MAC-ENC-MTP-015
BLAST MANAGEMENT PLAN

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Revision History

Version No.	Date Published	Details
1.0		Final draft submitted for approval.
1.1	March 2012	Amended following consultation with DP&I.
Final	14/11/2012	Approved by the Department of Planning and Infrastructure on 14/11/12
2.1	15/5/2013	Changes to response procedures
Final	27/5/2013	Approved by the Department of Planning and Infrastructure on 27/05/13
3.1	20/6/2014	Changes made to Appendix 5: Blast Fume Management Plan
Final	30/6/2014	Approved by the Department of Planning and Environment on 26/6/2014

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1. Introduction

Hunter Valley Energy Coal Pty Ltd operates the Mt Arthur Coal Mine Complex which consists of approved open cut and underground mining operations, a rail loop and associated rail loading facilities. The operations are located in the Upper Hunter Valley, NSW approximately five kilometres south west of Muswellbrook.

Blasting of mine overburden to allow efficient recovery of the underlying coal can have impacts on the surrounding community. These impacts mainly include vibration through the air (overpressure) and earth (ground vibration) along with the generation of dust and fume.

Overpressure and ground vibration limits in place for private residences and heritage structures are prescribed by government based on standards. Blasts are designed and managed to minimise the risk of exceeding these limits, and to minimise impacts they have on the community, surrounding structures and environment.

This Blast Management Plan (BMP) has been prepared to detail the relevant blasting and vibration impact assessment criteria and compliance procedures and controls relating to open cut blasting activities. This Plan has been prepared to fulfil requirements of the Department of Planning and Infrastructure (DP&I) Project Approval (09_0062) dated 24 September 2010, and the NSW Office of Environment and Heritage (OEH) Environment Protection Licence (EPL) conditions, which are presented in Appendix 1.

The proposed Mt Arthur Underground operation has not commenced. This management plan will be reviewed and updated prior to the commencement of underground operations.

Statutory conditions are listed in Appendix 1. This management plan describes procedures required to ensure compliance with project approval conditions relating to blasting impacts. Details regarding monitoring locations, and frequencies are provided in a separate Blast and Vibration Monitoring Program.

1.1. Objectives

The objectives of this BMP are to:

- Ensure all relevant statutory requirements and BHP Billiton Policies and Standards are met;
- Manage and minimise the impact of blasting from mining operations on the environment and nearby residences;
- Maintain an effective response mechanism to deal with issues and complaints; and
- Ensure the results of blast monitoring comply with applicable criteria.

1.2. Environmental Management System

Mt Arthur Coal has a firm commitment to minimising the impact of its operations on the local environment and community, and has a comprehensive Environmental Management System (EMS)) that is certified to the International Standard 14001:2004, in place to fulfil this commitment. This BMP is a component of the Mt Arthur Coal EMS.

1.3. Consultation Process

This BMP has been prepared in consultation with DP&I and OEH. Consultation has also been undertaken with neighbouring coal mines, including the Drayton and Bengalla Mines and the Mt Pleasant Project in relation to blast scheduling.

2. Blast Mitigation Measures

2.1. Best Practice Control Measures

Best practice blast management procedures will be implemented at Mt Arthur Coal to minimise air blast overpressure, ground vibration levels, flyrock, fume, dust and odour from blasting activities.

Best practice control of ground vibration, overpressure and flyrock impacts will be achieved by implementing the procedures and safe guards shown below. Particular care will be exercised when blasting is undertaken within the hatched area illustrated in Appendix 2, to ensure that the blast impact assessment criteria are met for public infrastructure, private residences and heritage sites including Edinglassie and Rous Lench. (For further technical information on specific blast procedures relating to minimising impacts within the hatched area illustrated in Appendix 2, refer to the Blasting Technical Note included in Appendix 3).

- Complying with the relevant procedures prior to the initiation of any blast by referring to the *MAC-STE-MTP-008 Mine Safety Management Plan* and the *MAC-PRD-PRO-001 Developing Shotfiring Safe Work Procedures*;
- Conducting a pre-blast environmental assessment with consideration given to wind speed, direction and shear and the strength of temperature inversions prior to each blast. Meteorological conditions will then be compared with internal blasting guidelines before an approval to blast is issued;
- Use of initiation systems that minimise vibration is detailed in the blast pre approval procedure *MAC-PRD-PRO-106 Environmental Approval for Blasting*;
- Use of adequate stemming lengths to ensure maximum confinement of explosive charges minimizing flyrock and overpressure;
- Use of suitable quality stemming material - being either drill cuttings, rock sourced from site or imported gravel, when necessary;
- Ensuring adequate burden is present on all faces. In some instances face surveying (laser profiling) techniques may be employed to measure overburden between the blast face and blastholes to ensure sufficient burden is present to prevent blowouts and blast

anomalies. The initial blast design factors in the amount of overburden present on faces and drilling is undertaken in line with blast design;
- Adherence to blast loading and initiation designs unless risks are determined by the shotfirer at the time of loading that may be mitigated through changes to design;
- Use of monitoring data to establish and refine predictive tools to estimate likely overpressure and vibration levels during the design process of subsequent blasts; and
- Evaluating new technology and alternative blasting methodologies that become available for their potential to lessen environmental impacts from blasting, in the context of safe, efficient mining operations.

Best practice control of blast fume, dust and odour will be achieved by the following, including additional detail within the Blast Fume Management Strategy (Appendix 5):

- Minimising the potential for delayed firing of shots which have been loaded into wet holes within the constraints of prevailing weather conditions;
- Conducting a pre-blast environmental assessment with consideration given to wind speed, direction and shear and the strength of temperature inversions prior to each blast. Blasts will be fired in suitable weather conditions that minimise the potential for blast generated dust and/or blast fume to be blown towards neighbouring residential areas. A blast guidelines matrix is used as part of the pre-blast environmental assessment indicating, for each specific pit, the wind speed and wind direction conditions for which the decision will be made not to proceed with tying up the blast pattern for firing (identified in the matrix as the ‘red zone’).

2.2. Management of Fly Rock

The generation of fly rock is managed by incorporating appropriate controls in blast designs. These controls include design of stemming lengths and stemming materials to minimise the potential for generating fly rock. Adequate burden, which is the distance from a charge to a free face, is maintained to minimise the risk of generating fly rock due to face bursting. These measures are used to ensure there is no damage to property, equipment or power lines from flyrock with additional consideration also provided to road closures and determination by the shot-firer of the safety distance required based on the level of risk which may increase the exclusion zone area.

In certain situations, crushed rock stemming will be used to improve stemming confinement and hence reduce the chance of flyrock and elevated blast overpressure.

An appropriate exclusion zone for people and livestock will be established around each blast site in accordance with relevant mine safety regulations prior to firing a blast. The exclusion zone will be established beyond the expected range of any fly rock with an additional safety margin. The establishment of this zone will minimise the risk of any injuries to people or livestock due to fly rock.

Any unusual level of fly rock generated by blasting, with the potential to cause a safety risk will be noted for each blast. This information will be used to continually re-assess the adequacy of blast design controls in reducing the generation of fly rock. The information will also be used to re-assess the size of the safety exclusion zone established for people and livestock in the vicinity of a blast.

2.3. Protection of Underground Utilities

The level of ground vibration that would result in damage to underground utilities is likely to be greater than 25 mm/s, based on recommendations in AS 2187.2-2006 'Explosives—Storage and use Part 2: Use of explosives'. Given the significant distance between Mt Arthur Coal blasting locations and adjacent private land, it is unlikely that any damage to underground or public utilities will occur. In addition, checks are undertaken by the surveying department where required to determine the location of public utilities throughout the mining lease so that blasts can be designed to minimise the risk of damage.

2.4. Management of Road Closures

A Road Closure Management Plan for Denman Road (*MAC-ENC-MTP-024 Denman Road Closure Management Plan*) has been prepared in consultation with Muswellbrook Shire Council (MSC) and the NSW Roads and Traffic Authority (RTA) and is approved by the Director General to address the management of public road closures during any blasting within 500m of Denman Road.

Mt Arthur Coal seeks to minimise the requirement for road closures, and their impacts on the local community. The primary objective of the *MAC-ENC-MTP-024 Denman Road Closure Management Plan* in accordance with MAC-PRD-PRO-043 Blasting within 500m of public roads is to provide a framework to coordinate safe and efficient road closures when blasting occurs within 500 metres of Denman Road.

Fundamental to achieving this objective is to;

- Ensure safety and protection of potentially affected persons and property;
- Minimise road closure periods;
- Minimise potential impacts on road users, local residents and businesses, through avoiding peak traffic periods;
- Coordinating blast schedules with neighbouring mines to minimise cumulative impacts of blasting;
- Notify in advance relevant stakeholders, including the public, of blasts that will temporarily close Denman Road; and
- Ensure that emergency service activities are not restricted by road closure events.

No blasting is planned to be undertaken within 500 metres of Edderton Road within the next five years. Should any blasting within 500 metres of Edderton Road be required the management plan and procedure will be reviewed and updated as required.

2.5. Management of Aboriginal Heritage

The most significant known Aboriginal heritage feature which has the potential to be impacted by blasting is the axe grooves site at Saddlers Pit. A geotechnical study was done on this particular area and it determined that blasting should not occur within 150m of the centroid of the grooves. Blasting in this area is now moving away from the axe grooves site, and blasting will not occur within 150m of the centroid of the site. Should further artefacts be found, a risk assessment will be conducted and full pre-blasting assessment done to ensure that blasting will not damage those artefacts.

3. Consultation

3.1. Consultation with Neighbouring Mines

Mt Arthur Coal has undertaken consultation with the operators of neighbouring mines in the past, and provides regular notification to all operators of future blasting schedules to ensure that blast schedules are coordinated and cumulative impacts are minimised.

3.2. Consultation with Neighbouring Residents

The public will have access to the blasting schedule which will be posted on the internet via the Mt Arthur Coal web site. As appropriate, the blasting schedule will be further disseminated via mail, e-mail, and fax to appropriate organisations and individuals. It should be noted that the weekly schedule is subject to variation depending on daily factors including variable weather which may ultimately delay a blast until conditions improve.

Further to this, Mt Arthur Coal will make telephone contact with relevant residents as requested prior to blasting in order to avoid surprise and maintain good working relationships. Residents can request to be added to the blast notification phone and/or email list through the Mt Arthur Coal Community Response Line on 1800 882 044.

Blasting events which require road closures activate the notification section of the *MAC-ENC-MTP-024 Denman Road Closure Management Plan* which details the community consultation and notification requirements.

3.3. Community Consultation

Mt Arthur Coal has in place a comprehensive community engagement program which includes the establishment of a Community Consultative Committee (CCC). The CCC is operated in accordance with the DP&I “Guidelines for Establishing and Operating Community Consultative Committees for Mining Projects”. Mt Arthur Coal’s blasting results are reported to the CCC on a regular basis.

The community response line (1800 882 044) enables members of the community to contact environment and community staff directly to discuss concerns with blasting.

Residents within 3km of blasting have been sent letters to inform them that they are entitled to request structural inspections on their property.

3.4. Consultation with Transgrid

Mt Arthur Coal will consult with Transgrid to determine the most appropriate damage criteria on a regular basis before any major changes in blasting practices and prior to any modifications to the existing agreement in relation to the Bayswater to Mt Piper 330/500KV transmission line. Monitoring is undertaken with portable monitors at pre-determined monitoring locations.

3.5. Consultation with Government Agencies

This BMP has been prepared in consultation with OEH and to the satisfaction of the Director General (see correspondence in **Appendix 3**).

4. Response Procedures

4.1. Exceedance Protocol

In situations where the blast results are identified as exceeding the impact assessment criteria, follow actions outlined in in *MAC-ENC-MTP-041 Environmental Management Strategy.* Blasting consultants may be engaged to provide expert analysis and interpretation of blasting results as part of an investigation into an exceedance of impact assessment criteria.

4.2. Complaint Response

All complaints received regarding operational blast activities will be responded to in accordance with *MAC-ENC-PRO-042 Community Complaints Handling, Response and Reporting*. This procedure details Mt Arthur Coal's obligations in regards to receiving, handling, responding to, and recording details of all community.
Upon receipt of a complaint from the Community, preliminary investigations will commence as soon as practicable to determine the likely causes of the complaint using information such as the prevailing climatic conditions, the nature of activities taking place and recent monitoring results. A response will be provided as soon as practicable, which may include the provision of relevant monitoring data.

Where specific complaints are received in relation to blast overpressure and/or vibration at a particular residence, portable attended monitoring units may be deployed in consultation with the complainant to monitor blast impacts at the relevant location.

Every effort will be made to ensure that concerns are addressed in a manner that facilitates a mutually acceptable outcome for both the complainant and Mt Arthur Coal. If required, property investigations under Schedule 3, Condition 15 and/or independent review under Schedule 4, Condition 4 of PA 09_0062 will be followed.

4.3. Complaints Register

Mt Arthur Coal will record all community complaints into the site event management database in accordance with *MAC-ENC-PRO-042 Community Complaints Handling, Response and Reporting*. The database is maintained to include reporting, incident/event notification, close out action tracking, inspections, and audits.

4.4. Landholder Notification – Property Inspections and Property Investigations

In accordance with conditions 13 of the Project Approval, Mt Arthur Coal has notified all owners of privately-owned land within 3 kilometres of any approved blasting operations that they are entitled to a structural property inspection to establish the baseline condition of building and other structures on their properties.

Property inspections will be undertaken on any privately-owned land within 3 kilometres of any approved blasting operation in accordance with condition 14, when Mt Arthur Coal receives a written request.

Property investigations will be undertaken in accordance with condition 15, if any landholder within 3 kilometres of blasting operations or any other landholder nominated by the Director-General, claims that buildings and / or structures on their land have been damaged as a result of blasting at the project.

