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Fimiston Gold Mine Operations (Ministerial Statement 782) - 5 Year Performance Review

2015-2019

KCGM

March 2020

Project Number: TE19058

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1 Introduction

1.1 About Kalgoorlie Consolidated Gold Mines

Kalgoorlie Consolidated Gold Mines Pty Ltd (KCGM) operates the Fimiston Gold Mine Operations (the Fimiston Operations), which are located adjacent to the City of Kalgoorlie-Boulder, approximately 600 km east of Perth, Western Australia (WA). The Fimiston Operations consist of the Fimiston Open Pit, the Fimiston Processing Plant, three Tailings Storage Facilities (TSFs), waste rock dumps (WRDs), run of mine (RoM) Pad, infrastructure corridors and workshop areas. Ministerial Approval was granted for the Fimiston Operations in January 2009 under Ministerial Statement 782 (MS782) although the Fimiston Open Pit has been operating for over 30 years.

From March 1989 until late 2019 KCGM has been operating the Fimiston Operations as the management company of the 50/50 Joint Venture (JV) between Newmont Goldcorp Australia Pty Ltd (Newmont) and Barrick (Australia Pacific) Pty Limited (Barrick). In November 2019 Barrick sold their 50% share of the JV to Saracen Mineral Holdings Limited (Saracen) and in January 2020 Newmont sold their 50% share of the JV to Northern Star Resources Ltd (Northern Star).

KCGM continues as the management company of the new JV between Saracen and Northern Star.

KCGM also operates the Mt Charlotte Underground Mine and the Gidji Processing Plant. The Fimiston Operations and Mt Charlotte Underground Mine are located adjacent to the City of Kalgoorlie-Boulder, whilst the Gidji Processing Plant is located approximately 17 km north of Kalgoorlie-Boulder (**Figure 1-1**).

KCGM comprises many facets of mining and mineral processing including:

- Open pit mining (Fimiston);
- Waste rock disposal (Fimiston);
- Underground mining (Mt Charlotte);
- Mineral processing (Fimiston and Gidji);
- Tailings disposal (Fimiston and Gidji);
- Ultra-fine grinding (Fimiston and Gidji);
- Electrowinning and refining (Fimiston); and
- Exploration.

On average, KCGM produces 600,000 ounces of gold each year and has a gold reserve of approximately 7 million ounces. At the time of writing, the estimated production mine life for the Fimiston Operations will see mining continue until around 2026, and mineral processing until 2034 through the processing of low-grade stockpiles. On completion, the Fimiston Open Pit will measure 3.5 km in length, 1.5 km in width and up to 700 metres in depth.

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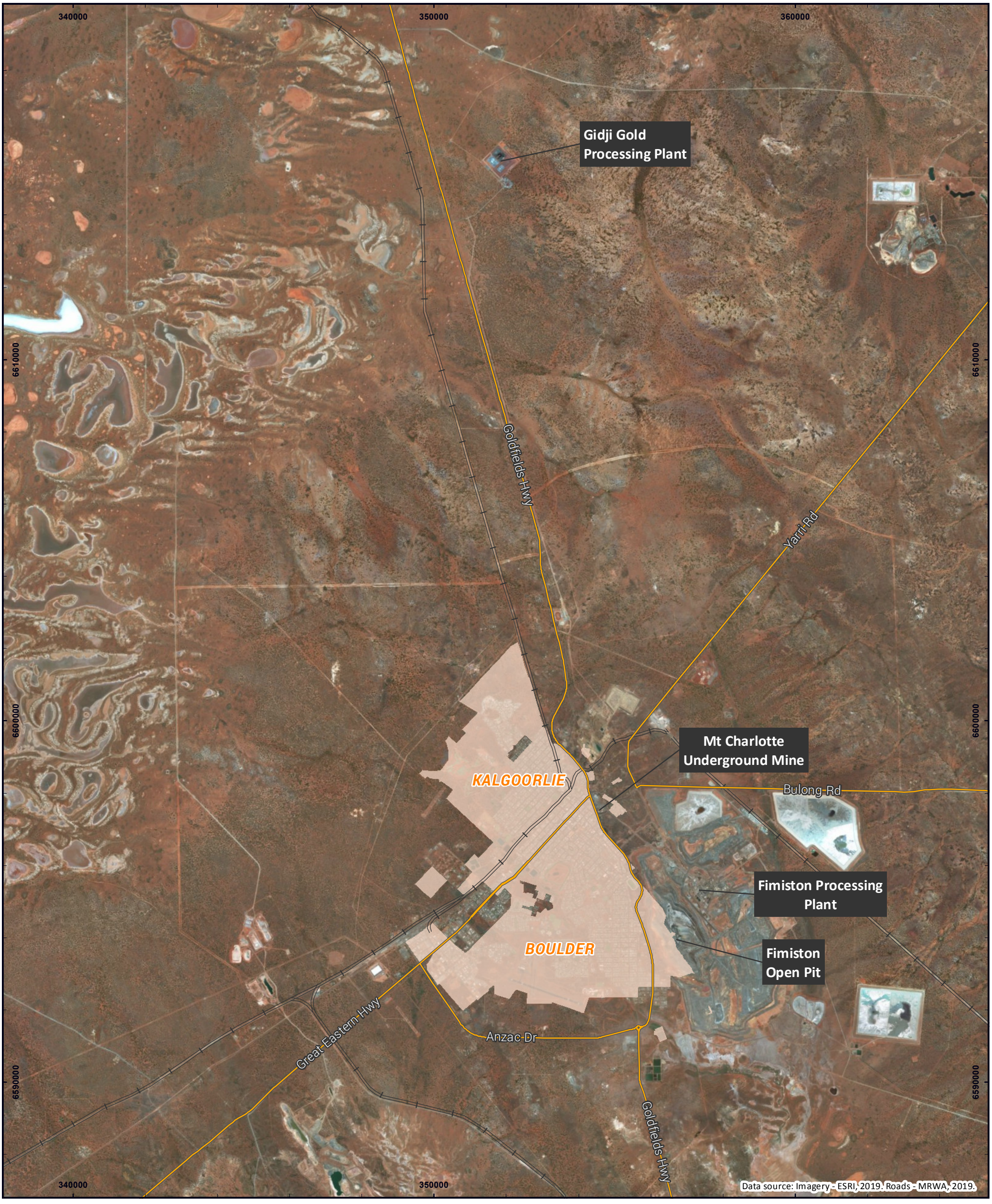

LEGEND

- Major Road
- Urban Centre
- Railway Line

REGIONAL LOCATION

5 Year Environmental Performance Review
Kalgoorlie Consolidated Gold Mines Ltd

N
0 1 2 3 4 km
Scale @ A3: 1:100,000
Coordinate System: GDA 1994 MGA Zone 51, Projection: Transverse Mercator, Datum: GDA 1994

Prepared:	F Walker
Reviewed:	G Barrett
Project:	TE19058
Revision:	A
Date:	11/10/2019

Figure 1-1

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In recent years the following significant developments have occurred at the Fimiston Operations:

- Additional tailings storage capacity was obtained through recommissioning the Kaltails tailings storage facility (TSF) in 2011 and subsequent height increases of the Fimiston I and II TSFs;
- Inclusion of the Morrison and Brownhill mining areas within the existing Fimiston open pit mine schedule,
- Increased disturbance footprint for the TSF haul road and infrastructure; and
- Conversion of the former Kaltails water supply borefield to establish a managed aquifer recharge scheme.

1.2 Purpose of this report

The Fimiston Operations have been subject to formal environmental assessment under Part IV of the WA *Environmental Protection Act 1986* (EP Act) on two occasions. The most recent assessment was concluded in January 2009, following a Public Environment Review of the *Fimiston Gold Mine Operations Extension (Stage 3) and Mine Closure Planning* Project, culminating in the issue of Ministerial Statement 782 (MS782) which is regulated by the Department of Water and Environmental Regulation (DWER).

Condition 5 of MS782 requires KCGM to prepare and submit a performance review every 5 years as shown in the following:

> ***5 Performance Review***
>
> *5-1 The proponent shall submit a Performance Review report every five years after the start of mining activities forming part of the expanded and revised proposal to the Environmental Protection Authority, which addresses:*
>
> 1. *the major environmental issues associated with implementing the project; the environmental objectives for those issues; the methodologies used to achieve these; and the key indicators of environmental performance measured against those objectives;*
> 2. *the level of progress in the achievement of sound environmental performance, including industry benchmarking, and the use of best available technology where practicable;*
> 3. *significant improvements gained in environmental management, including the use of external peer reviews;*
> 4. *stakeholder and community consultation about environmental performance and the outcomes of that consultation, including a report of any on-going concerns being expressed; and*
> 5. *the proposed environmental objectives over the next five years, including improvements in technology and management processes.*

This report represents the second Performance Review prepared for the Fimiston Operations, covering the calendar year period from 2015 to 2019. The review addresses three major

environmental issues associated with the Fimiston Operations for which specific conditions are included in MS782. These major environmental issues are:

- Noise, vibration and airblast;
- Air quality; and
- Rehabilitation and closure.

The environmental objectives for these issues are outlined within the management plan for each issue and assesses performance against those objectives as presented in section 5.

1.3 Project Status

The current KCGM Life of Mine Plan sees gold processing until around 2034. Mt Charlotte underground mining will finish around 2024 and Fimiston Open Pit mining will conclude around 2026. On completion, the Fimiston Open Pit will measure 3.5 km in length, 1.5 km in width and up to 700 metres in depth.

While the current Life of Mine Plan has KCGM operating to around 2034, KCGM continues to look for opportunities to extend mine life.

As part of its purpose to create value and improve lives through sustainable and responsible mining, KCGM continues to focus on the growth of its people and resource. To deliver on this commitment, KCGM is currently exploring a number of growth opportunities relating to the Fimiston South open pit and Mount Charlotte East underground projects. In addition, the company is seeking approval to extend the Fimiston II TSF which will allow for the uninterrupted continuation of KCGM's operations to end of the current Life of Mine, providing ongoing economic and employment benefits to the City of Kalgoorlie-Boulder. KCGM is also reviewing a number of options to remediate the Fimiston Pit East Wall Failure, with recommendations due to be reported in early 2020.

2 Fimiston Operations

The main elements of the Fimiston Operations are the Fimiston Open Pit, the Fimiston Processing Plant and three TSFs (**Figure 2-1**).

2.1 Fimiston Open Pit

The Fimiston Open Pit is located on the eastern boundary of the City of Kalgoorlie-Boulder as shown in **Figure 2-1**. It is one of the largest open pit gold mining operations in Australia. The Fimiston Open Pit operates 24 hours a day, 365 days a year. On completion, the Fimiston Open Pit is expected to measure 3.5 km in length, 1.5 km in width and up to 700 m in depth, encompassing the ground known as the Golden Mile.

Mining of the Fimiston Open Pit is undertaken using conventional open pit mining methods. Mine planning identifies the locations of ore and waste rock to be mined based on the location of ore, its grade and sulphur content, the current gold price, the presence of old workings and the quantity and grade of ore required by the Fimiston Processing Plant.

Areas to be mined are drilled and blasted, taking care to locate and plan for mine voids arising from historical mine workings. Blasting is conducted under strict controls. Ore and waste rock are loaded into trucks by shovels and hauled to the surface. Face shovels can scoop 66 tonnes of ore or waste rock at a time with each truck carrying 240 tonnes of material.

2.2 Fimiston Processing Plant

The Fimiston Processing Plant comprises two parallel circuits for processing refractory sulphide ore from the Fimiston Open Pit and ore from the Mt Charlotte Underground Mine.

The processes undertaken in the Fimiston Processing Plant are outlined below and shown in **Figure 2-2**:

- Two crushing circuits that supply coarse ore as a mill feed stockpile;
- Two milling circuits, the Fimiston and the Mt Charlotte. The Fimiston circuit comprises a semi-autogenous grinding (SAG) mill and a pebble crushing circuit with two secondary ball mills and four Knelson concentrators. The Mt Charlotte circuit is a single SAG mill and ball mill with a single Knelson concentrator;
- A flotation circuit and three carbon-in-leach (CIL) circuits through which milled ore is processed;
- Filtration and Ultra Fine Grind (UFG) via a carbon in leach circuit through which flotation concentrates are de-slimed and processed;
- A gold recovery circuit comprising an Acacia reactor, elution, electrowinning, smelting, pouring and production of gold bullion; and
- Tailings storage facilities (TSFs).

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360000

Yarri Rd

Mt Charlotte Underground Mine

Fimiston I TSF

Bulong Rd

Fimiston II TSF

Fimiston Processing Plant

Fimiston Open Pit

Goldfields Hwy

Anzac Dr

Kaltails TSF

6590000

6590000

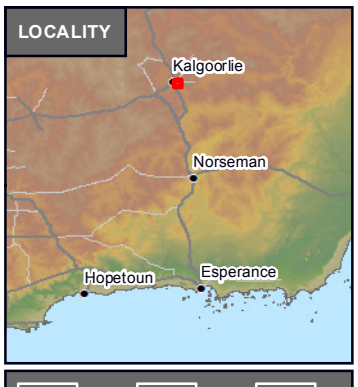
360000

Data source: Imagery - Landgate, December 2018. Roads - MRWA, 2019.

LEGEND

- Major Road
- Railway Line

LOCALITY



0 100 200 300 400 500 km

FIMISTON MINE AND PROCESSING OPERATIONS

5 Year Environmental Performance Review
Kalgoorlie Consolidated Gold Mines Ltd

N

0 0.35 0.7 1.05 1.4 km

Scale @ A3: 1:35,000

Coordinate System: GDA 1994 MGA Zone 51, Projection: Transverse Mercator, Datum: GDA 1994

Prepared:	F Walker
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Figure 2-1

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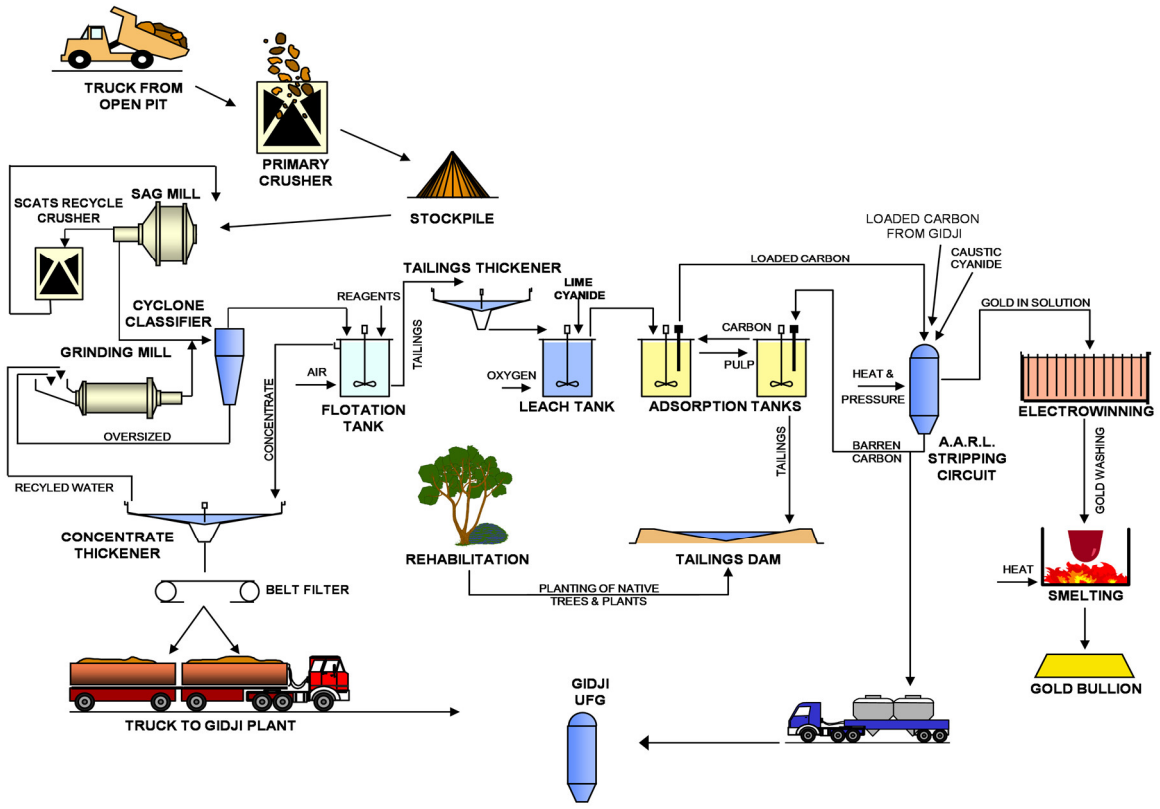
Figure 2-2: Gold ore treatment flowchart



Gold is generally present as either free gold, within telluride minerals, locked in pyrite or silicate minerals. Ore is ground to liberate the pyrite in preparation for the ensuing processes. In the flotation circuit the gold bearing refractory sulphide is separated and referred to as concentrate. This concentrate is de-slimed, and the slimes are subjected to flotation to recover any coarse sulphide particles. The slimes flotation tailings (SFT) are treated at Fimiston in one of the CIL circuits, CIL1.

The de-slimed concentrate and slime sulphides are combined and classified into two streams. One stream is washed, filtered and transferred to Gidji for further treatment. The other stream is directed to an Ultra-Fine Grinding (UFG) circuit at Fimiston. The UFG circuit reduces the particle size of the concentrate to facilitate acceptable cyanide leach recoveries; this material is combined with the SFT. Flotation circuit tailings are further treated on site in two of the CIL circuits, CIL2 and CIL3. Final tailings are pumped to the TSFs.

2.3 Infrastructure

The mining and processing operations are supported by other infrastructure comprising:

- Workshops;
- Fuel storages;
- Administration and offices;
- Haul and access roads; and

- Water supply and dewatering facilities (including water storages and a managed aquifer recharge scheme for reinjection of excess water).

Power is supplied by the privately-operated Parkeston power station and by Western Power.

2.4 Production in 2015-2019

About 70 Million tonnes of ore (both oxide and refractory sulphide ores are mined) and waste rock is removed from the Fimiston Open Pit each year, although total tonnages of ore and waste rock mined varies. During 2018 and 2019, the Fimiston Open Pit operation was significantly impacted by the two rock falls which occurred in May 2018, resulting in a 50% reduction in mining production. During the five year review period mined gold grade averaged 1.85 grams per tonne.

On average, KCGM produces 600,000 ounces of gold each year. Due to the reduction in mining production from the Fimiston Open Pit during 2018 and 2019, KCGM commenced processing of low grade stockpiles which resulted in reduced gold produced.

Production for both mining and processing in 2015-2019 and the previous five year review period is shown in **Table 2-1** and **Table 2-2**.

