

## LEADERS IN STATE-OF-THE-ART CHLORINE DIOXIDE TECHNOLOGY

### Innovation and research solved the ClO<sub>2</sub> challenge

CDG Environmental, LLC was built on the foundation of CDG Technology, Inc., and CDG Research Corporation. These organizations recruited top chemical, engineering, and water experts to discover a practical way to produce and use ClO<sub>2</sub>. Today CDG Environmental is proud to continue its tradition of extraordinary innovation to offer the first Ready, Steady & Pure ClO<sub>2</sub> for use in a multitude of important applications.

### Recognized and approved by top authorities

CDG Environmental's products and processes have received approvals from all relevant regulatory authorities. CDG Environmental has in-house expertise in the areas of regulatory compliance, methods of handling, applications, and reaction chemistries.

### Management committed to excellence

CDG Environmental's senior management team has extensive experience in the fields of technology and marketing of chemical disinfection and sanitation. The company commitment to innovation and excellence has made CDG the state-of-the-art leader in chlorine dioxide technology.

### APPROVALS — CDG Solution 3000™ concentrate is...

**EPA-Approved:** As a FIFRA registered antimicrobial pesticides in all 50 states and Puerto Rico for a wide variety of industrial, commercial, agricultural, and food processing applications.

**NSF certified:** CDG Solution 3000™ concentrate along with SAF-T-CHLOR™ sodium chlorite is certified by the National Sanitary Foundation (NSF) under the NSF/ANSI Standard 60 for drinking water treatment.

**FDA & USDA Approved:** FDA & USDA approved for antimicrobial uses with poultry, fruits & vegetables, and red meat.

**DOT-Approved:** Department of Transportation approved for transport via truck or rail.

**OMRI-Listed:** Listed by the Organic Materials Review Institute (OMRI) for use in certified organic production, food processing, livestock handling, and crop management.

**Star-K Kosher Certified.**



PRACTICAL CHLORINE DIOXIDE. READY | STEADY | PURE

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## PRACTICAL CHLORINE DIOXIDE

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Unique technology for the production, delivery and application of pure and stable ClO<sub>2</sub>

# THE INDUSTRY'S BEST BIOCIDES

In a world of ever-increasing pathogen awareness, chlorine dioxide (ClO<sub>2</sub>) has become recognized as the most effective biocide available for sterilization, disinfection, sanitization and decontamination in the food, beverage, water treatment and agricultural markets.



## Why is Chlorine Dioxide so effective?

Chlorine Dioxide (ClO<sub>2</sub>) is a synthetic, green-yellowish gas that is soluble in water. It is a powerful, fast-acting, highly effective, eco-friendly biocide.

- **Effectiveness:** Unparalleled effectiveness against a broad spectrum of micro-organisms at low concentrations and short contact times.
- **Destroys Biofilm** that protects pathogen from conventional disinfectants.
- **Head Space:** As a gas, ClO<sub>2</sub> treats the entire, closed system including non-wetted surfaces.
- **pH Independent:** Avoids need for supplemental chemicals to adjust pH.
- **Efficiency:** Selectivity against microorganisms means that ClO<sub>2</sub> is not quickly dissipated by other compounds.

### Competitive Biocidal Effectiveness

Performance Criteria	Bleach (Sodium Hypochlorite)	Bromine	Peracetic Acid (PAA)	Quats	Chlorine Dioxide (ClO <sub>2</sub> )
Effectiveness	A	A	A	B	A
Destroys Biofilm	C	C	C	C	A
Head Space	D	D	D	D	A
pH Independent	C	C	C	C	A
Efficiency	C	C	C	C	A

### What about Acidified Chlorite (aka "Stabilized Chlorine Dioxide")?

Usually contains varying levels of chlorite, is very acidic, and does not have the performance profile as pure ClO<sub>2</sub>.

## So — what's the problem?

While chlorine dioxide has been known as the industry's most effective biocide for more than a hundred years, the problematic technologies required to produce and use it have limited its adoption. Conventional on-site generation systems and other preparation methods result in cost-prohibitive systems, harmful by-products, or impractical real-world solutions.

## CDG ENVIRONMENTAL SOLVES THE PROBLEM

For decades, scientists have worked to produce a practical system for harnessing the superior effectiveness of ClO<sub>2</sub>. A number of systems involving generators or manual preparation have been introduced in the marketplace with varying degrees of success. It took the dedicated team at CDG Environmental to develop a proprietary process for the production, delivery, and simplified application of pure and stable chlorine dioxide solution.

## Introducing...Practical Chlorine Dioxide

Practical ClO<sub>2</sub> is created by a unique technology for the production, delivery, and simplified application of pure and stable ClO<sub>2</sub> solution — without the need for on-site generation or preparation.

