# Explosive control plan

1. **AIM:** The aim of our explosives control plan is to ensure that all explosives used on site are transported, stored, used, disposed and managed in a safe manner to eliminate any potential harm to workers, equipment, the environment, contractors and members of the community.

Our plan is designed to manage all activities associated with blasting, by ensuring the competency of people handling and using explosives, ensuring the security of explosives on site, the correct design of blasts, the use of agreed blasting risk based checklists and procedures, the allocation of responsibilities and the promotion of consultation.

1. **WHAT:** The explosives control plan will consist of four primary pieces of documentation, namely:

* Form 17A – Whole of site explosives and blasting risk assessment
* Form 17B – Blast specific check sheet
* Form 17C – Managers blast checklist
* Form 17D – Blast plan and report

These four documents reference information obtained from industry publications and *Australian Standard 2187 Explosives – Storage, transport and use*. The use of these documents will prompt the user in determining the appropriate actions to control drilling and blasting activities and it will enable a record to be kept of the decisions made during the process.

## Blast design

Blast sequencing will, in principle, follow the mine plan and will be conducted in accordance with the operating conditions set out in the quarry development consent. The design will consider geotechnical and geological information, final terminal walls, forecast production demands and constraints such as the type and size of equipment, haul distances, road widths and road gradient.

We will always review historical blast information for pattern size, powder factors, back break, fragmentation and wall failures.

## Mark out and drilling

The area to be marked out for drilling will be prepared to provide a workplace free of hazards, including a physical barrier or windrow to separate the blast zone from the everyday quarry activities. The blast zone will be marked out and signs and / or physical barriers will be used to keep unauthorised workers and visitors out of the blast zone while drilling and loading of the blast is taking place.

An exclusion zone will be established at the face or crest of the bench using an edge protection system that will have a structural capability. Soft barriers (painted lines) will not be acceptable.

As a rule, holes will not be marked or drilled within a distance equal to half the face height of the adjacent highwall at the rear of the shot and an exclusion zone will be identified to warn people of the potential of falling debris from the adjacent high wall. Where this is not possible the blast risk assessment should address the hazards associated with potential back break and working in proximity to a highwall.

Drill rigs will operate perpendicular to the face when drilling holes near the face or crest. Where this is not possible the blast risk assessment should address the operation of the drill rig close to the face.

For all blast patterns the driller will provide a log of holes to the shotfirer, taking into consideration depth of hole, location of any broken ground, cavities or geological features.

During each blast we will seek guidance from the shotfirer with regards to the use of laser profiling of the face and bore tracking of drill holes as a blast control.

## Loading and firing

All blast holes will be loaded in accordance with the shotfirers design and any alterations will be discussed with the quarry manager, approved and recorded on check sheet Form 17B.

We will establish a blast exclusion zone around each blast to manage the risk of exposure to flyrock. This will be determined after consulting with the shotfirer and we will position sentries at locations around the quarry to ensure that other persons are not able to enter the exclusion zone.

|  |  |
| --- | --- |
| Exclusion zone distance (metres) |  |
| Sentry location #1 |  |
| Sentry location #2 |  |
| Other sentries |  |

All neighbours will be notified as per the requirements of our development consent and confirmation of contact with them will be recorded on check sheet Form 17B.

Monitoring equipment for measuring overpressure and vibration should be located on neighbour’s properties (with their consent) if required and after consultation with the shotfirer. The location of the monitors will be recorded on Form 17C.

We intend on videoing each shot to enable an accurate appraisal of each blast.

Firing will only occur after the quarry manager and shotfirer have confirmed that all requirements detailed in Form 17B and Form 17C have been complied with and it is safe to do so.

A warning device such as a siren will be sounded prior to the initiation of the blast.

## Post blast inspection

The shotfirer will conduct a post blast inspection to ensure that the blast has initiated and performed as per design. If misfires or any other hazards are identified during the post blast inspection the shotfirer will not give the all clear and will initiate the misfire procedure to manage the situation.

