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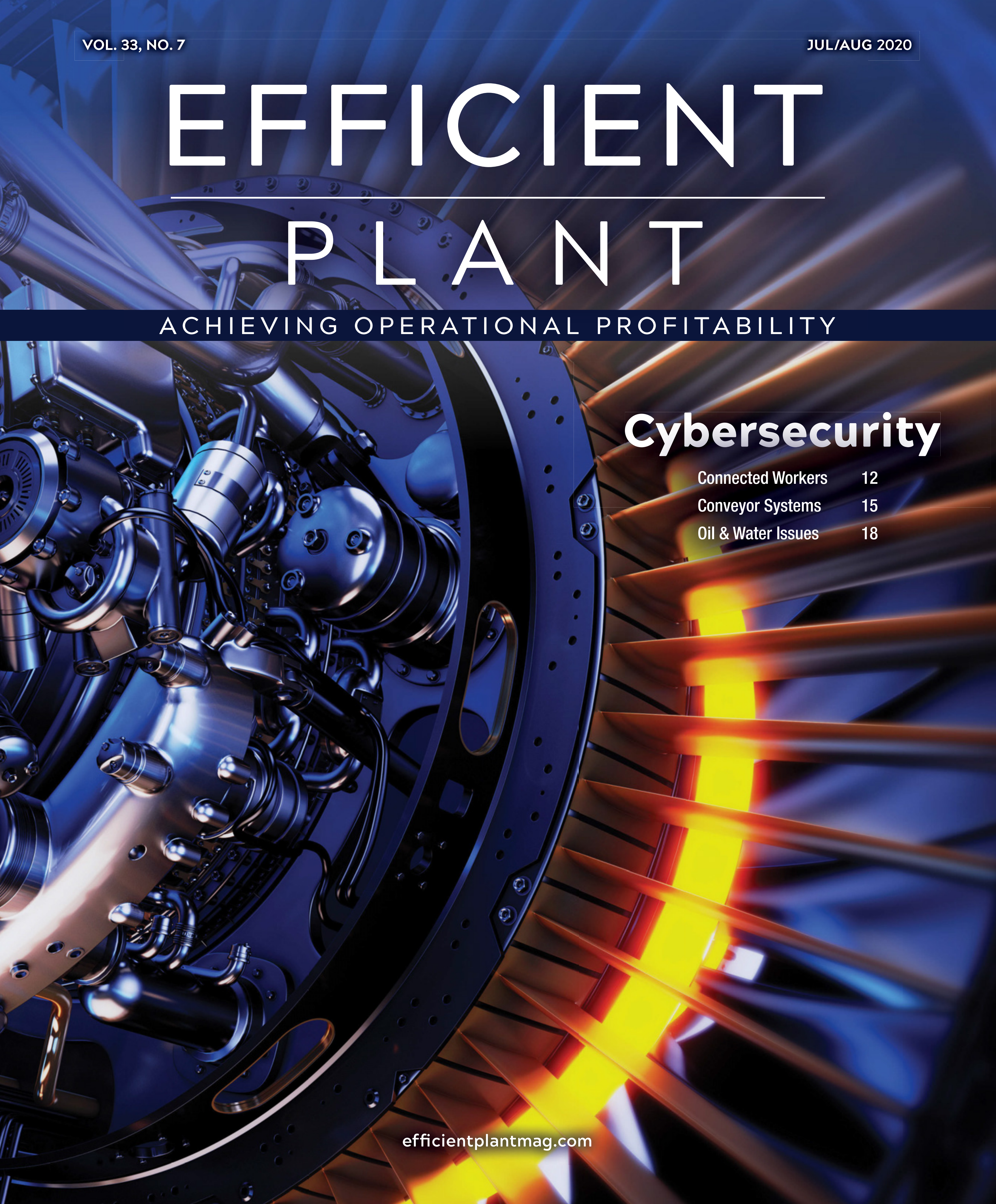

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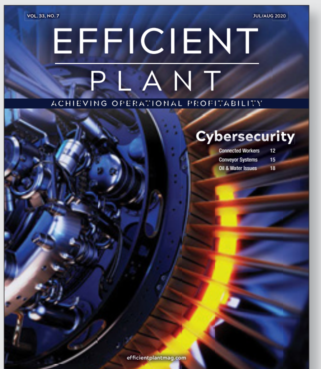

On The Cover

When MES programs are properly implemented, they can play a major role in your operation's success. Turn to p. 23 for tips that will help you realize maximum benefit from your system.

DEPARTMENTS

EP

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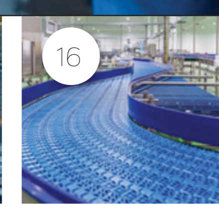
For information on Jul/Aug's web-exclusive content, see page 2.

FEATURES



R+M
RELIABILITY+MAINTENANCE
CENTER

CORRECTION:
In the June "On the Floor" article, p. 24, we omitted co-author Dr. F.H. (Skipper) Yocum's name. Our apologies to Dr. Yocum.

When conveyor systems are designed based on life-cycle cost, benefits usually accrue and costs are lower, resulting in a net savings over time.

