

Neutral Electrolyzed Water using HYPOGEN technology



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1.0 Preface

NEW (Neutral Electrolyzed Water) is an **all-natural, organic, non-toxic, non-irritant, environmentally and ecologically safe sanitizing and disinfecting solution**. It is produced from the electrochemical reaction of water, salt, weak acid and electricity. The applications for this technology are infinite and include any process or facility requiring **sterilizing, disinfecting, cleaning or water purification**.

NEW is revolutionizing sanitization and disinfections in all industries. Not only does this product provide a 'Green' solution, it is in line with the American public's concern over escalating disinfection processes and "deep cleaning" that has become necessary with the advent of COVID-19 and their growing demand for the industry to move quickly to implement more safe and natural products. **This process provides a disinfectant that is up to 100 times more powerful than bleach but is not harmful to people.**

NEW offers many advantages over traditional chemical technologies, including:

- Safety – not harmful to people
- Superior disinfections performance – 80 to 100 times more powerful than bleach
- Removal of biofilm
- A more stable, longer-lasting chlorine residual
- Minimal odor

The primary component of **NEW** is hypochlorous acid, the most effective element of chlorine. **NEW** is pH neutral, super-oxidized water generated by electrolysis of a diluted NaCl solution passing through an electrolytic cell. **This process creates large volumes of a gentle, but extremely potent antimicrobial solution capable of rapid reduction of bacteria, viruses, spores, cysts, scale and biofilm. NEW is stable, cost-effective to produce, greener than traditional chemical technologies, and can be used in multiple applications across a wide variety of industries.**

NEW is an oxidizing agent; due to a mixture of free radicals it has an antimicrobial effect. Studies have shown that **NEW** is highly biocidal and can substantially reduce pathogens such as *Salmonella* and *E. coli* and viruses such as the *Avian Influenza virus*, *Norovirus*, among others, without the use of costly toxic chemicals. In addition, it offers the added benefits of being able to remove biofilm and scale from manufacturing equipment, thus, greatly minimizing a major contributor to contamination problems.

Because **NEW** effectively destroys microorganisms, **they cannot build up resistance to NEW as they can to other sanitizers and disinfectants**. Standard toxic chemicals can create strains of pathogens that become resistant over time, because the cell can expel or neutralize the chemical before it can kill it, thereby causing the overall efficacy of chemical cleaners and disinfectants to be significantly reduced.

Not only is **NEW** safe to use for "deep cleaning" and sanitizing facilities but it has also been tested and identified in agricultural, food processing and retail grocery venues where the produce, poultry, meat, seafood and dairy industries are particularly impacted. **NEW** can be safely applied to food products, equipment and facilities using a variety of methods, including **fogging, direct application or dosing**.

The following document describes the benefits and applications of **NEW** and describes the production of **NEW** using the machines.

2.0 Electro Chemical Activation (ECA) Technology

2.1 Background

A breakthrough in chemical engineering can now generate consistently high quality, pure HOCl (**Hypochlorous acid**) from unassuming food grade precursors (salt) to produce the biocidal disinfectant, **NEW**. The technology used to produce **NEW** is based on the electrochemical activation of water and salt brine (ECA technology, described below), and has been developed in line with the world trend to reduce the amount of chemicals, especially traditional Chlorine, used to purify, disinfect or sterilize. This technology was originally designed in Russia as a disinfection process, and is currently being successfully used in the USA, Europe and Canada.

HOCl generated by ECA technology carries with it fewer negative hydroxides than the previous HOCl formed via disassociation from sodium Hypochlorite. Because of this, ECA-generated HOCl behaves uniquely and must be considered separately from chlorine. HOCl as a stand-alone chemical, separate from chlorine. This breakthrough results in a need for a paradigm shift in biocidal approaches. HOCl is an “old”, well appreciated chemical but is now available as HOCl with possibilities and applications that many consider revolutionary.

NEW is manufactured through validated processes and devices in accordance with EPA standards and can now be produced in large volume (making onsite production of NEW commercially viable)

The biocidal disinfectant produced by the HYPOGEN machines consists of 85 - 100% **NEW**.

