KALGOORLIE CONSOLIDATED GOLD MINES PTY LTD

FIMISTON AIR QUALITY MANAGEMENT PLAN

NOVEMBER 2019

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1. SUMMARY

1.1 Purpose of the Document

This Fimiston Air Quality Management Plan (FAQMP) is submitted in accordance with Condition 7-1 of Ministerial Statement 782 for the *Fimiston Gold Mine Operations Extension (Stage 3) and Mine Closure Planning*. Initially the FAQMP required review on an annual basis however this was amended to a three yearly revision cycle following approval of the 2012 FAQMP.

This is the ninth version of the FAQMP prepared by Kalgoorlie Consolidated Gold Mines Pty Ltd (KCGM) in consultation with air quality consultants Ramboll Australia Pty Ltd. KCGM believes the FAQMP incorporates best practice to minimise impacts to air quality as a result of the Fimiston Gold Mine Operations.

1.2 Management Plan Summary

Title of proposal	Fimiston Gold Mine Operations Extension (Stage 3) and Mine Closure Planning
Proponent	Kalgoorlie Consolidated Gold Mines Pty Ltd
Ministerial Statement number	782
Purpose of the Condition EMP	The FAQMP is submitted to fulfil the requirements of conditions 7-2 and 7-3 of the above Statement.
Condition environmental objective	To manage air emissions from the Fimiston Operations to minimise potential impacts to the residents of the City of Kalgoorlie-Boulder
Environmental criteria	Criterion 1: Ambient PM_{10} dust Criterion 2: Mercury Air Emissions

1.3 Document History

Table 1: Document History

VERSION	DATE	DOCUMENT CHANGES
1	SEP 2007	New Document. An integrated air quality management plan was developed to incorporate a number of management plans including: Blasting Dust Management Plan (BDMP), Dust Monitoring and Management Programme (DMMP) and the Carbon Kiln Mercury Emissions Reduction Program (CKMERP) as recommended by the Department of Health (DoH) and included feedback received from the [then] Department of Environment and Conservation (DEC) following submission of the Public Environmental Review (PER) for the *Fimiston Gold Mine Operations Extension (Stage 3) and Mine Closure Planning* in September 2006.
2	MAY 2009	Revised and implemented to meet requirements of Ministerial Statement 782.
3	DEC 2009	Annual Review
4	DEC 2010	Annual Review
5	DEC 2011	Annual Review
6	MAR 2012	Revised to include DoH and DEC comments.
7	DEC 2012	Revision to Ambient Mercury Monitoring Programme.
8	DEC 2015	First Triennial Review. Reviewed PM_{10} dust monitoring data and updated the trigger levels (Table 4) of DMMP, included an additional performance target for DMMP, removed the ambient mercury monitoring programme as it has been completed, and updated the notification/reporting requirements. Addressed issues that the [then] Office of the Environmental Protection Authority (OEPA) asked to consider in this review in a letter dated 14 August 2013.
	JUN 2016	Inserted methodology for determining a significant contribution following a request by the OEPA via email dated 14 June 2016.
9	JUN 2019	Triennial Review. Format updated to align with the EPA's template for Environmental Management Plans. Updated information regarding implementation of the Fimiston Emissions Reduction Project.
	NOV 2019	Inserted additional information to Section 6.2 to further clarify the use of back trajectories following a request by the EPA via email/letter dated 11 October 2019.

1.4 Corporate Endorsement

I hereby certify that to the best of my knowledge, the Condition EMP provisions within this Condition EMP are true and correct and address the legal requirements of Ministerial Statement 782.

[Signature of duly authorised proponent representative]

Name: Briony Coleman

Signed: Briony Coleman.

Designation: Manager, Services KCGM POA

Date: 13.11.19

2. CONTEXT, SCOPE AND RATIONALE

2.1 Overview of the Fimiston Operations

KCGM manages and operates the following mining and processing operations for Joint Venture Owners, Barrick (Australia Pacific) Pty Limited (Barrick; 50%) and Newmont Goldcorp Australia Pty Ltd (Newmont; 50%):

- Fimiston Open Pit (Super Pit): open pit mining and waste rock disposal.
- Mt Charlotte Underground Mine: underground mining.
- Fimiston Processing Plant: crushing, mineral processing, refining and tailings disposal.
- Gidji Processing Plant: mineral processing and tailings disposal.
- Exploration: mineral resource definition drilling and core processing.

The Fimiston Operations are comprised of the Fimiston Open Pit and the Fimiston Processing Plant which are located adjacent to the City of Kalgoorlie-Boulder approximately 600 kilometres (km) east of Perth, Western Australia. KCGM produces up to 800,000 ounces of gold each year and has a current open pit mine life until 2024 and mineral processing life until 2032.

Up to 85 million tonnes (Mt) of ore and waste rock material are mined from the Fimiston Open Pit each year. Up to 13 Mt of ore is processed at the Fimiston Processing Plant annually, whilst the waste rock material is transported to various waste rock dumps or marginal ore stockpiles adjacent to the open pit operations. The current footprint of the Fimiston Open Pit extends approximately 1.5 km in width, 3.5 km in length and to a depth of approximately 600 m making it one of the largest open pit gold mines in Australia.

2.2 History of the Fimiston Air Quality Management Plan

KCGM developed and implemented a Dust Monitoring and Management Programme (DMMP) in accordance with condition 5 of Ministerial Statement 188 in the early 1990s. The DMMP was updated periodically to ensure that it continued to achieve its objectives as the Fimiston Operations developed over time.

KCGM developed the FAQMP in 2007 as an integrated air quality management plan to incorporate a number of management plans including: Blasting Dust Management Plan (BDMP), Dust Monitoring and Management Programme (DMMP) and the Carbon Kiln Mercury Emissions Reduction Program (CKMERP) as recommended by the Department of Health (DoH) and included feedback received from the DEC following submission of the PER in September 2006.

While each of the above programs was managed separately due to their different approaches, requirements and areas of application, the FAQMP was produced to ensure that they are managed within a consistent and integrated framework.

Following approval of the PER via Ministerial Statement 782 on 29 January 2009, the FAQMP was formally implemented in May 2009 in accordance with Ministerial Condition 7.1.

Ministerial Condition 7.2 requires revision of the FAQMP on an annual basis. However, this was amended to a three yearly revision cycle following approval of the 2012 FAQMP by the OEPA on 14 August 2013.

2.3 Key Environmental Factors

This Condition EMP specifically addresses the air quality environmental factor.

Air quality is a key environmental factor for this proposal due to the proximity of the Fimiston Gold Mine Operations to the City of Kalgoorlie-Boulder (CKB) and nearby Ninga Mia Aboriginal community. It is essential that KCGM manages environmental air quality aspects which may impact on nearby residents (e.g. fugitive dust emissions). KCGM's management approach is detailed in Section 3.

2.4 Requirements of the Condition

Specifically, this Condition EMP is submitted in accordance with Conditions 7-1 to 7-7 of Ministerial Statement 782. Table 2 provides a summary of where the requirements of these conditions are addressed in this Condition EMP.

