are fitted with an effective odour control system, such as a bio-filter.

7.7.4 Recommendations

It is recommended that GW amalgamate RAQMP Rules 21 and 22.

It is recommended that GW consider implementing some set thresholds such as above, however this may require further consultation with network utility operators and other stake holders.

An evaluation of existing resource consents for pump stations relating to sewage and gas reticulated storage options is also recommended. Thresholds could be similar to the ARC thresholds, where:

- The pumping, transfer and storage of water is permitted
- The pumping, transfer, storage of Xm^3 of gas and sewage facilities is permitted
- The pumping, transfer, storage of Xm^3 to Ym^3 of gas and sewage facilities is permitted, provided odour control is fitted to the facility.

Where X is the lower threshold (for example, 4,000m^3) and Y is the higher threshold above which a resource consent would be required (for example, 10,000m^3).

Note that water pumping stations would be permitted as they would not typically release odour irrespective of size of operation.

7.8 Ventilation, Cooling Towers and Laboratory Fume Cupboards

7.8.1 Introduction

This activity was identified as an amalgamation of two existing permitted activity rules, Rule 17 and Rule 22 of the RAQMP.

Rule 17 permits discharges to air from industrial and trade premises and their associated cooling towers and heat exchangers and from the ventilation of indoor working spaces.

Rule 22 permits a mix of miscellaneous activities such as vehicle engine maintenance and servicing, dry cleaning (discussed in Section 8.6 of this report), laboratory fume cupboards, tunnels and car parks, welding (discussed in Section 8.3 of this report), spray painting of roads and bridges (discussed in Section 7.5 of this report), road construction and paving, and incidental equipment for natural gas transmission pipe lines (discussed in Section 7.7 of this report).

The following activities are proposed to share the same general guidelines included in this section's recommendations:

- Laboratory fume cupboards
- Steam and vapour emission processes (including water vapour plumes, steam and air-cooled heat exchangers)
- Forced air ventilation from indoor working spaces (for the purposes of office space and the like)

7.8.2 Authorities and documents queried

The following documents and authorities were queried for relevant thresholds for this activity. Table 7.8 summarises the documents and the findings:

Table 7.8 - Summary of Research for Ventilation and Fume Cupboard processes

Document/Search term	Contains reference to activity?	Relevant threshold?
AS/NZS standards	Yes – AS/NZS 2243.8:2006	Yes
NPI Guidelines	No	N/A
ARC Plan	No	N/A
BOPRC Plan	No	N/A
ECAN plan	Yes	Yes
EW Plan	Yes	Yes

7.8.3 Discussion

The proposed activity grouping brings together three generally unrelated processes that are potentially similar in the manner of control.

The conditions required by Conditions 17 and 22 of the existing RAQMP seek to ensure that there is no cross-contamination of potential discharges (water vapour and heat) with other like devices, which would impair their operation.

ECan maintains four rules that are pertinent to these activities. For fume cupboards, the relevant rules are:

AQL45 – Laboratory fume cupboards from educational institutions

AQL 46 – Laboratory fume cupboards from commercial properties

They contain similar conditions to GW, however, for fume cupboards, contaminants are required to be discharged into air above the maximum height (or 1m above the roof ridge line) of the roof of any building within 15m of the stack.

There is an AS/NZS standard for the design of fume cupboards as well. There are two threshold requirements of note:

- Minimum fume discharge velocity to be **10m/s**
- Minimum stack discharge height above the roof at the point of penetration and any access area to be **3m**

While the thresholds are different, the intent of both the ECan threshold and the AS/NZS standard is the same: To minimise the potential for emissions from fume cupboards to have a direct impact on near-field receptors.

The ECan rules for discharges of heat and water vapour are controlled by AQL 48 – discharges of heat, steam or water vapour.

Given that the discharges from cooling and ventilation towers are most likely to be inert, the intent of the conditions seeks to ensure that the visible plumes do not cause an objectionable effect on neighbouring properties.

Waikato Regional Council operates a similar rule. Rule 6.1.20.1 allows for visible steam plumes from processes with a rate of heat release not exceeding 50MW. This is a high threshold for cooling and ventilation towers. A number of amenity-driven conditions include considerations such as:

- Providing that plumes do not cause shadowing (e.g. from an opaque plume) beyond the boundary of the property
- Providing that the plumes do not impinge on an aircraft flight path
- Providing that biocides that are used to inhibit microbial growth comply with other legislation requirements; while also prohibiting the use of hexavalent chromium as a biocide.

Emissions from workplace ventilation are provided for in ECan rule AQL 56. The rule is the corollary to the GW Rule 17 for 'forced air ventilation from indoor working spaces'; but provides a more detailed interpretation and threshold for what defines an indoor working space. For example, the GW Rule could potentially be interpreted as permitting the ventilation of a general workplace that deals with hazardous air pollutants; however, the discharge of hazardous air pollutants is restricted by the ECan rule.

As work place ventilation is in place to ensure compliance with Department of Labour standards specified for Workplace Exposure Standards (WES), the ECan rule also ensures that the concentration within the workplace prior to discharge does not exceed the relevant WES; which would therefore also imply that ground level concentrations after the point of discharge will also be acceptable for the protection of the general population.

7.8.4 Recommendations

For fume cupboards, it is considered appropriate to consider the requirements of the AS/NZS standards as a minimum acceptable threshold for emissions from fume cupboards. While it is possible that various chemicals (including hazardous air pollutants) could be discharged from fume cupboards, they serve an essential function for educational and commercial institutions to protect worker health and safety. The mass emission rate of any such pollutant is likely to be extremely low, and it is expected that the design guidelines provided in the AS/NZS standards have been formulated to ensure the protection of the receiving environment.

There is some difficulty in interpreting phrases such as 'generally accessible area', so it may also be of some assistance to define a minimum set back distance from access areas such as windows, doorways, etc.

Potential thresholds for fume cupboards could be:

- Have a minimum fume discharge velocity of 10m/s
- Have a stack height of 3m higher than the roof ridge of the building from which the discharge emanates
- Have a separation distance of 15m or more from a generally accessible area.

For cooling towers and steam plume discharges, potential thresholds could be:

- Permit the discharge of water vapour, heat, and steam into the air from industrial or trade premises
- No shadowing caused beyond the boundary of the property

There is also the potential to include the requirement to comply with other legislation (specifically the Hazardous Substances and New Organisms Act 1996) with respect to the use of biocides; however, this could result in a situation where GW is required to determine compliance with a matter that would be best handled by a different authority.

For workplace ventilation discharges such as air conditioning units and forced air extraction for general workplace areas, potential thresholds could be:

- No emission of a hazardous air pollutant (i.e. existing RAQMP Appendix 1 pollutants)

7.9 Cleanfills

7.9.1 Introduction

This rule was prioritised as the existing provisions in the RAQMP are reasonably stringent when compared with other permitted activity rules identified in other Regional Plans.

Rule 20 of the RAQMP currently permits landfilling and composting and discharges from closed landfill activities provided the waste materials are not accepted from sources other than the property on which the landfilling or composting takes place. The definition of 'landfill' in the RAQMP specifically excludes 'cleanfill' material (also defined). Therefore, it would appear that all types of cleanfill activities require technical compliance with Rule 23 as a discretionary activity.

7.9.2 Authorities and documents queried

The following documents and authorities were queried for relevant thresholds for this activity. In the case of regional plans, only the air quality management plans (where relevant) were consulted. Table 7.9 summarises the documents and the findings:

Table 7.9 - Summary of Research for Cleanfilling Activities

Document/Search term	Contains reference to activity?	Relevant threshold?
AS/NZS standards	No	N/A
Environment Waikato	No	N/A
ARC Plan	No	N/A
ECan Plan	Yes	Yes
Ministry for the Environment Guideline	Yes	No

7.9.3 Discussion

The discharge of contaminants to air arising from cleanfill processes is inherently linked to the permissiveness of the relevant regional discharges to land plan. For instance, if there is a volume threshold for cleanfill discharged to land, the commensurate effects of the discharges to air may be less than minor and such could potentially also be permitted.

Of importance in the consideration of both discharges is that of the composition of the material. The Ministry for the Environment "Good Practice Guide to Managing Cleanfills" 2007 identifies acceptable materials for disposal at cleanfill, and the reasons for that, as:

- Asphalt (cured) - Weathered (cured) asphalt is acceptable: After asphalt has been exposed to the elements for some time, the initial oily surface will have gone and the asphalt is considered inert

- Bricks - Inert - will undergo no degradation
- Ceramics - Inert
- Concrete (un-reinforced) - Inert material. Ensure that other attached material is removed
- Concrete (reinforced) - Steel reinforcing bars will degrade. However, bars fully encased in intact concrete will be protected from corrosion by the concrete. Reinforced concrete is thus acceptable provided protruding reinforcing steel is cut off at the concrete face
- Fibre cement building products - Inert material comprising cellulose fibre, Portland cement and sand. Care needs to be taken that the product does not contain asbestos, which is unacceptable
- Glass - Inert, and poses little threat to the environment. May pose a safety risk if placed near the surface in public areas, or if later excavated. The safety risk on excavation should become immediately apparent, so glass is considered acceptable provided it is not placed immediately adjacent to the finished surface
- Road sub-base - Inert
- Soils, rock, gravel, sand, clay, etc - Acceptable if free of contamination
- Tiles (clay, concrete or ceramic) - Inert

When relating the above to potential for discharges to air, the main effect is likely to be on amenity from wind propagated dust. Recommendations contained in this report (Sections 7.3 and 7.4) which relate to the handling of bulk material suggest consideration of thresholds based on the number of tonnes handled on site (with further work suggested to determine the appropriateness of thresholds of between 50 tonnes and 200 tonnes per day). Provided similar mitigation measures are in place to those for the handling and storage of bulk material, the thresholds for cleanfill discharges to air could potentially be related to these same tonnages derived.

However, as indicated earlier, it is most important in the context of potential for adverse effects that cleanfill discharges to air be related to the relevant discharge to land rules and permitted activity thresholds. It is considered appropriate to require discharge to air consents from a cleanfill activity that would also require a discharge to land permit.

7.9.4 Recommendations

Correlate thresholds for discharges to air from cleanfill processes to the same thresholds that are developed for discharges to land from cleanfills.

Alternatively, consideration could be given to determining whether the recommended ‘bulk handling and storage’ thresholds could be appropriate in the context of the discharge to land plan thresholds, and implement the same threshold for discharges from cleanfills.

8 Non-Combustion Activities with Potential Health Effects

8.1 Overview

A number of activities where the engineering or mitigation controls were well understood, and where there were existing permitted activity thresholds which either required a more comprehensive review were identified from the prioritisation process.

Those activities that were identified as having a 'high' priority for evaluation were:

- The drying and heating of minerals
- The processing of metals
- Chemical processes
- Closed Landfills
- Dry cleaning

The following sections explore the reasons for the prioritisation for each activity, and any potential thresholds that could be implemented as permitted activity rules and conditions.

8.2 Drying or Heating of Minerals

8.2.1 Introduction

This activity was prioritised as it has a permitted activity threshold and conditions in the existing RAQMP.

Excluding those activities listed in clauses (a) to (d) of Rule 11, the "drying and heating of minerals" typically encompasses the production different types of clay-based products, which can be broadly categorised as.

- Bricks and structural clay products (e.g. roofing or paving tiles)
- Pottery products
- Ceramics

Similarly, there is a range of cement-based structural products like blocks and paving stones, whose commercial production includes drying in relatively low temperature ovens.

The primary discharges to air from all of these activities are particulate matter (dust) from raw materials handling and forming (e.g. extrusion) and combustion products from the kilns. The key differences in emissions between these activities are related to VOC emissions from different types of additives, glazes, sealants and paint finishes.

8.2.2 Authorities and documents queried

The following documents and authorities were queried for relevant thresholds for this activity. Table 8.1 summarises the documents and the findings:

Table 8.1 - Summary of Research for Drying and Heating of Minerals

Document/Search term	Contains reference to activity?	Relevant threshold?
AS/NZS standards	No	N/A
NPI Guidelines	Yes	No
ARC Plan	Yes	Yes
BOPRC Plan	No	N/A
ECAN plan	Yes	Yes
EW Plan	Yes	Yes

8.2.3 Discussion

One difficulty with existing Rule 11 is clause (e), which relates to the list of hazardous air pollutants in Appendix 1 of the RAQMP. This is a very comprehensive and exhaustive list and is likely to capture a large number of activities, regardless of the scale of potential effects. We note that although it causes practical difficulties, most regional plans in New Zealand have adopted a similar approach and include a list of hazardous air pollutants. However, some plans have attempted to quantify a permitted activity threshold for these contaminants, either as a mass emission or in terms of avoiding health effects.

An example is the general permitted activity rules in the ARP:ALW, which includes a condition in the general permitted activity rule (4.5.1):

"That beyond the boundary of the premises where the activity is being undertaken there shall be no discharge into air of hazardous air pollutants that does, or is likely to, cause adverse effects on human health, ecosystems or property."

However, this approach requires either that an adverse effect is identified beyond the boundary of the site before a consent is required, or a diligent proactive approach which may require a greater time investment from a Council compliance investigation staff member to determine whether there is an effect from the discharge of hazardous air pollutants. It is noted that this may be difficult for many hazardous air pollutants as the threshold for detection of the contaminant through observation (in the form of odour) may be higher than when there is an adverse effect.

It is likely that a pragmatic approach to evaluating compliance with permitted activities is taken to well-known activities that could potentially emit very minor quantities of hazardous air pollutants.

There has been no specific industry guidance identified in the course of this investigation that would identify a suitable threshold for avoiding effects of particulate emissions from manufacture of mineral products.

