



Recognised standard 15

Underground respirable dust control

Coal Mining Safety and Health Act 1999

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This document is issued in accordance with Part 5—Recognised standards of the *Coal Mining Safety and Health Act 1999* (the Act). Section 37(3) of the Act provides for the way recognised standards affect the discharge of safety and health obligations. Extracts of Part 5 and section 37(3) of the Act is provided below.

Part 5 Recognised standards

71 Purpose of recognised standards

A standard may be made for safety and health (a **recognised standard**) stating ways to achieve an acceptable level of risk to persons arising out of coal mining operations.

72 Recognised standards

- (1) The Minister may make recognised standards.
- (2) The Minister must notify the making of a recognised standard by gazette notice.
- (3) The chief executive must keep a copy of each recognised standard and any document applied, adopted or incorporated by the recognised standard available for inspection, without charge, during normal business hours at each department office dealing with safety and health.
- (4) The chief executive, on payment by a person of a reasonable fee decided by the chief executive, must give a copy of a recognised standard to the person.

73 Use of recognised standards in proceedings

A recognised standard is admissible in evidence in a proceeding if—

- (a) the proceeding relates to a contravention of a safety and health obligation imposed on a person under part 3; and
- (b) it is claimed that the person contravened the obligation by failing to achieve an acceptable level of risk; and
- (c) the recognised standard is about achieving an acceptable level of risk.

37 How obligation can be discharged if regulation or recognised standard made

- (3) If a recognised standard states a way or ways of achieving an acceptable level of risk, a person discharges the person's safety and health obligation in relation to the risk only by—
 - (a) adopting and following a stated way; or
 - (b) adopting and following another way that achieves a level of risk that is equal to or better than the acceptable level.

Where a part of a Recognised Standard or other document referred to in the Recognised Standard conflicts with the *Coal Mining Safety and Health Act 1999* or the Coal Mining Safety and Health Regulation 2001 (the Regulation), the Act or Regulation takes precedence.

This recognised standard was issued under the authority of the Minister for State Development and Minister for Natural Resources and Mines.

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1 Purpose

The purpose of this recognised standard is to state ways for the site senior executive (SSE) to meet their safety and health obligations, and develop their mine's safety and health management system (SHMS), for the control of respirable dust in an underground coal mine.

2 Scope

This recognised standard applies to all activities at an underground coal mine and any surface activities that may impact on surface 'dust make' (perceived visible content of dust in the air) in the mine intake airways of an underground coal mine.

3 Application framework

This recognised standard has been developed to help the mine SSE identify the key operational areas of respirable dust generation, as well as assist with risk management of exposure to respirable dust. This also includes validation of the effectiveness of the controls, and implementation of corrective actions if controls have been found to be ineffective. The cumulative exposure to respirable dust is a significant health risk and, as such, the SSE shall consider developing a Dust Management Plan similar to principal hazard management plans.

This recognised standard needs to be applied in conjunction with recognised standard 14 *Monitoring respirable dust in coal mines*, and recognised standard 2 *Control of risk management practices*. Recognised standard 15 provides specific information on compliance with the requirements of the Regulation, s. 89 (Dust)—including s. 89(1) on exposure to respirable dust being kept at an acceptable level.

As a minimum, the mine's safety and health management system (SHMS) shall consider dust sources and control measures in all of the following areas of the underground coal mine:

- outbye;
- development panels;
- extraction panels; and
- surface areas of underground mines that may affect the ventilation circuits entering the underground workings.

4 Obligations, roles and responsibilities

A number of obligation holders within the management structure at mine sites have responsibilities to ensure the level of risk from operations is within acceptable limits and is as low as reasonably achievable for ongoing exposure to respirable dust.

4.1 Ensure dust exposure is managed to an acceptable level of risk

In the context of respirable dust, the Act requires a mine's SHMS to incorporate risk management elements, procedures and practices appropriate for each coal mine to:

- ensure the safety and health of coal mine workers and visitors to the workplace with regard to dust exposure
- achieve effective management and control of respirable dust exposure (e.g. through a dust management plan)
- consult with coal mine workers within areas where there are respirable dust risks
- identify, analyse and assess respirable dust hazards and resultant risks
- avoid or remove unacceptable risks of respirable dust exposure and control retained dust risks
- monitor levels of dust and the adverse consequences of retained residual risk
- investigate and analyse the causes of serious accidents and high potential incidents with a view to preventing their recurrence, including incidents involving high exposure to respirable dust
- review the effectiveness of dust risk control measures
- take appropriate corrective and preventive action when control measures fail or workers are potentially exposed to levels of respirable dust above prescribed limits
- mitigate potential adverse effects arising from residual risks.

4.2 Develop an SHMS that includes effective management and control of respirable dust exposure

Under s. 42 of the Act, the SSE is responsible for the development of a single SHMS for the mine and to ensure the risk to persons from coal mining operations is at an acceptable level, including respirable coal dust exposure. The requirements of the SHMS are detailed in s. 62 of the Act to ensure the risk to coal mine workers' health and safety is at an acceptable level. This includes the requirement that the SHMS contains a plan to regularly review and continually improve the SHMS to maintain an acceptable level of risk for respirable dust exposure—under s. 62(f).

Although there is no specific legislative requirement to develop a dust management plan, or dust management strategy that incorporates all of the elements considered in this recognised standard, under s. 42(f) of the Act there is a requirement for the SSE to provide:

- (i) adequate planning, organisation, leadership and control of coal mining operations
- (ii) completion of critical work at the mine that requires particular technical competencies
- (iii) adequate supervision and control of coal mining operations on each shift at the mine
- (iv) regular monitoring and assessment of the work environment, work procedures, equipment and installations at the mine
- (v) appropriate inspection of each workplace at the mine including, when necessary, pre-shift inspections

Further, under s. 42(e) of the Act, the SSE has an obligation to provide training for coal mine workers so they are competent to perform their duties.

To achieve this, the SSE shall follow the requirements of s. 89 of the Regulation, which requires that the coal mine SHMS must provide ways of ensuring:

- (i) each coal mine worker's exposure to respirable dust at the mine is kept to an acceptable level
- (ii) controls for minimising dust are reviewed if the average concentration of respirable dust in the atmosphere cannot be reduced to an acceptable level
- (iii) excessive airborne dust is suppressed so a person's safety is not threatened (e.g. by reduced visibility).

In the context of this recognised standard, this would include the requirement to develop and maintain documents within the SHMS that detail the process and procedures for controlling respirable dust exposure to an acceptable level of risk.

Under s. 10 of the Regulation, the SSE is required to develop standard operating procedures to manage and control dust hazards at the mine.

Under s. 10(3) of the Regulation, in relation to developing a standard operating procedure, the SSE must:

- (a) use a risk assessment process recognised by the mining industry as an acceptable process for identifying and controlling hazards
- (b) consider the methods of controlling hazards stated in the database kept by the chief executive under s. 280(1)(a)(i) of the Act.

4.3 General obligations

Under s. 39(2) of the Act, a coal mine worker or other person at the mine has additional obligations to:

- (a) work or carry out the worker's or person's activities in a way that does not expose the worker or person or someone else to an unacceptable level of risk
- (b) ensure, to the extent of the responsibilities and duties allocated to the worker or person, that the work and activities under the worker's or person's control, supervision or leadership is conducted in a way that does not expose the worker or person or someone else to an unacceptable level of risk
- (c) participate in and conform to the risk management practices of the mine to the extent of the worker's or person's involvement.
- (d) to comply with instructions given for safety and health of persons by the coal mine operator or site senior executive for the mine or a supervisor at the mine;
- (e) to work at the coal mine only if the worker or person is in a fit condition to carry out the work without affecting the safety and health of others;
- (f) not to do anything wilfully or recklessly that might adversely affect the safety and health of someone else at the mine.

4.4 Consultation with workers

Consultation with coal mine workers regarding dust risk management must be in accordance with s. 10 of the Regulation.

Consultation with coal mine workers in relation to changes to the SHMS is also required under s. 64 of the Act.

4.5 Effective management and control of respirable dust exposure

Under s. 60(2) of the Act, the SSE must appoint a person to be underground mine manager to control and manage the mine. In relation to the management and control of respirable dust, the underground mine manager shall:

- develop a dust control strategy in consultation with a relevant cross-section of the affected coal mine workers involved in carrying out the tasks
- implement a control plan that includes a permit to mine system that incorporates the applicable respirable dust control requirements of this recognised standard
- develop and implement a system to inspect critical dust controls in production panels and any high dust exposure areas on each shift in accordance with s. 312 of the Regulation, including, but not limited to, those operational areas in Section 6.1 of this recognised standard
- appoint an appropriate person as ventilation officer for the mine, unless the underground mine manager personally assumes those duties and responsibilities.

