40824 Manage underground extractives blasting operations

Kaupae | Level	4
Whiwhinga | Credit	10
Whāinga | Purpose	This skill standard is for underground extractive managers who need to manage underground extractive blasting operations where licensed blasting personnel conduct the blasting activities. It equips underground extractive managers with the knowledge and skills to safely and effectively oversee underground blasting processes at an underground extractive site. It is important to note that this standard is not intended for those directly involved in carrying out the actual blasting. This skill standard may be used in programmes leading to qualifications and micro-credentials at Level 4 or above in extractive operations.
Whakaakoranga me mātua oti | Pre-requisites	Skill standard 40822, *Determine compliance and safety management obligations for explosives in an extractive blasting operation,* or demonstrate equivalent knowledge and skill.

Hua o te ako me Paearu aromatawai \| Learning outcomes and assessment criteria

Hua o te ako | Learning outcomes	**Paearu aromatawai** | Assessment criteria
1. Conduct risk assessment for underground extractives blasting operations and set controls to mitigate risks effectively.	a. Explain common hazards specific to underground extractive blasting activities.
	b. Explain methods to mitigate these hazards.
	c. Conduct a risk assessment for underground blasting operations and set appropriate controls.
2. Determine geological and environmental factors that influence underground extractives blasting operations and the impact on blast design and execution.	a. Identify geological and environmental factors that influence underground blasting operations.
	b. Explain how these factors are assessed and addressed to optimise blast design and ensure safety.
3. Identify safety protocols and site preparation activities necessary to conduct underground extractives blasting operations in compliance with safety and regulatory requirements.	a. Describe safety protocols for underground blasting in compliance with safety and regulatory requirements.
	b. Describe site preparation activities for underground blasting operations in compliance with safety and regulatory requirements.

Hua o te ako | Learning outcomes	**Paearu aromatawai** | Assessment criteria
4. Implement a communication plan for underground extractives blasting operations.	a. Implement a communication plan for underground blasting, ensuring clear coordination between the blasting team and other key site personnel and stakeholders.
5. Identify emergency documentation requirements and emergency protocols for underground extractives blasting operations in compliance with safety and regulatory requirements.	a. Identify emergency documentation requirements for underground operations.
	b. Describe emergency protocols for handling misfires.
	c. Identify evacuation procedures and assembly points for underground blasting emergencies.
6. Evaluate underground extractives blasting processes.	a. Evaluate underground blasting processes compared to the blasting plan, noting any deviations.
	b. Evaluate the implementation of safety protocols during underground blasting operations, identifying any breaches or lapses.
	c. Evaluate the effectiveness and adherence to communication plans involved in the operations, checking for clarity, completeness, and timeliness.
	d. Propose appropriate corrective actions to address any non-compliance or deviations identified, or any opportunities for improvement.

Pārongo aromatawai me te taumata paearu | Assessment information and grade criteria

Assessment specifications:

Evidence presented for assessment against this skill standard may include oral, visual, video, written and practical activities demonstrated in the workplace.

The site manager (who holds the relevant CoC) and blast crew supervisor (shot-firer) must ratify the candidates' risk assessment and appropriate controls prior to carrying out the blasting; this may be a third-party contractor.

The Environmental Protection Authority (EPA) is responsible for assessing and approving hazardous substances and, where appropriate, setting controls on the way the substances are used. Any questions relating to the provisions for hazardous substances should be directed to EPA New Zealand. Contact information https://www.epa.govt.nz/contact-information/

Definitions:

Blasting plan refers to site assessment, objectives, blast design, safety measures, environmental considerations monitoring and control, emergency response, documentation and reporting, including pre-blast, blast logs, monitoring data and post-blast assessment.

Company procedures are the documented methods for performing work activities. They include health and safety, operational, environmental, and quality management requirements. They may refer to legislation, manuals, codes of practice, or policy statements.

Extractive industries refer to mining, underground and surface, quarrying and tunnelling operations.

Recommended Knowledge

It is recommended that those working in underground metalliferous, tunnelling and underground coal mining complete or hold the following unit standards or can demonstrate equivalent knowledge or experience:

- Unit 15666 *Demonstrate knowledge of geology for underground extraction*.
- Unit 21281 *Test for gases, interpret findings, and demonstrate knowledge of follow-up actions in an underground coal mine*.
- Unit 30900 *Test for gases, interpret findings, and demonstrate knowledge of follow-up actions in a non-coal underground operation*.

Ngā momo whiwhinga | Grades available

Achieved.

