

Putting DPR Rules Into Context: Regulatory Developments Across the United States

Eva Steinle-Darling, PhD, PE
Carollo Engineers, Inc., USA
Email: esd@carollo.com

ABSTRACT

The United States has a long history of successful water reclamation driven by a combination of effluent diversion and water supply scarcity. Both drivers have more recently resulted in a number of states working to develop regulations for direct potable reuse (DPR). Many stakeholders in these states and elsewhere will find themselves asking: What is the basis and rationale behind various parts of my state's approach to DPR?

While the authors claim no prescience with regard to regulator intent in drafting their respective DPR rules, all regulatory progress is incremental and builds on prior work. Thus, the basis of much of the current draft rules can be found in various forms of prior guidance or regulations. This presentation will walk through guidance developed by Carollo and others through the progression of stakeholder processes in various US states that have gotten us to this point. We'll start with the 2015 National Water Research Foundation (NWRI) "Framework for Direct Potable Reuse" and discuss how the major topics in that framework have evolved through various phases of regulatory development. Starting with the overarching public health and regulatory priorities that are consistent across all US-based guidance to-date, we'll define the key components of a sustainable DPR program, and how those have evolved since the 2015 NWRI Framework

KEYWORDS

Direct potable reuse (DPR), regulations, rules, log removal value (LRV), constituents of emerging concern (CECs)

INTRODUCTION | BACKGROUND

The United States has a long history of successful water reclamation driven by a combination of effluent diversion and water supply scarcity. Both drivers have more recently resulted in a number of states working to develop regulations for direct potable reuse (DPR). Active regulatory processes include: (1) Texas, where DPR has been implemented in the absence of rules since 2013, and the 2021 state legislature passed a bill requiring its regulators to develop guidelines that will make DPR permitting more transparent; (2) California, which has just released its proposed DPR rules for public comment; (3) Florida, where the stakeholder-driven Potable Reuse Commission guidance is now helping shape a series of draft DPR regulations published by the FDEP, (4) Colorado, where state regulators are currently holding stakeholder workshops to help draft the language for future DPR rules, and (5) Arizona, where stakeholder-driven guidance and rulemaking recommendations were delivered to state regulators, who are now gearing up to draft regulations of their own. Examples of these documents are shown in Figure 1. All of these efforts are also ongoing within the little-known context of DPR being allowed and regulated in two other US states: Ohio (since 2015) and North Carolina (since 2014).



Figure 1. States have taken different approaches to DPR

Many stakeholders in these states and elsewhere will find themselves asking: What is the basis and rationale behind various parts of my state's approach to DPR?

METHODOLOGY

Regulatory approaches being used or contemplated for regulation of DPR discussed in this paper are summarized from available literature and observed active participation in stakeholder workshops from 2018 through early 2022.

RESULTS | DISCUSSION

While the authors claim no prescience with regard to regulator intent in drafting their respective DPR rules, all regulatory progress is incremental and builds on prior work. Thus, the basis of much of the current draft rules can be found in various forms of prior guidance or regulations.

While significant research and engineering on potable reuse, including DPR, has been ongoing for some time, the seminal starting point in the regulatory literature is the “Framework for Direct Potable Reuse” (WateReuse, 2015). This document summarized the literature to date and developed a list of important topics that must be addressed for DPR, including obvious concepts around (1) water quality goals, (2) advanced treatment and monitoring requirements, and (3) the importance of public outreach. This framework also established the importance of other DPR program elements that were less obvious at the time, such (4) evaluating a utility’s technical, managerial, and financial (TMF) capacity to develop a DPR program, (5) pursuing interagency cooperation and (6) the importance of “managerial barriers” such as enhanced source control, to supplement treatment.

Establishing Log Removal Value (LRV) Requirements for Pathogens

The 2015 DPR Framework, building on the literature and regulatory approaches at the time, documented the now generally accepted (in the U.S.) risk-based water quality goal with respect to pathogens as achieving a less than 1 in 10,000 (or 10^{-4}) annual risk of infection from waterborne pathogens such as enteric virus, protozoa, and bacteria. This water quality target is shown conceptually in Figure 2 as the blue circle towards the high-quality (right-hand) end of the spectrum of water quality and represents the minimum acceptable microbial water quality produced by DPR.

