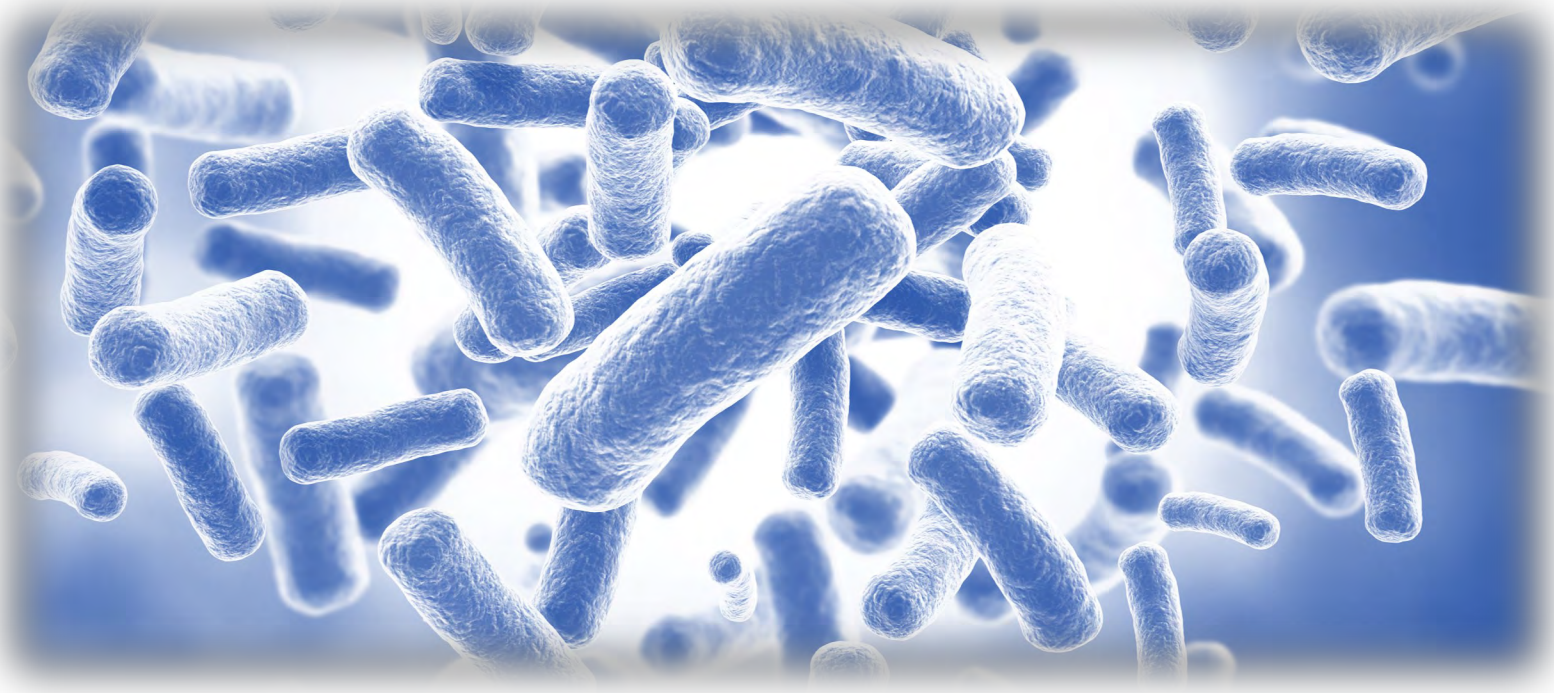
ClorDiSys

US-EPA Registered Sterilant



Microbial Decontamination

Chlorine Dioxide Gas Equipment and Services

- Safest Fumigant Method
- Complete Decontamination of All Surfaces & Crevices
- Minimal Production Downtime
- Safe for the Treatment of Food Contact Surfaces
- True Gas at Room Temperature
- No Residues
- Guaranteed Dosage with Concentration Monitoring
- Decontaminate Pieces of Equipment up to Entire Buildings

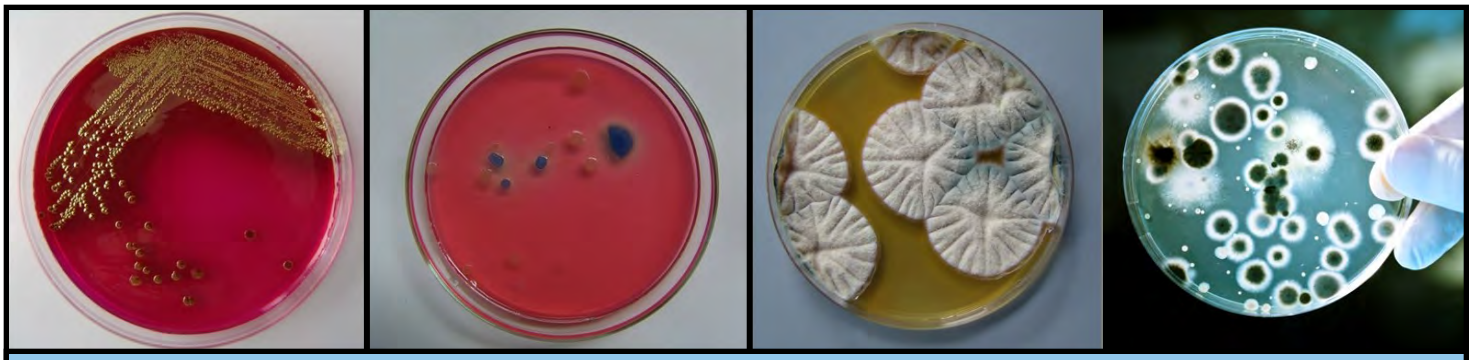
Ph: 908-236-4100 **www.clordisys.com** **info@clordisys.com**

