

- SIMPLE
- COST EFFECTIVE
- RELIABLE



**Strong Support Organization**  
Experienced Engineering/  
ClO<sub>2</sub> Team



**Engineering Resources**  
Generator Housing and  
Tank Equipment/Design



**System Monitoring**  
Performance Management



**On-Site ClO<sub>2</sub> Production**  
Best-in-Class Equipment  
and Chemistry



**Generator KPI On-Line  
Tracking/Chemical Inventory  
Management**  
Automation and Efficiency  
Management

## The PURATE program – delivering results with a positive impact on your bottom line

The benefits of the PURATE program have been validated in various case studies in multiple industries and applications.

DOCUMENTED PURATE BENEFITS	APPLICATION
<b>Less Biocide Deliveries</b> 80% fewer deliveries compared to bleach	POWER PLANT
<b>Reduction of Objectionable By-Products</b> 47% - 98% 100% – non-detectable	POWER PLANT STEEL PLANT
<b>Reduction of Corrosion Rates</b> 90% copper metallurgy 66% mild steel	POWER PLANT REFINERY
<b>Microbial Control Improvements</b> > 90% reduction	REFINERY
<b>Condenser Flow Increase</b> 4,400 GPM (+13%)	POWER PLANT
<b>Condenser Inlet Temp Decrease</b> 0.9 - 2.7°F	POWER PLANT
<b>Heat Exchanger Improvement</b> 400%	REFINERY
<b>TCO (Total Cost of Operation) Reduction</b> > \$0.2M (-15%) \$1.0 - 2.6M \$2.7M	STEEL PLANT POWER PLANT PETROCHEMICAL PLANT

### What customers say about PURATE

“The cost benefits from implementing PURATE are considered to be significant. Based on this finding, permanent installation was recommended.”

*Power Plant Engineer*

“Even though there is no cost reduction for the biocide program, the operational benefits are very positive for us.”

*Power Plant Operations Manager*

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**NALCO** Water  
An Ecolab Company

# PURATE™

A BEST-IN-CLASS BIOCIDES PROGRAM  
SIMPLE • RELIABLE • COST EFFECTIVE

ON-SITE CHLORINE DIOXIDE GENERATION



**NALCO** Water  
An Ecolab Company

## Your Operations Face Unique Challenges...

Security concerns, regulatory discharge limits, contaminated and changing water conditions in combination with the use of an ineffective biocide program and poor monitoring can negatively impact the bottom line of your industrial operation.



### SAFETY

Increasing concern for safer on-site delivery and operations



### DISCHARGE REGULATORY FINES

Violation of NPDES Permit due to discharging higher amounts of AOX, THM and HAA



## INCREASE THE TOTAL COST OF OPERATIONS

# PURATE

NALCO Water's PURATE program is a best-in-class biocide program for challenging water conditions, designed to improve efficiencies and reduce costs.

**PURATE brings together turnkey technologies and services to maximize results.**

NALCO Water combines integrated, innovative technologies and broad application and engineering expertise to meet your individual performance goals and to maximize results.

## SIMPLE • COST EFFECTIVE •

### From chemistry production to on-site application – the PURATE program delivers the performance you need.

While chlorine dioxide is considered an effective biocide in high-demand cooling water applications, it has to be delivered in a safe, reliable and cost-effective manner. Designing the PURATE biocide program step by step from chemistry production to meeting discharge limits, we have your security, regulatory compliance and operational efficiency needs in mind.



### PRODUCTION

#### ISO-Certified Production

Best-in-class manufacturing and QA procedures



#### Chemistry Cross-Contamination Elimination

Exclusive use of designated PURATE trailers



### DISCHARGE

#### By-Products

Minimizes the formation of objectionable by-products

### Reliable generator operations

Reliability is a must in Heavy Industry. These systems have been proven in the field for over 15 years with installations now including the Power, Chemical, Steel and Paper industries. They are designed to perform under the harshest of conditions with best-in-class materials of construction, including ECTFE, Tantalum and PVDF. Generators are mounted on a 316 stainless steel frame and equipped with the latest PLC technology. System design features incorporate:

- Marine-grade cabinet for saltwater applications
- Documented Process Hazard Analysis (PHA)
- Advanced safety relays
- Redundant interlock control logic
- 40+ point Quality Control inspection



### Monitoring and innovative automation and communication technology for increased operational efficiency

The PURATE program offers a variety of options to monitor the key performance indicators of the generator and to efficiently manage the inventory of the two pre-cursors (PURATE and sulfuric acid).



#### LOCALLY

from the generator PLC interfaced with your DCS/PLC

#### REMOTELY

monitored via the performance dashboard website

In an upset situation, such as low precursor inventory or low water flow, an alert message can be sent to the local operator or the NALCO Water service representative for immediate corrective action. This process minimizes the risk of potential downtime caused by out-of-product situations or change of operational conditions.

