



Australian Government

Department of Education, Employment and Workplace Relations

RIIMCU602A Establish and maintain the gas management system

Release: 1

RIIMCU602A Establish and maintain the gas management system

Modification History

Not applicable.

Unit Descriptor

This unit covers the establishment and maintenance of gas management systems in the coal industry. It includes identifying, analysing and evaluating gas and outburst hazards and risks, identifying, analysing and evaluating gas control options and measures, designing and developing gas management systems, establishing the gas management system, planning and preparing for the implementation of the gas management system, and auditing and reviewing the gas management system. Licensing, legislative, regulatory and certification requirements that apply to this unit can vary between states, territories, and industry sectors. Relevant information must be sourced prior to application of the unit.

Application of the Unit

This unit is appropriate for those working in a management or supervisory role at worksites within:

- Coal mining

Licensing/Regulatory Information

Refer to Unit Descriptor.

Pre-Requisites

Not applicable.

Employability Skills Information

This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify, analyse and evaluate gas and outburst hazards and risks	1.1. Access, interpret and apply compliance documentation relevant to the work activity 1.2. Identify, evaluate and clarify coal seam characteristics and mine conditions, which contribute to flammable or irrespirable atmospheres or outbursts 1.3. Identify, analyse and evaluate hazards and risks relating to gas emissions and outbursts 1.4. Identify, analyse and evaluate the requirements for ventilation in relation to the types and amounts of gas emissions 1.5. Identify, analyse and evaluate gas hazards caused by disruption to the ventilation system and the impact on the mine atmosphere 1.6. Identify, analyse and evaluate the impacts of fire, ignition, outburst and explosion on the gas hazards 1.7. Identify, analyse and evaluate the impacts of water accumulations on gas management
2. Identify, analyse and evaluate gas control options and measures	2.1. Identify, analyse and evaluate the types and advantages/disadvantages of gas control options and management methods including gas drainage 2.2. Identify, analyse and evaluate the method, purpose and uses of gas monitoring systems 2.3. Identify, analyse and evaluate methods to maximise the effectiveness of a gas management program
3. Design and develop gas management systems	3.1. Access, interpret and clarify the legislative, and site requirements related to gas management systems 3.2. Establish gas management systems to satisfy the operational conditions of the mine 3.3. Establish surface infrastructure, which eliminates the risk of induced hazards in relation to potential gas emissions 3.4. Incorporate gas monitoring systems to minimise the potential hazards of gas

	3.5. Incorporate ventilation systems and controls to minimise the risk of gas leakage 3.6. Incorporate contingency systems to mitigate the risks and hazards of gas
4. Establish the gas management system	4.1. Establish gas management system objectives, descriptions and responsibilities and incorporate into the management system 4.2. Identify, develop and establish hazard control procedures associated with gas management 4.3. Establish gas management monitoring system installation, operation and maintenance procedures 4.4. Establish gas control device installation, operation and maintenance procedures 4.5. Establish gas management systems maintenance procedures 4.6. Establish gas management system information recording and reporting procedures 4.7. Determine and review action levels and responses to minimise the hazards of gas 4.8. Establish gas emergency and evacuation procedures 4.9. Establish a program, including systems and procedures, to satisfy identified gas management training requirements 4.10. Incorporate, audit, review and update procedures
5. Plan and prepare for the implementation of the gas management system	5.1. Identify and interpret the legislative and site requirements related to gas management system 5.2. Access, interpret and clarify the gas management system 5.3. Identify, clarify and communicate to all personnel roles and responsibilities, as specified in the gas management system 5.4. Identify, forecast, obtain and allocate/schedule resources required for the implementation of the gas management system 5.5. Implement the gas management training program

