For more than 75 years chlorine has been effectively used to disinfect drinking water, eliminating dangerous bacteria and toxic compounds. Water supply engineers and treatment facility operators are used to necessary risks and problems associated with chlorine disinfection in order to deliver safe water.

Typically three methods are used to apply chlorine:
1. Chlorine gas dosing
2. Dosing of sodium or calcium hypochlorite solution
3. Electrolytic chlorine generation

These methods present a variety of risks and issues. Chlorine gas applications involve managing risks associated with accidental releases and contact with the dangerous gas. Dosing hypochlorite solutions require handling concentrated and dangerous chemicals, usually in bulk quantities. Beyond managing safety, operators often face operational issues such as off-gassing of liquids, degradation of the product, calcification when injecting and equipment failures. Managing these issues adds operational and capital costs for drinking water installations.

Treatment facilities often turn to sodium hypochlorite to deliver disinfection results and mitigate risks.

Electrolytic chlorine generation is an alternative method to apply sodium hypochlorite for disinfection, offering unique benefits for operations. Electrochlorination uses common raw materials – salt, water and electricity – to generate a low strength sodium hypochlorite solution (up to 0.8% concentration) on site. Installed generation equipment includes a brine storage tank, the actual electrogenerator and a final product solution tank from which the sodium hypochlorite is dosed.

Electrochlorination helps relieve operators of multiple concerns associated with other disinfection methods. Operators only store and handle common salt, eliminating the risks of handling dangerous chemicals. The final product, while still effective sodium hypochlorite, does not degrade as readily as stronger concentrations, allowing for on-demand service and reducing calcification of injection points. The generators also operate on demand, eliminating bulk storage of chemicals.

In electrolytic generation of chlorine, a brine solution is passed over a series of electrodes in an electrolytic cell. DC power is applied to the electrodes, resulting in the generation of sodium hypochlorite. Hydrogen gas is produced as a by-product, and must be safely managed. (See Figure 1).

This presents several issues with generating equipment. Often equipment is complicated and difficult to use or fix. Capital equipment and replacement parts are often expensive. And the generation of hydrogen gas requires special equipment to dilute and vent it to the atmosphere to keep the concentration below...
4 percent (the Lower Explosion Limit of LEL threshold). Most installations require special diluting equipment and explosion-proof designs for the rooms to ensure safety. All equipment in this potentially explosive atmosphere must meet strict design requirements to prevent sparks. This adds installation and risk costs.

Operators and engineers must look for electrochlorination equipment engineered to maximize the value and reduce the risks. The key to adding value in a water plant is to simplify engineering and controls and make the unit safe and reliable – all while keeping an eye on the total cost of operation.

Ideal systems provide safe and simple operation, making start-up and ongoing maintenance easy. Inherent and interlocked safety features are a must but the unit must help manage total operational costs. (See Figure 2)

One key area of focus is in the handling of hydrogen gas. Electrochlorination generator designs may look for ways to eliminate the need for explosion-proof zones and equipment. The vertical cells permit free release of hydrogen without accumulation inherent to horizontal cells. Also engineers should look for cell and degassing column enclosures with forced air ventilation to ensure any leaks stemming from poor maintenance or mechanical failure are diluted. Safety interlocks must ensure that the integrity of the system is maintained at all times. Finally, any system must feel safe to cut power to the cell if any unsafe conditions are detected.

Onsite electrochlorinators offer safe and effective application of sodium hypochlorite while reducing total facility costs and risks compared to other technologies. With the right engineering this can enable treatment engineers and operators to focus on delivering clean, safe water for their communities.

Figure 2. Electrochlorination generator with vertical generation cell (left column), degassing column (right) and integrated air flow handling system (bottom left).