## Security of explosives

Security of explosives is a major concern and is an obligation on all persons who are identified in the lifecycle of the blast management process. All explosives must be recorded and accounted for including during the transport, loading (use), return of unused explosives (storage) and post firing (misfires) stages. The shotfirer will make available a reconciliation of products used during each blast to the quarry manager. This reconciliation will accompany the post blast report Form 17D.

Any discrepancies with respect to explosives reconciliation will be reported to the relevant authority immediately.

## Blasting contractor and shotfirers requirements

During the engagement of our shotfirer and blasting contractor, they will be required to provide a blast management plan that will cover all aspects of the transport, storage, use and disposal of explosives while operating on our site. This will also incorporate the controls to account for the following:

* potential for unintended detonation of explosives.
* types and characteristics of explosives to be used.
* when and where types of explosives will be used.
* details that explain the processes used to work safely during the lifecycle of explosives use – for example, transport (including inspection and maintenance of equipment), storage, loading, firing, misfires, disposal, reconciliation and reporting incidents.
* procedures for sleeping blasts overnight, including security arrangements.
* deterioration of explosives.
* potential for theft or misuse of explosives.
* potential for flyrock.
* a register of people who are licensed to transport, use, store or handle explosives and the method used to confirm that licenses are current.
* details of procedures that confirm that any conditions on various licenses are being complied with and are current.

1. **WHO:** Only people who are licensed or authorised will handle and use explosives or explosive precursors. The quarry manager will be responsible for ensuring that the relevant forms (17A, 17B and 17C) are completed during the blasting life cycle. The shotfirer will supply Form 17D to the quarry manager upon completion of each blast.

Our licenced shotfirer will be:

A copy of their qualifications will be obtained and held on site (blasting explosives users licence and security clearance), along with a register of other persons who are licenced to work under the Explosives Act.

1. **HOW:** Form 17A will be completed prior to any blasting and during the planning and selection phase of engaging a blasting contractor. It will be completed by the quarry manager in consultation with a shotfirer.

Form 17B will be completed for each blast by all people who are involved in the drilling and blasting activities.

Form 17C will be used by the quarry manager to control and record all activities that are associated with each blast.

Form 17D will be provided to the quarry manager by the shotfirer at the completion of each blast.

1. **WHEN:** Each form listed above will be used during the life cycle of the blast, including consultation with all members of the drilling and blasting team.
2. **ACTION:** Each blast will be reviewed for compliance with regulatory requirements and monitored for any community complaints. The person responsible for reporting a breach to the regulator where a statutory non-compliance is identified is:

An investigation into the non-compliance or community complaint will be conducted with the shotfirer to identify any failure of control measures and review procedures to prevent any reoccurrences.

1. **DOCUMENT CONTROL:** The person responsible for collating all information relating to each blast is:

This information will be filed in:

This file will be located:

Form 17A: Whole of site explosives & blasting risk assessment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Mine:** | | **Team members:** | | | |
|  | | **Shotfirer:** | | | |
| ***To be completed for overall site and reviewed periodically*** | | **Date:** | | | |
|  | | | | |
| **Category** |  | | **Risk**  **H | M | L** | **Audit observations – Controls** | |
| **Legislation** |  | |  |  | |
| **Competencies** | Has a qualified shotfirer been engaged to conduct blasts? | |  |  | |
|  | Do all persons having unsupervised access to explosives or explosive precursors have a security clearance? | |  |  | |
| **Licences** | If explosives or explosive precursors are to be stored will they be stored in licenced premises in accordance with AS2187? | |  |  | |
|  | Has the risk of theft been considered and a security plan been drafted (if required)? | |  |  | |
|  | Is the site allowed to blast pursuant to its development consent? | |  |  | |
| **Planning** |  | |  |  | |
| **Notification** | Has community consultation taken place with neighbours prior to blasting? | |  |  | |
|  | Has an exclusion zone been identified (>800m suggested)? | |  |  | |

