

www.GlobalGypsum.com

Contents

Subscribe

Ad Index

SEPTEMBER 2021

global  
gypsum™  
MAGAZINE

Retrofits of  
board dryers  
and curing  
ovens

# 5500 TONS OF MINERAL WOOL PRODUCED EVERY DAY ON MÜNSTERMANN MACHINES

CURING OVENS FOR GLASS AND STONE WOOL  
FORMING SECTIONS AND FORMING DRUMS  
EXHAUST AIR FILTERS AND WET SCRUBBERS  
PROCESS AUTOMATION AND OPTIMISATION  
RETROFITS OF EXISTING PLANTS

INNOVATIVE.  
EXPERIENCED.  
RELIABLE.



MUENSTERMANN.COM

Christian Raestrup

Business Development Insulation Industry  
christian.raestrup@muenstermann.com



## Gypsum

### 6 Diary Dates

**8 News** - CNBM's wallboard sales rise; USG Boral to leave New Zealand market; Saint-Gobain's sales recover in first half of 2021.

### 12 De-mystifying 'other' by-product gypsums

Ferro Duo's Terry Walsh reports on the potential of using by-product gypsum from unconventional sources.

### 20 Living on the cutting edge

Embrace diagnostics technology to maximise plant productivity.

### 24 Engineering safer conveyors: Art meets science

Martin Engineering looks at ways to optimise conveyor safety.

## Insulation

**29 News** - Rockwool commissions Ranson plant in US; Fletcher Building stops making glass wool; PU plant burns down.

### 32 Insulation in the EU

Global Insulation's annual report on the state-of-play in the European Union's insulation sector.

## Regulars & Comment

**36** Subscription form

**37** The Last Word

**38** Advertiser Index



Martin Engineering

## Engineering safer conveyors: Art meets science

All new conveyor systems inevitably succumb to the punishing bulk handling environment and will begin the slow process of degradation. They will require more time and labour for maintenance, experience shorter spans between outages, longer periods of downtime and ever-increasing operating costs. This period is also accompanied by an increased chance of injury or fatality as workers become exposed to equipment to perform cleaning, maintenance and short-term fixes. A total system replacement is cost prohibitive, but to remain compliant and/or meet ever-increasing production demands, upgrades and repairs are unavoidable. How can the operator strike the right balance?

When examining the safety of a system, improving efficiency and reducing risk can be achieved by utilising a hierarchy of control methods for alleviating hazards. 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. This usually requires a greater initial capital investment than short-term fixes, but yields more cost-effective and durable results.

### The science: Hierarchy of controls

Examining the US Occupational Safety and Health Administration (OSHA) accident database reveals the dangers of working around conveyors.<sup>1</sup> The highest prevalence of accidents are near locations where cleaning and maintenance activities most frequently take place: take-up pulley, tail pulley and head pulley.

Designs should be forward-thinking, exceeding compliance standards and enhancing operators' ability to incorporate future upgrades cost-effectively and easily by taking a modular approach. Designing hazards out of the system means alleviating causes with the intent to bolster the safety of a conveyor system, but the 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 in and of themselves.

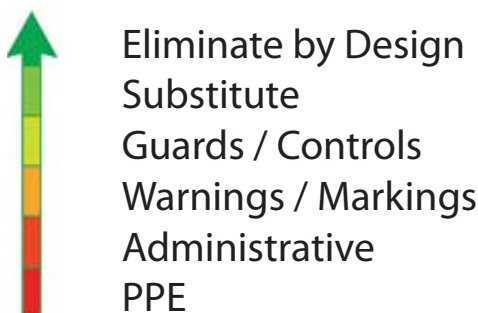
PPE includes respirators, safety goggles, blast shields, hard hats, hearing protectors, gloves, face shields and footwear, providing a barrier between the wearer and the hazard. The downsides are that they can be worn improperly, may be uncomfortable to use through an entire shift, can be difficult to monitor and offer a false sense of security. However, the bottom line is that they do not address the source of the problem.