Table 2-1: Ore and waste rock mined in the period 2010-2019

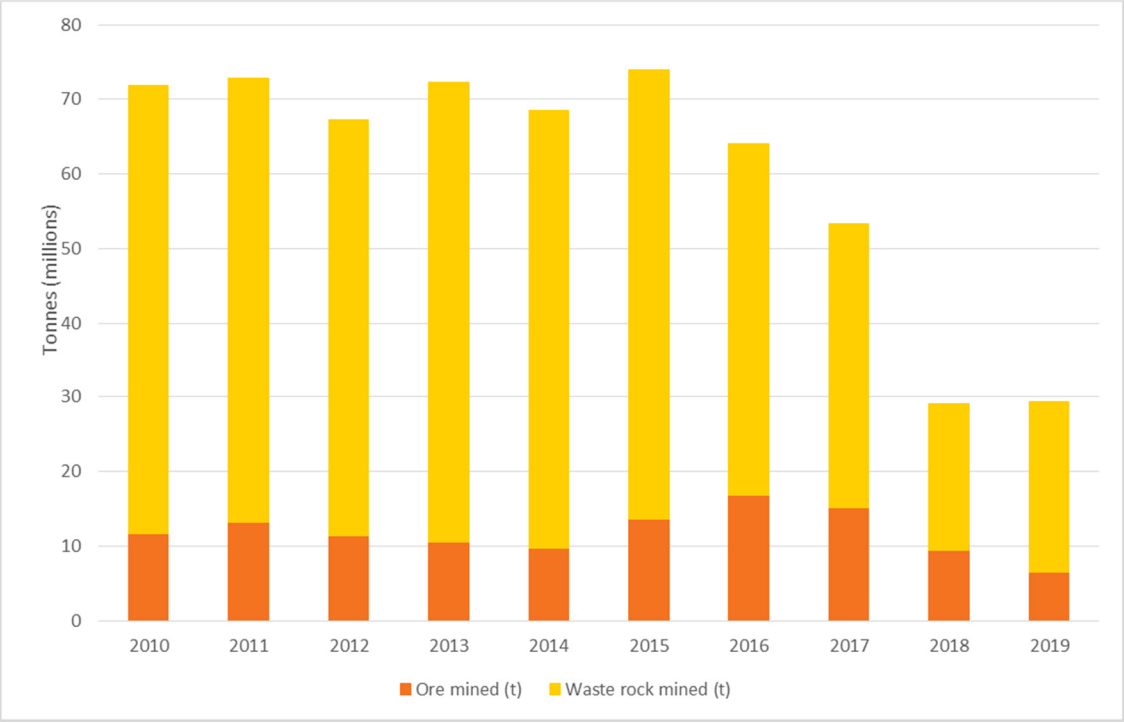
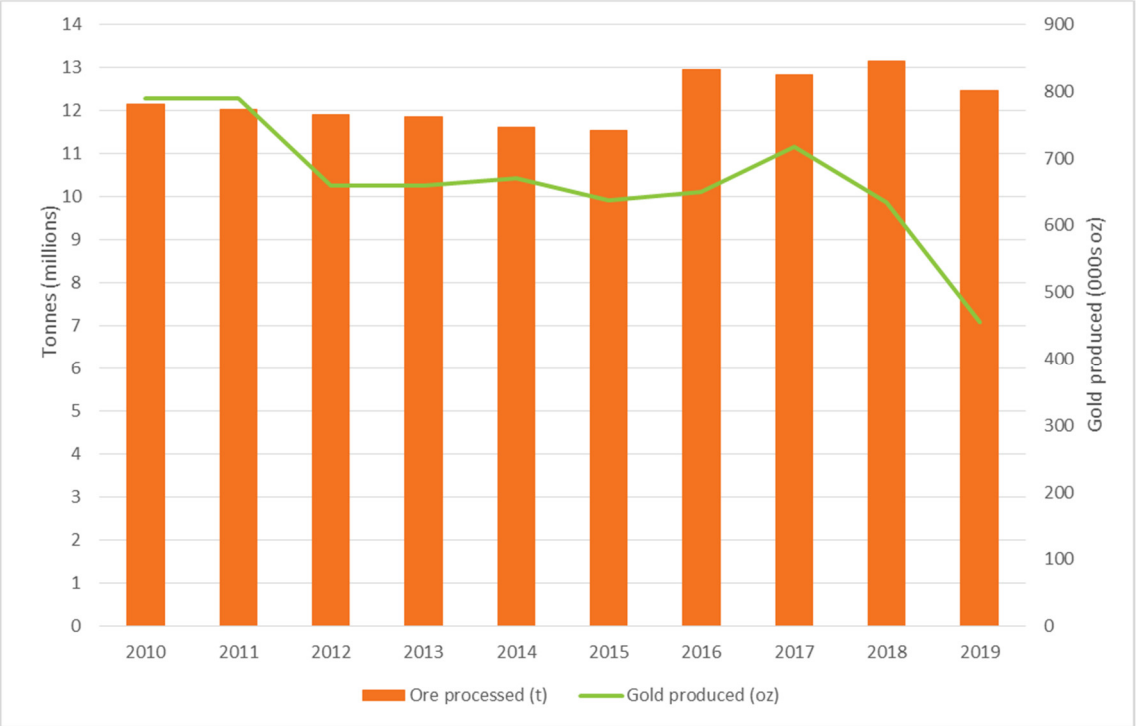


Table 2-2: Ore processed and gold output in the period 2010-2019



3 Stakeholder and community consultation

The proximity of the Fimiston Operations to the City of Kalgoorlie-Boulder means that community consideration is a priority, and as such KCGM consults with the community on an ongoing basis regarding day-to-day operations, to review plans and practices, and in the case of any significant new proposals. KCGM has an established stakeholder engagement network and utilises a range of mechanisms to facilitate consultation and capture input from the wider Kalgoorlie-Boulder community, and other key stakeholders including the relevant regulatory authorities.

3.1 Community consultation forums

The main community consultation forums include the Community Reference Group (CRG) and the Public Interaction Line (PIL), although a range of other consultation forums and mechanisms are also used by KCGM to facilitate consultation and capture input from the wider Kalgoorlie-Boulder community on an ongoing basis.

3.2 Social impact assessment

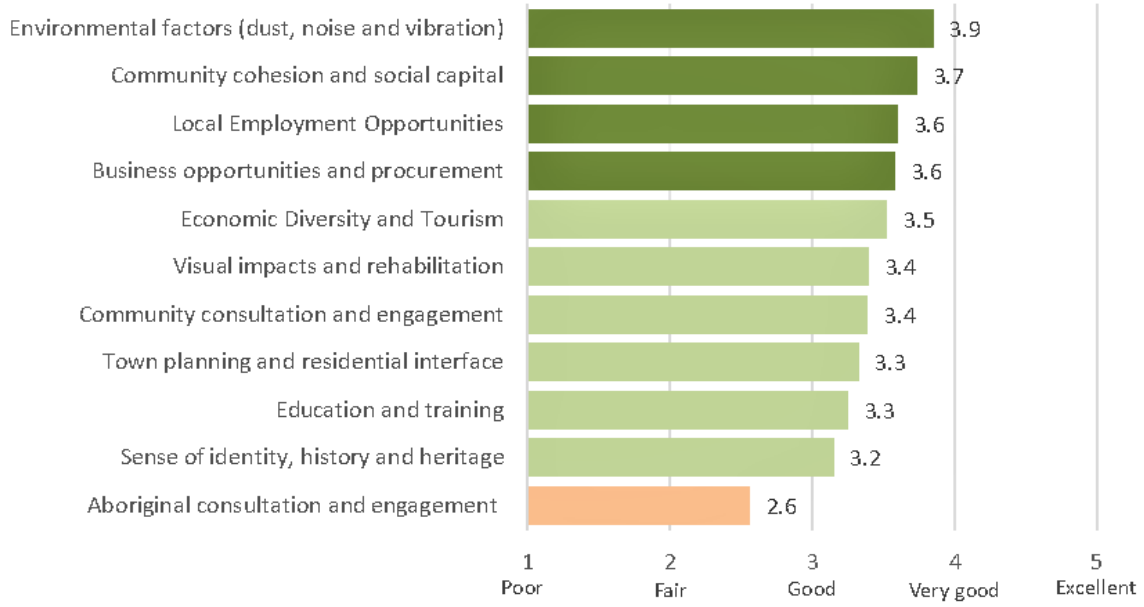
The views of Kalgoorlie-Boulder residents are captured regularly in KCGM's Social Impact Assessments (SIA), which are conducted every five years or when there is a major operational change. The purpose of the SIA is to:

- Quantify and describe social impacts;
- Engage with stakeholders and enhance relationships;
- Update and, where required, renew impact management strategies;
- Provide recommendations for the development of KCGM's Social Impact Management Plan and Stakeholder Engagement Strategy;
- Provide a framework for ongoing monitoring and evaluation; and
- Meet internal reporting requirements.

The most recent SIA was undertaken in 2015 by Creating Communities Pty Ltd. The SIA identified 11 key social impacts categories, including 'Environmental factors' – the impact of KCGM's activities which produce dust, noise, and blast vibration on amenity, property and health.

Participants of the SIA were asked to rate KCGM's performance in managing each of these impact variables on a scale of 1 – 5 where 1 is poor and 5 is excellent. Whilst the participants viewed 'Environmental Factors (dust, noise and vibration)' as having a negative impact, their perception of KCGM's performance in managing this key social impact was rated the highest (**Figure 3-1**), indicating that 'Environmental Factors (dust, noise and vibration)' was considered to be well managed by KCGM.

Figure 3-1: Social impact assessment - ratings of KCGM's performance in managing key social impacts



3.3 Local Voices

Local Voices is a unique community engagement program developed over 10 years within Australia's leading science agency, the Commonwealth Scientific and Industrial Research Organisation (CSIRO). Voconiq is an independent company which was founded by a team of dedicated social scientists at CSIRO, in conjunction with Local Voices.

KCGM has engaged the services of Voconiq to implement and coordinate a Local Voices program within Kalgoorlie-Boulder over the next three years, with the aim of improving engagement, increasing understanding and generating better relationships and outcomes between KCGM's Operations and the surrounding communities.

Local Voices was launched in August 2019, with an initial anchor survey open to all community members including KCGM employees. It is designed to provide a platform for the people of Kalgoorlie-Boulder to have a direct voice in expressing their views on current and planned activities associated with KCGM's Operations.

This will better inform KCGM of issues that matter most to communities surrounding the Fimiston Operations, and subsequently these insights can be used in business decision making.

The KCGM Local Voices page can be found **https://voconiqlocalvoices.com/kalgoorlie-boulder/**.

3.4 Consultation specific to environmental performance

In accordance with conditions of the *Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval* (2009, 2016), KCGM prepares an Annual Noise Report. This report provides a summary of the noise and airblast levels recorded during the year; and progress of the implementation of the noise

management plan. The report is submitted to the DWER and is made publicly available on the KCGM website.

Results of continuous noise monitoring and compliance noise monitoring are provided in the Quarterly Noise and Blast Monitoring Reports submitted to the DWER.

From 1993 to 2011, KCGM publicly advertised trigger events associated with the continuous noise monitoring programme in the Kalgoorlie Miner newspaper on a quarterly basis. In 2011, the format of the advertisement was amended to advertise the results from the quarterly compliance noise monitoring (rather than the trigger events). In 2016, KCGM deemed that it would be more appropriate to provide these results on the KCGM website; subsequently advertising in the Kalgoorlie Miner newspaper was discontinued.

Since October 2011, real-time monitoring results from a noise logger (located at MEP) have been made publicly available on the KCGM website. The real-time noise report is automatically updated every 15 minutes and graphically displays the data over a 48-hour period.

Results of the PM_{10} dust monitoring programme are made publicly available on the KCGM website. The 'KCGM Dust Report' is automatically updated daily and provides the 24 hour average recorded at each dust monitoring site for 1 month.

The following documentation is also made publicly available on the KCGM website:

- The 5 year Performance Report 2010-2014;
- Annual Compliance Assessment Reports for MS782;
- Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016;
- Noise and Vibration Monitoring and Management Plan;
- Fimiston Air Quality Management Plan;
- Mine Closure Plan;
- Information sheets for: noise, blasting, air quality, water and tailings; and
- Monitoring network maps for: noise, blasting and dust.

No concerns have been expressed by the DWER or the community with regards to environmental performance as a result of the above consultation.

4 External peer review and benchmarking

4.1 ISO 14001 certification

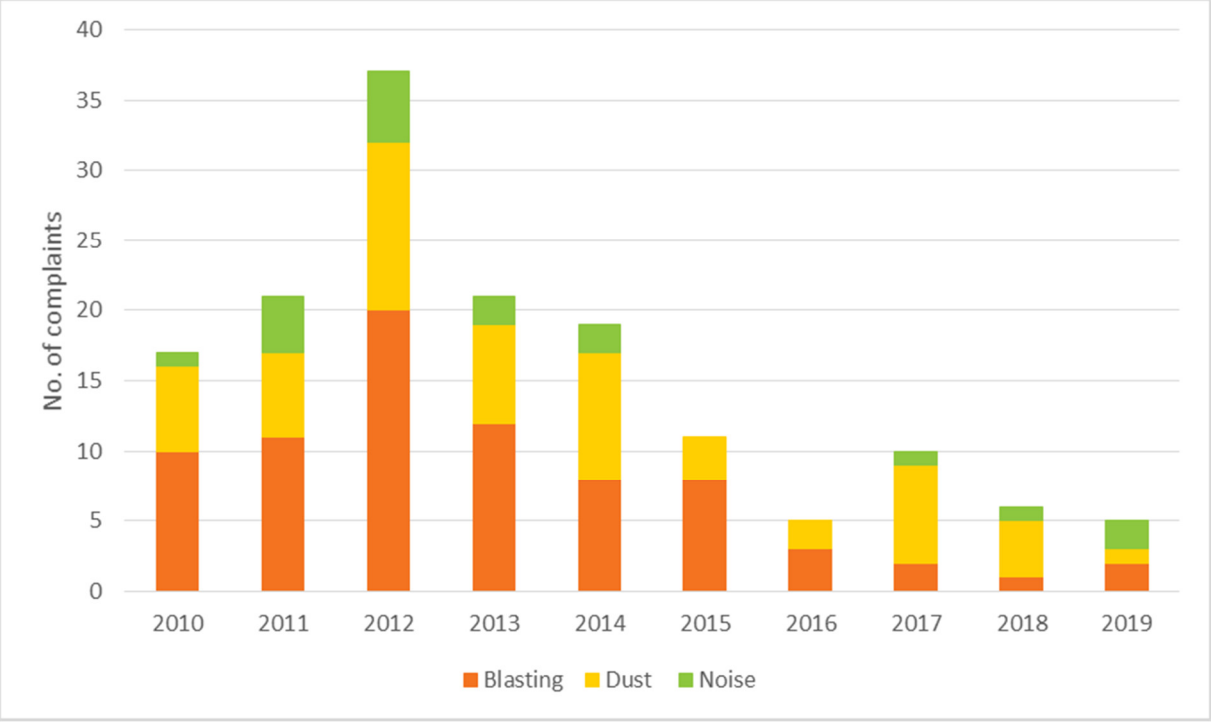
In September 2013, KCGM gained certification to the international standard ISO 14001 that specifies requirements for an effective environmental management system (EMS). This means that the systems that KCGM has developed to manage environmental issues are consistent with the internationally recognized approach as defined within the standard. Using an EMS consistent with the ISO 14001 principles provides assurance to company management, employees and external stakeholders that environmental impact is being monitored and improved.

In September 2017, KCGM was found compliant with new revised ISO Standard 14001:2015 by external auditing firm DNV. During the five year review period, KCGM has maintained its ISO 14001 certification.

4.2 Complaints

The number of complaints received related to environmental aspects of the Fimiston Operations since 2010 are presented in **Figure 4-1**. The trend in complaints data collected over the last 10 years shows that the overall number of complaints related to environmental aspects of the Fimiston Operations has steadily declined from the peak that occurred in 2012. This peak was largely due to repeat complaints from two individuals which were investigated and resolved.

Figure 4-1: Complaints relating to environmental issues for the period 2010-2019



A summary of the details of each complaint received by KCGM regarding environmental aspects of the Fimiston Operations during the five year review period is provided in Appendix A.

4.3 Compliance

KCGM has demonstrated an excellent compliance record for the Fimiston Operations throughout the life of the project. Compliance with conditions of MS782 is detailed within the Compliance Assessment Reports which are submitted annually to the DWER.

There has been two non-compliances recorded in the period 2015-2019, relating to an exceedance of approved airblast levels in 2015 and an exceedance of the approved frequency for vibration levels greater than 5 mm/sec in 2016. On each occasion that a non-compliance has occurred, KCGM has identified and implemented effective mitigation measures to prevent recurrence. KCGM has received correspondence from the then OEPA whereby these non-compliances are considered to be resolved and no further action by KCGM is required.

Over the 2015-2019 period, there were also five potential non-compliances recorded, relating to instances where the 24 Hour Dust Monitoring Report was not available to the public within 24 hours, as required by Condition 7-5 of MS782. KCGM has not received any formal advice from the DWER regarding these potential non-compliances.

A summary of the details of each non-compliance and non-conformance recorded by KCGM regarding the Fimiston Operations during the five year review period is provided in Appendix B.

4.4 External auditing

During the five year review period there has been one desktop audit conducted by the DWER. The aim of the audit was to verify compliance with the implementation conditions of MS782. The audit was completed on 11 November 2016 and found KCGM to be in compliance with the implementation conditions of MS782.

5 Environmental Performance Review

The context for the following information is outlined in section **1.2**.

5.1 Noise, Vibration and Airblast

5.1.1 Objective

Factor	Objective	Management Plans
Noise, vibration and airblast	To manage noise emissions and blasting from the Fimiston Operations to minimise potential impacts to the residents of the City of Kalgoorlie-Boulder.	Noise and Vibration Monitoring and Management Plan (August 2018)

5.1.2 Management measures

5.1.2.1 Noise

Noise, Vibration and Airblast are managed under the Noise and Vibration Monitoring and Management Plan (NVMMP). While routine measures are used to reduce noise generated by KCGM that may affect nearby residential areas, investigations (noise modelling undertaken in 1992) identified that a noise bund would lead to a significant reduction in noise levels from mine operations in residential areas. The original noise bund was constructed in 1993 with subsequent extensions to take account of pit expansions. The bund now extends for more than six kilometres along the western edge of the Fimiston open pit (**Figure 5-1**).

Other measures aimed at reducing the risk of nuisance noise include:

- Restrictions on the use of certain equipment to daytime only;
- The use of high intensity magenta strobe lights on the ROM pad in lieu of a reversing alarm;
- The use of 'broadband' reversing alarms that produce a less tonal noise than traditional 'beeping' alarms on mining equipment;
- Adjustments to conveyor maintenance procedures; and
- The use of screening using sea containers (**Plate 5-1**) to reduce noise emissions from exploration drilling activities when operating in close proximity to the community.

Plate 5-1: Noise barrier to reduce noise from drilling activities at sensitive receptors

5.1.2.2 Vibration and airblast

Blasting generates noise (airblast) and ground vibration, both of which have the potential to cause annoyance to nearby residents.

The key management measures employed by KCGM to mitigate potential impacts caused by blasting include:

The key management measures employed by KCGM include:

- Restricting blasting times to daylight hours (between 07:00 and 18:00 hours) and on most occasions occurs at a publicised time each day (generally 13:00 or 17:00 hours). Whenever possible, explosives placed for surface blasts are fired when weather conditions are such that the impact of airblast and dust emissions on residential areas of Kalgoorlie-Boulder are minimised;
- Avoiding blasting on Sundays where possible. Sunday blasts are not included in the fortnightly production schedules and only used when there are mitigating factors;
- Internal procedures and training for blasting to ensure that the quality of the blast design and set up is within the set guidelines;
- Implementing a quality assurance (QA) system of continuous measurement and review of drilling, charging and firing practices to ensure the best possible outcomes from a blast. KCGM has completed several QA studies measuring every aspect of drilling and charging. The studies have revealed that the more intense the QA, the more accurate is the drill and blast process; and
- Selection of competent personnel and subsequent supervision to overcome the 'human factor' in the implementation of procedures and encouragement of a professional culture within the respective drilling and blasting crews. Any blasts which exceed the KCGM internal limits are investigated and notification is provided to the people responsible for preparing the blast.

KCGM has also been proactive in research and development in less invasive blasting techniques while still achieving the mining outcomes required. Initiatives include:

- The 'near field' vibration study to further understanding of how the rock behaves when subject to the pressure waves of a blast and 'fine tune' blasting methods to minimise blasting vibration;
- Continued research into the use of electronic detonators, driven in part from the perceived environmental benefits (reduced vibration) of extremely accurate timing that is 'customised' for particular ground conditions;
- Studies of 'domain blasting' where the rock strength is predicted by examining the penetration rate of drills or studying the geology of the area. The aim of the exercise is to have a formal prediction process that prevents weaker rock areas being overcharged, which can lead to elevated airblast levels; and
- Use of a high speed camera capable of showing blasts in one two-thousandth of a second frames to provide a better understanding of what processes are leading to unfavourable events within blasts.

