Potable Water Reuse Report

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The Factors Shaping DPR Regulations in the United States

Key Takeaways:

- DPR regulations are being developed on a state-by-state basis in the U.S.
- Between states, there is significant variability in the individual requirements that make up the regulations
- Despite this variability, there is general consistency in the requirements for public health (i.e., pathogen and chemical control)
- The variability in DPR regulations is often influenced by non-public health factors including:
  - **Scale of implementation**: finding the appropriate balance between cost and conservatism in DPR requirements may be impacted by the scale at which DPR will be implemented
  - **Environmental discharge**: restrictions on discharge may impact the type of treatment required (reverse osmosis vs. carbon-based)
  - **Statutory scope**: states with greater statutory scope have more flexibility to include requirements for contaminants beyond those specified in the Safe Drinking Water Act and Clean Water Act
  - **Political climate**: political support can influence whether regulations are developed, the speed of development, the funds available for research addressing knowledge gaps, and the resources available to develop, implement, and enforce the regulations

Introduction

In the absence of a federal regulation for direct potable reuse (DPR), U.S. states are developing their own regulations with Colorado and California leading the way as the first two states to create and adopt regulations. A survey of DPR regulations that have been adopted or proposed nationwide can be insightful for states seeking to develop their own regulations. This survey, however, would immediately shed light on the fact that these regulations are in fact quite different. If the primary goal of DPR is public health protection, how are states ending up with such diversity in their regulations? A deeper analysis of DPR regulations nationwide shows broad similarity in the requirements for control of the two main public health threats: pathogens and chemicals. If the *public health* requirements are not responsible for the diversity in DPR regulations, then diversity must stem from elements *beyond* the public health sphere.

To understand the diversity in DPR requirements, **we interviewed stakeholders from several states** (Figure 1) that are interested in DPR to understand what factors shaped the development of their regulations or guidance. Four location-specific factors emerged: (1) scale of implementation, (2) environmental discharge restrictions, (3) statutory scope, and (4) political climate. These four factors – which exist outside of the public health sphere – play an important role in determining the strictness, expansiveness, and speed of regulatory development. This issue of the Potable Water Reuse Report focuses on these location-specific factors to help prospective reuse stakeholders tailor the development of their own DPR requirements.

1. Scale of Implementation

The *scale* at which DPR will be implemented in each state varies significantly and can impact how stakeholders think about regulatory requirements. While all states we interviewed confirmed the criticality of potable reuse for their future water supplies, most interviewees predicted that potable reuse might be a relatively small (<10%) contributor to their overall portfolios. In Florida, where groundwater provides approximately 95% of the water supply, potable reuse may only play a 5-10% role in the near-term, according to Bart Weiss from Hillsborough County Public Utilities. In El Paso, Texas – where the next full-scale DPR facility in the U.S. is anticipated to start up

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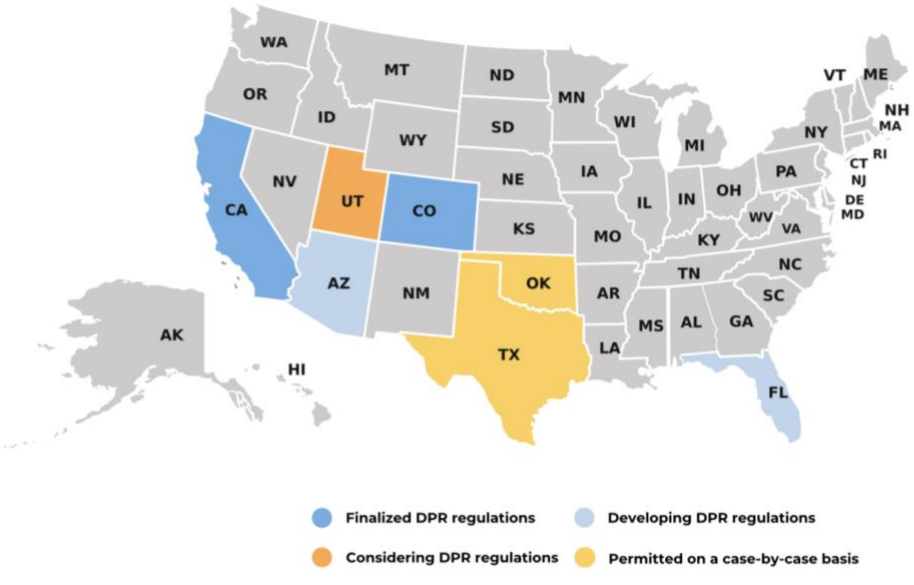