Administrative controls (changes to the way people work) create policy that articulate a commitment to safety, but written guidelines can be easily shelved and forgotten. These controls can be taken a step further by establishing 'active' procedures to minimise the risks. For example, supervisors can schedule shifts that limit exposure and require more training for personnel, but these positive steps still do not remove the exposure and causes of hazards.

Warning signage is generally required by law, so this is less of a method than a compliance issue. Signage should be posted in plain sight, be clearly understood and be washed when dirty or replaced when faded. Like most lower-tier methods, signs do not remove the hazard and are easily ignored.

Installing systems such as engineering controls that allow remote monitoring and control of equipment, or guards such as gates and inspection doors that obstruct access, greatly reduce exposure, but again, do not remove the hazard.

Using 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



**Right:** Safety improves as the type of hazard control moves higher up the hierarchy of methods.<sup>2</sup>  
©Martin Engineering 2021.

could be replaced by installing remotely triggered air cannons.

Examples of elimination by design include longer, taller and tightly-sealed loading chutes to control dust and spillage or heavy-duty primary and secondary cleaners to minimise 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.

## Economic analysis of prevention through design

Another way of saying ‘eliminate by design’ is ‘prevention through design’ (PtD), the term used by The National Institute of Occupational Safety and Health (NIOSH). As a department of the US Centers for Disease Control (CDC), the organization spearheaded the PtD initiative.<sup>3</sup> In its report, the Institute points out that, while the underlying causes vary, studies of workplace accidents implicate ‘system design’ in 37% of job-related fatalities.

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, rather than retrofitting the system later. The added engineering cost of PtD is often less than an additional 10% of engineering but has enormous benefits in improved safety and increased productivity.

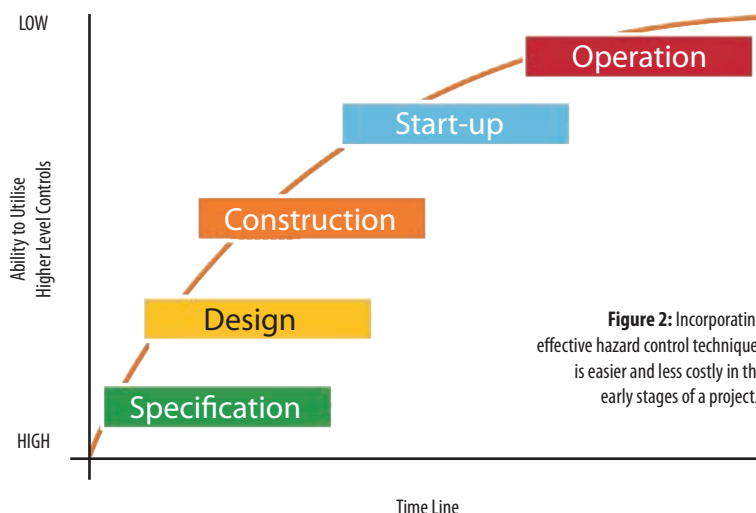
The cost of PtD initiatives after initial construction can be three to five times as much as when the improvement is incorporated in the design stage. The biggest cause of expensive retroactive improvements is cutting corners initially by seeking lowest-bid contracts.

## Low-bid process and life cycle cost

Although the policy is generally not explicitly stated by companies, the low-bid process is usually an implied rule that is baked into a company’s culture. It encourages bidders to follow a belt conveyor design methodology that is based on getting the maximum load on the conveyor belt and the minimum compliance with regulations using the lowest price materials, components and manufacturing processes available. However, 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 continue to accrue and costs are lower, resulting in net savings over time.<sup>4</sup>

## The Art: Design Hierarchy

Rather than meeting minimum compliance standards, the conveyor system should exceed all code, safety and regulatory requirements using global best practices. By designing the system to minimise risk and the escape and accumulation of fugi-



**Figure 2:** Incorporating effective hazard control techniques is easier and less costly in the early stages of a project.<sup>2</sup>

