

COMPLIANCE PRIORITIES OUTCOMES

Blast exclusion zones in small mines

February 2021

Blast exclusion zone management

Blasting activities are frequently conducted in hard rock quarries to break the rock that is further processed in the crushing/screening plants.

As there are different variables such as geology, ground water, accuracy of drilling, blast design miscalculation, which may affect blasting, from time to time rocks are ejected beyond the expected limits at the time of the blast, which can affect people, property and environment. Unfortunately, blasting accidents in the mining industry tend to result in critical injuries or fatalities.

Fly rock and lack of blast area security were identified as the primary causes of blasting-related injuries in surface mining.

With four fly rock incidents in the past year, some sites may not be correctly calculating exclusion zones and/or recording this information on scaled aerial maps, even when exclusion zones are referenced in the sites' Blast Management Plans.

The Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 requires mine operators to ensure that any dealing with an explosive or explosive precursor at the mine or petroleum site is in compliance with the Explosives Act 2003 and the Australian Standard AS 2187 Explosives — Storage, Transport and Use. When determining the requirements for the establishment of an exclusion zone, reference should be made to relevant standards, including AS 2187.2 Explosives — Storage and Use Part 2: Use of Explosives, Appendix 'L'.

The WHS (MPS) Reg 2014 also requires mine operators to have an Explosives Control Plan that covers the management of all blasting activities on the mine site, including the establishment and implementation of the blasting exclusion zone to manage the potential for the ejection of fly rock. As a minimum, the blast exclusion zone must be clear of personnel before firing and effective communication must exist between all personnel managing or controlling the blast.

What we did

62 sites were assessed (38 desktop assessments and 24 site assessments) between July 2021 and November 2021.

Areas assessed at each mine were –

- Blast exclusion zones are established as required by the blast management plan or established procedures.
- Nominated methods of communicating upcoming blasting activities occur and are effective.
- Nominated methods of accounting for people leaving the blasting area are conducted and are effective.
- Nominated methods of preventing access to blast areas are put in place and are effective.
- Blast guards and sentries are familiar with their duties outlined in the Explosives Control Plan and associated documents.
- Nominated warnings are given immediately prior to blasting.

What we found

Some of the key findings that resulted from the program plan included:

Overall, the mines' compliance rate is high (i.e., 84 - 90%) on four of the areas assessed. Improvements still required on nominated methods of accounting the people and blast guards training (i.e., 70 – 73% compliance rate).

PC1.4 - 01	PC1.4 - 02	PC1.4 - 03	PC1.4 - 04	PC1.4 - 05	PC1.4 - 06	
Blast exclusion zones are established as required by the blast management plan or established procedures.	Nominated methods of communicating upcoming blasting activities occur and are effective.	Nominated methods of accounting for people leaving the blasting area are conducted and are effective.	Nominated methods of preventing access to blast areas are put in place and are effective.	Blast guards and sentries are familiar with their duties outlined in the Explosives Control Plan and associated documents.	Nominated warnings are given immediately prior to blasting.	Grand Total
89%	84%	73%	90%	70%	86%	82%

■ Yellow (>= 80% and <100%)
 ■ Orange (>= 65% and <80%)

Summary findings are given below for each area assessed:

- Blast exclusion zones are established as required by the blast management plan or established procedures.
 - Several mines did not have an Explosives Control Plan available for the blasting operations.
 - Several mines have developed an Explosive Control Plan using the Small Mines Safety Management System tool kit template but there are sections in the Plan that have not been completed.
 - At several mines, the Explosive Control Plan is a corporate document that is generic in nature and does not set out the site-specific written procedures to establish and disestablish blasting zones as per the requirements of AS 2187.2 2006 Explosives – Storage, transport and use. The mine operator has no other documentation that sets out the site-specific written procedures to establish and disestablish blasting zones.
 - Some mines currently rely on the drill and blast contractors 'Blast Management Plan' to outline the site-specific written procedures to establish blasting exclusion zones. Neither the contractors' Blast Management Plan nor the mine operator's Explosives Control Plan detail the process to be used to account for persons prior to a blast taking place.
 - Some Mines' Explosive Control Plan risk assessments were not available for review.

