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STRATEGIES TO KEEP YOUR BELTS CLEAN

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KEEPING BELTS CLEAN

Strategies to avoid spillage, carryback, chute clogging and dust in your conveying system

BY **DANIEL MARSHALL**

Discharge from a conveyor belt doesn't have to be dirty and dusty.

ALL IMAGES: MARTIN ENGINEERING

Suggesting the "total discharge" of cargo from a conveyor belt in any bulk handling application is enough to make operators and maintenance staff chuckle.

In the dirty and punishing atmosphere of bulk handling, there are no absolutes. Spillage, carryback, chute clogging and fugitive dust emissions obstruct walkways, foul rolling components, cause unscheduled downtime and degrade air quality – but they don't have to. Manufacturers of innovative equipment solutions are always striving to improve workplace safety and production efficiency by eliminating the causes as much as possible.

Following the installation of modern belt-cleaning technology, operators realize that the volume of material entering the transfer chute grows exponentially as opposed to piling around the discharge zone. This greater volume can lead to blockages in the transfer chute and be followed by downtime to unclog it.

Still, designers can take a holistic approach and engineer an efficient discharge transfer point with components that work together. This approach strives to make equipment last between scheduled closures. It also improves safety by minimizing maintenance and addresses the causes of inefficiency.

SIGNS OF INEFFICIENCY

The discharge zone starts at the last troughed idler before the conveyor belt flattens and encounters the head pulley.

Cargo falls from the conveyor into a transfer "drop" chute that can lead to several places, including another conveyor, a storage silo or pile, or a transport vehicle. The primary cleaner is located after the discharge stream to clear any adhered material caused by the weight or characteristics of the cargo.

A secondary cleaner, meanwhile, clears dust and fines from divots and cracks in the belt. Material cleared from the secondary cleaner is generally directed to a sloped surface connected to the transfer chute.

Obvious signs of discharge inefficiency are spillage, carryback, chute clogging and dust. Alone, each can lead to a workplace safety violation. Together, they result in unscheduled downtime and an increased cost of operation.

From an operational standpoint, three of an operation's most expensive consequences are workplace injuries, belt damage from friction and fouled equipment replacement.

SPILLAGE & SAFETY

Primary cleaners or scrapers can fail in several ways, causing adhered coarse aggregates and caked fines to pass by the blade and spill around the discharge area.

This fugitive material can build up quickly and encapsulate the belt, fouling rolling components and causing the belt to ride on top of the coarse pile while leading to serious belt damage and increased belt temperatures from friction.

Fugitive material spills into walkways, obstructs access for maintenance and creates a trip and fall hazard. When coarse grit fouls rollers, it causes them to freeze and leads to friction and high-heat damage to the vulnerable return side of the belt. This lessens the equipment's life.

Cleaning spillage can be costly, divert staff from other essential duties, and become a safety issue if workers are clearing material around a running belt. What may seem like a routine job in the beginning – clearing spillage by either shoveling it back into the cargo stream or into bins – requires more labor as time goes. Clearing material using machinery, meanwhile, can result in accidental contact with the stringer or supports and potentially leading to belt mistracking.

Mistracking can be a major cause of spillage – not just along the belt path, but at the discharge point. The blade is centered on the head pulley, but if the belt is not, adhered material becomes spillage.

One recommendation: Install a belt tracker a distance of three to four times the width of the belt prior to the head pulley as the trough angle flattens to ensure the belt hits the head pulley in the center.

Over-/under-tensioning or extending blade changes for too long can also cause spillage. Over-tensioning causes rapid wear on the belt/splice and lower blade life. Under-tensioning allows material to pass without being removed.

Allowing primary cleaners to go too long can result in pull-through, where the force of the belt causes the blade to face the opposite direction and, in some cases, break off. In this case, producers can enter a service agreement with the blade manufacturer to regularly monitor, tension and change blades as needed.

Also, consider installing a modern assembly that allows workers to slide units from the stringer for fast and easy one-person blade changes.

REDUCING CARRYBACK

Anything that clings to the return side of the belt and travels with it is considered carryback, which can seriously damage a system.

Not only is it a major source of fugitive dust and fines, but it migrates easily into return rollers and take-up pulleys, fouling the bearings, drives and the face of the roller. The grit grinds down roller bearings and leads to excessive friction heat, causing them to misshapen and seize.

Like spillage, carryback can migrate to

the non-carrying underside of a belt. These chunks travel all the way to the tail pulley. The intense pressure between the pulley and the belt causes the hard, sharp mass to damage the vulnerable side of the belt and the pulley face – with each cycle delivering more damage. Dust and fines can get into these blemishes and foul the pulley face, as well as lower the life of the belt.

