WILPINJONG COAL
BLAST FUME MANAGEMENT STRATEGY

September 2024

Document Owner		Document Approver
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Version	**Approval Date**	**Approver Name**
6	Sept 2024	Kieren Bennetts

General Description of Changes from Previous Version			
Version	**Date**	**Prepared/Reviewed By**	**Description of Change**
1	May 2014	Amanda French, Clark Potter, Polaris	New strategy to meet DP&E requirements (refer Attachment 1)
2	October 2016	WCPL	MOD 7
3	June 2017	WCPL	WEP
4	August 2020	WCPL	To align with progression of operations, revise fume management measures and update location of sensitive receptors
5.1	June 2021	WCPL	Update to Figure 1 Blast Fume Sensitive Receivers – addition of Pit 6 crib hut. Minor updates to blast fume management measures
5.2	October 2023	WCPL	Update to include Environmental Blast Hazard Analysis and use of the dispersion model.
6	Sept 2024	WCPL	Updated to include EBHA and plume model and in consideration of MOD2 and MOD4.

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1 Introduction

Wilpinjong Coal Pty Ltd (WCPL) has prepared this Blast Fume Management Strategy (BFMS) in accordance with correspondence received from the NSW Department of Planning, Housing and Industry (DPHI), requiring the development of a BFMS (**Section 5**).

The purpose of the BFMS is to document fume minimisation measures utilised at Wilpinjong Coal Mine (the Mine) for all surface blasting activities.

This BFMS is an appendix of the Blast Management Plan[1] (BMgtP) as required by SSD-6764 and has been prepared to minimise on and off-site fume emissions from blasting activities required by WCPL[2] [3].

Many factors have been identified as contributing to post blast fume, either individually or in combination, including:

- Geology and hydrology, particularly soft/weak overburden horizons with damp/wet conditions.
- Meteorological conditions, with rainfall onto a loaded shot potentially causing water ingress into dry holes, and wind speed and direction dictating the movement of post-blast fume.
- Blast design, with larger and/or wider confined blasts presenting higher fume risk.
- Product selection and quality, particularly if not suited to ground and/or water conditions.
- Blast crew education and on-bench practices, particularly with respect to water management, product selection and primer placement.

Management strategies for each of these factors are provided in **Section 2.0**.

WCPL carry out three very different blasting regimes:

- Standard overburden blasts, ranging from 10 to 40m-50m deep.
- Pre-split blasts, ranging from 20 to 60 m deep; and
- Shallow parting blasts, ranging from 2 to 15 m deep.

If blast fume is present, it will most likely be seen in an overburden or pre-split blast and rarely in the parting shots due to the smaller quantity of explosives used. In general, blast fume is not a common occurrence at the Mine.

[1] Condition 14, Schedule 3 of SSD-6764
[2] Condition 12(a), Schedule 3 of SSD-6764
[3] Condition 19(a), Schedule 3 of SSD-6764

2 Mitigation Measures

To ensure WCPL reduce the potential for fume generation, the mitigation measures in **Table 2-1** will be implemented. WCPL conduct the following actions as part of its blasting process to minimise blast fume events, including:

- Installation of Blastshield - a lining for blast holes that provides a barrier to prevent the ingress of water and potential product degradation, while also containing explosives within the blast hole if the surrounding material is compromised; and
- Dewatering water from blast holes, allowing for the installation of the Blastshield, if water recharge rate is low.

