



Attachment 3A Commissioning Plan

The KCGM Growth Project will be completed via an EPC contract whereby Northern Star Resources will engage a qualified and competent third party to complete the Engineering (E), Procurement (P) and Construction (C) activities for the scope of the project, including commissioning.

The commissioning activities will be completed over a period of approximately 26 weeks, with ramp up to full capacity expected within 20 weeks of commissioning completion. Construction activities for the mill expansion is due to commence in December 2022, with the commissioning and ramp-up completed in November 2025.

The sequence of commissioning activities has yet to be defined in detail, however, it is expected that the overall project will be broken down into systems and each commissioned independently of the others. A Commissioning Plan will be developed by the Contractor once the detailed engineering design has been completed and construction advanced.

Each system will be further broken down into subsystems and detailed in an execution level commissioning schedule prior to commissioning beginning.

The Commissioning Systems will be grouped as follows:

- Primary Crushing System
 - o Primary crushing circuit operating in parallel with the existing crushing circuit
 - o Conveying system for transporting the crushed ore to the new crushed ore stockpile
 - o Crushed ore stockpile
 - o Reclaim and emergency feeders for transferring crushed ore from the stockpile onto the new SAG mill feed conveyor
- Grinding Circuit System
 - o SAG and ball mill including new SAG mill feed conveyor
 - o Pebble crushing circuit including new pebble crusher and magnet
 - o Cyclone cluster
 - o Gravity circuit
- Flotation Circuit System
 - o Rougher and scavenger cells
 - o Existing flotation equipment repurposing
- Concentrate Handling Circuit
 - o Concentrate storage tanks
 - o Ultrafine grinding mills
 - o Ultrafine classification circuit
- Leaching Circuit System
 - o Pre-leach thickener
 - o Flotation tail leach tanks
 - o Regeneration kiln and off-gas scrubbing
 - o Existing CIL2/3 repurposing
- Elution Circuit System
 - o Split-AARL elution circuit
 - o Goldroom upgrades
- Reagent Circuit System
 - o Storage tanks and distribution pumps and piping
- Water Services System
 - o Process water and raw water tanks and piping systems
- Power Supply
 - o Upgraded power line from Parkston station

The commissioning inputs and outputs do not materially differ from the existing processing plant owing to the duplication or replacement of existing systems. Initially, the new equipment will be commissioned on water only before the introduction of ore.

In relation to atmospheric contaminants, these will not differ from typical operational exposures such as those from previous process plant expansions or shutdowns. These will be managed through the NSR Standard – Occupational Hygiene and KCGM Health and Hygiene Management Plan. This will include the requirement for personnel to participate in random sampling for atmospheric contaminants currently sampled in the processing plant and where utilised, welding fume for boilermaker/welders.

Sampling and analysis of carbon regeneration kilns during commissioning will be conducted by an independent third party. Methodologies chosen by the independent third party will reflect those listed in the KCGM Fimiston Air Quality Management Plan.

Construction and commissioning noise will be managed consistently with standard site procedures, i.e. where fixed, mounted or hand held power tools are being operated, mandatory hearing protection will be required. As construction will be in close proximity to the operating mill (which is a mandatory PPE sign posted area), this will apply to construction personnel also. The current occupational noise levels in the vicinity of the primary mill requires personnel to wear hearing protection devices to reduce auditory exposure. With the secondary mill being aligned with the primary mill, NSR expect a doubling of sound pressure levels in the immediate area. Occupational noise within the mill surrounds is estimated to range from 90 to 120dB (A). This will likely be elevated during the commissioning phase and captured during annual noise surveys. Workers during the construction phase will be required to undergo training in noise and hearing protection and will be sampled randomly for personal noise exposure recordings. Further action and controls will be implemented by NSR should the results of sampling warrant them.

Waste emissions, such as construction wastes will be handled in accordance with existing waste management plans and will be disposed of, or recycled the same as all other current mine site wastes. All non-recyclable inert and putrescible wastes will be disposed of to the site landfill trenches. All recyclable items (cardboard, paper, steel, poly pipe, etc.) will be sent off site for reuse or donated to local communities/stakeholders.

The Fimiston Air Quality Management Plan which outlines the ongoing collection, recording and reporting of data by NST is included as Appendix A.

The Noise and Vibration Monitoring and Management Plan as Appendix B.

The Contractor will be required to submit Health, Safety and Environmental Management plan that is aligned to and in compliance with NSR's site standards, policies and procedures.

ID	Task Name	Duration	Start	Finish	Predecessors	2nd Quarter Qtr 2	3rd Quarter Qtr 3	4th Quarter Qtr 4	1st Quarter Qtr 1	2nd Quarter Qtr 2	3rd Quarter Qtr 3	4th Quarter Qtr 4	1st Quarter Qtr 1	2nd Quarter Qtr 2	3rd Quarter Qtr 3	4th Quarter Qtr 4	1st Quarter Qtr 1	2nd Quarter Qtr 2	3rd Quarter Qtr 3	4th Quarter Qtr 4	1st Quarter Qtr 1	
1	KCGM GROWTH PROJECT	841 days	Mon 10/10/22	Mon 29/12/25																		
2	Process - EPC Contract - Engineering/ Detail Design	253 days	Mon 10/10/22	Wed 27/09/23																		
12	Process - EPC Contract - Procurement	495 days	Fri 28/10/22	Thu 19/09/24																		
181	Process - EPC Contract - Site Works	508 days	Wed 18/01/23	Fri 27/12/24																		
182	Process - EPC Contract - Site Works - P&G'S	301 days	Wed 18/01/23	Wed 13/03/24																		
190	Process - EPC Contract - Site Works - 305 Crushing	342 days	Fri 23/06/23	Mon 14/10/24																		
207	Process - EPC Contract - Site Works - 310 Grinding	441 days	Mon 27/03/23	Mon 2/12/24																		
244	Process - EPC Contract - Site Works - 315 Gravity Circuit	205 days	Mon 4/12/23	Fri 13/09/24																		
255	Process - EPC Contract - Site Works - 320 Flotation	460 days	Mon 27/03/23	Fri 27/12/24																		
270	Process - EPC Contract - Site Works - 330 Concentrate Treatment	325 days	Mon 7/08/23	Fri 1/11/24																		
291	Process - EPC Contract - Site Works - 340 Standard Leaching & Absorption	408 days	Wed 15/03/23	Fri 4/10/24																		
316	Process - EPC Contract - Site Works - 341 Concentrate Leaching & Absorption	60 days	Mon 2/09/24	Fri 22/11/24																		
323	Process - EPC Contract - Site Works - 350 Elution & Gold Room	276 days	Fri 8/09/23	Fri 27/09/24																		
340	Process - EPC Contract - Site Works - 360 Tailings	241 days	Fri 22/09/23	Fri 23/08/24																		
354	Process - EPC Contract - Site Works - 370 Reagents	402 days	Wed 5/04/23	Thu 17/10/24																		
364	Process - EPC Contract - Site Works - 380 Utilities	180 days	Wed 22/11/23	Tue 30/07/24																		
376	Process - EPC Contract - Site Works - General	266 days	Wed 8/02/23	Wed 14/02/24																		
383	Process - EPC Contract - Site Works - Commissioning	192 days	Fri 20/09/24	Mon 16/06/25																		
384	Process - EPC Contract - Site Works - Commissioning - Schedule Contingency	60 days	Tue 25/02/25	Mon 19/05/25																		
386	Process - EPC Contract - Site Works - Commissioning - C1 Dry Commissioning	96 days	Fri 20/09/24	Fri 31/01/25																		
387	Process - EPC Contract - Site Works - Commissioning - C1 Dry Commissioning - 305 Crushing	3.2 wks	Thu 17/10/24	Thu 7/11/24	196,200																	
388	Process - EPC Contract - Site Works - Commissioning - C1 Dry Commissioning - 310 Grinding	8 wks	Tue 3/12/24	Mon 27/01/25	217,221,231,237																	
389	Process - EPC Contract - Site Works - Commissioning - C1 Dry Commissioning - 315 Gravity Circuit	3 wks	Fri 20/09/24	Thu 10/10/24	177,247,250,254																	
390	Process - EPC Contract - Site Works - Commissioning - C1 Dry Commissioning - 320 Flotation	5 wks	Mon 30/12/24	Fri 31/01/25	260,263,266,269,																	
391	Process - EPC Contract - Site Works - Commissioning - C1 Dry Commissioning - 330 Concentrate Treatment	3 wks	Mon 4/11/24	Fri 22/11/24	280,283,287																	
392	Process - EPC Contract - Site Works - Commissioning - C1 Dry Commissioning - 340 Standard Leaching & Absorption	5 wks	Fri 4/10/24	Thu 7/11/24	298,303,308,312																	
393	Process - EPC Contract - Site Works - Commissioning - C1 Dry Commissioning - 341 Concentrate Leaching & Absorption	3 wks	Mon 25/11/24	Fri 13/12/24	319,322																	
394	Process - EPC Contract - Site Works - Commissioning - C1 Dry Commissioning - 350 Elution & Gold Room	5 wks	Mon 30/09/24	Fri 1/11/24	327,331,335,339																	
395	Process - EPC Contract - Site Works - Commissioning - C1 Dry Commissioning - 360 Tailings	2 wks	Fri 20/09/24	Thu 3/10/24	177,344,348																	
396	Process - EPC Contract - Site Works - Commissioning - C1 Dry Commissioning - 370 Reagents	2 wks	Fri 18/10/24	Thu 31/10/24	359,363																	
397	Process - EPC Contract - Site Works - Commissioning - C1 Dry Commissioning - 380 Utilities	2 wks	Fri 20/09/24	Thu 3/10/24	177,368,372																	
398	Process - EPC Contract - Site Works - Commissioning - C2 Wet Commissioning	102 days	Fri 4/10/24	Mon 24/02/25																		
399	Process - EPC Contract - Site Works - Commissioning - C2 Wet Commissioning - 305 Crushing	2.2 wks	Fri 8/11/24	Fri 22/11/24	387,410																	
400	Process - EPC Contract - Site Works - Commissioning - C2 Wet Commissioning - 310 Grinding	4 wks	Tue 28/01/25	Mon 24/02/25	388,410																	
401	Process - EPC Contract - Site Works - Commissioning - C2 Wet Commissioning - 315 Gravity Circuit	2 wks	Fri 18/10/24	Thu 31/10/24	389,410																	
402	Process - EPC Contract - Site Works - Commissioning - C2 Wet Commissioning - 320 Flotation	3 wks	Mon 3/02/25	Fri 21/02/25	390,410																	
403	Process - EPC Contract - Site Works - Commissioning - C2 Wet Commissioning - 330 Concentrate Treatment	2 wks	Mon 25/11/24	Fri 6/12/24	391,410																	
404	Process - EPC Contract - Site Works - Commissioning - C2 Wet Commissioning - 340 Standard Leaching & Absorption	3 wks	Fri 8/11/24	Thu 28/11/24	392,410																	
405	Process - EPC Contract - Site Works - Commissioning - C2 Wet Commissioning - 341 Concentrate Leaching & Absorption	2 wks	Mon 16/12/24	Fri 27/12/24	393,410																	
406	Process - EPC Contract - Site Works - Commissioning - C2 Wet Commissioning - 350 Elution & Gold Room	2 wks	Fri 18/10/24	Thu 31/10/24	410																	
407	Process - EPC Contract - Site Works - Commissioning - C2 Wet Commissioning - 360 Tailings	2 wks	Fri 18/10/24	Thu 31/10/24	349,351,395,410																	
408	Process - EPC Contract - Site Works - Commissioning - C2 Wet Commissioning - 370 Reagents	2 wks	Fri 1/11/24	Thu 14/11/24	396,410																	
409	Process - EPC Contract - Site Works - Commissioning - C2 Wet Commissioning - 380 Utilities	1 wk	Fri 4/10/24	Thu 10/10/24	397																	
410	Process - EPC Contract - Site Works - Commissioning - C2 Wet Commissioning - General - Buried Services	1 wk	Fri 11/10/24	Thu 17/10/24	378,409																	
411	Process - EPC Contract - Site Works - Commissioning - C3 Ore Commissioning	20 days	Tue 20/05/25	Mon 16/06/25																		
412	Process - EPC Contract - Site Works - Commissioning - C3 Ore Commissioning	12 wks	Tue 20/05/25	Mon 11/08/25	385																	
413	PROCESS - RAMP-UP & PERFORMANCE TEST	100 days	Tue 12/08/25	Mon 29/12/25																		
414	Process - Ramp Up & Performance Test - Ramp Up	90 days	Tue 12/08/25	Mon 15/12/25																		
415	Process - Ramp Up & Performance Test - Ramp Up	18 wks	Tue 12/08/25	Mon 15/12/25	412																	
416	Process - Ramp Up & Performance Test - Performance Test	10 days	Tue 16/12/25	Mon 29/12/25																		
417	Process - Ramp Up & Performance Test - Performance Test	2 wks	Tue 16/12/25	Mon 29/12/25	415																	

Project: KCGM Growth Project
Date: Fri 8/04/22

Task		Summary		Inactive Milestone		Duration-only		Start-only		External Milestone		Manual Progress	
Split		Project Summary		Inactive Summary		Manual Summary Rollup		Finish-only		Deadline			
Milestone		Inactive Task		Manual Task		Manual Summary		External Tasks		Progress			

Appendix A

FIMISTON AIR QUALITY MANAGEMENT PLAN

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

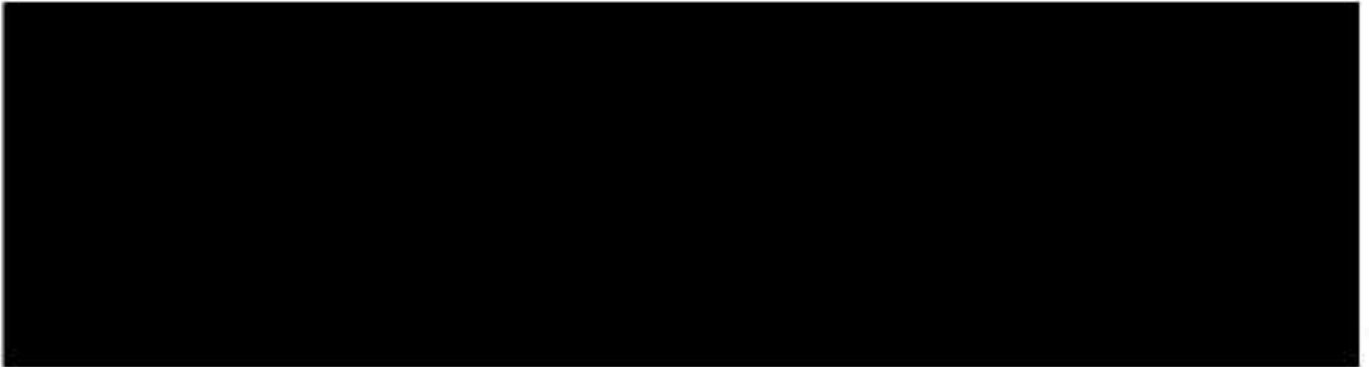
1.3 Document History

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 <i>Fimiston Gold Mine Operations Extension (Stage 3) and Mine Closure Planning</i> 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.