5.1.3 Key performance indicators

5.1.3.1 Noise: compliance monitoring

KCGM operates under a set of approved noise levels ('compliance monitoring') which are defined within the *Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016*, outlined in **Table 5-1**. These approved noise levels apply at five reference locations within Kalgoorlie-Boulder (**Figure 5-1**).

Table 5-1: Approved noise levels– evening and night

Location	Approved level (dB)	
	L_{A10}	L_{Amax}
BSW	45 + WIF	55 + WIF
BPS	45 + WIF	52 + WIF
KTS	45 + WIF	52 + WIF
OSB	49 + WIF	60 + WIF
YSB	49 + WIF	60 + WIF

Compliance noise monitoring is undertaken each quarter by specialist noise consultants during the evening and/or night periods to minimise the sources of contributing noise other than mining (i.e. traffic), and also as it represents the time of day that Kalgoorlie-Boulder residents are likely to be most affected by mining noise from the Fimiston Operations. These results have been provided to the DWER in the Quarterly Noise and Blast Reports and to the community in the newspaper advertisements and via the KCGM website.

For the five year review period, the noise levels measured at the five reference locations have all complied with the key performance indicators (the approved noise levels for the evening/night time period) (see **Figure 5-2** through to **Figure 5-6**).

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354000 355000 356000 357000 358000

6597000 6596000 6595000 6594000 6593000 6592000

BSW
KTS
MEX
YSB
BPS
OSB

Great Eastern Hwy
Goldfields Hwy
Anzac Dr

Data source: Imagery - Landgate, December 2018. Roads - MRWA, 2019.

LEGEND

- Noise Monitoring Site
- Weather Monitoring Site
- Environmental Noise Bund

LOCALITY

ENVIRONMENTAL NOISE MONITORING LOCATIONS

5 Year Environmental Performance Review
Kalgoorlie Consolidated Gold Mines Ltd

N
0 200 400 600 800 1,000 m

Scale @ A3: 1:20,000
Coordinate System: GDA 1994 MGA Zone 51, Projection: Transverse Mercator, Datum: GDA 1994

Prepared:	F Walker
Reviewed:	G Barrett
Project:	TE19058
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Date:	25/03/2020

Figure 5-1

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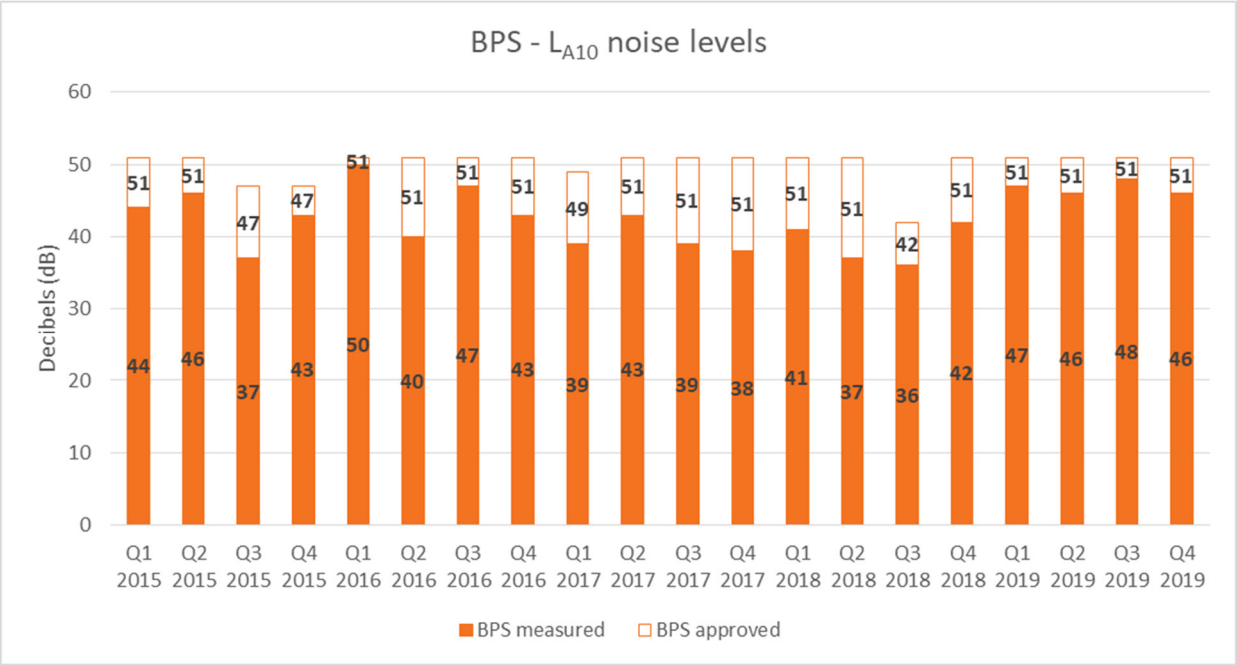
Figure 5-2: Boulder Primary School (BPS) – compliance noise monitoring – L_{A10} and L_{Amax} noise levels



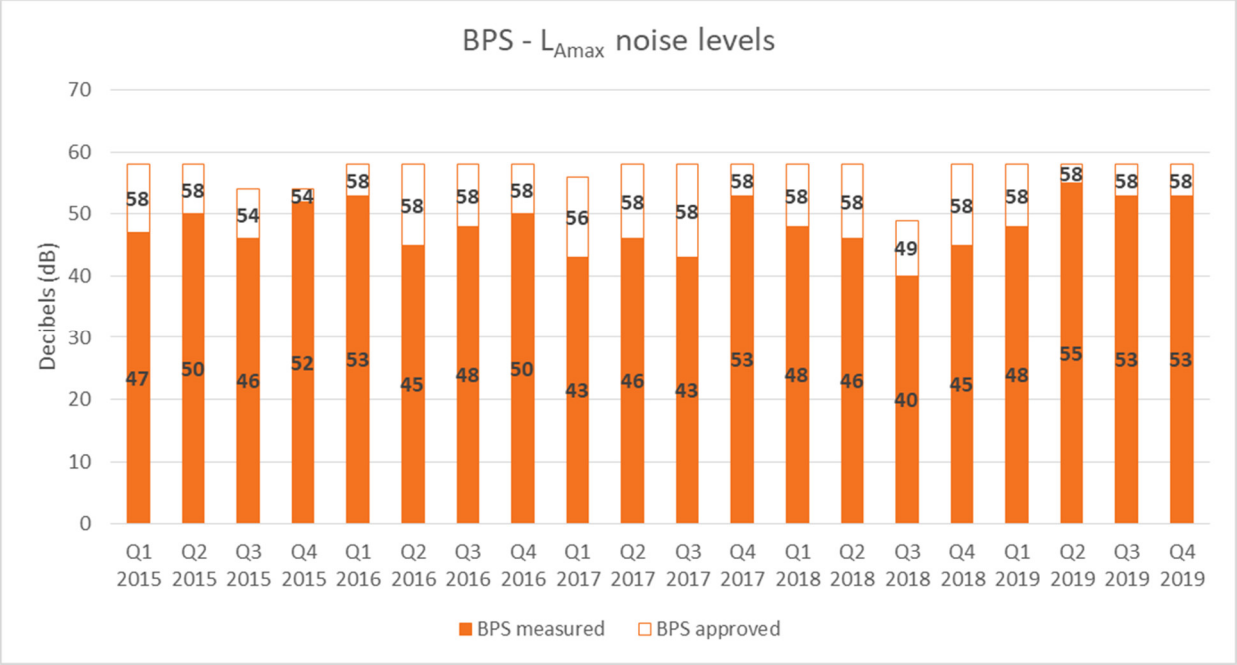
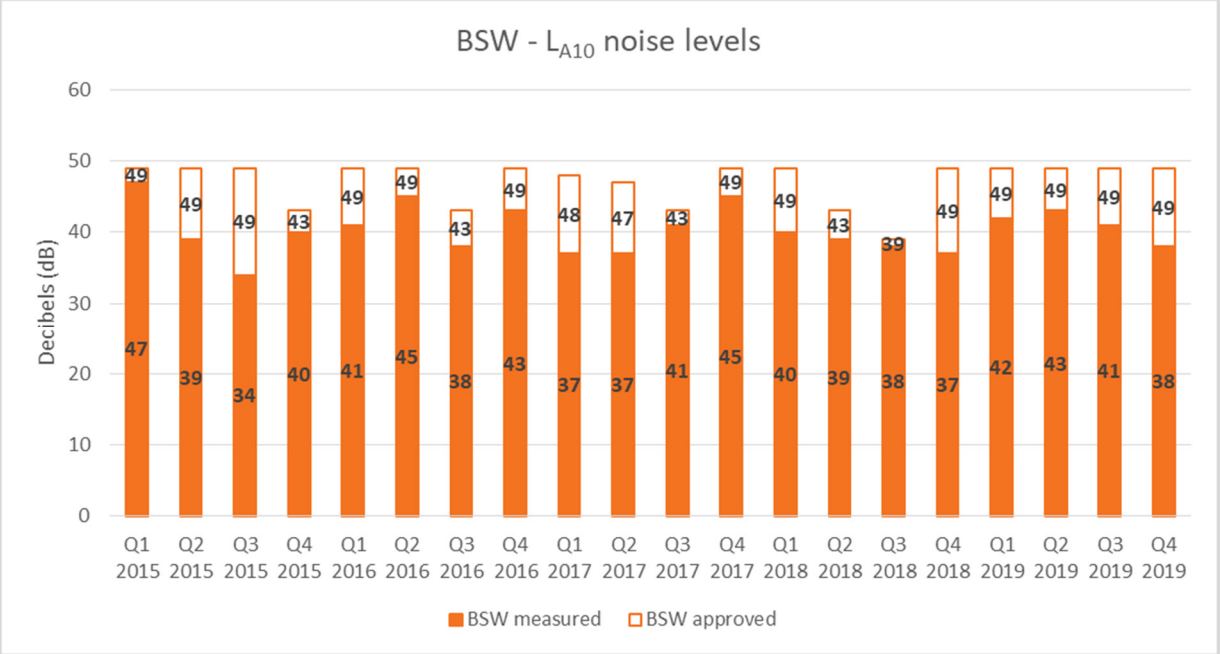


Figure 5-3: Barton Street Williamstown (BSW) – compliance noise monitoring – L_{A10} and L_{Amax} noise levels



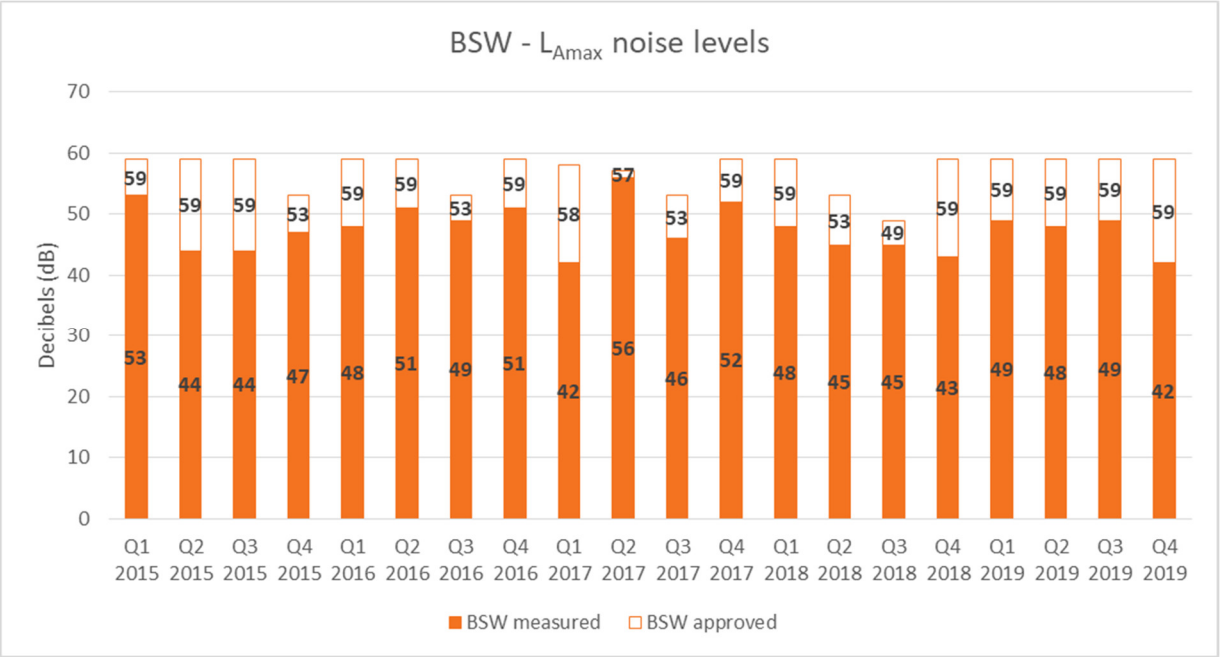
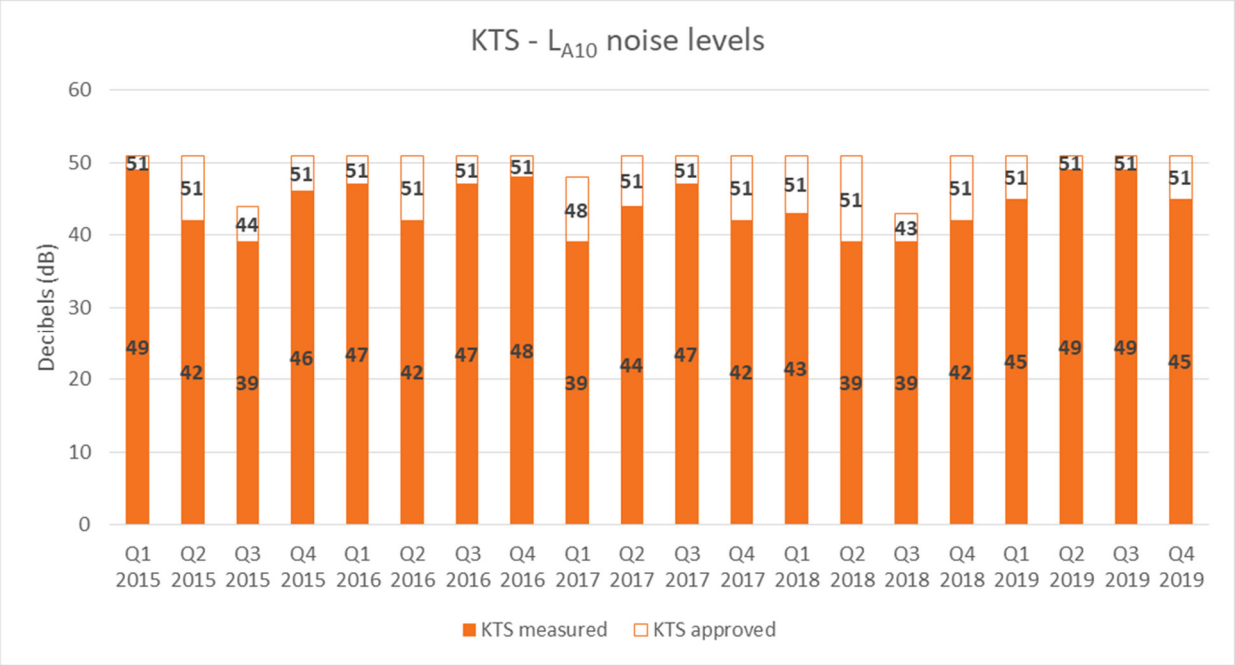


Figure 5-4: Kalgoorlie Technical School (KTS) – compliance noise monitoring – L_{A10} and L_{Amax} noise levels



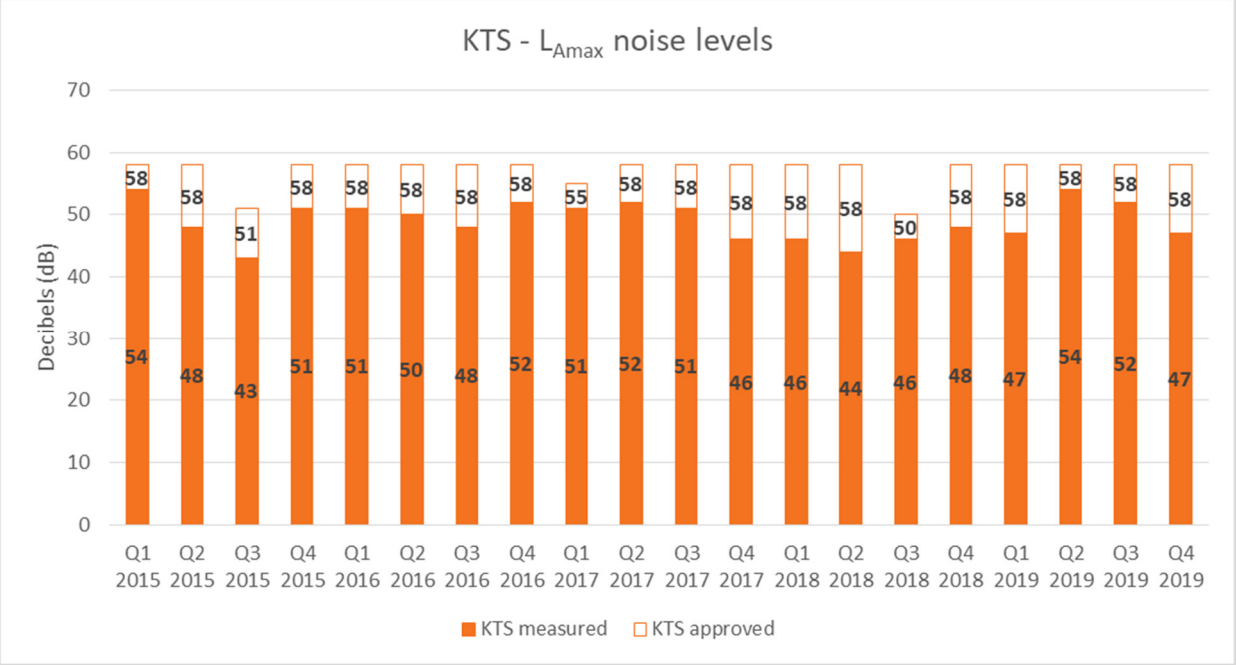
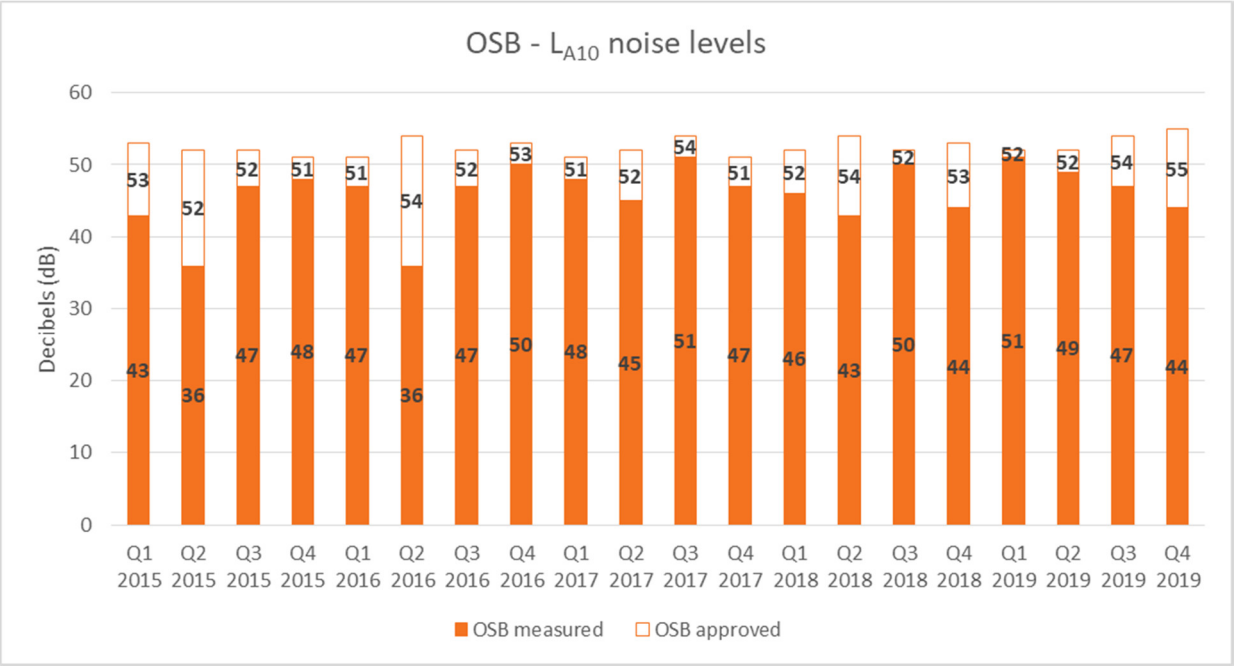