Stakeholders Interviewed for this Issue:

Arizona - Karthik Kumarasamy
Principal Engineer
Water Quality Division
Arizona Department of Environmental Quality

California - Darrin Polhemus
Deputy Director
Division of Drinking Water
California State Water Resources Control Board

Colorado - Tyson Ingels
Lead Drinking Water Engineer
Water Quality Control Division
Colorado Department of Public Health & Environment

Florida - Bart Weiss
Chief Officer for Innovation and Resiliency
Hillsborough County Public Utilities

Florida - Lynn Spivey
Director of Utilities
City of Plant City

Oklahoma - Shellie Chard
Director
Water Quality Division
Oklahoma Department of Environmental Quality

Texas - Gilbert Trejo
VP – Engineering, Operations and Technical Services
El Paso Water

Utah - Dani Zebelean
Environmental Engineer
Division of Drinking Water
Utah Department of Environmental Quality

Figure 1: Progress of direct potable reuse regulations in states interviewed for this issue.

– potable reuse will represent approximately 5% of their overall supply, according to Gilbert Trejo, Vice President at El Paso Water. In Oklahoma, the cities with the most urgent need for water supplies are frequently those with populations of 2,000 people or less, according to Shellie Chard, the Water Quality Division Director at the Oklahoma Department of Environmental Quality.

On the other end of the spectrum, California is anticipating that potable reuse projects will provide 50% or more of the water supply for its largest metropolitan areas including San Diego and Los Angeles. Arizona is also planning for reuse in many of its largest cities (e.g., Phoenix and Scottsdale), but small cities (e.g., Cottonwood) with less than 1 million gallons per day (MGD) demand have also expressed interest. Nationwide, the scale of potential DPR implementation covers the full range – from large metropolises to small towns – where reuse may represent either a minor fraction or a majority of the water supply.

Diversity between states in the scale of DPR implementation tends to drive diversity in DPR regulatory requirements. Regulations rely on a variety of "barriers" to protect public health and ensure reliability. Barriers are most often equated with "treatment" but also include non-treatment "management" barriers, such as staffing, monitoring, wastewater source control, and operator certification requirements. How states are using these barriers and which ones they are leveraging tend to vary based on the anticipated scale of DPR implementation.

In California – a state where potable reuse will make up a large portion of the water supply – nearly every barrier that increases the reliability of public health protection was leveraged with greater stringency for DPR: treatment train requirements, wastewater source control, staffing and operator certification, technical/managerial/financial capacity, and the scope and frequency of contaminant monitoring. In addition to requiring a robust treatment train that includes ozone, biologically activated carbon, reverse osmosis (RO) and UV-advanced oxidation process (AOP), the pathogen log reduction targets (LRTs) are perhaps the most emblematic of California's overall DPR approach. According to Darrin Polhemus, Deputy Director of California's Division of Drinking Water, California modified its risk assessment approach for calculating DPR LRTs by conservatively selecting reference pathogens, their concentrations in wastewater, and the dose-response functions describing their likelihood to result in infections. This contributed to the development of the highest minimum levels of virus (16-log) and *Cryptosporidium* (11-log) control to date. California also requires an additional 4-log redundancy above the minimum values resulting in overall LRTs of 20/14/15 for enteric virus, *Giardia*, and *Cryptosporidium*, respectively.

