# *Remediation of the Former Cresco Site, Bayswater*

# *Dust Management Plan*

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CSBP Limited
ABN: 81 008 668 371

Parsons Brinckerhoff Australia Pty Limited ACN 078 004 798 and
Parsons Brinckerhoff International (Australia) Pty Limited ACN 006 475 056
trading as Parsons Brinckerhoff ABN 84 797 323 433

*1 Alvan Street*
*Subiaco WA 6008*
*PO Box 1232*
*Subiaco WA 6904*
*Australia*
*Telephone +61 8 9489 9700*
*Facsimile +61 8 9380 4060*
*Email perth@pb.com.au*

*ABN 84 797 323 433*
*NCSI Certified Quality System ISO 9001*

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Author: Andrew Schultz, Environmental Engineer, Katrina Speers, Senior Environmental Scientist

Reviewer: Michael Lambert, Principal Environmental Scientist.....

Approved by: Michael Lambert, Principal Environmental Scientist.....

Signed: .....

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# 1. Introduction

## 1.1 Background

This Dust Management Plan has been prepared for the final remediation of the former Cresco fertiliser site located in Bayswater. The former Cresco site was used for manufacturing superphosphate, sulphuric acid, hydrochloric acid, and other small volume chemicals from 1928 to approximately 1990. The by-products and residues from these operations, in particular iron oxide/ pyrite cinders, and superphosphate den scrubber effluent (containing fluoride), were disposed of on site and have contaminated the soil and groundwater. CSBP now proposes to commence the final remediation of the site until it is suitable for its intended future industrial landuse.

The Environmental Protection Authority determined that this project was sufficient to warrant formal assessment under the provisions of the *Environmental Protection Act 1986* and as such a Public Environmental Review (PER) was submitted by CSBP to the Department in September 2004 (PB, 2004).

It should be understood that the site has been extensively investigated to determine the distribution and extent of soil impacts and that the proposed approach to remediation of the site has been documented in the public environmental review (PER) document. The remediation project and remedial approach has been formally approved by the Minister for Environment (Assessment 1477, Statement 691). This document should be read in conjunction with the approved PER, EPA bulletins and associated documentation to ensure a comprehensive understanding of the relevant environmental issues and the context of the works.

## 1.2 Purpose and Objective

The purpose and objective of dust management is to ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses, by meeting statutory requirements and acceptable standards.

CSBP will undertake all aspects of the remediation project in accordance with the legally binding Conditions set out in the Ministerial Statement of approval for the “Final Remediation Works for the Former Cresco Site, Bayswater” (Assessment No. 1477, Statement 691). This EMP addresses Ministerial Condition 6.1, which states:

6 Dust

6-1 The proponent shall not undertake remediation activities that have the potential to generate dust , other than in accordance with a Dust Management Plan prepared to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority and the Department of Health

The Dust Management Plan shall set out measures for all of the following :

- assess for the potential for health risk;
- controlling the generation of dust during excavation activities;
- establishing and implementing an ambient air quality monitoring program;
- a complaints process; and
- reporting monitoring results.

The proponent shall implement the Dust Management Plan required by condition 6-1.

The proponent shall make the Dust Management Plan required by condition 6-1 publicly available.

This plan is designed to facilitate compliance with Ministerial Conditions relevant to the project as well as describing a range of dust management procedures and detailing management controls relevant to commitments made within the PER pertinent to dust control. This document will be made available on CSBP's website (www.csbp.com.au).

Site remediation activities that have the potential to generate air emissions will be managed with the aim of avoiding degradation of local air quality, nuisance to surrounding receptors and the health and amenity of the general community. To achieve this aim it is proposed to ensure effective dust mitigation measures are identified and implemented at the source of any potentially dust generating activities.

The effectiveness of the dust mitigation measures will be monitored using an integrated approach which includes:

- visual monitoring at the source of any potential dust generating activities by site supervisors;
- real time monitoring at the source of any potential dust generating activities using hand held mobile equipment (DustTrak) by site supervisors;
- Automated continuous monitoring of dust concentrations at 2 selected locations on the boundary of the site using a combination of total suspended solids (TSP) monitoring (High Volume Air Sampler; HVAS) and monitoring $PM_{10}$ fractions (Tapered Element Oscillating Microbalance; TEOM); and
- Dust deposition gauges positioned at eight on and off-site locations.

A range of clear management intervention measures have been identified that will be implemented if trigger values are exceeded.

The results of the dust monitoring program can then be used to verify the effectiveness of the dust mitigation measures undertaken. Verification reports will be made available to stakeholders (including the public) on an ongoing basis via CSBP's community consultation program.

There are three phases in the remediation project, this dust management plan covers phase one only, which deals with the remediation of approximately 60,000 tonnes of class III and IV contaminated soils over a six month period.

## 1.3 Project Context

*Phase 1 Remediation Scope*

The 37 hectare former Cresco Site is located within the Bayswater industrial area and is bounded by infrastructure corridors and other industrial land use areas. The closest residential properties are located approximately 450 metres south west of the site boundary. The contaminated materials on the site which are the subject of remediation are located in the south-west and western one third portions of the site. It is important to recognise that while a range of dust mitigation measures will be implemented, and the effectiveness of these measures will be verified, the large distance to off-site receptors means that the risk of impacting upon receptors is considered to be low. It is also important to note that this document specifically addresses only off-site impacts that have the potential to occur. Any dust expected to occur within the site boundary is addressed in the project health and safety plan.

The active remediation phase of the project is expected to last approximately six months. The remedial activities include:

- stripping and stockpiling clean overburden;
- excavation of the contaminated soils selected for remediation;
- loading the soils into trucks for transport to landfill;
- validation sampling of the excavation pits; and
- backfilling the excavation pits with overburden and imported clean fill.

Approximately 60,000 tonnes of soil containing arsenic, copper and lead at concentrations above Health Investigation Levels for industrial landuse (HIL- F) will be removed from the site.

A portion of this material has been classified as Class IV waste and will be removed first (approximately 3 months). Class III waste will be excavated and removed immediately after (a further 3 months approximately). We anticipate approximately 20 semi-trailers movements per day during the active remediation phase and this is expected to last for a total of approximately 6 months. During this period, soil disturbing activities, vehicle movements and wind have the potential to generated dust. The dust particulate matter generated has the potential to contain soil contaminants of concern including arsenic, lead and copper.

The main characteristics of the site that are considered important in terms of potential to generate dust include:

- Any soil stockpiled on site is not expected to contain significant concentrations of contamination, will be validated using onsite X-Ray Fluorescence (XRF) and are not considered to represent a health concern beyond nuisance dust impacts and will be managed accordingly;
- All excavated soils containing contaminants exceeding HIL F soil criteria will be directly loaded into trucks and sent to landfill. There will be no stockpiling of these soils onsite. The estimated 60,000 tonnes of soil (classified as Class III and IV waste) being removed to landfill does however have the potential to impact health and must be managed accordingly; and
- Previous investigations at the site have identified iron cinders (formed as a result of roasting pyrite for sulphuric acid production) that contain some residual acidity. Approximately 130 cinders samples were tested in 2005 for pH and pH after oxidation. The mean pH of these samples was 5.0 suggesting that the majority of cinders do not contain actual acidity. Less than 10% of these samples exhibited a pH less than 4, and the samples exhibiting a pH less than 4 were consistently present at depths greater than 2.2 mBGL. The absence of acidity in the shallow soil profile was confirmed through SPOCAS testing of the acid generating capacity of the soil profile. Results of the laboratory testing confirmed the presence of very low acidity levels in the upper 2 m of the soil profiles, and higher acid concentrations with increasing depth.