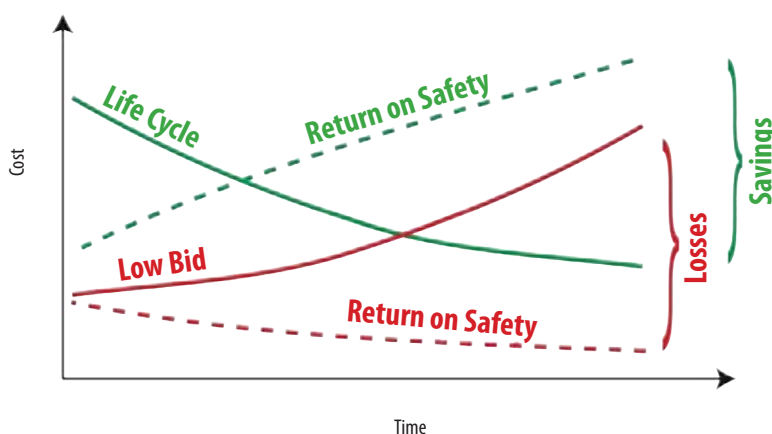
Risk Assessment Matrix				
Probability / Severity	Catastrophic (1)	Critical (2)	Marginal (3)	Negligible (4)
Frequent (A)	High	High	Serious	Medium
Probable (B)	High	High	Serious	Medium
Occasional (C)	High	Serious	Medium	Low
Remote (D)	Serious	Medium	Medium	Low
Improbable (E)	Medium	Medium	Medium	Low
Eliminated (F)	Eliminated			

tive material, the workplace is made safer and the equipment is easier to maintain.

Life-cycle-costing should play into all component decisions. Buying on life-cycle-cost and anticipating the future use of problem-solving components in the basic configuration of the conveyor 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.

**Above - Table 1:** Risk assessment applied to design helps create a safer conveyor system. © 2021 Martin Engineering.

**Below - Figure 3:** The return on better design and quality is realised over the extended life and safety of the system. © 2021 Martin Engineering.

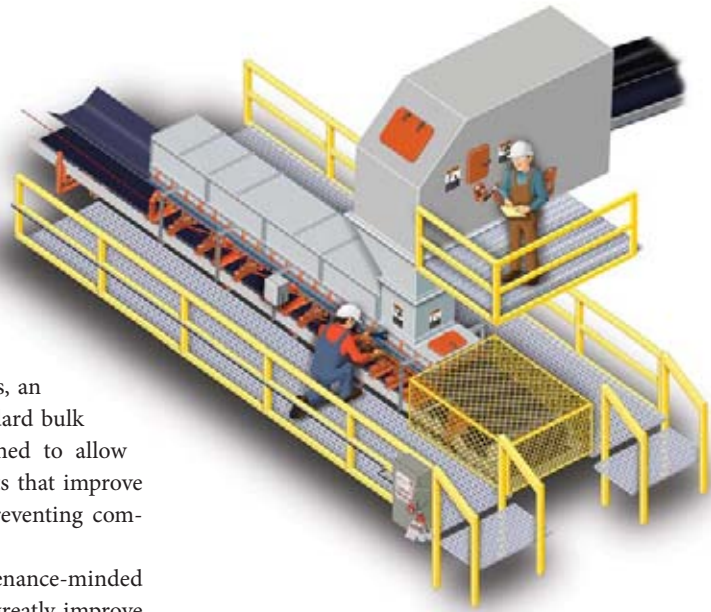




## Best practice: The Evolved™ Basic Conveyor

Using the hierarchy of controls along with the design hierarchy, engineers will be able to construct an Evolved™ basic conveyor, which meets the needs of modern production and safety demands. 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 safety, solving or preventing common maintenance problems.

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, impact cradles and support cradles. On larger conveyors, maintenance aids such as overhead monorails or jib cranes assist in the movement and replacement of components. Also, designers should



**Above - Figure 4:** Components of an Evolved™ Basic Conveyor facilitate operations, maintenance and safety. © 2021 Martin Engineering.

**Below - Table 2:** Rather than meeting minimum compliance standards, conveyor systems should exceed code, safety and regulatory requirements. © 2021 Martin Engineering.

