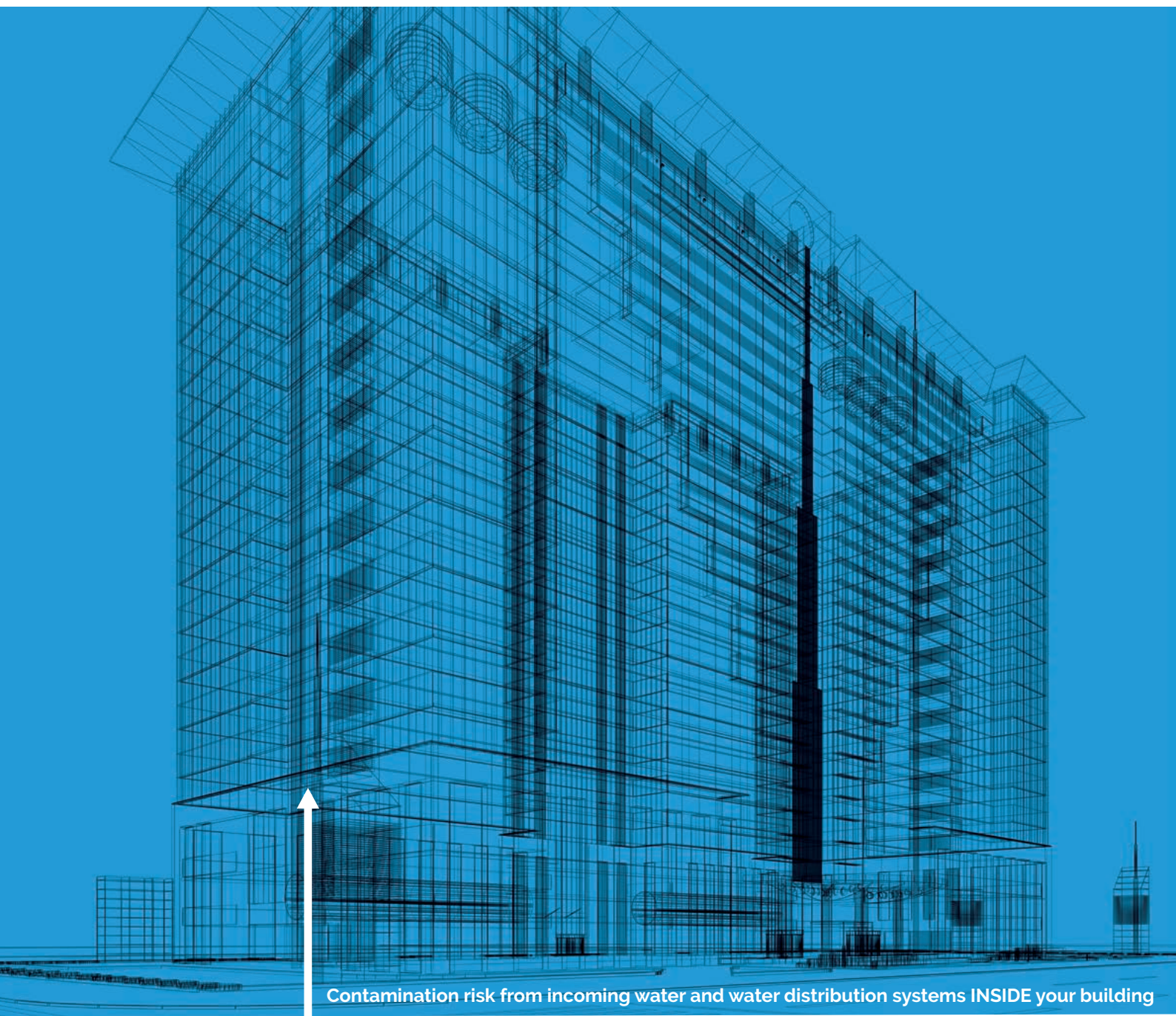


Protect your water

Water safety, disinfection and secondary disinfection

WCS Group
The H₂O experts
MARLOWE Critical Services



Contamination risk from incoming water and water distribution systems **INSIDE** your building

Choosing an appropriate solution

Adherence to the UK, Northern Ireland and Scotland Drinking Water Regulations
Compliance with ACoP L8
Meeting WHO Guidelines for Drinking Water Quality
WRAS Approved
Protecting patients, your workforce and building visitors

Protecting your water and water system

Safeguarding staff, patients, vulnerable people and choosing appropriate disinfection and secondary disinfection technologies.

