ENVIRON

DUST MODELLING STUDY – FIMISTON OPERATIONS EXTENSION

For

KALGOORLIE CONSOLIDATED GOLD MINES

DRAFT REPORT

August 2006

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Kalgoorlie Consolidated Gold Mines

Attention: Michelle Birch

Dear Michelle,

KCGM DUST MODELLING STUDY- FIMISTON OPERATIONS EXTENSION

We are pleased to present our draft report on the Dust Modelling Study to form part of the Super Pit Expansion Public Environmental Review (PER) Document. This report provides details of the emission inventory, approach and methodology and the results of the dispersion modelling study.

Should you require any additional information, please contact Neil Salisbury or the undersigned directly.

Yours faithfully
ENVIRON Australia Pty Ltd

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TABLE OF CONTENTS

Page No.

APPENDIX TOC

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

ENVIRON Australia Pty Ltd (ENVIRON) was commissioned by Kalgoorlie Consolidated Gold Mines (KCGM) to assess the predicted ambient dust concentrations arising from the proposed extension to the existing Fimiston Gold Mine Operations. The extension includes a cutback of the Fimiston Open Pit along part of the western edge referred to as the Golden Pike Cutback, additional waste rock storage areas and additional tailing storage capacity to meet processing requirements for the projected mine life.

The Kalgoorlie area has a semi-arid climate where the annual rainfall ranges from 100 mm to 500 mm with an average of 263 mm. Generally, more rain falls during the winter months, however, summer storm events occur regularly and often result in high intensity, short duration rainfall. These events are typically brought about by tropical depressions and can comprise a significant proportion of the total annual rainfall. The average potential annual evaporation rate is around 2,500 mm and the potential evaporation exceeds rainfall for all months of the year. Temperatures in the Goldfields can range from a summer maximum of 46ºC to a winter minimum of –3ºC with occasional frosts experienced during the winter months. Winds are strongest during winter, though not usually exceeding 30 km/h and are mainly from the northeast or west. At other times of the year winds are from the southeast. Windroses indicate that the predominant winds are from the east to south east for most of the year with a lower frequency of winds from the north, northwest and south.

The Air Dispersion Model (TAPM) was used to predict the local meteorology at Kalgoorlie and produce an Ausplume compatible meteorological input file. Ausplume was used to predict the ground level concentrations of PM_{10} and Total Suspended Particulates (TSP) arising from current operations and proposed extension of the Fimiston Open Pit. The assessment was base on synoptic meteorological data for the year 2004. Winds generated by TAPM are consistent with the annual summary statistics for the MEX station and historical data provided by the DoE. Terrain effects have not been considered in this screening assessment because these releases are typically neutrally buoyant, with no plume rise to consider.

The modeling undertaken to predict the impacts of the existing and proposed operations are based on the best available modelling techniques and approved DoE modelling guidelines. The model validation studies undertaken using the Beta Attenuation Monitors (BAM) monitoring data at Boulder Shire Yard (BSY) indicated the difference in the predicted vs. observed concentrations at BSY was within 20%. The dust roses (Figure 9) clearly indicates that KCGM is not the only source of particulates and as such, the apparent "under prediction" of the model is misleading. Review of time series data (Figure 13) at BSY indicate that the 24 hour average concentrations measured between July 05 – April 06 is 17 $\mu g/m^3$, with no exceedences above the NEPM guideline indicating that dust levels to the west of the open pit are below NEPM guidelines.

The emission estimates developed for this study were based on current best practice and the use of the NPI emission estimation manuals to produce emissions estimates for the major sources at Fimiston.

Emission estimates utilized in the modelling reflect the additional controls employed by KCGM to ensure that dust emissions during construction and operation are below NEPM guidelines beyond the facility boundary. The emission estimates generated in this study were based on the model validation work undertaken to ensure that model predictions were consistent with observations. This has resulted in a reduction of the emission estimates by 60 % compared to those detailed in the NPI report.

Dust emissions during construction are likely to occur as a result of vehicle movements, clearing and other construction activities related to the Golden Pike Cutback and the realignment of the noise bund. These activities have the potential to generate dust emissions and will be managed by KCGM's revised dust management plan. Due to the intermittent and constantly variable nature of the construction activities, dispersion modelling was not undertaken.

The modelling results indicate that the 24-hour average PM_{10} ground level concentrations are predicted to be below the NEPM standard at the nominated receptors for both the current and proposed operations with the exception of the Hewitt St receptors. The receptor at Clancy St also experienced slightly higher concentrations under the current and proposed scenario however evaluation of the 99^{th} Percentile 24 hour average concentrations at Clancy St indicate that these concentrations are below the NEPM guideline of 50 $\mu g/m^3$. This is viewed as a more robust statistic and removes the undesirable influence of unusual (stochastic) events, while still representing the highest concentrations. The modelling had indicated that there is a marginal decrease in the predicted ground level concentrations due to the proposed extension at the Hewitt St receptor. However at other receptors to the west of pit, the emissions from the proposed extension will be marginally higher than current emissions.

Similarly, the predicted 24-hour average TSP concentrations for both the current and proposed scenarios are at or below the nominated guideline values (Kwinana EPP) for all receptors with the exception of Hewitt St. In general the model predicted marginally lower ground level concentrations for the proposed scenario compared to the current scenario due the reduction in the mining rates and the increased depth of the pit.

To demonstrate there will be no $PM_{2.5}$ exceedences at sensitive receptors, the maximum PM_{10} concentrations over the modelled year were extracted at sensitive receptors and proportioned based on particle mass fraction data(*determined from Particulate Size Distribution Data, Table 8 in the Air Report*) to determine the contribution of $PM_{2.5}$ at sensitive receptors. The maximum predicted $PM_{2.5}$ ground level concentrations are below the nominated NEPM guideline values for the current and proposed scenarios at all nominated receptors with the exception of Hewitt St. This exceedence is similar to that for the PM_{10} modelling scenarios. The Hewitt St receptor is close to the open pit and waste dumps and therefore on occasion experience higher ground level concentrations due to prevailing winds.

The proximity of the Hewitt St receptor and the prevailing winds are the primary factors influencing the predicted PM_{10} and TSP concentrations at this receptor. As both the maximum 24-hr TSP and

PM_{10} modelling indicates values above nominated guidelines, ENVIRON recommends that further real-time monitoring be undertaken at this site to obtain a better understanding of actual dust impacts and to facilitated improved management of activities that may result in dust generation.

The revised Dust Monitoring and Management Programme will incorporate both a predictive and reactive control strategy to control dust emissions from KCGM operations based on the results of the proposed real-time monitoring. Further details are presented in Section 6 of this report.

KCGM DUST MODELLING STUDY – FIMISTON OPERATIONS EXTENSION

for
Kalgoorlie Consolidated Gold Mines

1. INTRODUCTION

1.1 BACKGROUND

Kalgoorlie Consolidated Gold Mines Pty Ltd (KCGM), located approximately 600 km east of Perth, on the eastern boundary of the City of Kalgoorlie-Boulder proposes to extend its existing Fimiston Gold Mine Operations. The extension will include the mining of a westerly cutback (known as 'the Golden Pike Cutback') of the Fimiston Open Pit covering a surface extent of 46 hectares (ha).

ENVIRON Australia Pty Ltd (ENVIRON) was commissioned to assess the potential dust impacts associated with the extension. The extension will include the following:

1. A cutback of the Fimiston Open Pit along part of the western edge referred to as the Golden Pike Cutback. The 46 hectares (ha) westerly extension will allow for both the widening and deepening of the pit to a depth of around 600 metres (m);

2. Additional areas for waste rock storage generated from the Fimiston Open Pit. Sites north of the pit have been identified as potential storage areas which includes the provision for backfilling waste within the pit itself. Additional waste rock dump areas will cover approximately 115 ha;

3. Additional tailings storage capacity is also required to meet processing requirements for the projected 2017 mine life. KCGM considers that raising the height of Fimiston I and Fimiston II tailing storage facilities (TSF's) or the re-commissioning of the Kaltails TSF provides significantly better environmental outcomes that far outweigh the justification for a new TSF; and

4. Separate approval has been obtained to realign the environmental noise bund further to the west of the Fimiston Open Pit to maintain the buffer between the KCGM operation and the community of Kalgoorlie- Boulder in the event of the Fimiston Open Pit extension.

1.2 ASSESSMENT APPROACH

This report details the screening level dust emission study associated with the Fimiston extension proposal to extend the life the open pit to 2017. This assessment is based largely on the requirements of the *Department of Environment's (DoE), Air Quality and Air Pollution Modelling Guidance Notes, June 2000* and on discussions with the Air Quality Branch of the DoE. The Ausplume air dispersion model was used in this study. A summary of the approach and methodology used in predicting the air quality impacts from current operations and proposed extension includes the following:

1. The review and prioritisation of dust emission sources from both the existing and proposed operations. This review and prioritisation also included collation and determination of emission source details such as source type, source dimensions and source characteristics;

2. The estimation of dust emissions from major dust generating sources at Fimiston using recognized emission factors such as those published in the National Pollutant Inventory (NPI) Manuals and the United States Environmental Protection Agency (USEPA), taking into account production rates and dust mitigation measures as appropriate;

3. The analysis and assessment of meteorological conditions prevalent in the study area. A TAPM generated site specific meteorological file was used in the dispersion model;

4. The analysis of local geographical features within the study area such as topographical features and land use characteristics. A site specific topographical file has been generated for the study area. As this is a screening assessment, default land use parameters have been used in this study;

5. The prediction of dust impacts from existing operations at Fimiston using the Ausplume air dispersion model;

6. The validation of the model predictions against KCGM ambient monitoring data to ensure representativeness of the model predictions;

7. The prediction of future dust impacts associated with the Fimiston extension taking into account the baseline conditions;

8. Review of the predicted concentrations against nominated NEPM guidelines; and

9. Recommended management and mitigation measures additional to that detailed in existing Dust Monitoring and Management Program where these are thought to be required.

The existing operation and management of dust emissions from the Fimiston operations provides a platform on which to base the prediction of the potential future impacts arising from the proposal. The emissions for the proposed extension are based on current best available estimates and information extracted from KCGM's Project Definition Document (PDD). The existing ambient monitoring programs undertaken at KCGM and the record of dust complaints data have been used to help ascertain the potential dust impacts from exiting operations and model validations.

The key dust emissions considered in this assessment are:

1. Total suspended particulates (TSP); and
2. Particles less than 10 micron (PM_{10}).

The particulate size ranges have been selected based on consideration of current relevant ambient air guidelines, predominant emission characteristics and knowledge gained from existing operations. The study has used the National Environment Protection Measure (NEPM) guidelines for PM_{10}.

This study focused on the assessment of PM_{10} and TSP impacts and has not included the assessment of $PM_{2.5}$ impacts. This is because the current NPI EET manual does not have emission estimates for $PM_{2.5,}$ and emerging information from the USEPA indicate that there are major discrepancies in the $PM_{2.5}$ emission estimates stipulated in the USEPA's AP-42 document. Review of the literature indicated that there is a discrepancy in particulate matter emissions ($PM_{2.5}$) determined from source attribution for the analysis of ambient filter samples. The review[1] also indicated that the major component of the apparent over-prediction was due to the near source removal by particle settling and filtration of vegetation (Etyemkexian *et al*, 2003). Emission factors are typically derived at or near the source before significant depletion occurs and therefore essentially comprising the total particulate emitted. However, ambient monitoring may be several kilometres from the major sources at which a significant proportion of the $PM_{2.5}$ may have been removed. Other hypothesis includes review of the measurement method employed. The method used hi-volume samplers fitted with a PM_{10} head and a subsequent cascade impactor for the sizing below PM_{10}. With the use of the cascade heads, the particles bounce on the cascade impactor stages may have resulted in higher $PM_{2.5}$ concentrations than actually occurred. Therefore for these reasons $PM_{2.5}$ was not assessed in this study. In addition KCGM does not have any $PM_{2.5}$ data on which to validate the emissions data and predicted impacts.

1.3 PREVIOUS DUST STUDIES - FIMISTON

A summary of previous dust studies associated with Fimiston mining operations include the following:

1. CSIRO Australia (Mine Site Rehabilitation Research Program), Dust Generation from Tailings: Development of the Micro Wind Tunnel and preliminary investigations in tailings surfaces. This study was commissioned to carry out research into specific aspects of dust generation from gold mining tailings dams. The study indicated that fresh hyper-saline tailings from KCGM and Kaltails have little potential for dust generation. However, weathered freshwater tailings can generate significant dust.

[1] SKM 2005, Improvement of NPI Fugitive Particulate Matter Emission Estimation Techniques

2. CSIRO, Dust Management System for Blasting: CSIRO developed a dust management system for blasting that combined information on meteorology, blast pattern location and design, bench height relative to the natural land surface and rock density, to produce a prediction of total mass and behavior of dust resulting from the blast. This model has since been replaced with a simpler program based on monitored wind data.

The above studies represent the primary external dust studies undertaken at KCGM to assess dust emissions from selected sources. Other internal studies have been undertaken including on-going dust monitoring and management which is discussed is subsequent sections. In addition to these studies, a number of regional (Kalgoorlie) air quality studies have been undertaken and include the following:

1. Coffey (1999), National Pollutant Inventory Kalgoorlie Mining Trial Aggregated Emission Study. A report prepared by the Department of Environment Protection, Pollutant Prevention division by Coffey Geosciences Pty Ltd.

2. DEP (1999), Kalgoorlie NPI Trial- A Trial of the National Pollutant Inventory Department of Environment Protection, Western Australia;

3. SKM (2005), Airborne Contaminants or Emissions of Significance in the Kalgoorlie-Boulder, Coolgardie and Kambalda Area, Kalgoorlie Gap Emission Study.

These studies and the results of the dust emissions detailed in the Kalgoorlie Airshed are discussed in more detail in section 2.4.

1.4 SUMMARY OF PARTICULATE INFORMATION

1.4.1 Total Suspended Particulate (TSP)

Total Suspended Particulate (TSP) is a measure of all particles that are entrained in the atmosphere. Particles can have health and environmental impacts, as well as causing nuisance. Particulate matter also has the potential to affect visibility, represented as haze. Fine particulate matter adversely impacts visibility because it scatters and absorbs light. The Victorian aesthetic objective for particles is equivalent to a minimum visibility of 20 km. This includes smaller particles such as PM_{10} and $PM_{2.5}$. The larger particles (ie. greater than 10 microns) are generally associated with amenity and nuisance impacts.

1.4.2 Dust Fine Particles (PM_{10} and $PM_{2.5}$)

PM_{10} (particles less than 10 microns in diameter) and $PM_{2.5}$ (particles less than 2.5 microns in diameter) concentrations are of interest because they can reach the lower parts of the respiratory system and may have health as well as amenity impacts. Particles above 10 microns (generally total suspended particles (TSP)) in diameter do not reach the critical areas in the lungs but can cause irritation and aesthetic nuisance (USEPA, 1999). Most PM_{10} particles are generated by combustion from motor vehicles, fires, industrial and extractive processes. Sulphate and organic carbon from motor vehicles, fires and industrial processes constitute most of $PM_{2.5}$ concentrations. Very fine particles can also affect visibility.

1.5 LEGISLATIVE SUMMARY

In December 2000, the DoE articulated an interim approach to adopt the National Environment Protection Measure (NEPM) standards for Ambient Air Quality. The NEPM outlines goals for PM_{10} and $PM_{2.5}$ but does not consider TSP. The Kwinana Environmental Protection Policy TSP standards have been used for the TSP guideline in the absence of a NEPM or World Health Organisation (WHO) guidelines.

1.6 NEPM

The National Environment Protection Council (Ambient Air Quality) Measure 1998 is a Commonwealth initiative aimed at achieving nominated standards of air quality across Australia by 2008. All states and territories have adopted the standards and goals for the so-called criteria pollutants specified in Schedule 2 of the NEPM. The Western Australian DoE have adopted the NEPM as part of its environmental objectives.

The NEPM (Ambient air Quality) goals relevant to this study are detailed below in *Table 1*.

Table 1:NEPM (Ambient Air Quality) Goals

Particulate Type	Averaging Period	Standard	Allowable Exceedences Goal[1]
Particles as PM_{10}	1 day	50 µg/m^3	5 days in a year
Particles as $PM_{2.5}$ [(2)]	1 day	25 µg/m^3	NA

<u>Notes</u>

1. To be achieved by June 2008.
2. The PM2.5 NEPM guideline is an advisory standard .

For the purposes of this study, these standards and goals have been applied at sensitive receptors in the study area. A summary of other relevant guidelines are presented below.

1.6.1 Other Particulate Matter Guidelines

Other particulate matter guidelines applicable or detailed in publications both nationally or internationally are presented in *Table 2*.

Table 2: Summary of Particulate Matter criteria

Dust Type	Averaging Period	Concentration	Source
TSP [1]	1 day	90 µg/m^3	The Kwinana Environmental Protection Policy (Kwinana EPP) (EPA 1999), Area B and C Standard.
PM_{10} [2]	Annual Average	20 µg/m^3	Minister of Environment (New Zealand), Ambient Air Guidelines (2002)
PM_{10} TSP (nuisance dust)	Annual Annual	30 µg/m^3 90 µg/m^3	Department of Environment and Conservation, Approved Methods, For the Modelling and Assessment of Air Pollutants in NSW.

Notes

1. The Kwinana EPP standard was used as a guide only in this study due to the absence of relevant TSP criteria in the Kalgoorlie Region.
2. The PM10 annual average guideline (Minister of New Zealand) was also used as a guide only in this study due to the absence of relevant annual average criteria in this study

2. EXISTING ENVIRONMENT

2.1 BACKGROUND

The Kalgoorlie area has a semi-arid climate where the annual rainfall ranges from 100 mm to 500 mm and the average of 263 mm. Generally, more rain falls during the winter months, however, summer storm events occur regularly and often result in high intensity, short duration rainfall. These events are typically brought about by tropical depressions and storms and comprise a significant proportion of the total annual rainfall. The annual potential evaporation rate of 2,500 mm/yr easily exceeds the annual rainfall and it also exceeds rainfall for all months of the year. Temperatures in the Goldfields can range from a summer maximum of 46ºC to a winter minimum of -3ºC with occasional frosts experienced during the winter months. Winds are strongest during winter, though not usually exceeding 30 km/h and are mainly from the northeast or west. At other times of the year winds are primarily from the east to southeast.

