



205 Webster Street
Bethlehem, PA 18015
888-610-2562

www.cdgenvironmental.com

Transport, Handling, and Application

of

CDG Solution 3000™

for

Commercial and Industrial Applications

August 2009

PREPARED BY:

CDG ENVIRONMENTAL, LLC
205 WEBSTER ST.
BETHLEHEM, PA 18015
888-610-2562

Guidelines and Recommendations for the Transport, Handling, and Application of *CDG Solution 3000*TM

PURPOSE

This document sets forth general discussion and guidelines for the proper use of CDG Solution 3000TM.

The purpose of this document is to assure that persons involved in any and all aspects of using CDG Solution 3000TM are fully informed of the procedures necessary to assure safe, efficient, effective delivery of services while maintaining full compliance with all pertinent government regulations.

Safety and Personal Protection information described herein are recommendations only. Users and Repackagers of CDG Solution 3000TM must document safety procedure and personal protection equipment requirements that are in accord with their individual Environmental Health and Safety standards.

Only persons who are fully capable of providing plumbing, piping, or electrical work as required and have been trained in the hazards and personal protective equipment required for proper usage of chlorine dioxide should work directly on the equipment used to dispense, control the dispensing of, or repackage CDG Solution 3000TM. Users and Repackagers of CDG Solution 3000TM must document training of personnel that is in accord with their individual Environmental Health and Safety standards.

CDG reserves the right to inspect and comment on any and all installations and documentation for the dispensing and/or repackaging of CDG Solution 3000TM prior to shipping product to users.

This document centers on the application of high-purity chlorine dioxide to potable and non-potable water systems in commercial and industrial facilities, in order to eliminate waterborne, disease-causing organisms. The chlorine dioxide is applied by means of CDG Solution 3000TM, a proprietary, ready-to-use, high-purity chlorine dioxide aqueous concentrate manufactured by CDG Environmental, LLC, Bethlehem, PA.

PRODUCTS

Chlorine dioxide

Chlorine dioxide is a relatively small, volatile and highly energetic molecule. Chlorine dioxide is almost never used commercially at high concentrations because of its instability; rather, it is usually generated at the point of use.

The notable exception to on-site generation is afforded by CDG Solution 3000™, which is a concentrated (3000 parts-per-million), ready-to-use aqueous solution of chlorine dioxide that is shelf stable at room temperature.

Chlorine dioxide gas has an intense greenish yellow color with a distinctive odor similar to that of chlorine. Chlorine dioxide is highly soluble in water but, unlike chlorine, chlorine dioxide does not react with water.

Chlorine dioxide exists in aqueous solution as a dissolved gas. It is readily liberated from solution by agitation, spraying or splashing. Chlorine dioxide vapor is highly irritating to mucosal membranes (eyes, respiratory tract). It can be lethal in higher concentrations in air. (See NIOSH limits on page 5)

In the presence of light with a UV component, chlorine dioxide rapidly decomposes to form chlorine, oxygen and a variety of transient intermediate oxychlorine compounds. Every effort must be made to minimize exposure of CDG Solution 3000™ to UV radiation.

CDG Solution 3000™

CDG Solution 3000™ is concentrated (3000 ppm), ready-to-use chlorine dioxide aqueous solution. CDG Solution 3000™ obviates on-site production and simplifies chlorine dioxide application for treatment of water. CDG Solution 3000™ is shelf-stable at room temperature (75°F) for up to nine months. It requires no on-site chemical mixing, and can be applied by means of a simple chemical metering pump.

CDG Solution 3000™ is pure chlorine dioxide gas dissolved in water. Care must be taken not to agitate, splash, spray or spill CDG Solution 3000™, which could cause the chlorine dioxide vapor to be liberated. Chlorine dioxide vapor is highly irritating to mucous membranes (eyes, respiratory tract).

RELEVANT REGULATORY AGENCIES

USEPA – United States Environmental Protection Agency. EPA works to develop and enforce regulations that implement environmental laws enacted by Congress. EPA is responsible for researching and setting national standards for a variety of environmental programs, and delegates to states and tribes the responsibility for issuing permits and for monitoring and enforcing compliance.

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act. The primary focus of FIFRA is to provide federal control of pesticide distribution, sale, and use. EPA was given authority under FIFRA.

NPDWR – National Primary Drinking Water Regulations. Primary standards protect drinking water quality by limiting the levels of specific contaminants that can adversely affect public health and are known or anticipated to occur in water.

USDOT – United States Department of Transportation is responsible for the safe transportation of materials on the nation’s highways, waterways and air.

OSHA – Occupational Safety and Health Administration is responsible for workplace safety and sets limits on allowable concentrations of workplace chemicals to which workers might be exposed.

GOVERNING REGULATIONS

A number of Federal and local regulations pertain to the use of chlorine dioxide as anticipated in this guide. All installations and services must be executed in accordance with the rules of the authority having jurisdiction.

United States Environmental Protection Agency (USEPA)

USEPA-FIFRA Registration

CDG Solution 3000™ is regulated as an anti-microbial pesticide. USEPA and the several states register or license pesticides for use in the United States. USEPA receives its authority to register pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). CDG Solution 3000™ received FIFRA registration on March 8, 2007.

US Department of Transportation (USDOT)

The U.S. Department of Transportation, established by an act of Congress in 1966, is responsible for ensuring the fast, safe, efficient, accessible and convenient transportation system that meets vital national interests. This includes regulating the shipment of chemicals, and protecting the public from dangers associated with the transportation of hazardous materials.

Under USDOT regulations, the transport of pure chlorine dioxide is forbidden. However, CDG Solution 3000™, which is 0.3% chlorine dioxide aqueous solution (diluted 99.7% with water), is permitted. CDG Solution 3000™ is classified as a Class 8 corrosive, and is classified as a Hazardous Material (HazMat) under requirements of 49 C.F.R. All packaging, labeling, and shipping papers must conform to DOT regulations.

Occupational Safety & Health Administration (OSHA)

OSHA is a part of the US Department of Labor. Established in 1971, OSHA is responsible for workplace safety. OSHA sets limits on allowable concentrations of workplace chemicals to which workers might be exposed, e.g., by inhalation.

