

KALGOORLIE CONSOLIDATED GOLD MINES PTY LTD

BLAST MANAGEMENT PLAN

JULY 2006

INTRODUCTION

The Golden Pike Cutback and subsequent western extension of KCGM's Fimiston Open Pit is currently subject to intense forward planning. This is to determine how the area can be mined in a cost effective manner and ensuring that any potential blasting impacts on the nearby community are minimised.

If approved, the Golden Pike cutback will extend the life of the Fimiston Open Pit by approximately five years. The cutback enables both a widening and deepening of the Fimiston Open Pit enabling access to the high grade ore body at the base of the Pit.

Blasting has been identified as one of the key mining activities within the Golden Pike Cutback that has the potential to cause inconvenience to the public. Blasting is an essential part of the mining cycle and must be undertaken in a way that does not endanger personnel and avoids damage to equipment and property.

The nature of blasting generates noise (overpressure), vibration and dust. In addition there is a risk of flyrock. Variations in the distance that flyrock is thrown is a direct result of collar rock conditions and the loading practices of the blast. As part of preparation for a blast, a "blast clearance area" is established within which personnel are evacuated and equipment are removed or protected, to avoid injury or damage, during a blast.

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

There are two key stages in the blast management plan and these are noted below:

- Preparation - where the knowledge level is built up and the required 'professionalism' is instilled into personnel likely to be involved.
- Operations - mining has commenced and it is important to trial what is proposed in less sensitive areas, fine tune strategies and ensure workmanship is of the highest quality.

PREPARATION

To comply with a stricter blasting regime in the Golden Pike Cutback preparation has commenced with identification of the potential impacts, the monitoring and modification of current practices, seeking expertise to audit and improve blasting techniques, and the formulation of specific strategies relevant to this area.

Blasting Impacts

The following impacts from blasting have been identified as requiring controls to minimise any potential impacts on the nearby community.

1. **Blasting Dust** - Localised dust impacts of high "nuisance value" for residents can be created from blasting. This is particularly a problem during summer when prevailing winds are from the east.
2. **Overpressure (Blast Noise) and Vibration** - When a blast is fired, the explosive energy is used to break the rock. The more energy used to break the rock the more efficient the blast. However, even in a very efficient blast, some energy escapes and is transmitted acoustically as air pressure waves (overpressure) and seismically as ground vibration waves.
3. **Flyrock** – Is rock that is generated from within the blast and projected varying distances beyond the blasting area.

Existing Control Regime

Since the commencement of the Fimiston Open Pit in the early 1990's, KCGM has built up considerable expertise in controlling the impacts of blasting and has achieved a high success rate of blasting within the parameters set. These parameters or restrictions might arise from regulatory controls or commitments by KCGM.

Current control parameters used at the Fimiston Open Pit and will be utilised for the Golden Pike blasting include:

- ***Blasting Dust***

As outlined in the KCGM Dust Monitoring and Management Programme, KCGM has introduced management procedures to minimise this impact which essentially involve avoiding surface blasting during unfavourable weather conditions. Real time wind speed and direction monitoring data is used in the decision making for the control of dust from blasting.

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

- ***Overpressure and Vibration***

As outlined in the KCGM Noise and Vibration Monitoring and Management Programme, primary blasting will be carried out only between 0900 hours and 1730 hours, and will, wherever possible, occur at a fixed publicised time each day or at a later time where weather or safety requirements preclude blasting at the earlier time.

Wherever possible, explosives placed for surface blasts will be detonated when weather conditions are such that the impact of blast over pressure and vibration on residential areas of Kalgoorlie-Boulder are minimised.

Ground vibration and air blast overpressure are monitored using Blastronics μ MX Remote Blast Monitors. There are monitors permanently installed at sites between the Fimiston Open Pit and the City of Kalgoorlie-Boulder. The trigger levels for the blast monitors are set at 1 mm/sec for vibration and 114 dB(L) for overpressure. If either of these levels are reached a result is recorded for the blast event.

