

# Mixed Oxidants Generator Improves Cooling Tower Overall Treatment



Cooltech Water Treatment  
When efficiency matters

Husam Smadi



# Presentation Overview

## Chemistry Background

- General background on On-Site Oxidant Generation

## Implementation of MOS at Selected Site

- Cooling Tower and MOS System Selection, and application of the new Biocide treatment program.
- Integration of Online Monitoring Tools and Performance Monitoring Tools.

## Results and Lessons Learned

- Biological Growth Control
- Impact on Corrosion and Scale/Fouling formation
- TCO and Environmental Impact of Miox in Cooling tower application



# On-Site Generation (OSG) of Biocides

*OSG biocide production is accomplished through the electrolysis of a sodium chloride brine stream to produce a chlorine based biocidal solution*

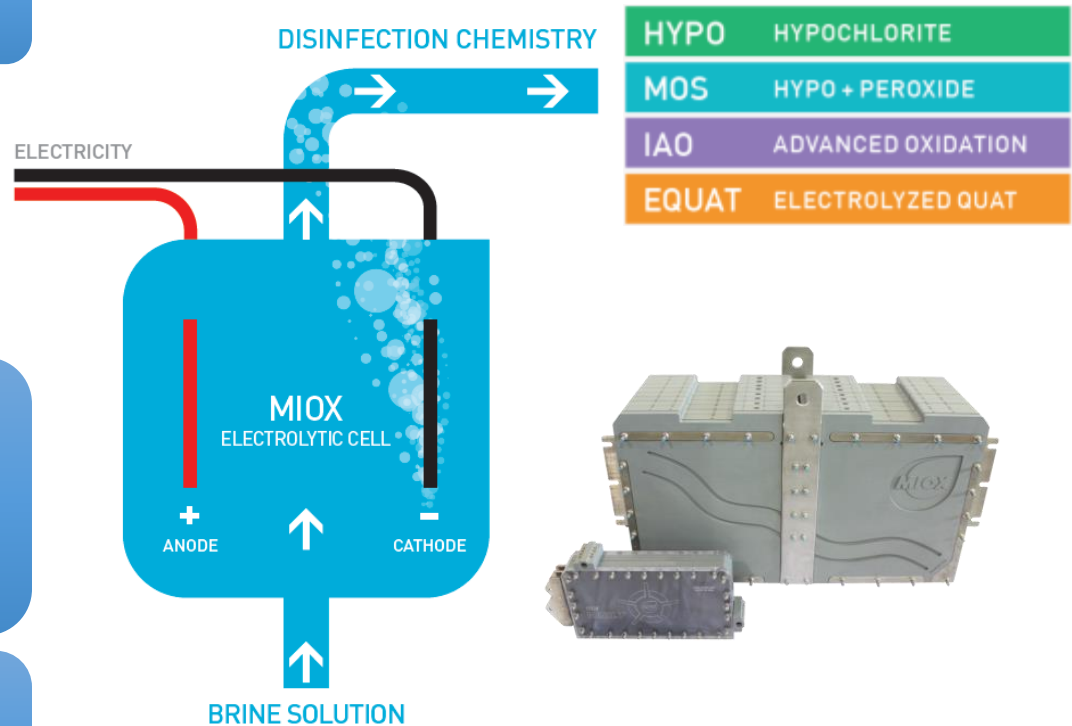
Electrochemical reactions occur on both the anode and cathode

- Primary anode reaction: chlorine production through chloride oxidation ( $2 \text{Cl}^- - 2\text{e}^- \rightarrow \text{Cl}_2$ )
- Primary cathode reaction: reduced of oxygen to produce hydrogen peroxide ( $\text{O}_2 + 2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2\text{O}_2$ )

MOS Produced at lower concentration (0.45%):

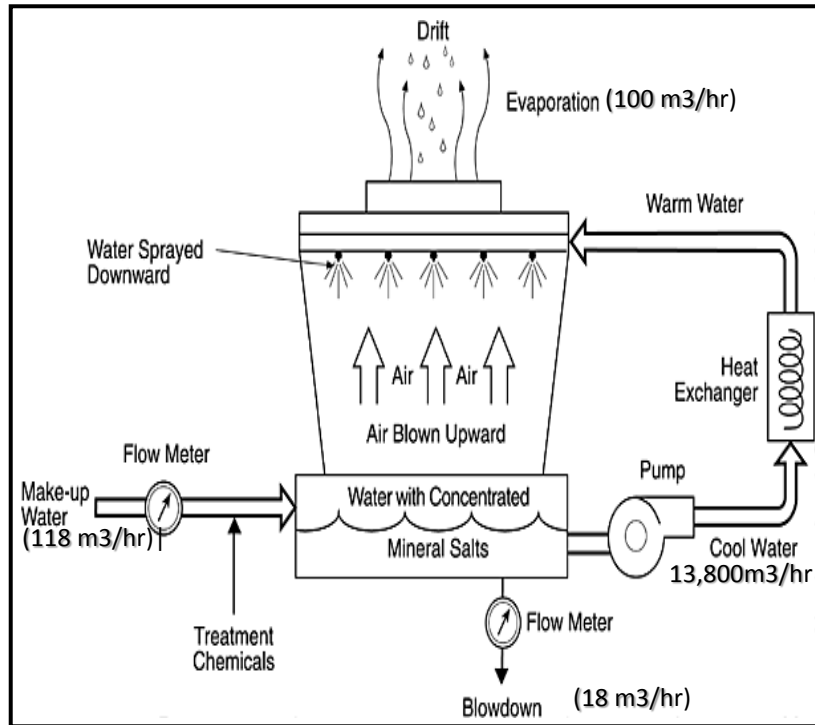
- More stable
- Un-Harmful

Revolutionary efficacy is derived from the 2nd oxidant present in the solution – Hydrogen Peroxide, which co-exists for 24-48 hours after electrolysis.