OSHA limits on chlorine dioxide in air in the workplace are:

PEL: 0.1 ppm (8-hour time-weighted average)

STEL: 0.3 ppm (15-minute short-term exposure level)

NIOSH limits are:

REL: 0.1 ppm (8-hour time-weighted average)

STEL: 0.3 ppm (15-minute short-term exposure level)

IDLH: 5.0 ppm anytime

National Sanitary Foundation (NSF)

NSF is an independent, not-for-profit organization that offers programs and services to augment and support the work of regulatory officials around the country, including standards development, product testing and certification, as well as onsite audits and inspections. Among other things, NSF certifies chemicals used to treat public water supplies. NSF is accredited by ANSI, IAS, NELAC and OSHA in the US. NSF is accredited by the Standard Council of Canada (SCC) in Canada. NSF certification is not required by Federal law, but is required by some states and municipalities. NSF certification has become a *de facto* requirement for chemicals used to treat public water supplies. CDG Solution 3000™ received NSF certification under NSF/ANSI Standard 60 on October 24, 2007.

Re-packagers wishing to receive NSF certification should contact CDG for assistance.

State Environmental/Health Departments

CDG Solution 3000™ is regulated as an anti-microbial pesticide. In addition to registration by EPA under FIFRA, the states, usually through their departments of health or environment, also register or license pesticides for use in the United States. CDG Solution 3000™ is registered in all of the states. A complete list of the several states that have approved CDG Solution 3000™ for use in treated water can be obtained from the offices of CDG upon request.

State and Local Transportation, Building and Fire Codes

Beyond applicable Federal regulations (e.g., DOT) the transportation of chemicals may be subject to additional state and local regulations. Also, installation of dosing equipment must comply with all local regulations and permitting requirements, including building and fire codes. Users and repackagers are responsible to ascertain if such local regulations are in force, and insure that all requirements for such regulations are met.

MATERIALS COMPATIBILITY WITH CDG SOLUTION 3000™

Undiluted, CDG Solution 3000™ is corrosive to most metals. It is incompatible with aluminum, brass, bronze, carbon and stainless steels, copper, iron and zinc. It is generally compatible with titanium and Hastelloy C.

Undiluted, it is also incompatible with many plastics and elastomers. In many instances, chlorine dioxide will diffuse into and through polymers. In some cases, it will denature plastics material, causing embrittlement, discoloration, or softening. Such materials as PVC, CPVC, HDPE, and polyethylene are in this category. When using such material with concentrated CDG Solution 3000™, they should be fully inspected monthly and replaced if any stress cracking is visible.

Generally, CDG Solution 3000™ is most compatible with fluoropolymers, such as Kynar™ and Halar™, and with fluorinated elastomers, such as Viton™, Teflon™, and Kalrez™. It also is compatible with vinyl ester-FRP materials. Even the highly resistant fluoropolymers listed as acceptable may embrittle with extended exposure to concentrated chlorine dioxide solutions and should be inspected monthly and replaced if any stress cracking is visible.

In diluted form of less than 50 ppm concentration, the solution is compatible with most common piping and seal materials for durations of up to one week. At less than 10 ppm concentration, it is generally safe for these materials.

Only approved materials, components, parts, storage conditions, assembly and construction techniques should be used with CDG Solution 3000™. CDG reserves the

right to inspect and approve any and all installations for the dispensing and/or re-packaging of CDG Solution 3000™ prior to shipping product to users.

Temperature of CDG Solution 3000™ must never fall outside the range of 32 – 140° F. Higher temperatures may cause a hazardous condition in the free space above the liquid surface. This can result in an auto-ignition situation within the containers.

Freezing does not cause a hazardous condition, but may burst containers or process lines, which will result in solution and vapor release upon melting. This can cause severe mucous irritation unexpectedly.

Recommended specification for transport and storage spaces are temperatures within the range of 50-110° F.

SAFETY & HEALTH

See CDG MSDS CD-004 starting on page 22 for detailed information.

For OSHA information see guidelines at: HYPERLINK "http://www.osha.gov/SLTC/healthguidelines/chlorinedioxide/recognition.html" <http://www.osha.gov/SLTC/healthguidelines/chlorinedioxide/recognition.html>

For NIOSH information see Pocket Guide at: HYPERLINK "http://www.cdc.gov/niosh/npg/npgd0116.html" <http://www.cdc.gov/niosh/npg/npgd0116.html>

Chlorine dioxide gas is a mucous membrane and respiratory tract irritant. Swallowing large amounts of this material may be harmful and possibly fatal. Respiration protection should be worn if concentrations exceed applicable standards. See NIOSH pocket guide for detailed information on types of respirators to use.

The primary routes of exposure to this material are ingestion, inhalation, and eye and skin contact.

Signs and Symptoms of Acute Exposure are:

Ingestion--stomach or intestinal upset (nausea, vomiting, diarrhea)

Inhalation--coughing, headache, sore throat, breathing difficulty, bronchitis, pulmonary edema, flu-like symptoms. Chronic exposure can lead to chronic bronchitis and emphysema.

Eye and Skin contact--skin irritation and redness, eye irritation, tearing and redness.

FIRST AID

Ingestion

DO NOT induce vomiting. DO NOT give anything by mouth if the patient is unconscious. Drink large quantities of water. Consult a physician immediately. Neutralization and use of activated charcoal are not recommended.

Inhalation

Move the victim to fresh air. If breathing has stopped, commence artificial respiration and obtain emergency medical help immediately. If cough or difficulty in breathing develops, administer oxygen and consult a physician immediately. Monitor the patient closely for delayed development of pulmonary edema, which may occur up to 72 hours after inhalation.

Skin Contact

Solutions are highly irritating. Chlorine dioxide may be absorbed through the skin causing tissue and blood cell damage. Remove contaminated clothing immediately. Immediately flush exposed skin with large amounts of water. Wash thoroughly with mild detergent or soap. Consult a physician if irritation or burning persists. Contaminated clothing must be laundered before re-use.

Eye Contact

Immediately flush eyes with large amounts of water for at least 15 minutes while frequently lifting the upper and lower eyelids. Consult a physician immediately.

PERSONAL PROTECTIVE EQUIPMENT

Eye Protection

Wear splash-proof face and eye protection where chlorine dioxide solution may splash or spray. PVC or acrylic with a chemical resistant coating is preferred. Safety glasses should be in compliance with OSHA regulations.

