

COVERING BEST PRACTICES FOR THE INDUSTRY

Sulfuric Acid

T O D A Y

www.H₂SO₄Today.com

Fall/Winter 2017



ASARCO's copper plant investment yields two-for-one: cleaner air and longer life Page 7



IN THIS ISSUE > > > > **Phosphate production in North America likely to trend down** PAGE 10

Reduced turnaround frequency is hard on acid cooling equipment PAGE 26

Detecting moisture leaks by measuring process gas dew point PAGE 30

Do small, modular acid plants fit in a world of mega plants?

By: Nelson P. Clark, Alexandre C. Bastida, Bruno B. Ferraro, and Vitor A. Sturm, Clark Solutions, São Paulo, Brasil

Sulfuric acid plants get bigger and bigger. Thirty years ago a 2,000 TPD acid plant could be called a large plant. Nowadays, plants as big as 4,500 TPD and 5,000 TPD are becoming common. In our current scenario, is there space for small 100-250 TPD acid plants?

While large smelting and fertilizer complexes are required to produce large amounts of acid either for pollution control purposes or as raw material, small consumers still struggle with logistics and supply reliability.

A small acid consumer in Brasil, Kalium Mineração, chose to build its own sulfur burning plant instead of buying acid. Due to the remote plant location, the company acquired a 150 MTPD modular, skid mounted plant.

The plant

Clark Solutions designed the 150 MTPD, sulfur burning, single absorption, hydrogen peroxide tail gas scrubber acid plant. Due to the logistics of the Kalium site, the company decided to build the plant on modular skids, which would be placed on civil basis and tied to each other at the site.

The plant consists of these 9 modules (skids), each one with the dimensions of a 40-foot standard container, or smaller:

—A sulfur melting and filtering skid: Consists of the sulfur melting and filtering areas and was designed to melt and filter up to 6 metric tons per hour of solid sulfur.

—An air drying skid: Consists of a high silicon stainless steel pump tank, drying tower, and piping.

—A compression and sulfur burning skid: An air blower followed by a horizontal, fixed spray gun refractory lined burner, followed by the waste heat boiler. Saturated steam is produced at 10 bar for use at site operations.

—A No. 1 converter skid: Gases from the waste heat boiler are admitted on a computerized fluid dynamics designed oblong converter with two passes separated by a superheater.

—A No. 2 converter skid: Gases from the first converter are admitted on the No. 2 converter, which

shares the same dimensions as the No. 1 converter. Cooling of gases going to pass No. 4 is made by dilution air. From pass No. 4, the gases are cooled to 220 C on a boiler/economizer before being admitted into the SO₃ absorption skid.

—A SO₃ absorption skid: Consists of a highly resistant austenitic stainless steel tower, pump tank, and piping system.

—Two boiler skids: These boilers are placed after conversion passes to produce steam at 10 bar.

—An H₂O₂ scrubbing skid: The single absorption arrangement does not allow conversions higher than 98.5 percent. The remaining unconverted SO₂ is driven to a plastic hydrogen peroxide scrubber where the acid gas reacts and turns into sulfuric acid. The acid produced is consumed as dilution in the plant.

The area required for Kalium's acid plant is minimal. With very open space for maintenance and operation access, and large aisles between skids, the total area required by the plant is smaller than 500 square meters.

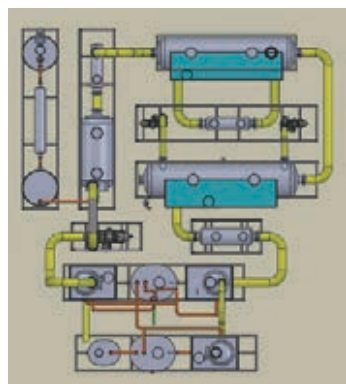


Fig. 1: Plant arrangement.

