New EPA Guidelines Highlight UV as Part of the Reuse Solution

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Across the globe, water supplies are becoming increasingly strained and climate change is making hydrologic cycles more erratic. Sustainable, alternative water supply options are needed to augment existing supplies. In many contexts, reclaimed water is a promising new water source, and is increasingly in the spotlight for its importance as a component of total water management.

Efforts, such as the National Academy of Science (NAS) project, "Assessment of Water Reuse as an Approach for Meeting Future Water Supply Needs," are taking a comprehensive look at the potential for water reclamation and reuse of treated municipal wastewater to expand and enhance water supply alternatives. The work by the NAS highlights opportunities where water reuse is most relevant and assesses the potential impacts to expanding water reuse in the United States (U.S). In 2012, the U.S. Environmental Protection Agency (EPA) will be releasing updated *Guidelines for Water Reuse*. In addition to addressing reuse as a water supply solution in the U.S., the guidelines also aim to bring awareness to global water reuse issues and opportunities.

The first EPA *Guidelines for Water Reuse* was originally published in 1980. The document was expanded in scope as a guidance document in 1992, and again in 2004, as the field of water reclamation and reuse continued to evolve. The guidelines are a collaborative effort between EPA and the U.S. Agency for International Aid (USAID), with the primary purpose to protect public health and the environment, while describing the conceptual framework for considering water reuse in various settings.

RE-ENVISIONING WATER REUSE

Previous versions of the EPA *Guidelines for Water Reuse* emphasized the technical and engineering aspects of water reclamation and reuse, as well as consideration of the economics of reuse at the project level. As with the earlier version, a committee of national and international experts in the field of water reclamation was established to draft new text and to update case studies for the 2012 update. The updated document will highlight the range of water reuse applications being implemented around the world—from low technology solutions, to very advanced treatment technologies, including those that are part of the potable reuse treatment process. The new guidelines will provide links to state reuse regulations and incorporate more case studies throughout the text, including those that reflect regional considerations in the U.S., as well as international reuse practices. A number of stakeholder workshops were held throughout 2011 to solicit input on the content of the guidelines. The following key topic areas were identified by stakeholders and will be specifically addressed in the update:

- The role of reuse in integrated water resources planning and management, also referred to as total water management
- Energy use and sustainability associated with water reuse
- Increased focus on agricultural reuse
- Wetlands polishing and stream augmentation
- Groundwater augmentation and managed aquifer recharge
- Coverage of individual onsite and graywater reuse systems
- New information on direct and indirect potable reuse practices

TREATMENT TECHNOLOGIES AND THE ROLE OF UV IN REUSE

The primary objective of treating reclaimed water is to protect human health and the environment. And, while the appropriate treatment level for reuse will vary depending upon state requirements and the reclaimed water's end use, the most critical treatment objective is pathogen inactivation. In the U.S., to date, there have not been any confirmed cases of infectious disease resulting from the use of properly treated reclaimed water. UV disinfection has played a key role in many of these reuse schemes, and the public health success of the treatment solutions has supported the case for water reuse in an increasing number of applications.

As water-scarce areas continue to consider water reuse as a potential supply, many utilities are taking the next step and implementing potable reuse solutions—which also involves advancing UV technologies. In the U.S., potable reuse is gaining interest as communities such as San Diego, California; El Paso, Texas and Orange County, California, are educating their citizens about the safety of using reclaimed water for drinking supplies. Indeed, the recent NAS report as part of the ongoing study concluded that risks from potable reuse may be orders of magnitude lower than any risk from conventional treatment, and the WateReuse Research Foundation has a portfolio of research that supports this conclusion.

These projects' success depends on a well-tested and reliable treatment process that can produce water supplies that protect public health and the environment. Countries such as Singapore, highlighted in the new guidelines, are already implementing comprehensive potable reuse programs that include source control, comprehensive secondary wastewater treatment, microfiltration (MF)/ultrafiltration (UF) processes, reverse osmosis (RO) and UV disinfection, followed by natural attenuation in surface reservoirs, and conventional water treatment before distribution. In Orange County, California, wastewater treated at the Orange County Sanitation District is further treated at the Groundwater Replenishment System (GWRS), where it undergoes a state-of-the-art purification process, consisting of MF, RO and UV with hydrogen peroxide (**Figure 2**) producing near-distilled-quality water. At the GWRS, approximately 35 million gallons per day (mgd) of treated water are pumped into injection wells to create a seawater intrusion barrier. Another 35 mgd are pumped daily to Orange County Water District's percolation basins in Anaheim, where the GWRS water naturally filters through sand and gravel to replenish the deep aquifers of north and central Orange County's groundwater basin. Using up to two-thirds less energy than it would take to import water from Northern California and three times less energy than ocean desalination, the GWRS produces enough water for nearly 600,000 residents annually, while saving enough energy to power 21,000 homes each year. Additional information on the GWRS project will be highlighted in the new guidelines.