Engineer Safer Conveyors

Using a life-cycle-cost approach to conveyor system design will result in increased reliability and worker safety.

Todd Swinderman
Martin Engineering

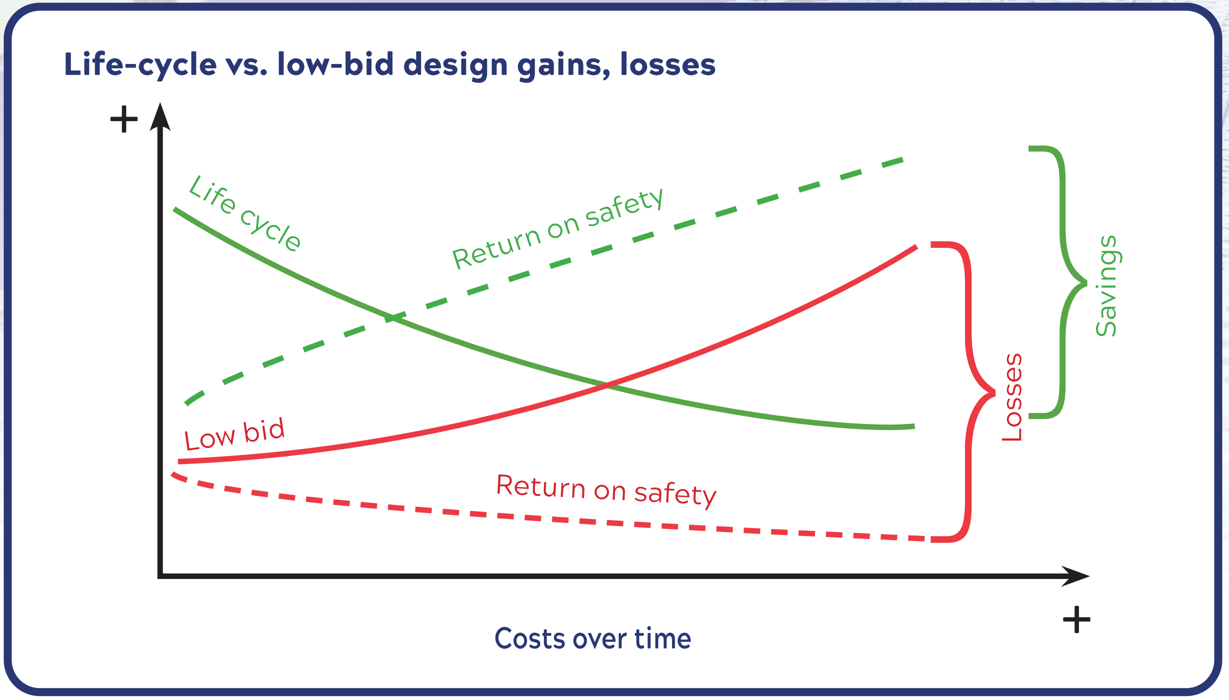
ALL NEW CONVEYOR systems inevitably succumb to the punishing bulk-handling environment and slowly degrade. Eventually, a system will require more time and labor for maintenance, deliver shorter periods of operation and longer periods of downtime, and become an ever-increasing cost of operation. This period is accompanied by an increased safety risk.

To reduce hazards involves a variety of methods, from use of personal protective equipment (PPE) to installing the latest and safest equipment designs. Improving efficiency and reducing risk can be achieved by using a hierarchy of control methods. The consensus among safety professionals is that the most effective way to mitigate risks is to design the hazard out of the component or system.

CONTROL METHODS

According to the U.S. Occupational Safety and Health Administration (OSHA, Washington, osha.gov) accident database, accidents involving conveyors occur near locations where cleaning and maintenance activities most frequently take place, *i.e.,* take-up, tail, and head pullies. Designing hazards out of a system means alleviating causes with the intent to bolster safety on a conveyor system, but the

The return on better design and quality is realized over the extended life and safety of a system.



methods of protecting workers can vary greatly. In many cases, it will be necessary to use more than one control method, by incorporating lower-ranked controls. However, these lower-ranking approaches are best considered as support measures, rather than solutions:

- PPE can be effective, but the devices can be worn improperly, may be uncomfortable to use, can be difficult to monitor, and offer a false sense of security.
- Administrative controls (changes to the way people work) create policy that articulates a commitment to safety but can be easily shelved and forgotten.
- Warning signage is generally required by law, so this is less of a method than a compliance issue.
- Engineering controls that allow remote monitoring and control of equipment or involve gates and inspection doors to obstruct access, greatly reduce exposure, but again, do not remove the hazard.
- The Substitute method replaces something that produces a hazard with a piece of equipment or change in material that eliminates the hazard. For example, manual clearing of a clogged hopper could be replaced by installing remotely triggered air cannons. However, operators may find that this method is not a practical solution for all belt-conveyor systems.
- Eliminate by design usually involves longer, taller, and tightly sealed loading chutes to control dust and spillage or heavy-duty primary and secondary cleaners to minimize carryback. By using hazard identification and risk-assessment methods early in the design process, engineers can create the safest, most efficient system for the space, budget, and application.

