

<b>Title</b>	<b>Design and maintain effective ventilation systems for an underground coal mine</b>		
<b>Level</b>	<b>5</b>	<b>Credits</b>	<b>20</b>

<b>Purpose</b>	People credited with this unit standard are able to, for an underground coal mine: explain the principles and practices of ventilation; design ventilation circuits, and select and position ventilation control devices; read and interpret a ventilation plan; explain how the ventilation system is established; measure, maintain, and document ongoing air velocity, air quality, and air quantity; measure gases and mixtures of gases, and interpret results and explain the effects; and explain the primary causes and control mechanisms for fires, spontaneous combustion, and hazardous atmospheres.
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<b>Classification</b>	Extractive Industries > Underground Extraction
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<b>Available grade</b>	Achieved
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<b>Prerequisites</b>	Unit 21281, <i>Test for gases, interpret findings, and demonstrate knowledge of follow-up actions in an underground coal mine</i> , or demonstrate equivalent knowledge and skills.
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### Guidance Information

- Performance of the outcomes of this unit standard must comply with the following:  
Health and Safety at Work Act 2015 (HSW);  
Health and Safety at Work (General Risk and Workplace Management) Regulations 2016;  
Health and Safety at Work (Mining Operations and Quarrying Operations) Regulations 2016;  
Health and Safety at Work (Worker Engagement, Participation, and Representation) Regulations 2016;  
approved codes of practice issued pursuant to the HSW Act.
- Any new, amended, or replacement Acts, regulations, standards, codes of practice, guidelines, or authority requirements or conditions affecting this unit standard will take precedence for assessment purposes, pending review of this unit standard.
- Joint assessment must be conducted in the assessment of this unit standard because of the high degree of risk. To conduct a joint assessment, two assessors, or one assessor and one technical verifier, must have witnessed the learner undertaking the tasks required in the unit standard and have come to the same conclusion in regards to the learner being competent or not yet competent.

At least one assessor or verifier must hold the unit standard they are assessing on their NZQA Record of Achievement.

- 4 Due to the high degree of risk associated with this unit standard, the assessment process must include a learner interview with one or both assessors.
- 5 **Definitions**  
*Company procedures* mean the documented methods for performing work activities and include health and safety, operational, environmental, and quality management requirements. They may refer to legislation, regulations, guidelines, standard operating procedures, manuals, codes of practice, or policy statements.  
*Industry best practice* may be documented in management plans, control plans, company procedures, managers' rules, occupational health and safety policy, industry guidelines, codes of practice, manufacturers' instructions, and safe working and/or job procedures (or equivalent).
- 6 All evidence for assessment against this unit standard must be in accordance with industry best practice and company procedures.

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## Outcomes and performance criteria

### Outcome 1

Explain the principles and practices of ventilation in an underground coal mine.

#### Performance criteria

- 1.1 The principles and practices of air movement and gas management in underground mines are explained in terms of effective and ineffective air circulation.

Range includes but is not limited to – air movement, gas occurrence, pressure differential, resistance, effects of temperature, air density, air power, areas, volumes.

### Outcome 2

Design ventilation circuits, and select and position ventilation control devices (VCDs) for an underground coal mine.

#### Performance criteria

- 2.1 Design meets requirements of industry best practice and company procedures.
- 2.2 The gas laws and Atkinson's formula are calculated to demonstrate the design is effective.

2.3 VCDs are selected and positioned on the designed plan to gain optimal atmospheric conditions for mine operation.

Range includes but is not limited to – main fans, air intake, return airflow, stoppings, air crossings, regulators, doors, auxiliary fans, seals, VCD's strength rating, design, location.

### Outcome 3

Read and interpret a ventilation plan for an underground coal mine.

#### Performance criteria

3.1 Standard symbols on a ventilation plan are interpreted in accordance with approved mine survey standards.

Range includes but is not limited to – main fan, air intake, return airflow, stoppings, air crossing, regulators, doors, auxiliary fan, air mover.

3.2 Mathematical calculations are made and interpreted for a ventilation plan for an underground coal mine.

### Outcome 4

Explain how the ventilation system for an underground coal mine is established.

