COVERING BEST PRACTICES FOR THE INDUSTRY

# Sulfuric Acid TODAY

www.H2SO4Today.com

Spring/Summer 2018

## Bestgrand Chemical successfully starts up world's largest wet-gas sulfuric acid plant in China Page 7

IN THIS ISSUE > > > >

# Kalium Mineração chooses SAFEHR® for its new 150 MTPD sulfuric acid plant

Kalium Mining is a Brazilian mining company based in Dores do Indaiá, in the mineral rich state of Minas Gerais. Kalium operations are currently aimed at extraction of glauconite to produce potassium and magnesium sulfate, as well as iron and aluminum oxides of high purity.

After careful evaluation of the requirements of the company's 150 MTPD 98 percent sulfuric acid plant operating at low-pressure, 8 bar steam, it was concluded that on-site acid manufacture was advantageous.

Clark Solutions proposed a modular (skid mounted), sulfur burning, single absorption acid plant with hydrogen peroxide tail gas scrubbing and maximum steam generation through Clark Solutions' SAFEHR® heat recovery technology.

## The plant

Given logistics and road access limitations, the chosen configuration was modular, built on metal skids, and transported to the site. The modular plant occupies a small area of less than 8,000 square feet. The processes are divided among seven modules and eleven skids, each about the size of a standard 40-foot container.

One of these modules enhances the steam generation via Clark Solutions SAFEHR® technology. This technology offers safety and efficiency improvements.

## SAFEHR®

Energy recovery plays an important role in sulfuric acid plants with standard heat recovery occurring in the furnace and catalytic bed steps, using waste-water reboiler, superheater, and economizers. Sulfuric acid plants, however, are long known to generate a substantial amount of heat during the $SO_3$ absorption process.

While the technologies for recovering $SO_3$ absorption energy have evolved, the corrosion, shut-down, and explosion concerns are still issues that limit the industry from implementing these technologies as standard. Clark Solutions SAFEHR® heat recovery technology addresses these issues, making heat recovery safer than conventional operations.

Figure 1: Skided plant.

In a conventional absorption tower, heat recovery relies on absorbing the $SO_3$ into highly concentrated acid (99.0 percent) at temperatures above 180° C to produce a hot acid stream. This hot acid stream could be cooled by a boiler, generating saturated 8- to 10-bar steam instead of rejecting heat to the cooling tower. Some solutions for recovering downstream energy were proposed through the years seeking efficiency and safety.

Compared to previous methods, SAFEHR® technology offers distinct advantages: it's safer, since water and acid are never in contact, it produces more high-pressure steam, and it reduces downtime costs.

SAFEHR® offers safety using a family of proprietary fluids, CS Fluids, which are non-corrosive, non-toxic, non-flammable, and non-oxidant. They also have low vapor pressures and are odorless, inert, and immiscible to acid and water, having a density between the two liquids and high boiling points (between 200-300° C).

CS Fluids are used inside a closed loop as an intermediate between acid and boiler feed water streams, where the fluids cool the acid and heat the water. The CS Fluid stream operates with pressure below the adjacent ones. This way, in the event of a leak, acid or water streams flow to the closed loop where they will not mix, due to CS Fluids' properties.

In a leakage scenario, the phase separation occurs in a liquid-liquid coalescer. Even in a case where water and acid leak at the same time, separation of the three phases is possible. Controlling this process with appropriate instrumentation can detect the leak quickly. This configuration gives the plant operators more time, allowing for a planned maintenance period, rather than having to perform an emergency shutdown and incurring the downtime costs, as with conventional heat recovery systems.

A substantial advantage of SAFEHR® with regard to heat recovery is the certainty of no contamination in the water side of the system. This allows the hot water generated in the boiler side to be transformed into high pressure steam in the plant's main boiler.

Since there is no hot acid contamination risk in the system, both low pressure and high pressure boilers can be constructed using less expensive materials.

At Kalium's sulfuric acid plant, SAFEHR® technology will recover energy from the absorption tower.

The 99 percent sulfuric acid goes from the tower bottom to a fully welded heat exchanger built in 310SS that prevents corrosion on the process side. The CS Fluid stream cools the acid, which passes through a liquid-liquid coalescer before finally recovering energy with boiler water in a 316L heat exchanger.

