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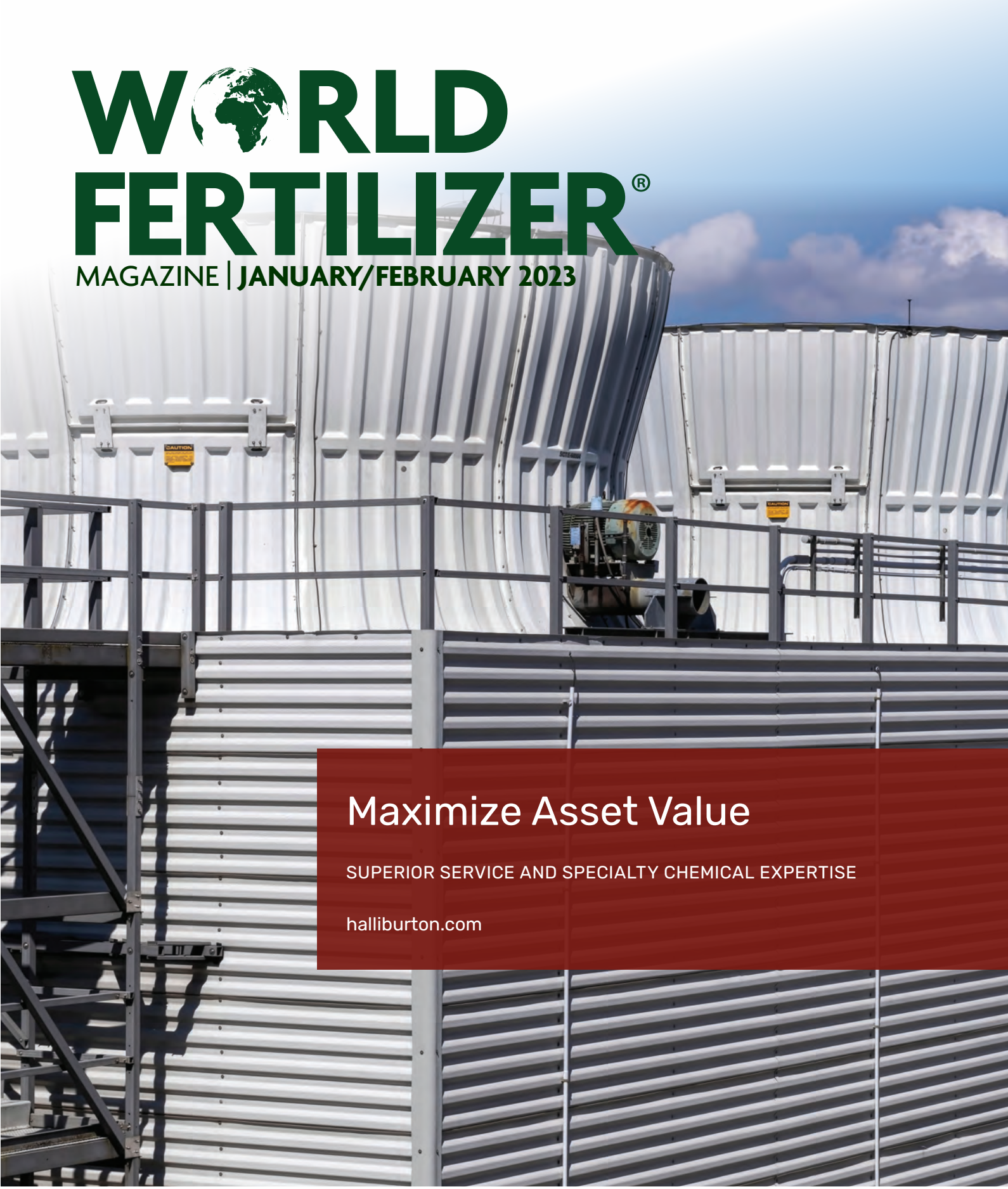

DIFFERENT INGREDIENTS REQUIRE DIFFERENT BELT CLEANERS

Chris Schmelzer and R. Todd Swinderman, Martin Engineering, USA, discuss how different fertilizer ingredients require different belt cleaners, and outline the best methods of maintaining efficient production.

The need for conveyor belt cleaning in fertilizer production is well established, yet many producers still do not use the correct blade type for the cargo, or even use conveyor belts at all. Urethane belt cleaners help reduce accumulations of carryback under the conveyor and minimise the release of dust from fouling rollers on flat belts. A poorly performing belt cleaning system will contribute to buildup on pulleys and idlers, collecting on the face of the components or getting into bearings, causing them to fail prematurely.

That material buildup is also one of the primary reasons for belt mistracking, causing it to drift into contact with the stringer and damaging the edges. Moreover, abrasive fouling and friction from seized rollers can erode the belt covers. The belt is typically the most expensive piece of equipment on a conveyor, and not adequately removing carryback at the discharge zone with the proper belt cleaner will contribute to premature belt failure.