Figure 2-1 Blast Fume Management Measures

Key Factor	Potential Issue	Mitigation Measure
Geology	Blasting in weak/soft strata *(<20m of surface)*	• Free dig where required (drilled holes often fail) and the high moisture content in the clay band results in significant degradation of the Ammonium Nitrate (AN) explosive. • Free face where possible. • Reduce powder factor where practical. • Modify timing where applicable (e.g. Boxcuts).
	High moisture content in clay holes	• Load with suitable wet hole product e.g. 70% emulsion product where blast supervisor /shot firer deems that there is a high-water content.
	Time between drilling & loading	• No correlation noted for holes loaded with varying delays after drilling, although charged quantities should be checked for backfilled/collapsed holes.
	Wet holes	• Gas bag in the hole to prevent product contact with wet base. • Use blast products suitable for wet conditions.
	Mud/sediment in base of holes	• Gas bag in the hole to prevent product contact with wet base.
Meteorological Conditions [1]	Rain events	• Loaded shots that may be affected by rain will be assessed by the Drill and Blast (D&B) Engineer in consultation with the Drill and Blast Superintendent.
	Strong winds	• Blast will only occur when in compliance with the Wilpinjong Blast Controller Checklist (**Appendix 1**).
Blast Design	D&B Standards	• Blast designs will be implemented using D&B standards for pattern layout, charging timing and review process monitoring each Blast.
	Explosives desensitisation	• Depth can contribute to desensitisation. The depth of drilled holes on the site do not exceed the range between 40m-50m for production shots there are some areas of the mine where presplits are up to 60metres deep which would be a small volume and is therefore not considered a major contributor to fume.
	Blast layout	• Increased precision through GPS guided equipment.
	Priming	• Holes deeper than 15 meters are double primed to ensure full detonation of the column of bulk explosives.
	Blast delays.	• Keep sleep times of loaded shots within timeframes recommended by Explosive Manufacturer. • Fume risk when blasting outside of these parameters will be assessed by the D&B Engineer in consultation with the Drill and Blast Superintendent and Explosive Supplier.
Product Selection & Quality	Explosive product selected	• Selections based on Explosive Manufacturer's recommendations.
	Compliance to manufactures specifications.	• The site D&B Engineer in consultation with the Explosives Manufacturers' representative will continue to monitor and progress product application and management against manufacturers' specifications. This process will result in a defined site-specific blast product application, in line with D&B standards.

Key Factor	Potential Issue	Mitigation Measure
	Explosives Quality	• Confirmed by the blasting contractors Quality Control process inclusive of the following: - Gassing rates and final density recorded on the delivery docket.
	Delivery system	• MPU calibrated as required.
	Product rotation	• Ammonium Nitrate stock management plan. • Pre-delivery quality assurance inspection (i.e. WCPL explosive Supplier product is in specification). • Visual inspection on arrival at site.
	Stemming materials & techniques	• Stemming diameter 16 to 28mm (inspected by Shotfirer). • Stemming depth determined by D&B Engineer dependant on individual blast conditions and measured by the blast crew.
	Loading sequence & technique	• Loading procedure is driven by product selection and manufacturer's specifications. • Wet holes loaded last to minimise water displacement into dry holes.
	Variation to blast plan	• Any irregularities or variations to the blast plan are to be determined by the D&B Engineer which is communicated to the Shotfirer and D&B Supervisor.
	QA & Auditing	• Explosives Manufacturers Auditing and Inspection Schedule.
Blast Crew Education	Qualifications of Blast Crew	• Peabody blast crew internal policy. • Training records maintained.
	Training requirements of blast crew	• Peabody blast training system incorporates the following: - Shotfirers permit. - Unsupervised handling permit. - Training to open cut site requirements (management plans and SOP's); - Product development and updates. - Product selection; and - On Bench practices.
On Bench Practices	Bench drainage techniques	• Minimise surface water where possible, • Utilise hole savers and drill cuttings, • Drains for re-directing water, • Blast hole dewatering.
	Sleep time	• Minimise sleep times of loaded shots where possible in accordance with the explosive manufacturer's recommendations. • Fume risk when blasting outside of these parameters will be assessed by the D&B Engineer and D&B Superintendent.
	Shot inspections	• Drill preparation, drilled shot, loading, firing
	Collapsed holes	• Holes are checked by the shot crew and shallow blocked holes are not loaded and are stemmed off. Redrills will be as necessary.
	Slumping Holes	• Loaded holes are checked by shot crew, slumping is reported to the D&B Supervisor and 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, decisions can be made to fire the shot earlier; not load all the holes; or change the product to a more water-resistant blend. Ingress of water into blast holes is an abnormal circumstance for this site.