	5.6. Encourage, receive, review and, where appropriate, implement suggestions and recommendations for changes to gas management system implementation procedures
6. Audit and review the gas management system	6.1. Audit mine gas monitoring systems operations for compliance with legislative and gas management system 6.2. Audit mine gas control devices for compliance with mine site requirements 6.3. Audit recording systems for compliance with the gas management system 6.4. Audit the maintenance program and procedures for compliance with the gas management system 6.5. Audit gas management training program for currency, relevance and compliance with the requirements of the gas management system 6.6. Establish procedures for response to instances of non-compliance or other discrepancies/deficiencies revealed by audit 6.7. Respond promptly to instances of non-compliance and other discrepancies/deficiencies revealed by audit and modify the management system where appropriate 6.8. Identify and evaluate future gas management requirements and incorporate into planning procedures as stipulated by the gas management system

Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

Required skills

Specific skills are required to achieve the Performance Criteria of this unit, particularly for its application in the various circumstances in which this unit may be used. This includes the ability to carry out the following, as required to establish and maintain the gas management system:

- apply legislative, organisation and site requirements and procedures for establishing and maintaining the gas management system
- access, interpret and apply technical information
- access and analyse archival and historical gas information related to the mine
- interpret and apply mathematical and scientific theorems / laws related to gas management
- perform gas planning mathematical calculations
- access, evaluate and apply design criteria for gas management
- interpret computer spreadsheets and gas modelling / simulations
- collect, collate and evaluate gas data
- establish technical procedures relating to gas management
- conduct enquiries / investigations and prepare reports
- communicate effectively in the workplace
- access, evaluate and apply data from monitoring systems and equipment
- establish gas training requirements, programs, systems and procedures
- apply risk management processes and techniques

Required knowledge

Specific knowledge is required to achieve the Performance Criteria of this unit, particularly for its application in the various circumstances in which this unit may be used. This includes knowledge of the following, as required to establish and maintain the gas management system:

- legislative requirements for including air quality, maximum values, control and distribution, flammable gas limits, ventilation fans, gas monitoring and inspections and recording/reporting
- the methods of mine ventilation and their applications/limitations including exhaust/force, antitropical, homotropical, flank returns, ascensional/descensional, bleeder, Z/U/Y systems and other combinations
- the methods of panel gas management and their applications/limitations including homotropical and antitropical (and in conjunction with these, the use of goaf bleed or back return), auxiliary fans, coursed ventilation (narrow side/wide side), machine mounted scrubber systems, compressed air venturis and bleeders
- the impact of mining techniques and mine and panel design on gas management
- the impact of coal characteristics and coal seam gradients on mine gas systems

- mine gases; the types and their characteristics, sources, physiological effects and methods of detection
- the use and calculation of specific gas emissions
- mine fires; the types, sources of ignition and possible impacts of gas management
- pressure changes; causes and the impacts on gas management
- heat / humidity; the sources and factors which may impact on gas management
- mine fans; fan laws, fan types, performance characteristics, configurations, application and limitations
- gas control devices; the types, purposes, design criteria and specifications, distribution / placement criteria, hazards and limitations including gas drainage
- de-gassing; methods of control - including brattice, auxiliary fans, compressed air venturis, sails, hurdles and bleeders
- fixed gas monitoring systems, types, characteristics, uses and limitations
- portable monitoring equipment, types, characteristics, uses and limitations
- functions, capabilities, advantages, limitations and uses of computer modelling and simulation techniques for gas management
- a basic knowledge of computer-based systems for mine gas analysis
- Gas Management System development requirements and processes
- gas surveys; the types, frequency and methods for conducting
- processes and techniques for determining alarms and trigger points / levels
- audit and review processes and techniques
- emergency response and disaster planning processes and techniques
- general uses and application of gas management theory, including:
 - gas laws including Charles and Boyle
 - natural ventilation
 - Coward's Triangle
 - Graham's Ratio
 - Ellicott Diagram
 - gas make
 - Morris' Ratio
 - Trickett's Ratio
 - leakage
 - psychrometry and heat
 - Hughe's and Raybould triangle
 - oxides of carbon ratio
 - Kirkoff's laws
- geological data
- principles of ventilation management
- mine and goaf ventilation systems
- underground water management principles
- gas management drilling techniques
- site environmental monitoring requirements