From our review of other regional plans, a potentially workable approach could be based on the relevant rules in the AC: ALWP for drying and heating of minerals (ceramics, bricks or tiles). The AC: ALWP contains one rule that is solely aimed at addressing effects of particulate matter and combustion products (4.5.39) and a separate, but related, rule (4.5.40) that address the effects of odour and hazardous air pollutants, as follows:

- 4.5.39 The discharge of contaminants into air from any process that includes the baking of ceramics, bricks or tiles with a total on-site capacity of more than 5 tonnes per day is a Discretionary Activity.
- 4.5.40 The discharge of contaminants into air from the drying, curing or baking of any substance (excluding food processes and those processes covered by Rules 4.5.37 and 4.5.38) that on heating at a rate exceeding a total on-site capacity of 500 kW (kilowatts) releases dust, odour or hazardous air pollutants is a Discretionary Activity.

The basis for the threshold of 5 tonnes per day production capacity is not known, however it is likely be intended to provide for small-scale activities (e.g. domestic or boutique-scale production and small-scale industry) as a permitted activity. It is considered likely that the production capacity of 5 tonnes could be aimed to be similar to a minimum production throughput for which it is economic to operate an activity.

The threshold for on-site heating capacity of 500kW derives from the definition of Part A processes, and is intended to provide for small-scale release of organic compounds from the application of heat. This is directly relevant to driving off the organic carriers from additives or sealants, etc. in the manufacture of clay or cement products.

The ECan NRRP proposes one threshold, based on a production capacity of 50 kg (dry basis) per day, with kilns fired by electric, natural gas or LPG. It is considered that this is much more likely to be applicable for domestic and small boutique operations than the larger 5 tonne threshold.

There is no record of significant complaints relating to the existing threshold for this activity in the GW complaints database, which potentially indicates that the existing heating threshold (100 kW) are still relevant for controlling the effects of the discharges from this type of activity; or conversely could indicate that there is no such industry in the region.

8.2.4 Recommendations

Further research could be conducted by evaluating whether the above types of industries occur and to what scale they occur in the Wellington Region. It is also important to consider the intent of the control – whether only domestic and boutique industries should be permitted, or whether small-scale industries could also potentially be permitted.

This could provide some assistance in determining an appropriate threshold, based on throughput and oven/kiln/drying capacity.

Permitted activity criteria for drying and heating of clay and cement-based products, could be specified as follows:

- Also comply with relevant combustion-related rules if applicable
- A total on-site manufacturing capacity of less than X kg per day
- A kiln heating capacity of less than Y kW for natural gas

Where either X is 50kg (if the intent is for only domestic/small boutique) or 5 tonnes (or less; for small industry)

Where either Y is 100kw (if the intent is for only domestic/small boutique) or 500kw (small industry).

8.3 Processing of Metals

8.3.1 Introduction

This activity was prioritised as it has a permitted activity threshold and conditions in the existing RAQMP.

The existing rule (Rule 12) excludes a significant number of activities listed in clauses (a) to (g). 'Metallurgical processes' can encompass a wide variety of activities. Minor, small-scale activities that could potentially fit into the existing rule would be activities such as:

- Arc welding of metal
- Soldering of electrical components
- Plasma cutting

The existing rule also permits activities such as the sweating of scrap metal (applying heat to a mixture of metals to separate metal types, determined by the various melting points of metals) and smelting activities.

In addition to some combustion-related discharges (associated with developing process heat to work the metal), there is also therefore a wide variety of potential discharges to air from the activities. Key differences in emissions between various metallurgical activities will be related to how the metals are processed (e.g. cut, moulded, formed, etc.), and the metal emissions released from the processing.

8.3.2 Authorities and documents queried

The following documents and authorities were queried for relevant thresholds for this activity. Table summarises the documents and the findings:

Table 8.2 - Summary of Research for Metal Processing

Document/Search term	Contains reference to activity?	Relevant threshold?
AS/NZS standards	No	N/A
NPI Guidelines	No	N/A
ARC Plan	No	N/A
ECAN plan	Yes	Yes
Waikato Regional Plan	Yes	Yes

8.3.3 Discussion

The existing rule contains a number of exclusions that list metallurgical processes that are carried over from the Clean Air Act 1972. The source of the processing threshold of 100kg/hour for most metals (and a 25kg/hour for lead) is unknown. When the exclusions are coupled with the list of hazardous air pollutants in Appendix 1, the majority of metal processing activities are likely to be excluded from consideration of the permitted activity, regardless of scale or potential effect.

As noted previously, although it causes practical difficulties, most regional plans in New Zealand have adopted a similar approach and include a list of hazardous air pollutants. However, some plans have attempted to quantify a permitted activity threshold for these contaminants, either as a mass emission or in terms of avoiding health effects.

An example is the general permitted activity rules in the ARP:ALW, which includes a condition in the general permitted activity rule (4.5.1):

"That beyond the boundary of the premises where the activity is being undertaken there shall be no discharge into air of hazardous air pollutants that does, or is likely to, cause adverse effects on human health, ecosystems or property."

There has been no specific industry guidance found that would identify a suitable threshold for avoiding effects of particulate and metals emissions from metallurgical processes.

From our review of other regional plans, a potential workable approach could be based on the relevant rule of the ECan NRRP.

Rule AQL41 of the ECan NRRP identifies specific metal processing activities that are permitted activities in the Canterbury Region. They are:

- Mechanical grinding
- Cutting or shaping by application of heat
- Machining
- Welding
- Soldering
- Arc air gouging

The activities can be undertaken outside or inside, and also allows for undertaking installation, repair or construction of structures. It is considered that the approach of specifically permitting metallurgical activities of a minor nature is a more practical when considering the existing 'hazardous air pollutant' restriction.

It has been noted that the Waikato Regional Plan has a similar list of metal processing activities to that which exists in the GW RAQMP. The rule permits (in certain circumstances) the melting, secondary melting an sweating of aluminium, ferrous metals, bronze, copper or brass where there is an aggregated melting capacity less than one tonne per hour. The source of this processing threshold is also unknown, however, it highlights that there is some variability in the degree of conservatism when comparing GW and Waikato regions.

8.3.4 Recommendations

Metallurgical processes outside of those specifically identified are less wide-spread and their effects are more difficult to quantify on a broad basis. It is considered that the ECan list is a reasonable preliminary set of activities that could potentially be permitted. A permitted activity 'threshold' could be structured as follows:

Only the following activities related to metallurgical processing are permitted:

- Mechanical grinding
- Cutting or shaping by application of heat (e.g. plasma cutting)
- Machining
- Welding
- Soldering
- Arc air gouging

In conjunction with identifying only certain activities to be permitted, general conditions could also be introduced to ensure that any potential discharges to air are mitigated and minimised appropriately. No specific AS/NZ standards were found in the literature search, but this is an area where industry guidance would assist in determining whether there is a 'best practice' method or air filter to employ when undertaking this type of activity.

For all other metallurgical processes, while it is considered that there may be some activities that have effects that are potentially less than minor, it may be too difficult to adequately provide for this small number of activities. Wider definitions that rely on the hazardous air pollutant list may not be practical; and wider definitions of permitted activities may not be conservative to the extent that population exposures to small concentrations of metals released from various activities will be low enough.

Therefore, it is considered that other metallurgical processes that are currently permitted in the RAQMP, such as the sweating of scrap metal piles, could remain at GW's discretion to consider to some degree and not be specifically provided for as a permitted activity.

8.4 Chemical Processes

8.4.1 Introduction

This activity was prioritised as it has a permitted activity threshold and conditions in the existing RAQMP.

The rule excludes a number of activities (a) – (h), but permits the processing and manufacture of any other chemical that are not excluded. Because the list of exclusions is so exhaustive, it is difficult to provide examples of a type of chemical process that could potentially be permitted by this rule.

8.4.2 Authorities and documents queried

The following documents and authorities were queried for relevant thresholds for this activity. Table 8.3 summarises the documents and the findings:

Table 8.3 – Summary of Research for Chemical Processing

Document/Search term	Contains reference to activity?	Relevant threshold?
AS/NZS standards	No	N/A
NPI Guidelines	No	N/A
ARC Plan	No	N/A
ECAN Plan	No	N/A
EW Plan	No	N/A

8.4.3 Discussion

The exclusions are mainly based on activities identified in Schedule 2 of Clean Air Act 1972. Additionally, another test for which a chemical process must pass is the exclusions of any process which involves the emission of a hazardous air pollutant.

As previously discussed, there are practical difficulties when excluding the emission of hazardous air pollutants. When considered in the context of the other activities specifically excluded in the rule, it is difficult to provide an example of an activity which could potentially be permitted.

Chemical processing and manufacturing can be a broad and varied industry, and the processes involved can be equally varied. Furthermore, the industries must comply with a condition which requires particulate emissions to be no more than 250mg/Nm^3 which appears to be based on particulate emissions. It is likely that particulate emissions will not be the predominant cause of adverse effects from chemical processes and that this threshold is unlikely to be effective in mitigating adverse effects of a discharge from chemical processes.

The variability in chemical processing and the inherent potential for adverse health impact is highlighted by the lack of permitted activity status in other regional plans.

8.4.4 Recommendations

It is recommended that consideration be given to removing this permitted activity in the Regional Plan review.

It is acknowledged that there may be individual chemical processing and manufacturing activities that could potentially have adverse effects that are less than minor. However, individual chemical processes have already been given weight as individual activities in the plan (e.g. di-isocyanate use, but not manufacture), it is considered that an area for future work could be investigating specific activities for chemical manufacture and processing where it could potentially be appropriate to have permitted activity status.

8.5 Closed Landfills

8.5.1 Introduction

The RAQMP provides for closed landfills as a permitted activity subject to a condition requiring that:

"there is no dust, gas (including carbon dioxide and methane gases), or odour from the process which is offensive, objectionable, noxious, or dangerous at or beyond the boundary of the premises or property".

A key issue for closed landfills is the migration of methane, particularly subsurface migration, beyond the boundary of the landfill site where it can create a flammable hazard in enclosed spaces, such as underground services or in buildings. Odour can also be an issue from fugitive emissions of landfill gas.

8.5.2 Authorities and documents queried

The following documents and authorities were queried for relevant thresholds for this activity. Table 8.4 summarises the documents and the findings:

Table 8.4 - Summary of Research for Closed Landfills

Document/Search term	Contains reference to activity?	Relevant threshold?
Ministry for the Environment Guideline	Yes	Yes
ARC Plan	Yes	Yes
Waikato Regional Council Plan	Yes	No[1]
ECan Plan	No	N/A

1. A threshold for production/collection of biogas is set; however, this implies knowledge of the rate of biogas generation

8.5.3 Discussion

The only one of the regional plans reviewed that set thresholds for closed landfills is the ARP:ALW, which includes the following rule (4.5.78):

"The discharge of contaminants into air from a landfill that ceased receiving waste materials (closed landfill) after 1 October 1991, and contained at least 200,000 tonnes of waste materials at time of closure, is a Restricted Discretionary Activity."

In effect, this means that, at the present time, landfills more than 20 years old and with less than 200,000 tonnes of waste in situ are a permitted activity.

The MfE has published relevant guidance on the risks associated with closed landfills in the document "A Guide for the Management of Closing and Closed Landfills in New Zealand" (MfE,). Table 6.2 of that document is reproduced below, which describes recommendations for monitoring of LFG at closed landfills. These recommendations are based on a broad risk assessment of LFG hazards for landfills of different age and sizes.

Table 8.5 - Recommendations for monitoring of Landfill Gas at closed landfills

Years since closure	Size of landfill		
	< 15,000 m^3	15,000–100,000 m^3	> 100,000 m^3
0–5	Annual: • visual inspection • building monitoring	Six-monthly: • visual inspection • building monitoring • subsurface monitoring	Three-monthly: • visual inspection • surface monitoring • subsurface monitoring • building monitoring
5–15	NR	Annual: • visual inspection • building monitoring	Six-monthly: • visual inspection • building monitoring • subsurface monitoring
15–40	NR	NR	Six-monthly: • visual inspection • building monitoring
> 40	NR	NR	NR

Notes:

NR = No monitoring required unless high-risk site (population density high or sensitive uses in close vicinity) or adverse effects.

Building monitoring (includes services trenches) is required for all within 250m of the site.

Additional monitoring is required at any site where there is an active gas collection system.

Criteria for identifying and permitted "low risk" closed landfills could be developed based on the guidance set out in MfE. These criteria can be summarised as:

- The amount of waste placed
- The years since landfill closure
- The distance to sensitive land uses, including service trenches and enclosed buildings

The risk associated with landfill gas migration is related to land uses in the vicinity of the area, particularly the construction of enclosed buildings within 250 metres of the landfill footprint. Closed landfills are often subject to encroachment and reverse sensitivity effects and these issues cross over into the responsibility of the Territorial Local Authorities for managing land use and also the administration of the Building Act, which includes requirements around managing hazards (such as landfill gas). For this reason, it is not considered reasonable or practicable to include permitted activity criteria relating to surrounding land uses.

Landfill gas is generated from organic material in the waste. Although it may be difficult to demonstrate the composition of waste in closed landfills, it is considered reasonable to include a criteria for a minimum percentage of organic (putrescible waste) to differentiate between landfills and clean fill sites. In relation to the requirement for capture and destruction of landfill gas, the National Environmental Standards for Air Quality set a limit of 5% by weight of material that is putrescible or biodegradable.

8.5.4 Recommendations

Assuming that the rules are promulgated in 2012, permitted activity criteria for closed landfills could be defined as:

- Any landfill that contains less than 5% putrescible or biodegradable waste
- Any landfill that has not accepted waste since 1972 (i.e. 40 years) or with a total capacity less than 15,000 cubic metres
- A landfill with a total capacity of less than 100,000 cubic metres of material, that has not accepted waste since 1997 (i.e. 15 years)

It is not considered necessary to include a separate rule for small landfills that have been closed more recently, as these will be covered by a suite of consents that permit filling, which will include requirements for aftercare.