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| **Category** |  | **Risk**  **H | M | L** | **Audit observations – Controls** |
|  | Has an agreed notification process to alert the community, employees & visitors that blasting will take place been developed? (signage, letter drop, verbal, sirens etc) |  |  |
|  | Has a geological assessment been undertaken to identify potential hazards? (cavities, jointing, faults, weathered material, hot or reactive ground etc) |  |  |
| **Blasting hazards** |  |  |  |
| **Flyrock** | Do procedures exist to control flyrock to a minimum? (stemming, loading, overcharging,) |  |  |
|  | Do procedures exist to ensure blast designs are ‘signed off’? |  |  |
|  | Do controls include laser (face) profiling & bore tracking? |  |  |
|  | Does the exclusion zone consider all possible flyrock scenarios? |  |  |
| **Ground vibration** | Have calculations been completed to model potential ground vibration levels? |  |  |
|  | Are monitoring devices being installed at agreed locations? |  |  |
| **Airblast (overpressure)** | Have calculations been performed to model potential airblast overpressure levels? |  |  |
|  | Are monitoring devices being installed at agreed locations? |  |  |
| **Dust & fumes** | Are adverse weather conditions considered in the modelling? |  |  |
|  | Is dust and or fume monitoring required at close residences? |  |  |

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| **Category** |  | **Risk**  **H | M | L** | **Audit observations – Controls** |
| **Traffic** | Has public and mine traffic been considered in relation to exclusion zones? |  |  |
|  | Has a communication strategy been developed to manage all traffic, clearing of exclusion zones and firing requirements? |  |  |
| **Managing the blast cycle** |  |  |  |
| **Transport** | Are vehicles transporting explosives licenced (if on a public road) or maintained to a similar standard (if on a mine site)? |  |  |
|  | Are procedures in place to exclude non-essential personnel from the blast area? (signage, removal of production equipment) |  |  |
|  | Will selected transport routes keep explosives vehicles separated from production equipment as much as possible? |  |  |
|  | The site has considered its response to a fire situation where explosives may be present? |  |  |
| **Loading** | Are procedures in place to control the amount of product that is loaded into each blast hole? |  |  |
|  | Are procedures in place to manage persons working near bench crests? |  |  |
|  | Are all bench crests protected by a structural barrier or a bund? |  |  |
|  | Is the site going to have to manage wet blasts? (ground water and surface water) |  |  |
| **Firing** | Are procedures in place to manage the clearing of exclusion zones? |  |  |
|  | Are procedures available to manage ‘misfires’? |  |  |
| **Category** |  | **Risk**  **H | M | L** | **Audit observations – Controls** |
|  | Does the misfire procedure reference AS2187? |  |  |
|  | Are procedures in place to ensure that any activity capable of generating a fire is not carried out within 10m of explosives? |  |  |
| **Loss of explosives** | Has the security of the site been considered, particularly with respect to ‘sleeping blasts’? |  |  |
|  | Has the site got systems in place to identify the loss of explosives and the reporting of the loss to the police and the regulator? |  |  |
| **Documentation** |  |  |  |
|  | Are blast specific risk assessments arranged? |  |  |
|  | Are SWMS to cover all activities relating to blasting arranged? |  |  |
|  | Are blast reports at the conclusion of each shot arranged? |  |  |
|  | Does the site need to develop a site security plan to cater for the storage of explosives or if excess explosives remain after a blast? |  |  |
|  | Are there copies of explosive legislation, standards, and codes available for persons to refer to? |  |  |
|  | * *Explosives Act 2003* |  |  |
|  | * Explosives Regulation 2013 |  |  |
|  | * AS 2187 (storage, transport and use of explosives) |  |  |
|  | * Australian Explosives Code (transporting explosives) |  |  |

