Buckman

Evaporator fouling reduction saves ethanol plant $400k per year!

Background

An ICM 115 MGY ethanol plant was realizing heavy mineral fouling in their evaporators resulting in elevated steam pressures that inhibited the plant from increasing production rates. Sulfuric acid was being utilized to drop the pH in an attempt to alleviate fouling tendencies. Chemical and maintenance costs along with employee exposure to a dangerous chemical were increasing as frequent CIPs and bi-annual hydro-blasting were required to keep the plant operating at less than desired production rates.

Action

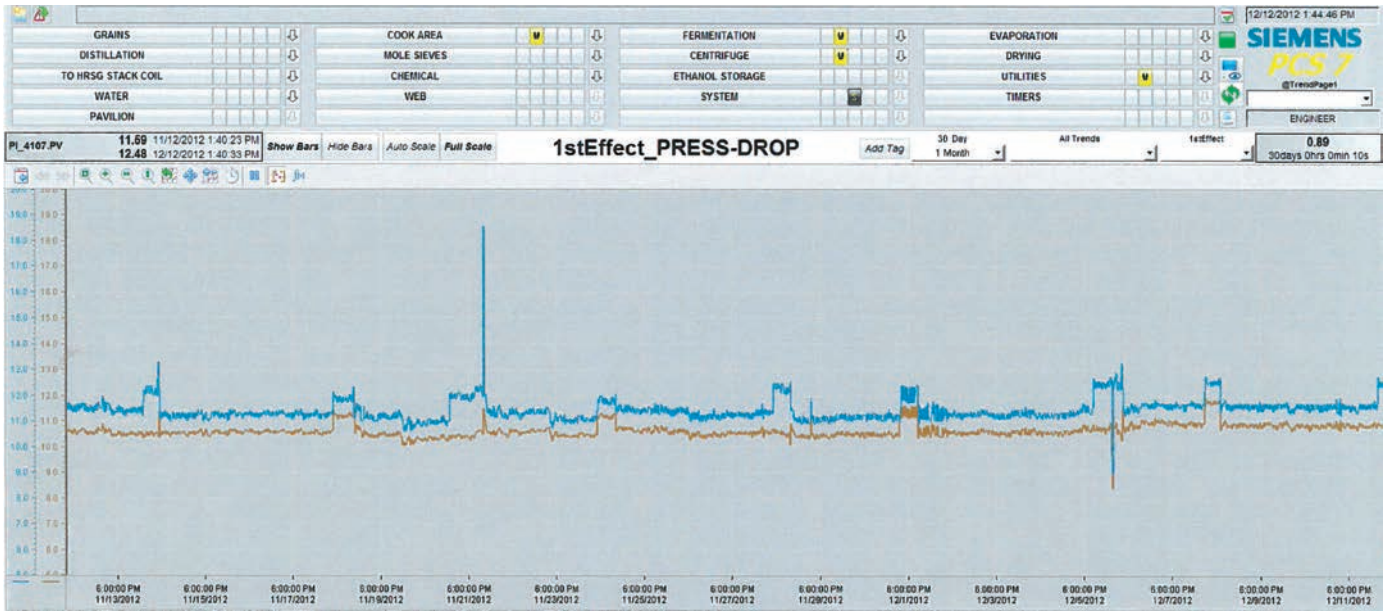
Buckman analyzed the mineral fouling and determined that calcium oxalate (Beerstone) was the main cause of the fouling. Bulab® 8301 was developed and administered due to its ability to reduce calcium oxalate deposition in process operations where high temperatures exist in conjunction with relatively higher pH ranges. Bulab 8301 was fed into the thin stillage stream with the use of a programmable metering pump proportional to thin stillage flow at a recommended rate of 10 ppm, well below the 20 ppm allowed under FDA regulations.

Results

The plant was able to reduce sulfuric acid usage by 45% (0.75 truckloads/week), decrease CIP frequency, increase process pH, increase syrup solids from 31% to 37%, improve water balance, significantly decrease hydro-blasting (zero in 30 months— still counting), operate beer column more consistently reducing steam usage and base losses, decrease employee exposure to unloading of acid, reduce maintenance costs associated with acid pumps/piping and maintain lower DDG sulfur levels.

