



The Gold Standard for Water Disinfection

GO₂TM APPLICATIONS IN COOLING TOWER TREATMENTS

Controlling and preventing the growth of microorganisms in a cooling tower system is extremely important and required to keep the system running at optimal levels. The presence of the microorganisms will cause the system to breakdown and need to be replaced more rapidly and decrease the efficiency of the heat transfer and removal. Typically oxidizing biocides such as chlorine and bromine have been used to treat cooling tower water. Unfortunately these chemicals are highly reactive with other chemicals and microbiological species found in the water. Once these reactions take place, both of these chemicals lose much of their biocidal efficacy and ability to eliminate the microorganisms present. GO₂ (ClO₂) however is very non-reactive to other items found in the water and retains biocidal efficacy. Likewise it is also a superior chemical for removing the biological film layers, "Slime layers" found within the cooling tower system. It is the formation of these biological film layers that lead to the most predominant problems that all cooling towers face.

Corrosion- Corrosion takes place beneath the biofilm layer. Anaerobes are a type of bacteria that exist and rapidly grow in an environment without the presence of oxygen. Underneath the biofilm layer such an environment exists, and these anaerobes secrete acidic by-products which corrode the metal and cause pitting. Once the pitting process has begun it is very hard to stop because of the layer of protection that is provided by the biofilm layer.

Scale and Deposits- The growth of the microbiological organisms can lead to a mineral scale formation with the towers. All scaling begins at a site where nucleation can occur. The biofilm later provides such a site, and its existence can lead to large scaling problems in a tower.

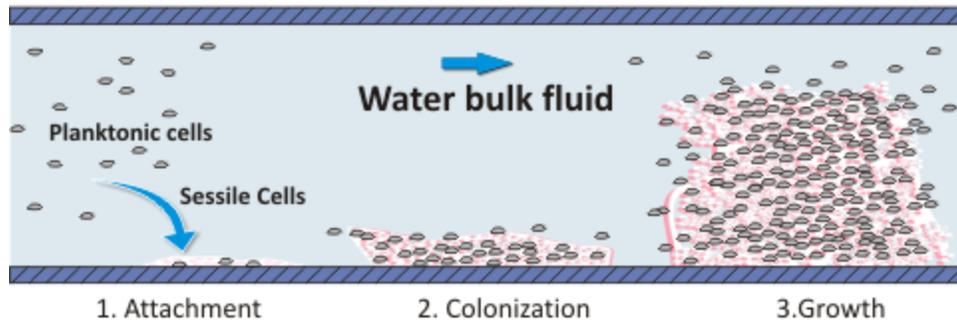
Inefficient Heat Transfer/ Removal- Fouling of the system by the growth the biological film, or scaling decreases the efficiency of heat transfer in the cooling tower. The growth of deposits on heat transfer surfaces also result in significant heat transfer loss.



THE PROBLEM OF SLIME (BIOFILM) IN WATER SYSTEMS

Slime grows very quickly in water systems. Planktonic cells flowing in the water clot together and form a layer of sessile cells, which attach to the inner walls of tubes and pipes. Colonies of cells grow rapidly, and attract more planktonic cells. The slime can grow and block free water flow, and forms a contamination which is a hazard for water quality.

Slime Formation



In existing water distribution systems, the distribution pipes are permanently contaminated with slime. Chlorine does not eliminate, or even inhibit, the growth of slime. **GO₂**™ removes slime within a short period of time. The hard layer requires longer time to remove, depending on the thickness of accumulation. The process of decontamination is completely safe and has no adverse side effects.

The structure of slime

The slime consists of two layers. A hard layer is found compacted against the inner wall of the distribution pipe. Within the diameter of the hard layer is a soft slime layer. The soft layer deposits flakes off slime into the water current. The slime deposits block piping systems, foul drinking water nozzles and cleaning sprays, etc.

Slime Structure



GO₂-generated chlorine dioxide (ClO₂) is a superior water treatment to chlorine. **GO₂** addresses specific disinfection tasks that chlorine cannot accomplish, such as slime removal. It also has a far longer effective life. In addition to purifying drinking water, **GO₂** will eliminate slime in water pipes, tanks and throughout the entire water distribution system... whether that is an entire city, a large industry or a small poultry farm. Chlorine does not address this important issue. Unlike chlorine, **GO₂** has no known negative side effects. 1 ppm **GO₂** delivers the same disinfecting power as a dosage rate of 10 ppm of chlorine. The dilution factor plays an important role in safety and cost comparison. **GO₂** is harmless, whereas chlorine is dangerous to use, has harmful side effects on human,

animal, plant and marine health and creates harmful by-products, that are corrosive and harmful for humans.

An example

Using **GO₂**, a city can start with 2 ppm **GO₂**-generated chlorine dioxide at the water plant and yield a concentration level of 0.3 ppm at the tap. Over time, using **GO₂**-generated chlorine dioxide the slime in the distribution system and storage tanks is killed off and removed, and the **GO₂** concentration can be lowered. For example, after the distribution system is cleaned, a concentration of 0.5 ppm **GO₂** at the water plant will still yield 0.3 ppm at the tap. These concentration levels can then be established as the stable application level. A consistent dosage will be indicated in the water distribution system and at the tap. This produces healthier drinking water at less cost to the city and to consumers. The same benefits apply in dairy, agricultural food processing and industrial applications.

Existing water conditions can vary widely. Biological loading can be low (even 1 KVE/ml), average (between 100-500) or high (60,000). Even if there is a low biological load, most water systems still have slimes. These are not separated, broken down or removed by sodium chlorine 10% or 15%, or by hydrogen peroxide. The company knows of no other commercially available water purifier that treats slime.

