MINERALS COUNCIL
SOUTH AFRICA

MOSH Industry Dust Bowtie Analysis

Coal – Respirable Coal Dust Containing Crystalline Silica (Surface)

Hazard: Respirable Coal Dust

Hazard name:	Respirable Coal Dust (surface operations)
Top event:	Liberation of Respirable Coal Dust
Affects:	Health
Description:	Coal dust, which may contain crystalline silica, generated by various mining activities

List of Threats and Consequences

Threats:	Threat Category
Coal Transfer (Underground to surface silos)	HC High Contribution
Drilling-Coal (Surface)	HC High Contribution
Blasting - Coal (Surface)	HC High Contribution
Loading (Surface)	HC High Contribution
Hauling (Roadways - Surface)	HC High Contribution
Tipping/Dumping (Surface)	HC High Contribution
Coal Conveyance (Surface Belt)	HC High Contribution
Coal Processing (Surface Plant)	HC High Contribution

Consequences:	Consequence Category
Dust Inhalation - Acute Exposure	MED Medium concern
Dust Inhalation -Chronic Exposure	MAJ Major concern
Business Continuity Disruptions	MED Medium concern
Stakeholder Relations	MAJ Major concern

List of Threats and Controls with descriptions

Threat	Controls
Coal Transfer (Underground to surface silos) Transfer of coal from one conveyor (Section Belt) to the other (Trunk Belt), or Trunk to Trunk belt, Trunk Belt to the Bunkers for storage or main conveyor belt to the Silo (Surface)	**Transfer Point Water Sprays** A water-based dust engineering control used to suppress dust or facilitate the airborne capture of dust particles at the conveyor belt transfer point.
	CBAT-SLP Primary dust engineering control system at ore conveyance transfer points. The system ensures that airborne dust particles are captured and trapped by increasing one droplet of water to create mist vapor (atomization) capable of capturing respirable dust particles. The coagulation and the absorption of the dust particle by water is further enhanced by adding low dose surfactants that descale, sterilize (treat the water for fungal and bacterial agents) and increase the dust binding effect.
Drilling-Coal (Surface) Drilling of coal face at open cast operation in preparation for blasting.	**Suction Drilling/Dust collectors** The use of dust suction system installed at surface drilling machines to collect fine dust into bags.
	Drilling Scrubber The extraction of dust particles through a scrubber device connected to the drilling machine.
	Wet Drilling Introduction of water during drilling of long holes using steel drill rods with water outlets at drilling points to suppress dust.

Drilling-Coal (Surface) continue	**Dust Curtain (C/Belt dust deflector)** Conveyor belt material placed underneath the drill rigs to prevent dust propagation
Blasting - Coal (Surface) Blasting of coal seam at opencast operations	**Explosive Selection** The use of low explosives which are less invasive during blasting, these explosives create deflagration which is sufficient to fragment the coal seam.
	Water Blast Canon The use of highly pressurized water, which is pumped through nozzles, turning the water into mist through atomization. This mist then captures the dust particles and dissipates.
	Burden & Spacing, patterns, stemming The spacing between the long holes affects the fragmentation of the coal seam, thus the dust generation.
Loading (Surface) Loading of blasted coal to Dump truck using excavators.	**Water Blast Canon** The use of highly pressurized water, which is pumped through nozzles, turning the water into mist through atomization. This mist then captures the dust particles and dissipates.
Hauling (Roadways - Surface) Tramming of coal from the blasted coal face to the tipping area or stockpile	**Roadway Dust Suppression (Watering down)** An engineering control that involves watering down of roadways by applying water and surfactants (or other agents such as hygroscopic salts or bitumen etc.), to consolidate the dust particles and to prevent them from becoming airborne.
	Environmental Roadway Construction Initial roadway construction using special dust binding and environmentally friendly agents to create a surface that prevents or minimizes dust liberation as the road is used.
Tipping/Dumping (Surface) Tipping coal from Dump truck to the tipping points or dumping point (Stockpile).	**Water Blast Canon** The use of highly pressurized water, which is pumped through nozzles, turning the water into mist through atomization. This mist then captures the dust particles and dissipates.

	Tips Sprays A water-based dust engineering control used to suppress dust or facilitate the airborne capture of dust particles at the conveyor belt.
Coal Conveyance (Surface Belt) Transfer of coal from the tipping point conveyor belt to the crusher.	**Water Sprays** A water-based dust engineering control used to suppress dust or facilitate the airborne capture of dust particles at the conveyor belt transfer point.
	CBAT-SLP Primary dust engineering control system at ore conveyance transfer points. The system ensures that airborne dust particles are captured and trapped by increasing one droplet of water to create mist vapor (atomization) capable of capturing respirable dust particles. The coagulation and the absorption of the dust particle by water is further enhanced by adding low dose surfactants that descale, sterilize (treat the water for fungal and bacterial agents) and increase the dust binding effect.
Coal Processing (Surface Plant) Crushing & separation of large coal material to sizeable coal material.	**Water Sprays** A water-based dust engineering control used to suppress dust or facilitate the airborne capture of dust particles at the conveyor belt transfer point.
	CBAT-SLP Primary dust engineering control system at ore conveyance transfer points. The system ensures that airborne dust particles are captured and trapped by increasing one droplet of water to create mist vapor (atomization) capable of capturing respirable dust particles. The coagulation and the absorption of the dust particle by water is further enhanced by adding low dose surfactants that descale, sterilize (treat the water for fungal and bacterial agents) and increase the dust binding effect.

