Bioenergy Insight

MARCH/APRIL 2022
Volume 13 • Issue 2

Biogas boost

Decarbonisation and energy security goals provide new opportunities

Pellet innovation

Pioneering fuels to help utilities cut emissions

Regional focus: US

A properly designed enclosure contains dust from biomass conveying operations, writes Daniel Marshall, product engineer at Martin Engineering

Keeping fugitive material in its place

When tons of bulk material hit a moving conveyor belt, three things happen: fines scatter in random directions, cargo shifts, and dust becomes airborne. The impact creates turbulent air pressure inside the transfer chute that escapes from any available gap, carrying dust and fines with it.

A properly designed enclosure will manage bulk solids, allow cargo to settle in the centre of the belt, and contain most of the dust inside a settling zone enclosure. Well-designed conveyor loading zones also keep walkways clear from spillage and control dust emissions, allowing hazard-free inspections and maintenance.

The cost of spillage

If left uncontained, fugitive material in the form of dust and fine particle spillage will increase labour costs for cleanup, foul equipment, potentially encapsulate the belt, and pose a serious safety hazard. A dirty and dusty environment also discourages workers from doing regular maintenance on the problem area and negatively affects morale.

Since trips and falls are among the most common workplace accidents, Occupational Safety and Health Administration (OSHA) inspectors are constantly on the lookout for those hazards. Dust levels are also strictly regulated by OSHA and permit violations are often accompanied by fines and potential downtime.

Sealed chute composition

A well-designed loading zone typically consists of a combination of components:

1. An enclosed transfer chute should be long enough to give dust and fines time to settle;
2. A heavy-duty belt support system absorbs impact, protects the belt and can handle rapidly shifting heavy material;
3. Closely spaced idlers help avoid sags in the belt that allow gaps where fines can escape and ease material disruption from bouncing;
4. Externally adjustable or self-adjusting skirting contains fine particles and adapts to fluctuations in the belt plane;
5. Easily serviced wear liners can be changed from outside the chute without confined space entry;
6. Dust curtains set strategically throughout the enclosure control airflow and help settle dust;
7. Dust bags or mounted air cleaners collect tiny, highly active particles;
8. A sealed tail box protects the tail pulley from the backflow of fines, dust and spillage;
9. Exit curtains prevent fugitive dust from escaping from the end of the chute.

Case study

A US power generating facility has drastically reduced dust and spillage from its biomass fuel handling system, helping to prevent fugitive material from reaching nearby homes and businesses. The fuel includes wood from open-loop sources (such as waste wood, limbs and agricultural waste) and closed-loop sources (dedicated crops of trees), to average 75% of the power generated from biomass fuels.

Dust accumulation on rolling components can cause abrasive damage and premature failure

The site's material handling system is critical to the plant's efficiency, but from the time it began operations, controlling dust and spillage was a challenge. Due to the largely residential area in which the facility is located, controlling carry-back and spillage were among the top priorities. After a thorough evaluation of the material handling system, Martin Engineering's technicians began by installing primary and secondary belt cleaners on all four conveyors. The primary units on each belt are brush-type cleaners, featuring a unique electric-powered design that provides an effective, cost-efficient solution for residual belt-borne material. The secondary units are versatile 'deflected blade' designs that feature a gentle pressure to prolong service life and prevent belt damage.

"We installed electric brush cleaners on each conveyor because they're very effective on the type of cleated belts used at this facility," said Martin Engineering's territory manager. "The rotating brush delivers good cleaning performance in difficult applications, including belts with ribs, grooves or chevrons, and belts carrying sticky materials or stringy fibres."

Part of the problem was that some of the conveyor

sections were at steep angles, and with the variable size and moisture content of the fuel, there were always chips that would fall. To address the issue, Martin Engineering's technicians removed troublesome sections of the conveyor and replaced them with specially-engineered transfer points. They also modified existing transfer points, installing drop chutes to help eliminate dust and transfer chutes with a hood-and-spoon design to improve the material flow.

"Reducing the material turbulence during transfers is key to preventing fugitive dust," noted one of the technicians. "By managing the material speed and direction, transfer chutes help minimise impact and wear on liners and belts while containing the dust and spillage that are often generated at transfer points. All of the chutes were field-fabricated, which helped us get an exact fit and minimise lead time."

The transfer chutes employ special geometries that capture and concentrate the material stream as it travels through. Each unit is customised to suit the specific material characteristics and conveyor systems of the individual customer. They provide the dual benefits of minimising aeration and preventing build-up within the chute, particularly important when dealing with combustible materials.

The installation team also placed electric rotary vibrators in key locations on drop chutes to reduce the potential for plugging. To further ensure control of fugitive material, settling zones were created at the transfer points to slow the air speed, with dust curtains to contain airborne particles.

Finally, skirt board sealing systems were installed on the sides of the loading zones to contain dust, eliminate spillage and reduce cleanup. The dual-sealing system incorporates a primary seal clamped on the steel skirt board to keep lumps on the belt and a secondary or 'outrigger' strip to capture any fines or dust particles that pass beneath the primary seal. The secondary seal lies gently on the belt and self-adjusts to maintain consistent strip-to-belt pressure, despite high-speed material movement and fluctuations in the belt's line of travel. The unique design incorporates two wear surfaces on a single elastomer sealing strip, installed along the bottom of the skirt board. When the bottom side of the strip against the belt is worn, the sealing strip is simply flipped over to deliver a second service life.

With the modifications in place, the facility has reported significant reductions in spillage and airborne dust.

"We're very pleased with the results we've seen in fugitive material control," said a source close to the project. "We're now reviewing several other conveyor sections to determine the opportunities for additional dust control measures. Our goal has always been to provide customers with safe, reliable power that's produced and delivered in an environmentally-responsible manner, and this work is a reflection of that commitment." ●

For more information:
Visit: martin-eng.com