Figure 5-5: Outram Street Boulder (OSB) – compliance noise monitoring – L_{A10} and L_{Amax} noise levels



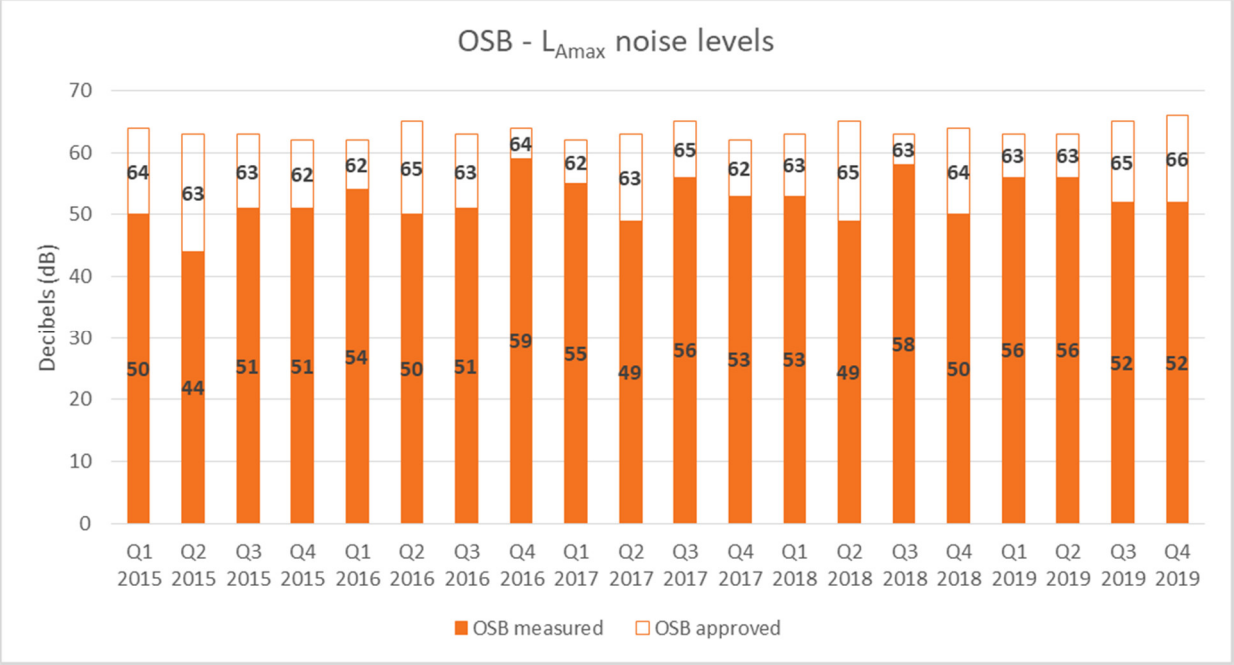
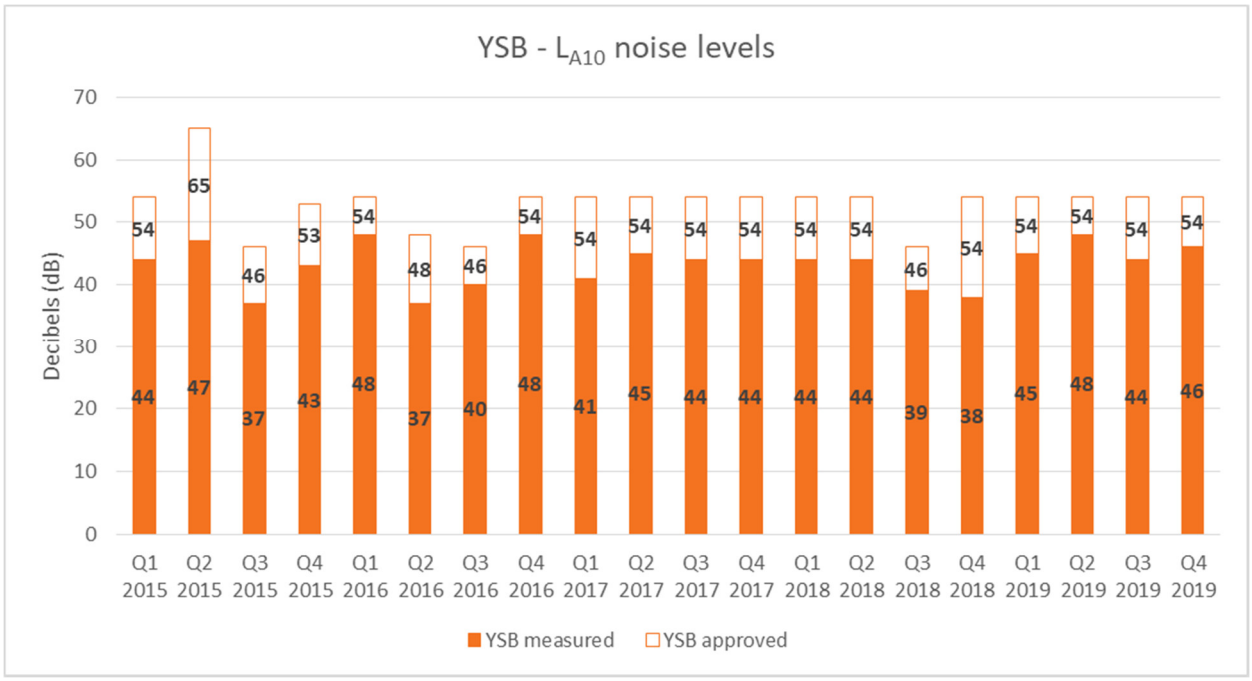
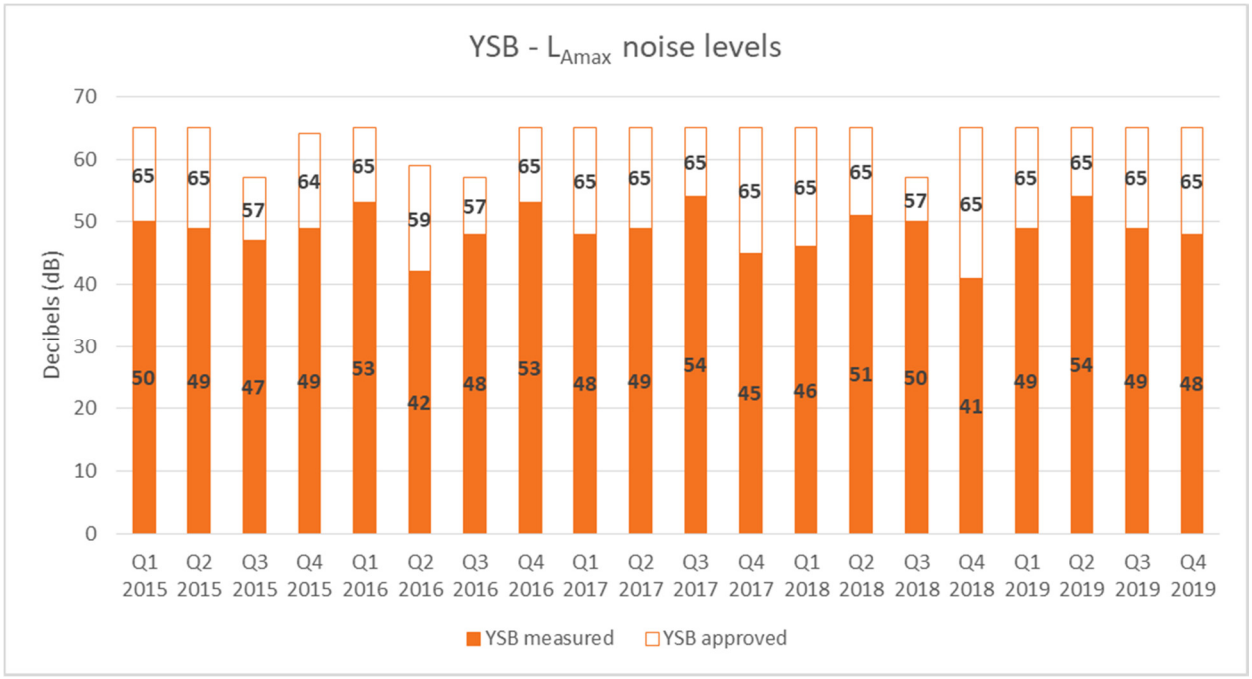


Figure 5-6: York Street Boulder (YSB) – compliance noise monitoring – L_{A10} and L_{Amax} noise levels





5.1.3.2 Noise: continuous monitoring

Continuous noise monitoring is also undertaken. While not required for compliance purposes, it provides a reference for the comparison of noise levels over time. It is not a reliable indicator of noise from the mine as it also records noise from a range of other sources from the residential area e.g. traffic, workshops etc. There are no key performance indicators that apply.

Continuous noise monitoring has been conducted over the five year review period at KTS[1], MEP[2] and BPS. Monitoring data is provided in the Annual Noise Report as an average over the reporting period. A summary of this data[3] is provided in **Figure 5-7** through to **Figure 5-10** and covers evening and night-time periods (as for compliance monitoring).

Noise levels are consistent with those of previous years.

[1] The 2016 Fimiston Noise Approval replaced Kalgoorlie Technical School (KTS) with Metals Exploration Premises (MEP) as a continuous noise monitoring site, as of the 22 March 2016; however, KCGM continued to recorded continuous noise data at KTS until 30 June 2016.

[2] Noise data from MEP is recorded as L_{eq} due to different configurations of the sound level meters, required for real-time data communication.

[3] The reporting period for the annual report was 14/7 to 13/7 for 2014/15 and 2015/16; whilst the reporting period was 1/4 to 31/3 for 2016/17, 2017/18 and 2018/19:

Figure 5-7: Boulder Primary School (BPS) - continuous noise monitoring 2014/15 to 2018/19 (evening).

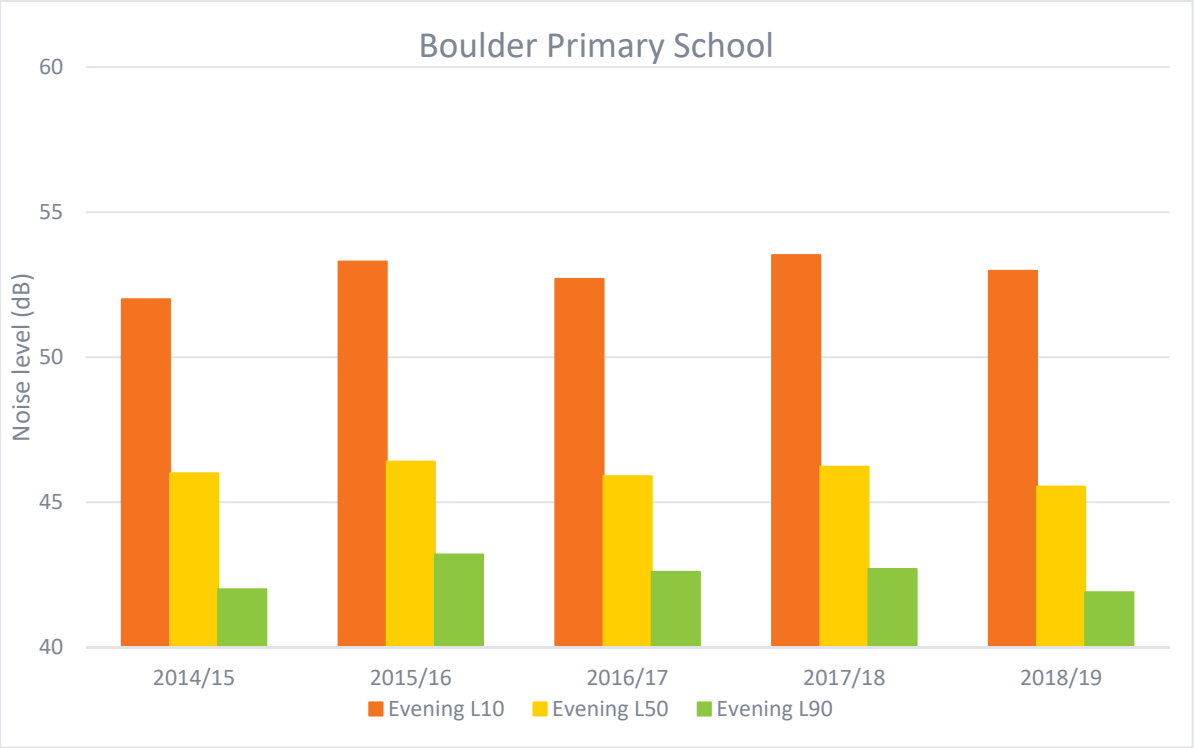


Figure 5-8: Boulder Primary School (BPS) - continuous noise monitoring 2014/15 to 2018/19 (night-time).

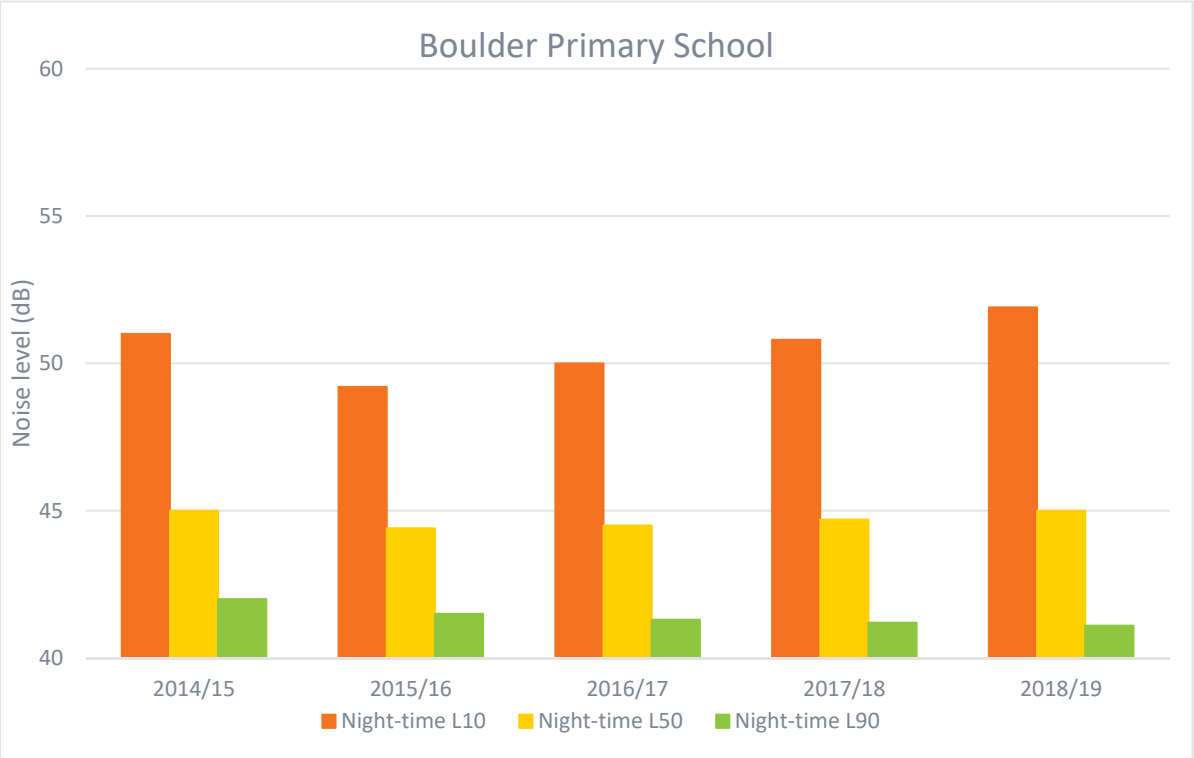


Figure 5-9: Kalgoorlie Technical School (KTS) - continuous noise monitoring 2014/15 to 2015/16 (evening).

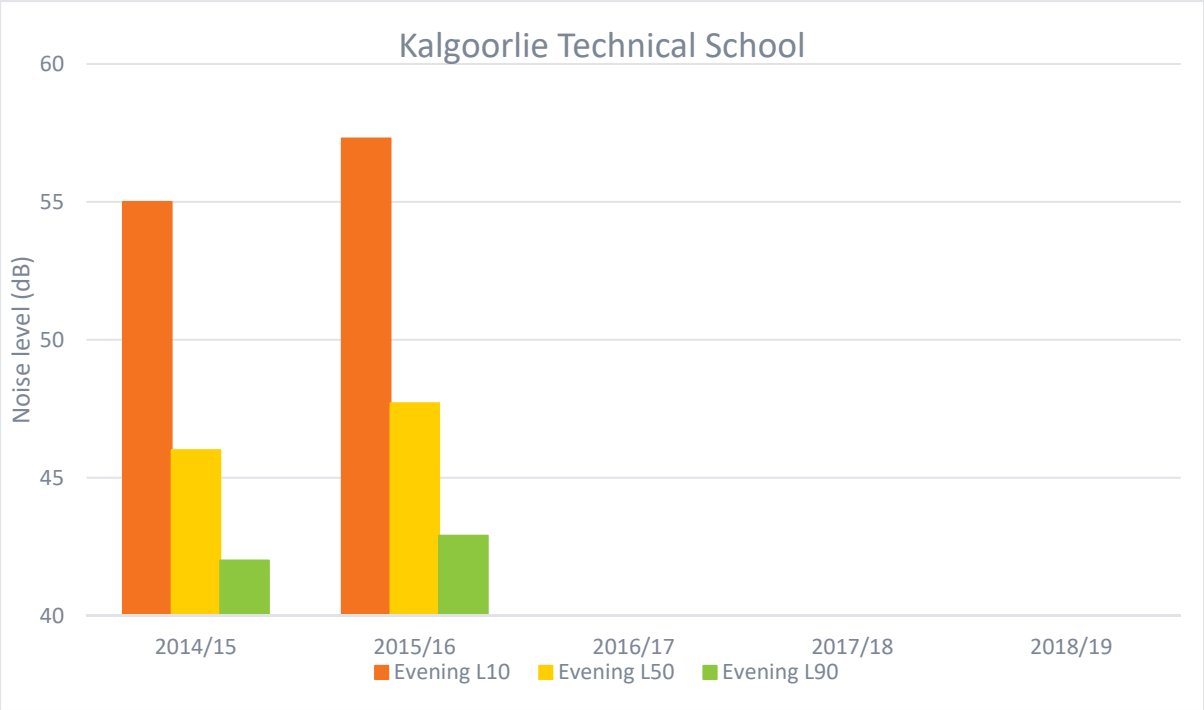


Figure 5-10: Kalgoorlie Technical School (KTS) - continuous noise monitoring 2014/15 to 2015/16 (night-time).