Production and consumption figures

The plant features a few interesting aspects, such as the production of low pressure steam, which Kalium's process requires and would otherwise be produced by burning fuel. Because the plant is a single absorption plant with a tail gas scrubber, the process consumes H₂O₂ as a scrubbing agent to produce weak acid. Emissions are below 100 ppm with this arrangement and the plant can turn-down up to 70 percent as there is no interpass circuit to

MODULAR PLANT WITH SAFEHR®					
PRODUCTS			RAW MATERIALS		
H ₂ SO ₄	TPD	150,0	SULPHUR	MTPD	49,5
			DILUTION WATER	TPD	22,6
STEAM	TPH @ 10 BAR (PROCESS)	8,0	H ₂ O ₂	KG/H	40,0
	TPH @ 10 BAR (SAFEHR)	3,0	COOLING WATER	M3/H	18,0
	TPH @ 10 BAR (TOTAL)	11,0	ELECTRICAL POWER	kW	300

MODULAR PLANT WITHOUT SAFEHR®					
PRODUCTS			RAW MATERIALS		
H ₂ SO ₄	TPD	150,0	SULPHUR	MTPD	49,5
			DILUTION WATER	TPD	22,6
STEAM	TPH @ 10 BAR	8,0	H ₂ O ₂	KG/H	40,0
			COOLING WATER	M3/H	180,0
			ELECTRICAL POWER	kW	300

affect the thermal balance.

An interesting approach being evaluated, given the need for low pressure steam, is the use of Clark Solutions' patented indirect heat recovery system, Safehr®. On Safehr®, strong (99.0-99.5 percent) hot acid at 200 degrees C is used to absorb the SO₃ at the tower. This acid, due to the heat of reaction, heats up to 220 degrees C and is cooled on a 310SS heat exchanger by heating Clark Solutions' proprietary fluid, CS 270.

The fluid is totally inert to acid and water, so in the event of an acid leak into the system, there is no risk of producing dilute acid and thus, no risk of catastrophic corrosion initiated by a leakage. In fact, as there is neither dilution nor heating of the acid, the leak will not increase as it normally

does in heat exchangers, and the plant can even operate with an acid leak into the fluid, allowing programmed decisions on when and how to shut-down. No emergency shut-downs will happen.

Safehr® helps to increase the steam generation by almost 40 percent, and for each ton of acid, Safehr® can produce up to 0.50 additional tons of steam. Besides increasing steam production, Safehr® actually reduces the requirement for cooling water in a conventional tower.

Overall benefits

The overall benefits of smaller modular acid plants include:

—Steam and side products: Steam is a by-product of the process that can be a very valuable asset. The tail gas scrubber

can also be designed to produce other by-products such as ammonium sulfate and sodium sulfate, among others.

—Reduced transport costs: Transportation, especially in places with limited infrastructure, is reduced both in terms of the amount of transport (3:1) as well as the inherent transport risk. Acid spills are more dangerous and harmful than solid sulfur spills.

—Smaller storage requirement: Sulfur can be stored in open or enclosed piles and consumed as required, while acid requires large tanks.

—Safer construction: The modular design concept eliminates risks inherent to site construction. Modules are shop fabricated under much more stringent safety conditions.

—Quality construction: Modules are shop fabricated and tested, guaranteeing a superior quality.

Conclusion

Even though acid plants are getting bigger and bigger, small, modular acid plants will continue to find applications for those customers who need 50-250 MTPD of acid and can benefit from the steam or power generated in such plants.

For more information, please visit www.clarksol.com. □

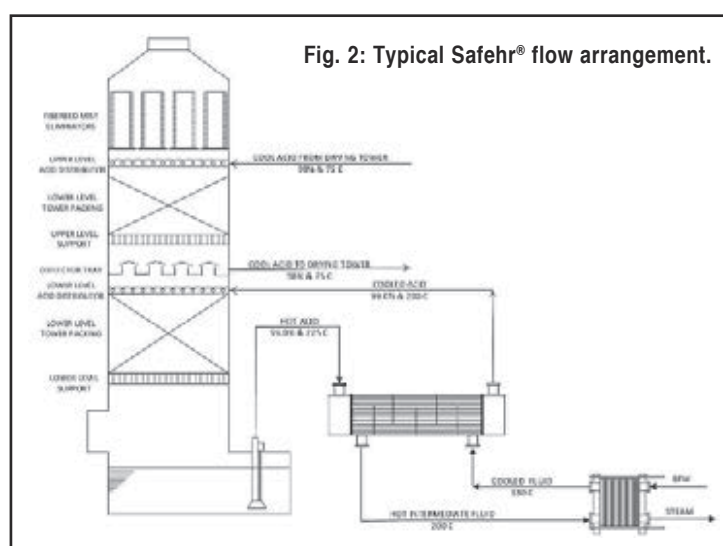


Fig. 2: Typical Safehr® flow arrangement.