Using **GO₂**, an initial 1ppm causes the slime to break down and remove. This will temporarily cause a high biological load. This load will remain high until all remnants of the slime are removed and until the water clarity returns. Once the slime has been completely removed, the water will appear clear, the biological load will drop to <1, and the dose for **GO₂** can be lowered to 0.5 ppm. Gradually, lowering the ppm each week can be experimented with until a continuous dosage level of 0.2 ppm is reached. Continuous use of **GO₂** guarantees the water will remain clean and clear, prevents the re-growth of slime and guarantees an ongoing low biological load. In warm climates, a final continuous dosage level of 0.3ppm is recommended.

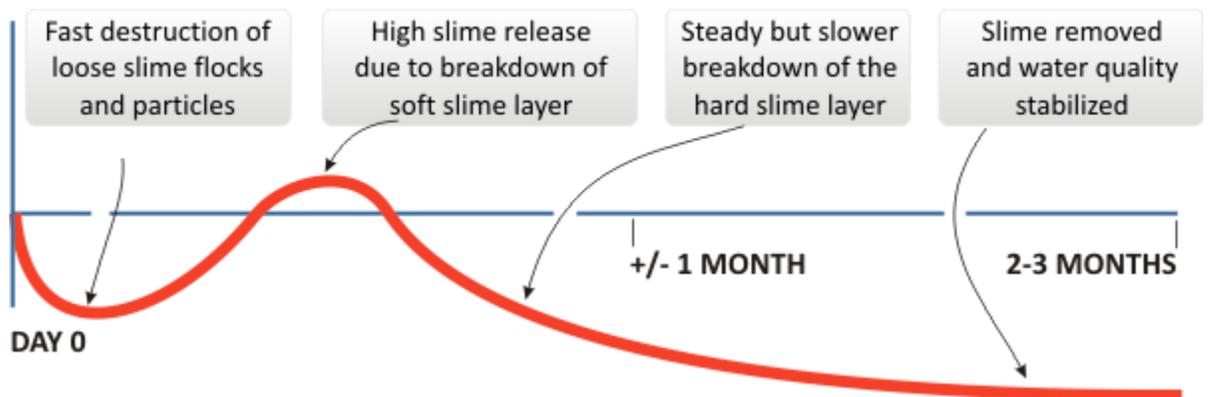
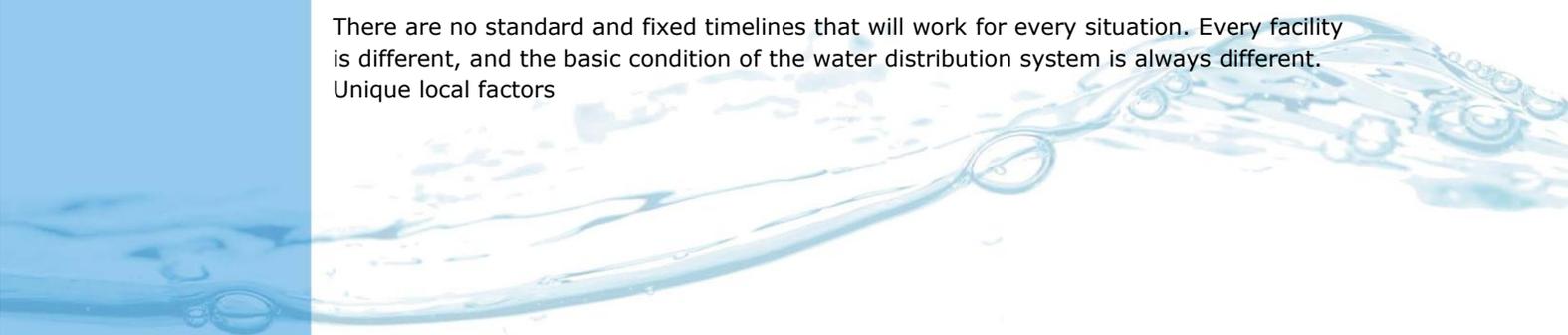


Figure 1: Slime contamination in water flow after start of **GO₂** deployment.

There are no standard and fixed timelines that will work for every situation. Every facility is different, and the basic condition of the water distribution system is always different. Unique local factors





The Gold Standard for Water Disinfection

A NEW, COST EFFECTIVE, EASY TO USE DELIVERY SYSTEM FOR CHLORINE DIOXIDE

GO₂ is a new product that produces 95+% pure Chlorine Dioxide (ClO₂) at high yields without the use of expensive equipment, dangerous chemicals or extensive operator training.

GO₂ uses 2 simple powders that are mixed together in a measured amount of water to produce a 4,000 ppm Chlorine Dioxide Concentrate that is stable with a half life of 30 days when properly stored. The powders themselves have a 5 year shelf life when kept in their sealed containers.

GO₂ is EPA approved disinfectant for Clean-In Place applications for potable water systems such as beverage preparation, storage, transfer and dispensing.

GO₂ is a superior oxidizing agent to chlorine based chemicals yet is non-corrosive to the infrastructure of water distribution and bottling equipment. The corrosivity is less than that of fresh water.

GO₂ unlike chlorine, will completely remove the biological film (bio-film) from the entire water distribution system.

GO₂ is highly efficient at removing iron and manganese from water sources.

GO₂ does not chlorinate organic material. It produces no THM's, HAA's, MX, chloramines, and other organic, carcinogenic or estrogenic compounds.

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Hanson Loran Co.
6700 Caballero Blvd.
Buena Park Ca. 92620
Office: 714.736.9811

