WAMBO COAL
BLAST FUME MANAGEMENT STRATEGY

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Document Control

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Title	Blast Fume Management Strategy
General Description	Responses and protocols for the minimisation of post blast fume generation
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Revisions

Rev No	Date	Description	By	Checked	Signature
1	Nov 2012	Original Draft	WCPL	TF	
2	Oct 2015	Review and update to ensure consistent with revised Blast Management Plan (BMP) (Version 5)-Draft for Submission to DP&E	WCPL, Palaris	SP	
3	Nov 2015	Updated to address DP&E comments on Rev. 2	WCPL	SP	

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1.0 Introduction

1.1 Background

The Wambo Coal Mine (the Mine) is situated approximately 15 kilometres west of Singleton, near the village of Warkworth, New South Wales (**Figure 1**). Wambo is owned and operated by Wambo Coal Pty Limited (WCPL), a subsidiary of Peabody Energy Australia Pty Limited.

A range of open cut and underground mine operations have been conducted at WCPL since mining operations commenced in 1969. Mining under the current Development Consent (DA305-7-2003) commenced in 2004 and permits both open cut, underground operations and associated activities to be conducted.

The approved run-of-mine (ROM) coal production rate is 14.7 million tonnes per annum and all product coal is transported from WCPL by rail. A summary of the approved Wambo Coal Mine is provided in the WCPL Blast Management Plan (BMP) (Table 1).

This Blast Fume Management Strategy (BFMS) has been prepared in accordance with correspondence received from the NSW Department of Planning and Environment (DP&E), formerly known as the NSW Department of Planning and Infrastructure (D&PI), on 23 August 2012, outlining the general requirements under Stage 2 of the fume minimisation measures (**Attachment A**). Stage 1 of the fume mitigation measures involved the commencement of rating and recording blast fume events following on from the Blast Fume Workshop held in Singleton on 19 June 2012.

1.2 Purpose

The purpose of this BFMS is to detail fume minimisation measures at the Mine for all surface blasting activities. The BFMS is an annexure to WCPL's BMP, a requirement of Condition 19, Schedule 4 of DA305-7-2003.

The structure of the BFMS is aligned with the *Elements of a Blast Fume Management Strategy* as provided by DP&E on 23 August 2012, regarding procedures and fume mitigation measures for:
:

- Monitoring & Reporting
    - Rating and Recording of Blast Fume Events
    - Reporting of Significant fume events
- Fume Mitigation
    - Geology
    - Meteorological Conditions
    - Blast Design
    - Product Selection and Quality
    - Blast Crew Education
    - On bench practices
- Emergency Response Procedures

1.3 Scope

The BFMS applies to all WCPL employees, contractors and sub-contractors, undertaking all or any surface blasting activities within WCPL's mining authorisations and approved mining areas (**Figure 2**).

1.4 Definitions

Definitions of specific technical terms used in the BFMS are detailed in **Table 1** below.

Table 1: Definitions

Term	Definition
ANFO	A mixture of ammonium nitrate and fuel oil with or without a dye colouring agent (Definition from AS2187.0)
Dynamic water	Water that is in motion (i.e. flowing water)
NOx (Oxides of Nitrogen)	A multiple combinations of oxides of nitrogen (N2O2, NO, NO2, N2O3, N2O4, N2O5) with nitrogen dioxide (NO2) being the principle hazardous nitrous fume
Post Blast Fume	Gases generated by the detonation of explosives during blasting
Precursor	A material resulting from a chemical or physical change when two or more substances consisting of fuels and oxidisers are mixed is intended to be used exclusively in the production of an explosive. (Definition from AEMSC Code of Good Practice Precursors for Explosives.
Sleep Time	The time between explosives being loaded into a blast hole and their initiation (Definition from AS2187.0)
Wet holes	Drilled holes that contain water, have been dewatered or moisture is present in the base or walls