Skin Protection

Wear waterproof protective clothing where chlorine dioxide solution may splash or spray. PVC rain suits such as those manufactured by Boss are suitable. Wear resistant gloves, such as Neoprene, rubber, or latex to prevent skin contact. Other protective equipment recommended is an eyewash station or emergency shower.

Respiratory Protection

Remember—Chlorine Dioxide gas is heavier than air. Ventilation intakes and toxic gas monitors should be placed no higher than four feet above the floor for proper operation.

Exposures in the workplace should be monitored to determine if worker exposure exceeds the facility-specified exposure "action level" or the use of the material produces adverse health effects or symptoms of exposure. Provide adequate ventilation to maintain all work areas at concentrations below 0.1 ppm chlorine dioxide concentration. If the generation of vapors or mists is possible, use local ventilation to outside air. Where gas concentration may exceed 0.1 ppm, only a NIOSH/MSHA approved full-face acid gas respirator should be used. This should include an organic vapor removing cartridge with a pre-filter approved for pesticides (MSHA / NIOSH approval number prefix TC-23C) or a canister approved for pesticides (MSHA / NIOSH approval number prefix TC-14G), or a NIOSH-approved respirator with an organic vapor (OV) cartridge or canister with any N, R, P, or HE pre-filter. See NIOSH Pocket Guide reference on page 7 for more details. Monitoring must be used to assess the proper level of respiratory protection necessary. Proper engineering and/or administrative controls should be used to reduce worker exposure.

The facility's respiratory protection program must meet the requirements established in 29 CFR 1910.134, which includes a program for medical evaluation.

A NIOSH/MSHA approved self-contained breathing apparatus, with full face piece, is required for leaks and emergencies where the concentration may exceed 5 ppm.

Engineering Controls

Provide sufficient mechanical ventilation--general and/or local exhaust--to maintain exposure below allowable limits. Suggested minimum is 1.0 to 1.5 cfm per sq.ft. of storage area floor space for ceiling height up to 10 feet. For high bay areas, 6 to 10 air changes per hour should be the normal level. In the event that the room monitoring device signals a level of over the allowable limit of chlorine dioxide, then a supplemental exhaust and fresh air makeup system should be activated that will provide fresh air at a rate of 2.5 to 3.0 cfm per sq.ft. or 15 to 20 air changes per hour until levels are below the allowable limit.

ACCIDENTAL RELEASE MEASURES

The primary concern if CDG Solution 3000™ is spilled is that chlorine dioxide gas will be released rapidly from the spilled solution into the air. The gas evolved from concentrated solution is bright yellow-green and is heavier than air. It will tend to accumulate in low places. When exposed to sunlight, it will sometimes form a short-lived “smoke” of oxychlorine intermediate compounds as it rapidly decomposes in ultraviolet light to form chlorine and oxygen.

This gas is a strong mucous membrane irritant. At concentrations above the regulatory limits, it can produce irritation of the respiratory passages, lungs, and eyes. The full effects of this irritation may not be apparent for several hours after the exposure. Severe exposure may result in pulmonary edema and other severe respiratory damage. Read the MSDS carefully before proceeding.

Large Spill

If a significant quantity of CDG Solution 3000™ is spilled:

Don respirator.

Immediately evacuate the area to prevent anyone breathing the vapors.

Enable emergency fresh air and exhaust system to remove vapors. Be sure that the exhaust gas is not vented to areas where people may be exposed.

Close doors and HVAC passages to prevent the vapor from being conveyed to other parts of the building. Evacuate any area where the gas may be carried.

Dilution of the spill with water will lower the partial pressure of the dissolved gas and minimize the gas release. In an area with sanitary sewer floor drains, diluted solution can be flushed to the sewer. **Concentrated solution spills should not be directed to storm drains which may lead directly to local streams.**

When the gas has dissipated, clean up the remaining water with mops, shop vacuum, or other devices for cleaning up water. Dispose of the resulting liquid to a sanitary sewer.

Small Spill

Absorb liquid on vermiculite, floor absorbent or other absorbent material that is compatible with acids and strong oxidizers. Flush area with water.

Leaking Fitting or Tubing

Stop dosing pump. Close isolation valve at injection point. Don protective equipment as necessary. Absorb any spilled liquid as above. Locate source of leak and repair or replace as required.

CONTAINER AND PRODUCT SPECIFICATIONS

CDG Solution 3000™ specifications

Classifications:

CAS # 10049-04-4

RTECS # FO3000000

ICSC # 0127

Concentration: 3000 parts-per-million in water +/- 10%

MSDS – See MSDS CD-004 on page 28.

Do not contaminate water, food or feed by storage or disposal. Keep containers tightly closed when not in use. Do not store with easily oxidizable materials (e.g. ammonia, hydrogen sulfide, methane, phosphine, organics, or fabric), acids, bases, or combustible materials. If containers are located near floor drains, spill containment should be utilized to prevent accidental discharge of concentrated solution to the drain.

Although CDG Solution 3000™ is shelf stable at room temperature for up to nine months, CDG recommends that product be used as directed within 90 days of the manufacture date indicated on the front panel of the container label to maintain optimum concentration.

The material should be stored indoors, only in the containers in which it is shipped, or in containers authorized by the manufacturer for such storage. Storage and transportation temperatures should be maintained above 50°F and below 110°F. The material should not be stored outside or exposed to freezing temperatures (below 32°F). The material should not be heated to temperatures in excess of 140°F. At temperatures above 140°F, the gas concentration in the headspace of the container may reach high, energetically unstable concentrations.

Container Specifications – CDG Solution 3000™ can be shipped in pails, drums, or intermediate bulk containers (IBC's). Containers must be plastic and should be opaque to UV radiation, or covered with material that is opaque to UV radiation.

Pails shall be able to contain 5 to 7 gallons (20 to 26 liters) of liquid. They shall be manufactured from high density polyethylene (HDPE) and shall be of the tight head type. If a drum extraction system is desired, each pail shall have one 2-inch buttress fitting with matching drum plug and seal of either Teflon or Viton. The plug shall have molded into it a 3/4" NPT knockout. Otherwise, the pail will have a cap of like material or PVC with Viton or Teflon gaskets. The pails shall meet or exceed UN 3H1/Y1.4/100 standards, and shall be so clearly marked.

