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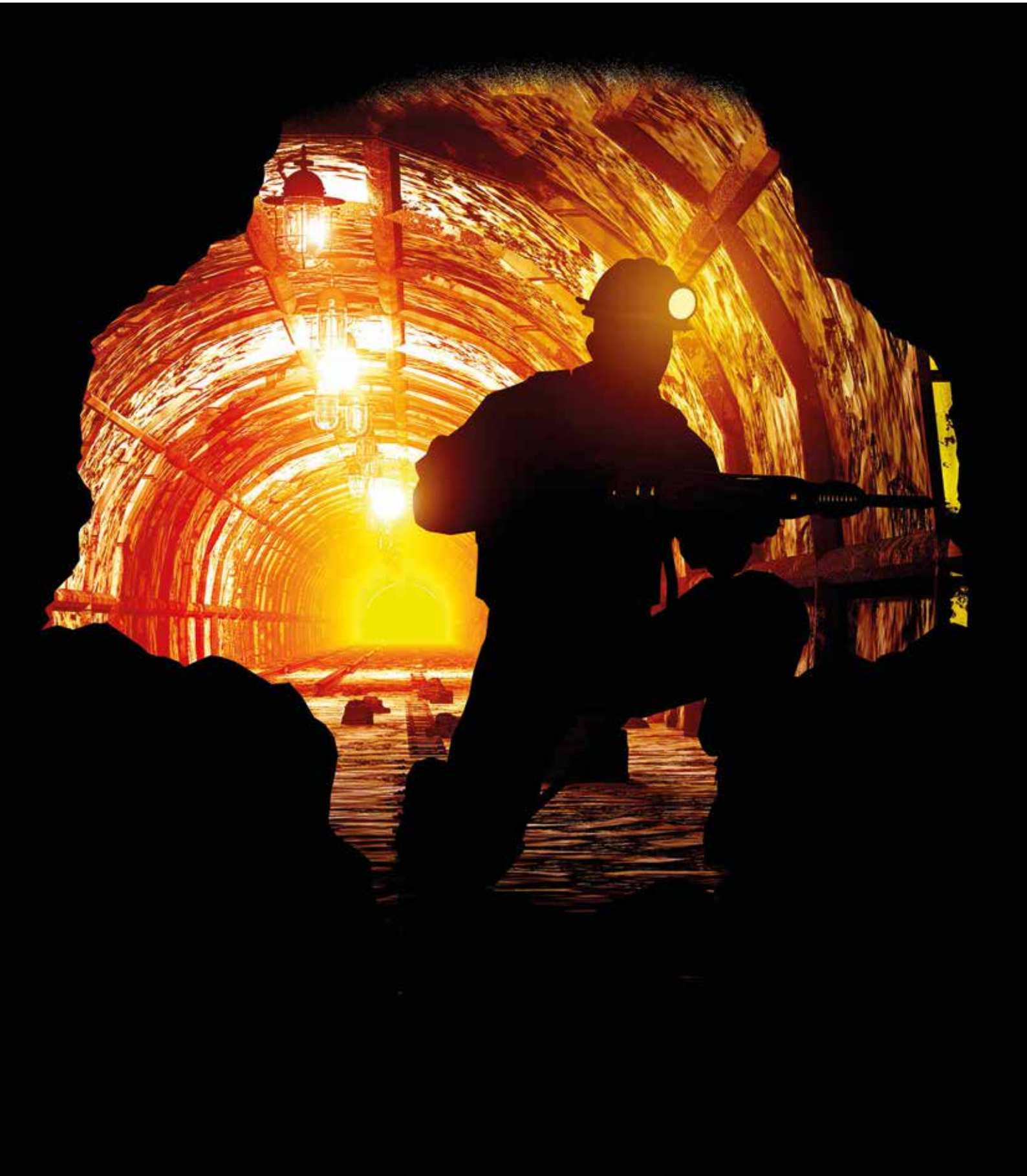

Unpleasant plumes: dust control at the conveyor load zone

When tons of raw or processed coal hit a moving conveyor belt, three things happen: fines scatter in random directions, cargo shifts and dust becomes airborne. The impact creates turbulent air pressure inside the chute that seeks to escape from any gap it can find, carrying dust and fines with it. A properly designed enclosure will manage bulk solids, allow cargo to settle in the center of the belt and contain most of the dust inside a settling zone enclosure.

