The HydroClenz™ Range

(Immersible and in-line Water Disinfection units)

incorporating

A Unique Disinfection Media

Consisting of

Active Ceramics

Combined with

Total Silver™
HSA Matrix with a 99% pure silver surface

Their use in treating Potable Stored Water and Hot Water systems

Table of Contents

Introduction

The traditional method of treating potable stored water to protect against the infestation of Legionellosis is through the use of chemicals.

Many companies are now looking for an alternative to chemical dosing. They want to avoid the expensive disruption to premises, toxic presence in the water, hazards in handling and use, and the inevitable damage to the environment that stem from their use.

We decided to investigate the potential for alternative treatment media, which provide the required protection without the downside. Our ongoing development and research has identified a variety of media that can be adapted to provide protection in a range of different situations.

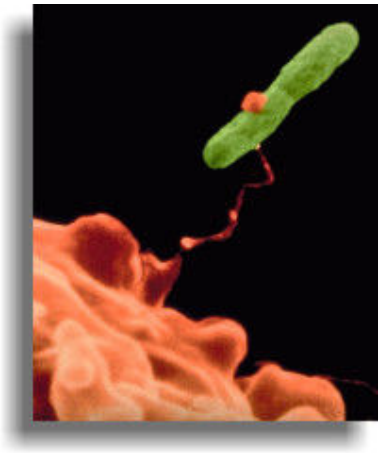
For the specific treatment of potable stored water we decided to focus on two particular media types, each able to perform the function quite adequately. However, when used together, the complimentary effect gives significant benefits. It is this combination of media which provides the 'active ingredient' for the HydroMaster™ 2000 modules.

The media used are 'Special Active Ceramics' and our own Total Silver™ matrix.

The following pages provide information pertaining to each specific media and how they work, together with some background information and Log Kill data.

Firstly, you can find some brief information regarding Legionella Pneumophila.

Legionella Pneumophila



What does Legionella look like?

An Amoeba grasping a Legionella bacterium

Legionella Pneumophila is a Gram-negative bacterium that is widely distributed in natural and manmade freshwater habitats. All members of the genus have small, rod-shaped cells 1-2 µm in length and 0.5 µm wide and require iron and cysteine for isolation. They will initiate growth on artificial media only over a narrow pH range of 6.8-7.0 but can tolerate a pH range from 5.5-9.0 in natural habitats.

When Legionella Pneumophila was first isolated, it was found to be only distantly related to other bacteria and was placed in its own family, the Legionellaceae. DNA-DNA hybridization experiments and 16S rRNA studies have shown that the species of Legionella are closely related to one another but distantly related to other bacteria. The most closely related groups are the purple sulphur bacteria, the Enterobacteriaceae and Pseudomonas.

Legionella Pneumophila was identified in 1979 following an outbreak of 'Legionnaire's Disease' caused by the bacterium. It was later learned that previous outbreaks of Legionnaire's disease had occurred as early as 1957. Legionella Pneumophila was isolated in 1947 in a guinea pig that had been inoculated with blood from a patient with an unknown disease.

Legionnaires Disease

The first identified outbreak of Legionnaires Disease occurred during a Pennsylvania State Convention of the American Legion in 1976. 182 cases resulted in 29 deaths within the hotel. 38 cases were reported amongst passers by, resulting in a further 5 deaths. In recent years 200 – 300 cases of the disease have been reported each year in England and Wales. The majority of outbreaks are associated with buildings such as; Hotels, Factories, Hospitals, Nursing Homes and Office Blocks.

More research has been carried out in the United States where, according to the OSHA (Occupational Safety and Health Administration – part of the U.S. department of Labour), Legionnaire's disease is considered to be fairly common and serious, and the Legionella organism is one of the top three causes of sporadic, community-acquired pneumonia.

Because it is difficult to distinguish this disease from other forms of pneumonia, many cases go unreported. Approximately 1,000 cases are reported annually to the CDC (Centre for Disease Control and Prevention), but it is estimated that over 25,000 cases of the illness occur each year and cause more than 4,000 deaths.

This is in excess of 25 times the number of reported cases, which would indicate that some 5000 – 7500 cases in England and Wales is, perhaps, a more accurate figure. There are sources in the UK that believe the true problem attributable to all of the 20+ different varieties of Legionella linked with human diseases, could be significantly higher than this.

In the UK 180,000 people die from all of the different varieties of pneumonia each year. As many cases apply to people in susceptible groups (such as the elderly, smokers, alcoholics, cancer sufferers and other immuno-suppressed patients) rarely is a full investigation of the true cause of the pneumonia carried out.

How do people contract Legionella? The most popular theory is that the organism is aerosolised in water and people inhale the droplets containing Legionella. However, new evidence suggests that there is another way of contracting Legionella. It appears that "aspiration" may be the way the bacterium enters into the lungs. Aspiration means choking such that secretions in the mouth get past the choking reflexes and instead of going into the oesophagus and stomach, mistakenly, enter the lung.