Relevance:

Food & Beverage

- Disinfection of product and process water
- Bottle cleaning, rinsing and pasteurisers
- Disinfection in CIP (cleaning in place systems)
- Water vapour treatment in dairies
- Fruit, vegetable, seafood, fish, poultry processing
- Breadcoolers
- Water Reclaim and Re-use

Industry

- Cooling water treatment
- Legionella control
- Disinfection in process water
- Removal of odorous substances in air scrubbers
- Slime control in the paper industry
- Secondary disinfection of potable / process water
- Effluent Remediation
- Water Reclaim and Re-use

Water companies

- Disinfection of potable water
- Disinfection of wastewater

Alternative to mains water

- Borehole
- River

Hospitals, hotels, care homes, sports centres etc

- Legionella and microbes (Pseudo, MRSA etc) protection in cold / hot water systems
- Secondary disinfection of potable water
- Disinfection in cooling towers and air conditioning systems
- High risk (hydro-pools etc)

Market Gardening

- Disinfection of irrigation water in plant cultivation
- Pig / Poultry feed water for livestock

Swimming pools

- Regular disinfection of filters
- Combatting Legionella (showers etc)
- Regular disinfection of pool water



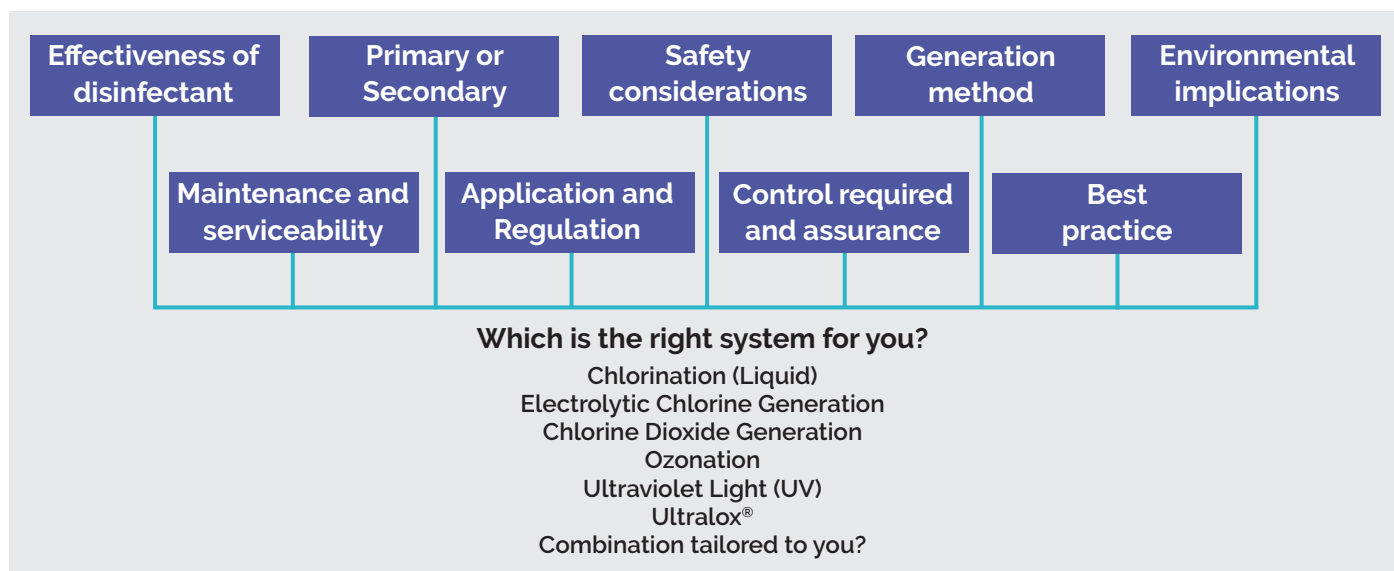
UK hospitals generate an average annual water consumption of between **193** and **415 m³/bed**.¹

Disinfection is an important step in ensuring that potable (drinking) water is safe. UK water companies are required to meet the EU Drinking Water Directive by disinfecting public water to the point of supply. They have to kill or inactivate disease-causing organisms in the water supply.