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| <ul style="list-style-type: none">• risk management procedures |
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Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment	
Critical aspects for assessment and evidence required to demonstrate competency in this unit	The evidence required to demonstrate competency in this unit must be relevant to worksite operations and satisfy all of the requirements of the performance criteria, required skills and knowledge and the range statement of this unit and include evidence of the following: • knowledge of the requirements, procedures and instructions for establishing and maintaining the gas management system • implementation of procedures and techniques for the safe, effective and efficient establishment and maintenance of the gas management system • the identification of the relevant information and scope of the work required to meet the required outcomes • the identification of viable options and the selection of gas management system elements that best meet the required outcomes • working with other to undertake and complete the establishment and maintenance of the gas management system • consistent successful establishment and maintenance of the gas management system
Context of and specific resources for assessment	• This unit must be assessed in the context of the work environment. Where personal safety or environmental damage are limiting factors, assessment may occur in a simulated environment provided it is realistic and sufficiently rigorous to cover all aspects of workplace performance, including task skills, task management skills, contingency management skills and job role environment skills. • Assessment of this competency requires typical resources normally used in a resources and infrastructure sector environment. Selection and use of resources for particular worksites

	may differ due to the site circumstances. • The assessment environment should not disadvantage the participant. For example, language, literacy and numeracy demands of assessment should not be greater than those required on the job. • Customisation of assessment and delivery environment to sensitively accommodate cultural diversity. • Aboriginal people and other people from a non English speaking background may have second language issues. • Where applicable, physical resources should include equipment modified for people with disabilities. Access must be provided to appropriate learning and/or assessment support when required.
Method of assessment	This unit may be assessed in a holistic way with other units of competency. The assessment strategy for this unit must verify required knowledge and skill and practical application using more than one of the following assessment methods: • written and/or oral assessment of the candidate's required knowledge to apply in undertaking of the establishment and maintenance of the gas management system • observed, documented and/or first hand testimonial evidence of the candidate's: • implementation of appropriate requirement, procedures and techniques for the safe, effective and efficient achievement of required outcomes • identification of the relevant information and scope of the work required to meet the required outcomes • identification of viable options and the selection of gas management system elements that best meet the required outcomes • consistent achievement of required outcomes • first hand testimonial evidence of the candidate's: • working with others to undertake and

	complete the establishment and maintenance of the gas management system • provision of clear and timely required support and advice on the establishment and maintenance of the gas management system
Guidance information for assessment	Consult the SkillsDMC User Guide for further information on assessment including access and equity issues.

Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
Relevant compliance documentation may include:	• legislative, organisational and site requirements and procedures • manufacturer's guidelines and specifications • Australian standards • Employment and workplace relations legislation • Equal Employment Opportunity and Disability Discrimination legislation
Coal Seam characteristics may include inherent factors such as:	• rank • petrology • moisture • particle size • seam gas • pyrites • permeability
Geological conditions may include:	• faults • dykes • intrusions • strata deformities • existing or induced stress or strain <i>Or depositional factors such as:</i> • seam thickness • multiple and rider seams • seam dip • depth of cover • cleats
Hazard is defined as: <i>a source of potential harm or a situation with a potential to cause loss</i> (definition from AS/NZS 4360:1999 Risk Management).	
Hazards may include:	• irrespirable atmosphere • noxious atmospheres • flammable or explosive mixtures

	induced outburst
Risk is defined as: <i>the chance of something happening that will have an impact upon objectives. It is measured in terms of consequences and likelihood</i> (definition from AS/NZS 4360:1999 Risk Management).	
Ventilation methods may include:	- exhaust/force - anistropal (antitropal) - homotropal - flank returns - ascensional/descensional - bleeder - Z/U/Y systems - overlapping systems - other combinations
Ignition sources may include:	- electrical - static discharge - friction - contraband - spontaneous combustion - naked flame - chemical - explosives
Maintenance of the ventilation system may include:	- inspection - servicing - repair
Action (alarm or trigger) level is a generic term used to describe a level determined at the mine site at which action is initiated or a response made.	
Gas Management System establishes procedures for maintaining a safe environment and may include:	- procedures for mine atmosphere monitoring - reporting requirements - auditing - ventilation system and usage - inertisation techniques - mine plan - action plans - response plans