8.6 Dry Cleaning

8.6.1 Introduction

Dry cleaning is specifically provided for in the Wellington RAQMP as a permitted activity subject to a general condition that "*there is no discharge of particulate matter, smoke, odour, gas, aerosols or vapours from the process, which is noxious, dangerous, offensive or objectionable at or beyond the boundary of the property*". This activity was prioritised as there are examples of more specific criteria that would assist in differentiating between activities with a low potential for effects and those with a greater potential.

Perchlorethylene is the main solvent used for drycleaning. Perchlorethylene has a reasonably high odour threshold (i.e. relatively low potential for odour effects) and does not participate in photochemical reactions. However, it is toxic and can cause effects on the central nervous system. From the complaints records, drycleaning operations do not typically result in complaints to the WRC.

Perchlorethylene use is reducing in New Zealand, mainly due to concerns about its health effects on drycleaning workers. Some drycleaners are changing to alternative hydrocarbon solvents, such as white spirit (also known as Stoddard Solvent or "pegasol") or liquid silicon. Although white spirit is less toxic (and therefore preferable from an occupational health and safety perspective) there is still a risk of off-site odour effects. The main controls used to avoid discharges to air of drycleaning solvents are:

- Good housekeeping measures
- Use of a refrigerated condenser

8.6.2 Authorities and documents queried

The following documents and authorities were queried for relevant thresholds for this activity. Table 8.6 summarises the documents and the findings:

Table 8.6 - Summary of Research for Dry Cleaning Processes

Document/Search term	Contains reference to activity?	Relevant threshold?
AS/NZS standards	No	N/A
NPI Guidelines	Yes	No
ARC Plan	No	Yes
BOPRC Plan	No	N/A
ECAN plan	Yes	Yes
EW Plan	Yes	No

8.6.3 Discussion

From our review of other regional plans and consideration of the main issues and environmental controls for drycleaners, a permitted activity rule could be used to encourage best practice, particularly the use of condensers to recover solvent for re-use.

The AC: ALWP proposes a threshold based on the rate of discharge to air of VOCs that does not exceed 20kg per hour, or 10 tonnes per year as a generic provision.

Similarly, the ECan NRRP also proposes a threshold based on rate of discharge, requiring 5kg of hydrocarbons discharged which does not exceed 5kg per day or 50kg per month. Other provisions within the rule require:

- That the discharge shall not contain chlorofluorocarbons
- That a record be kept of the type and quantity of hydrocarbon cleaning solvents used each month, and the quality of solvents recovered each month. This record is then to be held and provided to Environment Canterbury before 31 March each year
- That the discharge of odour beyond the boundary of the site shall not be noxious, dangerous, offensive or objectionable to such an extent that it has an adverse effect on the environment

We note that the trend to using white spirits may actually increase the potential for odour complaints (whilst reducing the potential for health effects on workers).

Assuming that a solvent condenser achieved 95% recovery of solvent, the AC: ALWP thresholds are equivalent to solvent use of 100 kg/day (approximately 130L per day). The effects of solvent emissions are short-term and therefore it is not considered necessary to apply a longer averaging period threshold.

8.6.4 Recommendations

Permitted activity criteria for drycleaners could be specified as follows:

- A maximum daily organic solvent use of no more than 100 kg per day; and
- Control of emissions using a refrigerated condenser designed to recover at least 95% of solvent.

9 Ground Truthing of Thresholds

9.1 Ground Truthing Methodology

In order to assess the potential scale of adverse effects that adoption of the initial recommendations for permitted activity thresholds might lead to, a screening-level dispersion investigation was undertaken.

Discharges from combustion activities were considered appropriate for this ground truthing exercise for the following reasons:

- Combustion discharges associated with industrial and trade processes and commercial activities are widespread throughout the region
- Combustion emissions and their potential effects are generally well understood
- The scale and nature of combustion emissions is generally closely related with certain discharge and combustion activity parameters, which can be used to define the discharge

An indicative set of discharge scenarios were developed to assess the combustion activity thresholds described in section 6.7.

Discharges from non-combustion activities are not as suitable for dispersion modelling as generic sources, given the:

- There is a wide variation in the potential scale and nature of emissions from non-combustion activities
- Such discharges are therefore more difficult to define in a generic sense by discharge or activity parameters
- The different types of non-combustion discharges are less common in the region

The thresholds for non-combustion activity discharges were therefore not included in this ground truthing investigation

It should also be noted that despite the comparative suitability of combustion activities to this type of exercise, site specific discharge characteristics and local environmental qualities will influence the potential effects of a discharge. Therefore while a conservative approach, encompassing likely worst-case scenarios has been take in developing emissions scenarios and discharge parameters, the results of this investigation can only be considered to be indicative of potential effects.

9.2 Model Design

9.2.1 Overview

This section provides a summary of the technical inputs into the modelling approach. The technical summary of the modelling and the combustion calculations, model input data, model verification and other technical details are found in full in Appendix B.

9.2.2 Dispersion Model

It was proposed that dispersion modelling be conducted using the software AUSLPUME version 6. AUSPLUME is a straight line Gaussian plume dispersion model developed by the Environmental Protection Authority Victoria in Australia. AUSPLUME is widely used throughout New Zealand and

Australia as a regulatory assessment model for industrial point source discharges where complex terrain and meteorological conditions are unlikely to significantly influence pollutant dispersion.

AUSPLUME is recognised as an appropriate model for use in New Zealand in the Ministry for the Environment Good Practice Guide for Atmospheric Dispersion Modelling 2004 (GPG Modelling).

Given that this assessment is to be an indicative screening assessment, and because it was expected that the most significant factor in influencing predicted ground level concentrations in the model scenarios would be the building downwash effects, the use of AUSPLUME is considered appropriate in this situation.

As recommended in the GPG Modelling, hourly averages have been reported as 99.9 percentile concentrations, while 24 hourly averages have been reported as the maximum predicted concentrations.

9.2.3 Meteorological Data

In order to represent meteorological conditions that are likely to occur within the region, a meteorological data set was developed to represent a local location. Given that highest peak particulate concentrations in the region have generally been measured at Masterton, the GW air quality monitoring station at Wairarapa College was chosen as the location.

A synthetic meteorological data input file for the year 2009 was developed using TAPM ('The Air Pollution Model") version 4, incorporating local meteorological observations from the site and a NIWA operated site at Masterton aerodrome.

9.2.4 Emissions Estimation

USEPA AP-42 Emission Factors and New Zealand-reviewed Emissions Factors were used to define emissions that are likely to be generated from combustion activities operating at a range of thresholds including those recommended in section 6.7. A full overview of the modelled emissions factors can be found in Appendix B, however, the main emissions modelled were for:

- Small industrial boilers (AP-42 and New Zealand Emissions Factors)
- Assumption of a stack concentration of 250 mg/Nm^3 for solid fuel
- Assumption of a stack concentration of 100 mg/Nm^3 for solid fuel

The model has assumed mass emission rates for PM_{10} and NO_X sourced from a variety of documents, including New Zealand based research and data from the US EPA AP-42 guidelines. The foundation for the emissions factors is individually documented, but should be thought of as an indication, as opposed to an overall maximum emission rate from that particular combustion device.

9.2.5 Building Downwash

The effects of building downwash were incorporated into predictions through the inclusion of buildings of generalised dimensions that might be encountered in the circumstances of 'typical' discharges. The effects were modelled using the PRIME algorithm.

Two generalised building sizes were included in separate scenarios. A 10m x 10m building (100m^2) is expected to be indicative of a stand-alone commercial/industrial building where a small operation or combustion engine could be located in. Conversely, a 20m x 20m building (400m^2) is expected to be more representative of a larger stand-alone building, or indicative of a location where a number of buildings are located in close proximity to each other, or joined together in a commercial/light-industrial area. In the Wellington Region, these types of buildings would be

located in industrial areas such as Wingate, Seaview, Petone and Ngauranga. The buildings were assumed to be 5m in height, which is approximately one level.

It should be noted that the dimensions of building in the area of a discharge will vary, along with the downwash effects in close proximity to those buildings.

9.2.6 Receptor Locations

Pollutant concentrations were predicted using a polar receptor grid. Receptor grid points were defined in 5m increments from the emission source up to 500m from the stack and in 10 degree increments.

It has been assumed that the boundary from the site is defined as being 25m away from the stack. In the case of a 20m x 20m building (with the stack located in the middle), this means that there is a minimum distance of between 11m – 15m from the edge of the theoretical building to a 'boundary'. It is considered that this is representative of a number of built-up commercial and industrial locations.

It has been assumed that the area surrounding the discharge is flat. However, terrain may vary particularly in complex topography found in some areas of Wellington. Emission plumes can impinge on receptors that are elevated in relation to a discharge, leading to increased contaminant concentrations at those locations. However, it is considered that the modelling provides a reasonable approach with conservative assumptions to provide an indication of what 'real world' ground level concentrations could be.

9.3 Scenarios Investigated

Permitted activity thresholds for discharges from combustion activity are discussed in section 6.7. Initial recommendations for thresholds are provided for combustion of the following fuel types:

- Natural gas and liquid petroleum gas
- Diesel (including biodiesel and blends) and kerosene
- Biogas generated from solid or liquid waste sources
- Untreated wood (including pellets)
- Coal, LFO and petroleum distillates of higher viscosity

Emissions from theoretical boilers of varying size and configuration were modelled in separate scenarios. Those scenarios were based on the following generation capacities (based on the higher heating value of the input fuel):

- 200 kW
- 500 kW
- 1 MW
- 2 MW
- 5MW (natural gas combustion)
- 10MW (natural gas combustion)

The chimney heights have been modelled for 3m above the building (8 m), which accords with the stack clearance thresholds of the current plan and at 9.5 m, as recommended in section 5.8.

Finally, the particulate emissions from the various boilers were estimated in two different ways:

- Based on emissions factors for small boilers

- Assuming a stack concentration of 250mg/Nm^3 for solid-fuels. It is not considered appropriate to apply a stack concentration of 250mg/Nm^3 for the liquid fuels as it is unlikely combustion in a commercial boiler would ever achieve stack concentrations this high

Table 9.1 provides a summary of the modelled particulate mass emission rates for the various boilers and fuel types. Table 9.2 provides a summary of the screening modelling emission rates for the NO_X emissions from natural gas combustion.

Table 9.1 - Summary of Mass Emission Rates (PM_{10}) for Modelling

Emission Estimation Method	Boiler Size	Wood emission rate (g/s)	Coal emission rate (g/s)	Diesel emission rate (g/s)	LFO emission rate (g/s)
AP-42	0.2MW	0.034248	0.037134	0.001124	0.004078
	0.5MW	0.085621	0.092835	0.00281	0.010194
	1.0MW	0.171242	0.18567	0.005621	0.020388
	2.0MW	0.342485	0.371341	0.011241	0.040777
250 mg/Nm^3 (NTP)	0.2MW	0.01401	0.014978	N/A	N/A
	0.5MW	0.035026	0.037445		
	1.0MW	0.070052	0.07489		
	2.0MW	0.140104	0.14978		

Table 9.2 - Summary of Mass Emission Rates (NO_X) for Modelling

Emission Estimation Method	Boiler size	Natural gas NO_X emission rate (g/s)
AP-42	2MW	0.084
	5MW	0.209
	10MW	0.418
AP-42 (scaled against 2MW boiler emissions characteristics)	0.2 MW	1.044
	0.5 MW	2.61

9.4 Assessment Criteria

9.4.1 Use of Assessment Criteria

Assessment criteria may be used to assess the potential adverse effects that may result from contaminant concentrations in ambient air. In general the criteria are based on recognised standards and guidelines, such as the NESAQ and MfE AAQG.

Specific assessment criteria have been developed to assess whether the contributions to ambient contaminant concentrations from discharges conforming to the recommended thresholds are likely to lead to effects that of a scale that is inappropriate for a permitted activity. The principle of 'actual or potential effects' being less than minor as developed in Section 4.2 still apply, however, other factors have also influenced the development of the criteria.

9.4.2 Consideration of PM_{10} Criteria

Recent amendments (June 2011) to the National Environmental Standards for Air Quality 2004 (NESAQ) have included a definition of significance' for PM_{10} emission sources as follows:

A consent authority must decline an application for a resource consent (the proposed consent) to discharge PM_{10} if the discharge to be expressly allowed by the consent would be likely, at any time, to increase the concentration of PM_{10} (calculated as a 24-hour mean under Schedule 1) by more than ***2.5 micrograms per cubic metre in any part*** *of a polluted airshed* ***other than the site on which the consent would be exercised***. [emphasis added]

This definition appears to have been derived from an earlier definition contained in MfE guidance on the assessment of discharges to air from transport sources[13]. In that guidance document the highest incremental increases in contaminant concentrations predicted from traffic links in screening level (Tier 2) modelling analyses are compared with significance criteria in order to determine whether more in-depth (Tier 3) analysis is required. For 24-hour averaging periods, the significance criteria were determined to equate to 5% of the relevant standard or guideline (2.5 µg/m^3 in the case of PM_{10}).

It should be noted that the determination of 5% of the relevant standard/guideline (or 10% in the case of averaging periods shorter than 24-hours) as 'significant' has not been based on health or epidemiological research (as the NESAQ and AAQG themselves have). In the case of PM_{10},epidemiological research has not identified concentration levels below which no adverse health effects are observed. The standard for PM_{10} concentrations of 50 µg/m^3 as a 24-hour average has instead been determined by agencies responsible for health protection and environmental regulation, such as the World Health Organisation and MfE, through rigorous consultative processes and on the basis of peer-reviewed health research as representing a level of acceptable risk to public health. The processes through which the significance criteria were developed were not as rigorous and those criteria could be considered as more arbitrary.

However, in order to maintain consistency with the requirements of the NESAQ, it was not considered appropriate to incorporate a 'significance' threshold that was higher that proposed in the NESAQ. The NESAQ 'significance' criteria of an incremental increase in off-site PM_{10} concentrations of 2.5 µg/m^3 as a 24-hour average has therefore been adopted for the assessment of PM_{10} modelling predictions in this investigation.