MORE THAN EQUIPMENTS, **SOLUTIONS**

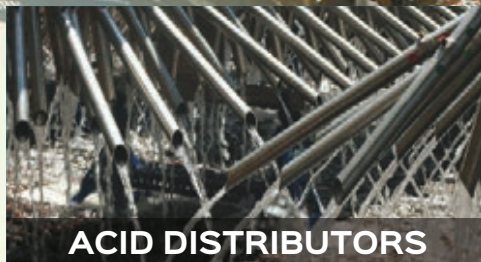
Mist Eliminators: MaxiMesh® and FiberBed®

Tower Internals: MaxiSaddle® and MaxiDome®

Acid Distributors: Through & Downcomers / Pipe Distributors.



MIST ELIMINATORS



ACID DISTRIBUTORS



TOWER INTERNALS

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

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

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

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



Faces & Places



Ed Knoll of Acid Piping Technology, left, Darwin Passman of VIP International, center, and Alex Knoll of Acid Piping Technology, right, visit during a dinner hosted by Weir Minerals Lewis Pumps during the AIChE Central Florida Chapter Convention in Clearwater, Fla.



From left, Nathaniel Bepperling, Eric Betournay, and Eduardo Cabera, all of Brunswick Smelter-Glencore, enjoy a session break during the 2017 Sulfuric Acid Roundtable in The Woodlands, Texas.



Visiting during Chemetic's hospitality suite held at the AIChE Convention in Clearwater, Fla. are, from left, Herbert Lee and Boris Nestic of Chemetics, Mark Salzbrener and Brad van Scoik of Veolia, and Bob Whitters of Chemetics.



Eco Services and Solvay's Baton Rouge, La. facilities participated in United Way's Jambalaya Jam cook-off in downtown Baton Rouge to benefit the local community. Pictured are, from left, Robert Mollier, Corey Wheat, Bruce Mayberry, Brad Touhey, Robert Musselman, Brittany Burton, and Daniel Tate.



Claude Champagne of Border Chemical, left, was the lucky door prize recipient from Brad Varnum of Central Maintenance & Welding, right, during the casino night networking function at the 2017 Sulfuric Acid Roundtable in The Woodlands, Texas..



The culinary team for this year's welcome Cajun Dinner at the 2017 Sulfuric Acid Roundtable in The Woodlands, Texas consisted of Randy Stanfill of Weir Minerals Lewis Pumps, left, Stan Miller of VIP International, center, and Hoss Maddry of VIP International. The crew prepared some delicious jambalaya, etouffee, corn maque choux, and fried fish from the day's fishing tournament.



Becky and Jack Harris of VIP International served some delicious etouffee and corn maque choux to the participants of the 2017 Sulfuric Acid Roundtable at The Woodlands Resort in Texas.



Catching up with one another at the AIChE's Central Florida Convention in Clearwater, Florida are, from left, Guy Cooper of NORAM Engineering & Constructors, George Wang of Acid Tech, and Nelson Clark of Clark Solutions.



Participating in the golf tournament at the 2017 Sulfuric Acid Roundtable at The Woodlands Resort are, from left, Bryan Argenbright of Ramco Manufacturing, Graeme Cousland of Begg Cousland Envirotec, Corey Muller of Outotec, and Steve ShROUT of Ramco Manufacturing.



Enjoying MECS' hospitality suite during the AIChE's Central Florida Convention in Clearwater, Fla. are, from left, Carlos Iwaszkowicz of MECS, Eugenio Barriga of Innophos, and Jose Antonio Cabrera of Innophos.



Michael Garcia of Tesoro, right, tries a hand-rolled cigar at the 2017 Sulfuric Acid Roundtable in The Woodlands, Texas.



Kleber Juado of Southern Peru Copper Corp., left, visits with Robert Maciel of Chemetics in his company's booth at the 2017 Sulfuric Acid Roundtable in The Woodlands, Texas.