4.6 Ventilation officer

Under s. 61(4)(b) of the Act, the appropriate person appointed as the ventilation officer is directly responsible for the implementation of the mine ventilation system, and for establishing and maintaining effective standards of ventilation for the mine. As part of the ventilation officer functions under s. 341 of the Regulation, and managing ventilation system requirements under s. 344 and s. 347 of the Regulation, this includes:

- ensuring adequate ventilation of the mine incorporates management of respirable dust to an acceptable level, including, but not limited to, management of those matters covered in Sections 5.3.1 and 7.4 of this recognised standard
- ensuring the standard operating procedure for ventilation design considers all relevant factors including, but not limited to, effective control of respirable dust and the implementation of the relevant sections of this recognised standard.

In addition, the ventilation design needs to incorporate the requirements of s. 89 of the Regulation so that exposure to respirable dust at the mine is kept to an acceptable level.

4.7 Providing advice or products to an underground coal mine

Under s. 44 of the Act, a designer or importer of a plant for use at a coal mine has an obligation to ensure the plant is designed so that, when used properly, the risk to persons from the use of the plant is at an acceptable level.

Under s. 46 of the Act, a manufacturer or importer of a substance for use at a coal mine has the following obligations:

- (a) ensure the substance is safe so that, when used properly, the risk to persons from the use of the substance is at an acceptable level
- (b) ensure the substance undergoes appropriate levels of testing and examination to ensure compliance with obligation (a) above.

Also, a manufacturer, importer or supplier of a substance for use at a coal mine has the following obligations:

- (a) ensure appropriate information about the safe use, storage and disposal of the substance is provided with the substance

- (b) take action (that the chief inspector reasonably requires) to prevent the use of an unsafe substance at a coal mine.

For subsection (2)(a), information is **appropriate** if the information clearly identifies the substance and states—

- (a) the precautions, if any, to be taken for the safe use, storage or disposal of the substance; and
- (b) the risks, if any, associated with the use, storage or disposal of the substance.

5 Technical guidance

The variability in underground operation practices means that each mine SSE will need to:

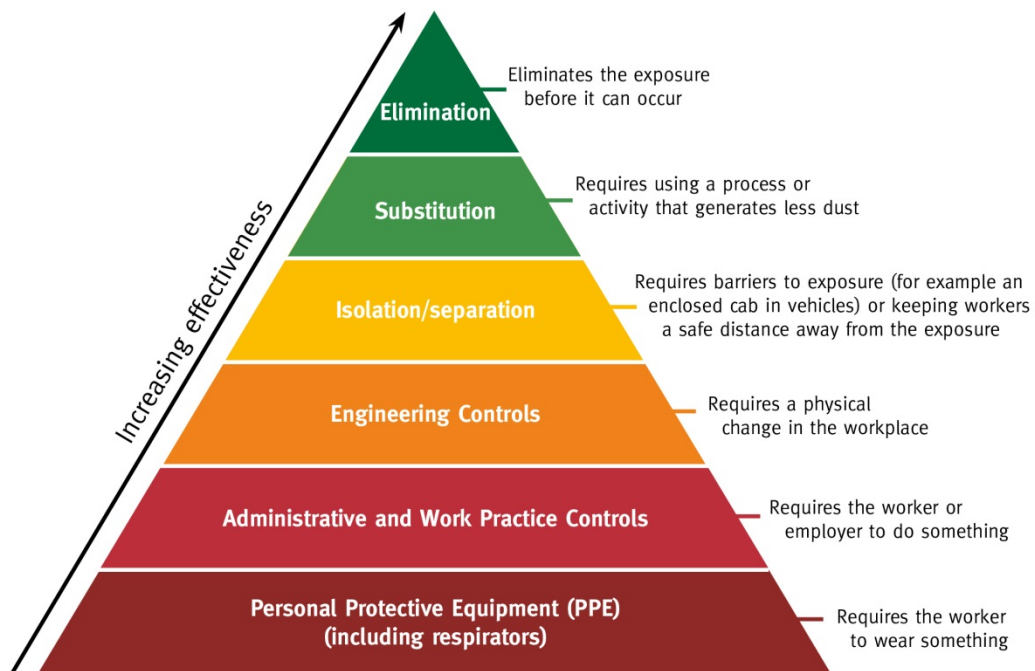
- identify sources of dust generation in all areas of the underground mine workings
- develop and implement dust controls for each activity in an underground coal mine
- follow the hierarchy of control principles to manage the risk of dust exposure to acceptable limits
- develop a Trigger Action Response Plan (TARP) for the purpose of mitigating personal exposure when critical dust controls are not functioning to their designed specification
- incorporate dust control measures into shift and daily routines that are documented and adequately resourced in short-term and long-term planning processes
- review the effectiveness of controls in a systematic way
- inspect, maintain and monitor controls and equipment (the inspection, maintenance and monitoring should be performed by appropriately trained and competent personnel).

5.1 General strategy for dust control

Due to the variability in mining operations, during development of the dust control strategy (and ongoing reviews of the Dust Management Plan), each mine SSE shall:

- review competencies related to dust control
- identify relevant engineering and technical expertise (for the dust control strategy)
- identify relevant occupational hygiene expertise (for the monitoring strategy)
- review the design risk assessment for the consideration of dust controls
- assess potential hazards from the operational tasks and the risk posed by those hazards to the safety and health of persons conducting these operations or who may be affected by these operations
- review any existing process for adequately identifying dust sources (determining when, where, who, how)
- undertake short-term and long-term planning to effectively manage dust controls (including resources, identifying when changes in operation will increase dust exposure)
- validate the adequacy and effectiveness of the controls being applied in-shift
- review any existing dust management plan, ensuring it is subject to a continuous improvement and review process triggered by the results of any inspections or audits of the mining activities and the results of any monitoring for respirable dust—this review process will be relevant to the specific mining process or equipment used and will meet the requirements of s. 62 of the Act.

5.2 Hierarchy of controls



The control measures reviewed in the risk management of respirable dust and silica shall follow the hierarchy of controls, with higher order control measures considered first. Examples of applying the hierarchy of controls for effective risk management of respirable dust and silica generation and exposure include:

- elimination—not considered achievable with current mining technology
- substitution—using mining methods that generate less respirable dust
- isolation/separation—using curtains, enclosures and containment
- engineering—dust suppression sprays
- administration—task rotation and use of procedures to limit exposure, including operator positioning
- personal protective equipment—using respiratory protective equipment.

5.3 Mine design

For mine design to be appropriate it must consider the effective control of dust sources, including, but not limited to, the following factors.

5.3.1 Early mine planning to minimise respirable dust

Early mine planning shall consider dust make and dust generation to minimise respirable dust. This includes, but is not limited to, sequence of production operations, particularly in known high risk areas including gate road drivage, mains drivage, place change, pillar extraction and longwall units. This shall also include a review of equipment specifications to minimise dust generation.

At a minimum, early mine planning and design shall consider the following factors.

5.3.1.1 Ventilation circuit design

The mine SSE shall assess the design to ensure ventilation velocities do not have substantial influences on the generation of respirable dust in the intake airway. This also includes consideration of outbye work in any given ventilation circuit. The design of the ventilation circuit shall consider:

- development ventilation—the use of forced, extraction or overlapping systems and the suitability to the mining method
- longwall ventilation—face ventilation requirements shall consider cross-sectional areas where dust may be generated due to increased velocities and/or coal transfer crushing (this includes consideration of the use of large air quantities for gas dilution and balancing the resultant air velocities on the longwall face district)
- place change ventilation—detail the requirements for the use of brattice or auxiliary ventilation systems with the associated mining sequence to minimise the exposure to dust, with mining sequence and exposure to workers involved in bolting operations also considered; the use of onboard scrubbers and associated ventilating devices for utilising controlled recirculation will also need to detail the requirements to minimise the exposure to dust
- pillar extraction—detail the requirements of the ventilation system where dust generated during lifting cannot be directed to the goaf area
- conveying systems in all mining methods—the risk of increased respirable dust exposure with the use of anti-tropical systems, multiple transfer points and the drying effect of ventilation moving in the opposite direction to the conveyor shall be considered and minimised with appropriate ventilation design (such as homotropical systems) as appropriate.

5.3.1.2 Gas drainage and de-watering

The impacts of gas drainage and/or de-watering of the coal seam shall be assessed in terms of how these matters will affect dust make and dust generation (e.g. de-watering creating a drier seam) to mitigate these effects.

5.3.1.3 Geological and geotechnical anomalies

Mine design shall consider the issue of whether present or anticipated geological and geotechnical anomalies will create excessive silica and dust exposure. Consideration also needs to be given to coal constituents (e.g. when considering risk of coal dust diseases)—further information is available from the National Institute for Occupational Safety and Health (NIOSH) publication number 2011–172, *Current intelligence bulletin 64: coal mine dust exposures and associated health outcomes—a review of information published since 1995*.

