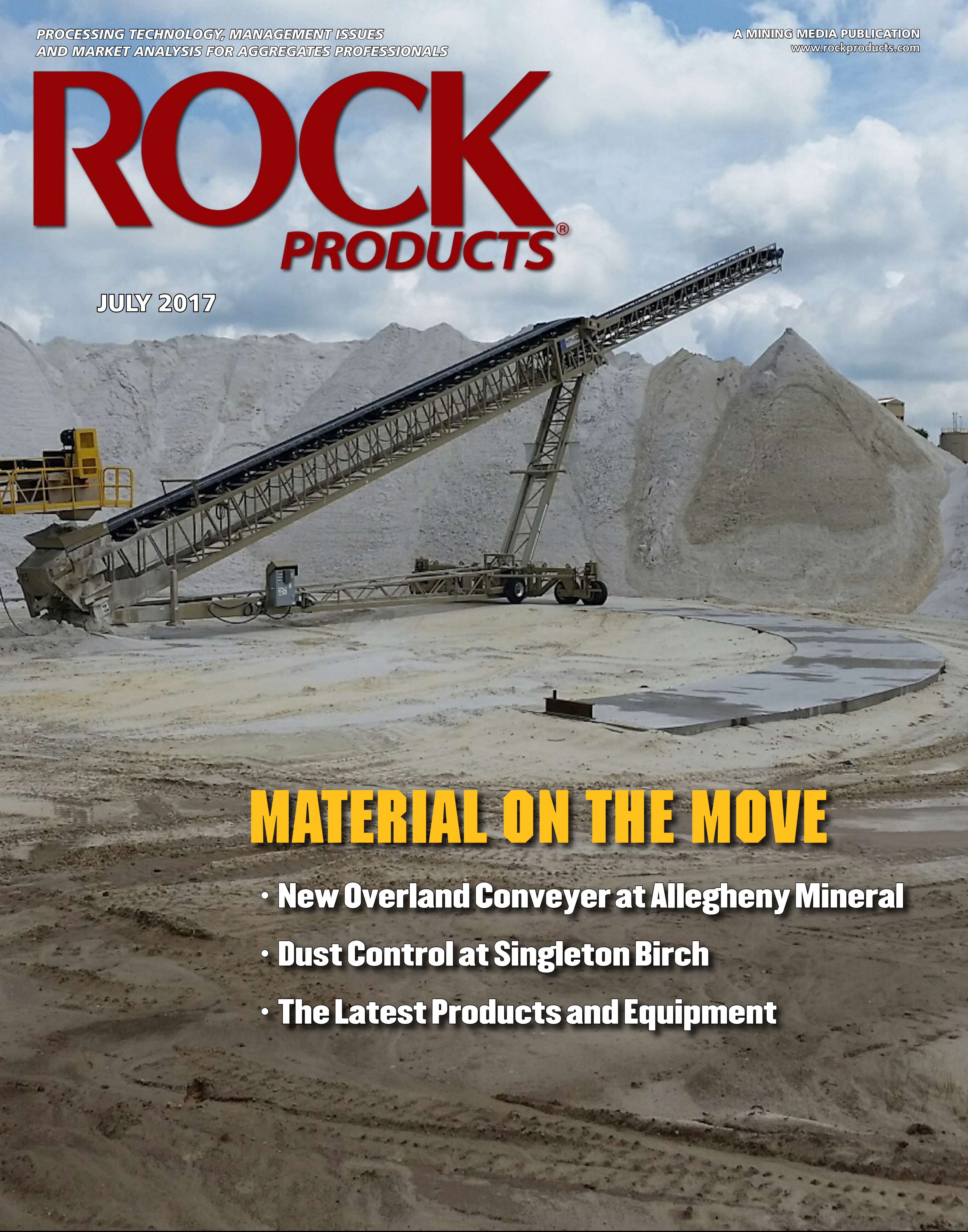
PROCESSING TECHNOLOGY, MANAGEMENT ISSUES
AND MARKET ANALYSIS FOR AGGREGATES PROFESSIONALS

A MINING MEDIA PUBLICATION
www.rockproducts.com

ROCK PRODUCTS®

JULY 2017



MATERIAL ON THE MOVE

- New Overland Conveyer at Allegheny Mineral
- Dust Control at Singleton Birch
- The Latest Products and Equipment

Plus: Rilite Aggregate Solves Water-Management Challenge • Meeting The Electronic Logging Device Mandate

VOL. 120 ISSUE 7 • July 2017

PROCESSING TECHNOLOGY, MANAGEMENT ISSUES AND MARKET ANALYSIS FOR AGGREGATES PROFESSIONALS

ROCK PRODUCTS®

Cover Photo Courtesy of Kolberg-Pioneer.

FEATURES

EQUIPMENT & TECHNOLOGY

By Mark S. Kuhar and Josephine Smith

EDITORIAL

NEWS

KEY ISSUES

BACK PAGES

Doing Away With Dust

A Singleton Birch Quarry Took Control of Fugitive Dust Emissions With a Combination of Experience and Technology.