Active Ceramics

What is an ‘active’ ceramic.

Most basic ceramics such as glass, porcelain, clay ware, and brick, are based on natural aluminium silicates, which are ‘inactive’ electrical and thermal insulators. New technology has led to a range of ‘special’ or ‘active’ ceramics which display physical properties of semi-conductivity, thermal and ultra-sound conductivity, magnetic properties, and light emission, achieved by the addition of various selected transition elements and sintering at very high temperatures.

These ‘active’ ceramics, used for the treatment of water and other liquids, are produced as spheres, having a layered structure around a central nucleus or ‘seed’ and a complex open structure, which can exchange ions (zeolyte), through minute electrolytic cells, which become active when in contact with an electrolyte such as water.

They present no hazard to health or body in either their use, handling, storage or transportation (COSHH Regulations and Occupational Exposure Limits).

How Do They Work?

Most bacteria have a short life expectancy and, deprived of nutrition or the wrong environmental conditions, quickly expire. They reproduce by one of two methods; binary fission, where individual cells continually divide into two identical cells, and sexual, where two cells merge before producing progeny by division or 'budding'. The function of any bacteriastat is to prevent or inhibit both types of reproduction.

Disinfection can be achieved by physical or chemical means, involving destruction of the information required by the cell to survive (the DNA complex), or of the membrane enveloping the cell. Physical methods include heat (wet or dry), electro-magnetic radiation (infra-red, ultra-violet, χ & γ rays), ultra-sound etc. These can kill all living microorganisms, the result being termed `Sterilisation'. Chemical methods include strong oxidising agents such as chlorine and its oxides, bromine, iodine, hydrogen peroxide and its derivatives and also heavy metal ions, such as those of copper, silver, mercury etc. and specific organic compounds such as pesticides, phenolic compounds, organo-chlorine and phosphorus. These tend to act in a general fashion by attacking the cell as a whole, or selectively by altering the genetic structure, and can vary in strength from mild to strong. These are termed `Disinfectants'.

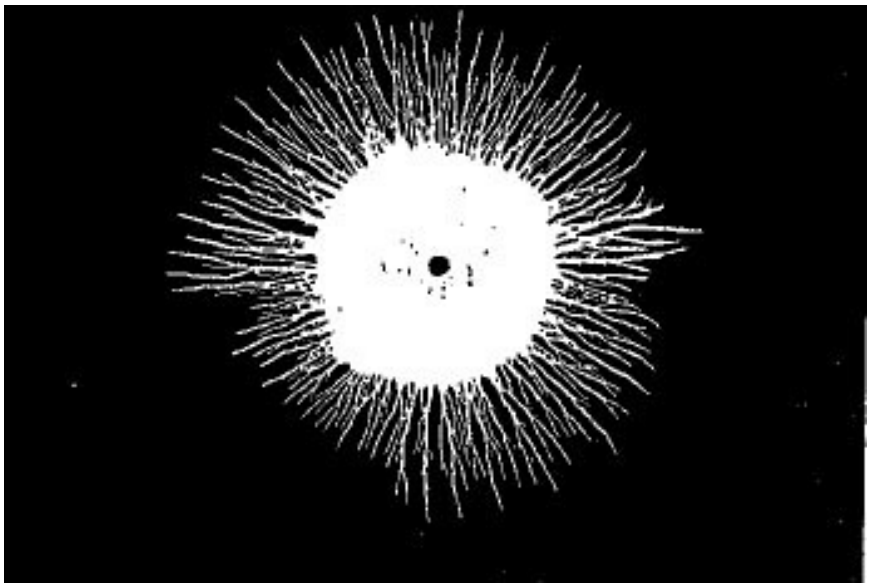
Active ceramics are a recent development in the production of specially designed, dedicated ceramics. When immersed in water these 'Active Ceramics' display physical properties of semi conductivity, magnetic properties and light emission (in the far infra red spectrum).

The effect is similar to a miniature electric cell, the current flow causing hydroxyl ions (OH) to convert to oxygen gas (O_2). At the same time the formation of hydroxyl and anolyte result in a neutral pH.

The radiation emitted by the spheres in the far infra red region of the electro magnetic spectrum is too low to cause sterilisation, but is sufficient to excite the molecules in the water, thereby stimulating the oxidisation process.

The oxidisation (and production of chlorine) by the electrolysis of water acts as a potent disinfectant, with the anaerobic bacteria (amongst which are Legionella and E.Coli) being the most sensitive to attack and therefore most quickly controlled or eliminated. Aerobic bacteria can also be affected but the protective enzymes they produce considerably extend the time taken to achieve the same result.