The general product specification of **NEW** is:

- PH 5.5 –7.0, adjustable by the operator
- Oxidation-Reduction Potential (ORP) > 900mV+
- Free Available Chlorine (FAC) >1,000 ppm, adjustable by the operator

The active oxidizers present in **NEW** are HOCl and Hypochlorite ion, OCl⁻. The quantity of HOCl and OCl⁻ is dependent upon the pH of **NEW** and is therefore adjustable to suit the needs of the operator.

Common Names for Hypochlorous Acid Solutions

- Electrolytically Generated Hypochlorous Acid
- Neutral Electrolyzed Water (**NEW**)
- Electrolyzed Oxidizing Water (EOW)
- Electro-chemically Activated Water (ECA)
- Super-oxidized water (SOW)

Table 1: Composition of **NEW**

Ingredient		CAS-No	EINICS-No	Wt/Vol %	Symbols
Sodium Chloride		7647-14-5	231-598-3	<0.33%	NaCl
Acetic Acid		64-19-7		<0.07%	CH3COOH
Free Available	Hypochlorous Acid (chlorine)	7790-92-3	323-323-5	<0.1% <i>Amount HOCl and</i>	HOCl
Chlorine (FAC)	Hypochlorite ion (Sodium Hypochlorite)	7681-52-9	231-668-3	<i>OCl- depending on pH</i>	OCl ⁻
Water		7732-18-5	231-791-2	>99.5%	H ₂ O

2.2 Electrochemical Activation (ECA) Technology

NEW is generated by electrolysis of a dilute NaCl solution passing through an electrolytic cell. This process is known as Electrical Chemical Activation, or ECA technology. ECA technology is based on Faraday's laws of electrolysis and was further developed by Russian scientists to combat biological contamination.

NEW Technology involves the electrolysis of molten salts. It utilizes electrolytic cells encompassing anodes and cathodes. By passing an electrical current through the solution, an electrochemical or oxidation-reduction (Redox) process occurs, generating a number of oxidized species.

2.3 Mechanism of Action

NEW is composed of oxidizing biocides HOCl and OCl⁻, which are general chemical oxidants. Since **NEW** consists of both HOCl and OCl⁻ it is believed that the bactericidal action exhibited is due to the combination of these substances. They are not selective for living organisms but react with any oxidizable matter. They are a bactericidal because certain bacterial cell components can react readily with them, having a higher oxidation potential than most other chemicals present in water.

The bacterial cell membrane provides the osmotic barrier for the cell and allows the active transport of substances into the cell. The bacterial membrane itself has an electrical charge. Alternations in transmembrane potential by the anions present in **NEW** result in the rupture of the membrane and outflow of the bacterial cell content; instantaneously destroying the cell.

NEW can also disrupt other functions of the cell. Unlike "higher" organisms, single celled organisms such as bacteria obtain their energy sources from the environment immediately outside the cell. Small molecules are transported across the cell membrane via an electrochemical gradient. Thus, any significant change in the ORP of the immediate environment has drastic consequences for the cell. Even if instantaneous death of the cell does not occur, all enzymatic functions in the membrane are affected and this will also result in loss of cell livability.

The mechanism of action for the eradication of various microorganisms by **NEW** is well documented by third party resources. The mode of action is as follows:

- The free ions in **NEW** rapidly react and denature (destroys) proteins.
- Once **NEW** comes in contact with a microorganism (viruses, bacteria, fungi and protozoa); it attacks the bacterial proteins located in the cell membranes.
- Because of the osmolarity difference (the concentration of ions in the solution versus in the cytoplasm), **NEW** induces the rupture of cell membranes, leading to cell lysis (destruction).

The high oxidation of **NEW** first damages bacteria cell walls, allowing infiltration by water. The microbe reaches capacity, causing an osmotic, or hydration, overload. The acidic fluid and water flood the cell faster than the cell can expel it, literally causing the cell to burst.

