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Conveyor training

getting measurable results while improving efficiency

Conveyor training can help employees identify and solve issues such as dust emitting from this coal conveyor offloading into a barge (all images ©2023 Martin Engineering).

Are you just checking the boxes by doing required training hours, or is your goal to get a return on your investment? There can be huge improvements in production, maintenance labour, risk avoidance and cashflow by training employees on how to safely control fugitive materials in bulk material handling and then implementing changes, *writes R. Todd Swinderman, President Emeritus/Martin Engineering*. Unfortunately, half measures don't get half results, so training alone won't be sufficient. Following through on what has been learned is the key.

Training should be robust enough to break the "We've always done it that way" mentality and encourage creativity in problem solving with safety at the forefront of the design. Companies that place a priority on safety — and address fugitive material problems seriously — benefit from fewer safety incidents, less regulatory oversight and higher productivity and profits.

Basic training

Everyone operating, cleaning or maintaining conveyors should be trained in the hazards of belt conveyors and bulk material handling. Operators and cleaning crews should have a basic understanding of what is normal conveyor operation and what the common problems are, so they can be aware that there are ways to reduce day-to-day problems such as spillage and belt wander.

Basic training includes topics such as guarding, identifying problems and safe work practices. Appropriate safety training emphasizes how the belt can store elastic energy even when Lock-Out Tag-Out procedures are followed and why additional securing of the belt is required. Further, with the retirement of many experienced operators and mechanics —

85% of conveyor maintenance is a result of fugitive materials escaping from transfer points.
2014 Pit and Quarry Conveyor University Handbook – MSHA quote in chapter 10

60% of all safety incidents occur during maintenance.
Pulp and Paper Safety Organization 2004 IDCON/Safety/Reactive Maintenance Survey

30% of serious or fatal accidents occur when cleaning near a moving conveyor.
A User's Guide to Conveyor Belt Safety: Protection from Danger Zones, IRSST and CNESST

A professional safety inspection takes a third-party perspective of aspects that workers often overlook.

and the difficulty in finding new workers — it becomes critical that new employees understand the basics of conveyor design and operation.

Advanced training

The engineering and maintenance staff should be additionally trained in fundamental conveyor design concepts, so they can analyse cause-and-effect relationships. Quite often the visible signs of poor conveyor operation are not the root cause of the problem. For example, using guide rollers to force the belt to track does not address the fundamental reason for the belt mistracking and usually results in belt edge damage.

Sometimes training is on a specific piece of equipment with the goal of creating trainers who can educate the rest of the maintenance department. This approach works well with certain types of equipment but ends up with one or two motivated and well-versed technicians who can troubleshoot.

A mechanic trained in installing problem solving components will run into a myriad of physical constraints. First, the original conveyor design and subsequent modifications can make it impossible to install equipment according to the manufacturer's instructions without a complete redesign. Second, often structural obstructions or conveyor arrangements don't allow enough room for installation, clear views for inspection or access for safe and easy maintenance access according to industry standards.

Conveyor design training for engineers and mechanics is critical so they can diagnose problems with an understanding of fundamental design methods. Systems are incrementally modified over time to minimize problems when belt speed and capacity exceed the original design specifications. No two conveyors are identical and even twin conveyors side by side can act differently. So, adhering to standard design methods allows one technician to make these slight adjustments and another technician to recognize the intentions even without the prior technician present.

Training for results

Training alone rarely results in meaningful actions to improve conveyor performance. When management understands the clear links between safety, cleanliness and productivity, it is much easier to turn training into results. There are many variations of how this can work, but most success stories have common threads:

- basic training in conveyor hazards and the methods for controlling fugitive materials;
- training in conveyor design fundamentals and the root causes of common problems;
- management participation in the training to show support;
- a pilot programme and measured results; and
- a long-term plan implemented from a successful pilot programme.

Where to start

A walkdown of one or two 'problem belts' and a review of goals the day before the training help the instructor focus on site-specific problems and management's expectations. The survey and interview usually take a few hours to half a day. The goal is for the instructor to have actual examples to show the class their problems are not necessarily unique. An experienced teacher will most likely have examples showing similar problems and their solutions.