Notes:

1. Exceptions - There may be circumstances in which failure to initiate blasts may increase the potential for fume generation with occupational health and safety risks to mine personnel. Such blast events may need to be fired in less-than-ideal weather conditions. In these specific and rare circumstances, the final decision-making process will be elevated to the Mine Manager (or in their absence, to the delegated authority) with relevant input from the D&B Superintendent, D&B Engineer, Blast Supervisor and Shotfirer.

3 Pre-Blast Checklist and Fume Risk Assessment

Prior to firing, a reassessment of the risks posed by the blast will be undertaken with due consideration given to the relevant factors applying at the time e.g., rain events, wind direction and speed, inversions, operational factors on site. Following the reassessment, it may be necessary to apply additional risk control measures, or defer the blast, to ensure appropriate safety levels are achieved.

The Blast Controller Checklist includes an assessment of whether there are risks associated with blast fume from the blast. An Environmental Blast Hazard Analysis (EBHA) and TARP have been developed which documents the process to be followed, depending on the level of risk presented by the predicted plume from the fume model, relative to the main risk zones (**Figure 3-1**).

Fume considerations for firing the shot include the following:

- Fume Dispersion Model showing the extent of the predicted plume relative to the main risk zones (**Figure 3-2**).
- Weather conditions – wind speed and direction.
- Blast Controller Checklist (**Appendix 1**);
- Environmental Blast Hazard Analysis (EBHA) completed (**Table 3-1**).
- Blast Fume TARP completed (**Table 3-2**).
- Operational factors.