Bacteria are attracted by the chemical activity and extensive substrate of the Active ceramics where they attach themselves to the surface. There the products of the electrolytic process destroy the D.N.A. and/or the membrane enveloping the cell, whereupon their ability to thrive and reproduce is ended.



Far Infrared Emissions from a Single Special Active Ceramic Sphere
(Autoradiograph on a photographic emulsion)

The Electro-Chemical Action of 'Active' Ceramic Spheres

Application of an electrical voltage of a certain value across two inert electrodes immersed in water will cause current to flow involving ions (not electrons as in metals and semiconductors), the positive hydrogen ions (H^+) collecting at the Cathode (-ve) where electrons convert the ions to hydrogen gas (H^2). This is only possible if a corresponding process takes place at the Anode, which transfers electrons from the water, achieved by the Hydroxyl ions (OH) converting to oxygen gas (O^2). Impurities in the water increase the electrical conductivity of the water and reduce the potential at the electrodes.

The region around the cathode is called the catholyte and is generally alkaline (high pH) due to the formation of the hydroxyl, while the region around the anode is the anolyte, which is acidic (low pH) and is where the oxidising entities are formed. When catholyte and anolyte mix the result is pH which is neutral, while some of the active species lose their potency.

Using natural water with a degree of mineralization, for example, NA^+, K^+, Ca^+, Mg^{2+}, $C1^-$, SO_4^{2-}, HCO_3^{2-}, etc..

ANOLYTE

pH = 3 →7 ORP = +700 →+1200 mV

Active products synthesised: HO_2, $HO*_2$, O_3, O^*_2, H_2O_2, O_2, H_+ (H_3O^+), O^*, OH*, Cl_2O, $C1O_2$, HC1O, $C1O^*$, $C1^*$ $C1_2$, $S_2O_8^{2-}$, $C_2O_6^{2-}$

.

CATHOLYTE

pH = 10 →11 ORP = - 500 → - 800 mV

Active products synthesised: NaOH, KOH, $Ca(OH)_2$, $Mg(OH)_2$, HO^*, H_3O_{2*}, HO_{*2}, H_2O_{*2}, O_{*2}, HO^-, O_2^{2-}, O_{2-}.

Note: * = free radical

Properties

The Active Ceramics transmit radiation, in the far-infra red region of the electro-magnetic spectrum, of low intensity and energy (of relatively low energy compared, say, to that of ultra-violet), too low to cause sterilisation but capable of exciting the molecules of water by vibration and rotation, and so increasing their mobility (by lowering viscosity) and thereby facilitating the oxidising process.

However, it is the electro-chemical property, which achieves disinfection. Over the surface of the ceramic minute cells are formed, comprising pairs of cathodes and anodes, where water is electrolysed, splitting into its component hydrogen and oxygen albeit in a complex manner.

While the hydrogen readily escapes, the oxygen so produced provides a powerful oxidising reagent capable of inhibiting the growth of micro-organisms and, indeed, killing them. This is akin not only to the physical sterilisation performed by heat, ultra-violet, χ and γ radiation and ultra-sound, but also the disinfecting properties of such powerful oxidants as chlorine, bromine, iodine, chlorine dioxide, peroxide and ozone, without leaving the latter group's obnoxious and often hazardous residues.

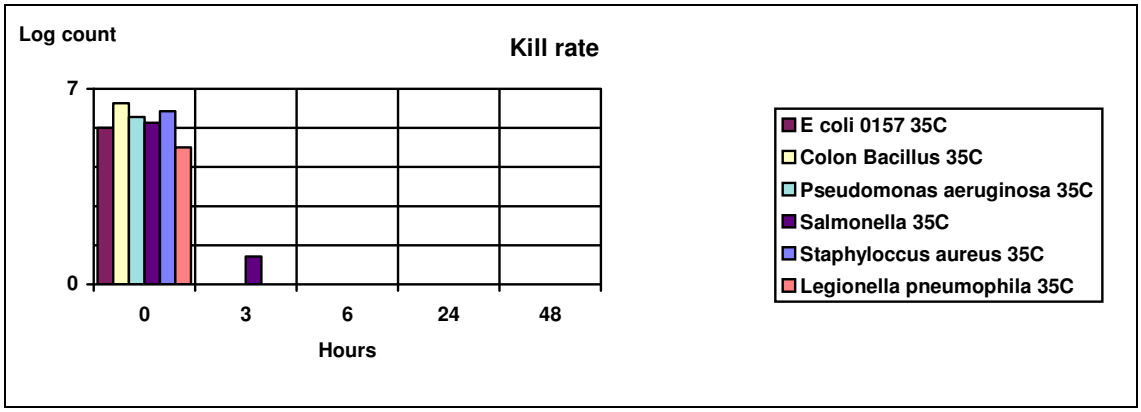
The significant advantage of Active Ceramics over other (non sterilising) products currently available for prevention of the infestation of bacteria is that the electrolytic process (Bactericidal action) begins immediately upon immersion, and is continuous and consistent thereafter, whatever the operating conditions. This compares with the effects of the most commonly used chemical treatments, which are transient and uncertain, requiring constant monitoring and re-dosing to ensure protection.