There are two principals of disinfection: **primary disinfection** achieves the desired level of microorganism kill or inactivation, while **secondary disinfection** provides enhanced protection by preventing the regrowth of microorganisms harmful to human health between incoming public water supply to your building and the water distribution system inside your building right up to point of use – tap, shower etc.

Choosing the optimal solution

When you partner with WCS Group, we will work with you to guide you to the most effective solution for your building / system / requirement. We are water safety and Legionella compliance experts taking in to consideration;



¹ Audit Commission for Local Authorities in England and Wales. Untapped savings: Water Services in the NHS, National Health Service: London, UK.

Comparing common disinfection techniques

Traditional Sodium Hypochlorite

Sodium Hypochlorite (NaOCl) is one of the most commonly used compounds for water purification, especially across large scale surface purification, bleaching, odor removal and water disinfection in cooling towers for example.

Advantages

Sodium hypochlorite is one of the most widely used and accepted disinfectants, cost effective and simple to dose. It can easily and be stored and transported when it is produced on-site. Dosage is simple. Transport and storage of sodium hypochlorite are safe. Sodium hypochlorite is as effective as chlorine gas for disinfection. Sodium hypochlorite produces residual effect.

Limitations

Sodium hypochlorite is a hazardous and corrosive chemical in concentration. While working with it, safety measures have to be taken to protect workers and the environment. Sodium hypochlorite does not deactivate Giardia Lambia and Crptosporidium. Its activity is highly pH dependant and mainly used in waters less than pH8, at higher pH values Sodium Hypochlorite efficacy is severely reduced.

Process

Sodium Hypochlorite is typically pumped into a water system proportionally to flow and usage, alternatively in industrial uses or swimming pools a controller may be used to deliver and maintain a set reserve of chlorine.

Equipment

Sodium hypochlorite is delivered and stored in appropriately sized tanks and bunds, typically from 25KG up to 1000KG IBCs.

Water meter or proportional flow controllers, dosing pumps and Chlorine Analysers.

Chemicals

Liquid Sodium Hypochlorite.

Usage

<1m³/day up to 1000m³/day and larger industrial processes.

Chlorination (Hypochlorous Acid Generation)

The GENOX generator produces a colourless liquid which is generated on-site, on-demand without buying, mixing or handling toxic chemicals. Direct electrolysis of brine, creates an oxidant NEUTHOX[®] on demand.

Advantages

Low cost (from 4.0 pence/m³) biocide. No hazardous chemicals are mixed, stored or handled. Inexpensive to operate and maintain. Direct injection in to the water system. Primary and Secondary disinfectant particularly effective against bacteria, water-borne pathogens, microbes and prevents biofilm reforming in water pipes. Effective Legionella control. NEUTHOX[®] contains hypochlorous acid as an active agent, the same style defence mechanism produced by the human immune system to fight infection.

Limitations

The solution decomposes and should not be stored for more than one month and is best generated on-demand in real time.

Process

Hypochlorous Acid (HOCl) is generated onsite by electrolysis of brine in a special wall-mounted or free-standing generator. This is controlled by a water meter and sensor which influences automatic dosing between 0.2-1.5ppm NEUTHOX[®] or higher for shock-dosing.

Equipment

Sodium chloride /salt tank. NEUTHOX[®] buffer tank. Injection unit for NEUTHOX[®]. Built-in dosing pump and back-up. Sensor. Stainless steel cabinet. Remote monitoring option.

Chemicals

None (HOCl is generated from GENOX salt).

Usage

< 20m³/day up to 400m³/day for large process water applications.

Comparing common disinfection techniques

Chlorine Dioxide (new style Catalytic Generation) or ClO_2IX

A universally effective primary and secondary disinfectant without the usual limitations of chemical mixing, handling or storage.

Advantages

Disinfectant effect is independent of pH. Sustained release effect means long-term stability in the water piping system. Destroys biofilms in pipework and tanks, offering reliable protection against Legionella for entire water systems. Does not react with ammonium. Does not form chlorophenols and other strong-smelling compounds. Does not form trihalomethanes (THMs) and other chlorinated hydrocarbons (AOX). Good conversion rates (> 75%). High yield (> 98.5%). New-style Catalytic Chlorine Dioxide Generators lower the risk from chemical handling and mixing toxic ClO_2 gas.

Limitations

Less effective in very hot water systems.

