

Well Water - Water Technology Magazine 2003

By Larry Lee

From the January 1999 edition of Water Technology magazine. When well water is treated by ozone, pollutants are either precipitated, flocculated and filtered or off-gassed out of the system. Ozone also will help stabilize the water's pH to between 7 and 8. Bacteria, viruses, and any other pathogens are destroyed when ozone gives up its third element and renders them unable to reproduce.

Before installing ozone systems, consider the necessary components that comprise a typical residential system. System components include venturi tubes, air dryers, ozone generators, and contact chambers with off-gas destruct vents. Often, systems are hooked up with PVC or copper piping.

The following are some guidelines for incorporating components into a system's design:

- Sediment filter. This type of filter removes solid particles from the well water before the water enters the venturi tube to prevent system clogging. It is best to use the clear bowl wound-cartridge type so that you can visibly see when it needs to be replaced. However, sometimes a double-cartridge type is needed to handle the amount of pollutants.
- Venturi tube. The venturi is a tube with a narrow throat (a constriction) that increases the velocity and decreases the pressure of water passing through it, creating a partial vacuum immediately after the constriction in the tube. Used to introduce ozone into the water stream, the venturi tube is the best choice for residential applications because there is no need for a compressor and also no chance of an ozone leak into the home. The venturi needs to be sized for the ozone generator requirement since most work best at a certain amount of airflow.

Any drain can be just plain PVC, but the contact chamber and all lines from the venturi tube to the charcoal filter should be CPVC. The venturi tube should be constructed of an ozone-safe material because severe deterioration can occur in many materials. It is not unusual for the venturi tube to break, so it is important to install unions on each side. This will allow you to resize the venturi tube at a later time if needed.

Some larger commercial systems use piping made of stainless steel, but that is not necessary for residential applications.

- Ozone generator. The generator should be able to withstand the environment it is required to function in, whether outside or in a pump room or well-house. The size (amount of ozone) should be worked out before the other requirements.

- Air dryer. The air dryer is necessary in any potable water system because it reduces the nitric acid buildup in the reactors.

A simple desiccant dryer is all that is needed, if the desiccant has sufficient time to recover. If not, a twin tower dryer will be needed so that one tower can be in use while the other is being regenerated. Don't skimp here. The dryer should be able to handle 150 percent of feed requirements.

- Contact chambers. A contact chamber should be as tall as reasonable. A CPVC 6-foot Dai pipe with endcaps will work for most applications. CPVC has an "A" rating with chemical engineering for ozone. The cost is reasonable, but goes up sharply if sized more than 6 feet mainly because the cost increases dramatically for the endcaps.

Limited space may not allow a very large contact chamber. If so you can increase the time “in-the-pipe” by lengthening the pipe that runs from the venturi tube to the contact chamber. You can also design the system so that the water runs back and forth if needed; this will increase the time that the ozone is active in the system.

The contact time is calculated by ozone concentration, level of contaminants and demand in gallons per minute (gpm).

The vent is used to prevent gas bubbles entering the point-of-use; if you introduce 20 to 30 SCFH (cubic feet of air per hour at standard conditions of temperature) into a system with only 20 percent oxygen available and of that 20 percent, only 3 to 5 percent is ozone, the rest (mostly nitrogen) will have to be vented out of the pressurized system.

- Off-gas destruct. There are several ways to destruct the unused ozone, but for this style of system there is very little ozone to destruct. A cartridge-type activated charcoal filter should work well.
- Drain valve. The drain valve is a little extra that works well if there is a lot of fine sediment that slips by the filter or if the ozone has precipitated pollutants out of suspension. It could be set on a timer and drain back to the sewer.
- Granular activated carbon filter. The GAC filter is a double-cartridge type, which helps to polish the treatment and to remove most of the ozone before it goes to the pressure tank and the point-of-use.
- Pressure switch. The pressure switch not only activates the well pump, but also turns on the ozone generator. The time it takes the pressure tank to build back-up to its cutoff pressure should, at a minimum, equal the necessary contact time.
- Pressure tank. The pressure tank is the reason that an ozone system can be used even with a cistern or holding tank.

With the pressure tank in-line, the water flow will reach venturi speeds and pull the ozone into the pipe and into the contact chamber with enough time to be effective. It also helps prevent contaminants from reaching point-of-use (POU) devices. Many system designs locate the pressure tank prior to the charcoal filter, but not all pressure tanks have an ozone-resistant bladder.

Consider using a charcoal filter to remove most of the ozone prior to the pressure tank. This type of design has the benefit of keeping the charcoal filter bacteria-free while the ozone bombards the filter, preventing growth.

Two other components to consider using with a residential ozone system are a water softener and a multimedia GAC filter with backwash capabilities. The water softener is important in areas that have high total dissolved solids.

Ozone manufacturers have increased the reliability of their product, but the fact remains that there is still maintenance required on any water treatment system. This opens the door for you to offer customers lease programs and maintenance contracts.

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