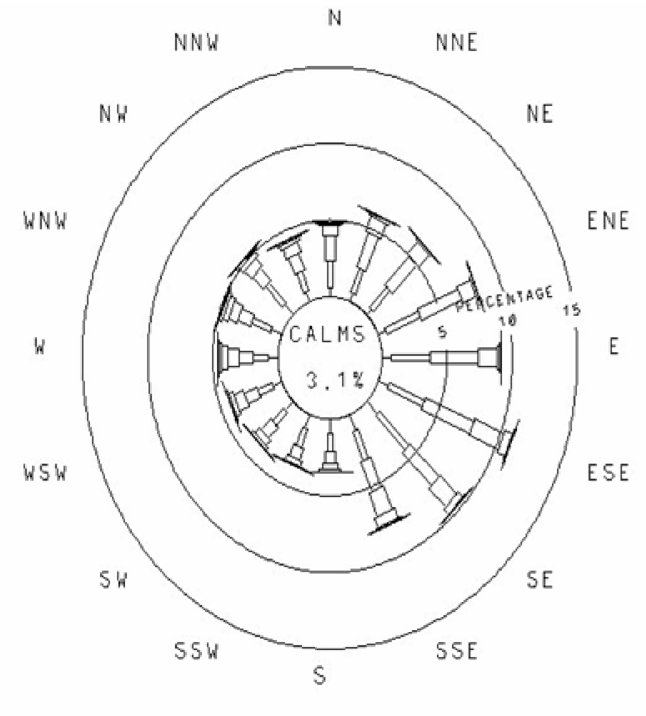
2.2 METEOROLOGY

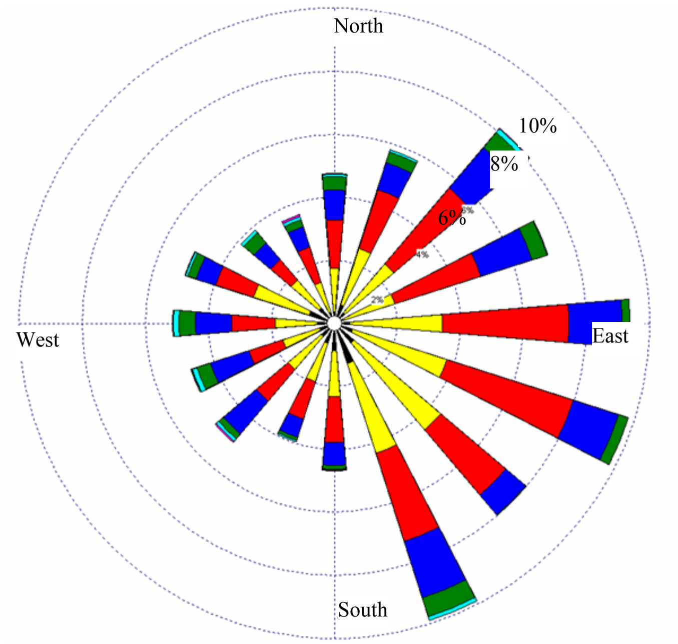
2.2.1 Surface Winds

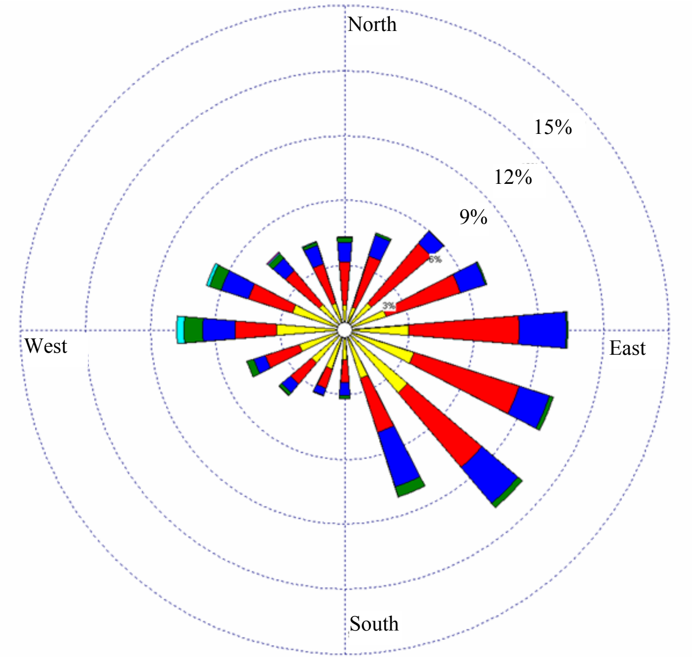
Prevailing winds in the study area are presented to provide an understanding of the measured wind statistics and the general features of winds affecting plume dispersion. Annual windroses for the Kalgoorlie region are presented in *Figure 1* with seasonal windroses presented in Appendix A. The windrose plots depict the frequency of occurrence of winds in each of the specified wind direction sectors and wind speed classes. The length of the bar represents the frequency of occurrence of winds from that direction and the width of the bar represents the wind speed categories, the narrowest representing the lightest winds. The wind roses summarising the measured wind statistics have been generated from the following data sets:

1. Metal Exploration (MEX) meteorological station: This is a KCGM operated station located at coordinates 355036E and 6594958N (GDA94). This is a 10 m surface meteorological station with the annual averaged windrose representing data from 1990-2003.
2. DoE generated surface meteorological file for the year 1984, which was generated using data collected by the DoE at the old Kalgoorlie Technical School and upper air data from the Bureau of Meteorology station at Kalgoorlie Airport.
3. TAPM generated prognostic meteorological data: TAPM generated prognostic data for 2004. Data at coordinates 355036E and 654958N have been extracted for use in the dispersion model.

Figure 1: Comparison of Annual Windroses for Kalgoorlie , MEX Station (1990-2003) (left), DoE generated Meteorological File (1984) (middle) and TAPM generated Meteorological File (2004) (right).

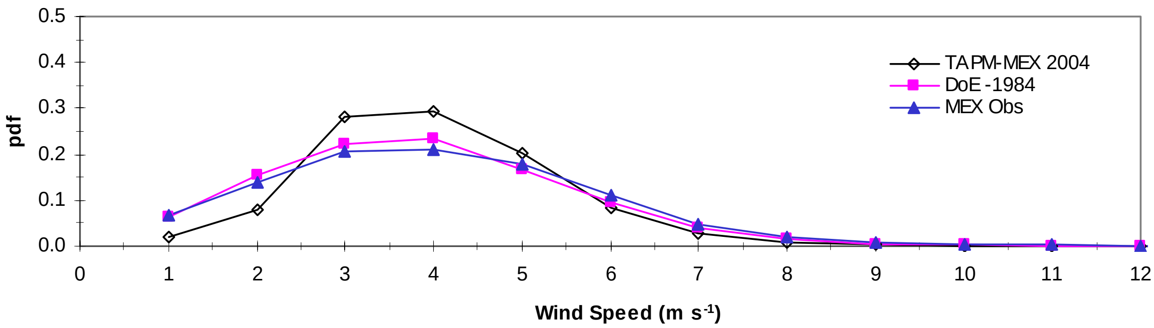


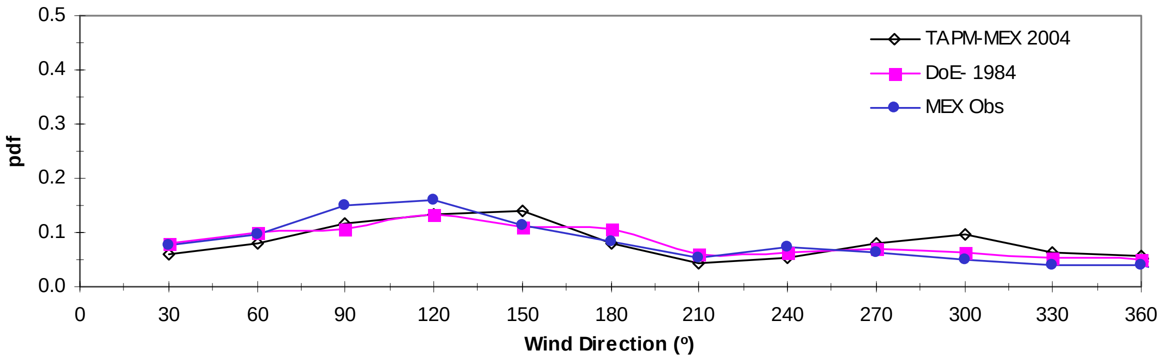




The annual windroses for all three stations indicate that the predominant winds are from the east to southeast for most of the year with a lower frequency of winds from the north, northwest and south. The TAPM generated windrose is consistent with the annual summary statistics for the MEX station and the DoE generated meteorological data. *Figure 2* presents the probability density function (pdf) plots of wind speed and wind direction for the TAPM predicted meteorological file , DoE 1984 file and the MEX observations for 2004.

Figure 2: Probability Density Function plots of wind speed (top) and wind direction (bottom) for the DoE meteorological File-1984 , TAPM generated meterological file and MEX observations (2004).



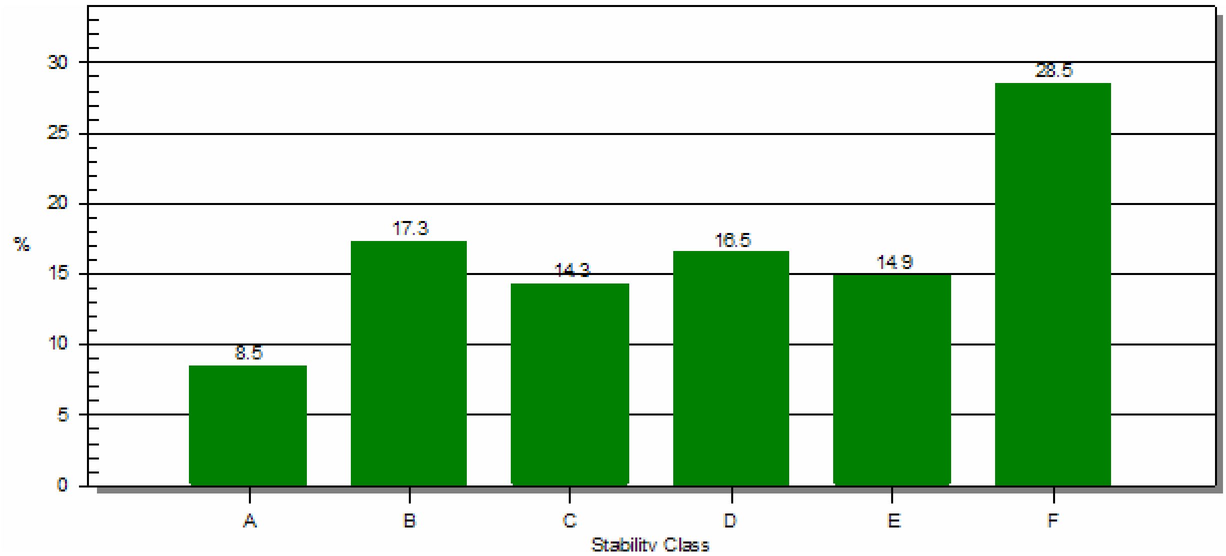


The pdf plots indicates that TAPM tends to under predict the light winds and over predicts the winds between 3 m/s and 5 m/s. TAPM also tends to under predict the northeasterlies and easterlies and overpredict the north westerlies. Note that the 1984 meteorological file was used for comparison only, no further analysis was undertaken as it is a completely different year.

2.2.2 Stability Class

Gaussian plume dispersion models such as the one used in this study, use stability classes as indicators of atmospheric turbulence and the dispersive properties of the atmosphere. *Figure 3* presents the TAPM generated stability classes for the 2004 data set and this shows a relatively high occurrence of F class stability under the light night-time conditions.

Figure 3: Frequency Distribution of Stability Class,, TAPM Generated Meteorological file.



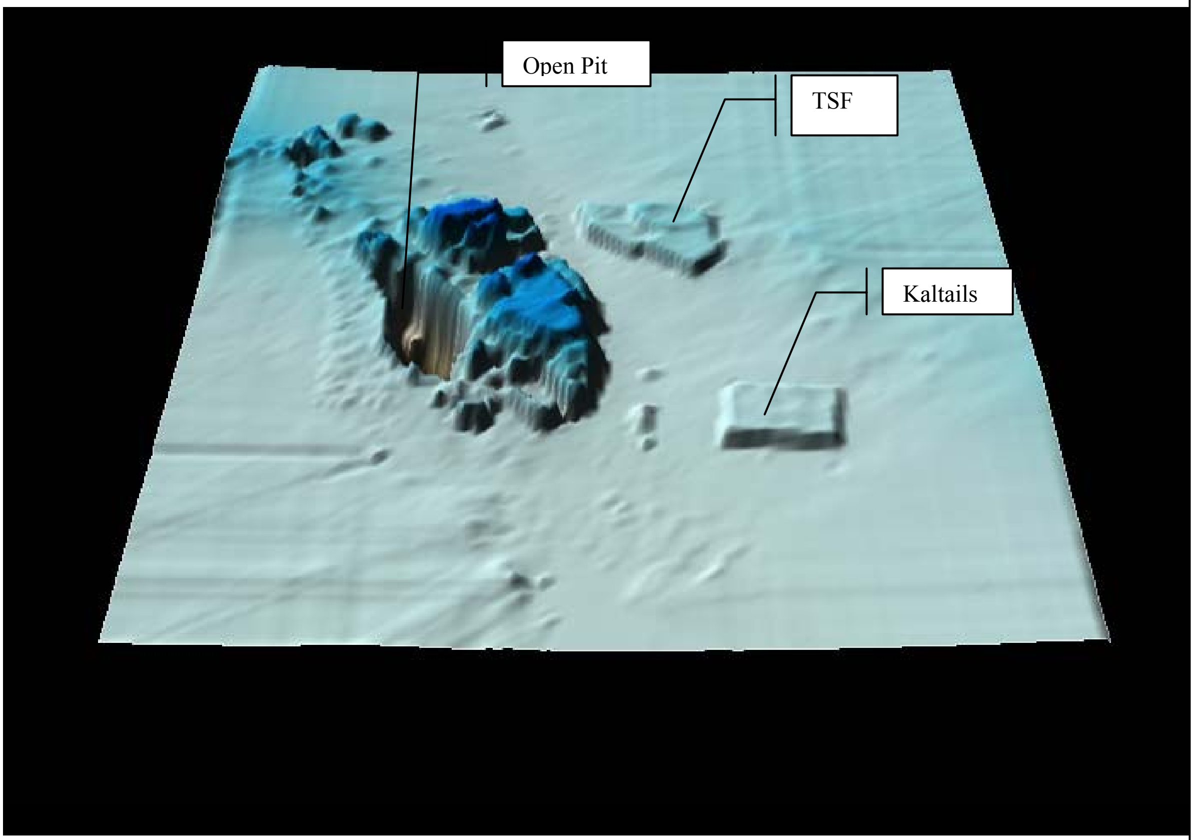
2.2.3 Mixing Height

The mixing height is the height to which the atmosphere is uniformly mixed and is determined by the level of thermal and mechanical turbulence. Mixing heights have diurnal variations and typically rapidly change after sunrise and sunset with model predictions of ground level concentrations being highly sensitive to changes in the mixing height for elevated point sources. However, within this study, mixing heights is not considered to be a significant issue due to the low level non-bouyant emission sources.

2.3 TOPOGRAPHY

The topography in the study area is gently undulating and broken up with occasional ranges of low hills. Within the modelled domain, the terrain comprises the open pit, surrounding waste rock dumps and the TSF facilities. Incorporating terrain is generally not a consideration when modeling fugitive releases (i.e. non-stack releases such as stockpiles, waste dumps and TSFs) because these releases are typically neutrally buoyant, with no plume rise to consider. Maximum impacts are thus expected to occur at the nearest downwind location. Therefore in this study terrain effects have not been included. In addition, Gaussian plume models like Ausplume can only partially simulate terrain effects, because of the assumption that the wind speed and direction remain constant over the full length of the plume. *Figure 4* presents a surface map of the study area showing the topographic features

Figure 4: Topographical relief Map

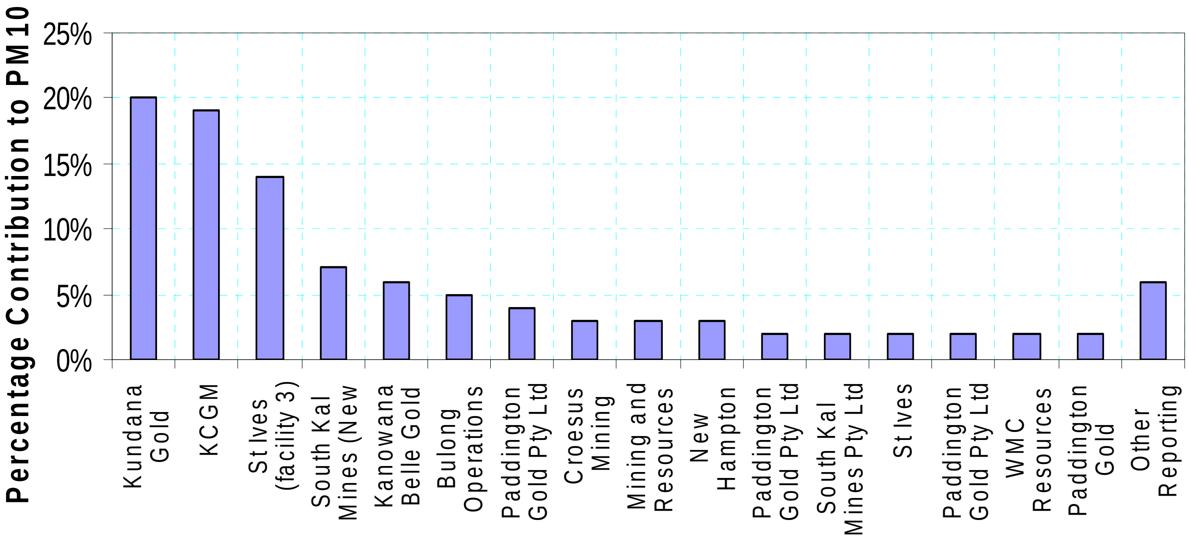


2.4 REGIONAL AIRSHED EMISSIONS

Cumulative impacts represent the combined impacts of two or more individual sources and individually minor sources can be significant when assessed on cumulatively. Regional (*Kalgoorlie, Coolgardie and Kambalda area extending approximately 50 km*) dust emissions are high due to the large number of industries and fugitive sources. In assessing regional dust impacts a review of industries contribution to dust emissions have been collated and include an estimation of their respective contribution based on NPI reporting estimates. There are approximately 22 mining /industrial operations in the region (based on NPI reporting) that contribute to cumulative dust emissions in the Kalgoorlie airshed. In addition to these industrial sources, background fugitive emissions from exposed areas are high, contributing to overall airshed emissions. Review of overall source contributions presented in the NPI data indicates that paved and unpaved roads is the largest source of dust emission in the Kalgoorlie airshed followed by solid fuel burning (domestic).

In order to assess the contribution of KCGM's dust emissions (including Fimiston, Mt Charlotte and the Gidji Roaster) to the airshed, a summary of NPI emission information for the major dust generating industries have been collated and summarized in *Figure 5.*

Figure 5: Summary of Industry Contribution to Dust Emissions (2003-2004 *NPI Report*)



In light of the information presented here, it can be concluded that:

1. The above figure indicates that KCGM contributes approximately 19% to cumulative industry emission in the Regional airshed based on NPI estimates (A large uncertainty factor needs to be applied to these data as both the emission estimates and calculations may have several shortcomings);
2. Other background sources such as fuel combustion, motor vehicles and wind erosion from exposed areas contribute a large proportion of the overall emissions. While this contribution cannot be accurately quantified, a review of KCGM monitoring station data indicates that background sources are a large contributor to total particulate emission in the study area.
3. The nature and extent of the emissions and sources in the study area is such that accurate quantification and estimation of cumulative impacts is difficult due to the lack of adequate data and is not considered in this screening assessment;
4. Assessing the existing and proposed project/activities in isolation will indicate if there is a net increase or decrease in emission from the proposed extension that can subsequently be used to qualitatively assess if there is a net increase or decrease in the contribution of KCGM's operations to overall airshed emissions.

3. EXISTING MINING OPERATIONS

3.1 BACKGROUND

KCGM's operations includes the Fimiston Mill, Gidji Roaster and Mt Charlotte underground mines and the workings of the Fimiston Open Pit (commonly referred to as the "Super Pit") and many other historical workings. About 85 million tonnes (Mt) of ore and waste are removed from the Fimiston Open Pit each year. About 14 Mt of ore are treated at the Fimiston Mill and the remaining 71 Mt of waste are transported to various waste rock dumps surrounding the pit perimeter. The Fimiston Open Pit is located on the eastern boundary of the City of Kalgoorlie-Boulder. The current footprint of the Fimiston Open Pit extends approximately 1.5 km in width, 3.4 km length and to a depth of approximately 360 m and is the largest gold open pit in Australia. The currently approved Fimiston Open Pit surface footprint allows open pit mining until 2012.

The sequence of current major operations at Fimiston includes the following:

1. Drilling and Blasting: Drilling and blasting of the rock material is undertaken to break and loosen the material for extraction by the hydraulic shovels. The blast pattern depends on the type of material being mined, oxide material (weathered rock from near the surface), or the harder sulphide material from the lower levels. Blasting in the Fimiston Open Pit is restricted to daylight hours. KCGM aims to blast at regular times to maintain consistency for the community and for visitors that are often able to view blasts from the 'Super Pit Lookout'. However, surface blasting is restricted to favorable wind conditions. The scheduled blast times are 1pm and 5pm each day, but if unfavorable winds, or a safety issues arise, KCGM may blast at anytime during daylight hours.

2. Mining, Load and Haul Operations: Mining is undertaken using hydraulic shovels that load haul trucks that can carry up to 225 t of ore and waste rock. These trucks transport the high-grade ore, over 1.2 grams of gold per tonne (g/t) to the mill for processing. The medium grade ore (0.9-1.2 g/t) and 'sub-grade' material (0.5-0.9 g/t) is placed on separate stockpiles for possible treatment at a later date and waste (material with less than 0.5 g/t) is trucked to various waste dumps. Mining is carried out seven days per week, 24 hours per day, 365 days a year.

3. Ore Processing: The Fimiston Mill comprises two separate ore processing circuits one for processing oxide ore from the Fimiston Open Pits and the other circuit for processing refractory sulphide ore from the Fimiston Open Pits and the Mt Charlotte Underground Mine.

   The ore generated from Fimiston Open Pit is treated through the following processing circuit:

   a. primary crushing plant;
   b. a semi-autogenous grinding mill with pebble crushing circuit:

c. two ball mills; and
d. flotation and two carbon-in-leach circuits.

In the flotation circuit, the gold bearing refractory sulphide ore is separated and referred to as concentrate. The concentrate is de-slimed, with the slimes (fine fraction) then leached at the Fimiston Mill. The coarse fraction is then separated into two streams. One stream is washed, filtered and transferred to the Gidji Roaster for roasting. The other stream takes this excess material that the Roaster cannot process, and grinds it in an Ultra-Fine Grinding Mill.

