GLOBAL MINING REVIEW

APRIL 2024
VOLUME 7 ISSUE 3

THINKING SAFETY

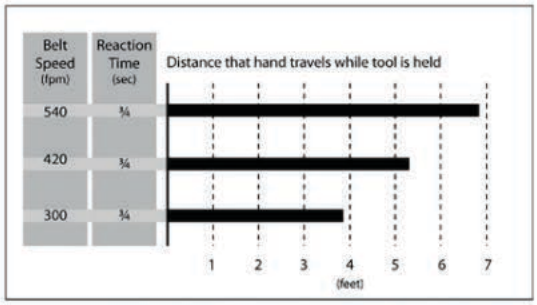
Jerad Heitzler and Dan Marshall, Martin Engineering, USA, outline how implementing practical safety improvements around conveyor belts can prevent avoidable injuries and lower operating costs.

The number of injuries and deaths from conveyor accidents has generally plateaued since 2015, compared to 20 or 30 years ago, where the annual number of worker fatalities was nearly 400 times what it is today.[1] Safety experts attribute some of the decrease in injuries and fatalities in the past decade partly to stringent regulation and reporting by the Mine Safety and Health Administration (MSHA) and the Occupational Safety and Health Administration (OSHA). Contributing factors also include modern safety-conscious equipment designs and operators addressing the root causes of injuries in mining environments, rather than treating the symptoms.

According to industry expert R. Todd Swinderman, there are five root causes of conveyor injuries: a 'production first' culture, 'low bid' purchasing, overly complex designs, too many rules, and understaffed or undertrained personnel. He has stated that companies who truly focus on safety are more productive, operate cleaner and safer facilities than their competitors, and have a higher share price.[2]

Examining three preventable conveyor injuries

Reduced workplace injuries and fatalities is a positive trend, but there are still predictable and preventable injuries happening. The goal of Martin Engineering's 'Production Done Safely' philosophy is to help mine operators achieve the greatest amount of production at the lowest cost of operation, with the least number of injuries possible. This is accomplished through awareness, extensive training, and safety-conscious equipment design.



National Safety council Data Sheet I-570 June 2006

Figure 1. Worker reaction times and drag distance for incidental contact with moving conveyor belt.

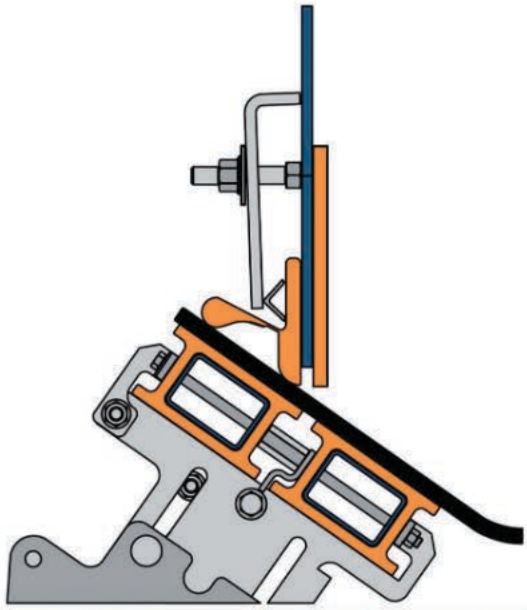


Figure 2. Components such as wear liners and skirt board seals reduce fugitive materials and cleanup hazards.

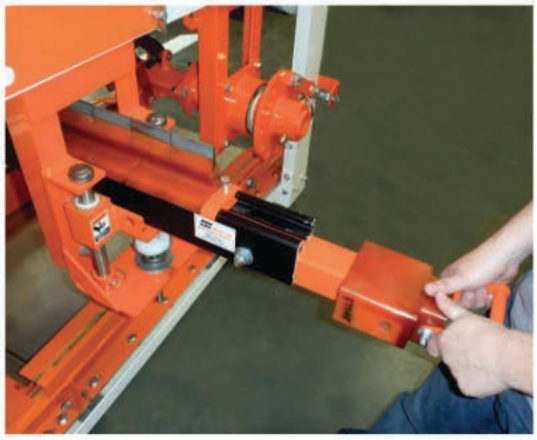


Figure 3. Some components are explicitly designed for safe service, such as track-mounted belt cleaners.