Ihirangi waitohu | Indicative content

Ancillary equipment

- Blasting galvanometer
- Exploder
- Tamping rods including non-ferrous for underground operations
- Non-ferrous tools
- Crimpers
- Cutters
- Lowering devices.

Blast Plan

- Blast design
- Rock properties
- Explosive selection and charge weight per hole
- Drilling pattern
    - Hole placement
    - Hole diameter, depth and spacing
- Timing and sequencing
- Initiation system
- Monitoring/analysis of blast
- Safety measures
- Water management.

Communication *plan* includes pre-blast warnings and area clearance confirmations, public notifications.

Controls to mitigate risks, including competent workers, inspection, testing of all machinery and ancillary equipment, ventilation systems, ground support, and adherence to underground blasting regulations and standard operating procedures, blast pattern optimisation and maintaining safe working distances.

Documentation

- Blast design
- Blast notification
- Blast log
- Safety procedures
- Clearance plans
- Exclusion zones
- Incident reports
- Environmental impact
- Regulatory compliance
- Misfire reports
- Post-blast assessment
- Communication records.

Environmental factors

- Air temperature
- Humidity
- Vibration
- Air overpressure levels during and after the blast.
- Unstable environments (underground)
    - Atmosphere (gases)
    - Combustible material(s)
- Ventilation in underground operations.

Geological features

- Types of rock
    - igneous (plutonic, volcanic)
    - sedimentary (clastic, chemical, organic)
    - metamorphic (foliated, non-foliated)

- Principles/considerations relevant to blasting
    - rock type and composition
    - geological structures, e.g. faults, fractures and joints
    - rock mass properties
    - groundwater conditions
    - seismicity and geohazards
    - geological mapping
    - environmental considerations.

Hazards, Underground

- Blast Fumes
- Coal Dust Explosion
- Confined Spaces
- Gas Explosion
- Misfires
- Rock Burst
- Rock Falls
- Ground Collapse
- Secondary Explosions
- Toxic Fumes
- Ventilation Disruption
- Ventilation Failure
- Water Ingress
- Blast overpressure
- Ground Vibration
- Mobile Equipment

Control measures for underground blasting hazards

- Blast Fumes
    - Enhanced Ventilation: Ensure adequate ventilation systems to dilute and remove gases quickly.
    - Blast Design: Optimize blast design to minimize the production of noxious gases.
- Coal Dust Explosion
    - Dust Control Measures: Use water sprays, ventilation, and dust collectors to reduce coal dust accumulation.
    - Regular Monitoring: Regularly monitor dust levels and implement rock dusting.

- Confined Spaces
  - Ventilation Systems: Implement effective ventilation to manage air quality.
  - Emergency Response Plans: Develop and practice emergency evacuation plans specific to confined spaces.
- Gas Explosion
  - Gas Detection Systems: Install and maintain methane detectors to monitor gas levels.
  - Adequate Ventilation: Use ventilation to control and reduce gas concentrations.
- Misfires
  - Handling Protocols: Establish strict protocols for dealing with misfires, including safe re-entry times and disposal procedures.
  - Training and Education: Train workers on proper procedures for handling misfires safely.
- Rock Burst
  - Monitoring: Use seismic monitoring to predict and mitigate rock burst risks.
  - Support Systems: Strengthen mine supports in high-risk areas.
- Rock Falls
  - Support Installations: Install physical barriers such as mesh, bolts or shotcrete to stabilise loose rocks.
  - Regular Inspections: Conduct frequent structural integrity assessments.
  - Explosives Loading Sequence: Load explosives into blast holes in a top-down sequence when loading faces so that rocks dislodged by the loading process will not strike any initiating explosives already loaded into holes below,
- Ground Collapse
  - Ground Supports: Use robust bolting and/or other support techniques to secure underground openings.
  - Continuous Monitoring: Monitor stress and deformation in the rock mass regularly.
- Secondary Explosions
  - Material Storage: Store explosives and flammable materials safely and securely.
  - Blast Area Inspection: Inspect blast areas thoroughly for residual explosives.
- Toxic Fumes
  - Bulk Explosives Selection: Ensure ANFO is not used in wet holes.
  - Respiratory Protection: Provide workers with appropriate respiratory protection equipment e.g. self rescuers.
  - Air Quality Monitoring: Continuously monitor air quality for the presence of toxic gases.
- Ventilation Disruption
  - Backup Systems: Install backup ventilation systems to ensure continuous airflow.
  - Regular Maintenance: Perform regular maintenance and checks on ventilation systems.
- Ventilation Failure
  - Redundant Systems: Design ventilation systems with redundancies to prevent total failures.
  - Comprehensive Checks: Conduct thorough checks and regular audits of the ventilation systems.