5.3.1.4 Outbye infrastructure

Ventilation designs that comply with s. 298 (i.e. separating conveyor services from general intake air) and s. 300(2) of the Regulation will control respirable dust entering the intake air. Water for dust suppression devices shall be considered, particularly for conveyor transfer points.

5.3.2 Operational planning and design review

Based on continuous improvement principles, the mine SSE shall review the availability of new operating methods (e.g. automation) or more effective higher order controls (e.g. engineering controls to minimise dust generation, including ventilation, water treatment and equipment). During operational planning and design review, the mine SSE shall consider implementation of controls that address relevant factors including, but not limited to, the following factors.

5.3.2.1 Implementation of new technology or mining methods

When implementing new mining methods or technology, the mine SSE shall ensure they can demonstrate compliance with change management and effective implementation that considers:

- documented evidence of the basis of the technology or method, including documented effectiveness of the new controls in similar mining conditions
- the introduction of any hazards from the implementation of any new technology, and the potential impacts to limit reliance on personal protective equipment as an interim measure.

5.3.2.2 Equipment selection, maintenance and overhaul

Equipment purchases shall be considered in terms of the hierarchy of controls, and equipment specifications shall consider control of dust generation at the source (e.g. dust sprays are of the correct engineering specification for the planned application).

Equipment purchase and specification requires input from persons with the relevant expertise in the area of engineering control of dust generation. Equipment includes all underground and surface equipment that may impact on surface dust make in the mine intake airways of an underground coal mine, including:

- fixed equipment installations (e.g. conveyors, dump hoppers, crushers, beam stage loaders)—fixed equipment also includes underground conveyor belt installations that may be assembled from components sourced from a number of suppliers, assembled by mine workers and have a limited operating time
- mobile equipment
- transportable and relocatable equipment.

Equipment overhauls shall consider the permanent integration of effective dust controls into overhaul scopes. This includes replacement and overhaul of existing controls, and also redesign of existing controls to improve integration and the reliability of these controls/parts.

6 Exposure or risk profile for similar exposure groups

At a minimum, the underground mine manager shall consider establishing an exposure or risk profile for each similar exposure group identified in Section 5.1 of recognised standard 14, *Monitoring respirable dust in coal mines*. This also includes the key respirable dust generation points at the mine site. The areas listed in Section 6.1 of this recognised standard shall also be considered.

6.1 Operational differences

Similar exposure groups will vary due to operational differences. Key areas of respirable dust generation within the mine shall be identified, and control measures be developed and implemented utilising the hierarchy of controls to maintain an acceptable level of risk. These control measures shall be documented in the mine's Dust Management Plan

Due to the variability of underground mining operations, the mine SSE shall consider all areas below to determine if they apply to their operations:

1. intake or entrance areas affected by adjacent surface mining operations or activities
2. coal clearance and transfer points
3. roadway general mains, intake and return
4. vehicle transport routes
5. road maintenance
6. continuous miner operation panels
7. longwall mining operation panels
8. stone dust application activities
9. application of cement products (including spraying of ventilation devices)
10. other activities within the area (e.g. crib room moves, electrical installation of transformers)
11. outbye activities that may result in dust generation (including shotfiring)
12. road header operations
13. underground construction, installation and maintenance activities not covered above (e.g. conveyor installation, drivehead construction).

Other one-off or irregular tasks may be identified via monitoring conducted in compliance with recognised standard 14, *Monitoring respirable dust in coal mines*.

6.2 Operational risk management

Controls to limit exposure to respirable dust shall be identified in the initial stages of planning mining operations and verified as being in place, using a process within the SHMS to ensure an acceptable level of risk. Mines have current systems to ensure this, such as permit to mine/authority to mine systems. Such systems shall include the requirement to verify that the following matters have been implemented and authorised as complete by the responsible persons:

- review of existing controls that have been previously used
- review of the dust control strategy for the specific mining operation and its applicability
- installation and testing of the dust controls required by the control strategy
- training of personnel in the use and application of dust control and monitoring requirements
- implementation of the system for ensuring dust controls are maintained and effective.

7 Dust control factors in all operational areas

7.1 General principles that apply to all mining methods

The mining sequences and equipment, in conjunction with environmental conditions, shall be designed with the capability to minimise operator exposure to respirable dust, with priority given to higher order control (e.g. engineering design) then separation (e.g. curtains and operator positioning in areas of less exposure).

Where any changes to the sequence or equipment result in potential deficiencies in dust control (including dust suppression or maintenance issues) needs to consider interim controls as outlined in TARP requirements as detailed in Section 8.3.2 of this recognised standard.

The TARP shall require implementation of additional interim controls (e.g. rotation of personnel to limit exposure to dust) and meet legislative requirements (i.e. within acceptable limits and as low as reasonably achievable) until a review of the dust control measures for that activity is conducted.

7.2 Mining sequence and method

Minimising dust exposure shall be considered when determining the cutting sequence and method. This includes interaction between method, dust generation sources, air quantity and roadway maintenance.

Some examples include the impact of uni-directional versus bi-directional sequences on personnel positioning, and the capacity to hose shields on the flit run on longwalls. Shearer cutting speed shall be considered with regard to dust generation and the ability of dust controls to remain effective, and the ability to maintain visibility and operator positioning outside high dust exposure areas.

7.3 Automation as a preferred control

Automation can provide benefits in reducing respirable dust exposure, and shall be considered when conditions allow. For example, automation of shearer cutting and shield advance removes the necessity to have an operator inside the higher dust generation areas on the longwall face. When full automation is not practical or possible, shields shall be advanced using adjacent control and operators shall remain on the intake side of the shearer and shield advance. Failures in automation must also be included in the TARP; and the TARP must require implementation of defined actions in response.

When continuous miners are fitted with extraction manifolds (whales mouth ducting), automation timing of cutting cycles can be utilised to minimise the exposure of operators to higher dust levels generated by the trapdoor operation during the cycle. This also requires consideration of the increase in risk profile if continuous cutting and bolting cycles are implemented and operators are conducting manual bolting operations.

7.4 Water application and spray design

Technical advice from those competent in the science of water behaviour in dust capture and spray design (including droplet size and interactions with dust particle size) is required to achieve effective respirable dust management. Some key considerations in effective water design are to ensure that effective water application is within the pressure and flow capacity of the delivery system, and ensure the ability to contain and manage the water generated. See Appendix A and Appendix C for examples and key considerations.

7.5 Ventilation

In addition to the ventilation design considerations listed in Section 5.3.1.1, the following shall also be considered to manage ventilation during operations:

- Ventilation will greatly affect dust dilution capability and spray efficiency, and appropriate quantities need to be configured at the right locations and with consideration of the inherent mining system requirements.
- Outbye work in any given ventilation circuit that may increase dust levels for inbye work groups must be considered.

7.6 Roadway surface dust suppression and maintenance

Dust suppression will include consideration of grading, salting, watering and other treatments as part of the dust management plan to ensure that risk is at an acceptable level. Further details on control measure components and examples can be found in Appendix A and Appendix C.

7.7 Planned equipment maintenance

The SHMS shall include provisions for a maintenance program for all installed dust control equipment. The program will be based on original equipment manufacturers' recommendations and optimised based on site experience and knowledge, and the planned maintenance of critical dust controls.

The maintenance program shall include components dealing with:

- establishing housekeeping standards designed to minimise accumulations of dust (e.g. on longwall shields, continuous miners, maingate drives, crushers, conveyor structure)
- acceptable wear limits (e.g. cutting bit wear limits)
- accidental damage
- routine and condition-based maintenance schedules
- maintenance of water quantity/quality
- spray nozzle maintenance - including how to deal with erosion and wear, corrosion, clogging and caking
- filter/scrubber replacement and cleaning standards
- dust leakage from shrouds, collector disposal points and dust hoods
- conveyor belt scraper maintenance
- improper reassembly
- post-maintenance commissioning checks, including performance testing of equipment.

7.8 Task rotation limiting exposure

Task rotation is an administrative control that requires monitoring and review and does not control dust generation. If task rotation is used as part of the TARP high exposure tasks shall be rotated to lower exposure tasks during the shift when exposure cannot be adequately controlled by other means (e.g. shearer and shield operation rotating through the maingate or bootend).

Task rotation still requires compliance with s. 89 of the Regulation.

7.9 Dust control zones

The SHMS shall consider development of dust control zones to ensure operators remain outside high dust exposure areas. When entry to dust control zones is required in

extenuating circumstances, risk management shall require consideration of additional controls to mitigate exposure.

8 Dust control measures

As part of the risk management of dust, controls for exposure to respirable dust need to consider factors including, but not limited to, the examples of effective controls in Appendix A, with priority given to higher order controls to mitigate dust generation (e.g. automation for normal operations) whenever conditions allow.