5. Monitoring Program

The *MAC-ENC-PRO-055 Blast Monitoring Program* has been prepared as a separate document to this management plan and addresses the following:

- Assessment criteria;
- Blasting and vibration monitoring methodology;
- Blast monitoring locations; and
- Data analysis and reporting.

The monitoring program has been designed to ensure that adequate monitoring is undertaken to confirm compliance with schedule 3, conditions 10 to 17 of the Project Approval. The program specifies monitoring requirements, and provides guidelines on data analysis and reporting. Additional information relating to maintenance and calibration of the monitoring system is also specified.

6. Performance Indicators

The extent to which this BMP complies with the Project Approval and EPL requirements will be measured by the following performance indicators:

1. Compliance with relevant blasting impact assessment criteria at monitoring locations, in particular those representative of sensitive receptor locations;
2. Compliance with blast restrictions associated with time and blast numbers;
3. The frequency and extent of complaints reported to the mine in relation to blasting; and
4. Compliance with the *MAC-ENC-PRO-055 Blast Monitoring Program* and this plan, as indicated by internal and statutory reporting.

7. Continual Improvement

Mt Arthur Coal strives to continually improve on the mine's environmental performance by applying the principles of best practice to mining operations, including where cost-effective and practicable, the adoption of new best practice technologies and improved blast control measures. Progress will be monitored using the above noted performance indicators.

8. Reporting and Review

8.1. Reporting

Mt Arthur Coal will report on the performance of the Blast Monitoring Program in the Annual Environmental Management Report (AEMR) and provide regular updates to members of the Community Consultative Committee (CCC). The AEMR will include:

- Blast monitoring results and comparison to performance criteria;
- Blast related complaints and management/mitigation measures undertaken;
- Management/mitigation measures undertaken in the event of any confirmed exceedance of performance criteria; and
- Review of the performance of management/mitigation measures and the monitoring program.

The AEMR will also be submitted to the CCC and made available for public information at the MSC office and Mt Arthur Coal's website.

The Annual Return for EPL11457 will include a blast monitoring report covering the following items relating to blasting on site:

- The date and time of the blast;
- The location of the blast on the premises;
- The blast monitoring results at each blast monitoring station; and
- An explanation for any missing blast monitoring results.

8.2. Review

This BMP and associated monitoring plan will be reviewed, and if necessary revised to the satisfaction of the Director-General (in consultation with relevant government agencies) in accordance with Condition 4 of Schedule 5 of the Project Approval:

- within 3 months of the submission of an:
  - annual review under Condition 3, Schedule 5 of the Project Approval;
  - incident report under Condition 7, Schedule 5 of the Project Approval;
  - Independent Environmental Audit report under Condition 9, Schedule 5 of the Project Approval;
  - Modification to the conditions of the Project Approval.
- When there are changes to project approval or licence conditions relating to blast management or monitoring;
- Following significant incidents at Mt Arthur Coal relating to blasting;
- Following the conduct of an independent environmental audit which requires changes to the Blast Management Plan or to the blast monitoring practices; or
- If there is a relevant change in technology or legislation.

9. Responsibilities

Table 1 below summarises responsibilities documented in the Blast and Vibration Management Plan, and should be read in conjunction with this document. Responsibilities may be delegated as required.

Table 1: Blast monitoring program responsibilities

No.	Task	Responsibility	Timing
1	Overpressure and vibration limits as specified in project approval to be met.	Drill and Blast Superintendent	For each blast event.
2	Blasting for open cut to be conducted between the hours 9am to 5pm, Monday to Saturday only.	Drill and Blast Superintendent	For each blast event.
3	Maximum number of blasts averaged over a 12 month period for Mt Arthur Mine complex as specified in Section 2.3.	Drill and Blast Superintendent	For each 12 month period.
4	Written permission to Blast on Sundays or public holidays.	Environment Manager	As required.

No.	Task	Responsibility	Timing
5	Transgrid will be consulted prior to any modification to the existing agreement in relation to the Bayswater to Mt Piper 330/500KV transmission line.	Planning and Services Manager & Drill and Blast Superintendent	As required.
6	Where practical, blasting activities will be coordinated with surrounding mines to minimise cumulative impacts.	Drill and Blast Superintendent	As required.
7	Upon receiving a written request from owners of properties listed in Section 4.2, a structural inspection will be undertaken within 14 days and provided to the owner within 14 days of receipt.	Environment Manager	As required.
8	Air blast overpressure and ground vibration will be monitored at the monitoring locations for each blast event.	Environment Superintendent	For each blast event.
9	Monitoring to be undertaken in accordance with Blast Monitoring Program.	Environment Superintendent	For each blast event.
10	Any problems associated with multi-storey buildings caused by vibration will be investigated.	Environment Manager	As required.
11	Results of investigations of multi-storey buildings will be reported to DP&II.	Environment Manager	As required.
12	Blast monitoring report will be included with the Annual Return for EPL11457.	Environment Superintendent	Annually.
13	Blasting complaints to be responded to in accordance with Section 4.2.	Environment Superintendent	As required.
14	AEMR to include blast monitoring results, complaints, mitigation measures undertaken and a review of the monitoring undertaken.	Environment Superintendent	Annually.
15	Review to be undertaken of the Blast Management Plan.	Planning and Services Manager; Environment Manager;	As per section 8.2.

10. References

10.1. External Documents

Australian Standard AS 2187.2-2006 'Explosives—Storage and use Part 2: Use of explosives'
Department of Environment, Climate Change and Water (12 November 2009) Environmental Protection Licence 11457

Department of Planning, Minister of Planning's Project Approval document (dated 29 September 2010, Application Number 09-0062, Mt Arthur Coal Mine – Open Cut Consolidation Project.

Department of Planning (December 2008) Minister of Planning's Development Consent (dated 2 December 2008) Application 06_0091 Mt Arthur Underground.

Environment Protection Authority (January 2000) NSW Industrial Noise Policy
Hansen Bailey (2009), Mt Arthur Coal Consolidation Project Environmental Assessment. Prepared for Hunter Valley Energy Coal Pty Ltd.

URS Australia Pty Limited (2000) The Mount Arthur North Coal Project, Environmental Impact Statement. Prepared for Coal Operations Australia Limited.

10.2. Mt Arthur Coal Internal EMS Documents

MAC-ENC-PRO-041 Real Time Monitoring Response
MAC-ENC-PRO-042 Community Complaints Handling, Response and Reporting
MAC-ENC-PRO-055 Blast Monitoring Program
MAC-ENC-MTP-046 European Heritage Management Plan
MAC-ENC-MTP-024 Road Closure Management Plan

MAC-PRD-PRO-001 Developing Shotfiring Safe Work Procedures
MAC-STE-MTP-008 Mine Safety Management Plan
MAC-PRD-PRO-106 Environmental Approval for Blasting

Appendix 1: Project Approval and EPL Requirements

Table 2: Project Approval and EPL Conditions associated with blasting

<table>
<tr><th>Consent/Licence</th><th>Schedule : Condition</th><th>Condition / Requirement</th><th>Management Plan Section</th></tr>
<tr><td>Open Cut Consolidation Project Approval</td><td>3:10</td><td>Blast Impact Assessment Criteria
10. The Proponent shall ensure that blasts on site do not cause exceedances of the criteria in Table 8.
Table 8: Blasting impact assessment criteria
<table>
<tr><th>Location</th><th>Airblast overpressure (dB(Lin Peak))</th><th>Ground vibration (mm/s)</th><th>Allowable exceedence</th></tr>
<tr><td rowspan="2">Residence on privately owned land</td><td>120</td><td>10</td><td>0%</td></tr>
<tr><td>115</td><td>5</td><td>5% of the total number of blasts over a period of 12 months</td></tr>
<tr><td>Heritage sites, including Edinglassie and Rous Lench</td><td>133</td><td>10</td><td>0%</td></tr>
</table></td><td>Refer to Blast Monitoring Program</td></tr>
<tr><td>Open Cut Consolidation Project Approval</td><td>3:11</td><td>Blasting Hours
11. The Proponent shall only carry out blasting on site between 9am and 5pm Monday to Saturday inclusive. No blasting is allowed on Sundays, public holidays, or at any other time without the written approval of the Director-General.</td><td>5.0
8.0</td></tr>
<tr><td>Open Cut Consolidation Project Approval</td><td>3:12</td><td>Blasting Frequency
12. The Proponent may carry out a maximum of:
(a) 2 blasts a day;
(b) 12 blasts a week; and</td><td>5.0
8.0</td></tr>
</table>

Consent/Licence	Schedule : Condition	Condition / Requirement	Management Plan Section
		(c) 4 blasts a week with a maximum instantaneous charge of greater than 1,500 kilograms, averaged over a 12 month period, for all open cut operations at the Mt Arthur mine complex. This condition does not apply to blasts that generate ground vibration of 0.5 mm/s or less at any residence on privately-owned land.	
Open Cut Consolidation Project Approval	3:13	**Property Inspections** 13. By the end of November 2010, the Proponent shall advise the owners of privately-owned land within 3 kilometres of any approved blasting operations that they are entitled to a structural property inspection to establish the baseline condition of buildings and other structures on the property.	4.4
Open Cut Consolidation Project Approval	3:14	**Property Inspections Cont.** 14. If the Proponent receives a written request for a property inspection from any such landowner, the Proponent shall: (a) within 2 months of receiving this request commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Director-General, to: • establish the baseline condition of any buildings and other structures on the land; and • identify measures that should be implemented to minimise the potential blasting impacts of the project on these buildings or structures; and (b) give the landowner a copy of the property inspection report.	4.4
Open Cut Consolidation Project Approval	3:15	**Property Investigations** 15. If any landowner of privately-owned land within 3 kilometres (including the whole of the Racecourse Road area and the area southwest of Skellatar Stock Route) of blasting operations, or any other landowner nominated by the Director-General claims that buildings and/or structures on his/her land have been damaged as a result of blasting at the project, the Proponent shall within 3 months of receiving this request: (a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Director-General, to investigate the claim; and (b) give the landowner a copy of the property investigation report. If this independent property investigation confirms the landowner's claim, and both parties agree with these findings, then the Proponent shall repair the damage to the satisfaction of the Director-General.	4.4

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Consent/Licence	Schedule : Condition	Condition / Requirement	Management Plan Section
		If the Proponent or landowner disagrees with the findings of the independent property investigation, then either party may refer the matter to the Director-General for resolution.	
Open Cut Consolidation Project Approval	3:16	**Operating Conditions** 16. During mining operations on site, the Proponent shall: (a) implement best blasting practice to: • protect the safety of people and livestock in the area surrounding blasting operations; • protect public or private infrastructure/property in the area surrounding blasting operations from blasting damage; and • minimise the dust and fume emissions from blasting at the project; (b) co-ordinate the timing of blasting on site with the timing of blasting at the Drayton and Bengalla coal mines to minimise the potential cumulative blasting impacts of the three mines; and (c) operate a suitable system to enable the general public and surrounding landowners and tenants to get up-to-date information on the proposed blasting schedule on site, to the satisfaction of the Director-General.	2.1 3.1 3.2 3.3
Open Cut Consolidation Project Approval	3:17	**Blast Management Plan** 17. The Proponent shall prepare and implement a Blast Management Plan for the project to the satisfaction of the Director-General. This plan must: (a) be prepared in consultation with OEH, and be submitted to the Director-General for approval by the end of March 2011; and (b) describe the blast mitigation measures that would be implemented to ensure compliance with the relevant conditions of this approval, including detailed demonstration that blasting within the hatched area shown on the figure in Appendix 6 can be undertaken in a manner that will meet the blast impact assessment criteria in Table 8 at all times; (c) describe the measures that would be implemented to ensure that the general public and surrounding landowners and tenants to get up-to-date information on the blasting schedule; (d) include a road closure management plan, prepared in consultation with the applicable roads authority, that includes provisions for: • minimising the duration of closures, both on a per event basis and weekly basis; • avoiding peak traffic periods as far as practicable; and • coordinating with neighbouring mines to minimise the cumulative effect of road closures; and	1.3 & 3.5 2.1, 2.2 & 2.3 3.2 & 3.3 2.4 Refer to Road Closure Mgt Plan

Consent/Licence	Schedule : Condition	Condition / Requirement	Management Plan Section
		(e) include a blast monitoring program for evaluating blast-related impacts (including blast-induced seismic activity) on, and demonstrating compliance with the blasting criteria in this approval for: • privately-owned residences and structures; • items of Aboriginal (including scarred trees and axe grinding grooves) and nonindigenous cultural heritage significance (including Edinglassie, Rous Lench and Balmoral); and • publicly-owned infrastructure;	5.0 Refer to Blast Monitoring Program & European Heritage Management Plan
Open Cut Consolidation Project Approval	5:2	**Management Plan Requirements** 2. The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include: (a) detailed baseline data; (b) a description of: • the relevant statutory requirements (including any relevant approval, licence or lease conditions); • any relevant limits or performance measures/criteria; • the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures; (c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria; (d) a program to monitor and report on the: • impacts and environmental performance of the project; • effectiveness of any management measures (see c above); (e) a contingency plan to manage any unpredicted impacts and their consequences; (f) a program to investigate and implement ways to improve the environmental performance of the project over time; (g) a protocol for managing and reporting any: • incidents; • complaints; • non-compliances with statutory requirements; and • exceedances of the impact assessment criteria and/or performance criteria; and (h) a protocol for periodic review of the plan.	- Appendix 1 5.0 Refer to Blast Monitoring Program 6.0 2.0, 3.0, 4.0, 5.0 & 8.0 4.1 & 7.0 7.0 4.0 & 8.1 8.2