Figure 2. Orange County, CA Groundwater Replenishment System UV Process

In San Diego, also highlighted in the new guidelines, nearly 90 percent of the city's current water supply is imported from the Colorado River and the California State Water Project. In the past, importing water has been a low-cost, dependable option, but these water sources have become less reliable and more expensive in recent years. As a result, as part of their Water Reuse Program, the city is conducting a pilot Water Purification Demonstration Project to evaluate the feasibility of using advanced treatment technology to produce water that can be sent to the city's San Vicente Reservoir, and later treated for distribution as potable water. The Advanced Water Purification demonstration facility is equipped with MF/UF, RO, and advanced oxidation with UV and hydrogen peroxide (**Figure 3**). Because at this time regulatory requirements have not been defined in California for indirect potable reuse (IPR) through reservoir augmentation, results from this pilot project will evaluate a range of treatment objectives, including removal of:

- Contaminants regulated by the Safe Drinking Water Act and California State regulations
- Disinfection by-products and trace constituents
- Nutrients that may lead to eutrophication of San Vicente Reservoir
- Surrogate constituents to effectively monitor the integrity of each unit process
- Local constituents of concern, endocrine disrupting compounds, pharmaceuticals and personal care products

With continued regulatory involvement and public outreach and education efforts, the demonstration project is on

Figure 3. San Diego, CA UV System that is Part of the Water Purification Demonstration Pilot

the path for gaining regulatory approval and public acceptance. Full-scale facilities could produce up to 15 mgd of purified water. Free public tours of the facility, as well as project presentations to interested groups throughout the community, help to increase public understanding of the role of UV disinfection in providing safe reclaimed water.

In addition to these high-profile, large-scale reuse implementation projects, a countless number of small-scale decentralized reuse scenarios are being developed, often employing UV disinfection as the final process prior to reuse. Decentralized systems are relevant to a number of reuse applications. They can be an important tool for accommodating growth and development in a way that does not tax community resources or disrupt community character as dramatically as large systems. In addition, these systems can be implemented more rapidly, or address the needs of seasonal communities. Decentralized systems that treat and reuse wastewater close to its source or reclaimed water reuse area can potentially save energy, money and greenhouse gas emissions associated with extensive collection and reclaimed water distribution systems.

Two Massachusetts case studies featured in the upcoming guidelines highlight how small decentralized systems can be tailored for specific needs. In Hopkinton, Massachusetts, EMC corporation had interest in LEED® certification and green design principles, and built a decentralized wastewater treatment and reclamation plant for its campus, where it manufacturers electronic data storage systems. EMC is the town's largest potable water user, which is groundwater sourced from its own wells within the town and from a neighboring town. During summer peak seasonal demand, Hopkinton has faced water shortages. The system reclaims 100 percent of the plant's wastewater, which is used for toilet flushing (25 percent) and irrigation (75 percent). The project has reduced the demand on the town's potable water supply system. The project reduced the potable water demand on a seasonally limited aquifer and provided needed groundwater recharge. The plant includes a sequencing batch reactor activated sludge process followed by cloth media filtration and UV disinfection.

At nearby Gillette stadium in Foxborough, Massachusetts, the New England Patriots management determined that the new stadium's potable water demand was projected to increase by as much as 0.6 mgd during home games, largely due to toilet flushing. Increased water demand would stress the town's wells and storage tank system. Furthermore, the corresponding increase in wastewater produced at the stadium would be greater than the capacity of the town of Foxborough's wastewater treatment plant. To reduce these impacts, the Patriots worked with the town and Massachusetts Department of Environmental Protection (DEP) to construct a new wastewater reclamation system in 2002 to reduce demand for potable water. The plant includes a membrane bioreactor, ozone and UV disinfection. On average, about 60 percent of the wastewater is reused for toilet flushing. The remaining effluent is pumped to the subsurface disposal system, where it recharges the groundwater.

SUMMARY

The EPA *Guidelines for Water Reuse* is scheduled for release at the annual Water Environment Federation (WEF) Technical Exhibition and Conference (WEFTEC) in October 2012, with online release of the document and related information at waterreuseguidelines.org. It is anticipated that the new guidelines will continue to fulfill an important role in reuse, just as its predecessor, which was one of the most widely circulated EPA documents ever issued. As the updated 2012 guidelines expands the scope of water reuse practices to present both U.S. and international experiences, it is clear that UV will continue to be prominent in treating reuse water as part of the global water supply solution. And, while there is still much work to be done in developing water reuse solutions, there have been significant advances in treatment technologies, as highlighted in the new NAS report and referenced herein. These treatment technologies, including UV, are part of the solution to reducing risks from potable reuse, which may be orders of magnitude lower than any risk from conventional treatment according to the NAS report. And, already, in the project case studies that will be highlighted in the guidelines, UV is a part of that template for success.