2016 Dust Audit: Port of Tauranga

24 April 2017

Prepared for
Bay of Plenty Regional Council

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2016 Dust Audit: Port of Tauranga

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Revision History

No.	Date	Author	Reviewer(s)	Details
1	11 Nov 2016	**Louise Wickham** Director & Senior Air Quality Specialist	**Rachel Nicoll** Senior Air Quality Specialist	Draft for internal peer review
2	23 Nov 2016			Draft for client review
3	19 Dec 2016		**Jayne Metcalfe** Director & Senior Air Quality Specialist	Second draft for client review
4	18 Jan 2017			Final draft for external comment provided to: • Port of Tauranga • ISO • ISL • C3 • NZ Marshalling & Stevedoring Ltd
5	13 April 2017		**Jayne Metcalfe** Director & Senior Air Quality Specialist	Final
6	24 April 2017			Revised Fig 1 (site layout) only

Executive Summary

Complaint investigation and research carried out by Bay of Plenty Regional Council (BOPRC) shows that Mount Maunganui and Sulphur Point areas of Tauranga experience elevated levels of nuisance dust and particulate matter (PM) under certain meteorological conditions (BOPRC, 2012). Dust composition analyses do not identify any one particular industrial activity, but rather indicate a range of contributing sources. In February 2015, BOPRC approved the development of a Dust Reduction Operational Plan for the Port that included the preparation of a comprehensive audit of dust sources.

In October 2016, Bay of Plenty Regional Council engaged Emission Impossible Ltd as an independent consultant to:

(i) Work cooperatively with Port of Tauranga management to identify all sources of fugitive dust emissions;
(ii) Undertake site audits of all dust generating activities to clearly assign responsibility for each source;
(iii) Draft recommendations for dust management, prioritising key sources; and
(iv) Present findings back to BOPRC and Port of Tauranga.

A site audit was undertaken between 17 and 21 October 2016. Conditions were dry and windy and therefore representative of meteorological conditions favourable for dust generation. It is important to note that dust emissions from the Port are weather dependent – there are no dust problems on rainy days.

Based on the October 2016 audit, the following key sources of dust from operational activities occurring at Port of Tauranga were identified:

- Bulk cargo handling;
- Open spaces (re-entrained dust from wind pick-up over exposed surfaces); and
- Log handling (primarily ground up bark and soil-based particulate matter);
- Vehicles (combustion, brake and tyre wear and re-entrained dust from vehicle movement).

Indicative, order of magnitude, estimates of annual dust emissions are summarised in Figure 1.

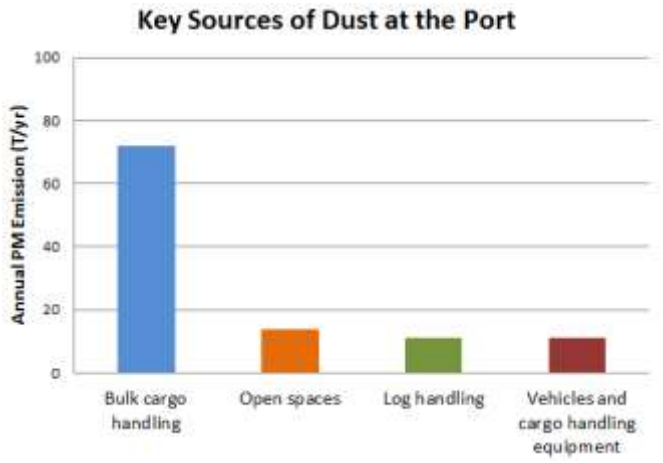

Figure 1 Indicative estimated Port Particulate Matter Emissions (tonnes/year)

Bulk cargo handling is potentially the most significant source of dust emissions from activities carried out at the Port of Tauranga. However, the remaining dust sources are also significant in the regional inventory when considered as a whole – the units in Figure 1 are *tonnes* per year and in most cases are likely to be underestimated.

The Port has made significant investment in dust mitigation and management as part of their on-going capital improvements programme. However, current dust mitigation and management measures are inadequate to effectively mitigate dust generation from port activities. During the audit excessive emissions of dust were observed from bulk cargo unloading, general log handling and open spaces (both sealed and unsealed) at the Port.

The following changes and/or improvements are recommended to improve dust **mitigation** at the Port:

- Significantly increasing the amount, and efficacy, of sweeping/vacuuming services;
- Installing a logging truck wash at the Hewlett's Road entrance;
- Using effective water sprays to control fine dust when handling logs and bulk cargo;
- Undertaking a systematic review of bulk cargo handling dust mitigation options;
- Increasing the height of the bund for the sweepings stockpile; and
- Reducing vehicle speeds.

There are also a number of interventions and tools available to the Port that would significantly improve **monitoring** and **management** of activities that generate dust. These include:

- Utilising existing real time monitoring to actively manage dust emissions from bulk cargo unloading;
- Contractually requiring Port activities to manage dust emissions;
- Developing a Port dust reduction operational plan with key stakeholders;
- Developing a Port emissions inventory;
- Undertaking monitoring for total suspended particulate (TSP) and PM_{10} in and around the Port; and
- Undertaking a thorough effects assessment of all discharges to air and applying for resource consent.

Fugitive dust emissions from the Port will include particulate matter less than 10 micrometres in diameter (PM_{10}). There is widespread scientific consensus that PM_{10} *causes* (i.e. is not merely associated with) serious adverse effects including respiratory and cardiovascular morbidity and mortality (WHO, 2006). In 2013, the International Agency for Research on Cancer (IARC) classified particulate matter as carcinogenic to humans (Group I) based on an increasing risk of lung cancer (with increasing levels of exposure to particulate matter).

Ambient monitoring of PM_{10} would be required to confirm whether or not ambient concentrations in and around the Port exceed the national environmental standard. However, exceedance of the standard is considered likely based on the evidence available to date, which includes:

- Investigative work undertaken by BOPRC and measurements of elevated levels of total suspended particulate (BOPRC, 2012);
- Complaint history;
- Visible brown haze; and
- Excessive visible dust observed during the audit.

Similarly, it is considered likely that a number of other contaminants (for example, wood dust, respirable particulate and inhalable particulate) may exceed occupational standards at workplaces in and around the Port.

The overlapping ambient and workplace exposure to multiple contaminants demands an integrated response.

It is recommended that Bay of Plenty Regional Council consider:

- Requiring the Port to assess and obtain resource consent for all discharges to air (i.e. not just particulate matter);
- According discretionary activity status in the Regional Air Plan review for Port activities with discharges to air; and
- Providing WorkSafe New Zealand with a copy of this report.

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1. Background

The *Resource Management (National Environmental Standards for Air Quality) Regulations 2004* (NES for air quality) require Bay of Plenty Regional Council (**BOPRC**) to ensure compliance with health-based standards for air quality. These regulations include a national environmental standard (NES) for particulate matter less than 10 micrometres in diameter (**PM_{10}**).

The NES limit for PM_{10} is 50 micrograms per cubic metre ($\mu g/m^3$) as a 24-hour average. This is a risk based standard, set to provide a guaranteed level of health protection for all New Zealanders (who may reasonably be exposed over the time averaging period). PM_{10} is known to cause both acute and long-term health effects,[1] and is also carcinogenic.[2] As such, compliance with the PM_{10} standard minimises risk, but will not completely avoid adverse health effects.

Following repeated complaints, in 2012 BOPRC undertook an investigation into elevated levels of nuisance dust and particulate matter (**PM**) in and around the Port of Tauranga (**the Port**). The investigation focussed on larger particles than PM_{10} (refer section 1.3, Definition of particulate matter), and identified a range of contributing types of PM from the Port (BOPRC, 2012a):

- Coal;[3]
- Palm kernel dust; and
- Wood and bark material.

Other types of PM (i.e. soil, sand, tyre wear, combustion PM, pollens and plant matter as well as man-made fibres, paint, rust and possibly welding residues) were not able to be distinguished from typical urban background PM.

In February 2015, BOPRC approved[4] the development of a Dust Reduction Operational Plan for the Port as follows:

(i) A comprehensive audit report of the Port of Tauranga operation in relation to nuisance dust;
(ii) A report discussing reduction/mitigation options for highlighted nuisance dust sources; and
(iii) A management plan with reduction/mitigation implementation timeframes.

The intent was that the Port would prepare Items 1 and 2 above to demonstrate compliance with Rule 17(b) and (c) of the operative Bay of Plenty Regional Air Plan (reproduced below):

[1] WHO, (2006).

[2] IARC, (2016).

[3] In 2004 Solid Energy installed a purpose built, enclosed coal storage and handling facility at the Port. Currently coal is not stored or handled at the Port. This enclosed facility is currently used for general bulk storage (including palm kernel).

[4] Minutes of Regional Direction and Delivery Committee. Item 2.3 *Tauranga and Mount Maunganui Air Quality Options Report*. 19 Feb 2015.

Rule 17 Permitted Activity – General Activities

All other discharges of contaminants into air which are not subject to an express rule in this regional air plan shall be a permitted activity subject to compliance with the following conditions. If the conditions cannot be complied with the activity shall be a discretionary activity.

(b) The discharge must not result in objectionable or offensive odour or particulates beyond the boundary of the subject property or into water;

(c) There must be no harmful concentrations of contaminants beyond the boundary of the subject property or into water;

Whilst the Port continued to implement a number of dust mitigation measures onsite (refer Section 3), the Port elected not to provide BOPRC with an audit report on the basis that they had already identified all sources of dust emissions.

In October 2016, BOPRC engaged Emission Impossible Ltd to:

(i) Work cooperatively with Port of Tauranga management to identify all sources of fugitive dust emissions;
(ii) Undertake site audits of all dust generating activities to clearly assign responsibility for each source;
(iii) Draft recommendations for dust management, prioritising key sources; and
(iv) Present findings back to BOPRC and Port of Tauranga.

