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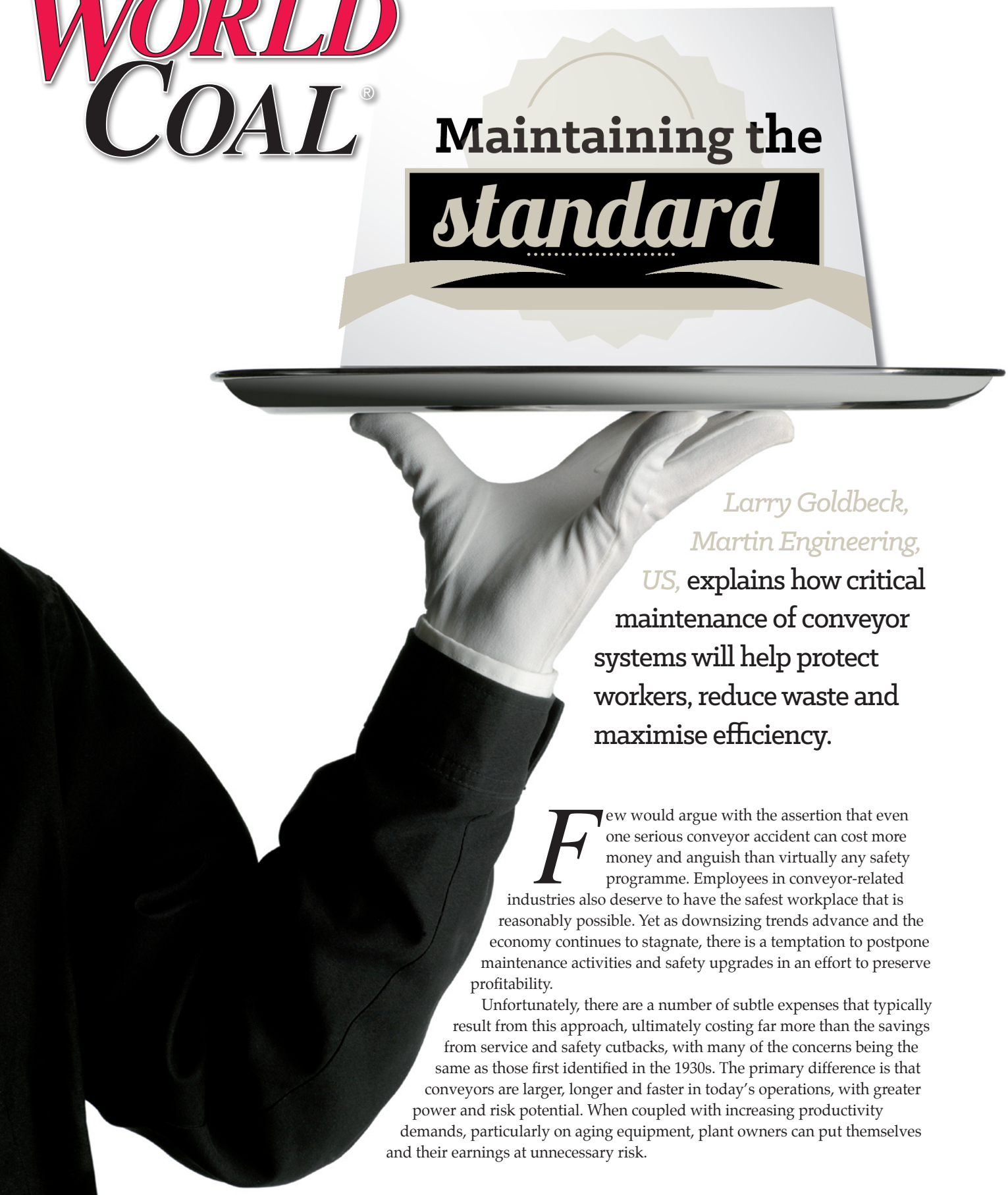
Maintaining the standard



Larry Goldbeck, Martin Engineering, US, explains how critical maintenance of conveyor systems will help protect workers, reduce waste and maximise efficiency.

