



State Water Resources Control Board

Division of Drinking Water

Expert Panel Review of Early
Draft Criteria for
Direct Potable Reuse

Meeting 4

February 28, 2022



Kevin M. Hardy

Executive Director
National Water Research Institute
Fountain Valley, CA

Welcome



About NWRI

The nation's collaborative resource for the advancement of water resources science, policy, and innovation.

The independent expert advisory services provider of choice for challenging water quality, water resource management, and related innovation issues.

We provide insight and understanding of current and future issues in water science and technology



Expert Panel Co-Chairs and Panelists

Co-Chair James Crook, PhD, PE, Panel Co-Chair
Environmental Engineering Consultant

Co-Chair Adam Olivieri, DrPH, PE, Panel Co-Chair
EOA, Inc.

Richard Bull, PhD
Washington State University (Emeritus)

Jörg E. Drewes, PhD
Technical Univ of Munich

Charles Gerba, PhD
University of Arizona

Charles Haas, PhD
Drexel University

Amy Pruden, PhD
Virginia Polytechnic Institute

Joan B. Rose, PhD
Michigan State University

Shane Snyder, PhD
Nanyang Technological University

Jacqueline E. Taylor, REHS, MPA
Los Angeles County Department of Public Health (Retired)

George Tchobanoglous, PhD, PE
University of California, Davis (Emeritus)

Michael P. Wehner, MPA
Orange County Water District (Retired)



Meeting No. 4 Objectives

- Provide an update on the status of the Expert Panel's review of the Early Draft of Anticipated Criteria.
- Consider presentations from DDW staff on key issues identified by the Expert Panel.
- Provide an opportunity for public comment related to the Early Draft of Anticipated Criteria.



Agenda

Monday, February 28, 2022

11:00 a.m.	Welcome, Introductions, Review Agenda, Overview of Panel Process	Kevin M. Hardy, NWRI
11:05 a.m.	Panel Report-Out	Adam Olivieri and Jim Crook, Panel Co-Chairs
11:30 a.m.	DDW Staff Presentations	DDW Staff
11:45 a.m.	Public Comment Session	Facilitated by Kevin M. Hardy
12:00 p.m.	Adjourn	



Meeting Ground Rules

- We appreciate your patience!
- Keep yourself muted unless recognized to speak.
- Please keep your camera turned off unless you are speaking.
- Zoom supports internet or phone audio.
- Please enter your name when you sign in so that we can identify who is speaking.
- This meeting is being recorded.



To Speak During the Public Comment Session

1. E-mail DDW staff to request special link and passcode at: DDWrecycledwater@waterboards.ca.gov
2. In the subject line write **DPR Criteria Expert Panel Meeting 4**
3. In the body of the email, provide the following:
 - Your name
 - Who you represent (yourself, another person, an organization)
 - Whether you will attend by videoconference or telephone
 - For phone commenters only, the last three digits of the phone number from which you intend to call



**DPR Criteria Expert Panel
Co-Chairs**

James Crook, PhD, PE

Adam Olivieri, DrPH, PE



Expert Panel Schedule

- Meeting 1: August 24-25, 2021
- Meeting 2: December 1, 2021
- Meeting 3: January 26, 2022
- Meeting 4: [February 28, 2022](#)
- Meeting 5: TBD

Technical Work Groups and support to DDW
through December 2023



Summary of Expert Panel Preliminary Findings, Key Comments, and Recommendations

- The Panel appreciates the collaborative and collegial working relationship with the DDW staff.
- The body of work by DDW and WRF is extremely important for California's development of a reliable and resilient water supply.
- The Panel clearly understands its charge to review the proposed criteria and, in its expert opinion, adopt a finding as to whether the proposed criteria **adequately protects public health**.
- The Panel's review is based on the review of each criterion and a comprehensive review of the draft criteria, dated August 17, 2021.



Summary of Expert Panel Preliminary Findings, Key Comments, and Recommendations

- While the focus of the Panel review is to determine if the proposed regulation provides adequate public health protection relative to the risk posed by the water being produced, there is a significant concern about unintended consequences—particularly related to excessive energy consumption and carbon footprint.
- A responsive, sustainable, and cost-effective approach to developing these regulations includes recognition by the State Water Board of potentially over-engineered treatment barriers and requires an intentional effort by DDW to develop a reasonable number and combination of such barriers.
- The Panel recommends that the State Water Board address the above concerns through a “holistic risk” analysis. The Panel looks forward to reviewing the analysis as part of review of the final draft criteria.