Form 17B: Blast specific check sheet

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Site** |  | | **Date blast commenced** |  | | **Date fired** |  | | **Blast number** |  | |
| Company performing drilling: | | | | | | Name of driller: | | | | | |
| Company performing blasting: | | | | | | Nominated shotfirer: licence number | | | | | |
| Person supervising drill and blast for quarry: | | | | | | | | | | | |
|  | | **(To be completed before drilling commences)** | | | **Y/N** |  | | **(To be completed before firing commences)** | | | **Y/N** |
| **Access and layout** | | Is the access road to the bench adequate? (gradient, edges protected, surface) | | |  | **Pre-initiation** | | Has loading occurred as per the blast design? (No overloading, slumping, lost blast holes) | | |  |
|  | | Is there appropriate distance from the back row of blast holes to the highwall? (> ½ the face height) | | |  |  | | Has an exclusion zone been established (>800m suggested)? | | |  |
|  | | Have all highwalls been scaled and confirmed safe? | | |  |  | | Is the shotfirer able to fire the blast without any known risks to people or infrastructure? | | |  |
|  | | Does everyone have SWMS to cover their work? | | |  | **Drilling** | | Can the drill rig drill all holes perpendicular to the face? | | |  |
| **Markout** | | Has the face been inspected from below? (no undercuts, overhangs, back break) | | |  |  | | Can all blast holes be drilled on gradients within the capabilities of the drill rig? | | |  |
|  | | Is the blast bench surface reasonably smooth & clear of trip hazards? | | |  |  | | Is there an exclusion zone around the boom of the rig? | | |  |
|  | | Are all edges protected by a structural barrier or a bund? | | |  |  | | Have all water sources been identified and drawn to the shotfirers attention? (wet holes) | | |  |
|  | | Have communication systems been agreed between the mine and the blasting contractor? | | |  |  | | Has the drill log sheet identified any anomalies? | | |  |
|  | |  | | |  | **Loading** | | Has the blast area been defined with signage and all non-essential equipment and people removed? | | |  |
|  | |  | | |  |  | | Can all blast holes be loaded without a person having to breach the structural barrier or bund near the bench crest? | | |  |

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| If required, what fall protection devices will be used: | |
| **Hazards identified and implemented controls (record actions)** | |
| 1. | |
| 2. | |
| 3. | |
| 4. | |
| **Sign –off (all members of blast cycle team to sign off on risk assessment)** | |
| 1. | |
| 2. | |
| 3. | |
| 4. | |
| 5. | |
| **Confirmation of completed checklist by manager** | (signature) |

Form 17C: Manager’s blast checklist

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| **Site** |  | **Date blast commenced** |  | **Date and time fired** |  | **Blast number** |  | |
| **Company performing drilling:** | | | | **Name of driller:** | | | | |
| **Company performing blasting:** | | | | **Nominated shotfirer:** | | | | |
| **Person supervising drill and blast for quarry:** | | | | | | | | |
|  | | | | | | | | |
| **Preparation:** | | | | | | | | ✓ or n/a |
| A copy of the drillers SWMS and/or contractor management plan has been obtained and reviewed (as per Form 13D) | | | | | | | |  |
| A copy of the shotfirers SWMS and/or contractor management plan has been obtained and reviewed (as per Form 13D) | | | | | | | |  |
| All persons have been inducted onto site | | | | | | | |  |
| A face & bench stability inspection has been conducted to identify any issues | | | | | | | |  |
| The blast design has been completed in consultation with the shotfirer and agreed upon | | | | | | | |  |
| A blast specific check sheet has been completed (Form 17B) | | | | | | | |  |
| Bench crest protection is in place prior to mark out (fencing with structural capability or bunded) | | | | | | | |  |
| **Drilling:** | | | | | | | | ✓ or n/a |
| Drilling equipment has been inspected and confirmed fit for purpose | | | | | | | |  |
| If the shot is laser (face) profiled, the results have been reviewed and accepted | | | | | | | |  |
| If the shot is bore tracked the results have been reviewed and accepted | | | | | | | |  |
| A copy of the final drill log has been supplied and reviewed with the shotfirer | | | | | | | |  |
| **Blasting:** | | | | | | | | ✓ or n/a |
| All neighbours have been notified as per DA or agreed requirements *(record details)* | | | | | | | |  |
| Environmental monitors have been positioned | | | | | | | |  |
| Is the blast going to occur between allowable hours | | | | | | | |  |
| Weather conditions are confirmed okay to blast | | | | | | | |  |
| Blast camera is in position to record blast | | | | | | | |  |
| Sentries have been positioned | | | | | | | |  |
| All persons on site have been accounted for and are outside of exclusion zone (> 800 m suggested) | | | | | | | |  |
| Control handed over to shotfirer | | | | | | | |  |
| All audible warning sirens have been sounded prior to blast | | | | | | | |  |
| **Post blast inspection:** | | | | | | | | ✓ or n/a |
| No misfires have been identified | | | | | | | |  |
| Misfires have been identified, recorded and dealt with in accordance with an approved misfire procedure | | | | | | | |  |
| Shotfirer has handed site back to mine operator | | | | | | | |  |
| No environmental exceedances identified | | | | | | | |  |
| Any blast concerns are noted on the blast plan and report | | | | | | | |  |
| Regulators have been notified of reportable incidents or exceedances *(flyrock, misfire, faulty product, exceedances)* | | | | | | | |  |
| A copy of the blast plan and record has been provided to the quarry operator | | | | | | | |  |