    - As part of the remediation activities there are no cinders materials at depths greater than 2 mBGL that are proposed to be excavated.
    - The proposed remediation of soils on the site mainly focuses on soils containing elevated concentration of As, Cu, and Pb as discussed previously and generally is not contained within the potentially acid generating cinders
    - These site conditions indicate that the likelihood of generating acid dust is low

During the remediation of the site, earthworks will be carried out in the south west and western one third of the site and to a lesser extent in the north western portion of the site. Established buildings and trees on the site are present along the boundaries (Figure 4.1) and will remain during the active remediation phase and act as barriers to the movement of dust that may be generated.

The active remediation of the site is expected to commence in February 2006, for duration of approximately 6 month, based on a 5 day expected working week. Wind data shows that during these months the prevailing wind direction will be predominately south westerly and easterly. It is important to note that neither of these prevailing wind directions are towards residential areas.

It is also important to note that the Minister for Environment has licensed the remediation of the site for a period of 5 years. Following this period ongoing surface and groundwater monitoring is proposed in addition to continued operation of the groundwater recovery (remediation) scheme that is currently operating.

*Phase 2 and 3 Scope*

After the above mentioned 6 month period of active remediation, the next phase of the project will include the demolition of the remaining general and asbestos clad buildings and other infrastructure (phase 2) and cut and fill earthworks (phase 3) to obtain the final levels for the site in anticipation of subdivision and redevelopment. It is unknown at this stage the amount of cut and fill required as well as the timing of the demolition activities. However, it is anticipated that dust monitoring and management will occur during any further cut to fill earthworks and that monitoring for asbestos in air will be undertaken during the demolition works. It should be noted that appropriate dust management practices and procedures will be required as part of these works and commonly form part of any building demolition licences/permits and WAPC conditions for site subdivision and redevelopment.

# 2. Air Quality Objectives

## 2.1 Particulate Matter

Multiple dust trigger values will apply at the site boundary during remediation works to monitor the effectiveness of the dust mitigation strategy undertaken. Trigger values will apply to $PM_{10}$ concentration, total suspended particulate matter (TSP) and deposited matter in addition to trigger values for metal concentrations in TSP.

The strategy adopted to ensure dust generation is mitigated at the site is to adopt an approach where corrective action trigger levels are established that provide adequate early warning of a potentially "unacceptable dust event" occurring. Threshold values for unacceptable dust events have been established and are shown Table 2.1 by designating a target of "nil" exceedence which will result in stop work and corrective action.

### 2.1.1 $PM_{10}$ Threshold

The acceptable background $PM_{10}$ level at the site boundary will be the National Environmental Protection Measure (NEPM) for Ambient Air Quality (NEPC, 1998). The Air NEPM states that the 24 hour $PM_{10}$ (the fraction of total dust less than 10 microns in size) pollutant standard of 50 µg/m$^3$ can be exceeded on no more than five days in a single year. The NEPM value represents a 24 hour average where instantaneous levels can be considerably higher than the limit.

A 15 minute average corrective action limit has been calculated using formulae from the Handbook of atmospheric diffusion (Hanna, 1982):

$C_1 = C_{24\ hr}\ [24/t]^{0.25*}$ Used to convert from 24 hours to times of greater than 1 hour

$C_{0.25} = C_{60}\ [60/t]^{0.2}$ Used to convert from 1 hour to less than 1 hour

* exponential factor can be in the range 0.25 to 0.3.where 0.25 provides a more conservative estimate of dust concentration

It should be noted that the calculation method requires a 2 stage calculation using firstly an exponential factor range of 0.25 to 0.30 to convert from the 24 hour average to 1 hour averages and subsequently an exponential factor of 0.2 to convert from a one hour average to an averaging time of less than 1 hour. A corrective action limit of 146 µg/m$^3$ has been calculated using the formulae and work stoppage value of 400µg/m$^3$ has been arbitrarily applied An average of the $PM_{10}$ concentration at the site boundary will be recorded at the western site boundary at 15 minute intervals using a Tapered Element Oscillating Microbalance (TEOM) meter.

In addition, a mobile DustTrak instrument will be used to monitor instantaneous concentrations of $PM_{10}$ directly down wind of excavation areas during active remediation on the site. This will provide real time monitoring of the effectiveness of dust mitigation measures being undertaken. The purpose of this monitoring is to use the DustTrak instrument primarily as a screening instrument and management tool to enable immediate real time response to dust issues arising on site. To ensure dust data collected using the DustTrak monitor is comparable with the data collected by the TEOM, the dust track results will be correlated against those of the TEOM on a regular basis ie monthly

### 2.1.2 TSP Threshold

The Kwinana EPP 24 Hour Total Suspended Particulate (TSP) limit for nuisance impacts is (90 and 150µg/$m^3$) will apply at the site boundary for working target and work practice investigation respectively This value is below that set for the maximum allowable level of dust at the boundary of a development sites (1000ug/$m^3$ proposed by DEP 1996) and is consistant with DoE policy. The values has also been confirmed as acceptable by calculating predicted metal concentrations in TSP, fall within the established trigger values for metals (including arsenic, copper and lead) discussed in section 2.1.4 will not be exceeded.

TSP threshold concentrations at the Eastern and Western site boundaries will be measured daily using two High Volume Air Samplers (HVAS)

### 2.1.3 Dust Deposition Thresholds

A monthly limit of either a maximum of 4 g/$m^2$ or a maximum increase of 2g/$m^2$ will apply for deposited matter collected in dust deposition gauges (Dec NSW EPA, 2005), which will be used to provide data on the effectiveness of the dust mitigation measures. The concentration of deposited matter will be measured monthly using eight dust deposition gauges located both on and off-site.

Trigger levels derived for the site for monitoring the effectiveness of the proposed dust mitigation strategy are summarised in Table 2.1.