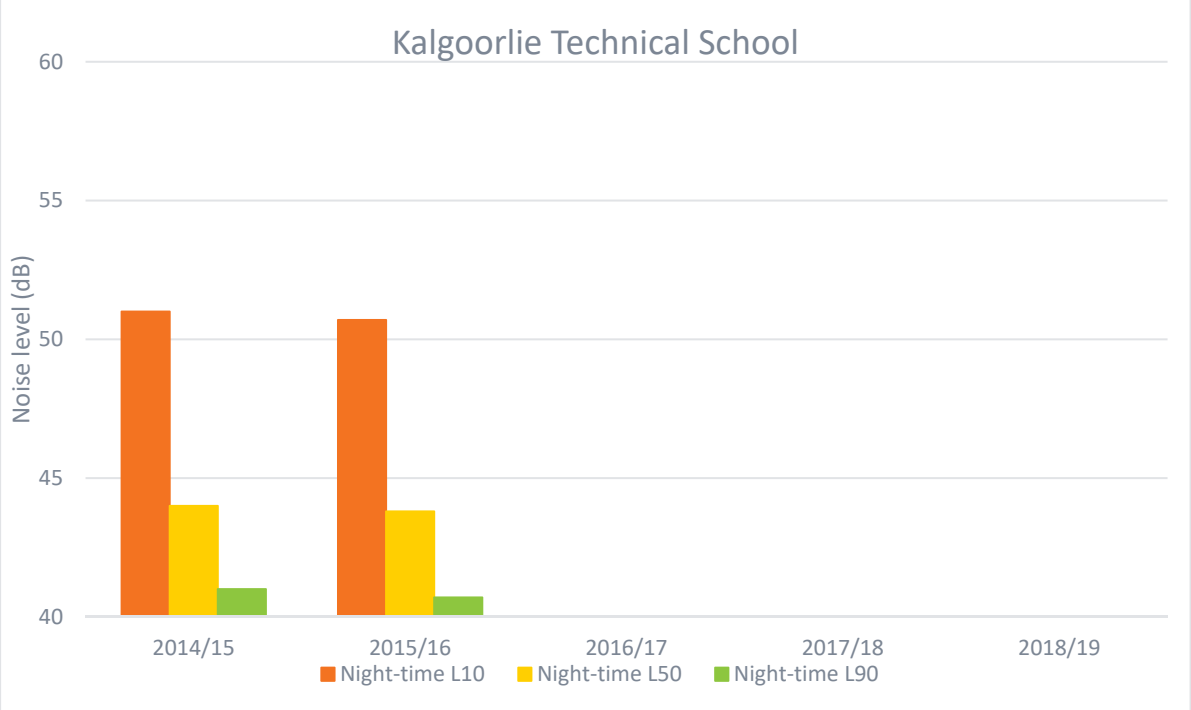
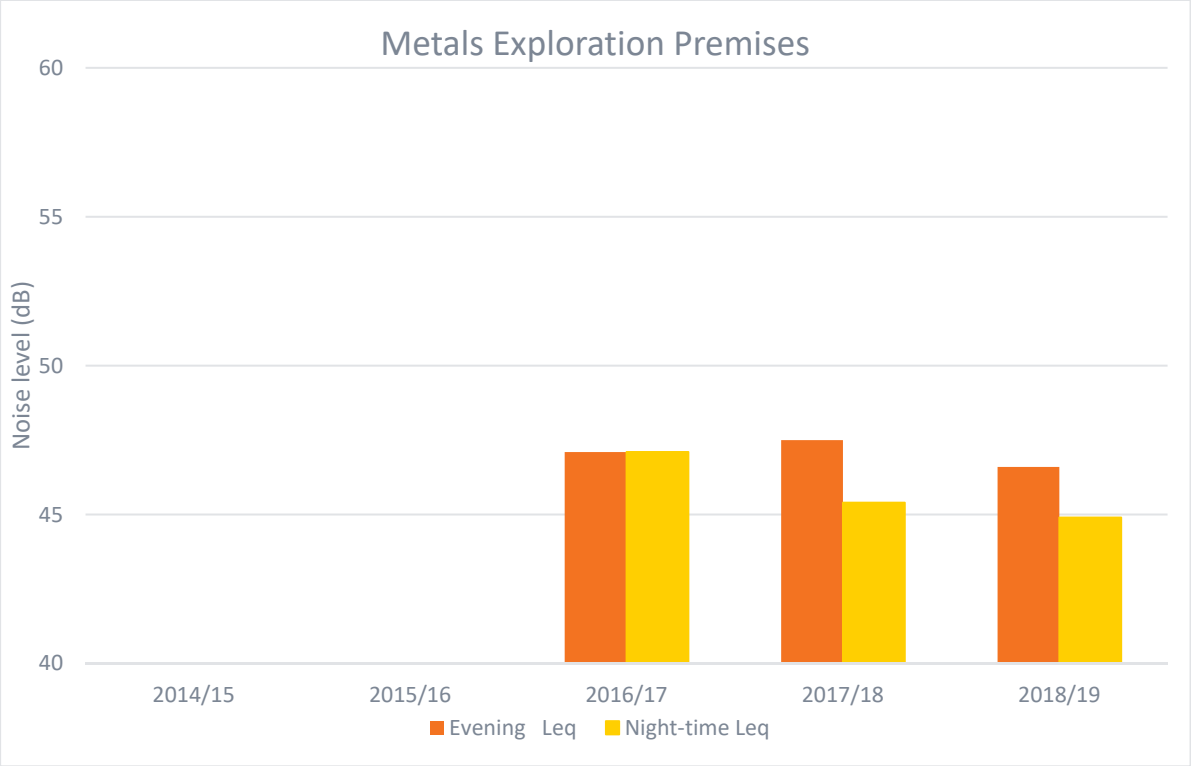


Figure 5-11: Metals Exploration Premises (MEP) - continuous noise monitoring 2016/17 to 2018/19 (evening and night-time).



5.1.3.3 Blasting: airblast monitoring

Blasting (**Plate 5-2**) creates an airborne shock wave ('airblast'), which is measured in $L_{Z\ peak}$ (the peak sound pressure level in decibels (dB) obtained using the "Z" frequency weighting characteristic). Monitoring of airblast is undertaken at six locations (see **Figure 5-12**).

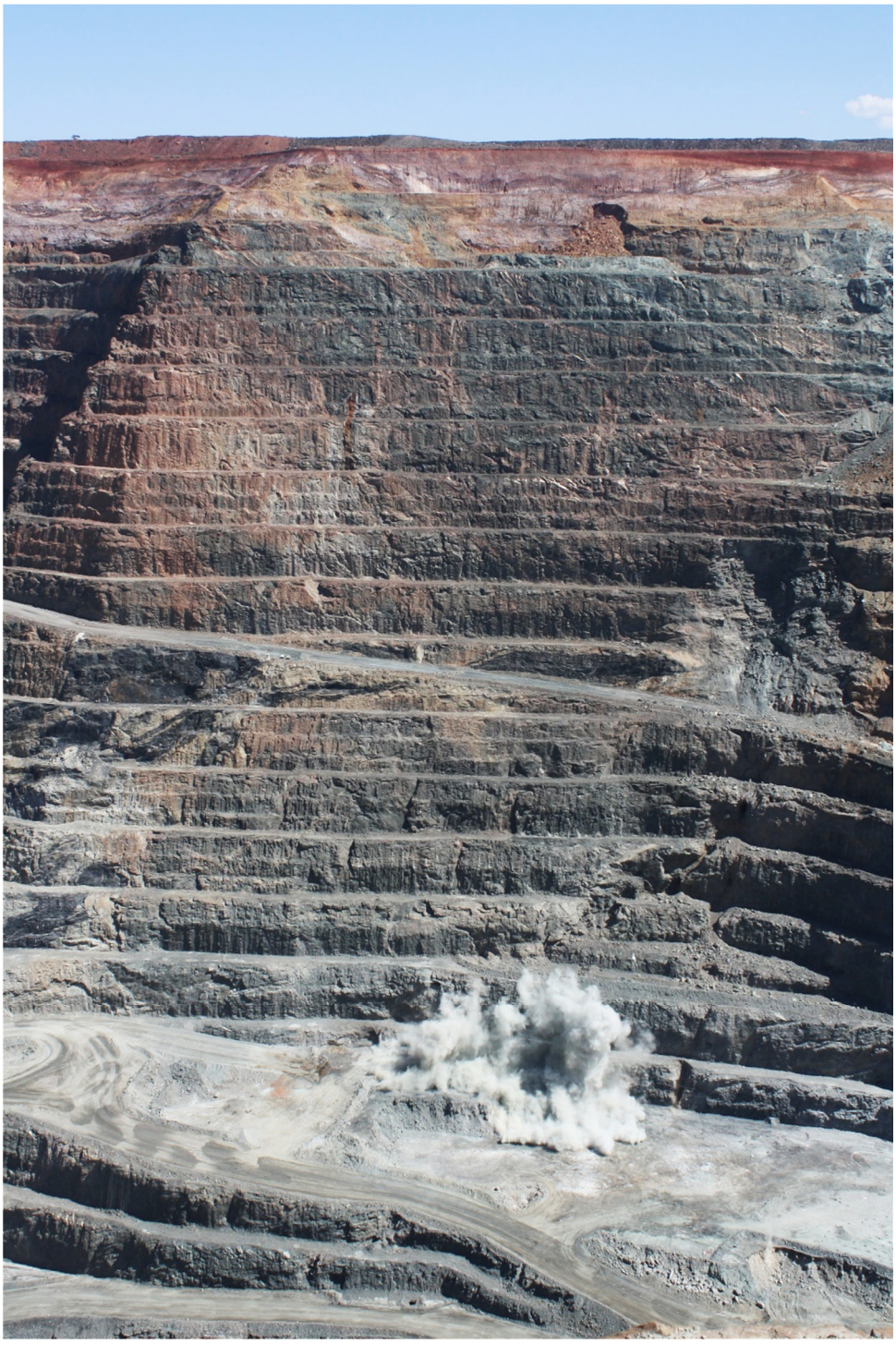
Prior to 22 March 2016, noise emissions resulting from blasting within the Fimiston Open Pit were regulated under the *Environmental Protection (Noise) Regulations 1997*, as shown in **Figure 5-12** and **Table 5-2**.

On 22 March 2016, KCGM was 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 levels (i.e. Bravo, Charlie or Delta). The approved airblast levels for Bravo, Charlie and Delta are outlined in *Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval,* as shown in **Table 5-3**.

All other blast monitoring sites (i.e. Alpha, Echo and Foxtrot) are still required to comply with the airblast levels prescribed in the *Environmental Protection (Noise)* Regulations 1997, as shown in **Table 5-4**.

Compliance with these requirements forms the key performance indicator that applies.

Plate 5-2: Fimiston open pit blast



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355000 356000 357000

6595000 6594000 6593000

Alpha
Bravo
Charlie
Delta
Foxtrot
Echo
Goldfields Hwy

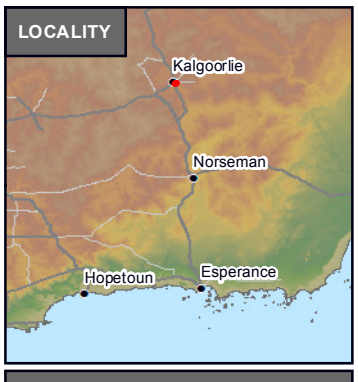
Data source: Imagery - Landgate, December 2018. Roads - MRWA, 2019.

LEGEND

Site Status – Airblast Monitoring

- Sensitive site
- Sensitive site on a residential property owned by KCGM
- Location other than a sensitive site

LOCALITY



AIRBLAST AND VIBRATION MONITORING LOCATIONS

5 Year Environmental Performance Review
Kalgoorlie Consolidated Gold Mines Ltd

N

0 100 200 300 400 500 m

Scale @ A3: 1:10,000
Coordinate System: GDA 1994 MGA Zone 51, Projection: Transverse Mercator, Datum: GDA 1994

Prepared:	F Walker
Reviewed:	G Barrett
Project:	TE19058
Revision:	A
Date:	5/11/2019

Figure 5-12

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Table 5-2: Summary of regulated airblast level standards applicable to all KCGM blast monitoring sites (prior to 22 March 2016)

Location	Time of Day	Airblast level (dB $L_{Z\ peak}$)	
		Not to be exceeded anytime	Not to be exceeded for 9 in any 10 consecutive blasts
Alpha, Bravo, Charlie, Delta, Echo and Foxtrot	0700 to 1800 hours Monday to Saturday	125	120
	0700 to 1800 hours on Sundays and public holidays	120	115
	1800 to 0700 hours on any day[1]	90	-

Notes:

1. Exceptions occur where blasting is in accordance with Regulation 8.28(4) of the *Mines Safety and Inspection Regulations 1995*, levels apply as appropriate for the time when it was intended for the blast to be fired.

Table 5-3: Summary of regulated airblast level standards applicable to sensitive sites on a residential property owned by KCGM (from 22 March 2016)

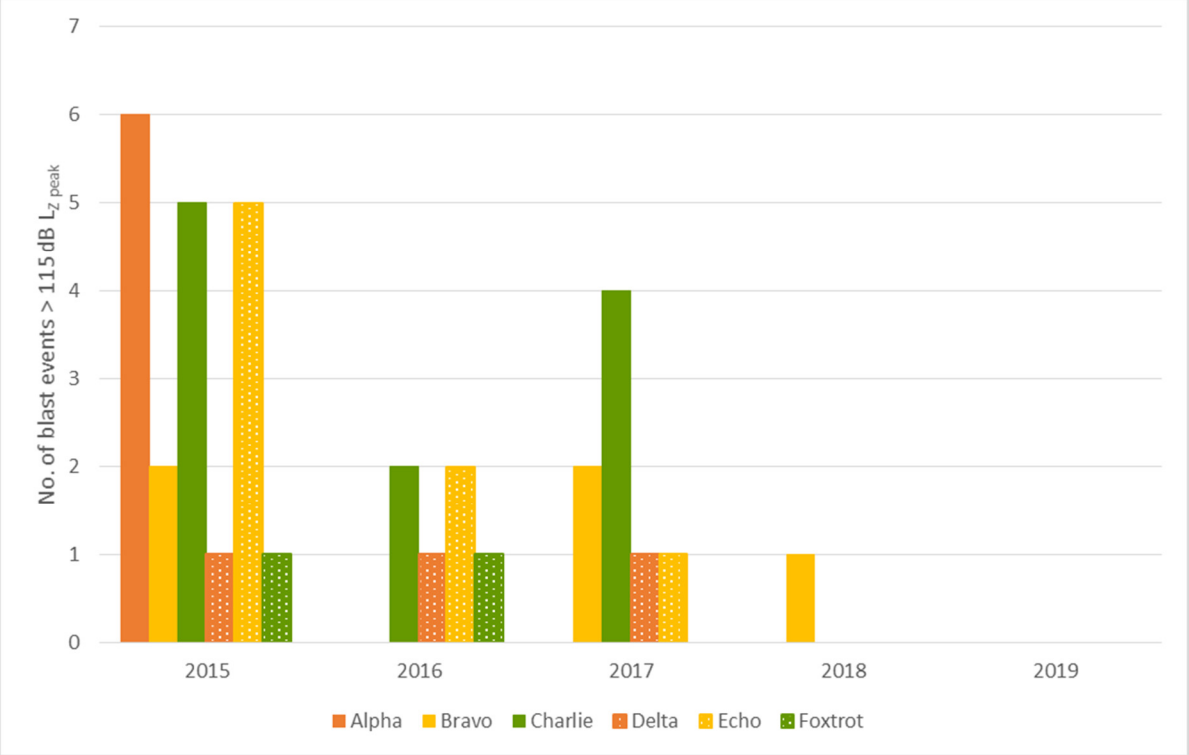
Location	Time of Day	Approved airblast level (dB $L_{Z\ peak}$)	
		Not to be exceeded anytime	Not to be exceeded for 9 in any 10 consecutive blasts
Bravo, Charlie and Delta	0700 to 1800 hours on any day	125	120
	0700 to 1800 hours on Sundays and public holidays	120	115

Table 5-4: Summary of regulated airblast level standards applicable to sites other than sensitive sites on a residential property owned by KCGM (from 22 March 2016)

	Time of Day	Approved airblast level (dB $L_{Z\ peak}$)	
		Not to be exceeded anytime	Not to be exceeded for 9 in any 10 consecutive blasts
Alpha	0700 to 1800 hours on any day at a sensitive site	120	115
Echo and Foxtrot	0700 to 1800 hours on any day at a location other than a sensitive site	125	120

The number of blast events where the airblast level exceeded 115 dB $L_{Z\ peak}$ is shown in **Figure 5-13**. Levels declined significantly over the reporting period with no blasts exceeding 115 dB $L_{Z\ peak}$ in 2019.

Figure 5-13: Airblast monitoring - number of blast events where airblast levels > 115 dB $L_{Z\ peak}$ were recorded



In terms of compliance, there was one occasion during the review period where KCGM was not able to comply with the key performance indicators for airblast. In Q1 2015, elevated airblast readings greater than the limit of 120 dB were recorded at monitoring sites Bravo (121.6 dB), Charlie (123.1 dB) and Delta (125.1 dB) and greater than the limit of 125 dB at monitoring site Echo (125.3 dB). Changes to blasting procedures resulted (see Appendix B for further information).

5.1.3.4 Blasting: vibration monitoring

Blasting also causes ground vibration, which is measured in terms of peak particle velocity (ppv) in mm/s. Monitoring of ground vibration is undertaken at six locations (see **Figure 5-12**).

Emission limits also apply to ground vibration. Limits are set to minimise annoyance and are well below levels that could give rise to damage to competent structures. For KCGM, the levels that apply are outlined in the following table.

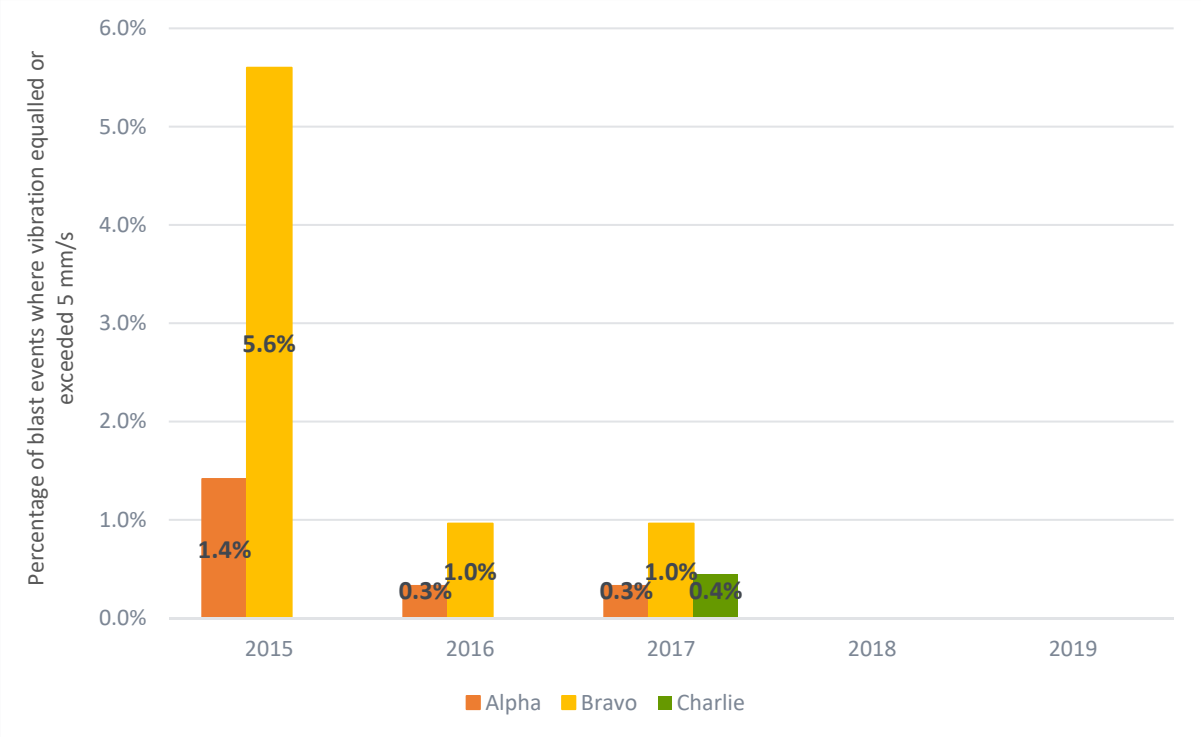
Table 5-5: Blast vibration levels applicable to the Fimiston Open Pit

Location	Requirement	Vibration level (peak particle velocity measured in mm/s)
Alpha, Bravo, Charlie, Delta, Echo and Foxtrot	No blast to exceed	10
	Not be to exceeded for 90% of blasts per year	5
	Not to be exceeded in more than one in ten consecutive blasts	5

For monitoring purposes, KCGM assesses each blast to determine whether a 'blast event' has occurred. All blasts are monitored but unless a blast exceeds a vibration level of 0.5 mm/s at one or more monitoring points (a 'blast event'), it is not considered further in monitoring records.