The Fimiston Mill also comprises elution, electrowinning circuits and facilities for smelting, pouring and the production of gold bullion.

4. Waste Dumps: The total waste movement for KCGM has been calculated at 908 Mt. This material will be relocated into waste rock dumps (WRDs) surrounding the eastern, northern and southern sides of the pit as well as internally within parts of the final pit void. Further details of the waste rock dumps are presented in KCGM's Project Definition Document and the associated PER.

5. Tailing Storage Facilities (TSF): KCGM currently operates two TSFs for the Fimiston operation called Fimiston I and Fimiston II TSFs. These TSFs store all of the tailings generated from crushing, grinding and leaching of about 14 Mt of ore per year. Fimiston I TSF takes about 20% of the tailings with the remaining going to Fimiston II TSF. The Fimiston I TSF covers an area of approximately 110 ha and the Fimiston II TSF covers approximately 350 ha.

3.2 EMISSIONS TO AIR

This section summarizes the predominant sources, typical release types and major dust emissions from KCGM operations at Fimiston. The prioritization and determination of emissions are based on current best practice in dispersion modelling from mining operations, a review of site activities and operations and information reported in KCGM's NPI reports. *Table 3* presents a summary of air emissions from major particulate emission sources at Fimiston.

Table 3: Summary of Emissions to Air – Current Operations

Process Area/Source	Major Emissions
Drilling	TSP & PM_{10}
Blasting	TSP & PM_{10}
In-pit loading	TSP & PM_{10}
Vehicle generated dust (in-pit) from loaders and dozers	TSP & PM_{10},
Ore Haulage (pit to base of the pit)	TSP & PM_{10}
Wind erosion (in-pit)	TSP& PM_{10}
Haul Operations from Pit to Processing Plant	TSP & PM_{10}
Haul Operations for Pit to Waste Dumps	TSP & PM_{10}
Ore Unloading (Stockpiles/Plant)	TSP & PM_{10}
Waste Unloading (Waste Dumps)	TSP &PM_{10}
Wind Erosion (service corridors)	TSP& PM_{10}
Wind Erosion (waste dumps)	TSP & PM_{10}
Wind Erosion (Tailing Storage facilities)	TSP & PM_{10}
Wind Erosion (stockpiles)	TSP & PM_{10}
Crushing	TSP &PM_{10}
Screening	TSP & PM_{10}
Conveying	TSP & PM_{10}

Notes:

1. The controls used in this assessment have been sourced from the NPI EET Mining Manual and review of KCGM's Dust Management Program and monitoring data.

Sources and/or activities that have not been included in the modelling as they are not considered significant (i.e. minor contributors to overall dust emissions) include the following:

1. Conveyor transfer points, all conveyor transfer points include controls with minimal dust emission generated from these sources.
2. Light vehicle movements on paved roads around Fimiston.
3. Emissions from other diffuse sources within the mill and processing plant.

3.2.1 Heavy Metal Emissions

Heavy metal emissions from the Fimiston Mill and Gidji Roaster have been quantified and characterized by KCGM via stack sampling and solid assay analysis undertaken to ascertain mass balance for a suite of heavy metal emission with particular focus on mercury emissions.

At Kalgoorlie, non-anthropogenic mercury primarily occurs naturally in the mineral coloradoite (HgTe). This mineral is one of 17 telluride minerals identified within the Kalgoorlie Lodes and is considered to be the most common of the telluride minerals within the deposit. Studies of the distribution of telluride mineralisation in the Kalgoorlie lodes are considered to be too limited to make definitive observations, however they do provide a sound basis for understanding telluride distribution. Golding (1978) noted its presence over a wide vertical range - having been located in mines from the 200ft (69m) level (just below the level of oxidation) to depths as great as 2,500 ft (865 m). It has also been recorded in drilling to depths of 1,380m.

The analysis of mercury concentrations from underground and pit wall samples indicates that low concentrations of mercury exist in the Western Lodes of the Fimiston Open Pit, (those west of the Golden Mile Fault) which includes the area of the Golden Pike Cutback. Therefore, it is unlikely that mercury concentrations will vary during current and proposed extension activities.

KCGM has undertaken extensive investigations with respect to effective controls for mercury emissions from the Gidji Roaster and Fimiston Mill. Air quality controls have been implemented and the introduction of engineering controls to reduce emissions have also commenced. Therefore, point source emission from these sources has not been considered in this assessment but has been considered as part of a different modelling programme for mercury presented in the PER.

In addition, some preliminary heavy metal speciation was undertaken on the ambient dust filter samples to obtain an understanding of the presence and concentration of heavy metal in the particulate fraction. The filters were selected based on prevailing wind direction over the sampling period and the monitored dust concentrations. A detailed list of the analytical results is presented in Appendix B that indicates that the particulate fraction of heavy metals are low and well below nominated guideline values and therefore represent levels of "no concern". Due to the complexity of measuring mercury concentrations in the ambient environment, these ambient results cannot be used to support this overall "no concern" conclusion. However, preliminary air dispersion modelling does support this conclusion.

3.3 EMISSION ESTIMATION

Estimates of emission have been made for each major source using recommended emission factors, estimation of activity and controls employed at Fimiston. The emission factors calculated for this study relate the quantity of an emission released to the atmosphere with an activity associated with the release or generation of that emission. These factors are usually expressed as the weight of emission divided by a unit weight, volume, distance, or duration of the activity resulting in the emission. Such factors facilitate estimation of emissions from various sources. In most cases, these factors are simply averages of all available data of acceptable quality, and are generally assumed to be representative of long-term averages for all facilities in the source category.

The general equation for emission estimation is:

$$E = A \times EF \times (1 - ER/100) \qquad \text{Equation(1)}$$

where:

E = emissions,
A = activity rate,
EF = emission factor, and
ER= overall emission reduction efficiency, %.

Emission factors, activity information and emission estimates have been determined from the following documents:

1. National Pollutant Inventory, Emission Estimation Technique Manual for Mining, Version 3.2, December 2001
2. National Pollutant Inventory, Emission Estimation Technique Manual for Fugitive Emissions, December 1999.
3. National Pollutant Inventory, Emission Estimation Technique Manual for Aggregated Emissions from Paved and Unpaved Roads, September 1999.
4. SKM, 2005, Improvement of NPI Fugitive Particulate Matter Emission Estimation Techniques.
5. PB 2005, KCGM National Pollutant Inventory Report 2004-2005. Draft (Revision A), October 2005:
6. KCGM Supplied Information (*Pers comm* KCGM, various)

A list of individual mining activities, and calculated emission estimates used in the assessment are presented in *Table 4*, with a summary of activities and emission factors presented in Appendix C.

Table 4: Summary of Emission Estimates – Current Operations

Sources	Coordinates (SW Corner)		Emission Estimate (Kg/yr)	
	E (m)	N (m)	TSP	PM10
1.Fimiston Open Pit				
Drilling	356652	6592856	58,804	30,897
Blasting (1)	356652	6592856	9,589	4,986
Loading	356652	6592856	67,924	32,126
Wind Erosion	356652	6592856	153,258	76,629
Haulage	356652	6592856	3,337,943	668,271
Total Pit Emission			3,627,517	812,909
2. Processing Plant				
Crushing	357195	6595158	2,275	227
Screening	357195	6595158	910	682
Conveying	357195	6595158	61,822	41,101
Carbon Kilns	357195	6595158	23,769	15,846
Total Processing Plant Emissions			91,758	59,845
3. Waste Dumps				
Wind Erosion – Waste Dump-1	355630	6595824	544	272
Wind Erosion – Waste Dump-2	357473	6595668	6,340	3,170
Wind Erosion- Waste Dump-3	357757	6592901	13,767	6,883
Wind Erosion- Waste Dump-4	357312	6591789	9,955	4,977
Total Waste Dumps			30,606	15,302
4. Haulage (Pit to waste dumps and processing plant				
Dump trucks- Small	357195	6595158	219,128	48,179
Dump trucks – Medium	357195	6595158	87,999	18,503
Dump trucks- Large	357195	6595158	1,705,766	344,324
Heavy Goods Vehicle	357195	6595158	861	574
Wheeled Loader	357195	6595158	438	292
Wheeled Tractor	357195	6595158	273	182
Total Haulage			2,014,465	412,054
5. TSF – Wind Erosion				
Fimiston-I	356704	6596930	511	255
Fimiston-II	361340	6595863	1,625	813
Total TSF			2,136	1,068
6. Wind Erosion (Other)				
Service Corridors	355630	6595824	4,086	2,043
Stockpiles	355630	6595824	2,563	1,281
Total Wind Erosion			6,649	3,324

Notes

1. A pit retention control of 50% was employed to the total emissions calculated above, therefore emissions used in the model (for the open pit) will be half of that displayed in the table above. This applies for both PM_{10} and TSP. The EET Mining Manual (V2.3) specifies a pit retention factor of 5% for PM10 however based on model validation studies, a 50% retention factor was used in the modelling as it provided better correlation with observations.
2. A high control efficiency has been applied for blasting emissions as KCGM employ a control strategy to ensure blasting is not undertaken during unfavorable winds. Therefore emissions from blasting are lower than other process emissions.

3.4 COMPARISON OF ESTIMATES AGAINST NPI REPORT.

The emission factors, activities and control factors used in determining the emission estimates have been compared against those presented in KCGM's NPI report to ensure that all major sources have been included as well as to ensure that there is consistency in emission estimates. Emission estimates utilized in the modelling reflect the additional controls employed by KCGM to ensure that dust emissions during construction and operation result in impacts that are below the NEPM guidelines beyond the facility boundary. For instance, surface blasting is not undertaken during unfavorable winds (i.e. when the winds are blowing towards town). In addition, watering of roads, the use of wind breaks, progressive rehabilitation and driver awareness training results in lowering the fugitive dust emissions from the site. Further, the predicted ground level concentrations have been compared to the ambient monitoring data and the emission estimates have been refined to ensure that the model predictions are consistent with observations. This refinement has resulted in a reduction of the emission estimates by approximately 60 % compared to those detailed in the NPI report.

In addition some of the differences in the emission estimates also include:

1. The variations in the estimated control efficiencies utilized in the NPI report.
2. Variations in the quantities and throughputs utilized in the NPI report; and
3. Variation in calculating the emission estimates.

3.5 LIMITATIONS IN EMISSION ESTIMATES DEVELOPED.

There are a number of limitations in determining ambient particulate concentrations arising from the estimation of emissions using emission factors, these include:

1. Fugitive Particulate Matter Estimations: There are limitations in the emission factors used for estimation of fugitive particulate emissions from areas such as unpaved roads and wind erosion. Developments in the US indicate that there is a likely overestimation of fugitive emissions. The major reason is the over-prediction due to near source removal by particle settling and filtration by vegetation (Etyemexiam *et al*, 2003). Another over prediction is that the unpaved road emission factors have no wind speed dependence, and as the dust from unpaved roads are generally wind speed dependent, the emissions at lower wind speeds are generally overestimated.
2. Haulage: Haulage emissions have been apportioned to represent haulage within the pit and haulage from the pit to the waste dumps and processing plant. In addition, haulage from the pit to each of the waste dumps have been apportioned (equally) for current and future operations.
3. Loading and Unloading of Waste: Due to limited data, loading and unloading of waste was estimated based on total ore throughput and total waste generated per annum assuming a constant rate throughout the year. The unloading component was apportioned evenly to each waste dump.
4. Where data were not available to generate emission estimates for individual plant and equipment, emission estimates detailed in the NPI report were used.

5. Data used to estimate wind erosion from exposed areas have been sourced from KCGM. This is slightly different to the information presented in the key characteristics table in the PER document as that table details the total footprint rather than the surface areas affected by wind erosion.
6. Controls stipulated in the NPI EET were used in all calculations as the base to estimate emissions. However, higher controls were employed based on model validation against monitoring data for nominated sources.

4. EXTENDED MINING OPERATIONS

4.1 BACKGROUND

KCGM intends to undertake a cutback along a section of the western edge of the existing Fimiston Open Pit. The cutback, referred to as the Golden Pike Cutback will allow for both widening and deepening of the pit to a depth of around 600 m. The surface extent of the Golden Pike Cutback is 46 ha. Proposed operations such as drilling and blasting, ore transportation and processing will remain the same as current operations including nominal throughputs. Additional activities include:

1. Realigning the environmental noise bund further to the west of the Fimiston Open Pit to maintain the buffer between the KCGM operation and the community of Kalgoorlie- Boulder. The realigned environmental noise bund will cover approximately 25 ha of historically disturbed land that has been revegetated with trees and scrub as part of the “Greening the Golden Mile” environmental program.

2. Additional areas for the storage of waste rock from the Fimiston Open Pit. Sites north of the pit have been identified as potential storage areas which includes the provision for backfilling waste within the pit itself. Additional waste rock dump areas will cover approximately 115 ha.

3. Additional tailings storage capacity to meet processing requirements for the projected 2017 mine life. KCGM considers that raising the height of Fimiston I and Fimiston II TSF’s or the re-commissioning of the Kaltails TSF provides significantly better environmental outcomes that far outweigh the justification for a new TSF.

4.2 EMISSIONS TO AIR

This section summarizes the predominant sources, typical release types and major dust emissions from proposed operations. The emissions have been divided into construction and operational impacts.

4.2.1 Construction Impacts

Emissions during construction include fugitive dust emissions from wind erosion, vehicle generated dust and minor emissions from fuel combustion (vehicles). Construction impacts will arise during:

1. The construction and realignment of the environmental noise bund. This is of importance due to its close proximity to sensitive residential areas;
2. The construction of additional waste dumps; and
3. Topsoil removal and surface works for the Golden Pike cutback.

Dust impacts will be managed, monitored and controlled by a comprehensive and rigorous dust management programme that includes:

1. Monitoring of current and forecast wind conditions using daily forecasts and real time wind speed and direction data to minimise off-site dust impacts and control construction operations;
2. Progressive rehabilitation to minimise exposed areas;
3. Use of water trucks and water cannons in areas that could produce dust. Fresh water will be used on areas to be rehabilitated;
4. Visual inspections for dust generation on a regular basis;
5. Use of additional dust control measures such as dust binding agents if required;
6. Suspending work as deemed necessary from inspections, public feedback or prevailing wind conditions;
7. All contractors and staff involved with the project will undertake a site-specific induction to raise awareness including the importance of dust control;
8. Use of current monitoring network to assess dust emissions during construction; and
9. Ongoing consultation with stakeholders to determine the success of the dust management measures.

In addition, KCGM's revised dust monitoring program will be used to measure the effectiveness of the construction dust management plan with additional controls employed, if required. A summary of the ambient monitoring data is presented in the results section and this indicates the effectiveness of KCGM's current dust management practices.

4.2.2 Operational Impacts

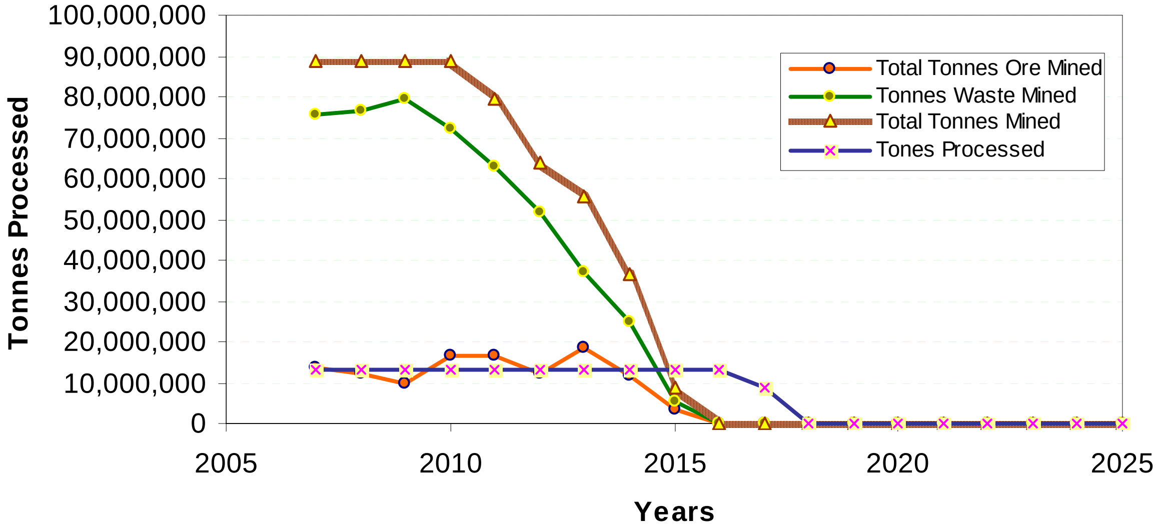
Operational impacts include dust generated from blasting, loading and haulage associated with the Golden Pike Cutback, dust generated from the additional waste dumps and changes to the TSFs. Key characteristics of the extension that will give rise to additional dust emissions over those arising from the current operations are presented in *Table 5*.

Table 5: Summary of Key Characteristics

Characteristics	Units	Proposed Operations
1. Open Pit		
Disturbance Area	ha	442
Depth	m	600
2. Production Rate	Mtpa	15
3. Waste Rock Dumps (entire operation)		
Disturbance Area	ha	1,627
4. Tailings Storage Facility		
Fimiston I- Surface Area	ha	110
Fimiston I- Height	m	50
Fimiston II–Surface Area	ha	350
Fimiston II - Height	m	54
Kaltails-Surface Area	ha	250
Kaltails-Height	m	40

All other characteristics that will remain unchanged include all current infrastructures, processing plant, water consumption, power production and ancillary services. The emission estimates have been developed from LOM (Life of Mine) information provided by KCGM presented in *Figure 6*.

Figure 6: Summary of Proposed Production Numbers



The information used in the emission estimates was extracted from the above production information with data used from Year 2007 to indicate worst case emissions from the proposed extension. This is because the total tonnes mined are proposed to be at its highest with less mined/extracted in subsequent years, as illustrated in Figure 6.

A summary of the emission estimates for the pit extension are presented below.

4.3 EMISSION ESTIMATION

Emission estimates[2] have been determined for the proposed pit extension for each major source using recommended emission factors, estimation of activity and controls employed at Fimiston as for the current emission scenario presented in Section 3. *Table 6* presents a summary of emission estimates for the expanded operations.

1. [2] National Pollutant Inventory, Emission Estimation Technique Manual for Mining, Version 3.2, December 2001
2. National Pollutant Inventory, Emission Estimation Technique Manual for Fugitive Emissions, December 1999.
3. National Pollutant Inventory, Emission Estimation Technique Manual for Aggregated Emissions from Paved and Unpaved Roads, September 1999.

Table 6: Summary of Emission Estimates – Pit Extension

Sources	Emission Estimate (Kg/yr)	
	TSP	PM_{10}
1.Fimiston Open Pit		
Drilling	58,804	30,897
Blasting	9,691	5,039
Loading	199,887	94,541
Haulage	3,628,519	739,784
Wind Erosion	171,056	85,528
Total Pit Emission	4,067,957	955,790
2. Processing Plant		
Crushing	2,600	260
Screening	1,040	780
Conveying	61,920	41,150
Carbon Kilns	23,769	15,846
Total Processing Plant Emissions	89,329	58,036
3. Waste Dumps		
Wind Erosion – Waste Dump-1	544	272
Wind Erosion – Waste Dump-2	6,340	3,170
Wind Erosion- Waste Dump-3	13,767	6,883
Wind Erosion- Waste Dump-4	9,955	4,977
Wind Erosion - Waste Dump-5	3,560	1,780
Total Waste Dumps	34,166	17,082
4. Haulage (Pit to waste dumps and processing plant		
Dump trucks- Small	243,232	53,478
Dump trucks – medium	97,678	20,539
Dump trucks- Large	1,893,401	382,200
Heavy Goods Vehicle	861	574
Wheeled Loader	438	292
Wheeled Tractor	273	182
Total Haulage	2,235,883	457,265
5. TSF – Wind Erosion		
Fimiston-I	511	255
Fimiston-II	1,625	813
Kaltails	5,804	2,902
Total TSF's	7940	3970
6. Wind Erosion (Other)		
Service Corridors	4,535	2,268
Stockpiles	2,845	1,422
Total Wind Erosion (other)	7380	3690

<u>Notes</u>

1. A pit retention control of 50% was employed to the total emissions calculated above, therefore emissions used in the model (for the open pit) will be half of that displayed in the table above. This applies for both PM_{10} and TSP. The EET Mining Manual (V2.3) specifies a pit retention factor of 5% for PM10 however based on model validation studies, a 50% retention factor was used in the modelling as it provided better correlation with observations.
2. A high control efficiency has been applied for blasting emissions as KCGM employ a control strategy to ensure blasting is not undertaken during unfavorable winds. Therefore emissions from blasting are lower than other process emissions.