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 <i>Mines Safety and Inspection Regulations 1995</i> .	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 60°) and not reflective of large variations in the wind directions
5	the 30-minute average wind speed is greater than 2 m/s

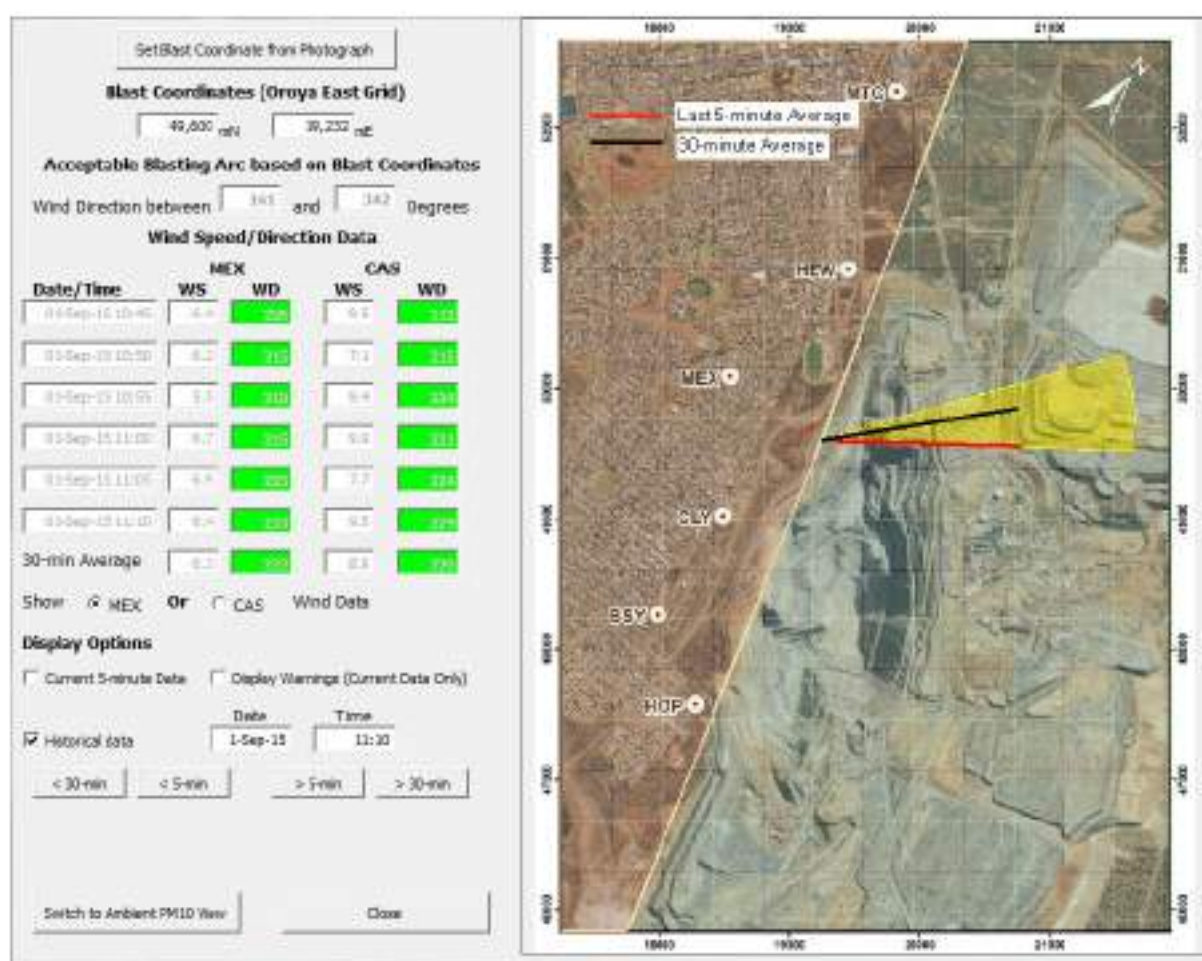


Figure 1: Example Display from the KCGM Dust Programme

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 PM₁₀ concentrations as a result of the Fimiston Operations are less than 50 µg/m³ 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 PM₁₀ ground level concentrations resulting from the Fimiston Operations were predicted to be less than 50 µg/m³ 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 PM₁₀ 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 PM₁₀ 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 PM₁₀ 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 PM₁₀ monitoring data from the BSY site on days where the measured 24-hour average PM₁₀ concentration was greater than 40 µg/m³. 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 PM₁₀ 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 PM₁₀ 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 PM₁₀ concentrations over a wide area.

If several of the monitors are recording high PM₁₀ 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.

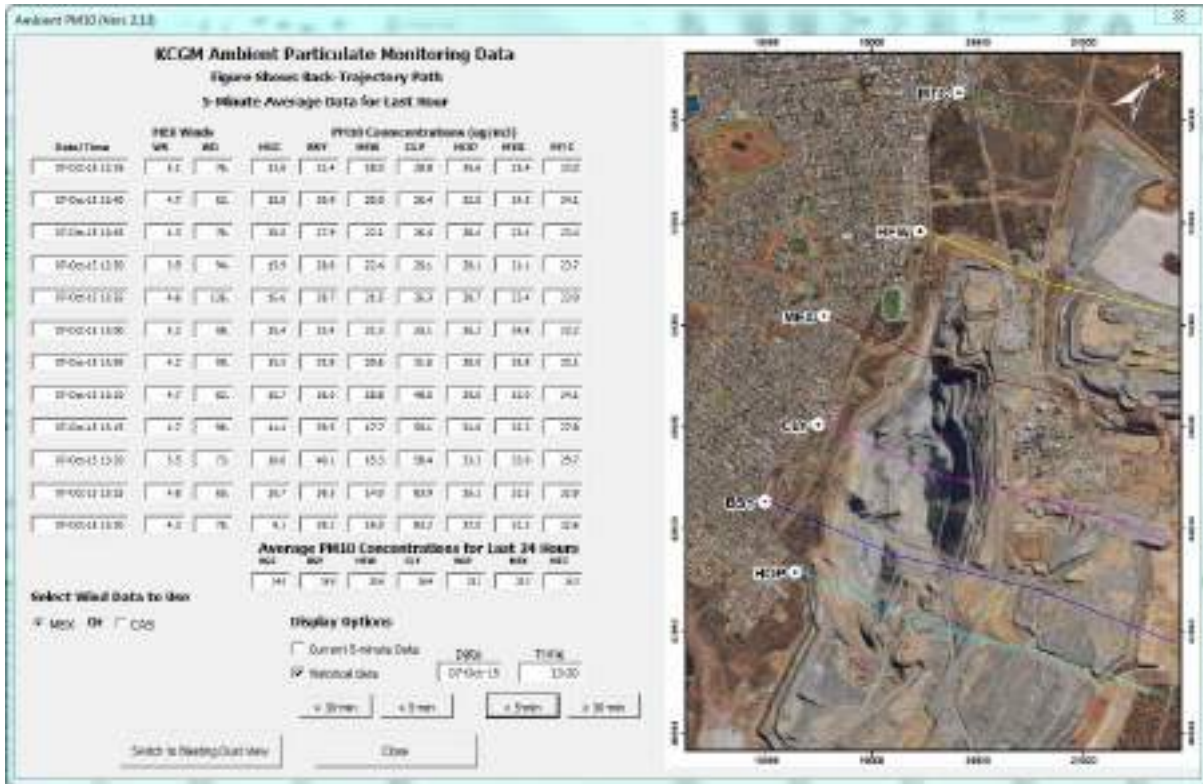


Figure 2: Sample Display from the Ambient Particulate Monitoring Data (KCGM Dust Programme)

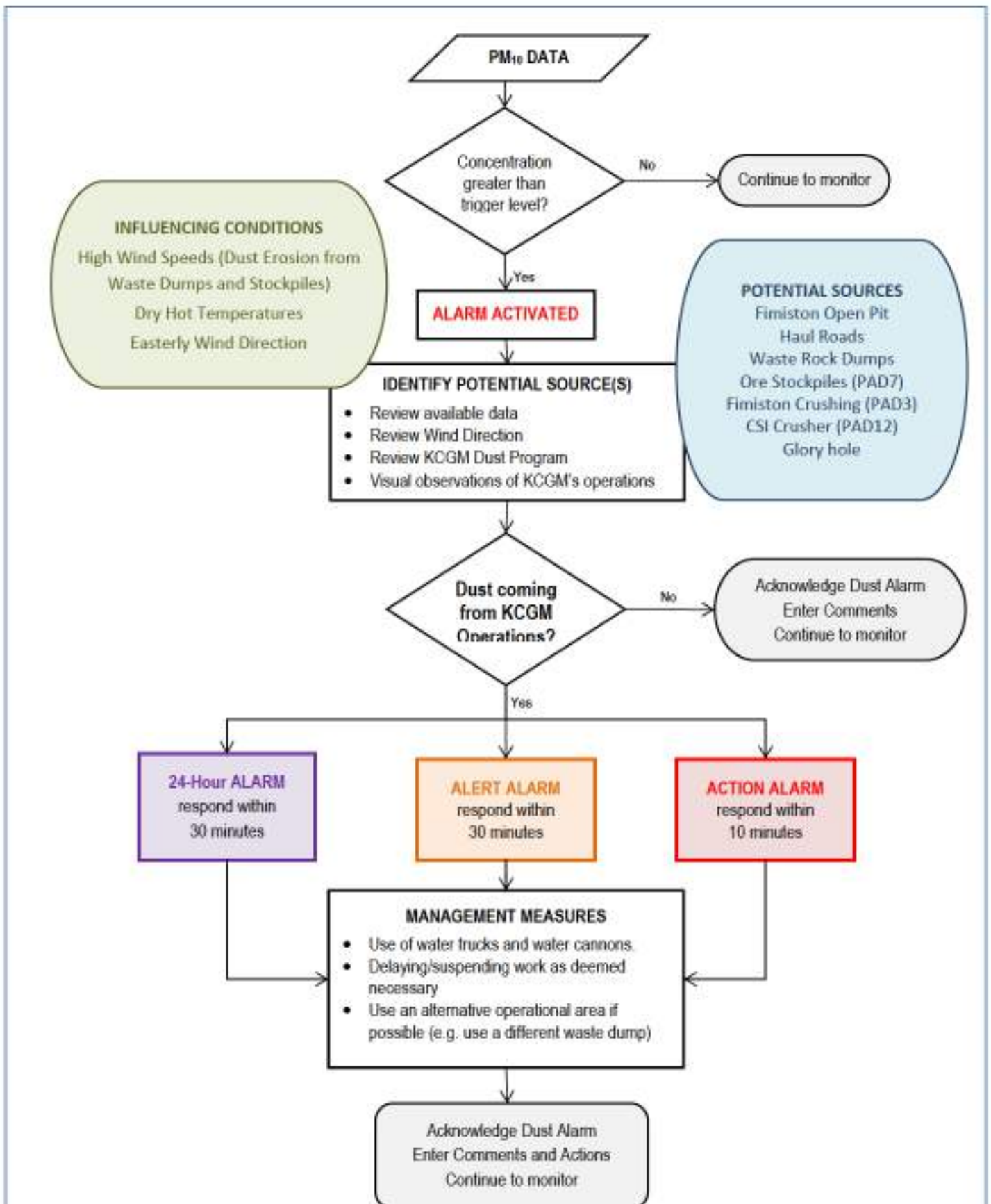


Figure 3: Process Flowchart for Reactive Component of DMMP

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/m³). 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 PM₁₀ Dust

KCGM's primary objective for the DMMP is to proactively manage its Fimiston Operations to ensure that the 24-hour average PM₁₀ concentrations as a result of KCGM's emissions are less than 50 µg/m³ at the monitoring locations. This performance target was based on the PM₁₀ 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 PM₁₀ dust monitoring network is adequately maintained, greater than 90% availability of the continuous PM₁₀ data from each dust monitoring locations is required on an annual basis.

The environmental criteria for KCGM's Continuous PM₁₀ Dust Monitoring Network is outlined in Table 7.

