Cooling Towers
2014
Common Problems Customers Face:

1- Cost

2- Compliance

3- Control (of Algae, Microbial Activity)
Cost

Customers pay too much for Delivered Chemicals for Cooling Towers

- Chemicals are diluted ~50%-75% water
- Unique chemicals with limited outcome
- Prices went up by 3X in the past decade

*US Price purchase index of aggregate industrial commodities
Compliance

Incidences forcing companies take action

- Chemical Spills – search for safer solutions
- Chlorine Gas leak – search for safer alternates
- Non-public incidences in 2013 (Paper Mill, Ammonia Producer)
Control

Imperative to Control the Microbiological Activity of the tower

June 6, 2013 – Diageo Distillery Cooling Tower Contamination; 80 people affected, 1 died
– Class Action Lawsuit is ongoing

Tower collapse due to tower fill fouling
Heat exchange efficiency loss
How MIOX can help

1) Significantly lower total cost of ownership
   ▶ MIOX and some competitive technologies can too

2) Price of the solution would stay flat year after year regardless of market (Oil, Commodities)
   ▶ MIOX and some competitive technologies can too

3) Solution would be meet all future regulations in next 20 years (such as EU regulations on biocides)
   ▶ MIOX and some competitive technologies can too

4) Complete peace of mind in controlling the microbiological activity of the tower
   ▶ Only MIOX can do
What is MIOX Electrolysis?

Brine Solution Options

1. Delivered Salt
2. Seawater
3. Waste Brine
Significantly Lower Cost of Ownership

To produce 1 lb of 100% Free Available Chlorine

Salt
3 lbs salt at $0.08/lbs (or delivered brine)

Salt Cost $0.24

Electricity
2.5 kW-hr power at $0.07/kW-hr

Electricity $0.18

Operational Cost

MIOX Cost $0.42

• per 1 gal equivalent delivered bulk Hypo at 12.5% concentration

Market Price Hypo (for delivered bulk Hypo per gal) $0.85 ~ $2.50

Market Price Bromine, Glut, IsoT $1.50 ~ $5.00
Control Legionella Better
By eliminating Pseudomonas harboring biofilm later

BETTER LEGIONELLA CONTROL

No Legionella detected at 2 mg/L Mixed Oxidant Solution (MOS) in 10 minutes. Study conducted by Larry Barton PhD, University of New Mexico, "Disinfection of Simulated Cooling Tower Water". Hypochlorite is a good Legionella disinfectant when the bacteria are planktonic (free floating). However Pseudomonas, a biofilm former organism, is more difficult to kill and can also form a protective biofilm layer for Legionella bacteria to harbor. MOS removes the biofilm and kills both microorganisms more effectively than hypochlorite.
Puerto Rico PREPA Power Plant

**Biofilm Removal → Increased Thermal Efficiency → ~7% Production Capacity Increase**

### Problem
- Proprietary biocides could not control biofilm in 40,000 ton tower. Visible biofilm/scale build up.

### Results After Using MIOX
- Improved thermal efficiency; increased production load by average of 7%, equaling to multi million of extra capacity
- <3 months payback
- Reduction in 31,000 lbs delivered chemical/year
- 57% reduction in water consumption and O&M costs
- Mixed oxidant chemistry eradicated the biofilm. Replaced the biocide regime.
NIPSCO Power Plant

Cleaner Condensers, Saving ~$160,000/yr per tower, totaling ~$640,000/yr

BEFORE MIOX

AFTER MIOX

Problem

► Proprietary biocides could not control biofilm in 90,000 ton tower. Visible biofilm build up in the condenser (seen on the left)

Results After Using MIOX

► Mixed oxidant chemistry eradicated the biofilm. Replaced the biocide regime.

► <36 months payback

► Reduced chemical cost with complete biofilm removal

“Reducing our treatment regimen ...down to a single mixed oxidant product generated on site has resulted in substantial treatment chemical and labor cost savings.”

--Paul Schrock, NIPSCO Senior Chemist
Thank You

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