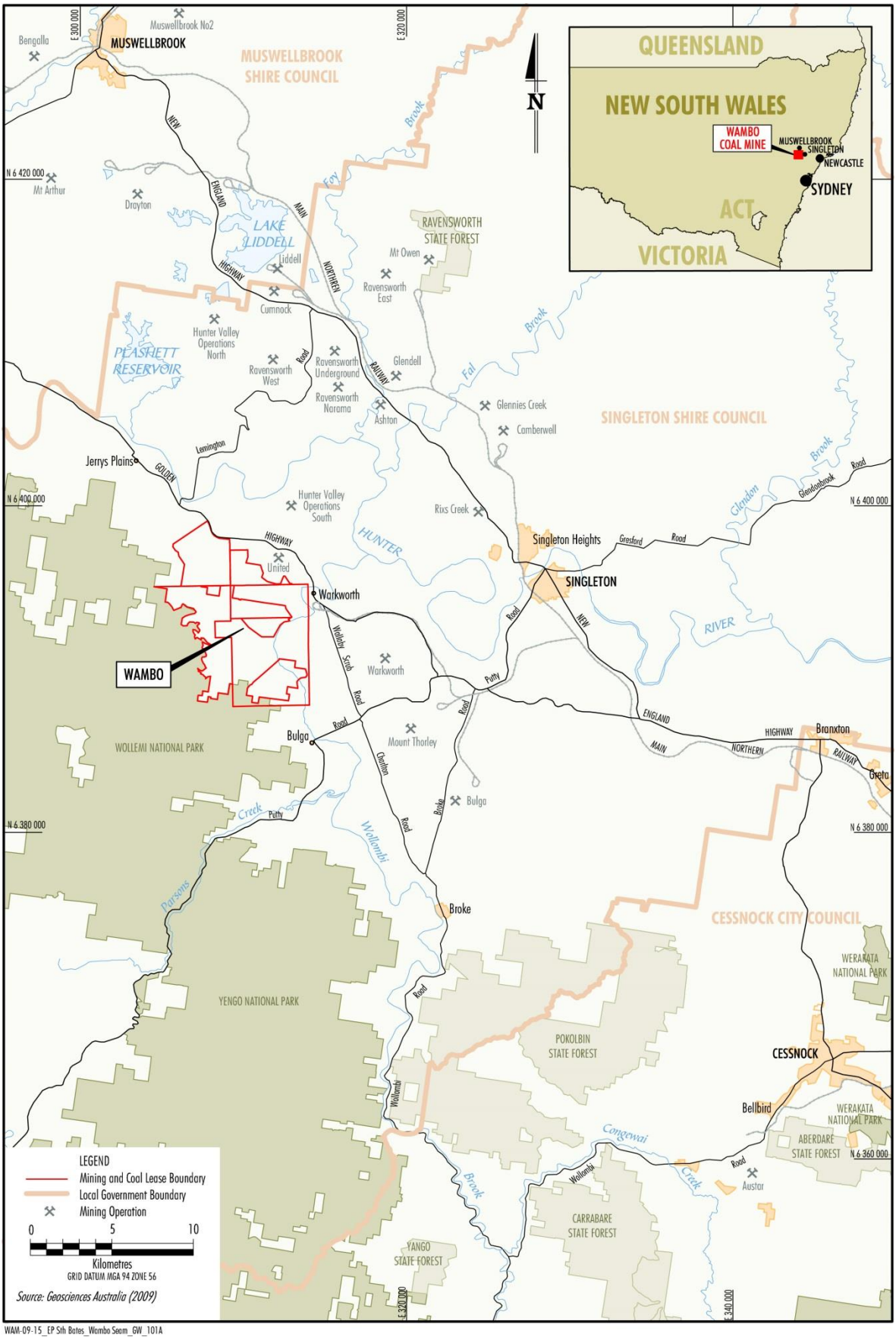

Figure 1: Wambo Coal Regional Location

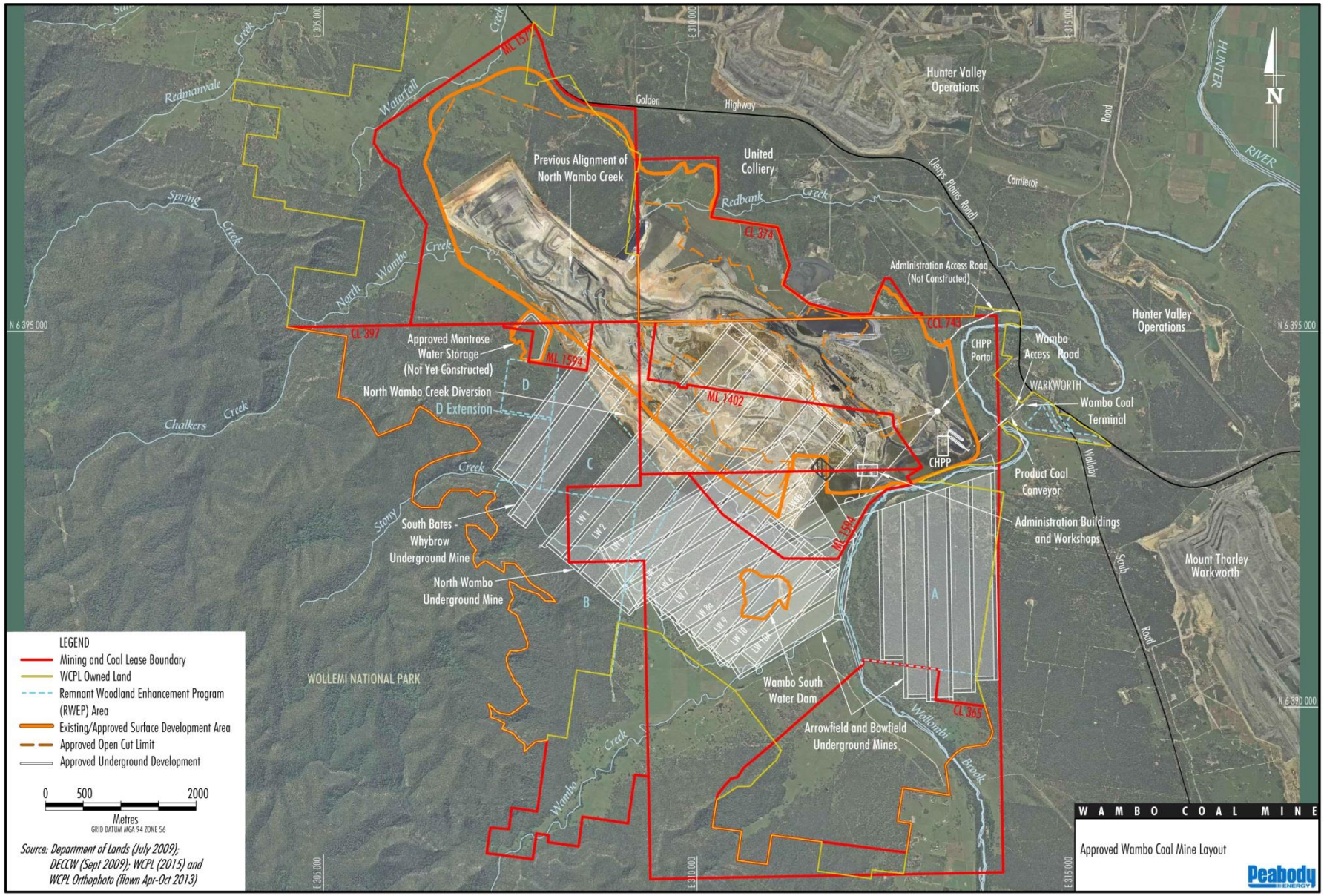

Figure 2: Approved Wambo Coal Mine Layout

2.0 Blast Fume Mitigation

2.1 Blast Process

WCPL has developed a blast process flowchart that summaries the various tasks involved in the blast process, who is responsible for those tasks and what quality assurance processes are in place for the task. This flowchart is provided in **Figure 3**.

Figure 3: Blast Process Flowchart

2.2 Blast Fume Mitigation Matrix

WCPL has developed a blast fume mitigation risk matrix for the Mine, which summarises the fume risk for each seam and the required fume mitigation controls to be implemented for those risks. This matrix is provided in **Table 2**.

