

# OZONE - Safe for You. Safe for the Environment.

## WHAT IS OZONE?

- Ozone is "active oxygen", nature's special element. (Each ozone molecule consists of three oxygen atoms.)
- Ozone is a natural purifier.
- Ozone is created in nature by the combination of oxygen in air and the ultraviolet rays of the sun or by the corona discharge during a lightning storm.
- Ozone has a clean, fresh scent noticed after a rainstorm.
- Ozone is the most powerful oxidizer safely used.
- Ozone is the alternative water purifier to traditional chemicals such as chlorine and bromine.

## WHAT DOES OZONE DO?

- The Ozone layer in the atmosphere protects the earth from deadly radiation.
- Ozone destroys bacteria, viruses, mold, and mildew.
- Ozone eliminates spores, cysts, yeast, and fungus.
- Ozone oxidizes iron, sulfur, manganese and hydrogen sulfate.
- Ozone eliminates oils and other contaminants in water.
- Ozone eliminates odors in air, such as smoke.
- Ozone keeps water clean and sparkling clear.
- Ozone keeps water fresh.

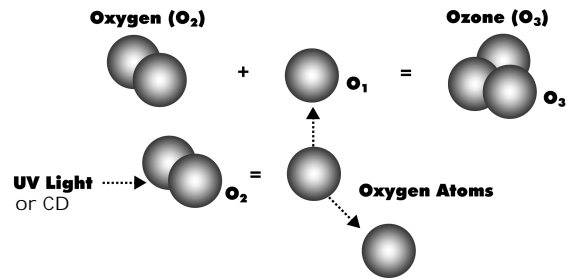
## OZONE IS HEALTHY

- Ozone leaves no chemical by-products in water.
- Ozone leaves no chemical taste or smell.
- Ozone will not burn eyes or make them red or irritated.
- Ozone will not irritate or dry out skin, nose, or ears.
- Ozone will not leave a chemical film on material or skin.
- Ozone will not discolor or damage hair or clothing.
- Ozone adds no contaminants or by-products to water.
- Ozone rids water and air of unhealthy microorganisms.
- Ozone is NOT a carcinogen.

## WHERE IS OZONE USED?

- In 1906, Nice, France built the first water purification plant to use ozone.
- Los Angeles, California has the largest ozone drinking water treatment plant in the world.
- Most bottled water is purified by ozone.
- Ozone is used to clean waste water and toxic waste.
- Ozone purifies water in well and home drinking water systems.
- Ozone systems have brought life back to "dead" contaminated lakes and pools.
- Ozone is used to purify air in hotel rooms, boats, RVs, cars, and smoke/fire damaged structures.
- Ozone is used in thousands of residential and commercial pools and spas all over the world.

## HOW IS OZONE MADE?



## OZONE IS SAFE FOR THE ENVIRONMENT AS WELL AS EQUIPMENT

- Ozone will not explode.
- Ozone is not a fire hazard.
- In the dose required for excellent purification, ozone does not produce harmful fumes.
- Ozone will not damage plumbing fittings or pipes.

## OZONE IS CONVENIENT IN POOLS AND SPAS

- Ozone does not have to be purchased or stored. Ozone is generated "on site" and is introduced into the water or air automatically.
- Ozone does not affect the pH balance of water, thus minimizing pH adjustments.
- Ozone helps reduce total dissolved solids in water so that the water does not have to be changed as often.
- Ozone eliminates much of the routine maintenance because it does such an effective job keeping the water clean.

## DEL OZONE PRODUCTS

There are a variety of DEL Ozone Generators available to accommodate any application.

Visit our website at [www.delozone.com](http://www.delozone.com) to find the correct ozone generator for your application and to find your local dealer.

You can call your local dealer for more details.

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# Information About Chloramines

When any type of chlorine is added to water, it usually forms hypochlorous acid (HOCl – the most powerful killing form of chlorine in water) and hypochlorite ion (OCl<sup>-</sup>), a relatively weak form of chlorine in water. The percentage of HOCl and OCl<sup>-</sup> is determined by the pH of the water. As the pH goes up, less of the chlorine is in the killing form and more of the chlorine is in the weaker form. The total of HOCl and OCl<sup>-</sup> is the free available chlorine.

Chlorine can combine with ammonia and nitrogen compounds in the water to form chloramines, sometimes called combined chlorine. By combining with ammonia and nitrogen, free chlorine in the water is disabled. Chloramines are 60 to 80 times less effective than free chlorine. Chloramines are formed any time ammonia and nitrogen are in the water. Some of the ammonia and nitrogen compounds are introduced into the water by swimmers and bathers in the form of perspiration, urine, saliva, sputum and fecal matter. An active swimmer sweats one pint per hour. The average person sweats three pints per hour in a heated spa. Ammonia and nitrogen compounds are also introduced into the water by rain. Each drop of rain has some dissolved nitrogen from our atmosphere and from automobile emissions.

Chloramines smell bad. This is the smell most often associated with pools and spas in health clubs and YMCAs. Chloramines are eye and skin irritants, and they cloud the water.

Chloramines can be removed from the water by the following three methods:

1. By adding a mega-dose of chlorine. Usually 3 to 6 times more chlorine than a normal dose is added to the water, or the level of chlorine is raised to 5 to 10 ppm and held there for 4 hours. This is called superchlorination. To remove chloramines, the ratio of chlorine to ammonia must be at least 7.6 to 1. If this ratio is not obtained, then more chloramines will be produced. Swimmers and bathers should not enter the water until the level of chlorine has dropped to 3 ppm or less.
2. By adding a non-chlorine shock to the water. The most common chemical used for this is potassium peroxymonosulfate. This "shocking" requires the addition of one pound of shock for each 10,000 gallons of pool water.
3. By adding ozone to the water. If an ozone generator is installed on a pool or spa, then oxidation of the ammonia and nitrogen compounds will take place whenever the ozone system is operating. The longer the system operates, the more the ozone can destroy the ammonia and nitrogen. Although most ozone systems operate only when the pool or spa pump is operating, there are 24-hour systems available which will continuously oxidize ammonia and nitrogen as they enter the water.