Drums shall be able to contain 15, 30, or 55 gallons of liquid. They shall be manufactured from high density polyethylene (HDPE) and shall be of the tight head type. Each drum shall have one 2-inch buttress fitting and one 2-inch NPT fitting in the top head, with matching drum plug and seal of either Teflon or Viton. One plug shall have molded into it a 3/4" NPT knockout. The drums shall meet or exceed UN 1H1/Y1.8/100 standards, and shall be so clearly marked. Drums shall have level indications molded into the drum sides.

Intermediate Bulk Containers (IBC) shall be either 275 or 330 gallon size. The container shall consist of a rugged, steel tube or steel rod cage with anti-corrosion treatment and a 100% recyclable translucent HDPE bottle. Cage shall be attached to a shipping pallet which may be plastic or metal. No wooden pallets shall be allowed. Cage shall be designed to reduce bulging of bottle, and shall be stackable. IBC shall be in full compliance with all applicable regulations, and shall be UN certified 31HA1/Y or 31H2/Y. The bottom draw valve shall be either 2" MPT ball, butterfly, or camlock valve of PVC or HDPE. Seals shall be Teflon or Viton. Top filling port shall be minimum 6" in size and shall have a 2" FPT fitting with plug of similar material to bottle. Cage shall be fitted with marking plates for labeling. Bottle shall be molded with level indications on one vertical surface. IBC's shall be wrapped with UV resistant poly-wrap to protect contents from sunlight and other UV radiation.

CDG will limit reuse of a container in shipping to 6 months from the first fill. Use of overpacks obviates any safety issue due to drum deterioration.

A drum extraction system can be installed on any container to aid in drawing CDG Solution 3000™ from the container and properly venting the container upon request. Use of this system requires careful design of the draw system and pumps such that the natural tendency of CDG Solution 3000™ to outgas will be taken into account. CDG can assist in this design upon request. Information on the drum extraction system can be obtained from CDG.



205 Webster Street
Bethlehem, PA 18015
888-610-2562

www.cdgenvironmental.com

Certificate of Analysis can be provided upon request for each batch indicating the measured concentration of the batch.

Containers will be shipped and stored with the approved EPA FIFRA label. Each label will be marked with the net contents, the serial number of the container, the date that the CDG Solution 3000™ was made, and the expiration date. All DOT required labels must also be attached.

MSDS will be provided to the carrier by CDG with each shipment.

PUMPING

Dosing:

Dosing pumps can be either solenoid operated or motor driven, depending on the dosing rate and back pressure in the system. Recommended manufacturers are Prominent, LMI, Pulsafeeder, and Walchem.

All wetted parts of the pump head shall be Kynar, PVC, CPVC, or ceramic. Seals and o-rings shall be Viton, Kalrez, or Teflon.

The electronic controls on the pump shall be selected in accordance with the control scheme that will keep levels of chlorine dioxide stable in the water stream. Typically, dosing will be controlled by a signal from a flow metering device on the main water stream. However, dosing may also be controlled by periodic injection on a regular time interval.

The pump should come with some type of automatic bleed system to expel gases that may evolve from the solution and “air bind” the pump head, and return them to the solution container. Consult the pump manufacturer for proper selection.

CDG can assist in pump selection upon request.

Transfer:

Transfer pumps should be motor driven centrifugal, magnetic drive style. Maximum recommended developed head is 20 psig or 45 ft. hd. Recommended manufacturers are Shur-flo, Iwaki, and Pan World.

All wetted parts of the pump head shall be Kynar, PVC, or CPVC. Seals and o-rings shall be Viton, Kalrez, or Teflon.

PIPING

If rigid pipe is used to conduct solution, it shall be PVC or CPVC. Schedule 40 pipe may be used from 5” Hg vacuum to 25 psig. Schedule 80 pipe shall be used for full vacuum to 25 psig.

Fabrication shall be cemented joints as much as possible. Flanged joints shall not be used. Threaded joints shall be kept to a minimum. All threaded joints shall be sealed with Teflon tape. No liquid Teflon shall be used. Where piping will run long distances or through wall or floors, double walled piping is required.

TUBING AND HOSES

Tubing:

Tubing used in dosing systems shall be flexible Kynar. Fittings shall be Kynar compression type. Tubing runs shall be kept to a minimum. Where there is exposure to UV radiation from sunlight or indoor lighting, the tubing shall be wrapped with tape or run inside a larger size tube of opaque material, such as colored polypropylene, preferably black.

Hose:

Transfer hose shall be PVC. Construction can be reinforced or non-reinforced, and shall be vacuum rated. Material can be clear or colored. Minimum size shall be 3/4". Hose connections shall be multi-barb style manufactured of PVC, CPVC, Kynar, or glass reinforced polypropylene. All threaded joints shall be sealed with Teflon tape. No liquid Teflon shall be used.

RECEIVING AT CUSTOMER'S FACILITY

Temperature of CDG Solution 3000™ must never fall outside the range of 32 – 140° F. Higher temperatures may cause a hazardous condition. Freezing does not cause a hazardous condition, but may burst containers or process lines, which will result in solution and/or gas release upon melting

Inspect shipment for any damage to containers, leaks, etc., and report such damage to the carrier and CDG.

Storage space should be cool, dry, dark, and well ventilated. **Do not store with easily oxidizable materials (e.g. ammonia, hydrogen sulfide, methane, phosphine, organics, or fabirc), acids, bases, or combustible materials.** Indoor storage is preferable, but CDG Solution 3000™ can be stored outdoors if protected from direct sunlight and other sources of UV radiation. If indoor storage, ventilation should be a minimum of 1.0 to 1.5 cfm per sq.ft. floor space. Additional ventilation will be required in the event of a spill or leak. If containers are located near floor drains, spill containment should be utilized to prevent accidental discharge of concentrated solution to the drain. Temperature should always be in the range of 50 – 110°F. An environmental chlorine dioxide monitor such as ATI model B12-12-4-0002-1 or approved equivalent should be located in the solution storage area and connected to audible and visual alarms. Personal portable monitors are also available, such as BW Technologies Gas Alert Extreme, but should be used only as secondary monitors.

