Potable Reuse: The Regulatory Context for Florida and the U.S.

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For most Floridians, the main source of drinking water is underground aquifers, and that source is, of course, limited. Water withdrawals for drinking, agricultural, or industrial uses compete with the need to maintain water levels to protect lakes, rivers, estuaries, and wetlands. Using too much groundwater for consumptive uses can result in negative impacts, such as drying out wetlands, reducing spring flows, lowering lake levels, and degrading groundwater quality from saltwater intrusion.

The challenge of maintaining a balance in the water withdrawals for consumptive use and minimum flows are driving increased interest in expansion of the use of reclaimed water. As a result, Senate Bill (SB) 536 Study, SB 536, which passed in the 2014 legislative session, requires the following: "Florida Department of Environmental Protection (FDEP), in coordination with stakeholders, shall conduct a comprehensive study and submit a report on the expansion of use of reclaimed water, stormwater, and excess surface water in this state."

The capacity of reclaimed water is certainly available to meet this objective; however, a review of the state inventory of reuse over the last three decades shows that reuse flows and ratios have leveled off since about 2007, as shown in Figure 1. While there are a number of reasons that this has occurred, one of the reasons may include the limitations associated with the capacities of existing purple pipe systems and the seasonal fluctuations in demand for nonpotable uses of reclaimed water.

Regulatory Considerations

To increase the use rates of reclaimed water in the state, potable reuse may be one of the most important means of meeting FDEP goals of increasing use of reclaimed water in the state. It is important to note that relevant sections of Chapter 62-610, including "Part V - Groundwater Recharge and Indirect Potable Reuse," provides the requirements for both groundwater recharge that results in potable water use, as well as indirect potable reuse (IPR), which covers surface water augmentation using reclaimed water for drinking water and other uses. Although direct potable reuse (DPR)—that is, potable reuse without an environmental buffer—is not currently an accepted practice in Florida, it is worth evaluating the national trends in considering this practice. Currently, DPR is being implemented in Texas in response to a long-term drought and is being considered as an alternative for long-term planning in California, North Carolina, New Mexico, Oklahoma, Georgia, and other states. With the implementation of the Big Spring and Wichita Falls DPR projects in Texas, the U.S. Environmental Protection Agency (EPA) has initiated a project to provide documentation of the state of the industry with respect to potable reuse in the United States.

The state of the potable reuse industry document will ultimately serve as a supplement to the 2012 EPA "Guidelines for Water Reuse." The EPA approaches water reuse by facilitating knowledge transfer, and therefore, the intended purpose of the supplement is not to promote potable reuse, but rather to outline current approaches and methods used in the U.S. There are numerous useful research reports on potable reuse; however the conclusions have not been summarized prior to this document, which strives to compile the necessary technical and policy information in a single location in order to furnish an understanding of the subject matter, and to assist planners and decision makers on key strategies to employ when considering potable reuse in their community. The target audience for this supplement is equivalent to that for the 2012 guidelines—policy makers,