#### Inventory Management



## 24/7 DATA TRACKING

ClO<sub>2</sub> levels and corrosion rates with 3D TRASAR™ controller technology can be tracked 24/7 to assure peak performance and extended heat exchanger life.



# PURATE

The most efficient and reliable ClO<sub>2</sub> hands-off solution

## PURATE Benefits and Superior Economic Advantages

### The ideal program for the following cooling water applications:

- Use of lake or river water; seawater; recycled (municipal reclaimed) water as make-up water
- Contamination with ammonia or organics such as oil caused by process leaks
- Challenges to meet NPDES discharge permits
- Systems with copper alloy metallurgies and high corrosion rates
- pH applications up to 10.0
- Production limitations due to poor heat exchanger performance
- Operational interruptions due to biocide feed pump failures and maintenance issues
- Challenges to meet Homeland Security requirements for chlorine gas storage

### Cost-effective, patented, two-component formula:

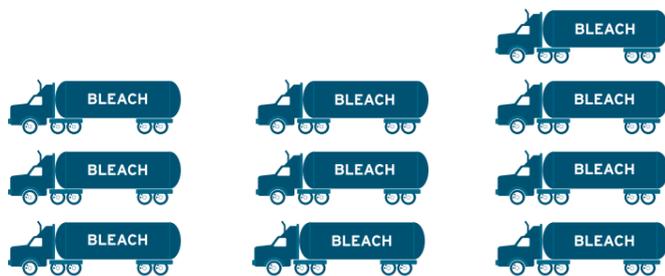
PURATE is a proprietary unique, stabilized solution of sodium chlorate (NaClO<sub>3</sub>) and hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>). The PURATE generator uses PURATE and sulfuric acid to safely produce on-site ClO<sub>2</sub>. No chlorine gas or hypochlorite are used to generate ClO<sub>2</sub> in this process.



PURATE is activated with sulfuric acid (78-98%)

**Capacity: Up to 4,000 lbs/day ClO<sub>2</sub>**  
(REPLACING UP TO 10,000 GALLONS/DAY OF BLEACH)

Benefits include: **\$ LOW OVERALL COST FOR INDUSTRIAL APPLICATION**



The potential impact of bleach deliveries can be significant compared to chlorine-based biocide programs:

**UP TO 80% LESS DELIVERIES**

**Cl<sub>2</sub> FREE<sup>2</sup>**

**95%+ EFFICIENT**

**2 PRE-CURSOR CHEMICAL PROCESS**

**RELIABLE GENERATION ClO<sub>2</sub>**



#### DECREASE OF PRODUCTION OUTPUT

Biofilm build-up can decrease heat transfer capabilities and negatively impact production



#### ASSET PROTECTION

Inadequate microbial control can result in microbiologically influenced corrosion in cooling water systems



