NATIONAL WATER RESEARCH INSTITUTE

Volume III

Expert Panel on the Development of Water Recycling Criteria for Indirect Potable Reuse (IPR) through Surface Water Augmentation and the Feasibility of Developing Criteria for Direct Potable Reuse (DPR)

for the
State Water Resources Control Board
Division of Drinking Water
(Agreement No. 13-21041)

Draft Final Panel Meeting Report: Panel's Initial Discussions on the Draft Surface Water Augmentation IPR Preliminary California Regulation Concept (Dated July 2014)

Based on a Panel Meeting Held July 24-25, 2014
Meeting #2

February 18, 2015
Fountain Valley, California

www.nwri-usa.org/ca-panel.htm

ABOUT NWRI

A 501c3 nonprofit organization, the National Water Research Institute (NWRI) was founded in 1991 by a group of California water agencies in partnership with the Joan Irvine Smith and Athalie R. Clarke Foundation to promote the protection, maintenance, and restoration of water supplies and to protect public health and improve the environment. NWRI's member agencies include Inland Empire Utilities Agency, Irvine Ranch Water District, Los Angeles Department of Water and Power, Orange County Sanitation District, Orange County Water District, and West Basin Municipal Water District.

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ACKNOWLEDGMENTS

The Expert Panel on "Development of Water Recycling Criteria for Indirect Potable Reuse through Surface Water Augmentation and the Feasibility of Developing Criteria for Direct Potable Reuse" (Panel) was formed at the request of the Drinking Water Program of the California Department of Public Health (CDPH) in 2013.

The Drinking Water Program was officially transferred from CDPH to the State Water Resources Control Board (SWRCB) and renamed as the Division of Drinking Water (DDW) on July 1, 2014. Financial support for the Panel is being provided by DDW through Agreement No. 13-21041.

The Panel would like to thank DDW staff for the information, materials, and suggestions received from DDW as part of the second Panel Meeting, which is the focus of this Panel Report. In particular, the Panel thanks Mr. Randy Barnard, Mr. Mark Bartson, Mr. Brian Bernados, Mr. Bruce Burton, Mr. Robert Hultquist, and Mr. Mike McKibben of DDW for their assistance. The Panel also appreciates the support of Mr. Bruce Burton, Chief of the Northern California Drinking Field Operations Branch, who serves as the DDW project representative on this effort.

In addition, the Panel thanks the National Water Research Institute for administering and organizing the Panel's efforts. The Panel would also like to recognize the WateReuse Research Foundation and members of DDW's Direct Potable Reuse (DPR) Advisory Committee for participating in the second Panel Meeting and providing valuable information on current and future potable reuse research projects.

DISCLAIMER

This report was prepared by an NWRI Expert Panel (Panel), which is administered by the National Water Research Institute (NWRI). Any opinions, findings, conclusions, or recommendations expressed in this report were prepared by the Panel. This report was published for informational purposes.

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Volume I

Volume II

Background Materials

1. *Supporting Material for Draft Surface Water Augmentation Criteria* (dated July 2014), prepared by DDW.
2. *California Direct Potable Reuse Initiative Research Briefing* (dated July 2014), prepared by WRRF and WateReuse California.
3. *California Direct Potable Reuse Initiative Research Plan* (updated July 2014), prepared by WRRF and WateReuse California.
4. *California Direct Potable Reuse Initiative Response to June 12, 2014 Expert Panel Report* (dated July 21, 2014), prepared by WRRF and WateReuse California.
5. *Draft DDW Advisory Committee for Expert Panel on Direct Potable Reuse Minutes of Meeting No. 2* (dated July 11, 2014), prepared by DDW Advisory Committee.

Volume III

Presentation Slides:

- Summary of Panel Activities: NWRI Expert Panel for DDW
- Surface Water Augmentation Statutory Mandates and Tasks
- Regulation Development
- Surface Water Augmentation Criteria Rough Draft
- WRRF DPR Research Update
- Briefing on Potable Reuse in California
- Regulating Direct Potable Reuse: A Possible Approach
- Real-Life Reliability (Or How It May Not Be Built as Designed Or How It May Not Be Operated as Intended)
- Summary of Meeting #2 of the DPR Advisory Committee

PRESENTATION SLIDES FROM THE JULY 24-25, MEETING OF THE EXPERT PANEL

NWRI

NWRI Expert Panel for the
State Water Resources Control Board's
Division of Drinking Water

Expert Panel Meeting #2

Development of Water Recycling Criteria for IPR through Surface Water Augmentation and the Feasibility of Developing Criteria for DPR

July 24-25, 2014
Fountain Valley, CA

Agenda Item #1

Welcome and Introductions

- Jeff Mosher, NWRI
- Adam Olivieri, Panel Co-Chair
- Jim Crook, Panel Co-Chair

Notice of Change

As of July 1, 2014, the California Drinking Water Program (which includes the Recycled Water Program) was officially transferred from the California Department of Public Health (CDPH) to the State Water Resource Control Board (SWRCB) and named the "Division of Drinking Water" (DDW).

California Water Boards

New Division Director of DDW

- Cindy Forbes named the Division Director of DDW in July 2014
- Served as Chief of the Drinking Water Program for CDPH's Southern California Field Operations Branch for over 30 years

DDW Representatives for Panel

- Bruce Burton (not in attendance)
- Randy Barnard
- Brian Bernados
- Bob Hultquist
- Mike McKibbon
- Mark Bartson (manages Advisory Committee)

Change to Panel Leadership

- Panel Chair Dr. Rhodes Trussell
  - Concerns about the increased role of his firm in DPR research
  - Resigned as Chair effective June 6, 2014
- NWRI and DDW
  - Process to select a new Panel Chair

New Panel Co-Chairs

In June, it was announced that Expert Panel member Dr. Adam Olivieri and environmental engineering consultant Dr. James Crook (retired CDPH) would serve as the new Panel Co-Chairs.

Adam Olivieri

James Crook

Purpose of Expert Panel: Surface Water Augmentation

Per California Water Code Section 13562 and 13565

- Prior to adopting uniform water recycling criteria for surface water augmentation, [DDW] shall submit the proposed criteria to the expert panel … the expert panel shall review the proposed criteria and shall adopt a finding as to whether, in its expert opinion, the proposed criteria would adequately protect public health.
- [DDW] shall not adopt uniform water recycling criteria for surface water augmentation … unless and until the expert panel adopts a finding that the proposed criteria would adequately protect public health.
- Advise DDW on "public health issues and scientific and technical matters regarding development of uniform water recycling criteria for IPR through surface water augmentation."

Purpose of Expert Panel: Direct Potable Reuse

Per California Water Code Section 13565

1. Advise DDW on "public health issues and scientific and technical matters" regarding the "investigation of the feasibility of developing uniform water recycling criteria for DPR.
2. "Assess what, if any, additional areas of research are needed to be able to establish [criteria] for DPR."
3. "Recommend an approach for accomplishing any additional needed research regarding [criteria] for DPR in a timely manner."

Introductions

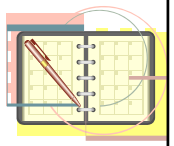
- Panel members
  - Not in attendance: Kara Nelson
- NWRI staff
- DDW staff
- Observers

Agenda Item #2

Review Meeting Agenda and Purpose of Panel Meeting

- Jim Crook and Adam Olivieri, Panel Co-Chairs

Meeting Agenda



Thursday, July 24

3. Summary of Panel Activities (Meeting #1)
4. DDW Perspective: Statuary Mandates and Specific Tasks of Panel
5. Draft SWA Criteria: Overview of Regulatory Process and Regulatory Feasibility
6. Overview of Preliminary SWA Criteria
7. Overview of DPR Research Initiative Efforts
8. Briefings on Potable Reuse in California
9. DPR Advisory Committee Update
10. Open Session Discussion

Meeting Agenda

Friday, July 25 – CLOSED SESSION

1. Review and Discussion:
   - SWA Criteria
   - DPR Research Status
   - Feasibility of DPR Criteria
2. Wrap-Up
3. Assignments for Meeting Deliverables
4. Schedule and Next Steps

Agenda Item #3

Summary of Expert Panel Activities (Meeting #1)

- Jeff Mosher, National Water Research Institute

Expert Panel Meeting #2
July 24-25, 2014 ◆ Fountain Valley, California

Summary of Panel Activities: NWRI Expert Panel for DDW

Jeff Mosher, NWRI Executive Director
Fountain Valley, CA
jmosher@nwri-usa.org

NWRI National Water Research Institute

Examples of Potable Reuse Projects

Surface Water Augmentation with IPR

- City of San Diego

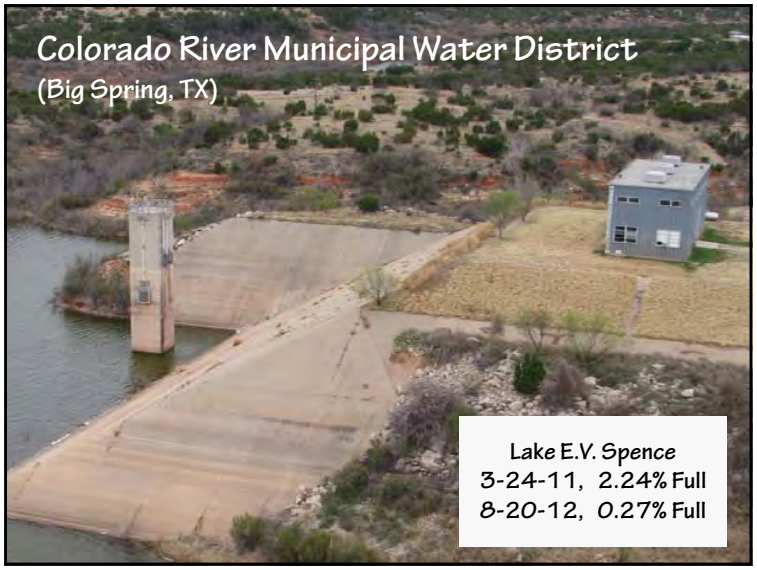
Direct Potable Reuse

- Big Spring, Texas (operating)
- Wichita Falls, Texas (operating)
- El Paso, Texas
- Cloudcroft, New Mexico (2015)