	• emergency procedures • individual group responsibilities • training and education procedures • hazard identification and quantification • risk assessment • authority and responsibility • controls established to manage identified risks • reporting and communication • document control • audit and review
Gas Management Training applies to:	• mine workers • tradespeople • permanent employees • contractors • mine officials • other special requirements
Audit is defined as: <i>a systematic examination against defined criteria to determine whether activities and related results conform to planned arrangement, and whether these arrangements are implemented effectively and are suitable to achieve the organisation's policy and objectives (AS/NZS 4804: 2001).</i>	
Principles of mine design include:	• recovery • reserve optimisation • mining direction • geological structures • ventilation • strata control • mining method • productivity • environmental considerations • access
Standard operating procedures (SOP) are also known as safe working procedures, safe operating procedures and standard working procedures.	

Mine atmosphere refers to all areas in the general mine ventilation district and beyond into waste working and goafs/gobs in the mine.	
Mine gases may include seam gases or gases from introduced sources and may include but not be limited to:	• methane • carbon dioxide • oxides of nitrogen • hydrogen • carbon monoxide • sulphur dioxide • hydrogen sulphide • hydrocarbons • combinations
Ventilation devices may include:	• stoppings • overcasts • regulators • preparation seals • ventilation doors • bulk heads • goaf seals • final seals • pressure chambers • air locks
Explosive control devices may include:	• water barriers • stone dust barriers • trickle dusters • calcium chloride • stone dust • triggered barriers
Gas management devices and options may include:	• gas drainage • infusion • scrubbers • automatic gas detectors • tube bundle systems • gassing device on auxiliary fans and gas monitoring systems • inertisation techniques - high, medium and low
Mine atmosphere monitoring may include:	• continuous monitoring • portable (hand held) monitoring • collection of bag samples

	- gas chromatography - ventilation measurements from all area of the mine including sealed areas and waste workings
Infrastructure may include:	- pipes - valves - hoses - pumps - drainage plant - flame arresters - power supply to bore holes - cleaning equipment
Types of fires may include:	- solid - liquid - gas - metals
Disruptions/ventilation pressure changes may include those resulting from:	- planned disruptions - changes in barometric pressure - fall of ground - fan changes/failure - ventilation control device changes/failure - outburst - holing into previous workings - re-circulation - ventilation circuit changes - natural ventilation pressure changes - explosions - changes in ambient temperature/humidity - fires - equipment moves - flooding of roadways
Effect of re-circulation may include:	- build up of contaminant concentration (gas, fumes, dust, heat) - decrease in oxygen
Criteria for safe mine ventilation may include:	- statutory and regulatory requirements - mine ventilation management plan - measures to reduce and/or control seam gas - introduced gas - fumes and dust - temperature/humidity and maximum/minimum velocity specifications - ventilation efficiency

Monitoring devices may include:	• barograph • tube bundle • real time telemetry • portable (hand held) monitoring • bag samples • gas chromatography
Monitoring includes that related to:	• atmospheric pressures • temperature • fire • condition monitoring of ventilation devices
Alarm systems and action plans may include those for:	• gas concentration/make • spontaneous combustion (physical and gaseous) • combustion indicators • condition monitoring for fans (vibration/temperature/current/failures) • ventilation devices • monitoring hardware
Procedures required to support the gas management plan may include those for:	• construction • action response • permit to work • condition monitoring • auditing • maintenance • document control • atmosphere monitoring • ventilation system control • communication systems • survey procedures • sealing procedures • changes • training and recording/reporting

Unit Sector(s)

Coal Mining (Underground)

Competency field

Refer to Unit Sector(s).

Co-requisite units

Not applicable.