Consent/Licence	Schedule : Condition	Condition / Requirement	Management Plan Section
Open Cut Consolidation Project Approval	5:4	**Revision of Strategies, Plans and Programs** 4. Within 3 months of the submission of an: (a) annual review under condition 3 above; (b) incident report under condition 7 below; (c) audit under condition 9 below; and (d) any modification to the conditions of this approval, the Proponent shall review, and if necessary revise, the strategies, plans, and programs required under this approval to the satisfaction of the Director-General. *Note: This is to ensure the strategies, plans and programs are updated on a regular basis, and incorporate any recommended measures to improve the environmental performance of the project*.	8.2
Open Cut Consolidation Project Approval	5:7	**REPORTING** **Incident Reporting** 7. The Proponent shall notify the Director-General and any other relevant agencies of any incident associated with the project as soon as practicable after the Proponent becomes aware of the incident. Within 7 days of becoming aware of the incident, the Proponent shall provide the Director-General and any relevant agencies with a detailed report on the incident.	4.0
Open Cut Consolidation Project Approval	5:8	**Regular Reporting** 8. The Proponent shall provide regular reporting on the environmental performance of the project on its website, in accordance with the reporting arrangements in any plans or programs approved under the conditions of this approval, and to the satisfaction of the Director-General.	8.1
Open Cut Consolidation Project Approval	5:11	**ACCESS TO INFORMATION** 11. From the end of December 2010, the Proponent shall: (a) make the following information publicly available on its website: • a copy of all current statutory approvals for the project; • a copy of the current environmental management strategy and associated plans and programs; • a summary of the monitoring results of the project, which have been reported in accordance with the various plans and programs approved under the conditions of this approval;	Refer to Mt Arthur Coal Website

Consent/Licence	Schedule : Condition	Condition / Requirement	Management Plan Section
		• a complaints register, which is to be updated on a monthly basis; • a copy of the minutes of CCC meetings; • a copy of any Annual Reviews (over the last 5 years); • a copy of any Independent Environmental Audit, and the Proponent's response to the recommendations in any audit; • any other matter required by the Director-General; and (b) keep this information up to date, to the satisfaction of the Director-General.	
Open Cut Consolidation Project Approval – Appendix 3 Statement of Commitments	*2*	*Mt Arthur Coal's Environmental Monitoring Programs for air quality, water quality, noise and blasting will be reviewed and updated as required, in consultation with relevant regulators for approval by the Department.*	5.0 Refer to Blast Monitoring Program
Open Cut Consolidation Project Approval – Appendix 3 Statement of Commitments	*7*	*Mt Arthur Coal shall undertake blast monitoring and associated reporting at the Woodlands property in accordance with protocols approved by the Department of Planning and for a time frame to be agreed with Woodlands.*	5.0 Refer to Blast Monitoring Program
Open Cut Consolidation Project Approval – Appendix 3 Statement of Commitments	*13*	*Transgrid will be consulted consistent with current practice when blasting in close proximity to the high voltage transmission line located near to the southern boundary of the mining area (as per South Pit Extension EA Statement of Commitment No. 6.4.3)*	3.4
EPL 11457	M4.2	**Recording of Pollution Complaints** M4.2 The record must include details of the following: (a) the date and time of the complaint; (b) the method by which the complaint was made; (c) any personal details of the complainant which were provided by the complainant or, if no (d) such details were provided, a note to that effect; (e) the nature of the complaint;	4.2 & 4.3

Consent/Licence	Schedule : Condition	Condition / Requirement	Management Plan Section
		(f) the action taken by the licensee in relation to the complaint, including any follow-up contact (g) with the complainant; and (h) if no action was taken by the licensee, the reasons why no action was taken.	
EPL 11457	L7.1	**L7 Blasting limits** L7.1 Blasting in or on the premises must only be carried out between 0900 hours and 1700 hours, Monday to Saturday. Blasting in or on the premises must not take place on Sundays or Public Holidays without the prior approval of the EPA.	5.0 Refer to Blast Monitoring Program
EPL 11457	L7.2	**L7 Blasting limits** L7.2 The airblast overpressure level from blasting operations in or on the premises must not exceed: (a) 115 dB (Lin Peak) for more than 5% of the total number of blasts during each reporting period; and (b) 120 dB (Lin Peak) at any time. At any residence or noise sensitive location (such as school or hospital) that is not owned by the licensee or subject of a private agreement between the owner of the residence or noise sensitive location and the licensee as to an alternative overpressure level.	5.0 Refer to Blast Monitoring Program
EPL 11457	L7.3	**L7 Blasting limits** L7.3 The ground vibration peak particle velocity from blasting operations carried out in or on the premises must not exceed: (a) 5mm/s for more than 5% of the total number of blasts carried out on the premises during each reporting period; and (b) 10 mm/s at any time. At any residence or noise sensitive location (such as school or hospital) that is not owned by the licensee or subject of a private agreement between the owner of the residence or noise sensitive location and the licensee as to an alternative ground vibration level.	5.0 Refer to Blast Monitoring Program
EPL 11457	M8.1	**M8 Blasting monitoring** M8.1 To determine compliance with condition(s) L7.2 and L7.3: a) Airblast overpressure and ground vibration levels must be measured and electronically recorded at locations representative of impacts likely to be experienced at residential properties, or other sensitive receivers, resulting from the operation of the mine, - for all blasts carried out in or on the premises; and	5.0 Refer to Blast Monitoring Program

Consent/Licence	Schedule : Condition	Condition / Requirement	Management Plan Section
		b) Instrumentation used to measure the airblast overpressure and ground vibration levels must meet the requirements of Australian Standard AS 2187.2-2006.	
EPL 11457	R4.1	**R4 Reporting of Blast Monitoring** R4.1 The licensee must report any exceedence of the licence blasting limits to the regional office of the EPA as soon as practicable after the exceedence becomes known to the licensee or to one of the licensee's employees or agents.	8.1

Appendix 2: Blast Control Area

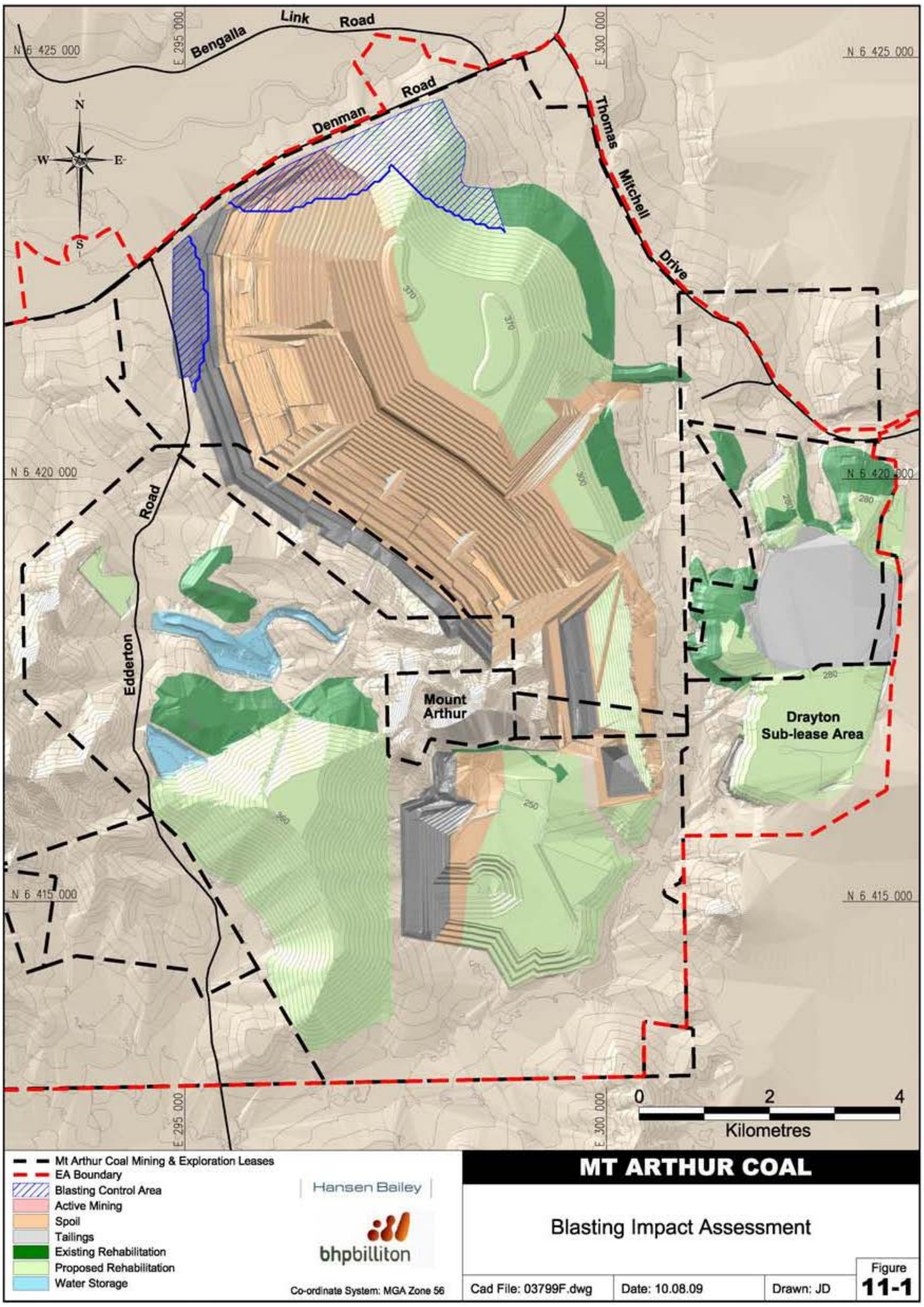

Figure 1: Blast control area

Appendix 3: Mt Arthur Coal - Blasting Technical Note

Mt Arthur Coal

New South Wales Energy Coal

Technical Note

Date: 29 April 2010

By: Jeff Hanlon

Subject: **Blasting Simplification**

Blasting – Vibration and Overpressure Discussion

Blasting is effectively the conversion of explosives into an energy form that is used to break rock. Like most processes, blasting is not totally efficient. Some of the energy created is transmitted into either the atmosphere above the blast or the ground adjacent to the blast. The energy lost to the atmosphere is referred to as overpressure, while the energy lost to the adjacent ground is referred to as vibration. To a neighbour, vibration would be perceived as a shake of the ground or building while overpressure is registered as noise or a rattle of the windows.

As a generalisation, distance is the most important issue for both these items where an increase in distance away from a blast will result in a reduction of both overpressure and vibration at a point of interest.

Vibration

Vibration is the movement of the ground adjacent to the blast due to some of the energy not being used in the rock breakage process. It travels as a set of three waves through the rock, one wave in each dimension (simple view).

Good predictive models exist for vibration as the ground is relatively constant. The models do simplify some geological impacts such as faulting and bedding, but they do enable reasonable predictions of vibration at points of interest, once a model has been developed. Models for vibration contain two variables, distance and maximum instantaneous charge (MIC), and two constants which are unique for each point of interest.

The mathematical expression relating distance and MIC has constants of 784.7 and -1.7 for vibration estimates at Edinglassie. Thus it is possible to predict the vibration at Edinglassie from any blast in the mine. Some simplified examples are shown in Table 1.

Table 1 – Simplistic Model for Edinglassie

Distance	500	1000	250	500	500
MIC	1000	1000	1000	2000	500
Vibration	7.2	2.2	23.3	13.0	4.0

From the table, it can be seen that distance has an inverse function in the order of 150%. That is, if the distance is halved, the resultant vibration is 3 times as high. In the case of charge, the function is of the order of 100%. That is, a doubling of the charge, doubles the resultant vibration. It should be noted that this relationship is different at every point of interest.

With respect to vibration impacts on other heritage homesteads in the area, blasting will be designed to ensure the stipulated licence conditions are met. In the case of Windmill Pit blasts, they will be designed to manage the vibration to the limits stated for Edinglassie as both Rous Lench and Balmoral are further away from the influence of blasting and thus, based on the distance component of the vibration equation, will experience a lower vibration than Edinglassie (considerably lower in the case of Balmoral). In the case of blasting in Macleans Hill, Rous Lench is the closest heritage property. It will be managed to the 10mm/s stated in the licence conditions. Achievement of this outcome will ensure vibration is less than 10 mm/s at both Balmoral and Edinglassie as they are further from blasting than Rous Lench. Additionally, the blast monitor at Yammanie is representative of Balmoral and will be used in conjunction with the Edinglassie monitor to verify compliance with the private residence criteria outlined in the Project Approval.

Overpressure

Overpressure relates to the movement of the air adjacent to the blast and how that movement is transmitted through the atmosphere. Unlike the ground, the atmosphere is not even remotely homogeneous. Thus there are a significant number of impacts on the amount of overpressure created from a blast that cannot be controlled. Overpressure cannot be as successfully modelled as vibration. The most successful model is achieved through the development of a database of actual results and the use of historical data to estimate blast outcomes.

The two main influences on overpressure are the atmospheric conditions and the pathways from a blast that reach the atmosphere. Atmospheric conditions include weather, humidity, wind speed and direction, inversions, cloud cover and fog. The pathways that are available for energy release include lack of confinement of the blast hole, holes too close to the edge of a blast, faulting and cracking.

As with vibration, distance and charge weight influence the overpressure result: i.e. the further from a blast and the less explosive involved, the lower the overpressure will be. This point can be erroneous on rare occasions when the overpressure "bounces" off an inversion layer and is transmitted a large distance away from a blast.

A good discussion of this information can be found at

http://terrock.com.au/vibration/blasting.html

Actual Data

In Appendix 1, a set of actual blast results have been provided. All of these shots have been fired since the end of 2008 in the Windmill Pit which is the closest to Edinglassie and Rous-Lench.

As can be seen from the data, all but one MIC provides results <10mm/s at Edinglassie. In fact, the data suggests that other variables have an important role in determining a vibration outcome. The main issue would probably be the delay scatter. The value supplied for MIC assumes that there are 3 holes initiating at the one time. The lower than expected vibration is probably related to the actual quantity of explosive rather than the predicted volume. This supports a view that engineering a solution that takes out the potential for hole initiation overlap would give a positive outcome at the relevant point of interest.