Well-designed conveyor loading zones keep walkways clear from spillage, control dust emissions and allow hazard-free inspections and maintenance. Operators need only take a broad look at the expense that fugitive material contributes to a system to realize the full cost that accompanies inefficient transfer point designs. Problems such as improper belt support, badly sealed chutes, damaged idlers and uneven cargo distribution all result in spillage and belt mistracking, contributing to increased costs for maintenance and cleanup, the potential for injury and compliance issues.

THE COST OF SPILLAGE

If left uncontained, fugitive material in the form of dust and fine particle spillage will increase labor costs for cleanup, foul equipment, potentially encapsulate the belt and pose a serious safety hazard.[**Figure 1**] A dirty and dusty environment also discourages workers from doing regular maintenance on the problem area and negatively affects morale.

Since trips and falls are regularly among the most common workplace accidents, Occupational Safety and Health Administration (OSHA) as well as Mine Safety and Health Administration (MSHA) inspectors are constantly on the lookout for those hazards. Spillage surrounding the loading zone is an easy violation to spot, in severe cases blocking access to the system and exacerbating the hazards of working near a moving belt.

Dust levels are also strictly regulated by OSHA, and permit violations are often accompanied by fines and potential

Figure 1: With the proper enclosure design, dust volumes can be lowered to below regulatory levels.

downtime. In many industries known for dust generation, workers wear personal dust monitors to measure particulate levels throughout their shifts. Working within proximity of poorly designed loading zones can cause monitored levels of PM10 (particulate material <10 microns in size) to exceed allowable limits.

SEALED CHUTE COMPOSITION

A well-designed loading zone typically consists of a combination of components. These include:

1. An *enclosed transfer chute* should be long enough to give dust and fines time to settle.
2. A *heavy-duty belt support system* absorbs impact, protects the belt and can handle rapidly shifting heavy material.
3. *Closely spaced idlers* help avoid sags in the belt that allow gaps where fines can escape and ease material disruption from bouncing.
4. *Externally adjustable or self-adjusting skirting* contains fine particles and adapts to fluctuations in the belt plane. [**Figure.2**]
5. *Easily serviced wear liners* can be changed from outside the chute without confined space entry.
6. *Dust curtains* set strategically throughout the enclosure control airflow and help settle dust.
7. *Dust bags or mounted air cleaners* collect tiny, highly active particles.
8. *A sealed tail box* protects the tail pulley from the backflow of fines, dust and spillage.
9. *Exit curtains* prevent fugitive dust from escaping from the end of the chute.

Dust and spillage are top concerns for many safety professionals. Field tests have shown that enlarged skirtboards and engineered settling zones promote dust settling and reduce fugitive material. [**Figure 3**]

CASE STUDY

A mine in north central Mexico was experiencing excessive spillage and dust emissions at the loading zone of its tower-mounted conveyor transporting gold, silver, zinc oxide, copper, lead, and molybdenum. Despite installing various transfer and loading chute components, workers found that dust filled the tower and chunks of material 2-3 in. (51-76 mm) in diameter spilled from the transfer chute onto the stairs, partially blocking access to the area and creating a potential workplace hazard. [**Figure 4**] Twice per month operations had to be disrupted for 12-24 hours so that a 4 to 5 person team could clean spillage and return it to the cargo flow. Cleanup and downtime raised the cost of operation and lowered efficiency.

Technicians from Martin Engineering Mexico were invited in, and after a thorough inspection designed a plan based on the principles of Production Done Safely®. It addressed all aspects of the bulk handling process for properly guiding the cargo through the transfer chute. Impact Cradles were installed to center the material and help prevent belt damage, improving performance as well as safety by pulling out for external maintenance, a system invented by Martin Engineering. The project also included skirting and