**Table 2.1: Trigger Values as applicable to ambient dust management**

| Pollutant | Measured By | Averaging period | Maximum concentration | Maximum allowable exceedance | Reference |
|---|---|---|---|---|---|
| Particles as $PM_{10}$ | TEOM | 24 hours | 50 µg/m$^3$ | 5 days in a year | National Environment Protection and Heritage Council (2003) |
| Particles as $PM_{10}$ corrective action threshold | TEOM | 15 minute | 146 µg/m$^3$ | To be minimised | Derivation National Environment Protection and Heritage Council (2003) |
| Particles as $PM_{10}$ work stoppage and corrective action threshold | TEOM | 15 minute | 400 µg/m$^3$ | Nil # | Arbitrary threshold |
| $PM_{10}$ corrective action threshold | Dustrak | Instantaneous | 250ug/m$^3$ | To be minimised | Arbitrary threshold to be review on site after correlation with the TEOM |
| TSP work target | High Volume Sampler | 24 Hour Average | 90 µg/m$^3$ | To be minimised | DEP 1996, |
| TSP work practice investigation target | High Volume Sampler | 24 Hour Average | 150 µg/m$^3$ | Nil # | DEP 1996, |
| Deposited Matter | Dust Deposition Gauge | 1 month | 4 g/m$^2$/month or max' increase of 2 g/m$^2$/month | Nil | NSW EPA (2001) |

# exceedence result in immediate work stoppages and corrective action

### 2.1.4 Heavy Metals

Within the proposed remediation areas on the site, arsenic, lead and copper concentrations in soil are present above Health Investigation Levels (HIL) for proposed industrial landuse (level-F). Therefore, dust containing elevated concentrations of these metals has the potential to become airborne and migrate off-site. The tier one risk assessment shows the likelihood of dust containing elevated concentrations of metals reaching sensitive receptors to be low.

It is acknowledged that where the screening level risk assessment identifies that there is the potential for toxic impacts (moderate or high risk) to result from exposure of receptors to dust being generated from this site, it is appropriate to establish trigger values that are protective of human health.

The qualitative screening level risk assessment undertaken shows the likelihood of a significant exposure occurring is extremely low, resulting in a corresponding low risk of an adverse impact occurring to sensitive receptors off-site. The low risk of adverse impacts is supported by a number of factors including: the position of the site in relation to sensitive receptors; the distance of receptors from the site; the proposed dust mitigation strategy and the proposed monitoring to demonstrate the effectiveness of the dust mitigation strategy.

On this basis, it is considered to be acceptable to utilise extremely conservative generic trigger values in lieu of undertaking a detailed tier 3 health risk assessment to determine acceptable trigger values. The trigger values are designed to initiate a management response and while being overly conservative, are not designed to provide acceptable exposure thresholds for human health.

Relevant criterion for each identified substance has been adopted from the National Occupational Health and Safety Council (NOHSC) document *Exposure Standards for Atmospheric Contaminants in the Occupational Environment* (1995).

Although threshold limit values (TLVs) provide an indication on the potential health risks associated with the exposure to potentially toxic compounds, they cannot be used to assess ambient air quality levels as the following assumptions have been made in the development of TLVs:

- the person that is exposed to the potentially hazardous substance is relatively healthy;
- the threshold limit value-time-weighted average (TLV-TWA) refers to the time weighted average concentration for a conventional 8-hour workday and a 40-hour work week, to which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse effects. They do not account for extended periods of exposure, such as 24 hours or longer; and
- the criteria assumes that after exposure, the same person ceases to be exposed to the hazardous substance. That is, after 8 hours of exposure, the same person is exposed to a ‘clean’ or non-hazardous environment.

The above assumptions cannot be applied to ambient exposure levels and adopted in this instance, as the variability and range of people that may be affected is much wider. Furthermore, ambient air concentrations, although lower than the corresponding occupational concentrations, occur over a longer exposure period and make the determination of what constitutes a ‘safe’ long-term exposure level difficult to assess.

The Victorian EPA (VIC EPA) has been using ground level concentration criteria based on TLV-TWA criteria as indicators of ambient air quality. The criteria are based on the safety factor '30-rule'. Firstly, the respective TLV is divided by 3 to account for the increased exposure time from 8 to 24 hours and secondly, the result is divided by 10 to provide an additional, highly conservative safety factor in the absence of long-term human health risk information data. This method of assessment has also been used in NSW on specific occasions.

Ambient air quality criteria for the nominated individual pollutants (chemicals of concern identified in the PER) have been adopted by application of the TLV-TWA rule and 24 hour average exposure concentrations for arsenic, lead and copper are shown in Table 2.2.

Airborne dust samples will be collected at the site boundary using HVAS filter papers over a 24 hour period. For the first month of remediation, filter papers with the two highest TSP concentrations will be selected from the week's samples and analysed for arsenic, lead and copper concentrations and compared to the identified trigger values.

It has been calculated based on the maximum allowable average 24 hour TSP concentration (discussed in the previous section) and the estimated concentration of metals in soil to be remediated (calculated using the mean concentrations plus 1 standard deviation), the proposed trigger values for metals are unlikely to be exceeded.

In the event that the conservative trigger values for selected metals are exceeded, the need to develop SSTL using a detailed health risk assessment will be considered.

**Table 2.2: Proposed Trigger Values for heavy metals in TSP measured at site boundary**

| Pollutant | Averaging period | Maximum concentration | Reference |
|---|---|---|---|
| Arsenic | 24 hour | 1.6 µg/m$^3$ | Modified TWA (NOHSC) |
| Copper | 24 hour | 33 µg/m$^3$ | Modified TWA (NOHSC) |
| Lead | 24 hour | 5 µg/m$^3$ | Modified TWA (NOHSC) |

### 2.1.5 Data Quality Objectives

The dust monitoring and analysis procedures specified in this plan have been designed to provide reliable data of a standard suitable to enable interpretation of the performance of proposed dust management procedures in relation to prevention of nuisance dust while ensuring that no adverse health impacts occur upon surrounding site occupiers.

The following list and standards are considered necessary to meet these requirements and have been used as guidance in preparation of this document:

AS3580.9.3-2003: Methods for sampling and analysis of ambient air — Determination of suspended particulate matter — total suspended particulate matter (TSP) — high volume sampler gravimetric method;

AS2922-1987: Ambient Air — Guide for the Siting of Sampling Units;

AS 3580.9.8-2001: Particulate Matter – $PM_{10}$ – TEOM;

AS 3580.10.1-2003: Particulates – Deposited Matter – Gravimetric Method; and

AS 2800 – 1985: Lead – Particulate Collection by High Volume Sampler.

In addition to the above, the following Quality assurance and control standards and procedures will be used:

All analytical methods will be undertaken by a laboratory that holds NATA accreditation for the required analysis;

Duplicate analysis will be completed for metals will be completed at a ratio of 1 in 10 samples to allow calculation of relative percentage differences (RPD); and

RPDs will be considered acceptable where samples concentration at greater than 10 times the detection limit are within 15% RPD and for samples below 10 times the detection limit are within 40% RPD.

# 3. Sources of Dust

## 3.1 Fugitive Dust Generation

Inherent with any bulk earthmoving operations is the potential for fugitive dust releases. In specific reference to the former Cresco site is the requirement of soil excavation and off-site material transport. The handling, stockpiling and sorting of significant volumes of contaminated soils is required to be managed to ensure the potential to generate dust is minimised.

Fugitive dust generation is generally caused by two basic physical phenomena (Chapter 13.2 of the US EPA document AP42 – Compilation of Air Emission Factors (AP42):

pulverisation and abrasion of surface materials by application of mechanical force through implements, such as wheels, blades (soil disturbance); and

entrainment of particles by the action of turbulent air currents from an exposed surface (wind erosion).

The impact of a fugitive source on air pollution primarily depends on the quantity and drift potential of the particles injected into the atmosphere. In addition to large dust particles that settle out near the source (often creating a local nuisance problem), considerable amounts of fine particles are also emitted and dispersed over far greater distances from the source. $PM_{10}$ represents a relatively fine particle size range and is not overly susceptible to gravitational settling.