In accordance with our Ministerial requirements open pit blasting operations are carried out so that:

- the air-blast over pressure level generated by any blast, does not exceed 125 dB linear peak; and
 - not more than one in any ten consecutive blasts results in an air-blast over pressure level greater than 120 dB linear peak;
- when measured at the approved monitoring site (Site F).

Vibration levels from open pit blasting will be no greater than Australian Standard AS 2187.2 - 1993 of 10mm/s and no more than 1 in 10 consecutive blasts will exceed 5mm/s.

- ***Flyrock***

Investigation of current practice for routine production blasting in the sulphide, oxide and transition zones within the Fimiston Open Pit, has shown that flyrock is contained within 95 m of the blast. To achieve the safety clearance factor for plant and equipment, this maximum throw distance is doubled, i.e. 190 m or a safety factor of '2'. For personnel safety, this distance is doubled again, i.e. 380 m or a safety factor of '4'. This is consistent with the 400 m Blast Clearance Area within which KCGM currently operates.

Mining at the Chaffers West Cutback that incorporated improved procedures for blasting, proved that with more efficient confinement of explosives, (i.e. controlling the height of stemming material) flyrock throw can be limited to 50 m. Therefore, for a safety clearance factor of '2' to plant and equipment the maximum throw distance is 100 m. For personnel safety this distance is 200 m or a safety factor of '4'.

- ***Public Inquiry Line (PIL)***

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

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

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

- ***Procedures and Training***

KCGM has internal procedures and training for blasting to ensure that the quality of the blast design and set up is within the set guidelines. It has been shown that charging the rock to specification will significantly reduce undesirable events that may be produced from a shot during the blasting process.

KCGM have been blasting in the current environment since 1989 and have built up considerable expertise in controlled blasting. The Chaffers Cutback commenced in 2003 and it involved blasting in ground conditions similar to what will be encountered in the Golden Pike cutback (i.e. oxide, transitional then to fresh rock conditions). Considerable trialling of the use of electronic detonators and minimum charge weight was undertaken to ensure vibration control.

- ***Quality Assurance***

KCGM has a quality assurance system of continuous measurement and review of drilling, charging and firing practices to ensure the best possible outcomes from a blast.

Daily production at the Super Pit is approximately 250,000 tonnes per day. Blasting has to keep pace with this level of production, requiring the drilling and loading of about 300 holes per day. Often these holes are loaded in a difficult environment because of the number of old workings in the area. Monitoring the results of these blasts helps establish a sound knowledge base that can be used for future blasting.

- ***Personnel and Supervision***

It is recognised that the selection of very competent personnel and their subsequent supervision will largely overcome the 'human factor' in the implementation of procedures and quality assurance systems in the drilling and blasting process.

To assist this, KCGM have encouraged the concept of a professional culture within the respective drilling and blasting crews. For example videos of blasts are examined by blast crews in detail for evidence of surface ejection and discussion will arise as to their possible causes.

In addition, any blasts which exceed the KCGM internal limits are recorded in the Incident Reporting System where they will prompt a full investigation and provide notification to the people responsible for preparing the blast. With each incident there is an increase in the knowledge base in working in this environment of all involved personnel. Human errors are also recorded so that all the crew can continually examine and improve their work and back-up systems.

To create extra accountability, the Senior Mining Engineer in charge of drilling and blasting views as many blasts as possible to assist in the development of this professional culture. Verbal assessments and praise can be immediately given to the blast crew to assist in achieving this professionalism. Approximately 80% of all blasts are reviewed.

- ***External Projects***

In April 2006, a joint exercise between Ausdrill, Dynos and KCGM assisted the Kalgoorlie-Boulder City Council to blast cap rock that was holding up construction of a dam that was being dug for the new Golf Course project. The thickness of the rock was approximately 5 m.

There was significant infrastructure in the area, including the rail line, a pipeline and an above ground concrete water storage dam belonging to the Water Corporation. There were a number of houses to the west of the dam and well within the designated blast clearance area.

