

# INDUSTRIAL WATER DISINFECTION TECHNOLOGY (COOLING WATER SYSTEM)

**TERSUS® PowerOx 3-S** CHLORINE DIOXIDE TECHNOLOGY

## POWER PLANT – COOLING WATER SYSTEM

#### ONCE THROUGH COOLING WATER



#### RECIRCULATING COOLING WATER





## FOULING PROBLEMS IN COOLING WATER



#### Causes & Symptoms

- » Bacteria, Algae, Fungi growth
- » Microbial corrosion
- » Loss of the heat transfer
- » Loss of thermal cycle efficiency
- » Silt deposit on sticky surface
- » Tube chocking due to fouling
- » Reduction of Condenser Vacuum
- » Frequent condenser tube leakage

#### Causes & Symptoms

- » Mussels, Barnacels, Sepulid
- » Worms, Hydroys, Algae (sea)
- » Encrusting problems
- » Loss of water flow rate
- » Intake tunnel plugging
- » Corrosion under deposit
- » Accumulation on dispersion





## MICRO-FOULING GROWTH CYCLE





## MACRO-FOULING GROWTH & SYMPTOMS





## COOLING WATER CHEMISTRY



## WATER DISINFECTION- ANTI-FOULING

## • Oxidizing Biocides : -

- Gas Chlorine Plant \*
- Sea Water Electro-chlorination Plant (Hypo dosing)
- Ozone system
- TERSUS<sup>®</sup> PowerOx 3-S Chlorine Dioxide Technology

## • <u>Non-oxidizing Biocides : -</u>

- Quaternary Ammonia compound
- Carbamate / Isothiazolene / Bisphane





## TYPICAL SEA WATER E.C.PLANT







Water solubility for Chlorine & Chlorine Dioxide



**ATERSUS** 



**Chlorine Hydrolysis (Chlorine Efficiency LOSS)** 







Chlorine Ammonia Reaction (Chloramines') NH<sub>3</sub> + HOCl → NH<sub>2</sub>Cl + H<sub>2</sub>O





**SUSEST** 









### **Executive Summary on Advantages of ClO<sub>2</sub>** over Cl<sub>2</sub>

- $\clubsuit$  Available as gas ClO2 dissolved in Water Readily soluble
- $\clubsuit$  No-Hydrolysis at Alkaline water pH Suitable CW system
- $\clubsuit$  No-Reaction with Ammonia No Chloramines' formed
- $\clubsuit$  No-reaction with Oil & Grease Less demand
- $\clubsuit$  Effective against SRB No special treatment for SRB
- → Produced on-site, on-demand No storage hazards
- $\blacklozenge$  Almost NIL DBPs formation No TTHM / HAA formation
- → Environmental friendly due to lower demand & No-THM
- $\clubsuit$  Less corrosive due to lower demand & intermittent dosing
- $\clubsuit$  Easy integration to the existing GCP / ECP plant
- → Effective Microbial control / anti-fouling treatment
- → TERSUS<sup>®</sup> PowerOx Safe technology



# CHLORINE DIOXIDE PRODUCTION CHEMISTRY

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**SUSSES** 





 $\bullet 2 \operatorname{NaClO}_2 + \operatorname{NaClO} + 2 \operatorname{HCl} \rightarrow 2 \operatorname{ClO}_2 + 3 \operatorname{NaCl} + \operatorname{H}_2 \operatorname{O}$ 

**2** NaClO<sub>2</sub> + Cl<sub>2</sub> --> 2 ClO<sub>2</sub> + 2 NaCl

**\odot** 5 NaClO<sub>2</sub> + 4 HCl --> 4 ClO<sub>2</sub> + 5 NaCl + 2 H<sub>2</sub>O





# "TERSUS® POWEROX 3-S" CHLORINE DIOXIDE TECHNOLOGY

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## TERSUS® POWEROX 3-S Chlorine Dioxide Technology

## o <u>Safety: -</u>

"Safety" is our utmost priority for power plant application, a system that is free from hazard and avoidance of any possible accident have to be incorporated in the system design.

These features are;

- > No storage & handling of hazardous chemicals like Chlorine/ Sodium Hypochlorite.
- > Innovative encapsulated reactor design.
- > Environmentally friendly & safe.
- > No possible escape of ClO2 due to TERSUS<sup>®</sup> PowerOx 3-S Technology & design.



## TERSUS® POWEROX 3-S Chlorine Dioxide Technology

## o <u>Savings: -</u>

"Savings" forms a basis for a technology comparison and every professional company would want to maximize its profit by reducing its costs as one of the strategy.

With that in mind, our responsibility to the customers is to assist them to optimize the operation efficiency with the lowest possible costs.

Hence, we offer following benefits;

- > Significantly lower capital investment comparing to ECP.
- > Lower operating costs.
- Lesser routine maintenance.
- > Eliminating unnecessary chemicals or biocide.
- > Largely reducing the use of electricity comparing to ECP.
- > Improved ClO2 yield with TERSUS<sup>®</sup> PowerOx 3-S Technology.



## TERSUS® POWEROX 3-S Chlorine Dioxide Technology

## o <u>Solution: -</u>

"Solution" forms a basis of fulfilling the requirement achieving our customers objectives are pivotal to our business success. We are tasked to provide solutions that are align to our customers' objectives.

Hence, we offer following guarantees;

- > Eliminating bio-fouling in the cooling water system.
- Increase the efficiency of turbine condenser by effective antifouling treatment.
- > Reduce "break-down" time.
- > Minimize effluent as per regulatory guidelines.



## TERSUS® POWEROX 3-S Chlorine Dioxide Plant Layout



## TERSUS® POWEROX 3-S Chlorine Dioxide Plant Layout



## CHLORINE DIOXIDE PLANT 1600 MW POWER PLANT – INDIA (2005)



## CHLORINE DIOXIDE PLANT 1600 MW POWER PLANT – INDIA (2007)





## CHLORINE DIOXIDE PLANT CAPTIVE POWER – STEEL PLANT (2010)





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# THANK YOU...



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