The first day typically starts with reviewing the typical problems and getting the class to talk about their specific challenges. The class identifies a couple of problem conveyors and the class splits into small teams. Each team can look at the same problem or select different ones. Photos and videos of the issues are taken to be used in the problem-solving

discussions.

The rest of day one and the start of day two review basic design principles that relate to the problem conveyors. The discussion centres on possible root causes and solutions. Once the teams reach an agreement on a way forward, they prepare a short presentation with the help of the instructor, using their actual conveyor problems and the knowledge they gained. The presentations may also include an estimate of the cost of the proposed solutions.

The Martin Conveyor Belt Carryback Gauge is a patented tool for estimating carryback on the return side of a conveyor belt.

Management's role

At the end of day two, management is invited to listen to the team presentations and solutions. By participating in the class presentations, management shows a commitment to making improvements and has an opportunity to ask questions. The trainees, by making the presentations, show the knowledge they gained and support for the proposed solutions. The photos, videos and inspection sheets help shed light on issues and solutions crews experience every day.

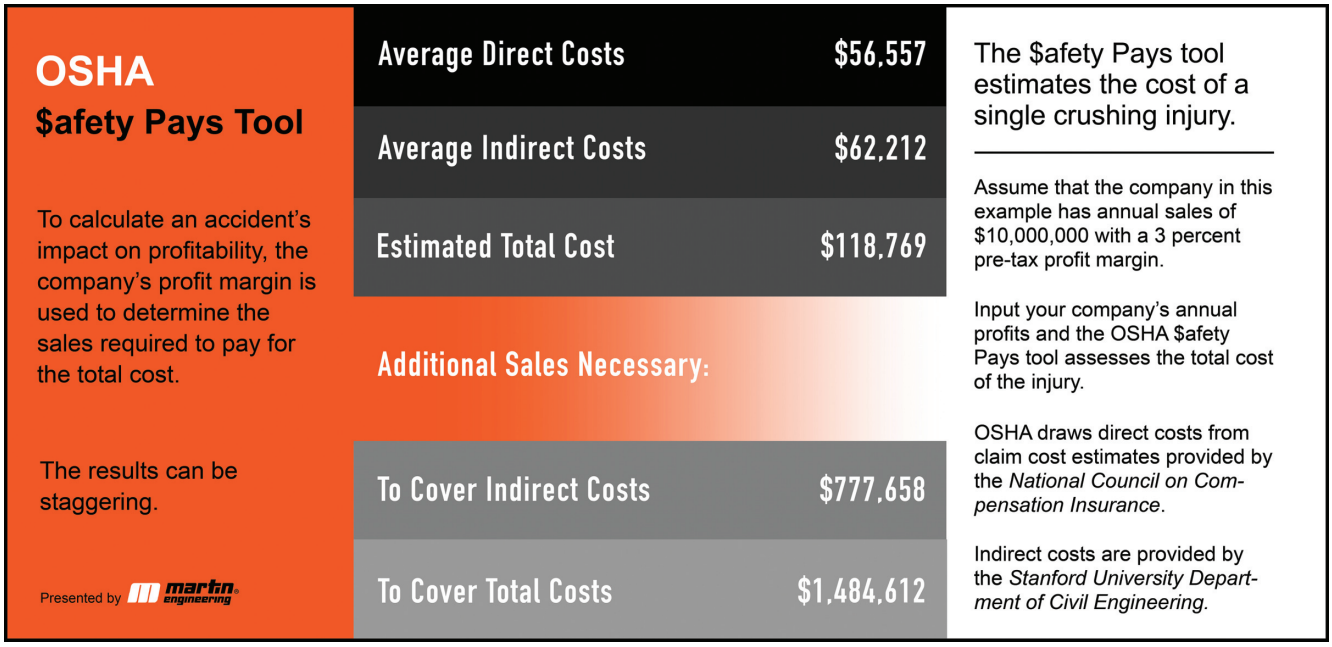
It is critical at this step that the manager(s) who attend the presentations have the authority to act on the proposals and are willing to commit to a pilot program to prove the theoretical results can be turned into reality.