#### Performance criteria

4.1 A VCD's construction is described.

Range includes but is not limited to – temporary and permanent materials, timber, fabric, concrete, blocks, shotcrete, mesh, steel, brattice cloth, strength rating.

4.2 The installation of auxiliary ventilation fans and ducting is explained.

4.3 The installation of VCDs is explained.

4.4 The methods for testing the effectiveness and efficiency of the ventilation system and VCDs are evaluated against the intent of the ventilation plan and site requirements.

Range includes but is not limited to – pressure differential, air flow quantity and velocity, air leakage, air quality, air power.

### Outcome 5

Measure, maintain, and document ongoing air velocity, air quality, and air quantity in an underground coal mine.

**Performance criteria**

- 5.1 Air velocity and quantity is measured in accordance with equipment manufacturers' specifications.
- Range includes – anemometer  
may include – smoke tubes, velometer, pitot tube.
- 5.2 Air quality is measured in accordance with equipment manufacturers' specifications.
- Range includes – humidity measurement, hand-held gas detection, remote gas detection (tube bundle and real time), thermometer (wet and dry bulb), dust monitoring, diesel particulate matter;  
may include – chemical gas tubes.
- 5.3 Anomalous readings or readings indicating hazardous situations are reported and recommended actions taken.
- 5.4 Actions to minimise hazards are implemented and reported.
- 5.5 Adjustments required to VCDs and equipment to maintain required air flow and air quality are described.
- 5.6 Documentation is completed.

**Outcome 6**

Measure gases and mixtures of gases found in an underground coal mine, and interpret results and explain the effects.

Range may include but is not limited to – carbon monoxide, carbon dioxide, methane, hydrogen, oxygen, nitrogen, sulphur dioxide, hydrogen sulphide, damps, oxides of nitrogen, higher hydrocarbons.

**Performance criteria**

- 6.1 The type and proportions of gases and mixtures of gases are measured in accordance with instrument specifications.
- 6.2 The potential hazards of the gas concentrations measured are interpreted in terms of consequences to mine site and mine workers.
- 6.3 Hazards are eliminated and/or minimised.
- 6.4 The characteristics and behaviour of gases are explained in terms of known gas laws.
- Range includes but is not limited to – Boyle's law, Charles's law, Combined Gas law, Coward's Triangle, Ellicott's diagram, Jones-Trickett's Ratio, CO make by volume.

**Outcome 7**

Explain the primary causes and control mechanisms for fires, spontaneous combustion, and hazardous atmospheres in underground coal mines.

**Performance criteria**

7.1 Primary causes of underground fires, spontaneous combustion, and hazardous atmospheres are explained in terms of an underground environment.

7.2 Sources of ignition are explained in terms of an underground environment.

Range includes but is not limited to – frictional ignition, electrical, mechanical, spontaneous combustion, prohibited material, flammable substances.

7.3 Control mechanisms for underground fires, spontaneous combustion, and hazardous atmospheres are explained.

Range includes but is not limited to – fire fighting methods, emergency responses, fire fighting equipment, neutralising agents.

<b>Planned review date</b>	31 December 2022
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**Status information and last date for assessment for superseded versions**

Process	Version	Date	Last Date for Assessment
Registration	1	29 August 1996	31 December 2017
Revision	2	17 December 1996	31 December 2017
Revision	3	18 December 1998	31 December 2017
Review	4	25 November 2000	31 December 2017
Review	5	24 November 2005	31 December 2017
Rollover and Revision	6	16 July 2010	31 December 2017
Review	7	18 June 2015	31 December 2019
Review	8	1 March 2018	N/A
Revision	9	28 June 2018	N/A

<b>Consent and Moderation Requirements (CMR) reference</b>	0114
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This CMR can be accessed at <http://www.nzqa.govt.nz/framework/search/index.do>.

**Comments on this unit standard**

Please contact MITO New Zealand Incorporated [info@mito.org.nz](mailto:info@mito.org.nz) if you wish to suggest changes to the content of this unit standard.