Polhemus shared that the scale of implementation played an important role in how California approached the development of the regulation. The possibility of a failure threatening public health and breaking public trust was a risk they did not want to take:

> "There's no way I want to look back after our municipalities pursuing [DPR] have invested tens of billions of dollars to have public opinion make them shut it off. That would be the worst thing."

Consequently, California augmented many of the barriers available to them in DPR – both treatment and non-treatment – to minimize the probability and impact of failures.

Many states planning smaller scales of implementation expressed concern that high degrees of conservatism and redundancy would put reuse out of reach for their communities, some of whom have limited options besides reuse. Bart Weiss voiced that:

> "…we're going to end up with a rule that's so draconian that everybody says, 'Well, I'd like to do it, but I can't afford it!'"

Similarly, Karthik Kumarasamy from the Arizona Department of Environmental Quality had concerns about project costs saying:

> "We're still figuring out what are the right pre-requisites so that we protect public health but make sure that the technology is affordable to all communities."

Dani Zebelean from the Utah Department of Environmental Quality confirmed that they were leveraging the regulations and guidance from Colorado, Arizona, and Texas – in lieu of California – because they did not want to make implementation unreachable. Oklahoma is also grappling with how to structure reuse requirements that can accommodate small towns, particularly those who may be only months away from losing access to historical water supplies, said Shellie Chard.

These perspectives illustrate how the scale of implementation is impacting the shape of regulations. In general, states with smaller scales of implementation or those with small communities interested in reuse tend to omit the layers of conservatism and redundancy that were added by states with larger scales. In this light, states who are considering DPR regulations may consider reflecting on their own scale of implementation and the appropriate balance between cost and conservatism.

Agreement on California's Conservative LRTs?

While also using risk-based approaches, other states are proposing *not* to follow California's level of stringency for pathogen LRTs in DPR. According to Lynn Spivey, the Director of Utilities at The City of Plant City, Florida, stakeholders in Florida compared California's 20/14/15 against the industry "standard" of 12/10/10. After evaluating the performance of reuse systems across Florida, they concluded that they would *not* propose extending the pathogen requirements to 20/14/15 but may extend beyond 12/10/10. Arizona independently evaluated LRTs using two new pathogen datasets – both a local dataset and one developed in California – and found that both approaches led them to a requirement of 13/10/10. Regulatory development remains ongoing in both states.

2. Environmental Discharge Considerations

Typically, the protection of public health and the protection of the environment are viewed as two independent objectives. In potable reuse, however, these two goals may be inextricably linked: projects are often driven and/or constrained by environmental considerations.

One of the most common examples of this is when **regulatory restrictions** *prohibit* the discharge of wastewater effluents into the environment for ecological reasons. Florida, which is experiencing widespread issues with blue-green algae, red tides, and eutrophication of its lakes and surface waters, passed Senate Bill 64 that prohibits the non-beneficial discharge of effluents into surface waters (including ocean discharges) by 2032. This environmental discharge restriction is providing additional motivation to develop potable reuse regulations, which would offer Floridians an additional strategy for beneficially reusing the water. Without a potable reuse option, agencies would likely dispose of their non-beneficial discharges through deep well injection. This practice can be technically challenging and costly while also eliminating the possibility of reusing the water. Lynn Spivey noted that brackish water desalination plants in Florida currently inject their RO concentrate into deep wells, but that stakeholders were doubtful that this was a sustainable strategy for all non-beneficial discharges.

Florida's legislation will also impact the disposal of waste streams that are produced from the advanced water treatment facilities required for potable reuse. The

Discharge Restrictions on the Horizon

Similar legislation that would eliminate the discharge of treated wastewater into the environment has been proposed in California (Senate Bill 332 "Hertzberg/Wiener Bill"), though these bills have yet to pass – in part due to opposition from the reuse industry to ensure provisions for RO concentrate discharge are included.

feasibility of disposing of waste streams – such as RO concentrate – may influence the selection of treatment processes on a project-by-project basis. Florida's draft potable reuse regulations do not specify the types of advanced treatment that are required, but allow projects to pursue an array of technologies, including both RO-based and carbon-based advanced treatment (CBAT).