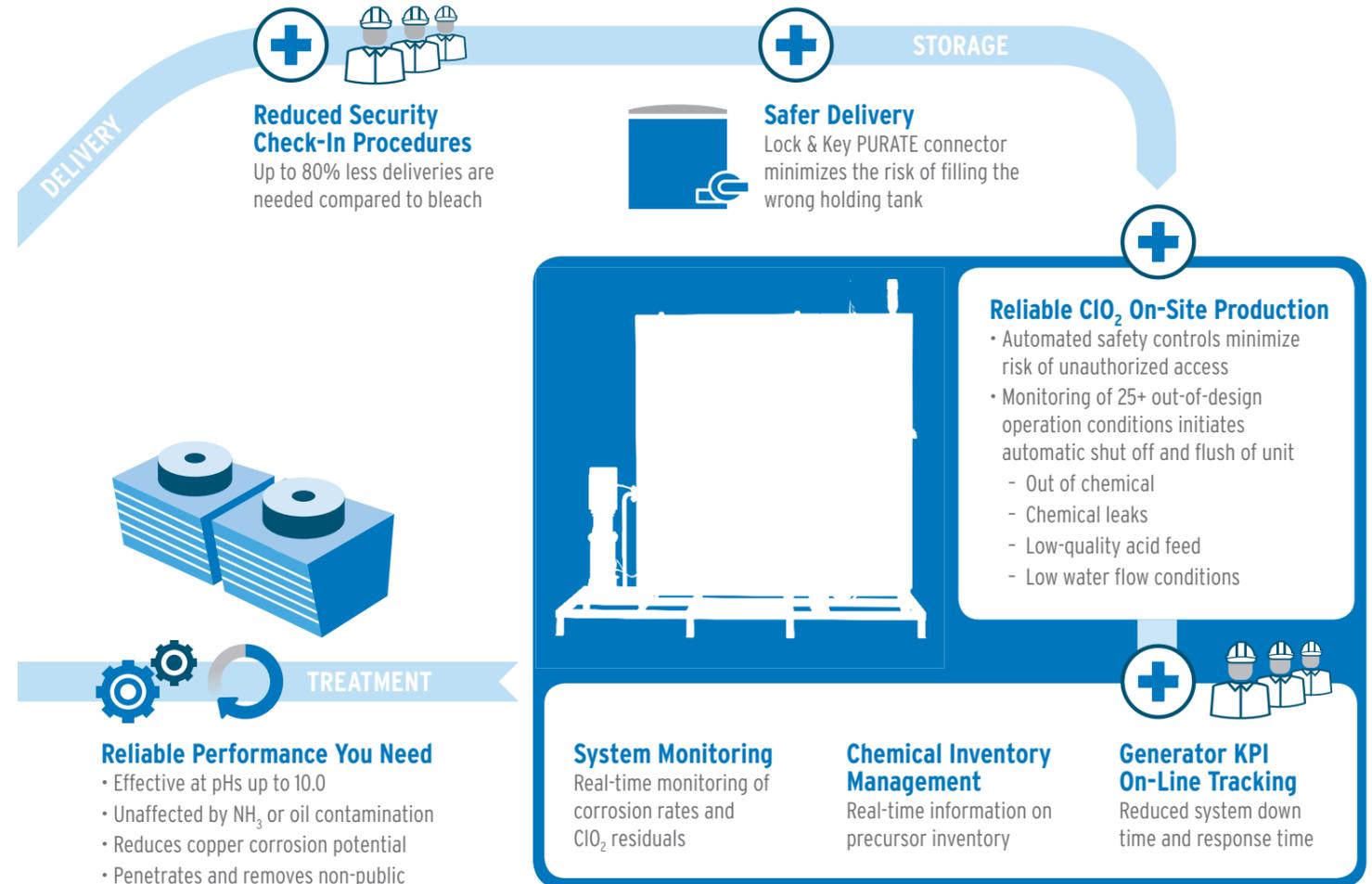
#### MANPOWER LIMITATIONS

Waste of labor resources due to a high number of biocide deliveries, maintenance and feed pump failures

## RELIABLE

### NALCO Water is your partner in water treatment.

Our dedicated water treatment experts can help you with a strategy to manage safety concerns, complex regulatory compliances and operational challenges caused by demanding water conditions. We understand the significance and financial impact of those factors on your operation. By partnering with the leading water expert, you will have access to technologies and services that will improve your operational efficiencies and help to make your operation safer and more reliable.



# CHLORINE DIOXIDE

A world-class biocide for challenging water conditions

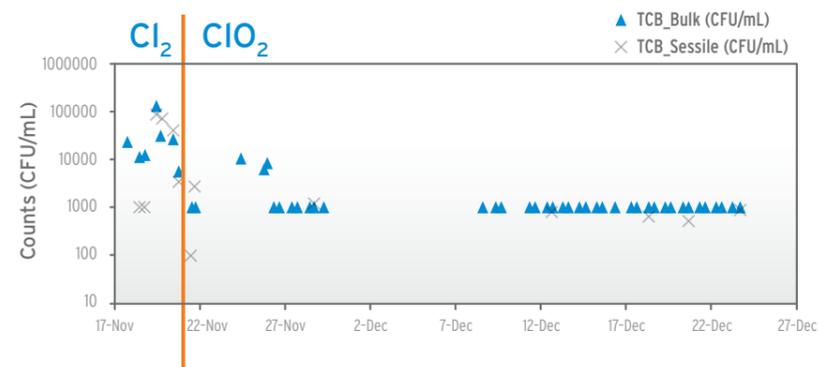
## Chlorine Dioxide Advantages

Chlorine dioxide (ClO<sub>2</sub>) is a world-class water antimicrobial that can be applied in treatment of recirculating cooling towers with the following advantages:

**Effectively reduces bacteria counts** including oil contamination compared to chlorine-based biocide programs. Less ClO<sub>2</sub> is required to achieve similar performance.

### RESULTS IN A REFINERY

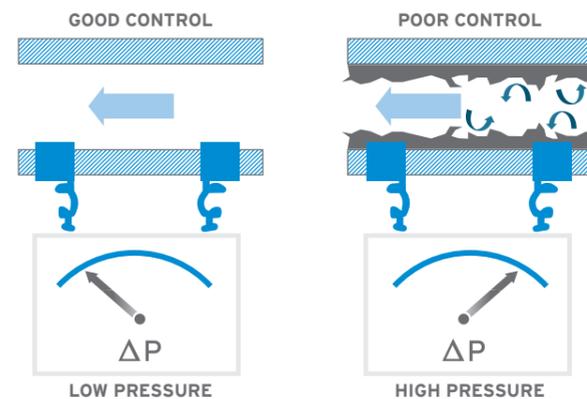
> 90% Total Count Bacteria reduction in bulk and sessile samples



**As a dissolved gas, it penetrates and removes non-public health biofilm**, helping to recover the performance of your heat exchangers (condenser and cooling tower).