Summary of Expert Panel Preliminary Findings, Key Comments, and Recommendations

The Panel's Preliminary Finding

- The draft DPR regulation **adequately protects public health.**
- The Panel's preliminary finding assumes that the SWB-DDW will fully consider and address the Panel's comments and recommendations when developing a revised draft of the DPR criteria.
- It is our expectation that the revised draft will be shared with the Panel for final review before being considered for adoption by SWB.



Summary of Expert Panel Preliminary Findings, Key Comments, and Recommendations

Define RWA in Criteria

- The Panel agrees with DDW's intent to keep the criteria broad enough to cover all forms of DPR.
- However, the Panel recommends that clearly acknowledging raw water augmentation (RWA) in the criteria or Statement of Reasons is appropriate and necessary.
- For example, inserting clear acknowledgement on how the draft criteria would apply to an RWA project relying on a small reservoir with an existing SWTP is necessary.



Summary of Expert Panel Preliminary Findings, Key Comments, and Recommendations

Chemical Control Criteria Recommendations

- Recommend that ozone and biological activated carbon (BAC) processes be located appropriately before the reverse osmosis (RO) process to manage low molecular weight (LMW) compounds as well as other CECs.
- Recommend using carbamazepine and sulfamethoxazole as ozone performance indicators.
- Recommend using acetone and formaldehyde as BAC performance indicators.



Summary of Expert Panel Preliminary Findings, Key Comments, and Recommendations

Chemical Control Criteria Recommendations (Continued)

- Delete the applied ozone/total organic carbon (O_3 /TOC) dosage language and include a requirement to develop a project-specific dosage as part of the engineering report clause.
- Recommend online nitrite monitoring for ozone feedwater.
- Alternatives relating to O_3 /BAC should be addressed as part of the alternatives clause.



Summary of Expert Panel Preliminary Findings, Key Comments, and Recommendations

Engineering Report Criteria - Recommendations

- Include the requirement to define a chemical peak as part of monitoring and plant operation plans, including defining an action. Use the DPR-4 report as a guidance document.
- Include a requirement to address optimizing the secondary treatment process. Criteria need to result in producing stable and high-quality, fully nitrified water prior to introduction into the advanced water treatment facility (AWTF).
- Include a reference to technical, managerial, and financial capacity (TMF) documents that DDW will use to review and approve TMF plans. (Could also be in Statement of Reasons).



Summary of Expert Panel Preliminary Findings, Key Comments, and Recommendations

Engineering Report Criteria - Recommendations (Continued)

- Include a requirement to address other plant operation and performance issues such as:
 - Changing wastewater characteristics (both initial design and long-term).
 - Climate change.
 - Influent flow and load equalization.
 - WWTP optimization to reduce energy and chemical use at the AWTF.
 - Equalization and treatment of return flows.
 - Temperature effects on treatment and distribution system chemistry.



Summary of Expert Panel Preliminary Findings, Key Comments, and Recommendations

Engineering Report Criteria - Recommendations (Continued)

- Include a requirement to develop a project-specific O₃/TOC dosage as part of the engineering report clause.
- Include a requirement to assess the project's cybersecurity plans or to develop a plan.



Summary of Expert Panel Preliminary Findings, Key Comments, and Recommendations

Monitoring Disease Surveillance Programs or Community Raw Wastewater Surveillance Monitoring Programs

- The concept of community raw wastewater surveillance monitoring to locate disease outbreaks within the served community may be practical as an early indicator of outbreaks but is not a practicable and/or feasible approach for assessing the adequacy of water treatment.
- The Panel does not recommend that raw wastewater surveillance monitoring be a requirement within the DPR criteria.