Table 2: Summary of Conditions

CONDITION		SECTION IN CONDITION EMP
Ministerial Statement 782		
7	**Air Quality**	1.3 Document History
7-1	Within three months following the issuing of the notice to the decision-making authorities under section 45(7) of the Environmental Protection Act 1986, the proponent shall implement the Air Quality Management Plan (September 2007) to the requirements of the Minister for the Environment on advice of the Department of Environment and Conservation and the Department of Health.	
7-2	The proponent shall review the Air Quality Management Plan referred to in condition 7-1 at twelve-monthly intervals, unless otherwise required by the Environmental Protection Authority, and shall amend the Plan to the requirements of the Minister for the Environment on advice of the Department of Environment and Conservation and the Department of Health.	1.3 Document History 2.2 History of the Fimiston Air Quality Management Plan
7-3	The proponent shall implement the amended Air Quality Management Plan required by condition 7-2.	1.3 Document History
7-4	The proponent shall only detonate explosives at surface level on the premises when wind directions favour the carriage of dust away from the residential areas of Kalgoorlie-Boulder, unless undertaken in accordance with regulation 8.28 (4) of the *Mines Safety and Inspection Regulations 1995.*	3.1.1 KCGM Dust Programme
7-5	The proponent shall make available continuous dust monitoring data on their website within 24hrs of the recording of that data.	6. Reporting Provisions
7-6	The proponent shall install two additional dust monitoring stations, which are to be co-located with the existing wind speed and wind direction monitoring stations.	4.2.1 Continuous PM_{10} Dust Monitoring Network
7-7	The proponent shall keep and make publically available a register of complaints regarding air emissions; investigate those complaints; and keep a record of the investigations and actions taken with regard to the complaint.	5. Public Consultation

3. MANAGEMENT APPROACH

KCGM's approach to managing air emissions is based on the identification of major air emission sources using conventional risk assessment methodologies, air quality modelling and air quality monitoring results and experience drawn from community feedback and complaints. The management measures implemented to address the major air emission sources identified by KCGM are summarised in Table 3, and detailed within the following sub-sections.

Table 3: Summary of Air Emission Sources

ACTIVITY	EMISSION SOURCE SUMMARY	AIR EMISSION TYPE	MANAGEMENT PLAN/PROGRAMME
Ore Processing	The Fimiston Processing Plant treats ore mined from the Fimiston Open Pit and the Mt Charlotte Underground Mine. Crushing activities and conveyor transfer points have the potential to create fugitive dust emissions.	Fugitive Dust	Dust Monitoring and Management Programme
	During the gold recovery process there is potential for point source atmospheric emissions of mercury from the carbon regeneration kilns and the gold room.	Mercury	Mercury Emissions Management Plan
Tailings Storage Facilities	KCGM operates three Tailings Storage Facilities (TSFs) for the Fimiston Processing Plant. These are the Fimiston I TSF, Fimiston II TSF and the Kaltails TSF. Fugitive dust from the TSFs is generally caused by strong winds resulting in wind erosion.	Fugitive Dust	Dust Monitoring and Management Programme
Drilling and Blasting	Drilling and blasting is undertaken to break and loosen the rock material for extraction by hydraulic shovels. Blasting activities have the potential to cause high short term fugitive dust emissions and therefore need to be carefully managed and planned, particularly for blasts that occur near the surface.	Fugitive Dust	Blasting Dust Management Plan
Mining	Mining is undertaken using hydraulic shovels that load ore/waste rock into haul trucks to transport ore to the run of mine (ROM) pad or stockpile to be subsequently processed whilst waste rock is dumped on various waste rock dumps. Load, haul, and dumping activities have the potential to create fugitive dust emissions through the following: handling, transporting and dumping; use of earth moving equipment; vehicle movement on unsealed roads; and wind erosion in pit, from waste dumps, stockpiles and unsealed roads.	Fugitive Dust	Dust Monitoring and Management Programme

3.1 BLASTING DUST MANAGEMENT PLAN

Blasting is essential to the mining process. In simple terms a blast is defined as a pattern of charged holes that are fired in a sequence to fracture the rock enabling digging by hydraulic shovels and subsequent load and haul activities. Open pit blasting has the potential to cause fugitive dust resulting in high short-term ambient dust emissions.

Due to the proximity of the Fimiston Open Pit to residential areas of Kalgoorlie-Boulder, it is necessary to determine the potential for a blast to result in fugitive dust emissions being transported into residential areas, prior to a blast being conducted. Blasts within the Fimiston Open Pit that have the potential to impact on residential areas are termed "Wind Direction Dependent" blasts; as the name implies, the firing of these blasts is dependent on wind direction. Wind Direction Dependent blasts are primarily related to surface blasting undertaken in the upper benches of the open pit.

3.1.1 KCGM Dust Programme

To manage Wind Direction Dependent blasts, the KCGM Dust Programme was created to graphically display the current wind speed and direction data recorded at the Metals Exploration Yard (MEX) and Cassidy Headframe (CAS) weather monitoring stations.

The KCGM Dust Programme is used by Drill and Blast personnel to determine the acceptable wind direction arc for a Wind Direction Dependent blast. Firstly the blast location is selected and then the KCGM Dust Programme calculates and displays the acceptable wind direction arc within which that blast can be undertaken. Wind directions recorded over the last 30-minutes at both MEX and CAS are shaded green if they fall within the acceptable arc and red if they fall outside of the acceptable arc. Figure 1 provides an example of the KCGM Dust Programme display.

In order for a Wind Direction Dependent Blast to proceed, the KCGM Dust Programme is reviewed fifteen minutes prior to the blast being initiated to ensure the conditions outlined in Table 4 are met. If the conditions are not met then the blast is cancelled and delayed until the conditions are favourable.

Occasionally, it is necessary to fire a Wind Direction Dependent blast even though wind conditions are unfavourable. For example: if the explosives have been in place for up to 14 days, at which time the explosives need to be fired for safety reasons (i.e. they may not detonate properly if left in-situ for longer periods); if inclement weather is forecast which may result in inadvertent detonation of the shot from lightning or rockfall; or if the shot contains underground workings whereby subsidence may result in misfires if the shot is not fired within a timely manner.

The MEX wind data are used in assessing these conditions. If the data from MEX are not available the CAS wind data are used. Conditions 4 and 5 in Table 4 are relaxed (or considered not applicable) when the current winds are clearly in the ‘green arc’ and are forecast to remain that way.

Table 4: KCGM Dust Programme - Required Conditions for Wind Dependent Blasting

CONDITION	
1	at least four of the 5-minute average wind direction boxes are shown as green
2	no more than one of the last three 5-minute wind direction boxes are shown as red
3	the 30 minute average is shown as green
4	the variation in the measured wind direction (as depicted in yellow) is narrow (e.g. less than 60º) and not reflective of large variations in the wind directions
5	the 30-minute average wind speed is greater than 2 m/s