4.4 LIMITATIONS IN EMISSION ESTIMATES

A number of limitations exist for the expanded emission estimates and include:

1. Generally waste will be sent to the shortest haul dump based on dump availability, however for this study "worst case" emissions are considered with waste dumping equally proportioned between waste dumps.
2. Total surface areas have been considered in this assessment for estimation of wind erosion and this is considered "worst case".
3. Vehicle generated activities have been proportionally increased as they will vary during the construction phase of the extension however this will be managed through a comprehensive dust management plan. Therefore, the proportional increase in activities is considered conservative for the operational phase of the extension.
4. Wind erosion from service corridors, stockpiles and pads have also been assumed to increase proportionally (conservative estimate), due to limited information currently available on typical dimensions and surface areas of stockpiles, pads and service corridors.
5. Wind erosion from waste dumps and the TSFs have been determined based on the increased surface footprints.

5. AIR QUALITY IMPACT ASSESSMENT

5.1 BACKGROUND

This section outlines the air dispersion model used, its limitations and parameterisation, and presents the results of the modelling for both the existing and proposed operations.

5.2 MODEL METHODOLOGY

The dispersion of emissions from KCGM's Fimiston operations was modelled using Ausplume V6.0, Ausplume is a steady state Gaussian plume dispersion model based on the Victorian Environment Protection Authority's "Plume Calculation Procedure" (EPAV 1985) and was originally based on the US EPA's ISC3 model originally developed by Bowers *et al.* (1979). Ausplume is designed to predict the concentration or deposition of pollutants emitted from a variety of sources including stacks, area sources, volume sources, or any combination of these. Line source are not explicitly handled, but it is possible to improvise by modelling with multiple volume sources.

Initially, the Industrial Source Complex (ISCST3) model was chosen to estimate impacts for particulate emissions originating from a below grade open pit. This model accounts for partial retention of emissions within the pit by calculating an escape fraction for each particle size category. The variations in escape fractions across the particle sizes result in a modified distribution of mass escaping the pit. However due to the large size of the open pit, the ISCST3 in-pit algorithm could not be used. Therefore, the open pit was modelled effectively as an area source in Ausplume with a pit retention control efficiency of 50% employed (EET Mining Manual, Version 2.3).

5.3 MODEL ASSUMPTIONS

For modeling atmospheric dispersion of emissions from KCGM operations, the following options were selected.

1. Regulatory and/or default options were used unless stated otherwise;
2. Ground level concentrations are predicted at discrete receptors corresponding to locations of sensitivity. A Cartesian receptor grid was also used with local grid coordinates and a resolution of 250 m;
3. As a conservative assumption, only dry deposition was considered, as the effects of wet deposition would be minimal due to the generally low rainfall;
4. The air dispersion dispersion model has been used to determine the 24-hour and annual average ground level concentration of TSP & PM_{10}.
5. Ignore or only partly account for horizontal and vertical variation in turbulence, wind speed and wind direction within the boundary layer;
6. Predict ensemble-average concentrations but not the transient peaks caused by downdrafts in thermal convection eddies;

7. Assume quasi-steady conditions. This precludes simulation of events such as inversion breakup fumigation neither of which are considered to be significant for the emissions sources relevant to this project;
8. Ignore longitudinal diffusion (parallel to the plume axis), which restricts applications to wind speeds above about 0.5 m/s or so;;
9. Cannot precisely parameterise the complex flow in the wakes of buildings or other obstacles.

5.4 MODEL PARAMETERISATION

A summary of the model parameters and discharge characteristics are presented in the tables below.

Table 7: Summary of Model Parameters

Parameters	Description
Dust Types *Assessed*	TSP and PM_{10}
Terrain	No terrain elevation considered for screening assessment
Model Domain	The model domain covered a grid of 10 km x10 km.
Model	Ausplume
Meteorological File	TAPM Generated Meteorological file for 2004.
Background Concentrations	No background concentrations were included
Depletion	Only Dry depletion was considered
Wind profile exponents	Urban

The sources modelled in this study include the open pit, waste dumps, service corridors, stockpiles, processing plant, tailing storage facilities and associated haulage operations. A comprehensive summary of the sources modelled, source characteristics and emission estimates is presented in Appendix C. Figures 7 and 8 identify the location of the sources modelled for both the current and proposed operations. A copy of the Ausplume input file is presented in Appendix D

Figure 7: Summary of Sources – Existing Operations

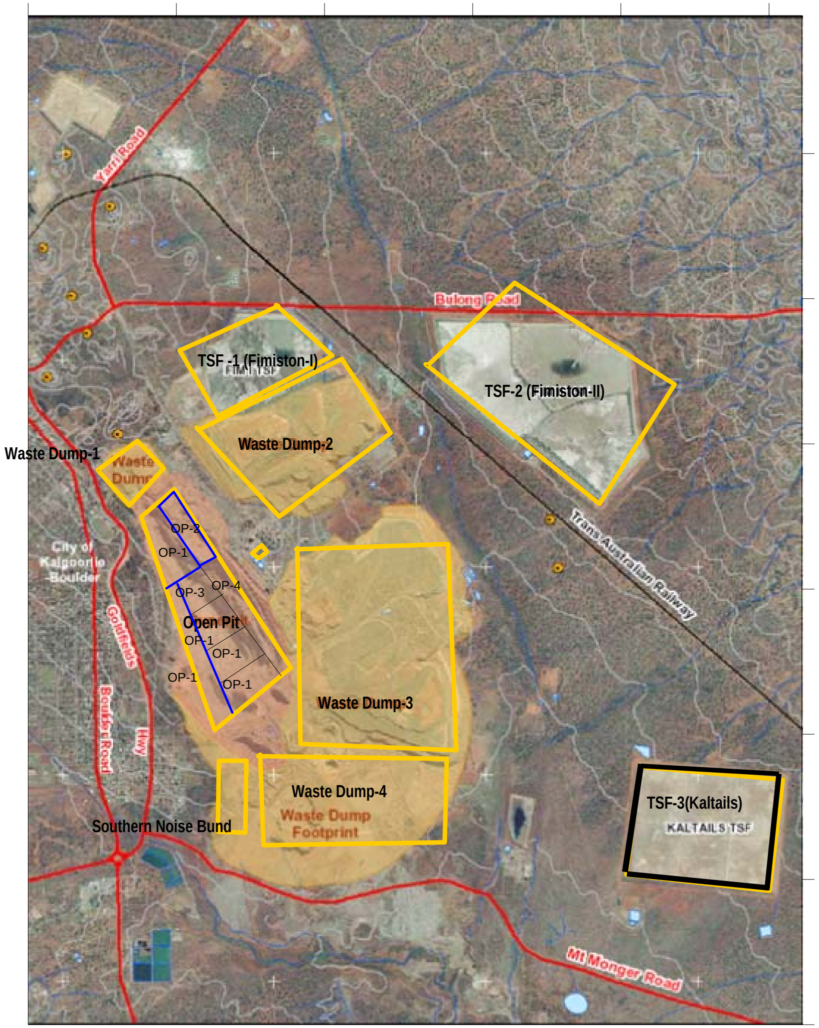
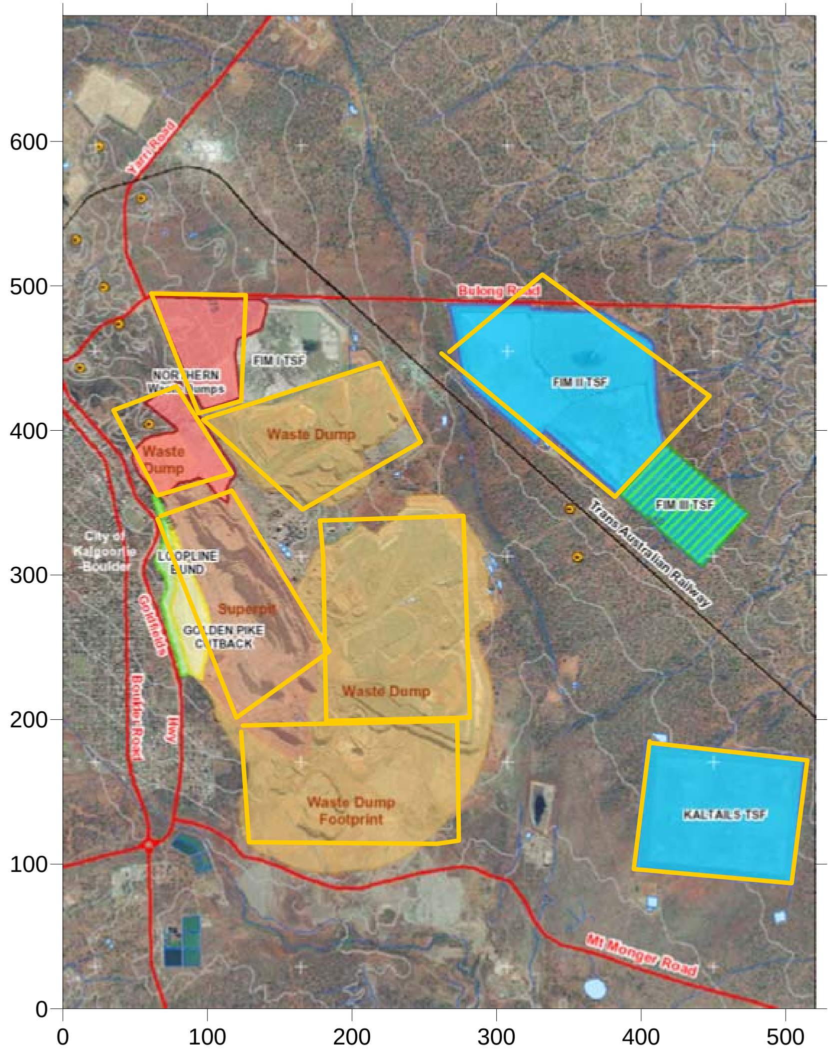


Figure 8: Summary of Sources – Proposed Extension



5.4.1 Dry Depletion Method

This study utilises Ausplume's dry deposition algorithm to calculate the dry deposition of particles. The deposition algorithm utilizes the product of concentration values and deposition velocity to determine deposition flux ($Fd = \chi d \upsilon d$), where χd is the airborne concentration just above the surface and υd is the deposition velocity (U.S. EPA, 1995b). Deposition velocity is characterized by gravitational settling, aerodynamic resistance, and deposition-layer resistance. Therefore, the physical attributes of the particle, such as diameter, shape, and density, are important and are direct inputs into the model. Aerodynamic resistance is parameterized by variations in the wind speed, atmospheric stability, and surface roughness length. The deposition-layer resistance is characterized by Brownian diffusivity and impaction.

Particle deposition can also result from the turbulent transport of atmospheric particles to a surface (vegetation, objects, or the ground). Dry deposition rates of particles from the plume to the ground are also dependent upon physical and chemical processes. The model used is a nonreactive emission model, and therefore chemical reactions that may affect deposition are not considered.

5.4.1.1 Particle Size Distribution

The particle size distribution (PSD) data used in this study were sourced from a combination of previous studies and reports as well as further PSD analysis undertaken by KCGM to determine mass fractions. A summary of the PSD data used to generate a composite data set is presented in *Table 8*.

Table 8: Summary of Particle Size Distribution Data

Source	<2.5µm	2.5-5.0 µm	5.0-10.0 µm	10-15 µm	15-30 µm	30-50 µm	50-90 µm
USEPA wind erosion (expressed as <30 µm)	20	30		10	40		
USEPA wind converted to <50 µm (expressed as TSP)	14.8	11.1	11.1	7.4	29.6	26	
USEPA Batch/Continuous (expressed as TSP)	11	9	15	13	26	26	
SPCC Operations –Isokinetic sampler	4	9	17	11	22	17	13
PSD Analysis – previous KCGM Reports	11.9	13.9	15.7	13.6	16.6	10.3	18
This Study (composite)	12	14	15	7.4	22	17	13

Notes

1. Percentages may not add up to 100% due to rounding.

For this study, a combination of USEPA PSD data and analysis undertaken on KCGM dust monitoring filters have been used to determine mass fraction data utilised in the model. The USEPA PSD and SPCC data was given priority over the filter analysis data primarily due to the distance of the TSP monitors from KCGM sources and therefore may not be representative of PSD at the source (due to particle deposition and settling).

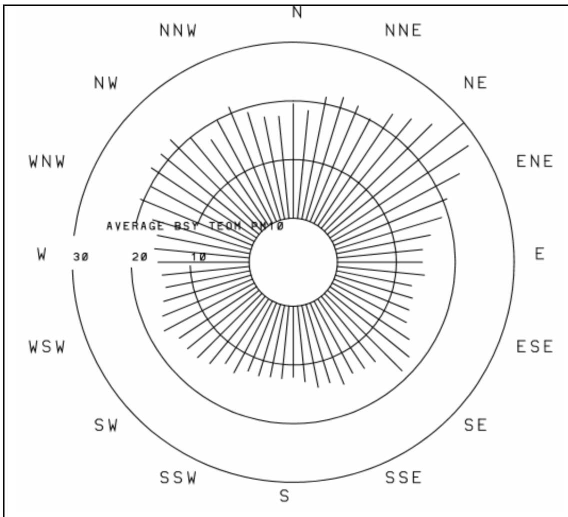
This study used the mass fractions presented in Table 8.

5.5 MODEL VALIDATION

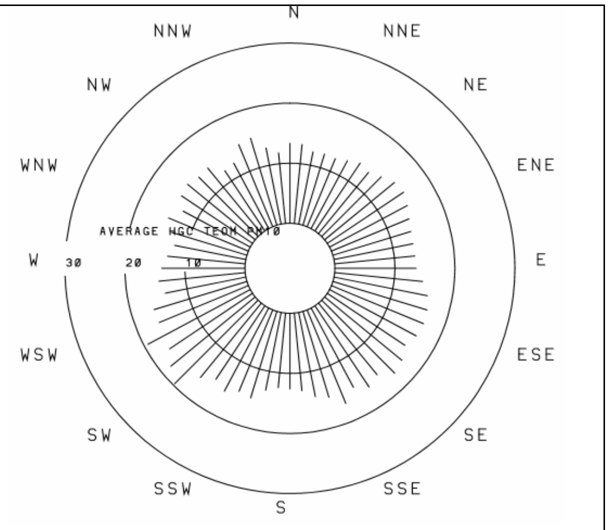
In order to obtain a measure of model performance, model predictions have been compared against monitoring data collected by KCGM. Both modelling and monitoring have some inherent uncertainties; the USEPA (USEPA 2001) indicates that modelling typically has inaccuracies of ±10% to ±40%. Ambient particulate monitoring is also associated with a number of inaccuracies and these increase as the monitored values approach the threshold of detectability. Typically measurement uncertainty ranges between ±5% and ± 20%.

KCGM owns and operates a network of high volume dust monitors. Three TSP dust monitors are located in close proximity to the Fimiston Open Pit at the Boulder Shire Yard (BSY), Clancy Street (CLY) and Hewitt Street (HEW) and are used to monitor particulate concentrations on days where blasting may be undertaken at the Fimiston Open Pit (Figure 4). These dust monitors are operated every day between 9:00am and 6:00pm on blasting days as blasting is only carried out between 9:00am to 5:30pm. An additional PM_{10} monitor was commissioned to measure dust arising from the southern extension of the environmental noise bund. In addition to the HVAS network, KCGM operates two BAM (Beta Attenuation Monitors) PM_{10} samplers with one located to the west of the pit and the other to the northwest of the KCGM operations. All monitors are operated in accordance with manufacturer specifications and relevant Australian and US EPA standards. A description of the sampling locations is presented in Appendix E. A summary of the BAM data as a function of wind direction (Dust roses) are outlined below. The dust roses present the average PM_{10} concentration for each of the nominated wind directions and are derived from the 5-minute average data recorded by the BAMs and the MEX wind data.

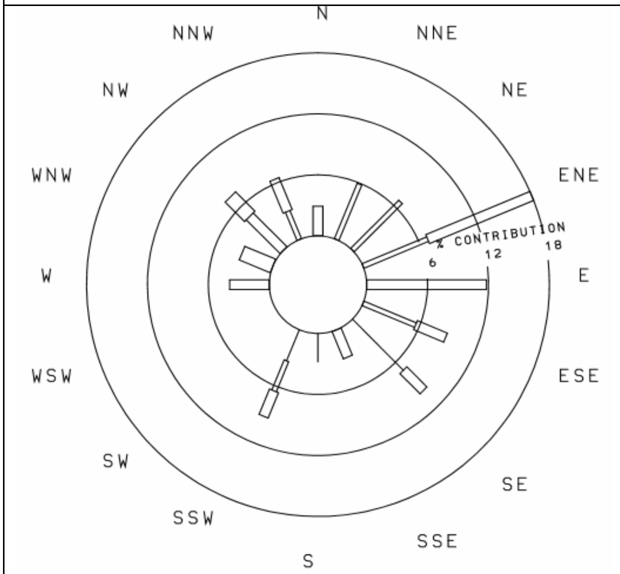
Figure 9: Dust Roses – BAM Monitoring Data



BSY BAM



HGC BAM



KCGM Social Club: percentage contribution to average PM10 as a function of average wind speed and wind direction, 26th May 2004 to 31st Dec 2005

The BAM monitor situated at the Boulder Shire Yard (BSY) indicates that the higher PM_{10} results are from the direction of KCGM, although the results clearly indicates that there is no strong wind direction dependence. Similarly the PM_{10} Dust rose for the Hannan's Golf Club (HGC) indicates that there is no dominant single particulate source contributing to the PM_{10} concentrations. As the KCGM social club monitoring is only available as a 24-hr average, a different analysis has been undertaken that calculated the average wind speed and direction and used this with the 24-hr average concentrations recorded to estimate the percentage contribution of each sector to the recorded concentrations. This analysis shows that the sectors aligned with KCGM's operations are a contributor to the overall PM_{10} concentrations recorded at the site. This result is not entirely unexpected for this site as the data were collected during the southern extension of the noise bund.

A time series summary (9 hour averages as the TSP monitors operate between between 9:00 am to 6:00 pm) of TSP data is presented in Figure 10.

