FIGHTING CONVEYOR CORROSION

Mitigating conveyor corrosion starts with identifying causes and designing the most durable piece of equipment

INTRODUCTION

The industrial sector is one of the largest and most important drivers of global economic growth and stability. Whether it is mining, paper & pulp, fertilizer or utilities, the impact of the billions of dollars at stake in these, and similar sectors, cannot be overlooked.

According to the recent Global Market Study on Construction Aggregates: Industry Analysis and Forecast 2016-2024, the consumption of construction aggregate was estimated to reach 43.3 billion metric tons (mt) by the end of 2016, valued at $350 billion. In addition, the market seen a year-over-year growth in 2016 at more than 6%, with consumption projected to reach 69.2 billion mt at the end of 2024. Rising infrastructure and renovation projects are major drivers in the global and North American markets, generating major demand for construction aggregate and other industrial materials. Advanced commercial construction, residential construction, tourism and manufacturer preferences for recycled aggregate and manufactured sand are also expected to fuel demand.[3]

As one of the largest industrial sectors in the world, the pulp and paper industry represents billions of dollars. Paper mills in the U.S. accounted for more than $44 billion in revenue in 20161 According to Statista, worldwide production of paper and cardboard was more than 407 million (mt) in 2015, while revenues for the U.S. forest, paper & packaging (FPP) industry exceeded $96 billion.2

Constant production within these sectors relies on effective and reliable infrastructure, including conveyors that must move a diverse assortment of materials located in some of the harshest environments on Earth. One of the biggest challenges facing these operations is keeping those conveyors, and the materials they transport, moving 24/7.

Challenging that efficiency is the constant threat of corrosion and the downtime it can cause any operation.

> **The World Corrosion Organization estimates the global cost of corrosion to be about $2.2 trillion annually. It is estimated that as much as 25% could be eliminated or slowed by applying simple, well-understood prevention techniques.** [4]

THE CHALLENGE

Corrosion is the deterioration of a metal as a result of chemical reactions between it and the surrounding environment. Both the type of metal and the environmental conditions, particularly gasses that are in contact with the metal, determine the form and rate of deterioration. It is important to recognize that all metals can corrode. Some, like pure iron, corrode quickly. Other metals, such as stainless steel, which combines iron and other alloys, is slower to corrode.

When it comes to a conveyor's design, and its components, corrosion is a variable that must be taken into consideration. You cannot stop or prevent corrosion of metal, but you can design conveyors to optimally withstand particular characteristics indigenous to the materials being moved, the surrounding environment and the placement of equipment.

Often the physical properties of material are counter-intuitive to erosion and corrosion of metal components. It is not always a matter of the texture of what is being moved by a conveyor, hard or soft, smooth or irregular shaped, each product contains some caustic element that can start and accelerate corrosion. In any state, dry potash is considered only mildly corrosive, while any of the sulfates – nickel, zinc or copper – are extremely corrosive even in a dry state.

A dry application may have a conveyor that lasts 10 years while the same application that is wet will last only two years. Consider sludge, whether its waste water or pulp and paper, it contains excessive moisture that can be highly corrosive. Even the humidity or the vapors that can be created from moving these materials at high temperatures is enough to begin corrosion of metal components. Due to heightened pH levels which add acidity or alkalinity to pulp and paper sludge, it is highly corrosive. Therefore, the actual texture of any material is not necessarily a deciding factor on mitigating corrosion. Accounting for all of the materials' chemical properties is critical.

Variables that impact corrosion:

- Material shape
- Material chemistry
- Placement of equipment
- Moisture
- Environmental factors
- Excessive heat
- Vapors
- Conveyor speed

A carbon steel surface, which might typically be highly resistant to corrosion, may become vulnerable when the product starts to move at a higher conveyor speed. Add additional moisture, excessive heat, surrounding environmental sulfate or oxide vapors that could interact with metals in the conveyor, and it's easy to understand the importance of taking every aspect in consideration when designing a conveyor for a particular task.

Outdoor environmental factors such as humidity, excessive hot or cold temperatures and even salt air, will have an impact on metal corrosion. Dusty environments that are subject to rain can pick-up those airborne contaminants and deposit them onto conveyor surfaces, initiating or escalating corrosion.

It is important to note the symbiotic relationship between corrosion and erosion of metal surfaces on conveyors. While it may be an initial reaction to the material being moved that causes corrosion on a conveyor, other variables such as the speed of the conveyor can escalate and further enhance the erosion of the metal surface. This can lead to component failure. [3]

So, why not apply highly corrosive-resistant stainless steel to every situation? Firstly, stainless steel costs anywhere from four to six times the expense of carbon steel. Stainless steel has its own unique properties and while it may be highly resistant to corrosion, it is not as hard as carbon steel. This creates a trade-off of corrosion resistance for durability which must be considered for each unique conveyor situation.

"Corrosion can take down a conveyor costing a company's operation in excess of a $1 million a day."

When components fail on a conveyor, whether it be shafts, sprockets, pins or trough structure, the conveyor must shut down for repairs. This unplanned downtime, in addition to the labor and parts costs to repair the equipment, can significantly reduce production goals and ultimately impact an operation's bottom line. If left untreated, relatively small parts affected by corrosion can take down a conveyor costing a company's operation in excess of a $1 million a day.