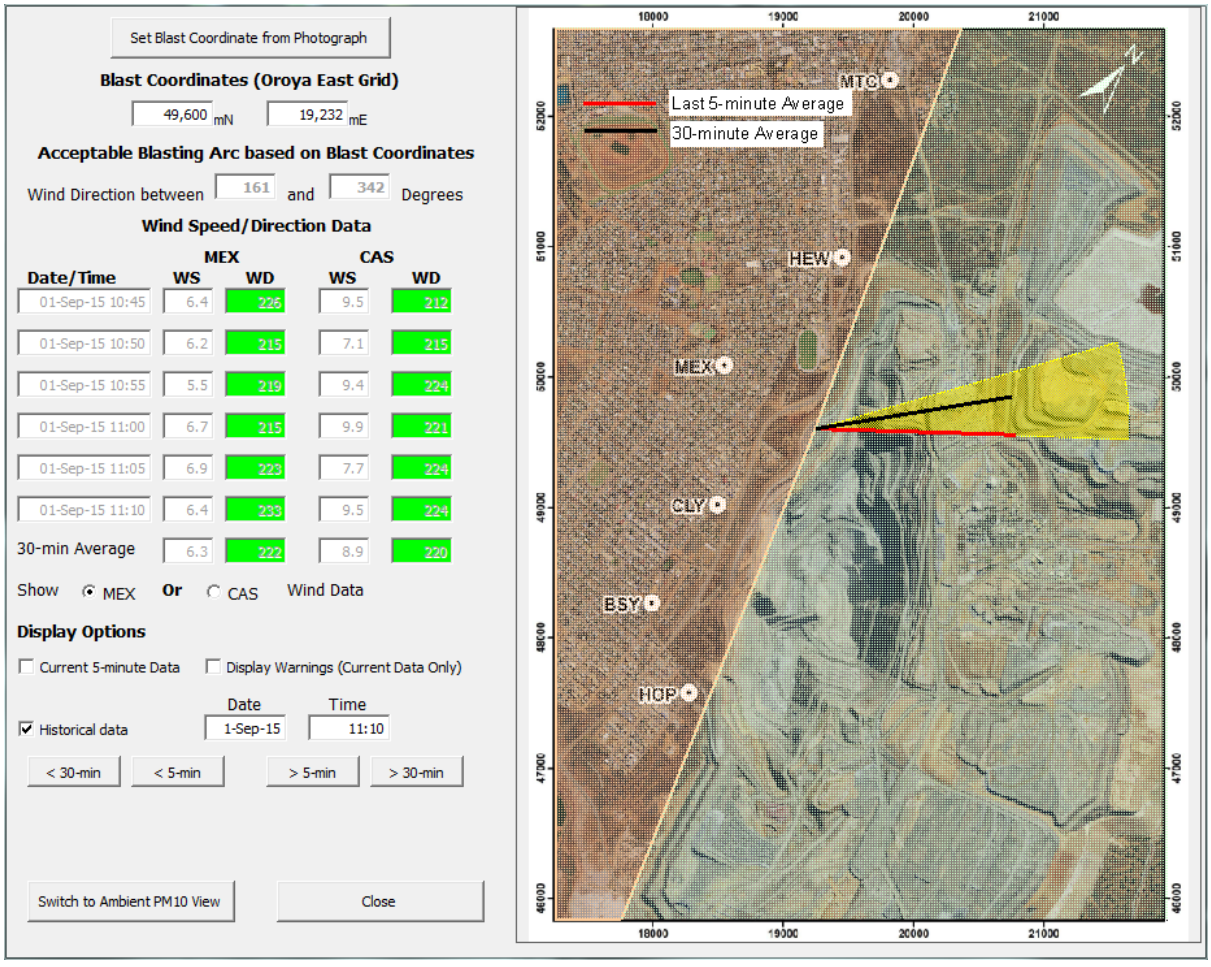


Figure 1: Example Display from the KCGM Dust Programme

Each request to fire a Wind Direction Dependent blast is considered on a 'case by case' basis and requires appropriate environmental review and managerial authorisation prior to being fired. Table 5 outlines the restrictions imposed on Wind Direction Dependent blasts and examples of situations which require authorisation.

Table 5: Blast Restrictions for Wind Direction Dependent Blasts

SITUATION	BLASTING RESTRICTION	AUTHORISATION REQUIRED
Normal	Blast may be fired only if the KCGM Dust Programme meets the conditions of Table 4 with relaxation of Conditions 4 and 5 if winds are clearly in the "green" arc.	No
Opportunity to blast due to dust mitigating circumstances (e.g. rain, depth in pit).	Decision to blast on a case by case basis.	Yes
Necessity to blast for safety reasons (e.g. sleep time for explosives is approaching 14 days, risk of lightning strike or rockfall, shot contains voids).	Decision to blast on a case by case basis.	Yes

3.2 DUST MONITORING AND MANAGEMENT PROGRAMME

The objective of the DMMP is to ensure 24-hour average PM_{10} concentrations as a result of the Fimiston Operations are less than 50 $\mu g/m^3$ at the monitoring locations (daily performance target, refer to Section 4.1.1). A dust modelling study for the Fimiston Operations, undertaken by Environ Pty Ltd for KCGM in August 2006, indicated that the 24-hour average PM_{10} ground level concentrations resulting from the Fimiston Operations were predicted to be less than 50 $\mu g/m^3$ at the nominated receptors with the exception of the HEW monitoring site (see Figure 4 for monitoring locations).

It must be recognised however that air dispersion modelling results are only indicative as they are influenced by a number of factors, including the effectiveness of the management measures and the prevailing meteorological conditions. The DMMP has been developed to enable KCGM to actively manage its operations to mitigate fugitive dust emissions. This is achieved via real time monitoring of ambient PM_{10} concentrations.

3.2.1 Dust Management Strategy

3.2.1.1 Preventative Control Strategy

KCGM implements the following preventative control strategies:

- Progressive rehabilitation of bare ground areas to minimise the fugitive dust emissions from wind erosion;
- Use of water trucks and water cannons in areas that could produce dust such as haul roads, service corridors and other active surfaces;
- Watering down ore/waste rock material prior to load and haul activities as required;
- Watering down the surface of the blast prior to firing as required;
- Plan activities in high risk areas (e.g. digging/loading) during day shift when fugitive dust can be seen and managed where practicable; and
- Use of additional dust control measures (i.e. a dust binding agent) where necessary.

3.2.1.2 Predictive Control Strategy

KCGM uses forecast weather conditions to manage potential fugitive dust emissions associated with blasting and earthmoving activities (e.g. top-soil stripping, rehabilitation, landform management and construction) through implementation of the following control measures:

- Delaying/suspending work as deemed necessary; and
- Use of alternative operational areas if possible (e.g. use a different waste dump).

3.2.1.3 Reactive Component of Dump

KCGM has implemented a dust alarm system which actively monitors the ambient PM_{10} dust data and based on a set of criteria automatically activates an alarm which prompts a reactive response by KCGM to mitigate dust emissions if the dust is likely to be from the Fimiston Operations. The alarm system is primarily based on trigger levels for each monitoring site to address the occurrence of short-term/high concentration events. The management of longer-term/lower concentration data that could potentially result in the 24-hour average being greater than the daily performance target was integrated into the alarm system in 2016.

The alarm system also caters for missing data and/or instrument failure requiring remedial action. In order to implement the DMMP alarm system the following are required:

1. Determination of appropriate trigger levels for ambient PM_{10} concentrations over different time periods (i.e. 30-minute, 1-hour, and 6-hour averages). The trigger levels should also be low enough to allow adequate response time to reduce the risk of exceeding the Daily performance target, but high enough to ensure that they do not unduly disrupt normal operations (without due cause).

   The trigger levels were initially determined by assessing the historical PM_{10} monitoring data from the BSY site on days where the measured 24-hour average PM_{10} concentration was greater than 40 $\mu g/m^3$. This analysis determined the average and maximum of the peak (initially 30-minute to 6-hour averages) to mean (24-hour average) ratios from the monitoring data. The trigger levels for an ‘Alert’ alarm were set at a point that is at or below the average peak to mean ratio while the trigger levels for an ‘Action’ alarm were set at a point at or below the maximum peak to mean ratio.

   It is expected that the peak to mean ratios will change over time as more data become available. Therefore, the trigger levels are reviewed every few years or following any high level events based on the monitoring data collected at each monitoring site (the last review was conducted in May 2019 where data from each individual monitoring site were used).

2. Determination of the most appropriate response time subsequent to an alarm being activated. This may include consideration of wind speed and travel time. The response time is the elapsed time taken to implement control measures following an alarm being raised. Two alarm conditions have been adopted: Alert and Action which correspond to a response time of 30 minutes and 10 minutes respectively.

   The Alert alarm trigger levels are indicative of the possibility of on-site activities contributing to ambient concentrations that may approach the daily performance target and where reasonable and practicable management measures could be implemented to reduce this risk.

   The Action alarm trigger levels are set at values that indicate it is likely that on-site activities are contributing to ambient concentrations that may be higher than the daily performance target and where reasonable and practicable, immediate management measures should be implemented to reduce this potential.

The trigger levels for each monitoring site as recommended by Ramboll Australia Pty Ltd following a review of the PM_{10} data in May/June 2019 are provided in Table 6. As the HGC site is used as a control monitoring site no trigger levels have been set for this site.

Table 6: Trigger Levels for PM_{10} Dust Monitors

DUST MONITOR CONCENTRATIONS (µg/m^3)							
	HOP	**CLY**	**HEW**	**BSY**	**MTC**	**MEX**	**HGC**
1/2 hr Alert	160	135	155	155	175	165	-
1/2 hr Action	315	320	360	365	375	300	-
1 hr Alert	140	115	135	140	155	145	-
1 hr Action	270	250	285	285	325	235	-
6 hr Alert	75	65	75	80	90	90	-
6 hr Action	115	110	115	130	150	115	-

In the event of an alarm being activated the Open Pit Dispatch is notified via an audible and visual alarm and the Dispatch Operators are notified with the alarm type (Alert or Action) and the monitoring site of interest. The alarm system also displays the dust concentration over the different time periods (i.e. 5-minute, 30-minute, 1-hour, and 6-hour averages), wind direction, and wind speed. The KCGM Dust Programme is then used to identify the potential sources/causes of the alarm.