The potential drift distance of disturbed soil particles is governed by the initial injection height of the particle, the terminal settling velocity of the particle, the reflection co-efficient of the particle, the specific gravity of the particle and the degree of atmospheric turbulence.

Wind erosion of exposed areas are typically characterised by non-homogeneous surfaces impregnated with non-erodible elements (particles larger than approximately 1 centimetre [cm] in diameter). For wind erosion to occur, mean atmospheric wind speed alone is sufficient to sustain wind erosion from most flat surfaces. Emissions generated by wind erosion are also dependent on the frequency of disturbance of the erodible surface. This is because each time a surface is disturbed, its erosion potential is restored. A disturbance is defined as an action that results in the exposure of fresh surface material.

## 3.2 Bayswater Potential Dust Sources

During the remediation of the Bayswater site, the following actions have the potential to generate fugitive dust either via physical disturbance of the soil and/or creating exposed surfaces susceptible to wind erosion:

Excavation of clean overburden and contaminated soil using an excavator;

Stockpiling of excavated soil;

Transportation of soil around the site;

Loading of trucks with excavated soil;

Transport of soil in trucks; and

Movement of vehicles on internal dirt roads.

Options to manage the dust generation potential of the above identified activities are outlined in Section 5.

# 4. Potential Dust Impacts

During the dryer summer months and without appropriate dust suppression, remediation activities have the potential to generate dust. The generation of airborne dust from the remediation activities will depend on:

- the frequency at which a dust generating activity takes place;
- meteorological conditions such as wind speed; and
- condition of the source.

## 4.1 Wind Conditions

Bureau of Meteorology data for the Perth Regional Office was used to evaluate the wind directions impacting the site (refer to Appendix A for wind rose data). The prevailing morning winds at the former Cresco site come from the east and the prevailing afternoon winds are from the south west, except during winter when the prevailing wind direction is perturbed slightly such that the morning winds are north-easterly and the afternoon winds are westerly. Winds speeds are, on average, faster during the summer months.

## 4.2 Receptors

The site is located in an industrial area with boundaries on the Tonkin Highway and Midland rail line. Beyond the Tonkin Highway, to the west and adjacent to the north eastern boundary lie industrial estates with mixed industrial and commercial land use.

The closest residential properties are located approximately 450 m to the southwest of the site. Refer to Figure 4.1. It should be noted that during the summer months the prevailing wind direction will be blowing away from residential areas.

## 4.3 Potential Health Impacts

Studies of air pollution on health have linked particulate matter (alone or in combination with other air pollutants) with a number of significant health effects. These include increased mortality and aggravation of existing respiratory and cardiovascular disease, as evidenced by increased hospitalisation, school absences and lost work days (MPCA, 2005).

The health effects of atmospheric particulate matter are related to its ability to penetrate the respiratory system. In general, respiratory defence mechanisms are able to remove 99 percent of particles larger than 10 µm (>$PM_{10}$) from the inhaled air stream. Smaller particles (> 2.5 µm), called "inhalable," can cling to protective mucous and removed in the upper respiratory system. Fine particles (< 2.5 µm), also called "respirable," can enter the lungs and end up in lung capillaries and air sacs (alveoli), (MPCA, 2005).

In the lungs, particulates slow the exchange of oxygen and carbon dioxide in the blood, causing shortness of breath. The heart may be strained because it must work harder to compensate for oxygen loss. Laboratory studies show that high concentrations of components of particulate matter cause persistent cough, phlegm, wheezing and physical discomfort, (MPCA, 2005).

When heavy metal impacts are present in dust it is appropriate to initially consider total exposure to heavy metal dose through concentrations identified in TSP. This provides a highly conservative approach where the impact of the exposure can be more thoroughly investigated through a more detailed health risk assessment.

## 4.4 Qualitative Health Risk Assessment

For a potential health risk from airborne dust to be present at the site, a source, a receptor and a transport mechanism between the source and the receptor are required to be present. If a source, a receptor and a transport mechanism are all present, then a potentially complete exposure pathway exists. The objective of the qualitative risk assessment is to identify any actual or potentially complete exposure pathways and comment on the risk of adverse impacts occurring using the consequence and likelihood of exposure.

The potential sources of dust at the site are the contaminated soil.

Identified potential sensitive receptors include:

- Workers and visitors to the industrial area located immediately north east of the site, downwind of the prominent afternoon wind direction during summer;
- Workers and visitors to the industrial area located beyond Tonkin Highway west of the site, downwind of the prominent morning wind direction during summer; and
- Residents located 450 south west of the site, downwind of the prominent morning wind direction during winter.

The transport mechanism is the wind, having the potential to transport the dust to the sensitive receptors.

Identified potentially complete exposure pathways include:

- Potential inhalation of dust in the event that dust is transported to identified sensitive receptors which could potentially result in mucus membrane irritation or other impacts resulting from the potential dose ; and
- Ingestion in the event that dust is transported to rainwater tanks used for drinking water purposes.
- Dermal contact resulting in potential absorption through skin.
- Ingestion by hand to mouth activity in the event that dust settling occurs.
- Uncontrolled exposure of workers on-site operating under an appoved health and safety plan

Tables 4.1, 4.2 and 4.3 detail the consequence, likelihood and risk ranking definitions, respectively for the risk assessment matrix for the dust exposure pathways outlined above.

Table 4.4 shows the results of the qualitative risk assessment of the exposure pathways identified indicating the determined risk levels.

**Table 4.1: Adopted Consequence Levels**

| Level | Descriptor | Consequences |
|---|---|---|
| 1 | Insignificant | No health impacts, no need to contact authorities, no possibility of prosecution, no community complaints. Management of consequences within existing internal procedures. |
| 2 | Minor | Proactive liaison with authorities, no prosecution, community concerns dealt with internally, potential for damage to human health able to be averted. |
| 3 | Moderate | Site inspection by authorities, community complaint, local media attention likely, short-term (acute) effects on human health, future use of site as an industrial site unaffected. |
| 4 | Major | Potential prosecution, significant media attention, serious (chronic) impacts on human health, continued use of site in doubt. |
| 5 | Catastrophic | Loss of life, site closure. |

**Table 4.2: Adopted Likelihood Levels**

| Level | Descriptor | Description of Likelihood |
|---|---|---|
| A | Almost Certain | The event is expected to occur in most circumstances |
| B | Likely | The event will probably occur in most circumstances |
| C | Moderate | The event should occur at some time |
| D | Unlikely | The event could occur at some time |
| E | Rare | The event may only occur in exceptional circumstances |