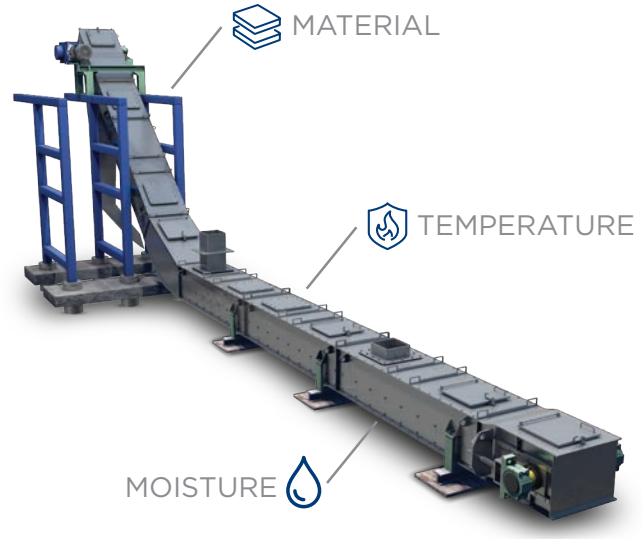
In addition to hard costs, corrosion can become a serious threat to safety on a job site. A broken component can cause catastrophic failure for an entire conveyor line, creating jams and other serious safety concerns.

The saying goes: A conveyor is only as good as the people maintaining it. Any 24/7 operation must have planned downtime for essential maintenance, including identifying and evaluating potential trouble spots for corrosion. The more hostile the surrounding environmental elements – the more critical the preventative maintenance schedule becomes for keeping an operation's bottom line in the black.

THE SOLUTION

Since corrosion is not something that can be stopped, the best way to mitigate its effects is to build a conveyor correctly from the start. This process begins by understanding the relationship between the metal components of the equipment and the potential for corrosion. Recognizing corrosion can be caused by the materials being handled, as well as the surrounding environment, extreme temperatures, moisture and many other variables, it is imperative to factor all of this into a conveyor design. If all of these factors are considered, a conveyor can be designed to be the most durable piece of equipment possible.

An effective corrosion prevention system begins in the design stage with a proper understanding of the environmental conditions and metal properties. Engineers work with metallurgical experts to select the proper metal or alloy for each situation. They must also be aware of possible chemical interactions between metals used for surfaces, fittings, and fastenings. By designing a trough capable of accommodating the required material volumes and understanding the impact of chain speed and chain wear, rates of corrosion can be significantly decreased.



In addition to addressing corrosion in the design, developing set maintenance intervals that can focus on potential trouble spots will help to address corrosion before it can cause equipment failure and downtime.

All CDM Systems' conveyors are designed and built on a per suit basis that allows tailoring the conveyor construction and materials to suit the application. CDM engineering and design principles are founded in the science of material movement and bulk density, the technology of optimum chain speed intersecting acceptable chain pull, and the innovation of wear resistance and anti-corrosion techniques. To be profitable, an operation must trust that its equipment can deliver materials in a consistent, controlled and reliable manner. CDM partners with companies to design the correct chain inside the conveyor. This guarantees a conveyor will meet the demands of any operation.

More than 40 years ago, CDM began with the premise that building the highest quality, longest-lasting conveyors for heavy-duty industrial applications starts with the chain. The CDM founders worked in bulk material handling industries for many years and saw the challenges of those industries as an opportunity to deliver optimum production levels with conveyors that could meet the 24/7, aggressive demands of the applications.

CDM en-masse chain conveyors effectively move material from Ash to Zinc, operating in industrial sectors ranging from mining, energy and utilities to steel, light ore and chemicals. From a variety of chain link options to custom flight configurations, CDM covers the entire spectrum of en-masse conveying requirements. In addition to welded malleable steel flights, CDM offers materials such as stainless and abrasion-resistant steels.

CONCLUSION

Every conveyor must deal with corrosion. It is a factor that must be recognized when designing, maintaining and safely operating a conveyor. Designing a conveyor that takes all of the variables at a particular site into account can help slow corrosion. This kind of attention to detail in the conveyor design stage is essential to avoiding costly breakdowns or catastrophic failures that can negatively impact short- and long-term production and revenue goals.

In today's world, where labor and maintenance costs can account for far more than the initial cost of a piece of equipment, CDM's goal is to supply equipment that provides the most value. While initial equipment costs may be slightly higher – the total cost of ownership will be significantly lower than competing equipment. With a marginal increase in the initial CDM conveyor investment, replacement parts, major maintenance and costs for overhauling equipment can be significantly reduced.

For more than 40 years CDM has been successfully designing heavy-duty conveyors to handle the toughest materials in the harshest conditions possible. Their ability to custom design each conveyor to adapt to the bulk material being handled, as well as taking into account the surrounding environmental impact, offers the best possible scenario for slowing corrosion's impact. Considering the steep cost for equipment repairs and unplanned downtime, it is easy to see ROI from a CDM conveyor.

ABOUT THE AUTHOR:

Andrew Parker is Vice President for CDM Systems, Inc. He has more than 20 years of experience in the bulk material handling industry. He oversees operations including conveyor design and development.

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