OCCUPATIONAL HEALTH IN THE SOUTH AFRICAN MINING INDUSTRY

GETTING DUST UNDER CONTROL

FACT SHEET 2016

CONTEXT

South Africa's gold mines are almost unique globally in that gold-bearing ore is extracted from deep underground mines through a labour-intensive process in a challenging environment.

Limiting dust generation, controlling dust liberation at source, monitoring workers exposure and ensuring the availability and provision of personal protective equipment (PPE) make up the comprehensive efforts that the industry uses to address dust as an occupational hazard.

Mining is typically undertaken in a three-phase cycle of drilling, blasting and cleaning, with both the depth and the nature of the 'hard rock' and narrow reefs limiting opportunities for mechanisation. Access to workings is usually via vertical shafts or incline shafts (in shallower operations)-these shafts are also used for intake ventilation and emergency access. Most mines have dedicated upcast shafts to return air back to surface. As working places extend further and further from both the surface and shaft infrastructure, high virgin rock temperatures mean that cooling and ventilation become critical.

In the face of these challenges South African miners have become world-leaders in cooling and ventilation management, particularly when it comes to dust control knowledge and technology.

Silicon dioxide (known as silica) is a natural component of the earth's crust, and is found in high concentrations in some areas – most notably the rock that hosts gold-bearing minerals. It is through blasting, cleaning and ore transportation that silica dust (minute particles not visible to the human eye) becomes airborne and presents a health risk when breathed in.

If inhaled, crystalline silica dust may cause a fibrotic reaction (or scarring) in the lung, which results in a restriction of lung elasticity – this is known as silicosis. In turn, silicosis may predispose an individual to the development of pulmonary tuberculosis, which is already a significant public health threat in southern Africa.

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CONTAINING AND CONTROLLING DUST GENERATION

As far as possible, mines aim to prevent the generation of dust at source. Dust may be caused by various mining activities, such as blasting, drilling and sweeping, and during transport. One of the most effective ways of managing the dust that is inevitably generated is through efficient ventilation, with fans and detailed ventilation plans in place to remove the dust from working areas.

Extensive research and development has been undertaken into appropriate technology (such as wet drilling and ventilation) and mine planning to reduce the generation of respirable crystalline silica at source. Some of these techniques and technologies include wet drilling, ventilation, dust allaying, filtration at tipping points and centralised blasting to prevent peak exposure.

Potentially higher exposed work places or occupations are monitored more frequently and control measures improved to reduce exposure. The sampling program is designed and executed in accordance with the Guideline on Airborne Pollutants issues by the Chief Inspector of Mines.

Dust monitoring, sampling frequencies and dust analysis methods have improved in recent years in light of new knowledge and improved technology.

HOW IS DUST MEASURED?

Dust exposure is measured through full shift sampling using a gravimetric sampler, these results are used in exposure control and are also submitted to the Department of Mineral Resources.

WHAT HAS BEEN ACHIEVED?

Collectively these efforts have resulted in the incidence of silicosis (the number of new cases in a study population in a given period) declining over time. This is also evidenced by the increasing period of exposure before diagnosis. (For more on Silicosis, see the factsheet at http://www.oldcollab.co.za/downloads/send/4-2015/4-fact-sheet-silicosis).

Targets are set by the Mine Health and Safety Council (MHSC) which is a tripartite entity, established by the Mine Health and Safety Act, comprising State, Employer, and Labour members and chaired by the Chief Inspector of Mines. It is funded by public revenue and is accountable to Parliament.

In 2003 the MHSC set as a target at its biennial summit that "By December 2008, 95% of all exposure measurement results will be below the occupational exposure limit for respirable crystalline silica of 0.1mg/m^3" (these results are individual readings and not average results).

It also stated that after December 2013, using present diagnostic techniques, no new cases of silicosis will occur among previously unexposed individuals. Previously unexposed individuals are individuals unexposed prior to 2008, that is, equivalent to a new person entering the industry in 2008.

In line with international trends towards even more rigorous dust controls, the renewed 2014 MHSC milestones set a new target – that 95% of all exposure measurement results will (by 2024) be below the milestone level for respirable crystalline silica of 0.05 mg/m3.

