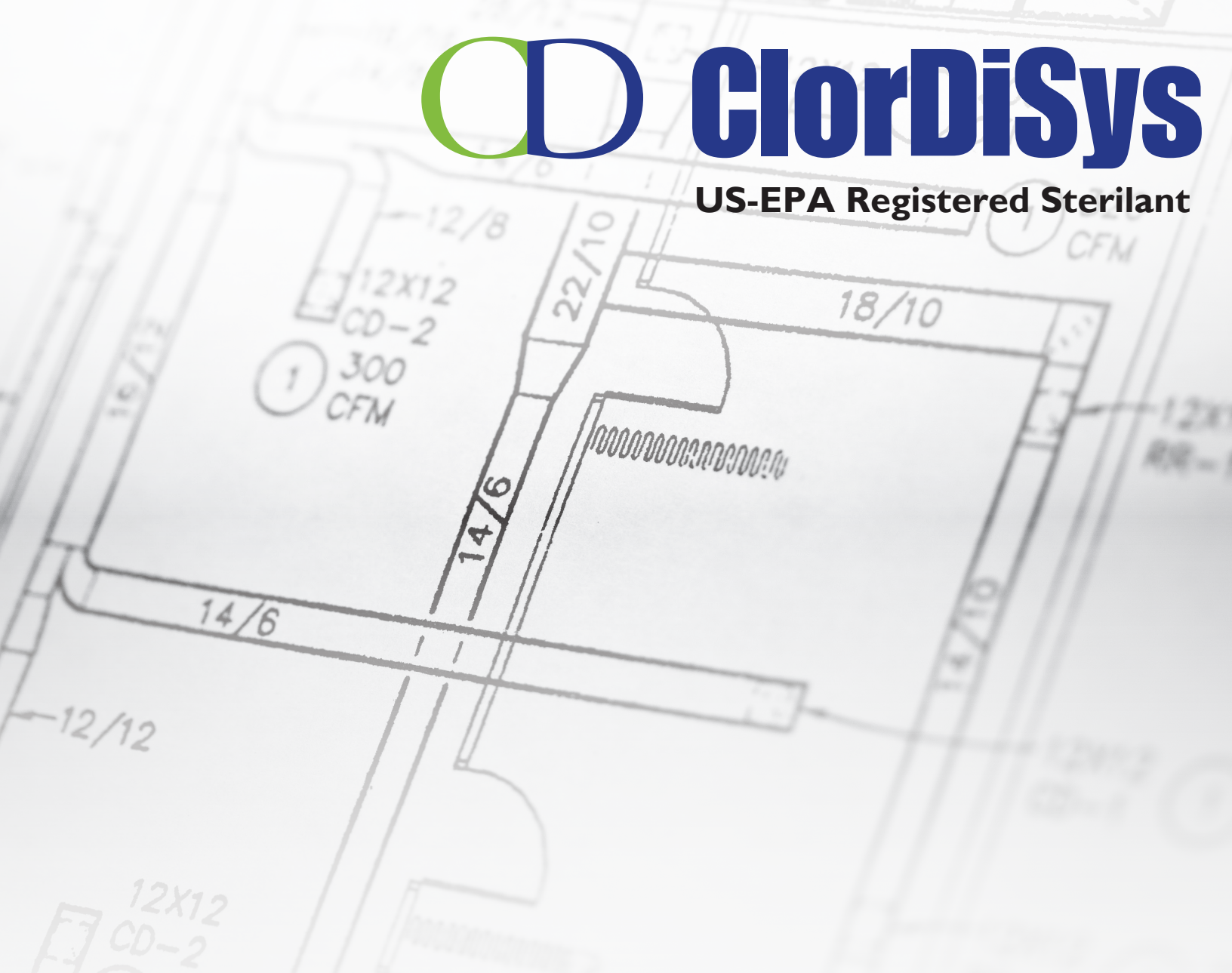




US-EPA Registered Sterilant



Microbial Decontamination Services

6-log Sterilization Level Kill

- Effective Against all Viruses, Bacteria, Fungi, Mold, Spores, & Beta Lactams
- Guaranteed Dosage with Concentration Monitoring
- Faster Cycle Times with Quicker Aeration than VPHP and Formaldehyde
- Complete Decontamination of BSCs to Entire Buildings
- No Residues or Post-Decon Clean Up
- Non-carcinogenic

DECONTAMINATION SERVICES

ClorDiSys provides decontamination services for routine or single-time events. Whether it is for contamination response or preventative decontamination of new or existing facilities, ClorDiSys' method of using chlorine dioxide gas allows us to completely decontaminate your facility all at once, with minimal equipment and minimal downtime. Gaseous systems provide the ability to achieve complete distribution and penetration to all surfaces within your facility, including cracks and crevices, which other methods (vapors, mists or fogs) cannot promise.