In the case of the one result over 10mm/s, detailed investigation found that a small number of holes had been marginally over-drilled, the shot was tied as a box cut and the worst case scenario of multiple holes initiating together all compounded to give 10.99mm/s at the Edinglassie blast monitor. Edinglassie blast monitor is used for management purposes only.

Reduction Strategies

The major influences on both overpressure and vibration are geography and blast issues. As the geography is fixed, all reduction processes will predominantly focus on the blasting issues.

Vibration management relates to how a point of interest "sees" a blast. Simplistic changes to the blasting process are reductions in explosives being fired at any one time. However, the same explosives quantity per blast hole can give widely different vibration results.

The current method of blasting at MAC uses pyrotechnics. Thus any quoted MIC will encompass an assumption that 3 holes are firing at the same time. This is due to the inherent inaccuracies with this method of initiation (delay scatter). Current blasting practices in the Windmill Pit have been changed so that slower delay times are used between holes. This gives rise to a longer gap between holes firing, which in turn, negates the compounding effect of timing overlap because there are longer time gaps between individual holes initiating.

Appendix 2 shows Table 3 from the Orica report *Affects of Expansion on Blasting Operations – October 2009*, previously provided as part of the adequacy assessment of the Mt Arthur Coal Consolidation Environmental Assessment. Table 3 shows a matrix of drill holes sizes and the use of electronic detonation of blasts to demonstrate how vibration levels at Edinglassie and

Rous Lench are able to be met, and how blasting practices can vary close to receivers to achieve acceptable results.

The first column shows the criteria to be met through the application of site laws and principles of electronics (either 5mm/s or 10mm/s depending on the location).

Columns two to five compare drill bit thickness, ie the width of the drill hole (Mt Arthur Coal currently utilises 200mm, 251mm and 270mm drill bits), and the depth of the hole. Essentially, the depth and width of the hole will govern the amount of explosive that can be used in each hole. For example, a 200mm hole drilled to 15 metres can use the same amount of explosive as an 11.2m hole drilled to 270mm.

The remaining columns represent metres from the monitor (listed in column 1) that a shot can be fired, using the relevant drill hole width to achieve the result of five or ten mm/s at the receiver.

Columns six and seven assume single and double holes firing at the same time – this would be achieved as described below using electronic initiation rather than traditional pyrotechnic methods.

The final column illustrates triple hole firing, which is achieved using pyrotechnics currently used onsite.

For example, a 15m deep hole drilled using a 200mm diameter drill bit and standard pyrotechnic initiation (as currently employed onsite) may potentially exceed vibration limits at Edinglassie / Rous Lench if the blast is within 470m of the homesteads. (as read from Row 12 of Table 3). This distance could be varied through the use of electronic initiation (to double shot precision) to 385 metres. The same results could be achieved through using a 270mm drill bit and a drilling depth of 11.2m.

As MAC moves closer to receivers, further adjustments may have to be made. The MIC can be adjusted a number of ways. They include:

- Decking
    - Decking effectively splits a hole up into a number of smaller explosions. Each deck of explosives is fired at a different time and separated from another by a layer of stemming. This system is commonly used in industry today and reduces the MIC in a reasonably simple way.
- Hole diameter
    - Reduction of hole diameter reduces the quantity of explosive in a hole thus reducing the MIC.
- Hole length
    - Reduction of hole length reduces the quantity of explosive in a hole thus reducing the MIC.

- Electronics
  - Electronic initiation systems allow two features to reduce vibration:
    - Firstly, their accuracy is significantly enhanced over the standard pyrotechnic initiation systems. This allows for less scatter and thus, single hole firing. Effectively, depending on the tie up method being used, the MIC will be reduced by half to two thirds, due to one hole initiating at once rather than two or three.
    - Secondly, as the system is extremely accurate, different timing arrangements can be used which will dictate the order in which holes go off. This allows for less confinement of the blast, resulting in the transmission of less energy in the form of vibration.
- Tie Up
  - The tie up dictates the order in which holes fire.
  - Different tie ups will produce different results for the post blast profile. Typically, the post blast profile is designed to move material to final profile and assist with digging operations.
  - A fairly simple change in tie up can sometimes reduce the vibration output from a shot.
  - By firing a shot away from points of interest, the resultant vibration is reduced as the compounding nature of the vibration waves travels away from those points.
- Shielding
  - It is possible to fire a shot in a specific way to establish a zone of broken rock first between the main body of the shot and the point of interest. Effectively a “curtain” of broken rock is created which inhibits vibration transmission towards the point of interest.

Blasting results are continually assessed to ensure all vibration criteria are met. All of these options will be applied to the review of blasting to ensure the best technique is applied to future blasting. The achievement of stipulated targets is paramount and as such the appropriate resources and techniques will be applied.

The best way to manage overpressure from a blast is to develop effective guidelines as to when the environmental conditions permit blasting and to ensure good blast practices exist on site.

The environmental guidelines currently in place at Mt Arthur Coal ensure that the prevailing weather conditions are taken into account when blasting. Information is provided to the Drill and Blast team related to inversions, wind direction and speed. This information, together with general weather advice, is utilised to formally gain approval for a blast. Once approval is gained, the team will prepare the blast. At any time between being given approval and the firing of the shot, the shot can be called off if conditions change to a point where there will be poor outcomes offsite from a blast. As with all models, the environmental inputs are continually reviewed to ensure they stay effective and relevant.

In the case of blasting practices, the systems for blasting need to account for the geology of an area, the geography of a blast and good practice. At the design stage, blast hole location takes account of any geological anomalies such as faults. In the field, hole location is adjusted based on any ground cracking observed and the location of the blast free face. During the design of the charging, stemming lengths are set based on conservative overpressure outcomes. During the actual charging process, the shot crew are able to manage any unforeseen circumstances (such as cracked ground) which could impact overpressure. Stemming lengths are regularly increased and holes occasionally undercharged to reduce overpressure results. Also, the shot is typically tied up so that any energy releases are orientated away from the mine boundaries.

Summary

Overpressure and vibration are effectively managed at MAC. Experts have confirmed that with careful blast specific design, overpressure and vibration will stay below target levels at sensitive receptors for all blasts. As mining moves closer to the boundaries and the distance to neighbours shrinks, blasting practices will be adjusted to ensure conditions are met.

Table 3: Vibration data for Windmill North

Blast Name	Date Fired	MIC (kg)	Vibration	Distance
WMn1916/EG1	15/12/2008	2,787	8.62	1201
WMn1918/EG1	30/12/2008	2,087	3.87	1317
WMn1920/EG1	5/01/2009	2,102	5.71	1467
WMn2014/BA	18/02/2009	1,808	5.00	1009
WMn2515/BOW	24/02/2009	663	2.64	644
WMn2213/Ramp	4/03/2009	713	2.94	664
WMn2316/BOW	4/03/2009	1,635	5.00	818
WMn2020/CB	4/03/2009	970	0.25	1345
WMn2416/BOW	13/03/2009	1,269	3.44	741
WMn2017/CT	13/03/2009	999	3.55	1086
WMn2516/BOW	20/03/2009	1,254	2.15	666
WMn2317/BOW	26/03/2009	1,082	5.13	923
WMn2517/BOW	9/04/2009	951	2.32	820
WMn1919/T	18/05/2009	527	1.22	1209
WMn2215/BL	3/07/2009	742	4.23	871
WMn2315_RL150	13/07/2009	1,574	6.01	770
WMn2020/BA	14/07/2009	1,306	1.13	1321
WMn2320/VU	14/07/2009	1,898	5.90	1069
WMn2317/VU	22/07/2009	1,727	7.17	2588
WMn2016/BA	22/07/2009	1,021	4.36	1097
WMN2415_RL150	30/07/2009	1,775	7.11	681
WMn2419_RL150	6/08/2009	888	5.38	894
WMn2515_RL150	21/08/2009	708	6.42	572
WMn2517_RL150	2/09/2009	900	9.38	701
WMn2519_RL150	19/09/2009	737	3.66	940
WMn1920/R1	7/10/2009	2,082	2.86	1504
WMn1918/R1	15/10/2009	3,403	3.48	1360
WMn1916/R1	21/10/2009	693	5.47	1245
WMn1821/R1	21/10/2009	1,752	1.64	1726
WMn2520_RL130	30/10/2009	477	6.98	1094
WMn2117/BL	10/12/2009	956	6.16	1017
WMn2418_RL130	10/12/2009	1,338	10.99	1503
WMn2517_RL130	10/12/2009	1,845	10.99	1503
WMn2217/BL	17/12/2009	1,097	2.70	950
WMn2518_RL130	17/12/2009	1,593	6.44	969
WMn2219/BL	23/12/2009	1,489	2.48	1164
WMn2119/BL	6/01/2010	2,022	1.93	1218

Table 4: Orica Report

Summary of PPV Distance Contours*

POI	200mm Horizon Thickness (m)	229mm Horizon Thickness (m)	251mm Horizon Thickness (m)	270mm Horizon Thickness (m)	Single Hole Minimum Distance (m)	Double Hole Minimum Distance (m)	Triple Hole Minimum Distance (m)
Denman Road West 5 mm/s	5	5	5	5			
	10	9.0	8.6	8.5			
	15	12.9	11.8	11.2			
	20	16.7	15.0	13.9			
	25	20.5	18.2	16.7			
	30	24.3	21.3	19.4			
	35	28.1	24.5	22.2			
	40	31.9	27.7	24.9			1150
Edinglassie / Rous-lench 10 mm/s	5	5	5	5			
	10	9.0	8.6	8.5			350
	15	12.9	11.8	11.2		385	470
	20	16.7	15.0	13.9	325	460	565
	25	20.5	18.2	16.7	370	525	645
	30	24.3	21.3	19.4	415	585	715
	35	28.1	24.5	22.2	450	635	780
	40	31.9	27.7	24.9	485	685	840
Racecourse Road 5 mm/s	5	5	5	5			
	10	9.0	8.6	8.5			
	15	12.9	11.8	11.2			
	20	16.7	15.0	13.9			
	25	20.5	18.2	16.7			
	30	24.3	21.3	19.4			
	35	28.1	24.5	22.2			
	40	31.9	27.7	24.9			
Scriven 5 mm/s	5	5	5	5			
	10	9.0	8.6	8.5			
	15	12.9	11.8	11.2			
	20	16.7	15.0	13.9			
	25	20.5	18.2	16.7			
	30	24.3	21.3	19.4			
	35	28.1	24.5	22.2			
	40	31.9	27.7	24.9			
Sheppard Avenue 5 mm/s	5	5	5	5			
	10	9.0	8.6	8.5			
	15	12.9	11.8	11.2			
	20	16.7	15.0	13.9			
	25	20.5	18.2	16.7			
	30	24.3	21.3	19.4			
	35	28.1	24.5	22.2			
	40	31.9	27.7	24.9			

* This table is based on the current Site law information and should be used for feasibility purposes only (not for daily production blasting requirements)

[grey shading] Exsiting blasting methods acceptable

Table 3 – PPV Distance Contours

Appendix 4: Correspondence Records

Telephone correspondence on 16 March 2011, 3.38pm

Steve Perkins from Mt Arthur Coal contacted Steve Clair from the Department of Environment, Climate Change and Water (now Office of Environment and Heritage) on 16 March 2011 and asked if Mt Arthur Coal could meet with him to review Management Plans. Steve Clair advised that the Department of Environment, Climate Change and Water does not provide comment on Management Plans. Steve Clair informed Steve Perkins that he could send the Management Plans to him for review, but that he would not submit any comments on the Management Plans.

Email correspondence on 31 March 2011, 4.12pm

From: Perkins, Steven R (NSWEC)
Sent: Thursday, 31 March 2011 4:12 PM
To: 'steve.clair@environment.nsw.gov.au'
Subject: Blast Management Plan
Attachments: MAC Blast Management Plan Final Draft 110331.doc; MAC Blast Monitoring Program Final Draft 110331.docx

Good afternoon Steve,

Please find attached the Mt Arthur Coal Blast Management Plan and Blast Monitoring Program for your review.

Regards,
Steve

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resourcing the future

Steven Perkins
Environmental Superintendant
Mt Arthur Coal
NSW Energy Coal

BHP Billiton
Thomas Mitchell Drive, Muswellbrook, 2333, NSW, Australia
Mail To Steven.R.Perkins@bhpbilliton.com
Internet http://www.bhpbilliton.com
Phone +61 2 6542 4874
Mobile +61 408 220 765
Please consider the environment before printing this email

Contact: Ben Harrison
Phone: 02 6575 3402
Fax: 02 6575 3515
Email: benjamin.harrison@planning.nsw.gov.au
Our ref: 10/20755

Michael White
General Manager Operations
Mt Arthur Coal
PMB 8
MUSWELLBROOK NSW 2333

Dear Mr White,

Mt Arthur Coal Mine – PA 09_0062
Environmental Monitoring and Management Plans

Thank you for forwarding the following management plans required under project approval 09_0062 for the Department's consideration:

- Blast Management Plan (Condition 17 of Schedule 3);
- Biodiversity and Rehabilitation Management Plan (Condition 40 & 44 of Schedule 3);
- Rehabilitation Strategy (Condition 42 of Schedule 3).

The Department has reviewed these plans (as amended following previous correspondence) and is satisfied that they generally address the requirements set out in the relevant conditions of the project approval. Consequently, I would like to advise you that the Director-General has approved the plans.

Could you please forward finalised copies of the above plans for the Department's records at your earliest convenience.

Should you have any enquiries on this matter please contact me on (02) 6575 3402.