### Practical vs. Conventional ClO<sub>2</sub> Systems

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Is it?	Criteria	Generators	Manual Preparation	CDG Solution 3000™ Concentrate
Ready?	Equipment expense Complex control Labor intensity	NO (needs equipment)	NO (needs preparation)	YES
Stable?	Consistency Over time	N/A (produced on-site)	N/A (produced on-site)	YES
Pure?	Undesirable by-products that reduce efficiency	Varies by system & operator	NO	YES

How does it work?	Easy to use	Capital equipment produces ClO <sub>2</sub> on-site	Powders, liquids, packets, tablets	Storage-stable concentrate for on-demand process applications
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**The power and advantages of ClO<sub>2</sub> are now available for applications where it was formerly impractical or expensive**

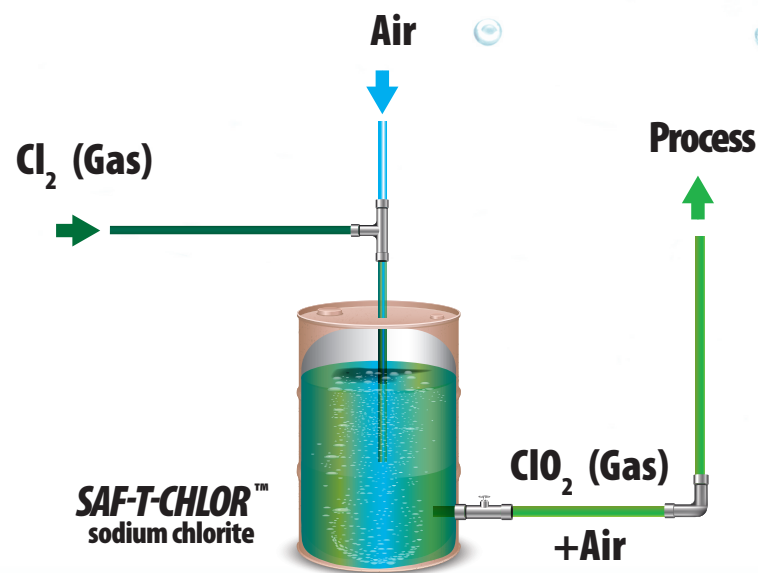
# THE PRACTICAL ClO<sub>2</sub> TECHNOLOGY STORY

## Generated on-site

The **GAS:SOLID™** system is an integrated process combining CDG's patented **SAF-T-CHLOR™** sodium chlorite — thermally stable, solid NaClO<sub>2</sub> — and commercially available gaseous chlorine. It produces high purity ClO<sub>2</sub> gas for direct application and constitutes the first step in the production of **CDG Solution 3000™** concentrate. This reaction produces no by-products — just pure ClO<sub>2</sub> gas free of chlorite, chlorate, perchlorate or molecular chlorine.

### GAS:SOLID™ SYSTEM

The safest, simplest means available for on-site production of high-purity Chlorine Dioxide



## CDG Solution 3000™ CONCENTRATE READY-TO-USE

**CDG Solution 3000™ concentrate** (3000 ppm) — the first stable, ready-to-use liquid ClO<sub>2</sub> biocide. It is DOT-approved for transport via truck or rail throughout the continental U.S., eliminates the need for on-site production, and requires no mixing or activation. It is easier to apply, safer to handle, and more effective than chlorine based products.

Chlorine Dioxide in its absolute, easiest-to-use form. All that is required is a chemical feed pump to connect to the desired application. **CDG Solution 3000** concentrate:

- can be easily shipped as the only liquid-based, ready-to-use chlorine dioxide product on the market.
- is storage stable at room temperature — for up to 9 months.
- eliminates the need for on-site production equipment and requires no chemical mixing, activation or complex recalibration.
- maintains efficacy at high pH.
- rinses clean leaving no residual toxicity.



### Saf-T-Chlor™ SODIUM CHLORITE



- There is no direct operator contact with **SAF-T-CHLOR** sodium chlorite materials.
  - Drums are completely sealed at the factory (used containers are picked up when new ones are delivered) and feature simple, quick-connect couplings.
  - The dry, granular formulation can't splash, spill or leak.
- Operation is safe and easy with instantaneous start and stop.
- **SAF-T-CHLOR** sodium chlorite is a specially formulated, thermally stable form of dry sodium chlorite that will not ignite.
- No bulk liquid chemical storage or acids are required.
- When chlorine gas reacts with **SAF-T-CHLOR** sodium chlorite, the result is pure chlorine dioxide gas, free of chlorites, chlorates, perchlorates or molecular chlorine. The only reaction residual from the process is plain table salt, which can be easily disposed.

## Liquid Dispersing Made Easy

### Colder DrumQuik® PRO System Overview

- Metal-free insert/dip tube quick connect dispensing system for extracting chemicals from rigid containers.
- Professional dispensing that minimizes worker and environmental exposure.
- Factory-installed by CDG.
- External components of the Colder System are reusable.
- Single easy quick connection.