Few would argue with the assertion that even one serious conveyor accident can cost more money and anguish than virtually any safety programme. Employees in conveyor-related industries also deserve to have the safest workplace that is reasonably possible. Yet as downsizing trends advance and the economy continues to stagnate, there is a temptation to postpone maintenance activities and safety upgrades in an effort to preserve profitability.

Unfortunately, there are a number of subtle expenses that typically result from this approach, ultimately costing far more than the savings from service and safety cutbacks, with many of the concerns being the same as those first identified in the 1930s. The primary difference is that conveyors are larger, longer and faster in today's operations, with greater power and risk potential. When coupled with increasing productivity demands, particularly on aging equipment, plant owners can put themselves and their earnings at unnecessary risk.

Skirtboards help reduce spillage and dust, containing the load until it assumes a stable profile.

New advances include a skirtboard seal design with a primary seal clamped to the skirtboard and an outrigger strip to capture fines.

The path to injury

Conveyors apply large amounts of mechanical energy to what is essentially a giant elastic band, stretched tight and threaded through a maze of components. This elastomeric band is burdened with a heavy load of material and moved at high speed, sometimes with drive motors as large as 600 hp. (450 kW). Given the inertia and kinetic energy, enormous forces are involved. The human body, able to generate less than 1 hp. (0.75 kW), is simply no match.

A report from the Mine Safety and Health Administration (MSHA) found that over a recent four year period, more than 40% of injuries were caused when a worker was inspecting or performing maintenance on a conveyor. Nearly as many more were hurt when the subject was cleaning or shovelling near a moving belt.

In another study of more than 200 fatal mining accidents, data compiled by the MSHA and the US Department of Labor observed that 48 of those involved conveyors. Activities most often leading to conveyor-related fatalities were service (such as replacing idlers or clearing blockages) and clean-up (including shovelling or hosing). Together they accounted for more than 50% of the total.

In 2011, the US National Safety Council estimated the average cost of a work-related death to be around US$ 1.3 million, a figure that is likely to be even higher now. The accounting included medical expenses, wage and productivity losses and administrative costs, but not property damage.

Training

The single most critical element in conveyor safety and efficiency is training, beginning with management. While managers are often too busy to take a course on conveyor systems, they will frequently require attendance by an employee who has little or no influence in the decision-making processes that affect the safety and efficiency of the plant. The commitment to reduced risk must be initiated by managers and supervisors, if they expect operations personnel to buy in to the concept.

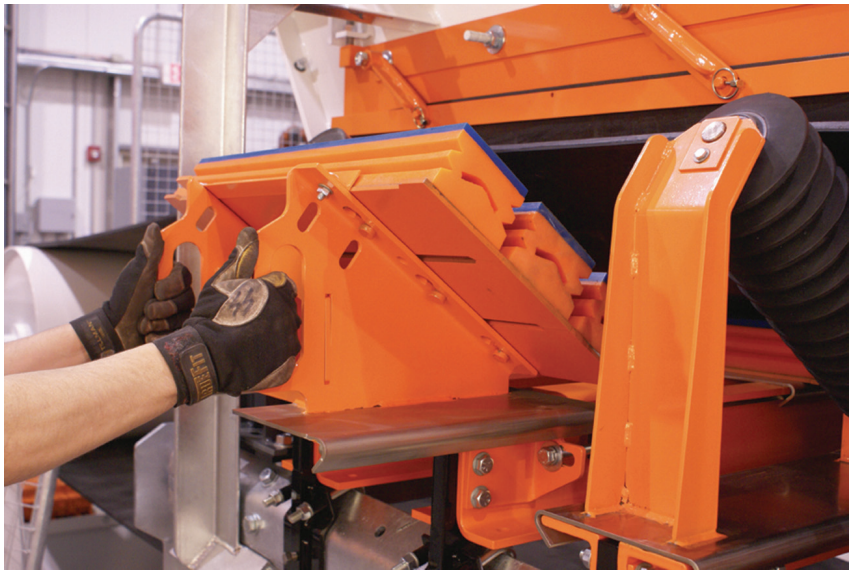
Many industries require specific amounts of training for new employees, while some also demand continuing education, a good practice for reducing risk and maximising productivity. These programmes typically provide an introduction to the work environment and may also include topics such as hazard recognition, risk avoidance and health and safety. Unfortunately, there are few standards that focus on conveyor training and, in light of the number of conveyor-related accidents each year, it appears that existing programmes have not accomplished their mission.

