

COMPLIANCE PRIORITIES OUTCOMES

Blast exclusion zones in small mines

March 2021

Blast exclusion zone management

Blasting activities are frequently conducted in hard rock quarries to break the rock for further processing in crushing/screening plants. Blasting accidents may result in critical injuries or fatalities. During a blast, fly rock may be ejected further than anticipated, which can affect people, property and the environment.

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 effectively maintaining an exclusion zone during a blast.

The Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 requires mine operators to ensure that any activity 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

Sixty-two 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

Overall compliance rate was high (i.e., 84 - 90%) on four of the areas assessed. Improvements were still required on nominated methods of accounting for 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	Grand Total
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.	
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.
 - At several mines, the Explosive Control Plan is a corporate document that is generic in nature, not specific to the mine, had incorrect legislative references or had not been reviewed in the past three years.

- Some mines neither the contractors' Blast Management Plan nor the mine operator's Explosives Control Plan detailed all the requirements for safe blasting such as methods for clearing exclusion zones.
 - 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 maps were unavailable for review.
 - Risk assessments were not conducted for drill and blasting activities or were inadequate.
 - The Exclusion zone procedure did not cover all the elements from the AS 2187.2 Appendix E relevant to the quarry blasts.
 - Exclusion zone distances varied between documents. In one case, an exclusion zone was specified for plant and equipment but not for personnel.
 - Absence of detailed 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, consideration of free face and clearance procedure (including air-space above).
 - The process for ensuring that persons and equipment are moved outside of the exclusion zones was not recorded.
 - The Blast Management Plan does not detail:
 - if nominated warnings are given immediately prior to blasting.
 - the procedures on how the shotfirer will initiate a misfire.
 - the blast exclusion zone required during a lightning storm
 - 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.
- Nominated methods of communicating upcoming blasting activities occur and are effective.
- At several mines there was no evidence of an effective site wide communication process for a scheduled blast or a procedure for radio communication for firing the shot.
 - Some mines did not have an adequate procedure to contact the closest neighbours to the quarry before the blast.
 - Some mines' blast packs did not include a description or map of the exclusion zones
- 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.

- Several mines have properties inside the blasting exclusion zone owned by the mine operator but leased to a third party and 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 adjoining land to the quarry within the exclusion zone to confirm that unauthorised persons are not present.
- At some mines critical control checks were not adequately carried out by the shotfirer when firing a shot.
- 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, informally trained or had no evidence to demonstrate that blast guards and sentries were trained in their duties and obligations.
- Nominated warnings are given immediately prior to blasting.
- Some mines' blasting procedure did not document if warnings are given immediately prior to blasting or warning times differed between the procedure and the blasting management plan.
- At some mines the warning sirens did not allow sufficient time for personnel who may be inadvertently inside the exclusion zone to take appropriate action.

Outcomes

The assessments resulted in the following notices being issued:

- no Section 195 Prohibition notices were issued.
- 19 Section 191 Improvement notices were issued.
- 38 Section 23 Notices of concern were issued.

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 further action 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 their blasting risk assessments for the potential of 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 operators' requirements

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

- The blast size, geology, shot location and topography
- The hole diameter, depth of charge and burden (charge weights, locations and detonation sequences) when determining an exclusion zone, using additional buffering material when necessary
- The predicted throw direction and extent 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
- A documented blast plan that 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 for each blast, including the air-space above
- 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 inspected prior to its reuse
- Blasting procedures and blast management plans are updated to refer to blast exclusion zones.

Further resources

DATE PUBLISHED		
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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