FOOD SAFETY

A clean food production environment is more important than ever

Food production facilities are facing greater scrutiny from both the public and the government to provide safe foods. The FDA will be aggressive in its environmental monitoring and sampling under the food safety guidelines and regulations required by FSMA. Facilities will be closely monitored and tracked using the national laboratory network PulseNet, allowing foodborne illness cases to be traced back to the contaminated production facility or field of origin.

Advances in environmental monitoring and microbial sampling have brought to light the shortcomings of the food industry's sanitation methods. While there are many reasons for recurring contamination by a persistent pathogen, insufficient cleaning and decontamination is the most common. Recurring contaminations are caused by microorganisms that were never fully eradicated from the facility. Traditional cleaning methods, such as isopropyl alcohol, peracetic acids, quaternary compounds, bleach and ozone, are incapable of reaching all surfaces and crevices. Liquids, fogs and mists all have difficulty achieving an even distribution throughout an area, with surfaces closer or easier to reach receiving a higher dosage than those further away or in hard-to-reach areas, like the bottom, back or insides of equipment. These methods are able to reduce the organisms present, but have difficulty reaching crevices, pipe threads, screws, and other harbor locations, which allow the pathogens time to reproduce and recontaminate. Chlorine dioxide gas is able to overcome the inherent difficulties of other sanitation methods.



FAST FACTS ABOUT FOOD RECALLS & ILLNESSES

Foodborne illnesses cost an estimated $152 million each year in health-related expenses.	There are about 48 million cases of foodborne illness annually. That's 1 in 6 Americans each year.	Dairy products remained the top FDA recalled food category in 2015.	On average, each recall costs a full quarter's worth of profits in addition to the value of the recalled product.

HOW CHLORINE DIOXIDE GAS BENEFITS FOOD MANUFACTURERS

- Elimination of pathogens within harbor areas that traditional sanitation cannot reach
- Reliable decontamination due to superior process control
- Used for both contamination response and prevention to ensure sterility
- Routine use provides better contamination control and recall prevention than other methods
- Does not leave residues, making it safe for the treatment of food contact surfaces
- Rapid decontamination to limit downtime in production
- Can provide a "break" in production batches

DECONTAMINATION SERVICES

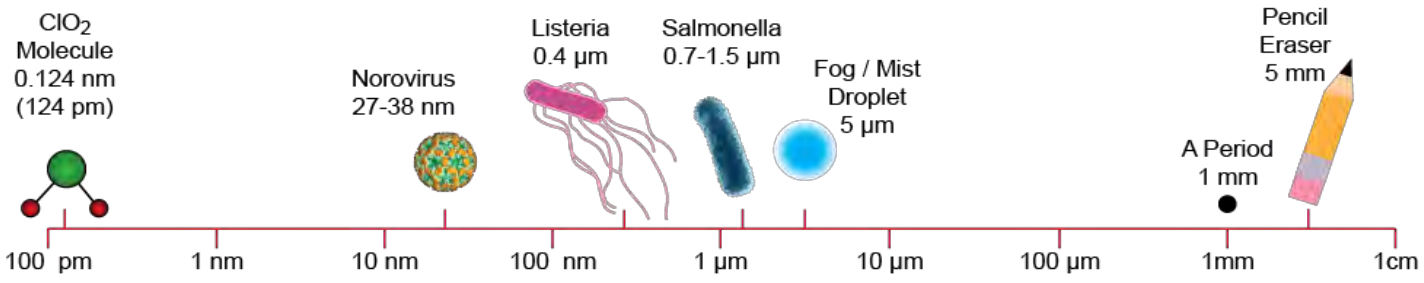
Decontamination Services can be utilized for a variety of applications within the food industry from tented pieces of equipment and small chambers up to entire facilities. **Services can be arranged for contamination response or preventive control needs.** They can be scheduled as needed or contracted for routine prevention in accordance with Environmental Monitoring Data, scheduled maintenance, and shutdown periods.

Chlorine dioxide gas is able to reach and kill all organisms wherever they are hiding. **CD gas naturally fills the area it is introduced into evenly and completely, and penetrates deeper into crevices than pathogens can hide because its molecule size is smaller than the smallest viruses and bacteria, resulting in complete kill.** This allows a better decontamination than traditional sanitation methods such as sprays, mists, fogs, foams, and vapors. The treatment of crevices and harbor locations, which evade traditional sanitation, makes CD gas highly suitable for both contamination remediation as well as routine preventative decontamination during scheduled downtimes to help reduce the risk of contamination in your facility.

The chlorine dioxide gas process allows for fast decontamination of all surfaces within the area being treated. Spaces are decontaminated all at once in order to limit transition areas where cross-contamination can occur. **Small volumes can be completed within a few hours, and entire facilities can be treated in 1-3 days which limits production downtime.** HVAC systems can be included in most cases as well to provide an even more thorough decontamination. The process leaves no residue, so there is no need to rinse, wipe, or clean surfaces afterward.