As the pH of the water treated is changed towards neutral the deposit of scale is immediately inhibited, and removed over time, down stream of the influence of the Active Ceramics. This is shown by the formation of fine deposits in waters of measurable 'hardness' (lime scale).

Disinfecting Capability

Most common disinfectants, such as sodium hypochlorite, take a significant time to kill the total number of microorganisms present, depending on their size and structure. For example, a 1% (10,000 mg/litre) solution of free chlorine can take up to 10 minutes to achieve 100% eradication, while the normal 1mg/litre in municipal water supplies can take as much as 24 hours to give total kill, by which time it has been considerably diminished by side reactions.

In comparison, the effectiveness of one of the 'Active Ceramic' formulations is demonstrated in the following graph:



Note: Other formulations achieve 100% kill in 24 hours but at different rates and microorganism selectivity.

Microbiological tests undertaken By South West Water Laboratories, Countess Wear, Exeter, Devon. Bacterial Kill Experiments.

Organism		T_0	T_1	T_3	T_6	T_{12}	T_{24}	T_{48}
E.Coli (ATCC 25922)	Ceramic Spheres	$1.8x10^5$ /ml	$3.8x10^5$ /ml	$2.8x10^3$ /ml	$1.1x10^3$ /ml	<1/ml	<1/ml	<1/ml
	Control	$5.4x10^5$ /ml	$4.8x10^5$ /ml	$2.4x10^5$ /ml	$2.6x10^5$ /ml	$4.7x10^4$ /ml	$2.9x10^4$ /ml	48/ml
Pseudomonas aeruginosa (ATCC 27853)	Ceramic Spheres	$2.7x10^5$ /ml	$2.3x10^5$ /ml	$1.9x10^5$ /ml	$4.2x10^4$ /ml	$7.3x10^2$/ml	40/ml	8/ml
	Control	$1.6x10^5$ /ml	$3.4x10^4$ /ml	$2.8x10^3$ /ml	65/ml	7/ml	2/ml	<1/ml
Staphaureus (ATCC 6538P)	Ceramic Spheres	$9.2x10^4$ /ml	$8.4x10^4$ /ml	$4.8x10^4$ /ml	$1.0x10^3$ /ml	<1/ml	<1/ml	<1/ml
	Control	$5.7x10^4$ /ml	$4.3x10^4$ /ml	$3.4x10^4$ /ml	$3.9x10^4$ /ml	$2.2x10^2$/ml	<1/ml	<1/ml
Entero Aerogenes (ATCC 13048)	Ceramic Spheres	$2.9x10^5$ /ml	$2.3x10^5$ /ml	$2.4x10^4$ /ml	$1.6x10^3$ /ml	<1/ml	<1/ml	<1/ml
	Control	$2.4x10^5$ /ml	$1.8x10^5$ /ml	$1.8x10^5$ /ml	$1.9x10^5$ /ml	$9x10^4$ /ml	$3.6x10^5$ /ml	$1.9x10^6$ /ml
Total Viable Count at 22°C	Ceramic Spheres	$7.0x10^4$ /ml	$1.2x10^5$ /ml	$2.1x10^5$ /ml	$4.4x10^4$ /ml	$5.1x10^4$ /ml	$6.9x10^5$ /ml	$3.9x10^5$ /ml
	Control							
Salmonella typhimurium	Ceramic Spheres	>$1.6x10^7$ /ml	$5.4x10^6$ /ml	$2.4x10^6$ /ml	$1.1x10^6$ /ml	$2.4x10^3$ /ml	50/ml	<1/ml
	Control	$9.0x10^5$ /ml	$7.0x10^6$ /ml	$2.2x10^7$/ml	$1.6x10^7$ /ml	$5.5x10^5$ /ml	$5.5x10^5$ /ml	

