Comparison between ECA and other traditional chemicals used

	ECA	Chlorine Gas	Chlorine Dioxide	Ozone	Sodium Hypochlorite
Disinfection	300x more effective than Hypochlorite. More rapid disinfection. Broader inactivation range. Oxidants generated on-site - fresh solutions with constant potency.	Effective kill on certain organisms. Slower disinfection. Cannot kill some resistant organisms.	Inactivates most microorganisms. More effective than chlorine less than ozone. Biocidal properties not influenced by pH. Effective against *Cryptosporidium* and *Giardia*.	Strong disinfectant and oxidation agent. More effective than chlorine and chlorine dioxide. Requires very short contact time. Very effective against *Cryptosporidium* and *Giardia*. Biocidal activity not influenced by pH.	At high pH, OCl- dominates, which causes a decrease in disinfection efficiency. Requires higher concentrations. Requires longer contact times. Not effective against *Cryptosporidium* and *Giardia*.
Residual and stability	More stable – Solution shelf life up to 9 months under optimal conditions. Residual effect without affecting taste and odour. Less disinfectant required to maintain residual. No need for Ammonia. Low levels of THM formation. Doesn't produce chlorites/chlorates.	Can vary widely throughout system. Must often be boosted or combined with ammonia to last throughout the system. A higher dosage is required to maintain equal residual. Production of THM's is much greater.	Reacts with many organic and inorganics. Chlorites and chlorates are produced - cause of health effects. Does not produce THM's - ClO_2 aids in reducing the formation of THM's. Residual in system can cause taste/odour problems. It decomposes in sunlight.	Ozone provides no residual. Ozone decays rapidly at high pH and temperatures. Forms DBP's including aldehydes, ketones, organic acids, bromine containing THM's and bromates. Upon decomposition the only residual is dissolved oxygen.	Formation of THM's and other DBP's as well as chlorites and chlorates. The stability of sodium hypochlorite solution depends on the hypochlorite concentration, the storage temperature, the length of storage (time), the impurities of the solution and exposure to light. Sodium hypochlorite solutions degrade over time. Sodium hypochlorite solution is typically not diluted prior to mixing to reduce scaling problems.
Safety	Uses only salt, water and electricity. Reduction in liability exposure. Avoids special equipment and training for worker safety. Reduced equipment corrosion problems. Avoids fire hazards from chlorine concentrates.	Packed Cl_2 gas is under pressure - potential for explosion or fire. Liability exposure. Poses hazards to surrounding community and to system operator. Potential for chlorine burns and highly corrosive to equipment. Safety equipment and training is necessary.	ClO_2 gas is explosive at levels >10% in air. CLO_2 dosage cannot exceed 1.4mg/L to limit formations of Chlorites and Chlorates. Measuring ClO_2 gas is explosive. Chlorine dioxide also highly corrosive.	High levels of ozone is toxic when inhaled. Ozone, when correctly applied, has been proven to maintain uniformly low corrosion rates, similar to and frequently better than systems treated with traditional chemicals.	Sodium hypochlorite solution is a corrosive liquid with an approximate pH of 12. Therefore, typical precautions for handling corrosive materials such as avoiding contact with metals, including stainless steel, should be used. Chlorates may be formed, avoid by limiting storage time, high temp and reduce light exposure. Spill containment must be provided for. Safety equipment and training is essential.
Generation	Oxidants generated on-site - fresh solutions with constant potency. No hazardous materials to transport or store.	Transportation of hazardous materials requires permits, EISs, etc. Storage of hazardous materials often requires gas scrubber to remove fumes.	Must be generated on-site, easy to do this. Generated as needed and directly injected into diluting stream. Variety of feedstock used like sodium chlorite, Cl_2 gas, NaOCl, HCL or H_2SO_4. Only small samples up to 1% can be stored if solutions are protected from light, chilled, has no unventilated head space.	Generation of Ozone requires high energy and should be generated on-site.	Sodium hypochlorite is produced when chlorine gas is dissolved in a sodium hydroxide solution. Alkaline solution produced with lower biocidal effect. Dilute sodium hypochlorite solutions can be generated electrochemically on-site from salt brine solution.

Cost Considerations	Higher capital cost is offset by lower lifecycle cost when compare to other chemicals.	Lower installation cost when gas scrubber is not considered but higher lifecycle cost.	Equipment is typically rented and costs of sodium chlorite are high. Costs associated with training, sampling and testing for chlorates/chlorites are high.	Initial cost of ozonation equipment is very high. Considerable expenses for operators' training and installation support.	Least expensive when bought in containers, But can be expensive when on-site generators are used. Typically, sodium and calcium hypochlorite are more expensive than chlorine gas.
Simplicity & Reliability	Fully automated unit requires minimal training and maintenance - periodically add salt and check system. Safety gear is unnecessary. Reactor is easily replaced and only requires replacement once/year.	Regular change-out of cylinders requires complicated safety training and gear. Periodic cleaning required. Cylinders is changed frequently - up to 2x per month.	Oxidant demand study should be completed to determine approx ClO2 dosage to obtain required CT value for disinfection. Decomposes in sunlight. Generator efficiency and optimization difficulty can cause excess chlorine to be fed into system - can potentially form halogen based DBP's.	Biologically activated filters are needed for removing organic carbon biodegradable DBP's. Maintenance on generators requires skilled technicians. The process is highly automated and very reliable, requiring only a modest degree of operator skill and time to operate an ozone system.	Easiest and least expensive disinfection method. No maintenance required. Easier to use, are safer, and need less equipment compared to chlorine gas.
Taste & Odour	Excellent taste - does not react with ammonia and phenols to produce compounds that normally impart chemical taste and odours. Removes H2S to improve water quality.	Often imparts a chlorine taste and odour especially when combined with ammonia. Cannot eliminate H2S taste or odour.	Concerns about possible taste and odour complaints have limited the use of ClO2 to provide a residual in the system.	Ozone controls colour, taste and odours.	Finished water could have taste and odour problems, depending on the water quality and dosage.
Multiple Uses	Can be used for a wider range of disinfection purposes than Cl2. Can be used for heavy metal removal - iron and manganese. Used for H2s removal. Improve filter runs. Improves turbidity - enhancing prefilter flocculation.	Mainly used for disinfection purposes.	Primary and secondary disinfectant, for taste and odour control. TTHM/HAA reduction, Fe and Mn control, colour removal. Sulphide and phenol destruction. Zebra mussel control. Enhance clarification process.	Ozone can sometimes enhance the clarification process and turbidity removal. Ozone oxidises iron, Manganese and sulphides.	Oxidises iron, Manganese and sulphides.