Table 7: PM₁₀ 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 µg/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 PM₁₀ Dust Monitoring Network

KCGM's Continuous PM₁₀ dust Monitoring Network is detailed below:

- Continuous PM₁₀ 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 PM₁₀ 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 PM₁₀ concentrations to assist with the detection and assessment of any high short-term PM₁₀ 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 PM₁₀ 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 PM₁₀ 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.
- PM₁₀ dust data are recorded in µg/m³ which are averaged over 5 minutes.
- PM₁₀ 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.

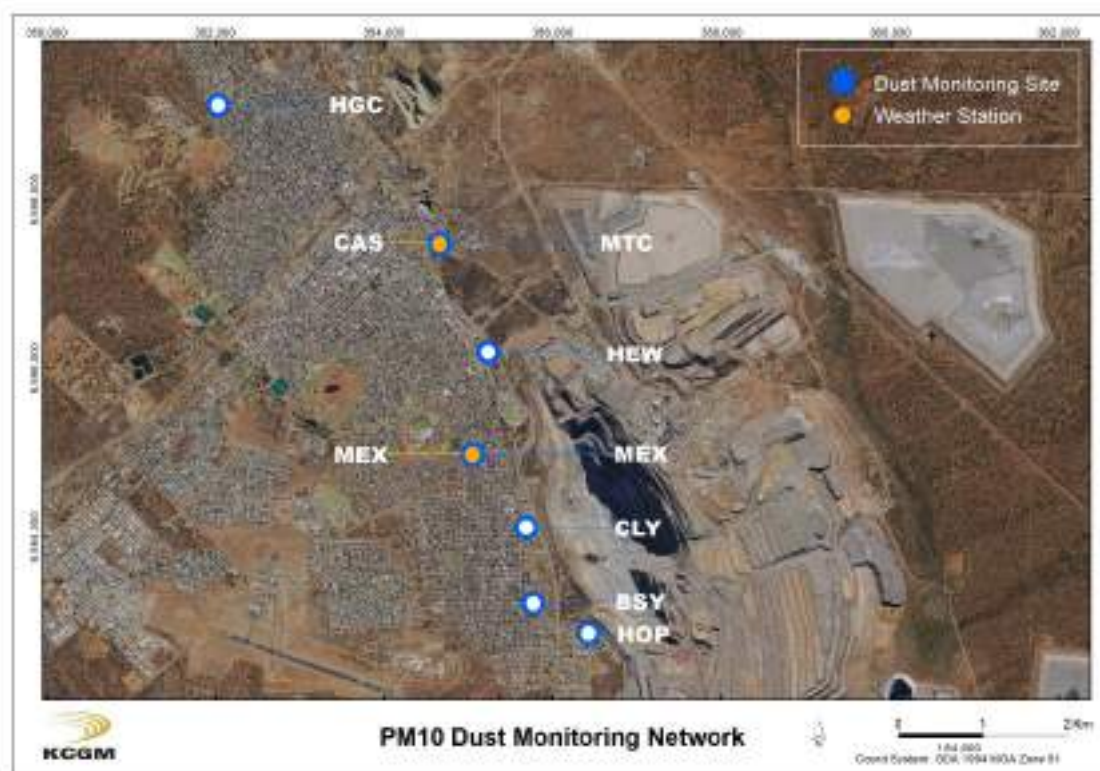


Figure 4: Dust and Weather Monitoring Locations

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 $0.08 \mu\text{g}/\text{m}^3$, which indicates comfortable compliance with the annual ambient air quality criteria $0.2 \mu\text{g}/\text{m}^3$ 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/m ³)						
	Hainford Golf Course (HGC)	Yard (BY)	Holmes Street (MS)	Mt Chertside (MFC)	Pease Street (PES)	Clancy Street (CL)	Holmes Street (HQP)
28 May 2019	12	13	13	16	29	17	18
27 May 2019	14	12	18	14	28	13	17
26 May 2019	12	0	11	12	19	7	13
25 May 2019	15	14	18	15	18	13	15
24 May 2019	20	31	29	21	30	38	28
23 May 2019	20	31	29	21	37	28	30
22 May 2019	17	30	32	16	26	32	48
21 May 2019	24	22	23	23	32	32	28
20 May 2019	7	24	17	10	16	26	17
19 May 2019	7	6	13	5	11	6	11
18 May 2019	2	6	11	7	13	14	7
17 May 2019	3	0	0	3	6	5	0
16 May 2019	8	24	18	22	26	27	32
15 May 2019	11	47	22	11	23	31	37
14 May 2019	10	17	17	11	23	25	26
13 May 2019	14	31	38	18	31	42	34
12 May 2019	10	22	18	9	19	24	27
11 May 2019	14	33	13	10	15	15	23
10 May 2019	22	34	24	21	30	24	33
09 May 2019	21	38	27	21	34	24	28
08 May 2019	17	21	21	21	24	24	26
07 May 2019	19	21	18	20	25	21	25
06 May 2019	9	12	11	17	16	12	21
05 May 2019	12	18	26	16	25	21	27
04 May 2019	6	21	18	11	20	21	36
03 May 2019	11	11	12	10	18	17	18
02 May 2019	13	20	28	14	25	22	23
01 May 2019	9	12	---	10	17	13	12
30 Apr 2019	8	12	11	14	14	12	16
29 Apr 2019	10	30	13	16	20	28	18

The National Environment Protection Measure for Ambient Air Quality particles as PM₁₀ is an average of 50 µg/m³ for a 24 hour period.
 Record generated at 29 May 2019 06:00:00
 (*) indicates that the daily average value calculated from unvalidated for that date

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Figure 5: Sample of KCGM Dust Monitoring Report

If requested, PM₁₀ 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 PM₁₀ dust concentration is exceeded KCGM will undertake an assessment of the ambient PM₁₀ 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 PM₁₀ concentration (based on the average of the 5-minute average concentrations recorded for the day) exceed 50 µg/m³ (provided there is sufficient data available to validate the 24-hour average), then KCGM undertakes a review of the 5-minute average PM₁₀ 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 PM₁₀ 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 PM₁₀ 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 PM₁₀ 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 PM₁₀ 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 PM₁₀ 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

PM₁₀: 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

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

Appendix B
NOISE AND VIBRATION MANAGEMENT PLAN

KALGOORLIE CONSOLIDATED GOLD MINES PTY LTD



NOISE AND VIBRATION MONITORING AND MANAGEMENT PLAN

AUGUST 2018

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1. SUMMARY

1.1 Purpose of Document

This Condition Environmental Management Plan (Condition EMP), generally referred to as the Fimiston Noise and Vibration Monitoring and Management Plan (NVMMP), has been developed and implemented in accordance with conditions of Ministerial Statement No. 782 *Fimiston Gold Mine Operations Extension (Stage 3) and Mine Closure Planning (782:M)* and the *Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016* (2016 Fimiston Noise Approval).

KCGM believes this Condition EMP incorporates best practice to minimise noise and vibration impacts to nearby residents of the City of Kalgoorlie-Boulder as a result of the Fimiston Operations.

1.2 Management Plan Summary

The table below presents the environmental criteria to measure achievement of the conditioned environmental outcome that must be met through implementation of this Condition EMP.

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 NVMMP is submitted to fulfil the requirements of condition/s 9-6, 9-7, 9-8 and 9-9 of the above Statement.
	The NVMMP is submitted to fulfil the requirements of condition 9 of the Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016.
Condition environmental objective	To manage noise emissions from the Fimiston Operations to minimise potential impacts to the residents of the City of Kalgoorlie-Boulder.
Environmental criteria	Criterion 1: Environmental Noise Levels Criterion 2: Airblast Levels Criterion 3: Blast Vibration Levels

1.3 Document History

Table 1: Document History

Version	Date	Document Changes
1	JAN 1993	New Document. Submitted to the EPA to meet requirements of Condition 5 of Ministerial Statement No.188.
2	JUN 2004	Revised to meet requirements of the Southern Landform Extension Project Section 45C Approval.
3	AUG 2009	Revised to meet requirements of Ministerial Statement No.782 and the <i>Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2009</i> .
4	APR 2010	Revised to include the recommendations of the Appeals Committee regarding an appeal against the <i>Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2009</i> .
5	OCT 2010	Finalised in response to feedback from the OEPA and the DEC in regards to the April 2010 Provisional Noise and Vibration Monitoring and Management Plan.
	JUN 2013	Changes to the environmental noise monitoring programme approved by the DEC via email dated 21 June 2013.
6	JUN 2016	Revised to meet requirements of the <i>Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016</i> .
7	JAN 2018	Changes were made to the blast monitoring network following a recommendation that the Echo blast monitoring site be relocated to a point further south of the current site. The recommendation was made following a blast assessment conducted in 2017 by George Boucher Consulting for then proposed Morrison mining project, located at the southern end of the Fimiston Open Pit. A revised NVMMP, showing the proposed new location for the Echo blast monitoring site was submitted with the Change to Proposal to Ministerial Statement No.782 application in February 2018 and subsequently approved under Section 45C of the <i>Environmental Protection Act 1986</i> 26 June 2018.
	AUG 2018	This revision is submitted to the CEO of the DWER to approve the relocation.

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 No. 782 and the *Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016*.

[Signature of duly authorised proponent representative]

Name:

Signed:

Designation:

Date:

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 (Australia Pacific) Pty Limited and Newmont Asia Pacific Pty Ltd:

- 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 around 700,000 ounces of gold each year and has a current open pit mine life until 2021 and mineral processing life until 2031.

KCGM proposes to mine the Morrison and Brownhill areas of the existing Fimiston Open Pit. Together the Morrison and Brownhill reserves add approximately 1.8 million gold ounces to the Fimiston Open Pit. The Project allows for continued mining of the Fimiston Open Pit as identified in KCGM's life of mine Plan. These reserves will extend the estimated life of mine for KCGM's open pit operations by five years to around 2026 and by three years to around 2034 for mineral processing operations.

Approximately 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 and is currently one of the largest open pit gold mines in Australia.

2.2 History of Fimiston Noise Approvals

KCGM's Fimiston Operations commenced prior to the development of the *Environmental Protection (Noise) Regulations 1997* (Noise Regulations) and historically operated in accordance with Ministerial Statement No.188 Fimiston Project Stage II – Mine and Waste Dumps (188:M) granted on 24 October 1991.

Condition 4 of 188:M required the Minister to set noise level standards for the Fimiston Operations. On 19 November 1992 the "Noise Level Standards for Operations at Kalgoorlie" were established within which the Minister recognised the unique situation of the KCGM operations:

"The residential areas of Kalgoorlie-Boulder affected by noise from mining activities have existed for many years and are located very much closer to the mine sites than the standards today would permit. Mining and ore processing activities have occurred very close to these residential areas for almost one hundred years. Thus the residential and mineral processing land uses impact adversely on each other. This makes it impracticable and unreasonable for KCGM to achieve fully desirable noise levels at all residences as it is not feasible to move either the ore body or all the closer residences.

Additionally, some locations in Kalgoorlie-Boulder currently have ambient noise levels which exceed fully desirable levels in the absence of noise from the proponent's mining and mineral processing activities."

Under the Fimiston Project Stage II approval, mining of the Fimiston Open Pit would have ceased in around 2012. To enable the Fimiston Operations to continue approval was sought from the Environmental Protection Authority (EPA) for the Fimiston Gold Mine Operations Extension (Stage 3) and Mine Closure Planning; commonly referred to as the Golden Pike Project, extending the life of the Fimiston Open Pit to around 2019.

The Golden Pike Project underwent a Public Environmental Review (PER), released in September 2006, during which time it was highlighted that the applicability and enforceability of the "Noise Level Standards for Operations at Kalgoorlie" set by the Minister in 1992 was unclear and required clarification. It was identified that the existing Fimiston Operations may not comply with the night time assigned noise levels under the Noise Regulations even with controls in place (e.g. the environmental noise bund). However, it was also noted that the ambient noise levels in Kalgoorlie-Boulder with no mining activity occurring are also above the night time assigned noise levels.

In February 2007, KCGM applied to the Minister for Environment in accordance with Regulation 17 of the Noise Regulations for approval to allow noise emissions to vary from the assigned levels. In December 2007, The EPA released its report and recommendations to the Minister and subsequently the Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2009 was published in the Government Gazette on 14 July 2009.

One appeal against this approval was received and an Appeals Committee was appointed by the Minister. The Appeals Committee Report was reviewed by the Minister and while the appeal was dismissed in March 2010, two recommendations made by the committee required further investigation and implementation by KCGM (refer to Sections 4.2.1 and 5.2.4).

The 2009 Approval was valid for 5 years until 13 July 2014 unless KCGM applied for further approval within the first four years. Accordingly, on 21 June 2013 KCGM re-applied for a Noise Regulation 17 Variation which the Minister referred to the Department of Environment Regulation (DER) on the 22 July 2013 for assessment.

On 5 December 2013 the Noise Regulations were amended, notably the levels for airblast were lowered. Consequently KCGM applied for another Noise Regulation 17 Variation, this time for approval to allow airblast levels to vary from those prescribed under regulation 11. The DER assessed this application in conjunction with KCGM's initial application over a two year period. A final assessment report was prepared 01 July 2015 and following approval by the Minister, the *Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016* was published in the Government Gazette on the 22 March 2016. No appeals were lodged against the approval.

2.3 Key Environmental Factors

This Condition EMP specifically addresses the noise and vibration environmental factor.

Noise and vibration are a key environmental factor for this proposal due to the proximity of the Fimiston Operations to the City of Kalgoorlie-Boulder (CKB), it is therefore essential that KCGM manages environmental noise and vibration aspects which may impact on nearby residents. KCGM's management approach is detailed in Section 4.

2.4 Requirements of the Condition

Specifically, this Condition EMP is submitted in accordance with 782:M (Conditions 8-1 to 9-9), and the 2016 Fimiston Noise Approval (Conditions 9(1) and 9(2)). Table 2 provides a summary of where the requirements of these conditions are addressed in the Condition EMP.