Note

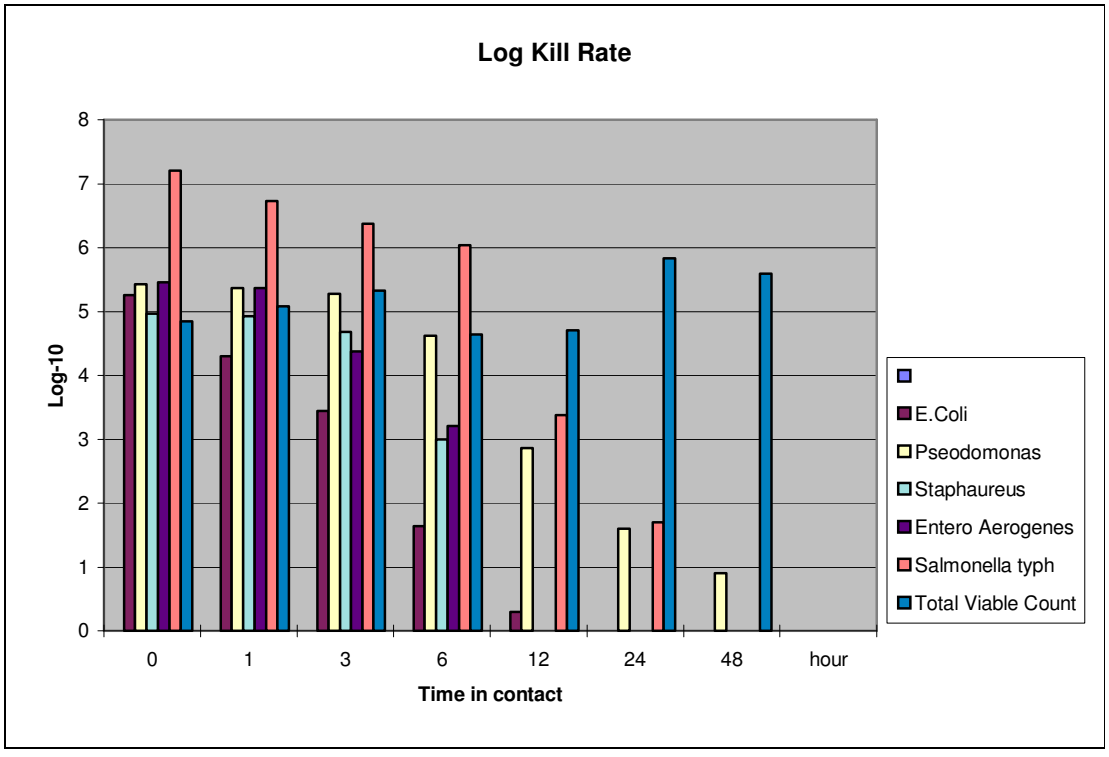
Typically, the Total Viable Count may in some cases appear to be high. Over the first few days the spheres kill the anaerobic (pathogenic) bacteria. The aerobic (beneficial) bacteria are not affected by the active oxygen generated around the spheres. This selective disinfecting action of the spheres is intentional and desirable. The aerobic bacteria are necessary in the natural treatment of the water and are not pathogenic. The aerobic bacteria by their nature coexist with oxygen from the air.

The anaerobic bacteria are affected and killed by the activated oxygen around the spheres which causes the interruption of the feeding / life cycle.

Microbiological tests undertaken By South West Water Laboratories, Countess Wear, Exeter, Devon.

Graphical Representation of Bacterial Kill.

Organism	Hours						
	0	1	3	6	12	24	48
E.Coli	5.255	4.301	3.447	1.643	0.301	0	0
Pseudomonas	5.431	5.362	5.279	4.623	2.863	1.602	0.903
Staphaureus	4.964	4.924	4.681	3.000	0	0	0
Entero Aerogenes	5.462	5.362	4.380	3.204	0	0	0
Salmonella typh	7.204	6.732	6.380	6.041	3.38	1.699	0
Total Viable Count	4.845	5.079	5.322	4.643	4.708	5.839	5.591



Total Silver™ HSA Matrix

Introduction

A Noble metal (such as the silver used in our matrix) is chemically inert or inactive, especially toward oxygen. It has superior properties (e.g. highly resistant to corrosion) and is usually of a relatively higher value than so called base metals (such as iron), which tend to be of comparatively low value and have inferior properties (such as lack of resistance to corrosion).

In a world concerned with the spreading of virus and disease, silver is increasingly being tapped for its bactericidal properties and used in treatments for conditions ranging from severe burns to Legionnaires Disease.

While silver's importance as a bactericide has been documented only since the late 1800s, its use in purification has been known throughout the ages. Early records indicate that the Phoenicians, for example, used silver vessels to keep water, wine and vinegar pure during their long voyages. In America, pioneers moving west put silver and copper coins in their water barrels to keep it clean.

In fact, "born with a silver spoon in his mouth" is not a reference to wealth, but to health. In the early 18th century, babies who were fed with silver spoons were healthier than those fed with spoons made from other metals, and silver pacifiers found wide use in America because of their beneficial health effects.

Recent research compared silver-copper ionisation with the use of high temperatures to destroy bacteria. Contaminated cold water re-infected the hot water system even when temperatures in hot water heaters reached as high as 60 degrees Centigrade. But experiments showed that even at lower water temperatures, ionisation of soft water with silver and copper ions was effective against the bacteria.

'Ionisation showed better results' said Nigel Pavey, principal research engineer for BSRIA Water Services Technology Centre in Berkshire and, to make certain its benefits are widespread, 'there should be more emphasis on copper-silver ionisation in legislation'.

