Executive Summary on Ozone for Drinking Water

Ozone (O_3) is a form of oxygen which has properties that make it exceptionally potent for use in water treatment. No other chemical or agent can match its strength as a disinfectant or oxidant. It can easily kill *E. Coli* and it is the most effective agent against *Cryptosporidium*. Figure 1 shows the relative strength of ozone compared to chlorine, which is the next most powerful disinfectant and oxidizing agent.

Figure 1 - Relative Strengths of Ozone and Chlorine for Disinfection

Agent	Enterobacteria	Viruses	Bacterial Spores	Amoebic Cysts
Ozone	100	1	.4	.1
Chlorine	4	.2	.01	.01
Chloramines	.02	.001	.0002	.004

Notes: 1. 100 = Best Performance
2. *E. Coli* fall under Enterobacteria
3. *Cryptosporidium* falls under Amoebic Cysts

Source: American Water Works Association

While ozone is typically associated with disinfection, its power as an oxidant is also very important in water treatment. In simple terms, oxidation is analogous to burning. The pollutants can be equated to wood, ozone to the flame, and the ashes to the byproducts created through ozonation. Byproducts of ozonation are usually inert compounds which can be filtered, although in some cases pollutants may be broken down into carbon dioxide and water. Through oxidation, ozone is able to remove or make removable via filtration a large variety of pollutants including organic compounds, iron, hydrogen sulfide, manganese, and nitrite. Typically, most or all oxidizable pollutants must be removed before disinfection can occur (this is also the case for chlorine). Ozonation does not produce any harmful byproducts. Normally, chlorine will be added after ozonation to protect the water from pathogens which enter the distribution system through leaks or cracks. An ozone residual cannot be established due to its short half life in water.

Ozone is generated by passing air over specially designed ultraviolet lamps (VUV Technology) or passing oxygen through a high voltage field (Corona Discharge). VUV systems generate less ozone, but they also cost considerably less and require no maintenance. They can be used in systems which require reductions in *Enterobacteria* and which are mildly polluted (hydrogen sulfide, iron). Corona discharge systems can be designed to handle any volume of water and are capable of killing *cryptosporidium*. Due to there complexity, they require operator training and regular maintenance. Typically, it is recommended that the end user lease the equipment or sign up for a maintenance contract unless skilled technicians are available.

The most important aspect of ensuring effective disinfection with ozonation is the system design. Ozone contacting methods, source water quality, ozone dose, pH, contact time, and temperature all impact system performance. Normally, a preestablished number called the CT value determines many of these factors. CT = Ozone Concentration x Contact Time and is determined through a variety of methods.