As part of a good training programme, operators should learn the importance of observing the speed limit and capacity rating on any conveying system, ensuring that design specs are not exceeded. A safety walk-around will become second nature any time inspection or repair is performed, so that all tools and work materials are removed before restarting the conveyor. In a well-designed system, emergency shut-offs and controls will be located close to the belt, with ready access that is unobstructed by debris.

It is important that only competent, well-trained personnel – equipped with the proper tools – perform conveyor service and maintenance. These individuals should be trusted veteran employees empowered with the authority to shut down a conveyor for minor repairs that are likely to prevent injury, major outage or future equipment failure. One way to optimise maintenance is to document standard procedures for performing each task, ensuring that it is completed in the safest and most efficient manner possible.

A computerised maintenance management system (CMMS) is a

A settling zone controls the air current travelling with the material stream, allowing airborne particles to fall back into the bulk material.



Modular components, such as track-mounted pulleys, can deliver slide-in/slide-out convenience.

useful tool for archiving these service procedures. The specialised software will administer work orders and manage information, so the maintenance staff can perform tasks according to priority. Most systems will also track expenditures, an essential element in justifying equipment upgrades or purchases.

Fugitive material

Another fundamental approach to reducing risk and improving profitability is to manage fugitive material. There are many ways that fugitive material from belt conveyors can create hazards – the most obvious being that it creates the need for personnel to perform maintenance around moving equipment. Any time that employees are in close proximity to the moving belt, even minor or inadvertent contact can become a serious injury or fatality in just seconds.

By nature, spillage costs money. If people are cleaning up fugitive material, they are wasting labour; if material is escaping, the process is losing a valuable resource or product. While some operations can return the spilled material to the process, it often contains impurities that can impact product quality. In other facilities, the material must be discarded or washed away, a particularly expensive approach if the conveyor's contents have already undergone some amount of processing by the time they reach the spill point.

In an example not uncommon in bulk materials handling, one facility conveying 800 tph was estimated to be effectively washing more than US$ 1 million worth of material down the drain every year. An effective system of fugitive material control that is properly installed can drastically reduce such waste, often paying for itself in as little as 6 – 12 months.

Another problem caused by fugitive material is flow restrictions. Chute or bin blockages can bring even a large-scale process to a standstill, causing thousands of dollars in downtime, corrective measures and lost production. Blockages can also cause material boilover and sudden surges, as large amounts of material suddenly break free and drop through a receiving vessel and onto the belt. Both conditions are major contributors to spillage, which can also exacerbate belt tracking error, damage equipment and increase the risk of injury.

A well-designed conveyor system will often employ skirtboards for reducing spillage, used to contain the load as material is placed on the belt and until it assumes a stable profile. Skirtboards at each transfer point must be engineered to match the characteristics of the material, the receiving conveyor, drop height and transfer point design.

Another form of fugitive material is dust, whether settled or airborne. In addition to the potential trip/fall hazard, risk occurs primarily when fine, lightweight particles are sufficiently disturbed to launch them into the air, where their low mass causes them to be suspended in the air and travel in the wind.