Figure 3-1: Blast Fume Main Risk Zones at WCPL

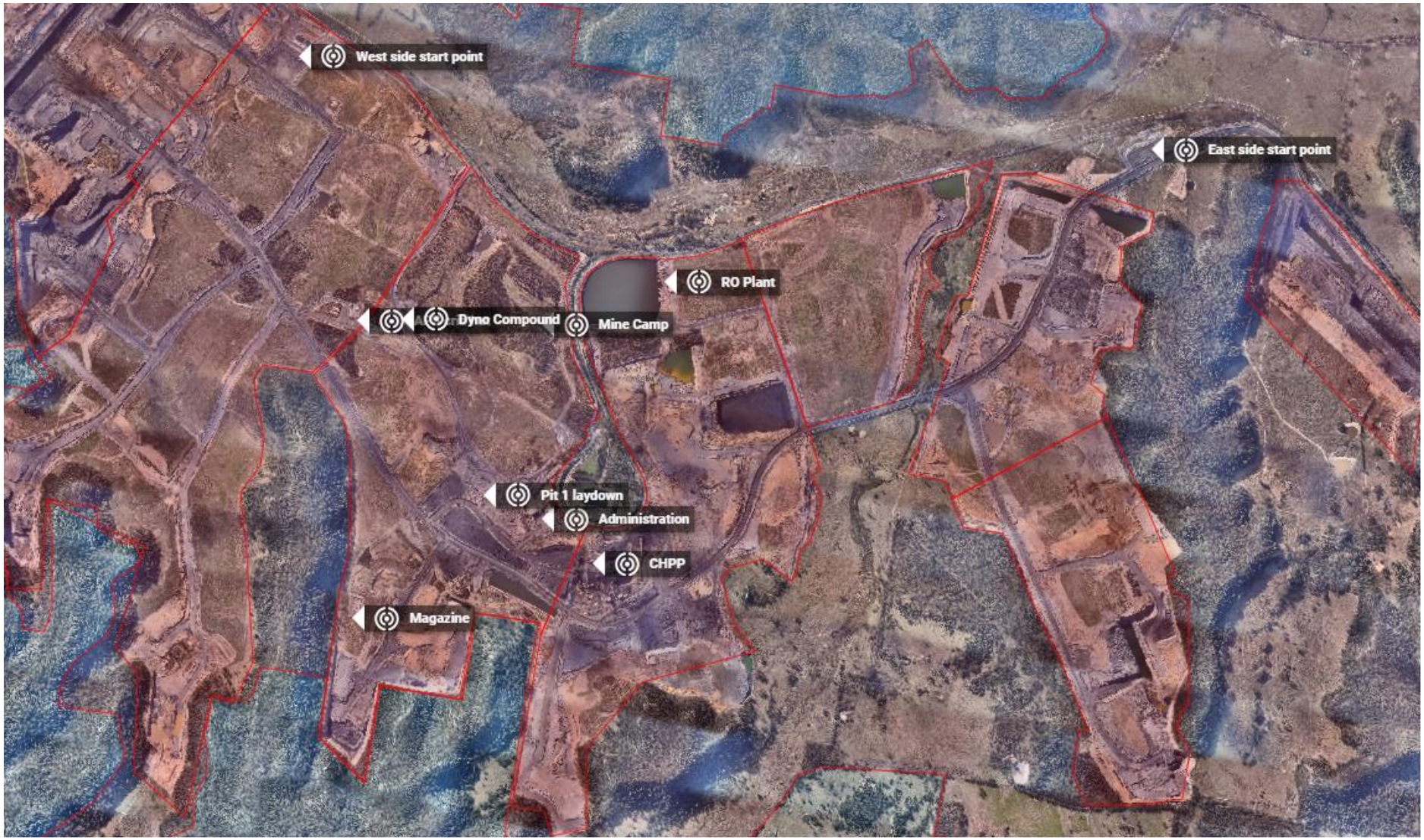

Figure 3-2 Example of Blast Fume Main Risk Zones and Plume Modelling at WCPL

Table 3-1 Environmental Blast Hazard Analysis (EBHA)

Peabody

WILPINJONG ENVIRONMENTAL BLAST HAZARD ANALYSIS

SIGNOFF *(as required)*			
DB Engineer		**DB Supt. / Mine Manager**	
Date:		Date:	
Sign:		Sign:	

Blast Number:		**Blast ID/Location:**		**Planned Firing Date:**				**Planned Firing Time:**			
PRE-BLAST	**Weather Check**		**Vibration Analysis**		**Blast Notifications**	**Website**	**Phone**	**Board**	**Dust Dispersion Fume Model Date:**		**EBHA Date:**			

Instructions:

A. Negligible risks: score 1 and proceed with blast.

B. Elevated risks: score all underlined items 2 and review with D&B Superintendent.

C. Significant risks: score all underlined items 3 and review items with D&B Superintendent.

Approval Required from Mine Manager to fire blast if total category score exceeds Significant level in any category.

Blast Design / Planning	**A. Negligible risks (score 1)**	**B. Elevated risks (score 2)**	**C. Significant risks (score 3)**	**ACTIONS**	***Score: 3 - 5, NEGLIGIBLE; Score: 6 - 8, ELEVATED; Score: > 9, SIGNIFICANT***
Blast design – Refer to design drill plan, charge sheets, and tie-up plan (in blast pack)					
Blast design implementation aligns with plan?	Blast Implemented to design:	Minor adjustments to:	Significant changes to:		
	- Drilling , designed pattern	- Drilling , designed pattern	- Drilling , designed pattern		
	- Charge design (product type/position etc)	- Charge design (product type/position etc)	- Charge design (product type/position etc)		
	- Design timing/initiation	- Design timing/initiation	- Design timing/initiation		
Sub Total	/ 3	/ 6	/ 9	**Total:**	

Ground Vibration	**A. Negligible risks (score 1)**	**B. Elevated risks (score 2)**	**C. Significant risks (score 3)**	**ACTIONS**	***Score: 4 - 6, NEGLIGIBLE; Score: 7 - 9, ELEVATED; Score: > 11 SIGNIFICANT***
Estimated vibration results	Estimates < 70% of limits.	Estimates > 70% and < 85% limits.	Estimates > 85% limits.		
Max charge per hole	Design +10%	Design +20%	Design > +20%		
Distance to residential receivers	> 3,000m	< 3,000m to 1,500m	< 1,500m	(Limit - 5mm/s)	
Distance to sensitive receivers	> 1,500m	< 1,500m to 500m	< 500m	(Limit Road/Rail - 100 mm/s)	
Total	/ 4	/ 8	/12	**Total:**	