By Mark S. Kuhar

Respiratory issues associated with limestone extraction and processing are among the oldest recognized workplace safety hazards. Modern limestone handlers often take a number of safety measures, including masks, respirators, enclosed processing systems, sprinklers, hoses and/or frequent cleaning schedules.

Beyond potentially increasing the cost of operation, cumbersome equipment and unpleasant cleaning procedures all add to processing costs and can take a toll on staff morale. However, some operators, like those at the Singleton Birch Ltd. quicklime production facility in east central United Kingdom, are turning to solutions that address the dust at the point of emission to reduce risk and enhance workplace safety.

"Plant safety is one of our chief concerns," said Chris Smith, lime maintenance leader at Singleton Birch. "We strive to balance productivity with a good working environment, and addressing dust emissions is a high priority."

Piled high enough to encapsulate the tail pulley and belt, the dust was a serious problem.

The Process

Established in 1815 at the Melton Ross Quarry outside of Barnetby, UK, Singleton Birch has grown into a global provider of quicklime, chalk products and services for steel production, land stabilization, acid neutralization, water treatment and building renders/mortars. The addition of modern kilns and equipment to the existing infrastructure of the plant has allowed the organization to provide quicklime and other products to many new and emerging markets.

The company currently produces 1.5 million mtpy (1.65 million tpy) of processed limestone and chalk, as well as 300,000 mtpy (330,700 tpy) of calcium oxide products.

The limestone is quarried from Melton Rose a short distance away and transported to the facility, where it is crushed to 150-mm minus (6-in. minus) and transferred to the kiln. For approximately 16 hours the aggregate is passed through the twin-shaft parallel-flow regenerative kiln running at about 1,000 C (1,832 F) using natural gas as the fuel source.

The calcined soft-burned lime (slowly heated limestone with small cracks where CO2 has escaped during the calcination process) is discharged into another crusher and reduced to 50-mm minus (2-in. minus), and then either deposited into hoppers for bulk delivery or transferred to the GLC1 conveyor. This system transports the limestone to conveyors leading to either the crushing and screening operation or the milling plant.

"We've found soft burned material will produce more fines than harder burned material," Smith pointed out. "The increased production volume has naturally resulted in more dust, and this is very apparent on GLC1."

Dusty Drop

The dual transfer chute system that loads the GLC1 conveyor is a 7- to 8-m (approximately 25-ft.) dead drop onto a troughed 600-mm (24-in.) wide belt. Supported by heavy-duty cradles with polyurethane impact bars, the loading zone was surrounded by an unsealed chute with no settling zone, but had two top-mounted mechanical dust filtration systems. Running at 2 mps (393 fpm) and transporting 100 mtph (110 tph) of dry calcined aggregate, the impact caused dust to billow out the sides of the chute and fill the area.

Dust blocked walkways and posed a potential safety risk.

"The entire system is housed in a long steel-sided enclosure that runs the length of the belt with an internal walkway on either side, so dust is prevented from traveling, but it was quite unpleasant inside the enclosure," said James Kevill, the Martin Engineering technician who led the inspection and installation. "Once the transfer process began, my observations were that around 80 percent of the material stayed on the belt and as much as 20 percent would spill along the belt path. The dust was so dense, it was hard to see your hand in front of your face."

Although the enclosure confined the fugitive dust, many serious issues arose due to the sheer volume and density of the particles. Abrasive material would get into the bearings of rolling components and cause them to seize, leading to increased friction on the belt – a potential fire hazard.

Dust would quickly build up around the loading zone and encapsulate the tail pulley, eventually causing the belt to just slide over the built-up material rather than riding on the rollers, which fouled the return side of the belt and the face of the tail pulley. Fugitive material would travel freely throughout the long shaft, piling up and restricting access for maintenance workers to address these issues.

"The encapsulation and equipment failure issues really took a toll on the system," explained Oliver Whelpton, process optimization specialist at Singleton Birch. "We first tried to mitigate the dust using mechanical filtration systems

Dust curtains are set throughout the chute to slow air flow and reduce fugitive particle emissions.

mounted on the top of the loading chute, but the filters clogged so quickly, maintenance became burdensome."

According to Whelpton, to maintain normal operation of the system and avoid serious hazards, the area needed to be cleaned by two workers once per week, requiring nearly an entire shift. Before engaging in what he described as a "substantial undertaking," the system would be shut down so workers could see.

Anyone entering the enclosed area was required to wear personal protective equipment (PPE), including breathing masks with respirators and hooded suits to protect against airborne particles. Workers first had to clear thigh-deep piles of dust from walkways and around the mainframe using the plant's central industrial vacuum system, in order to access the conveyor for inspection and maintenance.

"We needed a solution that bolstered safety and would deliver a return on investment in a reasonable amount of time," Smith said. "That meant installing highly effective equipment that needed as little ongoing maintenance as possible."