Table 2: Fume Mitigation Risk Matrix

Seam	Description	Width (m)	Process	Fume Risk (Low, Med, High)	Fume Mitigation Controls
Whybrow Seam	Waste	30	Blast	***High***	• Appropriate powder factor • Utilise gassed 2070 with appropriate density Minimise sleep time
	WWA	1.178	Free Dig	Not Applicable	
	Partings				
	WWC	0.547			
	Waste				
	WWD1	0.2			
	Waste				
	WWD2	0.335			
Redbank Seam	Waste	6.845	Blast	Low	
	RCA	0.338	Free Dig	Not Applicable	
	Waste	1.5			
	Partings				
	RCC	0.711			
	Partings	0.438			
	RCD	1.289			
Wambo/Rider Seam	Waste	12	Blast	Low	
	WRA	0.538	Free Dig	Not Applicable	
	Waste	11.685	Blast	Low	
	WRC	0.442	Free Dig	Not Applicable	
	Waste	17.145	Blast	***Med***	• Dewatering the holes or use water resistant product • Minimise sleep time <7 days
	WMA	2.031	Free Dig	Not Applicable	
Whynot Seam	Waste	15.5	Blast	***Med***	• Dewatering the holes or use water resistant product • Minimise sleep time <7 days
	WTA	2.615	Free Dig	Not Applicable	

2.3 Blast Fume Factors and Management Strategies

Many factors have been identified as contributing to post blast fume. A combination of these factors or any single factor may contribute to the production of post-blast fumes. These factors have been classified under the following categories and management strategies outlined in
Table 3:

- Geology;
- Meteorological conditions;
- Blast design;
- Product selection and quality;
- Blast crew education; and
- On bench practices.

Table 3: Blast Fume Factors and Management Strategies

Category	Factor	Management Strategy
Geology	Blasting in weak/soft strata (<20m of surface)	• Free dig where possible (drilled holes often fail) and the high moisture content in the clay band results in significant degrade of the AN structure)
	Faulted/fractured ground	• General practice is to stand off the faulted fractured ground by 1-4m. This is dependent on many factors. • Geology should be noted and consideration made in the blast design
	High Clay content holes	• Load the 70 % emulsion product with appropriate powder factor
	Time between drilling & loading	• No correlation noted for holes loaded with varying delays after drilling, this does not include wet weather events or drilling in soft strata as these are considered under separate management strategies.
	Wet holes	• Dewatering drilled holes, check if the water is regenerating. • Gas bag of hole to prevent product contact with wet base • Use blast products suitable for wet conditions.
	Mud/sediment in base of holes	• Where feasible gas bag toe of hole to prevent product contact with wet base
Meteorological Conditions[1]	Rain Events and Strong Winds	• A pre-blast meteorological assessment will be completed periodically throughout the course of the day leading up to the scheduled time of the blast. The pre-blast meteorological assessment will consider wind speed and direction, however other meteorological conditions that may influence the impact of blasts on the community such as temperature inversions will also be considered. • A meteorological and dispersion forecasting tool is actively used to identify the most favourable day, and time of day, for blast initiation. Opportunities are identified to reduce impacts on the local community. • Loaded shots affected by rain will be assessed by the Drill and Blast (D&B) Engineer in consultation with the Shotfirers • Where conditions are determined to be unfavourable, the blast will be delayed, postponed or cancelled until favourable meteorological conditions are observed.
Blast Design	Explosives desensitisation	• Depth can contribute to desensitisation and decked loading style applied, however the depth of drilled holes on the site does not exceed 40m and is therefore not considered a contributor to fume. • Tie up <125m between the holes, no greater than 175ms
	Blast layout	• Increased precision through GPS guided equipment.

Category	Factor	Management Strategy
	Priming	• Boosters placed at design depth RL • Holes deeper than 15m are double primed to ensure full reaction of the column of bulk explosives.
	Blast delays	• Minimise sleep times of loaded shots where possible based on the manufacturers recommendations • Fume risk when blasting outside of these parameters will be assessed by the D&B Engineer in consultation with the Shotfirers
Product Selection and Quality	Blast contractor selected	• Blast contractor selection included the following criteria: ○ Local R&D Team of Engineers to provide support on blast design and product selection
	Explosive product selected	• Selections based on manufacturer's recommendations and consultation with the Blast Contractor
	Compliance to manufactures specifications	• The site D&B Engineer in consultation with the Blast Contractor will continue to monitor and progress product application and management against manufacturer's specifications. This process will result in a defined site specific blast product application.