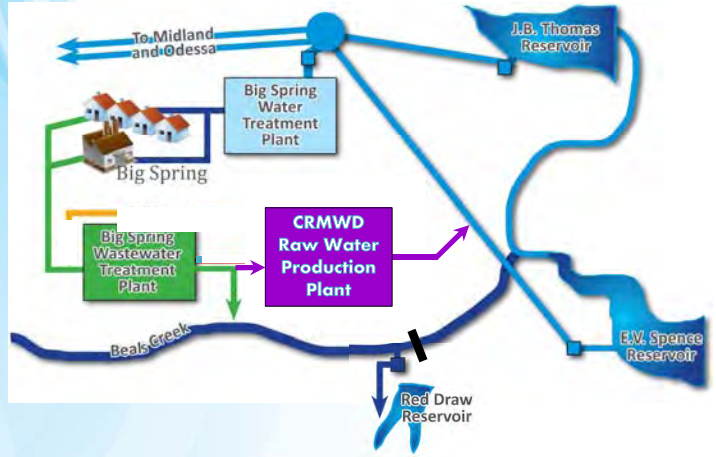
San Diego – Reservoir Augmentation

- Expert Panels
- Demonstration Facility
- Concept Approved by CDPH

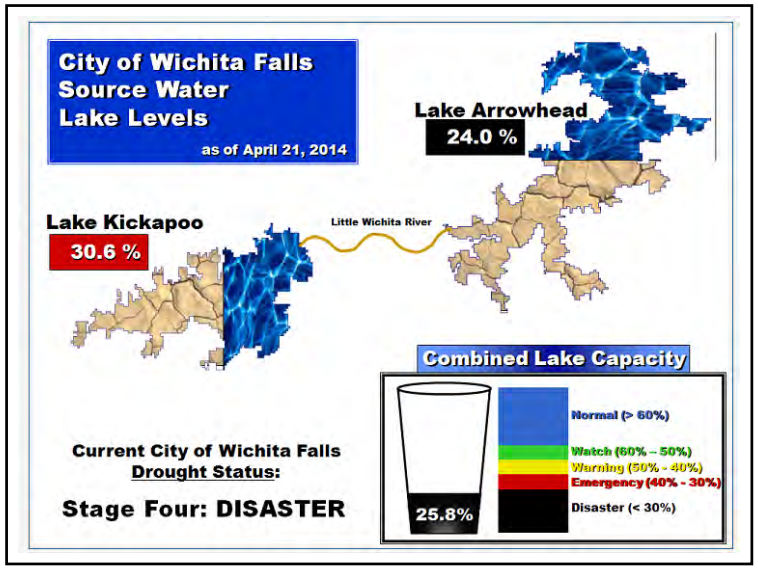
Colorado River Municipal Water District
(Big Spring, TX)



Big Spring (TX) Reclamation Project

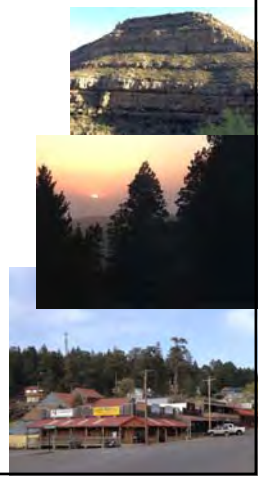


Big Spring Startup – 2013



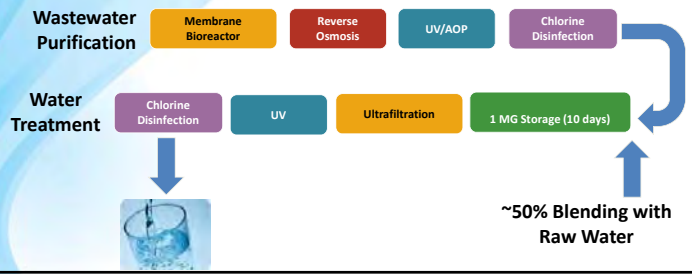
Cloudcroft, New Mexico - 2014

- Water Supply is low, and DPR is the answer.
  - Vacation community.
  - At 9,000 feet, there are limited groundwater resources.
  - No surface water resources.
  - Population doubles/triples during peak tourist season.
  - Water is needed to sustain tourism in the Village.
- Public support is split 50/50



Proposed DPR System for Cloudcroft

- System is not yet operational.
  - 80% constructed.
  - Goes online Spring 2015.
- Highly advanced and redundant processes.



Critical Issues to Address in Cloudcroft

New Mexico Environment Department needs answers.

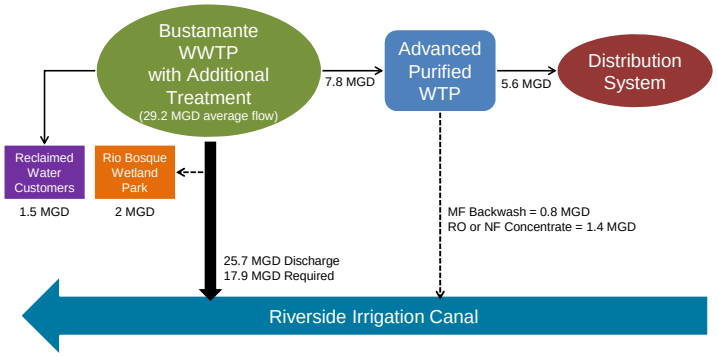
- What level of treatment meets public health standards?
- Is the existing treatment scheme sufficient? What about process monitoring?
- How will a small community properly operate an advanced facility?
- What type of statewide guidance is needed for big and small DPR projects?

NWRI NM Panel Addresses Key Issues

- Operation and maintenance (O&M) issues are key!
  - Training
  - Retraining
  - Staff redundancy (small community!)
  - Budgeting - this will be a large increase in O&M costs.
- Outreach & Education ASAP



El Paso Water Utilities
Advanced Purified WTP Concept
Irrigation Season (February 16-October 15)



White Paper on DPR Guidelines

- NWRI Project
- Sponsored by WateReuse Association
- Co-Sponsored by:
  - WEF
  - AWWA
- National in scope
- Panel members
  - George Tchobanoglous (Chair)
  - Joe Cotruvo
  - Andy Salveson
  - Shane Trussell
  - Jim Crook
  - Adam Olivieri
- Project Advisory Committee representatives from:
  - ASDWA and U.S. EPA

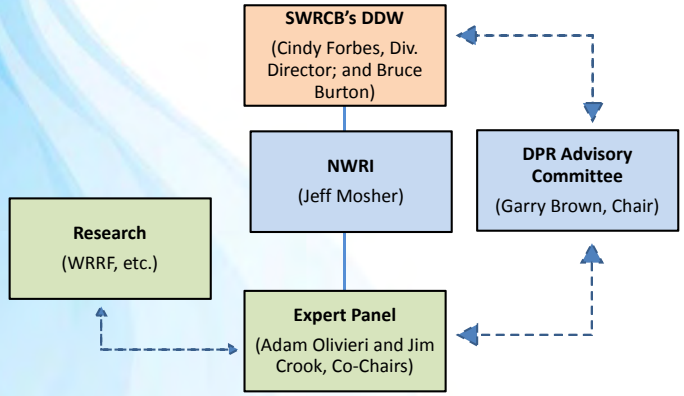
Other DPR Activities

- New Mexico Environment Department
  - Including Cloudcroft DPR
- Texas Water Development Board
  - DPR “Resource Document”
- NWRI “DPR implementation” project funded by NSF:
  - Treatment/water quality requirements for treatment wastewater effluent as an input into a drinking water treatment plant
  - Involvement by TCEQ, Water Research Foundation, and U.S. EPA

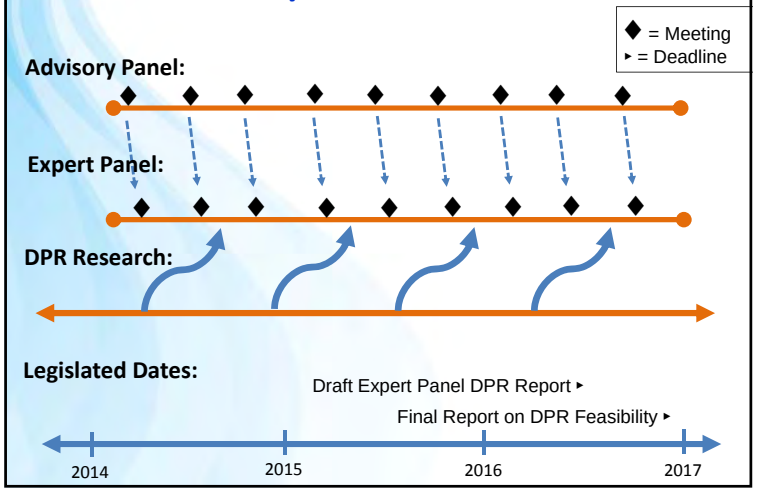
NWRI Expert Panel for State of California

- Legislative mandate for Expert Panel
- Legislative mandate for Advisory Committee
- Specific to California

Calif. Expert Panel Organization



Calif. Expert Panel Timeline



First Expert Panel Meeting

- Conference call held on March 5, 2014
- All Panel Members attended
  - Rhodes Trussell served as Chair
- Focused on:
  - Discussing CDPH's (now DDW's) mandate
  - Reviewing current version of the California DPR Initiative Research Plan and other current DPR research activities
  - Identifying additional areas of research needed to establish criteria for DPR

Panel Report - Contents

The report represent a summary of the issues on the Panel's mind as they begin deliberations. Comments are provided to help WRRF strengthen its DPR research plan and for DDW's consideration.

Volume I

- General Comments
- CDPH Mandate and Panel Process
- Comments about the Research Plan
- Panel's Response to Research Plan Questions

Volume II

- Presentation Slides from the March 5, 2014, Web-Enabled Conference Call Meeting of the Expert Panel
- California Direct Potable Reuse Initiative Research Plan
- California Water Code Section 13560-13569

Meeting #1 Outcomes

- NWRI established file sharing server for important documents (Huddle)
- NWRI developed e-newsletter on expert panel news and activities
- DDW provided data on out-of-spec behavior for IPR projects and drinking water treatment plants throughout CA
- WWRF updated the DPR Research Initiative Plan
  - WRRF to provide presentation
- Panel report provided to DPR Advisory Committee for review and comments

DPR Advisory Committee

Per California Water Code Section 13565

- "[DDW] shall convene an advisory group … of water and wastewater agencies, local public health officers, environmental organizations, environmental justice organizations, public health NGOs, the department, the state board, the US Environmental Protection Agency, ratepayer or taxpayer advocate organizations, and the business community…."
- Purpose: To advise the expert panel regarding the development of water recycling criteria for DPR and the draft report required by Section 13563.

Committee Members

- Chair: Garry Brown, Orange County Coastkeeper
- Ray Tremblay, Los Angeles County Sanitation Districts
- Jim Fiedler, Santa Clara Valley Water District
- Marsi Steirer, City of San Diego
- Mike Wehner, Orange County Water District
- Al Lau, Padre Dam Municipal Water District
- Keith Solar, San Diego County Taxpayers Association
- Traci Minamide, LASAN Bureau of Sanitation
- Andria Ventura, Clean Water Action
- Conner Everts, Environmental Justice Coalition for Water
- Fran Spivy-Weber, SWRCB
- Alisa Reinhardt, San Diego Regional Chamber of Commerce
- Charles Mosher, Mariposa County Health Department
- Bruce Macler, U.S. EPA
- Randy Barnard, DDW

Advisory Committee Activities

- Meeting #1 held on February 21, 2014
- Meeting #2 held on July 11, 2014
- The meetings are public meetings
- Agenda included:
  - Update and review of expert panel activities, including the panel report
  - Discussion and comments for expert panel
  - Scheduling expert panel meetings and advisory committee meetings
- Meeting minutes available
- Mike Wehner will give presentation on Meeting #2 of the Advisory Committee

Expert Panel Meeting #2

- Primary focus:
  - Draft surface water augmentation criteria
- Anticipated deliverables:
  - Meeting summary responding to (1) draft SWA criteria and (2) Advisory Committee comments
  - Develop approach/outline for DPR review
- Schedule next few meetings in advance

Questions?