9.4.3 Consideration of NO_x and NO_2 Criteria

Although PM_{10} is likely to be a contaminant of principal importance when considering combustion of solid fuel and the heavier liquid fuels, NO_2 concentrations resulting from combustion of lighter liquid fuels such as diesel and, in particular, gaseous fuels such as natural gas are also likely to be of importance.

NO_x emissions from combustion appliances are predominantly comprised of NO rather than NO_2. nitric oxide (NO) constitutes approximately 90-95% of NO_x emissions from boilers and other external combustion appliances. The proportion of NO_2 in internal combustion NO_x emissions can potentially be higher but no greater that the 40% NO_2 seen in NO_x emissions from low-NO_x configuration diesel engines.

[13] MfE. 2008. *Good Practice Guide for Assessing Discharges to Air from Land Transport*. Section 7.4.2.

As NO is the predominant constituent of NO_X emissions and atmospheric conversion of NO to NO_2 is dependent on the presence of oxidants such as ozone (O_3), NO conversion needs to be accounted for when assessing predicted NO_X concentrations.

An approach recommended in the MfE 'Good Practice Guide for Assessing Discharges to Air from Industry' (2008) is the 'Ozone Limiting Method' (OLM). This method assumes that there is a typical concentration of O_3 readily available which is able to react quickly with NO to form NO_2. This is also considered conservative in an industrial area as any discharges of NO will be competing for a finite amount of O_3 in close proximity to other sources.

The OLM assumes that an upper limit of NO_2 formed by the oxidation of NO with a maximum background concentration of O_3 is 72µg/m^3. A conservative estimate of direct NO_2 emissions from combustion is 10% of NO_X, and thus the OLM can be described by the general equation:

Estimated [NO_2] (µg/m^3) = ([NO_x]modelled x 0.1) + 72

GW monitored NO_x and NO_2 concentrations at various locations in the Wellington Region and analysis of those measurements can be used to assess the relevance of this method in the region.

Figure 9.1 shows this correlation for monitoring data between 2005 and 2009 as 1-hour averages at the GW Linden site, where some of the highest NO_2 measurements have been recorded.

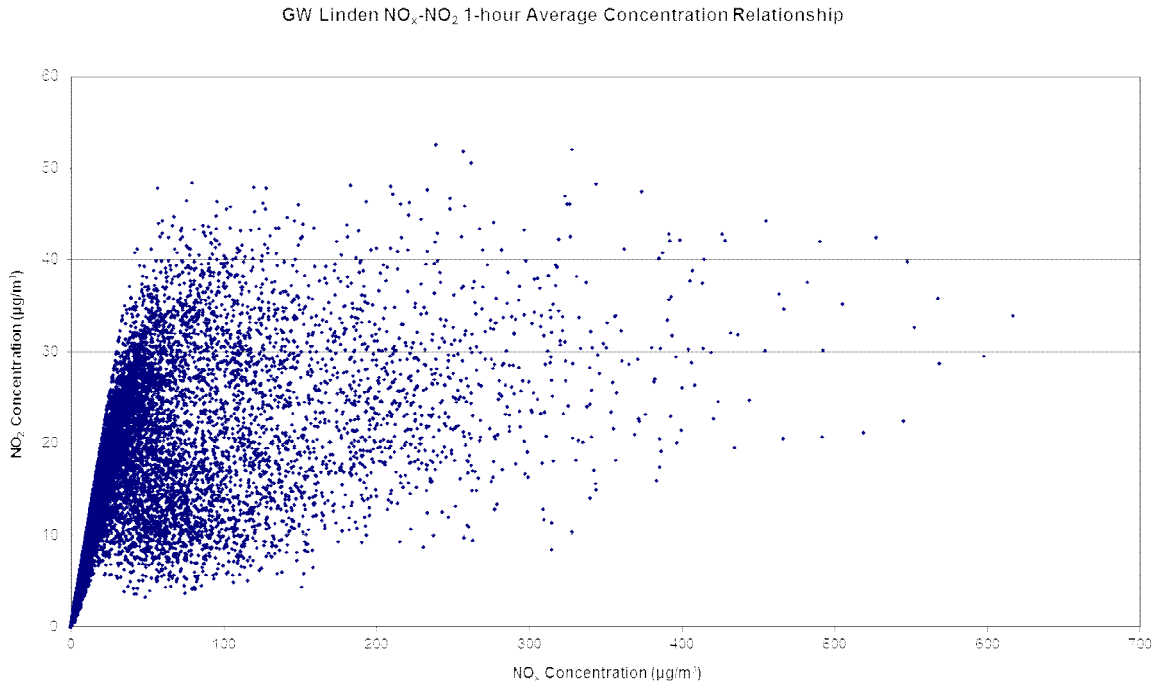


Figure 9.1 - Monitored Relationship between NO_X and NO_2 1-hour average concentrations

While NO_2 at times comprised all of the NO_X measured at low concentrations below 40 µg/m^3, NO_2 was only a minor constituent when NO_X concentrations were high. For example, NO_x concentrations of over 600 µg/m^3 were measured, but NO_2 concentrations at the time were no higher than 35 µg/m^3. Overall NO_2 concentrations have not exceeded 55 µg/m^3 at the Linden site over this period. This demonstrates that the OLM, based on a background oxidant concentration of 72 µg/m^3, is likely to lead to conservative overestimations of NO_2 concentrations when applied to NO_X discharges within the region.

The previously referenced MFE significance criteria for transport discharges that was used as the basis for the NESAQ significance criteria sets criteria for 1-hour average concentrations at 10% of the relevant standard or guideline, including the NESAQ for NO_2 of 200 µg/m^3.

However, the predominance of NO in NO_X emissions and the variable conversion of those emissions to NO_2 means than the use of the NO_2 significance criteria to assess NO_X concentration could lead to a substantial overestimation of potential effects.

Therefore, it is considered that a more pragmatic approach would be to evaluate NO_X concentrations by converting them to NO_2 via the OLM and comparing them with the NESAQ. Given that the OLM has comparatively high background oxidant concentration assumptions relative to those likely to be encountered in the Wellington region, no significance criteria as a percentage of the NESAQ is provided.

9.5 Model Results

A full discussion of the modelling and the technical inputs to it can be found in Appendix B. However, a summary of the results are described in the tables below.

Table 9.3 details where the modelling predicted ground level concentrations as being less than 2.5µg/m^3 as a 24 hour average no more than 25m from the stack. The estimated emissions for each fuel type were based on published emissions factors for small boilers. These results are indicative of 'real world' boiler use.

Table 9.3 - Summary of modelling parameters - based on Emissions Factors

Fuel Type	MW Rating	Stack Height	No building downwash	10mx10m building	20mx20m building
Coal	0.2MW	8.0m	N	N	N
		9.5m	N	N	N
	0.5MW	8.0m	N	N	N
		9.5m	N	N	N
	1.0MW	8.0m	N	N	N
		9.5m	N	N	N
Wood	0.2MW	8.0m	N	N	N
		9.5m	N	N	N
	0.5MW	8.0m	N	N	N
		9.5m	N	N	N
	1.0MW	8.0m	N	N	N
		9.5m	N	N	N
LFO	0.2MW	8.0m	Y	N	N
		9.5m	Y	Y	N
	0.5MW	8.0m	Y	N	N
		9.5m	Y	N	N
	1.0MW	8.0m	N	N	N
		9.5m	Y	N	N
	2.0MW	8.0m	N	N	N

Fuel Type	MW Rating	Stack Height	No building downwash	10mx10m building	20mx20m building
		9.5m	N	N	N
Diesel	0.2MW	8.0m	Y	Y	Y
		9.5m	Y	Y	Y
	0.5MW	8.0m	Y	Y	N
		9.5m	Y	Y	N
	1.0MW	8.0m	Y	N	N
		9.5m	Y	Y	N
	2.0MW	8.0m	Y	N	N
		9.5m	Y	N	N

Notes: "Y" means that the thresholds of fuel type, boiler size, stack height and building downwash effect result in ground level concentrations that are not 'significant' at 25m from the stack.

"N" means that the combined matters considered have resulted in concentrations that are 'significant' beyond 25m from the stack.

Table 9.4 also details where the modelling predicted ground level concentrations as being less than 2.5µg/m^3 as a 24 hour average no more than 25m from the stack. However, instead of using emissions factors to base the emission rates on, the assumed stack concentration of the existing RAQMP provision for required TSP stack concentrations was used.

Only coal and wood are assumed to have concentrations of 250mg/Nm^3, it is considered unlikely that liquid or gas-fuelled boilers would emit concentrations of particulate that are this high.

Table 9.4 - Summary of modelling parameters - assumed stack concentration of 250mg/Nm^3

Fuel Type	MW Rating	Stack Height	No building downwash	10m x 10m Building	20m x 20m Building
Coal	0.2MW	8.0m	N	N	N
		9.5m	N	N	N
	0.5MW	8.0m	N	N	N
		9.5m	N	N	N
	1.0MW	8.0m	N	N	N
		9.5m	N	N	N
Wood	0.2MW	8.0m	N	N	N
		9.5m	N	N	N
	0.5MW	8.0m	N	N	N
		9.5m	N	N	N
	1.0MW	8.0m	N	N	N
		9.5m	N	N	N

Notes: "Y" means that the thresholds of fuel type, boiler size, stack height and building downwash effect result in ground level concentrations that are not 'significant' at 25m from the stack.

"N" means that the combined matters considered have resulted in concentrations that are 'significant' beyond 25m from the stack.

As the solid fuels all produce off-site concentrations that are greater than 'significant' irrespective of the MW rating of the combustion engine, the modelling was scaled to an assumed stack concentration of 100mg/Nm^3. It is important to note that it is unlikely that coal and wood combustion engines will achieve this stack concentration without additional engineering controls. Table 9.5 presents the results of the scaling.

Table 9.5 – Summary of scaled parameters – assumed stack concentration of 100mg/Nm^3

Fuel Type	MW Rating	Stack Height	No building downwash	10m x 10m Building	20m x 20m Building
Coal	0.2MW	8.0m	Y	N	N
		9.5m	Y	N	N
	0.5MW	8.0m	Y	N	N
		9.5m	Y	N	N
	1.0MW	8.0m	N	N	N
		9.5m	N	N	N
Wood	0.2MW	8.0m	Y	N	N
		9.5m	Y	N	N
	0.5MW	8.0m	Y	N	N
		9.5m	Y	N	N
	1.0MW	8.0m	N	N	N
		9.5m	Y	N	N

Notes: "Y" means that the thresholds of fuel type, boiler size, stack height and building downwash effect result in ground level concentrations that are not 'significant' at 25m from the stack.

"N" means that the combined matters considered have resulted in concentrations that are 'significant' beyond 25m from the stack.

Modelling was also conducted for NO_X emissions from natural gas combustion as a 'reality check' of the most conservative modelling assumptions (8m high stack, 20m by 20m building) for a 1-hour average to determine the possible contribution of NO_X and the consequential ground-level concentrations of NO_2.

Table 9.6 provides a summary of the findings of the modelling, and two potential methodologies for the conversion of modelled NO_X concentrations to NO_2 in the ambient air, and a comparison of the conversions to the 1-hour NESAQ standard for NO_2.

Table 9.6 – Summary of screening modelling parameters and findings from natural gas combustion (99.9th percentile, 1-hour averages)

MW Rating	Stack Height	Efflux Velocity (m/s)	Highest Concentration of NO_X (µg/m^3)	OLM NO_X to NO_2 Conversion (µg/m^3)	% of NESAQ Standard
2MW	8.0m	6	120	84	42%
5MW	8.0m	6	200	92	46%
10MW	8.0m	6	301	102	51%
		10	275	100	50%
NESAQ Standard (1-hour average) for NO_2				200 µg/m^3	

In order to provide a preliminary indication of possible emissions of NO_X resulting from the combustion of diesel, the predicted 1-hour concentrations of NO_X as a result of combustion in a 2MW natural gas boiler were up-scaled by the mass emission rate of diesel, calculated for a 200kW and 500kW boiler.

It should be noted that the volumetric flow rates and efflux velocities are likely to be different when comparing between diesel and natural gas combustion rates. However, the scaling is intended to provide a preliminary 'check' of predicted NO_X concentrations when considering the higher mass emission rate of NO_X from diesel combustion processes. Table 9.7 provides a summary of the scaled results.

Table 9.7 – Diesel mass emissions scaled to Modelling Results from a 2MW Natural Gas boiler (99.9th percentile, 1-hour averages)

MW Rating	Stack Height	Highest Concentration of NO_X (µg/m^3)	OLM NO_X to NO_2 Conversion (µg/m^3)	% of NESAQ Standard
0.2MW	8.0m	1492	221	110%
0.5MW	8.0m	3732	445	222%
NESAQ Standard (1-hour average) for NO_2			200 µg/m^3	

9.6 Recommendations for Combustion Thresholds

9.6.1 General thresholds combustion sources

Some initial recommendations arising from a review of the various regional plans and a number of chimney height design guidelines were developed in Section 5 of this report. It is considered that the initial recommendations for chimney height guidelines in Table 5.2 are generally appropriate. They are reproduced below as:

- Height of discharge above ground level: Minimum of 9.5m
- Minimum Clearance of the Discharge point above Adjacent Obstacles: Minimum of 3m above any building or structure within a 50m radius of the stack
- Setback/Buffer Distance from Property Boundary: None recommended
- Discharge Temperature: None recommended
- Vertical Efflux Velocity: Must be vertical and unimpeded (optional minimum velocity of 5.3m/s which is the slowest efflux velocity from the modelling)
- Regular Maintenance of Equipment: At least once a year, with the report held by the operator and presented to GW on request

It is recommended that all combustion activities would have these thresholds implemented as conditions to be complied with.