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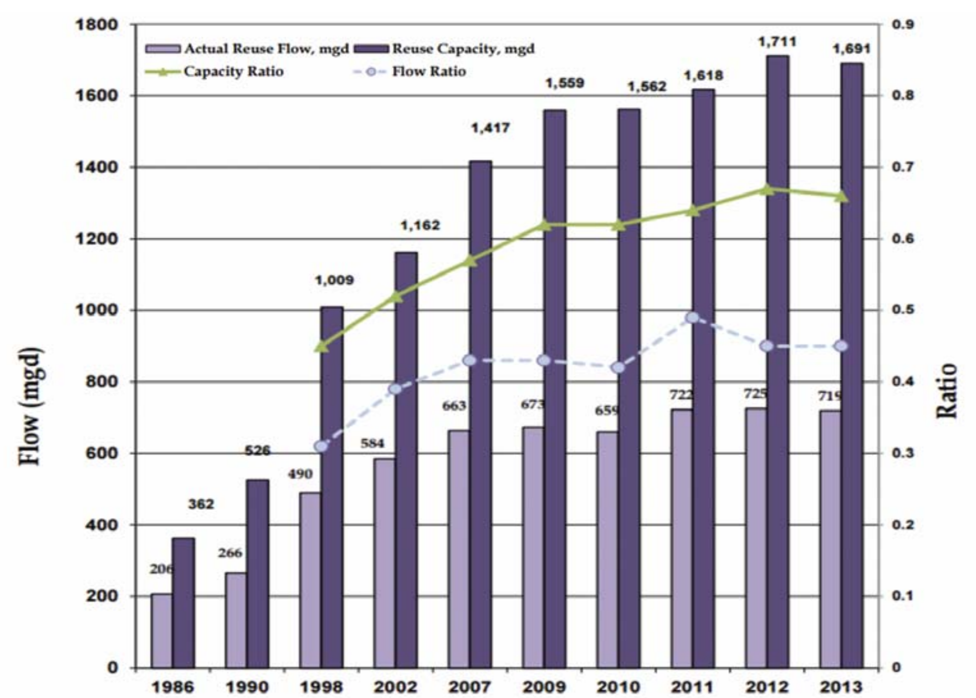

Figure 1. Reuse Rates in Florida *(Reproduced from the 2013 Reuse Inventory; FDEP, 2014 http://www.dep.state.fl.us/water/reuse/docs/inventory/2013_reuse-report.pdf, accessed 3/20/15).*

legislators, water planners, and water reuse practitioners, including utility staff, engineers, consultants, and the general public.

Being developed under a Cooperative Research and Development Agreement (CRADA), the document is intended to have relevance across the spectrum of geographies in the U.S., with specific experiences being drawn from case studies on existing DPR approaches in the country. The document will include discussions on potable reuse drivers, regulation of potable reuse in the U.S., relevant treatment technologies, complete treatment trains, source control, environmental and engineered buffers, process operations, risk analysis and multibarrier protection, life cycle costs and alternatives analysis, public acceptance tools, potable reuse case studies, and research and knowledge gaps. The EPA will provide review of the contributions from external experts, to ensure that the document development is consistent with the current federal regulatory framework so that it is technically robust and broadly acceptable to EPA, other members of the regulatory community, and end users.

Thus, while the U.S. currently has no specific federal regulations governing potable reuse, outside of the Clean Water Act and the Safe Drinking Water Act that provide a framework under which *de facto* reuse is practiced, there are states, including Florida, that have IPR rules, and many states are reconsidering the need for DPR guidance. To address this regulatory gap, the WateReuse Research Foundation and the National Water Research Institute (NWRI) funded development of a "Report of an NWRI Expert Panel for Developing a Direct Potable Reuse Framework," which is aimed at supporting decision makers in understanding the role DPR projects can play in providing a new raw water source for drinking water. Additionally, the American Water Works Association (AWWA), Water Environment Federation (WEF), and National Research Council (NRC) have recently revised their water reuse policy statements to include recognition of IPR/DPR to supplement the nation's water supply (NRC, 2012). The AWWA has also recently released a new reclaimed water management standard, and although this document recognizes DPR, the standard does not include management of DPR projects.

Treatment Requirements and Cost Implications

As national trends indicate a growing interest in sustainable water supply solutions, there will be a need to leverage advances in the science and engineering of water treatment, such that broader application of potable reuse practices can be applied. Utilities in the U.S. that are already implementing DPR rely on a full advanced treatment (FAT) model, similar to the treatment train that has been the standard for planned IPR in California. The FAT model leverages advanced treatment technologies that are linked together, including microfiltration (MF), reverse osmosis (RO), ultraviolet (UV) light disinfection, and advanced oxidation (AOP) to form a multibarrier treatment process. While this model has been proven for producing source water quality suitable for both IPR and DPR, it has a high capital cost and is energy intensive, particularly where RO concentrate disposal is complicated and expensive.

