Public Comments
Report to the Legislature on DPR
Deadline:10/25/16 12:00 noon

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SWRCB Clerk

Jeanine Townsend
Clerk to the Board
State Water Resources Control Board
1001 I Street, 24th Floor
Sacramento, CA 95814

Subject: Comment Letter - Report to the Legislature on DPR

Dear Ms. Townsend:

Carollo Engineers, in partnership with Ventura Water, appreciates the opportunity to provide comments to the State Water Resources Control Board (SWRCB) on the Draft Report titled "Investigating the Feasibility of Developing Uniform Water Recycling Criteria for Direct Potable Reuse," which was submitted to the Legislature by the Division of Drinking Water (DDW) on September 8, 2016. Carollo Engineers has been leading potable reuse projects for nearly two decades, including providing engineering planning, design, and/or construction management support to close to twenty different water utilities in California seeking to augment their water supply portfolios through potable reuse. Carollo Engineers has also been working with the WateReuse Research Foundation and Water Research Foundation to fill knowledge gaps to advance indirect (IPR) and direct potable reuse (DPR) as viable water supply alternatives. Carollo has also completed the extensive 2-year water quality analysis of the only DPR system in the United States at Big Spring Texas. Given our engagement and experience on IPR and DPR, our focus in providing comments on the Draft Report is twofold:

1. To illustrate through examples of potential DPR projects that uniform water recycling criteria can be developed for a range of different DPR applications. By providing these examples, we highlight a uniform public health approach that would allow the State to approve and regulate DPR projects that are currently under evaluation.
2. To comment on several specific components of the Draft Report that we believe warrant clarity and/or revision in the final report.

The Draft Report highlights three possible types of DPR projects:

1. "A project delivering recycled water to a surface water reservoir, with the reservoir providing some benefits, but without an extensive storage time within the surface water reservoir;
2. A project delivering recycled water directly to a surface water treatment plant or a surface water reservoir, with the reservoir providing no benefits; and
3. A project delivering finished water to a public water system's distribution system."

By definition, these projects would not have the minimum percent blending and/or detention time specified in the criteria for groundwater replenishment or expected to be in the criteria for IPR with surface water augmentation. Therefore, the projects would be defined as DPR and would require additional reliability features to provide a level of public health protection on par with or better than conventional supplies or IPR.

Table 1 illustrates a range of potential DPR projects that Carollo Engineers anticipates submitting to the State for approval in the near-term that would fit within the continuum of DPR projects highlighted in the Draft Report. **Project A** has similar features to the Orange County Water District (OCWD) Groundwater Replenishment System (GWRS), but with 100 percent groundwater injection and less than a 2 month retention time in the subsurface, thus characterizing it as a DPR project. **Projects B through D** range in blending locations (i.e., surface water reservoir, groundwater, or direct to drinking water treatment plant (WTP)), attenuation times, and percent blending with conventional supplies. The short attenuation times result in a DPR classification for these example projects. A "direct to distribution" project may also be considered, but is not one of the four projects below. For such a system, the levels of treatment and the levels of risk to the public would be identical compared to any of the four listed projects.

Table 1 - Example DPR Projects that May Be Submitted to the State for Approval

Project Characteristics	Project A	Project B	Project C	Project D
Treatment Train	MF-RO-UV AOP-ESB followed by groundwater injection and transport, groundwater extraction, and chlorination	MBR-RO-UV AOP-ESB followed by soil aquifer treatment, groundwater transport, groundwater extraction, and chlorination	MF-RO-UV AOP-ESB followed by reservoir augmentation and conventional WTP	UF-RO-UV AOP-ESB followed by UF-Cl_2 disinfection at WTP
Pathogen Log Inactivation / Removal	• Minimum of 12-log virus, 10-log *Giardia,* and 10-log *Cryptosporidium* • Raw water pathogen monitoring coupled with quantitative microbial risk assessment (QMRA)			
Blending Location	Groundwater	Groundwater	Surface water reservoir	Direct to drinking WTP
Attenuation Time (V/Q)(1)	<2 months	3 weeks	2 weeks	< 1 week
Percent Blending(2)	0%	< 90%	< 90%	< 90%

Notes: MF - microfiltration membrane filtration; RO - reverse osmosis; UV AOP - ultraviolet (UV) photolysis with advanced oxidation through hydrogen peroxide or chlorine addition; ESB - engineered storage buffer; MBR - membrane bioreactor; UF - ultrafiltration membrane filtration.
(1) V is defined as the reservoir volume and Q is defined as the flowrate of purified water.
(2) Percent of supply comprised of conventional source water.