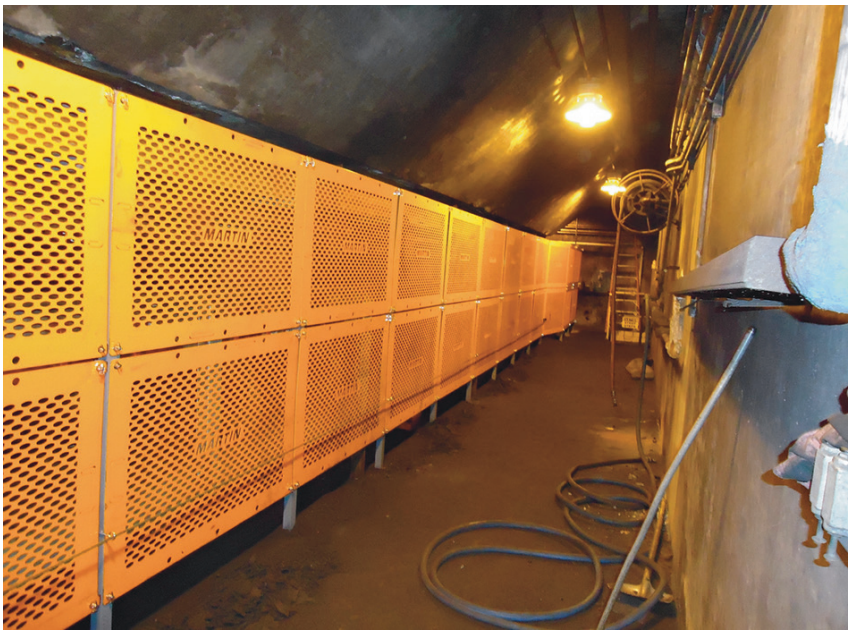
Dust inhaled by workers or members of the surrounding community can irritate airways and exacerbate medical conditions, such as asthma. From a purely financial perspective, significant amounts of airborne dust can lead to more frequent equipment maintenance and faster wear, causing operating costs to rise. Conveyor dust can also generate complaints from local residents and businesses, affecting community relations, creating obstacles to future operating permits or leading to increased scrutiny.

As material escapes, it accumulates on idlers and other components, contributing to premature failure. Once a bearing seizes, the constant belt movement can wear through an idler shell with surprising speed, leaving a razor-sharp edge that poses a threat to workers and the belt itself.

Spillage can also contribute to the risk of fire by interfering with pulleys and idlers and by providing potential fuel. Most conveyor fires are ignited by friction-generated heat from a pulley turning against a stalled belt or a belt moving over a seized idler. A conveyor belt fire of any size is a serious issue, not only because the belt or its contents may burn, but also because the length and movement of the belt can spread a fire a great distance in a very short time. One overheated bearing and a small amount of powdered material can quickly turn into a large-scale event.

An edge seal is often used to prevent the escape of fines, typically constructed from steel plate. In addition to managing the bulk material to control spillage, the skirtboard and sealing system form a settling zone that contributes to effective dust management. In this zone, the air current travelling with the material stream is slowed and controlled, allowing airborne particles to fall back into the bulk material.

When a conveyor has multiple loading points relatively close together, it may be advisable to install a continuous skirtboard between the load zones. An experienced supplier of conveyor technology should be well-versed in the design options and able to provide sound advice on optimum features to suit an individual application.



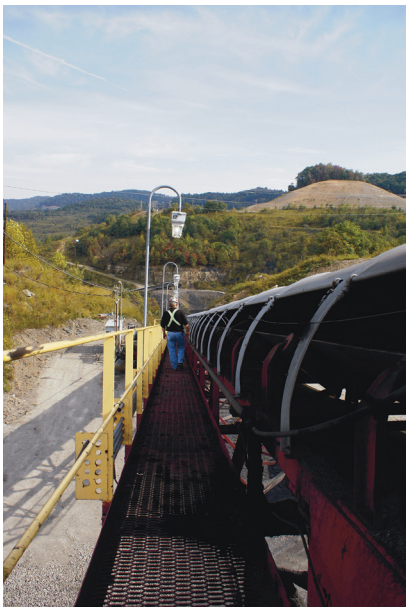
Pinch points should be equipped with well-designed guards to prevent accidental or unwise encroachment by employees or visitors.