	Explosives Quality	• Confirmed by the Blast Contractor's Quality Control process inclusive of the following:
		  ○ MPU calibrations
		  ○ Product samples collected for every MPU for each shot
		  ○ Gassing rates and final density recorded on Delivery record

	Mixing of materials	• Product mixed by MPU (calibrated and sampled)
	Delivery system	• MPU calibrated fortnightly at a minimum or as required.
	Product rotation	• Prill stored in Silos • Pre-delivery inspection • Visual inspection on arrival at site
	Stemming materials & techniques	• Stemming diameter 20 to 30mm (Inspected by Shotfirer) • Stemming depth determined by D&B Engineer dependent on individual blast conditions
	Loading sequence & technique	• Loading procedure is driven by product selection and manufacturer's specifications.
	Variation to blast plan	• Any irregularities or variations to the blast plan are to be communicated by the shotfirers to the D&B Engineer and, where relevant, in consultation with the Blast Contractor
	QA & Auditing	• Blast Contractor Auditing and Inspection Schedule
Blast Crew Education	Qualifications of Blast Crew	• Blast Contractor internal policy. • Training records maintained

	Training requirements of blast crew	• Blast Contractor operator training system incorporates the following:
		  ○ Shotfirers permit
		  ○ Unsupervised handling permit
		  ○ Training to open cut site requirements

Category	Factor	Management Strategy
		○ Product development and updates ○ Product Selection ○ Bench practices
On Bench Practices	Bench drainage techniques	• Minimize surface water where possible • Utilise hole savers • Drains for re-directing water
	Sleep time	• Minimise sleep times of loaded shots where possible based on the manufacturers recommendations • Fume risk when blasting outside of these parameters will be assessed by the D&B Engineer in consultation with the Shotfirers
	Shot inspections	• Drill preparation, drilled shot, loading, firing
	Slumping holes	• Loaded holes are checked by the shot crew and any slumping is reported to the D&B Engineer • If dynamic water is present or the holes are slumping the blast plan will be assessed by the D&B Engineer. In this situation it can be decided to fire the shot earlier, not load all the holes or change the product to a more water resistant material. (abnormal circumstances)
	Drill hole location error tolerance	• Drill error tolerance 10-50cm • Visual inspection, identify suspect holes and re-check by survey • Re-drills are to be checked and re-drill approved by the D&B Engineer

Notes:

1: There may be circumstances in which blast events need to be fired in less than ideal weather conditions. Failure to initiate blasts may indeed increase the potential for fume generation and or occupational health and safety risks to mine personnel. In these specific and rare circumstances, the final decision making process will be elevated to the General Manager position (or in their absence, to the delegated authority) with relevant input from D&B Engineer, Shot Firer and Environment and Community (E&C) Manager

.

3.0 Monitoring and Reporting

Section 6 of WCPL's BMP details WCPL's Blast Monitoring Program, which has been developed in accordance with the requirements of DA305-7-2003, DA177-8-2004 and WCPL's Environment Protection Licence 529. All blasts at the Mine are monitored for overpressure, ground vibration and visually recorded using video equipment (**Section 3.2**). Meteorological conditions are also monitored and assessed prior to and during blasts.

Reporting of blast results, non-compliances and incidents is undertaken in accordance with Section 9 of the WCPL BMP.

3.1 Pre-Blast Fume Risk Assessment

The potential for blast fume will be considered at the following stages of the Blasting Process:

- Preliminary Design;
- Final Design; and
- Blast Clearance Maps.

A Blast Pack will be developed for each blast and contain all relevant records associated with the design and quality assurance process for each individual shot. A Pre-blast Fume Risk Assessment will be completed prior to each blast as part of the Pre-blast Checklist.

3.2 Rating and Recording of Blast Fume Events

In accordance with Stage 1 of fume minimisation measures, all blasts at Wambo are fume rated applying the Fume Ratings in **Attachment B**. In the case of a fume event, video recording of the blast events is utilised to assist in the determination of an appropriate fume ranking for reporting purposes.

