

WateReuse California ANNUAL CONFERENCE **2022**  2022 DDW UPDATE DIRECT POTABLE REUSE Northern Cal Water Reuse CA December 9, 2022

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## **Speaker Bio**

- Brian Bernados, P.E., MSCE
- Senior Engineer (Technical Specialist)
- 30 years with CDPH/SWRCB
- Former District Engineer in charge of San Diego and Imperial County
- Currently Technical Specialist
- Water Treatment operator Grade T5

## **Criteria Goal**

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- DPR criteria must control pathogens and toxic chemicals
- One goal of the DPR criteria is to address the findings in the 2016 report by the
- Expert Panel on the Feasibility of Developing Uniform Water Recycling Criteria for Direct Potable Reuse



## 2016 Expert Panel Findings Summarized

DPR practices need to provide the following features in addition to the requirements already specified in IPR regulations for California

- The DPR system must be reliable
- Ensure the independent treatment barriers represent a diverse set of processes (i.e., robustness)
- Providing the ability to divert advanced treated water that does not meet specifications
- "averaging" of potential chemical peaks

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# DPR Expert Panel Report (2016) & Research

- DPR-1 Quantitative Microbial Risk Assessment (QMRA) Implementation
- DPR-2 Measure Pathogens in Wastewater
- DPR-3 Feasibility of Collecting Pathogens in Wastewater during Outbreaks
- DPR-4 Treatment for Averaging Potential Chemical Peaks
- DPR-5 Develop methods to identify low molecular weight unknown compounds

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## Pathogen Control Overview

- Pathogen reduction targets to achieve specific health risk goals
- Reliability multi-barrier treatment, diverse mechanisms, redundant treatment
- Validate treatment trains to ensure pathogen removal targets can be met
- Real-time monitoring
- Pathogen control point critical limits
- Control system that responds appropriately

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## Pathogen Control Operational Requirements

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- Discontinue delivery if treatment train does not achieve 16 Virus, 10 Giardia and 11 Cryptosporidium Log Removal (LRV).
- Discontinue delivery if minimum # of treatment processes or treatment mechanisms are not provided.
- Investigate the cause and report if treatment train does not achieve minimum design LRV 20/14/15 ninety percent of the time in a month.
- See the link on Derivation of Log Removal Values
  <u>https://www.waterboards.ca.gov/drinking\_water/certlic/drinkingwater/documents/direct\_potable\_reuse/Irvderivation.pdf</u>

## Pathogen Reduction - Reliability

- For each reference pathogen:
  - At least 4 pathogen treatment processes,
  - At least 3 mechanisms (physical separation, chemical disinfection, UV disinfection)
- Quantitative microbial risk assessment (QMRA) used to evaluate failure scenarios – DPR-1: QMRA "DPRisk" tool
- Critical failure scenario → +4 log reduction to achieve daily risk goal → treatment train designed to provide 20/14/15

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## RWA vs. TWA

- A project with a small reservoir preceding an existing SWTP has benefits.
- transport time through the reservoir can be used to meet the flow path requirement in section 64669.85 (k) [in CCP response plan].
- Attenuation of peak chemical contaminants due to mixing in the reservoir can meet or help meet the requirement in section 64669.50 (k).
- Other quantifiable risk management benefits of a RWA can also be considered, including pathogen LRV credit, if demonstrated via continuous dilution in the reservoir.

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## Surface Water Treatment Plant

- For an existing SWTP, one obvious benefit of a RWA project is the virus credit.
- Free chlorine disinfection is extremely effective at inactivation of viruses.
- In addition to inactivation of viruses, some existing SWTPs are also achieving 0.5-log inactivation (or more) of giardia through free chlorination.
- All chlorine treatment at SWTPs have been validated using protocols approved for surface water treatment by DDW, thus meeting the requirement in section 64669.45 (a)(3).

### Chemical Control in DPR vs. IPR



- Without an environmental buffer, pulses of low molecular weight chemicals may pose an acute threat
- Without an environmental buffer the urgency of recognizing and responding to treatment deficiencies increases

## **Chemical Control Approach**

- The approach:
  - Enhanced source control and public education
  - Conformance with MCL and Notification Level (NL) requirements
  - Monitoring and development of additional NLs as appropriate
  - Multi-barrier advanced treatment
  - Criteria to address pulses of low molecular weight chemicals
  - Chemical control points and critical limits
  - Control systems and response plan

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#### Source Control and Joint Plan § 64669.25

- Since source control may be the responsibility of a sanitation district and not the permitted DiPRRA
- (a) At a minimum, the Joint Plan shall include the following:
  - (3) The procedures to implement source control requirements pursuant to section 64669.40, including provisions to conduct source control investigations;
- (d) A DiPRRA, through the Joint Plan, shall implement a sewershed surveillance program to receive early warning of a potential occurrence that could adversely affect the DPR treatment and that contains the following:

#### Wastewater Source Control §64669.40

- "Rigorous Source Control" addressed in Draft Criteria, which includes the following:
  - Ordinances that utilize "local limits" applied to dischargers that goes beyond the EPA pretreatment compounds to protect DPR
  - Audits
  - Early warning of potential peaks
  - Source control committee
  - Continuous improvement process

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## 2019 Source Control for DPR Panel