QUALITY ASSURANCE

When performing a decontamination service, accurate gas concentration measurements are taken continuously from various places within the space using a calibrated photometer. The decontamination is only said to be complete once the proper dosage has been exceeded at all sample locations.

In addition to concentration measurements, biological indicators (BIs) can be used to test the efficacy of the decontamination. BIs consist of over 1 million bacterial spores known to be among the most resistant to chlorine dioxide gas. The BIs are placed in hard-to-reach places during the decontamination and then dropped into a growth media and incubated to check for growth. After 36 hours, the BIs are checked and if no growth is present, the decontamination is deemed successful.

PROCESS FEATURES

- Accurate CD Gas concentration monitor ensures every cycle is effective
- Able to decontaminate any size space
- Fully turnkey process
- No cycle development necessary
- Effective against viruses, bacteria, fungi, spores, beta lactams and pinworm eggs
- Fast turnaround time, entire facilities in 1-3 days
- Great material compatibility
- Capable of achieving kill within ductwork

BENEFITS OF CHLORINE DIOXIDE GAS

- Safe on materials including sensitive electronics
- Process not affected by temperature or dew point
- ClO₂ molecule smaller than viruses, bacteria and spores
- Naturally fills the space its contained within, contacting all surfaces evenly, including crevices deeper than microorganisms can reach
- No measurable residue
- Non-carcinogenic
- US EPA registered as a sterilant, able to kill all viruses, bacteria, fungi and spores
- Effective against beta lactams and pinworm eggs

CHLORINE DIOXIDE GAS

Safety & Material Compatibility

CD gas is scientifically less corrosive than most other common decontamination methods. CD gas is compatible with electronics, epoxies, materials of construction (stainless steels), and more.

Biocidal Agent	Oxidation / Corrosion Potential (V)	↑ MORE CORROSIVE
Ozone	2.07	
Peracetic Acid	1.81	
Hydrogen Peroxide	1.78	
Bleach	1.49	
Chlorine Dioxide	0.95	

SAFETY FEATURES

Odor Detection

CD has an odor at the 8-hr OSHA safety level, so the user is self-alerted to exposure at a low level and the reliance on external sensors is not as imperative.

Non-Carcinogenic

Formaldehyde and ethylene oxide are known carcinogens. The ACGIH designates VPHP as an A3, Confirmed Animal Carcinogen with Unknown Relevance to Humans. Chlorine dioxide gas is not listed as a carcinogen of any kind.

Effective within Water

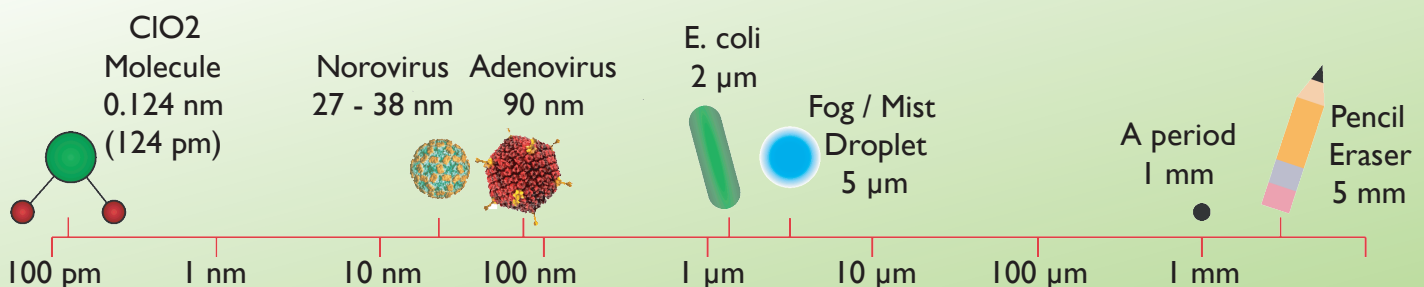
Gaseous CD is the only decontaminating fumigant that penetrates water, decontaminating both the water and the surface beneath. If liquid is present, the sterilization efficacy of CD is not affected.

Widespread Use

Chlorine dioxide is used for both drinking water treatment and the sanitization of many foods.