HOCl also destroys viruses by chlorination. It acts on anything, from lipids to nucleic acids. For example, [Hawkins et al](#), [2002](#) describe in detail the effects of HOCl on nucleic acids. HOCl, by direct chlorination, leads to the formation of chloramines, and ultimately nitrogen-centered radicals. These radicals often react with each other to form dimers. Also, they have reported formation of single- as well as double-stranded breaks on application of HOCl on plasmid DNA.

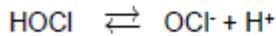
NEW produces a residual that continues to remain available based on bacterial or viral demand. ORP levels can last for long periods of time depending on organic burden. Tests show that not only is **NEW** an effective sanitizer and disinfectant, but it is also sporicidal. Sporicidal tests have demonstrated that **NEW** treatment eliminates bacterial spores and biofilm.

2.4 Chemistry

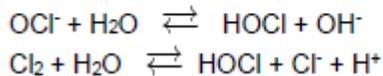
ECA technology generates **NEW** consisting of the following known chemical species:

- Hypochlorous Acid (HOCl)
- Sodium Hypochlorite (NaClO)
- Sodium Chloride (NaCl)

In aqueous solution, hypochlorous acid partially dissociates into the anion Hypochlorite ClO⁻:



HOCl and OCl⁻ exist in a state of equilibrium:



The relation between HOCl and OCl⁻ is solely dependent on pH value. The pH level of **NEW** is preferably set to ~6 to produce the highest HOCl content. HOCl and OCl⁻ are measured as FAC (Free Available Chlorine). The FAC compound is adjustable in **NEW** from 500 to 1,000ppm, which is many times less than the level currently found in most biocides, but many more times potent due to the composition of **NEW**.

HOCl and OCl⁻ have been shown to be the sole active substances in the biocidal effect of **NEW**. The quantity of HOCl and OCl⁻ formed is dependent upon the pH of **NEW**. This is in contrast to traditional electrolysis processes, which would typically result in unstable oxidized water. Electrolysis of water may produce such products as H⁺ and OH⁻ ions, H and OH radicals, H₂, O₂, HO₂, and O₃ due to Redox reactions. As a result, hydrogen and ozone gas are released and a percentage of hydroxides remain in the solution in various forms including but not limited to hydrogen peroxide.

3.0 Benefits of NEW

NEW is revolutionizing sanitization and disinfections in all industries. Not only does this product provide a 'Green' solution, it is in line with the American public's concern over escalating disinfection processes and "deep cleaning" that has become necessary with the advent of COVID-19 and their growing demand for the industry to move quickly to implement more safe and natural products. **This process provides a disinfectant that is 80 – 100 times more powerful than bleach but is not harmful to people.**

NEW is Efficient:

- **NEW** is generated on demand and applied where required to eliminate the logistical concerns of purchasing, transporting, storing, preparing and using traditional chemical applications
- The elimination of hazardous chemicals translates into reductions in regulatory paperwork, safety training requirements, safety inspections, and liability exposure
- Eliminates the need to monitor for chlorine dioxide residuals, chlorite, or bromates
- Provides more effective cleaning ability than other toxic chemicals
- The higher biocidal capacity relative to traditional chemical solutions permits the use of lower dose rates, lessening the risk for environmental impact
- The solution is less corrosive than alternate products
- Reduces the frequency of cleaning within a facility

NEW is Effective:

- **NEW** has been demonstrated to be up to 80 to 100 times more effective than Sodium Hypochlorite, **Extensive tests have shown that the solution has the power to kill bacteria, viruses, fungi, spores and microbial toxins**
- Rapidly destroys microorganisms, scale, and biofilm
- More effective than alternate sanitation chemicals
- Can be used effectively to protect against bioterrorism
- Reduces risk mitigation
- Allows for the marketability of a “clean” & “Green” facility
- Completely safe, non-harmful, green product using only natural ingredients
- More effective sanitization than Chlorine alone
- The systems are all “plug and play” and require little adjustment

NEW Saves Money:

- **NEW** is cost effective due to the fact that many more deliveries of bulk chemicals are required for the same chlorine equivalent generated by a single delivery of salt, a fact that becomes even more critical as fuel costs rise
- The capital cost of the on-site HYPOGEN device can often be recovered in 3 years
- HYPOGEN devices are depreciable assets
- A single unit produces a natural solution to supply an entire facility with numerous cost-effective applications
- Eliminates the need for expensive and potentially toxic chemicals
- Reduces the costs of purchasing, transporting, storing, preparing and using traditional chemical applications
- Decreases labor requirements and costs

NEW is Convenient:

- Onsite generation allows **NEW** to be produced on demand, 24/7
- **NEW** can be applied as it is being produced
- The systems are mobile
- Produced and applied directly from a validated system

NEW is Safe:

Safe for Users:

- No health and safety risks
- No protective gear required
- No eye or skin irritation
- Non-toxic (inhalation, ocular, cutaneous, ingestion)
- Non-hazardous
- No additional protective equipment required
- No exposure limits
- Lowers the risk of sickness and absence in the workplace

Safe for Products:

- Addresses public safety concerns
- All-natural, safe
- Non-toxic, non-hazardous
- No storage compatibility issues
- No residue to rinse
- No special disposal required
- Does not require a hazardous use permit

Safe for the Environment:

- The only elements introduced into the system are water, salt, weak acid and electricity, and are all safe and environmentally friendly
- No disposal precautions
- Provides opportunity to reduce water usage
- Reduces volume of wastewater
- No adaptive resistance chance for microorganisms
- No environmental impact
- Fully biodegradable
- Satisfies the demand for implementing safer and more natural food products

3.1 Comparison of *NEW* to Currently Used Technologies

In the early development of electrolyzed water, electrolytic cells were only capable of generating small volumes of acidic electrolyzed water with a limited shelf life. In recent years, **neutral electrolyzed water (*NEW*) has been introduced as a stable, high-level disinfectant, which is non-corrosive and able to penetrate cell membranes more easily in comparison with other currently used technologies.**

***NEW* is less toxic, less volatile, easier to handle, compatible with other water treatment chemicals,** effective against biofilm and generates no by-products compared to currently used biocides. ***NEW* is highly biocidal but has a very low chemical load (measured in FAC) as compared to sodium Hypochlorite and is thus not harmful for the environment or human beings.**

Because *NEW* effectively destroys microorganisms, they cannot build up resistance to *NEW* as they can to other sanitizers and disinfectants. Standard toxic chemicals can create strains of pathogens that become resistant over time, because the cell can expel or neutralize the chemical before it can kill it, thereby causing the overall efficacy of chemical cleaners and disinfectants to be significantly reduced.

***NEW* offers an environmentally sound alternative to chlorine and other oxidizing biocides. *NEW* is proven to be more effective in killing bacteria, noroviruses, molds and other microbiological organisms than Chlorine* alone and yet remains benign enough to ingest in concentrated form. (*Hydrochloride)**

***NEW* is by chemical content nearly identical to the active components found in common chemical bactericidal agents. However, unlike the extremely toxic substances, such as chloramines, formaldehyde or iodine, the active components of *NEW* are non-toxic, non-irritant, biologically harmless and ecologically safe.** Because of its neutral pH, ***NEW* does not aggressively contribute to the corrosion of processing equipment or irritation of hands and is more stable due to the fact that chlorine loss is significantly reduced at pH 6-9.**

NEW has a high Oxidation-Reduction Potential (ORP, expressed in millivolts). ORP correlates to the level of sanitizing ability of treated water irrespective of the kind of disinfectant used. For example, any water which is treated to have an ORP of >500mV for more than approximately one hour would be assured of being free of E. coli, Listeria, Salmonella and other pathogens. The high ORP levels of >800 mV found in **NEW** are possible due to the elimination of caustic chemicals. This feature of **NEW** allows for a higher level of ORP than disinfectants such as Sodium Hypochlorite (NaOCl), for example. **When caustic Sodium Hypochlorite is used, it also simultaneously raises the pH of water and thereby dramatically reduces its efficacy (ORP). When NEW is used, the pH of water is not raised, but is slightly lowered, and its ORP remains stable or is enhanced.**