Figure 10: Time Series Plots – HVAS TSP Monitoring Data

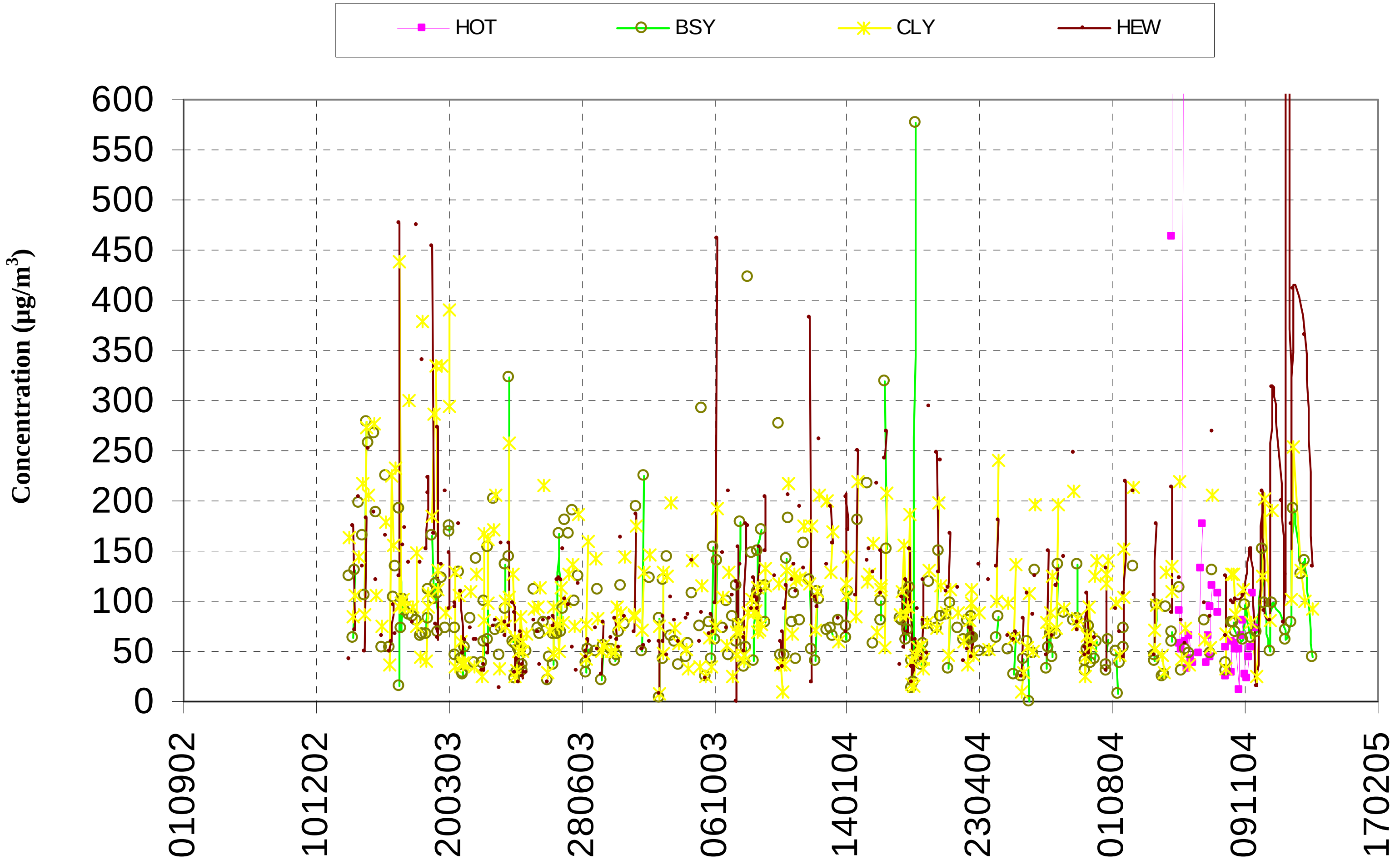
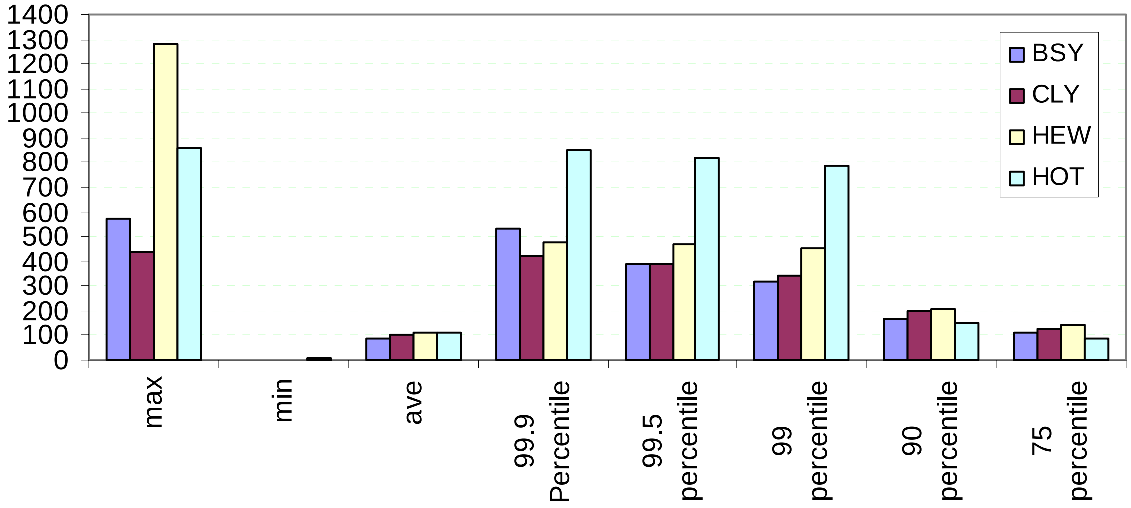


Figure 11: Summary of TSP Statistics



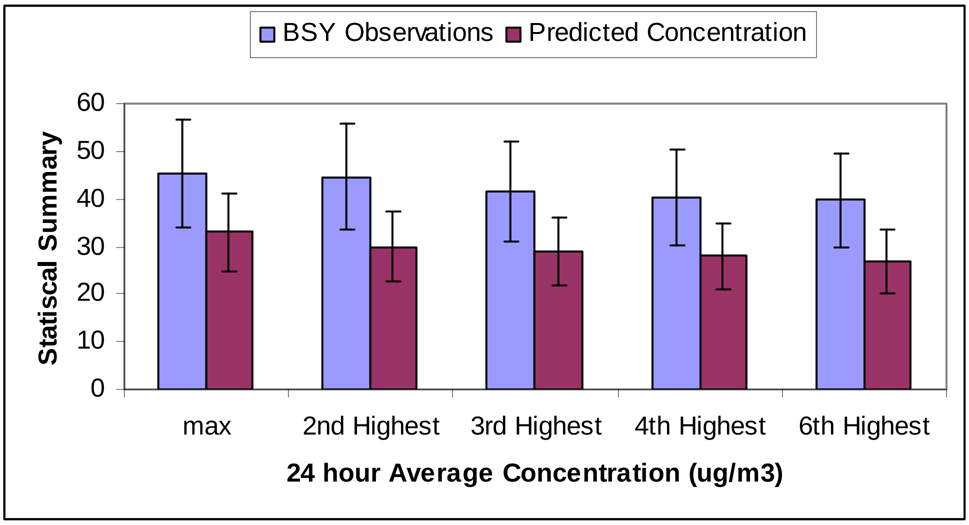
The results presented in Figures 10 and 11 indicate that the maximum TSP concentrations between the monitoring sites are highly variable and ranging from 400 µg/m^3 to 1200 µg/m^3 across the sites. However, the average concentration (9 hour average) for the four stations are between 90 µg/m^3 and 110 µg/m^3.

The air quality model results used in this study were compared against the PM_{10} monitoring data and not against the TSP monitoring data as the HVAS located to the west of the open pit only operate between the hours of 9.00 am and 6.00 pm to match the likely blasting times.

There are likely to be additional uncertainty in the comparison as the modelled vs monitoring periods are different. This is because the PM_{10} monitors were only installed in July 2005 and the modelled year was 2004. It is likely that intra-annual variability will be low as production throughput and other associated activities are similar between 2004 and 2005.

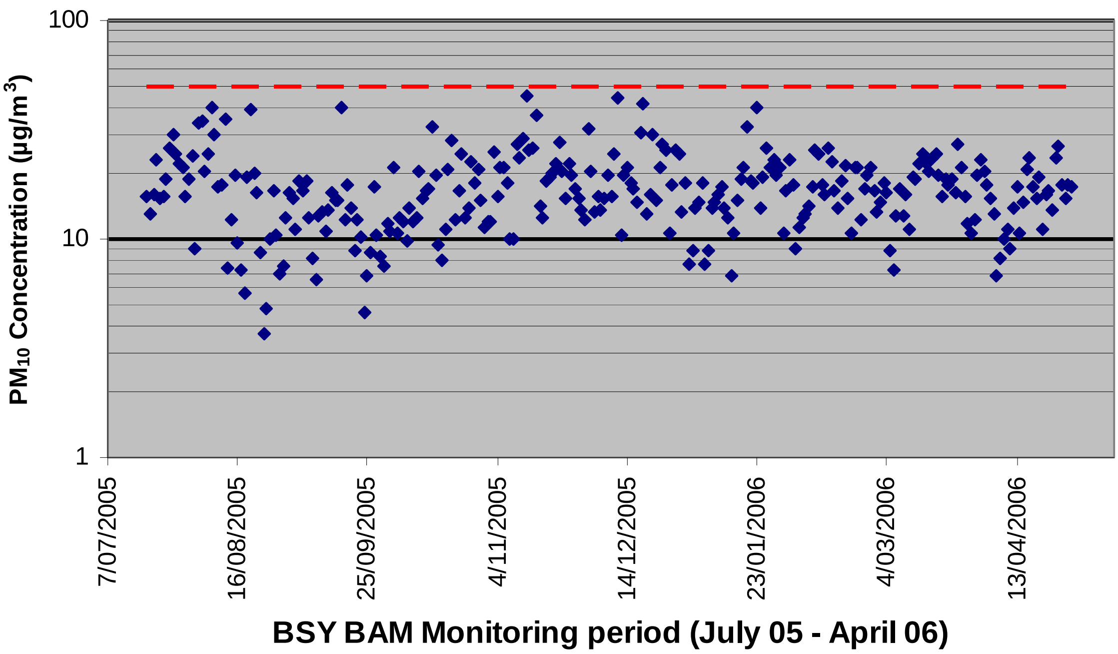
Figure 12 presents a comparison of the predicted vs. observed PM_{10} concentrations at the BSY site.

Figure 12: Statistical Summary – Observations vs. Predicted 24-hr PM_{10} Concentrations



The above results of the statistical summary indicates that the model under predicts the maximum concentrations, however screening the data based on wind direction (winds from KCGM) indicate that there is approximately a 20% difference between the predicted vs. observed concentrations. However, the modelling only considered KCGM's emissions whereas all of the monitoring data was used in the above comparison The dust roses (Figure 9) clearly indicates that KCGM is not the only source of particulates and as such, the apparent "under prediction" of the model is misleading. Review of time series data (Figure 13) at BSY indicate that the 24 hour average concentration measured between July 05 – April 06 is 17 µg/m^3, with no exceedences above the NEPM guideline.

Figure 13: Summary of BAM 24 hour Average Concentrations.



5.6 MODELLING RESULTS

A summary of the modelling results and concentration isopleths are presented in Table 9 and Table 10 and Figures 14 to 19.

Table 9: Summary of PM_{10} predicted ground level concentrations, existing and proposed extension.

Locations	Averaging Period	Existing ($\mu g/m^3$)	Proposed ($\mu g/m^3$)	NEPM Guideline ($\mu g/m^3$)
Hopkins St	24 hr maximum	48	47	50
	Annual Average	3.39	3.47	NS
Boulder Shire Yard	24 hr maximum	33	33	50
	Annual Average	4.28	4.30	NS
Clancy St	24 hr maximum	56	57	50
	Annual Average	8.37	8.30	NS
Hewitt St	24 hr maximum	137	133	50
	Annual Average	26.4	25.0	NS

Notes

1. NS – Not Specified in the NEPM Guideline value.
2. Bold value indicates exceedence of the NEPM guideline for PM_{10}.

Table 10: Summary of predicted TSP ground level concentrations, existing and proposed extension

Locations	Averaging Period	Existing ($\mu g/m^3$)	Proposed ($\mu g/m^3$)	EPP Guideline ($\mu g/m^3$)
Hopkins St	24 hr maximum	89	90	90
	Annual Average	7.0	6.5	NS
Boulder Shire Yard	24 hr maximum	70	76	90
	Annual Average	8.8	8.2	NS
Clancy St	24 hr maximum	91	91	90
	Annual Average	14	14	NS
Hewitt St	24 hr maximum	192	211	90
	Annual Average	38	37	NS

Notes

3. NS – Not Specified in the EPP Guideline value.
4. Bold value indicates exceedence of the EPP guideline.
5. Concentration units extracted from the closest grip point to the receptor coordinates.

Figure 14: Maximum Predicted 24-hour average ground level concentrations for PM_{10}, existing operation (top), proposed extension (bottom) (µg/m³)

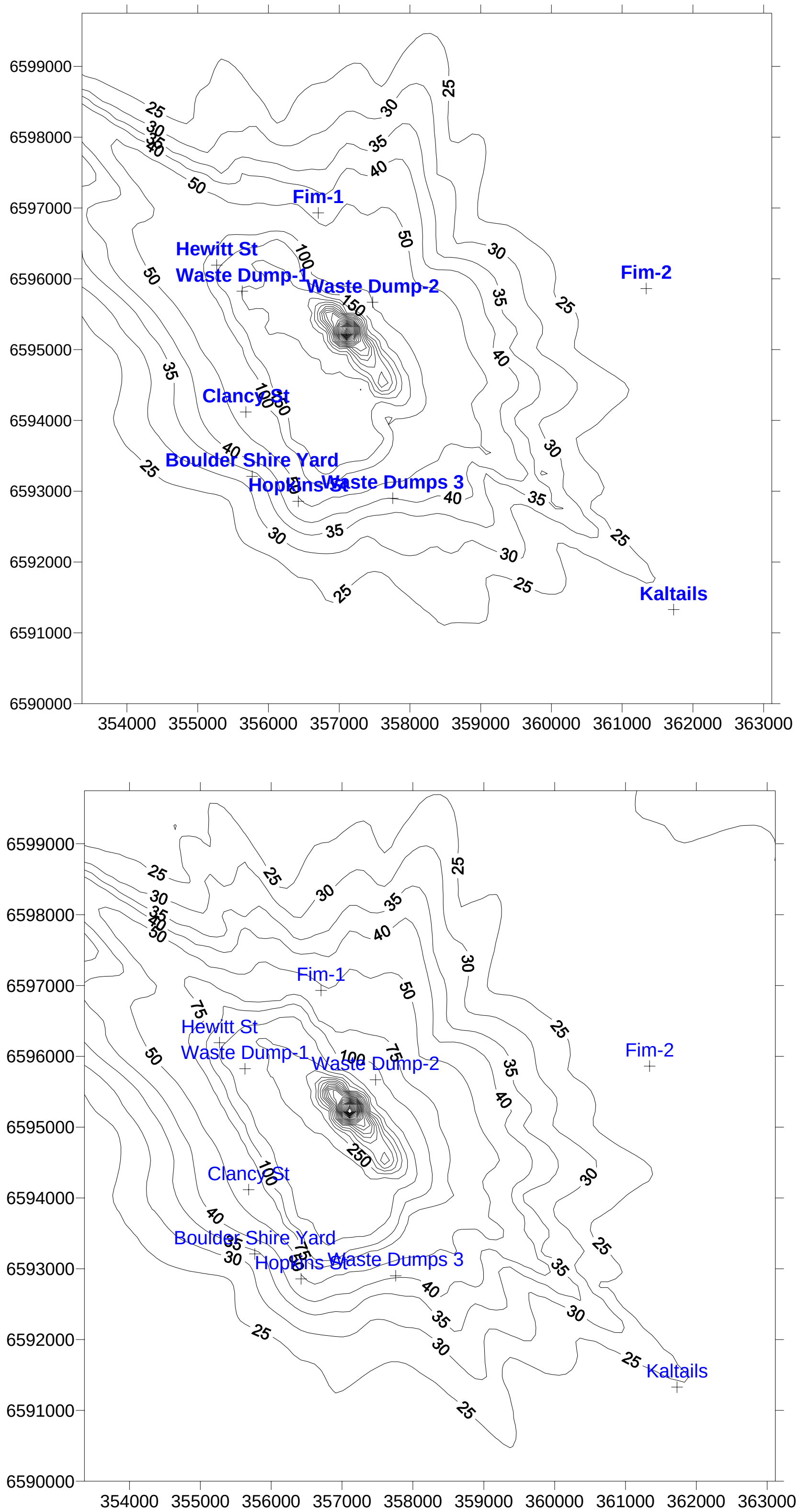
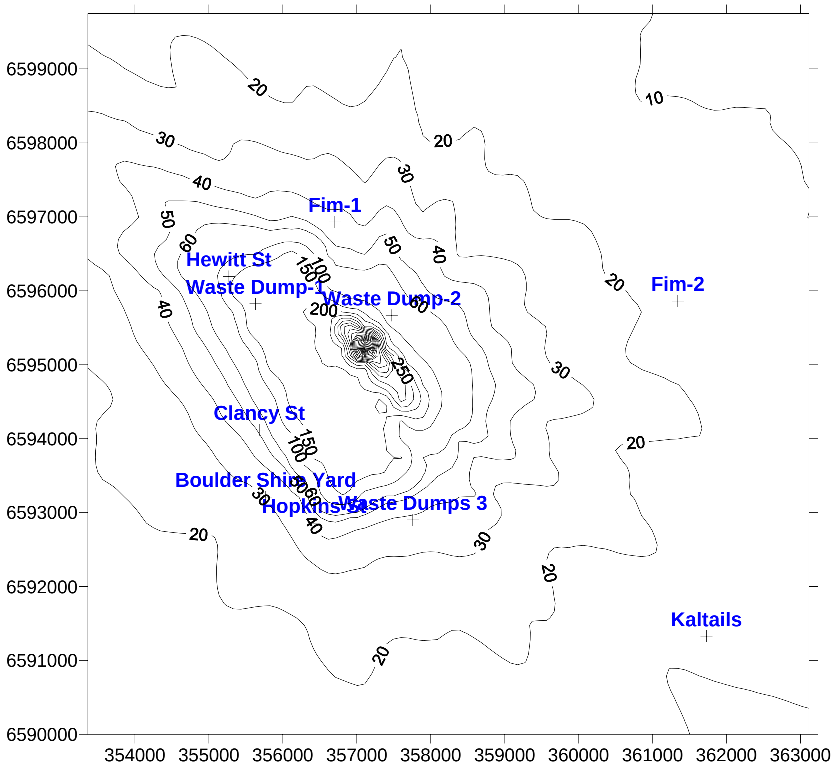


Figure 15: 99.5th Percentile predicted 24-hour average ground level concentrations for PM_{10}, existing operation (top), proposed extension (bottom) ($\mu g/m^3$)



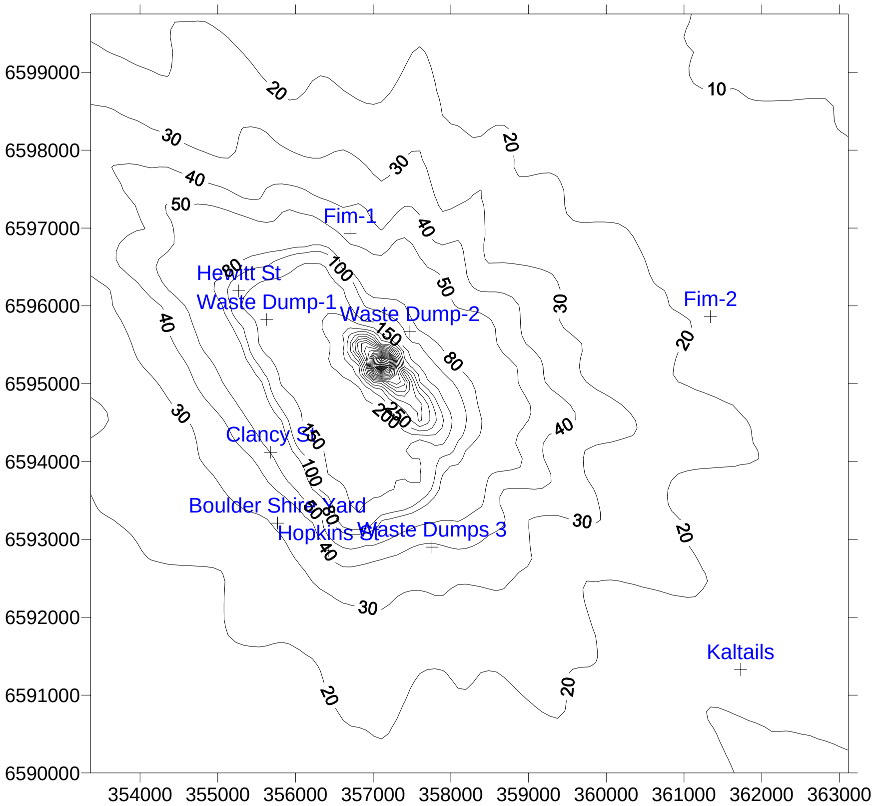


Figure 16: Predicted annual average ground level concentrations for PM_{10}, existing operation (top), proposed extension (bottom) ($\mu g/m^3$)