How It Works

Our unique Total Silver™ matrix (Patent Pending) is comprised of numerous separate woven strands of wire manufactured from pure silver coated copper. These strands are then compressed into a matrix format that has a considerable surface area, yet does not restrict the flow of water into which it is immersed. Once in contact with water the differences in electromotive series between the metals cause the release of minute quantities of the metal ions allowing for their uptake by any microorganisms.

The common methods of treatment (adding dilute solution or releasing the metals electrochemically) are fraught with problems, particularly in controlling the final concentrations in the treated water, as both copper and silver are toxic to humans and other vertebrates. Controlling the final concentrations using electrochemical ionisation in areas of hard water is particularly difficult due to electrode scaling.

The Total Silver™ matrix offers an improved disinfection method, overcoming many of these problems, by releasing a strictly controlled quantity of ions into the water within it.

For over two millennia it has been known that, copper and silver purified water. It was found that storage of water in copper vessels prevented the growth of algae, while silver kept the water potable. However, it was only a hundred years ago that the oligodynamic action of such metals on biological processes became understood.

It is now known that silver attaches to sulphur atoms which link the helices of DNA in individual cells of bacteria thus preventing replication and growth, while copper has a pronounced effect on the photochemical reproduction of algae and certain bacteria. It is known that there is synergism between the two metals, as with other chemical species, which further oxidise and complex the metals' ions rendering them more soluble in water.

Disinfecting Capability

The effectiveness of silver as a bactericide is well known and researched. Tests carried out using one of our Silver Copper Matrix showed the following results. At all times the levels of silver and copper in the water remained well within The Drinking Water Directives.

Microbiological tests undertaken By South West Water Laboratories, Countess Wear, Exeter, Devon.

Organism	0	1	3	6	12	24	48
E.Coli	5.591	5.58	4.716	3.041	0	0	0
Pseudomonas	5.415	4.322	3.477	2.799	0.699	0	0
Staphaureus	2.544	2.204	1.342	0.301	0	0	0
Entero Aerogenes	5.519	5.114	4.079	0.778	0	0	0
Salmonella typh	8.225	8.225	5.398	4.301	2.633	0	0
Total Viable Count	4.919	4.612	4.681	4.886	5.361	5.792	4.968
Legionella pnuemo	5.398	3.176	0.778	0	0	0	0

The Benefits of combining the two media

Both the 'Active Ceramics' and the 'Total Silver™ matrix' are independently capable of providing protection against bacterial infestation and, subsequently, satisfying a 'Duty of Care'.

However, there are limitations in the use of each individually. For instance, each individual media demonstrates variations in the kill rate of the different bacteria. The 'Special Active Ceramics' treat the stored water tanks but have little residual downstream effect. They will stop the formation of bio-film but not that of algae. The 'Total Silver™ matrix' doesn't balance the pH of the water nor will it prevent the formation of biofilm.

Combining the media in the HydroMaster™ modules provides a variety of additional benefits.

- It allows us to optimise the disinfection of each individual bacteria type.
- Residual downstream protection is provided through the release of silver and copper ions.
- The modules balance the pH of the water, immediately inhibiting the deposit of scale and removing it, over time, downstream.
- It stops the formation of bio-film and algae.
- The minute electric charge and oxidisation produced by the 'Active Ceramics' actually stimulates the effect of the 'Total Silver™ matrix'.

And in addition to all the above the modules are guaranteed for up to 5 years*.

* Dependant on application

Applications

The combined media is packed in specially designed HydroClenz™ Modules, which maximise the 'Active Ceramic' and 'Total Silver™ matrix' surface area exposed, and, therefore, the contact time with the water to be treated.

The media will keep the water free from a number of pathogenic bacteria and organisms thereby keeping the water stored in a safe condition for extended periods of time. In fact, the HydroClenz™ Modules are long lasting, with a guaranteed lifespan of up to 5 years*.

These composite modules have the additional property of balancing the pH, which precipitates the coagulation of many of the dissolved metallic species such as calcium, magnesium, iron, manganese, etc. inhibiting the build up of limescale or the formation of rust.

There are a number of different 'Active Ceramic' spheres made to various specific formulas. The spheres are designed for use in many different applications, including potable water treatment, grey water reclamation, sewage treatment, chlorine removal, red water and scale control.

There are clear advantages for the food industry where the ceramics will be used in plastics and work surfaces to control Ecoli, Salmonella and other harmful organisms experienced in food preparation and storage.

At present we are specifically targeting the stored potable water arena but a range of other products for different applications will become available in the not too distant future.

*Dependant on application.

A Case History

Safewater Limited "HYDROCLENZ™" Modules – A Case History

A Leisure Centre in London had a serious problem with positive legionella results in the Sports Ground changing rooms. It is probable that the inherent problem was the infrequent use of the water services, leading to infection of the system.

