

Expel New Zealand Ltd

Frequently Asked Questions about Expels Chlorine Dioxide

1. How does Chlorine Dioxide work?

Chlorine Dioxide is an oxidizing biocide, not a metabolic poison. It deactivates micro organisms by attacking and penetrating their cell wall, disrupting the transport of nutrients across the cell wall and inhibiting protein synthesis. Since this action occurs regardless of the metabolic state of the organism, oxidizing biocides are effective against dormant organisms and spores (Giardia Cysts and Poliovirus). To use an analogy, a spiked drink cannot kill a sleeping man. He has to wake up and drink it before it has any effect. A sleeping man is however easily killed by a .357 calibre in the head. Chlorine Dioxide is a Bullet.

2. Can organisms build up a resistance to Chlorine Dioxide?

No. Metabolic poisons such as anti-biotics can lead to organism resistance. With continued, sub-acute exposure, resistance is common. Chlorine Dioxide is however not a metabolic poison and resistance is not possible. If you drink for many years and don't die of liver cancer, you are likely to be able to consume alcohol in volumes, which would kill anyone else. You are to some degree resistant, however, being run over by a bus will still kill you! Chlorine Dioxide is a bus to micro organisms.

3. Is Chlorine Dioxide the same as Chlorine or Hypochlorite?

Although they have similar names and elements they are very dissimilar. The commonality of the name arises from the fact that they all contain the element chlorine, but their properties are quite different. Chlorine and Hypochlorite are very powerful oxidizing agents but more importantly their reaction with organic matter can lead to unacceptable concentrations of chlorinated organic compounds via substitution reactions. Some of these compounds such as the by-products of reactions with phenolic compounds are either odoriferous (such as 2,6-dichlorophenol) or extremely carcinogenic like dioxin. Chlorine Dioxide on the other hand is incapable of causing such chemical transformations. Chlorine Dioxide is non-mutagenic, non-carcinogenic and relatively non-irritating unlike Chlorine and Hypochlorite.

4. If Chlorine Dioxide is only an Oxidising agent, why not use Peroxide or Ozone?

Why not indeed! Ozone is a very powerful oxidizing agent. In acidic environments its oxidizing power is only exceeded by fluorine, which dissolves glass! Ozone will react with most substances at 25° C, but accidental skin or eye contact would lead to immediate, irreparable tissue damage. It only has a half-life of 2 minutes so must be produced where you want to use it and cannot be stored. It is generally manufactured as a dilute water solution, on-site, but there is a high production cost.

Hydrogen Peroxide on the other hand is very stable, if correctly handled. Contact with even trace amounts of metal ions (Mn^{+2} , Fe^{+2}) can cause rapid, explosive decomposition. Dilution with anything other than distilled or de-ionised water will lead to unstable solutions. Contact with any metal other than passive stainless 316L will also cause decomposition. It is a powerful oxidising agent and accidental contact would again result in immediate, irreparable tissue damage.

Chlorine Dioxide is nowhere near as powerful an oxidising agent, but is sufficiently strong to act as a biocide. It is safe for all uses and contact with skin will cause no damage. It is used as a mouthwash and pet deodoriser.

For the extremely chemically minded, the oxidation potential of chlorine dioxide is only 0.954 E°V, compared with acidic ozone 2.07, Hydrogen Peroxide 1.77, Hypochlorite 1.48 and Chlorine 1.36.

5. Why can Chlorine Dioxide be used at lower concentrations than Peroxide or Hypochlorite even though they are more powerful?

Peroxide and Hypochlorite are more powerful and that is their problem. They are unselective and easily consumed by all manner of materials present in the environment. As a result, large quantities must be used to ensure there is a sufficient residue to act as a biocide. Just think of the Western Australian Koala. You don't need to cut down all the gum trees in Western Australia to cause their extinction. They only live on the leaves of the Red River gum tree (*E.camaldulensis*) and the Coolibah (*E.coolibah*). In order to cause the extinction of the Koala you need only employ 5 timber workers and ask them to selectively destroy the few remaining pockets of the Red gum and Coolibah, not employ thousands of workers to destroy the other 750 species of eucalypt in an unselective campaign. Chlorine Dioxide is a relatively weak oxidising agent. It only reacts with some sulphur compounds; selected amines and other reduced organic compounds. As a result, low levels can be used to eliminate microorganisms, as it is not consumed attacking non-target compounds.

6. Is Chlorine Dioxide Safe and Environmentally Friendly?

Yes. There are many reasons why Chlorine Dioxide is safe and friendly. Environmentally, the by-products formed when using Chlorine Dioxide are benign. Compare this to chlorinated by-products formed when using Chlorine or Hypochlorite and you can see why so many Pulp and Paper Mills use Chlorine Dioxide. They have virtually eliminated trichloromethanes, chloroacetic acids, chlorinated dioxins and furans from their waste streams, all of which used to pose significant risks in the environment. In its reaction, Chlorine Dioxide oxidizes (removes electrons) other compounds and is itself reduced (gains electrons) to the Chlorite anion (ClO_2^-). Toxicological studies have shown the Chlorine Dioxide and its disinfection by-product, Chlorite, pose no significant risk to human, animal or fish health. Chlorine Dioxide was first introduced for drinking water disinfection in 1944 at the Niagara Falls. Today over 1000 municipal water treatment processes use Chlorine Dioxide.

7. Why can't I buy pure Chlorine Dioxide and reduce the freight costs?

Pure Chlorine Dioxide is a yellowish gas, highly reactive and liable to explode. Its transportation is prohibited. It is however soluble in water up to 8000ppm. These pure solutions are only stable in the dark at low temperatures. As a result, Chlorine Dioxide has always been produced at the site of its use. However, over the past 20 years numerous methods have been patented for the short-term stabilization of chlorine dioxide.

Expel's Stabilized Chlorine Dioxide is specially formulated to ensure long-term stability under typically uncontrolled storage conditions. As the quality of water can influence the long-term stability of Chlorine Dioxide, it is only offered at the concentrations for specific application. In this way stability can be assured.

8. Is it expensive?

The cost per litre is higher than most other disinfectants but the usage rates are far lower. In most applications the cost per clean/disinfection will be less using Chlorine Dioxide and in many instances it is the only choice. Chlorine Dioxide is active over the pH range 2-12 and is non-corrosive. It has broad applicability. Hypochlorite on the other hand is only useful in alkaline situations and is corrosive to all but the most exotic (Hastalloy C) metals.

9. Why does it smell and look like water?

Water is the perfect solvent in which to dissolve the Chlorine Dioxide and the closely guarded stabilizing materials. A food grade surfactant has also been added to allow the solution to wet even the most difficult surfaces, which allows contact between Expel and the target organisms. Expel is taste and odourless so the solution looks, smells and tastes just like water.