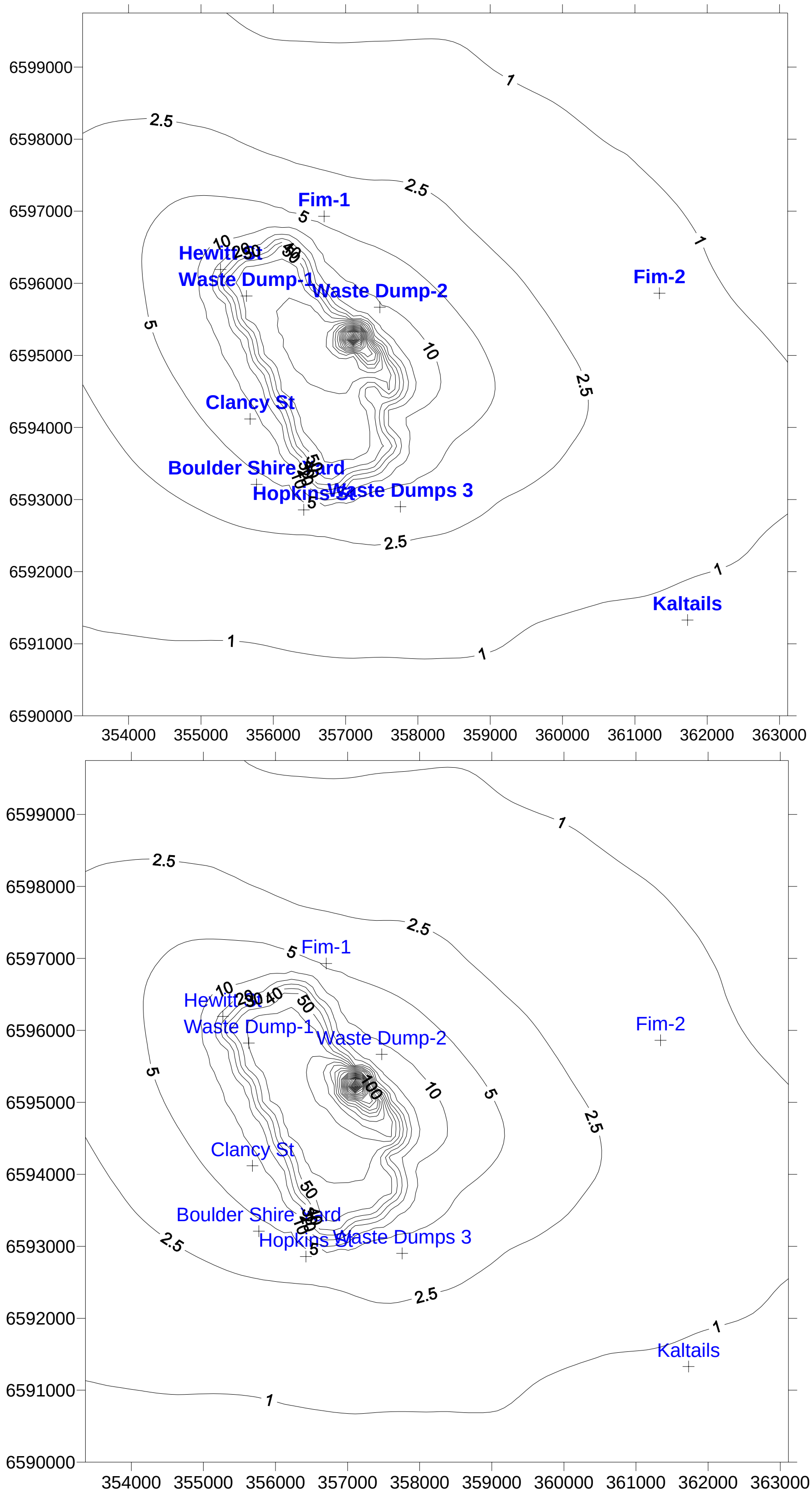
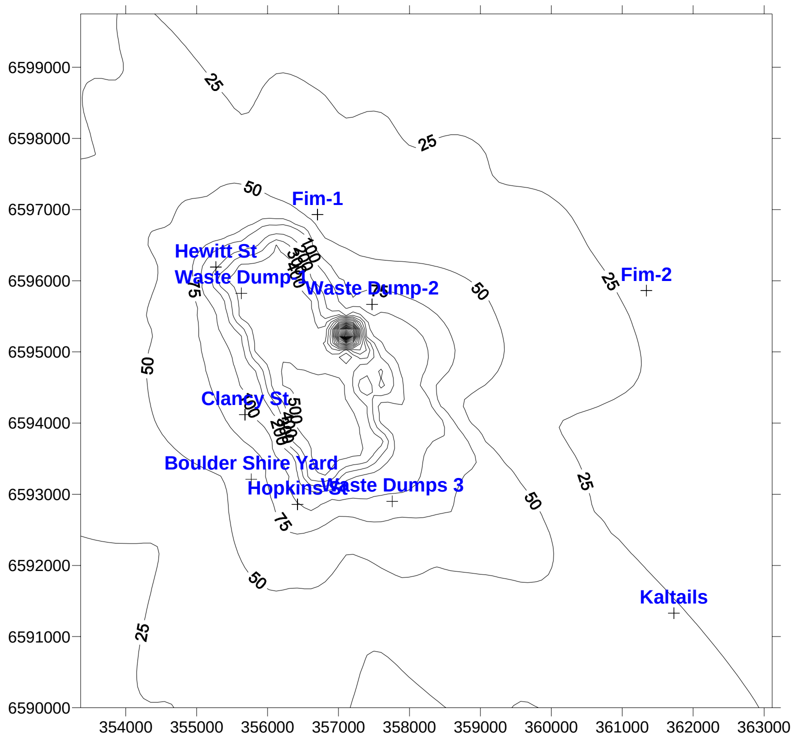


Figure 17: Maximum predicted 24-hr average ground level concentrations for TSP, existing operation (top), proposed extension (bottom) (µg/m^3)



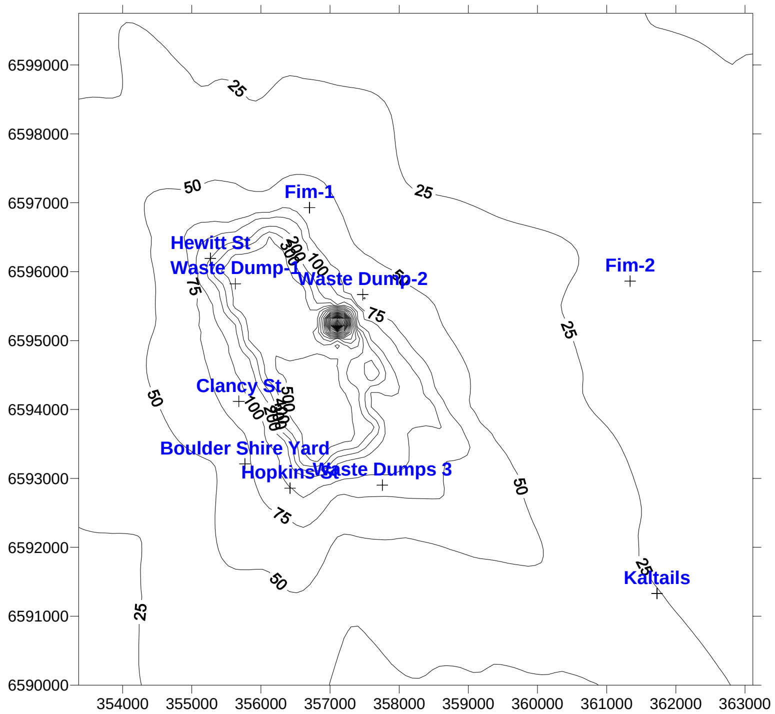
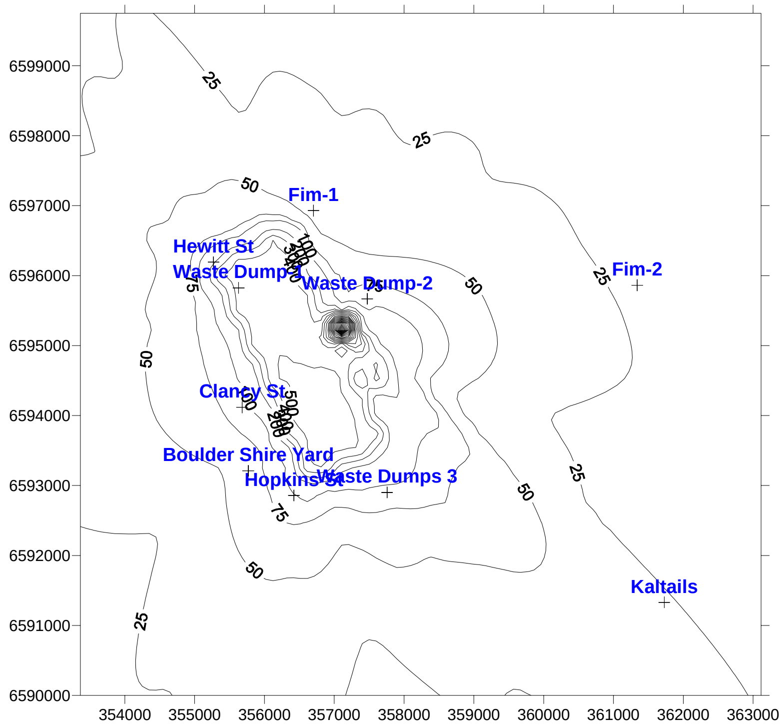


Figure 18: 99.5 Percentile predicted 24-hr average ground level concentrations for TSP, existing operation (top), proposed extension (bottom) (µg/m³)



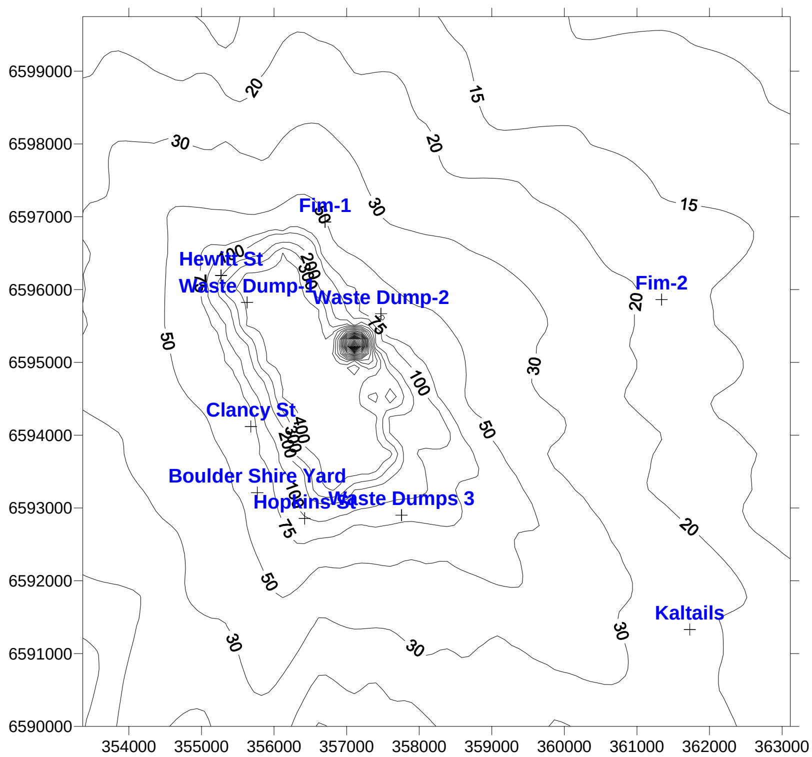
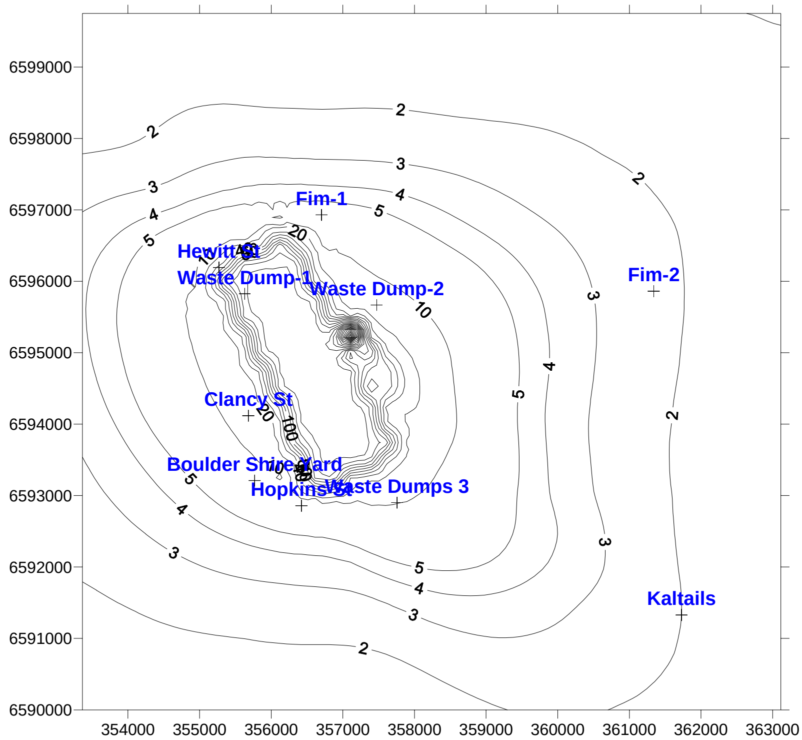
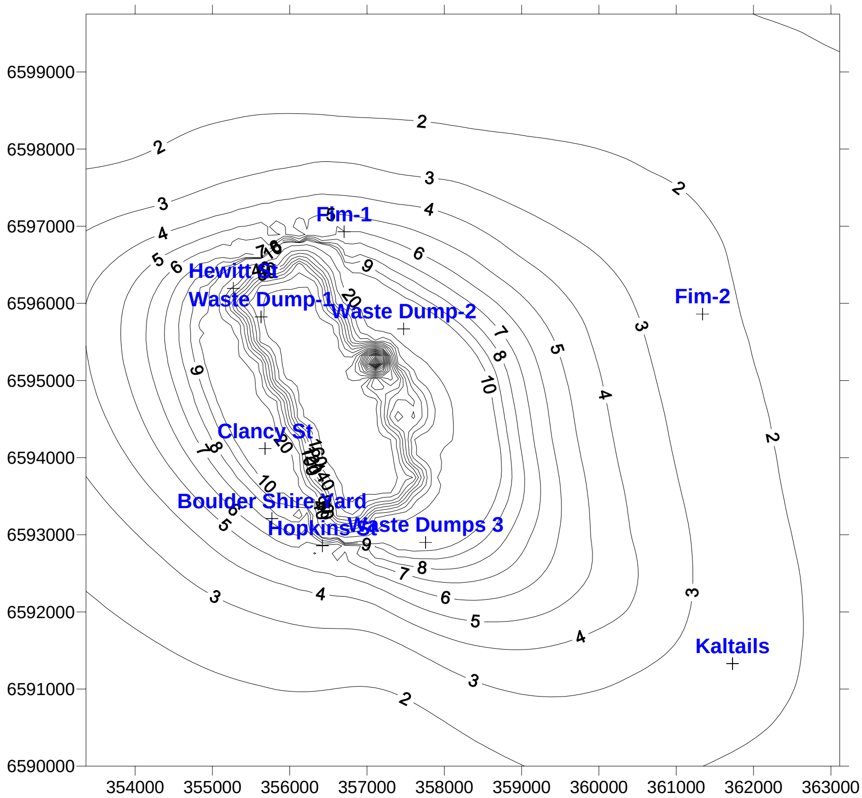


Figure 19: Annual average ground level concentrations for TSP, existing operation (top), proposed extension (bottom) (µg/m^3)





5.7 KEY FINDINGS

The key findings from the modelling study are:

1. The maximum predicted 24-hour average ground level concentrations are at or below the NEPM guideline values for the current operational scenario at all nominated receptors with the exception of the Hewitt St. The Hewitt St site is close to the open pit and waste dumps and therefore experiences higher ground level concentrations. Clancy St also experienced slightly elevated concentrations, however evaluation of the 99th Percentile 24 hour average concentrations at Clancy St indicate that these concentrations are below the NEPM guideline of 50 µg/m^3. This is viewed as a more robust statistic and removes the undesirable influence of unusual (stochastic) events, while still representing the highest concentrations.
2. Maximum 24-hour and annual average PM_{10} results exceed guideline values in the vicinity (within the KCGM facility boundary) of the sources modelled. These concentrations reduce rapidly further from the source.
3. The maximum 24-hour average ground level concentrations are below the NEPM guideline values for the proposed operational scenario at all nominated receptors with the exception of the Hewitt Street site. Clancy St also experienced slightly elevated concentrations, however evaluation of the 99th Percentile 24 hour average concentrations at Clancy St indicate that these concentrations are below the NEPM guideline of 50 µg/m^3
4. Overall predicted ground level concentrations from proposed operations are similar to predicted concentrations from current operations. This is because processing activities and total tonnes moved are similar. There are likely to be some higher localised impacts due to additional waste rock dumps and larger pit, however the impacts beyond the facility boundary are similar to that of current operations,
5. The results of the PM_{10} modelling indicate that the proposed pit extension is unlikely to result in an exceedence of the NEPM guideline at sensitive receptors to the west of the pit. However it is likely that on occasion receptors are likely to experience short term peaks in dust levels due to prevailing meteorology.
6. The results of the TSP modelling indicates that the 24-hour maximum concentration within the modelled domain exceeds guideline values within the KCGM boundary with these concentrations reducing rapidly further from the source.
7. All nominated receptors are at or below the Kwinana EPP 24-hour average guideline value with the exception of the Hewitt St location. The 24-hour maximum concentration at Hewitt St is above this guideline value at 190 µg/m^3 and 211 µg/m^3 for the current and proposed scenarios respectively.
8. Impacts at Hewitt St are above nominated guideline values for TSP and PM_{10} and are proposed to increase with the proposed extension due to the prevailing winds. These concentrations are above the NEPM guideline, and therefore ENVIRON recommends that additional real-time monitoring is undertaken to confirm the predicted modelling results. In the event that the dust concentrations measured at Hewitt St are above the nominated guidelines, additional management measures and controls are recommended to ensure that the NEPM guidelines are not exceeded.

6. DISCUSSIONS AND CONCLUSIONS

This assessment has largely been undertaken based on the requirements of the *Department of Environment's (DoE), Air Quality and Air Pollution Modelling Guidance Notes, June 2000* and on discussions with the DoE's Air Quality Branch. A Gaussian dispersion model (Ausplume) was used in this screening assessment.

The Air Dispersion Model (TAPM) was used to predict the local meteorology at Kalgoorlie and produce a Ausplume meteorological input file used to predict the ground level concentrations of PM_{10} arising from current operations and proposed extension of the Fimiston open pit. The assessment was base on synopitic meteorological data for the year 2004.

The annul windroses for all three data sets (TAPM generated, MEX (Metal Exploration Site) surface observations and DoE generated-1984 wind fields) indicate that the predominant winds are from the east to south east for most of the year with a lower frequency of winds from the north, northwest and south. TAPM generated winds are consistent with the annual summary statistics for the MEX station and the DoE generated meteorological data. Probably density function (pdf) plots indicates that TAPM tends to under predict the light winds and over predicts the winds between 3 m/s and 5 m/s. . Terrain effects have not been considered in this screening assessment because these releases are typically neutrally buoyant, with no plume rise to consider

Predicting the impacts of existing and proposed operations are based on best available modelling techniques and approved DoE modelling guidelines. The model validation studies undertaken using the BAM monitoring data at BSY indicated the difference in the predicted vs. observed concentrations at BSY was within 20%, indicating that the model predicted ground level concentrations arising from KCGM's operations were in the same range as that observed at the monitoring site.

The emission estimates developed for this study were based on current best practice and the use of the NPI emission estimation manuals to produce emissions estimates for the major sources at Fimiston. Emission estimates utilized in the modelling reflect the additional controls employed by KCGM to ensure that dust emissions during construction and operation are below NEPM guidelines beyond the facility boundary. Therefore, the emission estimates generated in this study were based on the model validation work undertaken to ensure that model predictions were consistent with observations. This has resulted in a reduction of the emission estimates by 60 % compared to those detailed in the NPI report.

6.1 CONSTRUCTION IMPACTS

Emissions during construction include fugitive dust emissions from wind erosion, vehicle generated dust and minor emissions from fuel combustion (vehicles). Construction impacts will arise during:

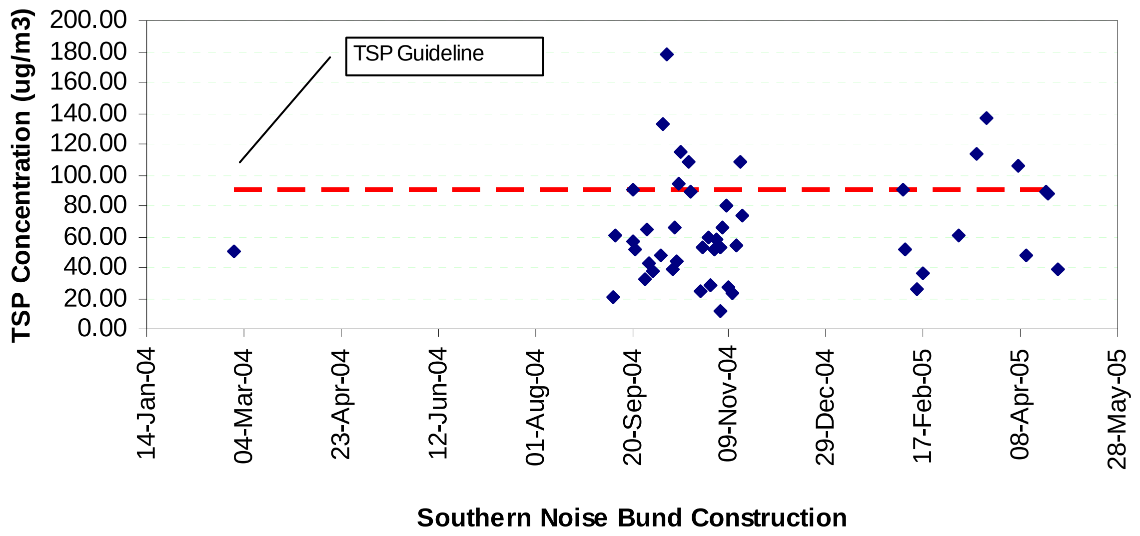
1. The construction and realignment of the environmental noise bund. This is of importance due to its close proximity to sensitive receptors and the nature of the material used;
2. The construction of additional waste dumps; and
3. Topsoil removal and surface works for the golden pike cutback.

