Mixed Oxidant Solution (MOS) versus Ozone

	MOS	Ozone
Safety	• Not classified as a hazardous material • Concentrations are below any regulatory thresholds • Uses only salt, water, and power, so is safe to operate and safe for the community • Reduces liability exposure, with no pollution rider needed • No safety training or equipment required	• Classified as a hazardous material -- when inhaled, can damage the lungs • Relatively low amounts can cause chest pain, coughing, shortness of breath and throat irritation. May worsen chronic respiratory diseases such as asthma and compromise the ability of the body to fight respiratory infections. • OSHA threshold limit value (TLV) is 0.1 ppm over 8 hrs. per day and 5 days per week, or 0.3 ppm for a 15-minute continuous exposure. • Improper dosage can cause serious corrosion and worker exposure risk
Chemical Destruction	• No destruction required	• Because of the health hazards, it is crucial to destroy any excess ozone in a safe way • Destruction can be done via: – Catalytic conversion – Activated carbon filtration (consumes carbon, which needs to be replaced; carbon also presents a fire risk) – Thermal destruction via heating over 300 degrees C – UV radiation at 254 nm
Durability	• In contrast, the full potency of MOS lasts 2-3 days, making it easier to deal with unplanned lapses in service	• Ozone has a short life of approximately 18 hours, so interruptible electrical service is not acceptable
Residual Disinfectant	• Provides a very durable chlorine residual, superior to conventional chlorine, even at lower doses • Meets Safe Drinking Water Act requirements for residual maintenance	• No residual disinfectant capacity • A secondary chlorine disinfectant must be added to meet Safe Drinking Water Act requirements • May not be effective in systems with longer piping – increased initial dose is not an option, since that increases corrosion near the injection area and damages seals, gaskets, etc.

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Effectiveness	• Very effective against key organisms like *E. Coli, Legionella, Psuedomonas, Streptococcus, Clostridium, Giardia, Cryptosporidium, etc.* • Concentration and time required for thorough inactivation is closer to ozone and chlorine dioxide than to conventional chlorine*	• Very effective against key organisms like *E. Coli, Legionella, Psuedomonas, Streptococcus, Clostridium, Giardia, Cryptosporidium, etc.* • Without the presence of a residual disinfectant, has been shown to triple weekly bacterial counts and double long-term bacteria in distribution. (Escobar et al, AWWA Journal, Oct 2001) • Ozone dissolution is inversely proportional to water temperature, which can cause operational compromises during warm water months when water demand is at the highest
Biofilm Control	• Provides excellent biofilm control, eliminating build-up and preventing regrowth, especially in contrast to conventional chlorine	• May increase biofilm growth due to the breakdown of large organic molecules into smaller particles measurable as assimilable organic carbon (AOC), which serves as a food source for bacteria and biofilms. (Escobar et al, AWWA Journal, Oct 2001)
Corrosivity	• Non-corrosive to plant surroundings, even at doses in excess of 50 mg/L	• Ozone gas released from solution can get trapped in vessels, piping, valves, etc. and subsequently cause damage • Over time, will aggressively attack structural concrete rebar due to weeping through concrete cracks from settlement or poorly sealed or constructed joints, etc.
DBPs	• Does not form bromate or chlorite • Forms TTHM, but typically at 30% to 50% lower levels than with conventional chlorination	• Will form bromate in the presence of bromide, particularly at pH values > 6.5 • Bromate is regulated to a maximum limit of 10 ppb • Does not form TTHMs
Taste	• Excellent taste – does not react with ammonia and phenols to produce compounds that normally impart chemical taste and odors	• Excellent
Micro-flocculation	• Can cause microflocculation in pretreatment, improving settling, reducing turbidity, and reducing coagulant required. The microflocculation effect is not dose-sensitive, although proper dosing will minimize THM formation.	• Can cause microflocculation in pretreatment, improving settling, reducing turbidity, and reducing coagulant required. However, the effect is highly dose-sensitive – even slight overdosing negates the microflocculation effect.

* Note that the EPA currently requires mixed-oxidant customers to utilize chlorine CT values. Further testing is underway.

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Lifecycle Costs	• Comparable to the cost of chlorine gas and much less than the cost of ozone or chlorine dioxide systems • Capital cost is usually less than ozone or chlorine dioxide and is equivalent to gas chlorine if a scrubber is required • Lifecycle costs tend to be much lower than ozone or chlorine dioxide	• High operating costs due to high maintenance and power requirements • High equipment and installation costs; costs can be very high for equipment and facility modifications for a suitable contact chamber
Simplicity & Reliable	• Fully automated unit requires minimal training and maintenance • All parts are easily removed and replaced; 5-year cell warranty	• Requires highly trained operator • Reliable when properly maintained