The following examples display common injuries that could have been prevented through several established safety methods. Beyond the tragic loss for the workers and their loved ones, the companies in which the fatalities occurred were heavily fined. Consequently, some are also enduring ongoing litigation, serious morale issues, and higher than normal turnover.

An unfortunate beginning

The first fatality is a common one. On a January morning in 2020, a 33-year-old worker was cleaning spillage around a running conveyor system at a facility in New Jersey. Listed as a temporary non-union worker, he got too close to the moving belt, and a piece of loose clothing came in contact with the belt, dragging him into a pinch point. He was strangled with the fabric before aid could be administered or the system shut down. This incident resulted in US$36 500 in fines from OSHA.[3]

There were several details left out of the public report. One is the presence of guarding around the belt, which prevents limbs and objects from 'breaking the plane' of the system. The 'plane' is the line (generally indicated by the outside of the stringer) that, once crossed, becomes a hazard for this type of incident. Guarding is designed with mesh that prevents incidental contact but allows for inspection. Often, there is a procedure required to remove guarding, and in some cases, removal triggers an automatic shutdown of the system.

It was not revealed in the report how much training the individual had received, but a trained worker would have been aware of the hazards around a moving belt with regards to loose-fitting clothing or long hair. Moreover, the presence of a buddy or supervisor is unknown, but the implementation of work teams might have allowed a faster response to shut off the system or free the worker before asphyxiation occurred.

Unsafe hopper entry

On an August day in Southern California, a 21-year-old worker with just over a year of experience at a sand and gravel mine noticed a clog in the drop chute of the cone crusher. After entering the vessel to remove the obstruction, while he was inside, material that had built up on the sides fell inward, encasing him up to his chest. Fire crews were able to extract him, but the injury damage from the pressure and force of the material was too significant and he later died in the hospital. Citation and litigation data were not available for this case.[4]

What was not revealed in the report was whether the worker was certified for confined space entry. Knowledge of chute entry rules specifies safety procedures for these types of actions, including clearing all loose material, which would have likely prevented the worker from entering the hopper.

There are safe and economical accessories designed to mitigate obstructions in chutes, hoppers, bins, and silos. To prevent injuries and equipment damage associated with methods such as striking the sides of the vessel with mallets, stabbing at obstructions from below, or dangerous chute entry, equipment manufacturers offer vibration and air cannon technologies.

Vibration at specified points agitates dust and fines that adhere to surfaces, preventing buildup that leads to clogging. Going one step further, air cannons use a forceful shot of

pressurised air pointed towards the material flow to free buildup over wide areas of the vessel's surface. Air cannons not only prevent clogs, but also promote the consistent flow of cargo through the process.

A fast conveyor

In April of 2020, a 49-year-old worker in Illinois was using a broom to clean dust and spillage around the conveyor feed pit leading to a moving conveyor transporting dried manure to a transfer point. The worker accidentally slipped and fell onto the belt. He was quickly conveyed 100 ft to the blade cleaner at the discharge point, where he suffered multiple life-threatening injuries and later died. According to the report, the employer was initially fined US$66 794, but was able to settle with OSHA for US$30 000. Any further pending litigation was unreported.[5]

Conveyors in full production mode often move so fast that they can exceed the reaction time of even a highly-trained Olympic athlete (see Figure 1). When faced with a situation where a worker suddenly contacts the cargo side of the belt, the only hope may be another worker making it to the shutoff switch in time.

The report cited the presence of a guardrail but did not specify the circumstances by which it was crossed. However, the best practice is to prevent as much dust and spillage discharging from the system as possible, then clean safely during scheduled downtime. Employers can mitigate excessive dust and spillage by installing equipment specifically designed for sealing the conveyor belt and controlling emissions.

Accounting for injuries

The importance of protecting workers should be the top priority for any employer. The loss felt by family and coworkers after a workplace fatality can weigh heavily on a community and staff, not to mention the financial consequences. Thus, investing in equipment and training that protects workers from injury and illness is essentially investing in the community and the company culture.