Ozone oxidizes soap, deodorant, hair spray, cologne, makeup, perfume, body lotion, hand cream, sun tan lotion, saliva and urine. In addition, ozone kills all pathogenic bacteria, germs and viruses. Ozone takes care of the big job of oxidizing all these organic contaminants. Ozone frees up the combined chlorine, thus leaving the chlorine free to provide a residual. Ozone ultimately enhances the performance of chlorine and bromine.

Less chlorine or bromine will be needed to maintain a residual. Commonly, ozone reduces chlorine or bromine use by 50-90 percent. The quality of water will be dramatically better with the combination of ozone and chlorine or the combination of ozone and bromine than with chlorine and bromine alone.

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# Frequently Asked Questions About Ozone

## 1. What is Ozone?

Ozone is active oxygen, O<sub>3</sub>. It occurs naturally in the earth's atmosphere to protect us from the sun's harmful rays.

## 2. What are some uses of ozone?

Some common uses are: pool and spa water purification, drinking water purification, waste water purification, and air freshening.

## 3. How long has ozone been used to purify water?

Since the late 1800's.

## 4. How long has ozone been used to purify pool and spa water and remove odors from the air?

Over 50 years.

## 5. How does the ozone used for water purification affect the air we breathe?

The amount of ozone produced by an ozone generator is insignificant to the normal atmosphere we live in. When dissolved in water, ozone is extremely safe. Excess ozone quickly converts back to oxygen. Note: do not breathe concentrated ozone gas.

## 6. Is ozone the same as "SMOG"?

No! "Smog" is air pollution created by combustion pollutants. While smog contains small amounts of ozone, it is largely composed of harmful chemicals such as carbon monoxide. In fact, smog and other pollutants may contribute to the damage of the ozone layer.

## 7. If I use ozone in my pool or spa, will I help replenish the ozone layer?

No. Because ozone reacts so quickly with contaminants in water and air, it converts back to oxygen within minutes or even seconds. Any ozone molecules that break free from the pool or spa water will convert to oxygen and never reach the atmosphere.

## 8. Will ozone hurt me?

No! In the quantities necessary to be effective, ozone is very gentle to humans and equipment in the water. However, you should never breathe concentrated ozone gas.

## 9. Does ozone have an odor?

Yes. Depending on the concentration, the odor ranges from slightly sweet to moderately antiseptic.

## 10. Will ozone kill bacteria?

Yes. It is one of the most effective, complete bactericides of all earth's measurable elements.

## 11. Will ozone kill viruses?

Yes. Ozone kills virtually all known forms of viruses in water and air.

## 12. How is ozone different from chlorine?

In the quantities needed for water purification, it has no noticeable odor, taste or color. It is not irritating to humans or equipment. Ozone purifies water and air very quickly and efficiently, 3,000 times faster than chlorine. Ozone leaves no by-products except pure oxygen. In contrast, chlorine leaves a chemical by-product called hypochloric acid and additional salts in water applications.

# Frequently Asked Questions About Ozone

## 13. Will Ozone reduce scum lines and foaming in spas?

Yes. With proper filtration it should completely eliminate them.

## 14. How is ozone produced?

Ozone can be produced by ultraviolet (UV) light or by corona discharge (CD).

## 15. How does ultraviolet light ozone generation work?

A special lamp gives off a specific wavelength of ultraviolet light which converts oxygen ( $O_2$ ) molecules into ozone ( $O_3$ ) molecules by splitting the oxygen molecules into individual oxygen atoms ( $O_1$ ) which then recombine with oxygen molecules to form ozone. This all occurs instantly inside the ozone chamber in the ozone generator.

## 16. How does Corona Discharge Ozone Generation work?

Ozone is produced by passing air through a high voltage electrical discharge, or corona. A minimum of 5,000 volts of electricity is necessary to create the corona. Air or concentrated oxygen dried to a minimum of  $-60^\circ\text{C}$  *dewpoint* passes through the corona which causes the  $O_2$  bond to split, freeing two  $O_1$  atoms which then collide with other  $O_2$  molecules to create ozone. The ozone/gas mixture discharged from the CD ozone generator normally contains from 1% to 3% ozone when using dry air, and from 3% to 6% ozone when using high purity oxygen as the feed gas.

## 17. Can ozone damage my pool or spa equipment?

No. In fact, it is very gentle to spas, pools, and equipment. Applied properly, ozone is more gentle than any other water purifier in existence.

## 18. Can the ozone in my pool irritate skin or eyes like chlorine in pools?

No! Ozone is very gentle to skin and eyes.

## 19. How long will ozone last in my pool or spa water?

Scientific theory states that Ozone has a half life of about 22 minutes in water. In residential applications, ozone reverts back to oxygen in minutes (ozone breaks down faster in warmer water).

## 20. Will water temperature affect ozone?

Wide variations in pool water temperature will affect how well ozone works. An ozone generator should be designed and sized for maximum water temperatures and bather load.

## 21. Will ozone affect my pH?

Ozone is pH neutral. It will not adversely affect the pH.

## 22. Do I still have to filter the water as often?

Yes. Because impurities are constantly being introduced into the water and the ozone is constantly destroying them, the microscopic remains will need to be filtered out of the water.

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