**Table 4.3: Adopted Risk Level**

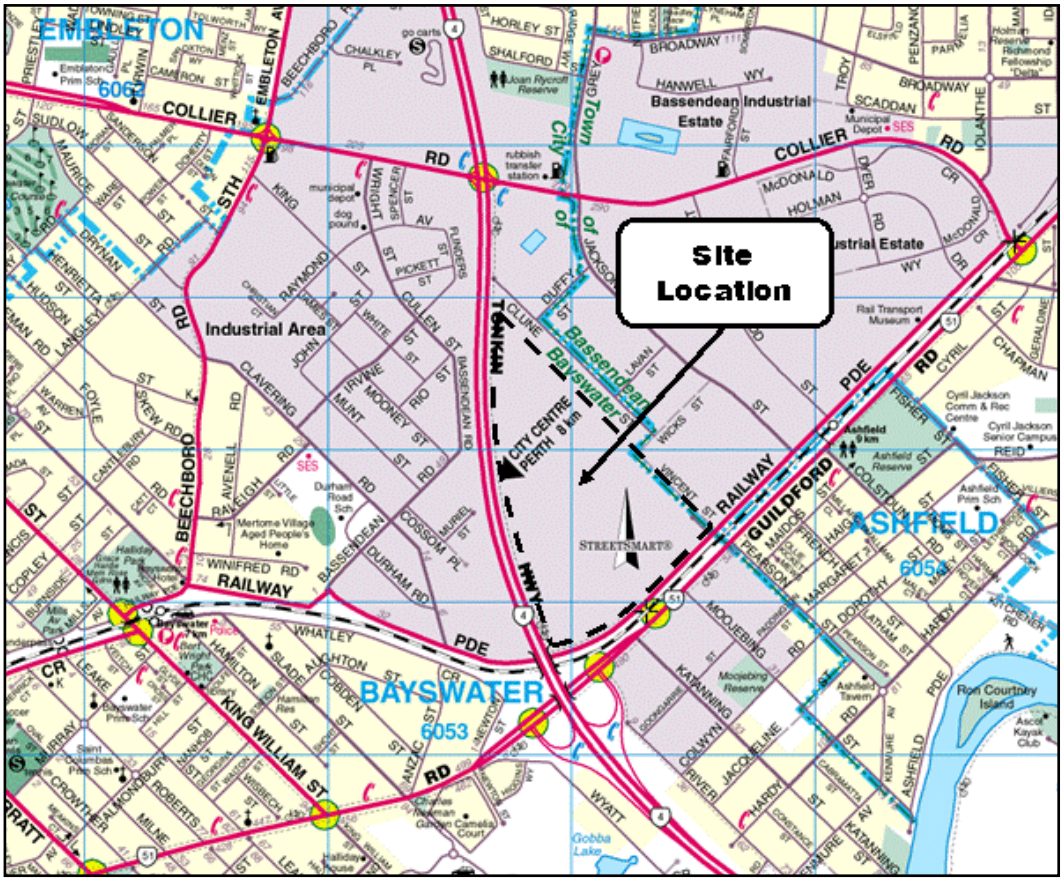
| | Consequences | | | | |
|---|---|---|---|---|---|
| **Likelihood Level** | **1 Insignificant** | **2 Minor** | **3 Moderate** | **4 Major** | **5 Consequence** |
| A (Almost Certain) | S | S | H | H | H |
| B (Likely) | M | S | S | H | H |
| C (Moderate) | L | M | S | H | H |
| D (Unlikely) | L | L | M | S | H |
| E (Rare) | L | L | M | S | S |

Note: H = High, S = Significant, M = Moderate, L = Low Risk

**Table 4.4: Qualitative Risk Assessment**

| Source | Exposure | | Description of Consequences | Consequence | Likelihood | Risk Level |
|---|---|---|---|---|---|---|
| | Pathway | Receptor | | | | |
| Dust Generation | Inhalation, dermal contact or ingestion | Residents & Commercial Workers | The likelihood of dust reaching receptors is low due to implementation of proposed management controls. Exposure duration is also low due to length of remediation program and management controls on-site with an alarm triggering after 15 minutes if adopted trigger levels have been exceeded. This leads to corrective actions and/or work stoppage. In addition the distance to potential receptors is greater than 300 metres from the source.<br>Overall management controls lead to relatively short possible exposure periods and expected low frequency of events. | Minor | Unlikely | Low |
| | Ingestion | Residents | The likelihood of dust reaching receptors is low due to implementation of management controls Exposure duration is also low due to length of remediation program and management controls on-site with an alarm triggering after 15 minutes if adopted trigger levels have been exceeded. This leads to corrective actions and/or work stoppage. In addition the distance to potential receptors is greater than 300 metres from the source.<br>Overall management controls lead to relatively short possible exposure periods and expected low frequency of events. | Minor | Unlikely | Low |

Revision of the health risk assessment using the above framework will be undertaken on the basis of metals concentrations obtained from HVAS during initial phases of monitoring.




Note: Figure not to scale

Source: StreetSmart Perth 2003 Street Directory, Map 344.

**Figure 4.1: Site Location in Context of Industrial and Residential Areas**

# 5. Proposed Dust Mitigation

Specific dust mitigation measures will be undertaken on an ongoing basis. The proposed dust management procedure and checklist is provided in appendix D. Dust mitigation will include a range of routine dust mitigation measures including:

- Monitoring of weather conditions on an ongoing basis to determine dust generating potential;

Retaining as much vegetation as possible during remediation activities;

- Impose site speed limits on all vehicles to 10kph
- Water application on stockpile, work areas and traffic areas on a minimum of a daily basis. Where the dust generating potential is considered high, Water truck will be on stand by and water as required; and

Stabilisation of over-burden stockpiles using a combination of water applications, dust fencing as required or hydro mulching where these methods are not achieving the desired outcome.

The effectiveness of dust mitigation will be monitored on an ongoing basis using a combination of visual assessment, mobile and fixed monitoring equipment. Where unacceptable dust events occur as indicated by exceeding trigger values, additional mitigation will be undertaken. Mitigation measures include additional watering as discussed above on an as required basis and the effectiveness reviewed on an ongoing basis to ensure that dust generation is minimised and controlled. Secondary management measures available to mitigate dust generation include:

Further water application to stock piles, internal access roadways and work areas. Application rates will be related to atmospheric conditions and the intensity of work activities;

provide wind fencing where no vegetation or building provides a barrier to downwind receptors;

backfill and stabilise disturbed areas as soon as possible to prevent or minimise source areas for dust generation using hydro mulch;

place stockpiles away from adjacent receptors (as far as practicable) and shielded from prevailing winds;

use of wheel wash facilities (or similar facility) near site exit to remove mud and dust from vehicles; and

reducing drop heights during loading and dumping;

The effectiveness of these reactive measures will be assessed and if unsuccessful the following measures will be implemented;

avoid or minimisation of dust generating activities (particularly contaminated soil excavation) during dry and windy conditions;

restrict vehicle and machinery movements during the remediation activities to designated areas;

Ground surface stabilisation techniques including hydro mulching.

Stop works

Any dust exceedence observation and mitigation measures will be documented on the dust procedures and checklist form (appendix D).

Where monitoring indicates the potential for dust generating conditions (dry and windy conditions) site personnel will be notified and site works modified accordingly.

Where excessive or visual dust is identified at the excavation, practices will be modified or management controls may be implemented to reduce dust generation to the lowest practical levels.

Weather forecasts will also be used to assess the potential for dust generation. A weather station will be installed at the site to monitoring ambient weather conditions and will be used to monitor the potential for dust generation and verify the sources of dust measured at the site.