When total dissolved solids reduction is not necessary from the source water, there may be alternative treatment processes, such as ozone-biological activate carbon (BAC), following advanced wastewater treatment that can achieve high quality for drinking water supplies. Thus, it is important to utilize research at full-scale planned IPR facilities to advance the understanding of alternative treatment processes that may have cost advantages to the traditionally accepted treatment model.

To protect public health and provide safety in any DPR scenario, monitoring and process validation approaches must strive to manage risks by early identification of failures with appropriate responses. Ongoing research is being conducted with criteria that are protective of public health for DPR treatment technologies. Researchers are also studying proposed locations within a treatment scheme where contaminant criteria and aesthetic criteria should ultimately be met, along with final contaminant criteria that must be achieved before blending with another water source.

Conceptual criteria for these purposes are that water is: 1) free of pathogens, and 2) free of toxic chemicals. In traditional drinking water treatment systems, multiple treatment barriers have historically formed the cornerstone for safe drinking water, and water agencies rely upon advanced treatment processes to remove "all" contaminants; however, this is partially presumptive and could lead to overtreatment of water. As previously described, the FAT model is currently the most common process train used to improve water quality of recycled water potable reuse. Thus, the industry is looking for more cost-efficient means of implementing potable reuse, particularly where total dissolved solids do not require implementation of RO membranes.

When a combination of filtration, ozonation, and BAC is implemented, following advanced wastewater treatment that provides nutrient removal, it is likely that this objective could be achieved. The ozone-BAC model would have substantially reduced costs compared to the FAT model; additionally, there is no resulting RO concentrate. A recent feasibility evaluation that was conducted for a 10-mil-gal-per-day (mgd) facility, not needing dissolved solids removal to meet secondary drinking water standards, showed that there is a significant cost savings in both capital and operating costs for use of ozone-BAC, compared to the traditional FAT model (Table 1).

Considering that many inland facilities would need to address concentrate by means other than disposal through ocean outfalls, additional costs associated with disposal could result in FAT process capital costs that are five to seven times greater than for ozone-BAC. If ozone-BAC can be proven to produce source water quality that is equivalent to alternative

Continued on page 50

Table 1. Capital and Operation and Maintenance Cost Summary for FAT and Ozone-BAC to Produce Source Water Using Effluent From an Advanced Wastewater Treatment Facility

Process	Capital Cost for 10 MGD Facility	O&M Cost ($/1000 gal)
Total FAT Cost, including concentrate evaporators	$126 - 136M ($34M for evaporators)	$5.10 – 8.10
Total Ozone-BAC Cost, including post-BAC ozonation	$19 -32M	$1.00 – 2.50

Continued from page 49

water supplies, it could provide the scientific comparison necessary to: 1) inform regulatory processes, and 2) provide an alternative treatment train to the FAT process, enabling implementation of DPR at inland locations struggling with water supply issues. This information is critical for utilities that are seeking to identify new, cost-effective means of providing alternative water supplies as part of a portfolio of water resources to protect against changing climate and drought conditions.

Summary

With national trends that indicate a growing interest in providing sustainable water supply solutions through broader application of potable reuse, there is important information needed from both a regulatory and a cost perspective. There are already utilities in the U.S. that have implemented DPR, and many others that are evaluating how this practice fits into a diversified water supply portfolio. And, while much of the technical information that is needed to support development of a potable reuse guidance document is already developed, the challenge is that much of the necessary information to support DPR is not in a format that is readily accessible to local regulatory authorities.

In response to the technical gap in federal regulations or guidelines for DPR, as previously noted, national industry groups are collaborating to develop a framework that could be used to approach guidelines for DPR. Supplemental information on potable reuse practices from EPA will help inform these efforts and provide a means of supporting local regulatory authorities that are responsible for development of rules or guidelines that are protective of human health. Finally, alternative treatment options that are less capital- and energy-intensive than the current model are critical to putting potable reuse within reach of utilities that are in great need of new water supplies.

References

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