SERVICE CONTRACTS ARE AVAILABLE FOR MONTHLY, BI-MONTHLY, QUARTERLY, OR YEARLY OCCURRENCES.

WHAT	WHEN
Rooms	New Construction
Pieces of Equipment	Renovations
Entire Facilities	Contaminations
HVAC Ductwork	Decommissioning
Processing/Holding	Routine Prevention
Transport Trucks	



CHLORINE DIOXIDE GAS

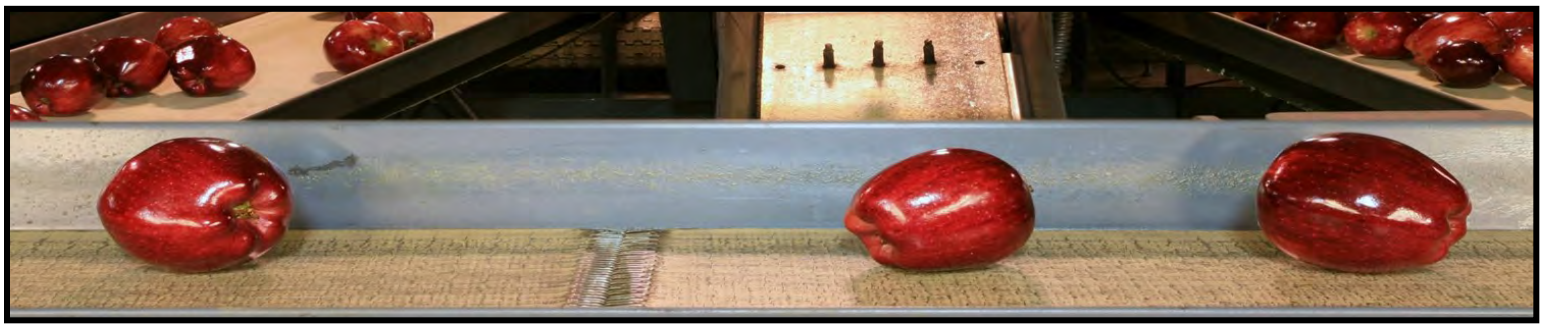






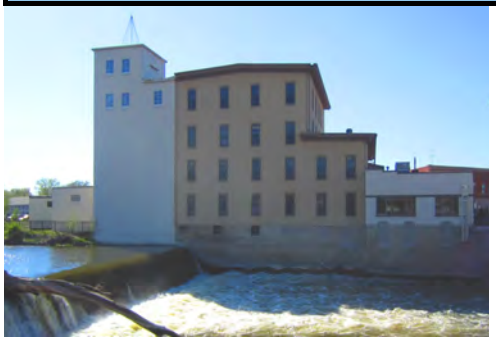



APPLICATIONS



DECONTAMINATION SERVICE CASE STUDIES

GRAIN REFINING & PACKAGING FACILITY — Flooded Facility



A 230,000 ft^3 production facility was flooded by a nearby river during a season of heavy rains. The floodwaters completely submerged the first floor, and most of the second floor, carrying a variety of organisms. A mildew odor was prevalent. Microbial remediation was required prior to production being resumed. The facility consisted of a large warehouse, a loading dock, a few processing areas, a packaging area, a break room, maintenance shops, and an office. The floodwater damaged some of the sheetrock walls beyond repair and contaminated the equipment with a number of different organisms. The sheetrock was removed, and the facility was physically cleaned of soil and debris prior to the fumigation using gaseous chlorine dioxide. ClorDiSys was able to successfully decontaminate utilizing chlorine dioxide gas, eliminating the organisms while providing sporicidal kill of Biological Indicators placed throughout the facility. All mildew odors were also eliminated.

ASEPTIC JUICE BOTTLING FACILITY — Post-Maintenance

A 25,000 ft^3 aseptic juice bottling facility routinely utilizes chlorine dioxide gas to decontaminate after maintenance work and during scheduled plant shutdowns. This process allows the workers more flexibility in performing maintenance knowing that it will undergo complete decontamination before production is resumed. The plant also conducts chlorine dioxide gas decontaminations during its scheduled shutdowns to act as a preventative measure without causing production delays.

DAIRY POWDER PROCESSING FACILITY — Salmonella Remediation + Yearly Preventive Decon

In 2015, a 580,000 ft^3 processing and packaging area contaminated with salmonella was decontaminated. ClorDiSys was able to eliminate the salmonella from the facility by treating the area (dryer, production floor, bin room, and packaging room) all at once. Since the initial remediation, the facility has undergone a preventive decontamination every fall during its yearly shutdown period. The decontamination occurs over the course of 2-2.5 days depending on other coinciding maintenance activities.

ASEPTIC JUICE DISTRIBUTION FACILITY — Between Batches

An empty 625,000 gallon aseptic juice holding tank has been routinely decontaminated prior to the delivery and introduction of the next batch of juice. This facility switched to chlorine dioxide gas for the decontamination of the holding tanks to reduce the downtime. Previously, they would fill the tank with an iodophor where it would reside for upwards of a week, but by changing to chlorine dioxide gas, the downtime was reduced to hours.

