# **ELCHLOR**<sup>™</sup> BROCHURE

www.cumberlandec.com

# **CLEAN AND SAFE WATER** FOR OIL AND GAS, OFFSHORE MARINE AND INDUSTRIAL APPLICATIONS.

With an emphasis on process design and a commitment to research and development.



# ELECTROLYTIC HYPOCHLORITE GENERATION



Many industries today use large quantities of water for process cooling. Power generation plants, chemical plants, refineries, LNG facilities, paper mills, steel works etc. In addition, in many areas of the World, desalination of seawater and brackish water by flash evaporation or membrane process is commonplace.

In most cases, the presence of biofouling such as molluscs, algae or slime, cause numerous problems for plants and equipment. Fouling can adversely affect system hydrodynamics, restricting flow, increasing pumping pressures and accelerating corrosion potential. Such problems not only shorten the life of pumps, screens, heat exchangers and other plant items but also increase the operation and maintenance costs.





#### BIOFOULING

The treatment of biofouling problems is generally acceptably controlled by the addition of a disinfection process into the system. Commonly, gas chlorination has been the historic choice. However, increasingly the more efficient and environmentally sustainable technology of electrochlorination is being chosen.

Electrochlorination also known as Hypochlorination Electrochlorination is the 'onsite' instantaneous production of sodium hypochlorite solution at a safe, dilute concentration suitable for direct injection into process. The elimination of transportation and storage of chlorine gas or other disinfection chemicals means electrochlorination is now a more viable, cleaner, safer technology for today's industries.



## WHY CUMBERLAND?

Cumberland has a heritage in electrochemical processes since 1912 when Elliott Cumberland established **The Cumberland Engineering Company** to provide corrosion and scale control in industrial boilers and in 1916 launched cathodic protection systems for locomotive engines.

Cumberland is one of the Worlds leading electrochlorination manufacturers.

With an emphasis on electrochemical process design and a commitment to research and development in our field we have been at the leading edge of electrolyser technology since our formation in 1949. Our World-renowned **ELCHLOR<sup>™</sup>** brand of electrochlorinators and systems are installed in hundreds of locations throughout the World.

Our new generation cell technology is the culmination of our dedication to continuing product development, engineering excellence and quality assurance.



## WHAT IS ELECTRO CHLORINATION?



## **ELCHLOR**<sup>™</sup>

The electrolysis of seawater or artificial brine in an electrochemical cell produces sodium hypochlorite by a combination of electrochemical and chemical reactions. At the anode the oxidation of chloride ions to produce chlorine takes place:



## $2CI^{-} \rightarrow CI_2 + 2e^{-}$

At the Cathode the reduction of water to produce hydrogen takes place;

## $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$

The electrolysis takes place in an undivided cell with a slightly alkaline pH so that as soon as chlorine is liberated at the anode it immediately reacts with water to produce hypochlorite:

## $Cl_2 + H_2O \rightarrow HOCI^- + H^+ + CI^-$

The overall process therefore can be summarised as the reaction of salt with water according to:

## $NaCl + H_2O \rightarrow NaOCl + H_2$

Hypochlorite is a powerful biocide and although it eventually decomposes back to chloride ions and oxygen it has the advantage over other biocides in that it is relatively stable. Electrolytic production of hypochlorite satisfies the instantaneous requirement for biocide.

## CUMBERLAND'S ELCHLOR<sup>™</sup> TECHNOLOGY



Cumberland's **ELCHLOR**<sup>™</sup> cells have been specifically designed for offshore and marine applications where acid cleaning of plate type electrolysers is undesirable. In the **ELCHLOR**<sup>™</sup> cell the tubular anode and cathode are mounted concentrically in a uniquely simple construction.

The salt water passes through the annular gap between the electrodes where electrolysis takes place. This annular path produces a uniform velocity flow and promotes conditions which prevent the build up of salt deposition in the cells.

**ELCHLOR**<sup>™</sup> is a once through process and cells are arranged in series and parallel streams in order to meet capacity requirements. All **ELCHLOR**<sup>™</sup> systems are factory assembled and tested in accordance with rigorous QA protocols to ensure that installation and commissioning at site is a simple process.

The **ELCHLOR**<sup>™</sup> range of standard and custom plant are constructed on mild steel skid frames and are fully pre-piped and prewired with capacities ranging from 0.5kg/ hr to 25kg/hr. Systems can be fitted with manual or automatic pre-filters, multiple dosing pumps for both continuous and/or shock dosing, air scour blowers, transformer rectifiers and control systems for fully automated operation.

**ELCHLOR**<sup>™</sup> systems can be built to safe or zoned area specifications for installation in hazardous areas in offshore applications etc. Control systems can be located off skid in safe areas and/or from central DCS as required.

#### LOW-MAINTENANCE ELECTROCHORINATORS

A highly-developed, controlled and monitored electro-chemical process is performed continuously in the **ELCHLOR**<sup>™</sup> electrochlorinator by means of robust and practical components and uncomplicated design, without moving parts.

The plants require minimal maintenance with negligible outages at long intervals of unattended operation.