In aggregate, the ambitious target was close to being reached, according to MHSC data published in November 2014 by the Chief Inspector of Mines. As regards silicosis, as far as we are aware, there have not at this stage been any such diagnoses at the 6 companies that form the Silicosis Working Group companies. However, successes in dust management mean that it takes an average 20 years of exposure to silica dust before a silicosis diagnosis can be made, so we cannot yet claim full success.

Improvements have been achieved through constantly improving dust control methods and developing new technologies, as well as through placing a very high emphasis on employee training and education.

95%

The 2003 MHSC health and safety milestones agreed between government, labour and business committed companies to achieving, among other things, the target that 95% of all exposure measurement results would improve on current regulatory requirements and by 2014, be below the milestone level for respirable crystalline silica of 0.1 mg/m3. The milestones also set the goal of no new cases of silicosis among individuals unexposed prior to 2008.

KEY "LEADING PRACTICES" IN DUST CONTROL

1 CONTINUOUS REAL-TIME MONITORING OF AIRBORNE POLLUTANT ENGINEERING CONTROLS

This practice allows for a quicker response time to investigate and/or initiate exposure reduction controls when the continuous real-time monitoring system detects excessive airborne pollutant levels.

2 FOGGERS

In March 2008 industry experts identified an atomised water dust suppression system (the fogger dust suppression system) as one of the leading practices for addressing the risk of airborne respirable crystalline silica dust. This system offers dust control at source, has broad applicability, is easy to install and maintain, and has the potential to have a significant positive impact on a large number of employees when applied together with other silica dust controls.

In gold mines, foggers and/or mist spray systems are especially important around station ore pass systems.

3 FOOTWALL/SIDEWALL TREATMENT

This involves the wetting of tunnel surfaces (floor and walls) with water and surfactants (or other agents, which could include hygroscopic salts, soil cement and bitumen). Spray cars are pulled by a locomotive and spray the solution onto foot and side walls to consolidate the dust and to prevent it from becoming airborne

Treatment is mainly conducted on intake airways where people travel, but many mines extend it to all haulages where people work and travel on a regular basis.

4 MULTI-STAGE FILTRATION SYSTEMS

Multi-stage filtration systems have been recognised as a primary form of dust control in intake airways. The principle of multi-stage filtration ensures that contaminated air is drawn / extracted by means of a fan through the filtration unit where it goes through three stages of filtration, each removing increasingly smaller particles of dust. The final stage is a High Efficiency Particulate Air (HEPA) filter, which removes the smallest particles (invisible to the naked eye) – which are most likely to prove a silicosis risk if inhaled.

5 WINCH COVERS

Winches are used for a range of applications underground, especially moving rock. By their nature they can produce a lot of dust, which has an impact on the mineworkers operating them or working in their vicinity.

Winch operators have been identified across industry as the occupation with the highest exposure to silica dust. In principle, the winch cover simply involves fitting a cover to the winch drum guard or to the winch casing of existing winches – reducing the dust exposure of winch operators and others in the vicinity. The installation of a winch cover has been found to result in a 50% reduction in aerosol particles in the breathing zone of winch operators.

EDUCATION IS CRUCIAL

While companies and mines can and do put a significant amount of time and resources into installing technologies and implementing methodologies to control dust exposure, that work will not have the necessary impact if it is not accompanied by intensive education programmes.

Mineworkers need to understand why there are systems in place and why exposure rules need to be adhered to (i.e. keeping a dust mask on even in hot and humid conditions). Supervisors need to ensure that neither they nor their teams cut any corners when dust management is concerned.

A range of tools are available for this – including regular health training sessions, messaging included in internal communications (i.e. educational comic strips), posters at workplaces, leisure / changing areas and health facilities, and discussions at team meetings during work hours. Education and training initiatives are regularly undertaken, including at induction sessions and annual medicals, and also in workplace briefings.

THE WORKING GROUP ON OCCUPATIONAL LUNG DISEASE

The mining industry working group on Occupational Lung Disease (OLD) was established in 2014. Initially representing five companies and now extended to six (African Rainbow Minerals, Anglo American, AngloGold Ashanti, Gold Fields, Harmony and Sibanye Gold), we are focusing on issues relating to compensation and medical care for occupational lung disease (OLD) in the gold mining industry in South Africa.

Our goal is to engage all stakeholders in order to work together to design and implement a comprehensive solution that is both fair to past, present and future gold mining employees, and also sustainable for the sector.

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