When a roller or a pulley face is fouled, it is caked with abrasive grit that can degrade and damage belting over time. In some cases, fouling causes slippage that can disrupt the smooth operation of the belt and promote mistracking.

A plow diverts fugitive carryback to either side of the system, ensuring tail pulley health.

If adequate space is available, install secondary and tertiary cleaners to ensure the belt is clean on the return. To improve safety, consider units that allow a single worker to pull them away from the stringer for faster external servicing.

Also, consider a diagonal or v-shaped plow underneath the loading zone – right before the tail pulley – that rides on the underside of the belt to remove loose traveling material.

For more effective cleaning and to reduce friction damage, consider a plow with torsion arms rather than one held in place by chains. Install belt trackers or crown rollers along the upper and low belt path to ensure alignment.

SAFELY ADDRESSING BULK HANDLING CLOGS

A clogged transfer chute or hopper is one of the most dangerous situations in bulk handling.

Untrained and uncertified (enclosed chute entry certification) personnel should never enter a clogged chute or bin under any circumstances. A sudden discharge can be deadly, as an unknown void engulfs and crushes a worker. Material adhered vertically to the sides can loosen and send a sheet of debris falling onto anyone occupying the vessel.

Buildup points in chutes include:

- **Rock boxes.** Shelves, even if sloped, can experience buildup.
- **Exit gates or doors.** As these help control flow, they are prone to clogging.
- **Sloped points.** Under the secondary cleaner, chute grades or located at choke points.
- **Metal surface grain.** The metal grain of chute plating should match the flow of cargo.
- **Exposed surfaces.** Surfaces where moisture can collect and cause buildup.
- **Damaged surfaces.** Surfaces that have scratching, denting, creasing or divots.

Misguided practices for addressing buildup are banging on the sides of the hopper with a mallet or loosening the obstruction by poking at it from below.

In some operations, clogs are so frequent that spots for pounding are marked and mallets are left in the area for convenience.

This is hazardous because it reduces the structural integrity of the vessel or chute and causes it to buckle. Ripple damage from pounding creates a situation where material build is more likely, shortening periods between clogs while leading to more unscheduled downtime. Poking from below is even more dangerous, because a sudden discharge sends tons of material in a surge that can injure anyone in the vicinity and break equipment below.

Air cannons can dislodge material and prevent buildup by distributing powerful shots of air inside a vessel.

To avoid these unsafe approaches, air cannons can strategically be installed around the chute and have nozzles pointed in the direction of the material flow. Powerful shots of air can be distributed across the surface inside the vessel, dislodging material and preventing buildup.

Air cannons are supported by vibration units that ensure gates and narrow spouts on hoppers and chutes retain proper flow before bridging starts. In many cases, vibration alone can handle most dry material flow, but changes in humidity raising the stickiness of cargo and chute surfaces, along with fluctuations in production volumes, are much better handled by air cannons.

DISCHARGE DUST

Emissions at the discharge zone can be found billowing out of the chute against the direction of the cargo stream or exiting the sides and bottom as it loosens from the belt's return side.

Dust has become a highly regulated workplace and environmental concern that can lead to stiff fines and forced downtime if high volumes of respirable crystalline silica are detected.

Dust emissions returning from the chute can derive from uncontrolled airflow at the exit point. The emissions can also be caused by hitting rock boxes meant to slow the flow of material, as well as by an unobstructed impact causing turbulence.

Dust from carryback can permeate the area and spread emissions down the entire length of the belt return. If the belt reaches into a tower or is exposed to the outdoors, this causes dust to be carried long distances on air currents into nearby communities – leading to possible violations.

Studies have shown that dust can be controlled by adequate cleaning at the discharge using cleaners. Also, by reconfiguring the chute's exit into a sloping scoop, material can be slowed and loaded onto the next belt in a controlled and centered manner with less turbulence. Air cannons installed along the chute are pointed with the material stream and can help direct air flow.

CONCLUSION

Modern bulk handling industries are changing and growing every day. Demand for raw and processed materials for construction and manufacturing continue to rise. Production increases can change throughput volumes and belt speeds, which have a direct effect on spillage, carryback, clogging and dust.

Retroactively installing equipment that improves safety and efficiency should be a priority of every operator. Although the initial capital investment might be higher, the return on investment and the resulting benefits are not just fewer injuries, but reduced labor costs for maintenance, fewer equipment replacements, greater compliance and an overall lower cost of operation. **P&Q**

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