Process

In Catalytic Chlorine Dioxide ($\text{ClO}_2\text{IX}^\circ$) generation, to make Chlorine Dioxide, chlorous acid must first be formed. The $\text{ClO}_2\text{IX}^\circ$ systems produce a solution of chlorous acid without residual Na^+ by using cation exchange resin in the H^+ form. This removes the Na^+ from the sodium chlorite and replaces it with H^+ to form pure chlorous acid. By utilising catalytic technology, the $\text{ClO}_2\text{IX}^\circ$ systems convert virtually all (> 98.5%) of the chlorous acid to Chlorine Dioxide instantaneously. The resultant dilute 700 mg/l Chlorine Dioxide product contains no chlorine and virtually no chlorite. Continuous generation also means no required onsite storage of ClO_2 . This is a duplex system for uninterrupted ClO_2 generation.

Equipment

Modern Catalytic Chlorine Dioxide ($\text{ClO}_2\text{IX}^\circ$) systems incorporate ion exchange and catalytic technologies, a duplex cation resin and catalyst cartridge to ensure consistent chlorine dioxide generation for large fixed (industrial) or mobile (portable) systems for field trials and emergency disinfection.

Chemicals

Sodium Chlorite and HCl.

Usage

< 20m³ / day up to 800m³ / day for larger process water applications.

Chlorine Dioxide – WRAS Approved Pureox 3500

A universally effective primary and secondary disinfectant, generated using a patented Safe Generation per Batch (SGB) technology.

Advantages

Disinfectant effect is independent of pH. Sustained release effect means long-term stability in the water piping system. Destroys biofilms in pipework and tanks, offering reliable protection against Legionella for entire water systems. Does not react with ammonium. Does not form chlorophenols and other strong-smelling compounds. Does not form trihalomethanes (THMs) and other chlorinated hydrocarbons (AOX). >98.6% Conversion efficiency of yield. The Pureox 3500 range is WRAS Approved to remove any obstacle for installation onto a drinking water system.

Limitations

As with any ClO_2 dosing system the residence time of treated water in a drinking water system needs to be minimal to avoid build up of oxidants that will breach the DWI limits of <0.5ppm total oxidants (as measured by ClO_2 and chlorite).

Process

The Pureox 3500 generator utilises two precursor chemicals, which are mixed in the SGB reaction chamber. The SGB process ensures an efficient conversion of pre-cursor chemicals and a consistent high yield of ClO_2 and negligible degradation whilst the batch is held in the SGB Chamber. The output from the generator is ClO_2 with minimal chlorite by-products. ClO_2 is then dosed from the batch into the water stream, and a new batch created when required.

Equipment

A Pureox 3500 generator is retailed as a packed system to cover the following equipment:

- Generator unit incorporating a central controller and peristaltic pump
- ClO_2 chemical dosing pump
- Stock tanks and bunds (sizes based on site specific requirements)
- ClO_2 and Chlorine probes
- Gas Alarm

Central controller provides detailed maintenance records and service schedule, can be configured for different set points and upgrades to provide GPS and BMS outputs.

Can dose multiple systems of the same generator.

Chemicals

Two precursors – Cloxide GST (Chlorite 7%) and HCl 1:1 ratio.

Usage

The range of eight different model generators.

Pureox 10 – up to 480m³ per day
Pureox 20 – up to 960m³ per day
Pureox 30 – up to 1400m³ per day
Pureox 40 – up to 1920m³ per day
Pureox 50 – up to 2400m³ per day
Pureox 60 – up to 2880m³ per day
Pureox 80 – up to 3840m³ per day
Pureox 100 – up to 4800m³ per day

Comparing common disinfection techniques

Ozonation

Ozonation is a water treatment process that destroys microorganisms and degrades organic pollutants through the infusion of ozone, a gas produced by subjecting oxygen molecules to high electrical voltage.

Advantages

Requiring a shorter contact time and dosage than chlorine, ozone can be added at several points throughout the treatment system for both primary and secondary disinfection in water systems. Usually it is recommended to use ozone for pre-oxidation, before a sand filter or active carbon filter. After ozonation, these filters can remove the remaining organic matter. Odour and taste neutral. Enhancer of the flocculation / coagulation decantation process. Effective in large scale effluent treatment to reduce BOD and COD. Can also reduce some disinfection by-products.