In other locations in the U.S., there may be **environmental and legal requirements** to *return* wastewater effluents into the environment. This is the case in Colorado, a headwater state whose streams and rivers feed several downstream states in the U.S., and in El Paso, who is required to ensure minimum flows to the Rio Grande. In such cases, the quantity of water available for reuse may be restricted.

Independent of legal restrictions, the geographical environment of many states also impacts their disposal options. Landlocked cities in states like Colorado, Arizona, and Texas may have no options for the disposal of RO concentrate streams beyond evaporation ponds and deep well injection, both of which may be technically and/or economically infeasible.

Environmental discharge considerations typically have the biggest impact on treatment requirements for DPR – and specifically, whether the use of RO is mandated. Many states (including Florida, Colorado, Arizona, and Utah) are providing flexibility for – but do not require – the use of RO. In these locations, environmental discharge constraints will likely lead to more widespread use of CBAT trains. It should be noted that this does not necessarily equate to less public health protection. Tyson Ingels of the Colorado Department of Public Health and Environment noted that rigorous testing of CBAT trains through the Pure Water Colorado demonstration project provided regulators with confidence that such trains could provide adequate protection against both pathogens and chemicals.

Dealing with Salts in Landlocked States

Several states mentioned that some projects will require RO for salt control. Notable examples of RO-based treatment trains in states with discharge restrictions include projects in El Paso, Texas; Scottsdale, Arizona; and Salt Lake County, Utah. Even though many states have salinity discharge restrictions, to ensure feedwaters to potable reuse systems are not too high in salts (i.e., above the MCL for TDS), projects may have to move forward with RO. In such cases, there is clear need for regulatory flexibility to incorporate RO into the DPR treatment trains, rather than uniformly prohibiting its use.

3. Statutory Scope

The latitude that state regulators have to prescribe potable reuse requirements varies based on their statutory scope. Many state statutes require regulators to ensure the "safety" of drinking water supplies. Colorado's Primary Drinking Water Regulations require assurance of "the safety of public drinking water supplies" and Texas's Administrative Code requires public water systems to "supply safe drinking water in adequate quantities." What is "safe" is frequently interpreted to be water that is compliant with the federal Safe Drinking Water Act (SDWA). California's Safe Drinking Water Act, on the other hand, grants broader power to ensure that water also be "pure" and "wholesome," in addition to being "safe to drink." By including requirements for both the *purity* and *wholesomeness* of the water, California regulators have greater flexibility to extend requirements beyond those required only for *safety*.

One practical outcome of California's broader statutory scope is the ability to require monitoring of contaminants *beyond* those regulated by the federal SDWA (i.e., chemicals with maximum contaminant limits, or MCLs). Many contaminants with MCLs are determined based on their occurrence and concentration *in conventional supplies* (i.e., groundwaters and surface waters), but many regulators and industry experts agree that this is not representative of the breadth of chemicals potentially present in wastewater. Furthermore, many secondary treated wastewater effluents meet most of the MCLs, while not being of potable quality. Thus, many industry experts endorse an approach that includes monitoring and control of a larger suite of chemicals of emerging concern (CECs) for potable reuse beyond only the regulated MCLs.

While California's statutory scope provides a pathway to expand monitoring to include CECs, regulators in other states may experience more resistance. In Arizona, there was pushback on the inclusion of CECs in the draft DPR regulation from the utilities, who questioned the need to go beyond the SDWA. Karthik Kumarasamy stated that regulations are primarily being shaped to comply with federal SDWA requirements, but some CEC monitoring beyond the SDWA will be required as well. Tyson Ingels

similarly echoed that it was more difficult to include CECs in Colorado's DPR regulation than it would be for California given their different statutory scope:

> "We knew we needed to right-size [the DPR regulations] for our state and what utilities could reasonably implement under our regulatory structure that was still very protective of public health."