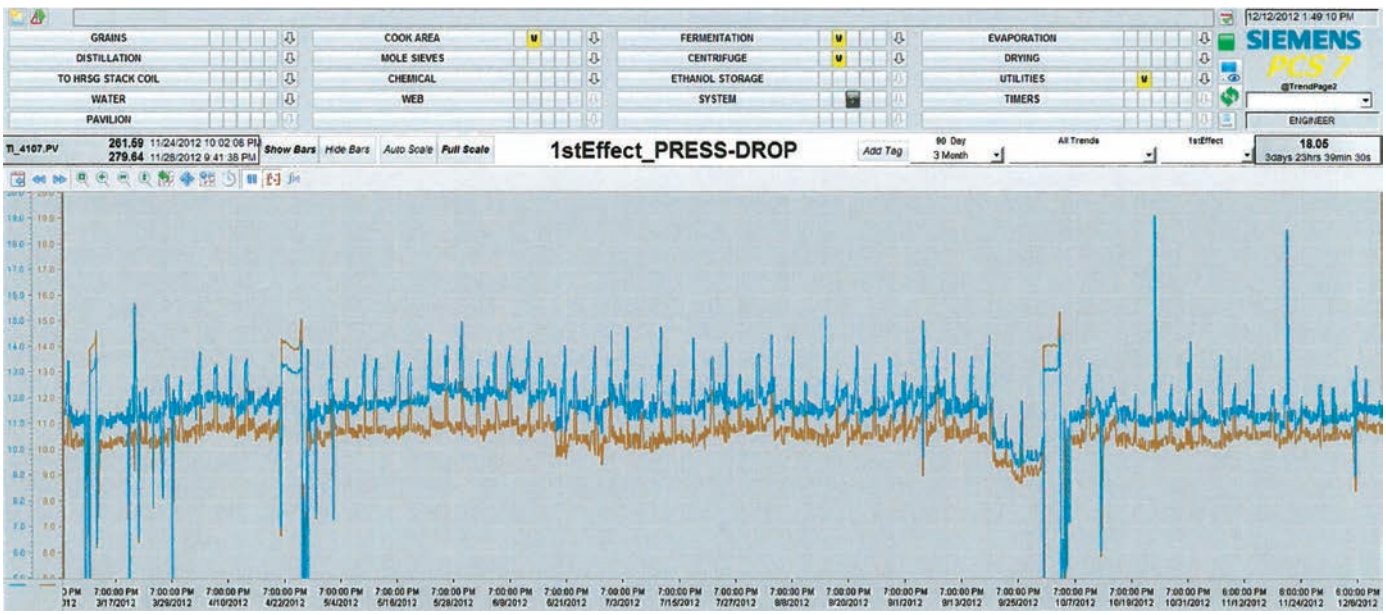
Evaporator pressure graphs

Graph 1. Three-month graph



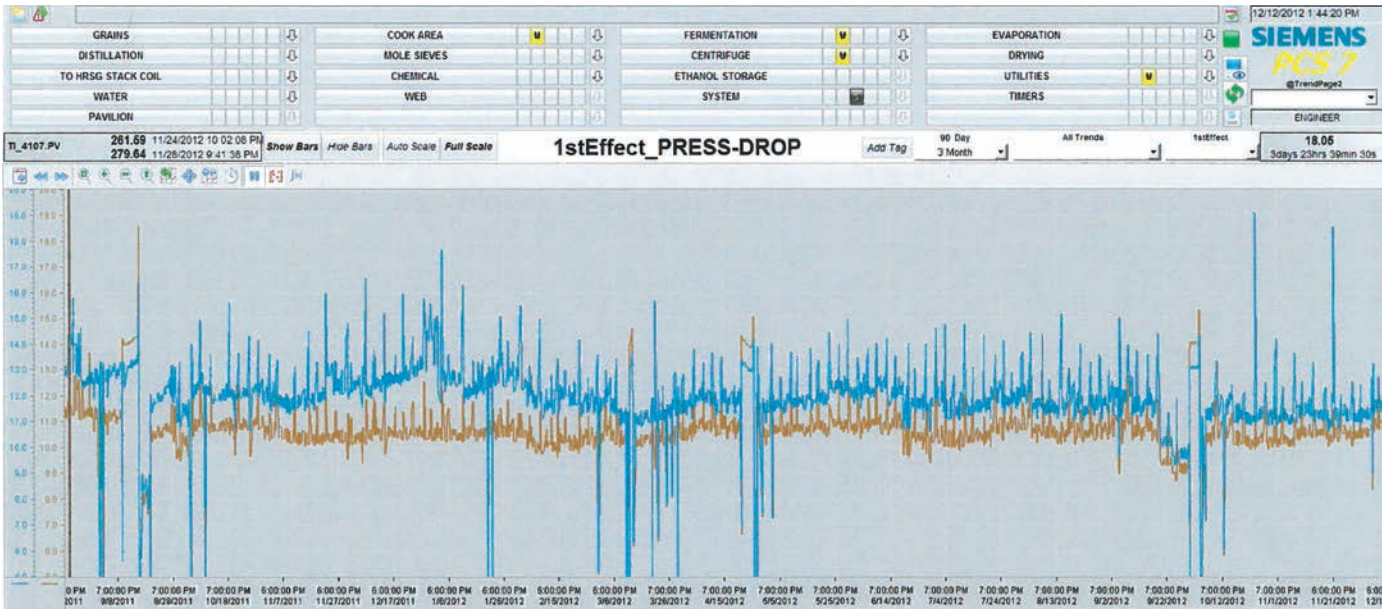
Graph 1 shows that the plant has settled into a CIP schedule that consists of 2 CIP's/week. When trying to reduce to 1 CIP/week slight pressure increases were realized. The blue line depicts the incoming steam pressure to the 1st effects and the orange line depicts the pressure going to the 2nd effects. Delta P is consistent as steam to the 1st effects was slightly increased near the end of the month. This has been the case at all operational rates across the past three years.