APPLICATIONS

- Rooms
- Entire facilities
- HVAC ductwork
- HEPA housings
- Processing tanks
- Pass-throughs
- Tented equipment
- Transport vans
- Lyophilizers
- Isolators
- Piping
- Biological safety cabinets
- Spiral Freezers



DECONTAMINATION SERVICE CASE STUDIES

Decontamination Services can be utilized for a variety of applications from tented pieces of equipment and small chambers up to entire facilities. ClorDiSys has the capability to decontaminate areas over 4,000,000 ft³ (113,267 m³). Services can be arranged for contamination response or preventive control needs. They can be scheduled as needed or contracted for routine prevention, scheduled maintenance, and shutdown periods. If you have contamination issues or are interested in overall facility decontamination prior to move-in, ClorDiSys can help you.

DEVELOPMENT OF RESPONSE PLAN AND PROTOCOL FOR MMV or MOLDS

To minimize downtime if a facility becomes contaminated with molds, MMV, or other unwanted organisms, preplanned decontamination protocols can be put into place. ClorDiSys can work with your Operations, Engineering, and QA Personnel to develop a response plan and document it in a protocol. Advantages include: plan arranged prior to the actual crisis when resources are available; time savings with a simple phone call initiating action response; and cost savings with a pre-negotiated treatment cost.

RENOVATION

A 35,000 ft³ facility was being completely renovated to update everything from its ventilation system to its equipment and casework. Prior to moving back into the facility, the area was decontaminated in order to provide a guaranteed sterile environment for research. Decontamination took one day and included all rooms, hallways, and supporting ductwork. The floors above and below the facility were occupied throughout the decon with no chlorine dioxide gas detected and no adverse effects seen.



OCCUPIED SPACES SURROUNDED BY ROOMS BEING GASSED

A facility in Australia had three occupied rooms within its vivarium; a holding room and its adjoining procedure and necropsy rooms. These rooms were surrounded by contaminated holding and procedure rooms being gassed with chlorine dioxide. The occupied rooms were monitored for leakage throughout the decontamination. During the process, no leaks were observed in any of the areas, and all biological indicators were killed.

DUCTWORK

In some cases, facilities are interested in just decontaminating their ductwork and not the accompanying rooms. An eight room HIV lab was built with an undersized HVAC system and was looking to replace it with a correctly sized unit. There was concern as to whether or not the exhaust ductwork was contaminated from the research performed within the lab, so a decontamination was scheduled. A recirculation loop was setup in order to ensure that the gas was migrating throughout the entire length of ductwork. Biological indicators were placed in the ductwork and the recirculation loop in order to prove efficacy. All biological indicators were dead upon completion.

SALMONELLA REMEDIATION & YEARLY PREVENTIVE DECON



In 2015, a 580,000 ft³ processing and packaging area within a dairy powder facility 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.

DECONTAMINATION SERVICE CASE STUDIES

PINWORM EGGS



Pinworm eggs are known to travel very easily throughout rooms and facilities due to their small size and ability to become “airborne.” Chlorine dioxide gas has been proven effective at eliminating pinworm eggs by the University of Tennessee at Knoxville. An 85,000 ft³ facility infected with pinworms was treated with CD Gas in order to inactivate the eggs from the environment and ductwork. Animal racks were left running in order to help circulate the gas through the air plenums, cages, and filters to inactivate all eggs that may have been present. Pinworm eggs require a chlorine dioxide dosage twice the normal sterilization level dosage, so advanced notice of this concern is necessary to plan accordingly.

AMPLICONS

Chlorine dioxide gas was validated by PCR equipment manufacturers and is proven effective against amplicons. CD gas can inactivate them in rooms or on equipment, so there is no risk of cross contamination causing misreads on subsequent analysis. As a true gas, it will reach all areas of your room and equipment surfaces including the inside of most equipment. Equipment can also be sent to ClorDiSys for treatment. After inactivation, analysis equipment can be used for testing with no risk of contamination or false readings.

TRANSPORT VEHICLES

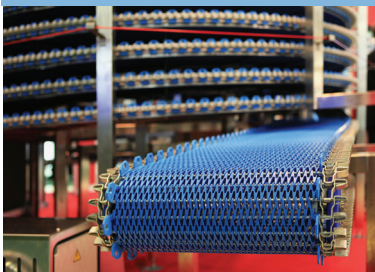
Multiple facilities use chlorine dioxide gas to decontaminate their trucks, vans, and shipping containers. A commercial breeder decontaminates their transport vehicles in between deliveries, with CD gas taking just 3-4 hours from start to finish. Another facility uses shipping containers to decontaminate equipment from their facility as an external decontamination chamber.