Ultimately, Colorado's regulations include comprehensive chemical reduction requirements focused on ensuring the effectiveness of treatment barriers (i.e., critical control point monitoring) to provide protection against chemicals.

An additional statutory issue that impacted multiple states was bridging the historical separation between drinking water and wastewater jurisdictions. Dani Zebelean highlighted that the agencies having primacy over the SDWA and the Clean Water Act (CWA) in Utah have historically been bifurcated. DPR would require novel partnerships between these regulatory groups. One example of this arose in California with regard to wastewater source control, which has historically been overseen by regulators enforcing the CWA. California's drinking water regulators requested a change in statutory scope to give them authority over wastewater source control in DPR settings, which would allow them to implement enforcement actions against violating dischargers. To date, this issue remains unresolved. A final case study is Oklahoma, where the existing drinking and wastewater regulations do not *prohibit* DPR. Agencies interested in pursuing DPR need to comply with the SDWA and CWA, while also meeting the reuse-specific treatment requirements specified in their construction standards.

4. Political Climate

Political support for or against reuse can impact all aspects of regulatory development including *whether* regulations are developed, *how* they are shaped, and *what* resources are available to develop, implement, and enforce them. In Colorado, support for potable reuse from Governor Hickenlooper's administration and the Colorado Water Conservation Board was an important springboard to DPR regulatory development in the mid-2010s. Coupling the 2015 Colorado Water Plan with the success of early potable reuse projects by Aurora Water and Castle Rock allowed Colorado to build and maintain *momentum* that ultimately led to the development of the nation's first DPR regulations in November 2022. Arizona has similarly leveraged political momentum for potable reuse, which began with grassroots support from utilities and grew to include support from Governors Ducey and Hobbs. Arizona is currently in the rulemaking process with plans to finalize in 2024. California passed legislation – sponsored by the reuse industry – requiring DPR regulatory development, but support from the mayors of California's largest cities and Governor Newsom provided widespread backing that propelled the state to finalize regulations in 2023.

In many cases, political support also translated into the availability of resources for regulatory development. Research funding is particularly important for areas with little to no potable reuse experience since it may be one of the only ways to fill knowledge gaps. **Regulators in Colorado, Arizona, Florida, and California all cited research as a critical element for their regulatory development.** In discussing the benefits of the multi-million-dollar DPR research effort in California, Darrin Polhemus stated:

> "Research made it possible for us to proceed. The work gave us confidence. We were able to clearly see that we could go all the way to DPR."

Funding also allowed engagement with two Expert Panels that gave regulators advice, grounding, and confidence in their requirements. Tyson Ingels also highlighted the importance of research in Colorado noting the criticality of efforts overseen by the National Water Research Institute in 2018 and the Pure Water Colorado demonstration project. Similarly, Arizona is conducting nine research and literature review projects to address knowledge gaps, develop guidance documents, and collect data. Many states – including Arizona and California – are also developing their own operator certification program specifically for reuse. The funding for these efforts is often dictated by the degree of political support for potable reuse. As new states move forward with DPR regulations, one useful lesson from the past is to seek out and educate advocates in the political sphere who can help build support for reuse.

Like many things, however, political support is often transient and may change from state to state and within the same state over time. For example, Bart Weiss noted that several regulatory staff members have left the Florida Department of Environmental Protection during recent administrative cycles. This has resulted in a loss of institutional knowledge at a time when an understanding of Florida's past reuse experience would be highly valuable. Both Bart Weiss and Lynn Spivey noted that in recognition of this, the Florida Department of Environmental Protection has dedicated consistent staff members to completing the rulemaking process. Dani Zebelean also noted that the amount of regulatory staffing needed to develop, implement, and enforce DPR

regulations would need to improve if they were to move forward with DPR regulations in Utah. Oklahoma's regulatory climate is also more challenging given that any new regulation must be accompanied by the removal of an existing regulation.

