Potash WORKS

North America's premier publication dedicated to the promotion, production and distribution of potash

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Mining ideas towards a net-zero Canada

LOOKING BACK AT 2021: A year in the potash industry

Combatting corrosion during potash cooling

HOW THE VERTICAL PLATE HEAT EXCHANGER IS LAST MAN STANDING IN MOST OPERATIONS

BY IGOR MAKARENKO

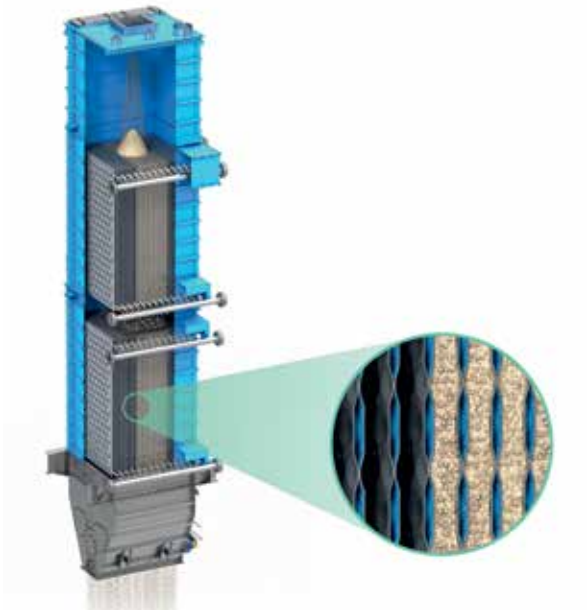
The path to profitability for potash producers starts with the mineral deposit, followed by choosing the right mining and process equipment to extract, process, and refine the mineral into a valuable commodity product. Harsh processing conditions are common to these facilities, which tests the lifespans of all equipment in the facility.

The corrosive nature of this processed material, specifically, has the potential to erode producers' pockets by threatening the effectiveness and reliability of their facilities' equipment. Best case, corrosion still leads to cumbersome maintenance schedules and downturns. Yet a more common effect of corrosion is costly downtime that results in capital retrofits of equipment that, otherwise, should still have many years of operating lifespan.

Like many other areas of a potash processing facility, the challenges associated with corrosion are also acutely felt at the product cooling stage, directly prior to storage, packaging, and transport. Vertical plate technology, however, gives producers an effective solution to indirectly cool their product to consistent outlet temperatures without facing traditional corrosion challenges or cumbersome maintenance schedules.

It accomplishes this through stainless-steel fabrication standards and material selection adequacy that have been proven over the past several decades to better withstand the high temperatures and corrosive environments associated with potash processing.

It is complemented by a simple yet effective mass flow design that requires minor maintenance and minimizes product degradation, as well as the need for downstream product cleaning equipment.

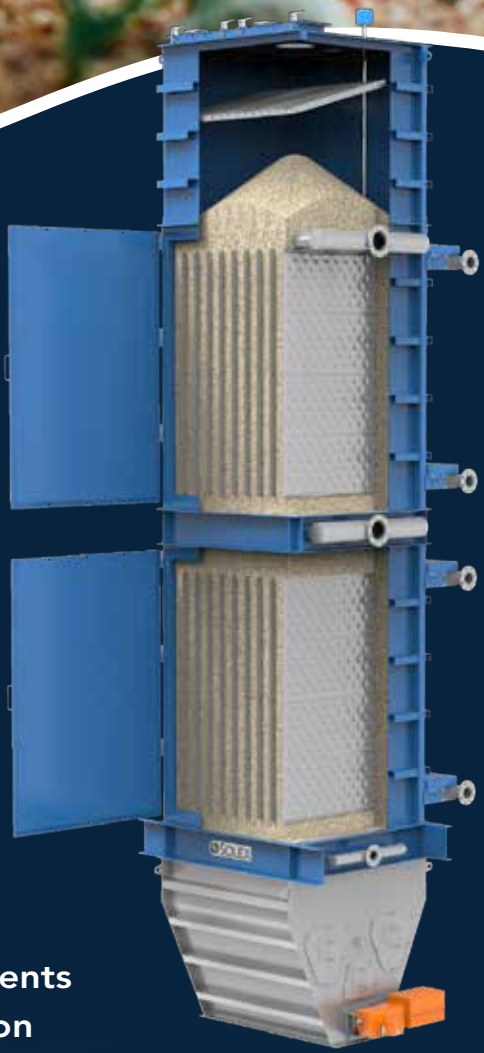


Located just prior to storage, packaging and transport, vertical plate technology is well suited to indirectly cool corrosive bulk materials such as potash due to its use of high-alloy austenitic stainless steel. Photo courtesy of Solex Thermal Science.