9.6.2 Coal, Wood and LFO

The modelling indicates that for larger buildings (20m x 20m), the building downwash effect is so pronounced that PM_{10} ground level concentrations are in excess of the NESAQ 'significance' threshold of 2.5µg/m^3. Additionally, further modelling and investigation assuming stack PM_{10} concentrations of 250mg/Nm^3 and 100mg/Nm^3 indicate that even with emissions control technology with removal efficiencies generally equivalent to a wet scrubber on a very small solid fuel combustion device would not be able to meet the 'significance' threshold.

Therefore, the findings of the modelling suggest that, for combustion engines 0.2MW and larger and using the following fuels would not be permitted:

- Untreated wood (including wood pellets)
- Coal
- LFO and petroleum distillates of higher viscosity

9.6.3 Diesel

The modelling indicates that a threshold could be considered for a 200kW combustion engine fuelled with diesel based on the predicted off-site contributions of PM_{10}.

The modelling has also shown that when considered in the context of a smaller 10m x 10m building, a 500kW diesel-fired combustion engine is also able to meet the 'significance' threshold for PM_{10}.

The scaling of predicted ground level concentrations of NO_X from a 2MW boiler to a 200kW and 500kW diesel fuelled boiler suggests that there are elevated concentrations of NO_X close to the stack. Even if the OLM is applied to the scaled predictions, the NESAQ standard of 200 µg/m^3 is theoretically breached.

It is considered that NO_2 the predicted concentrations are unlikely to occur in practice, predominantly because for the reasons discussed in Section 9.4.3. If the monitored background (just above 60µg/m^3) is applied instead of the 72 µg/m^3 in the OLM calculation, at the 200kW threshold, there is only a slight theoretical exceedence of NO_2 in close proximity to the theoretical building, before decreasing rapidly as distance increases from the building.

Therefore, the findings of the modelling suggest that, for diesel-fired combustion engines, a threshold of 200kW could potentially be permitted.

9.6.4 Natural Gas

No modelling for PM_{10} was conducted for natural gas emissions, as natural gas was considered to be a fuel source with low mass emission rates of PM_{10}. However, a coarse screen was undertaken for NO_X emissions from natural gas combustion.

As discussed in Section 9.4.3 and shown in Table 9.6, the conversion of NO_X to NO_2 in the atmosphere is a significant consideration when deciding the most appropriate threshold or percentage of the NESAQ standard to compare against.

Based on the assumptions of the conversion of NO_X to NO_2 in the atmosphere, it is recommended that a threshold of 5MW could be appropriate as a maximum generation capacity.

9.6.5 Additional Dialogue

It is considered that further work should be conducted prior to making any final recommendations for permitted activity thresholds for combustion activities.

10 Recommended Thresholds

10.1 Summary of Findings

A summary of the activities for which detailed research was conducted, and for which new thresholds were recommended for, are shown in Table 10.1.

Table 10.1 - Summary of Recommendations for Permitted Activity Thresholds

Activity	Section of Report	Thresholds Recommended
Combustion Activities	Section 9.6	Further evaluation of the NESAQ 'significance threshold' of 2.5µg/m^3 and its applicability to permitted activities is recommended.
Processing of Animal and Plant Matter (Food Product Manufacturing)	Section 7.2	▪ Any processing of animal or plant matter (including any process incidental to the cooking of food such as deep fat frying, oil frying, roasting, drying, curing by smoking, and the slaughter or skinning of animals), with a total on-site production capacity of less than 250 kg per hour. ▪ Consider also specifying a permitted activity threshold for fermentation of plant matter for alcoholic beverages. ▪ The activity should also comply with relevant combustion-related rules if applicable.
Crushers, screeners and the storage, handling and processing of materials (Within a quarry, mine or similar)	Section 7.3	▪ A throughput for mining, quarrying, crushing, screening, processing, stockpiling and handling of X tonnes per hour, to a maximum of Y tonnes per day ▪ A setback distance to the nearest sensitive receptor of 200m ▪ No more than a total of 1000 tonnes to be stored on site when the material is of a particle size less than 3.5mm Where X equates to a threshold of 200 – 250 tonnes per hour; an Y equates to a maximum based on the total number of tonnes to be stored on site and when evaluating the GW consent database and what activities are permitted
Crushers, screeners and the storage, handling and processing of materials (Conducted elsewhere)	Section 7.3	▪ A throughput for crushing, screening, processing, stockpiling and handling of X tonnes per hour, to a maximum of Y tonnes per day ▪ A setback distance to the nearest off-site sensitive receptor of 200m if the activity exceeds Z tonnes per hour ▪ No more than a total of a day's worth production at Z tonnes to be stored uncovered on site when the material is of a particle size less than 3.5mm. Where X equates to a threshold of between 100 and 200 tonnes per hour; where Y equates to a maximum of 800 tonnes per day (equivalent to 100 tonnes per hour for a working day); and where Z equates to a percentage of X (for instance, ECan has used 50% in their threshold). As the control on throughput for processes located in industrial/trade zones, throughput could be limited by the 'Z' variable, consultation with stakeholders and evaluation of the consented thresholds in the GW region would assist in determining the correct thresholds to implement.

Activity	Section of Report	Thresholds Recommended
Pneumatic conveyance of bulk materials	Section 7.4	▪ A throughput of product of less than X tonnes per hour ▪ A throughput of product of between X to Y tonnes per hour which also requires compliance with ▪ An emission concentration of no more than 50mg/Nm^3 at the point of discharge (equivalent to many existing bag and cartridge filter efficiencies) Where X is a minimal throughput rate that could be developed on consultation with small-scale stakeholders such as carpentry shops – say 1/100th of Y. Where Y is a throughput rate that could be developed with an evaluation of existing throughputs experienced by consented pneumatic conveyance sites; but no more than 50 tonnes per hour as required in the ECan provisions. Further work could also evaluate whether there are other methods such as defining beta filter efficiencies based on PM_{10}, which would be easier to determine compliance with than a stack concentration.
Surface coating and spray application of coatings including the use of di-isocyanates (Spray application within a spray booth)	Section 7.5	▪ At a rate of consumption not exceeding 30 litres (or 30 kg) per day and also not exceeding 3 litres (or 3 kg) per hour on a coating premises ▪ The spray booth shall be fitted with an air extraction system and the discharge shall be via a filtration system that is designed to removes at least 95% of particulate matter from the discharge ▪ The filtration system shall be maintained to ensure that this particulate removal efficiency is achieved at all times ▪ The discharge of contaminants to air is vented with an unimpeded vertical flow, through a chimney(s) or vent(s) which terminates at least three metres above the level of any adjacent area to which there is general access (i.e. ground level, roof areas or adjacent openable windows) within 35 metres of the stack and as far as practicable from the boundary of any residential property
Surface coating and spray application of coatings including the use of di-isocyanates (Spray application not within a spray booth)	Section 7.5	▪ Using not more than 0.5 litre of coating material per hour and not more than 5 litres of coating material per month; or ▪ Using not more than 5 litres of coating material per hour and not more than 20 litres of coating material per month, at a location at least 100 metres from any sensitive activity beyond the boundary of the property where the spray coating is undertaken ▪ The discharge shall occur at least 10 metres from any sensitive activity beyond the boundary of the property where spray coating is undertaken. ▪ These rules for spray painting would need to be cross-referenced to the rule relating to use of di-isocyanates and organic plasticisers.
Printing processes using water-based inks	Section 7.5	▪ The undiluted water based inks, dyes and additives used shall contain less than 5% volatile organic compounds by weight. ▪ The total quantity of hydrocarbon solvents discharged shall not exceed the 5 kilograms per day or 50 kilograms per month. ▪ Controls on stack discharge parameters

Activity	Section of Report	Thresholds Recommended
		■ Records are maintained of ink and solvent use. The discharge to air from photocopying, photographic development and printers serving computers can be provide for as a permitted activity due to the low potential for effects.
Abrasive Blasting (stationary)	Section 7.6	The thresholds for stationary abrasive blasting (including dry abrasive blasting) could potentially be: ■ Materials used for dry abrasive blasting to not contain more than 5% free silica on a dry weight basis ■ The abrasive blasting shall be undertaken within an enclosed booth in order to minimise over-spray of blast debris (applies to wet and dry processes) ■ The emission from dry abrasive blasting shall be extracted and filtered booth for which the concentration at point of discharge is no greater than 50mg/Nm^3 at STP (this would relate to a bag filter or cartridge filter as a minimum) ■ Minimum chimney height from dry abrasive blasting would comply with general chimney height guidelines
Abrasive Blasting (mobile)	Section 7.6	Not permitted, but possibly become restricted discretionary subject to: ■ The distance of notification of potentially affected parties ■ Working hours ■ Minimum period prior to and after notification for works to begin ■ Separation distances to waterways ■ Separation distances to sensitive receptors ■ General amenity provisions ■ Type of coating to be blasted (e.g. no lead-based paints to be removed) ■ Types of mitigation measures to be installed at the site
Gas, water, wastewater reticulated supply and transfer	Section 7.7	■ The pumping, transfer and storage of water is permitted ■ The pumping, transfer, storage of Xm^3 of gas and sewage facilities is permitted ■ The pumping, transfer, storage of Xm^3 to Ym^3 of gas and sewage facilities is permitted, provided odour control is fitted to the facility. Where X is the lower threshold (for example, 4,000m^3) and Y is the higher threshold above which a resource consent would be required (for example, 10,000m^3). Note that water pumping stations would be permitted as they would not typically release odour irrespective of size of operation.
Ventilation, Cooling Towers and Labporatory Fume Cupboards	Section 7.8	Potential thresholds for fume cupboards could be: ■ Have a minimum fume discharge velocity of 10m/s ■ Have a stack height of 3m higher than the roof ridge of the building from which the discharge emanates ■ Have a separation distance of 15m or more from a generally accessible area. For cooling towers and steam plume discharges, potential

Activity	Section of Report	Thresholds Recommended
		thresholds could be: ■ Permit the discharge of water vapour, heat, and steam into the air from industrial or trade premises ■ No shadowing caused beyond the boundary of the property There is also the potential to include the requirement to comply with other legislation (specifically the Hazardous Substances and New Organisms Act 1996) with respect to the use of biocides; however, this could result in a situation where GW is required to determine compliance with a matter that would be best handled by a different authority. For workplace ventilation discharges such as air conditioning units and forced air extraction for general workplace areas, potential thresholds could be: ■ No emission of a hazardous air pollutant (i.e. existing RAQMP Appendix 1 pollutants)
Cleanfills	Section 7.9	Correlate thresholds for discharges to air from cleanfill processes to the same thresholds that are developed for discharges to land from cleanfills. Alternatively, consideration could be given to determining whether the recommended 'bulk handling and storage' thresholds could be appropriate in the context of the discharge to land plan thresholds, and implement the same threshold for discharges from cleanfills.
Drying or Heating of Minerals	Section 8.2	■ Also comply with relevant combustion-related rules if applicable; ■ A total on-site manufacturing capacity of less than X kg per day; ■ A kiln heating capacity of less than Y kW for natural gas combustion. X is either 50kg (if the intent is for only domestic/small boutique) or 5 tonnes (or less; for small industry) Y is either 100kw (if the intent is for only domestic/small boutique) or 500kw (small industry).
Processing of Metals	Section 8.3	Only the following activities related to metallurgical processing are permitted: ■ Mechanical grinding ■ Cutting or shaping by application of heat (e.g. plasma cutting) ■ Machining ■ Welding ■ Soldering ■ Arc air gouging
Chemical Processes	Section 8.4	It is recommended that consideration be given to removing this permitted activity in the Regional Plan review.
Closed Landfills	Section 8.5	Assuming that the rules are promulgated in 2012, permitted activity criteria for closed landfills could be defined as: ■ Any landfill that contains less than 5% putrescible or biodegradable waste ■ Any landfill that has not accepted waste since 1972 (i.e. 40

Activity	Section of Report	Thresholds Recommended
		years) or with a total capacity less than 15,000 cubic metres ■ A landfill with a total capacity of less than 100,000 cubic metres of material, that has not accepted waste since 1997 (i.e. 15 years) It is not considered necessary to include a separate rule for small landfills that have been closed more recently, as these will be covered by a suite of consents that permit filling, which will include requirements for aftercare.
Dry Cleaning	Section 8.6	■ A maximum daily organic solvent use of no more than 100 kg per day; and ■ Control of emissions using a refrigerated condenser designed to recover at least 95% of solvent.

10.2 Further work areas

A number of other activities have been identified in Supplement 1 as possible activities for which permitted thresholds could be developed. However, it may be that only very small numbers of these activities occur in the Wellington Region.

It is recommended that further thought be given to developing a general permitted activity rule that permits very minor discharges, provided they meet certain effects criteria. Such a rule could be similar to the AC:ALWP Rule 4.5.1.

The results of the modelling for combustion activities suggest generation capacity thresholds that are very low for combustion of fuels other than natural gas. This could result in either a significant number of resource consent applications for small/minor combustion devices that cannot comply with the limits, or impose a significant cost on industry in order to modify small combustion appliances to combust natural gas.

It is recommended that further consultation with stakeholders be undertaken to determine the best approach to implementing combustion activity thresholds for these other fuels.