Discovery

Singleton Birch initially brought in Martin Engineering for conveyor training of 10 employees using its Foundations program and reference book. Now in its 4th edition, the 574-page volume teaches basic and advanced level conveyor system maintenance and safety. As part of the hands-on program, instructors took students on a walkthrough and created a report for several conveyors in the plant, including GLC1, where points of potential improvement were identified. These reports were then provided to plant supervisors.

Since Martin Engineering has a division in nearby Nottingham, managers asked local representatives to draft a proposed solution to the GLC1's issues. "A local contractor and I took measurements and then created a detailed design overhaul," Kevill said. "The goal of our proposal was to contain the dust at the point of production by creating an environment that would quickly settle agitated particles and return them to the cargo flow. This would control spillage and improve air quality."

Improved Loading Zone Design

The first step of the plan was to raise and lengthen the existing chute to create a more robust settling zone. Using 2.5 metric tonnes (2.75 tons) of steel, the contractor fabricated a 4-m (13-ft.) chute extension and tail box. The overhaul integrated Martin ApronSeal Double Skirting HD and an EVO External Wear Liner to protect the chute wall and seal in dust. In addition, a series of dust curtains was installed and the mechanical dust filtration system was cleared and put back into operation.

In standard chute designs, the wear liner is a sacrificial layer securely welded to the inside of the chute, with the skirt seal located on the outside, a configuration that has presented operators with several costly problems.

- First, the internal placement of the wear liner creates a gap between the skirt seal and liner, in which material could get trapped and cause abrasion damage to the belt.
- Second, removal and replacement of most wear liner designs requires workers to enter the chute with a grinder and torch cut the worn equipment. The grueling and potentially dangerous job can take as many as three people up to two days of downtime to complete.

The new design raised the chute 102 mm (4 in.) from its previous position to accommodate the EVO External Wear Liner. Mounting brackets with jackscrews provide a secure mount, with precision adjustment of the wear liner to reduce spillage. The system closes the gap between the liner and the sealer, thus eliminating abrasion from trapped material without interfering with existing supports. When accompanied by the Double Sided ApronSeal skirting and clamps, the

The EVO External Wear Liner helps prevent damage to the chute wall.

ApronSeal Skirting contains small lumps and fines.

system forms a tight belt seal, delivering outstanding fugitive material control.

The special mounting tabs allow the liner to be both adjustable and replaceable from outside the chute, requiring no confined space entry. Maintenance staff merely needs to loosen the mounting tabs and remove the wear liner, then slide the new one in. This reduces the replacement procedure to a fraction of the time and makes the operation significantly safer, with far less downtime.

Placed flush with the wear liner on the outside of the chute, the ApronSeal includes a primary and secondary sealing strip with a dual-sided elastomer construction made of 70 durometer EPDM rubber composite for its low abrasion index characteristics.

The primary strip holds a tight seal on the belt to trap fugitive dust and contain it within the cargo flow. The self-adjusting secondary seal rides smoothly on the belt alongside the rigid primary strip to provide an extra dust seal. Once the contact area of the sealing strip has worn down, workers merely loosen the mounting brackets, slide the strip out and flip it over, doubling its wear life.

Following the loading zone, several dust curtains stop dust from escaping out of the end of the chute by trapping it within the settling zone. Previously, the mechanical dust filtration systems had been unable to handle the sheer volume of particulate matter, so the filters clogged quickly and created a maintenance burden, causing the units to be abandoned. With the units operational again, technicians cleaned the area and replaced the filters. Combined with the new chute design, the systems are able to effectively filter any overflow of dust.

"Is It On?"

Over a four-day period coinciding with other work at the plant, Kevill and the three-person contractor team replaced the tail pulley box, loading zone and settling zone. Since GLC1 resided in a tower more than 20 m (65 ft.) high, special lifting equipment and safety measures were required to execute the installation. The fabricated chute was fitted in place, and with minor adjustments the rest of the Martin Engineering equipment was installed and calibrated over a single day.

"When we turned the system on with a full volume of material being loaded onto the belt, there was some confusion at first from the person over the intercom as to whether the system was operating, since there appeared to be no dust," Kevill recalled. "Even after nearly a year of operation, the air inside of the enclosure is clear enough to see down the entire length of the shaft."

According to Whelpton, spillage and accumulation along walkways and around the mainframe has been eliminated. There has been no encapsulation of the belt or tail pulley since installation, and rolling components are far less prone to fouling due to dust and spillage.

Protective suits are no longer required for people to enter the area, as they need only PPE masks to protect against trace particles emitted through normal operation. "This has led to a morale boost for the plant staff," he pointed out. "I don't get complaints when I assign people to do something in that area anymore, which is generally a sign of appreciation."

Over and above the complete turnaround of the operating environment and its effect on morale, managers were impressed by the reduced labor costs and improved safety due to external adjustment and replacement of the chute's wear parts. Operators report the cleaning and maintenance schedule has been adjusted accordingly, freeing up staff for other assignments. Additionally, the time and cost for replacement of rolling components and chute accessories is a fraction of what it used to be. ▲

Information for this article courtesy of Dave Harasym, UK sales manager, Martin Engineering.