8.1 Respiratory protective equipment program

A respiratory protective equipment (RPE) program shall never be used as the primary means for exposure control in situations when other higher order controls are available and effective (e.g. in longwall and development panels). In all uses of RPE, the RPE program shall be established in accordance with applicable sections of AS/NZS 1715:2009, *Selection, use and maintenance of respiratory protective equipment*, for particulate filter respirators. RPE for mitigation of dust control shall meet the relevant requirements of AS/NZS 1716:2012, *Respiratory protective devices*.

8.1.1 Additional notes about RPE

RPE is the least effective form of mitigating dust exposure according to the hierarchy, as it does not remove the hazard and relies on correct fit and use by the individual, as well as adequate supervision. However, it is recognised that RPE will generally always form part of the mine's overall dust management strategy. In these situations, the use of RPE will provide additional protection to coal mine workers if worn correctly and for the full duration of the task.

Examples of situations in which RPE will form part of the overall control strategy include:

- supplementing higher order controls for coal mine workers operating in high dust-generating tasks (e.g. shearer driver, shield operator, continuous miner driver, drilling/bolting)
- completing non-routine or short duration tasks with the potential for intermittent high intensity exposure (e.g. spraying cementitious products, stone dust application)
- an interim mitigation measure if additional engineering controls are being developed, implemented and evaluated—if RPE is being used as an interim control it shall be linked to an action plan that clearly specifies the stages for implementation of higher order controls
- any task for which a coal mine worker requests the use of these devices.

8.2 Education on dust

To meet the requirements of s. 82 (Training Scheme) of the Regulation, the SHMS must include a provision for all coal mine workers to be educated to understand the respirable dust health impacts and control mechanisms relative to their mine. Relevant general components of the education of all underground coal mine workers include:

- what coal dust is
- what respirable dust is
- what silica is
- what inhalable dust is
- the effects of respirable dust on a person

- known dust exposure and outcomes (e.g. pneumoconiosis, including silicosis and coal workers' pneumoconiosis, resulting from breathing silica or coal dust)
- coal health assessment components that monitor dust exposure (e.g. lung function tests, chest X-rays)
- high risk exposure areas on site (underground versus surface)
- overview of testing and monitoring for respirable dust in the workplace and acceptable levels
- how to mitigate and manage the impacts of respirable dust on coal mine workers
- how the hierarchy of controls for dust management is applied.

8.2.1 Mine site SHMS and training scheme

All coal mine workers engaged in a mining area or activity shall be trained and assessed in the key dust control strategy matters they are responsible for implementing and maintaining. This includes documented procedures that detail controls to mitigate exposure in the following areas:

- installed controls and their designed capability
- prestart and inspection procedures, and reporting of dust and maintenance issues
- operator positioning
- professional health monitoring programs, standard operating procedures and TARP requirements
- application of the recognised standards for dust control and monitoring
- respiratory protection standards and requirements
- high risk dust exposure zones.

In addition, the SSE of underground coal mines shall consider the need for those coal mine workers supervising or directing activities that include high dust-generating tasks or that are in high dust exposure areas to possess the following competencies from 'RIIENV401D—Supervise dust and noise control (Release 2)':

- plan dust control measures and work practices with colleagues to ensure compliance
- implement dust control measures and work practices to ensure compliance
- identify, rectify and report actual/potential dust promptly and decisively to ensure compliance
- manage activities so that potential non-compliance issues are minimised
- submit recommendations on improvements in dust control
- inform individuals/teams of the results of improvements in dust control
- maintain systems, written records and reporting procedures.

8.3 In-shift validation of controls

The SHMS shall consider the development and maintenance of a process to monitor the effectiveness of dust controls in all operational areas of the mine, including a process for in-shift validation of controls and documented shift inspection of respirable dust control functionality. If shift inspections identify variances or failed controls, the actions undertaken will be in accordance with the TARP. The in-shift validation of the controls will be undertaken by persons with direct responsibility for these matters in each work area, and persons with direct responsibility for all operations on shift.

8.3.1 Shift inspection process for critical dust controls

These inspections shall be conducted prior to commencement of any production activities or dust-generating processes on every shift. Other hazards that may present a significant increase in risk to coal mine workers must be considered before undertaking these

inspections (e.g. the shearer is not in a position where these tasks can be undertaken; therefore, the shearer would cut to the maingate end of the longwall face or another place that is deemed safe).

Details of the inspection process and required critical controls must be documented to validate the effectiveness and adequacy of the process and controls have been assessed.

If the inspection process relates to a production panel, the outcomes of the inspection shall be related back to the relevant dust control TARP for that work area.

The inspection process shall cover all relevant critical dust controls including, but not limited to:

- all dust suppression sprays
- all ventilation control devices (fixed or temporary)
- all dust scrubbing or filtering devices
- all dust wetting agent systems
- number and condition of picks.

8.3.2 Dust control TARP (production panels)

To ensure the level of risk to coal mine workers from exposure to respirable dust is as low as reasonably achievable and within acceptable limits, actions must be implemented whenever there is a deficiency in critical dust controls.

A TARP must be developed for all producing panels, identifying the actions required to be taken by the responsible persons for these matters.

The TARP shall includes:

- key triggers that indicate when controls are not working to their designed specification
- the escalation process to ensure that any increase in the level of risk is considered with appropriate actions to mitigate the effects of the exposure
- clear definitions, responsibilities and names/positions of those required to implement these actions.

The TARP shall include key matters with metrics to determine their effectiveness, for example:

- the number of defective picks
- the number of defective sprays
- water flow and pressure requirements
- automation functionality
- the increase in exposure when a number of metrics are not effective.

The TARP shall also consider the use of short-term alternative controls if key controls are deficient. These controls are designed to limit exposure to coal mine workers, including:

- task rotation
- real-time monitoring while control effectiveness is not working to the designed parameters
- decreasing cutting rates to reduce dust make.

9 Audit and review process

The mine SSE must develop and maintain an audit and review program to ensure the effective implementation of this recognised standard. The program shall include the use of internal and external audits to verify that the matters in this recognised standard are addressed. These audits must be conducted at the commencement of new installations and at frequencies appropriate to the level of risk identified from review of all dust monitoring results.

9.1 Periodic review of dust control

A review of dust control measures shall be considered in the event of:

- the risk assessment for first or second workings being undertaken
- any significant changes in mining operations or conditions
- any changes in the equipment being used in mining operations
- any increase in personal monitoring results for a similar exposure group that increases the risk profile of that group (as defined by Section 6.7.5 and Section 6.7.6 of recognised standard 14, *Monitoring respirable dust in coal mines*).

In addition, a review of the effectiveness of controls in each operating panel shall be undertaken at the end of each panel. This shall be based on all dust monitoring results and all hazard, geotechnical, maintenance and incident reports that relate to these matters.

The review must be conducted by a relevant cross-section of the affected workers involved in carrying out the tasks to ensure that dust generation areas are identified, controlled and incorporated in the mine's respirable dust management plan and SHMS updates.

9.2 Demonstration of effective review

After reviewing this recognised standard, a coal mine must be able to demonstrate effective review of systems to reduce exposure to respirable dust and monitor the effectiveness of their controls. Commitment to continuous improvement shall be demonstrated by objective means, including:

- documenting the mine's overall dust management strategy, showing that the strategy has considered relevant factors including, but not limited to, the engineering controls in this recognised standard
- applying a risk management approach to the selection and implementation of applied controls
- documenting ongoing monitoring and review to assess exposure and the effectiveness of controls
- maintaining implemented controls, as evidenced by an auditable maintenance system
- implementing a systematic investigation process for exceedances that complies with recognised standard 14, *Monitoring respirable dust in coal mines*, with a focus on preventing further exceedances
- adequate resourcing to allow for effective recording, documentation and communication of these systems.