The percentage of blast events where the vibration level exceeded 5 mm/s is shown in **Figure 5-14.** No blasts exceeded 5 mm/s at the Delta, Echo and Foxtrot monitoring locations during 2015-2019. Levels declined significantly over the reporting period with no blasts exceeding 5 mm/s in 2018 or 2019 at any location.

Figure 5-14: Vibration monitoring – frequency of blast events where vibration levels of > 5 mm/s were recorded



Over the review period:

- No blast exceeded 10 mm/s at any location in any year;
- Greater than 90% of blasts were less than 5 mm/s at all locations in every year; and
- There was one instance (June 2016) when 5 mm/s was recorded more than once in ten consecutive blasts.

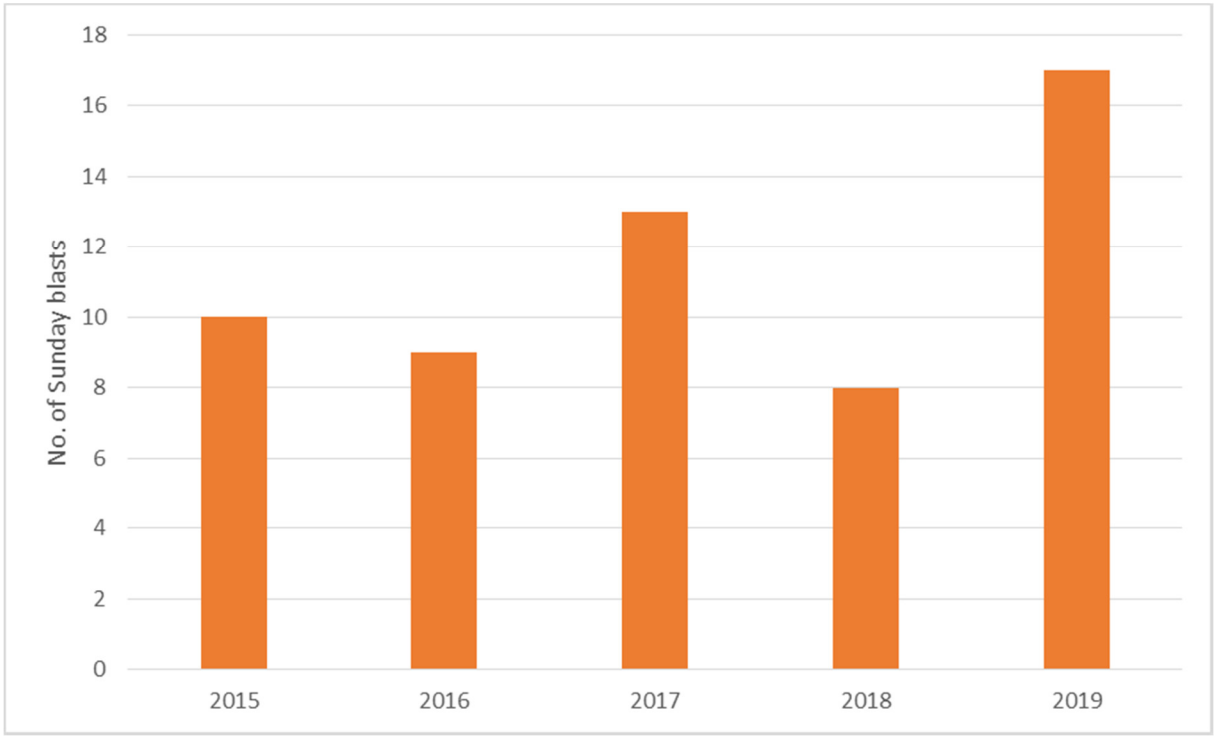
5.1.3.5 Monitoring (Sunday blasting)

Under MS782, KCGM is also required to "make all reasonable effort to avoid blasting on Sundays".

The number of Sunday blast events recorded during the period 2015-2019 is shown in **Figure 5-15**. The number of blasts on a Sunday ranged from eight in 2018 to 17 in 2019.

Blasts are not scheduled on Sundays and each internal request to do so is subject to a multi-departmental review and takes into account a number of considerations including likely impact to near neighbours. In most instances, the decisions to blast on a Sunday were primarily due to safety concerns and adverse weather conditions (e.g. opportunity to fire under favourable wind conditions to mitigate the potential for dust impacts on local residents). It is important to note that no complaints or queries have been received as a result of these blasts.

Figure 5-15: No. of blasts occurring on a Sunday during the period 2015-2019



5.1.4 Initiatives and developments

In response to the airblast event in Q1 2015 (see section **5.1.3.3**), the following mitigation measures were identified and implemented:

- Changing the shovel 'No Dig Line' to 2.5 metres to ensure sufficient blast burden material is retained;
- Ensure the shovel 'No Dig Line' is placed on the first row of face holes;
- Implement the Drill Monitoring System to electronically transfer accurate blast hole collar positions to enable engineered control of the distribution of explosives in blast holes;
- Implement a change management process when changing to the free facing of blasts;
- Update blasting procedures to specify the requirements for the loading of face holes; and
- Update the training package on face mark-up loading and the loading of angled holes.

In response to the vibration event in Q2 2016 (see section **5.1.3.4**), the following mitigation measures were identified and implemented:

- The Senior Drill and Blast Engineer reviews and approves the "tie-in design" (including the location of the POI) for all blasts that are inside the 1 in 10 consecutive blast window. The approval will be recorded utilising the "1 in 10 Blast Form"[4] which has been updated to include a "Blast Design Approved" column for sign off of each blast that is inside the 1 in 10 consecutive blast window; and
- A hardcopy printout of the tie-in design (showing POI and timing contours) for shots designed using the IKON electronic detonation system will be provided to the Blast Crew. This will enable the Blast Crew to perform a visual check of the POI and the direction/angle of firing during blast preparation.

In 2012, KCGM implemented a Noise Amelioration Programme by means of co-funding 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). The project was 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 truck muffler.

During 2016, UWA developed and tested a redesign of the exhaust muffler. Laboratory test results have indicated improved noise distribution (broadband) and reduced tonality. A second muffler was purchased to undertake the redesign works so that subsequent field testing could be undertaken.

During June and July 2017, field testing of the proposed engine enclosure and muffler design was undertaken at a workshop in Bunbury. Results from this test indicate that:

- The partial noise barriers are able to reduce the engine noise by 5 dBA at 500 rpm, and 3 dBA at 1950 rpm; and

[4] KCGM implemented the "1 in 10 Blast Form" following elevated vibration events in 2012.

- The noise reduction of UWA-modified mufflers are better than that of the original mufflers by 2 - 5.6 dBA, depending on the measurement locations.

In December 2017, final testing of all noise reduction components was conducted on site at KCGM. The engine enclosure, muffler, and active noise control components were tested both separately and together as an entire system, with initial results promising.

The final report for the ARC Linkage Project (LP140100987) "Integrated Passive and Active Control of Humming Noise from KCGM's Haul Trucks" was submitted to KCGM in August 2019. In summary, the outcome of this project includes three innovative techniques that can effectively reduce the noise from KCGM haul trucks. Of these techniques, the partial acoustic enclosure and retrofitted mufflers are considered the most practicable and cost-effective for use on-site to achieve noticeable noise reduction. Whilst the single-channel Active Noise Control (ANC) is a good method for the control of tonal noise radiation in a specific direction, it is not practical for use on-site. KCGM is reviewing these noise reduction techniques to determine if implementation is feasible.

5.1.5 Discussion

Monitoring indicates that KCGM has met all its key performance indicators in respect of noise over the five year review period. There were two instances where the key performance indicators were not met for airblast (Q1 2015) and vibration (Q1 2016). With regard to blasting on Sundays, no blasts are scheduled for Sundays but blasting may still occur, primarily when blasts planned to be executed earlier are delayed due to safety concerns or adverse weather conditions.

Through the ongoing implementation of the Noise and Vibration Monitoring and Management Plan (**NVMMP**), KCGM continues to seek to reduce its impacts from noise and vibration.

5.2 Air Quality

5.2.1 Objective

Factor	Objective	Management Plans
Air quality	To pro-actively manage the Fimiston Operations to ensure that the 24-hour average PM_{10} concentrations as a result of KCGM's emissions are less than 50 µg/m^3.	Fimiston Air Quality Management Plan (December 2015)

5.2.2 Management measures

Air quality is managed under the Fimiston Air Quality Management Plan (FAQMP). KCGM routinely implements dust control strategies including:

- Monitoring current and forecast weather conditions using daily weather forecasts and real time wind speed and direction monitoring data to plan work activities, particularly activities such as blasting which have the potential to produce significant dust levels over a short period;
- 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 inspections, dust alarms, public feedback or prevailing wind conditions; and
- Use an alternative operational area if possible (e.g. use a different waste rock dump).

KCGM ensures all contractors and staff undertake site-specific inductions which include awareness of the importance of dust control. Ongoing consultation with stakeholders is undertaken to get their view of the success of the dust management measures.

A key part of the FAQMP is to monitor dust (as PM_{10}[5]). KCGM uses data from its dust monitoring network (seven continuous PM_{10} monitors and two wind speed and direction monitors) to assess the potential contribution of mining operations to any elevated concentrations.

KCGM undertakes continuous PM_{10} monitoring at the sites shown in **Figure 5-16.**

The MTC and MEX PM_{10} monitors are located near the wind speed and wind direction monitoring stations CAS and MEX respectively; these two dust monitoring sites were installed to comply with condition 7-6 of MS782. The HGC site is primarily used as a control/background monitoring site for PM_{10} as it is located some 4.5 km from the Fimiston Operations. It is considered to be representative of the local environment and data enables comparison of background levels with the other monitoring sites.

[5] Particulate matter less than 10 µm in diameter.

Another air quality consideration is the level of mercury emissions, namely from the Fimiston Processing Plant. 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 a Kiln Off-Gas Cleaning Circuit (KOGCC) comprising an exhaust off-gas wet 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 reduce mercury emissions from the furnace.

During the commissioning phase, KCGM experienced operational issues with the KOGCC, namely poor performance of the RTO. 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 from the Carbon Regeneration Kilns were captured via the KOGCC.

The project is still in commissioning phase and requires further refinements to enable the KOGCC to be operated in accordance with the commissioning plan outlined in Works Approval W5532/2013/1.

5.2.3 Key performance indicators

5.2.3.1 Particulate matter (PM_{10})

The data obtained by the PM_{10} monitoring program is used to generate 24-hour average concentrations for comparison against the National Environmental Protection (Ambient Air Quality) Measure (NEPM) PM_{10} standard of 50 µg/m^3.

The 24-hour average PM_{10} concentrations measured at each site are contained in the KCGM Dust Monitoring Report which is available on the KCGM website (**www.superpit.com.au**) within 24 hours of the data being recorded. The provision of the KCGM Dust Monitoring Report meets the requirements of Condition 7-5 of MS782.

Where a 24-hour average PM_{10} concentration of greater than 50 µg/m^3 is recorded (a "PM_{10} Dust Event"), KCGM completes a review of the monitoring data, in combination with meteorological and operational data. The data from PM_{10} monitors, in combination with the wind data, are used to identify the potential sources of the emissions using back trajectory analysis techniques. If several of the monitors are recording high PM_{10} concentrations at any one time, this may indicate that the emissions are from more regional sources rather than KCGM-specific sources.

Where KCGM is considered to be a significant contributor, further assessment is undertaken to identify the likely source of dust (i.e. mining operations, vehicle movements and/or wind erosion). KCGM report the findings of these assessments to the DWER (Industry Regulation and EPA Services) and the Department of Health. Corrective actions arising from these assessments are recommended where appropriate.

The FAQMP specifies a performance target of not more than five PM_{10} Dust Events at any dust monitoring site per annum where KCGM is considered to be a significant contributor[6]. This performance target was met each year during the period 2015-2019.

The results of monitoring for each of the monitoring sites are shown in **Figure 5-17** through to **Figure 5-22**.

[6] The NEPM was modified in 2015 to remove allowable exceedences (i.e. 5 days per year where the 24-hour average exceeds 50 µg/m^3). KCGM has retained the allowable exceedences within the FAQMP as the monitoring points have been located at sites where KCGM may influence air quality and not, as the NEPM requires, at locations where "they contribute to obtaining a representative measure of the air quality likely to be experienced by the general population in the region or sub-region."

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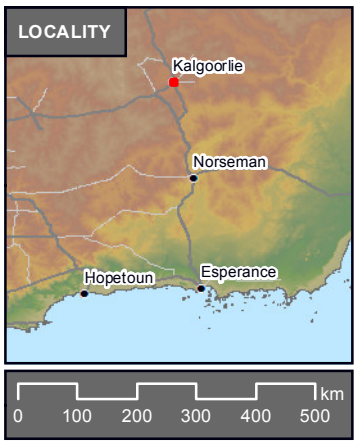
LEGEND

- Dust Monitoring Site



AIR QUALITY MONITORING LOCATIONS

5 Year Environmental Performance Review
Kalgoorlie Consolidated Gold Mines Ltd

N
0 0.2 0.4 0.6 0.8 km
Scale @ A3: 1:20,000
Coordinate System: GDA 1994 MGA Zone 51, Projection: Transverse Mercator, Datum: GDA 1994

Prepared:	F Walker
Reviewed:	G Barrett
Project:	TE19058
Revision:	A
Date:	11/10/2019

Figure 5-16

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Document Path: \\SERVER\Talis\SECTIONS\Environment\Projects\TE2019\TE19058 - KCGM 5-Year Review\GIS\Maps\TE19058_5-7_AQMonitoring_RevA.mxd

Figure 5-17: Boulder Shire Yard (BSY) – number of days where 24-hour average PM_{10} concentrations of greater than 50 µg/m³ was recorded

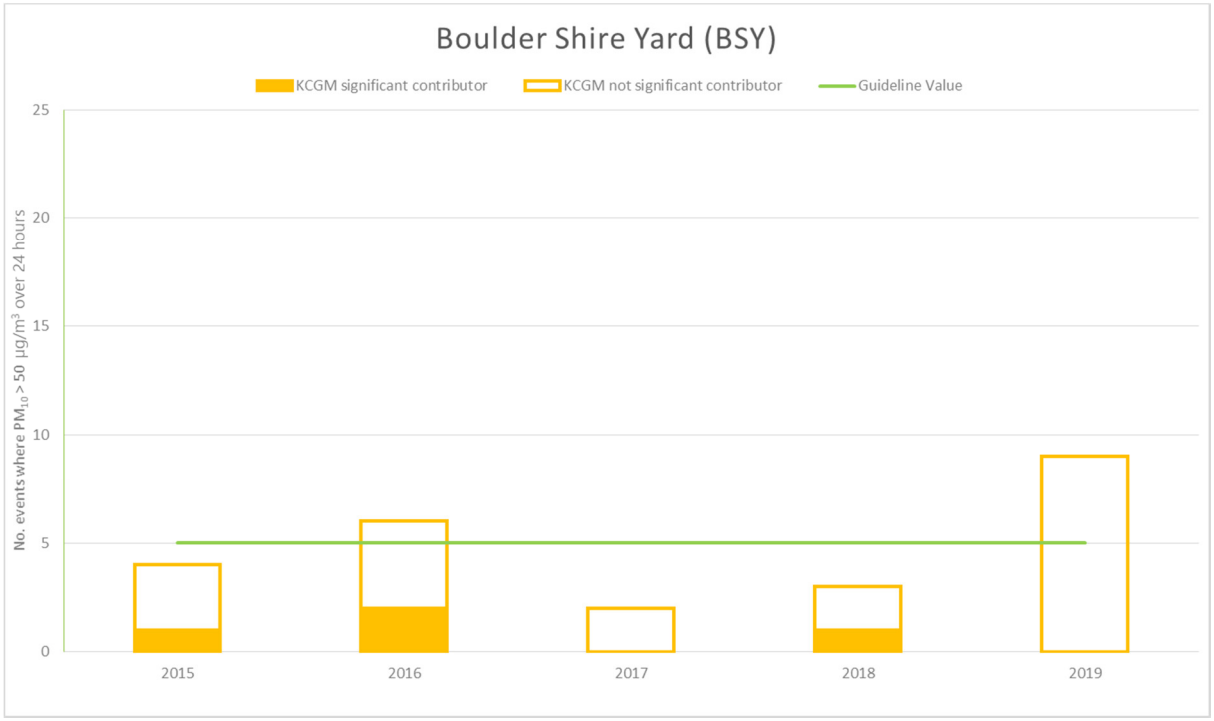


Figure 5-18: Clancy Street (CLY) – number of days where 24-hour average PM_{10} concentrations of greater than 50 µg/m³ was recorded

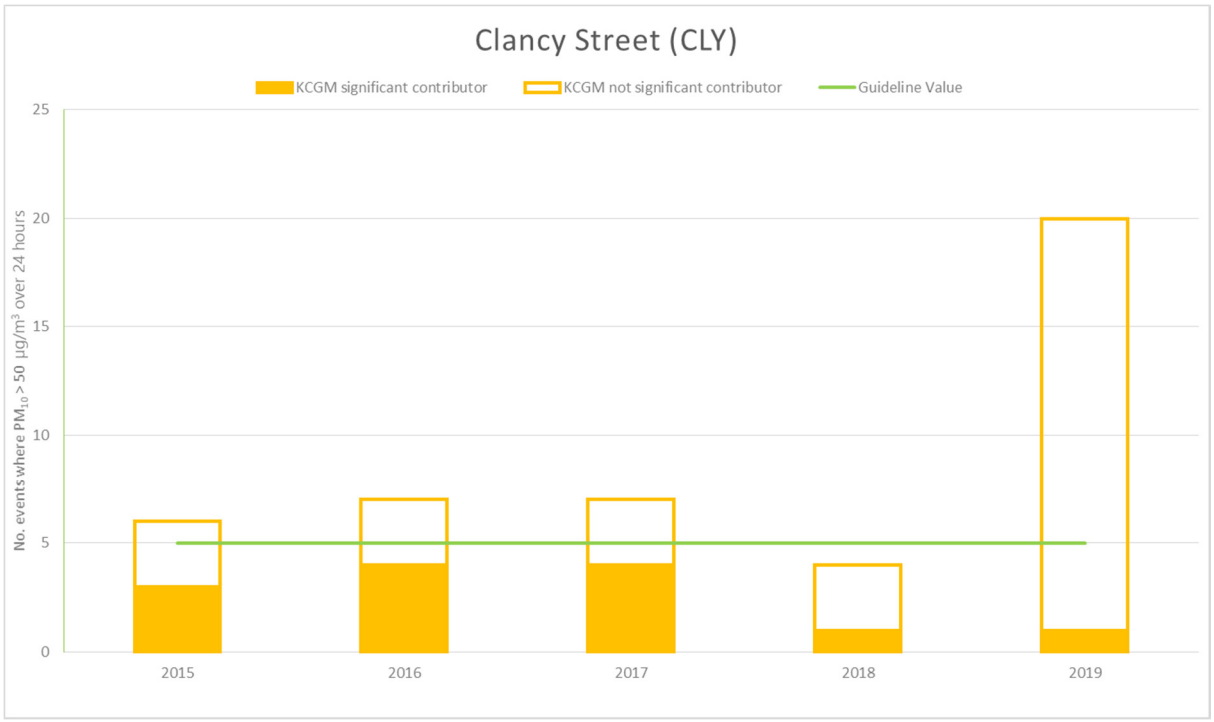


Figure 5-19: Hewitt Street (HEW) – number of days where 24-hour average PM_{10} concentrations of greater than 50 µg/m³ was recorded