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| **Neighbour’s names** | **Notification method (verbal, mail, etc)** |
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| **Monitor locations** | **Regulatory notifications** |
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Form 17D: Blast plan and report

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| **Site** |  | **Date fired** |  | **Time fired** |  | **Blast number** |  |
| **Nominated shotfirer:** | | | | | | | |

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| **Drilling and loading details** | | | | **Explosives used** | | | |
| **Type of stone** |  | | | **Type** | | **Quantity** | **Cost $** |
| Density of stone |  | | tonnes/m3 |  | |  |  |
| Burden |  | | metres |  | |  |  |
| Spacing |  | | metres |  | |  |  |
| Number of blast holes |  | |  |  | |  |  |
| Average blast hole depth |  | | metres |  | |  |  |
| Total metres drilled |  | | metres |  | |  |  |
| Total tonnes of stone |  | | tonnes |  | |  |  |
| Subgrade drilled |  | | metres |  | |  |  |
| Pattern type |  | | Square / staggered |  | |  |  |
| Blast hole diameter |  | | millimetres |  | |  |  |
| Number of rows |  | |  |  | |  |  |
| Blast hole angle |  | | degrees |  | |  |  |
| Bench height |  | | metres |  | |  |  |
| Stemming depth |  | | metres |  | |  |  |
| Stemming material |  | |  |  | |  |  |
| **Unit cost (cents per cubic metre or tonne)** | | |  | **Total cost $** | | |  |
| **Total explosive charge** | |  | kg | **Powder factor** |  | kg / cubic metre | |
| **Heaviest charge detonated on any one delay (Maximum instantaneous charge)** | | |  | | | kg | |
| **Remarks** | | Variation from standard in loading, drilling, for example, wet or misaligned holes, undercut face, stemming changes, delays different, etc | | | | | |

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| **Consider names of products** | | | | | | | | | | | | | | |
| **Fragmentation** |  | | **% of oversize** | | | |  | | **Muckpile profile** |  | | | | |
| **Weather** |  | | | | | | | | | | | | | |
| **Ground vibration** |  | | mm/s | | | **Airblast overpressure** |  | | dB(linear) | | | **Location** |  | |
| **Shot loaded by** |  | | | | | | | | **Supervisor** |  | | | | |
| **Complaint** | **Date received** | | |  | | **Person(s) concerned** | | |  | | | | | |
| **Nature of comments** |  | | | | | | | | | | | | | |
| **Action taken** | | **Who** | | | **What** | | | **Time / date** | | | **Checked** | | | **Feedback and response** |
|  | |  | | |  | | |  | | |  | | |  |