10 Definitions

Critical dust control	A control that is crucial for preventing the generation of dust above exposure limits—the absence or failure of a critical dust control would significantly increase the risk despite the existence of other controls
Dust Management Plan	Outline of the ways in which the underground coal mine undertakes monitoring and management of coal dust to an acceptable level of risk, including roles, responsibilities and processes for TARPs (when used)
Dust control strategy	Strategy developed as part of a review of effectiveness of existing dust controls (including as a result of review of this recognised standard), including roles, responsibilities and processes for implementing additional and/or more effective controls
Dust control zones	Areas within the underground mine designated as requiring higher order dust controls due to high dust exposure
Dust make	A measured airborne dust concentration from a number of sources—this measured cumulative dust concentration cannot differentiate between the concentrations from the various sources, which are perceived from visible observations
High dust exposure areas	Those areas within the underground mine that have actual or probable exposure to dust generation above exposure limits
High dust-generating tasks	Refers to tasks performed at an underground mine that have been found to have high exposure to dust, which have been identified through monitoring results at the site or other means
Higher order controls	Refers to control measures that are higher on the hierarchy of controls, such as elimination, substitution or engineering; administrative and personal protective equipment are considered the lowest forms of control
Interim control	Refers to the use of a lower order control such as personal protective equipment or administrative controls (e.g. task rotation or slowing shearer speed). Use of interim controls needs to be specified in the TARP with specific timeframes, or in change management procedures for introduction of new higher order controls

Respirable dust	Coal dust and silica particles that are less than 10 microns in size and are retained in the gas exchange region of the lungs
Risk assessment	The overall process of risk analysis and risk evaluation should be in accordance with AS/NZS ISO 31000:2009, <i>Risk management—principles and guidelines</i> , as well as meet the intent and requirements of the <i>Coal Mining Safety and Health Act 1999</i> , the <i>Coal Mining Safety and Health Regulation 2001</i> and recognised standard 2, <i>Control of risk management practices</i>
Risk management plan	(From ISO guide 73:2009, <i>Risk management—vocabulary</i> , definition 2.1.3) Scheme within the risk management framework (2.1.1) specifying the approach, management components and resources to be applied to the management of risk (definition 1.1) Note 1 to entry: Management components typically include procedures, practices, assignment of responsibilities, sequence and timing of activities Note 2 to entry: The risk management plan can be applied to a particular product, process and project, and part or whole of the organisation

11 Acronyms

AFC	Armoured face conveyor
BSL	Beam stage loader
LAS	Lower advance set
RPE	Respiratory protective equipment
SHMS	Safety and health management system
SSE	Site senior executive
TARP	Trigger action response plan

12 References: normative standards

The following documents form an integral part of this recognised standard, and are referred to directly or indirectly.

Department of Natural Resources and Mines 2003, *Control of risk management practices: Coal Mining Safety and Health Act 1999—recognised standard—02*, <www.dnrm.qld.gov.au/data/assets/pdf_file/0018/240381/recognised-standard-02.pdf>.

Department of Natural Resources and Mines 2016, *Recognised standard 14: Monitoring respirable dust in coal mines—Coal Mining Safety and Health Act 1999*, <https://www.dnrm.qld.gov.au/data/assets/pdf_file/0012/978879/recognised-standard-14.pdf>.

Standards Australia 2009, *AS/NZS 1715:2009 Selection, use and maintenance of respiratory protective devices*, <www.saiglobal.com>.

Standards Australia 2009, *AS/NZS ISO 31000:2009 Risk management—principles and guidelines*, <www.saiglobal.com>.

Standards Australia 2012, *AS/NZS 1716:2012 Respiratory protective devices*, <www.saiglobal.com>.

13 References: informative standards

The following documents are for information and guidance only, and may be of assistance in determining dust sources and/or effective controls.

Centers for Disease Control and Prevention & National Institute for Occupational Safety and Health 2010, *Information circular 9517*, NIOSH publication number 2010–110, pp. 1–76, Department of Health and Human Services, United States.

Centers for Disease Control and Prevention & National Institute for Occupational Safety and Health 2011, *Coal mine dust exposures and associated health outcomes: a review of information published since 1995*, NIOSH publication number 2011–172, Department of Health and Human Services, United States, <<http://www.cdc.gov/niosh/docs/2011-172/pdfs/2011-172.pdf>>.

Coal Services 2008, *Airborne dust in coal mines: respirable dust & quartz inhalable dust*, pp. 25–29.

Colinet, JF & Thimons, ED 2006, *Dust control practices for underground coal mining*, National Institute for Occupational Safety and Health.

Rider, JP & Colinet, JF, 2006, 'Dust control on longwalls—assessment of the state-of-the-art', *11th US/North American Mine Ventilation Symposium 2006: proceedings of the 11th US/North American Mine Ventilation Symposium*, 5–7 June 2006, CRC Press, United States.

14 Research, reports and examples of good practice and/or new technology

Balsu, R, Ren, T & Plush, B 2009, *Dust control technology for longwall faces—shearer scrubber development and field trials*, ACARP project C14036.

Krzysztof, C, Malich, B & Wieczorek, A 2015, 'Evaluation of the effectiveness of coal and mine dust wetting', *Journal of Sustainable Mining*, vol. 14.2, pp. 83–92.

Ren, T, Wang, Z, Plush, B, Karekal, S, Cooper, G & Cooke 2012, *Improved dust control on longwalls using a new water mist venturi system*, ACARP project C18019.

Appendix A: Examples of current practices for dust control

Longwall

Containment curtains and sprays on the beam stage loader discharge

The beam stage loader (BSL) discharge is to be enclosed as much as practical using skirting and shrouds, and fitted with sprays to reduce airborne dust being generated from the coal transfer to the maingate belt.



Figure 1: BSL looking inbye from outbye position showing shroud on delivery end

Sprays fitted to the conveyor crossover outbye of the discharge hood

These sprays can be positioned to capture any dust generated by the re-introduction of the crushed coal to higher roadway velocity via misting sprays and larger droplet sprays to wet the coal prior to it travelling outbye along the belt.

Scrubber fan systems to collect dust created in the BSL/crusher

Hydraulically powered extraction fans draw dust-laden air from the crusher inside the BSL. The extracted dust is passed through water-doused filter panels to entrap the dust. The panels must be back flushed periodically.



Figure 2: Scrubber fan system mounted on BSL

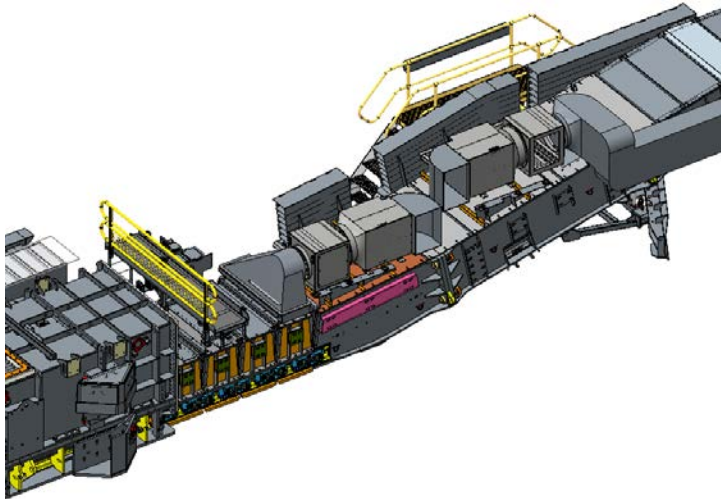


Figure 3: BSL fitted with two scrubber fan units

Curtains and sprays fitted inside the BSL

These curtains are fitted to remove air velocity and allow the sprays to thoroughly encapsulate the dust generated by the passage of crushed coal through the BSL.

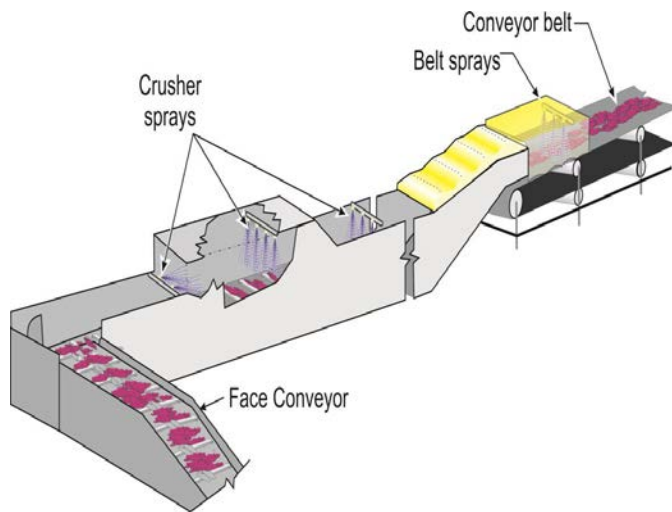


Figure 4: BSL spray locations

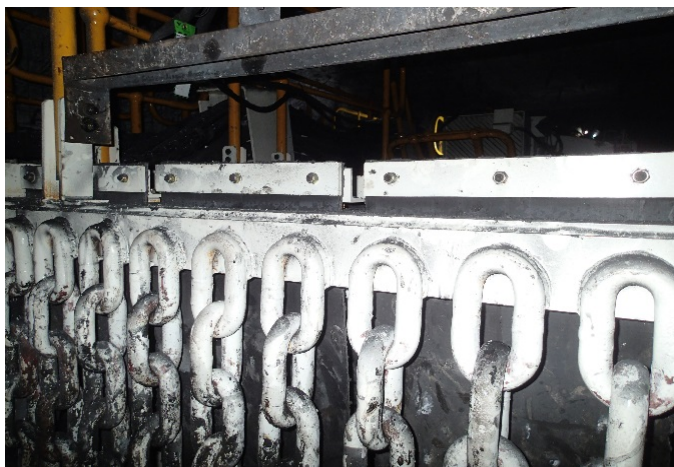


Figure 5: BSL entry dust curtain

Shield canopy sprays

Canopy water curtain sprays, lemniscate sprays and pontoon sprays can be fitted to each shield and are activated on shield advance.