Blast Overpressure	**A. Negligible risks (score 1)**	**B. Elevated risks (score 2)**	**C. Significant risks (score 3)**	**ACTIONS**	***Score: 5 - 9, NEGLIGIBLE; Score: 10 - 15, ELEVATED; Score: > 15, SIGNIFICANT***
Distance to receivers	> 3,000m	< 3,000m to 2,000m	< 2,000m		
Face Burden	> 6m	4.8m to 6.0m	< 4.8m		
Stem height	> 4m stem	< 3.5m to > 4m stem	< 3.5m stem		
Max charge per hole	Design +10%	Design +20%	Design > +20%		
Distance to sensitive receivers	> 1,500m	< 1,500m to 500m	< 500m	(Limit Road/Rail - 100 mm/s)	
Timing Reinforcement	Fired away from sensitive recievers	Fired towards sensitive recievers	Short delays (< 25ms), fired towards sensitive receivers.		
Total	/ 6	/ 12	/ 18	**Total:**	

WILPINJONG ENVIRONMENTAL BLAST HAZARD ANALYSIS

Blast Number:		Blast ID/Location:		Planned Firing Date:		Planned Firing Time:	

Instructions:

A. Negligible risks: score 1 and proceed with blast.
B. Elevated risks: score all underlined items 2 and review with D&B Superintendent.
C. Significant risks: score all underlined items 3 and review items with D&B Superintendent.
Approval Required from Mine Manager to fire blast if total category score exceeds Significant level in any category.

Fume (NOx)	**A. Negligible risks (score 1)**	**B. Elevated risks (score 2)**	**C. Significant risks (score 3)**	**ACTIONS**	***Score: 11 - 16 , NEGLIGIBLE; Score: 17 - 24, ELEVATED; Score: > 25, SIGNIFICANT***
Blast design implementation aligns with plan?					
Ground Conditions	Firm to hard (fresh)	Weathered and/or broken	Natural Surface / Paleo Channel		
	Dry	Damp / Dewatered	Wet / wet walls / rain affected		
Fume History	No recent fume recorded	Recent level 1 - 3	Known history / or > 4		
Confinement	Free face	Confined / Buffer blast	Significant confinement (deep / wide)		
Depth	< 15m	15m - 25m	> 25m (confined)		
Charging	As per design +/- 10%	< 10% across blast / minimal slumping	> 10 % across blast / widespread slumping	(consider ground type/bulk product in this response)	
	< 100 tonnes / < 0.6 PF	> 0.6 to < 0.9 PF	> 0.9 PF	(consider ground type/bulk product in this response)	
Bulk Product	Sleeved ANFO	LD HANFO / Augured Wet product	HD HANFO / Pumped Wet product (Dynamic)	(consider ground type/bulk product in this response)	
Sleep time	LTF / < 7 days	7 - 12 days	> 12 days		
Blast Volume	< 100,000 BCM	> 100,000 - 650,000	> 650,000	(consider confinement in this response)	
Dispersion Modelling	Fume NOT impacting sentries or blast clearance / > 500m from mine boundary	Fume may leave blast clearance zone / remain < 500m from mine lease boundary	Fume MAY leave mine lease boundary		
Sub Total	/ 11	/ 22	/ 33	**Total:**	

Dust	**A. Negligible risks (score 1)**	**B. Elevated risks (score 2)**	**C. Significant risks (score 3)**	**ACTIONS**	***Score: 3 - 5, NEGLIGIBLE; Score: 6 - 8, ELEVATED; Score: > 8, SIGNIFICANT***
Number of Blast holes	< 200	> 200 to < 1500	> 1500		
Relative Level within Mine	Partings / Lowest RL	M4 - A12 Horizons	GLB / Natural surface, base of weathering		
Rain within last 2 days	Heavy	Mild - Moderate	Nil		
Total	/ 3	/ 6	/9	**Total:**	

