Risks and Benefits of Energy Management for Drinking Water Utilities

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The most common of these disposal options are brine lines and POTW discharge, both of which have an associated surcharge. POTW surcharges can add an average additional cost of $2.52/million gallons (MG) of brine discharge [2006 escalated value based on Consumer Price Index from $1.83/MG (USEPA 1993)] while brine line discharge fees can be much higher. For example, Santa Ana Regional Interceptor charges $1,200/MG of brine discharged to its brine line, excluding the connection fee (SARI 2005); however, this is likely on the higher end of brine line discharge fees in the country. Total annual costs for NF/RO with POTW discharge or brine line discharge at the aforementioned rates are illustrated in Figure 3.5.

Ultraviolet Disinfection

UV disinfection can be used to comply with the upper bin treatment requirements of the LT2ESWTR by increasing log credit inactivation of *Cryptosporidium*. UV can also facilitate compliance of Stage 2 by reducing the required dose of chlorine, thereby reducing concentrations of DBPs. UV has proven to be more effective at inactivation of some pathogens, including *Cryptosporidium*, than other more commonly used disinfectants, such as chlorine. The number of UV plants installed in the U.S. and Canada has grown considerably since 1987, as shown in Figure 3.6. The number of UV treatment plants operating in North America more than tripled from 12 in 2002 to 37 in 2005.

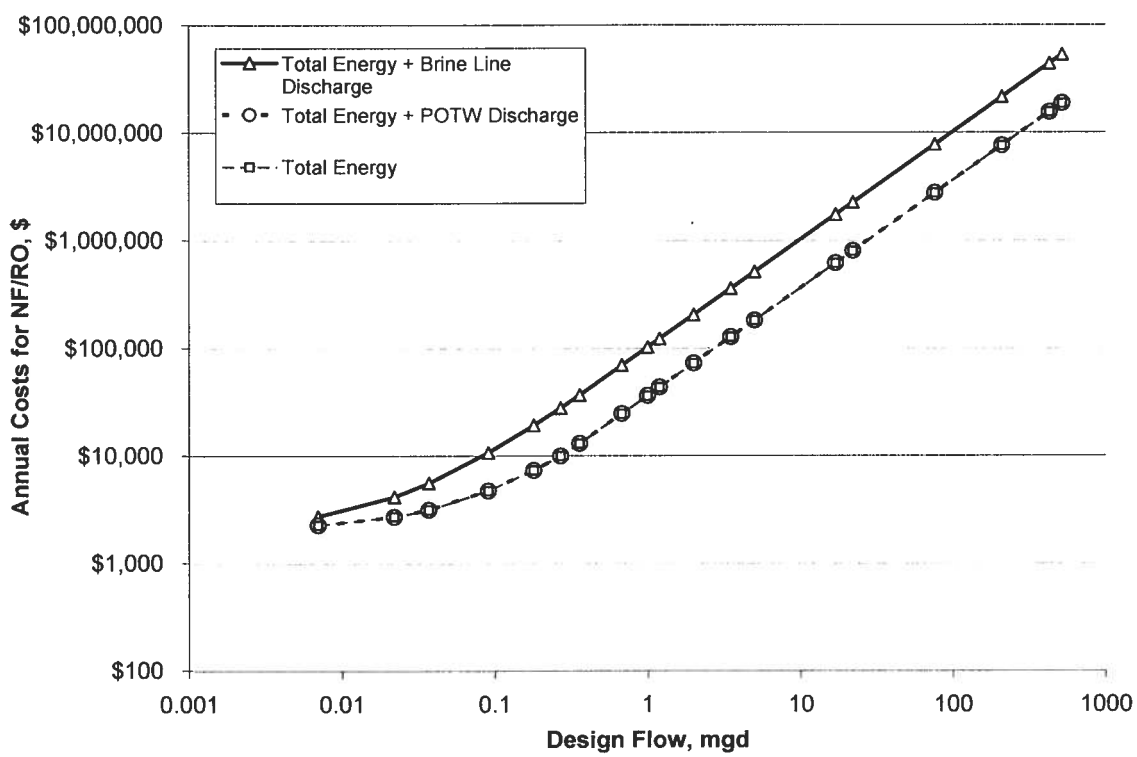
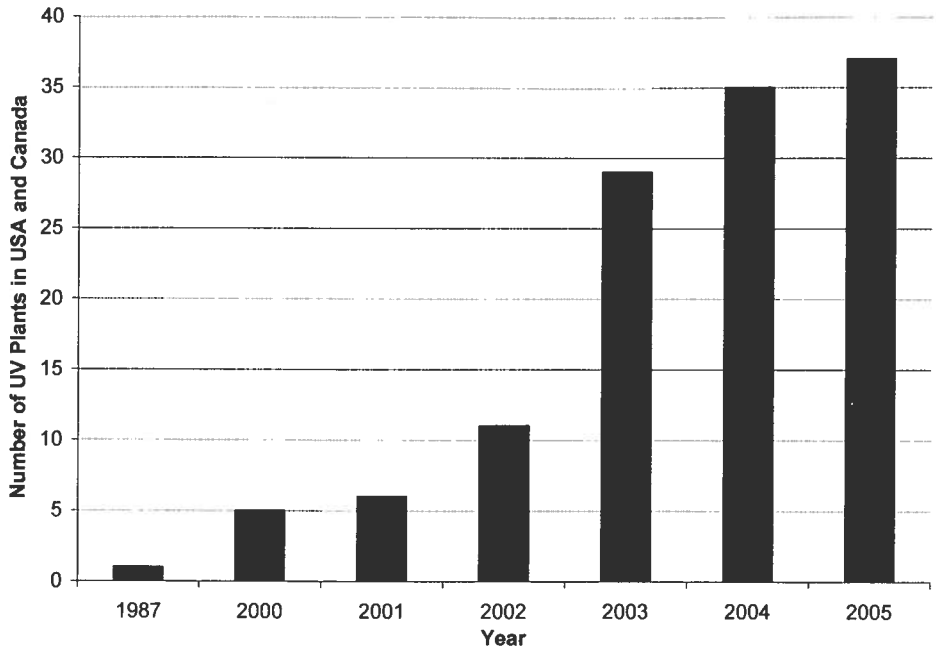