Figure 6: Shield canopy sprays

Side shield and leg sprays

Spray systems can be installed in the side seals of the roof supports that activate with the shield lower advance set (LAS) cycle to create a curtain to wet the dust that falls off the canopies during shield movement.

Leg sprays are fitted on the underside of the shield canopy (with ability to be installed on the leg gland mounts) to aid in preventing the accumulation of dust on the shield legs and other components.

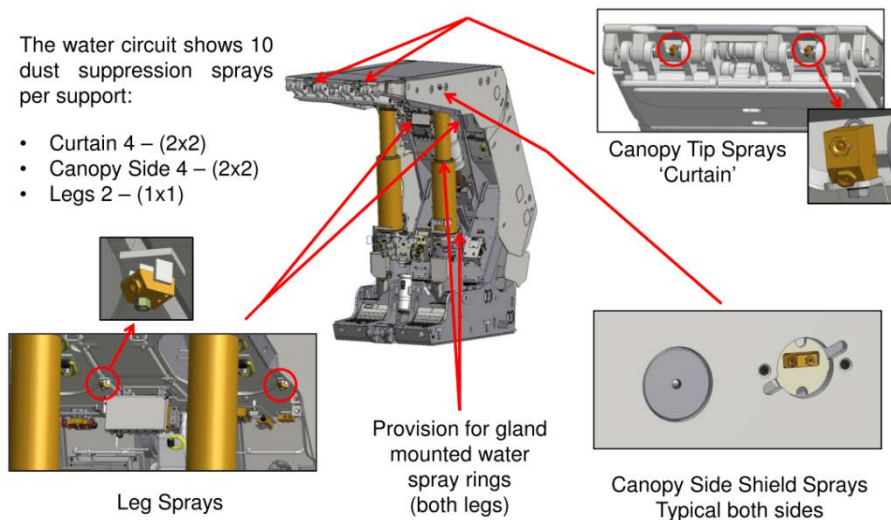


Figure 7: Dust suppression spray positions



Figure 8: Leg sprays activating during LAS cycle

Face partition sprays

These sprays are used to control dust by providing a curtain of sprays through which the main ventilation flow must pass as it proceeds down the face.



Figure 9: Face partition sprays installed on a shield canopy

Rear caving door sprays for longwall top coal caving faces

These sprays are activated automatically when the caving doors are opened to reduce dust from coal transfer onto the rear armoured face conveyor (AFC).



Figure 10: Rear caving door sprays

AFC pan sprays

Sprays are fitted to the AFC to control dust generated by the passage of coal interacting with the air velocity across the AFC or fine dust being ground in the return race.

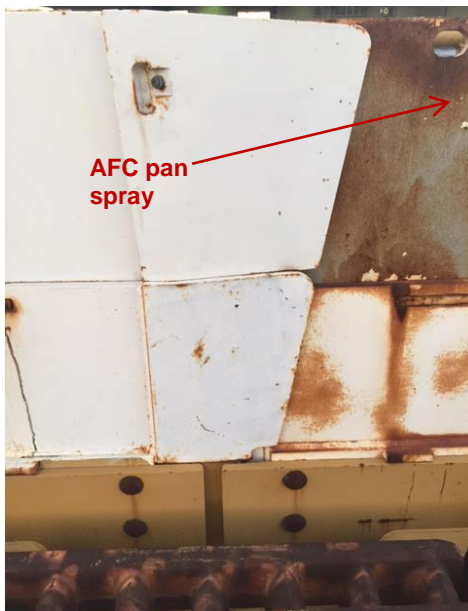


Figure 11: AFC pan spray installed in spill tray

Shrouding of BSL/AFC interlace (including operations using top coal caving)

BSL/AFC transfer containment covers

The AFC to BSL transfer discharge can be enclosed as much as practical using skirting and shrouds to segregate the area from high and turbulent air velocity. Top coal caving operations should consider this for both front and rear AFC transfer points to the BSL.

The shrouding can be used to position sprays directly above the coal flow to control the dust being generated from the coal transfer to the BSL.

To be sustainable, the shrouding must be robust yet flexible to allow the transition of large face slabs of stone when required.

The shrouding can also improve the efficiency of the suppression sprays by containing the water droplets in the interlace area and reducing the potential for the mist to create nuisance issues, such as wetting operators and impacting upon visibility.

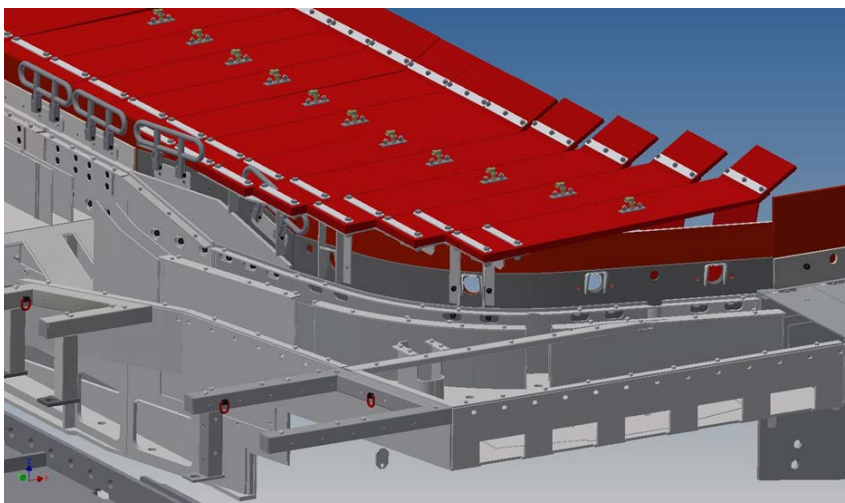


Figure 12: BSL/AFC transfer containment covers – view from goaf side

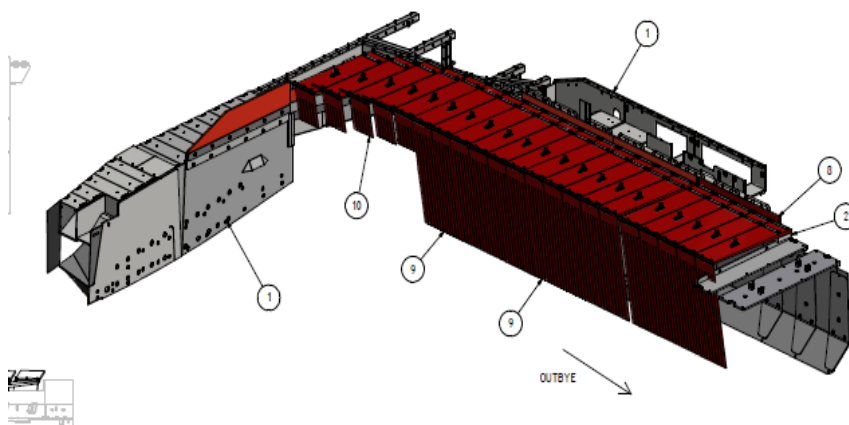


Figure 13: BSL/AFC transfer containment covers – view from block side

Cutter drum face flushing sprays

Drums can be fitted with either back or pick face flushing sprays.

Back flushing sprays are primarily utilised to control frictional ignition potential, but are also effective for dust suppression.



Figure 14: Back flushing pick spray



Figure 15: Back flushing pick spray

Pick face flushing sprays are primarily used for dust suppression, as water is mechanically mixed with the coal during the cutting process.

These sprays provide dust suppression directly at the point of coal fracture and add moisture to minimise dust liberation.

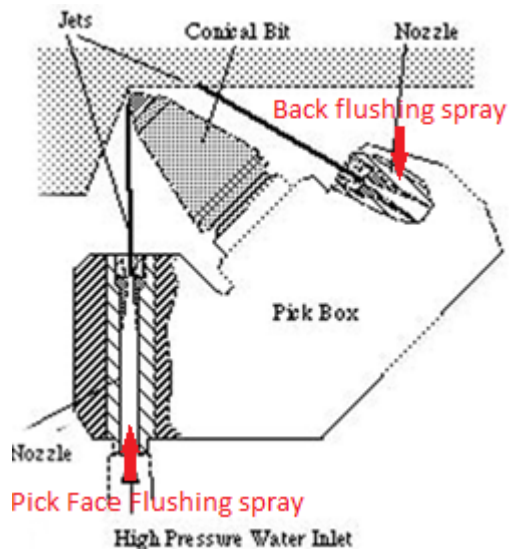


Figure 16: Pick and flushing spray position

Cowl drum sprays

These crescent-shaped spray manifolds are fitted to the ranging arm drum mount and provide a curtain of water on the goaf side of the drum.