Agenda Item #4

DDW Perspective and Panel Overview

Statuary Mandates and Specific Tasks of the Panel

- Mike McKibben, DDW

Agenda Item #5

Review Draft DDW Surface Water Augmentation Criteria

Overview of Regulatory Process and Regulatory Feasibility

- Mike McKibben, DDW

Agenda Item #6

Review Draft DDW Surface Water Augmentation Criteria

Overview of Preliminary Surface Water Augmentation Criteria

- Bob Hultquist, DDW

Agenda Item #7

DPR Research Update

Overview of DPR Research Initiative

- Doug Owen, Board Vice Chair, WateReuse Research Foundation

Agenda Item #8

Approach to DPR Criteria Review

Briefing on Potable Reuse in California

- Randy Barnard, DDW
- Bob Hultquist, DDW
- Brian Bernados, DDW

Agenda Item #9

Approach to DPR Criteria Review

DPR Advisory Committee Update

- Mike Wehner, Orange County Water District and Advisory Committee Member

Expert Panel Meeting

Open Session Discussion

Expert Panel Meeting

Adjourn Day 1

Surface Water Augmentation
Statutory Mandates and Tasks

Michael G. McKibben, PE
Regulatory Development Unit
Division of Drinking Water
State Water Resources Control Board
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General Mandate

Water Code §13562:

- By December 31, 2016, the State Board's Division of Drinking Water (DDW, *formerly* the CA Department of Public Health's Drinking Water Program), must adopt uniform water recycling criteria for surface water augmentation…*if* the expert panel finds that the proposed criteria would adequately protect public health.

Specifics – Expert Panel

WC §13565(a)(1)…

- No later than February 15, 2014, DDW to convene and administer an expert panel
- Expert panel's purpose is to advise DDW on *"public health issues and scientific and technical matters regarding development of uniform water recycling criteria for indirect potable reuse through surface water augmentation"*

Specifics – Expert Panel, cont.

WC §13565 (a)(2)…

At a *minimum*, the expert panel must include:

- A toxicologist
- A CA licensed engineer, with at least 3 years of wastewater experience
- A CA licensed engineer, with at least 3 years of drinking water experience
- An epidemiologist
- A microbiologist, and
- A chemist

General Definitions

- Surface Water Augmentation (WC §13561): SWA is *"the planned placement of recycled water into a surface water reservoir used as a source of domestic drinking water supply"*
- Uniform water recycling criteria (WC §13561): States that uniform water recycling criteria has the same meaning as in WC §13521. Here's the referenced 'meaning':
  - *"The State Department of Public Health shall establish uniform statewide recycling criteria for each varying type of use of recycled water where the use involves the protection of public health."*

Specifics – Uniform Criteria

WC §13564, uniform water recycling criteria elements the DDW must consider:

(a) Final National Water Research Institute (NWRI) Independent Advisory Panel report for San Diego's SWA project

(b) Monitoring results and research from SWA studies

(c) SWA demonstration studies

(d) SWA epidemiological studies and risk assessments

Uniform Criteria, cont.

(e) Applicability of RW advanced treatment, including GW recharge/replenishment projects

(f) WQ, limnology, and risk assessments associated with existing potable water supplies subject to municipal wastewater, stormwater, and agricultural runoff

(g) The recommendations of the CA Constituents of Emerging Concern Recycled Water Policy Science Advisory Panel

(h) State-funded research conducted pursuant to WC §§79144 and 79145(b)

Uniform Criteria, cont.

(i) Research and recommendations from the US EPA's Guidelines for Water Reuse.

(j) The National Research Council of the National Academies' report titled *"Water Reuse: Potential for Expanding the Nation's Water Supply Through Reuse of Municipal Wastewater."*

(k) Other relevant research and studies regarding indirect potable reuse of recycled water.

*In addition, WC §13567 requires the criteria to meet the CA SDWA, and the federal CWA and SDWA requirements

Each of these elements *must* be considered.

Uniform Criteria, cont.

WC §13562(b): States that the uniform water recycling criteria is subject to GC Chapter 3.5, §11340 et seq.

- Government Code, Chapter 3.5, establishes requirements for regulations and rulemaking procedures
- *Implies* the uniform water recycling criteria must be a regulation

More on this subject in the regulation process presentation

Misc.

H&SC §116551: DDW shall not permit a source of supply reservoir to be augmented with RW per WC §13050(n) unless the DDW…

- Performs an engineering evaluation of the proposed treatment
- Finds that the treatment will ensure that the RW *"meets or exceeds all applicable primary and secondary drinking water standards and poses no significant threat to public health"*
- Holds at least 3 public hearings in the community to be supplied the augmented drinking water and receives testimony, while making the evaluations and findings available to the public at least 10 days prior to the first hearing

Misc.

…and **finally**,

WC §13563.5:

- Requires the DDW/Board to report, annually (from 2011-16), on the progress toward developing uniform water recycling criteria for SWA.

Contact Information

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Regulation Development

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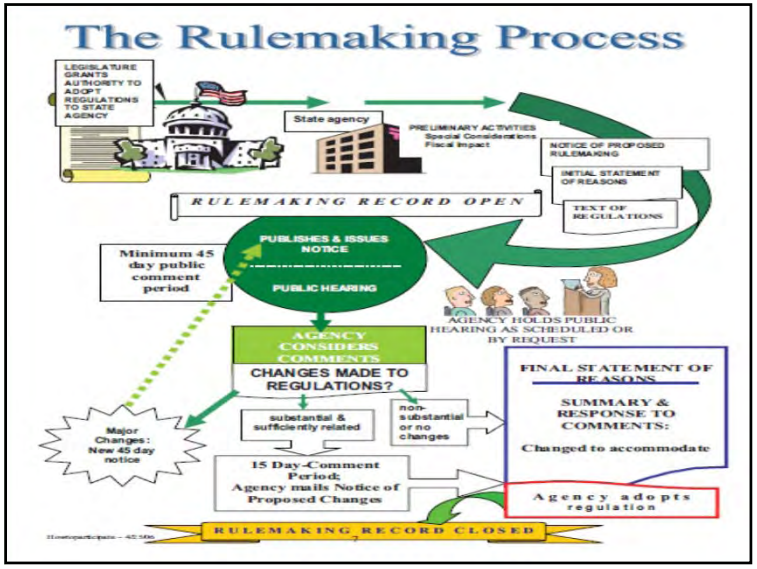

Hierarchy of Law

Constitution

Statutes

*Regulations**

Permit Provisions

~~*Underground Regulations*~~

State Board Policies

*In some cases, the State Board can adopt "policies" and "plans" that also have the force of law, akin to regulations.

- Specifically, for policies and plans for "water quality control"
- WC 13050(i) defines WQ control as *"the regulation of any activity or factor which may affect the quality of the waters of the state and includes the prevention and correction of water pollution and nuisance."*

Board Policies – UWRC?

- With the Drinking Water Program now being DDW under the Board, will DDW be able to utilize the same process to adopt such policies, rather than regulations?
- Could the SWA uniform criteria be adopted as a policy?

Board Policies – UWRC?

WC §13562(b): States that the uniform water recycling criteria is subject to GC Chapter 3.5, §11340 et seq.

- Chapter 3.5 establishes requirements for regulations and rulemaking procedures, *implying* the criteria must be regulations
- However, within Chapter 3.5 is Article 9 - "Special Procedures" – which includes the requirements for the adoption of policies by the Board, having the force of law
- Adoption of policies under Article 9 are exempt from a number of requirements for adoption of regulations

Is this a viable option for adoption of the SWA uniform water recycling criteria?

All regulations follow a similar path. The major phases are…

- *Inspiration, cause, or need for a regulation*
- *Regulatory package development*
- *Formal regulation adoption process*
- *Implementation*

Inspiration, cause, or need for a regulation…

- For DDW regulations, the inspiration or need may come from one or a combination of the following:
  - *A public health concern.* Examples: New contaminants of concern (e.g. perchlorate, 1,2,3-TCP, hexavalent chromium), or other needs to ensure protection of public health
  - *Promulgation of a Federal Regulation.* Examples: SWTR (e.g. IESWTR, LT1, LT2) and DDBP (e.g. Stage 1 & 2), arsenic, lead & copper, GW Rule, etc.
  - *Required and/or authorized by State law.* Examples: Perchlorate, MTBE, Hexavalent Chromium, POU/POE, GW Replenishment, Surface Water Augmentation, WW Standards, Cross-Connection, etc.
  - *Revision of and updating current regulations.* Examples: Cross Connection Control, Waterworks Standards, GW Recharge, etc.

Regulation phases

- *Inspiration, cause, or need for a regulation*
- *Regulatory package development*
- *Formal regulation adoption process*
- *Implementation*

Regulatory package development…

- Most regulation packages consist of the following primary documents:
  - Transmittal memos
  - Notice of Proposed Rulemaking
  - Initial Statement of Reasons (including documents relied upon or referenced)
  - Informative Digest
  - Regulation Text
  - Cost Estimating Methodology and Form 399

The Key Components – Reg Text

- Proposed Regulation Text:
  - In developing the draft regulation text, the DDW works with committees typically consisting of…
    - Field staff,
    - Management,
    - Stakeholders, as well as
    - The general public
  - Underline or use italics to indicate additions; strikeout text to be deleted
  - Federal regulations typically must be re-written to be coherent with existing State regulations and, if necessary, make them more stringent or more clear
  - If a change is proposed for a section, the entire section must be included…no matter how minor the proposed change

The Key Components - ISOR

- Initial Statement of Reasons – primary elements:
  - Description of the specific purpose of the proposed regulatory action
  - Description of the rationale and reasons that the proposed action (regulation) carries out the purpose
  - A list of all material relied upon by the agency
  - Reasonable alternatives
  - Fiscal impact on the state, etc.

The Key Components – CEM

- Cost Estimating Methodology:
  - aka…a fiscal impact analysis
  - Cost breakdown and summary of the proposed regulations on those directly impacted
  - Includes:
    - Statement of Mandate
    - Background and introductory material
    - Working data
    - Assumptions
    - Calculations
    - Conclusions

The Key Components - Notice

- Notice of Proposed Rulemaking:
  - Published in the California Regulatory Notice Register (Register Notice), which includes:
    - General information - agency, contact information, date by which comments must be submitted, etc.
    - Informative Digest –
      - Summary of existing law and regulations directly related to the proposed regulatory action
      - Whether the proposed action differs substantially from federal statutes or regulations
      - A 'policy statement overview' explaining the objectives of the action

MCL package development… Public Health Goals (PHGs)

- For regulations setting MCLs, the Office of Environmental Health Hazard Assessment (OEHHA) plays a critical role.
- Through a risk assessment, OEHHA derives a PHG. The risk assessment includes a comprehensive review of scientific literature & human and/or animal exposure studies based on public health considerations.
- H&SC §116365(c): A PHG is *"an estimate of the level of the contaminant in drinking water that is not anticipated to cause or contribute to adverse health effects, or does not pose any significant risk to health."*

MCL package development…

- H&SC §116365(a): Requires each primary drinking water standard to be set *"at a level that is as close as feasible to the corresponding public health goal placing primary emphasis on the protection of public health…to the extent technologically and economically feasible…"*
- This leads to an extensive cost-benefit analysis at various "trial" MCLs, which takes into consideration:
  - Occurrence data
  - Treatment feasibility and costs
  - Costs of monitoring, analysis, and contaminant removal
  - Potential population exposed/affected

Regulatory package development…
Federal considerations

- To maintain its primacy, the DDW must:
  - Adopt regulations no less stringent than the Federal regulations
  - Adopt parallel regulations within 2 years of EPA's promulgation of their new or revised regulations. This timeframe, even with an allowed 2 year extension, is rarely met. The regulatory development and adoption process is lengthy!