The KCGM Dust Programme (Figure 5) provides a visual representation of the location of the potential emission sources via back trajectory paths based on wind speed and direction. If the back trajectory indicates that the Fimiston Operation is the possible source, the Dispatch Operators, Shift Supervisor or nominated person will determine what activities are occurring in the indicated area and implement control measures as appropriate within the appropriate response time (Figure 3).

There are many natural and anthropogenic sources of particulate emissions in the Goldfields Region and it is not unusual to have regional dust storms that can result in significant ambient PM_{10} concentrations over a wide area.

If several of the monitors are recording high PM_{10} concentrations at any one time, this may indicate that the emissions are potentially from regional sources rather than specific KCGM sources. In all instances where an alarm is activated the ambient monitoring data will be reviewed at that time and this review may include visual observations to aid in the identification of emission sources.

Figure 3 shows the process flow that occurs on an ongoing basis as part of the DMMP.

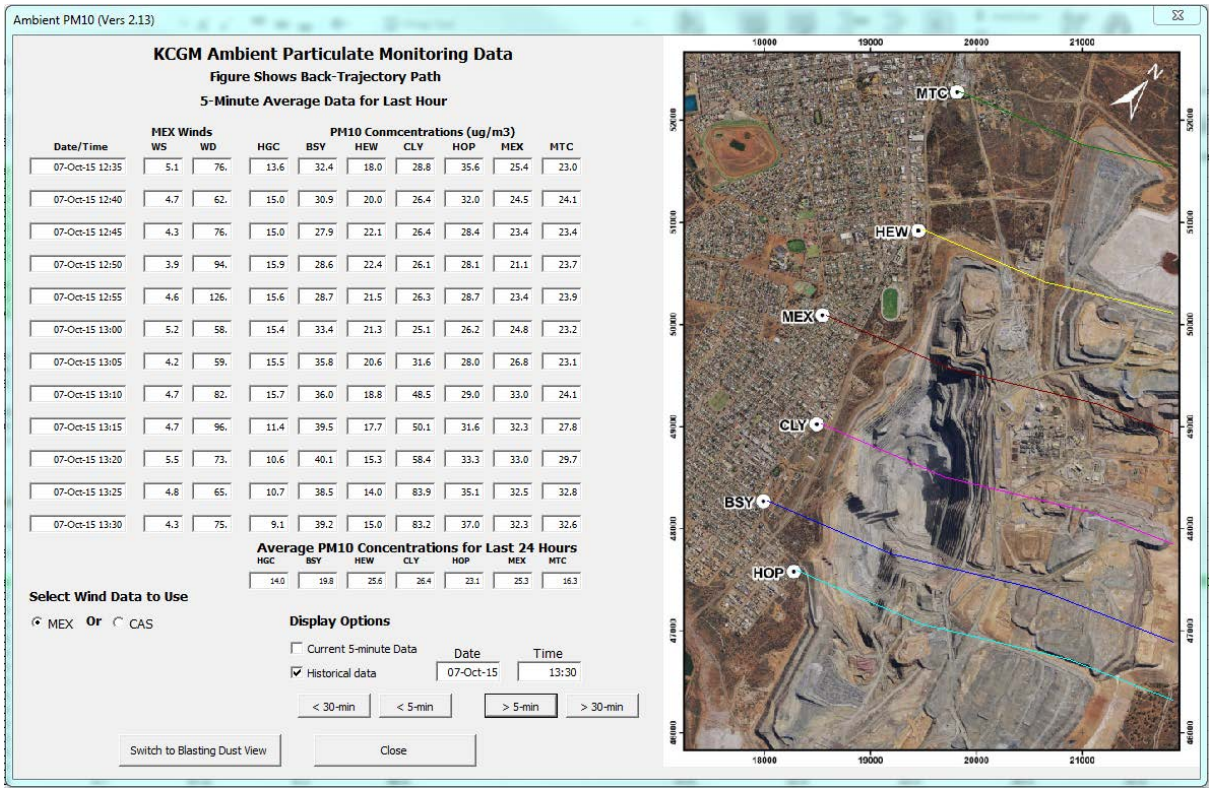


Figure 2: Sample Display from the Ambient Particulate Monitoring Data (KCGM Dust Programme)

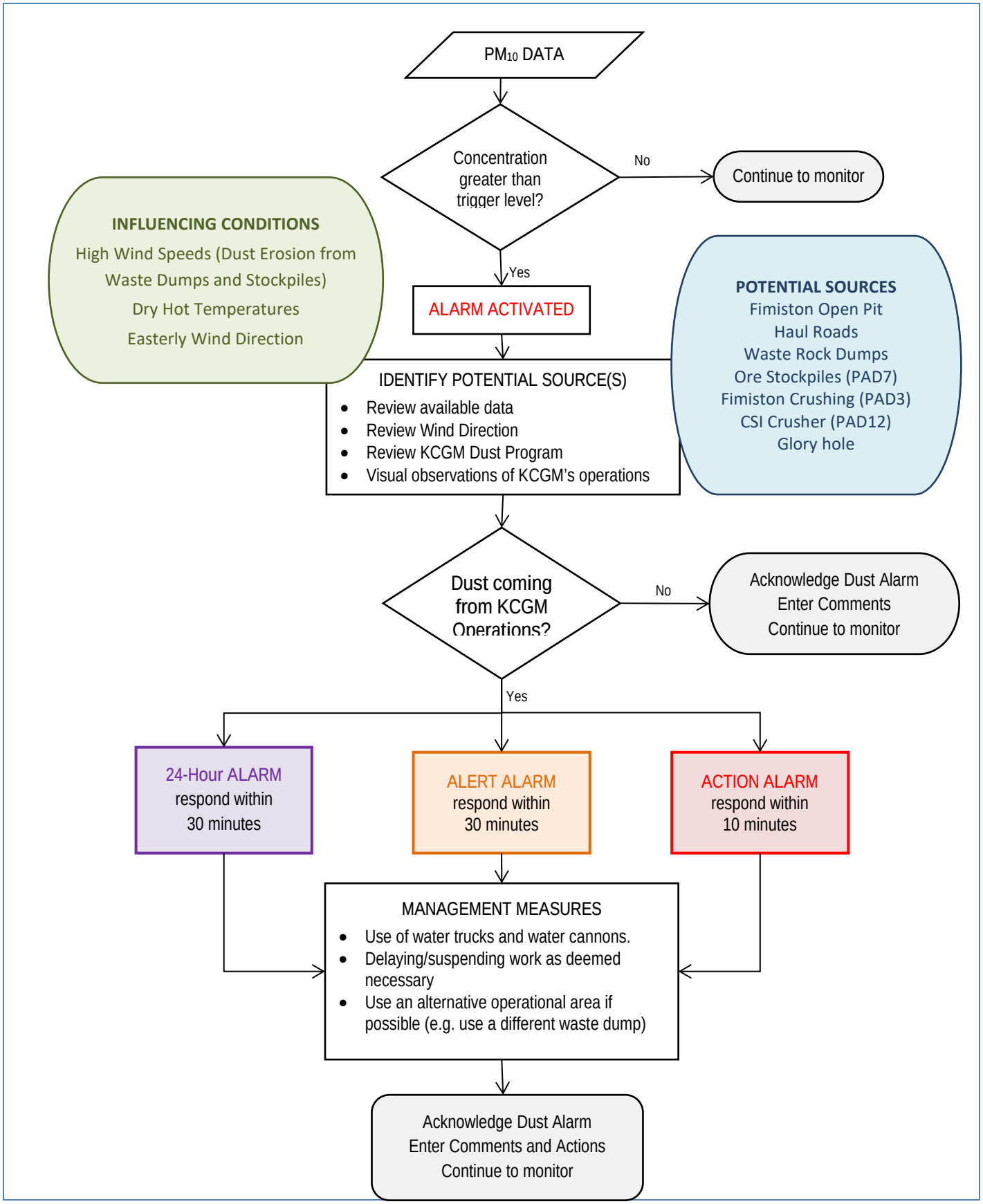


Figure 3: Process Flowchart for Reactive Component of DMMP

3.2.2 Dust Management Measures

Dust management practices implemented by KCGM have proven to be successful and include (but are not limited to):