1.1 Audit approach

The audit approach was to work cooperatively with Port of Tauranga management and all stevedoring companies to systematically identify key sources of fugitive dust emissions at the Port. This included observing port activities at Sulphur Point and Mount Maunganui.

Fieldwork was undertaken between 17-21 October 2016. Conditions were dry and windy and therefore representative of meteorological conditions favourable for dust generation. Photographs and videos were recorded at Mount Maunganui and Sulphur Point wharves and surrounds (the Port) during this period which encompassed stevedoring and marshalling of:

- Logs (bark on and off);
- Bulk cargo (palm kernel, wheat and cement clinker only); and
- Containers (general cargo).

Individual interviews were undertaken with the following representatives:

- Port of Tauranga – Maurice Hume (Property Services Manager), Mark Whitworth (Cargo Services Manager), Rowan Johnstone (Port Engineer)
- ISL – Mike Danen (National Operations Manager)

- ISO – Grant Robb (General Manager, Safety & Compliance), David Dragovich (General Manager Stevedoring), David Blackburn (National Manager, Bulk Cargo), Neil Weber (General Manager, Marshalling & Transport) and Vern Taniwha.
- C3 – Glen Procter (Operations Manager – Mount Logs)
- NZ Marshalling & Stevedoring Ltd – Matthew Clark (Labour Coordinator)

The intent of the audit was to mirror the steps taken in the implementation of the successful BOPRC Ngāpuna Dust Reduction Operational Plan (BOPRC, 2012b). The Ngāpuna plan engaged all parties upfront in an open and transparent manner in a three stage approach as follows:

Stage 1 Awareness raising and voluntary reductions

Stage 2 Light-handed enforcement

Stage 3 Active enforcement

Accordingly, Louise Wickham from Emission Impossible Ltd met with management representatives of the Port and the three main stevedoring companies (ISL, ISO and C3) on the first day of the audit. Ms Wickham presented an overview of the Ngāpuna dust reduction project to set the context that the audit was Stage 1 of a similar approach being adopted by BOPRC for the Port.

However, there are significant differences between the Ngāpuna Industrial Estate and the Port of Tauranga that impact on the transferability of approach:

1. Scale – the area of Port activities is significantly larger (around 190 hectares) than the Ngāpuna Industrial Estate (around 60 hectares). Scale is directly correlated with magnitude, with PM emissions from the Port being orders of magnitude greater than those of Ngāpuna. This in turn, impacts on the amount of time required to implement dust mitigation and ultimately achieve compliance with the Regional Air Plan;

2. Responsibility – the Ngāpuna Industrial Estate is a collection of disparate entities with no sole body in charge. However, the Port of Tauranga owns most of the land on which port-related, dust-generating, activities occur. This provides options for control of dust generating activities, both regulatory and non-regulatory, which were not feasible at Ngāpuna.

1.2 Limitations of audit

This report has been prepared on an independent basis based on the experience of Emission Impossible Ltd and in accordance with best practice dust management in New Zealand. As such, it reflects the recently published *Good Practice Guide for Assessing and Managing Dust* (Ministry for the Environment, 2016).

The report relies in good faith upon information provided by third parties such as Port of Tauranga and stevedoring companies in October and November 2016.

It is acknowledged that the emissions estimates are indicative only, being subject to uncertainty of up to ±50% or more in places. Where available, ratings for published emission factors are provided. However, the purpose of this audit was not to prepare accurate emissions estimates (this being a much more detailed study). Rather the purpose of the audit was to identify and prioritise the main sources of dust generation at the Port and provide recommendations for mitigation and management. The emissions estimates, whilst being indicative only, are therefore considered reasonable for the purposes of this audit.

The findings of this audit relate directly to the site visit of 17-21 October 2016 during which the following operations were not witnessed in person:

- handling of fertiliser; and
- handling of bulk cargo types other than those listed (for example, cotton seed meal, boucra or soy flour).

It should also be noted that interviews were not undertaken with importers, exporters or ship agents.

1.3 Definition of particulate matter

The *Good Practice Guide for Assessing and Managing Dust* defines particulate matter (**PM**) as (Ministry for the Environment, 2016):

> *Particulate matter is the collective term used to describe very small solid, liquid or gaseous particles in the air. Some of these particles are big enough to be seen, while others are so small that they are invisible to the human eye and small enough to inhale. The range of particle sizes depends on source and composition as shown in Figure 2.*

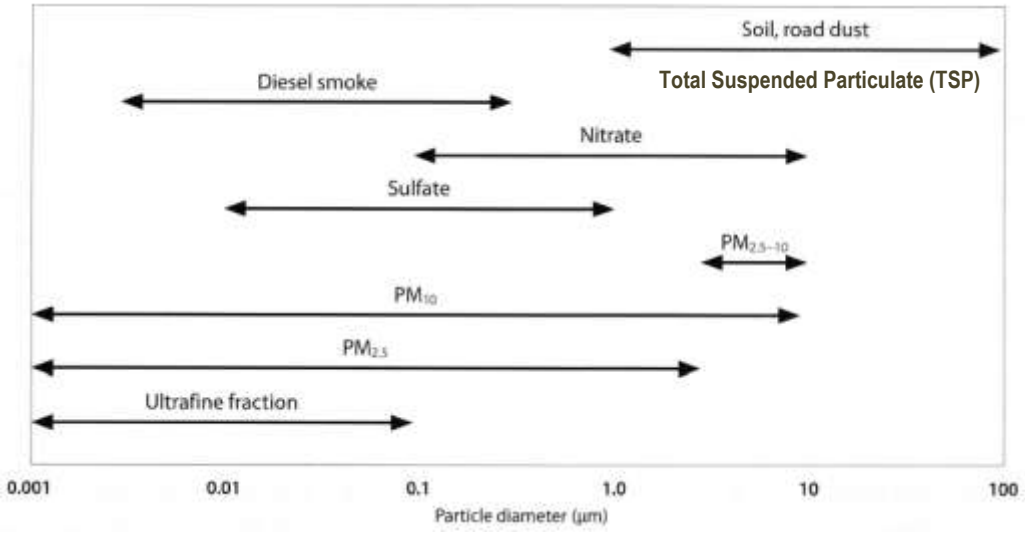

Figure 2 Size range of airborne particles [Source: World Health Organisation, 2006]

> *Particulate matter includes total suspended particulates (TSP), which can be considered as anything smaller than 100 micrometres (µm) in diameter. In practice, the large particles (ie, greater than 20-30 micrometres) do not last long in the atmosphere, as they tend to fall out rapidly and settle. Particles deposited on a surface will only become individually visible at about 50 micrometres.*
>
> *…Particles smaller than 10 µm in diameter are known as PM_{10}. PM_{10} includes particles referred to as 'coarse' (between 2.5 and 10 µm) and 'fine' (less than 2.5 µm, also known as $PM_{2.5}$).*
>
> *It is the larger dust particles that are generally responsible for nuisance effects. This is because they are more visible to the naked eye, and therefore more obvious as deposits on clean surfaces. Smaller particles ($PM_{2.5}$ and PM_{10}) are known to cause adverse health effects.*

This audit aims to address all size fractions of PM (as shown in Figure 2) because all size fractions are emitted from various sources at the Port. The terms PM (particulate matter) and dust are used interchangeably.

PM_{10} is a subset of PM and/or dust as it refers only to the fraction that is less than 10 micrometres (µm) in diameter ($PM_{2.5}$ is the fraction that is less than 2.5 µm in diameter).

1.4 Effects of dust

The effects of dust are discussed in the *Good Practice Guide for Assessing and Managing Dust* (Ministry for the Environment, 2016) which states:

> *The effects of dust are primarily determined by particle size and particle composition. Larger dust particles are generally considered to be biologically inert and their effects relate to our sense of aesthetics (soiling, visibility and amenity). However, finer dust particles (especially PM_{10} or smaller) can cause adverse health effects.*

PM_{10} is known to cause both acute and long-term health effects,[5] and is also carcinogenic.[6]

The Good Practice Guide also notes that some nuisance dust may also have the potential to cause direct health effects because of the presence of specific biologically active materials. For Port of Tauranga it is particularly important to note that (natural) wood dust is carcinogenic. If treated it can also contain toxic chemicals from the wood treatment processes used.

It is beyond the scope of this audit to assess the potential health effects of emissions from the Port of Tauranga site. However it is important to recognise that dust is not just a nuisance issue.

[5] WHO, (2006).

[6] IARC, (2016).

2. Inventory of key dust sources

Indicative estimates of key sources of particulate matter (PM) at the Port are as shown in Table 1. These are primarily intended to provide an estimate of relative emissions from each source for the purpose of prioritising dust control. These are discussed in more detail below.

It should be noted that Table 1 excludes shipping which is likely to be around 145 tonnes per year based on vessel movements numbers at Port of Tauranga compared with published emissions inventory for Auckland (Peeters, 2010). The inventory further excludes emissions from trains (the Port receives five trains of logs a day).

Table 1 **Inventory of key PM sources at the Port**

Source	Location	Type	TSP/ PM_{10}	Estimate (tonnes/yr)
Bulk cargo handling	Wharves	Finer materials only (e.g. palm kernel)	TSP	72
Open spaces	Wharves, roadways, access ways and storage and handling areas – excepting areas covered by logs	Re-entrained PM from wind pick-up over exposed surfaces (sealed and unsealed)	TSP	14
Log handling	Log storage, transport and marshalling areas	Primarily ground up bark and soil-based PM	TSP	11
Vehicles and cargo handling equipment	Wharves, roadways, access ways and storage and handling areas	Diesel combustion, brake and tyre wear, re-entrained PM from vehicle movement	PM_{10}	11

Figure 3 presents a site layout of the Mount Maunganui and Sulphur Point wharves and all log handling areas. Berth numbers 1 through 11 are located north to south at Mount Maunganui wharves. Berth numbers 23 – 25 are also located north to south at Sulphur Point.