With no comparable federal regulations, this isn't relevant to SWA.

Regulation phases

- *Inspiration, cause, or need for a regulation*
- *Regulatory package development*
- *Formal regulation adoption process*
- *Implementation*

Formal regulation adoption process
A new intermediate step…

Now that DDW is under the Board, it appears H&SC §57004 will apply to DDW regulations, since no statutory exemption was carved out during the transition process.

- H&SC §57004 requires regulations (and policies with the effect of a regulation) to undergo a scientific peer review

Formal regulation adoption process
A new intermediate step…cont.

H&SC 57004 peer review:

- Only the "scientific basis" and "scientific portions" are subject to the peer review. What do those terms mean?
  - *"…those foundations of a rule that are premised upon, or derived from, empirical data or other scientific findings, conclusions, or assumptions establishing a regulatory level, standard, or other requirement for the protection of public health or the environment."*

Formal regulation adoption process A new intermediate step…cont.

H&SC §57004 peer review…by who?

- Board enters into agreement with…
  - National Academy of Sciences,
  - University of CA,
  - Cal State University,
  - Similar scientific institution of higher learning,
  - Any combination of those entities, or
  - *A group of scientists of comparable stature and qualifications that is recommended by the President of the University of California**

Formal regulation adoption process A new intermediate step…

H&SC §57004 peer review…by the expert panel?

- (c) states: *"No person may serve as an external scientific peer reviewer for the scientific portion of a rule if that person participated in the development of the scientific basis or scientific portion of the rule."*

***[Flashback**…*WC §13565(a)(1): Expert panel's purpose is to advise DDW on *"public health issues and scientific and technical matters regarding development of uniform water recycling criteria for indirect potable reuse through surface water augmentation"]*

Formal regulation adoption process The primary steps…

- Once the package is 'complete', it's ready to enter the formal process. The *primary* milestones or steps in the formal process are…

1. Package review by the Office of Regulations(?)…and typically a number of attorneys throughout the process
2. Budget Office review
3. Department of Finance review
4. Board and Cal EPA review

Formal regulation adoption process The primary steps…

5. Office of Administrative Law (for preparation of public notice through OAL's California Regulatory Notice Register)
6. 45-day (calendar days) public comment period and a public hearing
7. 15-day (calendar days) second public comment period. The second public comment period is only needed if substantive changes are made as a result of the 45-day comments received
8. Development of the Final Statement of Reasons, along with obtaining other approvals

Formal regulation adoption process The primary steps, cont…

9. 30-day (working days) Office of Administrative Law review. *If* disapproved, OAL will transmit its legal opinion to the regulatory agency explaining its basis. The agency then has 120 days to correct the problem(s) and will usually involve another 15-day public comment period.

10. Signature by the Secretary of State (i.e. OAL approval and filing with the Secretary of State). The regulation becomes effective….
    - January 1 if the regulation is filed from September 1 to November 30
    - April 1 if the regulation is filed on December 1 to February 29
    - July 1 if the regulation is filed on March 1 to May 31
    - October 1 if the regulation is filed on June 1 to August 31

OAL Review

- What does OAL want?!
  - Authority…they want us to identify statutes that provide the agency the authority to take the proposed action or what obligates the agency to take the action
  - Reference…they want us to identify statutes, court decisions, etc., interpreted or made specific by each proposed regulation
  - Consistency…they want our regulation to be in harmony with (i.e. not conflicting with) existing statutes, court decisions, etc.
  - Clarity…they want our regs to be written so that the meaning of the regulations will be well understood by the regulated community

OAL Review, cont…

- What else does OAL want?
  - Non-duplication…they want to make sure our reg does not serve the same purpose as another CA or federal rule
  - Necessity…they want substantial evidence for the need of the regulation to effectuate the purpose of the proposed regulation and, of course…
  - Ensure comments received during public comment periods are summarized and responses are provided, and the requirements of the APA were met.

Regulation phases

- *Inspiration, cause, or need for a regulation*
- *Regulatory package development*
- *Formal regulation adoption process*
- *Implementation*

Implementation

In an ideal world…

- State regulations are adopted and become effective in a timely manner, meeting any and all statutory deadlines, leading to smooth transition of enforcement
- State regulations are so clear, concise, and well conceived that no questions arise after promulgation
- The regulated communities read every word of the regulation, clearly understand what's expected of them, and act accordingly

Implementation

In the real world…

- The DDW often *implements* the Federal requirements without a State regulation in place as a basis for enforcement
- Regulations can be ambiguous, have loop-holes, or imply a more (or less) stringent standard than intended
- The regulated community doesn't have the personnel or expertise to keep up with all the ever-changing complex regulations

Implementation

So, what do we do?…

- We attempt to bridge the gap between the ideal world and the real world, to ensure consistency and protection of public health by way of…
  - Letters being sent to the regulated communities from field offices,
  - Guidance documents,
  - Information placed on the Internet,
  - Answers questions by regulated community, and
  - Having meetings like this....

Contact Information

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State Water Resources Control Board
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San Diego, CA 92101
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619.525.4023

SURFACE WATER AUGMENTATION

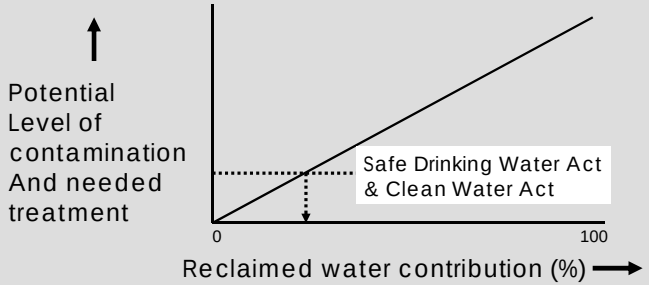
CRITERIA ROUGH DRAFT

Bob Hultquist
July 2014

TYPES OF POTABLE REUSE

- Conventional – waste discharges to a source of supply
- Indirect (IPR) – augment/replenish a groundwater or surface source
  - Do no harm to an existing source
- Direct (DPR) – reclaimed water directly into SWTP or distribution system

CONVENTIONAL IPR



GROUNDWATER RECHARGE IPR

- Regulations adopted
- The groundwater may end up being 100% recycled water at drinking water wells

SURFACE WATER AUGMENTATION IPR

- Water Code definition of surface water augmentation is:

  "the planned placement of recycled water into a surface water reservoir used as a source of domestic drinking water supply."

Reservoir, not any surface water

DIRECT POTABLE REUSE

Water Code definition of direct potable reuse is:

"the planned introduction of recycled water either directly into a public water system, as defined in Section 116275 of the Health and Safety Code," (*includes the distribution system*)

"or into a raw water supply immediately upstream of a water treatment plant." (*presumably a SWTP*)

FIT THE LAW

- Criteria must fit existing Federal and California statutes and Federal regulations
  - Changing a statute
    - Takes considerable time and resources
    - Outcome can be unpredictable
- All forms of potable reuse can be regulated with existing Federal and California law
- However - regulations addressing each specific type of potable reuse makes their regulation relatively straightforward

CALIFORNIA CODE AND REGULATIONS

- "Pure, wholesome, potable, and healthy water"
- Thorough permit process
- Chemical Standards (MCLs)
- Surface Water Treatment Rule (SWTR)
  - A water system "using an approved surface water shall provide multibarrier treatment necessary to reliably protect users from the adverse health effects of microbiological contaminants …"
  - Organism log reductions are determined as part of source approval process

APPROVED SURFACE WATER SOURCE FOR SURFACE WATER AUGMENTATION

- Source Water Assessment
  - Federal SDWA amendments of 1996 call for a SWAP by states to:
    - Delineate the watershed
    - Inventory potential contamination sources
    - Determine the susceptibility of the source to contamination
    - Provide recommendations to protect the source water
- Reservoir impairment by SWA IPR?
  - Vis-à-vis last SWAP bullet
  - Vis-à-vis state policy
  - Vis-à-vis Framework
- Treatability

WHERE IN TITLE 22?

	Recycling Criteria	Drinking Water Regs
Groundwater Recharge IPR	Public hearing Source Control Primary/secondary TOrC treatment Organism LRV treatment Natural barrier criteria Reliability scheme Monitoring and reporting Operations plan	
Surface Water Augmentation IPR	Permit Pretreatment Primary and secondary TOrC treatment Organism LRV treatment Monitoring and reporting Operations plan	Public hearing Permit Organism LRV treatment Reliability scheme Monitoring and reporting Operations plan
Direct Potable Reuse	Permit Pretreatment Primary and secondary	Public hearing Permit TOrC treatment Organism LRV treatment Reliability scheme Monitoring and reporting Operations plan

KEY SWA CRITERIA OBJECTIVES

- Pathogen control
- TOrC
- Reservoir Criteria to:
  - Make it true IPR (not DPR)
    - Opportunity to identify and respond to a treatment failure (as iin the groundwater recharge IPR regulation)or something similar
  - Define an approved surface source

POTABLE REUSE REGULATION PRINCIPLES

- What is “Safe”?
- Low tolerable risk
  - 10^{-4} annual risk of infection
  - Drinking water standards
  - Unregulated chemicals controlled to match good conventional supplies
    - Potentially harmful organic material found in wastewater (TOrCs, CECs, PhACs, et cetera)

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IMPLEMENTING THE GENERAL PRINCIPLES

What make SWA safe is largely in the details:

2nd layer
- Organism log reductions specified
  - Correct organisms?
- Treatment specified for TOrCs

3rd layer
- LRV consistency required
- TOrC treatment design and performance standards

WHAT IS SAFE?

- In the end SWA project that complies with the adopted regulation will be considered "safe"

SAFE = ADEQUATE PROTECTION OF PUBLIC HEALTH

"The expert panel shall review the proposed criteria and shall adopt a finding as to whether, in its expert opinion, the proposed criteria would adequately protect public health."

The panel is not obligated to accept our general principles or regulatory approach in its evaluation of criteria adequacy.

REGULATION OUTLINE

- Overview first
- then focus on a few key sections
  - Identified in **bold**

REGULATION DEFINITIONS

- **Surface Water Source Augmentation Project (SWSAP) -** a project that implements surface water augmentation at a specific reservoir.
- **SWSAP Water Recycling Agency -** any agency that receives water-recycling requirements for a SWSAP from a RWQCB and is, in whole or part, responsible for the SWSAP meeting the requirements of this Chapter.

MORE DEFINITIONS

- **SWSAP Sponsor** - the PWS, or PWSs, that assume responsibility for the reservoir design, monitoring, and operation requirements of the augmentated reservoir, and the SWT treatment of the abstracted water.
- **Augmented Reservoir -** a reservoir used as a domestic water source that receives a discharge of recycled water as part of a SWSAP.

TITLE 22 RECYCLING CRITERIA

- Section 60321. General Requirements.
- Industrial pretreatment and pollutant source control program
- Operations plan
- Adequate managerial and technical capability to assure compliance
- All necessary treatment processes have been installed and can be operated

RECYCLING CRITERIA - 2

- Section 60321.001 Alternatives.
- May use an alternative to a requirement
-
- Section 60321.002 Laboratory Analyses.
- Use approved methods

RECYCLING CRITERIA - 3

- Section 60321.003. **Control of Pathogenic Microorganisms**
- 12-log enteric virus, 10-log Giardia cyst, and 10-log Cryptosporidium oocyst reduction from the raw sewage to the finished drinking water
- Wastewater treatment must provide 8-log enteric virus, 7-log Giardia cyst, and 8-log Cryptosporidium oocyst reduction less the organism log reductions provided in the reservoir
- Multi barrier standard
- Validate each of the barriers

RECYCLING CRITERIA - 4

- Section 60321.004. Control of Regulated Chemicals and Physical Characteristics.
- Compliance with MCLs.