Summary

This national survey of DPR regulations – including those adopted, proposed, and in development – provides evidence that water reuse is not and will likely never be a one-size-fits-all endeavor. While regulations are largely shaped by public health concerns (i.e., control of pathogens and chemicals), this issue shows how elements outside of the public health sphere *also* shape the requirements (Figure 2). The impact of four key elements – scale of implementation, environmental discharge, statutory scope, and political climate – on DPR requirements provides an important perspective as states look to develop their own DPR regulations. Ideally, this discussion can serve as a guide to help stakeholders understand what the key issues are, their impact on specific DPR requirements, and how to tune them to account for each state's specific constraints.

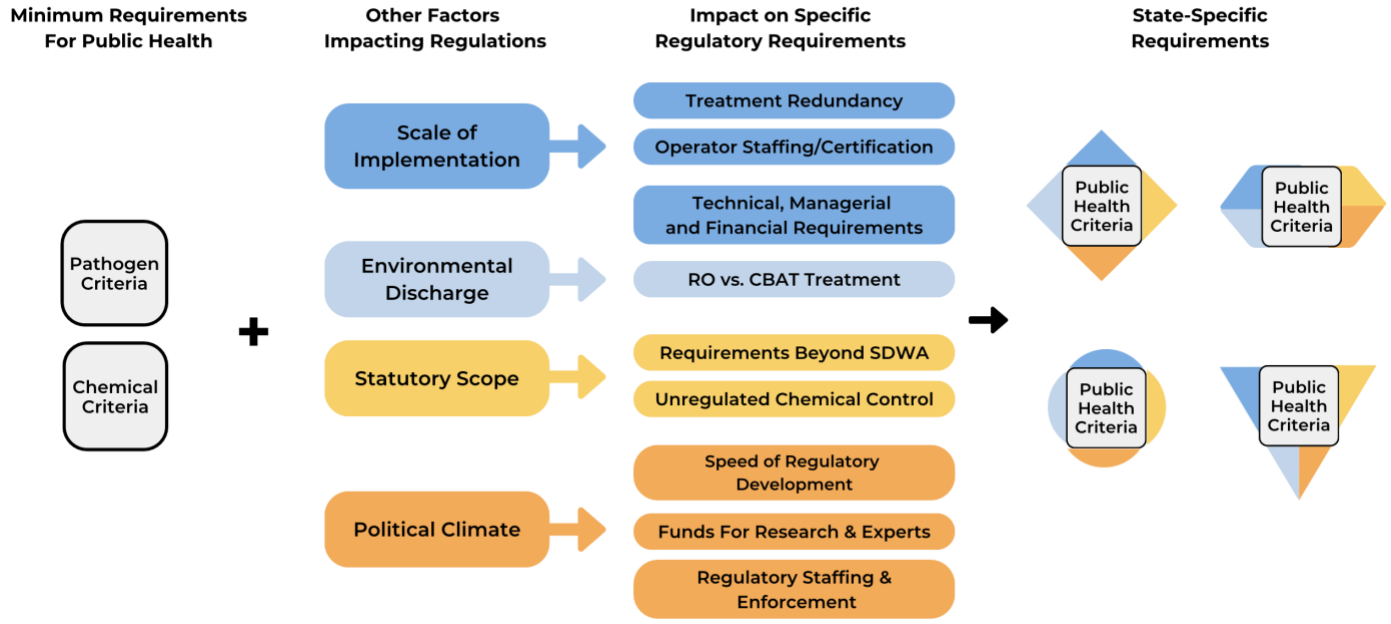

Figure 2: Despite similar requirements for public health protection, state regulations are impacted by several factors beyond public health. These factors lead to a diversity of requirements that ultimately contribute to the unique shape of each state's regulations.

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