

Developing Uniform Criteria for Direct Potable Reuse

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DPR Types

1. Small environmental buffer





National Water Research Institute Framework for Direct Potable Reuse

- Identifies 10 key issues including:
- Public health risks and measures to mitigate these risks.
- Treatment performance
 - treatment reliability,
 - water quality (i.e., monitoring),
 - operation & maintenance programs,
 - source control
 - Operator training & certification.



CUWA Operator Certification Paper

- A white paper entitled "Potable Reuse Operator Certification Framework" was prepared by the California Urban Water Agencies (CUWA)
- Provides nine (9) recommendations on program elements and considerations
- Recognizes the need for interim certification program
 - Potential collaboration with CWEA and AWWA ad hoc committees

Advisory Group Operator Certification Recommendations

- A training and certification program is needed for operators employed at advanced water treatment facilities (AWTF)
- Protection of public health is paramount for successful implementation of DPR projects
 - Operation by experienced and well-trained staff to make sure the treatment processes function properly, regulatory requirements are met consistently, and water produced is safe for public consumption

Expert Panel Findings

Multiple barriers (A+B+C+D=Good) **Diverse** TREATMENT **PROCESSES** Parallel trains — Parallel trains — CHEMICALS => CHEMICALS Diversion of off-spec water

Knowledge Gaps Remain

• Key Panel findings on DPR performance and reliability lead to further questions.

Extra LRV Capacity

"Use a treatment train ... with multiple, independent treatment barriers ... that meet performance criteria greater than the public health threshold goals ... for microorganisms"

 How much additional LRV capacity is necessary?

Knowledge Gap Treatment Diversity

 "Ensure the independent treatment barriers represent a diverse set of processes ... in the treatment train that are capable of removing particular types of contaminants by different mechanisms."

– How do we define treatment "diversity"?

– Is there a way to identify the degree of diversity necessary?

Knowledge Gap Chemical Peak Attenuation

- Regarding short-term discharges of chemicals into the wastewater collection system -
- "... incorporating a final treatment process ... after the advanced water treatment train may result in some "averaging" of these potential chemical peaks."
 - How much "averaging" is necessary and how do we specify it?

Conclusions

While developing criteria is feasible -

- There are knowledge gaps that have to be addressed before we can <u>adopt</u> unambiguous DPR regulations that are protective of public health.
- DPR criteria could be developed without this additional research. But that criteria would probably have a lot of extra treatment and monitoring requirements because of the uncertainty around these missing research topics that we need to be more assured the public health is protected.

Further Research

- 1. Source control and monitoring
- 2. LRV risk assessment
- 3. Confirm wastewater data
- 4. Outbreak data
- 5. Average peaks
- 6. Identify unknowns

DPR Expert Panel Report Chapter 8 Chemicals Source control

Research Recommendation #1:



"To better inform targeted monitoring for source control and final water quality"

Expert panel states, "Because of the lack of an adequate environmental buffer ..., short-duration releases of chemical contaminants could be problematic for DPR projects.

Of specific concern are chemicals that adversely affect the development of fetuses and children."

DPR Expert Panel Report Chapter 8 Chemical Unknowns

Research Recommendation #6:

"It is important to focus on non-targeted analysis and, furthermore, low molecular weight compounds." Expert panel states, "Contaminants that are difficult to remove . . . such as acetone, methyl ethyl ketone, and methanol . . . " "In addition, these methods also could address the potential vulnerability of AWTF treatment processes to unintended spills or batch releases of chemicals in the sewershed. See Chapter 3."

Coordination with Division of Water Quality

- Recycled Water Research Workshop:
- Monitoring (including non-targeted analysis)
- Constituents of Emerging Concern
 - Tuesday October 27th and Wednesday October 28th, 2015
- Use of in vitro Bioassays to Assess the Safety of Recycled Water and Drinking Water – February 17-18, 2016

Research - Bioassays

• WE&RF 15-02



Creating a Roadmap for Bioassay Implementation in Reuse Waters: A cross disciplinary workshop

- Near Term
 - Review & improve concentration methods
 - Selection of appropriate health endpoints
 - Adapt bioassays for recycled water
 - Standardize methods, procedures, and QA/QC
 - Assess treatment performance
- Long Term

Link to human health significance

Quantitative Microbial Risk Assessment

Research Recommendation #2: "The State Water Board should adopt the use of probabilistic QMRA to confirm the necessary LRVs of viruses, *Cryptosporidium,* and *Giardia* needed to maintain a risk of infection equal to or less than 10⁻⁴ per person per year."

Recommendation #6-1 "To reduce uncertainty, a major initiative to characterize pathogens in wastewater is encouraged. ...Data should be collected from multiple facilities for several years ...These results can be used to inform the ...probabilistic QMRA."

Analytical Methods

- Research Recommendation #3:
- "To better inform decisions associated with updating LRVs as well as probabilistic-based QMRA modeling, ... measure pathogens (i.e., Giardia cysts, Cryptosporidium oocysts, and several human viruses) in raw (untreated) wastewater feeding a DPR system that provide more complete information on concentrations and variabilities. Improved methods should be used that will allow better characterization and improved precision of concentrations of pathogens. See Chapters 5 and 7."



Molecular Methods

Assessment of Techniques to Evaluate and Demonstrate the Safety of Water from Direct Potable Reuse Treatment Facilities

WRF Project 4508/ WRRF Project 13-14 Literature Review describes in detail the status of newer analytical methods.

Expert Panel report recommends collecting pathogen concentration data via:

- quantitative polymerase chain reaction (qPCR),
- digital droplet PCR (ddPCR) and
- flow cytometry.



Flow Cytometry (FC)

- Physical detection via FC goes beyond turbidity.
- "Researchers have presented methods to identify
 - pathogenic E. coli O157:H7,
 - C. parvum, and
 - non-pathogenic E. coli in water."



- "FC has evolved in recent years resulting in increased sensitivity and a reduction of background noise."
- "This type of monitoring should be further investigated at full scale treatment plants."

Other Needs

- DPR depends on the capability of the operator and technician
- Specialized initial and on-going training
- High level of expertise needed
- Appropriate setpoints meaningful
- Verification frequent checks to a bench unit
- Proper interpretation of info
- Calibration proper procedures take skill.
- Preventative maintenance
- Spare parts on hand





Moving from Feasibility to Criteria

- Our experience with the development of IPR criteria has shown that it is a sizable step,
 - -from being confident that something is technically feasible
 - to producing criteria that assure that public health will be protected, in every case, all the time.

Criteria Objectives

- When the Expert Panel embarked we offered several objectives for criteria. The criteria:
 - Must be enforceable (enable an objective compliance determination);
 - Must be unambiguous regarding the critical protective features; and
 - Must assure that any proposal that can comply will actually produce safe water continuously.

Finally ...

 Draft criteria and then challenge them with all imaginable proposals to make sure they will always assure safe DPR projects

Uniform Framework

- Whether or not criteria for all types are developed simultaneously criteria should be coordinated
- A framework across the various types will avoid discontinuities in the risk assessment/risk management approach, especially if progressively more difficult situations are addressed sequentially

Path Forward

- Draft regs concurrently
- Technical workshops
- Monitor research
- Phased regs