Personal Protection Equipment and an emergency spill kit must be available and readily accessible.

The Customer is responsible for defining, preparing, and dissemination of procedures for the proper transporting and delivery of containers within the treated facility, and for the proper installation of the injection system. The Customer is responsible for obtaining any and all permits required for the installation of equipment required. CDG can aid with this task upon request.

CHLORINE DIOXIDE LEVEL MONITORING

The Customer is responsible for monitoring chlorine dioxide and/or chlorite levels for regulatory compliance. The Hach Pocket Colorimeter II for Chlorine Dioxide, Product #5870051 can be used to test levels of chlorine dioxide in treated water. The procedure is in Appendix A.

Amperometric probes are also available from Prominent (Type CDE and CDP-1) and Sensorex (Type CLD). These can be used for online measurement, but must be calibrated periodically to ensure accuracy.

Both of these methods should be calibrated by amperometric titration by a qualified laboratory, utilizing an amperometric method described in *Standard Methods for the Examination of Water and Wastewater*, 20th Edition or newer. CDG can aid with this task upon request.

At present, only amperometric titration and Ion Chromatography can be used to test for chlorite levels.

ORP is not a valid method for measuring chlorine dioxide in treated water.

The customer is responsible for monitoring pathogens as required. CDG can aid with this task upon request.

EMPTY CONTAINER DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

Improper disposal of pesticide, prepared solutions, or rinse water is a violation of Federal law. If wastes can not be disposed of according to container label directions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative of your nearest EPA Regional Office for guidance.



205 Webster Street
Bethlehem, PA 18015
888-610-2562
www.cdgenvironmental.com

Empty containers with residual CDG Solution 3000™ in them may be disposed of locally by adding 0.75 oz. of sodium thiosulfate per gallon of residual to the container. Sodium thiosulfate is the primary ingredient in dechlorinator powder sold by aquarium and pool suppliers. The crystals may be added directly to the container, or mix the required amount of sodium thiosulfate with water in the ratio of not more than 1 ounce per cup of water, or 1 pound per gallon. Add this to the container slowly and mix until the color is gone. The reaction may release a slight sulphurous odor. Fill container with water and check pH. If it is within the limits for the local sanitary sewer, dump the contents to the sewer. Triple rinse with water and offer the container for recycle or cut up for disposal in a sanitary landfill.

Containers may also be returned, at the customer's expense, to CDG for disposal.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

CDG Solution 3000™ is a chlorine dioxide product designed to purify water which has previously been treated in accordance with the Safe Drinking Water Act (SDWA), including: potable water and cooling water in hospitals & healthcare facilities, nursing homes, hotels, commercial office buildings, government buildings, residential buildings, and ships; industrial process water; food processing water; livestock drinking water. CDG Solution 3000™ is also designed to control slime in potable water systems, process water systems, and cooling towers. Pathogenic organisms controlled include bacteria and viruses set forth in USEPA *Guide Standard Protocol for the Purification of Water* (1987), *i.e.*, *Klebsiella terrigena*, Poliovirus and Rotavirus.

In preliminary laboratory tests, CDG Solution 3000™ also has been shown to inactivate pure cultures of *Legionella* bacteria. However, the ability CDG Solution 3000™ to control the growth of, or inactivate *Legionella* bacteria in institutional drinking water systems, process water systems, cooling water systems, or other operating environments in which the water may be exposed to UV light, organic material, other microbial contamination and aeration, has not been documented. These preliminary findings also do not address the problem of long-term preventative maintenance of the drinking water systems, cooling water systems, process water systems and other systems for which application of this product is intended.



205 Webster Street
Bethlehem, PA 18015
888-610-2562

www.cdgenvironmental.com

Carefully read and follow the instructions for the CDG Solution 3000™ dosing equipment provided by the manufacturer or its authorized agent.

POTABLE WATER, COOLING WATER, AND PROCESS WATER SYSTEMS

CDG Solution 3000™ is intended for use in water systems which use as their source treated municipal water, including:

- Hospitals
- Office buildings
- Animal facilities
- Nursing homes
- Hotels
- Food processing plants
- Schools & public buildings
- Residential buildings
- Beverage production facilities

Minimum contact time for control of listed pathogenic organisms is 5 minutes.

Injection point for CDG Solution 3000™ should take into consideration such things as good turbulence for mixing, longest contact time before exposure to UV radiation, mixing with other treatment chemicals for compatibility and interaction, accessibility for ease of maintenance, etc. CDG will assist with selection of injection point upon request. Injection quills should be chosen so as to inject CDG Solution 3000™ as close to the center of any metal pipe as possible to minimize corrosion of the pipe.

If containers are located near floor drains, spill containment should be utilized to prevent accidental discharge of concentrated solution to the drain.

Positioning of dosing pumps should be such that no natural trap is formed in the suction line from the container to the pump. CDG Solution 3000™ will outgas in much the same way as sodium hypochlorite, and the same precautions with piping and pumps should be taken to prevent “air binding” of the pump. Degassing valves or automatic bleeds should be utilized, with bleeds returned to the container.

Undiluted CDG Solution 3000™ should not be fed together with organic corrosion inhibitors or other chemical treatments. Interaction of CDG Solution 3000™ with other chemicals in the water system must be checked with the manufacturer or CDG.

It must be remembered that using CDG Solution 3000™ in older pipes with a slime layer already on them will cause the slime layer to be removed and can result in pin-hole leaks in the pipe grid. Subsequent repair or replacement of sections of pipe can be expected.

TREATMENT OF POTABLE WATER FOR HUMAN CONSUMPTION



205 Webster Street
Bethlehem, PA 18015
888-610-2562

www.cdgenvironmental.com

Add CDG Solution 3000™ to the water at a dose of up to 2.0 ppm (2.0 mg/L) chlorine dioxide (a dilution ratio 1:1500). **Under US EPA regulations, drinking water intended for human consumption may not contain more than 0.8 ppm (0.8 mg/liter) residual chlorine dioxide nor more than 1.0 ppm (1.0 mg/liter) chlorite ion.**

TREATMENT OF WATER FOR ANIMAL CONSUMPTION

(For use to treat water for human consumption, see specific directions.)