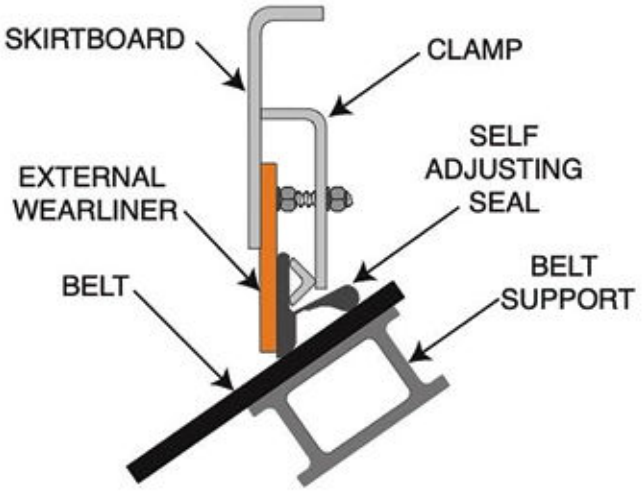

Figure 2: External wear liner and dual self-adjusting seal with belt support.

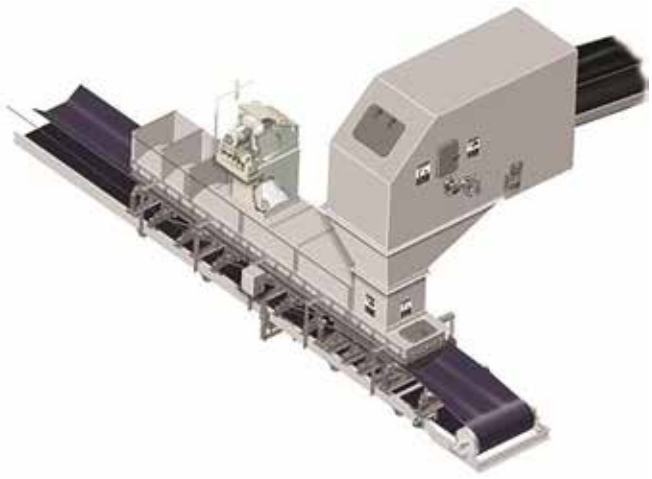

Figure 3: Modern loading zone design has elements that focus on safety for both personnel and equipment.

Figure 4: Bulk material drops onto a moving conveyor belt, creating dust and spillage.

Figure 5: The reconfigured conveyor controls emissions for improved safety and easier maintenance.

dust bags to contain emissions and spillage throughout the settling zone. Strategically placed belt trackers maintain belt alignment along the entire path. Heavy-duty primary and secondary cleaners that can be pulled out for easy service were installed at the discharge zone to reduce carryback and promote safer blade replacement. The entire system was designed with innovative safety features and ease of maintenance in mind. Each of the components works together to deliver a comprehensive bulk handling solution that promotes efficiency and a safer workplace. [**Figure 5**]

Following installation, fugitive material was significantly reduced and spillage no longer blocked access to the area. The air around the transfer point and throughout the tower was much clearer. "We no longer need scheduled shutdowns just for cleaning," said an operations manager. "We're very happy with the work done." The customer cited the expert service from the Martin Engineering team, a thorough understanding of the mine's needs and the quality of the equipment.

CONCLUSION

With some fairly simple calculations, cost-minded managers can see the negative impact of labor costs for cleanup and maintenance on the bottom line. Combined with the expense of fouled equipment replacement, potential OSHA violations and unscheduled downtime, the expense of a chute redesign can become an essential capital expense. Using the technologies described here, even poorly-performing conveyors need not be replaced, but merely modified and reconfigured by knowledgeable and experienced technicians installing the right equipment. These improvements help operations improve efficiency, reduce risk and facilitate regulatory compliance[1].

REFERENCES

1. Swinderman, Todd: "The Payback of Safety and Justifying Expenditures for Safety Improvements," paper presented at the 2017 SME Annual Conference and Expo; CMA 119th National Western Mining Conference.

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Daniel Marshall received his Bachelor of Science degree in Mechanical Engineering from Northern Arizona University. With nearly 20 years at Martin Engineering, Dan has been instrumental in the development and promotion of multiple belt conveyor products. He is widely known for his work in dust suppression and considered a leading expert in this area. A prolific writer, Dan has published over two dozen articles covering various topics for the belt conveyor industry; he has presented at more than fifteen conferences and is sought after for his expertise and advice. He was also one of the principal authors of Martin's FOUNDATIONS™ The Practical Resource for Cleaner, Safer, and More Productive Dust & Material Control, Fourth Edition, widely used as one of the main learning textbooks for conveyor operation and maintenance.