FACILITY DISINFECTION POST MAINTENANCE SHUTDOWN

Yearly planned maintenance shutdowns create dirty environments since foreign equipment, tools, and people enter the clean areas. Previously, this 300,000 ft³ facility underwent three cycles of detergent cleaning and water rinse followed by three treatments with Spor-Klenz. This required over a dozen personnel with mops and buckets over multiple shifts and a minimum of a week’s worth of time. The process was costly (consumables alone cost approximately \$100,000) and had inherent failures in the process since it was a laborious manual process. The facility switched to chlorine dioxide gas decontamination. The result was a disinfection cost of under \$100,000; a time savings cost of three days, and efficacy improved to a complete 6-log sporidical kill.

SPIRAL FREEZERS

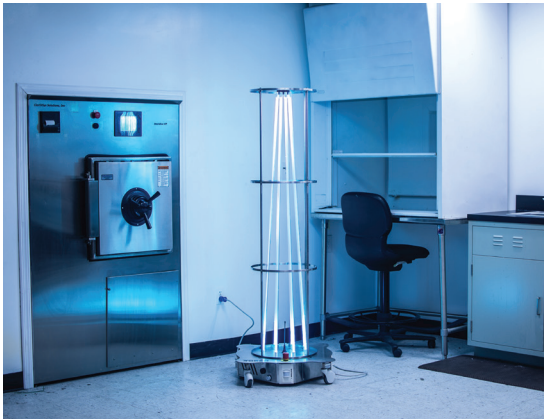


A 25,000 ft³ Spiral Freezer used at a frozen sausage production facility had a consistent listeria problem, producing positive environmental swabs time and again. After one treatment with chlorine dioxide gas, the facility reached 16 weeks without a single positive swab for listeria after swabbing 2-3 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.

BETA-LACTAM INACTIVATION

Chlorine dioxide gas is proven effective against Beta-Lactams and validated to inactivate them on equipment or in rooms, so there is no risk of allergic exposure. The validation consisted of testing to achieve a 3-log inactivation of eight different Beta-Lactams. After inactivation, equipment and buildings can be used for non-Beta-Lactam products.

OTHER SOLUTIONS AVAILABLE FROM CLORDISYS



Ultraviolet Light Disinfection Services

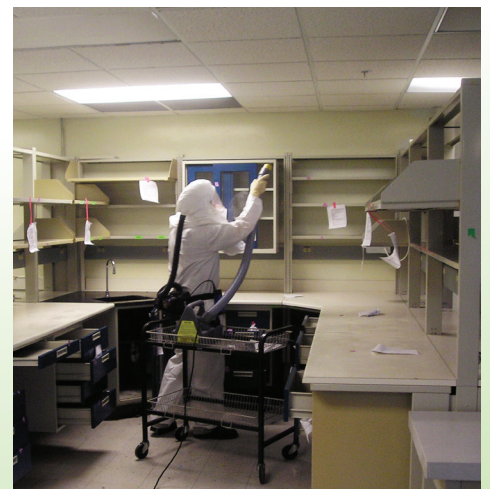
ClorDiSys offers ultraviolet light disinfection services for contamination response or routine preventive disinfection. Rooms, vehicles, and other enclosed spaces can be disinfected quickly and safely using this chemical free, residue free method. UV is effective against a broad spectrum of microorganisms including viruses, bacteria, molds, and even spores. UV-C is extremely inexpensive, and disinfection cycles are fast, allowing for quick turnover times of the spaces being disinfected.

A holding room was treated with UV light to eliminate a Mouse Parvovirus contamination. UV light works in a line-of-sight fashion, so multiple UV treatments took place to disinfect all sides of the equipment and animal racks.

Liquid CD and UV light both provide line-of-sight efficacy with difficulty achieving kill within crevices. Liquid CD and UV light are both capable of sporicidal kill, however it is impossible to guarantee sporicidal kill on all surfaces as accurate dosage cannot be measured.

Chlorine Dioxide Electrostatic Spraying Disinfection Services

ClorDiSys provides electrostatic spraying disinfection services with liquid chlorine dioxide. Liquid chlorine dioxide is sprayed onto surfaces using a handheld sprayer. Handheld sprayers are used, so a trained technician is able to reach more surfaces than a stationary fogger, by opening drawers, cabinets and enclosures and changing the angle of application in order to minimize shadow areas which are not being contacted. Liquid chlorine dioxide is applied at concentrations capable of eliminating all viruses, bacteria, fungi and spores.



A new facility was disinfected by treating with a liquid chlorine dioxide to provide a clean start for research taking place within the facility. A high concentration liquid chlorine dioxide was sprayed throughout the facility similar to a hydrogen peroxide vapor treatment. A team opened drawers, cabinets, and equipment in order to ensure that all visible surfaces were sprayed and treated with liquid chlorine dioxide. This method offers a level of disinfection comparable to utilizing VPHP.