

Technical COMPARISON



Comparison of Water Treatment Alternatives

TECHNOLOGY OVERVIEW

Delivered Bleach from Olin	Manufactured bleach delivered to site by rail or truck with certificate of authentication guaranteeing strength and quality. Bleach is stored on site. Bleach introduced into water through an engineered handling system.
Onsite Generation of Bleach	Brine is made on site using salt and softened water. Salt solution is moved to electrolytic cells. A weak DC current is administered, and bleach is produced.
Ultraviolet	Water is exposed to UV light, which usually is produced by mercury-based gas discharge lamps.
Ozone	Ozone is produced from oxygen exposed to a high-voltage current.

HOW IT WORKS

Delivered Bleach from Olin	When bleach is introduced to water, hypochlorous acid is formed. This acid is divided into hydrochloric acid and oxygen. (The oxygen atom is a strong oxidizer.) These substances are what make bleach.
Onsite Generation of Bleach	Same as bleach from Olin
Ultraviolet	Alters DNA of bacteria, viruses, mold, parasites so they can't reproduce.
Ozone	Kills bacteria and viruses through oxidation

SAFETY

Delivered Bleach from Olin	Biggest concern is not mixing with inappropriate materials. Fewer issues to manage than chlorine gas.
Onsite Generation of Bleach	Biggest concern is not mixing with inappropriate materials. Fewer issues to manage than chlorine gas. Hydrogen generation is a concern.
Ultraviolet	No issues with the process, but must be supplemented with chlorine or bleach to keep water disinfected as it travels through pipes to end users. Mercury vapor lamps pose disposal issues.
Ozone	No issues with the process, but must be supplemented with chlorine or bleach to keep water disinfected as it travels through pipes to end users.

RELIABILITY

Delivered Bleach from Olin	The bleach we produce for use in water disinfection is registered by the U.S. EPA under FIFRA and by Health Canada under PCPA. It is certified to the quality standards of NSF/ANSI Standard 60, and meets the requirements of AWWA B300-10. Plus, Olin has an extensive bleach network capable of delivering bleach from 10 different plants in North America. Introduction into water supply is a simple process, and simple systems are almost always the most reliable. Can be done manually if power is lost.
Onsite Generation of Bleach	Bleach quality can be affected by weather, temperature and human error. Stored salt is hygroscopic, can lump and harden. Loss of power renders system ineffective (can be overcome by backup generators for a time).
Ultraviolet	Bulbs gradually lose their effectiveness, must be replaced periodically. Loss of power renders system ineffective.
Ozone	Effectiveness is dependent on good mixing of ozone with the water, and ozone does not dissolve particularly well, so a well-designed system that exposes all the water to the ozone is important. Loss of power renders system ineffective.

Technical Comparison *(continued)*

EFFECTIVENESS AGAINST VARIOUS CONTAMINANTS

Delivered Bleach from Olin	Same effectiveness as chlorine. Not effective against Cryptosporidium on its own, but additional processing steps can be taken to treat effectively.
Onsite Generation of Bleach	Same effectiveness as chlorine. Not effective against Cryptosporidium on its own, but additional processing steps can be taken to treat effectively.
Ultraviolet	Effective against every major contaminant, including Cryptosporidium, but must be supplemented with chlorine or bleach to protect while water is travelling through pipes.
Ozone	Effective against many contaminants, including Cryptosporidium, but must be supplemented with chlorine or bleach to protect while water is travelling through pipes.

EASE OF CONVERTING FROM CHLORINE GAS

Delivered Bleach from Olin	Small infrastructure investment. Storage areas may need expansion.
Onsite Generation of Bleach	Requires new generator + onsite disposal facility and internal wastewater treatment. State approval, state permits, inspection reporting.
Ultraviolet	Major infrastructure investment. Still requires chlorine for residual treatment.
Ozone	Major infrastructure investment. Still requires chlorine for residual treatment.

EASE OF OPERATION

Delivered Bleach from Olin	Less stringent than training to handle chlorine gas. Simple delivery system to operate.
Onsite Generation of Bleach	Human error is possible. System adjustments may be needed to compensate for variations in temperature, water pH level. Backup disinfection needs to be considered.
Ultraviolet	Lamps need periodic cleaning and replacement. Backup disinfection needs to be considered.
Ozone	More complicated than chlorine, bleach or UV systems. Requires high degree of operator training.