14.11.12

Ben Harrison
A/Team Leader Compliance

As Nominee for the Director-General

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NSW GOVERNMENT | Planning & Infrastructure

Contact: Ben Harrison
Phone: 02 6575 3402
Fax: 02 6575 3515
Email: benjamin.harrison@planning.nsw.gov.au

Our ref: 10/20755

Michael White
General Manager Operations
Mt Arthur Coal
PMB 8
MUSWELLBROOK NSW 2333

Dear Mr White,

Mt Arthur Coal Mine – PA 09_0062
Environmental Monitoring and Management Plans

Thank you for forwarding the following modified management plans required under project approval 09_0062 for the Department's consideration:

- Blast Management Plan, inclusive of monitoring program (Condition 17, Schedule 3);
- Air Quality Management Plan inclusive of monitoring program(Condition 24, Schedule 3)
- Noise Management Plan, inclusive of monitoring program (Condition 9, Schedule 3)
- Environmental Management Strategy (Condition 1, Schedule 5)

The Department has reviewed these plans and is satisfied that they generally address the requirements set out in the relevant conditions of the project approval. Consequently, I would like to advise you that the Director-General has approved the plans.

Could you please forward finalised copies of the above plans for the Department's records at your earliest convenience.

Should you have any enquiries on this matter please contact Ben Harrison on (02) 6575 3402.

Scott Brooks
Team Leader Compliance

As Nominee for the Director-General
27 - 5 - 2013

NSW GOVERNMENT | Planning & Environment

Contact: Ben Harrison
Phone: (02) 6575 3402
Fax: (02) 6575 3415
Email: benjmain.harrison@planning.nsw.gov.au
Our Ref: MP 09_0062

Xavier Wagner
General Manager Operations
Mt Arthur Coal
PMB 8
MUSWELLBROOK NSW 2333

Dear Xavier

Mt Arthur Coal Mine –Approval of Revised Blast Fume Management Strategy

Thank you for forwarding the revised Blast Fume Management Strategy for the Department's consideration.

The Department has reviewed the plan and accordingly, I wish to advise you that the Secretary has approved the plan.

Could you please ensure that the finalised Blast Fume Management Strategy is forwarded to the Department at your earliest convenience and that the plan is uploaded onto the company's website as soon as possible.

Should you have any enquiries on this matter please contact Ben Harrison on (02) 6575 3402.

Yours sincerely

Scott Brooks
Team Leader Compliance
As nominee of the Secretary
26-6-2014

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Appendix 5: Blast Fume Management Plan

(REVIEW FREQUENCY: 2 Years)

CONTENTS

AUTHOR:	**NAME:**	**Adrian Williams**
	POSITION:	**Acting Drill & Blast Superintendent**
AUTHORISED:	**NAME:**	**Michael White**
	POSITION:	**Technical Services Manager**
	SIGNATURE:	**Master Copy Signed by Technical Services Manager**

1. PURPOSE

The purpose of this plan is to address the issues related to blast fume. Specifically, this plan will detail:

- the methods used on site to reduce the generation of blast fume,
- the timing of shots to reduce the impact of fume on the environment, and
- the data collection and reporting requirements

2. AIM

The aim of this plan is to employ a pro-active approach to reduce the quantities of visible blast fume in the first instance and then to ensure that, if produced, the fume has no potential to leave site.

A secondary aim of the plan is to enable a reporting structure to feed back into the drill and blast design process and reduce the risk of re-occurring fume related incidents.

3. REFERENCES

The main reference document used in the development of this plan is the AEISG Code of Practice – Prevention and Management of Blast Generated NOx Gases in Surface Blasting (the Code). A secondary reference document is the Queensland Guidance Note (QGN 20 v3) – Management of Oxides of Nitrogen in Open Cut Blasting.

4. BACKGROUND

The first item to state in this Plan is that, as quoted in the Code, "It should be understood that, given the complexity of the problem and the inherent variability in the blasting environment, NOx events may still occur even after prevention and mitigating actions have been put in place."

Fume and dust are normally occurring by-products of any blasting operation. The quantities of each produced from a blast are determined by a large number of variables, some of which are better understood than others.

Dust from blasting is predominantly managed by only blasting in conditions where the prevailing weather conditions cause the production of such dust to remain on site.

In an ideal blasting environment, nitrogen, carbon dioxide and steam are the only gaseous products produced. As all of these products are effectively colourless and odourless; there are no concerns with their production.

Typically, there is no such thing as an ideal blasting environment. Thus, some of the explosive material can be converted into gases nominally called oxides of nitrogen (NOx) or carbon monoxide. Some of these gases are visible and some are invisible. Nitrogen dioxide is the main contributing gas to the colour of the fume that may cause issues for health and the environment. It is either a product of a non ideal blast or is created by the “oxidation” of another toxic gas, nitric oxide.

In order to develop this fume management strategy NOx gas causes and mitigation measures were assessed, which are outlined in Appendix A. These causes and mitigation measures were assessed in conjunction with the AEISG Code of Practice.

5. RESPONSIBILITIES

Role	Accountabilities for fume management
Drill and Blast Engineer	• Ensure designs take into account the potential for fume by assessing (inter alia) the following: - Horizon risk level - Expected hole conditions for the blasting material type - Correct energy match for material type - Designed powder factor - Product selection - Expected sleep time - Bench topography • Ensure D&B design are signed off by the D&B Superintendent (Production Planning) or D&B Senior Engineer • Ensure the charge sheets are developed using measured data • Ensure charge sheets are approved by D&B Superintendent (Production Planning) • Ensure any alterations to previously approved charging plans are re-approved by the D&B Superintendent (Production Planning) • Ensure the reporting protocol is followed
Drill and Blast Superintendent (Planning Production)	• Ensure this management plan is communicated to all personnel involved in the blasting process • Ensure D&B Engineers are taking into account the potential for fume generation for all D&B designs and that these design are signed off by an experienced D&B engineering person (Superintendent or Senior Engineer) • Ensure the shot firer in charge of the blast has a charge plan prior to loading • Approve all charge plans • Approve all alterations to previously approved charging plans • Ensure the reporting protocol is maintained • Ensure this plan is audited every two years • Report and track fume ratings • Escalate fume events to the appropriate areas in accordance to the NSWEC Escalation Process • Maintain horizon risk matrix • Ensure all blasts are scheduled to reasonably expected weather windows • Conduct a pre-scheduling risk assessment for all high risk blasts • Monitor sleep time of all blasts
Drill and Blast Superintendent (Production)	• Ensure the explosive supplier(s) meets the required standard for their explosives, as the contract owner • Ensure relevant approvals are in place prior to initiating a blast. • Ensure hazards related to blast fume are incorporated in operating standards and procedures for drilling, charging, stemming, blast guarding and post blast inspections

	• Ensure that all personnel working on the shot are trained and competent • Sign off of all blasting schedules
Drill Supervisor	• Coordinate drill activities in consultation with the D&B engineers • Coordinate drill bench preparation prior to drilling and where possible minimise the potential for water pooling on the pattern • Ensure drillers are fulfilling their responsibilities • Coordinate water management activities on the pattern from the bench preparation stage through the completion of drilling
Driller	• Drill the drill pattern to plan • Notify the Drill Supervisor when conditions cause a change to the design, which include: - Strata hardness - Depth to coal seam - Moisture conditions • Ensure adequate hole protection is in place (eg. Use of hole savers for holes greater than 15m)
Blast Supervisor	• Ensure adequate resources are assigned to blasting activities • Ensure the charge plan is followed • Ensure any changes to the charge plan are approved by the D&B Superintendent (Production Planning) • Ensure shot firers are fulfilling the shot firer's responsibility • Report all fume events to D&B Superintendent (Production) • Ensure approvals for blasting are in place before initiating a shot • Ensure the sentries are placed at the appropriate locations to reduce the risk of fume exposure for personnel on site • Ensure blasting activities follow blasting standards and procedures for shot prep, charging, stemming, blast guarding and post blast inspections
Shot Firer	• Ensure the charging plan is followed • Ensure that any changes to the charging plan are discussed with the D&B technical service department prior to their implementation and an alteration to design form is completed and signed off by the D&B Superintendent (Production Planning) • Supervise trainee shot firers • Ensure explosive supplier(s) are recording hole by hole loading • Monitor product usage during loading • Ensure blasting activities are completed in accordance with the drill and blast standards and procedures, in particular: - Managing loading activities to prevent contamination of explosives - Appropriate stemming practices are employed - Accurate placement of gas bags - Ensure adequate hose handling techniques are employed - Cup density checks are conducted to ensure correct densities are met - Identify and record any hole slumping • Ensure all reporting is completed to requirements

6. BLAST FUME MANAGEMENT

The AEISG mentions that practically fume generating conditions might be a result from one or many of the following conditions:

1. Explosive formulation and quality assurance.
2. Geological conditions.
3. Blast Design.
4. Explosive product selection.
5. On-bench practices.
6. Contamination of explosive in the blast-hole.

It can be seen that there are a number of variables that can occur through the drilling, loading and firing processes that contribute to the generation of blast fume. Mt Arthur's strategy is to control and/or eliminate all these factors where possible. The objective is to take a pro-active approach that will assist in keeping fume generated from blasts to a low level.

This pro-active approach requires considering the impacts that each decision throughout the whole process has on potentially to generating post blast fume in each shot. Therefore through the assessment of causes and mitigating measures required to reduce to the generation of blast fume, the following fume management strategy outlined below in Figure 1 was developed.

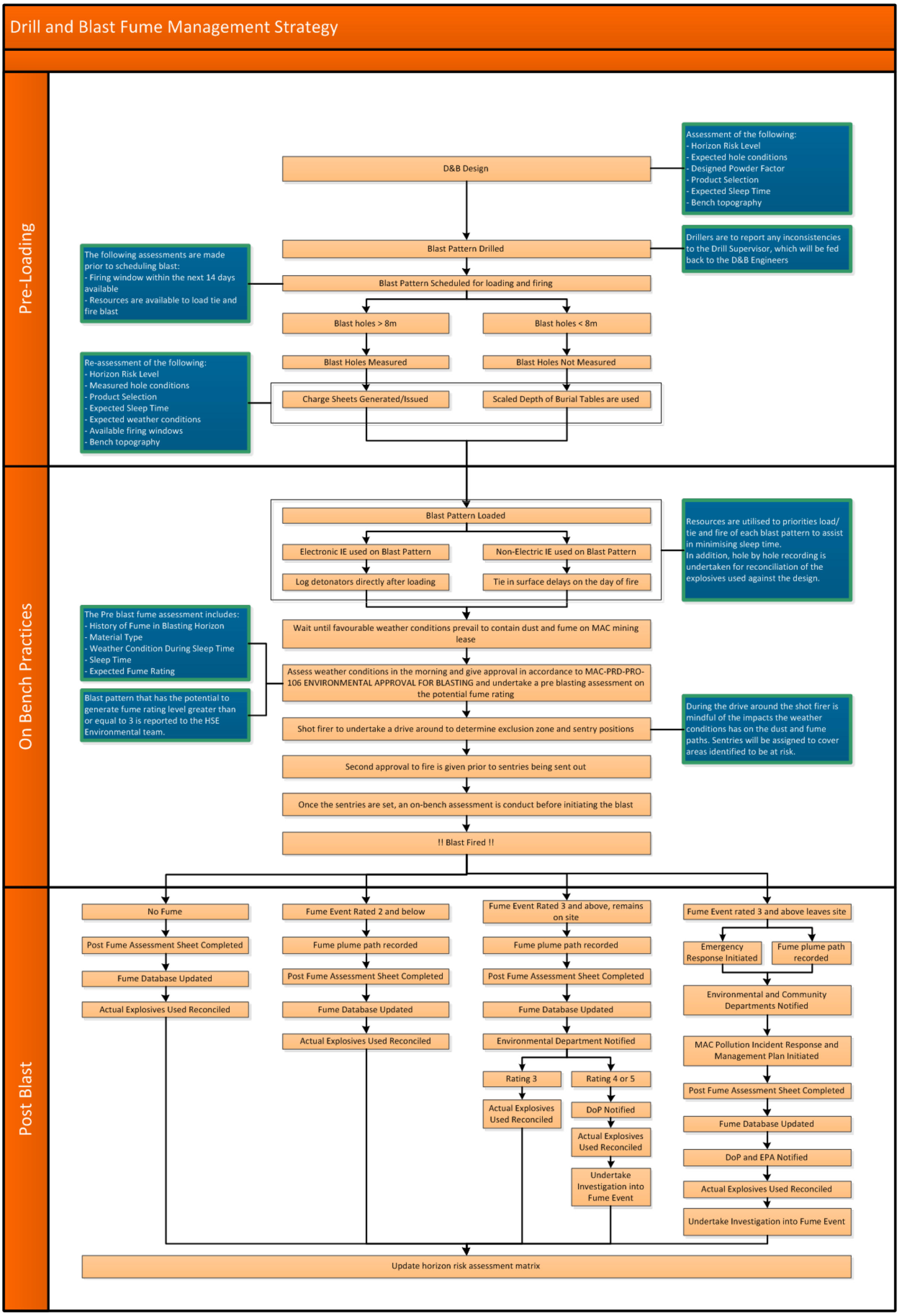

Figure 2. Drill and Blast Fume Management Strategy

As can be seen in the above fume management strategy, the blasting process in relation to fume management is split up into three main areas:

1. Pre-loading – Pro-active
2. On bench practices – Pro-active and Re-active (depending on the actions taken)
3. Post-blast – Re-active.

Through the development of the strategy and in reference to the AEISG Code of Practice there are 9 areas that need to be focused on in mitigating fume for all blasts. Two of these areas are required in order sustain this pro-active strategy (training and reporting). These areas are as follows:

1. Horizon Risk Matrix
2. Shot Design
3. Sleep Time
4. Explosive Quality
5. Explosive Selection
6. On-Bench Practices
7. Blast Initiation
8. Reporting and Documenting
9. Training

6.1 Horizon Risk Matrix

A common control to mitigate the cause of fume is to understand geology of each shot and design (timing and explosive product) to ensure adequate relief in weak/soft strata.