Add CDG Solution 3000™ to the water at dose of 5.0 ppm (5.0 mg/liter) chlorine dioxide (a dilution ratio of 1:600).

TREATMENT OF COOLING AND PROCESS WATER SYSTEMS TO CONTROL SLIME

Add CDG Solution 3000™ to the water at a dose of 50 ppm (50 mg/liter) chlorine dioxide (a dilution ratio of 1:60) and circulate or let stand overnight. Drain and rinse with clean water before re-use. To prevent slime growth after initial treatment, add CDG Solution 3000™ to the water at a dose of 5.0 ppm (5.0 mg/liter) chlorine dioxide (a dilution ratio of 1:600).



205 Webster Street
Bethlehem, PA 18015
888-610-2562
www.cdgenvironmental.com

CONDITIONS OF SALE AND WARRANTY

CDG Research Corporation (“CDG”), its Supplemental Distributors and the Seller warrant that this product conforms to the chemical description on the label and is reasonably fit for the purposes referred to in the Directions for Use.

TO THE EXTENT PERMITTED BY LAW, NEITHER CDG NOR ITS SUPPLEMENTAL DISTRIBUTORS MAKE ANY OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE OR OF MERCHANTABILITY OR ANY OTHER EXPRESS OR IMPLIED WARRANTY. THIS WARRANTY DOES NOT EXTEND TO, AND THE BUYER SHALL BE SOLELY RESPONSIBLE FOR, ANY AND ALL LOSS OR DAMAGE WHICH RESULTS FROM THE USE OF THIS PRODUCT IN ANY MANNER WHICH IS INCONSISTENT WITH THE LABEL DIRECTIONS.

CDG, its Supplemental Distributors, and the Seller offer this product, and the Buyer accepts it, subject to the foregoing Conditions of Sale and Warranty. No employee or agent of CDG, its Supplemental Distributor, or the Seller is authorized to vary or exceed the terms of this Warranty in any manner.

Appendix A - CDG Solution 3000™ Testing

This section includes information that will determine the concentration of the chlorine dioxide solution in treated water. It can be used to troubleshoot any malfunctions in the operation of these systems.

Use of the Hach Pocket Colorimeter II with the DPD pillow reagents necessitates that the sample be less than 2 ppm chlorine dioxide concentration. Raw samples greater than 2 ppm must be diluted with deionized or distilled water to less than 2 ppm concentration prior to testing.

1. Apparatus Required

Hach Pocket Colorimeter II

Chlorine Dioxide Reagents—10% glycine and DPD test pillows

10 ml Hach sample vial

100 ml graduated cylinder

1 ml pipette

Pipette bulb

Plastic funnel

250 ml plastic bottle

50 ml plastic bottle

Deionized or distilled water

Waste collection bucket—plastic

Lens cleaner or paper towel

2. Raw Sample Collection

With 250 ml plastic bottle, withdraw 50-100 ml of solution at the sampling point to purge line of old sample.

With 50 ml plastic bottle, withdraw 25-40 ml of solution. Take to testing station.

3. Sample Preparation

Remember—Chlorine dioxide gas will be liberated from solution upon agitation or stirring. Care must be taken in this step to ensure that minimal chlorine dioxide is lost during preparation. If desired dosage is less than 2 ppm, no sample dilution is necessary. Go to step 4.

Determine the concentration of chlorine dioxide desired in the treated water. Call that C_d .

Dilution water required per ml of sample can be calculated by $\text{ml (water)} = (C_d - C_r) / C_r$, where C_r is the required concentration of 2 ppm. Thus, for 5 ppm dosage, add 1.5 ml water to 1.0 ml of raw sample. For 50 ppm, add 24 ml of water to 1 ml raw sample.

10 ml of test solution is required for the Hach meter. It is advisable to make at least 50 ml of test solution. Thus, it may be necessary to use multiples of the dilution water and sample calculated in step 3.2.

Put the required amount of dilution water into the 100 ml cylinder. Add the required amount of sample with the pipette. Cap cylinder and go to step 4.

4. Sample Testing

Remember—Chlorine dioxide gas will be liberated from solution upon agitation or stirring. Care must be taken in this step to ensure that minimal chlorine dioxide is lost during preparation.

Turn Hach Colorimeter on. Wait while internal startup finishes.

Take one of the 10 ml sample vials and fill with deionized water to 10 ml line. Clean outside of vial with lens cleaner or paper towel. Cap vial and place vial in holder of colorimeter and close cover over vial. Press zero key.

Remove vial and dump water into waste bucket. Fill vial with sample from step 3.3 or directly from treated water sample, and dump into bucket.

Fill vial with sample from step 3.3 to 10 ml line. Cap, wipe vial with lens cleaner or paper towel, and place vial in holder and close cover. Press test key. If result is zero, proceed to next step. If not, clean outside of vial again and retry.

Open vial and place 4 drops of glycine solution and contents of one pillow into vial.

Cap vial, swirl slowly for 10-15 seconds, and place vial in holder; close cover.

Wait 30 seconds. Press test key. When result appears, press test key again. If result is the same, proceed; if not, press test key until two successive results are the same.

Multiply this result by the amount of dilution water required in step 3.2 to get concentration in ppm for dosages >2 ppm. Read result directly for treated water sample of <2 ppm.

Empty vial into bucket. Rinse with sample or deionized water. Dump all samples into bucket and discard.

Turn colorimeter off and return to case. Store labware.

Material Safety Data Sheet

Material: Chlorine Dioxide 0.3% Aqueous Solution
Company: CDG Environmental, LLC
MSDS No. CD-004
Date of Preparation: August 13, 2009
Revision: 006

Section 1 – Chemical Product and Company Identification

Chemical Name: Chlorine Dioxide Aqueous Solution
General Class: Class 8 - Corrosive Liquid
Packing Group: 3
General Purpose: Biocide
Synonyms: Chlorine Oxide Solution
Chlorine Peroxide Solution
Chlorine (IV) Oxide Solution
Chloroperoxyl Solution
UN ID 1760 Corrosive liquid NOS
Company Name & Address: CDG Environmental, LLC
205 Webster Street
Bethlehem, PA 18015

Section 2 – Composition / Information on Ingredients

Hazardous component(s):

Chemical name	Chlorine Dioxide
CAS #	10049-04-4
Molecular formula	ClO ₂
Concentration	0.3% (3,000 ppm)

Non-hazardous component(s):

Chemical name	Water
CAS #	7732-18-5
Molecular formula	H ₂ O
Concentration	≥ 99.7% (≥ 997,000 ppm)

Section 3 – Hazard Identification

Potential Health Effects – General:

Chlorine dioxide gas is a mucous membrane and respiratory tract irritant.