MINERALS COUNCIL
SOUTH AFRICA

List of Threats and Controls with descriptions

Consequence	Controls
Dust Inhalation - Acute Exposure Coal dust inhalation which may result in short-term respiratory symptoms such as sneezing, coughing, lung-tissue swelling, asthma and throat infections.	**Travelling Speed Management** A traffic management programme to regulate mobile equipment travelling speed to eliminate accident and damage of property.
	Cabin Integrity The structural condition of the cabin must prevent ingress of dust particles into the cabin thus exposing the operator
	Windsock Indicator Determining the wind direction to ensure work is always conducted upstream of air direction thus preventing direct exposure. This air direction can be determined during truck spotting.
	Operator/passenger enclosed cabins Operator cabin enclosure (physical) to create a barrier between the operator and the airborne coal dust particles.
	Canopy Air Curtain Technology/Practice Maintaining clean breathing air supply by maintaining a positive air pressure inside the cabin, through the introduction of filtered air to create a barrier and prevent any contaminated air into the cabin.
	Job Rotation Multi license system that allows operators to change their work activities or between machines during the shift
	Dust Mask (PPE) Dust respiratory personal protection equipment with the correct protection index.

Dust Inhalation - Acute Exposure continue	**Respirators (PPE)** Dust respiratory personal protection equipment with the correct protection index.
	Real Time Dust Monitoring Electronic systems aimed at monitoring and communicating the performance of engineering controls in real time. This allows operations to act immediately in implementing appropriate dust control measures or procedures (administrative controls) where there are engineering control failures.
	Ventilation Control Systems Installation of ventilation control appliances to dilute/remove dust using ventilating air.eg. Fans, vent brattices, etc.
Dust Inhalation -Chronic Exposure Coal dust inhalation which may result in long-term adverse respiratory diseases (occupational lung diseases such as Coal Worker's Pneumoconiosis/Silicosis).	**Travelling Speed Management** A traffic management programme to regulate mobile equipment travelling speed to eliminate accident and damage of property.
	Cabin Integrity The structural condition of the cabin must prevent ingress of dust particles into the cabin thus exposing the operator.
	Windsock Indicator Determining the wind direction to ensure surface loading work is always conducted upstream of air direction thus preventing direct exposure. This air direction can be determined during truck spotting.
	Operator/passenger enclosed cabins Operator cabin enclosure (physical) to create a barrier between the operator and the airborne coal dust particles.
	Canopy Air Curtain Technology/Practice Maintaining clean breathing air supply by maintaining a positive air pressure inside the cabin, through the introduction of filtered air to create a barrier and prevent any contaminated air into the cabin during loading and transportation.

Dust Inhalation -Chronic Exposure Continue	**Job Rotation** Multi license system that allows operators to change their work activities or between machines during the shift.
	Personal Dust Monitoring A formal system of Occupational Hygiene Measurements where employees are sampled for dust based on their HEG (Homogeneous Exposure Group) allocation and classification.
	Periodic Medical Screening A formal system of medical surveillance where employees undergo medical examination (Lung Function Tests) at the start of their employment and at appropriate intervals as determined by the risk profile.
	Job Re-Classification The transfer of employees from high-risk areas (with regards to their exposure to dust) to low-risk areas with an aim to prevent an occupational lung disease which may have already started showing signs.
	Canopy Air Curtain Technology/Practice Maintaining clean breathing air supply by maintaining a positive air pressure inside the cabin, through the introduction of filtered air to create a barrier and prevent any contaminated air into the cabin.
	Ventilation Control Systems Installation of ventilation control appliances to dilute/remove dust using ventilating air.eg. Fans, vent brattices, etc.
	Real Time Dust Monitoring Electronic systems aimed at monitoring and communicating the performance of engineering controls in real time. This allows operations to act immediately in implementing appropriate dust control measures or procedures (administrative controls) where there are engineering control failures.

Business Continuity Disruptions Total or partial mine operation closure or production stoppage due to statutory instructions due to non-compliance.	**Occupational Health Monitoring Programme** System of Occupational Hygiene Measurements based on their HEG (Homogeneous Exposure Group) allocation and classification and linked with medical surveillance records of employees.
	Business Continuity Training Training of all relevant personnel on Business Continuity Plan and the role of each incumbent during business disruption.
Stakeholder Relations Working relationship amongst the tripartite parties including investors and communities, in the interest of health & safety of employees. (Look at description).	**Stakeholder Management Plan** A management process that consists in managing the expectations and requirements of all the internal and external stakeholders that are involved with a project to ensure successful delivery of any project, programme, or activity.