# Implementation of MOS at site

*An MOS system was installed for the cooling tower biological treatment in the District Cooling Plant EX-01*



Previous Biocide treatment program comprises Non-Oxidizing Biocide and Chlorine Base Biocide

Miox System (Vault M15SC) of 6.8 kg of FAC/day was installed.

Peak Water Consumption per day = 2800 m<sup>3</sup>/day, Holding Volume = 750 m<sup>3</sup>

Study monitored the last 40 weeks of operations.

# Implementation of MOS at site

*Biocide Program was replaced with MOS*

## Biocide Treatment Program

- Mixed Oxidant dose was controlled by ORP at very low level. No or negligible reserve of Free Chlorine residual was achieved.
- After transition to MOS, no additional biocides were used

## Chemical Treatment Program Monitoring

- Treatment Program was monitored by:
  - Online Tracing system for Corrosion and Scale Inhibitor chemical dosing
  - Online pH, Cond. and ORP monitoring System



CoolTech

When efficiency matters

# Integrated Online Monitoring System

## Online Performance Monitoring tools

- *Online Corrosion Monitor indicates Corrosion rates instantly for M.S and Cu*
- *Scale and Fouling Online Monitoring System.*
- *Tracker Technology monitor and control the dosing of the corrosion inhibitor*
- *ORP monitor the relative dosing of the Oxidizing Biocide and control the same*



CoolTech

When efficiency matters

# Online Scale and Deposit Monitor

## *Performance Monitoring*



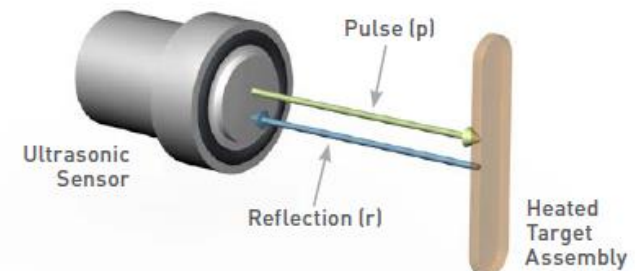
### On-Guard 3H / Scale and Fouling Analyzer

- Patented Solenis ultrasonic technology to detect and measure scale deposition as low as 5 micron.
- Allows for real time measurement of scale and provides notification of changing system conditions.
- Simulate the actual conditions of the Chiller tubes in terms of
  - Reynolds number
  - Skin Temperature



#### Working Principle

Time  $(p + r) \propto$  Scale Build-Up



CoolTech

When efficiency matters

# Case Study Results

## *Cooling Tower Biological Key Performance Indicators*

KPI	Results After Miox	Results Before Miox
Algae growth in Wet Areas	Not seen	Sometimes, depends on season
Total Bacterial Count	Under control 100 – 1,000 CFU/ml	Under control < 10,000 CFU/ml
ATP Count	< 100	< 150
ORP and Chlorine Residual	ORP is controlled at very low level < 200 mV Free Chlorine content is negligible	ORP was not controlled Extreams for ORP and Free Chlorine Residue during shock dosing



CoolTech

When efficiency matters

# Case Study Results

## *Cooling Tower Corrosion and Scale Key Performance Indicators*

KPI	Results After Miox and Optimization	Results Before Miox and Optimization
Corrosion Rates (Steel)	< 5 mpy The last two quarters were 3.5 and 3.1 mpy	5 – 7 mpy
Corrosion Rates (Copper)	0.03 mpy	0.15 mpy
Scale and Fouling Formation	Stable Tracker Technology applied	Minor increasing tendency




CoolTech

When efficiency matters

# Case Study Results

## *Cooling Tower Economics and Safety Key Performance Indicators*

KPI	After Miox	Before Miox
Pay back Period for Miox System	3 – 5 years Could be < 3 years by using smaller Miox unit size	N / A
Safety of Handling Biocides	Safe Chemical for handling 	Hazardous chemicals Corrosive
Number of Biocides Used	Only MOS generated Fresh at site using Table Salt	Oxidizing + Non-Oxidizing Biocides



CoolTech

When efficiency matters

# Case Study Results

## *Lessons Learned*

- Mixed Oxidant Solution can be applied successfully for Cooling Tower Treatment achieving better results in terms of Biological and Corrosion Results if Integrated Treatment Program and Control Equipment is applied.
- Mixed Oxidant shall be controlled by ORP meter at minimum level. High ORP due to shock dose can aggravate the corrosion of steel and copper metals.
- Smaller Miox systems can be utilized for medium size Cooling Towers



CoolTech

When efficiency matters

# Miox General Installation

## *Miox Foot Print*