The symptoms of carryback are most often seen as return roller build-up that causes belt tracking problems. Often, an employee will try to clean the return roll when the belt is running, a highly dangerous and potentially fatal decision. Absent or inefficient belt cleaning is both a safety hazard (because an employee is typically required to somehow remove the carryback) and an efficiency drain (because this material is not getting delivered to the desired destination).

While it may seem like a small amount of inevitable waste, in reality it is a preventable loss. If it is material that has already been processed in some way, then an even greater investment has been made without any return. Belt cleaning systems can drastically reduce the amount of carryback. Unfortunately, many bulk material handling systems exhibit symptoms of all three forms of fugitive material – spillage, carryback and dust – complicating the effort to correctly identify the sources and apply effective remedies.

Scheduled inspection and maintenance

It is easy to focus on the fact that companies make money only when the conveying system is loaded and running, especially if employee compensation is tied to plant performance. As a result, there is a reluctance to shut down a running line until there's a compelling reason, which creates an attitude of: "we'll fix it when it breaks."



Some suppliers will walk the belt and provide a state-of-the-system report from observing it in operation.

What some managers fail to recognise is that this approach will change their conveyor service from

scheduled maintenance to crisis management. Such short-term thinking is an almost certain path to component failure – probably catastrophic – which will ultimately cause more system downtime, higher repair costs and more labour investment than if a sensible plan had been created and followed from the outset.

It is critical that the production schedule allows adequate system downtime to perform necessary inspections and maintenance. A formal inspection and service schedule must be developed for the material handling system and followed religiously. This programme should include a review of emergency switches, lights, horns, wiring and warning labels, as well as the conveyor's parts and accessories, such as chutes, cleaners and other components.

There are certain conveyor safety practices that should always be observed, regardless of the size, design or operating environment. Lockout/tagout/blockout/testout procedures must be established for all of the belt's energy sources, as well as accessories and associated process equipment. Bulk material handling systems can still present a hazard from the energy that is stored in a stretched belt after its motion has stopped, which can cause the conveyor to move suddenly, even when the system is de-energised.

Lockout and tagout alone may not be enough to ensure a worker's safety, so it is imperative that the conveyor be blocked and tested to confirm that it cannot move. These procedures should be followed before beginning any work in the area, whether it be construction, installation, maintenance or inspection.

Contract services

When the economy lags, plants often reduce their head count. In an effort to concentrate the efforts of remaining staff on core activities and stabilise maintenance costs, many bulk material handlers entrust their conveyor installation and service to outside contractors. Most will find the best success with contractors that specialise in conveyor systems and bulk material flow. These specialists, employed by a proven manufacturer, trained and certified to specific standards, will have conveyor expertise that exceeds that of a general contractor.

Having an outside expert opinion often helps to identify problem areas that plant personnel may have come to view as normal. Some suppliers will offer to walk the belt and provide a state-of-the-system report from observing it in operation. While no repairs should be attempted with the belt in motion, watching and listening to the system will help an experienced conveyor mechanic identify components in need of attention, often before a catastrophic failure or safety incident occurs.

Trustworthy parts and service providers will provide upfront quotes on the equipment and labour they supply, as well as performance guarantees to ensure customer satisfaction. They should be experienced in conveyor science and safety, able to identify opportunities for system improvements and quantify the potential benefits. Some will also offer operator training programmes and continuing education, helping to facilitate a company-wide commitment to safety and preventive maintenance, while fostering a culture of continuously reducing risk and enhancing plant performance.

All forms of bulk material movement carry their own risks and safety concerns, but properly designed, maintained and operated conveyor systems remain one of the most effective modes of material transport. Rather than view them purely as an operating expense, owners and crews would be better served investigating the opportunities to improve both safety and productivity. Thorough planning by well-trained personnel will help maximise efficiency by eliminating fugitive material and minimising hazards as much as is humanly possible. The result will be healthier, happier employees and an improved bottom line. WC