PREVENTION THROUGH DESIGN

Another way of saying "eliminate by design" is prevention through design (PtD), an initiative spearheaded by The National Institute of Occupational Safety and Health (NIOSH, Cincinnati, cdc.gov/niosh). The institute report points out that, while the underlying causes vary, studies of workplace accidents implicate "system design" in 37% of job-related fatalities.

Although injuries are the focus of the NIOSH report, the prevention aspect of design also greatly affects production. In most cases, workplace hazards produce consequences such as downtime, product loss, and reduced efficiency from spillage, dust, and early equipment failure. Cost is most often the main inhibitor to PtD, which is why it's best to implement safer designs in the planning and initial construction stages. The added engineering cost of PtD is often less than 10% but has enormous benefits in improved safety and increased productivity.

LOW-BID VS. LIFE-CYCLE COST

Although the policy is generally not explicitly stated by companies, the low-bid process is usually baked into a company's culture. It encourages bidders to follow a belt conveyor design methodology that is based on realizing maximum load on the conveyor belt and minimum compliance with regulations using the lowest price materials, components, and manufacturing processes available.

When companies buy on price, the benefits are often short-lived, and costs increase over time, eventually resulting in losses. In contrast, when purchases are made based on lowest long-term cost (life-cycle cost), benefits usually accrue and costs are lower, resulting in a net savings over time.

DESIGN HIERARCHY

To safely maximize production, designers and engineers are urged to approach a project with a specific set of priorities. Rather than meeting minimum compliance standards, a conveyor system should exceed all code, safety, and regulatory requirements using global best practices. By designing a system to minimize risk and the escape and accumulation of fugitive material, the workplace is made safer and the equipment is easier to maintain.

Life-cycle costing should play into all component decisions. Be aware of specifications on project components that state, "Specific Manufacturer Name/Or Equal." Vaguely written "or-equal" specifications are there for competitive reasons and allow contractors to purchase on price without adequate consideration for construction or performance. Rather, buying on life-cycle cost or engineer-approved or equal and anticipating the future use of problem-solving components in the basic conveyor configuration provides improved safety and access, without increasing the structural steel requirements or significantly increasing the overall price. It also raises the possibility for easier system upgrades in the future.

EVOLVED CONVEYOR

There are several key points that should be considered when designing a safe and efficient conveyor system. Built competitively with a few modifications in critical areas, an Evolved Basic Conveyor is a standard bulk-material-handling conveyor designed to allow easy retrofitting of new components that improve operation and solve common maintenance problems.

One key to designing an Evolved Basic Conveyor is knowing the most critical requirements for the current operation and anticipating later production needs. Nearly 90% of the time, transition idlers in the tail zone never touch the belt, making them an unnecessary expense. Since transition idler frames can make it difficult to install and maintain tail plows, forgoing transition idlers for tail protection is recommended to prevent belt and pulley fouling from fugitive material.

Further, there should be enough space between the upper and lower run of the belt to install a plow by using larger terminal pulleys with a minimum diameter of 24 in. In addition to a larger tail pulley, an oversized head pulley allows more than one belt cleaner in the chute. That mitigates spillage along the belt path. In applications with tacky carryback, consider using a scavenger conveyor, which accommodates off-pulley cleaners along the conveyor return after the head pulley.

Installing or providing for maintenance-minded solutions in the loading zone can greatly improve safety and reduce man-hours and downtime. These components include slide-in/slide-out idlers and impact and support cradles. Designers should ensure adequate access to power and compressed-air utilities.

Dust, spillage, and belt tracking are top concerns for many safety professionals. Field tests have shown that enlarged skirt boards and engineered settling zones promote dust settling and reduce fugitive material. Curved loading and discharge chutes control the cargo transfer for centered placement and reduced turbulence.

Any transfer point is prone to buildup and clogging under the right conditions, be it ambient humidity, material moisture, volume, or surface grade. Flow aids, such as vibrators and air cannons on chutes, can sustain material movement, improve equipment life, and reduce safety hazards associated with manually clearing clogs.

To assist in installation of problem-solving components without welding or cutting, consider a buildup-resistant stringer in the load zone. A similar structure should be planned for the discharge zone to accommodate a cleaning station. To aid in this and all future maintenance, a belt splicing-and-repair station improves belt maintenance and reduces outage time. Finally, it is recommended to minimize conduit in critical maintenance areas and re-route the conduit overhead.

Engineering safer conveyors is a long-term strategy. Although design absorbs less than 10% of the project budget, engineering/procurement/construction-management (EPCM) services can be as much as 15% of the installed cost of a major project. Additional upfront engineering and applying a life-cycle-cost methodology to the selection and purchase of conveyor components will prove beneficial. **EP**

Todd Swinderman is CEO Emeritus of Martin Engineering, Neponset, IL (martin-eng.com), where he was instrumental in developing technologies to solve problems in bulk-materials handling. He holds more than 60 U.S. patents and 140 active patents in 12 countries. After his retirement, he formed RToddS Engineering LLC, Palm Coast, FL (rtodds-eng.com), to provide conveyor-system consulting and training services.