Stringent vibration limits were placed on the blast by the Water Corporation, and KCGM. KCGM undertook the design of the blast and the loading of the holes, and established a blast clearance area of 200m. This blast was successful in achieving the desired outcome of fragmentation without flyrock and excessive vibration.

Research and Development

The Golden Pike Cutback is closer to the community than KCGM's previous mining activity. However because mining will not commence until July 2008 it gives KCGM ample time to 'fine tune' its blasting techniques using the current cutbacks as practice areas. To date KCGM has been very proactive in promoting less invasive blasting techniques while still achieving the mining outcomes required.

Following are a number of initiatives designed to provide information on and improvements in blasting techniques at KCGM.

- ***Total Quality Assurance (QA) Studies***

Several studies have been completed to date, the most recent being in January 2006. These studies measure every aspect of drilling and charging and the aim of these studies is to see how accurately the KCGM drilling and blasting crews can follow the blast design given the pressures of being able to blast in a timely manner. The studies have revealed that the more intense the QA, the more accurate is the drill and blast process. Drilling and blasting to design will give fewer undesirable outcomes.

- ***'Near Field' Vibration Study***

This study was undertaken jointly with technical personnel from Orica in May 2006. By understanding how the rock behaves when subject to the pressure waves of a blast, it is possible to 'fine tune' blasting methods to minimise blasting vibration.

- ***Electronic Detonators***

For three years KCGM has been involved in a considerable amount of 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. The experimentation with electronic detonators is continuing.

- ***Computer Simulation of Blasting***

The Blast Crew now have access to electronic methods that pictorially display the timing of the blast and may assist in helping personnel recognise any undesirable effects during design of the blast (e.g. too many holes firing at the same time).

- ***Studies into 'Domain Blasting'***

This is 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 will lead to overpressure and flyrock. Domain blasting studies have previously been completed, and two new ones will commence in the near future.

- ***Orica 'Continuous Improvement' Technical Support***

KCGM has entered into an agreement with Orica to acquire an Orica technical consultant who is currently examining many aspects of the blasting process at KCGM with the aim of identifying areas for improvement. Part of the study area is to examine the limitation of the nuisance effects of blasting, particularly in reference to pre-split blasting. The Orica consultant commenced with KCGM in April 2006.

- ***Blasting Monitors***

KCGM is currently investigating the replacement of all blast monitors for updated models which will enable more useful data to be recorded that will assist in the 'fine tuning' of blasts.

- ***High Speed Camera***

KCGM is currently investigating the purchase of a high speed camera capable of showing blasts in one two-thousandth of a second frames. This, coupled with a better blast monitoring systems will be able to give KCGM a better understanding of what processes are leading to unfavourable events within blasts.

OPERATIONS

Quality Assurance

Blasting 'quality assurance' (QA) involves the continuous checking of the processes that go together to make up a blast. KCGM has proven that a strict quality regime to ensure that drilling and blasting is conducted according to design specifications will result in a blast that will significantly reduce adverse affects and still be adequate for the purpose.

Quality Assurance will be used on the following processes:

- Drill pattern mark up.
- Accuracy of collar location.
- Depth of drilled hole.
- Rock/ground competency in the area of the hole, and its subsequence relation to the charge mass of the hole after loading.
- Depth of stemming.
- Blast control regimes, such as deck-loading and surface moisture.

KCGM currently has a competent QA team and it is proposed that an extra person will be appointed to be dedicated to the Golden Pike Cutback project. This will ensure QA in a timely and effective manner. As the 'less sensitive' areas will be mined first, it will give KCGM sufficient time to fine tune blasting techniques if required to give the desired outcomes.

Blast Clearance Area

Blast clearance areas will be established around each blast for the Golden Pike Cutback. They will be set to achieve the following aims:

1. Ensure that personnel are not injured by the blasting process.
2. To reasonably prevent machinery and infrastructure from damage.

