

**TABLE 1
SUMMARY COMPARISON OF TTHM REDUCTION ALTERNATIVES
EXETER, NH SURFACE WATER TREATMENT PLANT**

Criterion	Spray Aeration	Chloramines	Granular Activated Carbon (GAC)	MIEX Anion IX	Ultraviolet (UV) Radiation
Design Capacity	1.5 mgd	2.0 mgd at SWTP and 1.5 mgd at GWTP	2.0 mgd	2.0 mgd	2.0 mgd
System Components	Six (6) 7.5 HP Mixers, two (2) Powervents, and Two (2) Mixing Systems installed in a modified Backwash Recycle Basin. Power Vents installed in all Distribution Storage Tanks. Will require hydraulic modifications to pump clearwell finished water to the modified Recycle Basin and aerated water from the Recycle Basin into the distribution System.	Liquid Ammonium Sulfate Feed Tank and two(2) 100% Chemical metering Pumps installed within the existing SWTP and the existing GWTP. No hydraulic modifications anticipated.	Two(2) skids each having Two(2) 10-ft diam. by 12 ft high pressure vessels each containing 20,000 lb. of GAC installed in a new building. Will require hydraulic modifications to direct filtered water to the GAC system and then back into the existing Clearwell.	Two (2) 13-ft diam. contactors, Regeneration skid, and Salt Saturator installed within a new Building. Will require hydraulic modifications to direct raw water into the MIEX contactors and then back into the existing contact basin upstream of the adsorption clarifiers.	UV reactors installed in reconfigured finished water pump discharge line either within the existing SWTP filter building or within a new structure.
Performance					
TTHM or TOC Reduction	40-percent Clearwell TTHM reduction. Estimated 10% TTHM reduction at the storage tanks.	Not Applicable. Sodium hypochlorite for primary disinfection and monochloramine as secondary disinfectant.	Reduction of filtered water TOC from approx. 2.5-3.0 mg/L to less than 1.0 mg/L prior to chlorination .	Reduction of raw water TOC from approx. 9.0 mg/L to 3.3 mg/L following coagulation.	Not Applicable. UV as primary disinfectant and monochloramine or sodium hypochlorite as secondary disinfectant.
TTHM Projections					
LRAA (4-Quarters) ppb	25-65 (non Enhanced Coagulation) 25-45 (Enhanced Coagulation)	25-35	20-25	30-55	60 -75 (chlorination as secondary disinfection) 20-25 (chloramination as secondary disinfection)
Capital Cost					
Construction Cost	\$549,000 (Recycle Basin aeration system)+\$65,000 (powervents in storage tanks)+ \$755,000 (hydraulic mods)+\$100,000 (Recycle Basin mods)	\$170,000 (feed tanks, chemical feed pumps, piping, and Chemscan monochloramine and ammonia analyzers for both SWTP and GWTP)	\$750,000 (GAC system) + \$270,000 (building) + \$400,000 (hydraulic mods)	\$1,913,000 (MIEX system)+\$300,000 (building) +\$150,000 (hydraulic mods)	\$310,000 (UV System)+ \$125,000 (piping reconfiguration) = \$435,000 within the existing SWTP building. Additional \$112,500 (building) for total of \$547,500 if within new structure.
Engineering and Contingencies (at 50% of Construction Cost)	\$447,000	\$85,000	\$710,000	\$1,182,000	\$217,500 (UV within existing SWTP building) or \$273,750 (UV within a new structure)
Total Construction, Engineering, and Contingencies	\$1,916,000	\$255,000	\$2,130,000	\$3,546,000	\$652,500 (within existing building) or \$821,250 (within a new building) The use of chloramination as secondary disinfectant will add \$255,000 to each option.
Annual O&M Costs (1.0 mgd average flowrate)	\$16,000 (electricity) \$45,200 (Suez maintenance Fee)	\$24,000 (liquid ammonium sulfate for both SWTP and GWTP)	\$120,000 (GAC replacement) \$3,500 (electricity)	\$34,000 (resin, power, and salt)	\$18,500 (electricity and replacements)
Advantages	No additional chemicals added to the SWTP treatment. Guaranteed 40-percent removal of Clearwell TTHMs. Two equipment suppliers.	Relatively easy to install in existing SWTP and GWTP. Established disinfection regime. Long-lasting secondary disinfectant. Multiple equipment suppliers.	No additional chemicals added to the SWTP treatment. Well established treatment process. Multiple GAC equipment suppliers.	No additional chemicals added directly to the SWTP treatment. Reduction in coagulant dosages and associated sludge.	No additional chemicals added to the SWTP treatment. Installation within the existing SWTP may be possible but would require discharge piping modifications. Minimal 1-2 foot pressure drop across UV system. Multiple UV system suppliers.
Disadvantages/Concerns	Requires repumping of clearwell water to the Recyle Basin and aerated water to the Distribution system. Absolute TTHM reduction depends on clearwell TTHM concentration at the time.	Additional chemical added to the treatment. Possible nitrification, taste and odor, nitrosamine production, lead and copper release, impact on elastomers, and on dialysis patients. Will require careful monitoring of monochloramine formation at the plants and distribution system ammonia and nitrate conditions. Will require that the GWTP convert to chloramines also.	Requires repumping of filtered water through new pressure GAC vessels and back into the Clearwell with associated 10-12 psi pressure drop. New building to house GAC system.	Requires raw water hydraulic modifications since it will become the first treatment process. New building to house MIEX system. Treatment requires operator attention for large amounts of salt regenerant handling and resin addition. Single system supplier.	Requires secondary disinfection for distribution system, spare parts and redundancy per regulations, and a reliable electric power source. A new structure to house the UV system may be required.