Supplement 1

Initial Screening (Spreadsheet Attachment)

Appendix A

Suitability for Permitted Activity

Sector	ANZSIC Code	Relevant ANZSIC Class - Descriptor	Activity	Current PA rule criteria in Wellington RAQMP	Auckland Regional Plan: Air, land and Water	ECAN Plan	Bay of Plenty Regional Plan	Waikato Regional Plan - Air Module	Review of Threshold Priority	Considered in Report?
Agriculture, Forestry and Fishing	A01	Agriculture	Disposal of livestock and offal	-----	General PA rule	-----	Disposal carried out under direction of either the Ministry of Agriculture and Forestry for dead diseased livestock or the Department of Conservation for dead diseased marine mammals. Environment Bay of Plenty must be notified a minimum of 1 hour before burning begins.	-----	Low	No
	A01	Agriculture	Manufacture and storage of silage	-----	General PA rule	-----	-----	-----	Low	No
	A01	Agriculture	Application of fertiliser	-----	General PA rule	-----	-----	-----	Low	No
	A01	Agriculture	Application of agrichemicals	Detailed	-----	-----	Must hold a current GROWSAFE certificate. No harmful concentration beyond boundaries and in water. Neighbours must be notified between 20 days and 12 hours before use of agrichemicals, unless agreement. Public notification between 20 days and 12 hours before use if used by aircraft.	-----	Outside of scope	No
	A01	Agriculture	Management of agricultural effluent	Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	Not carried out within 20m of a property boundary or surface water body Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	Med	No
	A01	Agriculture	Seed cleaning: Cleaning, Conveying, Packaging, Processing, Handling, Storage	-----	-----	Surfaces adjacent to the seed cleaning plant shall be cleaned regularly to prevent wind-blown dispersal or deposition of particles beyond the boundary of the property Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	Low	No
	A01	Agriculture	Discharge of agrichemicals using hand-held application techniques	Detailed	-----	Detailed	When applied, hold a GROWSAFE Certificate. Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	Outside of scope	No
	A01	Agriculture	Ground-based application of agrichemicals using techniques other than hand-held application	Detailed	-----	Detailed	Detailed	-----	Outside of scope	No
	A01	Agriculture	Aerial application of agrichemicals	Detailed	-----	Detailed	-----	-----	Outside of scope	No
	A017	Poultry Farming	Intensive poultry farming	-----	Less than 10,000 poultry General PA rule	Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	Med	No
	A0192	Pig Farming	Pig farming	-----	-----	-----	-----	-----		No
Manufacturing	C202	Ceramic Product Manufacturing	Baking of ceramics, bricks or tiles	-----	Less than 5 tonnes per day (by inference) General PA rule	Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	Med	Yes
	C202	Ceramic Product Manufacturing	Drying or heating of minerals (with exceptions)	Less than 100 kW heat release Discharge of particulate less than 250 mg/m3 Chimney at least 3m above any area where there is general access Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	-----	Less than 100 kW heat release.	High	Yes
	C2293	Metal Coating and Finishing	Abrasive blasting	Debris and used blasting material is collected Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property or beyond 50 metres of the discharge on public land.	In permanent facility Less than 5% free silica Emissions pass through fabric filter, or dry filtration to achieve 30mg/m3 (0°C, 1atm, dry gas) Fabric filter fitted with differential pressure and audible alarm Control equipment certified by engineer Area kept free of accumulated material Abrasive material - Less than 2% dry weight dust passing 0.15mm sieve General PA rule	Undertaken within enclosed booth fitted with air extraction system discharging all contaminants and exhaust air to emission stack or vent. Discharge at least 50m from any sensitive activities established prior to commencement of blasting operations. Free silica content of representative sample less than 5% by weight. Discharge shall be filtered via extraction system removing at least 95% of particulate matter. No blasting of lead-based paints. Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	Surface to be blasted must not contain any toxic substances or heavy metal substances When dry or wet abrasive blastings are undertaken in a booth, the abrasive blasting operation shall be contained by the best practicable option approach such as screening, wet nozzle attachments or vacuum blasting. Material used for blasting must contain less than 5% free silica. When mobile dry abrasive blasting is undertaken, notify (date, time, duration) neighbours within 200m at least 24h and not more than 2 weeks prior to work starts. Debris and waste material must be looked after Paint including c/lead/arsenic/chromium to be removed (by non dry abrasive methods) in accordance with DOL 1995 guidelines Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge	Discharge less than 100 mg/m3 (0deg C, 1atm, dry gas)	High	Yes
	C2294	Metal Coating and Finishing	Vacuum blasting	-----	Less than 5% free silica Emissions pass through fabric filter, or other collection system to achieve non-visible discharge Area kept free of accumulated material General PA rule	-----	Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	High	Yes
	C2296	Metal Coating and Finishing	Sweep blasting	-----	Less than 5% free silica General PA rule Area kept free of accumulated material	-----	Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	High	Yes
	C2296	Metal Coating and Finishing	Drying, curing or baking of any solvent-based coating onto any surface by the application of heat	-----	Solvent application rate less than 20 kg per hour (by inference) General PA rule	-----	-----	-----	High	Yes

C2297	Metal Coating and Finishing	Spray application of coatings	Rate of consumption not exceeding 30 litres (or 30 kg) per day and also not exceeding 3 litres (or 3 kg) per hour Discharge of particulate less than 250 mg/m3 Chimney at least 3m above any area where there is general access and as far away as practicable form boundary of residential dwelling Unimpeded vertical flow Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	-----	Rate of consumption which does not exceed 30 l/day (excpet for roads, buildings, bridges pipelines, transmission towers, or such structures) Discharge less than 100 mg/m3 (0deg C, 1atm, dry gas) at discharge of premises	High	Yes
C2298	Metal Coating and Finishing	Spray application of coatings from mobile sources	Discharge of particulate less than 250 mg/m3 Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	-----	-----	High	Yes
C2299	Metal Coating and Finishing	Stoving of enamel or baking and drying of any other coating material	Heat input less than 500 kW Discharge of particulate less than 250 mg/m3 Chimney at least 3m above any area where there is general access and as far away as practicable form boundary of residential dwelling Unimpeded vertical flow Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	-----	Heat input into the process or electrical energy used less than 500 kW. Discharge less than 100 mg/m3 (0deg C, 1atm, dry gas) at discharge of premises	High	Yes
C2300	Metal Coating and Finishing	Small scale spray coating not within a spray booth	-----	-----	Using less than 0.5l coating material/hr and less than 5l/month or less than 5l/hr and less than 20l/month at location at least 100m from any sensitive activity. No di-isocyanates or organic plasticisers in coating Discharge at least 10m away from any sensitive activity. Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	High	Yes
C2301	Metal Coating and Finishing	Small scale spray coating within a spray booth	-----	-----	Using less than 2l/h and less than 10l/day and less than 100l/month. Spray booth fitted with air extraction system discharging contaminants vertically, not obstructed, removing at least 95% of particulate matter. Emission Stack at least 3m above ridge line of roofs of any structure within 35m. Keep record of type, quantity, dye, coating material used each month. Provide it to Env Can. Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	High	Yes
C2591	Jewellery and Silverware Manufacturing	Welding or jewellery manufacture	Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	General PA rule	-----	-----	-----	Med	Yes
C21	Primary Metal and Metal Product Manufacturing	Metal processing (with numerous exceptions)	Melting capacity less than 100 kg/hour Discharge of particulate less than 250 mg/m3 Chimney at least 3m above any area where there is general access Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	Must be undertaken in the open air, at least 20 metres from any sensitive activity beyond the boundary of the property where the discharge originates; or be undertaken inside an enclosed building; or result from installation, repair, or construction of a structure which is fixed to the property on which the activity occurs or is attendant to that structure. Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	High	Yes
C24	Machinery and Equipment Manufacturing	Appliance, machinery and electrical equipment manufacture	-----	-----	-----	-----	-----		No
C14	Wood Product Manufacturing	Generation, Conveyance, Collection, storage, filtration of wood waste	-----	-----	Store in covered hopper or container Clean frequently to prevent wind-blown dispersal or deposition of wood particles beyond boundary of property Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	Med	Yes

	C14	Wood Product Manufacturing	Drying of timber	-----	-----	-----	-----	Rate < 20,000 m3/yr where drying temp is between 100 and 132 deg C or Rate < 40,000 m3/yr where drying temp is 100 or less deg C.		No
	C117	Bakery Product Manufacturing	Bread manufacturing	-----	-----	Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	Low	Yes
	C1212	Beer Manufacturing	Beer and malt manufacturing	-----	-----	-----	-----	-----	Low	Yes
	C113	Dairy Product Manufacturing	Drying of milk or milk products	-----	-----	-----	-----	Raw material capacity less than 2 t/hr	Low	Yes
	C114	Fruit and Vegetable Processing	Processing of animal or plant matter (some exclusions), cooking by smoking	Vented through chimney or vent to avoid downwash Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	-----	Raw material capacity less than 250 kg/hr (for deep fat frying or oil frying, curing by smoking, roasting)	High	Yes
	C1111	Meat processing	Frying, roasting, baking, cooking and processing by application of heat, cooking by smoking, extraction, distillation or purification of animal fats, rendering and reduction by application of heat,	-----	-----	-----	-----	Raw material capacity less than 250 kg/hr (for deep fat frying or oil frying, curing by smoking, roasting) Raw material capacity less than 0.5 t/hr and being processed for rendering or reduction or drying	High	Yes
	C112	Seafood processing	Frying, roasting, baking, cooking and processing by application of heat, cooking by smoking	-----	-----	-----	-----	-----	High	Yes
	C1192	Prepared Animal and Bird Feed Manufacturing	Animal and bird feed manufacture	-----	-----	-----	-----	-----		No
	C1220	Cigarette and Tobacco Product Manufacturing	Tobacco product manufacturing	-----	-----	-----	-----	-----		No
	C1311	Wool Scouring	Wool scouring	-----	-----	-----	-----	-----		No
	C13	Textile, Leather, Clothing and Footwear Manufacturing	Textile and clothing industry	-----	-----	-----	-----	-----		No
	C132	Leather Tanning and Fur Dressing	Leather tanning and finishing	-----	-----	-----	-----	-----		Yes
	C132	Leather Tanning and Fur Dressing	Processing of skins, including fellmongery and tanning	-----	-----	-----	-----	-----		Yes
	C201	Glass and Glass Product Manufacturing	Fibreglass product manufacturing	-----	-----	-----	-----	-----		No
	C25	Furniture and Other Manufacturing	Furniture and fixtures manufacturing	-----	-----	-----	-----	-----		No
	C1916	Paint and Coatings Manufacturing	Paint and ink manufacture	-----	-----	-----	-----	-----		Yes
	C2032	Plaster and Gypsum Product Manufacturing	Plasterboard and plaster manufacturing	-----	-----	-----	-----	-----		No
	C2031	Cement and Lime Manufacturing	Cement and lime manufacture	-----	-----	-----	-----	-----		Yes
	C19	Polymer Product and Rubber Product Manufacturing	Use of di-isocyanates and organic plasticisers	Usage rate less than 10 litres (or10 kg) per day and also at a rate of less than 3 litres (or 3 kg) per hour Discharge of particulate less than 250 mg/m3 Chimney at least 3m above any area where there is general access Unimpeded vertical flow Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	Usage rate less than 100 kilograms per hour (by inference) General PA rule (Note: rule includes methylene chloride)	-----	-----	Usage rate less than 8 litres per day. Discharge less than 100 mg/m3 (0deg C, 1atm, dry gas) at discharge of premises	High	Yes
	C	Manufacturing	Discharge of heat, steam or water vapour	-----	-----	Cooling towers and heat exchangers shall be maintained as often as necessary to minimise discharge of contaminants into air Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	Low	Yes
	C18	Basic Chemical and Chemical Product Manufacturing	Chemical processes (with numerous exceptions)	Discharge of particulate less than 250 mg/m3 Chimney at least 3m above any area where there is general access Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	General PA rule no more than 1kg/hr for certain contaminants, no more than 0.01 kg/hr for other HAPs, no more than 0.02g TEQ/yr for dioxins	-----	High	Yes
	F C	Wholesale Trade Manufacturing	Handling of bulk materials not part of a quarry or mining activity	-----	-----	Rate of activity less than 100t/h Quantity of material handled less than 100t/h If particle size of material les than 2.5mm then mount of bulk material stored less than 1000t any time	-----	-----	Med	Yes
	C16	Printing	Printing processes using water-based inks	-----	-----	Undiluted water based inks, dyes and additives used shall contain less than 5% volatile organic compounds by weight. Discharge into air shall occur via emission stack or vent above the roof, directed vertically, not obstructed. Total quantity of hydrocarbon solvents discharged shall not exceed the 5 kg/day or 50 kg/month. Keep record and provide to Env Can. Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	Med	Yes
	C2391	Shipbuilding and Repair Services	Shipbuilding, repair and maintenance	-----	-----	-----	-----	-----		No
Mining	B	Mining	Mobile crushers	Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	On site capacity less than 60 tonnes per hour Watering system on crusher Source of material	-----	-----	-----	High	Yes

	B	Mining	Storage and handling of bulk materials	Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	General PA rule	Rate of size reduction, screening, processing or pneumatic conveyance including handling of material (not located in a permanent structure) > 50tph, shall not be located within 200m of any sensitive activity on a different property, and if blasting, no closer than 500m Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	High	Yes
	B	Mining	Open-cast extraction, crushing, screening and processing	Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	Less than 5 tonnes per hour General PA rule	Less than 100t/h or 250t/h and 1250t/calendar day if extraction doesn't\t occur more than 21days per calendar year Rate of size reduction, screening.. Doesn't exceed 100t/h Amount of bulk material stored less than 1000t any time when practical size of material less than 3.5mm If rate greater than 50t/h in any one hour, of contaminants to air shall not be located within: 200 metres of any sensitive activity and if activity involves blasting, 500 metres of any sensitive activity Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	The sealing and maintenance of the access road, when it is within 150 metres of a neighbouring residential dwellingshall be implemented where the operation occurs within 1000 metres of a property boundary. Written notification to Waikato Regional Council within 7 working days prior to commencing work.	High	Yes
	B06	Coal Mining	Outdoor storage of coal	Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	Less than 2 tonnes General PA rule	-----	-----	-----	High	Yes
Electricity, Gas, Water and Waste Services	D27	Gas supply	Compressor stations and incidental equipment	Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	-----	-----	High	Yes
	D2921	Waste Treatment and Disposal Services	Treatment of raw sewage generated on-site	-----	General PA rule	-----	No spray irrigation of liquid waste within 20m of subject property or water. Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	Low	No
	D2921	Waste Treatment and Disposal Services	Disposal of treated sewage to ground	-----	Rural AQMA Less than 10 tonnes per day General PA rule	-----	-----	-----	Med	No
	D2812	Sewerage and Drainage Services	Pumping, storage and transfer of sewage	Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	General PA rule Storage - enclosed tank less than 4000 m3 or enclosed tank between 4000 and 10000 m3 fitted with odour control system	-----	-----	-----	High	Yes
	D2921	Waste Treatment and Disposal Services	Municipal solid waste landfills: closed landfills	Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	-----	-----	High	Yes
	D2921	Waste Treatment and Disposal Services	Disposal of clean fill material resulting from the maintenance, operation and minor improvements to legal road	-----	-----	Clean materials free of combustible, putrescible, leachable components, hazardous substances, liquid waste, materials that may present a risk to human/animal health. No discharge of air within urban area. No discharge within 300m of sensitive activity. Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	Med	Yes
	D2921	Waste Treatment and Disposal Services	Application of effluent to land	-----	-----	Keep record of type, amount of effluent used, location and wind direction when used. Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	Med	No
	D2921	Waste Treatment and Disposal Services	Cleanfills	Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	General PA rule	-----	-----	-----	Med	Yes
	D291	Waste Collection Services	Greenwaste collection or refuse transfer station	-----	Greenwaste kept on site for no more than 3 days No shredding General PA rule	-----	-----	-----	Med	Yes
	D2922	Waste Remediation and Materials Recovery Services	Oil recycling	-----	-----	-----	-----	-----		No
	D2922	Waste Remediation and Materials Recovery Services	Recycling station	-----	No refuse or greenwaste General PA rule	-----	-----	-----	Med	No

