St Marys' conveyor clean-up

Carryback on the return side of conveyor belts impacts on plant operations and presents avoidable safety risks. St Marys Cement's Detroit cement plant decided to minimise, if not eliminate, carryback on its No 14 conveyor, to help improve plant operations.

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The issue of carryback clinging to the return side of conveyor belts is an ongoing battle for many industries that depend on efficient bulk handling. Carryback and subsequent accumulation interfere with plant operations and expose personnel to unnecessary safety risks when they clean up the material in close proximity to a moving conveyor. Fugitive material also represents a loss of usable product, which is particularly expensive if it has undergone any level of processing prior to the spill points.

Additionally, carryback can lead to spillage along the entire conveying system and foul rolling components, with extra cleaning and maintenance raising the cost of operation. Faced with this issue, a cement grinding facility in the Carbon Works neighborhood of Detroit discovered a way to virtually eliminate the issue of tacky carryback on one of the plant's raw material transport conveyors.

Barges dock several times a week to drop off raw materials

Conveying at St Marys

St Marys Cement, a subsidiary of Votorantim Cimentos, is headquartered in Toronto, Canada, but has operations throughout the Great Lakes region. The Detroit plant produces 181-226tph (200-250stph) of Portland cement and CemPlus™, a chemical-resistant dry cement additive. With 15 tall silos at the Fisher Freeway crossing of the Rouge River, the plant provides premixed ground material for transport to other St Marys cement plants, directly to construction sites or to a nearby bagging facility, where it is packaged for sale.

"We're one of the smaller and more specialised plants in the company, so we have no kiln or concrete production on site," explains David Accomando, plant maintenance supervisor for St Marys Detroit. "It's efficiently run by a central control hub, and maintained by a small and dedicated crew that keeps the conveyors and other systems working at near-maximum capacity."

One of these systems is the covered No 14 conveyor. Front loaders transfer dusty 38-50mm (1.5-2in) minus limestone and gypsum aggregate from massive storage piles located along the riverfront into a 2.4m (8ft)-long vibrating trapezoidal chute

The St Marys Detroit plant is prominent on the Rouge River skyline

Conveyors transporting bulk materials have different entry points into the plant

Even though conveyors are covered, the cargo still absorbs moisture

that is flush with the ground at the top. Set at a 35˚ angle leading to the underground conveyor, the chute discharges directly onto the 30in-wide belt. Inclined approximately 20˚ at the point of loading, the No 14 belt conveys cargo for 6m (20ft) up to ground level, moves horizontally for 61m (200ft), then begins another long 30˚ incline into the top of a 50ft tall tower. The conveyor discharge zone, with only enough room to fit one primary cleaning blade, offloads into a chute leading to the No 11 conveyor, which proceeds to the grinding mill.

Managing carryback

Roughly 27,125t (30,000st) of raw material and clinker arrives weekly by truck and ship. The clinker is housed in a large shelter, while the raw aggregate is offloaded to an outdoor storage area where the material tends to get saturated when the Michigan weather turns wet and cold. This causes large amounts of mud and sludge to be loaded along with aggregate into the chute leading to the No 14 belt. Even though the conveyor system is partially covered with a hood along the entire belt path, cargo is still exposed to weather conditions and can dampen further on its way to the discharge zone.

Operators found that polyurethane cleaner blades were unable to completely clean the belt. "The fines and mud take on the tacky consistency of toothpaste, causing it to cling to the belt along with smaller pieces of aggregate and shale," Mr Accomando says. "This led to a lot of carryback spilled along the return path, where it fouled idlers and built up so high on the pan under the loading zone that it would encapsulate the tail pulley."

Maintenance technicians periodically had to stop other essential duties and shut down the system to replace frozen return idlers and prevent further damage. After digging out the tail pulley, workers needed to clean the face, which often had abrasive build-up that could reduce the belt life. In addition, 2-3 workers spent up to 8h twice per month cleaning the loading zone and the belt path using shovels and a vacuum truck.

To manage carryback at the discharge zone, workers would need to hose down and hammer off build-up from the belt scraper, as well as clean off the face of the head pulley, which was described as acting like sand paper against the belt. The cleaner required regular tensioning and periodically needed to be removed, recut and shaped. Despite meticulous care of the blade, it required replacing two or three times per year.

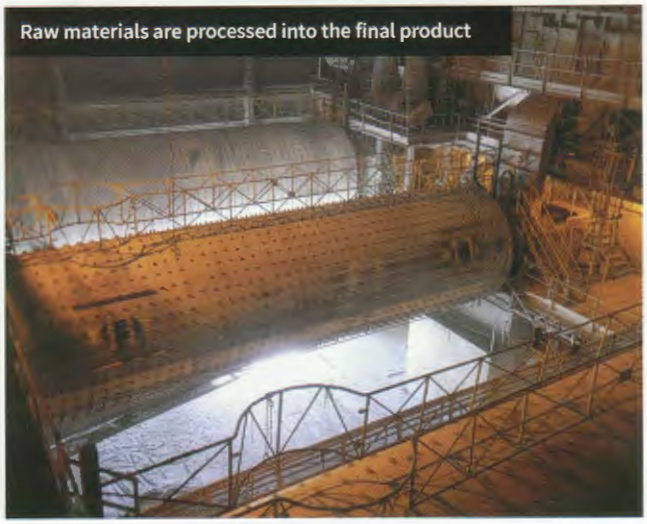
"All of the cleaning and maintenance was causing unscheduled downtime, burdening our crew and having an impact on operational costs," says Mr Accomando. "A big concern of ours was build-up around the loading zone and the tail pulley, which was affecting belt life and causing a safety issue. We needed a solution."

