CASE STUDY

Fatima Fertilizer Saves $610,000 and improves performance using Nalco Water PURATE™ Technology

eROI℠ by Ecolab

BACKGROUND

The Indus River Valley is the breadbasket of Pakistan. The river supports a population of close to thirty million people and a huge agricultural industry. Fatima Fertilizer supports agriculture in the area by producing ammonia, nitric acid, urea, and other fertilizers at their facility in Sadiqabad. Over the past decade, changes in agricultural practices and a growing population have put stress on the local water supplies, prompting local industries to look for ways to reduce their impact on this critical resource.

SITUATION

Ammonia fertilizer plants utilize recirculating cooling water in many processes. The cooling water chemical treatment program must not only prevent mineral scale, corrosion and microbial fouling, it must also tolerate ingress of ammonia from plant processes into the recirculating water.

Fatima Fertilizer used a blend of bleach (NaOCl) and bromine (NaBr) to control microbial growth. Normally a very robust treatment program in systems with ammonia contamination, particularly when compared to bleach alone, a bleach/bromine microbial control program has limitations.

Reduced nitrogen, especially ammonia, reacts with chlorine to make chloramines, which are poor antimicrobials. The hypobromous acid (HOBr) formed in a bleach/bromine program also reacts with ammonia, but unlike chloramines, bromamines are excellent antimicrobials, which is why Fatima Fertilizer maintained good microbial control in their cooling towers.[1]

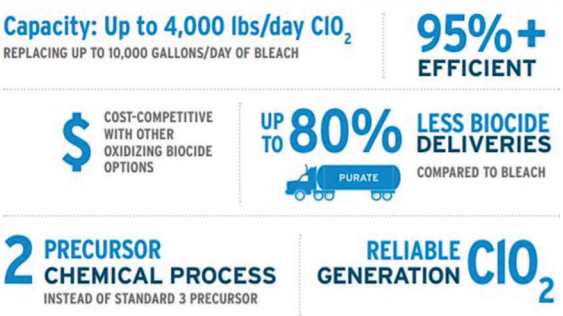

Figure 1: PURATE Technology offers benefits over bleach and bleach/bromine programs

ANNUAL SAVINGS

WATER

Reduced make-up water by 16%
(1.2 million m^3/year)

COSTS

US$120,000
Reduced water costs

US$375,000
Eliminated bleach and biodispersants

US$115,000
Reduction antiscalant costs

ASSETS

Reduced corrosion rates by 43%

Maintained excellent microbial control

TOTAL VALUE DELIVERED

US$610,000

NALCO Water
An Ecolab Company

Although a viable chemical solution, operationally and mechanically, there was room for improvement. High chloride concentrations can cause corrosion damage, particularly stress corrosion cracking (SCC) in stainless steels. At Fatima Fertilizer, steel corrosion rates were generally 3.5 mpy. High chloride concentrations limited cycles of concentration. The plant controlled the cooling system at 3.5 cycles of concentration, which increased make-up rates to the cooling system.[2]

SOLUTION

Chlorine dioxide is a biocide generated in-situ by reacting a precursor with acid to produce chlorine dioxide gas. Chlorine dioxide is highly soluble in water. It diffuses into biofilms. It doesn't hydrolyze like chlorine gas or bleach. It's effective at higher pHs and it doesn't react with most organics and ammonia. It is less aggressive toward other water treatment chemicals than other biocides. It produces no absorbable organo-halogens (AOX) or tri-halomethanes (THM).

At Fatima Fertilizer, Nalco Water's PURATE technology produced the chlorine dioxide by reacting the PURATE product – a combination of sodium chlorate and hydrogen peroxide – with sulfuric acid to produce chlorine dioxide.

$$NaClO_3 + ½\ H_2O_2 + ½\ H_2SO_4 \rightarrow ClO_2 + ½\ O_2 + ½\ Na_2SO_4 + H_2O$$

PURATE is the simplest, most reliable and cost-effective chlorine dioxide technology available, providing superior performance in systems with high pH, ammonia-nitrogen contamination, process leaks and persistent biofilm problems.

RESULTS

The change to PURATE technology helped Fatima Fertilizer achieve their mechanical, operational and chemical goals.

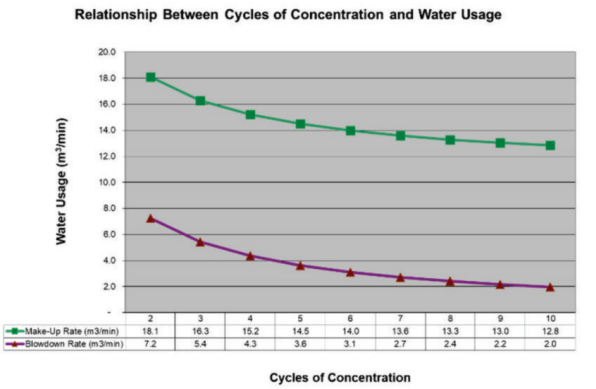

Figure 2: Increasing cooling water cycles of concentration reduces make-up water usage and blowdown.

By reducing the chloride contribution of the biocide program, cycles of concentration increased from 3.5 to 6.5 which reduced make-up water consumption by 16% from 15.2 to 12.8 m^3/min, representing an annual water use reduction of 1.2 million m^3 and a water cost reduction of $120,000 per year.

Reduced chloride concentrations also improved corrosion inhibition performance. Corrosion rates dropped from 3.5 mpy to less than 2.0 mpy. [3]

As noted above, chlorine dioxide is less aggressive toward other treatment chemicals than a bleach/bromine treatment. As a result of the change, biocide costs dropped by $375,000/year and antiscalant costs dropped by $115,000/year, representing a total chemical cost reduction of $490,000/year.

Microbial control remained consistent at about $1x10^2$ cfu/ml.

Total savings from the change to PURATE technology totaled $610,000.

[1] Microbial counts, measured by dip slides, were consistently 1x102 cfu/ml.
[2] Chloride concentrations were about 300 ppm in the recirculating water.
[3] Chloride concentrations were reduced from 300 ppm to 150 ppm.

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