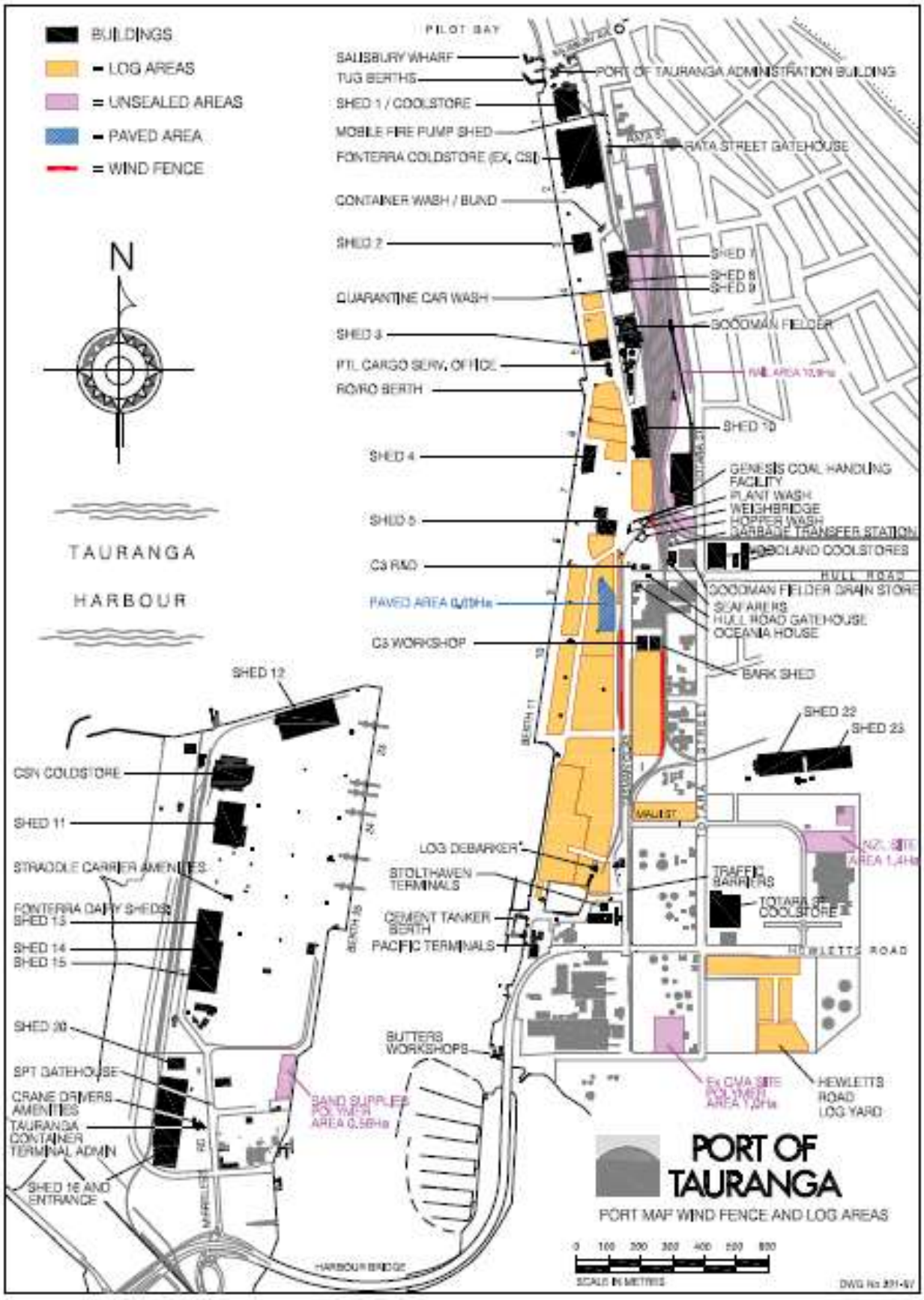

Figure 3 **Site layout** [Source: Port of Tauranga 24 Apr 2016]

2.1 Bulk cargo handling

Dust is generated during bulk handling as follows:

- Transferring product from the ship hold to hoppers (leaking grabs)
- Transferring product from the ship hold to the wharf (dust generated by wind pickup during unloading)
- Hopper loading (dust is created when material falls and strikes a receiving surface, the higher the fall – the more dust created)
- Spilt product onto wharf (wind pick-up and additional dust creation from vehicle movements grinding product into finer fractions)

Dust is also generated when standard operating procedures are not followed, i.e.:

- Overfilling hoppers
- Overfilling trucks
- High winds (dust pick up from all transfer points and exposed surfaces)

It is important to note that different materials handled at the Port have different properties. Accordingly, some materials are more prone to dust generation than others (e.g. palm kernel). During the site visit, palm kernel was witnessed being unloaded (Photo 1) as well as grain husks (Photo 2) and clinker (Photo 3).

Dust generation from clinker unloading was less visually obvious during the day time, particularly on a cloudy day (Photo 4). However, unloading at night under lights looked very different (Photo 5) with the trailing dust from the grab becoming much more evident (Photo 6).

Photo 1 Palm kernel collected from wharves during unloading
[Mount Maunganui Wharves 10:12 AM 18 Oct 2016]

Photo 2 Grain husks collected from wharves during unloading
[Mount Maunganui Wharves 3:20 PM 19 Oct 2016]

Photo 3 Clinker collected from wharf during unloading
[Mount Maunganui Wharves 5:29 AM 21 Oct 2016]

Photo 4 Clinker unloading using dedicated hopper and bag filter
[Mount Maunganui Wharves 11:49 AM 20 Oct 2016]

Photo 5 Clinker unloading using dedicated hopper and bag filter
[Mount Maunganui Wharves 11:49 AM 20 Oct 2016]

Photo 6 Dust trailing behind grab during clinker unloading
[Mount Maunganui Wharves 5:42 AM 21 Oct 2016]

It is also important to note that dust is particularly difficult to photograph and often best illustrated through video. Here are some examples.

Video 1 Dust generated from overfilled hopper, overfilled trucks and excessive wind during palm kernel unloading
[Mount Maunganui Wharves 12:31 PM 17 Oct 2016. If reading electronically use control click to view, alternatively go to: https://drive.google.com/open?id=0ByQyNZDMNCDAd3NiVjRETWk1NGs]

Video 2 Dust generated during emptying of hopper into truck during palm kernel unloading
[Mount Maunganui Wharves 11:55 AM 18 Oct 2016. If reading electronically use control click to view, alternatively go to: https://drive.google.com/open?id=0ByQyNZDMNCDAb0RyaEhabmFhNzA]

Bulk cargo PM emission estimate

Actual dust emissions will depend on, *inter alia*, the moisture content of each cargo, wind conditions at the time of unloading and the use of any control equipment (clinker is the only bulk cargo currently utilising hoppers fitted with extraction and bag filters).

The US EPA default emissions factor for uncontrolled PM emissions from shipping (receipt) of grains (wheat, corn, oats, rice, soybeans and sorghum) is 0.075 kg/tonne (US EPA, 2003).[7] This has an emission factor rating of E (Refer Appendix A) and may be considered indicative only (+/- 50%).

Based on the bulk cargo throughput[8] at the Port of Tauranga in 2016:

Palm kernel
710,616 tonnes/year x 0.075 kg/tonne
= 53.3 tonnes/yr PM

Grain
248,594 tonnes/year x 0.075 kg/tonne
= 18.6 tonnes/yr PM

It should be noted that the above estimate ignores additional handling of palm kernel (e.g. palm kernel being loaded in and out stores on Port land) and therefore likely underestimates actual dust emissions from palm kernel handling at the Port of Tauranga.

[7] Table 9.9.1-1 Source Classification Code 3-02-005-55 (Grain receiving – Ships)

[8] Personal comm. Rowan Johnstone, Port of Tauranga to Reece Irving, BOPRC 11 Apr 2017

The indicative estimate further does not address potential dust arising from handling of other products such as fertilisers (503,534 tonnes in 2016), salt (around 147,815 tonnes in 2016) and other bulk cargo for which no emission factors are readily available.

Indicative emissions of PM from bulk cargo handling

= 53 (palm kernel) + 19 (grain)

= 72 tonnes/year

As noted above, this estimate ignores several additional sources and is likely to be an underestimate.

2.2 Open spaces

Sealed areas

PM emissions can arise from sealed, trafficked surfaces due to direct emissions from vehicles (exhaust, brake wear and tire wear) and due to resuspension of loose material on the road surface.

Photo 7 shows fugitive dust generated from a sealed container handling and storage area.

Photo 7 Dust arising from vehicle movements over sealed surface
[Container storage area on Waimarie Street, Mount Maunganui Wharves, 2:48 PM 17 Oct 2016]

An empirical expression for resuspension of loose material on paved roads, *excluding* combustion PM and PM from tyre and brake wear is (US EPA, 2011):

$$E = k\,(sL)^{0.91} \times (W)^{1.02}$$

Where:

E = particulate emission factor (g/vehicle kilometre travelled, (VKT))

k = particle size multiplier for particle size range (g/VKT): TSP (PM) = 3.23, PM_{10} = 0.62

sL = silt loading (g/m^2); assume 0.03 for baseline

W = average weight of vehicles travelling the road (tons)

The emission factor rating is D (refer Appendix A).