In its 2002 white paper, the American Society of Safety Engineers (ASSE) concluded a direct, positive correlation between investment in Safety, Health, and Environment (SH&E) and its subsequent return on investment (ROI).[6] The organisation reported that of the American business executives polled, 95% believed workplace safety also has a positive impact on a company's financial performance. The same poll revealed that 61% believed their companies received an ROI of US$3 or more for each US$1 they invested in workplace safety.

Calculating these costs is specific to each operation, but in general, they can be broken down into 'direct costs' and 'indirect costs'.

Direct costs are explicitly associated with the accident or illness. In general, these include fines, medical bills, insurance premiums, indemnity payments, and temporary disability payments.

Indirect costs comprise a variety of other expenses resulting from the incident. They include:

- Cleanup time and product loss.

- Equipment repair or replacement.
- Purchase or installation of safety components.
- Overtime to fill in for the missing worker.
- Cost of hiring, training, and equipping new employees.
- Legal fees and litigation costs.
- Increased insurance premiums.
- Production delays and missed shipment targets.
- Reduced employee morale, greater absenteeism.
- Negative publicity.
- Increased scrutiny by regulators.

The price of recovering from an accident

Tallying the direct and indirect costs, the impact of an accident on a company's bottom line can be devastating. Safety rules are not maliciously created to complicate operations or limit profit. When taken into account, they actually improve a company's bottom line.

To demonstrate the benefit of safety to a company's bottom line, OSHA created the online tool, '$afety Pays,' which uses company-specific economic information to assess the potential economic impact of occupational injuries on that firm's profitability. The programme estimates direct costs (claim cost estimates provided by the National Council on Compensation Insurance) and indirect costs (provided by the Stanford University Department of Civil Engineering) and weighs them against financial details supplied by the company (see Figure 5).

Figure 4. Conveyor guarding with the proper grating protects from flying spillage.

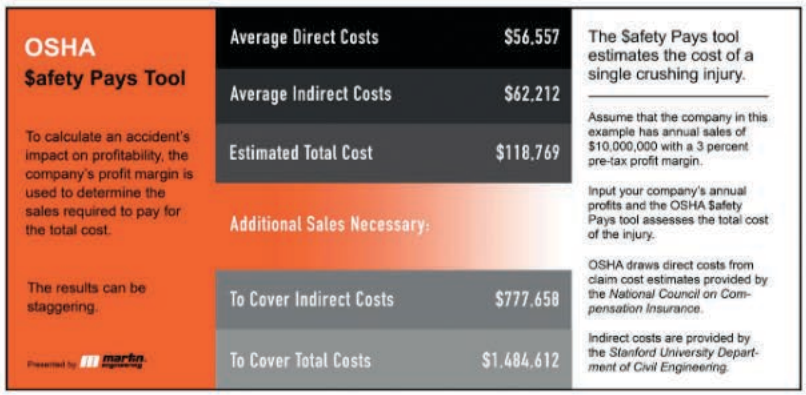


Figure 5. OSHA $afety Pays Tool example.

Return on Prevention (ROP)

The commonly used ROI model is calculated against a time frame in which the capital expenditure on new equipment is recaptured by the improvements. If a proposed project is within the budget expectations and has a payback period of less than one year, it is usually approved by mine management.

An issue with the ROI model is it requires someone to get hurt to provide a benchmark for calculating return, which is not a reasonable point of entry. Using the OSHA's '$afety Pays' tool to provide a cost model to calculate the ROP is a more practical approach.

Working with abstract numbers implicitly creates pushback, making it more difficult for safety-conscious managers to obtain approval for their proposals. However, the hard costs of worker injuries and fatalities are very real. The ROP model expresses the direction and strength of occupational safety and health programmes in helping to achieve company goals.

Conclusion

The death or injury of a worker in a conveyor accident is always tragic. Investigations usually reveal the incident could have been partially or entirely prevented with practical and cost-effective safety improvements. The ROP on durable, well-designed conveyor accessories and professional training not only makes good financial sense, but also produces a culture of safety that ripples throughout the company's balance sheet. GMR

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