All surface blasts in the open cut will be video recorded to capture the post blast environment. The video camera will be manned where possible in order to follow the path of any fume generated. All videos will be a minimum duration of 1 minute following the blast event or until the fume dissipates, leaves the site or the view of the camera. Video footage will be stored for a minimum of 1 year on site.

Each blast will be ranked when fume is at its greatest extent using the Australian Explosives Industry Safety Group (AEISG) ranking provided in **Attachment B** and all written records kept for a minimum of 2 years.

3.3 Reporting of Significant Blast Fume Events

Blast fume events, as identified from the fume ranking table in **Attachment B**, will be reported by WCPL's E&C Manager (or delegate) to the DP&E Singleton Compliance Office in accordance with WCPL's Pollution Incident Response Management Plan *(PIRMP)* for an event which is a:

- **Rating 3** fume event that leaves the project approval boundary or closed portion of public road; or
- All **Rating 4 or 5** fume events.

4.0 Training and Competence

All training associated with the BFMS is undertaken pursuant to WCPL's Training and Competency Management Plan.

Tool box talks are undertaken with relevant employees and contractors as required, including during reviews of the BFMS. Evidence of participation in these tool box talks is documented in accordance with the WCPL Training and Competency Management Plan. Upon scheduled reviews or authorised changes to the BFMS, additional tool box talks and documentation of participants will be undertaken.

5.0 Emergency Response

In the unlikely event of a major fume generation event, site personnel will be notified via the Mine's Emergency Response Procedure. Fume events with a material and not a trivial risk to harm the environment shall be reported immediately without delay as described in the WCPL Fume Incident Notification Procedure (WA-ENV-PRO-507.2) and WCPL PIRMP.

The Environment and Community (E&C) Manager (or delegate) will notify affected landholders of the potential fume event approaching their property and to proceed with measures to avoid potential exposure to the blast fume. Current contact details for landholders who may potentially be impacted by a blast fume event at the Mine are detailed in Section 3.4 of WCPL's Fume Incident Notification Procedure (WA-ENV-PRO-507.2).

6.0 Audit/Review

The BFMS will be reviewed:

- During each review of the BMP (refer to Section 9.1 of the BMP); and/or
- Following any blast event:
    - Rated 4 or greater produced from a blast event, or
    - With a rating of 3 which leaves the project approval boundaries or a closed portion of public road.

7.0 Responsibilities

Table 4 below summarises responsibilities documented in the BFMS. Responsibilities may be delegated as required.

Table 4: BFMS Responsibilities

No	Task	Responsibility	Timing
1	Ensure resources are available to WCPL personnel to facilitate the completion of responsibilities under this BFMS	General Manager	As required
2	Ensure that all process and procedures under this BFMS and all other relevant management plans in relation to Blast events are followed	D&B Engineer	As required
3	Ensure that all relevant personnel have reviewed the BFMS and any amendments to the BFMS	D&B Supervisor	As required
4	Ensure BFMS is implemented across all relevant personnel	E&C Manager	As required
5	Liaise with all relevant stakeholders, including external regulatory bodies, regarding all aspects of the BFMS	E&C Manager	As required
6	Ensure that the community is informed via the Blasting Information Hotline and the Peabody Wambo SMS blasting notification messaging service of a blast event	E&C Manager	by COB the day before the blast
7	Investigate and report to all relevant stakeholders of any fume generated events which are required under this BFMS and any other relevant approved management plan	E&C Manager	As required

8.0 References

- Development Consent (DA305-7-2003)
- Development Consent (DA177-8-2004)
- WCPL Environmental Protection Licence (529)
- Australian Explosives Industry Safety Group (AEISG) Code of Practice - *Prevention and Management of Blast Generated NOx Gases in Surface Blasting* (Edition 2. August 2011)
- Queensland Government - Queensland Guidance Note - *Management of Oxides of Nitrogen (No2) in Open Cut Blasting* (QGN 19. Version 1. 31 May 2011)
- NSW DP&E *Elements of a Blast Fume Management Strategy* (23 August 2012)
- AS 2187.0 –1983: Storage transport and use – Terminology
- AS 2187.1 - 1998: Explosives – Storage, Transport and Use, Part 1 - Storage
- AS 2187.2 – 2006: Explosives – Storage, Transport and Use, Part 2 – Use of Explosives