Graph 2. Nine-month graph



Graph 2 shows that even as steam was increased to the first effects in conjunction with increasing plant rate, the pressure to the second effects did not increase, indicating that fouling did not occur or change during that time.

Graph 3. Fifteen-month graph



Graph 3 shows same results as the 15-month graph. (Power outage occurred in December resulting in a degree of fouling as recirculation was off while heat stayed on. A pressure sensor froze up during the month of January.)

Economic savings

Results	Savings	Assumptions
Sulfuric acid	$ 187,000	39 trucks/yr @ $200/ton
Hydro-blasting	$ 82,500	Clean all 8 every 2 years
Evap steam	$ 175,000	3,000 lbs/hr @ $3.25 natural gas
Safety	✓	Return on Environment – less handling, trucks to unload
Maintenance	$ 10,000	Replace one acid pump, labor, piping
Increased production rate	Per plant	Varies/plant depending on design etc.
CIP frequency reduction	✓	Varies/plant
Total:	**$ 454,500**	**Annual savings**

Additional information

The information above is from a 115 MGY ICM designed ethanol plant that has been using Bulab® 8301 for more than four years. The plant has been operational for less than five years. During the past several years the plant has operated at different rates due to negative margin environments. The pH of the thin stillage has been consistent around 4.8 for the past couple of years while the solids have changed due to the introduction of corn oil extraction equipment. Solids were as high as 37% in the past but currently operate around 29%. It took time for the plant and Buckman to tweak operational procedures in order to fully realize all of the benefits stated in this case history. The plant believes the corn oil centrifuges are staying cleaner compared to others utilizing the same corn oil removal technology. This plant was using Bulab 8301 prior to installing the corn oil separation equipment, so it has no basis of comparison regarding before and after. The plant is only CIPing the corn oil centrifuge once per week.

The plant and Buckman have determined that best practice is to start using Bulab 8301 with clean heat exchanger surfaces. Starting with fouled or partially fouled surfaces will result in moderate pressure increases with increased steam usage as

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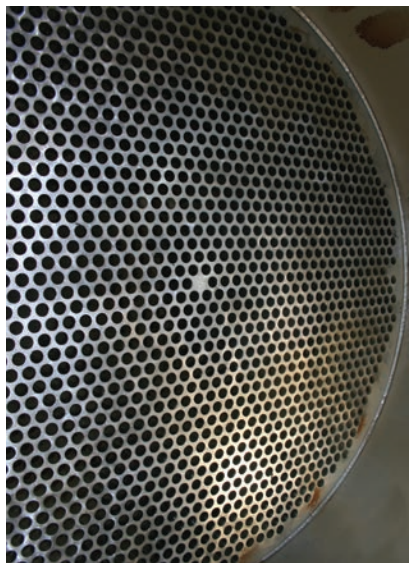
Bulab 8301® does NOT remove existing beerstone – only mitigates the formation of beerstone. Below are before and after pictures of Evaporator #8 tube sheets.

Photo above was taken shortly after beginning usage of Bulab 8301.



These photos were taken after implementing the Bulab 8301 application with no hydroblasting occurring for 18 months.

The recent addition of phytase-based products has masked the beerstone concerns in an ethanol process as high phytase dosages have resulted in elevated levels of magnesium phosphate which precipitates onto hot metal surfaces very easily. This fouling is much higher than typical beerstone levels, leading plants to focus on the magnesium phosphate issue, while forgetting there is still beerstone forming at the same time.

Bulab 8301 has the potential to assist in others areas within the ethanol plant where beerstone is prevalent. These areas are primarily the beer column top trays and mash exchangers.

Conclusion

The use of Bulab 8301 has great financial and process implications in assisting the ethanol plant operator. Understanding how to best implement the solution will set the plant up to succeed for many years to come.

Learn more

Let Buckman help fuel your success. To find out more about our fuel ethanol water treatment programs, contact your local Buckman representative, or visit us online at **buckman.com**.

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