Table 2: Summary of Conditions

Condition	Section in Condition EMP
Ministerial Statement No.782	
<p>8 Noise</p> <p>8-1 The proponent shall not conduct any mining activities forming part of the expanded and revised proposal unless and until approval has been granted under regulation 17(7) of the <i>Environmental Protection (Noise) Regulations 1997</i>.</p> <p>Note: In this condition "mining activities" does not include construction work within the meaning of regulation 13 of the <i>Environmental Protection (Noise) Regulations 1997</i>.</p>	2.2 History OF Fimiston Noise Approvals
8-2 The proponent shall undertake noise modelling to determine whether a special control area is required in accordance with the Goldfields-Esperance Regional Planning Strategy.	3 Noise Modelling and Verification
8-3 The proponent shall consult with the Western Australian Planning Commission, Department of Planning and Infrastructure, and the City of Kalgoorlie-Boulder in the implementation of Condition 8-2.	9 Stakeholder Consultation
<p>9 Airblast Overpressure and Vibration from Blasting</p> <p>9-1 The proponent shall only detonate explosives on the premises between the hours of 0700 hours and 1800 hours unless undertaken in accordance with regulation 8.28 (4) of the <i>Mines Safety and Inspection Regulations 1995</i>.</p>	4.4.1 Blasting Times
9-2 Where explosives are detonated on the premises outside the requirements specified in conditions 7-4 and 9-1, the circumstances which led to such detonation being necessary shall be reported by the proponent to the CEO within 36 hours following detonation.	7.4 Blasting Outside Daylight Hours (36-Hour Report)
9-3 The proponent shall ensure that all airblast overpressure levels due to blasting comply with Regulation 11 of the <i>Environmental Protection (Noise) Regulations 1997</i> .	5.1.2 Airblast Levels
9-4 The proponent shall make all reasonable effort to avoid blasting on Sundays.	4.4.1 Blasting Times
<p>9-5 For all blasting, the proponent shall comply with the following vibration limits, measured or calculated in accordance with section J4.2 of Australian Standard 2187.2 - 2006, for the protection of human comfort at any houses and low rise buildings, theatres, schools and other similar buildings occupied by people and not owned by the proponent:</p> <ol style="list-style-type: none"> 1. the peak particle velocity shall not exceed 5 millimetres per second for 90% of blasts per year; 2. the peak particle velocity shall not exceed 10 millimetres per second for any blast; and 3. no more than one in ten consecutive blasts shall exceed 5 millimetres per second peak particle velocity. 	5.1.3 Blast Vibration

Condition	Section in Condition EMP
<p>9-6 Within six 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 revise the Revised Noise and Vibration Monitoring and Management Programme, dated June 2004, to the requirements of the Minister for the Environment on advice of the Department of Environment and Conservation.</p> <p>This Programme shall include:</p> <ol style="list-style-type: none"> 1. Locations of the air blast overpressure and ground vibration monitors and demonstration that these locations meet the requirements of regulation 21 of the <i>Environmental Protection (Noise) Regulations 1997</i> and section J3.2.2 of Australian Standard 2187.2 - 2006; 2. Description of the monitoring equipment and demonstration that the equipment complies with the requirements of schedule 4 of the <i>Environmental Protection (Noise) Regulations 1997</i> and section J3.2.1 of Australian Standard 2187.2 - 2006; 3. Calibration by an approved calibration laboratory and field checks of the monitoring equipment in accordance with schedule 4 of the <i>Environmental Protection (Noise) Regulations 1997</i> and the manufacturer's specifications and section J3.1.2 of Australian Standard 2187.2 - 2006 (or any subsequent amendment) and recording of calibration; 4. Procedures for the recording of blast information in accordance with section J3.4 of Australian Standard 2187.2 - 2006; 5. Procedures for the reporting of air blast and vibration monitoring to the Department of Environment and Conservation; and 6. Details of a complaints procedure and recording of complaints and action undertaken to resolve complaints. 	<p>5.2.5 Vibration and Airblast Monitoring</p> <p>5.2.5 Vibration and Airblast Monitoring</p> <p>5.2.5 Vibration and Airblast Monitoring</p> <p>10.3 Blast Monitoring Records</p> <p>7 Reporting Provisions</p> <p>6 Complaint Management</p>
<p>9-7 The proponent shall implement the Revised Noise and Vibration Monitoring and Management Programme required by condition 9-6.</p>	<p>1.3 Document History (Version 3)</p>
<p>9-8 The proponent shall review the Revised Noise and Vibration Monitoring and Management Programme as required by the Environmental Protection Authority, and shall amend the Programme to the requirements of the Minister for the Environment on advice of the Department of Environment and Conservation.</p>	<p>1.3 Document History (Version 5)</p>
<p>9-9 The proponent shall implement the amended Revised Noise and Vibration Monitoring and Management Programme required by condition 9-8.</p>	<p>1.3 Document History (Version 5)</p>
<p>Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2009 Appeals Committee Recommendations</p>	
<p>(i) outline the steps required to develop and implement a noise amelioration program that will benefit the community most affected by noise from KCGM operations and that this would be over and above the commitments that KCGM have already made to other community projects.</p>	<p>4.2.1 UWA Research Project</p>
<p>(ii) detail, where practicable, the work required for the future installation and maintenance of a real-time noise monitoring site that is accessible by the public via the internet and preferably through the KCGM website.</p>	<p>5.2.4 Real-Time Noise Monitoring</p>
<p>Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016</p>	
<p>9(1) KCGM is to submit a noise management plan for the Fimiston Gold Mine to the CEO within 3 months after the start day.</p>	<p>1.3 Document History (Version 6)</p>

Condition	Section in Condition EMP
<p>9(2) The noise management plan is to include the following —</p> <ul style="list-style-type: none"> (a) details of a noise and airblast level monitoring programme; (b) details of a programme to monitor weather conditions relevant to the assessment of noise and airblast levels from mining operations; (c) details of a programme for the provision of information to the community regarding noise and airblast levels from mining operations; (d) procedures to be adopted by KCGM to respond to complaints about noise emissions; (e) procedures to be adopted by KCGM to identify major noise emission sources; (f) procedures to be adopted by KCGM to adjust mining operations to reduce noise emissions — <ul style="list-style-type: none"> (i) based on the noise and airblast level monitoring programme specified in paragraph (a); and (ii) based on responses to complaints about noise emissions; (g) procedures to be adopted by KCGM to eliminate tonality, modulation and impulsiveness in noise emissions from mining operations; (h) procedures to be adopted by KCGM to minimise noise emissions from equipment used for mining operations; (i) procedures to be adopted by KCGM to minimise airblast levels; (j) procedures to be adopted by KCGM for recording details of blasting practices used for any blast that exceeds the airblast level set out in regulation 11; (k) any other matter that the CEO may require. 	<p>5.2 Monitoring Programmes 5.2.3 Weather Monitoring</p> <p>7.5 KCGM Website</p> <p>6 Complaint Management</p> <p>4 Management Approach</p> <p>8 Adaptive Management and Review of the Condition EMP</p> <p>4.1.3 Reversing Alarms 4.2.1UWA Research Project</p> <p>4.1 Management of Mining Activities</p> <p>4.4 Management of Blast Vibration and Airblast</p> <p>7.6 Reporting on Exceedance of Environmental Criteria</p> <p>8 Adaptive Management and Review of the Condition EMP</p>

3. NOISE MODELLING AND VERIFICATION

Since the early 1990s KCGM has consulted with noise consultants Herring Storer Acoustics to undertake noise modelling and assessments of the Fimiston Operations. A baseline environmental noise study was undertaken by Herring Storer Acoustics in September 1991 to quantify the noise environment and establish a model for planning purposes. Results of this modelling identified the following major noise emission sources: haul trucks, reversing signals (including that used on the front end loader at the primary crusher), and the Croesus Plant¹.

To verify the noise modelling results, direct noise measurements were carried out during the night period (in order to minimise the effects of other noise sources). These measurements were taken at fixed sites in residential areas and involved a complete shutdown of the mining operation (All Plants “Off”) in order to achieve assessment of background noise levels (Herring Storer Acoustics, 1992). Supplementary noise modelling was undertaken by Herring Storer Acoustics with regards to the proposed Environmental Noise Bund in June 1992, which indicated significant noise reduction could be achieved by constructing a 20 m high bund extending the full length of the Fimiston Operations (Figure 1).

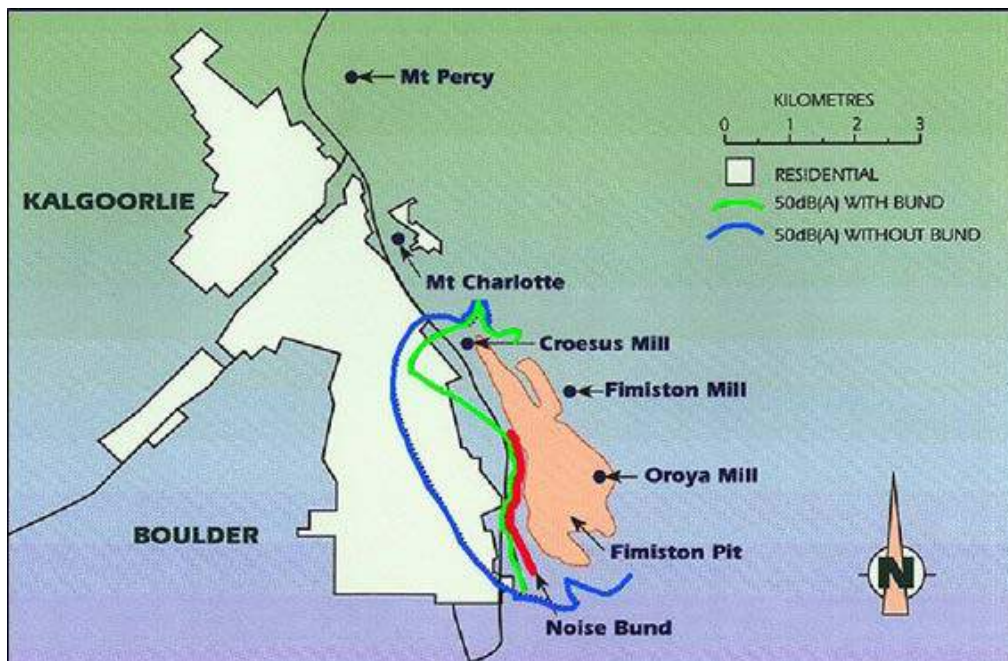


Figure 1: Impact of Environmental Noise Bund on the 50 dB(A) Contour

Based on the recommendations from this work, KCGM adopted management practices to minimise noise emissions from its mining and mineral processing activities, which are outlined in Section 4 (Management Approach).

As part of the ongoing life of mine planning process, KCGM undertakes additional modelling to evaluate any proposed changes to the mining activities. For example, in 2005, noise modelling was carried out to assess the impact of the Golden Pike Cutback. This modelling was reviewed as part of the PER undertaken for the Golden Pike Project where it was identified that the existing Fimiston Operations may not comply with the night time assigned noise levels under the Noise Regulations, even with controls in place (i.e. the environmental noise bund).

¹ The Croesus Plant was decommissioned in 1997 eliminating this as a major noise emission source.

As a result, KCGM sought approval under Regulation 17 of the Noise Regulations for approval to allow noise emissions to vary from the standards specified and subsequently the *Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2009* was published in the Government Gazette on 14 July 2009.

Modelling is primarily undertaken using the SoundPlan software programme to predict, assess and map noise. Equipment used for modelling is taken from KCGM's equipment inventories and sound power levels used are calculated from measurements of actual or representative equipment at the Fimiston Operations.

4. MANAGEMENT APPROACH

KCGM's approach to managing noise emissions is based on the identification of major noise emission sources using conventional risk assessment methodologies, noise modelling and noise monitoring results and experience drawn from community feedback and complaints. The management measures implemented to address the major noise emission sources identified by KCGM are detailed in Section 4.1.

4.1 Management of Mining Activities

4.1.1 Environmental Noise Bund

A key noise management feature at KCGM has been the establishment of the environmental noise bund. Prior to the commencement of the Fimiston Operations, results of modelling work (Herring Storer Acoustics, 1992) indicated that an earthen bund between the Fimiston Open Pit and City of Kalgoorlie-Boulder would significantly reduce noise emissions resulting from open pit mining activities (Figure 1).

The first stage of the environmental noise bund was constructed in 1992. Subsequent modifications and extensions have been undertaken as the Fimiston Open Pit has evolved over time (Figure 2). Most recently works undertaken to realign the environmental noise bund for the Golden Pike Cutback commenced in mid-June 2007 and were completed in July 2010.

Life of Mine planning and changes to the pit design take into consideration the location of the environmental noise bund. Noise modelling is undertaken for any major changes (e.g. cutbacks) and where noise modelling identifies modifications are required to the environmental noise bund these are incorporated back into the pit design.



Figure 2: KCGM Environmental Noise Bund Construction History

4.1.2 Surface Activities

Certain activities when undertaken at surface have been identified as a major source of noise emissions with the potential to impact the community. These noise sources are associated with equipment which can emit annoying characteristics i.e. tonality, modulation and impulsiveness (as defined within the Noise Regulations) and activities which occur within close proximity to residential areas.

Examples of such equipment include: long hole percussion drilling, rock breaking, tracked loaders and dozers, and reversing alarms. To prevent noise impacts, the use of certain equipment in certain areas is restricted to daytime² only.

Mining operations are also adjusted to reduce noise emissions where practicable. This includes limiting surface mining activities (e.g. the Golden Pike Cutback) to daytime only until a level of 20 m below the undisturbed ground surface level is reached. Figure 3 shows a schematic of the restricted surface mining activities. Ground surface level is defined as the RL at the pit crest adjacent to the Environmental Noise Bund.

