

Title	Design and maintain effective ventilation systems for a non-coal underground operation		
Level	5	Credits	20

Purpose	People credited with this unit standard are able to, for a non-coal underground operation: 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 and hazardous atmospheres.
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Classification	Extractive Industries > Underground Extraction
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Available grade	Achieved
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Prerequisites	Unit 30900, <i>Test for gases, interpret findings, and demonstrate knowledge of follow-up actions in a non-coal underground operation</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 a 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 An *underground operation* includes extractive or tunnelling operations.
- 7 All evidence for assessment against this unit standard must be in accordance with industry best practice and company procedures.

Outcomes and performance criteria

Outcome 1

Explain the principles and practices of ventilation in a non-coal underground operation.

Performance criteria

- 1.1 The principles and practices of air movement and gas management in underground operations 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.
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Outcome 2

Design ventilation circuits, and select and position ventilation control devices (VCDs) for a non-coal underground operation.

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 underground operation.

Range includes but is not limited to – main fans, air intake, return airflow, stoppings, doors, auxiliary fans, design, location.

Outcome 3

Read and interpret a ventilation plan for a non-coal underground operation.

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, doors, auxiliary fan, air mover.

3.2 Mathematical calculations are made and interpreted for a ventilation plan for a non-coal underground operation.

Outcome 4

Explain how the ventilation system for a non-coal underground operation 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.

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 a non-coal underground operation.

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, 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 a non-coal underground operation, and interpret results and explain the effects.

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

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 site and workers.
- 6.3 Hazards are eliminated 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.

Outcome 7

Explain the primary causes and control mechanisms for fires and hazardous atmospheres in non-coal underground operations.

Performance criteria

7.1 Primary causes of underground fires and hazardous atmospheres are explained in terms of a non-coal underground environment.

7.2 Sources of ignition are explained in terms of a non-coal underground environment.

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

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

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

Planned review date	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	1 March 2018	N/A
Revision	2	26 August 2021	N/A

Consent and Moderation Requirements (CMR) reference	0014
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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 if you wish to suggest changes to the content of this unit standard.