Assuming the average weight of vehicles trafficking the sealed areas at the Port is around 30 tons (half being full at 50 tonnes and half being empty at 5 tonnes averaging to around 30 US short tons), this gives a PM emission factor of 4.3 grams per vehicle kilometre travelled.

A detailed inventory of vehicles and cargo handling equipment (loaders, etc.) at the Port is not available. However, as an indicative estimate, Port data shows 552,000 trucks enter the Port each year. Assuming these each travel two kilometres within the Port precinct, this equates to a PM emission rate of 3.6 tonnes per year.

This estimate is for trucks only and neglects travel by forklifts and other cargo handling equipment. It is therefore, likely to underestimate actual dust emissions.

Unsealed areas

The Port has only 1.4 hectares of unsealed area[9] and this is leased to NZL for container storage. However, KiwiRail owns an additional 10.9 hectares of unsealed land that is integral to the Port activities. Dust generation from unsealed ground due to high winds was extremely evident during the site visit of 17-21 October. It is therefore, included as a key source in this audit.

Dust generation from unsealed ground is typically difficult to show in a photograph but may be clearly seen on video as demonstrated in the attached Video 3.

A default emission factor for TSP from bare, disturbed, ground is 0.4 kg/ha/hr (DEE, 2012). For 12.3 hectares of open, unsealed area, this suggests fugitive PM discharged during high winds is around:

0.4 kg/ha x 12.3 ha = 4.9 kg/hr (spread over 12.3 hectares)

However, dust from open ground is only generated when winds are above 5 m/s **and** it is not raining. Meteorological data from BOPRC indicates winds are elevated on average 23% of the year (min 12%, max 34%). Data on rain concurrence is not readily obtainable.

[9] CMA site and sand stockpiles stabilised through spray polymer and so not included

Video 3 Dust pick up due to high winds moving over (Kiwirail) open, unsealed ground
[Mount Maunganui Wharves 5:29 PM 17 Oct 2016. If reading electronically use control click to view, alternatively go to: https://drive.google.com/open?id=0ByQyNZDMNCDALTFXQTZDSmxXUWs]

To offset the likelihood of rain, the *average* time winds are elevated in Tauranga can be used to give an indicative (only) estimate of dust from wind pickup over unsealed ground.

This gives an indicative estimate of around of 10 tonnes of PM per year emitted from (KiwiRail and NZL) exposed, unsealed areas at the Port.

Open areas PM emissions estimate

An indicative estimate of emissions of fugitive PM from sealed and unsealed areas is:

	Sealed areas 3.6 tonnes per year (Port)
+	Unsealed areas 10 tonnes per year (Port and KiwiRail)
=	**14 tonnes per year**

This estimate neglects emissions from sealed areas traversed by forklifts and other cargo handling equipment. It is therefore, likely to underestimate actual dust emissions from sealed areas (131 ha) at the Port.

2.3 Log handling

Figure 4 shows the areas of the Port used for storage and handling of logs. This includes all roadways and equates to around 45 hectares. The Port estimates that the area taken up by log piles equates to around 29 hectares as shown in Figure 5.

Figure 4 Total area log handling and storage
[Source: Port of Tauranga, 20 Oct 2016]

Figure 5 Total area log storage
[Source: Port of Tauranga, 20 Oct 2016]

In 2015 the Port exported 5,592,000 tonnes of logs and 1,973,000 tonnes of other forest products.[10] Whilst the logs have the majority of bark removed in the forests, they still drop small amounts of bark and dust every time they are handled. Handling can occur several times at the Port:

- Upon arrival i.e. transfer from train/truck to Port storage area
- Upon pick-up from Port storage area for transfer to marshalling area
- Upon drop-off at marshalling area
- Upon pick-up at marshalling area for transfer to ship

Log ends are washed at the Port which removes dust from this part of the log (only).

The Port contracts Daltons to collect bark dropped in log storage areas for free (i.e. Dalton's do not pay for the bark which they can on-sell). Despite scraping and vacuum sweeping removed bark and dust, some particulate remains. This can then be ground into finer fractions by cargo handling equipment movements and picked up by the wind when speeds are above around 5m/s (Ministry for the Environment, 2016) resulting in fugitive PM discharges to air.

Log handling PM emission estimate

Excessive dust arising from scraped, swept exposed log handling areas during high winds was experienced first-hand at the Port such that it was not possible to be in the open air without wearing eye protection. This experience suggests PM emissions are likely to be significant.

A US EPA memorandum provides the following emission factors for particulate matter from log handling (US EPA, 2010):

- 0.00075 pounds per bone dry ton (lb/bdt) per "drop"[11] of 'wet' (i.e. 34% moisture) material from one surface to another
- 0.38 tons per acre per year wind erosion of pile

Converting into standard international units this suggests that each 'drop' gives 0.00031 kg/tonne of logs handled. Assuming 4 drops for logs at the Port, and 5.6 M tonnes of logs per year, this is around:

0.0031 kg/tonne/drop x 4 drops x 5.6E+6 tonnes/yr / 1,000 kg/tonne

= 6.9 tonnes/yr

[10] For year ended 30 June 2016. http://www.port-tauranga.co.nz/about-port-of-tauranga/commodities/

[11] Including, but not limited to:

(a) each mechanical conveyance drop between point of generation and storage bin (but not including bin unless open to atmosphere);

(b) loadout from storage bin into a truck bed or railcar; and

(c) drop onto a pile.

Apply emission factor to each 'drop'. No emission factor rating provided.

This further suggests that PM due to wind erosion over log piles is 0.14 tonnes/ha-yr in standard international units. For 29 hectares of log piles this is around 4.0 tonnes of PM per year.

Taken together, the default emission factors suggest an emission of around **11 tonnes of PM** from log handling per year. This does not include dust arising from open, exposed areas of ground and additional crushing by trucks and cargo handling equipment. This estimate is therefore, likely to underestimate actual dust emissions from log handling at the Port.

2.4 Vehicles and cargo handling equipment

Discharges to air of PM from vehicles and cargo handling equipment arise from diesel combustion, brake and tyre wear and re-entrained PM from vehicle and equipment movements. It should be noted that these discharges are separate (i.e. in addition) to PM discharges from materials handling (e.g. logs and/or bulk cargo).

The following discussion does not include trains, which a more detailed inventory should include. There are five trains a day bringing logs to the Port.

Tyres (PM)

The Port estimates that straddle carriers at the Sulphur Point wharves use around 27 m^3 of tyres per year. [12] The Port further estimates that tyre wear from these and trucks and other cargo handling equipment could easily add up to over 50 m^3 of particulate per year.[13] Assuming tyre density is 200 kg/m^3,[14] this suggests PM arising from tyres is around 10 tonnes per year.

In reality, not all this PM will be discharged to air as larger particles may be discharged to storm water. But it provides a 'worst-case', upper bound estimate.

Trucks – diesel combustion (PM_{10})

The Vehicle Emissions Prediction Model (VEPM, version 5.1) and the following general assumptions were used to estimate emissions of PM_{10} from truck (diesel combustion) at the Port:

- Fleet weighted emission factors for heavy commercial vehicles > 30 tonnes
- PM_{10} (exhaust) = 0.16 g/km
- 46,000 trucks per month = 552,000 trucks per year
- Assume each truck travels 2 km around the Port

Thus:

0.16 g/km x 552,000 trucks x 2 km ÷ 10^6 g/tonne

[12] 240 tyres x 4.7 m high x 0.4 m wide x 0.06 m thick = 27.5 m^3

[13] Personal comm. Rowan Johnstone, Port of Tauranga to Reece Irving, BOPRC 11 Apr 2017

[14] EPA Victoria, (2008). Waste Materials Densities Data.

= 0.2 tonnes/year

This indicates that PM_{10} from truck diesel combustion is around 0.2 tonnes per year.

Container cargo handling – diesel combustion (PM_{10})

The Ports of Auckland inventory estimates that PM_{10} from diesel use in cargo handling (i.e. diesel use in straddle carriers, reach stackers, forklifts and tractors) is low relative to other sources of PM at the Port. For example Peeters, 2010 estimates PM_{10} from cargo handling to be 0.5 tonnes per year when handling 867,368 Total Equivalent Units (TEUs).

The Port of Tauranga handled 954,006 TEUs in 2016. A pro-rata calculation indicates PM_{10} from diesel use in cargo handling may be around 0.5 tonnes per year.

Vehicles and cargo handling equipment PM emissions estimate

As an indicative estimate, it can be assumed that direct emissions of PM arising from vehicles and cargo handling equipment is as follows:

Straddle carriers tyre wear	10 tonnes per year
Trucks (exhaust)	0.2 tonnes per year
Cargo handling (exhaust)	0.5 tonnes per year
Total	11 tonnes per year

3. Mitigation measures implemented to date

The Port has progressively introduced a number dust mitigation and management measures to combat increasing emissions of dust associated with growth in the volumes of cargo being handled. These are described briefly below.

3.1 Sealing

The Port has successively sealed nearly all unsealed trafficked areas at both the Sulphur Point and Mount Maunganui wharves. Since 2010, the Port has sealed 39.7 hectares for a pavement cost of around $28M. This is a considerable sum and Port of Tauranga should be commended for undertaking this extensive dust mitigation measure.

The only *trafficked* area that remains unsealed is the NZL container storage depot located on Waimarie Street. This is an area of 1.4 hectares.

3.2 Cobbling

A small paved area (0.69 ha) of the Port near Berth 9 has been cobbled to date. Whilst initially expensive, over the longer term cobbles are cost-effective as they are significantly more durable than asphalt (which gets repeatedly torn by turning, heavily-laden loaders), requiring significantly less maintenance. From a dust generation perspective, cobbling offers no significant advantage to chip seal.