- Several Explosive Control Plans did not meet the requirements of the Work Health and Safety (Mines & Petroleum Sites) Regulation 2014. Issues identified at some mines include:
 - Blast exclusion zone map that depicts the blast exclusion zone, sentry location and muster point during blasting was unavailable for review.
 - One mine's Blast Management Plan states that a 200 metre blast exclusion zone is established for plant and equipment but does not detail an exclusion zone for personnel.
 - Risk assessments were not conducted for drill and blasting activities.
 - Some explosives & blasting risk assessments have been completed but the risks have not been fully assessed.
 - Some blasting risk assessments did not identify fly rock as a hazard.
 - Several mines did not identify all fly rock causes with their adequate controls in the blasting risk assessment and Explosives Control Plan.
 - The Exclusion zone procedure did not cover all the elements from the AS 2187.2 Appendix E relevant to the quarry blasts.
 - Different exclusion zone distances were written in different documents for the same type of quarry blasts, which creates confusion.
 - Absence of specific detail information in the Blast Design procedure regarding powder factor, MIC, initiation delays, stemming length/material, deck charging etc.
 - Lack of information in the blasting procedure regarding location of the shotfirer at the firing time.
 - Blasting procedure does not mention that people must not be located in front of the face at the time of firing.
 - No formal procedure for clearing the mine before the blast.
 - Absence of a procedure to confirm that the air space above the blast is clear.
 - No documentation identifying the role of participants to support the implementation of control measures for blast event.
 - The process for ensuring that persons and equipment are moved outside of the exclusion zones does not record that this has occurred prior to the firing of the shot.
 - The Blast Management Plan does not detail if nominated warnings are given immediately prior to blasting.
 - The Blast Management Plan does not detail the procedures on how the shotfirer will initiate a misfire.
 - The blast exclusion zone during a lightning storm is not adequate for the protection of personnel.
 - The training / duties for blast guards and sentries are not detailed in the Explosive Control Plan and associated documents.

- At several mines there was no evidence available that the Explosive Control Plan, Blast Management Plan and associated procedures have been implemented and workers trained.
 - At some mines the Explosives Control Plan has not been reviewed in the last three years, as per legislative and the mine operator's requirements.
 - At some mines the legislation reference in the Explosives Control Plan/Blast Management Plan was incorrect.
- Nominated methods of communicating upcoming blasting activities occur and are effective.
- At several mines there was no evidence that communications with the workers not involved in the blasting activities took place on the day prior to, or on the day of the blast.
 - Some mines' Explosives Management Control Plan or job pack did not include a list of neighbours to contact prior to blasting.
 - Some Contractors' Blasting Management Plan did not include information regarding notification of residences surrounding the quarry of planned blasting activities.
 - At several mines, the Blast Management Plan states that the blast sentries must maintain positive communication but does not specify by what means.
 - Some mines' blast packs did not include a description or map of the exclusion zones which may enable a better understanding of the areas that need to be cleared prior to firing the shot.
 - Some mines "Communication with the neighbours procedure" does not include the requirement to contact the closest neighbours to the quarry before the blast.
 - There is no procedure for radio communication for firing the shot.
 - There is no documentation to confirm the activity of communicating upcoming blasting activities to neighbours had occurred for blast event.
- Nominated methods of accounting for people leaving the blasting area are conducted and are effective.
- Some mines' Blasting procedures do not detail how all persons on site are accounted for prior to blasting. Blasting procedure does not detail if a checklist is used to account for persons on site prior to blasting.
 - No evidence was available that documents the check that all persons on site are accounted for prior to blasting.
 - Several mines have properties inside the blasting exclusion zone owned by the mine operator but leased to a third party. There were occasions when workers were on those properties when blasting occurred.
- Nominated methods of preventing access to blast areas are put in place and are effective.
- Some mines do not have blast sentry checklist to guide a sentry on what tasks they should be performing and where they should be positioned.