ATTACHMENT A
CONSULTATION

NSW GOVERNMENT | Planning & Infrastructure

Contact: Scott Brooks
Phone: (02) 6575 3401
Fax: (02) 6575 3415
Email: scott.brooks@planning.nsw.gov.au

Mr Peter Baker
General Manager
Wambo Mine
PMB 1
Singleton NSW 2330

Dear Mr Baker

Blast Fume Management Strategy

I refer to the Blast Fume Workshop held in Singleton on 19 June 2012 and the Department's letter dated 26 June 2012 requesting the Upper Hunter mines commence rating and recording blast fume events from 2 July 2012 as the first stage of fume minimisation measures.

The purpose of this letter is to now request that mines commence the second stage of the proposed minimisation measures by submitting a Blast Fume Management Strategy for approval, within three months from the date of this letter. The suggested minimum requirements for the Strategy, listed in Attachment 1, have been amended in consideration of industry comments from the above Workshop.

It is intended that each mine's Blast Fume Management Strategy, once approved, would be annexed to the mine's Blast Management Plan or, in the absence of a Blast Management Plan, to an appropriate operational management plan.

I appreciate your co-operation in developing and implementing a strategy to minimise amenity impacts from blast fume.

If you wish to further discuss this matter, please call the Department's Singleton office on 6575 3405.

Yours sincerely

23.2.12

Chris Wilson
Executive Director
Major Projects Assessment

Attachment: Elements of a Blast Fume Management Strategy

cc. Environment Protection Authority
Department of Trade and Investment, Regional Infrastructure and Services
NSW Health
NSW Minerals Council

Department of Planning & Infrastructure
22-33 Bridge Street Sydney NSW 2000 | GPO Box 39 Sydney NSW 2001 | T 02 9228 6111 | F 02 9228 6455 | www.planning.nsw.gov.au

ATTACHMENT 1: Elements of a Blast Fume Management Strategy

For the Blast Fume Management Strategy to be effective it will need to comprehensively address all the known factors that can affect the generation of fume. Further, it will need to address how post blast fume is rated and reported. Please find below suggestions for sources of information and topics to be included in your Blast Fume Management Strategy. These suggestions form minimum requirements for topics to be included in the Management Strategy. Mines are encouraged to enhance or add to these topics in drafting their Management Strategies based on operational experience and continuing research.

1. ***Rating and recording of blast fume events*** *(as requested in the Department's 26 June 2012 letter)*

- Rate and record the fume characteristics of all shots using the rating system in Appendices 2 and 3 of the Australian Explosives Industry and Safety Group Inc Code of Practice titled "Prevention and Management of Blast Generated NOx Gases in Surface Blasting, Edition 2, August 2011" (the "AEISG Code") available at http://aeisg.org.au/index.php/cop.html. This includes all blasts even if there is no visible post blast fume. The fume is to be rated when it is at its greatest extent. Further information is also available from the Queensland Dept of Employment, Economic Development and Innovation at: http://mines.industry.qld.gov.au/safety-and-health/631.htm.
- Records of fume ratings are to be kept on the mine site. The Department may take up the option of reviewing and discussing these results with the mine from time to time. Written records are to be kept for a minimum of 2 years. It is intended that these records would not currently be placed on the company's website.
- Video record each blast where a risk of post blast fume is identified. The forthcoming blast fume management strategy would define when such a risk is likely to occur.
- All video footage is to be stored for at least 1 year. All videos should be a minimum duration of 1 minute following the blast and should capture any post blast fume until the fume dissipates, leaves the site, or leaves the view of the camera.
- The rating and recording of post blast fume is to be kept from 2 July 2012.

Additional suggestions:

- When video recording fume events, suggest keeping the camera in one place and using the zoom to follow the fume, if necessary.
- A camera on the mine boundary could be helpful to confirm whether the fume extends beyond the mine site.