Electrochemically synthesized reagents, such as the neutral electrolyzed water of **NEW**[®], are gaining rapid popularity in a number of applications. Not only does this technology offer a cost-effective alternative to existing technologies, but it is also contributing to the protection of the environment. Advantages of electrochemically synthesized reagents include:

- These reagents are synthesized from diluted solutions of inorganic salts.
- Since these reagents are manufactured on-site, transportation costs are eliminated. This is in contrast to the use of traditional chemicals, which may require timely planning, purchasing and proper storage infrastructure
- Because these reagents are produced by an environmentally safe technology, there is no need for neutralization or purification prior to use as with traditional chemical technologies

All water disinfections will result in the formation of disinfections by-products. **NEW** is no exception but has the advantage that it does not contain the hydroxyl ion and will oxidize organic material to form lower levels of chlorates, thus reducing halogenated by-products. The inorganic by-products, (trihalomethanes, THMs, chlorite, chlorate and chloride ions) formed when **NEW** is used are held in balance at much lower levels. Thus, lower disinfections by-products are produced in the process, at a level of about 30% - 50% when compared with sodium Hypochlorite and other oxidants.

3.1.1 Comparison of **NEW** to Chlorine

Chlorine is currently the most widely used oxidizing biocide. It is a powerful oxidant and is used in bleaching and disinfectants.

The use of chlorine as a micro-biocide and water disinfectant is declining because of safety, environmental and community impact considerations. According to the MSDS for chlorine, this chemical is highly toxic, corrosive, and may be fatal if inhaled. It is considered to be a marine pollutant, and in the upper atmosphere, chlorine atoms have been implicated in destruction of the ozone layer. An environmentally sound alternative to chlorine and other oxidizing biocides is needed.

Various alternatives to chlorine use have been explored, including bleach, bleach with bromide, bromochlorodimethyl hydantoin (BBCDMH), non-oxidizing biocides, ozone, ultraviolet, chlorine dioxide, sodium chlorite, chloramines (chlorine & ammonia), copper-silver ionization, and thermal disinfections. Alternative devices include chlorinators, electrically generated ozonators, and copper/silver cathodes, which use electrical activity to cause the release of silver and copper ions into drinking water. Each chemical and device offers some unique advantages, but each has distinct disadvantages.

The HOCl of NEW is found to have the advantages of other biocidal alternates without their disadvantages. Categories of objective analysis include efficacy, safety, taste and odors, impact on equipment and systems, effect on scale, biofilm, residual effects, ease of use, maintenance and cost.

NEW is a mixed-oxidant solution. Although it is measured and dosed as free available chlorine, it exhibits behavioral traits associated with more active chlor-oxygen chemistry than traditional chlorine. In contrast to other chlorine technologies, mixed oxidants such as **NEW** offer superior disinfections efficacy, elimination of biofilm, more durable chlorine residual levels, and reduced formation of disinfections by-products. Mixed oxidants readily oxidize ammonia; sulfides, iron and manganese, and can cause a micro flocculation effect (reduction in turbidity) in pretreatment. In addition, mixed oxidants offer improved taste and odor. **NEW, even at residual levels over 12 ppm in treated water, leaves minimal to no odor or chlorine taste.**

Production of **NEW** is similar to the process of fabricating standard sodium Hypochlorite (NaOCl), with one significant difference. Sodium Hypochlorite combines Cl₂ with caustic soda (lye) to stabilize chlorine. The manufacture of **NEW** eliminates the use of caustic soda by instead using high rejection technology to produce pure HOCl. The benefits of HOCl become immediately evident when used as a biocide. Elimination of lye makes disinfection possible without the high pH elements associated with sodium Hypochlorite. **NEW** exists at a neutral pH (6-7), thereby delivering high efficacy in short contact times without the use of caustics. The human body pH level is approximately 7.3, therefore **NEW** falls within the range where it is safe to the human body.