The mass flow design of vertical plate technology at the cooling stage of potash processing also minimizes product abrasion and degradation from occurring while simultaneously mitigating wear to the unit. Photo courtesy of Solex Thermal Science.

An innovative solution to more efficient potash cooling

Solex indirect cooling technology guarantees efficient thermal performance. Our cooling solution ensures long-term, reliable plant operations, allowing operators to produce a finished product with the required stable temperature with also avoiding caking.



- **Guaranteed specified final product temperature**
- **Reduces anti-caking reagents usage/expenses**
- **Compact design is ideal for existing plant layouts**
- **Specially designed to withstand corrosive environments**
- **Environmentally friendly and energy-efficient solution**

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First, a bit of background . . .

During potash processing, equipment is continuously exposed to corrosive salts such as potassium chloride and sodium chloride. The addition of water – which forms a highly corrosive brine, intensified if the water is hot enough to fully dissolve the chloride salts – or moisture/carbon dioxide from the air compounds the corrosive effect. This is particularly the case with fresh metal surfaces on processing equipment where mechanical wear has removed the corroded layer or protective passive film.

Like many free-flowing solids, potash also has a knack of finding its way into nooks and crannies – in this case, hardening into sharp crystals and eating into the metal of processing equipment.

Several studies conducted at the University of Saskatchewan over the past two decades on the performance of different metals in potash brine environments have found some of the more common construction materials used in these processing facilities tend to be severely degraded by localized corrosion (e.g., pitting and crevice corrosion), whereas higher grades of stainless steel have proven to be more resilient.

Picking the right equipment

Vertical plate technology, which cools potash indirectly, has emerged as a more robust and now standard solution when compared to direct-contact moving bed heat exchangers.

The tower-like design cools the product by conduction instead of convection (e.g., air cooling). Free-flowing particles, such as potash, enter the exchanger at temperatures around 120°C or higher, slowly passing between a parallel series of heat exchanger plates that contain a counter-current flow of water or other heat transfer fluids.

The plates transfer the heat from the potash to the heat transfer fluid, and the product cools to temperatures between 40°C and 70°C as, pulled by gravity, it slowly and uniformly moves downward, controlled by a discharge device.

A key benefit to the reliability of vertical plate technology lies in how it is fabricated. Specifically selected grades of high-quality stainless steel are recognized benchmarks, thereby making the finished units incredibly resistant to corrosion, while also being able to prevent material hang-ups due to the smooth surface finish.

In addition, the sturdy heat exchanger design, which are finished to meet ASME (American Society of Mechanical Engineers) and/or PED (Pressure Equipment Directive) pressure vessel codes, as well as the plates inside, typically use corrosion-resistant material, which is a high-alloy austenitic stainless steel developed primarily to handle harsh products, including

chloride-bearing media such as potash. In fact, corrosion studies carried out at the University of Saskatchewan in recent years have found that the abovementioned high-alloy stainless steels have the highest pitting resistance when compared with other materials.

A better way to handle abrasion

Vertical plate technology also offers the benefit of minimizing product abrasion and degradation from occurring while simultaneously mitigating wear to the unit. It does this through the aforementioned mass flow design that uses gravity as the driving force, and a discharge feeder that controls the rate of flow of the product between the stainless-steel plates and through the unit at exceptionally low velocities. As a result, the slow material movement ensures there is no attrition and thus no dust formation from the product.

In addition, asset maintenance costs are also drastically lowered because of the gentle wear to the internal parts. The technology is designed to operate with a minimal number of moving parts, offering simple installation, virtually zero maintenance, and years of reliable operation.

When cleaning is required, the design offers easy access to the heat transfer areas and individual plates. (The mass flow design is also a key component to ensuring any product that goes into the exchanger comes out with a stable and uniform final temperature.)

Final considerations

As many North American producers increase potash production heading into 2022, the call for more reliable operations will continue to grow louder. This, in turn, will create even smaller margins of error for equipment failure or downtime caused by frequent and unplanned maintenance, as well as costly loss of production.

Vertical plate technology provides potash producers with the peace of mind they need to remain productive. The stainless-steel design is world-tested, with many units commissioned by Solex Thermal Science decades ago that are still in operation today. In fact, these exchangers are often one of the longest pieces of equipment standing in most potash operations due to their long-term durability.

At the same time, the gravity-fed design ensures gentle handling of the product, even temperatures at outlet and no wear and tear to the exchanger and the plates.

To learn more about how to more efficiently cool potash, visit www.solexthermal.com.

Igor Makarenko is the global director, fertilizers for Solex Thermal Science, a Calgary-headquartered company that specializes in bulk solids thermal exchange. ▲