"Enhanced Source Control Recommendations for Direct Potable Reuse in California"

- The NWRI panel members were:
  - Chair: Jeff Neemann, Black & Veatch
  - James Colston, Irvine Ranch Water District
  - Stuart Krasner, Independent Consultant
  - Ian Law, IBL Solutions and University of Queensland
  - Amelia Whitson, EPA Region 9

#### Feasibility Of Developing An Early-warning System

- The panel considered this question. These experts stated,
- "Monitoring an enhanced source control program is critical to verify that the program is working . . . one of the most significant risks in source control programs for DPR is caused by occasional noncompliant and illegal discharges."
- "Noncompliant discharges can be detected by enhancing monitoring at the industrial discharge point, ...."
- "while illegal discharges can be detected by installing monitoring systems at nodal points in the wastewater collection system and in the headworks at the WWTP."

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## A Robust Third Chemical Process 2016 Expert Panel Findings

"DPR practices need to provide the following features in addition to the requirements already specified in IPR regulations for California

- "Ensuring the independent treatment barriers represent a diverse set of processes (i.e., robustness) in the treatment train that are capable of removing particular types of contaminants by different mechanisms.
- This diversity provides better assurance that if a currently unrecognized chemical or microbial contaminant is identified in the future, there is a greater degree of likelihood it will be removed effectively by the treatment train."

### Chemical Control § 64669.50

- "A DPR project shall ensure that the municipal wastewater receives continuous treatment prior to its distribution as drinking water as follows:
- (a) The treatment train must consist of at least three separate treatment processes, using diverse treatment mechanisms, for chemical reduction. The treatment train shall include:
- (1) An ozone/biological activated carbon (ozone/BAC) process that meets the criteria in this section;
- (2) A reverse osmosis membrane process that meets the criteria in this section; and
- (3) An advanced oxidation process that meets the criteria in this section."

### Must Be Robust

 "To be feasible, DPR systems must meet or exceed the attributes of robustness... defined as the presence of different types of treatment processes acting via different mechanisms such that a yet-unknown pollutant likely will be removed by multiple stages."



separation



advanced oxidation



## OLD version 8/2021- Ozone/BAC for Chemical Peak Control §64669.50 (c)

- 1. City of San Diego Demonstration Project has been operating, studying, and challenging ozone BAC
  - a. Quoted in 2016 Expert Panel Report
  - b. WERF 14-12 report has details
- 2. Achieve 1.0 log formaldehyde, acetone & NDMA reduction
- Empty bed contact time of BAC = 15 min. per San Diego study
- 4. Ozone : TOC of 1.0

## NEW - Ozone/BAC for Chemical Peak Control §64669.50 (c)

- 1. Achieve 1.0 log carbamazepine and sulfamethoxazole reduction between pre-ozone & post-ozone
- 2. Achieve 1.0 log formaldehyde, acetone & NDMA reduction between pre-BAC & post BAC
- 3. Reason given by panel:
  - a. NDMA is addressed by UV/AOP
  - b. Carbamazepine does not easily biodegrade
  - c. Sulfamethoxazole is present in very high concentrations

## Reliable Hazard Analysis Critical Control Point §64669.50 (c), (d), (f), (i), (j)

- Continuous performance monitoring: at least one surrogate or operational parameter that indicates when treatment is not performing as designed or integrity of the treatment has been compromised, such as:
  - O3:TOC ratio
  - Online UVA
  - Online TOC
  - Continuously calculated UV dose or energy (EED in KWhr/1000gal)
- Demonstrate treatment under normal full scale operating conditions

## Operator Certification §64669.35

 "(b) A DiPRRA shall designate at least one chief operator and at least one shift operator for each operating shift that possess valid California-Nevada Section of the American Water Works Association/California Water Environment Association advanced water treatment operator (AWTO) grade AWT5 certificate ...."

#### Operations Plan - 2 §64669.80

"(d) The plan must address operator certification and appropriate type and level of certification for each treatment facility associated with the DPR project.

(e) Include a staffing plan that describes the staffing level at each treatment plant associated with the DPR project."

- Advanced Water Treatment Operator (AWTO) is minimum expectation
- Existing WW and DW certification programs run by the state do not generally cover advance treatment processes, such as membranes, UV or ozone

#### **Advanced Certification - AWTO**

#### www.awtoperator.org

- A diverse group worked on AWTO certification program, including experts from:
  - Utilities (EBMUD, SDCWA, Encina WA, SWMOA, Padre Dam, San Diego, LA, SF, LACSD, SCVWD, Santa Barbara, Long Beach)
  - State Water Board (DDW and DFA)
  - CA Section of the Water Environment Association (CWEA)
  - CA/NV Section of the American Waterworks Association (AWWA)



## **Expansion of Alternatives Clause**

- Alternatives are allowed for chemical control treatment
- DDW staff considered a broader Alternatives section
- Criteria fundamental to safe drinking water and are not appropriate for alternatives. These include:
  - 1. the pathogen log reductions values (LRVs),
  - 2. the need to immediately cease distribution of off-spec water
  - 3. the DPR project's TMF capacity.
- Any treatment technologies may be used for pathogen LRVs
- A more conservative, health protective approach towards allowing limited alternatives within the DPR criteria is justified.

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