# 6. Dust Monitoring Program

A preventative approach will be adopted to dust management that incorporates dust mitigation at the source, as described in section 5. Monitoring at the source will include ongoing visual assessment in addition to the use of a mobile dust track instrument to provide real time data to the site supervisor within the site boundary. A program of ongoing monitoring at the site boundary will also be undertaken to monitor the effectiveness of the mitigation measures. Details of the proposed monitoring program are provided in Appendix C.

## 6.1 DustTrac

The DustTrak instrument will be used as a screening and management tool on an ongoing basis. The DustTrak will be located in the prominent down-wind direction from the excavation on a daily basis and reviewed and relocated during the work day on the basis of changes in wind direction. The DustTrak logs $PM_{10}$ concentrations on an instantaneous basis and will have an alarm value set at 250ug/$m^3$. If the $PM_{10}$ air quality criterion exceeds the proposed instantaneous threshold, The DustTrak will forward a text alarm to the Site Supervisor. This will trigger a management response that will include a site inspection and implementation of one or a combination of the dust management options proposed.

The instrument will be correlated to the TEOM on a regular basis to ensure representative values are obtained. Alarm incidents response actions and relocation of the DustTrak will be logged on the audit sheet shown in Appendix D

Appendix B illustrates the position of the DusTrac $PM_{10}$ monitor during non working hour to collect addition dust data. As previously detailed during working hours the DustTrak monitoring will be moved to the site boundary in line with the prevailing wind direction and the location of the active excavation site.

## 6.2 High Volume Air Samplers

At the site boundary in the 2 dominant wind directions, High Volume Air Samplers (HVAS) fitted with a Total Suspended Particulate (TSP) head will be used to collect dust samples. Air drawn into the HVAS deposits entrained TSP (Total dust) on a pre-weighed filter paper, which is changed every 24 hours. Filter papers are analysed for TSP and held for potential metal analysis.

## 6.3 TEOM

At the western site boundary in the dominant morning wind direction a Tapered Element Oscillating Microbalance (TEOM) will be installed to monitor >$PM_{10}$ (which is the fraction of total dust less than 10 microns in size). The TEOM will continuously monitor the concentration of particulates less than 10 microns and calculates the average

concentrations over 15 minute intervals. The unit will be connected via telemetry to notify the site supervisor of dust levels exceeding the set alarm point.

The western site was chosen due to its close proximity to the remediation activities and to the residential properties and is not buffered by the main site storage shed, as would be the case on the eastern side of the Bayswater site.

If the $PM_{10}$ air quality criterion exceeds the proposed 15 minute average of 146ug/$m^3$ the TEOM will forward a text alarm to the Site Supervisor. This will trigger a management response that will include a site inspection and implementation of one or a combination of the dust management options proposed.

If the $PM_{10}$ air quality criterion exceeds 400 ug/$m^3$, then works will be suspended and dust mitigation actions implemented until dust concentrations fall below the 146ug/$m^3$ air quality criteria.

## 6.4 Deposition Gauges

Sub-regionally using 8 dust deposition gauges to monitor dust deposition rates. Dust deposition gauges are monitored on a monthly basis.

# 7. Reporting

## 7.1 Incident Reporting

An incident report will be lodged in the event that an exceedence of the following thresholds occurs:

- $PM_{10}$ 400ug/$m^3$ 15 minute average measured but e TEOM;
- TSP 150ug/$m^3$ 24 hour average measured using the HVAS; and
- 24 hour average metal concentrations in TSP

Control measures and management practices will be implemented or earthworks practices revised immediately to minimise the likelihood of reoccurrence. All corrective actions undertaken will be documented.

Results of any exceedances will be developed into a report and submitted to the site auditor and the DoE within 48 hours of the exceedence, including the information below as a minimum:

- air quality monitoring locations and results;
- work practices and meteorological conditions during the measurement period(s);
- identify additional responses implemented to achieve compliance; and
- describe the effectiveness of responses.

## 7.2 Routine monthly reporting

All dust monitoring results will be routinely reported and made available to the public and stakeholders through the CSBP website following review and endorsement by the site auditor. It is proposed that available data from the dust monitoring program will be reviewed by the site auditor and loaded onto the CSBP website on a monthly basis.

## 7.3 Final Reporting

All monitoring results will be maintained on the CSBP website. A compliance report will be submitted to the DoE after active remediation has been completed. The report will include:

the extent to which the applicable standards were met;

circumstances which caused any exceedances and corrective actions undertaken;

description of any monitoring failures; and

data for the reporting period.

# 8. Community Consultation

The community view on dust levels may be strongly influenced by perception. Existing community liaison procedures will be maintained with the local community being informed of times and durations of remediation activities and dust monitoring results through regular remediation bulletins and the CSBP website. Contact details will be provided should residents have an enquiry or wish to make a complaint.

Demonstrating a regular and stringent dust monitoring program, coupled with proactive dust controls and management programs, are important in reassuring neighbours and the public that dust issues are being adequately addressed.

## 8.1 Complaints Procedure

A community liaison and complaint response procedure will be implemented for the project, inline with CSBP's existing procedure undertaken for their Kwinana operations (DP-11-050-01).

The complaint response procedure will include the following key elements:

identify a site contact (e.g. project manager, site foreman or superintendent) to whom the community can make a written or verbal complaint;

- logging of complaint into electronic Incident Management System;
- document all complaints as they are raised with the following details:

  date of complaint

  time of complaint

  name and contact details of person raising the issue

  details of the complaint (note time and location that the event occurred)

  name of person responsible for action
- assign the complaint to appropriate staff for resolution;
- investigate complaint and document actions/outcomes on the complaint record:

  details of actions to resolve the complaint/issue

  date issue resolved
- advise the person who originally made the complaint of the resolution; and
- close the record.

In response to a dust complaint, corrective measures (including assessment of remediation activities and operational techniques) will be implemented to assess the nature of the complaint and to minimise the likelihood of reoccurrence of the situation leading to the complaint. Follow up monitoring will be used to verify the adequacy of the corrective measure. Following implementation, the complainant will be notified of all action outcomes.

# 9. Glossary

| Term | Definition |
|---|---|
| Deposited matter | Any particulate matter that falls out from suspension in the atmosphere. This measurement is expressed in units of mass per area per time (e.g. $g/m^2$/month). |
| Fugitive dust | Dust derived from a mixture of sources (non-point source) or not easily defined sources. Examples of fugitive dust include dust from vehicular traffic on unpaved roads, materials transport and handling and un-vegetated soils and surfaces. |
| Inhalable dust | The mass fraction of total airborne particles which is inhaled through the noise and mouth. The particles are less than 10 micrometres (microns) in diameter and approximately 80 percent of those particles are between 2.5 and 10 micrometres in diameter. When inhaled, these particles are deposited in the trachea and bronchia section of the lung. |
| Nuisance dust | Dust which reduces environmental amenity without necessarily resulting in material environmental harm. Nuisance dust comprises particles with diameters nominally from about 1 millimetre to 50 micrometres (microns). |
| $PM_{10}$ and $PM_{2.5}$ | Particulate matter less than 10 microns in size and 2.5 microns in size respectively. Measurements are also expressed in units of mass (micrograms) per cubic metre. The monitoring program for $PM_{10}$ follows *AS3580.9.6-1990*. There is no Australian Standard for $PM_{2.5}$. |
| Respirable dust | The mass fraction of inhaled particles which penetrates to the lung's unciliated airways. This represents those particles with diameters less than 2.5 micrometres that lodge in the alveolar region of the human lung. |
| Total suspended particulates (TSP). | A term used in air quality monitoring. The nominal size of this fraction has particles with a diameter up to 50 microns. The monitoring program for TSP follows *AS2724.3-1987*. This enables a determination of dust concentrations in units of mass (micrograms) per cubic metre. |

# 10. References

Department of Environment and Conservation NSW (2005), Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales, August 2005

Department of Environment and Heritage (formerly Environment Australia) 1998 *Best Practice Environmental Management in Mining — Dust Control*, Australian Government, [online:www.deh.gov.au/industry/industry-performance/minerals/booklets/dust], accessed 21 September 2004

Hanna S., 1982. Handbook on Atmospheric Diffusion. Book published by the U.S. Department of Energy, Office of Energy Research, Washington DC, DE82-002045.