The cooled acid returns to the absorption tower to be distributed over the lower packed bed promoting contact with the $SO_3$, leading to a highly exothermic reaction heating the acid stream again. The gas continues to the tower top section where carried mist originated due to the absorption reaction. High acid vapor pressure is condensed in the tower upper packed bed using circulating acid that is collected in a collector tray. Meanwhile, the hot absorption acid accumulates in the bottom, pumped to the SAFEHR® intermediate circuit.

At the water side of the intermediate circuit, CS Fluids enter the heat exchanger, generating heat for Kalium's 8 bar steam, which is directed to the mining processes.

In an acid leakage scenario, acid and CS fluid will flow to the coalescer ensuring proper phase separation. Once collected, leaked acid is drained. In the coalescer bottom, instrumentation can detect the leakage quickly. Pressure and level sensors detect water leakage.

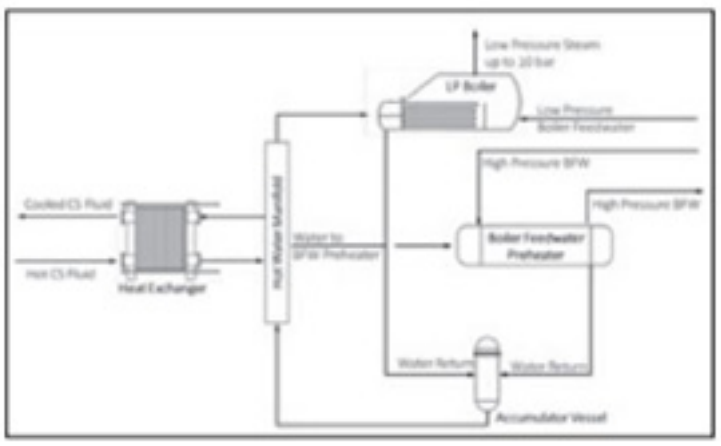



Figure 2: Steam system schematics

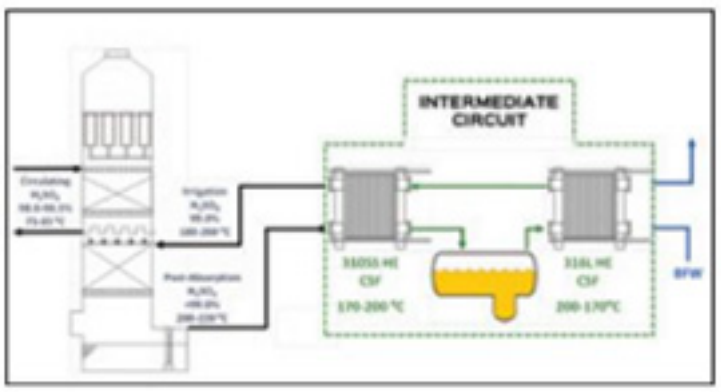



Figure 3: SAFEHR® intermediate circuit schematics.

## Conolusion

SAFEHR® is a new approach to acid production with higher energy output and lower cooling water requirements than conventional acid plants.