# STATIC- CELL ELECTRO CHLORINATOR



## **ELCHLOR**<sup>™</sup>

By preventing organic fouling, ELCHLOR<sup>™</sup> electrochlorinators ensure that water systems operate permanently at peak efficiency with

- Maximum heat-transfer performance
- No outages, shut-downs or malfunctions caused by blockages
- Low-friction pipe surfaces, requiring reduced pumping power
- Smooth, turbulence-free flows, discouraging corrosion/erosion
- Maximum availability of fire-fighting emergency services



#### ORGANIC FOULING THE BANE OF SEAWATER SYSTEMS

**ELCHLOR**<sup>™</sup> electrochlorinators sterilize water systems and permanently eliminate organic fouling by the injection of sodium hypochlorite which they produce on-site from raw seawater or brine using only electricity.

The many forms of life which abound in all seawaters cause severe problems to system-users, ranging from simple algae slime on system surfaces to complete blockage of condenser tubes and large pipes by mussels, barnacles and the like.

The results are loss of heat-exchanger efficiency, wasted pumping power, corrosion-erosion by turbulence, complete loss of essential services, valve malfunction and plant shut-down.

These problems are extremely difficult to eradicate by manual clearance or occasional chemical cleaning.

They are, however, easily and permanently prevented by chlorination.

# APPLICATION OF **ELCHLOR**<sup>™</sup>

#### **ELCHLOR**<sup>™</sup>

#### **ELECTROCHLORINATION**

Chlorination has been used for decades for the sterilisation of water and the prevention of fouling, originally in the form of bought-in chlorine gas, which was dispensed by metering devices, and increasingly by electrochlorinators.

Electrochlorinators make chlorine as sodium hypochlorite solution, NaOCI, which, unlike chlorine gas, is perfectly safe in the concentrations employed.

Users of electrochlorination have perfect control of the systems without dependence on an outside source and generally enjoy an overall economic advantage.

**ELCHLOR**<sup>™</sup> electrochlorinators embody these advantages in the simplest, most reliable form.

The **ELCHLOR**<sup>™</sup> ideally treats all the water entering the system at the main intake. A small proportion of the main chlorinated flow is passed through the solution. This is returned to the main intake where it disperses and is carried through the system in the main flow, ensuring complete freedom from organic fouling form intake to outfall.

The **ELCHLOR**<sup>™</sup> electrochlorinator uses the most advanced, proven materials and hydraulic and electrical design to provide:

- Cells optimized for long-term, salt-free operation without acid cleaning.
- Compact plant, generally in a single package, requiring minimal site-installation work.
- High output power ratio combined with long electrode life, warrented up to five years.
- Operation on seawater feed with wide range of temperature, salinity and pressure.
- Simple Hydrogen removal when required.

The **ELCHLOR**<sup>™</sup> plant is built to the highest standards with liberally rated components used advantageously to minimize initial cost while ensuring long, trouble-free, economic operation at site.

ROSEMOUNT

U-25-LT-54-33

# INSTALLATION OF ELCHLOR<sup>™</sup> SYSTEM





#### **TYPICAL ONSHORE INSTALLATION**



A typical land-based installation is outlined in the above diagram, showing the usual arrangement in which the hypochlorite is dosed before the main intake pumps. For sewage treatment, the hypochlorite is usually fed into the discharge line.

#### SHIPS' AND OFFSHORE SYSTEM



In ships' systems, the hypochlorite is fed to the sea-chest, thus ensuring that the primary grids as well as all the down-stream plant and piping is kept free of fouling. The diagram indicates singlepoint dosing while, in practice, the installation permits multi-point dosing when required. On platforms and other applications using submersible pumps the dosing point is at the stilling tube around the pump suction.

## MAIN COMPONENTS OF ELCHLOR<sup>™</sup> SYSTEM

## **ELCHLOR**<sup>™</sup>

#### **ELCHLOR<sup>™</sup> CELL**

In the **ELCHLOR<sup>™</sup>** cell, the tubular anode and cathode are mounted concentrically in a uniquely simple construction.



The salt water passes to the annular gap between the electrodes where electrolysis occurs and part of the sodium chloride, NaCI, is converted to sodium hypochlorite, NaOCI, with available chlorine.

The annular path produces a uniform velocity flow, promoting conditions which overcome the problem of salt deposition.

**ELCHLOR**<sup>™</sup> electrochlorinators basically use a once-through process and, for increased chlorine production and concentration,



The reactions at the two electrodes

the cells are arranged in series with factoryfitted hydraulic and cable termination for site connection.

The units are also arranged in a recycling system where circumstances require. The chlorine formed at the anode immediately combines with the caustic soda produced at the cathode to form sodium hypochlorite. No free chlorine gas is present at any time.

The electrolysis also produces hydrogen, at the rate of 0.37m/h per kg/h of chlorine, and where the feed is seawater, suspended salts such as magnesium hydroxide in quantities approximately equal to the chlorine produced.

These by-products are carried through the cell and may thereafter be extracted from the product flow or delivered to the dose point, as circumstances require.

#### **ELCHLOR<sup>™</sup>CONTROL**

**ELCHLOR**<sup>™</sup> electrochlorinators are provided with transformer-rectifier-control (TRC) equipment which produces the required d.c. from a.c. site services and gives the user complete and simple control of the chorine production, manually or by remote signal.

Variation of the electrolyzing current in the cells result in a proportional variation in the production of chlorine concentration of the product. Additional components are incorporated for the control of dosing regime where required.

# **ELCHLOR**<sup>™</sup>

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