Figure 3.5 Comparison of annual NF/RO costs for energy and brine disposal



Adapted From: Cotton and Schultz 2005.

Figure 3.6 Number of UV water treatment plants in the U.S. and Canada

One of the primary risks associated with the implementation of a UV disinfection system is reliability of power. UV systems are validated to operate within a specific range that is dependent upon the quality of the power source. Power fluctuations and interruptions can lead to a UV system operating outside of its validated range, known as off-specification. UV lamps can lose their arc when the voltage drops as little as 10 to 15% from the nominal voltage for as few as 2 to 5 cycles. Off-specification time, which is increased by the time required for UV lamps to reach full power after going down, increases the potential risk of exposure to pathogens. The time it takes for a lamp to completely restore power depends on the type of lamp. LP lamps can generally return to full operating status within 15 seconds after power is restored. Low pressure-high output (LPHO) and medium pressure (MP) lamps need to be restruck, which generally requires between 4 and 10 minutes to get full lamp power.

LT2ESWTR addresses this power quality issue by requiring that for unfiltered surface water supplies, at least 95% of the monthly flow into the point of entry of the drinking water system undergo UV disinfection within the range of validated conditions. Unfiltered systems need to apply UV doses sufficient to inactivate 2 or 3 logs of *Cryptosporidium* oocysts, depending on the source water quality. Therefore, assuming constant flow, unfiltered water system UV reactors could be out of service, bypassed, or operate off-specification (i.e., outside their validated conditions) for 36 hours per month. Installation of an UPS, which is basically a battery that delivers a consistent power supply if power fluctuations or interruptions occur, can relieve the risks of off-specification time due to power quality issues. Backup generated power can also be used until power is restored; however, the shifts between backup and primary power will likely cause UV lamps to lose their arc.