- Section 60321.005. Advanced Treatment Criteria.
- The section requires RO and AOP for the control of TOrCs
- Sets standards for the treatment

RECYCLING CRITERIA - 5

- Section 60321.006. Additional Chemical and Constituent Monitoring
- CEC monitoring
- Errors in NL subsection!

- Section 60321.007. Operation Optimization and Plan.

- Section 60321.008. Monitoring Between a SWSAP Recycled Water Discharge and Domestic Water Supply Withdrawal Point.
- Baseline and compliance chemical monitoring

TITLE 22 SURFACE WATER TREATMENT

- § 64601. **General Criteria for Determining the Suitability of a Reservoir Used as a Source of Domestic Water for Augmentation with Recycled Water.**
- Baseline reservoir water quality documented
- Project sponsor has sufficient control over operation of the reservoir

SURFACE WATER TREATMENT - 2

- § 64602. **Retention and/or Mixing of Recycled Water in the Reservoir.**
- Distinguish SWA IPR from DPR
- Provide IPR benefits similar to the RRT in GWR regulation
- Mixing and/or retention time

SURFACE WATER TREATMENT - 3

- § 64603. Sitting of the Point of Recycled Water Discharge to the Reservoir.
- § 64603. **Reservoir LRVs**
- § 64604. Public Hearings.
- § 64605. Alternative Source of Supply

THE DRAFT

- Intent and approach
- Regulation paraphrased

PATHOGENIC MICROORGANISMS

- Acute risk
- Set a log reduction treatment requirement
- Raw sewage to finished drinking water
  - 12-log Virus
  - 10-log *Giardia*
  - 10-log *Cryptosporidium*

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PATHOGENIC MICROORGANISMS - 2

- Start from raw sewage:
  - For virus and *Giardia* - Water Reuse (Asano et al, 2007) Table 3-9, high end of range
  - For *Cryptosporidium* use high (and rounded up) levels from studies in Melbourne and Norway
- End point are USEPA allowable drinking water densities

  (modified for *Cryptosporidium* infectious dose and exposure)
  - 10^{-4} annual risk of infection goal

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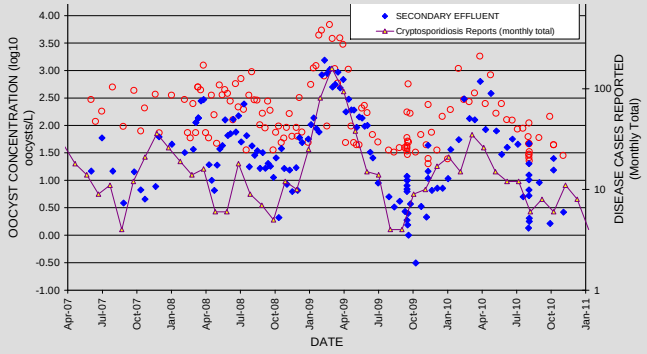
INITIAL PATHOGEN DENSITY DECISIONS

- Raw Sewage
  - Great range and variability of secondary treatment, filtration, and disinfection effectiveness
    - Can't ignore
    - Hard to address
  - Using raw allows case-by-case credit for all treatment
- Maximum density
  - Recycle water, not disease, even when there is an outbreak on the sewer-shed
  - Data sets will improve but regulation is relatively immutable

CRYPTOSPORIDIUM
MELBOURNE



MULTI-BARRIER PATHOGEN CONTROL

- Multiple barriers for reliability
  - Minimum number of significant barriers specified
- A project may select any set of treatment barriers that meet the total log reduction required
- Validate LRV with challenge test or report
- Verify performance

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60321.003 - CONTROL OF PATHOGENIC MICROORGANISMS.

- (a) Provide treatment to achieves at least
  - 8-log enteric virus,
    - 7-log Giardia cyst, and
    - 8-log Cryptosporidium oocyst reduction,
    - minus the organism log reductions provided in the reservoir.
- Treatment train shall consist of at least two separate treatment processes with no more than 6-log reduction and no less than 1.0-log reduction for each organism.
- *A project that would result in the need for more than the minimum SWT would constitute impairment of the reservoir source*.

PATHOGEN SECTION - 2

- (b) The SWSAP water recycling agency shall validate the treatment processes used to meet the requirements.
- The project sponsor shall include in its Operations Plan prepared on-going monitoring that verifies the performance.

PATHOGEN SECTION - 3

- (c) If the pathogen reduction is not met, immediately investigate the cause and initiate corrective actions.
- For failing to meet the pathogen reduction criteria longer than 4 consecutive hours or more than a total of 8 hours during any 7-day period, notify.
- If the reduction of virus is less than 6-logs, Giardia is less than 5-logs, or Cryptosporidium is less than 6-logs, immediately notify and stop discharge unless directed otherwise.

UNREGULATED CHEMICAL CONTROL

Advanced Treatment

- Continuous treatment with Reverse Osmosis and Advanced Oxidation
- Criteria were enhanced after repeated criteria failures
  - Multiple, independent barriers to organic chemical contaminants
    - RO permeate looks safe (when contaminant limits are met)
    - AOP is a precaution
- Effective at numerous sites

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UNREGULATED CHEMICAL CONTROL 2

- Alternatives must provide at least the same level of public health protection
- No blending required for DPR
- Error – recycling agency not sponsor

60321.005 - ADVANCED TREATMENT CRITERIA (FOR TORCS)

Use a reverse osmosis and an oxidation treatment process that:

(a) A project sponsor shall select for use a reverse osmosis membrane such that:

- (1) achieves a rejection of sodium chloride of no less than 99.0% and an average rejection of sodium chloride of no less than 99.2%, using specified test conditions
- (2) during the first twenty weeks of operation the membrane produces a permeate with no more than 5% of the sample results having TOC greater than 0.25 mg/L

FAT - 2

- (b) For the reverse osmosis treatment process, a project sponsor shall propose on-going performance monitoring.
- The proposal shall include at least one form of continuous monitoring, as well as the associated surrogate and/or operational parameter limits and alarm settings that indicate when the integrity has been compromised.

FAT - 3

- (c) To demonstrate a sufficient oxidation process has been designed for implementation, a project sponsor shall:
- (1) Perform an occurrence study to identify indicator compounds and select a at least 9, with at least one from each of the functional groups identified.
- (2) Utilize an oxidation process that achieves

FAT - 4

Requires:

- optimal removal of the indicator compounds selected and minimum specified removal functional groups
- Surrogate that reflects the removal of at least five of the nine indicator compounds selected – groups are specified

•Conduct testing that provides evidence that the requirements of paragraphs (2) and (3) can be met with a full-scale oxidation process. The testing shall determine the removal differential under normal operating conditions utilizing, at minimum, the nine indicator compounds identified.

FAT - 5

- (d) Alternatively a project may conduct testing demonstrating that the oxidation process will provide no less than 0.5-log reduction of 1,4-dioxane.

FAT - 6

- Surrogate and/or operational parameter monitoring
- Reporting
- MCL and NL compliance

64601 - General Criteria for Determining the Suitability …

- (a) Reservoirs must have been in operation as an approved surface water for a sufficient period of time to establish a baseline record of reservoir raw water quality and treated drinking water quality - no less than five years
- (b) The public water system using the reservoir must have sufficient control over the operation of the reservoir

RESERVOIR AS IPR

- Time between the advanced treatment and SWTP
  - Time to identify and respond to a treatment failure
    - Sampling period, analysis, evaluation, decision, remedial action, and time for action to be effective
  - 2 month minimum for groundwater recharge IPR
    - Minimum – more required if needed
    - Groundwater use is distributed and it may be complicated to respond to a failure
  - SWA response should be straightforward (less time required)
- Mixing off-spec water with good reservoir water mitigates the failure
  - 10:1 good for TOrCs
  - 10-100:1 provides an emergency 1 or 2 log pathogen LRV

64602 - RETENTION AND/OR MIXING OF RECYCLED WATER IN THE RESERVOIR.

(a) The reservoir must provide one of the following between the discharge and abstraction of the recycled water:

- A minimum 100:1 dilution of a 1-week production of recycled water with reservoir water
- A minimum 60-day retention of recycled water in the reservoir
- A minimum10:1 dilution of a 1-week production with reservoir water and a minimum 30-day retention of recycled water
- A minimum10:1 dilution of a 1-week production with reservoir water and a redundant 1-log reduction of each organism.

DILUTION AND TIME

- Reservoir water suitable for diluent credit must be from reservoir watershed runoff, imported water that has been approved as a surface water source, or compliant recycled water
- Recycled water may only be discharged into the reservoir when less than 1% of the reservoir water is off spec.
- The recycled water retention time in the reservoir is the elapsed time at which two percent of any volume of discharged recycled water has been abstracted.

64602 - THERMOCLINE

- (c) Where a thermocline is used to help meet the retention time requirements in (a):
- (i) The recycled water discharge must be above the thermocline and the withdrawal for drinking water use must be below the thermocline.
- (ii) Water shall not be abstracted from the reservoir for the duration of the relevant retention time option from subsection (a) once stratification is reestablished.

64601 – misc.

- (d) A reservoir theoretical retention time of at least twelve months.
- (f) Prior to the end of the sixth month of operation do a tracer study utilizing an added tracer.

64603 - RESERVOIR LRVS

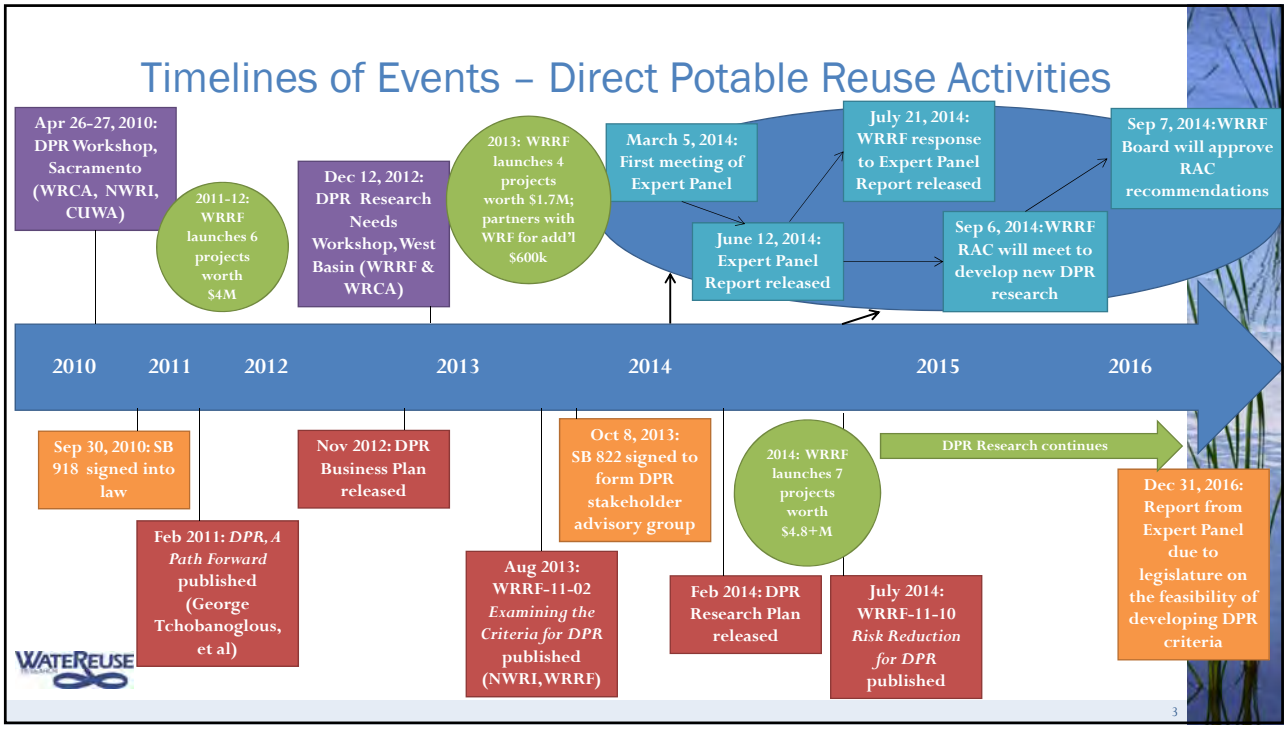
- For each month the recycled water is retained in the reservoir the recycled water will be credited with 1-log virus reduction.
- Reservoir LRVs for (other) organisms may be approved.