3.3 Wind break fences

The Port installed two large (8 metre high) wind breaks on the eastern side of the log yard (Photo 8) and the eastern boundary with Orica. The Tasman Quay wind break is 320 m long and the Orica wind break is 230 m long.

Photo 8 Wind break fence on eastern side of log handling area.
[Tasman Quay, Mt Maunganui Wharves 11:48 AM 18 Oct 2016]

3.4 Sweeping

Since 2015, the Port has contracted Daltons to scrape bark dust (Photo 9) and then vacuum/sweep with water spray (Photo 10) to minimise fugitive dust from the log handling areas, including the railway lines at the Mount Maunganui wharves. Sweepings are stored on a bunded stockpile (Photo 11).

The stevedoring companies also either own, or contract, a sweeper for use during bulk cargo handling (Photo 12, Photo 13 and Photo 14).

The Port also contracts a sweeper for Sulphur Point and the roads outside the Mount Maunganui wharves.

Photo 9 Daltons scraping bark debris (under contract to Port of Tauranga)
[Mt Maunganui Wharves 12:06 AM 20 Oct 2016]

Photo 10 Port (contracted) sweeper for Mount Maunganui Wharves
[Bark Shed, Mount Maunganui Wharves 1:20 PM 17 Oct 2016]

Photo 11 Bunded sweepings pile [Mt Maunganui Wharves 11:47 AM 18 Oct 2016]

Photo 12 Stevedoring sweeper in operation [Tasman Quay, Mt Maunganui Wharves 12:38 PM 20 Oct 2016]

Photo 13 Stevedoring sweeper in operation [Mt Maunganui Wharves 12:23 PM 20 Oct 2016]

Photo 14 Stevedoring water cart in operation [Mt Maunganui Wharves 12: 31 PM 17 Oct 2016]

3.5 Water carts

The Mount Maunganui wharves have a dedicated water cart (Photo 15).

Photo 15 Port of Tauranga water cart in operation [Mt Maunganui Wharves 11:38 AM 20 Oct 2016]

3.6 Vehicle cleaning

The Port recently commenced bark collection in the trailer hoist area where truck operators remove any remaining bark debris prior to leaving the Port (Photo 16). The Port also has a vehicle wash for small vehicles only (Photo 17).

Photo 16 Truck debarking area [Mt Maunganui Wharves 1:23 PM 17 Oct 2016]

Photo 17 Small vehicle wash [Mt Maunganui Wharves 5:38 PM 17 Oct 2016]

3.7 Sealing stockpiles and unpaved surfaces

The Port annually sprays a thin polymer on dredging sand stockpiles at Sulphur Point (Photo 18). A similar approach was taken for the unsealed areas at the CMA site on south Totara Street (Photo 19). This keeps the surface together unless the surface is broken (e.g. by walking over it).

Photo 18 Thin polymer applied to dredging sand stockpiles [Sulphur Point, 6:45 AM 21 Oct 2016]

Photo 19 Thin polymer applied to unsealed areas [CMA site, Totara Street, 10:42 AM 18 Oct 2016]

3.8 Bulk Cargo Handling Procedures

In 2013, the Port introduced a Standard Operating Procedure (SOP) for the handling of bulk cargo at the Port. This includes fine and dusty materials such as palm kernel. A copy is provided in Appendix B.

These procedures 'require' the following:

- Regular assessment of dust generation during unloading
- Trigger limits for review and/or stop work:
    - 'dust detected 100 metres from the operation'; or
    - contamination to other cargoes.
- Wind breaks (refer Photo 20) to be installed, if practicable, on seaward side of ship prior to unloading bulk cargo
- 'Save-alls' (refer Photo 21 (metal) and Photo 22 (tarpaulin)) to be in place prior to unloading bulk cargo
- Stop work if wind speed measured at the berth exceeds 15 knots for wind directions North through West to South. If wind direction is between North through East to South, Port Customer Service Centre is to be contacted for permission to continue unloading.
- No overfilling grabs, no leaking grabs
- Grabs to be opened gradually
- No filling hopper above level of the grid. Product must not extend above the grid level and hopper must not be peaked
- Where practicable, product to be kept in (hopper) bowl to reduce dust billowing when grab discharged
- Stevedores wishing to tip overloaded product onto wharf to seek approval of Port in writing and outline dust mitigation measures
- Levelling and tarping of loads to take place in stevedores work area adjacent to ship side.
- Trucks to be covered at all times, both full and empty, when travelling to and from the ship.
- Continuous suction or vacuum sweeping of truck tarping area, roadways and surrounding areas to be arranged by the stevedore.
- Water spray jets to be employed when sweeping.

Each individual stevedoring company has their own standard operating documentation.

Photo 20 Wind break (nets) on windward side of boat during unloading of palm kernel.
[Sen Treasure, Mt Maunganui Wharves, 11:48 AM 18 Oct 2016]

Photo 21 Save-all (metal) under path of crane grab during unloading of palm kernel.
[Sen Treasure, Mt Maunganui Wharves, 12:44 PM 17 Oct 2016]

Photo 22 Tarpaulin under path of crane grab during unloading of clinker.
[Mt Maunganui Wharves, 11:46 AM 20 Oct 2016]

4. Discussion

The Port has invested significant funds into infrastructure (e.g. sealing, cobbling, wind break fences) to mitigate dust. Similarly, the Port has worked with stakeholders to implement management practices (bark scraping, sweeping, bulk cargo SOP) to reduce emissions of fugitive dust.

However, in practice, it appears these measures are not adequate to manage dust emissions from the Port. During the audit, excessive emissions of dust from bulk cargo unloading, general log handling and open spaces (both sealed and unsealed) were witnessed at the Port. On windy days, a brown haze was clearly visible over large parts of the Mount Maunganui wharves. This haze extends over Totara Street where the public, and adjacent businesses, may be exposed.

Based on this audit it is considered that the activities on the Port of Tauranga do not comply with Rule 17 of the Regional Air Plan which requires that the discharge must not result in objectionable or offensive particulates beyond the boundary of the subject property.[15]

Dust mitigation measures appear to be insufficient and/or ineffective. For example;

- The two wind break fences shield only a tiny fraction of log storage areas.
- The single sweeper at Mount Maunganui is inadequate for the 114 hectares of open space it has to clean. Observing the sweeper during the audit, the brooms were not always turned on and the vacuum appeared to be either off or insufficient. The sweeper truck is not solely dedicated to the Port and is unavailable on occasions.
- Stevedore sweepers appeared unable to cope with the dust loadings, primarily due to them being undersized for the task at hand.
- The height of the bund surrounding the sweepings pile is below the height of the stockpile. During high winds, dust generation was evident.
- The (Port owned) water cart was deliberately set so that water gushed from the sprays in torrents 'to control the large bark fragments'. However, this was readily acknowledged as being a cause for mud and additional dust generation and therefore, not utilised frequently. Best practice dust management requires a fine spray of water to settle dust and minimise additional particulate generation.

Similarly, dust management measures appear to be failing in practice.

There is a fundamental disconnect between what management states is operational practice for management of dust, and what actually happens. On the first day of the audit, Port management and senior management from the three stevedoring companies all attended a meeting at which it was explained that a dust audit was about to commence. All present provided assurances that they abided

[15] It is noted that the boundary of the "subject property" is unclear because the individual dischargers do not necessarily have defined boundaries within the Port property.

by the Port standard operating procedures for bulk cargo handling which requires stop work in the event of high winds (> 15 knots or 7.7 m/s) and/or visible dust beyond 100 metres.

Despite this, thirty minutes later, bulk cargo was witnessed being unloaded in 22 knot winds, with obvious overfilling of hoppers and trucks.[16] Despite excessive dust billowing everywhere and remaining visible 100 m from the point of unloading, work did not cease until the Port management present called the (Port) Customer Service Centre who in turn requested the stevedore to cease works.

Follow-up interviews with senior management of the stevedoring company responsible revealed detailed work procedures that should ensure such an event could not take place.[17] Senior *management* stated such an event would be a 'level 2 or level 3' non-compliance under the company's internal procedures (this company being accredited to ISO 14,001). However, follow-up interviews with the same company's *operators* indicated that they had to wait to be told to stop works by the Port.

Port management repeatedly advised that there are no significant operational differences between the competing stevedores.

To some extent the problems with bulk cargo handling witnessed during the site audit reflect failures with the bulk cargo handling procedures (Appendix B). These procedures are unenforceable and do not represent best practice. For example:

- There are no penalties attached to the 'requirements' for stevedores.
- There is no information on *how* stevedores are to:
    - assess the level of dust being generated;
    - detect dust 100 metres from the operation; or
    - detect contamination to other cargoes.

  This means that stevedores have no clear way to demonstrate compliance.
- The stop work 'required' for winds in excess of 15 knots only applies to wind directions north through west and south. This potentially enables excessive dust emissions to continue unabated for winds directions north through east and south (i.e. *towards* the harbour) with subsequent deposition of PM into the water.

However, it is noteworthy that the issues with dust generation during bulk cargo handling are not associated with all products. For example, cement is pneumatically conveyed directly from the ship hold to dedicated storage silos. This contrasts with palm kernel, which is loaded using grabs from the ship hold into general use hoppers (with no bag filters).

[16] By Louise Wickham of Emission Impossible and representatives of BOPRC and Port management.

[17] e.g. Pre-shift briefing on wind speeds, warning to monitor hopper height by shift supervisor, ongoing supervision and stop-works issued in event of dust.