	D2922	Waste Remediation and Materials Recovery Services	Composting	Materials are generated on site Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	Fully enclosed and processing capacity less than 100 m3; or Urban AQMA, not enclosed and processing capacity less than 10 m3; or Not in Urban AQMA, not enclosed, material is greenwaste - Processing capacity less than 100 m3 Material includes refuse, waste or organic material other than greenwaste - less than 50 m3 General PA rule	-----	-----	-----	High	Yes
	D2922	Waste Remediation and Materials Recovery Services	Mechanical shredding of scrap indoors	-----	General PA rule	-----	-----	-----	Low	No
	D26	Electricity Supply	Temporary dry or wet abrasive blasting outside an enclosed booth of network utility or electricity generation infrastructure	-----	-----	Detailed	-----	-----	High	Yes
	D2619	Other Electricity Generation	Venting of geothermal gas and steam	-----	-----	-----	Water temperature>70deg C Gas or steam discharge vertically Chimney must rise at least 6m above ground and 3m above highest ridge line within 30m Discharge of heat or water less than 1000t/day Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	Dischargs less than 5 MW.	Low	No
Wholesale Trade, Retail Trade	F3321 G40	Petroleum Product Wholesaling Fuel Retailing	Motor fuel storage	-----	Tanks installed prior to 1 January 2007 - general PA rule Tanks installed after 1 January 2007 - general PA rule and vapour capture	Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	Rule applies to ventilation/displacement of liquids in storage tanks and tankers Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	High	Yes
	F331	Agricultural Product Wholesaling	Fumigation	-----	-----	No ethylene dibromide, ethylene oxide, methyl bromide, hydrogen cyanide, phosphine or chloropicrin included Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	Med	No
Other	I46	Road Transport	Unsealed roads	-----	General PA rule	-----	-----	-----	Low	No
	I5220	Airport Operations and Other Air Transport Support Services	Maintenance or "idle-testing" of aircraft engines outside of buildings in the Christchurch Clean Air Zone 2	-----	-----	Activity located within runway. During testing and maintenance aircraft engines shall be attached to a mobile aircraft.	-----	-----	Low	No
	I	Transport, Postal and Warehousing	Car parking building emissions	Misc Rule 22	-----	-----	-----	-----	Med	No
	I46	Road Transport	Tunnels	Misc Rule 22	-----	-----	-----	-----	Low	No
	I49	Air and Space Transport	Commercial aircraft	-----	-----	-----	Combustion into air conform to Civil Aviation Act 1990 and amendments	-----	Low	No
	I46	Road Transport	Vehicles and Small Internal Combustion Sources	-----	-----	-----	No smoke discharge visible for more than 10s Discharge of 3-stroke engines complies with manufacturer spec.	-----	Low	No
	E3101	Road and Bridge Construction	Earthworks or construction, maintenance and repair of roads	-----	General PA rule	-----	-----	-----	Low	Yes
	E3101	Construction	Fugitive dust from unconsolidated surfaces	-----	-----	Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	Med	No
	P	Education and Training	Laboratory fume cupboards in educational institutions	Misc Rule 22	-----	Vertical discharge of contaminants via emission stack above max height of ridge line of the roof of any structure within 15m of stack Discharge shall be vertical and not impeded by any obstruction Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	High	Yes
	E3233	Air Conditioning and Heating Services	Cooling towers and ventilation	Exhausts are located to avoid cross-contamination with air intakes in the same building and adjacent buildings Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	Concentration of contaminants in workplace lower than max conc requirements specified by law Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	High	Yes
	M691	Scientific Research Services	Commercial laboratory fume cupboards	Misc Rule 22	-----	Emission stack shall comply with NZ Standard 7203-1992 Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	High	Yes
	N7311	Building Cleaning Services	Water blasting	-----	-----	At the completion of blasting each day all blast debris shall be collected or covered to avoid discharge of wind-blown debris into air At completion of blasting all blast debris shall be collected, so far as is practicable Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	High	Yes

	S9531	Laundry and Dry-Cleaning Services	Dry cleaning	Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	The discharge shall not contain chlorofluorocarbons. The total mass of hydrocarbons discharged shall not exceed 5 kilograms per day or 50 kilograms per month. A record shall be kept of the type and quantity of hydrocarbon cleaning solvents used each month, and the quality of solvents recovered each month. This record shall be held and provided to ECan Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	High	Yes
	N/A	Miscellaneous	Vehicle engine maintenance and servicing, laboratory fume hoods, tunnels and car parks, spray painting of roads and bridges, road construction and paving activities	Intent is to ensure that there is no offensive, objectionable, noxious or dangerous discharge beyond the boundary of the property	-----	-----	-----	-----	High	Yes

Note: the blank cells mean that no relevant information was found for the activity

Appendix B

Technical Modelling Background

Dispersion modelling predictions

1.1 Introduction

The relative impact of the emissions from commercial and industrial combustion point sources were assessed using dispersion modelling techniques. Downwind ground level pollutant concentrations were predicted using the AUSPLUME regulatory dispersion model to assess the relative significant of emissions from different combustion source configurations. Predictions were made using meteorological inputs that are representative of dispersion conditions in the Masterton area.

This appendix provides a summary of the assessment methodology and the results of the predictions. A summary of the predictions and conclusion draw from the modelling is presented in Section 5 of the main report.

1.2 Dispersion modelling methodology

1.2.1 Dispersion model selection

Ground level concentrations have been predicted using the steady state Gaussian dispersion model AUSPLUME (v6.0) developed by the Victoria Environmental Protection Agency. AUSPLUME is a widely as a regulatory assessment model in Australasia. AUSPLUME is considered to be an appropriate dispersion model for the prediction of pollutants in the near field of emission sources in instances where complex terrain is unlikely to have a significant effect on pollutant dispersion.

The dispersion modelling assessment has focused on emissions of comparatively small commercial and industrial boilers with heat capacities between 0.2 to 2.0MW. Some additional modelling was also conducted for natural gas boilers between 2MW and 10MW. These emission sources could typically have low stack heights and be located near buildings that are tall enough to have an effect on pollutant dispersion. Maximum concentrations of the pollutants are therefore expected to occur close to the emissions sources. Given the likely significant influence of building downwash effects, pollutant dispersion is unlikely to be effect by wider regional meteorological conditions. AUSPLUME is therefore an appropriate model in this instance.

1.2.2 Building Wake Effects

Buildings located near emission sources are known to significantly influence the rate at which air pollutants are dispersed into the environment. Depending on the location and dimensions of buildings relative to the release height of the emission source, the net effect of nearby obstacles can be to either increase (usually) or decrease ground level concentrations.

For the types of emission sources considered in the assessment, it is often likely that nearby buildings will be large enough to have an influence on pollutant dispersions. In the assessment, three different building effect downwash scenarios have been considered. These scenarios are as follows.

1. **No building downwash effects**: the modelled stack emission source is not affected by nearby structures. Generally, a stack 2.5 times higher than the height of nearby buildings is assumed to unaffected by downwash effects.
2. **Small to moderate downwash effects**: the modelled stack emission source is located at the centre of building which is 10m in width and length and 5m in height, typical of a small building

3. **Moderate to high downwash effects**: the modelled stack emission source is located at the centre of building which is 20m in width and length and 5m in height, typical of a larger building

The effects of building downwash were incorporated in the AUSPLUME dispersion model using the PRIME building wake algorithm. Directional influences were determined using the USEPA Building Profile Input Program (BPIP) software.

1.2.3 Terrain Effects

The emission source is assumed to be located on a comparatively flat terrain and therefore no terrain effects have been incorporated into the model. This assumes that peak pollutant levels will typically occur in the near vicinity of the plant, as a consequence of relatively short stack heights and building downwash effects. However, higher concentrations could potentially if elevated terrain features were located near to the emission source, such a large hill. Therefore, surrounding terrain influences may need to be considered when apply the results to the specific emission sources.

1.2.4 Meteorological inputs

Ground level pollutant levels have been predicted using a 1-year meteorological input file representative of dispersion conditions in the Masterton township. An AUSPLUME compatible meteorological input file was developed using the TAPM v4 ('The Air Pollution Model') meteorological and dispersion model.

TAPM, developed by CSIRO, is a sophisticated computer model that predicts the three dimensional meteorology and air pollutant concentrations by solving the fundamental fluid dynamic and scalar transport equations. It consists of coupled diagnostic meteorological and air pollution components that predict the air flows important to local scale air pollution, such as sea breezes, against a background of larger scale synoptic meteorological patterns (Hurley, 1999).

One of the primary functions of the TAPM model's design is the provision of high quality meteorological data for dispersion models where suitable onsite information is not available. Using historical synoptic scale meteorological analyses in conjunction with local land use and terrain information, TAPM can produce realistic and high quality meteorological inputs for a number of air pollutant dispersion modelling systems including AUSPLUME. Validation studies show that TAPM can accurately predict localised meteorological conditions.

In this instance TAPM was used to generate one-year upper air meteorological input datasets in an AUSPLUME format. To help ensure that the wind fields predicted by TAPM accurately reflects the meteorological conditions, hourly wind speed and wind direction data recorded at the GWRC Wairarapa College, and the Masterton aerodrome meteorological monitoring stations during 2009 were assimilated into the model. A review of wind speed and wind dispersion between 2004 and 2010 recorded at the college site indicate that wind distribution condition recorded in 2009 were representative of the overall meteorological conditions experienced at both sites.

The AUSPLUME meteorological input file was extracted from TAPM at approximately the same location as the meteorological monitoring station at Wairarapa College. To ensure that the modelled wind speed wind direction distribution reflected observed wind conditions in Masterton the hourly wind speed and wind speed recorded at the Wairarapa College site was substituted back in to the input file. Slight adjustments were made to TAPM predicted Pasquill Gifford stability classes to ensure they were consistent with the observed wind speeds. Wind speed and wind directions are shown in Figure 1. The wind rose shows a predominance of south westerly wind flows.

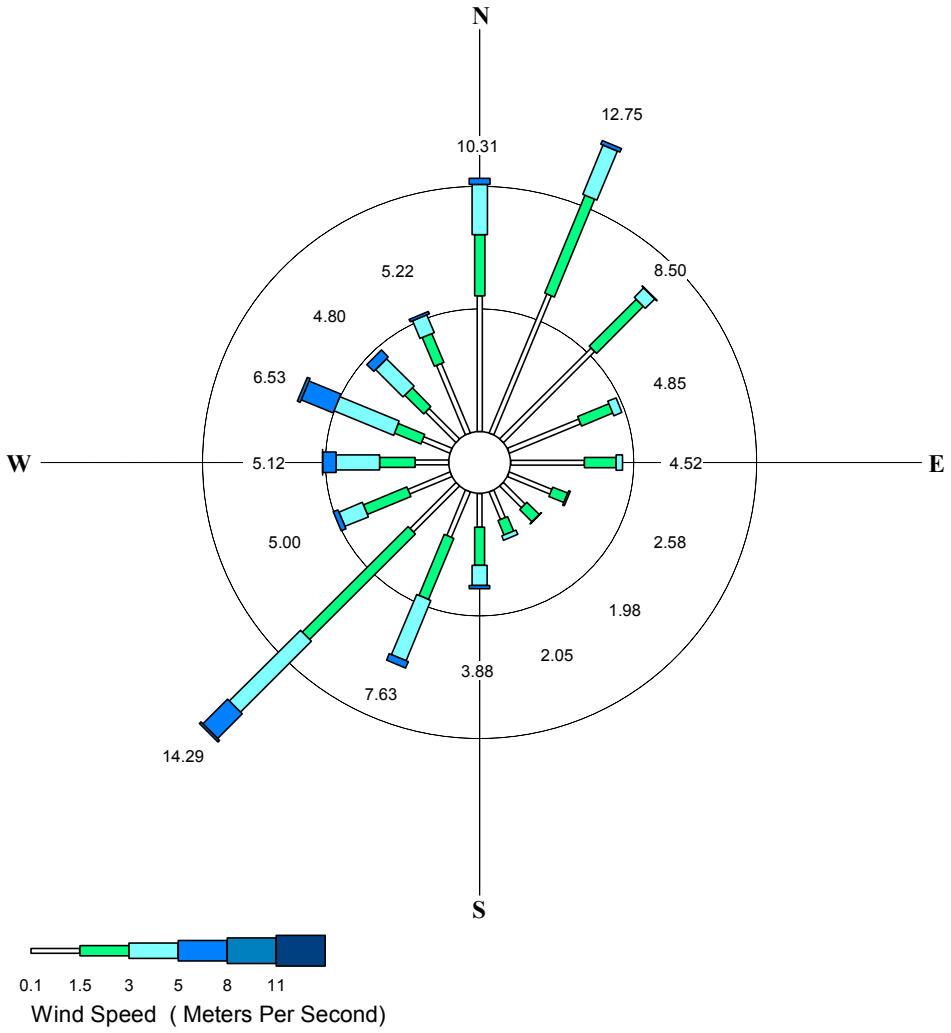


Figure 1. Wind speed and wind direction frequency distribution for the AUSPLUME Masterton meteorological input file

1.2.5 Receptor grid

Pollutant concentrations were predicted using a polar receptor grid. Receptor grid points were defined in 5m increments from the emission source up to 500m from the stack and in 10 degree increments (i.e. 10°, 20°, 30°, …, 350°, 360°).