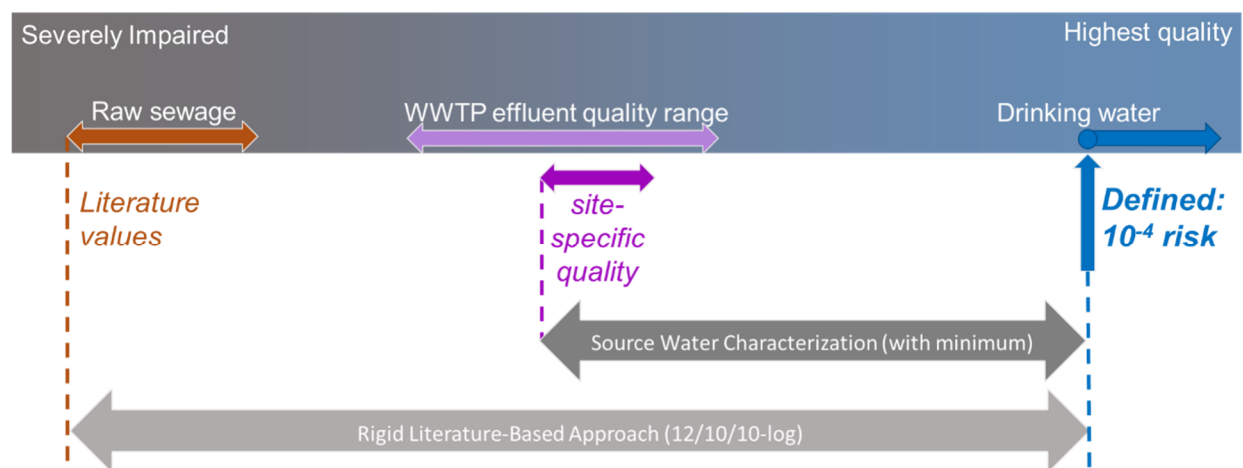


Figure 2. Defining disinfection requirements

In order to establish a disinfection requirement, one must understand both the starting point (source water concentrations) and end point (risk goal); the disinfection requirement is then simply calculated as the gap between these two points. Figure 2 illustrates that while defining disinfection requirements generally starts with the 1 in 10,000 risk *end goal*, there are two main approaches used by states to define the starting point of the analysis, and thus, by difference, the total disinfection (or LRV) requirements for DPR projects.

These two approaches are distinct from one another in two specific ways: One approach uses worst-case pathogen concentrations in raw sewage, pulled from the literature to define a rigid LRV goal that is applied to all projects. This results in a large LRV requirement, shown in the light gray arrow in Figure 2 as 12/10/10-log for virus, *Giardia*, and *Cryptosporidium*. The other approach requires an in-depth characterization of treated wastewater effluent to establish a range of site-specific water quality. This results in the establishment of a smaller LRV goal,

shown in the darker gray arrow on Figure 1. This second approach results in a smaller LRV goal, but also does not allow for any disinfection credit upstream of the effluent characterization point.

Ultimately, it is important to remember that microbial water quality end goals upon which both approaches are constructed are the same.

States also vary significantly in their approaches to unit process validations and how much disinfection credit can be obtained but all include significant safety factors which contribute to reducing the overall public health risk to well below the goals.

Goals for Chemical Removals

The goals and treatment requirements for chemical removals vary more greatly across the states, but do agree on a few basic principles:

1. DPR requires a multi-barrier approach that addresses chemical constituents through multiple modes of action, such as chemical oxidation, physical separation, biological degradation, or UV photolysis.
2. Standards for chemicals regulated in conventionally sourced drinking water must be met for DPR.
3. States at least *recommend* monitoring for unregulated chemicals (and unregulated pathogens)

States differ in their approaches to managing risks associated with otherwise unregulated chemicals, including with respect to monitoring requirements, the establishment of guidelines or enforceable standards that do not otherwise apply to drinking water, and the extent to which they prescribe specific treatment approaches (and process sizing) in order to address the potential presence of unknown chemicals.

REFERENCES

- WateReuse Research Foundation (WateReuse), 2015. *A Framework for Direct Potable Reuse*, Report for WateReuse Research Foundation Project No. 14-20, Co-sponsored by the American Water Works Association, The Water Environment Federation, and the National Water Research Institute. ISBN: 978-1-941242-30-8.
- WateReuse Colorado / Carollo, 2018. Advancing Direct Potable Reuse to Optimize Water Supplies and Meet Future Demands Project Technical Memorandum No.1 “Development of DPR Regulations in Colorado.”
- National Water Research Institute, 2018. Guidance Framework for Direct Potable Reuse in Arizona. Report prepared for WateReuse Arizona, AZ Water Association, and the Steering Committee for Arizona Potable Reuse.
- WateReuse Association, 2020. Framework for the Implementation of Potable Reuse in Florida. Report prepared for the Florida Potable Reuse Commission in collaboration with WateReuse Florida, Florida Section of the American Water Works Association Water Utility Council, Florida Water Environment Association Utility Council, and Water Research Foundation.