Agency

Interviewees stressed that to implement *effective* dust management at the Port, it would be critical to understand the contractual dynamics between different agents operating in and around the Port. The complexities of these arrangements are not readily apparent to the outside observer. An attempted summary follows:

1. The **ship owner** contracts a ship agent to 'husband' a ship.
2. The **ship agent** attends to crew needs, manages the vessel on the New Zealand coast, deals with customs and regulatory requirements and liaises with the Port regarding expected time of arrival and departure.
3. The **importer** purchases a cargo and arranges with the ship agent to bring this cargo to the Port. In doing so, the importer has to estimate how long they will need the vessel so they know how much it will cost.
4. The importer contracts the **stevedore** to unload this cargo and take it from the Port. The stevedores own the grabs that attach to the ships cranes to transfer bulk cargo from the ship hold to the hopper.
5. The importer then contracts a **transport company** to move the cargo from the port. In one instance, a stevedore owns trucks that are used to move the importers cargo from the port.
6. The **exporter** is the same as the importer but in reverse. Log exporters contract **marshallers** to assemble logs on the wharf prior to loading. Exporters also directly contract stevedores and marshalling companies to move product from truck to storage, then to the ship.
7. The **Port** charges the ship agent vessel marine and wharfage fees.
8. The **Port** owns the property on which all this activity takes place. They further own some of the equipment (hoppers) that they hire to stevedores and marshalling companies.

The upshot of all this complexity appears to be that there is no contractual relationship between the Port and the agents undertaking activities at the port, i.e. between the Port and:

- Importer
- Exporter
- Stevedoring companies[18]
- Marshallers

BOPRC has recently issued abatement notices for dust management to two stevedores at the Port. However, interviews further indicated that:

[18] It is noted that the Port leases hoppers and cranes to the stevedores

- Any delays in unloading (e.g. due to stop-work for high winds and excessive dust) increase costs for the importer.
- There are four stevedores at the Port (C3, ISL, ISO and NZSM) that compete with each other to win contracts from importers (and exporters). Contracts are fiercely competitive, with success often being decided by differences in cents/tonne. This means there is a financial disincentive for stevedores to stop work in the event of high winds and excessive dust.
- Abatement notices (from BOPRC) incur no financial penalty
- Infringement notices (from BOPRC) are "peanuts compared with the delay costs".

This indicates that abatement notices, on their own, are unlikely to be sufficient to resolve dust issues from bulk cargo handling.

Responsibility

The Port's view of themselves as a 'reluctant policeman' and 'landlord only' appears to be the prime reason for non-compliance with Rule 17 of the Regional Air Plan with respect to offensive and objectionable dust. This is because the Port's 'hands off' approach has resulted in discharges from Port activities remaining largely unregulated. For example:

- Neither the Port, nor any of the agents operating at the Port, currently holds any resource consents for activities resulting in discharges to air or storm water.[19]
- The Port Environmental Policy (refer Appendix C) is non-specific with no clearly defined responsibilities or actions. The requirement to 'comply with relevant environmental legislation' is not explained or described in any detail.
- The bulk cargo handling procedures does not reflect best practice and is unenforceable. Port management indicated that, theoretically, stevedores operating in violation of these procedures (as witnessed during the audit) could be refused access to the Port. This has not occurred to date and was considered by Port management to be unlikely in the future.

It is noted that this is not the case with other Ports in New Zealand and overseas. For example, Prime Port in Timaru has an air discharge consent with Environment Canterbury. A number of other Ports have Air Quality Management Plans (Timaru, Vancouver, Oakland) and some of these are cargo specific (e.g. Brisbane).

It is further noted that Mount Maunganui is home to a manufacturer of specialised bulk cargo hoppers with built-in extraction and bag filters (refer Photo 23).

[19] The exception to this is Genera, who have an air discharge permit for the use and discharge of methyl bromide to air. Methyl bromide is unrelated to the scope of this (dust) audit.

Photo 23 Dedicated hopper with inbuilt extraction and bag filter under construction at Mt Maunganui wharves [Mount Maunganui wharves 10:01 AM 18 Oct 2016]

Implications

Ambient monitoring of PM_{10} would be required to confirm whether or not ambient concentrations of PM_{10} in and around the Port exceed the national environmental standard for PM_{10}. However, exceedance of the standard is considered likely based on the evidence available to date, which includes:

- Investigative work undertaken by BOPRC and measurements of elevated levels of total suspended particulate (BOPRC 2012);
- Complaint history;
- Visible brown haze; and
- Excessive visible dust observed during the audit.

Regulation 15 of the NES for air quality imposes obligations on BOPRC to undertake PM_{10} monitoring if it is likely that the standard would be breached. However, this requirement may be met by other parties. For example, Auckland Council levies all industry holding air discharge permits to fund ambient air quality monitoring for PM_{10} in industrial areas. Existing monitoring at Totara Street at the Port, carried out by BOPRC, only measures TSP and is inadequate to demonstrate compliance with the NES for air quality.

Similarly, it is considered likely that a number of other contaminants (for example, wood dust, respirable particulate and inhalable particulate) may exceed occupational standards at workplaces in and around the Port.

Relevant exposure standards include:

- wood dust (soft); 2 mg/m^3 as an 8-hour average[20]
- respirable particulate (~PM_4); 3 mg/m^3 as an 8-hour average[21]
- inhalable particulate (~TSP); 10 mg/m^3 as an 8-hour average
- diesel particulate matter (~PM_1); 0.1 mg/m^3 as an 8-hour average

This has serious implications for workers of different companies working in close physical proximity to one another on Port land.

It is noted that unless the site has resource consent, the NES for air quality applies over the entire site (MfE, 2016).[22] Potential exceedances of both workplace and ambient criteria therefore cut across both BOPRC and Worksafe jurisdictions.

4.1 Recommendations for the Port

There are a number of recommendations for the Port to better manage dust emissions that fall into three main areas:

(i) Significantly improve dust mitigation;
(ii) Undertake TSP and PM_{10} monitoring in and around the Port; and
(iii) Significantly improve dust management.

These are discussed below.

(i) Significantly improve dust mitigation

Whilst the Port has implemented a large number of dust mitigation measures, it appears that these are inadequate. Some obvious areas for improved dust mitigation are:

- During dry, windy periods significantly increase the amount, and efficacy, of sweeping/vacuuming services for sealed areas at the Port.

  One sweeper is not sufficient for the Mount Maunganui wharves.

  NB: this is not referring to bark removal, but rather dust left behind after bark is removed. This should be extended to all sealed areas that may generate re-suspended particulate material (i.e. include container handling areas).

[20] NB: New Zealand workplace exposure standards currently differentiate between hard wood dust (1 mg/m^3) and soft wood dust (2 mg/m^3). This is at odds with expert conclusions on the likely carcinogenicity of soft woods being the same as hard woods (EU, 2005).

[21] PM_4 = particulate matter less than 4 µg in diameter. The ~ indicates this is an approximation (as the size fraction depends on a different sampling methodology).

[22] Section 4.1 (discussion of application of national environmental standards for air quality)

- During dry, windy periods use effective water sprays to control fine dust (as opposed to bark fragments) in log storage and handling areas. This may be through the use of industrial 'foggers' and/or sprinklers.

  One water cart is not sufficient for the Mount Maunganui wharves.

- Installing an automated truck wash at the Hewlett's Road Port entrance. This will dampen dust and bark fragments on the logs *prior* to unloading. Ideally, logging trucks should also use the truck wash before leaving the Port as well.

  NB: This recommendation is for a water spray to all surfaces (including the top) of the truck as opposed to a wheel wash only (refer Emission Impossible Ltd for examples at other sites).

- Undertake a systematic review of dust mitigation measures employed at bulk cargo handling at other similar ports in the world (to date the Port has only reviewed measures employed in New Zealand and Australia). For example, this should consider:

  - Dedicated hopper and bag filter (similar to existing arrangement for clinker unloading);
  - Pneumatic conveying systems;
  - Other bulk cargo handling options.

- Increase the height of the bund and/or cover the sweepings stockpile (refer Photo 11).

- Reducing vehicle speeds at the Port (emissions are directly correlated with vehicle speed).

To understand the scale of increased dust mitigation measures required, it may be helpful to compare the Port which is handling more than five million tonnes of logs per year, with a large quarry or mining operation handling a similar volume of material. (However, it should also be noted that the Port has significantly higher numbers of workers than mines or quarries).

(ii) Undertake TSP and PM_{10} monitoring in and around the Port

Given its size and scale of discharges to air, it is surprising that the Port is not already being required to monitor air quality in the vicinity of its operation.

Total Suspended Particulate (TSP) is a good indicator for dust nuisance and it is recommended that this be monitored by the Port. However, current best practice would be for the Port to also undertake PM_{10} monitoring. This should be suitably representative (the Port covers an extraordinarily large area) and sufficiently robust to support BOPRCs statutory obligations under the NES for air quality (MfE, 2016).

Port air quality monitoring should therefore incorporate:

- Additional TSP monitoring to alert Port management to possible dust nuisance events;

- Concurrent PM_{10} monitoring with (BOPRC) TSP monitoring at Totara Street for at least a year. This will provide useful information for comparison with historical data;

- Additional PM_{10} monitoring in accordance with Schedule 2 of the NES for Air Quality;
- Monitoring in the 'worst-case' locations[23] where people are likely to be exposed;* and

Adoption of the recommended trigger limits for PM_{10}, TSP and meteorology as shown in

- Table 2.

*To be clear, this is likely to equate to additional:

(i) TSP monitoring on the boundary of the Hewlett's Road log yard (to actively manage dust emissions and avoid dust nuisance on neighbouring businesses);

(ii) PM_{10} monitoring at the Port boundary close to either, or both, of the marinas (people may be living on boats and exposed over 24-hours); and

(iii) PM_{10} monitoring at the Port boundary close to the residential area at the north end of Totara Street (where people live).