Each of the example DPR projects would include the following key features for public health protection:

- Enhanced Source Control Program, including at a minimum:
  - An extensive review of the pretreatment program (e.g., types of industrials users, discharge limits for each, any previous violations, compliance reports, and local limits),
  - Revisions to local limits as needed to ensure adequate source water control within the redefined characterization of the sewershed as the source of recycled water for potable reuse,
  - Development of a historical water quality database and a rigorous process for monitoring and responding to water quality trends, and
  - Potential inclusion of online sampling in the sewershed for water quality excursions;
- Pathogen monitoring in the raw wastewater and final wastewater treatment plant (WWTP) effluent, including sampling for virus, protozoa, and surrogate organisms;
- Multiple, independent barriers for pathogens, achieving a minimum of 12-log virus, 10-log *Giardia*, and 10-log *Cryptosporidium* inactivation / removal with an additional margin of safety either through additional treatment achieved through the advanced water purification facility and / or through a subsequent drinking WTP;
- Quantitative microbial risk assessment (QMRA) of the pathogen data, which coupled with the treatment processes provides assurance that target finished water quality is achieved;
- Multiple, diverse barriers for chemical constituents (i.e., membrane filtration, membrane desalination, photolysis and advanced oxidation). The use of granular activated carbon (GAC) may be considered for some treatment trains post-RO to handle rare total organic carbon spikes in the collection system;
- Defined critical control points and corresponding parameters to assess process performance and operations at each step, including:
  - Advanced data analysis methods (continuous data compilation and trending) coupled with advanced system monitoring,
  - Direct integrity test (DIT) trending for membrane filtration processes,
  - Laser turbidimeters for MF filtrate,
  - Use of fluorescent tracer compound to demonstrate pathogen removal performance for the membrane desalination (e.g., RO) process,
  - Total organic carbon (TOC) monitoring across the membrane desalination process,
  - Nitrate and nitrite monitoring utilized to achieve nitrate and nitrite concentrations below the respective maximum contaminant levels (MCLs),

  - Oxidant weighted dose monitoring for the UV AOP process, and
  - Free chlorine monitoring for the Engineered Storage Buffer (ESB);

- Alarms and control for detection and response for off-specification water coupled to ESB hold times and water wasting. The ESB would be designed with sufficient storage to enable necessary responses based on the overall failure response time; and,
- Consideration of the non-treatment barriers outlined in the Draft Report, including WWTP optimization, technical, managerial, and financial (TMF) capacity, and operator training.

Inclusion of the above-listed features is consistent with the recommendations for reliability that are included in the Expert Panel Report and reiterated in the Draft Report submitted to the California Legislature by the SWRCB DDW. Further, by including these features, the DPR examples provide as good as, if not better public health protection than conventional supplies, IPR with groundwater replenishment, or IPR with surface augmentation. As such, ***we expect and advocate that the uniform water recycling criteria be written in a way that accommodates each of the types of DPR projects listed in Table 1.*** The reliability steps listed above provide an example framework for criteria that would facilitate inclusion of a range of DPR projects.

It is important to note that the projects listed in Table 1 represent a range of DPR projects that, to our knowledge, could be presented to the State for approval in the near-term. However, other types of DPR projects may be proposed that remain protective of public health, including projects in which the recycled water is blended into the drinking WTP at various locations (e.g., after coagulation or filtration), provided the basic reliability features listed above are incorporated.