- monitoring current and forecast weather conditions using daily forecasts and real time wind speed and direction monitoring data to plan work activities;
- use of water trucks and water cannons in areas that produce dust such as haul roads, service corridors and other active surfaces (potable water is used on areas to be rehabilitated);
- use of additional dust control measures where practical (e.g. a dust binding agent);
- progressive rehabilitation to minimise exposed areas;
- suspending work in a particular area or for a nominated activity as deemed necessary based on visual inspections, dust alarms, public feedback or prevailing wind conditions;
- Use an alternative operational area if possible (e.g. use a different waste dump);
- ensuring that all contractors and staff undertake site-specific inductions which include raising awareness of the importance of dust control;
- ensuring dust monitoring is undertaken, that the data are assessed in real time, and the results of the monitoring are reviewed and reported on; and
- ongoing consultation with stakeholders to determine the success of the dust management measures.

KCGM continues to work on reducing the impact of dust from its operations. Investigations into best practice management are ongoing and improvements are made when they are identified.

The above management practices are primarily implemented by the Shift Supervisor and/or Project Supervisor and the nominated Environment Advisor. However, each employee and contractor is made aware of the potential impact fugitive dust emissions can have on the community and are therefore required to implement dust control measures where required and report any notable visible dust coming from KCGM's operations to the Shift Supervisor and/or Project Supervisor or the nominated Environment Advisor.

3.3 MERCURY EMISSIONS MANAGEMENT PLAN

Mineral processing activities at the Fimiston Processing Plant can potentially result in point source emissions of mercury to the atmosphere; namely from the carbon regeneration kilns and the gold room. Mercury is known to be contained within coloradoite, one of a suite of telluride minerals that are rare but widely distributed through the Golden Mile lodes and generally represents less than 0.00014% of the ore mined from the Fimiston Open Pit and the Mt Charlotte Underground Mine. The percentage of mercury present in the ore processed through the Fimiston Processing Plant circuit is typically less than 0.0001%.

During the gold recovery process some of the mercury that is contained in the ore is leached and collected onto carbon via the Carbon in Leach (CIL) circuit. Whilst a small amount of mercury joins the gold in the refining process the majority of the mercury is retained on the carbon. Subsequently the mercury is recovered from the carbon during the carbon regeneration process and during the gold refining process (refer to Sections 3.3.1 and 3.3.2).

Mercury is also present in the waste rock (typically 0.00001%). KCGM undertook an analysis of particulate collected by its high volume samplers which showed that the maximum level of mercury present in the ambient dust samples (each collected over a 24-hour period) was around 0.002%

with an average concentration of approximately 0.0001%. The maximum particulate mercury level was recorded in a Total Suspended Particulate (TSP) sample and was much higher than the results obtained from all of the other filters that were analysed (which had an average of 0.0001%). The calculated *24-hour average* particulate mercury concentration in the maximum sample was less than 1% of the World Health Organisation (WHO) (2003) *annual average* guideline (0.2 µg/m^3). Therefore mercury contained in fugitive dust emissions from KCGM's operations is considered to represent a very small and negligible environmental and/or health risk.

Following the April 2011 monitoring program KCGM completed two short term continuous ambient mercury monitoring programs, in April 2012 and February 2013, along with a longer term monitoring program using passive samplers which ran from February 2012 through to March 2013. The results of these monitoring programs found the ambient mercury concentrations were well below the ambient guidelines, confirming the findings of the previous studies.

3.3.1 Carbon Kiln Mercury Emissions Reduction Programme

The management of mercury at the Fimiston Operations was initially focused on emissions from the Carbon Regeneration Kilns (Kiln 3 and Kiln 4) which were initially managed through implementation of the Carbon Kiln Mercury Emissions Reduction Programme (CKMERP), which consisted of the following:

- Developed and implemented a Carbon Regeneration Kiln Emissions Control Strategy that is used to restrict operation of the carbon regeneration kilns when the wind is blowing towards Kalgoorlie-Boulder and the mercury load on the carbon is high prior to any emission reduction equipment being installed.
- Undertaken air dispersion modelling of the mercury emissions from the carbon regeneration kilns to assess the potential health risks posed by the emissions in Kalgoorlie-Boulder. An independent assessment revealed that the levels being emitted from KCGM posed no risk to workers or the community. Modelling of mercury levels in the community using very conservative assumptions predicted that the annual average concentrations for residential air quality are well below WHO guideline values.
- Designed, installed and commissioned a scrubber in 2006 to reduce mercury emissions in the off-gas from the carbon regeneration kilns 3 and 4. This hypersaline wet scrubbing system enabled the mercury to be reabsorbed back into the tailings discharge. Emissions testing showed that the scrubber captured between 60% and 70% of mercury emissions. The scrubber was decommissioned in 2015 as part of the Fimiston Emissions Reduction Project (section 3.3.2).
- Completed an ambient mercury monitoring programme (see Section 4.2.2.1).
- Commenced the Fimiston Emissions Reduction Project (see Section 3.3.2).

3.3.2 Fimiston Emissions Reduction Project

During 2015, KCGM commenced implementation of the Fimiston Emissions Reduction Project (ERP) which has been designed to capture greater than 90% of the atmospheric mercury emissions associated with mineral processing activities at the Fimiston Processing Plant. The Fimiston ERP involved the installation of an exhaust off-gas scrubber, a regenerative thermal oxidiser (RTO), and a sulphur impregnated carbon scrubber to capture mercury from the carbon regeneration kilns off-gas prior to release. A mercury retort unit was also installed in the gold room to capture mercury emissions from the furnace.

During the commissioning phase, KCGM experienced issues with the KOGCC, namely the performance of the RTO. The issues with the RTO were rectified and a post commissioning emissions assessment was completed on the KOGCC in December 2017. The results were positive, showing that more than 90% of gaseous mercury emissions from the Carbon Regeneration Kilns were captured via the KOGCC.

In early 2018 KCGM identified that a number of the '316 stainless steel' components (pipework and mist eliminator) were showing signs of corrosion, which impeded the performance of the KOGCC. In December 2018 the pipework was replaced with a Fiberglass Reinforced Plastic pipe and the mist eliminator was replaced with a unit manufactured using Hastelloy (the same material used for the main body of the wet scrubber).

The project will continue to be commissioned until the KOGCC can be operated in accordance with the Commissioning Plan.

4. CONDITION EMP PROVISIONS

4.1 Environmental Criteria

4.1.1 Ambient PM_{10} Dust

KCGM's primary objective for the DMMP is to proactively manage its Fimiston Operations to ensure that the 24-hour average PM_{10} concentrations as a result of KCGM's emissions are less than 50 $\mu g/m^3$ at the monitoring locations. This performance target was based on the PM_{10} Standard from the *National Environmental Protection (Ambient Air Quality) Measure Variation 2003*, and included a target of not more than five events above the daily performance target at any dust monitoring location per annum where KCGM is a significant contributor (refer to Section 6.2.1).

To ensure the PM_{10} dust monitoring network is adequately maintained, greater than 90% availability of the continuous PM_{10} data from each dust monitoring locations is required on an annual basis.

The environmental criteria for KCGM's Continuous PM_{10} Dust Monitoring Network is outlined in Table 7.