Construction of the environmental noise bund and waste rock dumps which occur within close proximity to residential areas are managed through predictive noise modelling to determine potential noise impacts, and where necessary construction activities are restricted to daytime only.

During construction of the Northern Waste Rock Dump, KCGM implemented the following noise management strategy whereby construction was undertaken in two stages:

- 1) Construction of the outer wall to act as a noise bund (daytime only); and
- 2) Dumping of waste rock behind the outer wall. This methodology was successful and a similar approach will be adopted for future waste rock dumps constructed within close proximity to residential areas.

Additional noise controls which can be applied to surface activities include:

- Ensuring the quietest equipment available is used.
- Ensuring that all employees and contractors involved are made aware of the potential environmental impacts on the community and the importance of noise control measures.
- Ensuring action is taken (as appropriate) in response to feedback from stakeholders regarding noise management practices.

² Daytime hours are defined as: 0700 to 1900 hours Monday to Saturday and 0900 to 1900 hours Sundays and public holidays

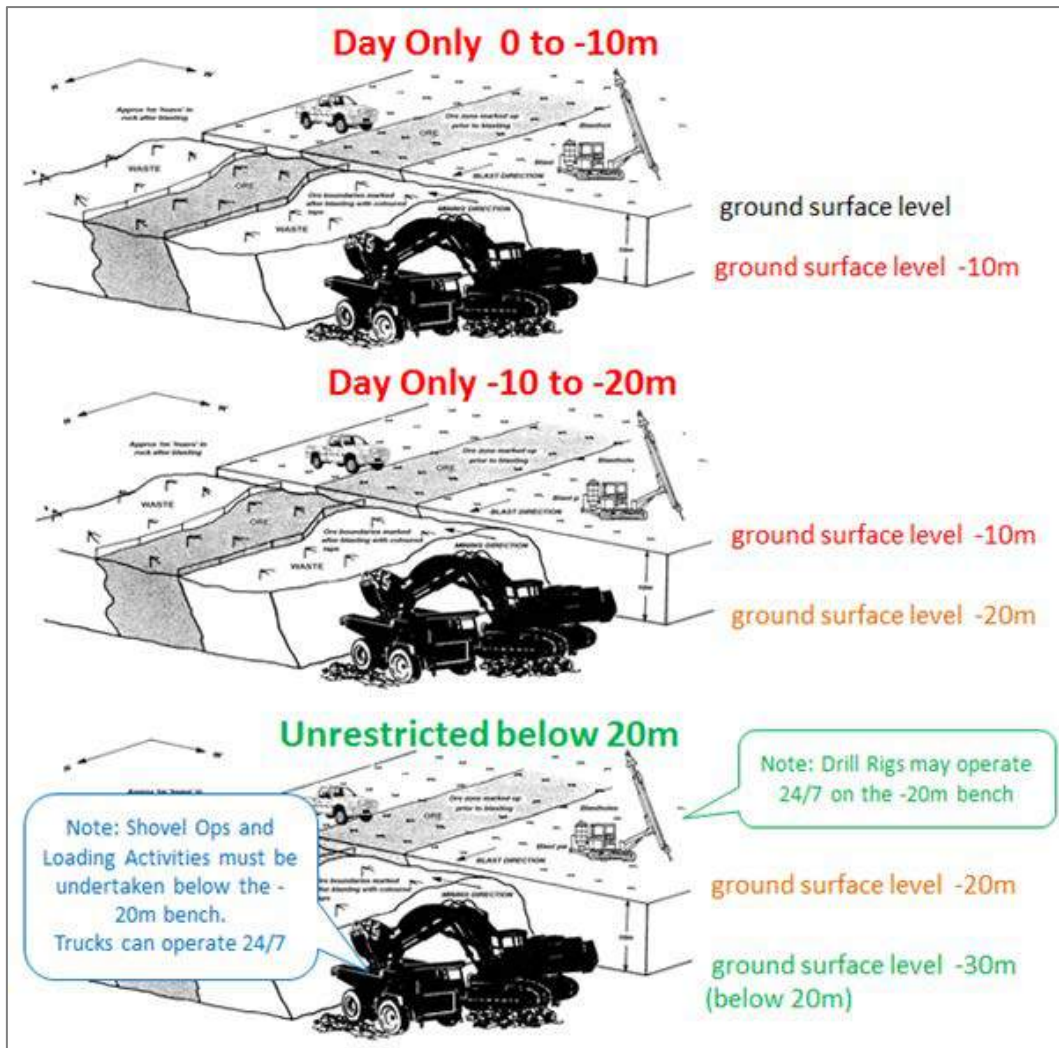


Figure 3: Schematic showing the restricted surface mining activities

4.1.3 Reversing Alarms

Results of the environmental noise study undertaken in 1991 identified reversing signals as a major noise emission source. Reversing warning alarms are required for safety purposes on mobile equipment operating on any mining or mineral processing site in accordance with Regulation 13.3(1) of the *Mines Safety and Inspection Regulations 1995*. The signals from these audible alarms are by design intrusive in nature (containing annoying characteristics) and therefore KCGM has continually investigated ways to minimise this noise.

Initially “smart alarms” were utilised on mobile mining equipment; these alarms were able to adjust their output so that the signal is adjusted to 5dB(A) above background noise levels. Thus the emitted signal (reversing alarm) is reduced during quiet periods (i.e. at night). The use of visual high intensity magenta strobe lights was also used on night shift on the ROM Pad as an alternative to the tonal reversing alarm.

In 2006 KCGM became aware of a new type of reversing alarm which produces a broadband frequency noise as opposed to tonal noise as the warning signal. After successfully trialing the broadband reversing alarms during 2007, KCGM commenced installing broadband reversing alarms on all mobile equipment permanently located onsite at the Fimiston Operation³. Since completing the roll out in late 2010, the use of broadband reversing alarms has been applied to all new mining equipment permanently located onsite.

In order to eliminate tonality, modulation and impulsiveness in noise emissions from mining operations, KCGM will continue to research the feasibility of mechanisms other than audible signals for use as reversing alarms on other equipment used at the Fimiston Operations.

4.1.4 Mt Charlotte Waste Rock Conveyor

Since the early 1990s, waste rock has been transported to the Mt Charlotte Glory Hole to provide backfill for the underground mining operation, which is important to ensure the safety and stability of the mine. Initially this was achieved by using haul trucks, however an increase in complaints received from nearby residents during 2000 identified this activity as a major noise emission source. In response, the number of trucks was reduced to a maximum of 12 per hour and operators were made aware of the environmental issues and improvements made to their driving techniques.

It became necessary to investigate alternative methods of transporting the waste rock which resulted in utilising the decommissioned conveyor equipment (previously used to transport ore from Mt Charlotte to the Oroya Mill). The conveyor eliminated the need for haul trucks which significantly reduced the noise emission levels associated with the transportation of waste rock to the Mt Charlotte Glory Hole.

However, the use of the conveyor introduced new noise emission sources, such as squeaky rollers and the noise from rocks falling off the belt and at designated transfer points. To reduce noise emissions, the conveyor design included fully enclosed sections internally lined with insulation and an enclosure (noise barrier) constructed around the transfer chute on the western side of the conveyor at the Glory Hole.

In 2009, it was identified through several complaints that metal clips (used to repair tears in the conveyor belt) travelling over the rollers was also a contributing noise source. KCGM replaced the conveyor belt during the first quarter of 2010 eliminating this noise source. The use of rubber clips in place of the metal clips has been trialed, however they were not suitable for repairing parallel rips or major tears. To mitigate the noise associated with the metal clips, a rubber strip is placed over the clips as required.

KCGM continues to manage noise emissions from the Mt Charlotte Waste Rock Conveyor via routine inspections and maintenance of the conveyor belt, the rollers and related infrastructure. Any feedback received regarding noise from the conveyor is responded to with a sense of urgency to ensure the source is identified and rectified.

³ Note: the PC 8000 Shovels and the CAT 994 Loader could not be fitted as the alarm could not be adequately heard above the idling of the equipment.

4.2 Management of Haul Truck Noise

Initial noise assessment and modelling of the Fimiston Operations identified haul trucks as a major noise emission source (Herring Storer Acoustics, 1991); recommendations from this assessment included investigating exhaust silencers and fitting panels to further enclose engines.

Consequently noise management regarding the haul trucks has continually been pursued by KCGM to address noise reduction opportunities, including the following:

- In 2002, KCGM undertook an improvement programme to retrofit existing haul trucks with quieter engines. New trucks purchased since this time have quieter engines and fans as a standard.
- KCGM purchased a Cat 793C “XQ” (eXtra Quiet) haul truck (226) in 2003 to trial on site; as the name suggests this truck model has additional noise control features. This was the first truck of its type to be used in the Goldfields and underwent an extensive trial period in order to measure its operational performance. The truck did not perform as expected, primarily due to the additional weight of the noise control features which meant the truck was less efficient in both the amount of material it could move and overall fuel consumption. It was also proven to be harder to maintain. For these reasons KCGM did not purchase any additional XQ models.
- In 2009, KCGM investigated the use of sound suppressant mufflers on a CAT 793C haul truck (213). Follow up noise testing undertaken indicated the newly installed muffler provided a 2 to 4 dB(A) sound pressure level reduction. However, there had been no significant change in the overall noise emission from the truck; for this reason it was not considered beneficial to install the mufflers on the rest of the fleet.
- From October 2008 to March 2016, KCGM has undertaken biannual sound power level testing on individual haul trucks to enable analysis of noise performance trends and identify if additional maintenance is required. Monitoring conducted during this time has demonstrated that haul truck noise levels have not increased over time. Given the stable nature and low variability of haul truck noise monitoring results the testing programme is considered completed. The request to cease the testing programme was formally presented in KCGM's 2013 Noise Regulation 17 Variation application.

4.2.1 UWA Research Project

In June 2010, KCGM commenced a Noise Amelioration Programme to satisfy a recommendation⁴ made by the Appeals Committee in relation to an appeal against the Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2009.

After comprehensive community consultation a Research Project entitled “Integrated Passive and Active Control of Humming Noise from KCGM's Haul Trucks” put forward by the University of Western Australia (UWA) was selected at KCGM's Community Reference Group (CRG) meeting held in March 2012 as the preferred Noise Amelioration Programme for KCGM to pursue.

This project was considered to satisfy the intent of the Appeals Committee recommendation to benefit the community most affected by noise from KCGM's Fimiston Operations (i.e. haul truck noise) and to be over and above the commitments that KCGM has already made to other community projects regarding noise amelioration.

⁴ *“(i) outline the steps required to develop and implement a noise amelioration program that will benefit the community most affected by noise from KCGM operations and that this would be over and above the commitments that KCGM have already made to other community projects.”*

The parameters of the research project were developed in conjunction with UWA. To finance the project, KCGM and UWA pursued a government funded Australian Research Council (ARC) linkage grant. The project is aimed at achieving total sound power attenuation through development of a prototype engine enclosure as well as examining ways to reduce noise associated with the haul trucks as described below:

- The noise attenuation design incorporates both passive and active noise control to achieve total sound power attenuation; passive control gives good attenuation above 200 Hz whilst the active control will be applied for frequencies below 200 Hz; and
- Improvements to the existing muffler design were investigated to further reduce noise associated with haul trucks.

Whilst the ARC linkage grant expired in December 2017, KCGM is considering its continued support of the noise amelioration project subject to receipt and review of the final report for the project.

4.3 Management of Resource Definition Drilling

KCGM's resource definition drilling programmes often occur in close proximity to the CKB and have therefore been identified as a major noise emission source. Due to their transient nature and differentiation from general mining activities, noise emissions associated with resource definition drilling programmes are managed to comply with the Noise Regulations.

In June 2002 a detailed noise management plan was developed by Herring Storer Acoustics for a drilling programme on the western side of the Fimiston Open Pit that was in close proximity to residential areas and Noise Sensitive Premises.

The 2002 Noise Management Plan included the design and construction of trailer mounted acoustic screens to act as a noise barrier. Noise contours were derived from computer modelling to depict predicted noise levels 'on the ground'. The modelling evaluated noise levels from the drill rig with the acoustic screens in position, to ensure compliance with the Noise Regulations.

KCGM continued to implement the noise control principles and practices detailed in the 2002 noise management plan, including the use of the acoustic screens, to manage potential noise impacts for drilling programmes within close proximity to residential areas.

In 2011, a noise assessment was undertaken for a drilling programme within close proximity of residential properties in Williamstown. The assessment determined that the acoustic screens could not provide sufficient noise attenuation to comply with the Noise Regulations. An alternative noise barrier was investigated which resulted in the decision to trial the use of sea containers.

Noise modelling was conducted by Herring Storer Acoustics (2011) with the sea containers in place which indicated that the sea containers provided a significant improvement in noise reduction when compared to the use of the acoustic screens. Noise contours were derived from computer modelling to depict predicted noise levels 'on the ground'. The modelling evaluated noise levels from the drill rig with the sea containers in position, to ensure compliance with the Noise Regulations.

Following this successful trial, the use of sea containers to manage potential noise emissions from drill rigs has been implemented for all drilling programmes within close proximity to residential areas.

A desktop assessment is undertaken for each drilling programme prior to commencement to verify compliance with the Noise Regulations; this process generally includes the following:

- Review of nearby land use to identify potential impacts on noise sensitive premises (industrial, rural or residential).

- Review of 'on ground' noise contours with sea containers in place for each planned drilling location to determine compliance with the Noise Regulations at the nearest noise sensitive premises.
- Undertaking additional noise modelling as required.