Table 3-2 Blast Fume TARP

NEGLIGIBLE EBHA 11 – 16	ELEVATED EBHA 17 -24	SIGNIFICANT EBHA > 25
PRIOR TO BLAST: • Blast Controller to take into consideration risk factors listed in the EBHA.: • Blast exclusion zone may need to be increased. **IMMEDIATELY AFTER BLAST:** • Blast Guards to monitor blast fumes to ensure fumes do not travel towards populated areas. • If blast fumes continue to travel towards personnel a radio call will be given to vacate the area or if in a vehicle put on the recycle aircon and wind windows up.	**PRIOR TO BLAST:** • If personnel are potentially at risk of blast fume drift "Safe Haven" areas shall be marked on the Blast Sentry Map and communicated to all personnel on site on the day of Blasting at the pre-Blast meeting and over the radio. Personnel shall remain on standby in preparation to relocate to a safe haven area. • Blast controller to position themselves outside of exclusion zones in a safe area where the fume drift path will be clearly visible. **IMMEDIATELY AFTER BLAST:** • If fume is present and drifting towards personnel, the OCE / Blast controller shall direct area supervisors to ensure that: o all personnel are contained within the designated buildings. o all doors are closed & all air conditioners switched off until such time as the Blast Controller gives all clear for personnel to be released from the designated buildings.	**PRIOR TO BLAST:** • Blast Controller to monitor & record wind direction & speed. • If fume could potentially cross the rail line, then at least 24hrs prior to Blast: o ARTC shall be called and train timetable received for the Wilpinjong line so blasting can be conducted during a vacancy. • If public roads are at risk of being engulfed by blast fume Blast Controller shall plan for: o Traffic Road Sentry's to block the Wollar Road outside the 1500m radius from the shot and place a gas monitor outside to record air quality. o If residential areas are at risk of being engulfed by blast fume Blast Controller shall plan for nearby residences to be placed on standby for potential blast fume drift over the residential area **IMMEDIATELY AFTER BLAST:** • If fume is not going to cross the Wollar Road, then reopen road at earliest convenience & notify nearby residences that fumes are all clear. • If fume is present and continuing to drift the over the Wollar Road towards the public o Communicate to all personnel in vehicles to put on the recycle aircon and wind windows up. o Roads remain closed until the Blast Controller gives the all clear for them to be re-opened

4 Post Blast Fume Management

Post blast fume is categorised using the *Australian Explosives Industry and Safety Group Inc (AESIG)* Visual NOx Gases Rating Scale (AESIG, 2011) (**Figure 4-1**). Assessing the amount of NOx gases produced from a blast will depend on the distance the observer is from the blast and the prevailing weather conditions. The intensity of the NOx gases produced in a blast should be measured on a simple scale from 0 to 5 based on the appearance of the plume, as illustrated in **Figure 4-1**.

The extent of the NOx gases also needs to be assessed and this should be done on a simple scale from A to C where:

- A = Localised (i.e., NOx Gases localised across only a few blast holes)
- B = Medium (i.e., NOx Gases from up to 50% of blast holes in the shot)
- C = Extensive (i.e., Extensive generation of NOx Gases across the whole blast)

The Shotfirer's Blast Report will include details of whether a fume event occurred and what the fume rating was. Video footage of the plume and the direction travelled are recorded by the Blast Team during the blast. Details of every blast, including post-blast fume rating, are also recorded in the Wilpinjong blast track spread sheet.

In the case where:

- A blast fume event rated 3 or higher leaves the site boundary, or
- If any blasts exceed a rating of 4

WCPL's Environment and Community Manager (or delegate) will notify the DPHI via the NSW Planning Portal and EPA (Environment Line ph:131 555) of the fume event immediately after becoming aware of the event (refer to Section 9 of the BMgtP).

In the event of an emergency where the fume moves towards sensitive receivers, the Wilpinjong Emergency Management Plan will be enacted.