Summary of Expert Panel Preliminary Findings, Key Comments, and Recommendations

Online Wastewater Collection System Monitoring Recommendations

- The concept is interesting, and the Panel applauds DDW's forward thinking on the topic.
- However, the technology to effectively develop and implement such a program is not currently feasible and/or practicable.
- The Panel recommends that DDW include criteria that encourage direct potable reuse responsible agencies (DiPRRAs) to continue to investigate future development and application of this concept through pilot programs.
- The Panel notes that DDW and/or the California Water Boards can update regulatory permits to include online collection system monitoring as such programs become feasible and practicable.



Summary of Expert Panel Preliminary Findings, Key Comments, and Recommendations

Pathogen Control Criteria – Conservative Assumptions

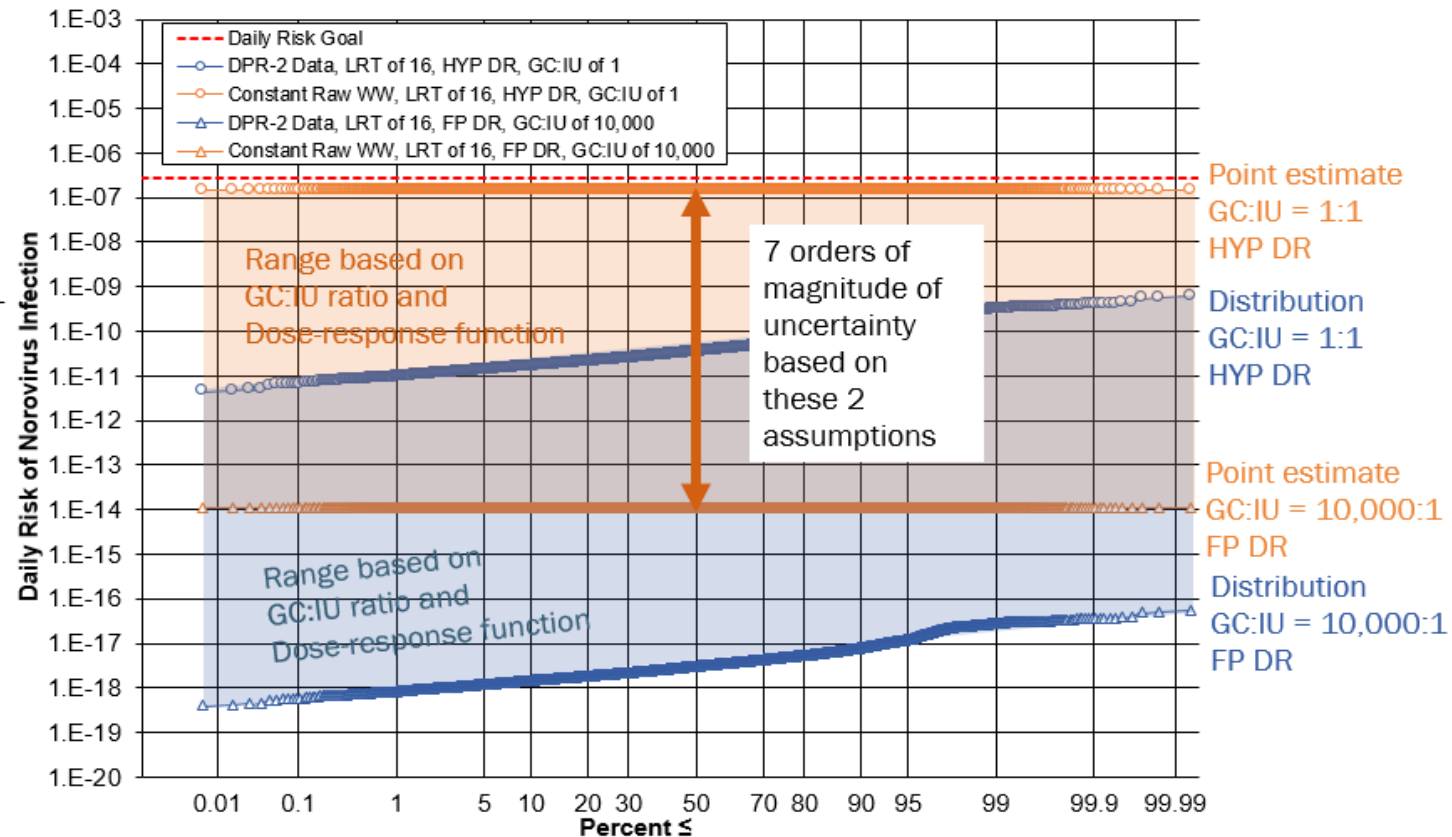
- Selected risk goal as daily versus annual (SDWA).
- Selected a single virus, norovirus (NoV), to represent human virus.
- Selected concentration of single maximum point versus use of distribution.
- Assumed ratio between gene copies (GC) and infectious units (IU) is always 1:1.
- Selected conservative dose-response functions (several for selected pathogens are available).
- Selected volume of drinking water consumed as single daily value versus distribution.
- Selected representative LRVs based on maximum point estimate versus statistical characterization from LRV distribution.