SPIRAL FREEZER — Listeria Remediation + Quarterly Preventive Decon

A 25,000 ft^3 Spiral Freezer used at a frozen sausage production facility had a consistent listeria problem, producing positive environmental swabs time and again. After one treatment with chlorine dioxide gas, the facility reached 16 weeks without a single positive swab for listeria after swabbing 2-3 times per day. Upon achieving these results, the facility purchased a generator and instituted the use of chlorine dioxide gas on a quarterly basis for preventive decontamination.

"Decontaminating the Difficult since 2001"

SPICE FACILITY — Salmonella Remediation

A 60,000 ft^3 processing room at a spice facility had a salmonella contamination that they were unable to eliminate through traditional sanitation methods. The room and the piping system connecting the room to the adjoining space were decontaminated simultaneously using chlorine dioxide gas. The decontamination was accomplished within 1 day, and the salmonella was completely eliminated.

ICE CREAM FACILITY — Listeria Remediation

A 260,000 ft^3 Ice Cream Production Facility was contaminated with listeria, and traditional sanitation was unable to eliminate it. Once the facility performed maintenance and repairs to eradicate some harborage sites and update the sanitary design, ClorDiSys was brought in to decontaminate. The entire facility was setup and decontaminated over the course of two days, and production started back up the following day.

BEVERAGE PROCESSING TANK — New Equipment Sterilization

A beverage processing facility was installing a new processing tank to help increase production. After the tank had been installed, but before it was put into use, the tank was decontaminated with chlorine dioxide gas in order to make it safe for product to be introduced. Treatment time to complete the decontamination was under 6 hours and the tank went into use the next morning. No rinse or wash down was necessary as ClorDiSys' chlorine dioxide gas does not leave a residue.

CONFECTIONARY — Decontamination of Tented Equipment

A roaster caught fire at a confectionary facility and was extinguished by the fire department. Worried the water used to put out the fire contained organisms which could contaminate their production line, they wanted to clean the equipment before production started again. Some of the equipment's interior was not easily accessible for the in-house sanitation team, so once the majority of cocoa powder was removed, the company opted to decontaminate with chlorine dioxide gas. That equipment was tented and fumigated, as the rest of the room was not deemed a concern. The setup and decontamination of the roughly 8,000 ft^3 space took place in 1 day and successfully provided a 6-log sporicidal reduction of all surfaces within the equipment.

TRANSPORTATION TRUCKS — Decontamination of a Vehicle

A food transport truck trailer was determined to have been contaminated with Salmonella from a load of food. The truck was decontaminated with chlorine dioxide gas over the course of 3 hours. Swabbing showed complete eradication of the organisms, and the trailer was put back into service.

CHEESE PRODUCTION FACILITY — Listeria Remediation

A 230,000 ft^3 mozzarella cheese processing area was contaminated with listeria. While shutdown, the facility underwent minor renovations, then decontaminated it with chlorine dioxide gas. Prior to the fumigation, forklifts, pallets, parts, and equipment from other areas were brought into the mozzarella processing area in order to maximize the impact of the decontamination. The decontamination took one day, and production started back up the next day.

TORTILLA PRODUCTION AREA — Salmonella Remediation + Routine In-House Decon

A 50,000 ft^3 Tortilla production area was contaminated with salmonella. The space was decontaminated using chlorine dioxide gas, and the salmonella was completely eliminated. Months later, the facility found salmonella at other locations within the facility, but the Tortilla Room remained negative. Pleased with the Tortilla Room's lasting results, they decided to purchase a chlorine dioxide gas generator for routine decontamination of various areas within the facility.

FREQUENTLY ASKED QUESTIONS

What is Chlorine Dioxide?

Chlorine dioxide (CD) is a greenish-yellow gas with a chlorine-like odor. CD has been recognized since the beginning of the 20th century for its disinfecting properties. It is widely used as an antimicrobial and an oxidizing agent in drinking water as well as to whiten paper for the pulp and paper industry.

Chemical Formula:	ClO_2
Molecular Weight:	67.45 g/mole
Melting Point:	-59°C
Boiling Point:	+11°C
Density:	2.4 times that of air

ClorDiSys uses chlorine dioxide gas for its broad efficacy against microorganisms, where its applied in a number of different applications and industries to provide sterilization level decontamination. The rapid sterilizing activity of CD is present at ambient temperature and at relatively low gas concentration, 0.3 to 20 mg/L.

Chemical Properties

TRUE GAS AT ROOM TEMPERATURE

Chlorine dioxide is a true gas at room temperatures, which enables it to fill the space it is contained within evenly and completely. That property is essential when trying to eradicate pathogens from an area, as the gas will get everywhere and not allow anything to "hide" from it.

MEASURED & CONTROLLED

Due to its yellow green color, chlorine dioxide gas can be measured using a photometer. A photometer measures the darkness of the gas (higher concentrations = darker color) which allows for a highly accurate and reliable measurement to ensure tight process control.

DIFFERENT FROM CHLORINE

While "chlorine" is in its name, chlorine dioxide gas is VERY different. Chlorine dioxide oxidizes as its method of kill, where chlorine kills through chlorination. Therefore, unlike chlorine, chlorine dioxide does not produce environmentally undesirable organic compounds.

How Does Chlorine Dioxide Work?