To improve this understanding a blast horizon risk matrix has been developed for the strata that have been blasted at Mt Arthur Coal.

This horizon risk matrix was developed and is maintained using historical data (fume data captured since July 2012) and the following risk matrix.

% of shots that fumed	**% of fume events >=3**				
	0% and mostly 1's	0% and mostly 2's	<=20%	>20% and <= 50%	>50%
>=80%	Medium	Medium	High	High	High
0>= 60% and < 80%	Low	Medium	High	High	High
>= 50% and <60%	Low	Medium	Medium	High	High
>=25% and <50%	Low	Low	Medium	Medium	High
<25%	Low	Low	Low	Medium	Medium

As it can be seen from the above risk matrix, each horizon is defined into one of three risk levels; low, medium or high. These risk levels help define the necessary controls to put in place throughout the entire drill and blast process. These controls are outlined below:

6.1.1 High Risk Horizons

a. Use Emulsion products on these horizons
b. Ensure the blast pattern is designed for appropriate energy match to explosive product within the required fragmentation limits
c. Do not use Heavy ANFO products in these horizons
d. Ensure sleep time is kept to minimum
e. Follow an uninterrupted load-tie-fire process in these horizons

6.1.2 Medium Risk Horizons

a. Use MAC charging rules
b. Ensure the blast pattern is designed for appropriate energy match to explosive product
a. Ensure sleep time is kept to minimum
b. Follow an uninterrupted load-tie-fire process in these horizons

6.1.3 Low Risk Horizons

c. Use MAC charging rules
d. Ensure sleep time is kept to minimum
e. Follow an uninterrupted load-tie-fire process in these horizons

6.2 Shot Design

Shot design is largely dictated by dig design. The primary focus is to provide the optimal breakage of the rock to enable the material to be loaded out safely and efficiently.

Shot depth is determined by either the target coal seam, the dig design or the maximum capacity of the drills. The maximum drill depth currently on site is 50m as holes of this depth are typically wet and the drills struggle to capture the cuttings under the dust curtains when the holes are that length.

The following factors that are considered throughout the shot design process to help mitigate blast fume generation are:

1. Ensure adequate controls are considered for the horizon risk level the blast is located in.
2. Assessment of the expected hole conditions.
3. Consideration for the expected sleep time of the blast.
4. Designing the pattern with an appropriate powder factor to ensure energy match to the explosive product used.
5. Assessment of bench topography to understand the impacts of surface runoff in the event of rain.
6. Providing appropriate separation of explosive decks.

All designs are peer reviewed and signed off by either the D&B Superintendent or the Senior D&B Engineer prior to implementation.

6.3 Sleep Time

Sleep time is defined on site as the time between loading the first explosive into the shot and the firing date measured in days.

Generally, the manufacturers' guidelines are used to determine what the sleep time should be for explosives. Manufacturers determine sleep time based on factors other than fume creation; however it is generally accepted that an increase in sleep time causes an increase in fume creation.

Mt Arthur Coal is highly focused on ensuring that any fume and/or dust generated from blasts remains onsite within the controlled blast exclusion zone, which has no impact on site personnel, surrounding neighbours and the local community. Therefore once the shot is charged, the blast will only be fired when the weather conditions are appropriate. At times this can result in blast sleeping for extended periods of time.

In order to help ensure that sleep times are kept to a minimum for all shots, Mt Arthur Coal targets a maximum sleep time of 14 days and in any event, aligned with the explosive manufacturer's recommendation. Risk in achieving this target is present in highly sensitive areas in the northern region of the operation. This causes the operation to adopt a focus of only scheduling the loading of shots once a reasonably expected firing window is identified for blasts in these high sensitive areas. These windows are identified by a combination of weather forecasts, seasonal weather patterns and actual recent weather conditions that have been monitored at Mt Arthur Coal. To achieve these windows and maintaining the focus on keeping the sleep times to a minimum, Mt Arthur Coal follows an uninterrupted load and tie approach for the blasts located in highly sensitive areas in the northern region of the operation. This allows MAC capitalise on the next available opportunity to initiate these blasts. Consideration of other weather conditions such as rainfall, which may prevent the shot crew from completing the blasts on time are also undertaken prior to loading.

6.4 Explosive Quality

The quality of the explosive supplied to site is managed within the Explosives Supply contract in place at the time. The primary contract is currently with Orica Limited and the current document details the standards required to be met by the supplier to ensure the explosives meet the site's needs. The contract also details audit requirements and frequencies of inspections.

Secondary suppliers are subject to the same reviews and inspection requirements.

6.5 Explosive Selection

Outlined in the AEISG Code of Practice and the cause and control matrix in Appendix A, a key contributor to post blast fume generation is the mismatch between explosive product and hole/ground conditions.

The site uses the standard explosives available being ANFO, Heavy ANFO and emulsion. Although under some conditions Heavy ANFO is considered to have water resistant properties, ANFO and Heavy ANFO are classed as dry products and emulsion is considered as wet product.

The actual explosive type used is dependent on the depth of the hole, the quantity of water in that hole and the horizon risk level the blast is located in. There are a variety of rules which have been developed over time which stipulate what types and quantities of explosives are used, in which position in the hole they are located and the length of stemming to be used to provide sufficient confinement and overpressure control.

Loading is governed by the charge plan provide by the Drill and Blast Production Planning team. Changes can be made by the shot crew on the ground based on the actual conditions experienced at the time of charging. Changes to charge sheets are discussed with the Drill and Blast Production Planning team to ensure the correct adjustments are being made and an alteration to design form is completed and signed off by the Drill and Blast Superintendent (Production Planning).

The initiating explosives used on site are those recommended by the manufacturer. The only change made to these items is when there is a need to use electronic detonation to provide for better vibration control.

6.6 On-Bench Practices

Throughout the loading and firing processes of a blast there are a number of factors and consideration that need to be addressed in order to ensure that the risks around blast fume generation are controlled. These typical factors include the follow:

1. Bench and Hole Conditions.
2. Weather Protection
3. On Bench Quality Assurance of Selected Explosives
4. Loading Sequencing
5. Loading Practices

6.6.1 Bench and Hole Conditions

The first step to be established in the successful management of fume is a determination of the state of the bench and holes prior to charging. A pre-loading assessment is undertaken prior to loading any shot at Mt Arthur Coal. This process is undertaken to help identify potential safety and blast quality risks that need to be addressed prior to loading the shot. The bench conditions that need to be assessed to help mitigate the potential for fume generation are as follows:

1. Typical drill hole and face burdens: to ensure sufficient burden is present to ensure adequate confinement of the explosive columns.
2. Bench grade: to understand where any surface runoff will pool and the holes that may be susceptible to water damage in the event of rain and/or dewatering activities.

3. Surface conditions: to understand the impact of silt run off into un-stemmed holes in the event of rain and/or dewatering activities.
4. Low lying areas: to understand holes that will be susceptible to water pooling in the event of rain and/or dewatering activities.
5. Surface water management: A general knowledge on how excess water will be removed/stored in the event of rain or water pooling from dewatering activities.

Actual hole conditions are also assessed prior to loading. This is done in one of two ways.

- Holes greater than 7m in depth: the holes are measured and the data is passed onto the drill and blast engineer to produce charge sheets for the shot firers.
- Holes that are less than 7m in depth: a sample dip is undertaken to get a broad view on the conditions of the pattern as a whole prior to loading. The idea of the sample measurement is generally to confirm whether the actual hole depths align with drilled depths and no major inconsistencies exist. The depths of all holes throughout the pattern are not recorded, as the shot firers load the shot in a dip and go process that requires them to measure every hole immediately prior to loading.

Typical hole conditions are outlined in the following definitions:

- Dry holes - Dry holes are defined as holes that are dry in the bottom and do not have wet or damp sides. Any explosive product can be used under such conditions.
- Wet holes - Wet holes are holes that contain more than 5m of water and/or holes defined as wet holes in the underlying damp and dewatered hole definitions.
- Damp holes - Damp holes contain less than 0.5m of water in the bottom or have wet or damp sides. Typically, in the case of 0.5m of water, an airbag is used to seal the explosive off from this water and then the hole is treated as a dry hole. If the sides of the hole are wet, then this hole will be treated as a wet hole.
- Dewatered holes - Dewatered holes contain less than 5m of water. Either the holes will be dewatered and assessed for no water re-charge allowing the hole to be treated as a dewatered hole or no dewatering will take place and the hole will be treated as a wet hole.
- Buffer Holes - Buffer holes refer to the dry holes surrounding holes determined to be wet. These holes are treated as wet holes to provide a protection buffer zone along the interface between the wet and dry section of the strata in the blast. At a minimum this buffer zone will incorporate the holes closest to the wet area along the rows and echelons.

To ensure the load plan is aligned with actual hole conditions, time between measuring and loading is kept to a minimum. Furthermore, to eliminate the occurrence of in correct loading for actual hole conditions a final check of all hole conditions are undertaken by the shot firer immediately prior to loading.

In addition to the hole conditions identified through measuring practices, poor blast hole wall integrity can also lead to higher fume generation in blasts. This may occur when blast holes are drilled in previously blast material, if cracking or open joint sets are present through the strata. Unless this occurs close to the collar of the holes, identification prior to loading is difficult. Therefore each hole is loaded incrementally and re-measured to ensure the expected column rise achieved.

6.6.2 Weather Protection

Throughout the loading process of a shot, the weather conditions are considered prior to performing each step from priming blast holes through to stemming them. In particular, forecasted weather is assessed when dealing with dry holes. The common controls that are considered when dealing with dry holes are as follows:

1. Where possible, ensuring all loaded dry holes are stemmed prior to predicted wet weather
2. Cap dry holes with drill cuttings to provide a better water seal over the holes.

6.6.3 On Bench Quality Assurance of Selected Explosives

As stated earlier, incorrect explosive selection can have a large impact on post blast fume. It is for these reason additional measures above the explosive suppliers quality assurance checks are undertaken on the bench. These checks consist of:

1. Cup Density Checks: These are completed when emulsion is used. The cup densities are taken to ensure that the correct explosive density is achieved and sufficient allowance for gassing of the emulsion product is allowed for prior to stemming the blast holes. This helps ensure that the blast holes are not over energised, adding to the potential for fume generation.
2. Alteration to the design sign off: This form is in place to provide a document trail of the revision and sign off of any alteration to the charge plan issued to the shot firers from the drill and blast engineer.
3. Hole by hole recording of explosives product: To ensure that Mt Arthur Coal continually improve the understanding on the causes of blast fume, a hole by hole recording regime has been put in place to allow for accurate reconciliation of the explosive type and quantity used in all areas on the blast pattern. This allows for ongoing update of the Horizon Risk Matrix and assist in determining accurate causal factors in the event of fume generation.

6.6.4 Loading Sequencing

The charge planning does not stop at what explosives to put in each hole, based on the hole condition. The other part of the planning is the sequence/overall plan that the MMU trucks can follow to ensure that the pattern is loaded safely and efficiently without sacrificing the quality of the blasted material and introducing post blast hazards such as blast fume and misfires. In relation to fume management the following factors are considered for each shot loaded at Mt Arthur Coal:

1. Loading the wet holes first: to ensure that if water is displaced (out of the hole collar and/or ground water through the strata) an assessment of the water impact on dry holes can be undertaken prior to loading.
2. Loading buffer holes around wet holes to ensure any displacement of water in these wet holes only effect holes loaded with wet product.
3. Low lying areas: in cases where these holes are identified as dry holes, due to risk of runoff from water displaced out of adjacent holes or rainfall, these holes are loaded last to allow for re-assessment of the hole conditions once the surrounding holes have been loaded and water impacts have been realised. Alternatively these low lying holes will be loaded with wet product prior to the arrival of predicted rainfall.

6.6.5 Loading Practices

In addition to ensuring on bench explosive quality assurance checks are undertaken and adopting an adequate loading sequencing across the bench, the shot firers are also required to employ practices that reduce the risk of contaminating the explosives while loading and monitor shot throughout its sleep time. These practices include:

1. Use of Hole Savers: The drill cuttings developed from holes greater than 15m are considered to have a high possibility to collapse and generate fall back, causing contamination of the explosive deck. Therefore to ensure that the explosive column is not contaminated by the drill cuttings, hole savers are used for blast holes greater than 15m.
2. Hose handling techniques: To ensure adequate delivery throughout the blast hole column wet product is pumped via a hose from the MMU. The hose is lowered down to the bottom of the hole and slowly raised as the column is filled with the explosive product at a manufacturer specified rate. This ensures that the water at the bottom of the hole is fully displaced and minimal traces of water exist throughout the explosive column, which results in an efficient initiation of the explosive product. This is essential in reducing the potential of blast fume generation, as inefficient initiation of the explosive causes the product to burn, resulting the generation of fume.
3. Shot Firer Daily Inspections: A core task that any shot firer must undertake when managing a blast is to complete and record a daily inspection of the shot throughout its sleep time. This inspection is undertaken to ensure that conditions of the shot have not changed, causing danger to anyone working on and/or within close proximity of the blast. All inspections are recorded and stored in a common place in the shot firers inspection book. In relation to fume generation, one part of the inspection is to check and identify if any loaded blast holes have slumped. This is a key indicator that the explosive column has degraded and these holes are recorded in the inspection booklet.

6.7 Blast Initiation

Once the blast has been loaded and stemmed, the next step in the process is to initiate the blast. As mentioned earlier in this document, Mt Arthur Coal is highly focused on ensuring that any fume and/or dust generated from blasts remains onsite within the controlled blast exclusion zone, which has no impact on site personnel, surrounding neighbours and the local community. Therefore once the shot is charged, the blast will only be fired when the weather conditions are appropriate.