1.3 Modelled Emission sources

Ground level concentrations were predicted for a range of boiler sources with heating capacities varying between 200kW to 2.0MW. For each of boiler heat capacity sizes PM_{10} emission rates were estimated for the combustion of sub-bituminous coal, wood, diesel and light fuel oil (LFO). NO_X emissions were also investigated for diesel and natural gas boilers of 0.2 kW, 500kW, 2MW, 5MW and 10MW in size.

Boiler stack combustion gas discharge volumes were estimated using standard combustion equation calculations assuming complete combustion and a percentage excess air typical of operating conditions. Since volumetric discharge rates did not vary significantly for fuel type a

representative volumetric discharge rate was used for each of the modelled boiler sizes. A stack efflux gas temperature of 150°C was assumed for all the modelled emission sources.

Two exit velocities were modelled for each source configuration in order to assess the sensitivity of predicted to discharge velocities. The dispersion of pollutants discharged from stacks which have a low discharge velocity can be more susceptible to stack tip and building downwash effects. The first exit velocity modelled was set to between 5.3 – 6.5m/s and is representative of a low discharge velocity. The second exit velocity was set to 10m/s and was representative of moderate discharge velocity. The diameter of the stack was varied to maintain the same volumetric discharge rate for the two exit velocity scenarios.

Stack heights of 8m (3m above the building, which is one of the existing thresholds for chimney height) and 9.5m (4.5m above the building, which would comply with the permitted activity rule for maximum chimney height found in all district plans in the Wellington Region) were modelled for each emission source configuration.

A summary of source emission parameters is presented in Table 1.

Table 1. Summary of modelled emission source parameters

Parameter	Boiler Heat Capacity (heat of combustion)							
	0.2 MW		0.5MW		1.0MW		2.0MW	
Exit velocity (m/s)	5.9	10	6.3	10	5.4	10	5.3	10
Stack Diameter (m)	0.15	0.115	0.23	0.182	0.35	0.26	0.5	0.365
Exit temperature (°C)	150	150	150	150	150	150	150	150
Stack height (m)	8.0 & 9.5		8.0 & 9.5		8.0 & 9.5		8.0 & 9.5	
Building downwash conditions	None, 10mx10m, & 20mx20m		None, 10mx10m, & 20mx20m		None, 10mx10m, & 20mx20m		None, 10mx10m, & 20mx20m	

1.4 Modelled PM_{10} Emission Rates

Emission rates of PM_{10} were estimated by multiplying emission factors and fuel consumption rates. The emission factor for coal combustion has been derived from Wilton et al. (2008)[1] review of NZ boilers. Based on available test data the authors proposed emission factors for three different boiler types which ranged from 1.3 to 3.8 g/kg. For this assessment the highest emission factor of 3.8g/kg has been used, corresponding to the uncontrolled Vekos boiler.

Emission factors for wood combustion have been derived from the USEPA AP-42 emission factor for the combustion of dry wood assuming emissions are uncontrolled. The derived emission factor of 2.46g/kg assumed a higher heating value (HHV) of 15.9MJ/kg for wood.

Emission for diesel and LFO were also derived from the USEPA AP-42 emission factors. The emission factor for LFO (No.4 oil) was calculated to be 0.84g/L and the emission factor diesel (distillate oil) was calculated to be 0.24g/L.

[1] Wilton E., Baynes M., Bluett J., 2008. Improving PM10 Emission Factors from Industrial Boiler in New Zealand – Stage 1. Prepared for foundation for Science, Technology and Research.

A summary of modelled PM_{10} emission rates with respect to boiler heat capacity and fuel type is presented in Table 2.

Table 2. Modelled PM_{10} Emission Rates

Boiler Heat Capacity	Coal (g/s)	Wood (g/s)	Diesel (g/s)	LFO (g/s)
0.2 MW	0.034	0.037	0.0011	0.0041
0.5 MW	0.086	0.093	0.0028	0.010
1.0 MW	0.17	0.19	0.006	0.020
2.0 MW	0.34	0.37	0.011	0.041

Emission rates for wood and coal emission rates were also modelled assuming a PM_{10} discharge concentration of 250mg/m^3 (@dry, 0°C, and standard pressure) and is summarised in Table 3. For the calculation of emission rates, no correction was made for gas oxygen or carbon dioxide concentration of the stack discharge. It should be noted that this assumption results in a lower mass emission of PM_{10} for a comparable boiler size calculated from the emissions factors assumptions shown in Table 2.

Table 3. Modelled PM_{10} Emission Rates Assuming a Discharge Concentration of 250mg/m^3

Boiler Heat Capacity	Coal (g/s)	Wood (g/s)
0.2 MW	0.014	0.015
0.5 MW	0.035	0.037
1.0 MW	0.070	0.075
2.0 MW	0.14	0.15

1.5 Modelled NO_X Emission Rates

Screening modelling for NO_X emissions from natural gas combustion was also undertaken, based on USEPA AP-42 emissions factors for small boilers. Additionally, the results of the natural gas NO_X modelling were scaled to provide a preliminary indication of the theoretical emissions of NO_X from the combustion of diesel at 0.2MW and 0.5MW to evaluate whether PM_{10} or NO_X emissions are likely to be limiting for determining the permitted activity threshold.

A summary of the modelled NO_X emission rates with respect to boiler heat capacity is presented in Table 4.

Table 4. Modelled NO_X Emission Rates for Natural Gas Combustion

Fuel Type	Boiler Heat Capacity	Natural gas NO_X emission rate (g/s)
Diesel	0.2 MW	1.044
	0.5 MW	2.61

Natural Gas	2.0 MW	0.084
	5.0 MW	0.209
	10 MW	0.418

1.6 Summary of Model Predictions

A summary of maximum 24-hour average PM_{10} ground level concentrations predicted more than 25m from the modelled stack source is presented in Table 5. 25m from the stack is an assumed set-back distance that is considered to be consistent with industrial areas and could also potentially be employed as a set-back distance in a rule. The most relevant averaging time for NO_X emissions is 1-hour averages; and the 99.9th percentile (9th highest) predicted ground level concentrations have been reported. Reporting of these predictions is consistent with the recommendations contained in the Ministry for the Environment 'Good Practice Guide for Dispersion Modelling' (2004).

Table 5. Summary of Predicted Maximum 24-hour Average PM_{10} Concentrations

Fuel Type	Stack Height (m)	Boiler Size (MW)	Discharge Velocity 1 (5.3-6.3m/s)			Discharge Velocity 2 (10m/s)		
			No Building	10m x10m	20m x20m	No Building	10m x10m	20m x20m
Coal	8	0.2	10	38	78	9	37	76
		0.5	15	74	150	15	71	145
		1	34	154	314	22	122	252
		2	27	174	377	25	163	358
	9.5	0.2	8	20	58	7	19	56
		0.5	12	38	113	12	35	108
		1	16	61	189	15	54	175
		2	23	96	293	22	80	269
Wood	8	0.2	9	36	82	9	34	80
		0.5	14	69	148	13	66	143
		1	31	148	310	20	113	249
		2	25	167	365	23	150	347
	9.5	0.2	7	18	54	7	17	52
		0.5	11	35	104	11	32	100
		1	15	56	174	14	50	161
		2	21	88	270	20	74	248
Diesel	8	0.2	0.3	1.2	2.4	0.3	1.1	2.3
		0.5	0.5	2.2	4.5	0.4	2.2	4.4
		1	1.0	4.7	9.5	0.7	3.7	7.6
		2	0.8	5.3	11.4	0.8	4.9	10.8
	9.5	0.2	0.2	0.6	1.8	0.2	0.6	1.7
		0.5	0.4	1.1	3.4	0.4	1.1	3.3
		1	0.5	1.8	5.7	0.5	1.6	5.3
		2	0.7	2.9	8.9	0.7	2.4	8.1
LFO	8	0.2	1.1	4.2	8.6	1.0	4.0	8.4
		0.5	1.7	8.1	16.4	1.6	7.8	15.9
		1	3.7	17.0	34.5	2.4	13.4	27.7

Fuel Type	Stack Height (m)	Boiler Size (MW)	Discharge Velocity 1 (5.3-6.3m/s)			Discharge Velocity 2 (10m/s)		
			No Building	10m x10m	20m x20m	No Building	10m x10m	20m x20m
		2	2.9	19.1	41.4	2.8	17.9	39.3
	9.5	0.2	0.8	2.2	7.3	0.8	2.1	7.0
		0.5	1.3	4.1	13.3	1.3	3.9	11.9
		1	1.8	6.7	22.2	1.7	5.9	20.6
		2	2.5	10.5	34.2	2.4	8.8	31.4

Predicted maximum 24-hour average PM_{10} concentrations above 2.5µg/m^3 are shaded grey in the table. The results show that predicted maximum concentrations do not change significantly with respected to the modelled discharge velocity. Grey shading indicates that the distance to 2.5µg/m^3 is greater than 25m from the modelled stack source.

A summary of predicted maximum 24-hour average PM_{10} concentration assuming a stack discharge concentration of 250mg/m^3 is shown in Table 6. Predicted maximum 24-hour average PM_{10} concentrations above 2.5µg/m^3 are shaded grey in the table.

Table 6. Summary of Predicted Maximum 24-hour Average PM_{10} Concentrations Assuming a Discharge Concentration of 250mg/m^3

Fuel Type	Stack Height (m)	Boiler Size (MW)	Discharge Velocity 1 (5.3-6.3m/s)			Discharge Velocity 2 (10m/s)		
			No Building	10m x10m	20m x20m	No Building	10m x10m	20m x20m
Coal	8	0.2	4	15	32	4	15	31
		0.5	6	30	60	6	29	59
		1	14	62	127	9	49	102
		2	11	70	152	10	66	145
	9.5	0.2	3	8	27	3	8	26
		0.5	5	15	49	5	14	44
		1	7	24	82	6	22	75
		2	9	39	126	9	32	115
Wood	8	0.2	4	15	33	4	14	33
		0.5	6	28	60	5	27	59
		1	13	60	127	8	46	102
		2	10	68	149	10	61	142
	9.5	0.2	3	8	22	3	7	21
		0.5	5	14	43	4	13	41
		1	6	23	71	6	20	66
		2	9	36	111	8	30	102

As Table 6 shows that coal and wood fuelled combustion processes greater than 200kW are likely to be in excess of the 2.5µg/m^3 guideline, further investigation as to whether a discharge concentration of 100mg/m^3 for PM_{10} could result in a level of permissiveness for coal and wood combustion. Table 7 shows the results of this modelling.

Table 7. Summary of Scaled Maximum 24-hour Average PM_{10} Concentrations Assuming a Discharge Concentration of 100mg/m^3

Fuel Type	Stack Height (m)	Boiler Size (MW)	Discharge Velocity 1 (5.3-6.3m/s)			Discharge Velocity 2 (10m/s)		
			No Building	10m x10m	20m x20m	No Building	10m x10m	20m x20m
Coal	8	0.2	1.6	6	12.8	1.6	6	12.4
		0.5	2.4	12	24	2.4	11.6	23.6
		1	5.6	24.8	50.8	3.6	19.6	40.8
		2	4.4	28	60.8	4	26.4	58
	9.5	0.2	1.2	3.2	10.8	1.2	3.2	10.4
		0.5	2	6	19.6	2	5.6	17.6
		1	2.8	9.6	32.8	2.4	8.8	30
		2	3.6	15.6	50.4	3.6	12.8	46
Wood	8	0.2	1.6	6	13.2	1.6	5.6	13.2
		0.5	2.4	11.2	24	2	10.8	23.6
		1	5.2	24	50.8	3.2	18.4	40.8
		2	4	27.2	59.6	4	24.4	56.8
	9.5	0.2	1.2	3.2	8.8	1.2	2.8	8.4
		0.5	2	5.6	17.2	1.6	5.2	16.4
		1	2.4	9.2	28.4	2.4	8	26.4
		2	3.6	14.4	44.4	3.2	12	40.8

Screening modelling was conducted to estimate the emissions of NO_X from natural gas combustion using a 20m x 20m building and a stack height of 8.0m; the most conservative set of circumstances of the modelling scenarios. A summary of the 99.9th percentile 1-hour average predicted ground level concentrations for NO_X emissions is presented in Table 8.

It should be noted that only a proportion of the estimated emission of NO_X will be NO_2, and that some NO_X will be converted to NO_2 in the atmosphere – the implications of this are discussed in Section 5 of the main report.

Table 8. Summary of 99.9th percentile 1-hour Average NO_X emissions from a Natural Gas Boiler

Fuel Type	Building Size	Stack Height	Boiler Size (MW)	Discharge Velocity (m/s)	99.9th percentile concentration (µg/m^3)
Natural Gas	20m x 20m	8.0m	2.0	6.2	120
			5.0	6.2	200
			10.0	6.2	301
				9.8	275
Diesel	20m x 20m	8.0m	200 kW scaled from 2.0MW		1492
			500 kW scaled from 2.0MW		3732