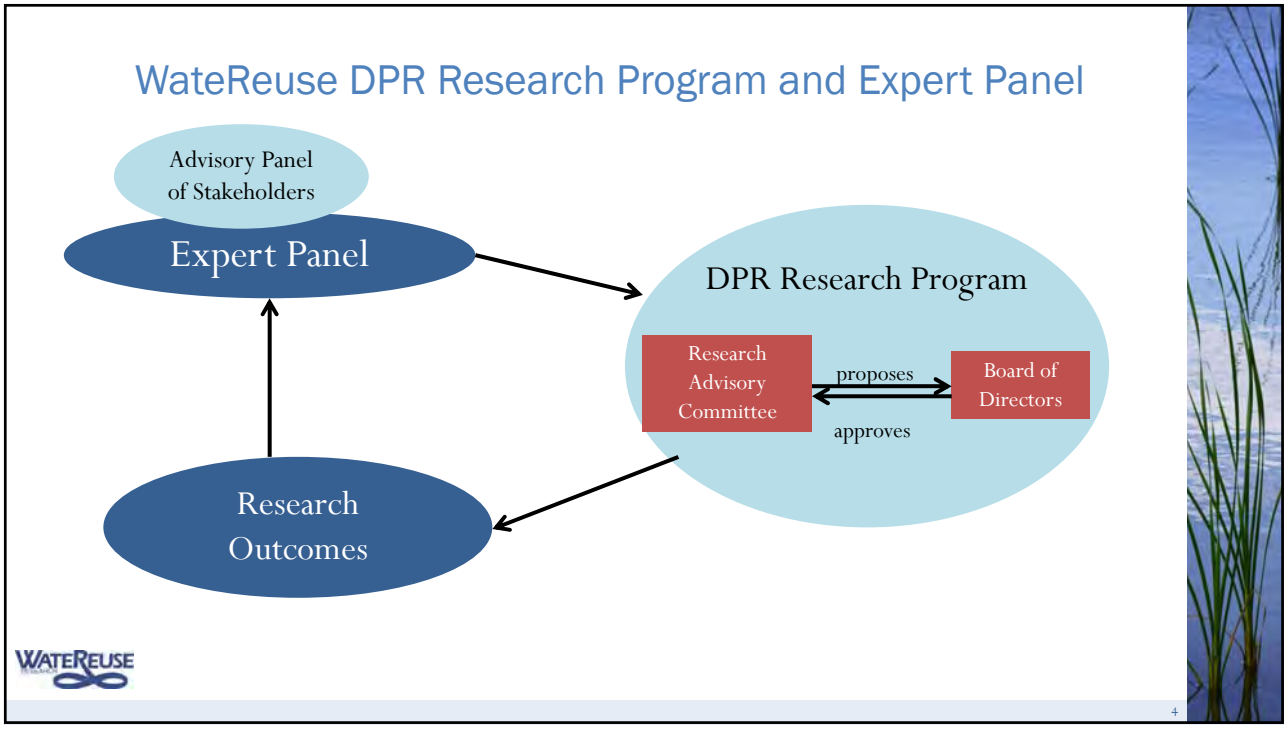
Questions?

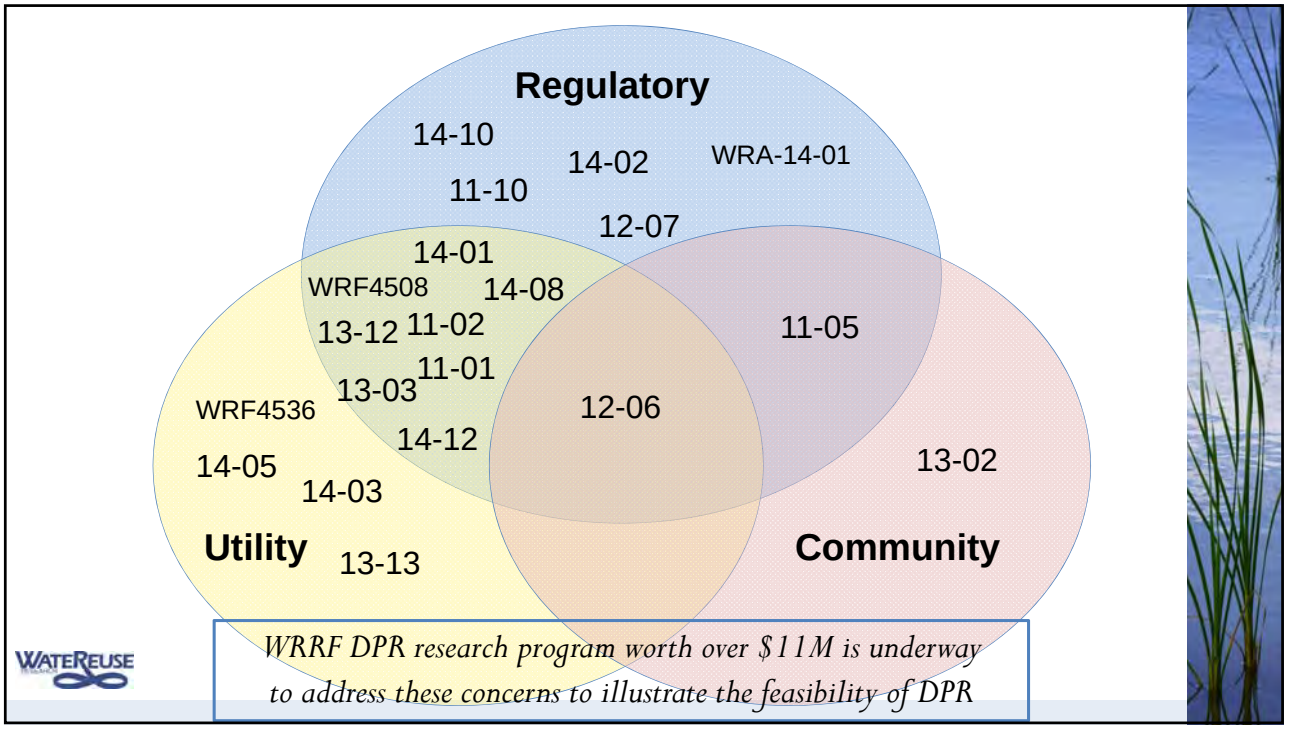
WRRF DPR Research Update

Expert Panel Meeting #2
July 24, 2014 Doug Owen, ARCADIS
WRRF Board Vice Chair

Overview of WRRF DPR Activities & Research


Timelines of Events – Direct Potable Reuse Activities
Apr 26-27, 2010: DPR Workshop, Sacramento (WRCA, NWRI, CUWA)
2011-12: WRRF launches 6 projects worth $4M
Dec 12, 2012: DPR Research Needs Workshop, West Basin (WRRF & WRCA)
2013: WRRF launches 4 projects worth $1.7M; partners with WRF for add'l $600k
March 5, 2014: First meeting of Expert Panel
July 21, 2014: WRRF response to Expert Panel Report released
Sep 7, 2014: WRRF Board will approve RAC recommendations
June 12, 2014: Expert Panel Report released
Sep 6, 2014: WRRF RAC will meet to develop new DPR research
2010
2011
2012
2013
2014
2015
2016
Sep 30, 2010: SB 918 signed into law
Feb 2011: DPR, A Path Forward published (George Tchobanoglous, et al)
Nov 2012: DPR Business Plan released
Aug 2013: WRRF-11-02 Examining the Criteria for DPR published (NWRI, WRRF)
Oct 8, 2013: SB 822 signed to form DPR stakeholder advisory group
Feb 2014: DPR Research Plan released
2014: WRRF launches 7 projects worth $4.8+M
July 2014: WRRF-11-10 Risk Reduction for DPR published
DPR Research continues
Dec 31, 2016: Report from Expert Panel due to legislature on the feasibility of developing DPR criteria
WATEREUSE
3


WateReuse DPR Research Program and Expert Panel
Advisory Panel of Stakeholders
Expert Panel
DPR Research Program
Research Advisory Committee
proposes
Board of Directors
approves
Research Outcomes
WATEREUSE
4


Regulatory
14-10
14-02
WRA-14-01
11-10
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WRF4508
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11-05
11-01
13-03
WRF4536
12-06
14-12
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Utility
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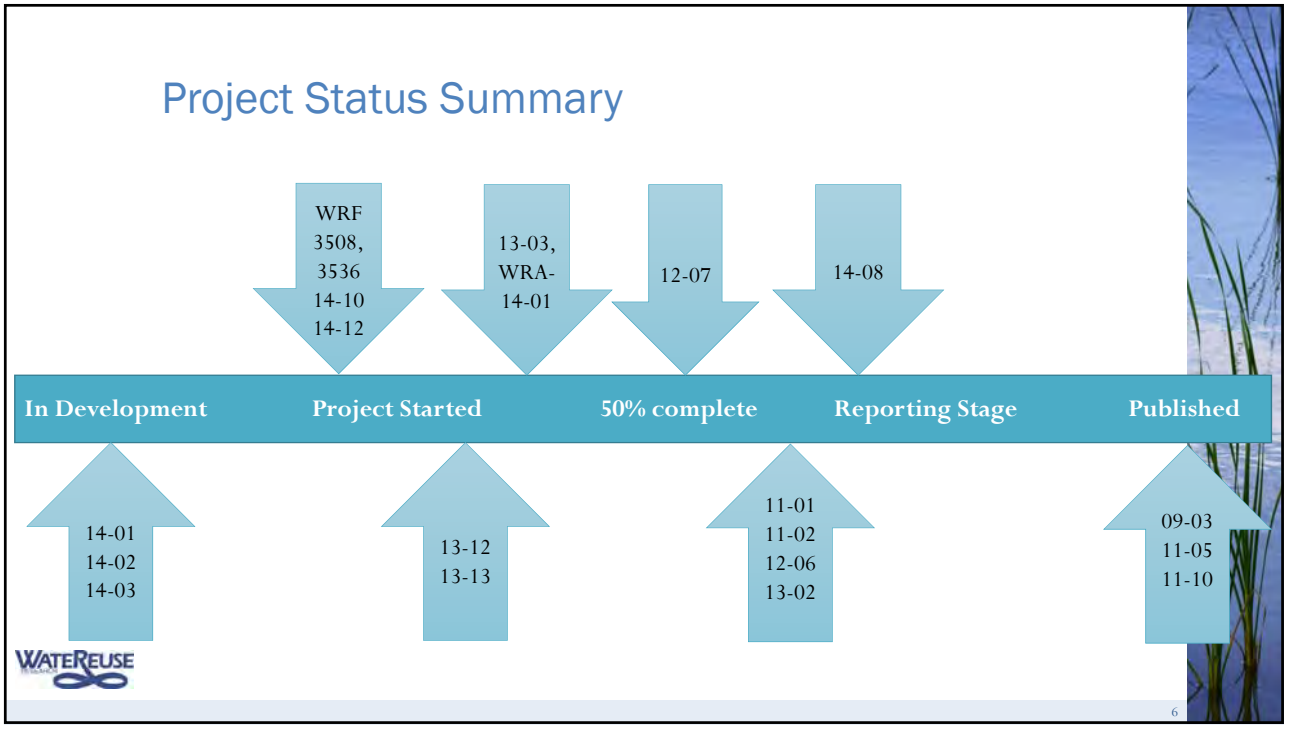
Community
WRRF DPR research program worth over $11M is underway
to address these concerns to illustrate the feasibility of DPR