The tanks were cleaned and chlorinated using Sodium Hypochlorite at 50 ppm. as per Approved Code of Practice and HS(G) 70. The infection soon returned and the client paid again to have the system chlorinated. This was an annual cycle and the problem persisted.

The contractor was changed and a specialist company later won the legionella control contract. A strong solution of Anthium Dioxide was used at 150ppm to thoroughly chlorinate the hot and cold-water services. Showerheads were cleaned, de-scaled and immersed in a strong solution of chlorine dioxide.

Three months later in July 1997 routine sampling was undertaken. Positive results as shown below. The system was re-chlorinated.

Water Sample Analysis Results of July Sampling: 08.08.97

Method: For Legionella -B S D.D. 211.92

Date	**Location: Sports Ground**	**Result of Legionella Analysis**
18.07.97	Ladies Showers 4 of 6 from LHS	**>25000 cfu/1SEROGROUP 1 isolated after 10 days.**
18.07.97	Ladies Showers 1 of 6 from LHS	**5500 cfu/1 SEROGROUP 1 isolated after 10 days**
18.07.97	Gents Showers 2 of 6 from LHS	**>25000 cfu/1 SEROGROUP 1 isolated after 10 days**
18.07.97	Gents Showers 6 of 6 from LHS	**2325 cfu/1 SEROGROUP 1 isolated after 10 days**
18.07.97	Kitchen Hot Tap Spot Sample	**1650 cfu/1 SEROGROUP 1 isolated after 10 days.**

The clients' instructions dictated that the tanks were thoroughly cleaned and chlorinated during a winter shut down period in January 1998. Prior to cleaning and chlorination, samples were taken from various outlets and module (AS170) units, one each per tank of 1,000 litres, put into the tanks. Results as follows:-

Date	**Location: Sports Ground**	**Comments**	**TVC 37ºC 1 Day cfu/100ml**	**TVC 22ºC 3 Days cfu/100ml**
30.01.98	Gents showers No. 1 from right	Not Treated	>3000	>3000
30.01.98	Ladies showers No.1 from left.	Not Treated	>3000	>3000
30.01.98	Cold water feed storage. Tank 1	Not Treated	>3000	>3000
30.01.98	Hot water feed storage. Tank 2	Not Treated	>3000	>3000
Then modules put into tanks. One AS 170 unit per tank on 30.01.98				
13.02.98	Gents showers No. 1 from right	Module Installed	9	Nil
13.02.98	Ladies shower No. 1 from left	Module Installed	10	Nil
13.02.98	Cold water feed storage. Tank 1	Module Installed	9	11
13.02.98	Hot water feed storage. Tank 2.	Module Installed	27	29
13.02.98	Inlet water tank cold (flamed)	Inlet water from mains	13	17

Subsequently, the client invested in 12 HydroClenz Units for the whole site. Units were put into the tanks July 20th 1998 for permanent use. The final results from samples taken in September are as follows:

Water Analysis Results: Sports Ground

Date	**Location: Sports Ground**	**Legionella Analysis Results**
14.09.98	Ladies showers 1 of 6 from LHS (furthest away from inlet)	**None isolated from 1 litre after 10 days incubation**
14.09.98	Gents showers 6 of 6 from LHS (furthest away from inlet)	**None isolated from 1 litre after 10 days incubation**
14.09.98	C W storage tank 1	**None isolated from 1 litre after 10 days incubation**
14.09.98	C W storage tank 2	**None isolated from 1 litre after 10 days incubation**

Routine sampling on 14 September indicated NO LEGIONELLA FROM ANY SAMPLES TAKEN.

Water Analysis Results - Leisure Centre.

Routine sampling after 12 months (14th July 1999)

No.	LOCATION	SAMPLE TAKEN FROM	Results Of Analysis. Presumptive Legionella @ 37°C cfu / Litre
	Main Building		
1	Legionella	Ladies changing showers Set 1	None Isolated from 1 Litre after 10 days incubation
2	Legionella	Ladies changing showers Set 2	None Isolated from 1 Litre after 10 days incubation
3	Legionella	Gents Changing showers Set 1	None Isolated from 1 Litre after 10 days incubation
4	Legionella	Gents Changing showers Set2	None Isolated from 1 Litre after 10 days incubation
5	Legionella	Disabled shower ladies	None Isolated from 1 Litre after 10 days incubation
6	Legionella	Disabled shower gents	None Isolated from 1 Litre after 10 days incubation
7	Legionella	Sauna suite showers	None Isolated from 1 Litre after 10 days incubation
8	Legionella	Changing room 1 showers	None Isolated from 1 Litre after 10 days incubation
9	Legionella	Changing room 2 showers	None Isolated from 1 Litre after 10 days incubation
10	Legionella	Changing room 3 showers	None Isolated from 1 Litre after 10 days incubation
11	Legionella	Changing room 4 showers	None Isolated from 1 Litre after 10 days incubation
12	Legionella	Main Tank	None Isolated from 1 Litre after 10 days incubation