Figure 17: Ranging arm sprays

Nose cone sprays

These sprays are similar to cowl sprays, but are fitted to the nose of the ranging arm. Use caution if sprays are utilised on the maingate ranging arm, as sprays will be oriented into the face airflow and have the potential to create turbulence and force dust towards the walkway.

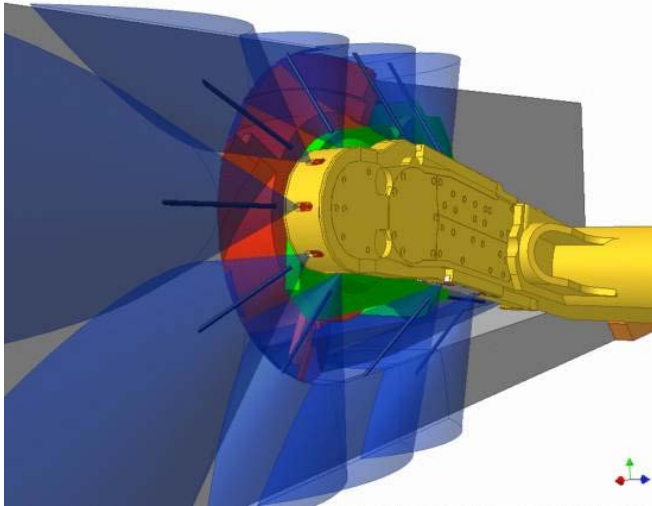


Figure 18: Nose cone spray pattern

Suitable cutting picks

Radial drums can be equipped with either radial or point attack picks. Dust generation through coal pulverisation shall be considered when selecting a pick—picks shall be maintained to minimise this. Replacing damaged, worn or missing bits cannot be over-emphasised, as dull bits result in shallow cutting and greatly increase dust generation.



Figure 19: Shearer drum fitted with Radial picks

Shearer clearer, ranging arm water spray manifold or cutter spray boom

A manifold boom is extended on the goaf side of the ranging arm and high volume water jet sprays are directed at the cutting face to prevent dust-laden air being directed back to the walkway where the shearer operators are positioned. Skirting on the spray boom can also provide a physical barrier to confine dust.

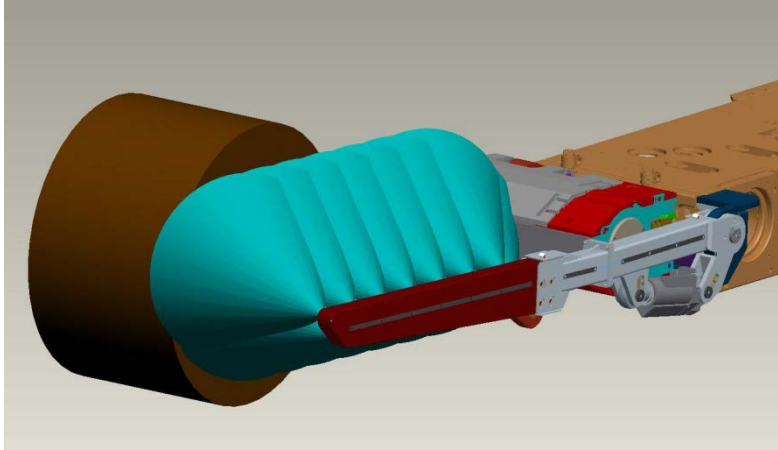


Figure 20: Shearer clearer spray pattern

A shearer scrubber uses a hydraulic-powered fan to draw dust generated by the shearer cutting drum into the scrubber box to encapsulate and remove the dust using sprays and filtration.



Figure 21: Shearer dust scrubber

Tailgate side sprays

A spray manifold mounted on the tailgate end of the shearer-oriented parallel to the ranging arm and angled slightly towards the drum confines dust-laden air to the face and carries it beyond the tailgate drum.



Figure 22: Side sprays on Tailgate ranging arm



Figure 23: Shearer Clearer

Remote operation

In addition to implementing automation, dust exposure reduction can be further enhanced by the use of a remote operating console. The console can be located outside the general operating area, reducing the amount of time operators are required to be positioned on the face to operate the face equipment. The system utilises cameras and mimic panels to control and manage the face operations.

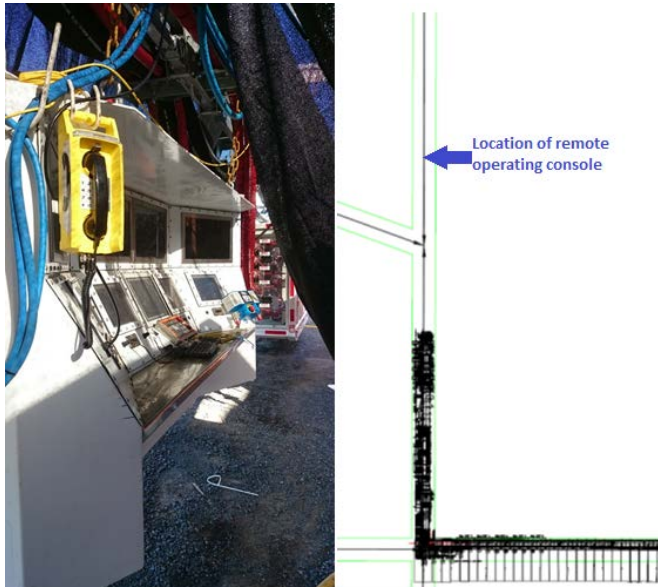


Figure 24: Remote operation console

Housekeeping standards

Regularly hose roof supports and AFC and BSL equipment to minimise coal dust exposure by reducing build-up.

This practice will reduce coal dust build-up from shield advance and the resulting float dust picked up by the face velocity and outbye activities on the face.

Continuous miner operations

The factors in Section 5.3.1.1 of this recognised standard shall be considered when designing ventilation.

Cutting sequences

The position of the vent ducting or the ventilation system shall be considered when determining cutting sequences to prevent the dust being drawn away from onboard scrubber or ventilation systems.

This can be easily achieved if the dust extractor is always kept next to the line of the solid coal. The coal acts as a curtain, guiding the dust to the dust extractor intake (see Figure 25).

Capturing the dust becomes more difficult if a mining sequence is adopted that creates a void next to the dust extractor (see Figure 26). In this instance, the combined effect of the ventilating current and the spray fan system is to push the contaminated air beyond the zone of influence of the dust extractor.

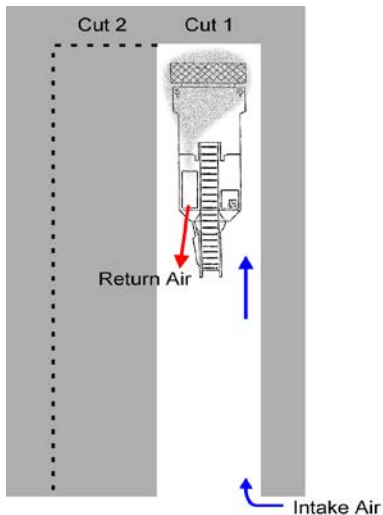


Figure 25: Correct sequence

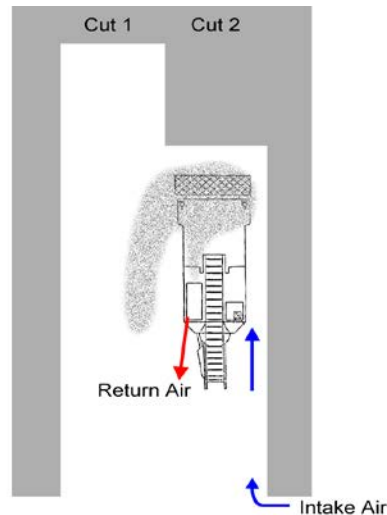


Figure 26: Incorrect sequence

Dust scrubbers and onboard ventilation systems

Onboard scrubber fans can be used to capture the dust generated by mining activities. Ventilation design must consider the capacity of the scrubber system to prevent the ventilation flow pulling dust away from the scrubber and reducing its efficiency.