- At several mines the blast sentries are not required to check the interface between adjoining bush and the quarry to confirm that unauthorised persons are not present.
 - At several mines the blast controller uses a 'Critical Control Check' document to manage blasting activities. Upon review there were several controls that were not being implemented due to the document's generic nature.
 - At some mines the neighbours are notified that the blast is going to occur, but the access gates are not locked during the blast to prevent people from entering the sites.
 - At some mines, not all access points into the quarry are attended to by sentries when blasting activities are conducted.
- Blast guards and sentries are familiar with their duties outlined in the Explosives Control Plan and associated documents.
- Several mines either did not provide training, or had no evidence to demonstrate, that blast guards and sentries were trained in their duties and obligations.
 - At some mines the sentries used for blasting arrangements are informally trained.
- Nominated warnings are given immediately prior to blasting.
- Some mines' Blasting procedure does not document if warnings are given immediately prior to blasting.
 - No evidence was available that the nominated warnings given immediately prior to blasting are completed on the day of the blast.
 - At some mines the first warning siren given immediately prior to blasting is 30 or 15 seconds before initiation. This short timeframe might not allow a person enough time to respond to the blast if he/she is located within the blast exclusion zone.

The nominated warnings given immediately prior to blasting detailed in the Explosive Control Plan are different to the nominated warnings detailed in the Blast Management Plan.

Outcomes

The assessments resulted in the following notices being issued:

- 0 x Section 195 Prohibition notices
- 19 x Section 191 Improvement notices.
- 38 x Section 23 Notices of concern.

Next steps

The Resources Regulator will continue to assess blast exclusion zones in small mines through planned inspections and targeted interventions. Results of these inspections will be monitored to determine

whether a more detailed assessment of industry practice is required, and whether industry assistance through some form of education is needed. Mine operators are also encouraged to review the outcomes of this report and determine potential areas of improvement that may be applicable to their own operations.

Recommendations

To address the continued compliance with blast exclusion zones, mine operators should:

- Develop or review their Explosives Control Plan to meet the requirements of the Work Health and Safety (Mines & Petroleum Sites) Regulation 2014
- Develop or review the Blasting risk assessments to cover the potential for fly rock that can be produced at the time of the blast and the relevant controls that must be implemented.
- Ensure the Explosives Control Plan, Blast Management Plan and associated procedures have been implemented and workers trained
- Ensure the Explosives Control Plan is reviewed every three years, as per legislative and the mine operator's requirements

To reduce the potential for fly rock incidents, mine operators should consider:

- The blast size, geological nature, shot location and site topography
- The hole diameter, depth of charge and burden (charge weights, locations and detonation sequences) when determining an exclusion zone, using additional blanketing material when necessary
- The predicted throw direction of the blast and the potential for fly rock
- Potential impact on public and private roads, infrastructure and neighbours, and identify their location on plans
- Whether the documented blast plan includes a surface plan or aerial picture to scale, displaying the calculated exclusion zone area.

Furthermore, mine operators should ensure that:

- Well-controlled blast exclusion zones are established around each blast
- Exclusion zones are clear of personnel before firing
- Effective communication exists between all personnel managing or controlling the blast
- Machinery within the blast zone is thoroughly visually inspected prior to its reuse
- Blasting procedures and blast management plans are updated to refer to blast exclusion zones.

Further resources

DATE PUBLISHED	REFERENCE	TITLE
2006	AS 2187.2	AS 2187.2-2006 Explosives - Storage and use – Appendix L
2008	Guide	Contractor OHS Assessment Tool
2011	AEISG Code of Good Practice	BLAST GUARDING IN AN OPEN CUT MINING ENVIRONMENT Edition 1 March 2011
2018	Guide	Health and safety at quarries
2018	Safety management kit	Safety management kit for small-scale mines, quarries and extractive industry operations

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RDOC22/8101