No.	LOCATION	RESULTS OF ANALYSIS	
	MAIN BUILDING	TVC 37°C 1 DAY	TVC 22°C 3 DAYS
17	Drinking water kitchen Coliforms & E.Coli NIL	0	0
18	Basin tap gents changing	0	1
19	Basin tap ladies changing	4	30
20	Basin tap sauna suite	3	3
21	Main Tank. Main Building.	0	1

Conclusions; Results indicate no Legionella in samples taken. Showers are safe to use. TVC results confirm water system in good safe working order.

WATER ANALYSIS RESULTS SPORTS GROUND.
Samples taken 14th July 1999.

No.	LOCATION	SAMPLE TAKEN FROM	Results Of Analysis. Presumptive Legionella @ 37°C cfu / Litre
	Sports Ground		
13	Legionella	Ladies showers	None Isolated from 1 Litre after 10 days incubation
14	Legionella	Gents showers	None Isolated from 1 Litre after 10 days incubation
15	Legionella	C.W. Storage Tank 1	None Isolated from 1 Litre after 10 days incubation
16	Legionella	Ladies showers Tank 2	None Isolated from 1 Litre after 10 days incubation

No.	LOCATION	RESULTS OF ANALYSIS	
	SPORTS GROUND	TVC 37°C 1 DAY	TVC 22°C 3 DAYS
22	C.W.Storage tank 1	0	0
23	C.W.Storage tank 2	0	0
24	Ladies showers	0	0
25	Gents showers	6	0
26	Canteen drinking water	0	0

Conclusions; Results indicate no Legionella in samples taken. Showers are safe to use.
TVC results confirm water system in good safe working order.

THE CLIENT IS DELIGHTED WITH THIS RESULT. He has peace of mind because the water treatment is continuous and 100% effective. There is NO DOWN TIME for any of the leisure centre and he has the benefit of a substantial **cost saving** by NOT HAVING TO CHLORINATE EVERY YEAR - OR IN THIS CASE EVERY SIX MONTHS FOR THE NEXT 5 YEARS.

The waters systems treated were free of Legionella at the last scheduled test visit (2001).

Conclusion

Detailed analysis of the technical information given above shows clearly that the HydroClenz™ products incorporate an extremely effective treatment media.

This case study shows how persistent Legionella can be in resisting the best efforts to treat with chemicals and, subsequently, how efficiently the HydroClenz™ Modules deal with, and eradicate, the problem. They therefore provide an advantageous, as well as cost effective, choice for the professional Building Services Manager / Facilities Manager who wishes to provide a safe, but constantly effective, treatment within his premises.

FACTS, BENEFITS AND RESULTS

THE FACTS	THE BENEFITS	THE RESULTS
1. It disinfects continually	Minimises risk and averts legal consequences	Provides peace of mind.
2. Does not produce bio-film	Reduces maintenance costs (i.e. tank cleaning)	Reduced costs - increased profits
3. Balances pH	Prevents deposits of scale and effects of corrosion	Reduced costs - increased profits
4. Non invasive - can be installed by customer	Minimum disruption of organisation reduced outside contract costs	Quality of life for customers and staff not affected Reduced costs increased profits
5. Non-toxic (when immersed)	Eliminates **Known Risk** associated with most other treatment currently available	Peace of mind
6. Environmentally Friendly	Safe to handle, transport and for disposal	Conforming to popular ethical approach. Also complying with regulatory requirements.

FACTS BENEFITS RESULTS COMPARISON

Property	HydroMaster™	Chlorine Hypo-chlorite	Chlorine Dioxide	Bromine	Iodine	Ozone	Ultra-violet
Capital	Modest	Low	Low	High	High	V High	V High
Running	nil	Low	High	High	High	High	V High
Maintenance	low	Low	Low	Low	Low	High	High
Health and Safety Handling	Safe	Hazard	Hazard	Hazard	Hazard	Hazard	Safe
Storage	Safe	Hazard	Hazard	Hazard	Hazard	Hazard	Safe
Transport	Safe	Hazard	Hazard	Hazard	Hazard	Hazard	Safe
Exposure	Safe	Toxic	Toxic	Toxic	Toxic	v Toxic	Hazard
Dosage	Simple	Simple	Simple	Simple	Simple	Complex	Complex
Disposal	Safe	Hazard	Hazard	Hazard	Hazard	Hazard	Safe
Environmental Power	none	none	none	none	none	V High	V High
Impact	none	High	High	High	High	V High	V High
Recycling	v good	poor	poor	poor	poor	none	low
“Green” Credential	high	poor	poor	poor	v poor	v poor	v poor