Independent research has confirmed that the effectiveness of **NEW** on reducing total microbial counts is superior to that of sodium Hypochlorite. The biocidal activity of **HOCl generated by the current ECA technology is 100 times more active than the sodium Hypochlorite generated by earlier systems**. Sodium Hypochlorite or gaseous chlorine at the same concentration as that found in **NEW** leads to slower microbial kill and more corrosion when tested per ASTM guidelines.

Activated solutions such as **NEW** have been conclusively shown to exceed chemically derived equivalents both in low dosage effectiveness as well as physicochemical purity. This heightened biocidal capacity relative to traditional chemical solutions permits the use of **NEW** at lower dose rates, decreasing the risk of adverse environmental impact.

4.0 Efficacy of NEW

4.1 Biofilms

Biofilms are a complex aggregation of microorganisms, including bacteria, protozoa and algae. Biofilms are usually found on solid substrates submerged in or exposed to an aqueous solution, and given sufficient resources for growth, will quickly grow to be macroscopic. In industrial environments, biofilms can develop throughout plants and on food processing equipment, which can lead to clogging, corrosion and rampant contamination. Reductions of biofilm in industrial facilities can result in substantial thermal efficiency improvements.

Biofilms are comprised of organisms which are closely packed and firmly attached to each other and usually a solid surface. Formation of a biofilms begins with the attachment of free-floating microorganisms to a surface. If the first colonists are not immediately separated from the surface, they can anchor themselves more permanently using cell adhesion molecules such as pili. The first colonists facilitate the arrival of other cells by providing more adhesion sites and building the matrix that holds the biofilms together. Once colonization has begun, the biofilms grows through a combination of cell division and recruitment and may continue to change in shape and size.

Bacteria living in a biofilm usually have significantly different properties from free-floating bacteria of the same species because the dense and protected environment of the film allows them to cooperate and interact in various ways. This environment allows the bacteria to develop increased resistance to detergents and antibiotics, as the dense extracellular matrix and the outer layer of cells protect the interior of the community.

Traditionally, there have been several strategies for preventing or removing biofilm, including:

- Using bactericidal compounds to chemically kill bacteria
- Using liquid or gas dispersants to break up the biofilm
- Using mechanical means to physically remove biofilm
- Using enzymes or chelants to weaken the biofilm structure

In the past, no traditional strategies have been proven to be completely effective against biofilm. Even high levels of disinfectant cannot eliminate pathogens within even small amounts of scale. Because biofilm is attached to the substrate by virtue of an electrical charge, dislodgement must be accomplished by disturbance of the charge – therefore very few chemicals are effective.

Now, researchers have been demonstrating the success of the use of electrochemically activated water as an effective alternative for removing biofilm.

4.2 Microorganisms

NEW has a strong bactericidal effect on most known pathogenic bacteria due to its high oxidation-reduction potential (ORP > 800 mV). This non-toxic oxidized antimicrobial solution capable of killing many pathogens in less than a minute. Since **NEW** consists of both HOCl and OCl⁻, it is believed that the bactericidal action exhibited is due to the combination of these substances. Based on various bactericidal, fungicidal and Sporicidal testing performed to date; **NEW** has proven to be a high-level disinfectant, substantially reducing pathogens without the use of costly toxic chemicals.

Destruction of most vegetative cells of bacteria, molds, and parasites is usually not difficult because they are sensitive to heat and chemicals. However, many organisms excrete extra cellular polysaccharides and form biofilm that protect individual cells and can be quite difficult to remove from surfaces and manufacturing equipment using traditional methods and chemicals. Studies have shown that **NEW** can remove biofilm and scale from manufacturing equipment, thus greatly minimizing a major contributor to contamination problems.

Molds, *Clostridium* spp., and *Bacillus* spp. form spores that are resistant to heat, acids, and other compounds. Parasites also produce resistant cells called cysts, and virus particles are notoriously resistant to heat, chemicals, and drying. **NEW** has been proven to be an effective Sporicidal and provides rapid reduction of spores and cysts.

Over time, microbes evolve to become resistant to some sanitizers and disinfectants. Because **NEW** effectively destroys microorganisms, they cannot build up resistance to **NEW** as they can to other sanitizers and disinfectants.