Table 2 **Trigger levels for total suspended particulate (TSP)** [Source: MfE, 2016]

Trigger	Averaging Period	Limit
PM_{10}	1 hour	150 µg/m^3
TSP	5 min 1 hour Daily (24-hours rolling)	250 µg/m^3 200 µg/m^3 60 µg/m^3
Wind warning	1 minute	10 m/s (during two consecutive 10-minute periods)
Rain warning	12 hours	There has been no rain in the previous 12 hours
Visible dust	Instantaneous	Visible dust crossing the boundary

(iii) Significantly improve dust management

(a) Utilise existing real time video monitoring to actively manage dust emissions from bulk cargo unloading

The Port has excellent real-time, video coverage of the berths where bulk cargo is unloaded. The Port already makes this monitoring available to BOPRC staff for regulatory purposes and is to be commended for this.

It is recommended, however, that this monitoring be stepped up so that the Port takes immediate action in the event of excessive dust being produced by an activity on site. This may require additional personnel to ensure that existing Port activities are not compromised.

[23] i.e. the standard is breached by the greatest margin or the standard is breached the most frequently, whichever is the most likely (refer Regulation 15, NES for Air Quality).

(b) Provide meteorological monitoring to stevedoring companies

The Port undertakes wind speed and wind direction monitoring at two locations in the bulk cargo loading area (berths 8 and 10). This data is critical for stevedores to fulfil the current bulk handling procedures.

It is recommended that this data be made available, preferably in real-time, to the stevedores.

(c) Contractually require Port activities to manage PM emissions

The Port may consider legal advice on requiring activities on their land to control dust by writing conditions into lease contracts.

For example, there is already a requirement that stevedores leave a berth in the same state as it was upon arrival. The stevedores also lease hoppers from the Port. This hopper lease should be augmented with requirements that whilst in use, the activity being undertaken at the berth will **not** cause:

- Exceedance of any workplace exposure standards at the berth; or
- Offensive or objectionable dust adjacent to the berth (specifically, no breach of Rule 17 of the Regional Air Plan or site TSP trigger limits in Recommendation 3); and/or
- Adverse health effects adjacent to the berth (specifically, no exceedance of the PM_{10} national environmental standard or site PM_{10} trigger limits in Recommendation 3).

Similarly, the current contractual arrangement with Dalton's for bark removal could be augmented with performance requirements for managing dust.

Lease contracts should also include enforcement provisions on a sliding scale to encourage and ensure compliance. For example, breach of contract could first incur a written warning and then a financial penalty and then, ultimately, cessation of contract.

(d) Develop a Port dust reduction operational plan with key stakeholders

Whilst the bulk cargo unloading is significant on its own, the remainder of sources (log handling, open spaces, vehicles and cargo handling equipment) are cumulatively significant. These dust generative activities are disparate and spread over a large area (as was the case with the dust generative activities in Ngāpuna, Rotorua).

It is recommended that the Port, works collaboratively with BOPRC, stevedores, marshallers **and** importers and exporters to develop and implement a Dust Reduction Plan similar to the Ngāpuna Dust Operational Reduction Plan. This should include revision of the bulk cargo handling procedures.

(e) Develop a Port emissions inventory

The focus of this dust audit was identification and prioritisation of key dust sources at the Port. As such, it is not accurate and limited in its scope.

A detailed emissions inventory would:

- Provide a basis for assessment of potential effects;
- Provide the Port with more accurate information upon which to perform cost benefit analyses for assessing mitigation and management strategies; and
- Assist to put PM emissions into context within the region.

Accordingly, it is recommended that the Port prepare a detailed inventory of all discharges to air (i.e. not just PM). This should include:

- Criteria pollutants (i.e. oxides of nitrogen, carbon monoxide, sulphur dioxide, etc.);
- Hazardous air pollutants (i.e. polycyclic aromatic hydrocarbons, metals, methyl bromide, etc.); and
- Greenhouse gases (carbon dioxide, methyl bromide, etc.)

(f) Undertake a thorough effects assessment and apply for resource consent for discharges to air

The audit has found that activities on the Port site do not comply with the conditions of Rule 17 of the Regional Air Plan. As such, the Port is a discretionary activity and should apply for resource consent.

4.2 Recommendations for BOPRC

It is recommended that Bay of Plenty Regional Council consider:

(i) Requiring the Port to assess and obtain resource consent for all discharges to air (i.e. not just particulate matter);
(ii) According discretionary activity status in the Regional Air Plan review for Port activities with discharges to air; and
(iii) Providing WorkSafe New Zealand with a copy of this report.

These are discussed in more detail below.

(i) Consider requiring the Port to obtain an air discharge consent

The focus of this audit was to identify key sources of dust and recommend mitigation measures. However, it is apparent that the complex relationship between the Port of Tauranga and the activities that discharge contaminants to air, is a significant issue.

The audit found that current operational management practices do not reflect best practice, are unenforceable and are not being implemented. It is considered unlikely that the mitigation measures recommended for the Port will be effective unless somebody is clearly responsible for discharges to air.

The current Regional Plan requirement applying to the Port of Tauranga is Rule 17:

Rule 17 Permitted Activity – General Activities

All other discharges of contaminants into air which are not subject to an express rule in this regional air plan shall be a permitted activity subject to compliance with the following conditions. If the conditions cannot be complied with the activity shall be a discretionary activity.

(b) The discharge must not result in objectionable or offensive odour or particulates beyond the boundary of the subject property or into water;

(c) There must be no harmful concentrations of contaminants beyond the boundary of the subject property or into water;

The audit has found that activities on the Port site do not comply with the conditions of Rule 17. The Regional Plan requires that any activity that does not meet the permitted activity rules (i.e. no objectionable or offensive dust) is a discretionary activity. It is recommended that BOPRC consider requiring the Port to apply for resource consent for discharges to air. Importantly, this would require, for the first time, an assessment of effects of discharges to air to be undertaken by the Port as part of the consent application.

It is noted that there is an established precedent for this recommendation; the Port of Timaru holds multiple consents for discharges to air:

- CRC160502 for the 'transfer, storage and transport of bulk cargo'; [24]
- CRC145151 for 'water blasting and spray painting vessels'; [25] and
- CRC064240 for 'discharges of dust and particulate'.[26]

However, in view of the:

- likelihood that the national environmental standard for PM_{10} is breached in and around the Port of Tauranga;
- potential for breaches of multiple workplace exposure standards with workers from different companies working in close proximity to each other being potentially exposed;
- multiple contaminants discharged to air from different activities in close proximity to each other at the Port; and
- overlapping responsibilities of BOPRC and Worksafe for ambient and workplace exposure of people in and around the Port;

There is a compelling argument for this resource consent to address all discharges to air (i.e. not just particulate matter).

[24] Granted 24 August 2015, expiring 24 August 2050

[25] Granted 15 May 2014, expiring 15 May 2029

[26] Granted 10 September 2008, expiring 30 April 2028

(ii) Discretionary activity status for Port activities with discharges to air

The current, and proposed, regional air plans have clear objectives, policies and rules that provide for requiring consent (as the Port is breaching permitted activity conditions). However, given the plan is currently being reviewed, it may further be timely to consider according discretionary activity status to:

- Transfer, storage and transport of bulk cargo in excess of 30,000 tonnes per year;[27]
- Log storage/handling in excess of 50,000 tonnes per year;[28]
- Diesel combustion in excess of 60,000 litres per year[29]; and/or
- Port related activities that discharge contaminants to air.

To date, the Port has maintained that they do not actually carry out the activities generating PM and, as such, may not be held responsible for discharges to air from its property. The Port considers its function similar to that of a landlord. Alternatively, or as well, therefore, BOPRC could require the stevedores to obtain their own air discharge consents.

The Resource Management Act 1991 (RMA) allows for anyone to obtain a resource consent but, in practice, having several consents for different stevedores and other activities on site becomes impractical. Proving which party is non-compliant is extraordinarily difficult. It is also extremely difficult, if not impossible, to assess cumulative effects from individual activities operating on a single site,[30] and the time and cost to obtain consents for each activity separately may be prohibitive.

The Port is one of the main sources of discharges to air in Tauranga/Mount Maunganui. There is no apparent reason that the Port should not be treated the same as all other activities that discharge to air in the Bay of Plenty.

Requiring resource consent would also provide the Port with an incentive to change behaviours of other operators. There are significant enforcement options within the RMA for breach of consent. It is also a method to 'flag' to stevedores and others requirements that must be complied with. This audit raises uncertainty that, without such regulation, there is any incentive for onsite operators to improve dust control measures.

(iii) Provide WorkSafe New Zealand with a copy of this report

It is recommended that BOPRC provide WorkSafe New Zealand with a copy of this report noting concerns that some workplace exposure standards may be exceeded at the Port.

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[27] This is approximately the amount of cargo that one ship holds (e.g. palm kernel)

[28] Or approximate equivalent of one ship load

[29] Nominal threshold based on HSNO requirements for diesel stationary container systems

[30] The difficulty in managing cumulative effects from more than one operator on the Port of Tauranga site was highlighted in the recent Environment Court Decision [2017] EnvC 12 *Envirofume Ltd v Bay of Plenty Regional Council*

5. Conclusions

The key sources of dust and particulate matter at the Port are:

- Bulk cargo handling
- Open spaces (re-entrained dust from wind pick-up over exposed surfaces);
- Log handling (primarily ground up bark and soil-based particulate matter); and
- Vehicles (combustion, brake and tyre wear and re-entrained dust from vehicle movement).

Bulk cargo unloading is potentially the most significant source. The remainder of dust generating activities are disparate and spread over a large area but when taken together are significant – 36 *tonnes* per year – and in most cases are likely to be underestimated.

Whilst the Port has made significant investment in dust mitigation and management, this is currently not adequate to manage dust generation from operations on the site. During the audit, excessive emissions of dust from bulk cargo unloading, general log handling and open spaces (both sealed and unsealed) were witnessed at the Port.