Table 7: PM_{10} Dust Monitoring Performance Targets

MONITORING LOCATIONS	PM_{10} DUST MONITORING PERFORMANCE TARGETS		
	DAILY	ANNUAL EVENT	ANNUAL DATA AVAILABILITY
Boulder Shire Yard (BSY) Hewitt Street (HEW) Clancy Street (CLY) Hopkins Street (HOP) Mt Charlotte (MTC) Metals Exploration Yard (MEX) Hannan's Golf Course (HGC)	24-hour average less than 50 $\mu g/m^3$	Not more than five events above the daily performance target at any dust monitoring location per annum where KCGM is a significant contributor.	Greater than 90% per annum.

4.1.2 Mercury Air Emissions

The Fimiston ERP has been designed to capture more than 90% of gaseous mercury emissions from the Carbon Regeneration Kilns.

4.2 Monitoring Programmes

4.2.1 Continuous PM_{10} Dust Monitoring Network

KCGM's Continuous PM_{10} dust Monitoring Network is detailed below:

- Continuous PM_{10} dust monitoring is undertaken at seven monitoring locations stations (BSY, HEW, CLY, HOP MTC, MEX and HGC), using Thermo Beta Attenuation Monitor (BAM) samplers, fitted with PM_{10} inlets. The monitoring locations are shown on Figure 4.

- The MTC and MEX dust monitoring locations were established in accordance with Condition 7-6 of Ministerial Statement 782, which required KCGM to install two additional dust monitoring stations co-located with the existing wind speed and wind direction monitoring stations.
- The BAM samplers are configured to provide 5-minute average PM_{10} concentrations to assist with the detection and assessment of any high short-term PM_{10} concentrations on a real time basis.
- The BAM samplers are serviced quarterly in accordance with the manufacture's recommendations.
- The number and location of monitors used within the dust monitoring network offers sufficient coverage of the residential areas adjacent to the Fimiston Operations to enable representative data of the potential ambient PM_{10} concentrations that may occur as a result of fugitive dust emissions from the Fimiston Operations. The results of the dust modelling study undertaken for the PER were used to assist in the selection of these monitoring locations.
- The HGC site is used as a control monitoring site for PM_{10} as it is located some 4.5 km from the Fimiston Operations. It is generally considered to be representative of the local environment and data from this site enables comparison of background concentrations with the other monitoring sites.
- PM_{10} dust data are recorded in $\mu g/m^3$ which are averaged over 5 minutes.
- PM_{10} dust data are validated on a weekly basis.
- Wind direction and wind speed is recorded at two weather stations (MEX and CAS), as shown on Figure 4.
- Wind speed and wind direction is measured at each weather station using MET ONE model 50.5 sonic anemometer equipment.
- The wind sensors are field checked every 6 months and wind tunnel calibrated every two years in accordance with the manufacturer's recommendations.

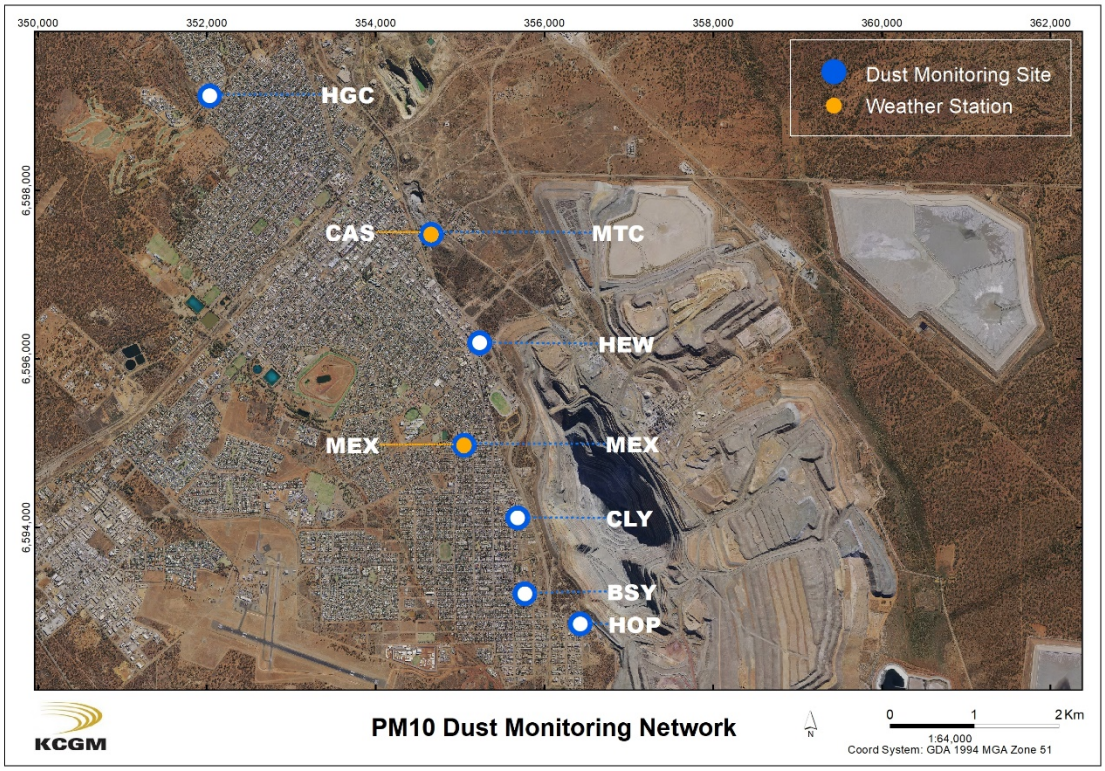


Figure 4: Dust and Weather Monitoring Locations

4.2.2 Mercury

4.2.2.1 Ambient Mercury Monitoring

KCGM commenced a twelve month ambient mercury monitoring program on 15 February 2012 in accordance with the FAQMP and the program was completed on 3 March 2013. The objective of the monitoring program was to confirm if the results obtained from the April 2011 ambient monitoring program are representative of the longer term ambient mercury concentration in the Kalgoorlie-Boulder residential area adjacent to the Fimiston Operations.

The average mercury concentration in ambient air at the HEW and CLY monitoring locations over the 12 month period was less than approximately 0.08 μg/m^3, which indicates comfortable compliance with the annual ambient air quality criteria 0.2 μg/m^3 specified by the WHO (2003). The ambient mercury monitoring program and its results were documented in a report that was provided to the OEPA in November 2013. The results of the monitoring program were consistent with the anticipated outcome based on the previous work that had been conducted.

As presented in Section 5.2, KCGM is also in the process of commissioning the Fimiston ERP which has been designed to capture more than 90% of gaseous mercury emissions from the Carbon Regeneration Kilns.

KCGM considers that further ambient mercury monitoring is not required given that:

- the ambient mercury monitoring program produced results that were consistent with those expected, and below the ambient guidelines; and
- that the Fimiston ERP would result in a significant reduction in the atmospheric emissions of mercury.

4.2.2.2 Carbon Kiln Mercury Emissions

Mercury emissions from the carbon regeneration kilns are estimated via a mass balance approach based on:

- The concentration of mercury on the carbon prior to it being treated in the kilns;
- The concentration of mercury on the carbon after regeneration;
- The rate at which carbon is fed into the kilns; and
- The times during which the kilns were being used.

The Fimiston ERP has been designed to ensure that more than 90% of gaseous mercury emissions from the Carbon Regeneration Kilns are captured via the KOGCC and not released to the atmosphere.

Therefore, until the KOGCC is commissioned, KCGM will continue to estimate mercury emissions from the carbon regeneration kilns via mass balance, incorporating a mercury capture factor of 90% into the calculation based on the fact that all off-gas from the carbon regeneration kilns is processed via the KOGCC.

5. COMPLAINT MANAGEMENT

KCGM's Public Interaction Line (PIL) was established in 1993 and is available 24 hours (Ph: 08 9022 1100) for anyone to contact KCGM for a wide range of issues including emergencies, complaints, inquiries and feedback.

