Title	**Demonstrate knowledge and evaluate the design of an effective ventilation system in an underground mine**		
Level	**6**	**Credits**	**20**

Purpose	People credited with this unit standard are able to: design parallel ventilation circuits; evaluate and describe the selection and design of a main ventilation fan for an underground mine; describe hazards associated with underground dust and methods used for their mitigation; describe spontaneous combustion and methods of detection, mitigation, and control in an underground coal mine; and demonstrate knowledge of hazards relating to coal outbursts and coal seam gas, and methods for evaluating and managing them.

Classification	Extractive Industries > Underground Extraction

Available grade	Achieved

Prerequisites	Unit 7145, *Design and maintain effective ventilation systems for an underground coal mine*, or demonstrate equivalent knowledge and skills.

Guidance Information

1 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 (Worker Engagement, Participation, and Representation) Regulations 2016;
Health and Safety at Work (Mining Operations and Quarrying Operations) Regulations 2016;
approved codes of practice issued pursuant to the HSW Act.

2 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.

3 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 Learning.

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 This unit standard is intended for, but is not limited to, workplace assessment.

Outcomes and performance criteria

Outcome 1

Design parallel ventilation circuits.

Performance criteria

1.1 Design meets requirements of approved codes of practice and industry best practice.

1.2 Airflows in parallel circuits are calculated in accordance with industry best practice and approved codes of practice.

Range includes but is not limited to – regulator location, regulator aperture size, efficiency, quantity, resistance, split limits, Atkinson formula, air pressure, kinetic energy, static energy, friction loss, airpower, Bernoulli's equation.

1.3 Ventilation control devices (VCDs) are selected and positioned to ensure optimal atmospheric conditions for mine operation.

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

1.4 Natural ventilation is described in terms of atmospheric conditions and ventilation systems in mine operations.

Range geothermal gradient, atmospheric temperature, ascensional and descensional ventilation.

Outcome 2

Evaluate and describe the selection and design of a main ventilation fan for an underground mine.

Performance criteria

2.1 Mine ventilation needs are evaluated.

Range includes but is not limited to – pressure-quantity survey, mine pressure differential, mine resistance, fan evasée, number of air splits, ventilation system efficiency, leakage.

2.2 Fan selection is described and evaluated in accordance with the mine ventilation needs and manufacturer's specifications.

Range may include but is not limited to – axial fan, radial (centrifugal) fan, pressure generation, fan efficiency, fan characteristics, fan curves, blade configuration and number, motor and drive power, type and efficiency, monitoring instrumentation, alarm settings, interlocks, communication.

2.3 Main fan portal and housing design is described and evaluated in accordance with industry best practice.

Range may include but is not limited to – pressure release doors, airlock doors, strength rating, return road area and profile, resistance, effective guarding and fencing, electricity main feed and backup supply, monitoring equipment, interlocks, door activation.

Outcome 3

Describe hazards associated with underground dust and methods used for their mitigation.

Performance criteria

3.1 Hazards associated with underground dust are described in terms of personnel and site safety.

Range includes but is not limited to – explosions, fire, pneumoconiosis, visibility, respirable and irrespirable dust, diesel particulate matter.

3.2 Methods for mitigation of hazards are described in accordance with industry best practice and company procedures.

Range includes but is not limited to – stone dust, water barriers, water sprays, filters, chemical dust suppression, ventilation system, dust removal, personal protective equipment, sampling and analysis.

Outcome 4

Describe spontaneous combustion and methods of detection, mitigation, and control in an underground coal mine.

Performance criteria

4.1 Spontaneous combustion, and factors which promote it, are described in terms of their mechanisms.

Range includes but is not limited to – oxidation, particle size, coal accumulations, coal age, rank, moisture, pressure differential, ventilation system, airflow, incubation period, occluded gases.

4.2 The development of company procedures and plans to eliminate or minimise risks of spontaneous combustion is described and evaluated in accordance with industry best practice.

4.3 Methods of detecting, interpreting, and controlling spontaneous combustion are described in accordance with industry best practice.

Range may include but is not limited to – Boyle's law, Charles's law, Combined Gas law, Coward's Triangle, Ellicott's diagram, Jones-Trickett's ratio, carbon monoxide (CO) make by volume, gas trends, coal dust, remote and portable detection equipment.

4.4 The interpretation and quantification of the level of risk and potential outcomes associated with spontaneous combustion are described in accordance with industry best practice.

Outcome 5

Demonstrate knowledge of hazards relating to coal outbursts and coal seam gas, and methods for evaluating and managing them.

Performance criteria

5.1 Methods for determining the seam gas content of a coal seam are described and evaluated.

Range includes but is not limited to – inseam gas sampling and analysis, insitu gas pressure, gas make by volume, gradient and elevation of mine workings.

5.2 Methods for controlling the seam gas content of a coal seam are described and evaluated in accordance with industry best practice.

Range includes but is not limited to – drilling equipment and systems, gas drainage systems, pipeline capacity, pipeline strength, pressure, suction pumps, gas discharge, safety features and equipment, gas monitoring, flow monitoring, safety valves, stuffing boxes, alarms, interlocks, operational controls, effect on the mine environment.

5.3 The propensity for coal outbursts and the conditions where outburst may occur are described and evaluated in accordance with industry best practice.

Range includes but is not limited to – inseam gas content, insitu gas pressure, gas make by volume, gas desorption rate, gradient and elevation of mine workings, depth of mine workings, strata type, coal rank, coal specifications (including fusinite content, strength), impermeable geological barriers, strata and coal permeability and porosity.

5.4 Methods for controlling the outburst risk are described and evaluated in accordance with industry best practice.

Range includes but is not limited to – analysis of strata, mylonite, in seam drilling equipment and systems, gas drainage systems, pressure, safety valves, stuffing boxes, alarms, interlocks, operational controls, effect on the mine environment.

Replacement information	This unit standard replaced unit standard 7169.

Planned review date	31 December 2022

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	24 November 2005	31 December 2017
Rollover and Revision	2	16 July 2010	31 December 2017
Review	3	18 June 2015	N/A
Rollover and Revision	4	25 January 2018	N/A

Consent and Moderation Requirements (CMR) reference	0114

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.