Figure 4-1 AEISG Post-blast Fume Rating Guideline

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	

5 References

NSW Planning Industry and Environment communications (and related departments)

- *Approval of Blast Fume Management Strategy (revision 5.1, June 2021), NSW Planning, Industry & Environment, 16th August 2021.*
- *Approval of various management plans, including Blast Fume Management Plan (revision 4, August 2020), NSW Planning, Industry & Environment, 7th September 2020.*
- *Approval of management plans, including Blast Management Plan, NSW Planning & Environment, 20th March 2017.*
- *Approval of management plans, including Blast Fume Management Strategy (May 2014), NSW Planning & Environment, 9th May 2016.*
- *Rating and recording of blast fume request, NSW Planning & Infrastructure, 24th March 2014.*

Prevention and Management of Blast Generated NOx Gases in Surface Blasting, AESIG Code of Practice, Edition 2, August 2011.

WI-SAH-PRO-0007 EMERGENCY RESPONSE PROCEDURES

WI-SAH -HM0010 EMERGENCY PRINCIPAL CONTROL PLAN Wilpinjong Emergency Management Plan

Appendix 1 – Blast Controller Checklist

Blast Controller Checklist					
Location:	Pit:	Strip:	Block:	Shot No:	Day/Date:
Scheduled Blast Time:				Actual Blast Time:	
Is this a road/ rail closure? **YES/NO**				If yes, are traffic Controllers on Schedule? **YES/NO** If Yes, proceed with tie up.	

WIND SPEED, DIRECTION AND CLOUD COVER Source: http://novecom.net/sentinex/index.php			
DO NOT BLAST IF: 1. WIND SPEED >7M/S IN PITS 7 & 8. Wind speed .10m/s			
TIME	RESULTS AND COMMENTS	OK to proceed with Blast?	Action
Pre Start		YES/NO	YES: Proceed to tie up. NO: Reschedule blast
1 Hour prior to Blast		YES/NO	YES/NO: Proceed blast, check conditions
5 mins prior to blast		YES/NO	YES: Proceed blast NO: 30-minute window to check conditions, if no change proceed with Blast Security Guard process.

CONFIRM PRIOR TO TIE UP	**Yes**	**No**	**N/A**	
Ensure blast map is displayed on blasting board at start of dayshift on day of firing				
Blast Notice Boards Active				
Peabody Office Notified				
Neighbours Notified				
Subcontractors Notified				
EBHA Completed				
500m Exclusion zone mapped				
Is there a risk of Blast fume				If Yes; Please see Blast Fume TARP Tarp Level:

CONFIRM AT LEAST 45 MIN PRIOR TO SCHEDULED BLAST TIME	
Does this blast comply with the maximum of 2 blasts per day limit?	**YES / NO**
Does this blast comply with the maximum of 5 blasts per week limit?	**YES / NO**
Contacted M2 to confirm who is working in the blast exclusion zone? Contacted relevant M3 depending on which pit the blast is occurring. (Written list of names must be provided)	**YES / NO**
Contacted Dispatch to determine personnel and vehicle movements in the blast exclusion zone shown by the Leica system	**YES / NO**

Blast Controller Checklist
Document Number: WI-MIN-FRM-0210 Version 5

PERSONNEL WORKING WITHIN BLAST EXCLUSION ZONE (attach relevant White Board printout where applicable)	

CONFIRM PRIOR TO HANDING BLAST TO SHOT FIRER	Yes	No	N/A
Equipment Park Up Confirmed			
Blast Area OCE Advised			
Physical Inspection of exclusion zone complete			
Local Council Notified (Road Closure)			
Blast Signs on Road			
Rail Possession Secured if within 500m			
Rail Protection officer secured			
Confirmed firing location is outside blast exclusion zone			
Sentry's checked and in correct position, exclusion Area confirmed secure and handed to shot firer			

MISFIRE EVENT	Yes / No	If YES:	Yes / No	Time
Advised by Shotfirer		Mine Manager Advised		
Delineated		Mine Supt. Advised		
Removed		OCE Advised		
Surveyed				
Investigation Complete				
Learnings Implemented		Date Implemented: / /		
Comments:				
Blast Fume Rating – Nil - 1 2 3 4 A B C D		Video Footage Captured – YES / NO		

	Blast Controller	Drill and Blast Supervisor
Signed		
Name		