MPCA *Particulate Matter (TSP and PM-10) in Minnesota* [online:www.pca.state.mn.us/air/emissions/pm10.html], accessed 25 September 2005]

NEPC 1998, National Environment Protection Measure for ambient air quality, National Environment Protection Council, 26 June 1998,

National Environment Protection and Heritage Council 2003 *National Environment Protection (Ambient Air Quality) Measure (amended 2003),* Office of Legislative Drafting, Attorney-General's Department, Canberra, 7 July 2003.

PB (2004). Final Remediation Works for the Former Cresco Site, Bayswater, Public Environmental Review, September 2004.

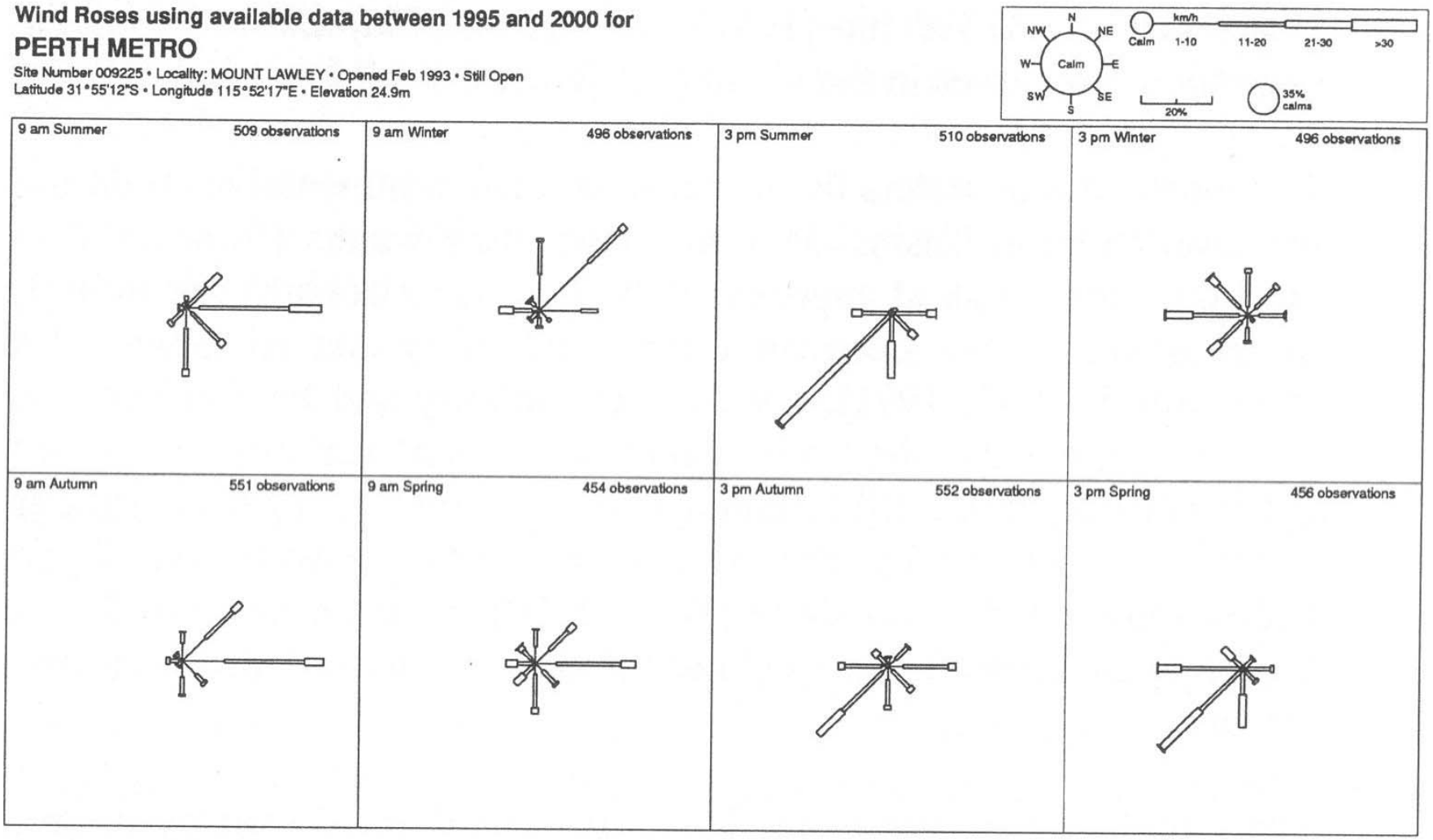
WorkSafe 2003 *Asbestos Removal — safe removal of building products*, Department of Consumer and Employment Protection, WA, February 2003.

