

# Ozone Treatment for Residential Well Water

Ozone does not need to be complicated in order to treat small water systems. A small water system consists of one or multiple households on well, spring or rooftop water. Treatment means removal of iron, manganese and hydrogen sulfide to below the U.S. Environmental Protection Agency (EPA) acceptable levels including bacterial control.

Ozone consists of three atoms of oxygen (O<sub>3</sub>) and is a powerful oxidizer and disinfectant. It must be generated on site since it reverts to oxygen (O<sub>2</sub>) within minutes. Ozone, which works faster and is more powerful than chlorine, adds nothing to the water except pure oxygen. Chlorine, on the other hand, can produce a carcinogenic byproduct called trihalomethanes (THMs) when combined with organic matter found mostly in surface waters. Its objectionable odor is another disadvantage to those who expect their well or spring water to taste and smell sweet and natural.

In traditional applications, ozone is produced by the corona or high voltage

spark method. In order to be effective, the corona-type ozone requires a dry filtered air. Its longevity depends on this because moisture creates nitric acid, thus decreasing ozone output and corroding the equipment. If the air dryer fails, so will the entire system. A corona ozone injection system uses lots of electricity, is complex and, therefore, not very reliable for the average homeowner or small system operator. In addition, applications of corona ozone must be done carefully as high concentrations of ozone literally can destroy common holding tanks and distribution systems. When using corona ozone, stainless steel tanks are recommended as well as an activated carbon filter to remove the excess ozone before the water enters the distribution system. This complicated corona method produces large amounts of ozone and uses a relatively short contact time with the water. For these reasons, corona ozone use is recommended for large commercial applications where it can be monitored on a consistent basis.

An alternative technology has been developed using small, safe levels of

ozone produced by the ultraviolet (UV) light method. With this technology, low levels of ozone are continuously introduced into an atmospheric holding tank. If the approach to water treatment would be by injection or single pass, this method would be insufficient to perform its oxidation and disinfection tasks. Since this system bubbles ozone into the tank water 24 hours per day, it not only is extremely efficient but also cost effective due to its low energy consumption of 55 watts, lack of an air dryer and compatibility with tank materials.

Unique to this system is a filter module that is suspended on a stainless steel chain and actually filters the entire contents of the holding tank. The water moves through the 100-square-foot filter at 10 gallons per minute or 14,000 gallons per day, thus removing all of the oxidized particulates and preventing debris from accumulating on the bottom of the tank. When the filter becomes loaded, it is washed off and returned to the tank, eliminating the need for costly filter replacements. This unique in-tank filtration also eliminates filter backwashing and its associated water loss.

An optional piece of equipment used with this system is a mixer/injector that diverts the ozone from the tank and injects it into the incoming water. This injection takes place only when the pump is in operation and the tank is being refilled with the raw water, thereby pretreating the water before its introduction into the tank.

This type of system is capable of removing all objectionable levels of iron, manganese and hydrogen sulfide. In severe cases, it may be necessary to use two tanks in series and to treat each tank individually. For instance, in a water supply containing 60 ppm of iron, the iron was successfully removed using this dual tank set-up. Generally speaking, tanks need to be sized at four times the daily water

usage. An average family of four uses approximately 350 gallons of water per day, so the minimum tank size should be about 1,500 gallons or larger. If possible, take irrigation water off the wellhead before the tank and use the tank water for household use only. Use one system per each 10,000 gallons to be treated. Multiple systems can be used in larger tanks.

When considering this technology for contaminant removal, it is important to know the volume of water used per day as well as the contaminant levels. Contaminant levels are best shown by a water analysis performed by an independent laboratory. Ozone readily oxidizes both iron and manganese but will oxidize all the iron before attacking the manganese. This is a phenomenon that will affect the prescribed dosage and contact times and is another reason to have a thorough knowledge of the water that will be treated. Also, water with a high organic content such a tannin will adversely affect the ozone's ability to act on inorganic material, further affecting dosages and contact times.