NEW gives a much quicker inactivation rate of a wider range of microorganisms than traditional chlorination technologies, and therefore decreases the risk of waterborne diseases, outbreaks, and illnesses. **NEW** has been successfully tested against the variety of microorganisms and pathogens listed below, including several different biological weapons agents:

- *Influenza*
- *Norovirus*
- *Listeria*
- *Bacillus anthracis (anthrax)*
- *Bacillus cereus*
- *Bacillus stearothermophilus*
- *Bacillus subtilis spores*
- *Bacteriophage (F2)*
- *Clostridium perfringens spores*
- *Coliphage MS2*
- *Cryptosporidium parvum oocyst*
- *Escherichia coli*
- *Francisella tularensis*
- *Giardia lamblia cyst*
- *Giardia muris cyst*
- *Hepatitis A virus*
- *Hepatitis virus analog (F2)*
- *Klebsiella terrigena*
- *Legionella pneumophila*
- *Listeria monocytogenes*
- *Pseudomonas aeruginosa*
- *Salmonella typhimurium*
- *Staphylococcus aureus*
- *Vaccinia virus (smallpox)*
- *Vibrio cholerae*
- *Yersinia pestis (plague)*

5.0 Stability of NEW

The parameters that are measured in order to establish shelf life include pH, ORP and FAC. In addition, a commonly used method to determine stability revolves around the ability of **NEW** to kill spores of *Bacillus subtilis*, a bacterium known to be among the most resilient to chlorine. This is a useful measurement used in determining the shelf life of **NEW**, since it is ultimately this anti-microbial nature that is key to **NEW**'s action as a high-level disinfectant.

A study was performed to compare the shelf life of **NEW** (446 mg/L of active chlorine) to a NaClO solution (334 mg/L of active chlorine) during a 54-day period under the following storage conditions: at 4°C under artificial light, and at room temperature (23 ± 2°C) in the presence of natural light in both open and closed containers. The pH, ORP and active chlorine concentrations were periodically measured during storage. Results showed that **NEW** exhibited better shelf life than NaClO in all of the evaluated conditions in terms of active chlorine degradation and bactericidal activity. The half-life of **NEW** was determined to be 21 days at room temperature, and more than 54 days at 4°C.

6.0 Toxicity of NEW

In data obtained from independent testing executed outside the USA by third parties, no evidence of toxicity in any form has been observed in any testing. Moreover, this claim is supported by the review of relevant literature, which has revealed that HOCl and OCl⁻, at the low doses occurring in **NEW**, **do not produce toxic effects**. Based on this information, it can reasonably be concluded that **NEW** is non-toxic and safe to use in the industries and applications considered in this document.

7.0 Regulatory

7.1 EPA

The EPA has approved the use of **NEW** and has granted Chlorking an “establishment number” (82229-GA-001) allowing the production and use of electrolyzed water that is produced on-site.

Because speciation studies from a variety of institutions have identified only chlorine in the mixed oxidant **NEW** solution, the U.S. Environmental Protection Agency (EPA) has determined that mixed oxidant customers need only to follow chlorine regulatory requirements, including use of chlorine CT values, limits on maximum chlorine allowed, and limits on total trihalomethanes (TTHM) and halo acetic acid (HAA5) formation.

NEW is approved under 21 CFR 173.315 for direct contact with processed foods and is approved for several indirect food contact applications under 21 CFR 172.892, 21 CFR 175.105, 21 CFR 176.170 and 21 CFR 177.2800. It is an approved sanitizer that meets 21 CFR 178.1010.

The EPA has also given approval (40 CFR 180.1054) for washing raw foods that are to be consumed without processing. **NEW** in its most concentrated form cannot be classified as hazardous in accordance with Directive 99/45/EC. Normal COSHH regulations apply. The Chlorking device does not require a hazardous use permit.