For drilling programmes located within close proximity to residential areas the following noise control measures are considered:

- Drilling personnel provided with information to improve awareness of environmental impacts.
- Restricting times of operation.
- Utilisation of sea containers. Generally the cab will face the premises and the sea containers positioned in an "L" shape around the cab. The sea containers are to be assembled so as to maximise disrupting the line-of-sight between the drilling operations and the community. There should be no gaps either in the containers or at the junctions.
- Any ancillary pumps should be located behind tanks or the sea containers. In addition, the pumps should be placed on tyres as this provides an effective vibration isolation medium from the ground.
- Any tanks should be located together. There should be no gaps between the tanks if they are to act as an additional noise barrier.
- Thick rubber matting should be laid between the drill rods as they are stacked.
- Lighting towers should be directed away from residential areas.
- Noisy activities e.g. pulling of rods should be avoided during the night time period (between the hours of 2200 and 0700 or 0900 on Sunday and public holidays).

Follow up noise monitoring is usually undertaken once the drilling programme has commenced to verify the predicted noise levels obtained from the desktop assessment. The measurements are used to calibrate the model to improve predictions made for subsequent drilling programmes. Additional control measures are implemented as required.

4.4 Management of Blast Vibration and Airblast

Careful management of blasting impacts, vibration and airblast, is critical due to KCGM's close proximity to the CKB. Since the commencement of the Fimiston Open Pit in 1989, KCGM has achieved a high success rate of blasting within approved regulatory levels and therefore minimised the impacts of vibration and airblast on the community.

The Fimiston Open Pit presents some unique challenges for blast management including: numerous faults which intersect the pit, a vast network of underground voids remnant from historic mining operations, and the close proximity of the Fimiston Open Pit to the City of Kalgoorlie-Boulder. Through extensive research and development projects coupled with learnings from both favourable and unfavourable blast events, KCGM's management of blasting is continually improving. Key management approaches undertaken by KCGM to minimise the impacts of blasting on the community are outlined below.

4.4.1 Blasting Times

Condition 9-1 of 782:M stipulates that KCGM shall only detonate explosives on the premises between the hours of 0700 hours and 1800 hours; which is also in accordance with regulation 8.28(3) of the *Mines Safety and Inspection Regulations 1995* (i.e. "...a person must not fire a charge at night.").

Where possible, KCGM blasts at around 1pm or 5pm. A daily blast notification is sent to a distribution list (which includes community organisations) advising of the planned blast time and location. Daily blast times are also made available through KCGM's Public Interaction Line (9022 1100).

Blasts may be scheduled with "one hour" notice when unfavourable weather is predicted or blast preparation is pending. Whilst every effort is made to notify the public of blast times, unexpected changes in weather and wind direction may cause a blast to be cancelled or rescheduled.

Additionally, in accordance with Condition 9-4 of 782:M, all reasonable effort is taken to avoid blasting on Sundays.

4.4.2 Blast Design and Modelling

Each blast is carefully designed to meet internal design criteria and takes into account external factors which may potentially increase the vibration and/or airblast levels. A blast plan is developed for each bench to identify fault structures and underground workings within the blast areas to determine the risk profile with regards to vibration and airblast. Criteria for blast design to minimise vibration and airblast includes the following:

- Blast size is generally less than 450,000 tonnes. Blasts carried out at KCGM are much smaller than those undertaken by remote mine sites, using less than ten percent of the amount of explosive used in standard production blasting.
- Blasthole diameter is determined based on the type of blast and from the vibration modelling results. Generally 165 mm is used for production blasts, however 115 mm is used to reduce vibration in certain areas and to preserve wall integrity as required.
- Blast modelling is undertaken for all blasts to predict vibration and airblast levels. The model includes a vibration constant (K-factor) which is created for each known fault; this K-factor is continually updated based on blast results. Blast modelling also takes into account the location of the blast within the pit (i.e. distance of blast from the monitoring sites).
- The type of initiation system (Nonel or Ikon) is determined based on the type of blast and from the blast modelling results.
 - Nonel is a nonelectric shock tube detonation system which requires manual tie-in using various period delay detonators to achieve the required blast pattern. Experience has shown that inter-hole (IH) and inter-row (IR) timing combinations for Nonel can effectively manage vibration.
 - Ikon is an electronic detonation system which is used to achieve single hole firing to minimise the Maximum Instantaneous Charge (MIC). Because of the electronic programming of each individual hole, the use of Ikon can achieve a very precise blast pattern with reduced risk of misfire and timing errors. The electronic initiation system is able to separate the timing between holes to 12 milliseconds.
- A minimum stemming height is required for each blasthole to optimise containment and reduce airblast. There is a strict QA process in place whilst loading holes to ensure the required stemming height is achieved.
- Atmospheric conditions (e.g. cloud cover) are taken into consideration to minimise airblast levels. Blasting schedules are modified where atmospheric conditions are conducive to reflection of blast noise and potential to produce erroneous data due to high wind speeds.
- Firing of blastholes adjacent to known voids and simultaneous detonation of adjacent blastholes is avoided to minimise airblast levels.

5. CONDITION EMP PROVISIONS

5.1 Environmental Criteria

5.1.1 Environmental Noise Levels

Environmental noise levels for KCGM's Fimiston Operations are stipulated in Condition 4 of the 2016 Fimiston Noise Approval.

For noise emissions other than those resulting from blasting, KCGM is granted approval to allow the level of noise emitted from the Fimiston Gold Mine to exceed the standards prescribed under regulation 7 of the *Environmental Protection (Noise) Regulations 1997* if the level of noise when received at a location at the time specified does not exceed the approved level as outlined in Table 3. The L_{A10} and L_{Amax} approved levels for specific reference locations are calculated by adding a Weather Influencing Factor (WIF) for that location which is determined according to the wind speed and direction at the time measurement is taken as outlined in Table 4.

Table 3: Fimiston Gold Mine Approved Noise Levels

Reference Location	Time of Day ⁵	Approved Level (dB)	
		L_{A10}	L_{Amax}
Barton Street, Williamstown (BSW)	Day	50 + WIF	65 + WIF
	Evening	45 + WIF	55 + WIF
	Night	45 + WIF	55 + WIF
Kalgoorlie Technical School (KTS)	Day	50 + WIF	62 + WIF
	Evening	45 + WIF	52 + WIF
	Night	45 + WIF	52 + WIF
Boulder Primary School (BPS)	Day	50 + WIF	62 + WIF
	Evening	45 + WIF	52 + WIF
	Night	45 + WIF	52 + WIF
Outram Street, Boulder (OSB)	Day	52 + WIF	65 + WIF
	Evening	49 + WIF	60 + WIF
	Night	49 + WIF	60 + WIF
York Street, Boulder (YSB)	Day	52 + WIF	65 + WIF
	Evening	49 + WIF	60 + WIF
	Night	49 + WIF	60 + WIF

Source: Schedule 2 Table 1 - *Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016*.

⁵ Day: 0700 to 1900 hours Monday to Saturday and 0900 to 1900 hours Sunday and public holidays
 Evening: 1900 to 2200 hours all days
 Night: 2200 on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays

Table 4: Weather Influencing Factor

Weather Conditions		Weather Influencing Factor				
Wind Direction	Wind Speed (km/hr)	Reference Location				
		BSW	BPS	KTS	OSB	YSB
Calm	<2	3	6	6	5	4
Northerly	≥2	-2	6	6	5	5
North Easterly	≥2	2	6	6	4	5
Easterly	≥2	4	6	6	4	5
South Easterly	≥2	4	6	6	3	5
Southerly	≥2	4	4	6	2	5
South Westerly	≥2	3	2	5	2	4
Westerly	2-7	0	2	3	3	2
Westerly	>7	-4	-3	-2	3	-3
North Westerly	2-7	-4	4	3	4	2
North Westerly	>7	-6	3	-1	3	-1

Source: Schedule 2 Table 1 - Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016.

5.1.2 Airblast Levels

Airblast levels for KCGM's Fimiston Operations are stipulated in Condition 4 of the 2016 Fimiston Noise Approval.

For noise emissions resulting from blasting, KCGM is granted approval to allow the level of noise emitted from the Fimiston Gold Mine to exceed the standards prescribed under regulations 11(4)(a)(i) and (6)(a)(i) of the *Environmental Protection (Noise) Regulations 1997* if the level of noise when received at a sensitive site on a residential property owned by KCGM at the time of day specified does not exceed the approved airblast level as outlined in Table 5.

Table 5: Fimiston Gold Mine Approved Airblast Levels

Time of Day / Location	Approved Airblast Level (dB L _{Z peak})	
	Not to be Exceeded Anytime (Limit)	Not to be Exceeded for any 9 in 20 Consecutive Blasts ⁶
0700 to 1800 hours Monday to Saturday (excluding public holidays). When received at a sensitive site on a residential property owned by KCGM.	125	120
0700 to 1800 hours Sunday and public holidays. When received at a sensitive site on a residential property owned by KCGM.	120	115

Source: Schedule 3 Table 1 - *Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016*.

In accordance with Condition 9-3 of 782:M, all other sites are required to comply with the airblast levels prescribed in Noise Regulations as outlined in Table 6.

Table 6: Regulation 11 Airblast Levels

Time of Day / Location	Approved Airblast Level (dB L _{Z peak})	
	Not to be Exceeded Anytime (Limit)	Not to be Exceeded for any 9 in 20 Consecutive Blasts ⁷
0700 to 1800 hours on any day. When received at a sensitive site	120	115
0700 to 1800 hours on any day. When received at a location other than a sensitive site	125	120

Source: *Regulations 11(4) and (6) - Environmental Protection (Noise) Regulations 1997*.

⁶ When received at the same monitoring site

⁷ When received at the same monitoring site

5.1.3 Blast Vibration Levels

Vibration levels for KCGM's Fimiston Operations are stipulated in Condition 9-5 of 782:M, as outlined in Table 7.

Table 7: KCGM Fimiston Operations Blast Vibration Levels

	No Blast Greater Than (Limit)	Not to be Exceeded for any 9 in 10 Consecutive Blasts ⁸	90% of Blasts Per Year Less Than
Vibration Level (PPV) ⁹	10 mm/s	5 mm/s	5 mm/s

Source: Condition 9-5 of Ministerial Statement 782 and specified in AS2187.2

5.2 Monitoring Programmes

5.2.1 Continuous Environmental Noise Monitoring

Condition 8(1) of the 2016 Noise Approval, requires KCGM to continuously record levels of noise received at BPS and Metal Exploration Premises (MEP).

KCGM's "Continuous Environmental Noise Monitoring Programme" has been implemented to meet the above requirement, as detailed below.

- Continuous noise monitoring is undertaken at BPS and MEP (Figure 4) using Bruel and Kjaer 2250 Sound Level Meter (SLM) equipment.
- Noise data at BPS is recorded in decibels as L10, L50, and L90 which are averaged over 1 hour.
- The SLM at BPS also records trigger events. The noise trigger function is set to operate between 1900 hours and 0700 hours. A noise trigger event is recorded when the noise level exceeds 60 dB(A) between 1900 and 2200 hours and 55 dB(A) between 2200 pm and 0700 hours for greater than 2 minutes. The digital recorder stamps all triggers with the date and time of the event. Trigger recordings are reviewed on an as need basis, usually in response to a noise complaint, to identify if the source of the noise was attributable to the Fimiston Operations.
- Noise data at MEP is recorded in decibels as Leq which are averaged over 5 minutes. The MEP site is used to record real-time noise monitoring data for the KCGM website (refer to Section 5.2.4) and therefore requires a different configuration to the SLM at BPS, which does not allow triggers to be recorded.
- The SLMs are NATA calibrated every two years in accordance with the manufacturer's recommendations.

⁸ When received at the same monitoring site

⁹ Vibration limits can be measured or calculated in accordance with section J4.2 of Australian Standard 2187.2-2006, for the protection of human comfort at any houses and low rise buildings, theatres, schools and other similar buildings occupied by people and not owned by the proponent.

It should be noted that the continuous noise monitoring data is influenced by other noise sources such as traffic, animals (e.g. birds and barking dogs) and social activity (e.g. music) and is not considered to be representative of noise emitted from KCGM's Fimiston Operations. Consequently the continuous noise monitoring data is not used to measure compliance against the approved noise levels for the Fimiston Gold Mine; rather this is achieved via KCGM's Compliance Environmental Noise Monitoring Programme (Section 5.2.2).



Figure 4: Continuous Noise Monitoring Sites

5.2.2 Compliance Environmental Noise Monitoring

In accordance with Condition 8(2) of the 2016 Fimiston Noise Approval, KCGM is required to record levels of noise received at each reference location. This monitoring data is used to determine compliance against the approved noise levels for the Fimiston Gold Mine (Table 3).

KCGM's "Compliance Environmental Noise Monitoring Programme" has been implemented to meet the above requirement, as detailed below.

- Compliance environmental noise monitoring is completed each quarter by specialist noise consultants using a manned sound level meter. Contributing noise (other than mining noise attributable to the Fimiston Operations) is excluded from the sound pressure level logs.
- Noise is measured at the five reference locations (as defined in Table 8 and shown in Figure 5) during the evening and/or night periods. This time period has been selected to minimise noise from other contributing sources (e.g. traffic).
- Noise data is recorded as $L_{A 10}$ and $L_{A max}$ which are averaged over the measurement period (minimum of 15 minutes).

- Weather data recorded at the time of the monitoring (refer to Section 5.2.3) is used to determine the WIF (Table 4) for calculation of the approved noise level (Table 3).

Table 8: Compliance Noise Monitoring Sites

Name	Abbreviation	Description
Barton Street Williamstown	BSW	Means any place at or adjacent to the intersection of Barton Street and Baden Street, Williamstown.
Boulder Primary School	BPS	Means any place within the boundary of the premises known as Boulder Primary School at 200 Lane Street, Boulder.
Kalgoorlie Technical School	KTS	Means any place within the boundary of the premises known as Kalgoorlie Technical School at 13 Davidson Street, South Kalgoorlie.
Outram Street Boulder	OSB	Means any place at or adjacent to the intersection of Outram Street and Shannon Street, Boulder.
York Street Boulder	YSB	Means any place on York Street, between the intersections of York Street with Lane Street and Hamilton Street, Boulder.