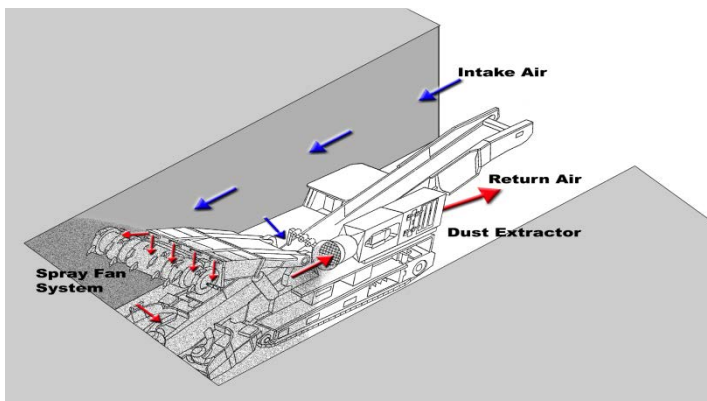


Figure 27: Continuous miner fitted with an onboard dust scrubber

Onboard ventilation systems are designed to keep the dust forward of the operating areas.

The support sequence and position of bolting personnel during the cutting cycle shall be considered when determining cutting and bolting sequences to prevent dust plumes being pushed back over coal mine workers.

Cutting head picks

Cutter heads are equipped with point attack picks. Dust generation through coal pulverisation shall be considered when selecting and lacing the picks—picks shall be maintained to minimise this. Replacing damaged, worn or missing bits cannot be over-emphasised, as dull bits result in shallow cutting and greatly increase dust generation.

Cutting head sprays

Original equipment manufacturers' spray system effectiveness shall be maintained and consideration shall be given to placement during design.



Figure 28: Cutter head sprays

Coal clearance sprays at the face and conveyor load points

These sprays can be positioned to capture any dust generated by the re-introduction of the crushed coal to higher roadway velocity via misting sprays and larger droplet sprays to wet the coal prior to it travelling outbye along the conveyor belt.



Figure 29: Single spray located on the tail of the Continuous miner.

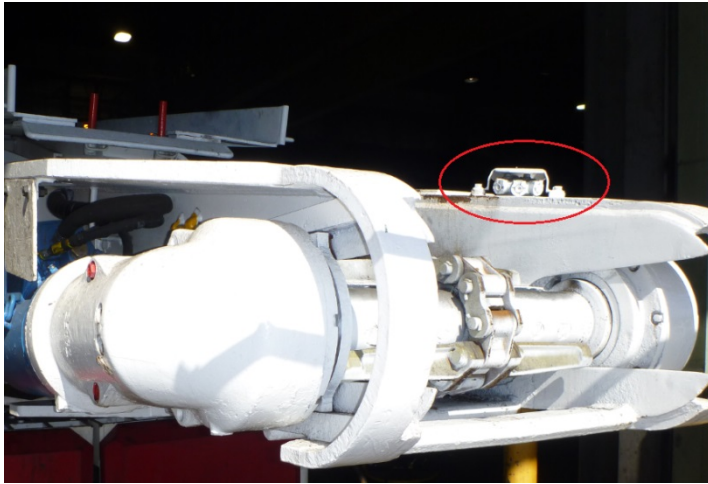


Figure 30: Spray bank located on the tail of the Continuous miner.

Auxiliary extraction fan ventilation

The negative pressure generated by extraction fans draws dust from the cutting face and deposits it in the return roadways via fire-retardant anti-static ducting.

Face ventilation extraction systems, whales mouth and onboard ducting

These manifolds allow the extraction fan negative pressure to remove dust from as close as possible to the coal cutting face. Sealing and regular cleaning of these ventilation paths shall be vigilantly conducted.

Dust curtains at the cutting face

These curtains are maintained between the operator platforms and the cutting face to help contain dust generated from cutting, and maximise both dust extraction by negative pressure provided by the auxiliary fan and encapsulation by sprays.

Regular hosing of equipment to minimise coal dust build-up

This practice will reduce coal dust build-up on equipment and the resulting float dust picked up by the face velocity.

Mains intake roadways

All roadways shall be designed and maintained to reduce dust, including the use of salting and other road treatments. At a minimum, this will include reference to the measures contained in Section 7.6 of this recognised standard.

Return roadways

Return roadways are considered to be high exposure dust zones. Prior to any coal mine workers working in return roadways, the risks of respirable dust exposure will be analysed and controlled. When available, this should include the analysis of respirable dust monitoring in terms of the measurements of the respirable coal dust and silica.

Inbye spray curtains

Spray curtains can be established to encapsulate any airborne dust generated adjacent to the entry to the workplace.

Regular grading and road maintenance ensures a compact surface and minimises fine dust build-up on road surfaces, which can become airborne as a result of vehicle traffic and outbye activities.

- All roadways shall be designed and maintained to reduce dust, including the use of salting and other road treatments. Some considerations for treatments include:
 - sodium chloride (dry salt granules), which draws moisture from the air and prevents fine dust build-up on roadway—sodium chloride is only effective when the air contains enough moisture;
 - magnesium chloride (liquid salt), which can be applied if the air is dryer (or a combination of both)—the initial application of the wet salt should be around 30%, but this can drop to 5% once the road is established;
 - dust suppressants, which can be applied to outbye roadways to create a sealed surface and help prevent fine dust becoming airborne as a result of vehicle traffic and outbye activities;
 - regular application of water to outbye roadways, which will help prevent fine dust becoming airborne as a result of vehicle traffic and outbye activities.

Conveyors

Transfer points fitted with containment spray systems

Spray systems shall be fitted to transfer points to encapsulate dust at the point of generation as the coal transfers from one conveyor to the next.

Transfer points fitted with containment curtains

Containment curtains shall be fitted to areas of high air turbulence to enhance dust suppression system efficiency.

Return belt fine dust scrapers

Scrapers shall be positioned to clean coal and mud from the conveyor after unloading and to minimise fine dust generation.

Return belt sprays

Spray systems can be fitted to wet return belts periodically and prior to entry to the boot to minimise fine dust generation.

Material wetting systems

Spray systems can be fitted to wet the coal being conveyed and minimise dust generation through coal movement.

Appendix B: Equipment selection, purchasing and life-cycle approach

As part of meeting the intent of s. 62 of the Act to ensure the risk to coal mine workers' health and safety is at an acceptable level, measures to minimise and control dust generation (a known hazardous substance) shall be considered for equipment specified and installed in the mine.

An example of a standard to consider is AS/NZS 4024.1302.2014, *Safety of machinery—risk assessment—reduction of risks to health from hazardous substances emitted by machinery—principles and specifications for machinery manufacturers*.

When equipment is specified, the equipment life cycle should be considered. The stages of life to be considered should include:

- construction
- transport installation and commissioning
- use, including
 - operation, start-up and shutting down
 - failure
 - setting or process changeover
 - cleaning
 - adjustment
 - maintenance and repair
- decommissioning and dismantling.

The equipment specification used to help design the dust control system should include

- environmental characteristics (e.g. temperature, humidity, wind, ventilation velocities, ventilation velocity and quantity relative to conveyor belt velocity in underground roadways, tunnels and galleries)
- physical constraints (e.g. building, pit, roadway and tunnel dimensions) and details of surrounding enclosures and structures
- details of other adjacent or contiguous plants
- water quality/quantity/chemical characteristics
- material properties of the dust (e.g. chemical composition, propensity to dust generation, moisture content, friability, particle size distribution, hydrophobic nature of the dust).

The equipment specification should consider reliability, accessibility, maintainability, buildability and operability.

Equipment specifications shall include requirements for commissioning plans that confirm the supplied equipment meets the specification requirements for dust control, and include a test plan to establish baseline effectiveness of the dust control equipment, as well as allowing for training of key personnel and adequate spare parts.

Appendix C: Water considerations

Some considerations for effective water usage in sprays include:

- minimising overspray
- automated activation
- air atomisation by mixing water with compressed air
- targeting the dust source.

Sprays are most effective with little air turbulence and may require enclosures or application of a larger droplet size.

- Nozzle size, pattern and direction shall be carefully assessed for effectiveness in each individual application.
- The addition of a surfactant to lower the surface tension of the water droplets and allow for better interaction between the water and coal dust shall be considered in areas of high dust exposure.

Some considerations for effective water and suppression methods for roadways include:

- sodium chloride (dry salt granules), which draws moisture from the air and prevents fine dust build-up on roadways—sodium chloride is only effective when the air contains enough moisture;
- magnesium chloride (liquid salt), which can be applied if the air is dryer (or a combination of both)—the initial application of the wet salt should be around 30%, but this can drop to 5% once the road is established;
- dust suppressants, which can be applied to outbye roadways to create a sealed surface and help prevent fine dust becoming airborne as a result of vehicle traffic and outbye activities;
- regular application of water to outbye roadways, which will help prevent fine dust becoming airborne as a result of vehicle traffic and outbye activities.

The utilisation of water infusion techniques should also be considered for longwall operations if methane drainage has reduced the moisture content of the coal, thus increasing the potential of increased dust make. Each mine SSE will need to assess the risk of this, taking into account geological factors, coal permeability and existing methane drainage holes.