Red, Amber and Green List for Designing Better Belt Conveyors	
<b>Red List</b>	<b>Procedures, techniques, products and processes to be prohibited in the Specification and Design stages of a conveyor project</b>
	Prevent loading on the transition of the belt
	Prevent transition of more than 1/3 trough
	Prevent loading against the direction of the receiving belt
	Prevent loading conveyor to 100% of CEMA standard cross section capacity
	Prevent control and sequencing that allows conveyor(s) to run empty longer than necessary
	Prevent belt identification stamps in top cover
	Prevent installing equipment in elevated locations without provision of safe access or tie-off
	Prevent component selection based on 'or equal' specification or 'price only' bidding
<b>Amber List</b>	<b>Procedures, techniques, product and processes to be eliminated or reduced as much as reasonably possible. Only allowed with a change in the specification and notice to project owner / manager explaining potential issues and availability to address them in the future</b>
	Avoid reversing conveyors
	Avoid multiple load points on a single conveyor
	Avoid designs created with the intention to increase capacity in the future by increasing conveyor speed; design the system to accommodate future needs
	Avoid combined vehicle and personnel travelways or uncontrolled exits from buildings into traffic patterns
	Avoid a site layout that does not allow for safe and efficient delivery, storage, lifting of major components such as pulleys, drives and belting
<b>Green List</b>	<b>Procedures, techniques, products and processes to be encouraged in specification and design stages of a conveyor project</b>
	Consider ergonomics in the design and access of frequently-cleaned or maintained equipment
	Consider use of pulleys with diameters larger than minimum required for the specified belting
	Consider access and clearances according to CEMA recommendations
	Consider the use of design to reduce exposure to hazards



**Right - Figure 5:**

A properly-configured conveyor minimises emissions for improved safety and easier maintenance.

© 2021 Martin Engineering.



ensure adequate access to utilities, typically electricity and/or compressed air, to facilitate maintenance and performance. Next-generation conveyor designs may even feature a specially-engineered idler capped with an independent power generator that uses the conveyor's movement to generate power for a wide array of autonomous equipment.

Dust, spillage and belt tracking are top concerns for many safety professionals. Field tests have shown that enlarged skirtboards 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. As the load is centered on the belt, guides ensure even travel through the take-up to promote consistent belt tracking.

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

## Conclusion

Engineering safer conveyors is a long-term strategy. Although design absorbs less than 10% of the total budget of a project, additional upfront engineering and applying a life-cycle-cost methodology to the selection and purchase of conveyor components

proves beneficial. By encouraging the use of the Hierarchy of Controls at the planning stage, along with the Design Hierarchy at the design stage, the system will likely meet the demands of modern production and safety regulations, with a longer operational life, fewer stoppages and a lower cost of operation.

## References

1. Conveyor Accident Database, OSHA, US Dept. of Labor. Washington, DC, US. 2018. [https://www.osha.gov/pls/imis/AccidentSearch.search?acc\\_keyword=%22Conveyor%20Belt%22&keyword\\_list=on](https://www.osha.gov/pls/imis/AccidentSearch.search?acc_keyword=%22Conveyor%20Belt%22&keyword_list=on)
2. Martin Engineering, 'Foundations for Conveyor Safety,' Ch. 31, pp. 404-440. Worzalla Publishing Company, Stevens Point, Wisconsin, US, 2016. <https://www.martin-eng.com/content/product/690/safety-book>
3. Howard, J.M.D.; 'Prevention through Design: Plan for the National Initiative,' National Institute of Occupational Safety and Health (NIOSH), US Centers for Disease Control (CDC), Department Of Health And Human Services. Washington, DC, US. 2010. <https://www.cdc.gov/niosh/docs/2011-121/pdfs/2011-121.pdf>
4. Swinderman, R.T. 'The Economics of Workplace Safety: Putting a price on material handling mishaps,' *Coal Age*. Vol. 123, No. 3, pp. 28-31. April 2018. <https://www.coalage.com/features/the-economics-of-workplace-safety> 