The investigation undertaken by Terrock of blasting at the Chaffers West Cutback which incorporated improved procedures for blasting, showed that with more efficient confinement of explosives, (i.e. controlling the height of stemming material) flyrock throw can be limited to 50 m. Therefore, for a safety clearance factor of '2' to plant and equipment the maximum throw distance is 100 m. For personnel safety this distance is 200 m or a safety factor of '4'.

The investigations and modelling demonstrated that with improved blasting performance such as that recently utilised during surface blasting at the Chaffers West Cutback, a 200 m blast clearance area for the Golden Pike Cutback will provide an adequate buffer given that blasting practice controls are implemented to reduce the flyrock throw distance. Improved blasting practices are important for those blasts within the area closer to the final pit outline and blasts undertaken at or close to the ground surface.

When blasting is conducted at levels below the pit perimeter, the horizontal throw of flyrock is reduced by the pit wall. The Environmental Noise Bund located to the west of the open pit also provides similar benefits for reducing horizontal throw. The pit wall and Environmental Noise Bund introduce an additional safety margin for preventing flyrock from blasts in the upper benches extending beyond the mining area.

KCGM will adopt the practices recommended by specialist consultants to minimise the potential impacts from flyrock generated during blasting. Modified blasting practices will be introduced during blasting particularly in the area identified near the pit perimeter. This will ensure that the throw of flyrock is limited to 50 m and that a safety factor of '4' is maintained. Modified blasting practices were introduced into blasting activities at the Chaffers West Cutback and proved effective in reducing the throw of flyrock.

The risk of flyrock during blasting of the Golden Pike Cutback will be reduced to as low as reasonably achievable by the following risk controls:

- Elimination – No toe blasts will be undertaken and 'free-dig' techniques will be used to avoid blasting if possible;
- Substitution – Electronic detonators (or similar alternative technology) rather than traditional detonators will be used for greater precision, reduced airblast and ground vibration;
- Engineering Measures – Mechanical methods used where practicable for secondary breaking;
- Administrative Controls – Quality Assurance Procedures regarding charge mass per unit length of blast hole and minimum stemming lengths will be used. Specified blasting design and loading procedures will be used to reduce flyrock where secondary blasting is required;
- Personal Protection – Temporary closure of the Eastern Bypass Road during blasting of near surface rock along the Golden Pike cutback (not expected to exceed 15 minutes on 8 occasions for a 200m blast clearance area or 61 occasions for a 400m blast clearance area, with emergency vehicles using the Eastern Bypass Road given priority over blasting). Industrial and KCGM owned residential properties within the Blast Clearance Area may also be evacuated during a blast if it is deemed that a blast clearance area greater than 200m is required.

In order to gauge the degree of disruption if a blast clearance area is a minimum of 200m to each nearest shot boundary has been calculated. Preliminary blast designs for the Golden Pike Cutback indicate a total of 86 separate blasts will be required for the first four benches (from surface to 30m below surface) which according to the current schedule will be mined over around 18 months. The approximate blast clearance area for each of these blasts to the nearest property not owned by KCGM has been determined and is shown in the table below:

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Authorised by: P Welten	App G3 - Draft Golden Pike Blast Management Plan.doc	Date:19/07/06

Blast Clearance Area	Surface (-60 bench)	10m Below Surface (-70 bench)	20m Below Surface (-80 bench)	30m Below Surface (-90 bench)	Total Blasts	Percentage of Blasts
200m	0	4	0	0	4	5 %
250m	2	3	6	3	14	16 %
300m	4	6	5	6	21	24 %
350m	3	4	5	7	19	22 %
400m	5	6	8	9	28	33 %

Figures showing the blast clearance area for each bench are shown in Appendix 1.

Re-verification that 200 metres is an Acceptable Distance

Following each blast in the Golden Pike cutback a review of flyrock will be undertaken to confirm if the control measures implemented are adequate.

The requirement for a 200m blast clearance area will not be required until the second bench (-70m) is blasted providing suitable time to review blasts to verify the smaller blast clearance area, while still using a larger clearance area.

This data will be examined by experts and a determination given on the way forward with the closer blasts.

APPENDIX 1