Excessive fugitive material can reduce component and belt life by as much as 30%.[1] The effect of a properly adjusted cleaner on the belt is far less than one that is under- or over-tensioned and allows material buildup to contribute to increased wear.

The proper equipment

There are several issues fertilizer producers can face when cleaning conveyor belts. Unlike other bulk handling operations with large, heavy and often sharp raw materials which require heavy-duty belting, fertilizer typically consists of low-weight mineral powders, specialised additives, or biological material, thus producers tend to use cost-effective polyvinyl chloride (PVC) belting. This lower grade PVC belt tends to have tiny depressions caused by shrinkage of the top layer of the solid woven belt carcass. The belt face resembles a hammered metal surface where adherent fines can get trapped in the dimples and then fall along the belt return, causing dust, spillage and more labour for cleanup.

The right cleaner system can address different fertilizer properties. One blade type can address sticky material and prevent it from falling along the belt return, whereas other blades are designed to handle low PH

acidic fertilizer, which can quickly erode a standard cleaner or cause it to wear unevenly.

The number and style of belt cleaners depend upon balancing many factors.[2] Firstly, the level of cleaning required for the application must be established. This is based on the volume of material being conveyed and the unique qualities of the fertilizer constituent, such as adherent, acidic, moist or dusty. Once the level of cleaning is established, the next task is determining the type and number of cleaners required to do the job. The trend in belt cleaning is to install two or more cleaners per discharge. In addition to better cleaning from multiple cleaners, there is a redundancy factor that can provide a longer service interval window. After confirming the level of cleaning and the number of cleaners, the appropriate materials of construction for the frame and tensioner are evaluated (e.g. stainless steel or powder coated mild steel) and the best blade for the application is selected.

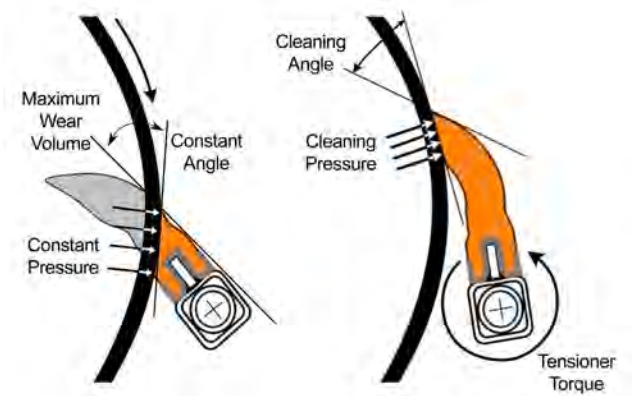

Figure 1. A primary cleaner with a constant angle and cleaning pressure equals constant belt cleaner performance and maximum blade life.

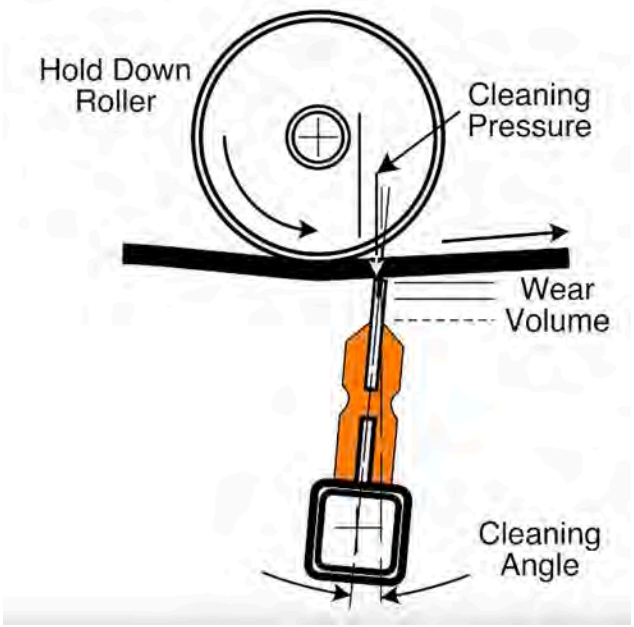

Figure 2. Secondary (or tertiary) cleaner with belt support.

Figure 3. Automatic tensioner.

Proper positioning of a cleaner blade

In Chapter 2 of the seventh edition of its design guide, Belt Cleaners for Bulk Materials, the Conveyor Equipment Manufacturers Association (CEMA) specifies the cleaning locations as primary, secondary and tertiary. The most desirable location for belt cleaners is on or very close to the head pulley in the primary position, so the material can fall with the main flow of material and reduce build-up on dribble chutes (Figure 1). If cleaning must be done away from the head pulley, cleaners should preferably be mounted in the secondary position. If the secondary position is not accessible, cleaners may be mounted in the tertiary position, but this may require a second dribble chute or collection pit (Figure 2).