Summary of Expert Panel Preliminary Findings, Key Comments, and Recommendations

- Seven OM difference due to two assumptions
- Ten OM due to three (point vs. distribution, GC:IU, D-R)

Dose-response comparison

LRT of 16
HYP DR vs FP DR
GC:IU of 10,000:1



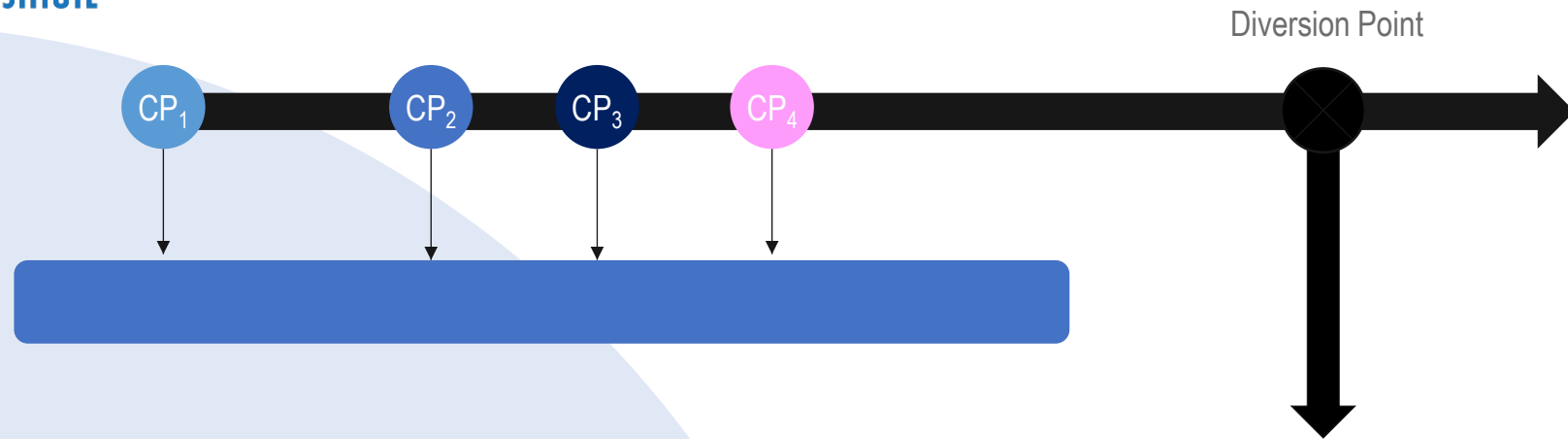


Summary of Expert Panel Preliminary Findings, Key Comments, and Recommendations

Pathogen Control Criteria Summary

- DDW erred on the side of caution to protect public health; however, compounding numerous conservative assumptions may result in unrealistic and impracticable results.
- While the current DDW **LRV criteria** can be considered protective of public health, additional analysis is **recommended** to address potential overengineering of treatment barriers and to conduct an intentional effort by SWB-DDW to require a reasonable number and combination of such barriers.
- The Panel **recommends a probabilistic analysis using the DPR-2 report dataset** rather than the *static maximum point estimate* approach for development of the LRVs.

