# GLOBAL MINING REVIEW

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## ON THE COVER

Nokia is the #1 private wireless supplier that is shaping the mining market digitalisation with one converged platform; including industrial-grade private wireless connectivity and Wi-Fi, industrial devices, industrial edge MXIE, and an application ecosystem that meets and addresses mining business needs for Industry 4.0.

# DO AWAY WITH DUSTY DISCHARGE

**Todd Swinderman and Dan Marshall, Martin Engineering, USA,** discuss how proper belt cleaning can mitigate emissions from carryback and control spillage, improving efficiency and compliance.

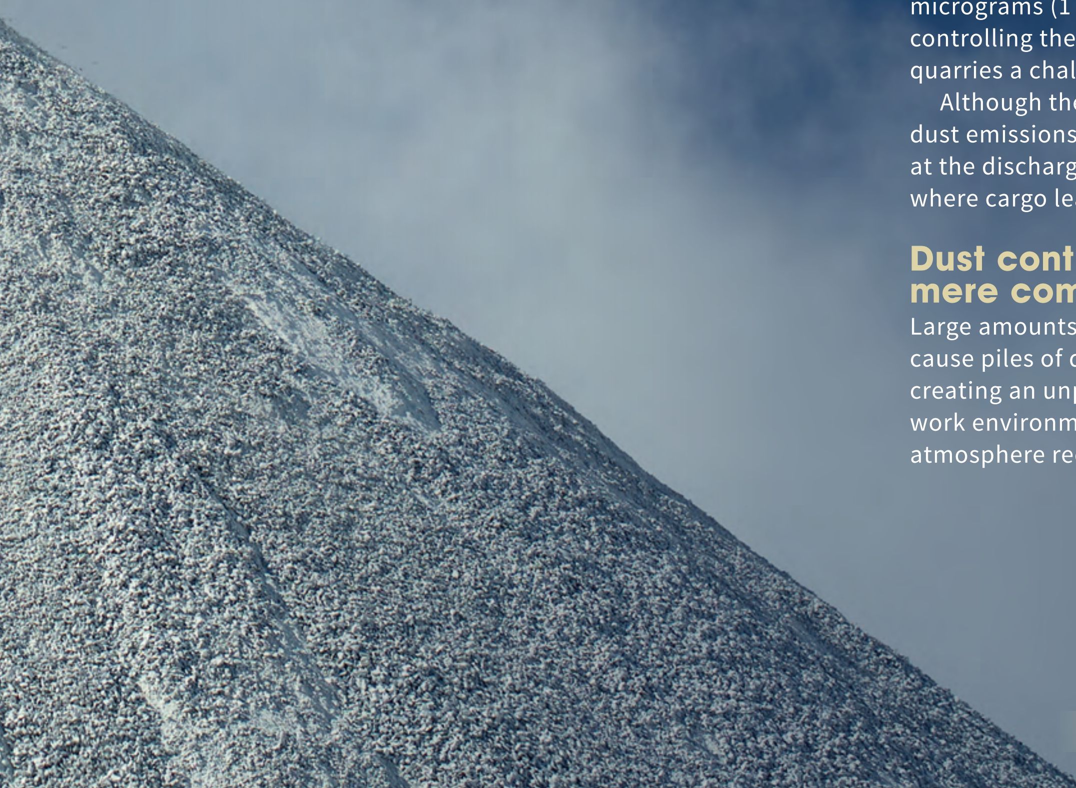
The handling of raw and processed materials in mines and quarries introduces several opportunities for cargo to be exposed to the elements and emit dust. From the time the material is extracted, it does not sit still for long. From storage to train/truck transport, processing, and shipping; the material passes through several conveyor transfers, shedding dust at every step.

One of the most highly regulated particulate emissions of any bulk handling material is respirable crystalline silica (RCS), which is found in nearly every raw material on earth. The fact that particle sizes for the substance are tested in micrometres (1000$^{th}$ of a millimetre) and volumes are monitored in micrograms (1 000 000$^{th}$ of a gram) makes controlling the fugitive dust in mines and quarries a challenge.