Project Status Summary
WRF 3508, 3536 14-10 14-12
13-03, WRA-14-01
12-07
14-08
In Development
Project Started
50% complete
Reporting Stage
Published
14-01 14-02 14-03
13-12 13-13
11-01 11-02 12-06 13-02
09-03 11-05 11-10
6

Updates since last meeting on March 5, 2014

- Updated DPR Research Plan
- Research Briefing Update
- Response to Expert Panel June 12 Report

Updated DPR Research Plan – Includes new 2014 projects

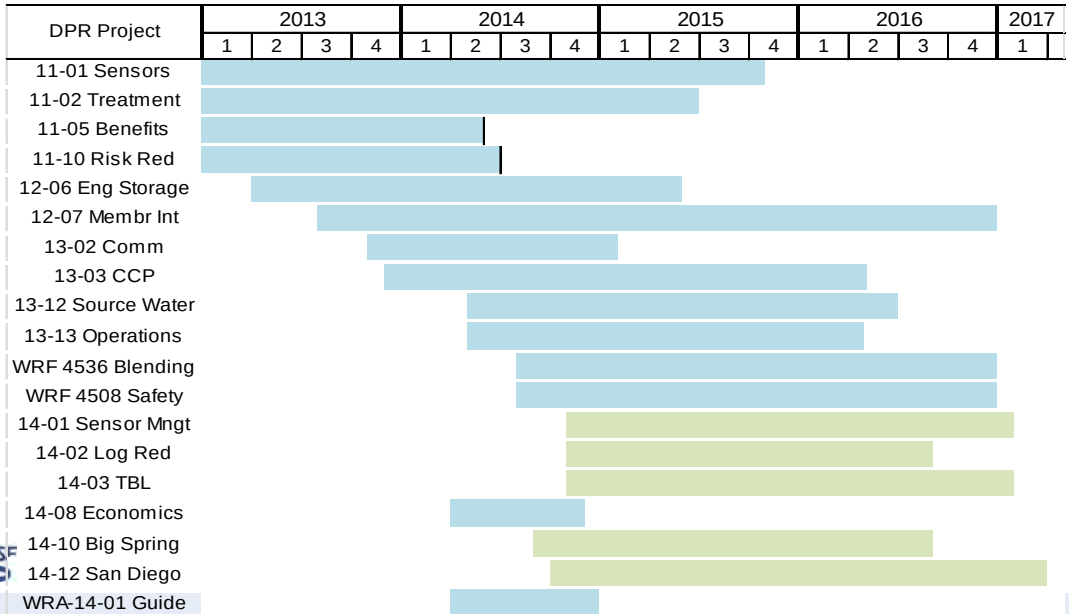
Project #	Title	PI, Affiliation	Research Focus	Budget
WRRF-14-01	Integrated Management of Sensor Data for Real Time Decision Making and Response	TBD	Regulatory - Process Reliability	$300,000
WRRF-14-02	Establishing additional log reduction credits for WWTPs	TBD	Regulatory - Treatment	$400,000
WRRF-14-03	Develop Methodology of comprehensive (fiscal/triple bottom line) analysis of alternative water supply projects compared to DPR	TBD	Utility	$250,000
WRRF-14-08	Economics of DPR	Bob Raucher, Stratus Consulting	Utility	$25,000
WRRF-14-10	Enhanced Pathogen and Pollutant Monitoring of the Colorado River Municipal Water District Raw Water Production Facility at Big Spring Texas	Eva Steinle-Darling, Carollo	Regulatory	$100,000 + $561,755 In kind
WRRF-14-12	Failsafe Potable Reuse Project at the City of San Diego's Advanced Water Purification Demonstration Facility	Shane Trussell, Trussell Technologies	Utility, Regulatory	$3,088,313 (DWR grant)
WRA-14-01	Developing Direct Potable Reuse Guidelines	Jeff Mosher, NWRI	Regulatory	$53,120

Research Briefing Update – Notable Project Updates since March 5

1. Regulatory Concerns
   - How to achieve treatment and process reliability through redundancy, robustness, and resilience
   - 13 ongoing projects, 2 published
2. Utility Concerns
   - Address economic and technical feasibility; operator training
   - 10 ongoing projects
3. Community Concerns
   - Awareness, Education, and Acceptance
   - 3 ongoing projects, 1 published

9

DPR Research Timeline



Response to Expert Panel June 12 Report

- Provides a response to the Comments Section (3), outlining where WRRF existing research will inform Expert Panel comments and where added research opportunities may lie.
- WRRF will assemble our Research Advisory Committee (RAC) on September 6, 2014 to expand our 2014 DPR program in response to this June 12 Expert Panel report.
- WRRF Board will consider and approve RAC recommendations for new DPR Research on September 7 meeting → new projects will be funded.

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Potential New Projects per June 12 Report – to be explored by the RAC in September

- The RAC will specifically address the concept of resilience and redundancy.
  - Evaluation of the different components of the treatment train and independence of the unit processes – what happens when one fails? Are they truly independent and is process resilient?
  - Also, WRRF-14-12 (San Diego demo) will illustrate the full concept of resilience

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Open for Discussion

- How to best interface with the Expert Panel
  - New research material will be continuously uploaded on dropbox
  - Briefing document provided prior to each Expert Panel meeting will provide project updates
  - WRRF PIs would be pleased to present at the Expert Panel meetings
- Application of Results
  - We will strive to create *practical* and *usable* products to ensure the **application** of results throughout the research process (in RFP, during project progress, deliverables).
  - We welcome specific recommendations to help foster the translation of results.

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Thank You!

Doug Owen, ARCADIS
WRRF Board Vice Chair

Appendix: Project Updates

Notable Updates: Regulatory/Utility Concerns

11-01 Monitoring for Reliability and Process Control of Potable Reuse Applications

- Bench scale work complete (evaluation of RO treatment of effluents ready soon).
- Pilot has been constructed, sensors installed, and trials have just begun.
- Evaluating reliability of multiple sensors for real-time detection of microbes through failure testing.
- Workshop #2 will be held 9/10 at the WateReuse Symposium in Dallas to discuss the results

11-02 Equivalency of Advanced Treatment Trains for Potable Reuse

- Phase 3 testing of MF-O_3-BAC-UV (Train 1a) ended in May and testing of O_3-BAC-MF-UV (Train 1b) will end shortly marking the end of pilot testing. Bench-scale UV photolysis testing for Train 1b will be finished soon as well.
- The 4th and final set of quarterly water quality samples from EPWU and UOSA will be collected in July.

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Notable Updates: Regulatory/Utility Concerns

12-07 Standard Methods for Integrity Testing of NF and RO Membranes

Key Workshop Findings:

- Ideal integrity monitoring technique should be on-line and real time to satisfy regulators
- On-Line TOC instruments are expensive ($40,000-$50,000 per unit; $3,000 per year operation and maintenance) with maintenance problems.
- Rhodamine WT (RWT) dye is being used at a full-scale plant to obtain 1.5 Log Reduction Value (LRV) credit from regulators. Challenge testing is performed once a year.
- Challenge testing with MS2 bacteriophage could be a cost-effective option if the water utility has its own lab capabilities.

13-03 CCP Assessment of Multiple Treatment Barriers of DPR Schemes

Key Workshop findings include:

- General water quality risks (grouping of classes of contaminants and microbes) were considered for this workshop as a means of optimizing the use of time. A detailed water quality risk assessment will be developed subsequent to the workshop by selected members of the team.
- The water quality targets for DPR included meeting all Federal drinking water standards as well as conforming to the pathogen reduction goals in the draft CA Groundwater Recharge Regulations including the "12-10-10" rule for virus, cryptosporidium, and giardia inactivation.
- Critical control point analysis was conducted and control points determined were reviewed for both the "FAT" of MF/UF-RO-UV/H_2O_2-Cl_2, and the alternative treatment process of O_3-BAC-GAC-UV-Cl_2.

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Notable Updates: Community Concerns

12-06 Guidelines for Engineered Storage Systems

- "The Ways of Water" video developed as part of Task 3 (Examining Public Perception)
- Many utilities (including Wichita Falls and El Paso) have requested a copy of the animation to use when meeting with news staff, tour participants, or on other occasions that they need to explain DPR to people who are not familiar with the terms. The video is currently available on the Foundation's website and has been translated to Spanish.

13-02 Model Public Communication Plan for Advancing DPR Acceptance

- Surveys and In Depth interviews have been completed, resulting in many interesting findings. A few key pieces gleaned from the surveys:
  - **DO** leverage public concern about California's ongoing water shortages to consolidate support for DPR – without relying on the current drought.
  - **DO** emphasize the role of scientists and public health professionals in designing and monitoring the process.
  - **DO** place a special emphasis on communications with women, communities of color, non-English speakers, seniors, and less well-educated and affluent communities.
  - **DO** continue to use "advanced purified water" as a term for the product of DPR.
  - **DO NOT** simply assert that technology has already made it possible to make any water safe to drink.

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EXPERT PANEL MEETING

BRIEFING ON POTABLE REUSE IN CA

July 24, 2014

IMPORTANT TIP

PERMITTING TYPICAL AND IMPAIRED SOURCES

WATER SUPPLY PERMITS

- Health and Safety Code
  - "pure and safe drinking water"
  - DDW is regulatory authority
- Permit is the permission to operate
  - Legal document
  - States operating conditions

TYPICAL SOURCE

- TMF
- DWSAP
- Water Works Standards
- Treatment information
  - Unit processes
  - Reliability
  - Disinfection
- Ops and Monitoring plans
- Operator certification

IMPAIRED SOURCES

- Source assessment - vulnerability
- Raw water quality - full characterization
- Source protection
- Effective monitoring and optimum treatment
- Health risks of failure
- Identify source alternatives

PERMITTING IPR PROJECTS

PORTER-COLOGNE ACT

- State Board has ultimate authority over water rights and water quality.
- Established nine Regional Boards.
- Boards permit discharges that affect ground and surface waters.