Chlorine dioxide (ClO2) acts as an oxidizing agent, which kills organisms by "stealing" electrons from cells which breaks their molecular bonds. The method and potency of chlorine dioxide gas prevents cells from mutating to a resistant form. This eliminates the need to rotate decontamination methods to prevent overuse and resistance. Additionally, because of the lower reactivity of chlorine dioxide, its antimicrobial action is retained longer in the presence of organic matter.

Is Chlorine Dioxide Environmentally Friendly?

Chlorine dioxide's properties make it an ideal choice to meet the challenges of today's environmentally conscious society. Chlorine dioxide gas is:

- **Non-carcinogenic**
- **Does not deplete the ozone layer**
- **Approved for organic crops on the USDA's National List of Allowed and Prohibited Substances**
- **Can be safely vented into the atmosphere in all parts of the world**

How Does Chlorine Dioxide React with Water?

While chlorine dioxide has "chlorine" in its name, it is very different from chlorine. Chlorine reacts with water to form hydrochloric acid, but chlorine dioxide does not and maintains a neutral pH in water. **Gaseous CD is the only decontaminant that penetrates water, decontaminating both the water and the surface beneath.** If small amounts of liquid are present, the sterilization efficacy of chlorine dioxide is not affected. Provided that the quantity is small, the gas concentration in the water reaches equilibrium quickly.

SAFETY

All decontamination agents are dangerous as this is their function. However, gaseous chlorine dioxide (CD) can be used safer than other fumigation methods due to its chemical properties and safety profile.

Self-Alerting Safety Warning

The best safety feature with CD is that it is self-alerting. Chlorine dioxide gas has a smell very similar to chlorine. It has an odor threshold at or below the 8 hour Time Weighted Average (TWA), so the user is made aware of exposure at a low, safe level. The potential for personal harm is decreased drastically being that workers can make corrective actions towards the cause of the leak or vacate the area without being subjected to unsafe levels. While there are external sensors, badges, and monitors available for chlorine dioxide gas, they do not need to be relied upon as heavily and the chance of experiencing a health hazard is greatly reduced.

Equipment Located Outside the Target Chamber

The CD generating equipment is always located outside the decontamination area. Therefore, if an issue occurs during a cycle, the equipment can easily be shut down and the issue corrected under safe conditions.

Quick Emergency Aeration

Chlorine dioxide gas is removed quickly from a space being it is a dry process that doesn't absorb or condense onto materials. Rooms can be aerated in as little as 30 minutes, while entire facilities can be down to safe levels in as little as 60 minutes. Chlorine dioxide gas is not an ozone depleting chemical, so ventilation to the outside is permitted, allowing faster aeration. For facilities which cannot accommodate outside ventilation, chlorine dioxide gas can be removed using carbon based scrubbers.

Non-Carcinogenic

Chlorine dioxide gas is non-carcinogenic. It is used to treat fruits, vegetables, poultry, and other foods. Chlorine dioxide has also been used in the treatment of drinking water since the 1920's around the world.

No Residues

Our proprietary method of generating chlorine dioxide gas produces a dry, 100% pure chlorine dioxide gas which leaves no residue after treatment. One of the first commercial uses for this method of chlorine dioxide gas was for the sterilization of implantable contact lenses, where it was proven to the FDA that no trace of residue were left on the contact lenses. Other chlorine dioxide gas providers generate the gas using liquids, and its byproducts can create residues when it settles on surfaces.

The ability to smell chlorine dioxide gas at it's 8-hour time weighted average offers a substantial safety benefit. The potential for personal harm is decreased drastically being that workers can make corrective actions towards the cause of the leak or vacate the area without being subjected to unsafe levels of chlorine dioxide gas.

US vs. THEM

Comparison of ClorDiSys and Traditional Sanitation Methods

Chlorine dioxide gas is not an alternative to traditional sanitation, but used as a supplement to provide a more complete decontamination. In order for any antimicrobial agent to be effective, it must achieve the following:

- **The agent must be capable of killing the organisms in question.**
- **The agent must be able to reach the organisms.**
- **The agent must contact the organisms at the correct concentration and time necessary to kill them.**

If the antimicrobial agent is able to achieve all three points, then decontamination will be successful. Traditional sanitation methods, such as sprays, fogs, liquids, steam and ozone, all have challenges trying to accomplish these points fully. Unable to consistently achieve all three rules of decontamination, these procedures often leave behind organisms in harborage sites, causing "recurring contaminations" as time goes on.

SPRAYS, FOGS, & LIQUIDS	OZONE	STEAM
Chemicals capable of eliminating specific organisms can be identified by reading their EPA approved product label. However, these methods lack the ability to contact organisms in hard-to-reach areas. Behind, underneath, and inside equipment becomes difficult for these methods to reach, as are cracks, crevices, and drains. Locations further away from the injection point and in hard-to-reach locations will have lower concentrations than nearby locations, making it very difficult to guarantee that all organisms are contacted at the right concentration for the right amount of time.	Ozone is effective against all organisms, and is a true gas However, its challenge is that it breaks down very quickly. This makes it difficult in reaching and killing organisms that are not close to the injection location, as the ozone levels will diminish the further the gas gets from the generator. As such, it becomes difficult to achieve a complete decontamination of large spaces such as rooms, and typically have limited efficacy.	Steam is capable of killing all organisms, but its efficacy is limited due to its difficulty treating large areas or intricate pieces of equipment. The main challenge is raising the temperature of a large space evenly and high enough at all points to eliminate all present pathogens. When steam treating equipment, it is difficult to raise the temperature of the interior sections if they are well isolated from the steam source as steel pulls heat away. Additionally, not all items can be steam treated due to the effect that moisture and condensation can have on electronics and other temperature sensitive components.