3

2. ***Reporting significant fume events to the Department***

- Notify the Department of Planning and Infrastructure compliance office in Singleton of any blast producing post blast fume that rates 3 at it highest extent and leaves the site (see definition below), and any blast that rates 4 or 5. It is not the intention that all shots required to be reported will require a formal incident report, as this will depend on a number of factors. Within this report the quantity of explosive and / or the number of blast holes should be included. The purpose of this is to provide a guide to size the fume event;

- *Site - includes any active mine site's project approval boundary and any closed portion of public road.*

3. ***Developing a management plan to minimise fume emissions by addressing those factors known to contribute to fume generation. The following should be considered.***

Geology

- A risk matrix for the site should be established based on geology and past blasting outcomes, then used as a guide for shot size, sleep time and product selection. The risk matrix will require frequent updating and as such should form a sub set of the Management Strategy;
- Blasting in weak and soft strata (primarily within approx 20m of surface);
- Areas known to contain a high incidence of faulted/fractured ground;
- Holes with high clay content;
- Time between drilling and loading;
- Ground movement/product desensitization;
- Industry has recognised that wet holes should be defined as those which contain water, have been dewatered or holes where moisture is present in the base or walls. The Management Strategy will need to define "wet" and "dry" holes so their different management requirements can be identified;
- Mud/sediment in the base of holes.

Meteorological conditions

- Meteorological forecasting for storms, rain events, strong winds and inversions;
- If rain is forecast what precautions are planned.

Blast Design

- Explosives desensitization;

4

- Blast layout and delays;
- Priming.

Product Selection, Quality and Blast Crew Education

- Choice of explosive product;
- Compliance with manufacturers recommendations and procedure for variations to manufacturers recommendations;
- Education and training on product selection and bench practices;
- How and where the blasting products are used;
- Explosive quality, QA and auditing, mixing of materials, delivery system, contractor, product rotation, etc;
- Stemming materials and techniques;
- Loading sequence and techniques;
- Product variation from approved blast plan.

On Bench Practices

- Bench drainage techniques;
- Sleep time taking into account a number of different hole conditions or forecast weather and a maximum sleep time for each product;
- Process for exceeding recommended or maximum sleep times;
- Inspection regime of sleeping shots;
- Management of slumping of holes;
- Tolerance of error allowable for the location of the drill holes.

Emergency response procedures

- Fume events with a material risk of harm to the environment should be addressed under statutory emergency response procedures, such as a "pollution incident response plan" consistent with EPA Environmental Guidelines: Preparation of pollution incident response management plans (March 2012).

Planning & Environment

Contact: Scott Brooks
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Our ref: 305-7-2003

The General Manager
Wambo Mine
PMB 1
SINGLETON NSW 2330

Attention: Steve Peart

Dear Steve

Wambo Coal – Approval of Blast Management Plan

Thank you for forwarding the Wambo Blast Management Plan and the Blast Fume Management Strategy and notification procedure as required under project approval DA 305-7-2003 for the Department's consideration.

The Department has reviewed these plans, and relevant attachments, 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 Secretary has approved the plan.

This Plan comes into force on the 30th November 2015 and remains in force until replaced by any future updated approved Plans.

Could you please forward finalised copies of the above plan (preferably in PDF format with a copy of this approval letter appended) for the Department's records by the end of November 2015.

If you require further information or clarification in this matter please contact Scott Brooks on 6575 3401 or by email to scott.brooks@planning.nsw.gov.au.

Yours sincerely

Scott Brooks
Investigations (Lead), Compliance
27-11-2015
As Nominee for the Secretary, Planning & Environment

ATTACHMENT B
AEISG FUME RANKING

Level		Typical Appearance
Level 0 No NOx gas		
Level 1 Slight NOx gas		
1A	Localised	
1B	Medium	
1C	Extensive	
Level 2 Minor yellow/orange gas		
2A	Localised	
2B	Medium	
2C	Extensive	
Level 3 Orange gas		
3A	Localised	
3B	Medium	
3C	Extensive	
Level 4 Orange/red gas		
4A	Localised	
4B	Medium	
4C	Extensive	
Level 5 Red/purple gas		
5A	Localised	
5B	Medium	
5C	Extensive	