### RESULTS IN A POWER PLANT

Replacing Cl<sub>2</sub> with ClO<sub>2</sub> decreased the micro-fouling and increased the flow rate through the condenser

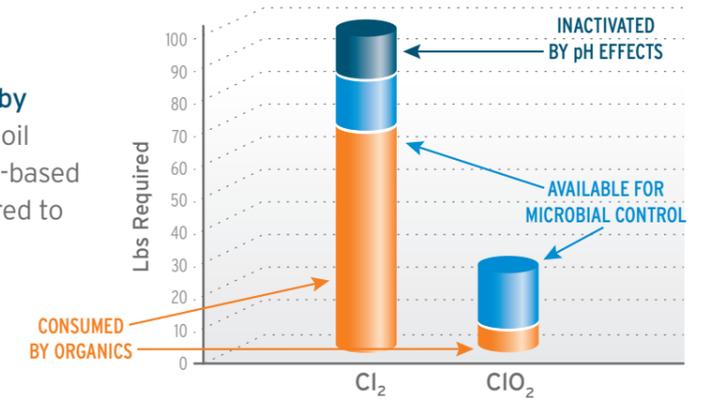


MICROBIAL FOULING CAN REDUCE FLOW AND INCREASE DELTA PRESSURE

PURATE ClO<sub>2</sub> GENERATOR FOR SMALL TO MEDIUM SIZED WATER SYSTEMS



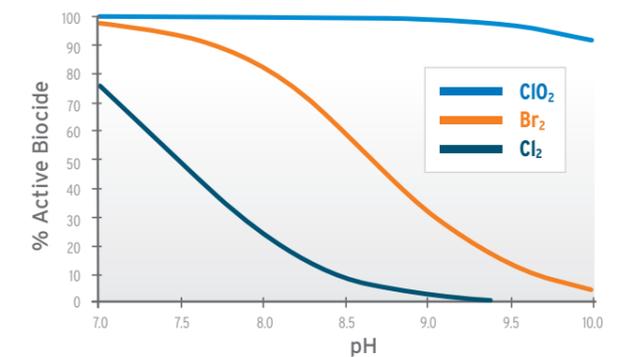
**Significantly reduces consumption by ammonia or organics loads** such as oil contamination compared to chlorine-based biocide programs. Less ClO<sub>2</sub> is required to achieve similar performance.



ClO<sub>2</sub> IS LESS AFFECTED BY pH AND CONTAMINANTS THAT CREATE DEMAND



**It is more effective at pHs greater than 7.0** compared to chlorine and bromine gas. Less ClO<sub>2</sub> is required to achieve similar performance.



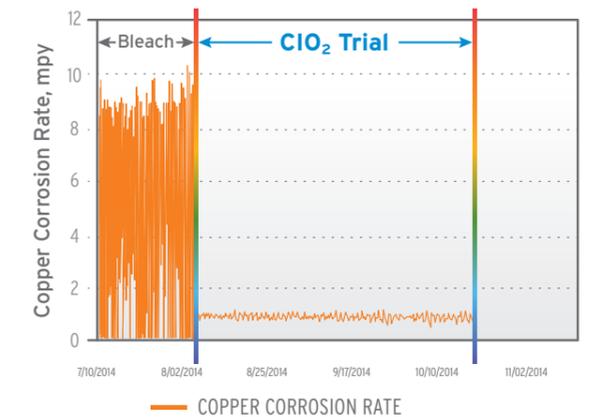
ClO<sub>2</sub> DISINFECTANT IS EFFECTIVE EVEN AT pH >9



**Reduces corrosion potentials**, helping to extend the life of assets such as condenser tubes and cooling system piping.

### RESULTS IN A POWER PLANT

Significant reduction of corrosion rate if ClO<sub>2</sub> was added to the system



**Minimizes the formation of objectionable by-products**, helping to meet NPDES permit requirements.

### RESULTS IN A REFINERY

Significant reduction in objectionable by-products after ClO<sub>2</sub> treatment, despite significant increase in oil and grease contamination

	100A Sump	
	8/11/2014	9/22/2014
Oil and Grease (mg/L)	5	39
Bromodichloromethane (ug/L)	5.6	<.5
Bromoform (ug/L)	<.5	<.5
Chloroform (ug/L)	42.3	<.5
Dibromochloromethane (ug/L)	1.7	<.5
Sample Number	NW137164	NW141291