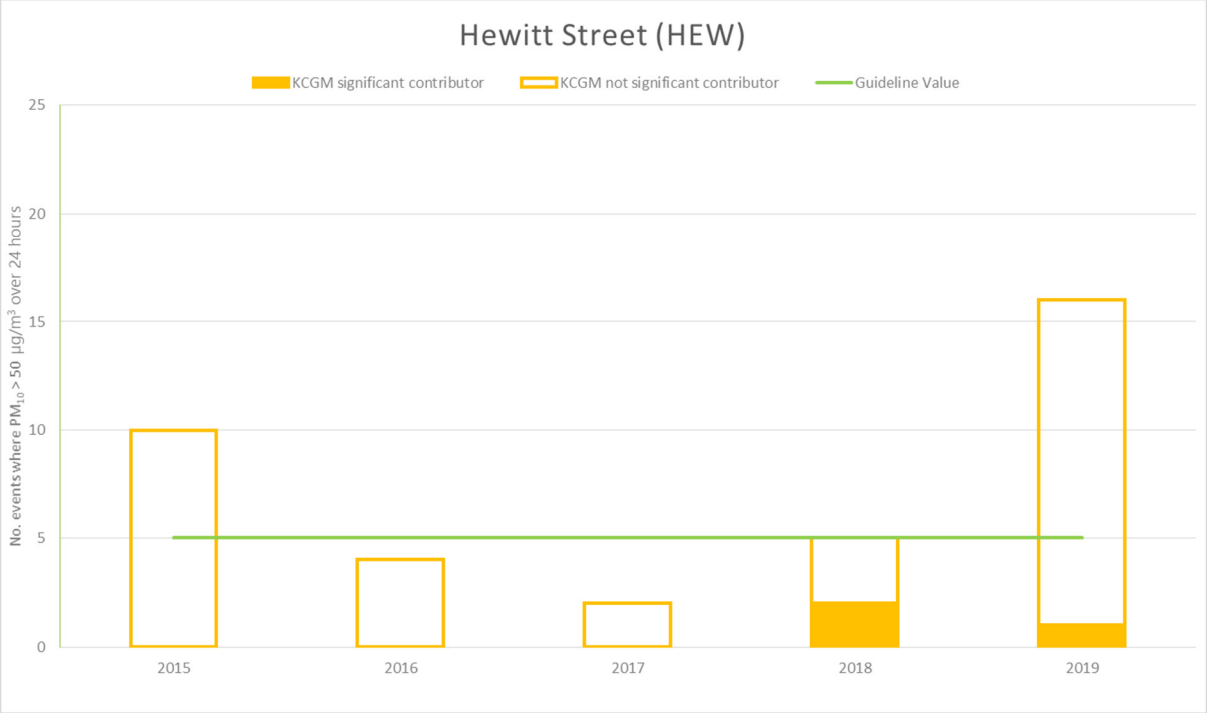


Figure 5-20: Hopkins Street (HOP) – number of days where 24-hour average PM_{10} concentrations of greater than 50 µg/m³ was recorded

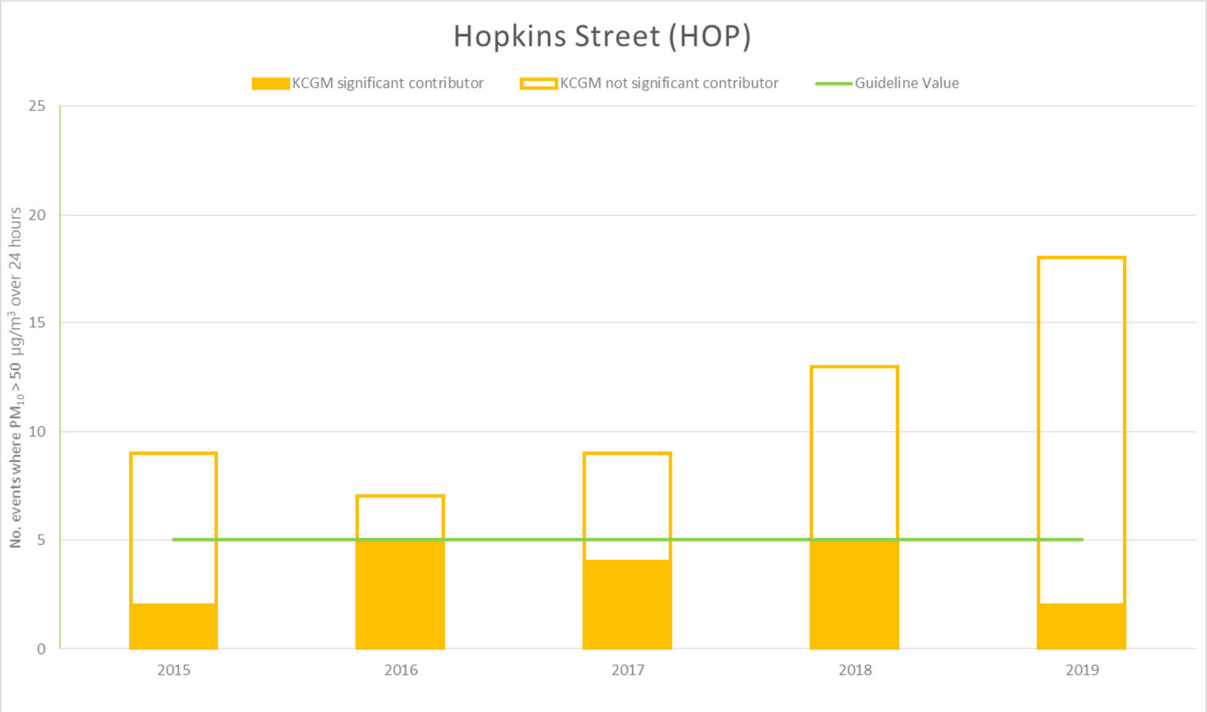


Figure 5-21: Metals Exploration Yard (MEX) – number of days where 24-hour average PM_{10} concentrations of greater than 50 µg/m³ was recorded

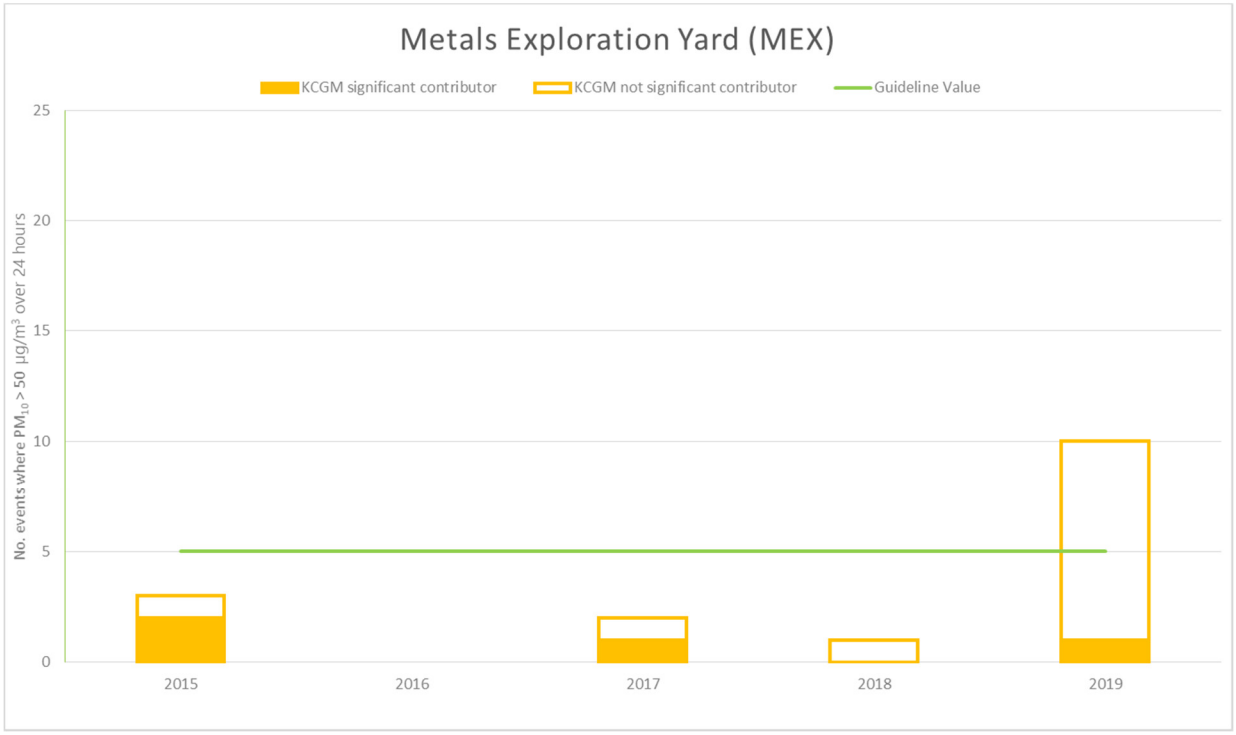


Figure 5-22: Mt Charlotte (MTC) – number of days where 24-hour average PM_{10} concentrations of greater than 50 µg/m³ was recorded

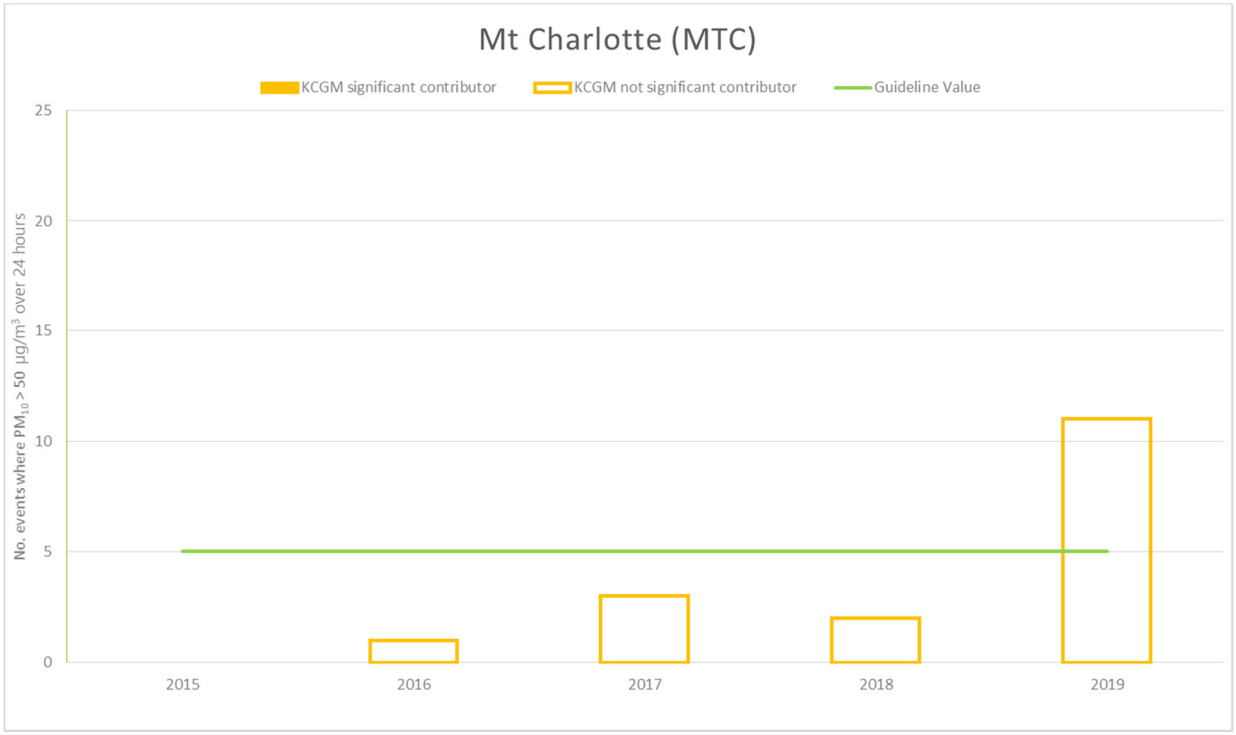
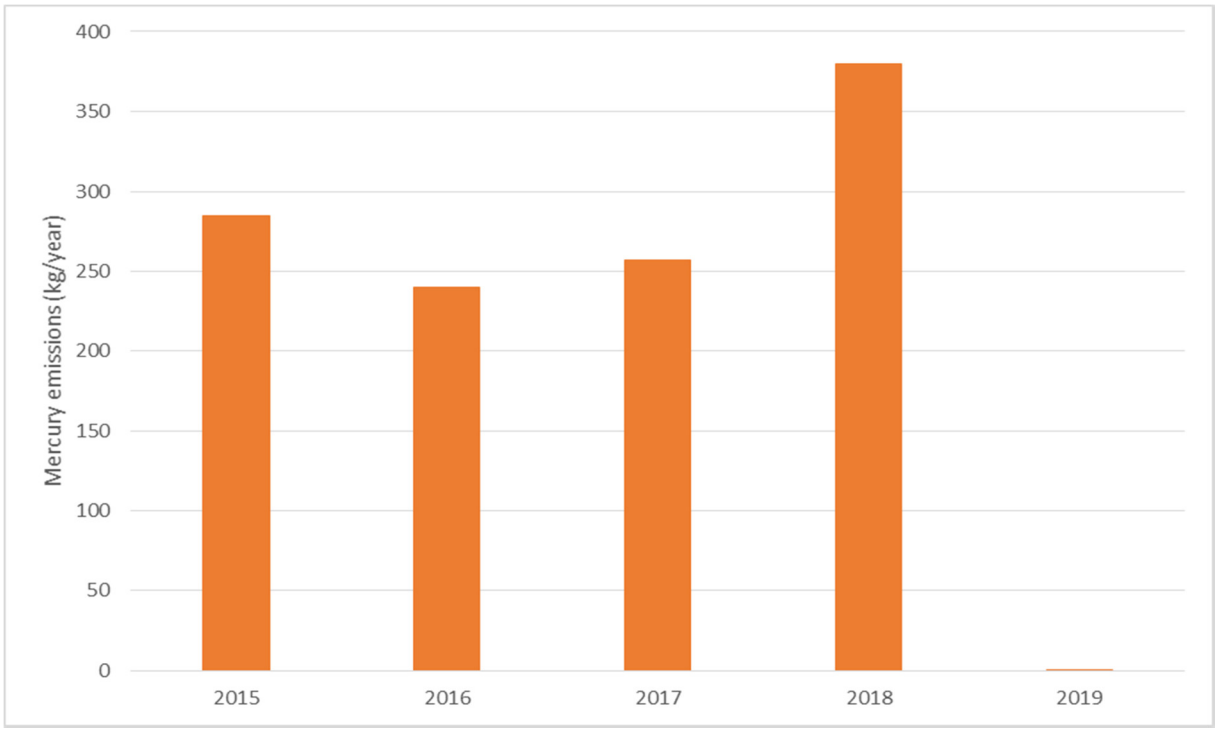


Figure 5-23: Hannan's Golf Course (HGC) – number of days where 24-hour average PM_{10} concentrations of greater than 50 µg/m³ was recorded

5.2.3.2 Mercury

In accordance with the FAQMP, mercury emissions from the carbon regeneration kilns are estimated via a mass/balance calculation and the data is submitted annually to the National Pollutant Inventory (**http://www.npi.gov.au/**). There is no target level of mercury emissions but, as outlined in the previous section, work has been underway in the Fimiston ERP to significantly reduce mercury emissions from the Fimiston Processing Plant. While commissioning is continuing, the mercury capture system is operational with emissions falling to close to zero, as shown in the following figure. While the emission loads are measured indirectly through calculations, the results are supported by stack testing.

Figure 5-24: Mercury emissions (kg/year) for the period 2015-2019



5.2.4 Initiatives and developments

The following initiatives and developments have been undertaken:

- Triennial review of the FAQMP was undertaken in December 2015 and June 2019;
- An external review by Ramboll Australia Pty Ltd of dust alarm trigger levels was undertaken to support each triennial review of the FAQMP;
- Introduction of a 24 hour alarm (i.e. an alarm designed to identify when there is a risk of the 24 hour PM_{10} guideline value being exceeded) in addition to existing alarms for short term events;
- Training of Open pit Dispatch Operators and development of procedures for responding to alarms triggered by high dust levels; and
- Continue commissioning of the KOGCC. By 2019 KCGM had successfully reduced mercury emissions from the Fimiston Processing Plant by more than 90%.

5.2.5 Discussion

KCGM has made significant developments during the five year review period with management of PM_{10} and mercury emissions. The key performance indicator for PM_{10} emissions was met and mercury emissions very substantially decreased.

During the next five year review period KCGM aims to:

- Complete an upgrade of the dust alarm system;
- Simplify the dust alarm system to make responding to alarms easier;
- Investigate blast modelling software provided by WeatherZone to improve the Blasting Dust Management Programme (BDMP); and
- Finalise commissioning of the KOGCC.

5.3 Rehabilitation and closure

5.3.1 Objective

Factor	Objective	Management Plan
Rehabilitation and closure	Undertake review of the Mine Closure Plan and continue with technical studies to ensure that it reliably reflects the current operations and that there are sufficient funds allocated for mine closure.	Mine Closure Plan (2018).

5.3.2 Management measures

Planning for rehabilitation and closure of the Fimiston Operations is well advanced and KCGM has an approved Mine Closure Plan (MCP) under the *Mining Act 1978* and in accordance with condition 11 of MS782. The approach to rehabilitation and closure evolves as more information comes to hand, and the MCP is formally updated every three years. The 2018 MCP was approved by the Department of Mines, Industry Regulation and Safety (DMIRS) in August 2018. The 2018 MCP was resubmitted to the DWER (EPA Services) in December 2019 and subsequently approved 31 January 2020.

KCGM does not set target areas for rehabilitation. Most of the site remains either active or potentially active and full scale rehabilitation is only undertaken when the mine plan determines the area will not be required in the future. An exception is rehabilitation of exploration disturbance where areas are made safe (e.g. drill holes capped, drill pads rehabilitated) pending future exploration or mining activity.

5.3.3 Performance

Land rehabilitation remains an active focus and the area of land under rehabilitation has kept pace with the overall area of disturbance during the period 2015-2019 (**Figure 5-25**). Efforts are currently concentrating on establishing effective techniques that will be successful in the long term.