Compliance – Approach (concept similar to response-time approach)



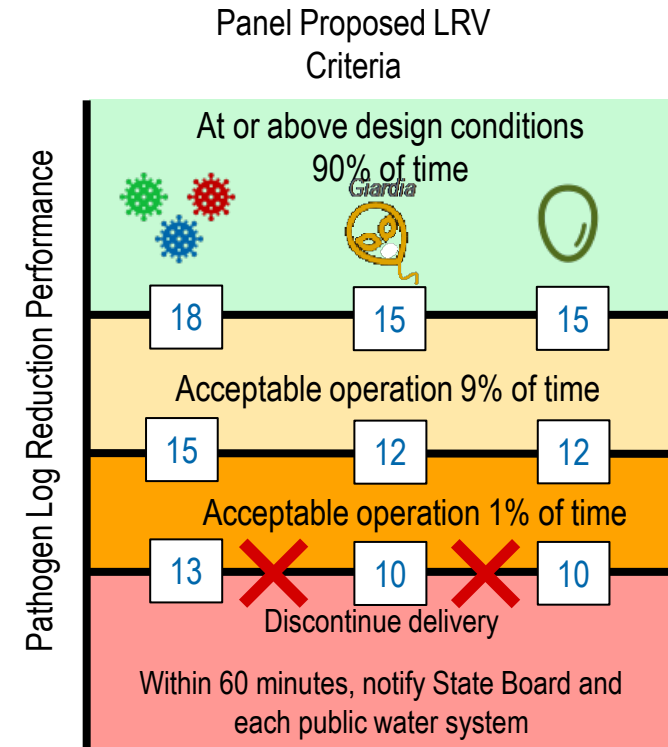
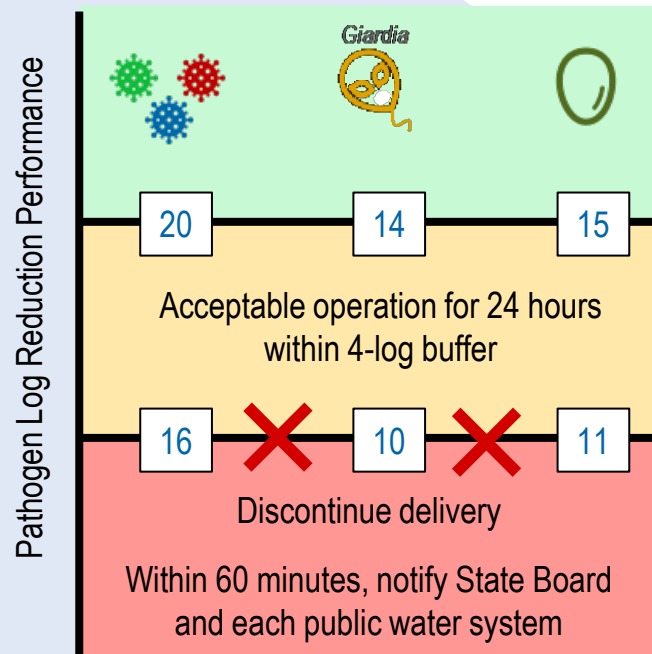
$$LRV = \sum lr_1, lr_2, lr_n$$

$lr_{1,n}$ = LR for each unit process (online meters)

LRV > than performance criteria – Possible actions:

- a. Determine an exceedance is occurring,
- b. Actuate a diversion or shutoff valve, and
- c. Divert or completely stop flow to distribution system

Summary of Panel Proposed LRV Criteria with 5-log Redundancy





Suggested Virus and Protozoan Requirements

- Minimum treatment for public health protection: log reduction target (LRT) = 13 Virus, and LRT = 10 for *Giardia* and for *Cryptosporidium* each.
- Minimum redundancy needed to address **undetected** failures:
 - +5 logs
 - 5-log buffer protective against a conservative **6-log failure rate** (1% occurrence)
 - 99% compliance with daily risk goal
 - > 99% with annual risk goal (< once in 100 years)
- Proposed compliance requirements for LRTs:

VIRUS

18 LRT – 90%

15 LRT – 9%

13 LRT – 1%

PROTOZOA

15 LRT – 90%

12 LRT – 9%

10 LRT – 1%



Summary of Expert Panel Preliminary Findings, Key Comments, and Recommendations

Pathogen Control Criteria (Continued)

- The Panel also suggests an alternative approach to address compliance with the log reduction values (LRVs) that greatly simplifies the response-time-based approach currently proposed.
- The Panel's probabilistic analysis identified alternative LRVs that adequately protect public health and are based on **scientifically defensible assumptions**.



