

# Wastewater Ultraviolet Disinfection

## Meeting the Challenge of Alternative Disinfection

Mounting concerns over safety, effluent toxicity, air emissions, and rising chemical costs are compelling many publicly owned treatment works (POTWs) to reevaluate the use of gaseous chlorine for wastewater disinfection. Typical alternatives to gaseous chlorine for disinfection include sodium hypochlorite/sodium bisulfite — which requires installing new chemical storage, containment, and handling systems — and ultraviolet radiation (UV). Knowing which alternative is best for your facility takes hands-on experience. Successful project implementation also requires the ability to match the right technology and equipment vendor with your needs. At Carollo Engineers, we are suited to the challenge.

### When is UV the Right Choice?



Disinfection with ultraviolet radiation can offer several advantages under the right circumstances. UV alters the genetic material in bacteria, viruses, and other microorganisms, rendering them unable to reproduce. Because it uses no chemicals, it is safer for operators, the public, and the environment. UV disinfection also works faster and may offer lower capital and operating costs than other disinfection methods.

Deciding if UV is the optimal disinfection method for a POTW frequently involves:

- ▼ Setting policies regarding the safety and relative risk of gaseous chlorine facilities.
- ▼ Determining the effects of water quality parameters such as total suspended solids, turbidity, and transmittance on required UV dosage.
- ▼ Establishing the UV dosage necessary to meet effluent requirements.
- ▼ Integrating the UV disinfection system with plant operations, including hydraulics, electrical power systems, and instrumentation.
- ▼ Comparing available types of UV equipment, including low and medium pressure UV systems.

### A Full Range of Services

Carollo offers a full range of services for UV disinfection system implementation.

- ▼ Pilot and bench-top testing programs
- ▼ Transmittance testing
- ▼ Preliminary design
- ▼ Equipment pre-purchase
- ▼ System integration
- ▼ Permit negotiations and agency coordination
- ▼ Full-scale design
- ▼ Construction services
- ▼ Program management

### Experience Counts

Our engineers have evaluated alternative disinfection methods and performed pilot/bench-top testing and design of UV disinfection systems for clients throughout the U.S.

**Ashland, Oregon.** As part of the design of a new \$15 million wastewater treatment plant for the City of Ashland, Carollo evaluated gaseous chlorine, hypochlorite, and UV disinfection, and recommended



*The Ashland Wastewater Treatment Plant, which includes an in-line UV system, produces the highest quality effluent anywhere in the Northwest.*

UV due to chemical handling concerns and neighborhood proximity to the plant site. Carollo developed prepurchase documents for both in-channel and in-line UV systems. The low-bid in-line system, which has performed flawlessly since installation, meets a 23 total coliform limit for wastewater reuse and consists of two parallel UV trains for redundancy.

**Phoenix, Arizona.** The Cave Creek Water Reclamation Plant is the City of Phoenix's first satellite water reclamation plant. Carollo provided planning, design, construction, and commissioning for this \$42 million

"Dedicated to creative, responsive, quality solutions for those we serve."



facility, which includes one of the largest UV disinfection systems in use in the state of Arizona. The medium-pressure system offers excellent disinfection capability without the formation of disinfection by-products. The resulting recycled water exceeds all current regulatory requirements for unrestricted use.



*Carollo designed one of the largest UV disinfection systems in the state of Arizona at the Cave Creek Water Reclamation Plant.*

**Springfield, Missouri.**

Carollo provided final design services for a \$12 million expansion of the City of Springfield's Northwest Wastewater Treatment Plant. The preliminary design included on-site sample collection and laboratory testing to evaluate key characteristics of the activated sludge mixed liquor and the treatability of the effluent for UV disinfection. Work included examining effluent samples for UV transmittance, particle size distribution, and collimated-beam dose/response. Sample results indicated the effluent quality was amendable to disinfection by UV and provided a basis for economically sizing this new equipment.

**Petaluma, California.** As part of the design of the City of Petaluma's Water Recycling Facility, Carollo designed an urban unrestricted reuse system with low-pressure, high-intensity UV disinfection. The existing sodium hypochlorite disinfection system will also remain in use to serve agricultural restricted reuse demands and provide for river discharge. This dual disinfection approach allows the plant to benefit from the advantages of both UV and chlorine while maintaining lower construction and annual costs than a UV system sized for all uses.

**Peoria, Arizona.** The City of Peoria hired Carollo to design the Phase 1 and 2 expansions of its Beardsley Road Water Reclamation Facility. Cost and safety issues led Peoria to select medium-pressure UV disinfection as an alternative to chlorine, and making this the first municipal UV installation in Arizona. The UV facility provides an effluent quality of 2.2 MPN/100 ml fecal coliform.

**Lewiston, Idaho.** To select the best disinfection system for the City of Lewiston, Carollo evaluated three different types of UV technology. Based on this evaluation, Carollo designed a new \$700,000 vertical-lamp system. The project saved Lewiston money by incorporating the UV system into the existing

chlorine contact basins, enabling the plant's hydraulic profile to remain unchanged. The new 8.6-mgd UV system, which has very low maintenance requirements, has operated successfully since startup.

**Vallejo, California.** Carollo completed final design to convert the Vallejo Sanitation and Flood Control District's existing gaseous chlorination and dechlorination system to UV disinfection. The project included a UV system to accommodate flows up to 30 mgd and a sodium hypochlorite/sodium bisulfite system to treat peak wet weather flows from 30 to 60 mgd. The fast-track design included hydraulic evaluation; permitting; equipment evaluation; site selection; UV and sodium hypochlorite/sodium



*The Vallejo Sanitation and Flood Control District uses UV disinfection accommodate flows up to 30 mgd.*

bisulfite system design; electrical, instrumentation, and control system design; standby generator control modifications; equipment procurement and cost negotiations; and UV design data review to assure system compliance with acceptable performance standards and design criteria.

**American Fork, Utah.** In response to high growth, Carollo designed an 8-mgd expansion to the Timpagogs Special Service District Wastewater Facility. New/expanded facilities include a headworks, oxidation ditches, clarifiers, sludge pumping, and medium-pressure UV disinfection.

**Redlands, California.** The City of Redlands hired Carollo to upgrade its wastewater treatment facility to provide recycled cooling water to a local power generator. The design provides for total inorganic nitrogen removal from 9.5 mgd to a level of less than 10 mg/L and treatment of 6 mgd of the total flow to meet California Title 22 requirements for low turbidity, disinfected effluent suitable for cooling tower use and crop irrigation. The project features new technology using immersed microfiltration membranes in a membrane bioreactor followed by UV disinfection.