Limitations

Ozone is an unstable gas and must be generated onsite. Use requires an additional disinfection control because ozone has a short life, is unstable and often has a limited residual effect in water. Capital cost is relatively high. Operating is complex and electricity costs can account for a significant percentage of total operating and maintenance costs for a small system.

Process

The five elements of an ozonation system are: air preparation or oxygen feed, electrical power supply, ozone generation (corona discharge cell with two electrodes), ozone contact chamber, ozone exhaust gas destruction.

Equipment

Air preparation equipment, ozone generator, contactor, destruction unit, instrumentation and controllers.

Chemicals

None but pure oxygen is a more efficient feed gas.

Usage

< 30m³/day and up to 300 m³/day in large industrial applications and swimming pools

Ultraviolet Light (UV)

Ultraviolet (UV) radiation is generated by a special lamp. When it penetrates the cell wall of an organism, the cell's genetic material is disrupted and the cell is unable to reproduce

Advantages

UV radiation effectively destroys bacteria and viruses. UV radiation can be attractive especially in small systems because it produces no known toxic residuals, requires short contact times and the required equipment is easy to install and maintain.

Limitations

UV radiation may not always reliably inactivate *Giardia lamblia* or *Cryptosporidium* cysts and should be used only by groundwater systems not directly influenced by surface water – where there is less risk of protozoan cyst contamination. UV radiation can be unsuitable for water with high levels of suspended solids, turbidity, colour or soluble organic matter because these can absorb and shadow UV radiation, reducing disinfectant performance.

Process

The effectiveness of UV radiation is dependent on energy dose absorbed by the organism, measured as a product of UV light intensity and absorption. If the exposure duration or energy dosage is insufficient, the organism's genetic material might only become damaged and not wholly destroyed. Ideally, energy dose and UV lamp intensity and duration of exposure should be higher than needed to meet disinfection requirements.

Equipment

Controller, UV lamps, hours run meter. Can also add a UV monitoring system and automatic wiper system.

Chemicals

None and no by-products.

Usage

< > 20m³/day and large scale 2000m³/day in effluent and aquaculture applications for example

Ultralox 40®

A Regulated, stable, highly effective low concentration form of chlorine and particularly efficacious fast-acting biocide.

Advantages

Only one chemical required. No generator required. No danger of Chlorite overdose. Low concentration solution. Particularly efficacious fast-acting biocide highly effective against bacteria and waterborne pathogens. Fully Article 95 compliant. Biocidal Product Regulation approved for potable and process water. Drinking Water Inspectorate Approved for potable and process water. Used widely across NHS sites. Can be dosed into incoming mains, break tank or via fixed or mobile control system. For domestic hot and cold-water systems. Low hazard. Breaks down and inhibits biofilm at nominal operating conditions. Long shelf-life. Colourless. Available in 25L, 200L and 1,000L. Used for flushing, shock-dosing, mobile and emergency disinfection and continuous disinfection in acute (critical) applications. pH 3-6.

Limitations

Primarily for smaller applications or critical applications (eg acute hospital systems). May impact pH. Generates THMs.

Process

Chemical solution. 1-2 day retrofit solution. Dosing is achieved via monitoring the active halogen via a chlorine analyser directly controlling the dose and doubling as a monitoring device.

Equipment

Chlorine analyser / controller, 2 x 25L drum bund (or larger bund with 200L drum), backboard control management system, flow meter, dosing pump(s), power supply fused switch, injection tubing and foot valve.

Chemicals

Hypochlorous Acid (HOCl)

Usage

< 20m³/day up to 60m³/day in domestic water systems. Can also be used through 1,000L delivery for significantly larger process water demands.

Complete systems for EVERY requirement



Whatever your starting point or priority, there is a viable, dependable water safety and disinfection solution available to meet your process requirements.

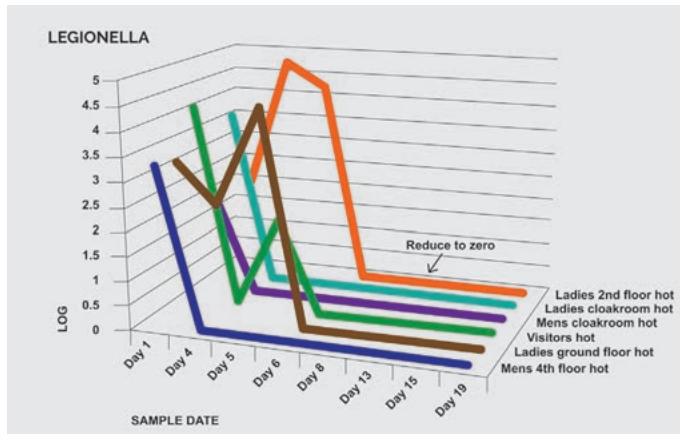
We will guide you through:

- Safe drinking and process water principles
 - Development and execution of Water Safety Plans
 - Key determinates are understood: Effectiveness of disinfectant | Primary or Secondary | Safety considerations | Generation technique | Maintenance and serviceability | Application and Regulation | Control required and assurance | Cost of ownership | Reputational risk | Return on Investment (ROI)
 - Proactive and preventative contamination measures and control
 - Using multiple disinfection methods to uncompromised water safety
 - Greatest risks we see based on hard evidence and deep sector knowledge
 - Waterborne pathogens risks – a reality check
 - Problematic pipes and troublesome water system
 - Particularly critical and vulnerable applications (healthcare, food processing etc)
 - The last meters to the tap where drinking water quality is at risk
 - Design of disinfection and management systems for water systems
 - Pre-commission cleans, system improvement, handover, expert witness
 - Water system microbiological chemical and physical control methods
 - Water quality guidelines and expectation on public health
 - Disinfection methods to counter contamination risks on site
 - Best practice water sampling, testing and analysis
 - Specialist water treatment needs, cooling towers and RO water
 - Private water supplies
 - Swimming pool, spa and leisure applications
 - Risk assessment, Legionella risk and control
 - ACoP L8 compliance
 - Water hygiene surveillance and critical incident management
 - Water Re-cycling, Reclaim and Re-Use
-

Disinfection solutions and water safety systems

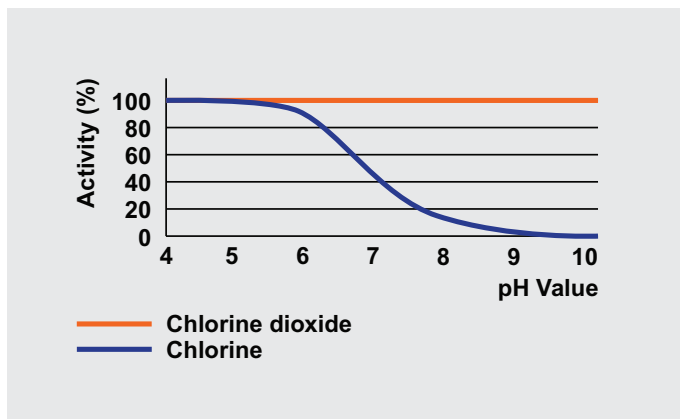
Tailored to what you need on site

Efficacious, proven disinfection solutions backed with evidence and experience.



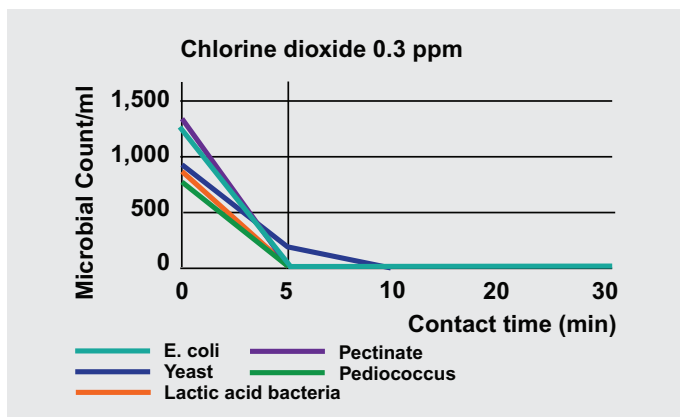
Ultralox40®

Shock-dosed for 24 hours before maintenance 1.0ppm in a Food and Beverage site transformed a stubborn Legionella issue quickly. With no recurrence.



pH dependency

Unlike chlorine, chlorine dioxide (ClO_2) is not affected in the pH range of 4-10. The independence of chlorine dioxide of pH value makes it an attractive disinfectant option.



Disinfectant action of chlorine dioxide

Even in low concentrations, ClO_2 has a strong disinfectant effect. At a concentration of just 0.3ppm for example, it reliably reduces the microbiological count from around 1,000 CFU/ml to zero and does not produce THMs.