Swallowing large amounts of this material may be harmful.

Respiration protection should be worn if concentrations exceed applicable standards.

Primary Route(s) and Symptoms of Exposure:

The primary routes of exposure to this material are ingestion; inhalation; and eye and skin contact

Ingestion--Signs and symptoms of exposure to this material through swallowing include stomach or intestinal upset (nausea, vomiting, diarrhea)

Inhalation--Signs and symptoms of exposure to this material through inhalation of its vapors include coughing, sore throat, breathing difficulty

Eye and Skin Contact--Signs and symptoms of exposure to this material through skin contact include skin irritation and redness. Signs and symptoms of exposure to this material through eye contact include eye irritation, tearing and redness.

Section 4 – First Aid Measures

Eyes

If symptoms develop, move patient away from the source of exposure and into fresh air. Flush eyes gently with large amounts of water while holding eyelids apart. If symptoms persist or there is any visual difficulty, seek medical attention.

Skin

First aid is not normally required. However, concentrated solutions of the material (> 1000 ppm) may be highly irritating, especially on prolonged contact. Remove contaminated clothing immediately. Immediately flush exposed skin with large amounts of water. Wash thoroughly with mild soap. Consult a physician if irritation or burning persists. Contaminated clothing must be laundered before re-use. Lower concentrations (<1000) ppm may cause some irritation with very-prolonged exposure.

Swallowing

First aid is not normally required when small amounts of the material are ingested. If symptoms develop or if large amounts of material have been ingested, DO NOT induce vomiting. DO NOT give anything by mouth if the patient is unconscious. Drink large quantities of water. Consult a physician immediately. Neutralization and use of activated charcoal are not recommended.

Inhalation

If symptoms develop, immediately move individual away from exposure and into fresh air. Seek immediate medical attention; keep person warm and quiet. If person is not breathing, begin artificial respiration. If breathing is difficult, administer oxygen. Monitor the patient closely for delayed development of pulmonary edema, which may occur up to 72 hours after inhalation.

Notes to Physicians

Probable mucosal damage may contraindicate the use of gastric lavage.

Section 5 – Fire-Fighting Measures

NFPA Rating

Health – 1
Flammability – 0
Reactivity – 1

Flash Point

Not applicable

Auto-ignition Temperature

Not applicable

Explosive Limit

Chlorine dioxide solution is not explosive. Chlorine dioxide gas, which may evolve from chlorine dioxide solution, may spontaneously decompose with a mild energy release at concentrations of 10% in air or greater at standard temperature and pressure (i.e., 76 mm Hg partial pressure).

Chlorine dioxide gas may explode with violent force at concentrations of 30% or greater in air at standard temperature and pressure (i.e., 228 mm Hg partial pressure)

Hazardous Products of Combustion

May form chlorine, hydrochloric acid gas, oxygen on combustion or decomposition

Fire and Explosion Hazards

There are no special fire hazards known to be associated with the material.

Extinguishing Media

Water

Fire Fighting Instructions

Wear a self-contained breathing apparatus (SCBA) with a full face piece operated in the “positive pressure demand” setting. Use SCBA in conjunction with appropriate chemically resistant personal protective gear. Refer also to the personal protective equipment section of this MSDS.

Section 6 – Accidental Release Measures

Large Spill

In the event of a large spill of the material, prevent runoff to sewers, streams, lakes or other bodies of water. If run-off occurs, notify proper authorities of any runoff, as required. Persons not wearing protective equipment should be excluded from area of spill until clean-up has been completed. Stop spill at source, dike area around spill to prevent spreading, and pump liquid to salvage tank. Remaining liquid may be taken up on sand, clay, earth, vermiculite, floor absorbent, or other absorbent material and shoveled into containers. Flush with water the area from which the bulk of the spill has been removed.

Small Spill

Absorb liquid on vermiculite, floor absorbent or other absorbent material. Flush area with water.

Section 7 – Handling and Storage

Handling

In order to prevent the evolution of chlorine dioxide gas into the breathing zones of workers, agitation of the material should be minimized, and the material should not be stirred, mixed turbulently, sprayed or splashed.

Storage

The material should be stored indoors, only in the containers in which it is shipped, or in containers authorized by the manufacturer for such storage. Storage temperatures should be maintained above 50°F and below 110°F. The material should not be stored outside or exposed to freezing temperatures (below 32°F). The material should not be heated to temperatures in excess of 140°F. At temperatures above 140°F, the gas concentration in the headspace of the container may reach high, energetically unstable concentrations.

Section 8 – Exposure Controls / Personal Protection

The OSHA permissible exposure limit (PEL) for ClO₂ gas in air is 0.1 ppm (0.3 mg/m³) as an 8-hour time weighted average. NIOSH recommended exposure limits (REL) and ACGIH threshold limit values (TLV) are also 0.1 ppm.

NIOSH and ACGIH short-term exposure limits (STEL) are 0.3 ppm (0.83 mg/m³) for periods not to exceed 15 minutes. The STEL concentration should not be repeated more than 4 times per day

and should be separated by intervals of at least 60 minutes.

Exposure Guidelines (vapor)

OSHA PEL 0.100 ppm – TWA

ACGIH TLV 0.100 ppm – TWA

ACGIH TLV 0.300 ppm - STEL

Eye Protection

Wear splash-proof face and eye protection (PVC is preferred) where chlorine dioxide solution may splash or spray. Safety glasses should be in compliance with OSHA regulations.

Skin Protection

Wear waterproof protective clothing (PVC is preferred) where chlorine dioxide solution may splash or spray. Wear resistant gloves, such as Neoprene, to prevent skin contact, wear impervious clothing and boots. Other protective equipment: eyewash station, emergency shower.