TRANSPORT, STORAGE ISSUES

Delivered Bleach from Olin	No issues in transport. Facilities may need to expand storage capacity.
Onsite Generation of Bleach	No transport issues. Need some storage for bleach produced by system.
Ultraviolet	None
Ozone	None

Technical Comparison *(continued)*

MISCELLANEOUS ADVANTAGES †

Delivered Bleach from Olin	<ul style="list-style-type: none"> ■ Same efficacy and residual protection as chlorine gas ■ Fewer training requirements than chlorine gas ■ Fewer regulations than chlorine gas ■ Certificate of authentication with each shipment ■ Olin can monitor inventory levels ■ Transportation issues are minimal
Onsite Generation of Bleach	<ul style="list-style-type: none"> ■ Because perchlorate and other undesirable byproducts are produced when sodium hypochlorite degrades in warm climates, a fresh solution is preferable. The onsite units can run on emergency generators as long as a stock of salt is on hand.
Ultraviolet	<ul style="list-style-type: none"> ■ No chemical generation, storage, or handling ■ Effective against Cryptosporidium ■ No known byproducts at levels of concern
Ozone	<ul style="list-style-type: none"> ■ Produces no trihalomethanes, has fewer safety regulations ■ Effective against Cryptosporidium ■ Provides better taste and odor control than chlorination

MISCELLANEOUS DISADVANTAGES †

Delivered Bleach from Olin	<ul style="list-style-type: none"> ■ Limited shelf-life (but Olin helps address) ■ Same byproducts as chlorine gas, plus bromate and chlorate ■ Higher chemical costs than chlorine gas ■ Corrosive; requires special handling
Onsite Generation of Bleach	<ul style="list-style-type: none"> ■ Requires either immediate use or additional processing to ensure adequate storage life. ■ Same byproducts as chlorine gas, plus bromate and chlorate ■ Higher chemical costs than chlorine gas ■ Corrosive; requires special handling
Ultraviolet	<ul style="list-style-type: none"> ■ No residual protection for drinking water ■ Less effective in turbid water ■ No taste and odor control ■ Generally higher cost than chlorine
Ozone	<ul style="list-style-type: none"> ■ More complicated than chlorine or UV systems ■ No residual protection for drinking water ■ Hazardous gas requires special handling ■ Byproduct formation (bromate, brominated organics and ketones) ■ Generally higher cost than chlorine

† http://www.americanchemistry.com/s_chlorine/sec_content.asp?CID=1133&DID=4530&CTYPEID=109#chart

Technical Comparison *(continued)*



About Olin Chlor Alkali Products

Olin Chlor Alkali Products has been in the business of making chlorine, caustic soda and bleach since 1892. Today we are the largest producer of industrial bleach in North America, and we are a leading supplier of chlorine and bleach for drinking water and wastewater disinfection and purification. We are owned by Olin Corporation, which also manufactures Winchester ammunition products.

In addition to chlorine, caustic soda and bleach, we make hydrochloric acid, hydrogen and potassium hydroxide. Our products are essential building blocks for a variety of chemicals and pharmaceuticals and can be found in food processing, health care facilities, building materials and high-tech electronic components.

In the bleach market, because of our size and capabilities, we can make delivered bleach economical and affordable for drinking water and wastewater treatment facilities. Our ability to provide a reliable supply of bleach is unsurpassed.

Olin has created an extensive bleach distribution network capable of delivering bleach from 10 plants in North America. We have a fleet of 300 rail cars and growing. Our proprietary rail-car technology enables us to deliver high quality bleach in a cost-effective manner to customer locations coast to coast. If you're unable to accept delivery by rail at your facility, we can usually arrange to serve you by truck.

Our plants have the combined capacity to produce more than 300 million gallons of bleach annually, and we can expand as demand increases. Our economics are good now, and they'll be even better as we phase in our new low-salt, high-strength technology that will allow us to deliver more active ingredient in each gallon of solution.

The bottom line is this:

Regardless of where you live in Canada or the continental United States, chances are that Olin can provide a reliable supply of all the bleach you need for drinking water and wastewater treatment. We can make it easy for you to make the transition. And we can do so at rates that are highly cost effective when compared with any other water disinfection or purification technology.

**The Bleach
EXPERTS**

Get in touch!

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