GENOX unit electrolysis of brine to generate HOCl, an effective form of chlorine and powerful biocide



Catalytic Chlorine Dioxide ($\text{ClO}_2\text{IX}^\circ$)
pH independent

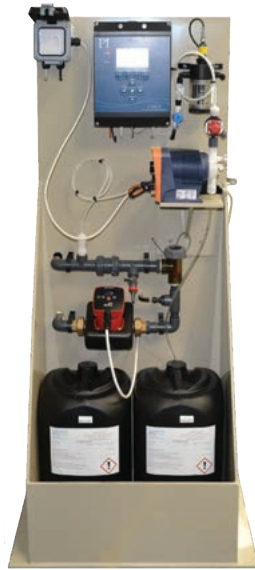
Ultimate disinfection – how to do it?

Chemical alternatives like Ultralox40®, or a super-efficient, cost effective of generating an effective biocide like NEUTHOX® through the electrolysis of brine, or state-of-the-art Catalytic ClO_2 Generators? Each has their place.

Examples

Ultralox40®

Approved, low concentration, highly efficacious biocide. Particularly effective against pathogens and biofilms. Plug and play mobile, temporary or permanent retrofit disinfection systems for domestic systems and larger applications.



Chlorine Dioxide - Pureox 3500

WRAS Approved. High purity, 2-pack generation of ClO_2 .

Low hazard, long residual effect available in 25Kg to 1,000L.



GENOX producing NEUTHOX®

Natural choice partner across healthcare, food and beverage, horticultural and many industrial applications – low generation cost and ecological.



Model T05



Model T10



Model T20

Catalytic Chlorine Dioxide Generators

State of the art, highly dependable chlorine dioxide generation. 5KG to 90KG/day.



Industrial



Mini CLO₂ system



Portable



Further reading

Fact Sheet | Water safety and disinfection

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The H₂O experts
MARLOWE Critical Services

Ultralox 40®
HOCl active form of chlorine as a biocide
Palatable and pleasant water
Article 35 compliant
DfW approved
Used widely in the NHS

Suitable for...
Hot / cold systems
System purges
Hospitals
Hotels
Care homes
Schools
Small offices
Legionella control
Domestic systems
Drinking water
Breweries
Dairies
Food processing
CIP systems
Laundries
Poultry houses
And more...

Low concentration, highly effective colourless biocide
Ultralox® is an extremely effective fast-acting stable biocidal hypochlorous acid or HOCl/HOCl₂ manufactured naturally by white blood cells (leukocytes) as part of the body's defence against pathogens. HSO₂ Zn other, hypochlorous acid (HOCl) the form of chlorine that is most effective as a biocide. It breaks down biofilm and is highly effective against pathogens and bacteria. Particularly for systems with low and high pressure, high bacteria counts, embedded or systematic biofilm challenges, require repeated flushing and one-off disinfections and therefore have requirements for secondary disinfection.

Small and medium applications
Delivered in 25L, 200L, or 1,000L package sizes. Can be dosed into incoming mains or a break tank, via fixed or mobile delivery and control systems that can be purchased or hired. The standard mobile or free-standing and mounted systems can be retrofitted and are suitable for systems up to 200m³/day. 200L systems are better suited for 20-50m³/day requirements.

Conformants: are BS EN approved BS EN 9001:2007 and BS EN 9142:2007
Appearance: colourless
Sg (at 20°C): 1.05
Intended dose rate: 0.2ppm-4.5ppm (higher for shock-dosing)
Drinking Water Inspectorate Approval (DWI 58.4.1074) under Regulation 35
Liquor of the Water Supply (Water Quality) Regulations 2000 SI 2000/2486 and
The Water Supply (Water Quality) Regulations 2010 SI 2010/994 (WQ 99)

Water Safety | Disinfection_Ultralox
Fact Sheet

Fact Sheet | Water safety and disinfection

WCS Group
The H₂O experts
MARLOWE Critical Services

GENOX
Products low hazard, HOCl biocide NEUTHOX® for primary and secondary disinfection.

GENOX
Safe alternative to ClO₂,
Low hazard HOCl biocide
Cost effective – from 4 pence / m³ of treated water
DfW approved
HSO₂ Zn HOCl is the most effective form of Chlorine
Used widely in the NHS

Suitable for...
Hot / cold systems
Primary disinfection
Secondary disinfection
Hospitals
Hotels
Care homes
Schools
Legionella control
Drinking water
Horticulture
Breweries
Dairies
Food processing
And more...