Many conveyors are designed without much consideration for belt cleaner location, despite the critical role they play in meeting production goals. Poor conveyor head chute designs often have the structure obscuring the optimum mounting location or simply not enough room at the head to install or access them so they can be serviced. When faced with these restrictions, using just one cleaner or installing it any random way is not good enough. Facilities need a supplier partner that can make the best decision on equipment and location for their specific situation.

Belt cleaner inspection and monitoring

Some manufacturers offer conveyor inspections and cleaner maintenance as part of a managed service relationship. Their monitoring systems can track component wear and update the service technician and/or operations personnel via WiFi or phone on upcoming service needs. There are some new systems that can even adjust belt cleaner tension automatically. The technology will also send an alert through a mobile app in the event of upset conditions.

Factory-trained service technicians provide an added set of eyes on the conveyors, travelling to and from the equipment to be serviced, and logging details in their service reports. Because they see so many different applications, they can often alert on problems that maintenance personnel do not see or have become accustomed to ignoring. With factory-direct managed service, the responsibility for maintenance falls on the manufacturer, allowing the staff to focus on other priorities.

Return on investment for cleaner blades

At first glance, it may seem that a fertilizer production facility has the in-house capacity to maintain belt cleaners, and hiring a managed service provider just does not make sense. The reality is that a conveyor will run with a belt, a head and tail pulley, and a drive – maintaining everything else can be put off (and often is)

for production at any cost. A 'run till broken' philosophy means more than broken machinery – it can exacerbate financial issues and affect worker morale, too. Then, in the rush to patch things together, maintenance workers are tempted to take shortcuts and work around established procedures, exposing them to greater potential for injury.[3]

When calculating the return on investment for professionally installing and maintaining belt cleaners, the analysis should be done over the life of the belt cleaner assembly using a net present value calculation. Many spreadsheet apps have a net present value function in the formula tab. A spreadsheet makes it easy to change the inputs and compare different equipment and savings scenarios.

The following example is based on simply reducing cleanup labour by 2000 hours per year at US$15/hr. Other benefits should also be factored in – although not estimated in the example – such as the savings from avoiding injury, increased equipment availability, improved equipment life, or reductions in citations and fines. Facility managers often find that the cash flow values are surprisingly large over the life of the equipment and service relationship (Table 1).

Figure 4. Blade wear indicator with remote monitoring.

Figure 5. A managed service provider can deliver complete onsite belt cleaner maintenance.

Table 1. Sample data for a decision based on Return On Investment (ROI) calculation.

Cost of capital	10%	Year by year savings and cost				
Initial investment	US$7 500					
		Year 1	Year 2	Year 3	Year 4	Year 5
Cleaning labour savings		US$30 000	US$30 000	US$30 000	US$30 000	US$30 000
Managed service and parts cost		(US$5000)	(US$5000)	(US$5000)	(US$5000)	(US$5000)
Net cash flow (savings-cost)		US$25 000	US$25 000	US$25 000	US$25 000	US$25 000
Net present value of cash flow	US$94 770					
Net present value of cash flow minus initial investment	US$87 270 free cash flow over 5 years of managed service.					

A typical belt cleaner assembly should last five years with minimal frame or tensioner repairs. Inspections should be done regularly and any problems addressed immediately. Some manufacturers with factory-direct service offer free replacement and upgrades of frames and tensioners as part of their managed service offerings.

Belt cleaner wear will vary based on the blade material and abrasiveness of the bulk cargo, along with several other factors such as correct cleaning pressure. Belt wear from the cleaner is typically in the neighbourhood of just 2% per cleaner, so concerns over blade type and cover wear are usually unfounded. The cost of safety is minimised by reducing the frequency and hours of manual cleaning and therefore the exposure to injuries.

An NPV analysis will often show such a large free cash flow that worrying over the cost of service or replacement blades is a misplaced concern. Similarly, an NPV analysis done when designing a new conveyor will often show there is no reason to skimp on the details or costs that improve belt cleaner performance and access for service.

Conclusion

Allowing the blade to wear past its limits, having the wrong tension, or installing a cleaner system that is hard to access creates hazards for workers and can lead to excessive downtime. Automated tensioning and monitoring equipment mitigates some of the issues with blade wear and provides data and alerts when blades need servicing. This can help lower labour costs and improve safety due to fewer inspections and proactive maintenance.

Belt cleaner maintenance can be time-consuming and pull labour from other essential tasks, so it is important to choose a supplier with trained and experienced service technicians who know the equipment and safety procedures and can respond quickly to customer needs. A managed service programme can make safety and productivity sense and improve profitability with additional positive cash flow. Trained technicians can identify fertilizer-related wear and install the correct blade for the application, saving money and improving production uptime. WF

References

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2. Basic Parameters of Conveyor Belt Cleaning; C.A. Rhoades, T.L. Hebble, and S.G. Grannes; U.S. Dept. of the Interior, Bureau of Mines; Pittsburgh, PA; 1989.
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