6.7.1 Blast Pattern Tie Up

Mt Arthur Coal utilise two types of initiating explosives, which consists of Non-electric and Electronic detonators. Dependent on which initiating system is used, the management of the tie up is dealt with differently.

Due to safety risks the Non-electric detonators are not allowed to be tied up for firing until the day of fire, as the shot is tied in series and the risk of uncontrolled detonation is too high.

On the other hand Electronic detonators can be tied up for firing well in advance of the blast initiation day, as the detonators consist of a capacitor that requires a specific voltage combined with a specific initiation code to initiate the detonators. Due to the ability to tie up blasts in advance, the Electronic detonators allow for a greater chance to initiate the blast at short notice.

6.7.2 Environmental Approval

Prior to any blast being undertaken, consideration of the relevant environmental conditions is made and the potential for fume generation is reviewed.

The fume generation review includes undertaking a pre-firing fume rating based on:

1. History of fume generation in the blasting horizon
2. Material type
3. Weather conditions experienced during the sleep time of the shot
4. Actual sleep time

The assessment for the potential fume travel path consists of reviewing multiple data sources and inspecting actual conditions in order to obtain a full understanding on the likely impacts of the dust and fume generated from the blast. This procedure is outlined in MAC-PRD-PRO-106 Pre-Blast Approval.

6.7.3 On Bench Weather Assessment

Mt Arthur Coal's foot print spans 8km north to south, 2km east to west, the open cut pit floor lies up to 180m below the natural surface and the spoil is currently up to 80m higher natural surface. Due to the scale of this operation the typical wind characteristics can vary due to localised tunnelling effects through the pit and diversion effects around the dump systems that are not captured by the monitoring network set up around the operation. Therefore to reduce the risk these localised impacts have on diverting the dust and fume in an unexpected direction Mt Arthur Coal undertakes an on bench assessment of the localised wind conditions, which is done once the blast exclusion zone is in place and immediately prior to blast initiation. This assessment varies dependant on location of the blasts.

- For blasts in Windmill and Macleans, a balloon is released immediately prior to firing to indicate the probable path that any fume and dust may take upon firing.
- For blasts in all other areas of the operation, the shot firer checks the weather has not changed since being given the approval to fire.
- Utilise a network of windsocks (3) on natural surface to assist in the on bench assessment of the prevailing surface wind direction.

This part of the blasting process will be under continual review and improvement.

6.7.4 Sentry Placement

Products of the blast include flyrock and dust and fume. Sentries are placed by the Shotfirer in Charge at a suitable distance based on the knowledge of where they expect these items to occur. In the case of flyrock, a general perimeter is set up. In the case of dust and fume, the sentries down wind will be placed further from the shot. Effectively, the “circular” perimeter will bulge to an ellipse in the down wind direction. Personnel will be evacuated further in this direction.

In cases where Mt Arthur Coal are firing blasts within 500m from a public road (Denman Road or Edderton Road), notices are sent out to the relevant authorities and parties prior to the day of firing. The road is closed and forms part of the blast exclusion zone managed by the Shotfirer in Charged at the time of firing. These closures are conducted within the times that have been approved by the RTA on the road occupancy permit held by the operation. This procedure is outlined in detail in MAC-PRD-PRO-043 Blasting within 500m of Public Roads.

Assessment of where sentries are placed is undertaken on the morning of firing by the Blast Supervisor and the Shotfirer in Charge.

6.8 Emergency Response

Any person (whether employee, contractor, visitor, or external person) who believes that they may have been exposed to blast fumes should report to Mt Arthur Coal health facility to be treated according to the protocol below, or follow steps as required for external persons. If fume has travelled offsite then Mt Arthur Coal’s Emergency Management Team should mobilise to fume impact zone to offer emergency response and general assistance to members of the public, any potentially exposed members of the public should be referred to Muswellbrook Hospital for observation.

6.8.1 Treatment Protocol

Step 1
A person who has been exposed to blast fumes or displays symptoms associated with blast fumes should move to a safe location into a fresh air environment and warn others in the area that may become exposed where possible:

- Notify their supervisor immediately or if warranted declare an emergency in accordance with MAC-STE-MTP-009 Crisis and Emergency Management Plan
- Administer first aid and manage priorities
- Rest the patient to avoid anxiety
- Provide high concentration oxygen therapy to the patient
- Assess the patient and record baseline observation i.e. respiratory rate and effort, skin colour etc.
- Treat symptomatically

Step 2
Call 000 and request an ambulance. Advise them of a suspected blast fume exposure and the symptoms the patient is presenting. Notify the Department Manager so a representative can be arranged to attend the hospital and assist the patient as required.

Print a copy of the Code of Practice, PREVENTION AND MANAGEMENT OF BLAST GENERATED NOx GASES IN SURFACE BLASTING, Edition 2 (2011: 28), **Appendix 4 – INFORMATION FOR TREATING MEDICAL STAFF**, for the Mt Arthur Coal representative to hand over to the attending medical officer at the hospital.

Step 3
The patient must not be left alone or allowed to drive themselves to the health facility.
Repeat baseline observations every 20-30 minutes, or until the arrival of the emergency services.

Step 4
The patient or accompanying ambulance officer will hand over the Code of Practice, PREVENTION AND MANAGEMENT OF BLAST GENERATED NOx GASES IN SURFACE BLASTING, Edition 2 (2011: 28), **Appendix 4 – INFORMATION FOR TREATING MEDICAL STAFF** printed copy to the attending medical officer for their reference and assessment. A precautionary medical check of the patient will be performed, and if considered necessary, the doctor may require the person to be admitted for observation. Mt Arthur Coal's Head of Human Resources or delegate will then advise the impacted person's next of kin of the situation. If the situation is deemed serious enough the IMT should be activated

in accordance with MAC-STE-MTP-009 Crisis and Emergency Management Plan

Step 5
If following the medical examination and investigations the patient is not admitted they will be driven back to work.

Step 6
Upon arrival back at work, the person should report to their supervisor. The supervisor and injury management advisor should assess and monitor the employees' condition in accordance with duty of care.

6.8.2 Pollution Incident Management

If a serious fume event is observed leaving site, it will trigger a serious site incident response in accordance with NEC-STE-MTP-009 Pollution Incident Management Response Plan, should a fume cloud travel in the direction of sensitive receivers, the cloud will continue to be monitored and attempts will be made to contact relevant personnel in its path.

For all mining areas where a fume cloud travels off-site towards private or tenanted dwellings or other occupied areas every endeavour will be made to contact persons who are in the path. Depending on the path and the density of the fume cloud, it may be possible to block the road thus reducing exposure.

6.9 Reporting and Review

6.9.1 Reporting

As a requirement on site, all blasts will be filmed and the records kept on site. Where the shot produces fume with a rating of 3 or higher, the video record will continue to capture the progression of the fume cloud tacking both its creation and dispersion and its direction of travel.

The origin of the reporting protocols come from a combination of the requirements of the Qld DEEDI (QGN 20 v3) and the data needs on site to ensure appropriate access to relevant information for investigative and blasting improvement applications.

A post blast checklist is completed for all blasts. This checklist includes the fume rating, fume characteristics, meteorological information, monitoring results and video recording details.

Upon completion of the post blast checklist, the blast fume assessment is entered into the fume database. This reporting is done utilising a spreadsheet.

The spreadsheet consists of 5 sheets. Copies of the database, the summary sheet and the post blast checklist are included in Appendix B. The remaining two sheets are the Visual Rating Scale from the Code and some graphical data to assist in fume management analysis. All shots will be rated using the scale in the Code and that rating recorded.

All other data from the blast will be accumulated and stored on site using the current databases and computer packages. This data will include blast designs, charge sheets, tie ups and blast videos.

In the case where a Level 3 or above fume event occurs, the blast will be reported to the HSEC Department. In cases where any fume leaves site or in the case of a Level 4 or 5 fume event, the incident will be reported to the Department of Planning and Infrastructure. The incident will then be handled as determined by the Mt Arthur Coal Pollution Incident Response Management Plan contained within MAC-STE-MTP-009 Crisis and Emergency Management Plan.

An annual database summary will be provided to the HSEC Department detailing the levels of fume obtained during the previous year.

6.9.2 Review

A feedback loop on the fume created from blasting will be available in the reporting structure. Should excessive fume be created, an investigation into the generation of the fume will be undertaken and the resulting casual factors will be fed into future designs that match the criteria of the offending blast.

The blast fume database is updated on a regular basis. The information contained in this database forms the basis of the horizon risk matrix. Based on observed results from blasts fired in each horizon, the respective horizon risk level will be reviewed regularly to ensure that the drill and blast designs are completed with adequate controls to assist in mitigating fume generation.

In the case of fume leaving site, the information will feed into the Blast Guidelines Matrix which forms a major part of the procedure to be followed to gain environmental approval prior to blasting.

6.10 Training

All Mt Arthur Coal employees are given general awareness information on blast fume in the Mt Arthur Coal generic site induction.

Training for relevant personnel will be undertaken to ensure adequate knowledge of blast fume generation, impacts and mitigation measures. This training will typically cover the following aspects in relation with blast fume management:

1. Health impacts of NOx gases
2. The potential causes of blast fume
3. Fume mitigating actions outlined in this document
4. Incident and emergency response procedures for blast fume management
5. Blast fume rating and post blast assessment
6. Reporting procedures associated with post-blast fume events

7. Contractor Management

All contractors engaged in undertaking any drill and blast tasks onsite are required to understand and follow this management plan. The Mt Arthur Coal representative managing the contractors must ensure that this management plan is adhered to and a copy of this plan is available to all contractor personal at all times.

8. Audit

This document will be audited every 2 years by the Drill and Blast Superintendent (Production Planning), and if necessary for the following reasons:

- Following significant incidents at Mt Arthur Coal relating to blast fume;
- Following the conduct of an independent environmental audit which requires changes to the Blast Fume Management Plan;
- If there is a relevant change in technology or legislation.

Appendix A

Causes and Control Matrix

The following matrix covers each potential cause and situation that may contribute to fume generation. For each potential cause, a likely indicator and control measure is outlined.

Primary Cause 1: Explosive Formulation and Quality Assurance		
Potential Cause	**Likely indicators**	**Possible Control Measures**
Explosive product incorrectly formulated	• Product appearance from auger / discharge point on truck abnormal • All blasts in a specific location utilising a specific explosive product creating fume	• Track explosive mix back with supplier • Visual check at discharge point • Explosives supplier to test formulations on the bench as per the Contract • Quarterly check of suppliers QA system • Remove truck from loading operation if unable to rectify
Inadequate mixing of raw materials	• Product appearance from auger / discharge point on truck abnormal • All blasts in a specific location utilising a specific explosive product creating fume	• Visual check at discharge point • MMU calibration every 6 months • Weekly MMU mass balance checks • On bench cup density checks • Remove truck from loading operation if unable to rectify
Delivery system metering incorrectly	• All blasts in a specific location utilising a specific explosive product creating fume • Not achieving collar height during loading process	• MMU calibration every 6 months • Weekly MMU mass balance checks • On bench cup density checks • Remove truck from loading operation if unable to rectify
Initiating explosives not manufactured to specification or degraded during transport storage	• Damaged IE • Out of date stock • Misfires	• Magazine management rules • Visual inspection of the IE and, if damaged, destroyed
Product degradation in hole	• Slumping	• Shot firers perform daily inspection of all sleeping shots

		• All slumped are recorded by the shot firer and reported back to the Drill and Blast Production Planning Department • Minimise sleep time of shot with the use of the uninterrupted load tie and fire approach and scheduling blasts to achievable firing windows

Primary Cause 2: Geological conditions		
Potential Cause	**Likely indicators**	**Possible Control Measures**
Blasting in weak / soft strata	• Specific areas known to contain weak/soft strata only • Excessive powder factor	• Understand geology of each shot and design blast (timing and explosive product) to ensure adequate relief in weak/soft strata • Utilise horizon risk matrix and implement adequate controls relevant to the determined fume risk level
Inadequate confinement in soft ground	• Specific areas known to contain weak/soft strata only • Excessive powder factor	• Utilise horizon risk matrix and implement adequate controls relevant to the determined fume risk level • Appropriate explosives product selection • Change design to suit conditions • Increase stemming length
Explosive product seeping into cracks	• Slumping • Not achieving collar height during loading process • Inconsistencies in explosive reconciliation	• Maintenance of accurate drill records e.g. loss of cuttings / air • Capture hole by hole charging data • Incrementally charge the holes and monitor charging on areas where product loss occurs in dry holes to identify cracked areas. Do not overload holes. • Bag off the hole above known cracking to avoid excessive seepage of product • Shot firers perform daily

		inspection of all sleeping shots • All slumped are recorded by the shot firer and reported back to the Drill and Blast Production Planning Department • Minimise sleep time of shot with the use of the uninterrupted load tie and fire approach and scheduling blasts to achievable firing windows
Dynamic water in holes	• Slumping • Not achieving collar height during loading process	• Minimise sleep time of shot with the use of the uninterrupted load tie and fire approach and scheduling blasts to achievable firing windows • Follow manufacturer's recommendations on explosive product selection • Understand hydrology of pit and plan blasting to avoid interaction between explosives and dynamic water (either natural or from other pit operations) • Load blast holes in a sequence that ensure the wet holes are loaded first to allow for re-assessment of what impacts the water displaced in the wet holes has on surrounding dry holes. • Load a buffer zone surrounding the wet holes with wet product to prevent water ingress into holes loaded with dry product
Moisture in clay	• Base of weathering shots • Excessive rainfall	• Utilise horizon risk matrix and implement adequate controls relevant to the determined fume risk level • Water resistant explosive products when the hole is classified as wet • Load a buffer zone surrounding the wet holes with wet product to prevent water ingress into holes

		loaded with dry product • Design blast to have correct explosive energy match to material type to ensure adequate confinement of explosives • Ensure all loaded dry holes are stemmed prior to predicted wet weather and that these holes are stemmed with drill cutters instead of gravel, as drill cuttings offer a better water seal over the holes then gravel.
Blast hole wall deterioration between drilling and loading e.g. cracks, voids, hole contraction	• Traceable to specific geological areas usually clay zones • Old drill holes • Holes drilled too close to adjacent shot	• Minimise time between drilling and loading • Drillers are to use hole savers for holes greater then 15m to prevent fall back from drill cuttings • Blast boundaries are surveyed prior to initiating every blast to help prevent drilling into shot ground • Effects from surrounding patterns are assessed in the pre-loading assessment prior to loading every shot • Leave an infill between adjacent shots
Ground movement	• Horizon offset • Area previously known for misfires	• Utilise horizon risk matrix and implement adequate controls relevant to the determined fume risk level • Design timing to prevent hole movement and explosive column dislocation • Use electronic initiating system to allow for timing flexibility and ensure all detonators are fired.