# PROVIDING CRITICAL PROTECTION IN KEY INDUSTRIES

CDG Environmental chlorine dioxide products provide critical disinfection and biofilm elimination across a variety of important industries.

## THE PRACTICAL ClO<sub>2</sub> *doing the job you need!*

**Antimicrobial:** Both in solution and in the gas phase, destroys a broad range of pathogens.

**Mold remediation:** Both in solution and in the gas phase, destroys mold, including toxic molds such as *Stachybotrus* and *Aspergillus*.

**Biofilm control:** Penetrates biofilm and destroys the resident bacteria.

**Odor control:** Oxidizes many odor-causing compounds, especially mercaptans and sulfur compounds.

**Metals oxidation:** Oxidizes undesirable metals found in water, such as manganese and iron, and converts them from a soluble state to an insoluble state, which enables their removal by precipitation or filtering.

**Color removal:** Removes the color from many compounds that may be found in drinking water or wastewater.

**Oxidation of THM/HAA precursor:** Does not react with organic matter, thus reducing the production of trihalomethanes (THM), haloacetic acids (HAA) and other chlorinated organic compounds.

## COOLING TOWERS & CLOSED LOOP SYSTEMS

Cooling towers and other closed loop systems provide ideal environments for the growth of micro-organisms and the biofilm that protects them. Control of this buildup is essential to prevent:

- Loss of heat transfer
- Increased corrosion rates
- Increased pumping energy
- Potential spread of aerosols containing pathogens such as *Legionella*



## MUNICIPAL DRINKING WATER

The **GAS:SOLID™** System is used in municipalities across the U.S. to supply chlorine dioxide for oxidation and disinfection.

## SECONDARY POTABLE WATER DISINFECTION

Chlorine dioxide is effective against the *Legionella* bacteria and other harmful organisms that can proliferate in potable water systems. At-risk populations can be particularly affected, and these applications often have rigorous regulatory requirements:

- Hospitals, surgery centers, nursing homes and assisted living facilities
- Hotels, commercial office buildings and other public facilities
- Cruise ships



## SANITIZING FOOD RINSE

**CDG SOLUTION 3000™** concentrate provides a sanitizing spray to destroy *E. coli* and other pathogens for:

- Animal carcasses
- Ready-to-eat (RTE) meats
- Raw agricultural commodities (RAC) such as lettuce

## FOOD & BEVERAGE PROCESSING

- Chlorine Dioxide can be used for process plant sanitization and the removal of bacteria from lines, vessels, tanks.
- Equipment and tanks for wine, beer and other beverages are in constant need of cleaning and sanitizing. ClO<sub>2</sub> saves time and rinse water.
- **CDG SOLUTION 3000™** concentrate has proven effective in the disinfection and treatment of poultry facilities.



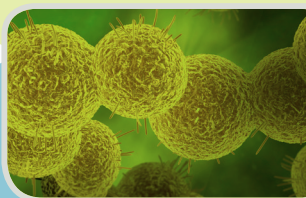
## AGRICULTURE

- **CDG SOLUTION 3000** concentrate is being used to purify animal drinking water to enhance animal development.
- Other important agricultural applications include the treatment of storage facilities, animal transport vehicles and confinement facilities, equipment cleaning and disinfection, greenhouses and irrigation systems.
- Biocidal treatment can control odors.

## OTHER APPLICATIONS

Chlorine Dioxide can be an effective agent to prevent bio-contamination in a host of applications including:

- **MEMBRANE CLEANING** — increasing the efficiency of reverse osmosis membranes and reducing downtime associated with traditional membrane cleaning processes.
- **INDUSTRIAL CLEANING** — inexpensive and environmentally friendly way to clean microbiological deposits such as biofilm on industrial equipment, like tanks and piping systems.



## BIOFILM: THE PATHOGEN'S BEST FRIEND

Biofilm is a complex aggregation of micro-organisms marked by the excretion of a protective and adhesive matrix (slime). It plays a key role in the proliferation of waterborne pathogens. Biofilm is ubiquitous in water environments and is found on most surfaces that are in prolonged contact with water, including the inside of both hot and cold water pipes in buildings.

Bacteria, fungi, protozoa and other pathogens living within the protection of biofilm have significantly increased resistance to the actions of detergents and biocides. True biocidal effectiveness requires dealing with the biofilm along with the micro-organisms it harbors.

Conventional oxidizers react mostly on the surface of the biofilm, and actually form an oxidized layer, like charring on wood, that precludes further penetration. Chlorine Dioxide is soluble, allowing it to travel to the base of the biofilm where it attacks micro-organisms and destroys the biofilm at its point of attachment.

Chlorine Dioxide is by far the most effective biocide for the elimination and control of biofilm.



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