Although there are many opportunities for dust emissions, this article covers fugitive dust at the discharge point of the conveyor transfer where cargo leaves the belt.

## Dust control reaches beyond mere compliance

Large amounts of emissions at a discharge can cause piles of dust to settle on every surface, creating an unpleasant and possibly hazardous work environment. Working in a dusty atmosphere reduces worker productivity –



in some studies as much as 20% – if respirators must be worn. Respiratory illness from exposure to even nuisance dust often leads to workers being put on long-term disability, increasing worker compensation costs. A dirty operation also attracts the attention of regulators and neighbours. A reputation as a 'dirty place to work' reduces the pool of employees who are willing to work in such an environment, and those already employed often suffer from low morale.

Fugitive materials are often a root cause of catastrophic events. Many types of dust present fire and explosion risks in addition to health and safety concerns. The destructive power of dust explosions is well documented in the coal industry. Static discharge into a dusty atmosphere is a common cause of many of these fires and explosions. Dust can foul components that create hazards. Friction from a seized idler due to fouling is a common root cause of major incidents. In many cases, a frozen idler bearing is the heat source that ignites the grease which catches fire.

## Uncontrolled material flow

Efficient throughput is all about controlling the cargo stream and proper discharge is at the heart

Figure 1. Dust cascading down from belt returns is a clear sign of inadequate belt cleaning.

Figure 2. The lines on this belt tell a story of deficient cleaning and mistracking leading to dust, spillage, and carryback.

of that control. The nature of fugitive material problems from any conveyor is indicated by the location and particle sizes of the accumulations. Fugitive materials at the discharge zone are generally categorised into spillage, dust, and carryback:

- Spillage is cargo that escapes the belt and accumulates on either side of the conveyor. Piles are formed rapidly and can occur from inadequately maintained transfer points.
- Dust is the fine particles, usually less than the diameter of a human hair in size, that are created as the bulk material moves through a conveyor system. Fine airborne dust is emitted at locations where the cargo is exposed or disrupted. Because dust particles are very small, when dry, they are easily dispersed.
- Carryback is fine material that sticks to the belt surface or becomes lodged in the cracks and crevices of the carrying side of the belt. Carryback material collects on components that the carrying side of the belt touches and eventually dries out, dropping beneath the system along the return path.

## Belt cleaning innovations mean less dust

The design and function of belt cleaners have come a long way. In the past, belt cleaners were rigid, linear pieces of hardware made out of various materials from brick to plastic that earned the name 'scrapers' or 'wipers', because that is what they did. They had a low operational life, broke or cracked frequently, and contributed significantly to belt wear.

Modern primary cleaners are usually mounted at the head pulley and made from engineered polyurethane. This specially formulated material is forgiving to the belt and splice, but still highly effective for dislodging cargo. Typically supported by mechanical or pneumatic tensioners, the designs require significantly less monitoring and maintenance of blade tension.

One primary cleaner design requires no tensioning at all after initial installation. It features a matrix of tungsten carbide scrapers installed diagonally to form a 3D curve around the head pulley and typically delivers up to four times the service life of urethane cleaners without ever needing re-tensioning.

As conveyor speeds and cargo volumes increase to meet production demands, secondary belt scrapers are often installed immediately after the belt leaves the head pulley to address dust and fines that escape the primary cleaner. Generally equipped with spring or air tensioners that easily adjust to fluctuations in the belt, secondary cleaners are particularly efficient for applications that produce wet, tacky, or dusty carryback.