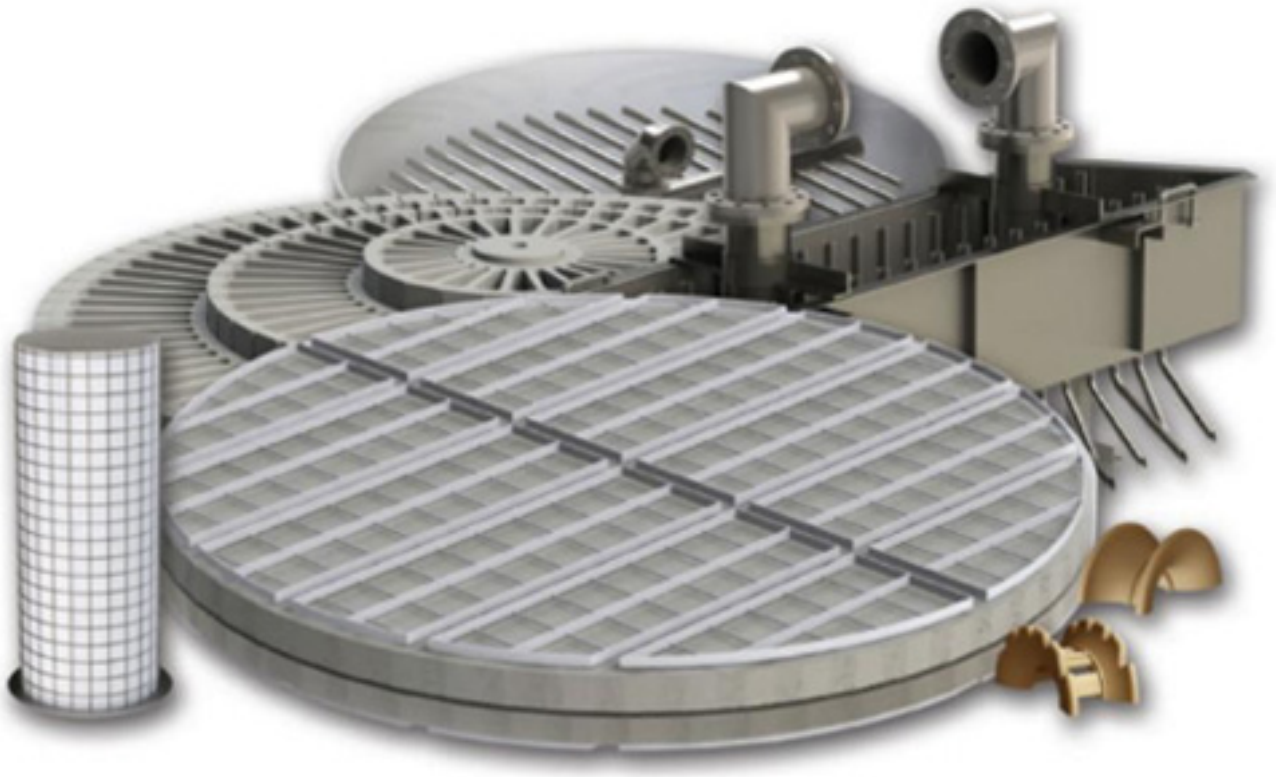
While adding process safety and reducing corrosion risk, SAFEHR® reduces substantial energy losses. Depending on the configuration, the system can also improve the plant's high-pressure steam formation, a particularly interesting advantage for plants generating electrical energy.

*For more information, please visit www.clarksolutions.com.br.* ❑

MORE THAN EQUIPMENT,

# SOLUTIONS

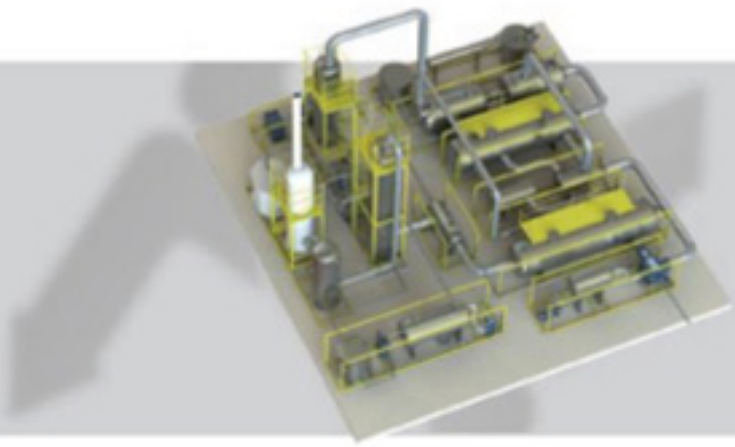
**Mist Eliminators:** MaxiMesh® and FiberBed®
**Tower Internals:** MaxiSaddle® and MaxiDome®
**Acid Distributors:** Through & Downcomers / Pipe Distributors
**Piping & Heat Exchangers:** CSX High Silicon Austenic Stainless Steel



SAFEHR
HEAT RECOVERY TECHNOLOGY

SAFEHR® is a unique, patented heat recovery technology for sulfuric acid plants that achieves increase in high and low pressure steam production while reducing safety risk.

Learn more at clarksolutions.com.br



**USA**
411 SE Mizner BLVD #72
Boca Raton FL 33432-6001

**Brazil Office**
281 Av. Moema
Moema / SP 04077-020

**Embu Plant**
91 Dn. Joaninha - Moinho Velho
Embu das Artes / SP 06807-690

**Chile Plant**
Volcan Lascar 801,2H
Pudahuel - Santiago - Chile

Clark solutions

clarksolutions.com.br | /clarksolutionsoficial | /company/clark-solutions-brasil