



by



Ozone has been used for disinfection of drinking water for more than 100 years. Despite this, ozone has seen limited adoption in the United States, primarily due to its perceived complexity and cost. There is a growing interest in using ozone to remove trace amounts of pharmaceuticals and other endocrine disrupting compounds. There may also be emerging contaminants in the future that ozone could oxidize.

### What is Ozone and how does it work?

Ozone is one of the strongest primary oxidants available to treat water. Ozone is three oxygen atoms combined. As shown in the table below, ozone has at least 53% greater oxidative potential than chlorine gas. Ozone introduced into solution, indiscriminately reacts with anything in the water. The effect of ozone treatment is a chain reaction of oxidant that continues until all the oxidative capacity is consumed.

Oxidizing Agent	EOP(V)	EOP Relative to Chlorine
Flourine	3.06	2.25
OH Radical	2.80	2.06
<b>Ozone</b>	<b>2.08</b>	<b>1.53</b>
H2O2	1.78	1.31
Hypochlorite	1.49	1.10
Chlorine	1.36	1.00
ClO2	1.27	.93

Adapted from Wastewater Engineering Treatment and Resuse, Metcalf and Eddy (2003)

In reality, this means that ozone reacts more completely and with a larger range of contaminants in the water.

### Disinfection

As a strong oxidant, ozone directly attacks the cell wall of the organism. Once breached, the cell contents are then spilled into the water and there oxidized further. Inactivation of viruses is thought to be similar, where ozone destroys the outer protein structure and then once compromised, the inner contents are spilled and destroyed.

### Taste and Odor

Most taste and odor can be efficiently removed using ozone treatment. These compounds readily oxidize with ozone in a chain reaction process. An exception to the effectiveness of ozone for taste and odor treatment is geosmin and MIB when natural organic content is high. These compounds may require ozone in combination with UV, hydrogen peroxide, or ultrasound to produce Advanced Oxidation Process conditions to handle high organic content at the same time as dealing with geosmin and MIB.

### Trace Organics and Pharmaceuticals

Increasing evidence shows that ozone is very effective at destroying pharmaceuticals, trace organics, and other endocrine disrupting compounds. Results generally show that treatment can achieve

greater than 70% removal of most common trace compounds. Although most compounds may not be fully oxidized by ozone, the breakdown compounds are more easily treated by downstream treatment processes such as carbon adsorption or others.

**TOCs and THMs**

There have been a number of studies that show that low dosages of ozone in raw water before coagulation can reduce both TOCs and THM precursors when the TOCs are low as well.

WtrFlw has been testing the effectiveness of ozone for taste and odor problems at Lee Hammond Water Users in Bloomfield New Mexico, as a pretreatment in the intake structure in the raw water reservoir. They are a surface water system on the San Juan River about 20 miles below a very large reservoir that grows algae naturally. In years passed, they have used copper sulfate and bleach to treat algal blooms. Lee Hammond Water has not treated their pond chemically since October of 2022. Up until November 2023, they had not received a single taste and odor complaint.

The Ozog3n unit has a PLC based control system with touch screen and recording of trend data including electrical loads and temperature of the process. It can be tied into your current scada system or we can give you remote access capabilities into the unit. Extra charges may apply.

WtrFlw has a demonstration model available to try out at your plant.

Contact WtrFlw about the possibility of pretreatment with Ozog3n today!

<b>Removal Efficiency with Ozone @ 2.5 mg/l</b>		
<30%	30%-70%	>70%
Musk Ketone	Atrazine	Sulfamethoxazole
TCEP	Meprobamate	Triclosan
	Iopromide	Acetaminophen
		Diclofenac
		Testosterone
		Progesterone
		Adrostenedione
		Estrial
		Ethynylestradiol
		Estrone
		Estradiol
		Erythromycin-H2O
		Trimethoprim
		Naproxen
		Ibuprophen
		Hydrocodone
		Carbamezepine
		Dilantin
		Diazepam
		Caffeine
		Fluoxetine
		DEET
		Metolachlor
		Galaxolide
		Pentoxifylline
		Femfibrozil
Adapted from Southern Nevada Water Authority, Snyder, et al., 2009		