Summary of Expert Panel Preliminary Findings, Key Comments, and Recommendations

Pathogen Control Criteria (Continued)

- The Panel recommends clarifying how alternative LRVs are addressed within the criteria such that there is no need to expand the alternatives clause to cover pathogen controls. For example, how LRV redundancy could be addressed for an RWA project.
- Options to address this recommendation include clarifying text in the criteria, expanding the alternatives clause, and/or including detailed clarification in the Statement of Reasons.



Summary of Expert Panel Preliminary Findings, Key Comments, and Recommendations

Communication and Notification

- All notifications to the public and public agencies need to be consistent with those currently required as part of the California potable water regulations and the SDWA, and references to existing potable water notification regulations should be included in the DPR criteria.
- The focus on developing a program of close communication and coordination with local and state public health agencies as well as major hospitals within the DiPRRA service area is an important element of the draft criteria.



Summary of Expert Panel Preliminary Findings, Key Comments, and Recommendations

Technical, Managerial, and Financial (TMF) Capability

- The criteria appropriately require development of a TMF plan. The Panel recommends that DDW include the following in the criteria (or Statement of Reasons):
 - Information (example if available) on what is expected to be included in the TMF documentation, and
 - Information identifying the key factors DDW staff will use to review the plan and determine acceptability.
- The Panel recommends utilizing independent third-party review of the TMF plan.



Summary of Expert Panel Preliminary Findings, Key Comments, and Recommendations

Third-Party Engineering Review

- The Panel recommends that the DPR criteria include a third-party peer review requirement to:
 - Review designs including instrumentation, controls, and the SCADA system before project preparation of bid documents.
 - Review a project at commissioning.
 - Review operational projects to identify engineering best practices that can be incorporated into future engineering designs.
- These reviews, because they lead to improved practices, will also inherently benefit the public health, safety, and welfare. (Source: National Society of Professional Engineers).



Summary of Expert Panel Preliminary Findings, Key Comments, and Recommendations

Other Items

- Include a criterion that requires 24/7 operation for at least 12 months before considering a request for reducing the number of operators and/or unstaffed operations.
- Include a clear linkage in the DPR criteria in monitoring and/or source control criteria and/or Statement of Reasons to the SWB Recycled Water Policy for chemicals of emerging concern (CECs) relative to constituents to be monitored, the monitoring trigger levels, and the response action plan.
- The criteria include TOC monitoring in several locations. The use of the 0.5 mg/L TOC, as written, could imply that TOC is a health-based criteria. The criteria and the Statement of Reasons should clarify that TOC is not a health-based criteria.



Summary of Expert Panel Preliminary Findings, Key Comments, and Recommendations

Other Items (Continued)

- The criteria should include specific time frames and digital formats for submitting monitoring data to the SWB-DDW.
- Include a 20-year life cycle planning horizon for the DiPRRA Joint Plan and a limited life-cycle cost analysis (LCCA) update every 5 years.
- The Panel agrees with the DDW draft criteria that existing drinking water treatment plant (DWTP) treatment processes that have been validated for LRVs and approved by DDW do not need to be revalidated.



Summary of Expert Panel Preliminary Findings, Key Comments, and Recommendations

Other Items (Continued)

- **Enhanced Source Control** – Redefine the wastewater source control criteria as “enhanced wastewater source control.”
- **Quantitative Risk Assessment (QRA)** – The source control section criteria requires QRA which is confusing, probably not productive for each utility to conduct, and duplicative of SWB-CEC efforts and should be deleted.

The Panel suggests a specific reference be added to the Statement of Reasons regarding enhanced source control QRA background information and to the SWB-CEC risk-based documents to eliminate confusion with other risk assessment approaches.



Panel Next Tasks

- **February 28** – Panel Meeting 4 – Report out Panel’s findings and recommendations.
- **Mid-March** – Panel draft memo to DDW – Preliminary findings and recommendations.
- **March/April** – Final memo to DDW.
- **TBD** – Review additional documents (peer review, revised draft criteria, Statement of Reasons, environmental documents, etc.) and produce FINAL Panel findings and recommendations memo.



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National Water Research Institute

18700 Ward St.

Fountain Valley, CA 92708

www.nwri-usa.org



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