CHLORINE DIOXIDE GAS

Chlorine dioxide gas is able to access the harbor locations and prevent recurring contaminations from happening. Being a true gas, it will fill the space it is introduced into evenly and completely. With a molecule size smaller than the smallest bacteria, it can reach further down crevices than organisms can hide. Together**, this means that there are no safe spaces for pathogens in your facility**. With the capability of monitoring its concentration at multiple locations throughout the area, the process is only complete when the correct parameters have been met. This leaves the decontamination process extremely effective compared to traditional sanitation.

Pseudomonas growing in a conveyor belt

Scratch in stainless steel harboring bacteria

US vs. THEM

Comparison of ClorDiSys and Other Chlorine Dioxide Gas

	ClorDiSys Solutions	Others' CD Gas
EPA Registration	Approved as a Sterilant (6-log sporicidal reduction)	Not approved as sterilants
Purity of CD Gas	100%	Less than 100%
Concentration Monitoring	Highly accurate sampling from multiple locations	Less accurate sampling method at single location or none at all
Humidity Control	Environment kept at ≥ 65%	Does not control humidity

ClorDiSys Solutions approaches decontamination differently than other chlorine dioxide gas companies.
We strive for excellent process control, high quality, and outstanding safety. Our principals were a part of the team who developed and refined this method of decontamination at Johnson and Johnson™. At ClorDiSys, we've built upon that knowledge by conducting research and performing testing on many topics and applications.

Our chlorine dioxide gas is registered with the US EPA as a sterilant.
It is proven capable of providing a 6-log (99.9999% reduction) of all viruses, bacteria, fungi, molds and spores. Our chlorine dioxide gas is the only one registered at this highest antimicrobial level.

Our method of generating chlorine dioxide produces a 100% pure gas.
Other methods of generating chlorine dioxide gas are not as pure, introducing acidic byproducts into the area which can cause corrosion issues and potentially leave residues. ClorDiSys' chlorine dioxide gas has been proven to the FDA to leave behind no measurable residue.

Our decontamination process recognizes the importance of relative humidity for sporicidal reduction.
Our studies have shown that a relative humidity level of 65% is essential to eliminate spores. Humidity is important for sporicidal reduction as it causes the spores hard shell to swell and crack, which allows the chlorine dioxide inside to inactivate the spore easier.

ClorDiSys uses a highly accurate UV-vis spectrophotometer to measure the concentration.
Our Decon Service team measures the concentration of chlorine dioxide gas throughout the entire process at multiple locations in order to ensure that all locations reach the proper dosage necessary to achieve a 6-log sporicidal reduction. Other chlorine dioxide gas decontamination processes monitor one location using a less accurate chemical sensor, making the process less repeatable and reliable.

PROCESS CONTROL AND VALIDATION

ClorDiSys provides superior process control, affording the utmost confidence that decontamination will be effective. **Most importantly is our EPA Registration, which proves the process' effectiveness at completely eliminating all viruses, bacteria, mold, fungi and their spores.** ClorDiSys utilizes a reliable, highly accurate concentration monitor to measure the chlorine dioxide gas concentration continuously throughout the process. **This concentration monitor has been validated by the US Army and US EPA and allows for the area under the concentration vs. time curve to be calculated, giving an accurate measure of the overall dosage.** The dosage becomes the governor of the decontamination process itself, such that the process is not completed until the proper dosage necessary to achieve a 6-log sporicidal reduction has been reached.

To validate the process achieved a 6-log sporicidal reduction, ClorDiSys employs the use of biological indicators (BI's). Also known as spore strips, BI's consist of a paper substrate impregnated with over a million *geobacillus stearothermophilus* spores and wrapped within Tyvek. **With spores being more resistant than bacteria and viruses, BI's are a great indicator of process efficacy.** BI's can be placed in the hard-to-reach areas of a facility, including the inside of equipment, under forklift tires, inside closed cabinets, and next to known hot spots. After the decontamination, BI's are processed to ensure 100% kill.

MATERIAL COMPATIBILITY

Chlorine dioxide is an oxidizer, as is hydrogen peroxide, ozone, bleach, and many other decontaminating agents. However, chlorine dioxide gas is the gentlest on materials among those options, due to it's lower oxidation potential. A higher oxidation potential means it's a stronger oxidizer and more corrosive. The table on the right shows several biocidal agents and their oxidation/reduction potentials. Chlorine dioxide has an oxidation/reduction potential of 0.95V, which is lower than other commonly known decontaminating agents.