The PIL is backed up by an electronic database. Each interaction is logged in the database and is categorised based on the nature of the interaction and the topic. For example a public interaction may be logged as a complaint regarding fugitive dust, or as an inquiry regarding air quality monitoring results. The database automatically sends out an email notification to key internal stakeholders based on the topic to ensure a timely response, especially if the interaction requires any follow-up actions. KCGM has made a commitment to respond to complainants within 24 hours, or the next working day.

Information received via community feedback can assist KCGM to identify air emission sources and improve air quality management in general.

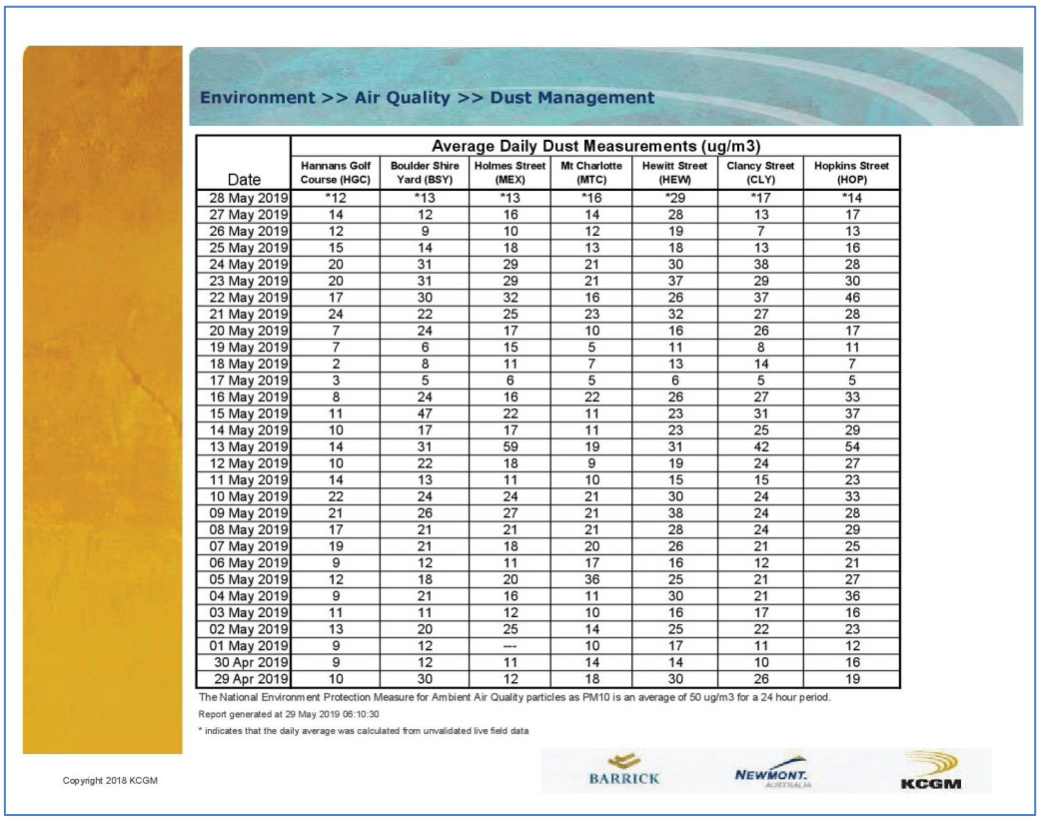
KCGM has implemented a Complaints and Grievance Management procedure to manage the actions taken to resolve complaints.

6. REPORTING PROVISIONS

6.1 KCGM Website

Condition 7-5 of Ministerial Statement 782 requires KCGM make available continuous dust monitoring data on the website within 24 hours of the recording of that data.

To meet this requirement, KCGM has developed a Dust Monitoring Report (Figure 5), made publicly available on the KCGM website (www.superpit.com.au). The report is updated daily at ~6 am and makes reference to the Daily performance target. Invalidated data are identified with a '*'.



Environment >> Air Quality >> Dust Management

Date	Average Daily Dust Measurements (ug/m3)						
	Hannans Golf Course (HGC)	Boulder Shire Yard (BSY)	Holmes Street (MEX)	Mt Charlotte (MTC)	Hewitt Street (HEW)	Clancy Street (CLY)	Hopkins Street (HOP)
28 May 2019	*12	*13	*13	*16	*29	*17	*14
27 May 2019	14	12	16	14	28	13	17
26 May 2019	12	9	10	12	19	7	13
25 May 2019	15	14	18	13	18	13	16
24 May 2019	20	31	29	21	30	38	28
23 May 2019	20	31	29	21	37	29	30
22 May 2019	17	30	32	16	26	37	46
21 May 2019	24	22	25	23	32	27	28
20 May 2019	7	24	17	10	16	26	17
19 May 2019	7	6	15	5	11	8	11
18 May 2019	2	8	11	7	13	14	7
17 May 2019	3	5	6	5	6	5	5
16 May 2019	8	24	16	22	26	27	33
15 May 2019	11	47	22	11	23	31	37
14 May 2019	10	17	17	11	23	25	29
13 May 2019	14	31	59	19	31	42	54
12 May 2019	10	22	18	9	19	24	27
11 May 2019	14	13	11	10	15	15	23
10 May 2019	22	24	24	21	30	24	33
09 May 2019	21	26	27	21	38	24	28
08 May 2019	17	21	21	21	28	24	29
07 May 2019	19	21	18	20	26	21	25
06 May 2019	9	12	11	17	16	12	21
05 May 2019	12	18	20	36	25	21	27
04 May 2019	9	21	16	11	30	21	36
03 May 2019	11	11	12	10	16	17	16
02 May 2019	13	20	25	14	25	22	23
01 May 2019	9	12	---	10	17	11	12
30 Apr 2019	9	12	11	14	14	10	16
29 Apr 2019	10	30	12	18	30	26	19

The National Environment Protection Measure for Ambient Air Quality particles as PM10 is an average of 50 ug/m3 for a 24 hour period.

Report generated at 29 May 2019 06:10:30

* indicates that the daily average was calculated from unvalidated live field data

BARRICK NEWMONT. KCGM

Figure 5: Sample of KCGM Dust Monitoring Report

If requested, PM_{10} dust monitoring data is provided to the DWER and/or DoH upon request.

6.2 Reporting on Exceedance of Environmental Criteria

In the event that the Daily performance target for PM_{10} dust concentration is exceeded KCGM will undertake an assessment of the ambient PM_{10} monitoring data and review the circumstances and potential emission source. Where KCGM is identified to be a significant contributor to the event the relevant authorities (i.e. DWER and DoH) will be notified within seven days of the date of exceedance.

The KCGM Dust Programme is used during the investigation of any recorded exceedance of the Daily PM10 dust monitoring performance target to determine whether operations had contributed to dust emissions despite the winds being outside the assumed arc of influence.

The KCGM Dust Programme has the ability to display data for any selected date and time including the ability to step forwards or backwards in 5-minute or 30-minute steps. These back trajectories in combination with KCGM's recorded operational activities (e.g., truck movements, waste rock dumping areas) are used within the analysis to identify potential dust sources.

The period of seven days allows for:

- the potential recovery of missing data if there have been any communication problems; and
- data validation and analysis including time for the determination of potential source contributors and the following up with dispatch operators on dust alarm actions, taking into account shift changes and out of office periods when staff are unavailable.

The following information is included in the notification:

- A summary of the event;
- Appropriate wind roses and time series analysis indicating dust concentration, wind direction and wind speed;
- Source contribution analysis; and
- Actions taken and identified mitigation measures, where appropriate.

Details of compliance against the Annual Event Target and Annual Data Availability are reported to the DWER via the Annual Compliance Assessment Report prepared for Ministerial Statement 782.