Dust impacts will be managed, monitored and controlled by a comprehensive and rigorous dust management programme that includes:

1. Monitoring of current and forecast wind conditions using daily forecasts and real time wind speed and direction data to minimise off-site dust impacts and control construction operations;
2. Progressive rehabilitation to minimise exposed areas;
3. Use of water trucks and water cannons in areas that could produce dust. Fresh water will be used on areas to be rehabilitated;
4. Visual inspections for dust generation on a regular basis;
5. Use of additional dust control measures such as a dust binding agent if required;
6. Suspending work as deemed necessary from inspections, public feedback or prevailing wind conditions;
7. All contractors and staff involved with the project will undertake a site-specific induction to raise awareness including the importance of dust control;
8. Use of current monitoring network to assess dust emissions during construction; and
9. Ongoing consultation with stakeholders to determine the success of the dust management measures.

In addition, KCGM's dust monitoring program will be used to measure the effectiveness of the construction dust management plan with additional controls employed, if required. Figure 20 presents a summary of the TSP results measured during the construction of the Southern Noise Bund. Please note that 24-hr sampling was undertaken during the Southern Noise Bund construction.

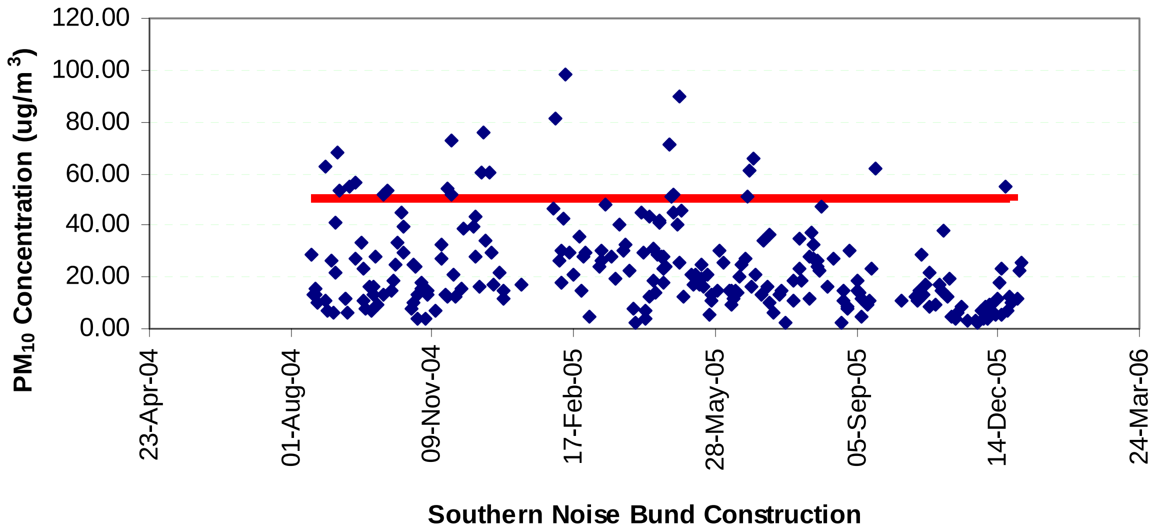
Figure 20: Summary of TSP Concentrations during Construction of Southern Noise Bund



The results presented in Figure 19 indicate that a majority of TSP concentrations recorded are well below Kwinana EPP guidelines of 90 μg/m^3. The measurement of a 24-hour TSP concentration of 180 μg/m^3 resulted in a review of dust control measures and the inclusion of additional controls. These data indicate that in general the measured TSP concentrations are below the guideline value with additional dust controls employed during high dust events.

Figure 21 presents a summary of the PM_{10} results measured during the construction of the Southern Noise Bund.

Figure 21: Summary of PM_{10} Concentrations during Construction of Southern Noise Bund



The results presented in Figure 20 indicate that there are approximately 23 exceedences of the NEPM over approximately 17 months of monitor operation during the construction of the Southern Noise Bund. Further analysis of the results were undertaken to review the predominant wind direction and speed during the high dust event periods. It must be noted that construction is not undertaken during high winds or when the prevailing winds are blowing towards town. Therefore it is likely that wind erosion (exposed surfaces and background sources) and other KCGM operations have contributed to the high dust events rather than construction activities on the southern noise bund. Presented in Table 11 is a summary of the predominant wind conditions during the recorded high dust event periods

Table 11: Summary of Wind Conditions during the High Dust (PM_{10}) Events

SNO	Date	PM_{10} Concentration ($\mu g/m^3$)	Wind Direction [1]	Average Wind Speed (m/s)	Comments
1	20/06/2005	**51.19**	**S, SW**	2.4	Not likely to be from Construction
2	29/04/2005	**52.04**	E, SE	3.6	Southern Noise Bund Sector
3	6/10/2004	**52.12**	**N, NW**	5.7	Combination of background sources and pit emissions
4	22/11/2004	**52.20**	**N, NW**	3.2	Combination of background sources and pit emissions
5	4/09/2004	**53.22**	E, NE	5.2	Southern Noise Bund Sector
6	8/10/2004	**53.65**	**S, SE**	2.5	Likely to be from other sources
7	20/11/2004	**54.16**	E, NE	2.7	Southern Noise Bund Sector
8	19/12/2005	**54.81**	N, NW	5	Emissions likely from the Pit and KCGM operations
9	11/09/2004	**55.02**	**E, SE**	4.9	Southern Noise Bund Sector
10	15/09/2004	**56.78**	**S, SE**	3	Not likely to be from Construction
11	14/12/2004	**60.06**	E, NE	4	Southern Noise Bund Sector
12	20/12/2004	**60.58**	N, NE	3	Southern Noise Bund Sector
13	21/06/2005	**61.43**	**S, SE**	1.5	Not likely to be from Construction
14	19/09/2005	**61.83**	N, NE	3.6	Combination of Background sources and pit emissions
15	25/08/2004	**62.50**	**W, SW**	5	Not from Construction
16	24/06/2005	**65.44**	**SW, W**	3.2	Not from Construction
17	3/09/2004	**67.91**	NE, E	3	Southern Noise Bund Sector
18	26/04/2005	**71.22**	E, SE	2.5	Southern Noise Bund Sector
19	23/11/2004	**73.10**	E, NE	3	Southern Noise Bund Sector
20	15/12/2004	**75.65**	N, NE	3	Combination of Background sources and pit emissions
21	4/02/2005	**81.50**	E, NE	3.2	Southern Noise Bund Sector
22	3/05/2005	**89.70**	**N, NW**	3.3	Combination of background sources and pit emissions
23	11/02/2005	**98.24**	NE	4.1	Southern Noise Bund Sector

Notes

1. Predominant wind directions are detailed in the Table above and extracted from 10min and hourly wind speed and direction data from the KCGM MEX station.

2. N = North, S= South, W= West, E = East

The data analysis indicates that 11 out of the 23 PM_{10} concentrations that were above the NEPM are most probably due to dust emissions generated from activities around the Southern Noise Bund sector. The other high PM_{10} concentrations are most probably due to background sources (6) and KCGM pit operations (6).

6.2 OPERATIONAL IMPACTS

The modelling of the current and proposed extension indicates that the 24 hour average PM_{10} ground level concentrations are below NEPM guideline values at nominated receptors for both current and proposed operations with the exception of the Hewitt St receptor. The receptor at Clancy St also experienced slightly higher concentrations under the current and proposed scenario however evaluation of the 99th Percentile 24 hour average concentrations at Clancy St indicate that these concentrations are below the NEPM guideline of 50 µg/m^3. This is viewed as a more robust statistic and removes the undesirable influence of unusual (stochastic) events, while still representing the highest concentrations.

The modelling had indicated that there is a marginal decrease in the predicted ground level concentrations due to the proposed extension at the Hewitt St receptor, whereas at other receptors to the west of pit the emissions from the proposed extension will be marginally higher than current emissions. The predicted 24-hour average TSP concentrations for both the current and proposed scenarios are at or below nominated guideline values for all receptors with the exception of Hewitt St. Annual average TSP concentrations predicted for both the current and proposed scenarios are also below nominated guideline values. In general the model predicted marginally lower ground level concentrations for the proposed scenario compared to the current scenario due the reflection of tonnes mined.

The prevailing winds and the proximity of to the mining operations influence the predicted PM_{10} and TSP concentrations at the Hewitt St receptor. As both the maximum 24-hr TSP and PM_{10} modelling indicates exceedence of their nominated guideline value, ENVIRON recommends that further real-time monitoring is undertaken at this site to obtain a better understanding of dust impacts to subsequently influence management of dust generating activities, if required.

6.2.1 Tailing Storage Facilities

KCGM currently operates two TSFs at the Fimiston Operations; Fimiston I and Fimiston II .

1. Fimiston I TSF: The Fimiston I TSF is situated to the north of the Fimiston Mill. Approximately 12 Mtpa of tailings solids are pumped as a slurry from the Fimiston Mill to both of the Fimiston I and Fimiston II TSFs. While this may vary annually, the ratio has generally been of the order of 20% to the Fimiston I TSF and 80% to the Fimiston II TSF. The Fimiston I TSF is approximately 110 ha in size and approved (subject to meeting

performance targets) to a height of 40 m. Height increases from 30 m to 40 m are limited to 2.5 m lifts.

2. The Fimiston II TSF is located east of the Fimiston operations and is bounded along much of the north eastern side by Bulong Road and along the western side by the Trans-Australian Railway line and corridor. Deposition into the Fimiston II TSF commenced in 1991 and the facility is currently operated as three separate cells A/B, C and D.

3. The Kalgoorlie Tailings Retreatment Project (Kaltails) was a joint venture project undertaken during the period 1988 to 1999. Kaltails reprocessed historical tailings material from storage facilities that were constructed along the Golden Mile during the early part of the century. The Kaltails TSF is located approximately 5.4 km east south east of the Fimiston Mill, and covers an area of 250 ha. The existing facility comprises of six cells. The perimeter embankments vary in height due to the difference in the natural ground slope across the extent of the TSF. Kaltails is currently not operational.

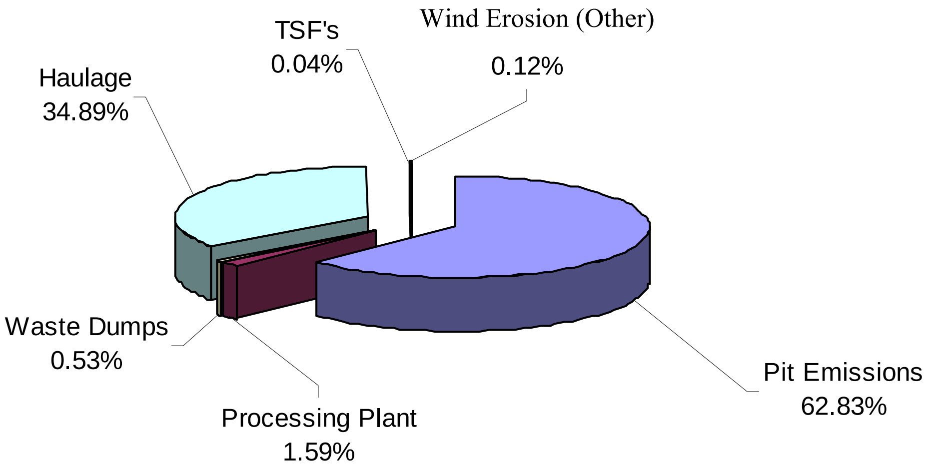
Dust emissions from TSF's are generated by wind action on the tailings dams and predominately from the surface of the dams as the wall of the embankments undergo progressive rehabilitation to minimize dust emissions from wind action. Research undertaken by CSIRO[3] had indicated that:

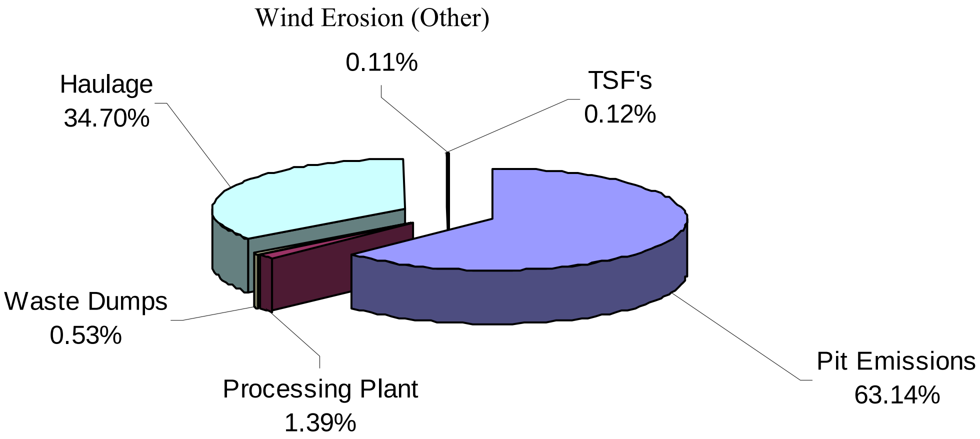
1. Both water content and salt content are important in binding potential saltation and dust particles to the surface;
2. the physical structure and chemical composition of the surface crust, important in limiting the extent of dust generation depends on the nature of the weathering processes and the salt transport

And on the basis of the work undertaken by CSIRO at KCGM it appears that the fresh hyper saline tailings prevalent at the Fimiston I & II have little potential for dust generation. In addition the calculation of emission estimates based on emission factors indicates that the TSF's are a minor contributor to overall dust emissions. A break down of TSP concentrations for all sources are presented in Figure 22 for both the current and proposed scenarios.

[3] CSIRO, Minesite Rehabilitation Research Program, Dust Generation from Tailings, Development of the micro wind tunnel and preliminary investigations of tailing surfaces, May 1997.

Figure 22: Summary of Source Contribution for Current (top) and Proposed (bottom) scenarios





6.2.2 $PM_{2.5}$

To demonstrate there will be no $PM_{2.5}$ exceedences at sensitive receptors, the maximum concentrations over the modelled year were extracted at sensitive receptors and the particle mass fraction of 0.293 (*determined from Particulate Size Distribution Data, Table 8 in the Air Report*) was used to determine the contribution of $PM_{2.5}$ at sensitive receptors. Presented in Table 12 is a summary of the calculated $PM_{2.5}$ concentrations at nominated sensitive receptors.

***Table 12*: Summary of $PM_{2.5}$ Concentrations (μg/m^3) at Sensitive Receptors**

Locations	Averaging Period	Existing Operations	Proposed Operations	NEPM Guideline
Hopkins St	24-hr Maximum	15	14	25
Boulder Shire Yard	24-hr Maximum	8.5	11	25
Clancy St	24-hr Maximum	15	13	25
Hewitt St	24-hr Maximum	25	28	25

The maximum predicted ground level concentrations are below the nominated NEPM guideline values for the current and proposed scenarios at all nominated receptors with the exception of Hewitt St. This exceedence is similar to that for the PM_{10} modelling scenarios. The Hewitt St receptor is close to the open pit and waste dumps and therefore on occasion experience higher ground level concentrations due to prevailing winds.

6.3 DUST MANAGEMENT PLAN – SUMMARY

The objective of KCGM's dust management and monitoring program is to pro-actively manage site operations to ensure that dust levels do not exceed NEPM criteria for PM_{10} at the KCGM dust monitoring locations.

Dust generated from blasting of the Golden Pike Cutback, land clearing and waste rock dump construction will be managed under a Revised Dust Monitoring and Management Programme. Through the implementation of this programme, KCGM commits to undertake all reasonable, practicable and safe measures to minimise dust emissions from its operations. Dust management for mining the Golden Pike Cutback, land clearing, the construction of waste rock dumps and general operations will incorporate the following practices:

1. Progressive rehabilitation to minimise exposed areas;
2. Monitoring of current and forecast wind conditions using daily forecasts and real time wind speed and direction information to determine the most appropriate conditions to undertake potentially dust-generating activities (e.g. blasting, construction activities);
3. Use of water trucks and water cannons in areas that could produce dust. Fresh water will be used on areas to be rehabilitated;
4. Use of additional dust control measures (i.e. a dust binding agent);
5. Visual inspections for dust formation on a regular basis;
6. Suspending work as deemed necessary from inspections, public feedback or prevailing wind conditions;
7. All relevant contractors and staff involved will undertake a site-specific induction to raise awareness including the importance of dust control; and

8. Ongoing consultation with stakeholders to determine the success of the dust management practices.

The proposed Dust Monitoring and Management Programme will incorporate both a predictive and reactive control strategy to control dust emissions from KCGM Operations. KCGM currently employ a predictive and reactive system for blasting emissions and during any construction activities undertaken at KCGM.

6.3.1 Predictive Control Strategy

The predictive control strategy is used to determine if forecast or actual meteorological conditions are likely to disperse these dust emissions towards town (Kalgoorlie). The predictive control strategy utilises the BoM daily forecast data and real time wind speed and direction monitoring data to inform KCGM whether additional controls are required during construction and ongoing operation activities such as stopping work or additional watering of roads, stockpiles and exposed areas.

6.3.2 Reactive Control Strategy

The reactive control strategy is currently triggered via inspections or public feedback. If the dust levels are deemed to be potentially unacceptable then work may stop or additional control measures will be employed.

KCGM is currently considering the setting of trigger values based on both meteorological measurements as well as dust measurement at the nominated allocated dust monitors that form the dust monitoring network.

Limits and targets will be defined based on achieving 24-hour average PM_{10} levels below the NEPM of 50 $\mu g/m^3$ at the KCGM dust monitors to reduce potential impacts on the adjacent community. However it must be recognised that there is some difficulty in determining the exact source of dust due to the numerous contributing sources, therefore KCGM will focus on periods when the prevailing winds indicate that the potential dust is from the Open Pit operations. This reactive strategy will be considered based on the results of the Proposed Monitoring Program, i.e. pursuant to the progressive replacement of the High Volume Samplers with real time monitors, this real-time data will be used (*in conjunction with meteorology and operational information*) to inform KCGM if a more advanced dust control strategy such as the reactive control strategy is warranted.

In addition, KCGM undertake continuous improvement programs which will ensure that the revised Dust Management Plan will undergo continuous improvement based on the efficiency of the control strategy. For instance an opportunity to improve water truck efficiency was recently identified and implemented. The diameter of the water discharge pipe at the filling station was increased to reduce the time taken to fill the water trucks and therefore reduce their standby time. Continuous improvement initiatives will continue to be identified throughout the life of the KCGM operation.

6.3.3 Proposed Monitoring Program

KCGM owns and operates a network of high volume dust monitors. These are located in close proximity to the Fimiston Open Pit and are primarily used to and monitor dust from blasting. The monitors are operated from 9:00am to 6:00pm on days when blasting is undertaken (blasting is only carried out between 9:00am to 5:30pm). The results of the dust monitoring network are provided to the DoE as part of the KCGM Annual Environmental Report.

KCGM has recently installed two Beta Attenuation Monitors (BAM) that can collect real-time data to assess short-term impacts. As part of the reviewed Dust Monitoring and Management Plan KCGM will progressively replace and update the existing high volume dust monitors with real-time monitors such as the BAMs or early warning monitors such as the EBAMs. However the suitability of these monitors will need to be investigated first, prior to implementation.

6.3.4 Predicted Outcome

The Fimiston Gold Mine Operations Extension is not expected to result in any noticeable change in dust impacts from existing operations. KCGM will continue to implement the Revised Dust Monitoring and Management Programme to ensure environmental values and health, welfare and amenity of people and land uses are not adversely affected.

7. GLOSSARY

Ambient measurement	A measurement taken in an ambient medium.
Background level	The concentration of a substance in a defined control area during a fixed period of time before during and after a data gathering operation
BOM	Bureau of Meteorology
E	East
PM_{10}	Particulate matter less than ten micron
PM2.5	Particulate matter less than 2.5 micron
EPA	Environment Protection Authority
Exposure Concentration	The physical course a chemical or pollutant takes from the source to the person exposed.
Guidelines	Principles and procedures to set basic requirements for general limits of acceptability for assessments.
Ha	Hectare
Limit of Detection:	The minimum concentration of an analyte that, in a given matrix and with a specific method, has a 99% probability of being identified, qualitatively or quantitatively measured, and reported to be greater than zero.
N	North
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
SPCC	State Pollution Control Commission of New South Wales
$\mu g/m^3$	micrograms per cubic metre
VKT	Vehicle Kilometre Travelled
VOC	Volatile Organic Compounds
W	West
Worst Case	A semi quantitative term referring to the maximum possible exposure, dose, or risk, that can conceivably occur, whether or not this exposure, dose or

8. REFERENCES

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3. National Pollutant Inventory, Emission Estimation Technique Manual for Fugitive Emissions, December 1999.
4. National Pollutant Inventory, Emission Estimation Technique Manual for Aggregated Emissions from Paved and Unpaved Roads, September 1999.
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6. PB 2005, KCGM National Pollutant Inventory Report 2004-2005. Draft (Revision A), October 2005:
7. Hurley, P. (2002). The Air Pollution Model (TAPM) Version 2 User Manual CSIRO Atmospheric Research Internal Paper No. 25. Apr. 2002.
8. National Environment Protection Council (NEPC) (1998). National Environment Protection Measure for Ambient Air Quality. NEPC, 26 Jun 1998.
9. EPA Vicoria (1986), Publication No.264, The Ausplume Gaussian Dispersion Model", Victorian Government Printer.