An additional benefit of this technology is the aeration process. A system such as this is able to remove undesirable gasses and their effects from the water because it uses ozone in combination with aeration. For instance, when low pH is attributed to carbon dioxide gasses, which are removed in the aeration process, the pH levels then are elevated. Due to the aeration process, this system acts on all dissolved gasses contained in the water including radon and methane. Another benefit applies when a customer has an existing holding tank with no particular water problem. This system can be used to prevent stagnation, algae growth and bacterial contamination.

This technology also is appropriate for use in surface water and/or rooftop catchment systems. Under surface water conditions, a sand filter is

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suggested to remove turbidity (dirt) and debris before the water enters the tank. The ozone then is able to expend all of its energy on killing bacteria. When treating surface water, it is advised that a secondary method of disinfection should be added as back-up protection, since you are dealing with water subject to fecal coliform and other primary health contaminants. If *Giardia* or *Cryptosporidium* (protozoa) are of concern, do *not* rely on ozone technology. Instead, use a 1 micron absolute filter for removal after the tank treatment. When treating other contaminants in well water such as total dissolved solids, use the in-tank ozone system before both water softeners and reverse osmosis units to keep resins and membranes clean.

Maintenance is a major consideration in any type of water treatment equipment. Maintenance required for this system is minimal. It consists of cleaning the filter approximately every three to six months by pulling it from the tank and hosing off the accumulated debris. The ozone diffuser also is cleaned at the time by dipping it into muriatic acid. The ozone-producing UV light needs to be changed every 18 to 24 months if treating secondary contaminants or every 12 months if used for bacterial control.

Installation is another important consideration when dealing with water treatment equipment. This ozone system normally will take less than two hours to install, and its installation is relatively simple. The ozone generator is mounted beside or up to 200 feet from the holding tank. Tubing that carries the ozone gas runs from the generator, up the side of the tank and down inside the tank where it connects to the filter module. The filter module is suspended from the tank top on a stainless steel chain and contains the diffuser that bubbles ozone up through the tank water. The mixer/injector is mounted into the inlet pipe to the tank.

Using atmospheric vented holding tanks/cisterns to apply ozone is a simple, viable, cost-effective and reliable method of water treatment for problem well water. Water treatment professionals worldwide have used this technology successfully since its development in 1990.

Your customers not only are expecting to have enough water supplied from their water source, but they also demand that it is of superior quality. Ozone's technology coupled with such treatment as filters or softeners can fulfill this expectation. **WQP**

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## Cattle Company Solves Iron Problems in Well Water With Ozone

The owners of a cattle company purchased acreage on Washington's Olympic Peninsula. Both the cattle business and the residence relied on a single low producing well for all of their water needs. The owners, Carol and Russ, drilled a new well that produced 38 gallons per minute, which met all of their water requirements.

Unfortunately, this solved one problem but began another. The primary problem of the new well was more than 10 parts per million of iron. "The heavy iron in the water ruined the internal workings of the systems," Carol said.

**"We have highly recommended this ozone system to other individuals in our area with water problems."**

The owners contacted Canal Pumps in Carlsborg, Wash., which recommended installing an ozone system. "We had no knowledge of this system and really didn't know what they were talking about," Russ said. "They then faxed us information related to the system. They said it would be very easy to install and that the maintenance would be very simple."

A 1,500 gallon holding tank, new water softening equipment and the Triple O ozone system were purchased. The owners were able to install the Triple O system themselves, which helped them save money.



The water was immediately improved with the installation of the equipment. With the extreme condition of the quality of the well water, a second ozone system was installed in the tank. With the help from the second system, all of the iron was successfully removed from the water.

"We are very sorry that we did not know about this system years earlier," Russ said.

The end result was high-quality drinking water and clear water that made tasks such as washing white clothes not a problem anymore. "Friends who visit us now cannot believe the difference in the water since our Triple O system was installed," Carol said. "They often comment that 'you can't see the water in the glass!'" **WQP**

**Location:** Olympic Peninsula, Washington

**Problem:** More than 10 ppm of iron in the well water.

**Solution:** Install an ozone treatment system with a new holding tank and new water softening equipment.

**Results:** Immediately improved well water, eliminated the iron, refined the appearance of the water.

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