6.2.1 Methodology for Determining Significant Contribution

Should a calculated daily average PM_{10} concentration (based on the average of the 5-minute average concentrations recorded for the day) exceed 50 µg/m^3 (provided there is sufficient data available to validate the 24-hour average), then KCGM undertakes a review of the 5-minute average PM_{10} concentrations and meteorological monitoring data to:

1. Determine the daily average concentration, if any, that was associated with wind directions that were within the arcs that align with KCGM's Fimiston Operations and use this value to calculate the ratio of the KCGM arc;
2. Based on an assessment of the winds that occurred, determine which ambient PM_{10} monitoring station is most likely to represent the "background" monitoring site (usually the HGC site) and the daily average "background" concentration recorded at that site;
3. Calculate the difference between the recorded daily average exceedance concentration and the daily average background concentration and determine the ratio of this difference and the recorded daily average exceedance concentration; and
4. If the ratios determined from steps 1 and 3 are both greater than 60% then KCGM is considered to be a potential significant contributor.

6.2.2 Other Contributory Factors

Should other factors be found to contribute to calculated daily average PM_{10} concentration, namely factors outside of KCGM's control, then KCGM is not considered to be a significant contributor to the event.

Other contributory factors may include, but are not limited to, the following:

- Fugitive dust caused by regional storm events. There are many natural and anthropogenic sources of particulate emissions in the Goldfields Region and it is not unusual to have regional

dust storms that can result in significant ambient PM_{10} concentrations over a wide area. Evident when several of the monitors record a high PM10 concentrations at any one time.

- Fugitive dust caused by a third party (e.g. vehicle activity on unsealed roads). A common contributory factor due to the location of some monitoring sites being adjacent to unsealed/dirt areas.
- Smoke from wood heaters. A common contributory factor during the winter months.
- When the potential source of the of the PM_{10} concentrations cannot be determined due to very low wind speeds and/or highly variable wind directions,

6.3 Annual Environment Report

In accordance with conditions of Prescribed Premises Licence L6420/1988/14, KCGM prepares an Annual Environment Report for the Fimiston Operations that includes:

- A summary of the PM_{10} dust monitoring results for the reporting period.
- An analysis of seasonal and annual dust trends to review the effectiveness of dust control measures and continuous improvement in air emission controls implemented through the FAQMP.

7. ADAPTIVE MANAGEMENT AND REVIEW OF THE CONDITION EMP

KCGM will also implement adaptive management to learn from the implementation of mitigation measures, monitoring and evaluation against the environmental criteria in order to meet the condition environmental objective. The following approach will be followed:

- Where KCGM is identified to be a significant contributor to events where the potential emission source(s) is from the same area, operational data will be reviewed to verify whether the DMMP is being implemented effectively, or if there has been a change to operating conditions. Where required, KCGM will implement improved dust management measures.
- Air Quality monitoring data and trigger levels pertaining to the dust alarm system are reviewed every three years as part of the triennial review process or following any high level events based on the monitoring data collected at each monitoring site.
- An increased number of complaints or repeated complaints from the same area will be reviewed to verify whether air quality management practices are being implemented effectively, if there has been a change to operating conditions or if the source is external to the Fimiston Operations. Information received via community feedback can assist KCGM to identify air emission sources and improve air quality management.

Review of the Condition EMP will be undertaken as per the following:

- On advice from the DWER and/or the DoH;
- Following a significant change in process or operational aspect; or
- Following an incident investigation or response to public complaint which identifies a gap in the management plan relating to either process or data collection.

8. STAKEHOLDER CONSULTATION

KCGM's close proximity to the City of Kalgoorlie-Boulder has necessitated a sustained effort in stakeholder engagement. It is this proximity, along with the principles of JV Owners Newmont and Barrick, which drive a concerted effort to engage local and government stakeholders. The KCGM Stakeholder Engagement Plan details key stakeholder, engagement methods and ongoing review of external relationships. KCGM utilises a range of mechanisms to facilitate consultation, provide information and capture input from the wider Kalgoorlie-Boulder community on an ongoing basis.

A summary of key stakeholder consultation undertaken by KCGM with regards to air quality management and the development of this Condition EMP is provided in the following sections.

8.1 Social Impact Assessments

The views of Kalgoorlie-Boulder residents are captured regularly in KCGM's Social Impact Assessments (SIA), which are conducted around every five years or when there is a major operational change. The most recent SIA conducted in 2015 included questions regarding management of environmental impacts, including air quality. Both key stakeholders and public phone survey respondents rated KCGM highly in management of environmental impacts.

8.2 Community Reference Group

The CRG is a self-selected group of local community members and invited guests from the DWER, Department of Mines, Industry Regulation and Safety (DMIRS), Kalgoorlie-Boulder Chamber of Commerce and Industry (KBCCI), Department of Planning, Lands and Heritage (DPLH) and State (elected Members) and Local (CKB) Government representatives. The group meets monthly to discuss current KCGM planning, operational activities and feedback from the community. Minutes of meetings are available on the KCGM website together with contact details for all CRG Members. The local community is encouraged to contact CRG members to discuss their issues if they do not wish to contact KCGM directly.

8.3 Regulatory Agencies

KCGM has previously consulted with numerous regulatory agencies on the development of the FAQMP, including the OEPA's Proposal and Implementation Monitoring Section, DEC Air Quality Branch, DEC Industry Regulation in Kalgoorlie and the DoH.

Consultation and feedback has been used for confirmation and approval of dust monitoring locations, instruments, implementation of monitoring programmes and inclusion of additional information in the FAQMP when requested.

9. GLOSSARY OF TERMS

μg/m³: micrograms per cubic metre

BDMP: Blasting Dust Management Plan

BSY: Dust Monitoring Location – Boulder Shire Yard

CAS: Weather Monitoring Location – Cassidy Headframe

CKB: City of Kalgoorlie-Boulder

CKMERP: Carbon Kiln Mercury Emissions Reduction Programme

CLY: Dust Monitoring Location – Clancy Street

CRG: Community Reference Group

DEC: Department of Environment and Conservation. (Now DWER)

DMIRS: Department of Mines Industry Regulation and Safety

DMMP: Dust Monitoring and Management Programme

DoH: Department of Health

DPLH: Department of Planning, Lands and Heritage

DWER: Department of Water and Environmental Regulation

EMP: Environmental Management Plan.

EPA: Environmental Protection Authority

ERP: Emissions Reduction Project

FAQMP: Fimiston Air Quality Management Plan

HEW: Dust Monitoring Location – Hewitt Street

HGC: Dust Monitoring Location – Hannan's Golf Course

KBCCI: Kalgoorlie-Boulder Chamber of Commerce and Industry

KCGM: Kalgoorlie Consolidated Gold Mines Pty Ltd

km: Kilometres

KOGCC: Kiln Off-Gas Cleaning Circuit

MEX: Dust/Weather Monitoring Location - Metals Exploration Yard

Monitoring: Is the process of sampling and measuring certain parameters

Mt: Million tonnes

MTC: Dust Monitoring Location – Mt Charlotte

NEPM: National Environmental Pollution Measure

OEPA: Office of the Environmental Protection Authority. (Now DWER)

PER: Public Environmental Review

PIL: Public Interaction Line

PM_{10}: Particulate Matter with an equivalent aerodynamic diameter of 10 microns or less

RTO: Regenerative Thermal Oxidiser

SIA: Social Impact Assessment

WHO: World Health Organisation

10. REFERENCES

Australian Standard AS/NZS 3580.9.11-2008 *Methods for sampling and analysis of ambient air - Part 9.11: Determination of suspended particulate matter - PM10 beta attenuation monitors*

ENVIRON Australia Pty Ltd (2006*). Public Environmental Review, Fimiston Gold Mine Operations Extension (Stage 3) and Mine Closure Planning.* Report prepared for Kalgoorlie Consolidated Gold Mines Pty Ltd.

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Minister for Environment (2009) Ministerial Statement 782: *Fimiston Gold Mine Operations Extension (Stage 3) and Mine Closure Planning.*

National Environment Protection (Ambient Air Quality) Measure Variation, 2003

National Environment Protection (Ambient Air Quality) Measure Variation, 2015

WHO (2003). Concise International Chemical Assessment Document No 50. Elemental Mercury and Inorganic Mercury Compounds: Human Health Aspects. World Health Organisation.