Source: Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016.

5.2.3 Weather Monitoring

In accordance with Condition 4(2) of the 2016 Fimiston Noise Approval, KCGM is required to determine the WIF for the weather conditions prevailing at the time the noise is measured, to calculate the approved noise levels for the Fimiston Gold Mine (Table 3).

KCGM's uses data obtained from a wind sensor installed at KCGM's MEX weather station to meet the above requirement, as detailed below.

- Wind monitoring (wind speed and wind direction) is undertaken at MEX (Figure 5) using MET ONE model 50.5 sonic anemometer equipment positioned at approximately 20 m above ground level.
- The wind sensor is wind tunnel calibrated every two years in accordance with the manufacturer's recommendations.
- Wind Direction data is recorded as degrees (0 - 360) which are averaged (using vector averages) over 5 minutes.
- Wind Speed data is recorded as metres per second (m/s) which are averaged over 5 minutes.
- If required, weather data can also be obtained from the Bureau of Meteorology site located at the Kalgoorlie-Boulder airport.



Figure 5: Compliance Noise Monitoring Locations

5.2.4 Real Time Noise Monitoring

In October 2011, KCGM installed a “real-time noise monitor” to satisfy a recommendation¹⁰ made by the Appeals Committee in relation to an appeal against the Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2009 gazetted on 14 July 2009. MEP was selected for the real-time noise monitoring site, based on an assessment undertaken by Herring Storer Acoustics (2010) and the existing equipment/communication capabilities at the site.

Noise data is recorded as L_{Aeq} which are averaged over 5 minutes. Whilst it was initially suggested that the L_{A50} noise level data be used, the SLMs used by KCGM (Brüel & Kjaer 2250) are only capable sending an analogue output as the L_{Aeq} noise level. In consultation with KCGM’s noise consultants Herring Storer Acoustics, the L_{Aeq} was selected as it is considered to be more easily understood by the public.

¹⁰ “(ii) detail, where practicable, the work required for the future installation and maintenance of a real-time noise monitoring site that is accessible by the public via the internet and preferably through the KCGM website.

The Appeals Committee recommendation also required that data be accessible by the public via the internet. To achieve this, KCGM set up a web-based report on the KCGM website which graphically displays the real-time noise monitoring data over a 48 hour period; the report is automatically updated every 15 minutes. The SLM used to record the real-time noise monitoring data is the same unit used to record the continuous environmental noise data at MEP (refer to Section 5.2.1).

5.2.5 Blast Vibration and Airblast Monitoring

In accordance with Condition 8(3) of the 2016 Fimiston Noise Approval, and Conditions 9-5 and 9-6 of 782:M, KCGM is required to record airblast levels and vibration.

KCGM's "Blast Monitoring Programme" has been implemented to meet the above requirements, as detailed below.

- Blast monitoring is undertaken at six (6) reference locations (Alpha, Bravo¹¹, Charlie, Delta, Echo¹² and Foxtrot) which were established in 1993 (as defined in Table 9 and shown in Figure 66).
- Blast monitoring is measured and recorded using Advanced Texcel remote blast monitor (ETM) equipment. The blast monitoring equipment and siting meet the requirements of regulation 21 and schedule 4 of the Noise Regulations and sections J3.2.1, J3.2.2 and J4.2 of AS2187.2-2006 as demonstrated in Section 10.2.
- The ETMs are NATA calibrated annually in accordance with schedule 4 of the Noise Regulations, the manufacturer's specifications, and section J3.1.2 of AS2187.2-2006. A performance check of the equipment is automatically completed daily and a copy of the performance report is sent to the drill and blast personnel.
- Blast vibration is measured as peak particle velocity which is recorded in millimetres per second (mm/s).
- Airblast is recorded in decibels as Lz peak.
- Recording of a blast is triggered by ground vibration exceeding the set trigger level of 0.5 mm/s. The trigger level is an internal level set well below the applicable standards and regulations in order to track blast vibration patterns and trends.
- Blast monitoring records for each blast undertaken in the Fimiston Open Pit are stored in KCGM's Operational Management Databases (MMRS and Connected Mine). Procedures for recording of blast information in accordance with section J3.4 of AS2187.2-2006 are included in Section 10.3.

¹¹ As a result of the Golden Pike Cutback project the Bravo blast monitoring site was relocated in 2010 to a more representative location as the previous location, within close proximity to the open pit, resulted in unusually large variation recordings which did not correlate with the other monitors. Approval from DWER was obtained prior to relocation through amendment of the NVMMP in October 2010.

¹² This version of the NVMMP has been amended to reflect the proposed relocation of the Echo blast monitoring site, following an assessment of blast induced ground vibration and airblast, associated with the proposed Morrison mining project (George Boucher Consulting, 2017). The assessment report recommended that the Echo blast monitoring site be relocated to a point further south of the existing site.

Table 9: Blast Monitoring Sites

Name	Description
Alpha	Sensitive site
Bravo	Sensitive site on a residential property owned by KCGM
Charlie	Sensitive site on a residential property owned by KCGM
Delta	Sensitive site on a residential property owned by KCGM
Echo	Location other than a sensitive site
Foxtrot	Location other than a sensitive site



Figure 6: Fimiston Open Pit Blast Monitoring Sites

6. COMPLAINT MANAGEMENT

KCGM's Public Interaction Line (PIL) was established in 1993 and is available 24 hours (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 nuisance noise, or as an inquiry regarding noise 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 noise emission sources and improve noise management in general.

KCGM has implemented a Complaints and Grievance Management procedure to manage the actions taken to resolve complaints. Where the complaint is in relation to blast vibration, KCGM offers property inspections to determine if any damage has been caused. This is managed in accordance with KCGM's property inspection process.

7. REPORTING PROVISIONS

7.1 Quarterly Noise and Blast Monitoring Report

Since 1993 (in accordance with the Noise Level Standards for Operations at Kalgoorlie set by the Minister in 1992), a Quarterly Noise and Blast Monitoring Report has been submitted. This report contains the following information:

Environmental Noise Monitoring

- Continuous noise monitoring data;
- Compliance noise monitoring results; and
- Information on any data loss, maintenance or calibration.

Blast Vibration and Airblast Monitoring

- Number of shots fired;
- Number of blast events (triggered by vibration greater than 0.5 mm/s);
- Results of vibration and airblast levels recorded from a blast event;
- Information on any data loss, maintenance or calibration; and
- Summary of any blast/s that occurred on a Sunday.

Complaints

- Summary of any complaints regarding noise and/or vibration received.

Noise Management

- Comments regarding any noise management initiatives (e.g. the UWA research project).

The quarterly report is submitted to the CEO (DWER).

7.2 Annual Noise Monitoring Report

In accordance with Condition 10 of the 2016 Fimiston Noise Approval, KCGM is required to prepare a written annual report for the year beginning on the 22 March each year. The annual report will include:

- a) a summary of the noise and airblast levels recorded under clause 8 during the year; and
- b) a summary of the progress of the implementation of the noise management plan submitted or revised under clause 9.

The annual report is due for submission to the CEO (DWER) within one month after the end of the reporting year (i.e. by the 22 April each year). The data presented in the annual report will be for the year beginning on 1 April each year to align with the quarterly reporting period.

7.3 Publishing of Noise Monitoring Results

Since 1993, KCGM has been advertising noise monitoring results in the Kalgoorlie Miner newspaper each quarter to satisfy Condition C4 of the Noise Level Standards for Operations at Kalgoorlie set by the Minister in 1992. Initially the newspaper advertisement contained information on how many triggers were recorded at the continuous noise monitoring sites and what the dominant noise was for each event recorded. In 2005 the formatting (graphic design) of the advertisement was revised based on public feedback. In 2011, the format of the advertisement was amended to advertise the results from the Quarterly Compliance Noise Monitoring compared with the approved noise levels¹³ (rather than the trigger events).

To date KCGM has not received any public feedback regarding the noise monitoring results published in the Kalgoorlie Miner and for this reason KCGM considers it more appropriate to provide the Quarterly Compliance Noise Monitoring results on the KCGM website; the reporting format will remain unchanged.

7.4 Blasting Outside Daylight Hours (24 Hour Report)

In accordance with Condition 9-2 of 782:M, if blasting occurs outside of the hours 0700 to 1800, KCGM is required to submit a report outlining why the blast was necessary to the CEO within 36 hours.

If required, an email notification will be sent to compliance@dwer.wa.gov.au

7.5 KCGM Website

Condition 9(2)(c) of the 2016 Fimiston Noise Approval requires KCGM to include details of a programme for the provision of information to the community regarding noise and airblast levels from mining operations.

To meet the above requirement, the following information is available on the KCGM website:

- Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016;
- Noise and Vibration Monitoring and Management Plan;
- Annual Noise Monitoring and Management Report;
- Results of Quarterly Compliance Noise Monitoring;
- Real-time Noise Monitoring Report;
- KCGM Noise Information Sheet;
- KCGM Blasting Information Sheet; and
- Noise and Blast Monitoring Network Maps.

¹³ Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2009

7.6 Reporting on Exceedance of Environmental Criteria

In the event that the threshold criteria for noise, airblast or vibration is exceeded, the CEO will be notified within seven (7) days of identification of the exceedance. Such events will include the following:

- Compliance Noise Monitoring result which indicates a measured level to be greater than the approved level (Table 3).
- Airblast level recorded above the approved limit level or more than 1 in any 10 consecutive blasts above the approved level (Table 5 or Table 6).
- Vibration level recorded above the approved limit level or more than 1 in any 10 consecutive blasts above the approved level (Table 7).

If required, an email notification will be sent to compliance@dwer.wa.gov.au

Additionally, KCGM is required to contact the Office of Heritage with regards to inspection of State Registered Places should a vibration level be recorded above the approved limit level (Table 5).

8. 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:

- Compliance Noise Monitoring data will be systematically evaluated and compared to the environmental criteria on a quarterly basis. Monitoring results which indicate a measured level to be within 1 dB of the corresponding approved level will be reviewed in a process of adaptive management to verify whether noise management practices are being implemented effectively, if there has been a change to operating conditions or if the noise source is external to the Fimiston Operations.
- Blast monitoring data will be systematically evaluated and compared to modelled results, internal limits and environmental criteria following each blast in a process of adaptive management to verify whether responses to the impact are the same or similar to predictions. Blast monitoring results above KCGM's internal limits (i.e. a vibration reading between 4 mm/s and 5 mm/s and airblast levels within 5 dB of the regulatory limit for that monitoring site) are reviewed to identify potential improvements to existing blast vibration and airblast controls.
- An increased number of complaints or repeated complaints from the same area will be reviewed to verify whether noise 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 noise emission sources and improve noise management.

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

- When requested by the CEO;
- When required by a condition of a subsequent ministerial approval;
- Where management actions identify the requirement for improvement; or
- When external changes occur during the life of the proposal which indicate a change to the proposed management actions (e.g. changes to the open pit operations).

9. STAKEHOLDER COMMUNICATION

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 stakeholders, engagement methods and ongoing reviews 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 noise and vibration management and the development of this Condition EMP is provided in the following sections.

9.1 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 in 2015 included questions regarding management of environmental impacts, including noise and vibration. Both key stakeholders and public phone survey respondents rated KCGM highly in management of environmental impacts.

9.2 Goldfields-Esperance Regional Planning Strategy

Condition 8-2 of 782:M required KCGM to undertake noise modelling to determine whether a special control area is required in accordance with the Goldfields-Esperance Regional Planning Strategy. To implement Condition 8-2, KCGM consulted with the Western Australian Planning Commission (WAPC), Department of Planning and Infrastructure (DPI), and the City of Kalgoorlie-Boulder (CKB).

KCGM provided copies of the following reports, prepared for the noise assessment of the project, to the DPI (representing WAPC) and CKB:

- Golden Pike Noise Report June 2005.
- Northern Waste Rock Dump Report July 2006.
- Supplementary Golden Pike Noise Report July 2006.
- Effects of Blasting in the Golden Pike Cutback February 2006.

Consultation is documented in the minutes of a meeting held between DPI, CKB and KCGM on 24 July 2009. A Noise Contour Map of worst case emissions overlain on CKB Town Planning Scheme was also prepared for this consultation and provided to DPI, CKB on 18 December 2009.

9.3 Heritage Council of Western Australia

In accordance with Condition 10-2 of 782:M KCGM were required to liaise with the Heritage Council of Western Australia to minimise environmental impacts associated with active mining on State Registered Places known as the Boulder Railway Station, Subway and Loopline, and Cornwall Hotel.

The feedback received in a letter dated 02 March 2010 included "If during the course of regular reporting, the vibrations go beyond the limit allowed under the Australian Standards for structural damage, KCGM is to contact the Office of Heritage to discuss way forward and to also discuss the inspection of the State Registered Places." (Refer to Section 7.6).

9.4 DWER

Since 1991 when the 188:M was issued by the Minister, KCGM has continuously consulted with the DWER including EPA Services and Noise Services with regards to development of the NVMMMP including confirmation and approval of noise measurement sites and instruments, and inclusion of additional information in the NVMMMP when requested.