Appendix A

Seasonal Wind Roses

Figure 1

Summer

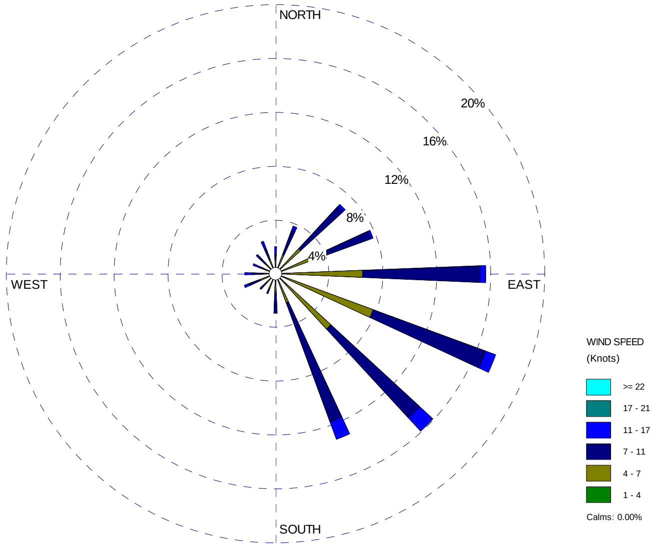


Figure 2

Autumn

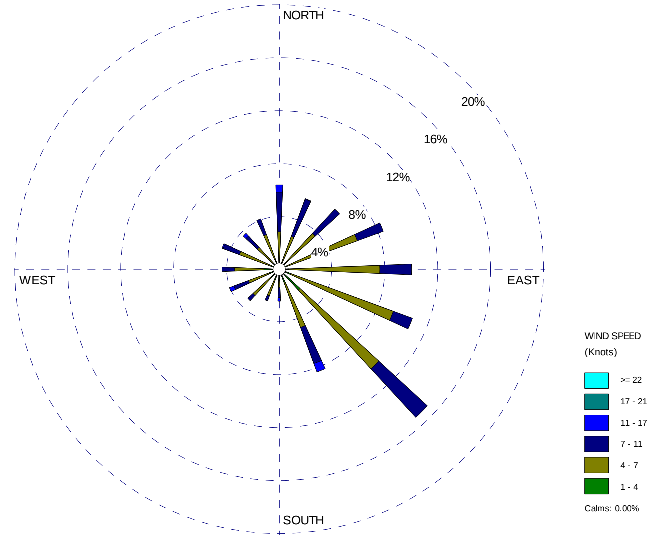


Figure 3

Winter

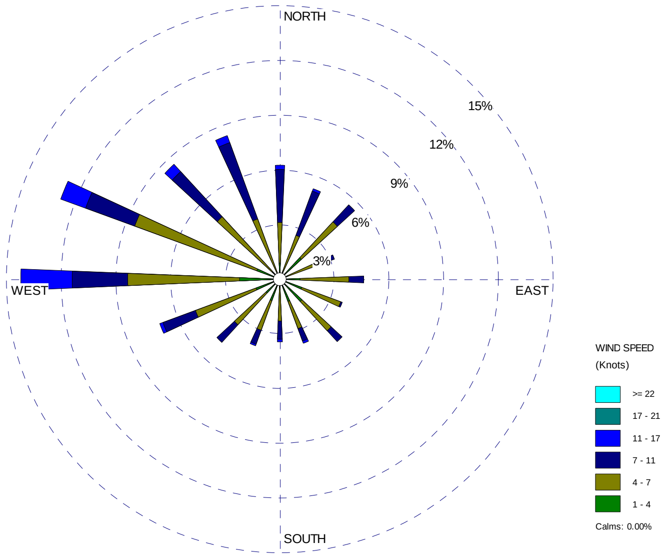
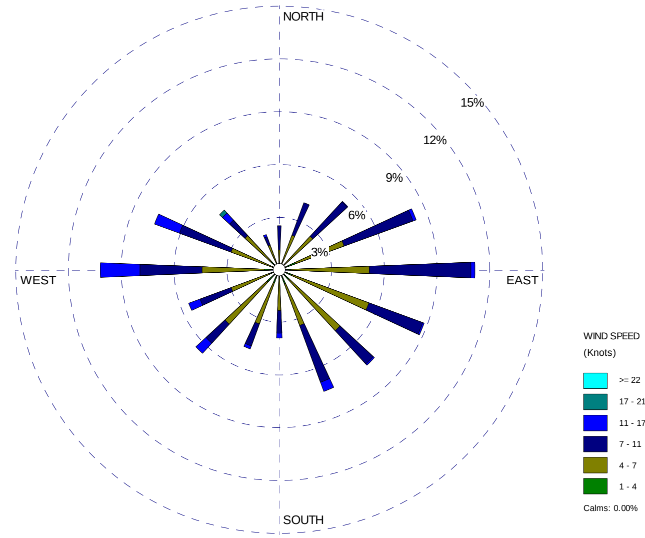


Figure 4

spring



Seasonal WIndroses

Client: KCGM

ENVIRON

Project: Dust Impact Assessment

Drawing Ref: NMS

Date:

Appendix B

Heavy Metal Speciation Analysis

Filter Analysis

A selected number of filters from the three High Volume Samplers were analysed for Heavy Metals by Geotech on the 9th November 2005 using AAS and ICP. As these were historical filters, filter blanks were not available therefore the clean sections of the filters from a selected number of filters were removed and analysed as blanks. Although this approach is not in accordance with Australian Standard methodology, an indication of filter blank concentrations was required. This approach is reflected in the high blank readings for Barium and Zinc, also it is important to note that zinc acetate is normally used as a binder is such filters. The filers were selected based on prevailing wind direction. The concentration results was calculated based on the volume of air sampled in cubic meters and corrected to reference conditions (0^oC and 101.3 Kpa) . The main focus of the filter analysis was to assess the As and Hg emissions presented on the filters.

Analyte	Client ID	**Blank (edges from two filters)**	**BSY**	**CLY**	**HOP**	**HOP**	**Guideline**
	PQL ug/filter	µg/filter	µg/filter	µg/filter	µg/filter	µg/m^3	
Antimony	40	<40	<40	<40	<40	<0.027	
Arsenic	2	<2	<2	<2	6	0.004	0.0073
Barium	20	3100	1900	1800	230	0.154	4
Beryllium	1	<1	<1	<1	<1	< 0.007	
Cadmium	4	<4	<4	<4	<4	<0.0027	
Chromium	20	<20	<20	<20	<20	<0.0135	
Cobalt	20	<20	<20	<20	<20	< 0.0135	
Copper	20	20	24	20	<20	< 0.0135	
Lead	20	<20	<20	<20	32	0.022	
Manganese	20	<20	<20	32	120	0.081	
Mercury	0.2	<0.2	<0.2	<0.2	0.36	0.0002	0.4
Nickel	20	<20	<20	<20	<20	< 0.0134	
Phosphorus	120	<120	<120	<120	<120	< 0.080	
Selenium	2	<2	<2	<2	<2	< 0.0013	
Silver	20	<20	<20	<20	<20	< 0.0135	
Tellurium	4	<4	<4	<4	<4	< 0.0027	
Zinc	20	2800	1800	2000	180	0.12	

Notes

1. Arizona State ambient guidelines used in the Guideline column
2. Volume sampled by this HVAS is 1486 m^3, approximately 21 hours run time.
3. HOP: Hopkins St Sampler
4. BSY: Boulder Shire Yard Sampler
5. CLY: Clancy Street Sampler

Appendix C

Emission Estimates – Current and Proposed Operations

Emission Estimates – Calculated to g/s based on Kg/yr

The modelling was completed using a standard unit emission rate of 1 g/s for all sources. The standard unit emission rate was used so that complete re-modelling of the different scenarios would not be required in the event of changes to the emissions factors. However this means that scaling of the files was necessary in the post processing so that the correct Ground Level Concentrations could be obtained.

Table 1: Scaling factors from each of the different source groups

Sources	Current Emission Estimates (g/s/m2) or g/s		Proposed Emission Estimates (g/s/m2) or g/s	
	TSP	PM10	TSP	PM10
Fimiston Open Pit	0.000015	0.0000033	0.000015	0.000003
Processing Plant	0.000687	0.000448	0.000692	0.000449
WD1 (Waste Dump1)	0.000000098	0.00000005	0.0000001	0.00000005
WD2 (Waste Dump 2)	0.00000001	0.00000005	0.0000001	0.00000005
WD3 (Waste Dump 3)	0.000000098	0.00000005	0.0000001	0.00000005
WD4 (Waste Dump 4)	0.000000098	0.00000005	0.0000001	0.00000005
WD5 (Waste Dump 5)	n/a	n/a	0.0000001	0.00000005
Dump Trucks Total	0.005	0.0025	0.0054	0.0028
Fimiston-I	0.00000001	0.00000001	0.00000001	0.00000001
Fimiston-II	0.00000002	0.00000001	0.0000001	0.0000001
Kaltails	n/a	n/a	0.0000001	0.00000004
Service Corridors/Stockpiles	0.0000003	0.0000002	0.0000001	0.0000001

Appendix D

Ausplume Input File

1

KCGM1-PM10

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects None
Plume depletion due to dry removal mechanisms included.
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? Yes
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m
Averaging time for sigma-theta values 60 min.

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Sigma-theta
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.400m
Adjustment for wind directional shear None

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

and in the absence of boundary-layer potential temperature gradients

given by the hourly met. file, a value from the following table
(in K/m) is used:

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

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

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
average over all hours

KCGM1-PM10

SOURCE GROUPS

Group No.	Members
1	WRD1
2	WRD2
3	WRD3
4	WRD4
5	FIM1
6	FIM2
7	STKSER
8	FIMOP

9 DT
10 PPLANT

1

KCGM1-PM10

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: WRD1

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
355391	6596339	0m	446m	394m	-33deg	2m	10m

(Constant) emission rate = 1.00E+00 grams/second per square metre

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.2930	2.5	2.60
0.3410	5.0	2.60
0.3660	10.0	2.60

INTEGRATED AREA SOURCE: WRD2

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
357473	6595668	0m	1707m	1200m	-38deg	2m	10m

(Constant) emission rate = 1.00E+00 grams/second per square metre

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.2930	2.5	2.60
0.3410	5.0	2.60

0.3660	10.0	2.60

INTEGRATED AREA SOURCE: WRD3

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
357757	6592901	0m	1779m	2500m	2deg	2m	10m

(Constant) emission rate = 1.00E+00 grams/second per square metre

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.2930	2.5	2.60
0.3410	5.0	2.60
0.3660	10.0	2.60

INTEGRATED AREA SOURCE: WRD4

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
357311	6591789	0m	3282m	980m	0deg	2m	10m

(Constant) emission rate = 1.00E+00 grams/second per square metre

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.2930	2.5	2.60
0.3410	5.0	2.60
0.3660	10.0	2.60

INTEGRATED AREA SOURCE: FIM1

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
356703	6596929	0m	1119m	1000m	-30deg	2m	40m

(Constant) emission rate = 1.00E+00 grams/second per square metre

Particle Particle Particle

Mass fraction	Size (micron)	Density (g/cm3)
0.2930	2.5	2.60
0.3410	5.0	2.60
0.3660	10.0	2.60

INTEGRATED AREA SOURCE: FIM2

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
361340	6596862	0m	1520m	2300m	-52deg	2m	44m

(Constant) emission rate = 1.00E+00 grams/second per square metre

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)

Appendix E

KCGM Dust Management Plan

KALGOORLIE CONSOLIDATED GOLD MINES PTY LTD REVISED DUST MONITORING AND MANAGEMENT PROGRAMME JUNE 2004

INTRODUCTION

As part of the approval for the Consultative Environmental Review for the Fimiston Mine and Waste Dumps, 1990, KCGM was required to prepare and subsequently implement a dust monitoring and management programme. This programme meets the requirements of Condition 5 of Ministerial Statement 188 for these operations.

The Dust Monitoring and Management Programme was developed by KCGM in April 1992. This programme was subsequently submitted to the EPA and was approved on 28 October 1992. The dust programme was revised in April 2001. This revised version of the dust monitoring and management programme resulted from discussions between the EPA and KCGM in May 2004.

KCGM believes this programme provides the best possible practices and procedures to allow KCGM to continue mining at Kalgoorlie in a reasonable and practicable manner, while providing an acceptable dust environment for residents of Kalgoorlie-Boulder.

Through implementation of this programme, Kalgoorlie Consolidated Gold Mines commits to undertake all reasonable, practicable and safe measures to minimise dust emissions from its operations.

This dust management programme is considered in three parts:

- Part 1 Dust Control Strategy
- Part 2 Dust Monitoring
- Part 3 Community Consultation

PART 1 – DUST CONTROL STRATEGY

2.1 Control at Operational and Construction Sites

Site specific source assessment and control methods have been provided in detail in historical KCGM Annual Environment Reports. The source assessment work has been useful in ranking dust sources and indicating where efforts are best applied to best effect. Dust from haulage and bare ground were identified as the major factors. Although dust from blasting was not found to be a major contributor it can create localised dust impacts of high "nuisance value" for residents.

Water trucks and cannons are extensively used in the Fimiston Open Pit operations to limit dust emissions from haulage and loading (Figure 1).

Figure 1
Watering Haul Roads in the Fimiston Open Pit

"Spray on" dust binding agents are also used to control dust on areas that are unable to be rehabilitated in the short term.

KCGM's dust management practices for the construction of the environmental noise bund will reflect normal ongoing operational practices, including the following:

- Noise bund construction is designed to enable rehabilitation to occur progressively.
- Monitoring current and forecast wind conditions using daily forecasts from the Bureau of Meteorology and real time wind speed and direction monitoring data.
- Use water trucks and water cannons in areas that could produce dust. Fresh water will be used on areas to be rehabilitated.
- Undertake visual inspections for dust formation on a regular basis.
- Use of additional dust control measures (i.e. a dust binding agent) or a pause in activity may result from our inspections, public feedback or prevailing wind conditions.
- Ensure that all contractors and staff involved with this southern extension undertake a site-specific induction to raise awareness including the importance of dust control.
- Ensure dust monitoring is undertaken (Refer to Part 2).
- Ongoing consultation with stakeholders to determine the success of the dust management practices.

It is envisaged that construction of the complete environmental noise bund will take approximately 24 months (2 years) as it will be undertaken during day shift only to ensure nearby residents are not affected by noise from this work at night. Some additional delays may also occur as KCGM is committed to stopping work if the wind causes a dust problem to ensure that residential and business areas are not unduly affected by dust.

However the aim is to undertake the construction in stages to allow rehabilitation of the western face to occur immediately after the construction of each stage (assuming wind conditions are favourable). This focus on staged completion of the noise bund ensures that the noise reduction and visual amenity benefits are provided to the community in a timely manner.

2.2 Open Pit Blasting

Blasting can create localised dust impacts of high "nuisance value" for residents. This is particularly a problem during summer when prevailing winds are from the east. Thus KCGM has introduced management procedures to minimise this impact which essentially involve avoiding surface blasting during unfavourable weather conditions (Figure 2). Real time wind speed and direction monitoring data is used in the decision making for the control of dust from blasting.

Surface blasts require additional dust control measures due to the nature of the oxide material and the shallow pit depth. Experience and data show that deeper pit blasts in hard rock are of lesser nuisance to the community.

Following any negative public feedback, KCGM reviews the conditions surrounding the event and, where appropriate, refines the management procedure to endeavour to minimise the likelihood of a recurrence of such an event. These efforts have resulted in a reduction in the number of public complaints relating to blasting dust over time.

KCGM's dust management practices for blasting include the following:

- Monitoring current and forecast wind conditions using daily forecasts from the Bureau of Meteorology and real time wind speed and direction monitoring data.
- Ensure dust monitoring is undertaken (Refer to Part 2).
- Ongoing consultation with stakeholders to determine the success of the dust management practices.

Figure 2
Surface Blasting Under Favourable Winds

2.3 Revegetation

Dust source assessment work has been useful in ranking dust sources and indicating where efforts are best applied to best effect. Dust from bare ground was identified as a major factor. KCGM's goal is to minimise the extent of bare ground and rehabilitate areas soon as they become available, this is known as progressive rehabilitation (Figure 3).

The benefits of progressive rehabilitation include the early establishment of vegetation, which reduces dust levels and improves visual surroundings. In addition this also results in a significant reduction in the amount of rehabilitation required when mining is completed. Further details of the KCGM rehabilitation programme are included in KCGM Annual Environment Reports.

KCGM commenced the "Greening the Golden Mile" rehabilitation programme in 1993 and has now established a green belt between the mine and the city. In this green belt more than 750ha have been rehabilitated and 230 000 trees planted.

KCGM is a major sponsor of the Kalgoorlie-Boulder Urban Landcare Group (KBULG). This group has taken over the activities previously undertaken by the Goldfields Dust Abatement Committee. Work includes the establishment and maintenance of vegetation green belts around the city as well as environmental education and the promotion of native, water conserving plant species.

The environmental noise bund will be developed in stages to allow rehabilitation of the western face to be done simultaneously with construction. In this way, rehabilitation of all working areas will form an integral part of the day-to-day operations. In rehabilitation areas potable water will be used. It is recognised that water is a scarce commodity in the Kalgoorlie goldfields and water management will continue to be an area of prime importance. A dust-binding agent will be used to reduce the water consumption where appropriate.

Figure 3
Dust from Bare Ground - Before Rehabilitation and After Rehabilitation

PART 2 – DUST MONITORING

KCGM owns and operates a network of high volume dust monitors. Three dust monitors are located in close proximity to the Fimiston Open Pit at the Boulder Shire Yard (BSY), Clancy Street (CLY) and Hewitt Street (HEW) to monitor potential blasting dust (Figure 4). These dust monitors are operated every day from 9:00am to 6:00pm as blasting is only carried out between 9:00am to 5:30pm. Dust monitors are calibrated every six weeks in accordance with manufacturers' requirements.

An additional monitor has recently been established to measure potential dust from the proposed southern extension of the environmental noise bund (Figure 5). Following consultation with the Department of Environment (DoE) regarding PM_{10} monitoring at this location, KCGM is currently investigating the purchase of a PM_{10} monitor. It is proposed that this dust monitor will be operated during the environmental noise bund construction times. To minimise the impact on the nearby stakeholders the construction is restricted to the hours of 7:00am to 7:00pm Monday to Saturday and not on Sunday or public holidays.

KCGM understands that the Kalgoorlie DoE office will be undertaking an air quality monitoring review of the Kalgoorlie-Boulder area in the near future. KCGM will revise this dust monitoring programme and the need for a performance target based on the outcome of this review in consultation with the Kalgoorlie DoE office.

In the interim, through the control measures outlined in this programme, KCGM commits to undertake all reasonable measures to prevent visible dust crossing the boundary of the premises from its operations.

Results from dust monitoring will be provided to the DoE in the KCGM Annual Environment Report.

Figure 4
Blasting Dust Monitoring Site Locations

Figure 5
New Dust Monitoring Site for the Southern Extension to the Environmental Noise Bund

PART 3 – COMMUNITY CONSULTATION

KCGM has a 24-hour Public Inquiry Line that can be contacted for a wide range of issues including emergencies, complaints, inquiries and feedback. Both the public and employees (including contractors) are encouraged to use the Public Inquiry Line for any matter relating to the operations. It is a particularly important avenue for capturing those issues which require follow up and action.

This feedback from the Public Inquiry Line system is very effective in helping to make KCGM aware of issues that are of concern to the community such as noise, dust or blasting. Being aware of the problems allows KCGM to investigate and implement control measures to address any community concerns.

In addition and to complement many of the community relations activities that KCGM undertakes, the company established a Community Reference Group (CRG) in late 1999. In 2001, the group was revitalised with a call for new members. The CRG includes community members who meet monthly to discuss issues that are of importance to both the community and KCGM.

KCGM is committed to ongoing consultation with our key stakeholders to determine the success of the dust management practices and where required investigate and implement additional control measures to address any community concerns.

This dust monitoring and management plan may be modified from time to time to reflect updated practices and procedures.