# Appendix A

Wind Rose Data

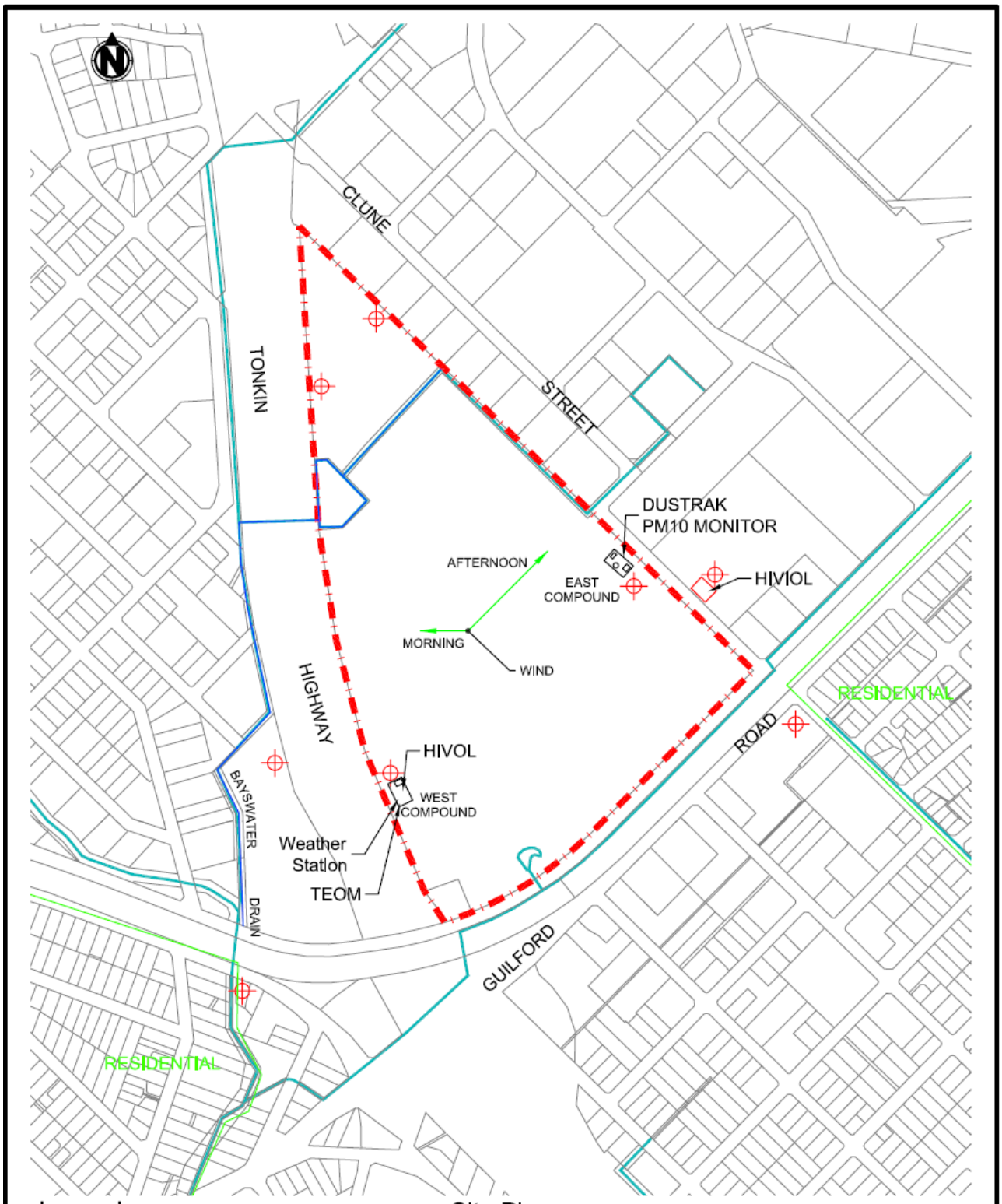
Source: Bureau of Meteorology 2002

**Figure 10.1: Wind Roses for Perth Metropolitan Region**



# Appendix B

Site Location Plan showing locations of dust monitoring instrumentation




Legend

Site Boundary

Depositlon Gauges

Site Plan

Compound Containing HVAS

DRN: R.Bargerbos Aug '05

CHKD: A.Schultz Aug '05

DATUM: N/A

SCALE: N.T.S.

# CSBP Bayswater

## Spring and Summer Dust Monitoring Plan

CLIENT:
CSBP Limited

Figure 1

2146194D;PR2_14245;RevB

# Appendix C

Monitoring Plan

**Dust monitoring program**

| Monitoring Period | Dates | Sampling Frequency | Monitoring Locations | Analytes | Data turn around time and Reporting Frequency to Website |
|---|---|---|---|---|---|
| **Pre-remediation** | Period of 1 month | Continuously | TEOM1 | $PM_{10}$, | Online/uploaded daily |
| | | Daily | HV1, HV2, | TSP, | 4days/uploaded weekly |
| | | Weekly | HV1, HV2, | Priority metal suite | 11days/uploaded fortnightly |
| | | Monthly | DG1 to DG8 | Deposition rate of insoluble solids | 4days /uploaded monthly |
| **Remediation** | Removal of soil classified as class IV ( estimated 3 months) | Continuously | TEOM1 | $PM_{10}$ | Online/uploaded daily |
| | | Daily | HV1, HV2, | TSP , | 4days/uploaded weekly |
| | | 2 x Weekly † | HV1, HV2, | Priority metal Suite | 11days/uploaded fortnightly |
| | | Monthly | DG1 to DG8 | Deposition rate of insoluble solids | 4days /uploaded monthly |
| | Removal of soil classified as class III ( estimated 3 months) | Continuously | TEOM1 | $PM_{10}$ | Online/uploaded daily |
| | | Daily | HV1, HV2, | TSP | 4days/uploaded weekly |
| | | 1 day per month | HV1, HV2, | As, Cu, Pb | 11days/uploaded fortnightly |
| | | Monthly | DG1 to DG8 | Deposition rate of insoluble solids | 4days /uploaded monthly |

† Heavy metals analysis for the first month of remediation will be carried out 2 times a week. Only the filter papers with the greatest collected TSP for 24 hours (such that winds blew over the site) during each week need by analysed. The need for further monitoring for metals is to be reviewed following the first month of remediation.

# Appendix D

Audit Table

# CSBP Site Dust Management Audit Table

## Start Checklist

**Date:**

| | Time | Description |
|---|---|---|
| Wind Direction | | |
| Wind Strength | | |
| Observations (ie Rain, Hot and Dry etc) | | |

Dust generation potential  Low ☐  Medium ☐  High ☐

| | Description |
|---|---|
| Nature of Days Work: | |
| Work Location (note location on map) | |

| | | Time | Dust mitigation strategies implemeted | | | |
|---|---|---|---|---|---|---|
| DustTrack setup (note location on map) | ☐ | | water application on: | | roads swept | ☐ |
| DustTrack setup (note location on map) | ☐ | | stockpiles | ☐ | drop heights reduced | ☐ |
| DustTrack setup (note location on map) | ☐ | | trafficked areas | ☐ | disturbed areas stabilised | ☐ |
| HiVol filter changed | ☐ | | work areas | ☐ | hydro mulching | ☐ |
| | | | other | | | |

## Observations throughout the day

| | Time | Description |
|---|---|---|
| Changes to Work Location (note changes on map) | | |
| | | |
| | | |
| Observed Meterological changes (note changes on map) | | |
| | | |
| | | |
| Changes to DustTrack Location and Dust Mitigation Actions | | |
| | | |
| | | |

### Event or Alarm Response

**Visible Dust across boundary** ☐

Response ☐

Dust Crossing the Boundary **Y / N**
Work Ceased **Y / N**
Water truck dispatched **Y / N**

note activities at time of visible dust

note dust mitigation actions taken

Dust Mitigation action successful  Yes ☐  No ☐

**DustTrack Alarm** ☐ _____ | note activities at time of alarm

Response ☐ _____ | note dust mitigation actions taken

Dust Crossing the Boundary **Y / N**

Work Ceased **Y / N**

Water truck dispatched **Y / N**

Dust Mitigation action successful Yes ☐ No ☐

**TEOM Alarm** ☐ _____ | note activities at time of alarm

Response ☐ _____ | note dust mitigation actions taken

Dust Crossing the Boundary **Y / N**

Work Ceased **Y / N**

Water truck dispatched **Y / N**

Dust mitigation action successful Yes ☐ No ☐

## Site Location Map

Mark location of work area, DustTrack monitor and wind direction at start of day

Note any significant changes to location of work area/wind direction/location of DustTrack