Pilot programme

One or more conveyors are selected for a trial program. While it is normal to select the "worst" conveyor, keep in mind that half measures do not get half results, so consider the project's scope. Once a conveyor(s) has been selected, detailed proposals for retrofit can be obtained. An experienced person from the selected equipment supplier should overview the designs, offer feedback, and supervise the installation. Either outside contractors or in-house personnel can be used. Sufficient downtime must be allocated to properly modify the conveyor.

Measuring results from improvements is important but relatively easy to do. Photos and videos of before and after must be taken. Dust levels are measured using common instrumentation, spillage can be measured by placing buckets or trays in appropriate locations and carryback is measured by placing a tarp under several return idlers close to the discharge pulley.

A properly-engineered conveyor system will maximize both productivity and safety.



The collected fugitive materials are weighed for comparison after the conveyor has been modified. Dust and spillage sampling locations should be marked so the tests can be accurately repeated after retrofitting and an improvement percentage can be calculated.

The length of time for collecting samples can vary from a day to a week and should give a good representation of the average or typical operating environment and weather conditions. It is important to keep the dust monitor running even if the conveyor is running empty, as maximum fugitive dust levels are often detected when running conveyors empty long enough that the carryback dries out and becomes airborne.

Usually, the results of the pilot program are immediately noticeable, but there is a temptation to assume the problem has been fixed and to revert back to delaying maintenance without follow-up maintenance, causing the results to deteriorate. Therefore, the test period should extend to the next scheduled maintenance shutdown with periodic inspections and adjustments made by the equipment supplier in the interim to ensure optimum efficiency.

The Payback on Training

To demonstrate the benefit of safety to a company's bottom line, the U.S. Occupational Safety and Health Administration (OSHA) created the online tool, '$afety Pays,' which uses company-specific economic information to assess the potential economic impact of occupational injuries on that firm's profitability. The program estimates direct costs (claim cost estimates provided by the National Council on Compensation Insurance) and indirect costs (provided by the Stanford University Department of Civil Engineering) and weighs them against financial details supplied by the company.

Conclusion

Experience has shown that the motivation to take action developed in the classroom often defaults back to prior habits. Sometimes it is a lack of funding, an understaffed maintenance department or a 'run-till-broke' mentality. The pressure to get back into production overwhelms the training that emphasizes the understanding of the root causes of inefficiency and injuries such as fugitive materials. A production-at-all-costs approach means the problems and safety concerns never go away, and employees just have to accept the poor performance and added risks, which demoralizes them.

It is incumbent upon management to take the safety and maintenance training as seriously as the staff, listen to the concerns of employees and fix the problem correctly the first time. As research has shown, companies that prioritize safety, training, and updating equipment enjoy fewer safety incidents, less regulatory oversight, higher productivity and greater long-term profits.

About the Author

R. Todd Swinderman earned his B.S. from the University of Illinois, joining Martin Engineering's Conveyor Products division in 1979 and subsequently serving as V.P. and General Manager, President, CEO and Chief Technology Officer. Swinderman has authored dozens of articles and papers, presenting at conferences and customer facilities around the world and holding more than 140 active patents. He served as President of the Conveyor Equipment Manufacturers' Association (CEMA) was the editor of CEMA's 6th and 7th editions of *Belt Conveyors for Bulk Materials, The Design Guide for Belt Conveyors*. Swinderman is active on several CEMA committees including Chair of the Bulk Safety Committee and is a member of the ASME B20 committee on conveyor safety which set US conveyor safety standards. Swinderman retired from Martin Engineering to establish his own engineering firm, currently serving the company as an independent consultant.

About Martin Engineering

Martin Engineering has been a global innovator in the bulk material handling industry for more than 80 years, developing new solutions to common problems and participating in industry organizations to improve safety and productivity. The company's series of *Foundations* books is an internationally recognized resource for safety, maintenance and operations training — with more than 22,000 print copies in circulation around the world. The 500+ page reference books are available in several languages and have been downloaded thousands of times as free PDFs from the Martin website. Martin Engineering products, sales, service and training are available from 17 factory-owned facilities worldwide, with wholly-owned business units in Australia, Brazil, China, Colombia, France, Germany, India, Indonesia, Italy, Malaysia, Mexico, Peru, Spain, South Africa, Turkey, the USA and UK. The firm employs more than 1,000 people, approximately 400 of whom hold advanced degrees. DCi