Biocidal Agent	Oxidation/Reduction Potential (V)
Ozone	2.07
Peracetic Acid	1.81
Hydrogen Peroxide	1.78
Sodium Hypochlorite	1.49
Chlorine Dioxide	0.95

While scientifically less corrosive, chlorine dioxide gas has a bad reputation due to the link with chlorine as well as the other chlorine dioxide products that lack the purity that our process uses. Other methods of generating chlorine dioxide mix an acid and a base which then forms an acidified chlorine dioxide solution which is then off gassed to fumigate a space. The production of two acidic components, acidified sodium chlorite and chlorous acid, is what makes these methods more corrosive. Our method of generating pure chlorine dioxide gas is accomplished by passing a low concentration chlorine gas through a proprietary sodium chlorite cartridge to convert the chlorine gas into chlorine dioxide gas. This allows our process to be safe when decontaminating stainless steel, galvanized metals, anodized aluminum, epoxy surfaces, electronics, and most common materials of construction.

OUR GENERATION METHOD

Not all chlorine dioxides are equal. Our CD Gas generators produce a pure chlorine dioxide gas without the acidic byproducts typical of other chlorine dioxide products.

OXIDATION POTENTIAL

Pure chlorine dioxide has a lower oxidation / corrosion potential than ozone, peracetic acid, hydrogen peroxide, and bleach. This means its safer on materials than those chemicals.

DRY STERILIZATION

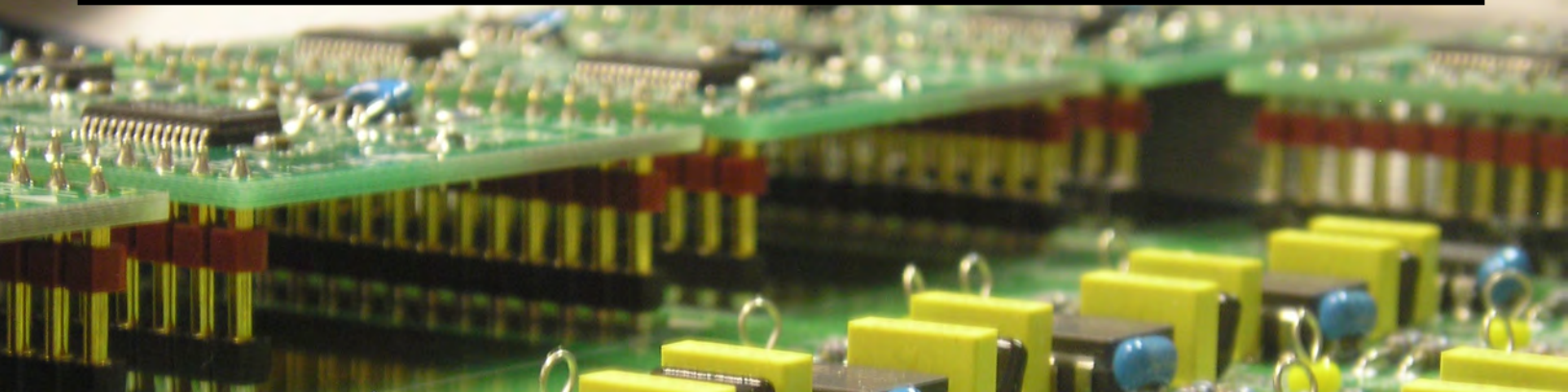
Our chlorine dioxide gas is generated through a completely dry process, leaving no concern over liquid sensitive materials or components being affected.

RESIDUE FREE

Our CD Gas does not leave a residue on equipment and surfaces after a decontamination. Once the gas has been removed, the area is safe and does not require additional cleanup.

WE OFFER FREE* MATERIAL COMPATIBILITY TESTING FOR ITEMS YOU ARE CONCERNED ABOUT

*ClorDiSys will expose your items/equipment to chlorine dioxide gas and return to you for observation and testing. Testing is free for small items or batches less S/H. For large items or extended testing, please call.



CLORDISYS FAMILY of CHLORINE DIOXIDE GAS EQUIPMENT

All of our chlorine dioxide gas generators automatically control the decontamination process. They have the capability to interface with nearly any chamber or room. The generators utilize industrial components and feature HMIs that are password protected and have recipe management systems with real time trending. Easy to learn and easy to use, our CD Generators are perfect for routine decontamination.

Megadox-P

The Megadox-P is designed for use in any manufacturing, laboratory, or research setting. It provides a rapid, highly effective method to decontaminate large volume areas up 280,000 ft^3 (7928 m^3). The Megadox-P is portable and can be moved throughout your facility using a pallet jack. The system features a sophisticated photometric sterilant concentration monitoring system allowing for a tightly controlled and consistent sterilization process. A run record is produced that contains the date, cycle time, cycle steps, as well as temperature, pressure, and chlorine dioxide concentration. The control system features a password protected, recipe management system with historical and real time trending.

Minidox-M

The Minidox-M Sterilization System can be used on any room/chamber sized between 1-70,000 ft^3 (1982 m^3). It comes standard with an accurate, real time concentration monitor, which allows for tight process control, easy validation, and great repeatability. A run record is produced that contains the date, cycle time, cycle steps, as well as temperature, pressure, and chlorine dioxide concentration. The HMI system features a password protected, recipe management system with real time trending.

IDEAL APPLICATION: Any facility looking to decontaminate rooms, isolators, tanks, vessels, equipment, or supplies.