- Water Ingress
  - Water Management Plans: Develop and implement water control plans including pumps and drainage systems.
  - Structural Assessments: Regularly assess and reinforce structural areas susceptible to water ingress.
- Blast Overpressure
  - Adherence to Blast Design: All blast holes are loaded per design.
  - Blast Clearance: Evacuation of personnel from the underground operation to avoid air blasts.
- Ground Vibration
  - Blast Design: Reduce the mass of explosives per hole and the number of blastholes detonating close together (the maximum instantaneous charge)
  - Blast Monitoring: Measure the peak particle velocity to determine compliance with compliance limits that have been set.
- Mobile Equipment
  - Spotter: Guide mobile equipment across the blast to avoid explosives.
  - Equipment Selection: Ensure vehicles are selected that can manoeuvre on the blast to avoid driving over explosives.

Personal Protective Equipment (PPE)

- Safety glasses
- Hearing protection
- Overalls
- Gloves
- Boots
- Safety helmet
- Breathing apparatus.

Safety protocols such as PPE requirements, escape way maintenance, and barricading procedures.

Site preparation, such as clearing and marking blast area, inspecting face, back and walls for stability, scaling of any loose rock, inspection of faces for undetonated explosives, ventilation setup, gas monitoring systems, setting up communication systems, protective barriers, blast mats, emergency access and egress planning.

Rauemi | Resources

Legislation, regulations and/or industry standards

- Hazardous Substances and New Organisms (HSNO) Act 1996; https://www.legislation.govt.nz/act/public/1996/0030/latest/DLM381222.html.
- Health and Safety at Work Act 2015 (HSW); https://www.legislation.govt.nz/act/public/2015/0070/latest/DLM5976660.html.

- Health and Safety at Work (General Risk and Workplace Management) Regulations 2016; https://www.legislation.govt.nz/regulation/public/2016/0013/latest/dlm6727530.html.
- Health and Safety at Work (Worker Engagement, Participation, and Representation) Regulations 2016; https://www.legislation.govt.nz/regulation/public/2016/0016/latest/dlm6314002.html.
- Health and Safety at Work (Mining Operations and Quarrying Operations) Regulations 2016 https://www.legislation.govt.nz/regulation/public/2016/0017/latest/DLM6732829.html.
- Health and Safety at Work (Hazardous Substances) Regulations 2017; https://www.legislation.govt.nz/regulation/public/2017/0131/latest/DLM7309401.html.
- Safe Work Instruments (SWIs) published by WorkSafe NZ.
- MinEx; Guidelines for the safe use, storage, and disposal of explosives in surface mines and quarries.
- Approved codes of practice issued pursuant to the HSW Act.
- Land Transport Act 1998 and associated Regulations; https://www.legislation.govt.nz/act/public/1998/0110/latest/DLM433613.html.
- AS 2187.1:1998 *Explosives – Storage, transport and use – Storage*.
- Territorial and/or Local Authority plans and bylaws for the storing of explosives.
- Occupational health and safety guidelines, available at https://worksafe.govt.nz/.

Where any Acts, regulations, standards, codes of practice, guidelines, or authority requirements and conditions cited in this skill standard are amended, replaced, or superseded during the lifetime of the standard, the current versions shall apply for assessment purposes until this skill standard is formally reviewed.

- Companies and/or contractors blasting policy and procedures.
- Blast management plans.
- Principal Hazard Management Plan for explosives.
- Emergency plan.
- Material safety data sheets.
- Explosive technical data sheets.

Pārongo Whakaū Kounga | Quality assurance information

Ngā rōpū whakatau-paerewa | Standard Setting Body	Hanga-Aro-Rau Manufacturing, Engineering and Logistics Workforce Development Council
Whakaritenga Rārangi Paetae Aromatawai | DASS classification	Engineering and Technology > Extractive Industries > Extractive Industries Management
Ko te tohutoro ki ngā Whakaritenga i te Whakamanatanga me te Whakaōritenga | CMR	CMR 0014

Hātepe | Process	**Putanga** | Version	**Rā whakaputa** | Review Date	**Rā whakamutunga mō te aromatawai** | Last date for assessment
Rēhitatanga | Registration	1	25 September 2025	N/A
Kōrero whakakapinga | Replacement information	N/A		
Rā arotake | Planned review date	31 December 2030		

Please contact Hanga-Aro-Rau Manufacturing, Engineering and Logistics Workforce Development Council at qualifications@hangaarorau.nz if you wish to suggest changes to the content of this skill standard.