Several specific components of the Draft Report warrant clarity and/or revision in the final report:

- **Provision of a final treatment step to "average" out any chemical peaks.** The SWRCB recommends that "short term research be conducted to identify suitable options for final treatment processes that can provide some attenuation with respect to potential chemical peaks (in particular, for chemicals that have the potential to persist through advanced water treatment)." (Item #6, p. 22) This recommendation is derived from the Expert Panel's recommendation that "a final treatment step [is provided] to 'average' out any chemical peaks". Incorporation of that language in the final report and / or criteria should provide further clarity of the objective of this proposed treatment step. If the SWRCB and Expert Panel are concerned with chemicals that pose chronic health impacts, "averaging" via equalization may or may not result in a health benefit. Further, large storage volumes for equalization following chlorine disinfection can result in a risk tradeoff of increased formation of halogenated disinfection by-products (DBPs). In contrast, if the motivation for "averaging" is to reduce peak concentrations in organic chemical concentrations, a granular activated carbon (GAC) or biologically-active carbon (BAC) polishing step can further reduce concentrations of these chemicals, rather than simply averaging. Public health benefits from incorporation of a final treatment step in the DPR treatment train for attenuation of chemical peaks should be balanced with an assessment of environmental impacts (e.g., carbon generation, regeneration/disposal, and transport).

- **Research on low molecular weight organics**. The SWRCB recommends that research be conducted to develop more comprehensive methods to identify low molecular weight unknown compounds for DPR, **including** non-targeted analysis as a screening tool (Item #7, p. 22 of Draft Report). The health effects research on emerging contaminants may not be sufficiently developed to reach a verdict on whether or not that contaminant poses a health risk at concentrations observed in DPR projects, and treatability data may not be available to indicate expected removal through DPR. The review should include a focus on identifying and documenting data gaps and additional research needs. Further, we recommend that the SWRCB's communication of the results carefully consider appropriate context to avoid negatively impacting public perceptions of DPR in the absence of robust and vetted data.

- **DPR projects without reverse osmosis (RO) treatment.** The Expert Panel recommended that the SWRCB consider proposals for DPR projects that do not employ RO. While RO provides a robust barrier for protozoa, viruses, nitrate, nitrite, TDS, and multiple metals and chemical microconstituents, it produces a concentrate stream of up to 20 percent or more of the raw water production rate that requires disposal with environmental implications. In some cases, non-RO treatment trains may be desirable to minimize costs, energy consumption, and **environmental** impacts of concentrate disposal. Thus, development of uniform water recycling criteria that allow for the possibility of a non-RO treatment train is important and there are potable reuse projects in the planning or operation phase in the U.S. that demonstrate the capability of achieving reuse in a manner that achieves public health goals without RO treatment. To facilitate consideration of non-RO treatment trains, the uniform water recycling criteria will need to be written in a manner that allows for these alternatives.

- **Start-up and commissioning.** The Expert Panel cautioned that the introduction of DPR water into a public water system be staged to demonstrate reliability before contribution is increased. We agree that the approach for start-up and commissioning requires careful consideration to ensure process performance prior to distribution of the purified water to the specified blending location, while also minimizing lost water.

Finally, we noticed the absence of any discussion on two topics:

- The impact of introducing a new water supply, i.e., purified water from a potable reuse facility, on distribution system stability. While the Lead and Copper Rule (LCR), and the anticipated Revised LCR, provides federal **guidelines** to protect public health from exposure to elevated concentrations of lead and copper in tap water, any criteria for DPR should maintain cognizance of the potential impacts of introducing a new source water to a change in distribution system water quality and stability. The criteria should be written in a manner that does not jeopardize the ability of water utilities to maintain optimal distribution system water quality.

- The need for operator training for DPR. We are aware (and are assisting) in two DPR operator training efforts. The first is with WE&RF project 15-05 and the second is with

Cal/Nevada AWWA. We strongly encourage the State to promote these efforts toward a rapid development of an AWT certification process.

We commend the SWRCB for its careful effort to develop a regulatory framework for DPR projects in California that includes input from both an Expert Panel and Advisory Group. We agree with the key finding that it is feasible to develop uniform recycling criteria for DPR that would incorporate a level of public health protection as good as or better than what is currently provided in California by conventional drinking water supplies, IPR systems using groundwater replenishment, and proposed IPR projects using surface water augmentation. We hope that by providing the examples in Table 1 of DPR projects that could be brought before the State for approval in the near term that we have illustrated that uniform water recycling criteria can be developed with appropriate reliability safeguards to facilitate implementation of projects that are at least as protective of public health as conventional or IPR water supplies.

Sincerely,

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