Trickledown

Loading onto a sloped belt can be challenging, but with a well-designed transfer system, a controlled incline and an adequate settling zone, there should be minimal spillage. However, without effective belt cleaning, carryback on an inclined belt can create issues all the way back to the tail pulley.

"Build-up of dust, fines and wet sludge fouling the face of the tail pulley leads to several issues that have expensive consequences on the entire conveying system," explains Jason Haynes, territory manager for Martin Engineering.

Pulley slippage can affect the belt speed and cause abrasion damage on the return side of the belt. Larger pieces of aggregate can migrate to the bottom side and get trapped between the belt and the tail



Raw materials are processed into the final product

Previously the blade became encrusted with material, degrading performance and causing build-up accumulation

Mounted diagonally, often at a 17° angle, the CleanScrape spans the entire belt profile

pulley. The force of pressure on these rocks caught between the belt and the pulley can gouge the face, drop it back onto the belt, and cycle it through over and over, further causing damage.

"A fouled and gouged tail pulley can cause the belt to wander as it enters into the loading zone, so cargo loads unevenly and creates spillage along the belt path," Mr Haynes adds. "No matter how well you design the loading and settling zone on sloped conveyors, without a good cleaner at the discharge point, the clean-up and equipment replacement costs from carryback can quickly derail the benefits of your loading zone improvements."

Testing new belt-cleaning technology

Having built a relationship with Martin Engineering and a familiarity with the manufacturer's products, Mr Accomando contacted the company to provide a solution. Mr Haynes examined the system by performing a meticulous Walk the Belt™ procedure, creating a checklist of potential causes and effects of the carryback issue. He concluded that the No 14 conveyor was an excellent candidate for Martin Engineering's CleanScrape® Primary Cleaner. Including latest-generation cleaning technology, the cleaner was a good fit because it requires considerably less space than other primary cleaners. Yet in the right applications, it can be effective enough to eliminate the need for a secondary blade, and the unique design has been proven to deliver as much as 4x the lifespan of competing urethane blades.

Choosing a free 30-day trial to test whether the cleaner was right for the job, the plant scheduled the installation to coincide with downtime for other maintenance. Two Martin Engineering technicians completed all the necessary fabrication and had the unit ready to be placed into service within a day.

Design features

There are many traits that separate the CleanScrape design from conventional urethane blade cleaners. Mounted using an upper and lower chain configuration attached to a Cleaner Tensioner Diverter, the surface spans the entire belt profile. The flexible cleaner is installed diagonally across the discharge pulley, forming a three-dimensional curve beneath the discharge area that conforms to the pulley's shape.

This design incorporates a matrix of tungsten carbide teeth and is tensioned lightly against the belt to prevent damage to the belt or splices. Despite extremely low contact pressure between belt and cleaner, it has been shown to remove as much as 95 per cent of potential carryback material. The low pressure allows the blade to pass over the No 14 conveyor's vulcanised splice without causing damage.

Suitable for belt speeds up to 4m/s (780 fpm), pulley diameters up to 1270mm (50in) and belt widths up to 2438mm (96in), the CleanScrape is designed to perform under the punishing conditions of the cement industry. Unlike other cleaners with a rigid mandrel, bulky tensioner or an unwieldy blade section, the dual-chain mounting has a significantly-lower installation footprint on the mainframe and a user-friendly design for adjustment, service and replacement, without the confined space entry.

Suitable for reversing belts, the CleanScrape is equipped with two breakaway links, allowing the operator side of the cleaner to separate from the tensioners and fall away from the belt. Remaining attached to the far side bracket, this important safety feature prevents damage to the cleaner or conveyor components, so that operators can shut down the system and safely replace the cleaner with minimal downtime.

Results

With the cleaner system ready for a fresh test, the results were apparent almost immediately. As cargo with a moisture level of 10-15 per cent was loaded onto the belt, dust and fines built up into a thick paste as usual, but were subsequently fully removed from the belt. After the 30-day trial was concluded, operators discovered the cleaner was so efficient that it extracted more material than the chute could process, causing it to build up in the chute and back up onto the blade. To address the increased volume of discharge, Martin Engineering technicians returned and installed a Vibrating Dribble Chute to enhance the flow capability of the discharge zone.

"For this application, we were very surprised by how well it worked," Mr Accomando says. "The return side of the belt might have a little bit of wet material still on it but nothing even remotely close to what it used to be. This has eliminated the issues we previously had with build-up around the tail pulley and fouling of the head pulley, meaning the belt life has definitely improved."

After a full year of punishing 24/7 operation with little downtime through conditions that included cold slush and mud, as well as hot and dry dusty material, the original cleaner continues to perform consistently well, without a single adjustment. The cleaning schedule has been altered from a 2-3 person crew over a full shift twice per month, to just a single worker hosing down critical areas for an hour or so, once per month, reducing St Marys maintenance costs and delivering a more efficient operation. ■