Primary Cause 3: Blast Design		
Potential Cause	**Likely indicators**	**Possible Control Measures**
Explosive desensitisation due to the blast hole depth	• In deep holes only	• Reduce bench height • Follow manufacturer's recommendations on

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		explosive product selection and blast design for deep holes, for example decking where appropriate. • Ensure explosives product are not outside the critical depth stated on manufacturer's technical data sheets
Failure to identify potential causes of fume generation	• In-experienced D&B engineer • Inadequate analysis	• D&B design checklist is completed for all designs • Utilise horizon risk matrix and implement adequate controls relevant to the determined fume risk level • All D&B designs are signed off by the D&B Superintendent (planning) or D&B Senior Engineer
Inappropriate priming and/or placement	• Misfires / product discovered during mining	• Follow manufacturer's recommendations on placement on initiating explosives • Ensure the bottom primer is located 1m above the bottom of the hole • Second primer where holes are greater than 15m deep.
Inter-hole explosive desensitisation	• Blast holes drilled too close together	• Utilise horizon risk matrix and implement adequate controls relevant to the determined fume risk level • Review drill pattern prior to drill leaving pattern to ensure the bench is drilled to design • Reduce charge per hole • Increased control on drilling in complex bench areas • Develop the timing design to the as-drilled pattern instead of the designed pattern
Intra-hole explosive desensitisation in decked blast holes	• When using decks only	• Appropriate separation of explosive decks • Use electronic initiating system to allow for greater control of timing design between decks
Initiation of significant explosive quantities in a single blast event	• Intensity of post-blast gases proportional to explosives quantity used	• Utilise horizon risk matrix and implement adequate controls relevant to the determined fume risk level

		• Design blast to have correct explosive energy match to material type to ensure adequate confinement of explosives • Reduce powder factor

Primary Cause 4: Explosive product selection		
Potential Cause	**Likely indicators**	**Possible Control Measures**
Non water-resistant explosive products loaded into wet or dewatered holes	• Blasts containing wet / dewatered blast holes only	• Follow manufacturer's recommendations on explosive product selection • Measure all holes in shots that have holes greater then 8m and conduct a sample measurement of shots with holes less then 8m to understand the hole conditions throughout the pattern • Weather forecasts are reviewed prior to loading to assess the expected sleep time and rainfall impacts prior to loading • Bench topography is assessed prior to loading to understand holes that will be susceptible to water pooling in the event of rain and/or dewatering activities. • Water resistant explosive products when the hole is classified as wet • Load blast holes in a sequence that ensure the wet holes are loaded first to allow for re-assessment of what impacts the water displaced in the wet holes has on surrounding dry holes. • Load a buffer zone surrounding the wet holes with wet product to prevent water ingress into holes loaded with dry product • Design blast to have correct explosive energy match to material type to ensure

		adequate confinement of explosives • Ensure all loaded dry holes are stemmed prior to predicted wet weather and that these holes are stemmed with drill cutters instead of gravel, as drill cuttings offer a better water seal over the holes then gravel. • Regular education of shot crew on explosive product recommendations from current supplier • Provision of load sheets detailing explosive type
Excessive energy in weak/ soft strata desensitising adjacent explosive product columns	• In specific areas known to contain weak/soft strata only	• Understand geology of each shot and design blast (timing and explosive product) to match • Utilise horizon risk matrix and implement adequate controls relevant to the determined fume risk level
Desensitisation of explosive column from in-hole cord initiation	• Only in areas where in-hole cord initiation is used	• Follow manufacturer's recommendations on compatibility of initiating systems with explosives • Minimise use of detonating cord for down the hole initiation

Primary Cause 5: On bench practices		
Potential Cause	**Likely indicators**	**Possible Control Measures**
Hole condition incorrectly identified	• Only when using non water-resistant explosive products • Slumping	• Measure all holes in shots that have holes greater then 8m and conduct a sample measurement of shots with holes less then 8m to understand the hole conditions throughout the pattern • Record wet, dewatered and dry holes on dip sheets and use this information as a basis for explosive product selection • Capture hole by hole charging data

		• Minimise time between dipping and loading, especially in soft and clay strata • Minimise sleep time of shot with the use of the uninterrupted load tie and fire approach and scheduling blasts to achievable firing windows • Training/competence of blast crew
Blast not drilled to plan	• Inaccurately drilled patterns	• Maintenance of accurate drilling records • Review drill pattern prior to drill leaving pattern to ensure the bench is drilled to design • Review of blast design if required to compensate for inaccuracies.
Dewatering of holes diverts water into holes previously loaded with dry hole explosive products	• Poor charging practices • Cross grade of bench	• Assess the bench topography to understand where pumped water runoff will pool and which holes will be effected by dewatering activities • Load dewatered holes in a sequence that allows for re-assessment of what impacts the pumped water runoff has on surrounding dry holes • Load dry holes after dewatering activities are completed • Training/competence of blast crew
Blast not loaded as per blast plan	• Incorrect tonnages / types of explosives used on shot	• Training/competence of blast crew • Effective supervision • Communication of loading requirements • Alteration to the design sign off is completed to provide a documentation trail of the revision and sign off of any alteration to the charge plan issued to the shot firers from the Drill and Blast Production Planning Department. • Capture hole by hole charging data

		• Perform on bench cup density checks to ensure correct explosive density is reached
Low lying areas susceptible to water pooling	• Pooled water on bench • Low spots in bench	• Load low lying areas last to allow for re-assessment of hole conditions once the surrounding holes have been loaded and water impacts has been realised. • In cases when wet weather is predicted load these low lying holes with wet product prior to the arrival of the rainfall. • Load a buffer zone surrounding the low lying area in cases where the holes are identified as wet holes to prevent water ingress into holes loaded with dry product

Primary Cause 6: Contamination of explosives in the blast hole		
Potential Cause	**Likely indicators**	**Possible Control Measures**
Explosive product mixes with mud/ sediment at bottom of hole.	• Blasts containing wet/dewatered blast holes	• Utilise horizon risk matrix and implement adequate controls relevant to the determined fume risk level • Use correct hose handling practices (no top loading of wet product) • Insert gas bag to separate mud/ sediment from explosive product • Ensure appropriate loading practices are followed during charging • Ensure primer is positioned in undiluted explosive product • Use blast hole savers after drilling • Training/competence of blast crew
Penetration of stemming material into top of explosive column (fluid/ pumpable explosive products only)	• Blasts charged with pumpable explosive products only	• Use appropriate stemming material • Ensure explosive product is

		gassed to manufacturer's specifications before stemming
Water entrainment in explosive product	• Intermittent NOx gases • Blasts containing wet/dewatered blast holes only	• Use correct hose handling practices (no top loading of wet product) • Ensure all primers are positioned correctly: - Bottom primer 1m above the base of the hole in explosive product - Use a second booster for hole greater then 15m • Use of gas bags in dewatered holes • Ensure all loaded dry holes are stemmed prior to predicted wet weather and that these holes are stemmed with drill cutters instead of gravel, as drill cuttings offer a better water seal over the holes then gravel. • Measure water recharge rate after dewatering and adjust explosive product selection to suit hole condition • Load holes identified as wet with wet product only • Load low lying areas last to allow for re-assessment of hole conditions once the surrounding holes have been loaded and water impacts has been realised. • Load dewatered holes in a sequence that allows for re-assessment of what impacts the pumped water runoff has on surrounding dry holes • Minimise sleep time of shot with the use of the uninterrupted load tie and fire approach and scheduling blasts to achievable firing windows
Moisture in ground damaging explosive product	• Frequent fume events in blasting horizon • Wet ground	• Utilise horizon risk matrix and implement adequate controls relevant to the determined fume risk level • Explosives product selection

		• Minimise sleep time of shot with the use of the uninterrupted load tie and fire approach and scheduling blasts to achievable firing windows • Load blast holes in a sequence that ensure the wet holes are loaded first to allow for re-assessment of what impacts the water displaced in the wet holes has on surrounding dry holes. • Load a buffer zone surrounding the wet holes with wet product to prevent water ingress into holes loaded with dry product
Contamination of explosives column by drill cuttings during loading	• Poor loading practices	• Drillers are to use hole savers for holes greater then 15m to prevent fall back from drill cuttings • Verify correct hose handling practices are in place eg operator competence, procedures, use explosives supplier's personnel • Training/competence of blast crew

Primary Cause 7: Weather		
Potential Cause	**Likely indicators**	**Possible Control Measures**
Rainfall on a sleeping shot.	• Rainfall • Ponding on the shot • Slumping	• Minimise sleep time of shot with the use of the uninterrupted load tie and fire approach and scheduling blasts to achievable firing windows • Drillers are to use hole savers for holes greater then 15m to prevent fall back from drill cuttings • In cases when wet weather is predicted load these low lying holes with wet product prior to the arrival of the rainfall. • Ensure all loaded dry holes

		are stemmed prior to predicted wet weather and that these holes are stemmed with drill cutters instead of gravel, as drill cuttings offer a better water seal over the holes then gravel. • Assess the bench topography to understand where pumped water runoff will pool and which holes will be effected by rainfall runoff • Load a buffer zone surrounding the wet holes with wet product to prevent water ingress into holes loaded with dry product • Consider squaring off the pattern and firing prior to the arrival of the rain event
Wind conditions preventing blasts from firing and causing long sleep time	• Seasonal Conditions • Horizon risk matrix	• Minimise sleep time of shot with the use of the uninterrupted load tie and fire approach and scheduling blasts to achievable firing windows • Utilise horizon risk matrix and implement adequate controls relevant to the determined fume risk level

Appendix B

Fume Assessment Database

Blast Fume Results

Calendar Year	2012

Number of Shots	1	
Shots with Ratings of 0 to 3	1	100%
Shots with Ratings of 4 or 5	0	0%
Shots with fume leaving site	0	0%

Name:	Jeff Hanlon
Date:	18/04/2012
Position:	D & B Superintendent
Signiture:	

Shot ID	Date Fired	Time Fired	Sleep Time (Days)	Fume Level	Fume Extent	Fume Rating	Fume visibility after the blast	Fume Path	Fume Location (on the shot)	Weather during initiation	Cloud Cover % (Nil 0 - Overcast 5)	Windspeed (Km/hr)	Wind Direction	Tie-up	Material Type	Burden	Spacing	Average Depth	Stem Height	PF kg/bcm	Charging Plan	ANFO (t)	Heavy ANFO (t)	Emulsion (t)	Total Explosives (t)	% of wet product	Damp Sides	Holes Dewatered	Wet Holes	Any Slumping	Did it rain during or after loading
WMn2722/W2	28/04/2011	12.00pm	8	1	A	1A	Visible instantly	Stayed low after the blast	Specific to a product type	Sunny / No wind	1			Vee	Siltstone / Mudstones	8	10	60	5	0.65	Full Column ANFO	500.00	2,500.00	5,000.00	8,000.00	94%	No	Yes	Yes	Yes	Yes
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Post Blast Data Checklist

Date:.. Time Fired:.................................... am/pm

Blast ID:... Shotfirer:...

Fume Rating

Fume Colour	Fume Extent	
0	No Fume	
1	A	A = Localised (ie NOx Gases localised across only a few blast holes)
2	B	B = Medium (ie NOx Gases from up to 50% of blast holes in the shot)
3*	C	C = Extensive (ie Extensive generation of NOx Gases across the whole blast)
4*		
5*		

Fume Rated by:...

* Fume ratings of 3 or above need to be reported to the Environment Dept.

Fume rating 3 and above reported to Enviro Dept by: Time:

Fume visability after the blast: Visible instantly / Visible < 5mins / Visible > 5mins

Fume Path: Stayed low after the blast / Achieved a high elevation / Left site / From initiation point / Rear of the blast / Buffered ends / Corners of blast / Directly into the air

Fume Location: Rear of the shot / Front of the shot / Specific to a product type / All over the shot / Patchy / Along control row

Meteorological Conditions at time of blast

Weather during initiation: Sunny / Cloudy / Light rain / Raining

Cloud cover (0 nil to 5 full) ....

Wind Speed at time of blast m/s

Wind Direction at time of blast degrees

Amount of rain during/after loaded mm

Hole Conditions

Damp sides: Yes / No

Holes dewatered: Yes / No

Wet holes: Yes / No

Any slumping: Yes / No

Loaded to design: Yes / No

Monitoring Results

EcoTech Reference

EcoTech Time of blast

Monitoring Station	Overpressure**	Vibration**
Denman Road West		
Edinglassie		
Sth Muswellbrook		
Racecourse		
Antiene		
Edderton		
Yammanie		

** Overpressure over 115 dB/Vibration over 5mm need to be reported to Environment Dept

Monitoring exceedances reported to Enviro Dept by Time:

Video Recording

Blast recorded by

Blast Uploaded: Yes / No

Boundary Video recorded by

Boundary Video Uploaded: Yes / No