Cost effective, safe and powerful biocide for large and small systems
A specially developed GENOX Generator System uses electrolysis of brine to generate a biocide NEUTHOX® on demand. NEUTHOX® is a powerful, proven disinfectant that controls biofilm and destroys Legionella and Pseudomonas and is effective even at 40-50°C. The active ingredient in NEUTHOX® is hypochlorous acid (HOCl) which is produced naturally in the human body within white blood cells to fight infection.

HOCl is lethal to pathogens. It is low hazard, easy to handle and easy to dose. Generation is inexpensive and HOCl is stored securely in a drum. The unit merely requires water, Genox salt and electricity.

A wide range of units are available and all are compact allowing for simple retro fitting to areas with small available space footprints. Horticultural units are also available.

How it works
HOCl renders bacteria inactive and achieves its results by a two-stage disruptive process. On breaching the bacteria cell wall, it interacts chemically with the cell's proteins, attacking the cell DNA and causing the whole cell to die. The cell floods with water and acidic fluid and dies. Once the bacteria has been destroyed, its co-dependent relationship with the biofilm is disrupted and the biofilm begins to break up, bringing Legionella and Pseudomonas levels back or permanently under control to acceptable levels.

NEUTHOX® is approved with food and has no impact on water pH.

Water Safety | Disinfection_Genox
Fact Sheet

Fact Sheet | Water safety and disinfection

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The H₂O experts
MARLOWE Critical Services

CHLORINE DIOXIDE GENERATORS (CLO₂IX)
Modern-day chlorine dioxide water treatment using CLO₂IX offers distinct advantages.

Proven new-generation
No storage of ClO₂,
Safe - no chemicals are mixed
Reliable CLO₂IX generation
No dangerous by-products
Dilute, high quality solution
Dispenses 700mg/l low concentration solution without storage
Self-monitoring / correcting

Suitable for...
Biofilm eradication
Legionella control
Membrane systems
Water distribution systems
Cooling towers
Hospitals
Hotels
Horticulture
Breweries
Dairies
Food processing
Universities
And restriction sites
And more...

CLO₂ - an effective, low concentration water disinfectant
CLO₂IX is a tech-enabled chlorine dioxide solution that contains no chlorine, no ozone, has a high conversion rate to O₃, produces low concentration levels, is high purity (98% Cl₂) generated in a controlled reaction that is extremely safe, with no storage of ClO₂ because it is generated ON DEMAND.

Beneficial properties of CLO₂
• Effective over pH range of 2 - 10
• Doesn't produce TriHs
• Breaks down chlorine-causing compounds
• Breaks down phosols
• Precipitates iron and manganese
• Can overcome organic loading
• Penetrates and destroys biofilm
• Potable and process water

Conventional ClO₂ generation negatives
• Hard to make and storage is a problem
• Unright, heat and time degrades it
• Chemical mixing generators create by-products, can be corrosive, produce low yield, require accurate dosing
• Electrochemical generators suffer poor conversion, require complex pre-treatment, are maintenance heavy, require accurate dosing

Introducing new generation, proven CLO₂IX chlorine dioxide generators
Solves all of the problems and perceived limitations of conventional ClO₂ generation and come in a range of models to provide 600 to 900kg/day of ClO₂.

Water Safety | Disinfection_CLO₂IX
Fact Sheet

Experts in chemical feed and water hygiene

WCS Group is the UK's leading water treatment, water hygiene, Legionella control, water treatment chemical supply specialist. We supply products, systems and services with highest standards of safety and uncompromising compliance, to over 7,000 customers across multiple markets all over the country.

Alex Winter | alex.winter@wcs-group.co.uk | +44 (0)113 200 5214

www.wcs-group.co.uk | www.gwtltd.com | www.clearwater.eu.com



Cert No. 11011
ISO 9001, ISO 14001,
OHSAS 18001

WCS Group is a trading name for WCS Environmental Ltd, registered in England and Wales (Number 02184649) at 20 Grosvenor Place, London, SW1X 7HN.
Head Office - 17 Wheatstone Court, Waterwells Business Park, Gloucester, GL2 2AQ.

The WCS Group is a portfolio company of Marlowe plc and leads the water treatment and hygiene division of Marlowe Critical Services. Guardian Water Treatment and Clearwater are WCS Group companies.