It is noted that wood dust and particulate matter (PM) can cause significant amenity effects, and more importantly, significant health effects. It is recommended that the Port scale up their dust mitigation efforts accordingly. Specific recommendations are provided in this report, including installation of a logging truck wash as the Hewlett's Road entrance.

There further appears to be a fundamental disconnect between how senior management of the stevedoring companies *perceive* dust is managed at the Port of Tauranga, and how it is *actually* managed. Specific recommendations for the Port to improve dust monitoring and management are:

- Utilising existing real time monitoring to actively manage dust emissions from bulk cargo unloading;
- Contractually requiring Port activities to manage dust emissions;
- Developing a Port dust reduction operational plan with key stakeholders;
- Developing a Port emissions inventory;
- Undertaking TSP and PM_{10} monitoring in and around the Port; and
- Undertaking a thorough effects assessment of all discharges to air and applying for resource consent.

Ambient monitoring of PM_{10} would confirm whether or not ambient concentrations in and around the Port exceed the national environmental standard. However, an expert judgement based on the available evidence indicates that exceedance of the standard is likely. This suggests that air discharges from the Port are likely to cause adverse effects on the environment, imposes monitoring obligations on BOPRC and may constrain granting of resource consent in the area.

Similarly, it is considered likely that a number of other contaminants (for example, wood dust, respirable particulate and inhalable particulate) may exceed occupational standards at workplaces in and around the Port.

The overlapping ambient and workplace exposure to multiple contaminants demands an integrated response. It is therefore, recommended that BOPRC consider:

- Requiring the Port to obtain resource consent for all discharges to air (i.e. not just particulate matter);
- According discretionary activity status in the Regional Air Plan review for Port activities with discharges to air; and
- Providing WorkSafe New Zealand with a copy of this report.

References

Bay of Plenty Regional Council (2012a). *Mount Maunganui dust monitoring*. Prepared by Shane Iremonger, Environmental Scientist, Environment Bay of Plenty. Environmental Publication 2012/04. February.

BOPRC (2012b). *Ngāpuna Dust Reduction Operational Plan*. Prepared by Bay of Plenty Regional Council, January 2012. Available at: https://www.boprc.govt.nz/environment/air/rotorua-air-quality/ngapuna-dust-plan/

DEE (2012). *National Pollutant Inventory, Emission Estimation Technique Manual for Mining, Version 3.1*, Prepared by the Department of Environment and Energy, Commonwealth of Australia.

IARC, (2016). Monographs on the Evaluation of Carcinogenic Risks to Humans. Volume 109 (2016) Outdoor Air Pollution. International Agency for Research on Cancer.

EU, (2005). Recommendation from the Scientific Committee on Occupational Exposure Limits: Risk assessment for Wood Dust, SCOEL/SUM/102. December 2003.

Ministry for the Environment (2016). *Good Practice Guide for Assessing and Managing Dust*. Publication ME 1277. Wellington. November.

Ministry for the Environment (2016b). *Good Practice Guide for Assessing and Managing Discharges to Air from Industry*. Publication ME 1276. Wellington. November.

Peeters, S. (2010). *Port-Related Air Emissions for the Auckland Region 2006 & 2010*. Prepared by M&P Consulting for Auckland Regional Council. September

US EPA (2011). AP-42 Compilation of Air Pollutant Emission Factors. Volume 1. Fifth Edition. Stationary Point and Area Sources, Chapter 13: Miscellaneous Sources. United States Environmental Protection Agency.

US EPA, (2010). Memorandum from Office of Air, Waste and Toxics dated 8 May 2014 re Particulate Matter Potential to Emit Emission Factors for Activities at Sawmills, Excluding Boilers, Located in Pacific Northwest Indian Country.

US EPA (2003). AP-42 Compilation of Air Pollutant Emission Factors. Volume 1. Fifth Edition. Stationary Point and Area Sources, Chapter 9: Food and Agricultural Industries: Grain Processing.

World Health Organisation (2006). *Air Quality Guideline. Global Update 2005*. Prepared by the WHO Regional Office for Europe. Copenhagen.

Appendix A US EPA Emission Factor Ratings

A = Excellent

Emission factor is developed primarily from A and B rated source test data taken from many randomly chosen facilities in the industry population. The source category population is sufficiently specific to minimize variability.

B = Above average

Emission factor is developed primarily from A or B rated test data from a moderate number of facilities. Although no specific bias is evident, is not clear if the facilities tested represent a random sample of the industry. As with the A rating, the source category population is sufficiently specific to minimize variability.

C = Average

Emission factor is developed primarily from A, B, and C rated test data from a reasonable number of facilities. Although no specific bias is evident, it is not clear if the facilities tested represent a random sample of the industry. As with the A rating, the source category population is sufficiently specific to minimize variability.

D = Below average

Emission factor is developed primarily from A, B and C rated test data from a small number of facilities, and there may be reason to suspect that these facilities do not represent a random sample of the industry. There also may be evidence of variability within the source population.

E = Poor

Factor is developed from C and D rated test data from a very few number of facilities, and there may be reason to suspect that the facilities tested do not represent a random sample of the industry. There also may be evidence of variability within the source category population.

Appendix B Standard Operating Procedure: Bulk Cargo Handling

17 June 2013.

BULK CARGO HANDLING PROCEDURES

These procedures outline the requirements for handling of all bulk cargoes, including but not limited to Palm Kernel, Cotton Seed Meal, Boucra, Soy Flour, Wheat, Reactive Phosphate Rock, and Clinker.

These requirements are the responsibility of the stevedore and are to be met at all times.

If prevailing weather conditions prevent the continuation of cargo operations, Port of Tauranga reserves the right to shift the vessel to a non working berth, at the importers expense.

Operational Limits

During discharge of a bulk cargo, stevedores are to regularly assess the level of dust being generated. If dust is detected 100 metres from the operation and/or is causing contamination to other cargoes, the operation is to be reviewed and if necessary cease until conditions improve or measures are put in place to contain the dust to control its spread.

Stevedores are to rig a wind break on the seaward side of the ship before discharge commences. This may require log stanchions to be raised. If a vessel is not suitably equipped, other means of rigging the wind break must be explored and erected where practicable.

When the wind speed measured at the berth exceeds 15 knots, cargo operations are to cease. This applies to all wind directions from North through West to South.

If the wind direction is between North through East to South (i.e.: off the berth), then the Port Customer Service Centre is to be contacted for permission to continue.

Any stored cargo contaminated during discharge, may be required to be de contaminated at the expense of the importer/stevedore.

It is the responsibility of the stevedore to stop an operation when these limits are being exceeded. The Port of Tauranga reserves the right to stop any operation which is not complying with these guidelines.

Grabs

All grabs being used shall be suitable for the product being handled. They should not be overfilled or leak product through poorly fitting jaws. There is a preference for diesel power operated grabs.

Hoppers

Before opening a grab to discharge product into a hopper the crane driver must ensure the grab is as close as possible (within 1 metre) to the hopper grating. When opening the grab it should be done so as to allow product to be released gradually.

The hopper is to be kept as full as possible up to the level of the grid, product MUST not extend above grid level, and hopper MUST not be peaked.

This will avoid dust being generated when product is discharge out of the grab.

Where practicable, hoppers should be kept with product in the bowl to try to mitigate dust billowing when grab is discharged.

Care needs to be taken to avoid spillage over the sides of hoppers. It is not always possible to provide large hoppers in all cases and crane drivers will need to take extra care when working large grabs with the smaller hoppers.

It is a requirement to position a save all (tarpaulin or similar) between the ship and the wharf or have in place other suitable apparatus to prevent any accidental spillage of product entering the harbour.

Priority use of hoppers with wind protection installed will be given to cargoes with a high contamination risk.

Accurate Loading Of Trucks

It has become the practice with some cargoes to overload trucks and after weighing to tip product out into a stockpile on the wharf. This creates a dust nuisance. If particular trades do require to undertaking this procedure, approval is to be sought in writing from Port of Tauranga outlining measures, which will be taken to mitigate dust.

Tarping Of Trucks

One designated roadway is to be established for trucks to exit the berth.

The leveling of cargo, once trucks are loaded, is to take place within the stevedores work area, adjacent to the ships side, to ensure that any product spilt is able to be cleaned up. No trucks should pull their covers in the adjacent general cargo area.

Trucks must be covered at all times, both full and empty, when travelling to and from the ship.

Sweeping

Ready access to a suction or vacuum sweeper suitable for the material being controlled is to be arranged by the stevedore. The water spray jets must be used when sweeping.

During all bulk discharges continuous sweeping operations must be undertaken in order to control any spillage, including the truck tarping area, roadways being used for truck entry and exit and any surrounding area, if product contamination has occurred.

After discharge is complete the cleanup of areas must include all areas that may have been affected by the product.

Environmental issues will continue to become more important and it is increasingly necessary to maintain the highest standard, when handling environmentally sensitive cargo. Should we not be able to meet acceptable standards for the handling of dusty bulk cargoes using the traditional methods of discharge/load it may be necessary to place restrictions on these products.

Phil Julian
Manager Operations.

Appendix C Port of Tauranga Environmental Policy

ENVIRONMENTAL POLICY

Port of Tauranga Limited will:

- Seek continual improvement to environmental and social outcomes by ensuring that these are considered as part of the day-to-day management of all business units;
- Seek to minimise the use of resources by implementation of new technologies, processes and practices;
- Identify and take into account community aspirations and needs;
- Comply with all relevant environmental legislation;
- Establish procedures for setting, reviewing and achieving environmental objectives; and
- Communicate policy and procedures, as required and appropriate, to all stakeholders including employees, other port users, government, iwi and other community interest groups