Cloridox-GMP

The Cloridox-GMP Sterilization System can be used on any room/chamber sized between 1-70,000 ft^3 (1982 m^3). The system can also be attached to most vacuum chambers to provide a method for component or product sterilization. The Cloridox-GMP comes standard with an accurate, real time concentration monitor, which allows for tight process control, easy validation, and great repeatability. A run record is produced that contains the date, cycle time, cycle steps, as well as temperature, pressure, and chlorine dioxide concentration. The HMI system features a password protected, recipe management system with real time trending.

IDEAL APPLICATION: GMP facilities or facilities where vacuum cycles need to be conducted in addition to the decontamination of rooms, isolators, pass-through chambers, spiral freezers, tanks, vessels, equipment, or supplies.

Equipment Decontamination Chambers

The Equipment Decontamination Chamber is custom designed for use with any Clordisys CD Generator. It provides the ability to rapidly and effectively decontaminate computers, electronics, instruments, supplies, components, and equipment entering an aseptic or clean facility, acting as a pass-through chamber. Items can also be decontaminated before removal from a dirty area into a clean area without the concern for cross-contamination.

IDEAL APPLICATION: Decontaminating incoming products, equipment, or supplies into a research or production area.

BIOLOGICAL EFFICACY OF CHLORINE DIOXIDE

ClorDiSys' Chlorine Dioxide Gas is registered with the United States Environmental Protection Agency as a **sterilizer**. The U.S. EPA defines a sterilizer as able "to destroy or eliminate all forms of microbial life including fungi, viruses, and all forms of bacteria and their spores."

Below is a table of some of the more commonly seen organisms that chlorine dioxide has been proven to eliminate. **To date, no organism tested against Chlorine Dioxide Gas has proved resistant.**

PRODUCT: CSI CD CARTRIDGE	**EPA REGISTRATION #:** 80802-1

BACTERIA
Blakeslea trispora[28]
Bordetella bronchiseptica[8]
Brucella suis[30]
Burkholderia spp.[36]
Campylobacter jejuni[39]
Clostridium botulinum[32]
Clostridium dificile[44]
Corynebacterium bovis[8]
Coxiella burneti (Q-fever)[35]
E. coli spp.[1,3,13]
Erwinia carotovora (soft rot)[21]
Franscicella tularensis[30]
Fusarium sambucinum (dry rot)[21]
Helicobacter pylori[8]
Helminthosporium solani (silver scurf)[21]
Klebsiella pneumonia[3]
Lactobacillus spp.[1,5]
Legionella spp.[38,42]
Leuconostoc spp.[1,5]
Listeria spp.[1,19]
Methicillin-resistant Staphylococcus aureus[3]
Multiple Drug Resistant Salmonella typhimurium[3]
Mycobacterium spp.[8,42]
Pediococcus acidilactici PH3[1]
Pseudomonas aeruginosa[3,8]
Salmonella spp.[1,2,4,8,13]
Shigella[38]
Staphylococcus spp.[1,23]
Tuberculosis[3]
Vancomycin-resistant Enterococcus faecalis[3]
Vibrio spp.[37]
Yersinia spp.[30,31,40]

VIRUSES
Adenovirus Type 40[6]
Calicivirus[42]
Canine Parvovirus[8]
Coronavirus[3]
Feline Calici Virus[3]
Foot and Mouth disease[8]
Hantavirus[8]
Hepatitis A, B & C Virus[3,8]
Human coronavirus[8]
Human Immunodeficiency Virus[3]
Human Rotavirus type 2 (HRV)[15]
Influenza A[22]
Minute Virus of Mouse (MVM-i)[8]
Mouse Hepatitis Virus spp.[8]
Mouse Parvovirus type 1 (MPV-1)[8]
Murine Parainfluenza Virus Type 1 (Sendai)[8]
Newcastle Disease Virus[8]
Norwalk Virus[8]
Poliovirus[20]
Rotavirus[3]
Severe Acute Respiratory Syndrome (SARS)[43]
Sialodscryoadenitis Virus[8]
Simian rotavirus SA-11[15]
Theiler's Mouse Encephalomyelitis Virus[8]
Vaccinia Virus[10]

BACTERIAL SPORES
Alicyclobacillus acidoterrestris[17]
Bacillus spp.[10,11,12,14,30,31]
Clostridium. sporogenes ATCC 19404[12]
Geobacillus stearothermophilus spp.[11,31]
Bacillus thuringiensis[18]

ALGAE, FUNGI, MOLD & YEAST
Alternaria alternata[26]
Aspergillus spp.[12,28]
Botrytis species[3]
Candida spp.[5, 28]
Chaetomium globosum[7]
Cladosporium cladosporioides[7]
Debaryomyces etchellsil[28]
Eurotium spp.[5]
Fusarium solani[3]
Lodderomyces elongisporus[28]
Mucor spp.[28]
Penicillium spp.[3,5,7,28]
Phormidium boneri[3]
Pichia pastoris[3]
Poitrasia circinans[28]
Rhizopus oryzae[28]
Roridin A[33]
Saccharomyces cerevisiae[3]
Stachybotrys chartarum[7]
T-mentag[3]
Verrucarin A[33]

PROTOZOA
Chironomid larvae[27]
Cryptosporidium[34]
Cryptosporidium parvum Oocysts[9]
Cyclospora cayetanensis Oocysts[41]
Giardia[34]

BETA LACTAMS
Amoxicillin[29]
Ampicilin[29]
Imipenem[29]
Penicillin G,V[29]

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