## Secondary cleaning

A carbon-tipped spring-loaded secondary cleaner takes a different approach from the standard secondary blade cleaner. It features independent 6 in. wide blades with

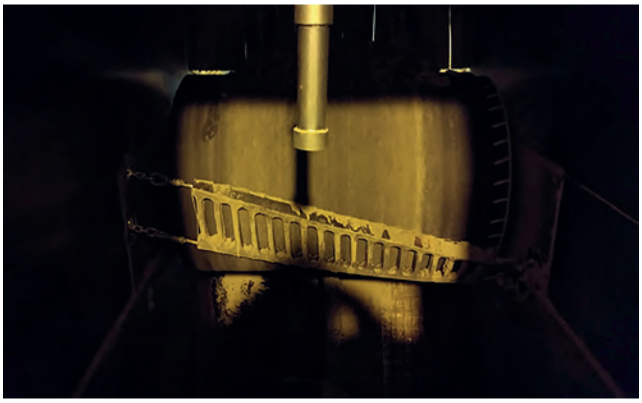


Figure 3. The next generation of belt cleaner stretches the width of the belt profile for full coverage.

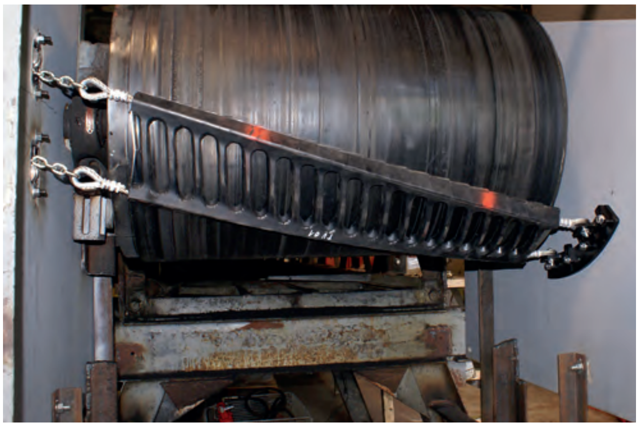


Figure 4. This innovative cleaner takes up less room and requires less maintenance than standard cleaners.


Figure 5. No tensioner monitoring or adjustment means less maintenance time, lowering maintenance costs.

carbide tips set on a stainless steel assembly. Each tip is supported on spring-loaded arms at both ends with a wide range of motion that provides equal load pressure across each blade and requires less tensioning over its lifespan. This design absorbs obstructions, responds to belt fluctuations, and is able to arc safely in the event of a belt rollback.

## Case study: Rock quarry

A US rock quarry was experiencing carryback on one of its conveyors. The system transfers thousands of tonnes of 4 in. (101 mm) minus aggregate on a 30 in. wide (762 mm) belt travelling 420 ft (128 m) at 250 fpm (1.27 m/sec.) from one crusher to another. The crusher-to-conveyor process results in the aggregate being reduced to 0.5 in. minus sand. Leading from the quarry to the interior of the facility, the outdoor portion of the belt was exposed to extreme weather, even though it is covered. Material adhered to the return side of the belt, collected around the mainframe and gummed up rollers, requiring downtime for maintenance and raising the cost of operation.

Martin Engineering showed managers the latest innovation in belt cleaning technology, the CleanScrape® Cleaner. Technicians needed to drill just four small holes required for mounting. Installed diagonally across the head pulley, it forms a 3D curve that allows the matrix of tungsten carbide scrapers to exert a low contact pressure with the belt, but still offer excellent removal of stuck material. Suitable for belt speeds up to 1500 fpm (7.5 m/sec.) with vulcanised splices and 800 fpm (4 m/sec.) if mechanically spliced, the light touch of the cleaner glides safely over splices while still effectively dislodging material and reducing carryback.

Having installed the cleaner on the system with the most carryback and experiencing instant and measurable results, operators immediately had one installed on a second conveyor and ordered five more. Operators say that the cleaner has reduced the labour needed for cleanup and improved system efficiency, and they expect a longer service life than previous cleaners.

## Conclusion

When fines are allowed to cling to the return side of the belt, suddenly dust can be detected along the entire length of the system. Spillage beneath the system is exposed to wind and adds to the dust. These fugitive emissions can cost mines and quarries in violations and potential lawsuits.

Innovations in both blade design and tensioner engineering have improved cleaning ability, increased equipment life, reduced the need for tensioning and blade changes, and decreased labour for maintenance and cleanup. Along with lowering the cost of operation, the most noticeable change is less dust along the belt path and in work areas. This improves employee morale and retention and results in better compliance. GMR