Respiratory Protection

Exposures in the workplace should be monitored to determine if worker exposure exceeds the facility-specified exposure "action level" or the use of the material produces adverse health effects or symptoms of exposure. Provide adequate ventilation to maintain all work areas at concentrations below 0.1 ppm chlorine dioxide concentration. If the generation of vapors or mists is possible, use local ventilation. Where gas concentration may exceed 0.1 ppm, only a NIOSH/MSHA approved full-face acid gas respirator should be used. Monitoring results must be used to assess the proper level of respiratory protection necessary. Proper engineering and/or administrative controls should be used to reduce worker exposure. The facility's respiratory protection program must meet the requirements established in 29 CFR 1910.134, which includes a program for medical evaluation. A NIOSH/MSHA approved self-contained breathing apparatus, with full face piece, is required for leaks and emergencies where the concentration may exceed 5 ppm.

Engineering Controls

Provide sufficient mechanical ventilation-- general and/or local exhaust-- to maintain exposure below allowable limits.

Section 9 – Physical and Chemical Properties

Ap Appearance and odor

Yellow-green liquid, with sharp, pungent odor

Liquid specific gravity

1.0 at 0° C

Boiling Point

100° C (212° F)

Odor threshold of gas

0.1 ppm

Section 10 – Stability and Reactivity

Hazardous Polymerization

Material does not undergo hazardous polymerization.

Hazardous Decomposition

Gas-phase vapors that evolve from the material may decompose on exposure to light, on contact with incompatible materials (see below), or spontaneously at concentrations above 10% in air at standard temperature and pressure (76mm Hg). On decomposition, material may form: Chlorine, hydrochloric acid gas and oxygen.

Chemical stability

The material, as solution, is stable in the dark. On exposure to light, the solution may decompose to an aqueous solution of chloride and chlorate ions. In regard to vapor (gas) that may evolve from the material, see “Hazardous Decomposition” above.

Incompatibility

Avoid exposure to light. Avoid contact with: metals, reducing agents, strong oxidizing agents, sulfur compounds or sulfur-containing components, carbon monoxide, excessive heat, mercury, organic materials, phosphorus.

Section 11 – Toxicological Information

Chlorine dioxide gas is a mucous membrane and respiratory tract irritant. Primary routes of exposure include ingestion, skin and eye contact and inhalation of vapors which may evolve from the material.

Target Organ Effects

Eye

This material may cause mild eye irritation; it is unlikely to cause serious eye irritation or injury.

Digestive Tract

This material may cause nausea, vomiting and diarrhea; it is unlikely to cause serious digestive tract injury. Chlorine dioxide given daily in drinking water at 1-100 ppm caused a decrease in blood glutathione, altered the morphology of erythrocytes, and caused osmotic fragility in laboratory animals.

Respiratory Tract

The fumes from this material may cause respiratory tract irritation, wheezing and difficulty breathing. In extreme cases, it may cause pulmonary damage and death.

Developmental/Reproductive Effects

Available information is insufficient to assess risk to the fetus from maternal exposure to this material during pregnancy. Chlorine dioxide did not cause birth defects in laboratory animals even at very high exposure levels.

Cancer Effects

Available information is insufficient to assess cancer risk (i.e., carcinogenicity) associated with exposure to this material. This material is not listed as a carcinogen by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP), or the Occupational Safety and Health Administration (OSHA) United States Environmental Protection Agency (EPA) or American Conference of Industrial Hygienists (ACGIH).

Other Health Effects

No data available on other possible health effects

Section 12 – Ecological Information

No data available.

Section 13 – Disposal Considerations

Disposal of this material should be in accordance with all applicable Federal, State and local rules, regulations and requirements.

Section 14 – Transport Information

Transport of this material should be in accordance with all applicable Federal, State and local rules, regulations and requirements, including, without limitation, the rules and regulations of the US Department of Transportation, including all applicable packaging and labeling requirements.

DOT Information: Regulated as a hazardous material when shipped by motor vehicle or rail car.

Proper shipping name:	Corrosive Liquid, N.O.S.
Class:	Class 8 – Corrosive.
Packing group:	III (must not ship or store in metal containers)
Hazard label:	CORROSIVE
Technical name:	Chlorine Dioxide Aqueous Solution (0.3%)

Section 15 – Regulatory Information

US Federal Regulations

TSCA (Toxic Substances Control Act) Status - United States



205 Webster Street
Bethlehem, PA 18015
888-610-2562
www.cdgenvironmental.com

The intentional ingredients of this material are listed.

CERCLA RQ- 40 CFR 302.4(a)

None listed

SARA 302 Components - 40 CFR 355 Appendix A

None

Section 311/312 Hazard Class-40 CFR 370.2

Immediate ()

Delayed ()

Fire ()

Reactive ()

Sudden Release of Pressure ()

SAARA 313 Components - 40 CFR 372.65

Section 313 Components	CAS Number	Percent (%)
Chlorine dioxide	10049-04-4	0.3



205 Webster Street
Bethlehem, PA 18015
888-610-2562

www.cdgenvironmental.com

OSHA Process Safety Management 29 CFR 1910

PSM Component(s)	Condition	TQ (lbs)
CHLORINE DIOXIDE		100

EPA Accidental Release Prevention 40 CFR 68

PSM Component(s)	Condition	TQ (lbs)
CHLORINE DIOXIDE Chlorine Oxide (ClO ₂)		100

International Regulations

Not determined

State and Local Regulations

California Proposition 65

None

Section 16 – Other Information

The information set forth herein is believed to be accurate. However, NO WARRANTY IS GIVEN AS TO THE ACCURACY OF ANY OF THE INFORMATION, WHETHER ORIGINATED BY THE COMPANY OR BY OTHERS. Recipients of this MSDS are advised to confirm, in advance of any need, that the information is current, applicable, and suitable to their circumstances.

CDG Solution 3000 is a “corrosive material” (Class 8), solely because it is corrosive to steel and aluminum. It is not highly corrosive to skin. It MUST be packaged and shipped in containers that will not react dangerously with or be degraded by the *CDG Solution 3000* (e.g., plastic).

For chemical spill information call CHEMTREC: 1-800-424-9300

For emergency medical information, call the National Pesticide Information Center at
1-800-858-7378.

Emergency Telephone Number: 800-424-9300 24 hours/day, 7 days/week

Emergency Telephone Number: 800-424-9300 24 hours, 7 days/week