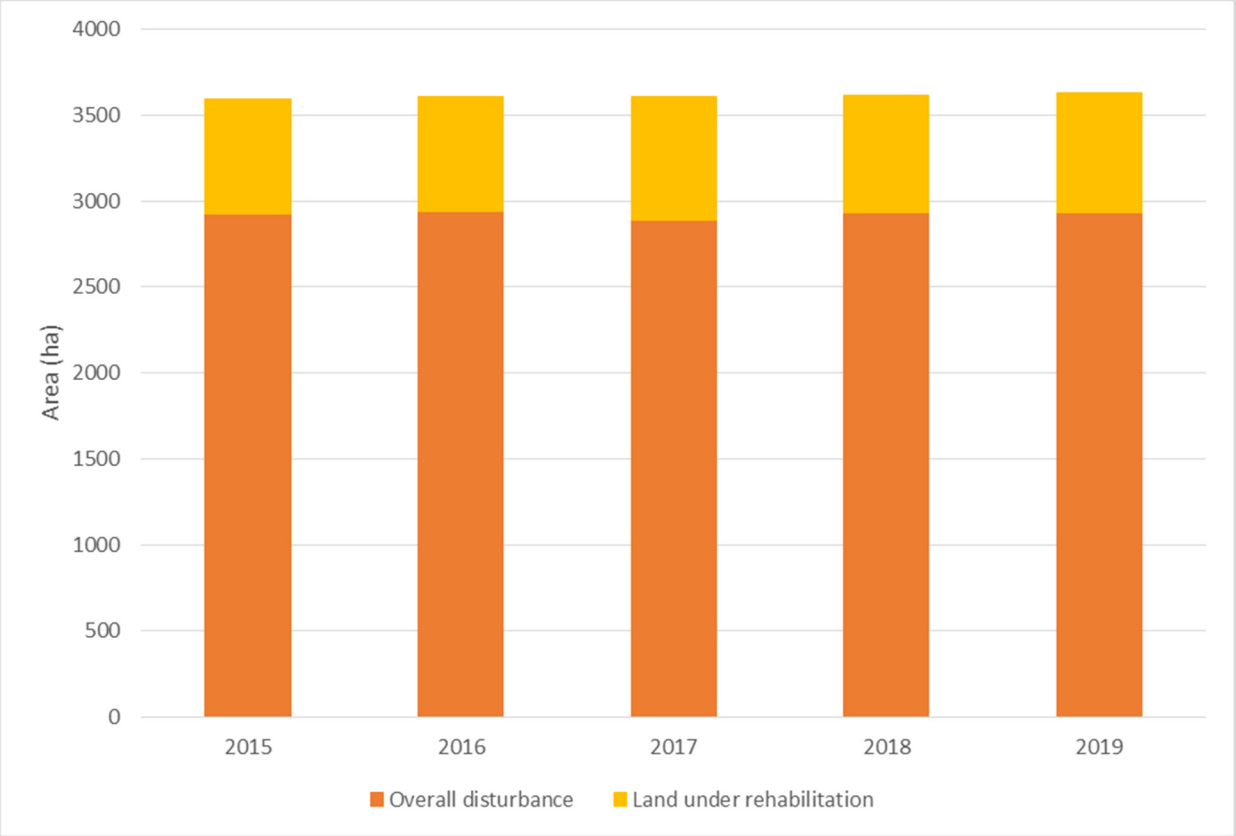
5.3.4 Initiatives and developments

The initiatives and developments outlined in **Table 5-6** have been undertaken in relation to rehabilitation and closure over past 5 years.

5.3.5 Discussion

Mine closure planning is well advanced but completion criteria and some rehabilitation techniques, particularly in regard to waste rock landforms, are still evolving. The next revision of the MCP is due in March 2021 and will describe further developments in these areas.

Figure 5-25: Area of total disturbance (ha) and area under rehabilitation (ha) for the period 2015-2019[7]



[7] Sourced from Mine Rehabilitation Fund submissions.

Table 5-6: Rehabilitation and closure – initiatives and developments

Issue	Activities
Completion criteria, and monitoring and assessment of waste rock landforms	KCGM continues to refine completion criteria in consultation with government. Completion criteria should clearly identify how waste rock landforms can be considered 'complete'. Limitations include materials availability, limited but improving scientific understanding of rehabilitated waste rock landforms over time and footprint constraints. Developments have included: • Refinements of vegetation monitoring techniques; • Techniques for field verification of completed rehabilitation against design, and erosion field observations; • Compilation of a consolidated flora and vegetation dataset for KCGM's footprint; and • Completion of a large scale rehabilitation trial undertaken on the Northern WRD. Extensive technical work to emphasise erosional stability supported this design revision, which comprised of: 16 – 20º slopes; 15 – 20 m wide benches; 10 – 15 m wide rocky bands to control erosion; and high percentage (20 - 30%) rock cover. This rehabilitation design has been accepted as preferred rehabilitation method for all newly constructed waste rock landforms. The future focus will be on: • Movement away from use of 'natural' analogues (e.g. rocky outcrops) for waste rock landforms in favour of successfully constructed landforms; • Quality assurance (QA) of rehabilitation activities against design intent; • Salinity, and change of salinity over time, as rainfall leaches salts; • Erosion observations; and • Ongoing refinement of vegetation monitoring techniques to achieve better alignment with completion criteria.
Open pit abandonment strategy	Work has focussed on the stability of the walls of mine voids and this focus is ongoing.
TSF closure strategy	During the five year review period, KCGM constructed a TSF haul road between the Eastern WRD and the Fimiston II and Kaltails TSFs to allow the transport of material (e.g. waste rock) for progressive rehabilitation of the TSFs. Rehabilitation of 8.4 ha of the Fimiston II TSF (D-Paddock, Bulong Road Side) was completed in 2019. The following areas have been the focus of investigations: • A review of TSF design criteria and, in particular, geotechnical considerations;

Issue	Activities
	• Waste rock capping requirements, including construction of a haul road specifically to facilitate transfer of waste rock to TSFs; and • Seepage recovery requirements post-closure and suitable completion criteria in this regard.
Contaminated sites	A site review has been conducted to enable progressing of contaminated sites investigations to be undertaken on a risk basis. This program will continue although some locations are subject to legal advice to clarify KCGM's liability.
Closure provision	A rigorous annual closure costing review is undertaken. This process reviews and improves designs, methodologies and costings to ensure that adequate funds are allocated for closure.

6 Proposed Environmental Objectives for the Next Five Years

The following objectives apply for the next five year period (2020-2024):

- Continue to implement the NVMMP;
- Apply for further approval under Regulation 17 of the *Environmental Protection (Noise) Regulations 1997*;
- Continue to implement the FAQMP and undertake a further triennial review in 2023;
- Upgrade the dust alarm system;
- Finalise commissioning of the Fimiston ERP (currently operating under Works Approval – transition to licence); and
- Continue to undertake technical studies to support mine closure methodologies and development of closure criteria.

7 Acronyms

A weighting	An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound.
BDMP	Blasting Dust Management Programme
Daytime	Between 07:00 and 19:00 hours.
ERP	Emissions Reduction Project
Evening	Between 19:00 and 22:00 hours.
IKON	An electronic detonation system used by KCGM to achieve precise single hole firing with zero scatter to minimise the Maximum Instantaneous Charge. This results in reduced vibration levels.
L_{A10}	The A-weighted noise level which is exceeded for 10% of the measurement period and is considered to represent the “intrusive” noise level.
L_{A50}	The A-weighted noise level which is exceeded for 50% of the measurement period and is considered to represent the “average” noise level.
L_{A90}	The A-weighted noise level which is exceeded for 90% of the measurement period and is considered to represent the “background” noise level.
L_{Amax}	The maximum A-weighted noise level during a particular measurement.
L_{eq}	The equivalent continuous sound level in decibels equivalent to the total sound energy measured over a stated period of time.
$L_{z\ peak}$	The peak sound pressure level in decibels (dB) obtained using the “Z” frequency weighting characteristic as specified in AS IEC 61672.1-2004 *Electroacoustics-Sound level meters Part 1: Specifications*.
mm/s	Millimetres per second.
Night	Between 22:00 and 07:00 hours.
PM_{10}	Particulate matter 10 micrometres or less in diameter.
POI	Point of Initiation.
ppv	Peak particle velocity in mm/s.
WIF	Weather Influencing Factor, a consideration of wind direction and speed that can increase or decrease the permitted noise level.

Appendix A: List of complaints relating to blasting, dust and noise for the period 2015-2019

Table A1: List of complaints received in relation to blasting, dust and noise during the period 2015-2019

Date	Aspect	Description
15/01/2015	Blasting	Dissatisfaction from a regular complainant with the findings of an independent structural engineers report delivered after a full property inspection and structural report. Request for blast vibration monitoring on property. Monitoring conducted for two week period. A review of the blast monitoring data confirmed vibration at the property was well below regulatory limits and demonstrated significant amelioration of vibration over distance from fixed monitors to the property.
3/02/2015	Blasting	Alleged house movement and cracking of rear porch concrete caused by blast vibration and request for information about blasting. A review of the blast monitoring data confirmed vibration levels for the period were below regulatory limits. Desktop review undertaken by independent structural engineer as part of the blast damage investigation process. Report findings identified soil conditions and water sources as the underlying cause of the damage, not blasting.
6/02/2015	Dust	General dust complaint. Dust monitoring levels were below the NEPM PM_{10} Standard for the period. Extended periods of hot dry weather, no obvious source of dust, KCGM water carts were deployed in accordance with standard operating procedures.
11/02/2015	Dust	DER received complaint regarding dust from blasting. Dust monitoring results were below the NEPM PM_{10} Standard. Report provided to the DER.
9/03/2015	Blasting	OEPA received a complaint regarding alleged house movement caused by blast vibration. Overview of blast damage investigation process and monitoring data provided to OEPA.
24/04/2015	Dust	General dust complaint following a blast. Dust monitoring results were below the NEPM PM_{10} Standard.
27/04/2015	Blasting	Alleged building movement and cracking caused by blast vibration. A review of the blast monitoring data confirmed vibration levels for the period were below regulatory limits. KCGM offered a property inspection to assess the alleged blast damage but this offer was not taken up.
28/04/2015	Blasting	Complaint about blast vibration for a specific blast and enquiry about property inspection process. A review of the blast monitoring data confirmed vibration levels were below regulatory limits. KCGM offered a property inspection but this offer was not taken up.
23/06/2015	Blasting	Blast vibration about a specific blast from a repeat complainant. A review of the blast monitoring data confirmed vibration levels for the period were below regulatory limits. Trending has identified that this resident feels vibrations more strongly when blasting occurs in a specific area and the resident receives phone calls to warn of blasts in that area. Phone call was missed on this occasion and complaint was about lack of warning.
27/07/2015	Blasting	DMP received a complaint regarding vibration from a specific blast. A review of the blast monitoring data confirmed vibration levels were below regulatory limits. Monitoring data results and overview of review process for monitoring data provided to DMP.

Date	Aspect	Description
14/08/2015	Blasting	Alleged building movement caused by blast vibration. A review of the blast monitoring data confirmed vibration levels were below regulatory limits. KCGM offered a property inspection to assess the alleged blast damage but this offer was declined.
4/01/2016	Dust	Complaint from a Boulder resident regarding dust after an open pit blast. Monitoring data showed that there was no significant increase of dust recorded and all levels were within limits. KCGM increased the volume of water used in pre-blast watering to control dust. Feedback was provided to the complainant.
13/01/2016	Blasting	The DMP received a complaint from a local resident regarding vibration from an open pit blast. A review of the blast monitoring data confirmed vibration levels were below regulatory limits. A response was prepared and provided to the DMP.
12/04/2016	Blasting	Complaint from a Boulder resident regarding blast vibration and alleged property damage. The complainant was supplied with Property Inspection Application information. Several contact attempts were made by KCGM to follow up with the resident; however no response was received.
20/07/2016	Blasting	Complaint from a local resident regarding an open pit blast that allegedly caused the glass in a door to shatter (which occurred two weeks prior to the complainant contacting KCGM). The complainant was asked to provide KCGM with further details; however no information was received.
23/11/2016	Dust	Complaint from a local resident regarding dust coming from the Fimiston Open Pit. Monitoring data did not show increased dust levels. The City of Kalgoorlie Boulder was conducting works in the area, which appeared to be the source of the dust. KCGM asked the resident to monitor and advise specific times of dust occurring. The External Relations Superintendent and Environmental Superintendent visited the resident, which was well received.
8/02/2017	Blasting	Local resident complaint that there is an excessive amount of dust and vibration caused by a blast in the Open Pit. It was identified by KCGM that this was due to the design of the shot causing material to fall further than usual, creating a large volume of dust. Procedures were reviewed and controls were implemented to avoid this outcome in the future. Feedback was provided to the local resident.
15/03/2017	Dust	Local resident complaint that there is an excessive amount of dust coming from the Open Pit. The dust was noticed at the property after the resident had been away from town for an extended period of time, during which a severe thunderstorm with strong winds had occurred. Measured PM_{10} concentrations at the dust monitor nearest the complainant's house averaged 13.2µg/m3, which is significantly lower than the NEPM PM_{10} Standard of 50µg/m^3, therefore it is unlikely the dust was caused by KCGM.
27/03/2017	Dust	Local resident complaint that there is an excessive amount of dust coming from the Open Pit. Dust was due to rock fall in Open Pit which occurred on the 27/03/17. Feedback was provided to the local resident.
5/06/2017	Noise	Williamstown resident complaint in regards to excessive noise coming from the trucks at the waste dump. In response, the trucks were immediately redirected to a different waste dump further from the resident's house. KCGM contacted the resident the next day to follow up and they were happy that the noise issue had been resolved.

Date	Aspect	Description
8/09/2017	Blasting	Local Business owner claimed that a blast on 08/08/2017 resulted in damage to their property. The External Relations Advisor contacted the local business owner and provided a Blast Vibration Property Damage Form. To date the form has not been completed and returned by the local business owner.
12/09/2017	Dust	Local resident complaint that black dust is settling on their car which is parked in the driveway. The source of the dust could not be readily identified, and the complainant was unable to be contacted by KCGM to allow further investigation.
13/10/2017	Dust	Local resident complaint regarding a large amount of dust coming from the Open Pit. KCGM tried to contact local resident to follow up, but was not able to get in contact with them. Dust monitors show elevated dust levels on that day likely from dust generated from the western wall slip area.
16/10/2017	Dust	Local business (Golden Mile Trotting Club) complaint regarding dust from the Open Pit occurring on 13/10/2017. Dust monitors show elevated dust levels on that day likely from dust generated from the western wall slip area, and this was reported to the DWER and DoH on the 19 October.
20/10/2017	Dust	Local resident complaint received via KCGM Facebook page regarding dust impacts from blasting, however due to the timing of the complaint (13 October) the dust was more likely generated from the western wall slip area. Dust monitors show elevated dust levels on that day likely from dust generated from the western wall slip area, and this was reported to the DWER and DoH on the 19 October. KCGM tried to contact local resident to follow up, but was not able to contact them.
24/11/2017	Dust	Local resident complaint about black dust all over their house and car. The source of the dust could not be readily identified, and the complainant was unable to be contacted by KCGM to allow further investigation.
26/03/2018	Blasting	Local resident complaint regarding an open pit blast which occurred during the Kalgoorlie-Boulder Community Fair. The blast was undertaken in accordance with KCGM's approved environmental management plans (FAQMP and NVMMP). To further mitigate potential community impacts, KCGM will review blast requirements during community events.
16/05/2018	Dust	Local resident complaint regarding dust from the Open Pit, due to two large rock falls which occurred on the 14/15 May 2018. Feedback regarding the rock falls was provided to the complainant.
16/05/2018	Dust	Second complaint from a local resident regarding dust from the Open Pit, due to two large rock falls which occurred on the 14/15 May 2018. Feedback regarding the rock falls was provided to the complainant. No further contact was received.
17/08/2018	Noise	Local resident complaint regarding truck noise from the Open Pit in the early hours of Thursday16/08/18.They claimed they were awoken at 2 am by the noise and could not sleep. At 4:30 am they drove to the KCGM mine site boundary to ascertain where the noise was coming from. They have lived at the address for four years and never before heard the noise at similar levels. Noise levels were checked by KCGM at the noise monitor closest to the complainant and no trigger levels were recorded for this day. Complainant was asked to call directly if there were any further issues. No further contact was received.

Date	Aspect	Description
25/10/2018	Dust	Resident visited KCGM's Security Gatehouse to complain about the amount of dust coming off the waste dumps due to strong winds. They reported their property is covered in dust and they requested that KCGM pay to relocate them to a hotel until the dust settles and KCGM can clean up the property. KCGM attempted to visit the property but the property address could not be found.
4/12/2018	Dust	Resident visited KCGM's Security Gatehouse to complain about the amount of dust coming off the waste dumps due to strong winds. There was a storm the night of the complaint in Kalgoorlie-Boulder, which could have been largely attributed to the dust experienced by the complainant. KCGM has made several attempts to contact the complainant but contact could not be made.
12/01/2019	Blasting	Local resident complaint regarding blast vibration at their home. KCGM's External Relations Advisor called and left a message to advise that no blasting occurred within the Fimiston Open Pit over the weekend. No further correspondence has been received.
17/01/2019	Dust	Local resident complaint regarding fugitive dust from KCGM's Tailing Storage Facilities during high winds. KCGM's External Relations Advisor spoke with the complainant, providing them with information on aspects of KCGM's dust management practices (e.g. water carts and rehabilitation) and how these have limited effectiveness during high winds. The complainant was encouraged to continue to provide feedback. No further correspondence has been received.
14/02/2019	Blasting	Local Resident complaint regarding property blast damage. KCGM's External Relations Advisor explained KCGM's blast property inspection process to the complainant, advising them to submit a Blast Property Inspection Application Form to initiate a structural inspection of the property. A copy of the Blast Property Inspection Application Form was provided to the complainant. No further correspondence has been received.
21/08/2019	Noise	Local resident complaint regarding mining noise from the Fimiston Open Pit. KCGM's External Relations Superintendent met with the complainant on Thursday 22 August 2019 to discuss. The complainant explained that they had been having trouble sleeping and that the noise from the Fimiston Open Pit had seemed worse over the past six months but did not give any specifics. KCGM offered to review the available noise monitoring data to be discussed with the complainant at a follow-up meeting. However, the complainant advised that the noise was no longer a concern and that there was no need for a follow-up meeting. The complainant was grateful for the follow up.
2/09/2019	Noise	Local resident complaint regarding noise from the open pit. He reported that for 3-4 weeks there has been a loud humming coming from the pit - both day and night. External Relations Superintendent followed up with complainant. No further correspondence has been received.

Appendix B: List of non-compliance and non-conformance records for 2015-2019

Table B1: List of non-compliance records during the period 2015-2019

Date	Regulatory requirement	Non-compliance / non-conformance[8]	Details
27/03/2015	Condition 9.3 of MS782	Non-Compliance	Elevated airblast readings greater than the limit of 120 dB were recorded at monitoring sites Bravo (121.6 dB), Charlie (123.1 dB) and Delta (125.1 dB) and greater than the limit of 125 dB at monitoring site Echo (125.3 dB)
1/05/2015	Conditions 7.5 and 9.9 of MS782	Potential Non-Compliance	24 Hour Dust Monitoring Report unavailable to the public within 24 hours
2/06/2016	Condition 9-5(3) of MS782	Non-Compliance	Two elevated blast vibration readings > 5 mm/sec were recorded within ten consecutive blasts
16/11/2018	Condition 7.5 of MS782	Potential Non-Compliance	24 Hour Dust Monitoring Report unavailable to the public within 24 hours
8/02/2019	Condition 7.5 of MS782	Potential Non-Compliance	24 Hour Dust Monitoring Report unavailable to the public within 24 hours
3/07/2019	Condition 7.5 of MS782	Potential Non-Compliance	24 Hour Dust Monitoring Report unavailable to the public within 24 hours
20/12/2019	Condition 7.5 of MS782	Potential Non-Compliance	24 Hour Dust Monitoring Report unavailable to the public within 24 hours

[8] A record is considered a non-compliance if formal advice to this effect from the DWER has been received.