Under Section 3 of the Pesticide Regulations under the Federal Insecticide Fungicide and Rodenticide Act as amended (FIFRA), the EPA regulates pesticides, which are registered and sold in interstate commerce. Under these regulations, Pesticide Devices are not required to be registered, but must have an approved label which meet the Section 3 Regulations, Part 162.10, and have a registered establishment in which they are produced. Under Section 7 of the FIFRA, each owner of a pesticide device must produce to the EPA enforcement program a report of products produced each year and to whom they are sold in a standard report form. The Chlorking device has an EPA establishment number of 82229-GA-001 and reports information pursuant to Section 7 of the Act.

Devices are subject to labeling and misbranding requirements under FIFRA section 2(p) and 2(q); registration and reporting requirements under FIFRA section 7; recording keeping requirements under FIFRA section 8; inspection requirements under FIFRA section 9; import and export restrictions under FIFRA section 17; and child resistant packaging requirements imposed pursuant to FIFRA section 25(c)(3).

The device uses electric current to produce hypochlorous ions on demand on site, which kill bacteria, mold, mildew, viruses and surface-filling algae. The device uses sodium chloride in a liquid format in water and an electric charge to generate the chlorine on demand. When the electricity has been turned off, the device produces no chlorine and contains no residual. No product is produced from the device for storage or later use per regulations.

In case of doubt or for clarification, your supplier should be consulted. Your supplier is unable to anticipate all conditions under which the product may be used, and users are advised to carry out an assessment of workplace risk and carry out their own tests to determine safety and suitability for the process and conditions of use.

8.0 Introduction Methods

NEW can be safely applied to food products, air, water, equipment and facilities. A variety of methods can be used to apply **NEW** in concentrated or diluted form. Upon production, **NEW** is collected into a storage container, from which it can be applied using methods such as dosing by means of a dosing pump, or applied to products, equipment or facilities via fogging, misting, spraying, soaking, immersing or rinsing. Items may be soaked or immersed in **NEW** for disinfection.

Fogging

Fog is a cloud in contact with the ground. Artificial fog is generated by means of aerosols or is created by vaporizing water. Fogging kills airborne bacteria, viruses and microbiological organisms. Fogging of **NEW** generally will not cause the floor to get wet.

Electrostatic Fogging

Electrostatic fogging occurs when a negatively charged solution is introduced into the air, which seeks out positively charged surfaces, causing larger areas to be treated more effectively.

Freezing

NEW can be dosed into ice machines creating sanitized ice, which has many applications in the food industry, including the storage and display of fish and shellfish.

Dosing

Dosing involves the introduction of **NEW** into a process fluid, atmosphere or to another media in intervals to give it sufficient time to react or show results.

Misting

A mist is a phenomenon of a liquid in small droplets floating through air. Misting is executed with the help of aerosols. Generally, misting **NEW** causes the floor to get wet.

Spraying

Spraying involves disinfecting a surface by applying **NEW** using a spray gun or high pressure cleaner. Spraying allows **NEW** sufficient contact time with the surface for disinfection.

Soaking

Soaking involves placing a subject in a bath and allowing the subject to become saturated or permeated with **NEW**.

Rinsing

Rinsing is accomplished by washing lightly, as by pouring **NEW** into or over a subject.

Immersing

Immersing in a bath involves plunging a subject into or placing it under a liquid, also known as dipping or sinking.

8.1 Consumables and usage

Consumable	Dilution required (water / acid)	Consumption
56% Acetic acid	3 parts water : 1 part acid	14oz of diluted acid per 20 gallons of HOCl produced at 6pH
Rock / solar salt	None (Saturated in feeder)	0.83lbs. of salt per 20 gallons of HOCl produced at 1,000ppm FAC

9.0 List of Abbreviations

COSHH	Control of Substances Hazardous to Health Regulations
ECA	Electro-Chemical Activation Technology
EPA	Environmental Protection Agency
FAC	Free Available Chlorine
FIFRA	Federal Insecticide Fungicide and Rodenticide Act
HOCl	Hypochlorous Acid
NaCl	Sodium Chloride
NEW	Neutral Electrolyzed Water
OCl-	Hypochlorite Ion
ORP	Oxidation-Reduction Potential