Since approval of the October 2010 version of the NVMMMP, received 06 December 2010, KCGM has consulted with the DWER with regards to the following:

- 19 January 2011 KCGM sent a letter to the OEPA and the DEC to advise them of the new format for advertising the quarterly noise results. No feedback received.
- 14 July 2011 KCGM sent a letter to DEC (Noise Regulation Branch) seeking approval for the location of the Real-Time Noise Monitoring Sites.
- 21 September 2011 DEC (Noise Regulation Branch) provided feedback via email approving the location of the Real-Time Noise Monitoring Site.
- 19 June 2013 KCGM emailed the DEC (Noise Regulation Branch) seeking approval to vary from the October 2010 NVMMMP regarding assessment of noise triggers and field calibration frequency.
- 21 June 2013 DEC (Noise Regulation Branch) provided comments via email regarding KCGM intention to vary from the October 2010 NVMMMP. The changes were accepted.
- 22 June 2016 KCGM submitted a revised NVMMMP, which was approved 19 September 2016.
- 24 January 2018 KCGM met with the DWER (Noise Services) to:
 - review the environmental noise assessments which were completed for the proposed Morrison Mining Operations and realignment of the ENB, the proposed Brownhill Mining Operations and proposed haulage of waste rock associated with a TSF Infrastructure Project; and
 - discuss the proposed relocation of the Echo Blast Monitor. Given the location of the proposed projects and results of the environmental noise assessments there were no concerns raised regarding potential noise impacts, and the relocation of Echo was to be sought through an amended NVMMMP.

9.5 Noise Working Group

A Noise Working Group was established in June 2010 to discuss KCGM's options to address the Appeals Committee recommendations with regards to the Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2009. The Noise Working Group consisted of KCGM personnel and stakeholder representatives from: CKB, DEC, Kalgoorlie-Boulder Community and Main Roads.

During the programme review, the function of the Noise Working Group was assessed and the decision made to incorporate discussions regarding the Noise Amelioration Programme and the Real-Time Noise Monitoring Programme into the CRG monthly meeting agenda, rather than coordinating a separate forum. Details are documented in KCGM's Quarterly Noise and Blast Monitoring Reports and the Annual Noise Monitoring and Management Report.

9.6 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.

KCGM has consulted with the CRG regarding the following items regarding noise management:

- Noise Amelioration Programme;
- Real-Time Noise Monitoring Programme;
- New Format for the Quarterly Noise Advertisement; and
- Proposed mining projects (Morrison and Brownhill).

10. SUPPORTING TECHNICAL INFORMATION

10.1 Blast Monitoring Sites

The following information is provided to demonstrate that the siting of blast monitoring equipment used by KCGM for blast monitoring complies with the requirements of regulation 21 of the Noise Regulations and section J3.2.2 of AS2187.2.

- The Advanced Texcel remote blast monitor equipment are permanently installed outdoors.
- The microphone is positioned at least 1 m (1.2 m to 1.6 m) above the ground plane and at least 5 m away from any substantial sound reflecting surface (other than the ground plane).
- As measurements are repeated at the same location (permanent installation), the geophone is fixed to an embedded mount to ensure consistency of results.

10.2 Blast Monitoring Equipment

The following information is provided to demonstrate that the equipment used by KCGM for blast monitoring complies with the requirements of schedule 4 of the Noise Regulations and section J3.2.1 of AS2187.2.

10.2.1 Vibration Monitoring

The Advanced Texcel remote blast monitor (ETM) equipment consists of a ground vibration transducer (geophone) for measuring particle velocity (expressed in mm/s). The vibration transducer records signals from three mutually orthogonal axes (vertical, radial and transverse). The recorded vibration signals are downloaded automatically and available for the full duration of the blast event.

The waveform data downloaded from the Texcel Easylink software indicates the absolute maximum signal value (referred to as the Peak Component Particle Velocity (PCPV)) and the maximum of a root sum of squares calculation (referred to as the Vector Peak Particle Velocity (VPPV)) for each of the three components over the whole signal duration.

Other specifications of the ETMs include:

- The frequency range of the geophone is 2 Hz to 250 Hz.
- Instrumentation noise is calculated during the annual calibration, which restricts instrumentation background interference to $\pm 2.0\%$ of maximum PPV.

10.2.2 Airblast Monitoring

The Advanced Texcel remote blast monitor equipment consists of a linear weighted microphone for recording airblast levels. Other specifications of the ETMs include:

- A windshield is fitted over the microphone in accordance with the manufacturer's recommendations.
- The microphone bandwidth is 2.0 – 500 Hz (-3dB).
- The sampling frequency is 1,000 Hz (which is greater than the recommended minimum sampling frequency of 500 Hz for a digital system).

10.3 Blast Monitoring Records

Blast monitoring records provide the data for determining any improvements in blast outcomes, including the management and control of ground vibration and airblast. The majority of KCGM's blast monitoring records are stored in the MMRS and Connected Mine database systems, which contain a full history of blast vibration and airblast monitoring data since 1999.

In accordance with section J3.4 of AS2187.2, KCGM's blast monitoring records include the following:

- Size of the blast i.e. number of blastholes and quantity of explosive in each blasthole:
 - Recorded in MMRS and Connected Mine.
- Method of initiation and design timing sequence:
 - Design saved electronically using SHOTPlus Premier software. Hardcopy printout kept on file with the Blast Report.
- Date and time of the blast:
 - Recorded by the Texcel Easylink software and entered into MMRS and Connected Mine.
- Location of the measurement transducers (blast monitoring sites):
 - Blast monitors are located at permanent fixed locations.
 - Geographical Information System (GIS) coordinates are recorded in Surpac which can be accessed as required by other software.
- Instrument trigger levels:
 - The trigger levels for each blast monitoring site are recorded in the Texcel Easylink software, this NVMMP, the Quarterly Noise and Blast Monitoring Report and internal documentation pertaining to the set-up of the blast monitoring equipment.
- Measurement equipment and operator details:
 - KCGM uses ETMs to measure blast vibration and airblast levels. The equipment is automatically operated by the Texcel Easylink software.
 - Details of the measurement equipment are recorded on the waveforms.
- Location of the blast (blasthole design) in relation to mine leases:
 - The location of the blast is recorded on the Blast Notice.
- Location of any structures and/or persons who may be affected by the blast:
 - A Blast Notice is prepared for each blast to record the location of the blast in relation to the mine operation and any structures and/or person who may be affected by the blast.
 - The Blast Notice also includes an action plan for managing access to the blast area (blast guard positions) and exclusion zones for personnel and equipment.
 - The Blast Notice is distributed electronically around the KCGM site and is put up on noticeboards and emailed to external stakeholders.

- Measured ground vibration and airblast values including the ppv values for each of the triaxial components, a derived vector ppv and the peak airblast levels:
 - Blast vibration and airblast values are recorded by the Texcel Easylink software and stored electronically. Full waveforms are produced for each blast event which are emailed to KCGM Drill and Blast personnel daily.
- Face Survey information indicating the proximity of the nearest blastholes to any free faces within the blast.
 - Survey data is recorded daily and is used to compare the proximity of blastholes to any free faces within the blast.
- Weather Conditions, especially wind speed, cloud cover and direction and any other notable conditions such as rain:
 - KCGM records wind speed and direction at the MEX weather station (refer to Section 5.2.3).
 - Weather data can also be obtained from the Bureau of Meteorology site (Station ID: 012038) located at the Kalgoorlie-Boulder airport if required.
- Information derived from a video of the blast:
 - Video footage is taken of each blast, using a high speed camera capable of showing blasts in one four-thousandth of a second frames.
 - Blasts videos are retained digitally on file and are examined by Drill and Blast personnel to confirm blasting outcomes have been met.
- Any subjective information from the shotfirer and any persons who may be affected by the blast:
 - Subjective information from the shotfirer is recorded on the Blast Report.
 - Any feedback received from any persons affected by the blast is recorded in KCGM's complaint database.

11. GLOSSARY OF TERMS

188:M: Ministerial Statement No.188 Fimiston Project Stage II – Mine and Waste Dumps.

2016 Fimiston Noise Approval: Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016.

782:M: Ministerial Statement No.782 Fimiston Gold Mine Operations Extension (Stage 3) and Mine Closure Planning.

Airblast level: A noise level resulting from blasting.

A-weighting: A frequency-dependent scaling of a sound wave that mimics the response of human hearing.

ARC: Australian Research Council.

Blasthole: A hole that has been drilled or prepared for the purpose of being charged with explosives, or has been charged with explosives.

Blasting: The use of explosive material to fracture:

- a) rock, coal and other minerals for later recovery; or
- b) structural components or other items to facilitate removal from a site or for reuse.

BPS: Boulder Primary School. Means any place within the boundary of the premises known as Boulder Primary School at 200 Lane Street, Boulder.

BSW: Barton Street Williamstown. Means any place at or adjacent to the intersection of Barton Street and Baden Street, Williamstown.

CEO: Chief Executive Officer.

CKB: City of Kalgoorlie-Boulder.

Competent person: A person who has acquired through training, qualification or experience, or a combination of these, the knowledge and skills to carry out the required task.

Component velocity: One of the orthogonal particle velocities; typically one of radial, transverse, or vertical velocity.

CRG: Community Reference Group.

DAA: Department of Aboriginal Affairs

Daytime: any time in the period:

- a) between the hours of 0700 and 1900 on Monday to Saturday, excluding public holidays; and
- b) between the hours of 0900 and 1900 on Sunday and public holidays.

Decibels (dB): logarithmic unit used to measure sound levels.

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

DER: Department of Environment Regulation. (Now DWER)

DMIRS: Department of Mines Industry Regulation and Safety

DPLH: Department of Planning Lands and Heritage

DWER: Department of Water and Environmental Regulation

EMP: Environmental Management Plan.

ETM: Advanced Texcel remote blast monitor equipment.

EPA: Environmental Protection Authority.

Evening: any time in the period between the hours of 1900 and 2200.

GIS: Geographic Information Systems.

Ground vibration: Mechanical energy (vibration) produced by a blast and transmitted through the ground.

Hz: Hertz. Unit of frequency, equal to one cycle per second.

KCGM: Kalgoorlie Consolidated Gold Mines Pty Ltd.

KTS: Kalgoorlie Technical School. Means any place within the boundary of the premises known as Kalgoorlie Technical School at 13 Davidson Street, South Kalgoorlie.

L_{A 10} approved level: an assigned level that, measured as an LA Slow value, is not to be exceeded for more than 10% of the representative assessment period.

L_{A 10}: the noise level in decibels exceeded for 10% of the measurement period, obtained using the “A” frequency-weighting characteristic.

L_{A 50}: the noise level in decibels exceeded for 50% of the measurement period, obtained using the “A” frequency-weighting characteristic.

L_{A 90}: the noise level in decibels exceeded for 90% of the measurement period, obtained using the “A” frequency-weighting characteristic.

L_{A max} approved level: an assigned level that, measured as an LA Slow value, is not to be exceeded at any time.

L_{A slow}: the reading in decibels obtained using the “A” frequency-weighting characteristic and the “S” time-weighting characteristic as specified in AS IEC 61672.1-2004 Electroacoustics-Sound level meters Part 1: Specifications, for class 1 and class 2 meters, with sound measuring equipment that complies with the requirements of Schedule 4 of the *Environmental Protection (Noise) Regulations 1997*.

L_{eq}: the Sound Pressure Level in dB, equivalent to the total Sound Energy over a given period of time.

L_{Z peak}: the peak sound pressure level in decibels (dB) obtained using the “A” frequency weighting characteristic, as specified in AS IEC 61672.1-2004 Electroacoustics-Sound level meters Part 1: Specifications, with sound measuring equipment that complies with the requirements of Schedule 4 of the *Environmental Protection (Noise) Regulations 1997*.

Measured: In relation to the measurement of a noise emission, means measured and adjusted in accordance with the *Environmental Protection (Noise) Regulations 1997*.

MEP: KCGM Real-time / Continuous noise monitoring site.

MEX: KCGM weather monitoring station (located within the same premises as MEP).

Monitoring: Is the process of sampling and measuring certain parameters.

mm/s: millimetres per second.

NATA: National Association of Testing Authorities.

Noise Regulations: *Environmental Protection (Noise) Regulations 1997*.

Noise Sensitive Premises: has the meaning given in Schedule 1 Part C of the *Environmental Protection (Noise) Regulations 1997*.

NVMMP: Noise and Vibration Monitoring and Management Plan.

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

OSB: Outram Street Boulder. Means any place at or adjacent to the intersection of Outram Street and Shannon Street, Boulder.

Particle velocity: The time history of the velocity of particles within the ground.

Peak component particle velocity (ppv): The peak level of the particle velocity for an individual component.

PER: Public Environmental Review.

PIL: Public Interaction Line.

Reference location: A location specified in the terms in *Environmental Protection (Fimiston Gold Mine Noise Emissions Approval) 2009* for the assessment of noise emissions.

Sensitive Site: has the meaning given in regulation 11(1) of the *Environmental Protection (Noise) Regulations 1997*.

SIA: Social Impact Assessment.

Significantly contribute to: A noise emission is taken to “significantly contribute to” a level of noise if the noise emission exceeds a value which is 5dB below the assigned level at the point of reception. As defined in the *Environmental Protection (Noise) Regulations 1997*, Regulation 7(2).

Sound level meter: A measuring device that measures the level of sound, and may provide dBL, dBA or dBC values.

Sound pressure level (dB): A logarithmic scale of pressure with a reference pressure of 20 µPa.

UWA: University of Western Australia.

Vector peak particle velocity: The peak level of the particle velocity calculated from the vector formed by the magnitude of the three orthogonal components of the particle velocity over their measured time history.

WIF: Weather Influencing Factor.

YSB: York Street Boulder. Means any place on York Street, between the intersections of York Street with Lane Street and Hamilton Street, Boulder.

12. REFERENCES

Australian Standard AS1259.1 1990 *Sound Level Meters Part 1: Non-integrating*

Australian Standard AS1259.2 1990 *Sound Level Meters Part 2: Integrating-averaging*

Australian Standard AS2923-1987 *Ambient Air – Guide for measurement of horizontal wind for air quality applications*

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