REGULATORY STRUCTURE

- Memorandum of Agreement (MOA) from 1996
- MOA delineates responsibilities
- RWQCBs have the permitting and ongoing oversight authority

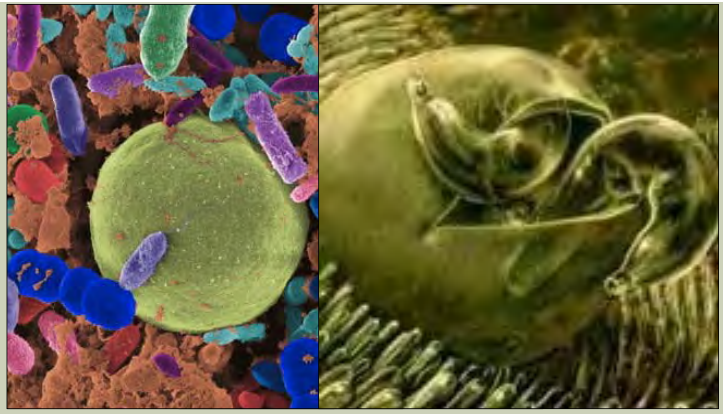
- DDW reviews reports when requested by RWQCB

CURRENT REGULATIONS

- Statutes
  - Health & Safety Code
  - Water Code
- Regulations
  - Title 17
  - Title 22
  - Groundwater Recharge (adopted July 18, 2014)
  - Surface Water Augmentation (under development)

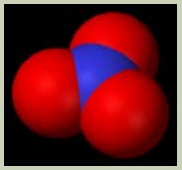
USING MUNICIPAL WASTEWATER AS A SOURCE

PATHOGENS



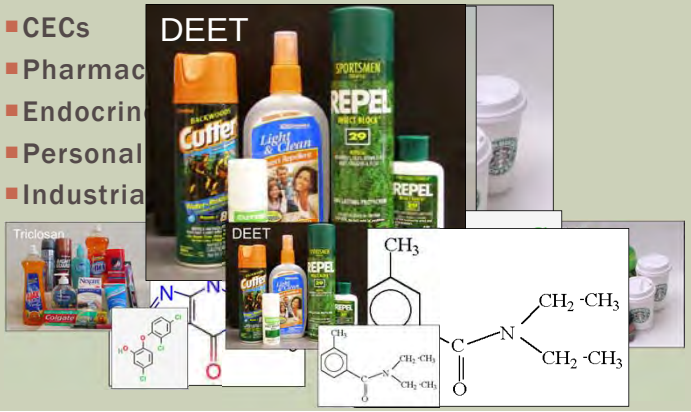
REGULATED CHEMICALS

- Inorganics
  - Nitrogen compounds
  - Lead
- Organics
  - Benzene
- Radionuclides
  - Radium
- DPBs
  - TTHMs
  - HAA5



UNREGULATED CHEMICALS

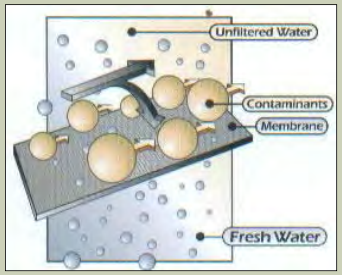
- CECs
- Pharmac
- Endocrin
- Personal
- Industria

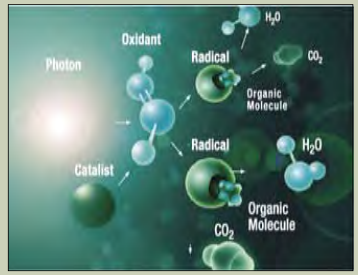


TREATMENT TECHNOLOGIES

FULL ADVANCED TREATMENT

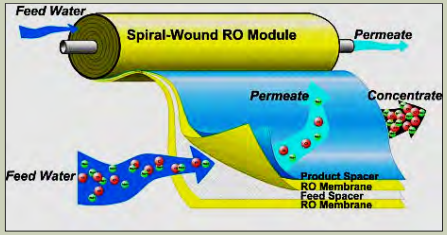
- Reverse Osmoses - Advanced Oxidation Process
- Common AOP
  - Ozone/H_2O_2 or UV/H_2O_2





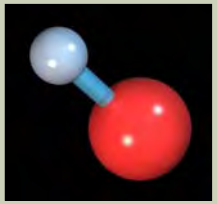
RO BASICS

- Best Available Technology for contaminants
- Effective on large / ionic / hydrophobic CECs
- Most MW > 200 are removed
- Less effective on:
  - NDMA
  - 1,4-dioxane



AOP BASICS

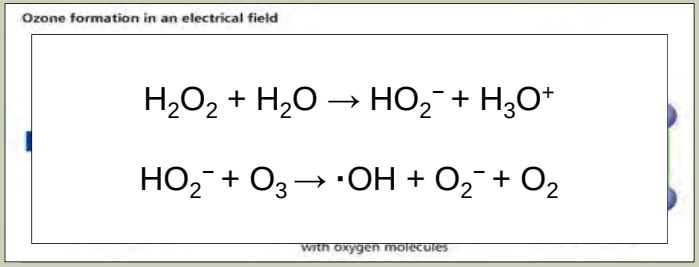
- Process of generating chemical radials used to oxidize organic material
- Very fast reaction (seconds)
- Produced via UV/H_2O_2 or Ozone/H_2O_2



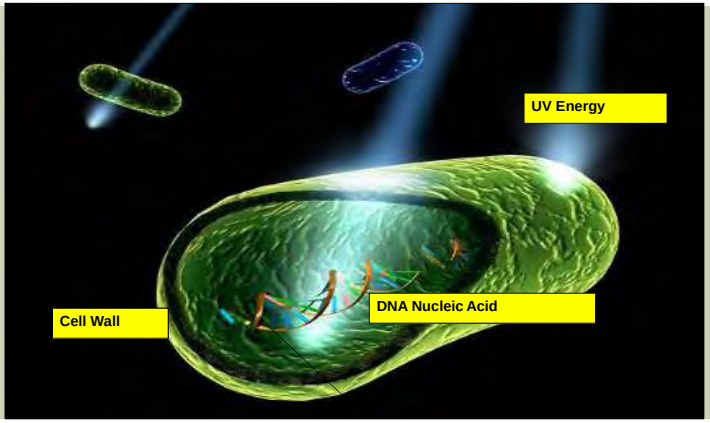
•OH

OZONE BASICS

- Composed of O_3
- Very strong oxidant
- Short life, goes back to O_2



UV BASICS



REGULATING DIRECT POTABLE REUSE

A possible approach

PATHOGENS CONTROL QUESTIONS FOR CRITERIA DEVELOPMENT

- Is the available monitoring sensitive and rapid enough to tell us when the organism reduction goal is not being met?
- How do we measure the overall reliability of the treatment scheme?

PATHOGENS CONTROL QUESTIONS FOR CRITERIA DEVELOPMENT

- How consistently must the treatment meet the organism log-reduction goal?
- How do we determine the necessary LRV capacity of the redundant barriers?
- What triggers the Fail Safe response if Safety is not Continuously Verified?

SUMMARY A POSSIBLE DPR SCHEME

- Regulate the critical treatment (advanced) under the SDWA
- Focus on acute risks (pathogens)
- Continuously verify treatment performance

SUMMARY
A POSSIBLE DPR SCHEME

- Provide sufficient barriers with:
  - Real-time organism reduction verification monitoring
    or
  - Best available monitoring with redundant barriers to strictly restrict the chance of off-spec water
- Provide a fail➔safe response to quality uncertainty

Real-life Reliability

OR
How It may not be built as designed
OR
How it may not be operated as intended

Brian Bernados, P.E., T5
Technical Specialist

2012 NRC report

Two major alternatives for the safe design of DPR systems:

1. The first focuses on replacing the environmental buffer with a tightly monitored *engineered storage buffer (*ESB) that provides time to ensure water is of appropriate quality before distribution
   – This first strategy focuses on monitoring DPR water quality to ensure that it meets public health (chemical and microbiological) and other treatment goals.
2. The second strategy, proposed by the 2012 NRC report places higher emphasis on increased treatment to achieve these same goals.

Paraphrasing *§13563.* (SB-918)

(b) . . . the department shall examine all of the following:

(1) The availability and **reliability** of water treatment technologies to ensure protection of public health

(2) Multiple barriers and sequential treatment processes

(3) Available information on health effects.

(4) **Mechanisms** that should be employed to protect public health if problems are found . . . including, but not limited to, the **failure of treatment systems** . . .

(5) **Monitoring** needed to ensure protection of public health.

(6) Any other scientific or technical issues that may be necessary . . .for additional research.

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Reliability

- Determine whether technologies are capable of ensuring that the water produced is safe to drink, including monitoring technologies
  - Off-spec detection
  - Fail in a safe fall-back mode, so the public is protected
- Initiate an automatic response
  - Early warning that can bring on redundant units
  - Shutdown flow, recycle to the head of the plant, or divert to waste

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Reliability - Critical Control Points

- Hazard Analysis & Critical Control Points principles
- Critical Control Points in the treatment train where online monitoring can detect atypical process operations different than the usual baseline
- Risk Management Plan - evaluate the risks of failure of the treatment system and potential health risks
- Critical Control Points in the treatment train located where online instruments can monitor critical treatment barriers.
- Easy access to critical information
- On-line monitoring for rapid operational response

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Mechanisms to deal with the **failure** of treatment

- The premise is that ***process failure is inevitable***.
- In a general sense, failure responses might include the following three options:

1. Automatic detection and diversion of water or return to the headworks for re-treatment;
2. Automatic detection and activation of stand-by treatment redundancy;
3. Continuous utilization of redundant treatment so that any one process upset does not degrade finished water quality below water quality goals.

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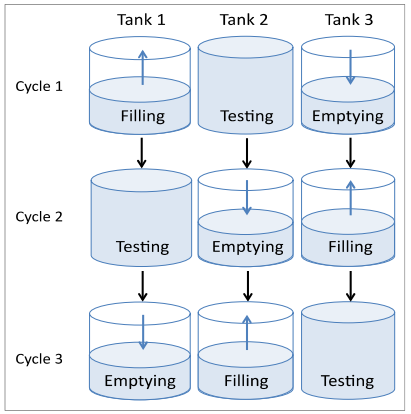
Real-time monitoring for **failure** identification



Rapid diversion in response to a **failure**

From "*Application of Risk Reduction Principles to Direct Potable Reuse*," WateReuse Research #11-10

Critical characteristics of any approach are:

- **Independence**. Highly coupled systems create higher-risk scenarios. This is the case when one element in a system depends heavily on the performance of one or more other elements. Being able to monitor each process step independently provides a measure of de-coupling.
- **Response Time**. Time is needed to identify the process failure, make a decision about the response & implement the response.
- **Sensitivity**. The monitoring method confirms the level of treatment achieved by the process or processes which it is monitoring.

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Rapid **Failure** Assessment

- The system reaction time is dependent on both technical and institutional factors.
- For example, if the SCADA system is set up to automatically divert water or bring on a backup process in response to failure, the system reaction time could be as short as a few minutes.
- But if human intervention is required (operator intervention, or even manager approval), the system reaction time might increase to several hours or even several days.

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Operation and Maintenance

- Much depends on the capability of the operator
- Specialized initial and on-going training
- High level of expertise needed
- Appropriate setpoints – meaningful assessment
- Verification – checks weekly
- Calibration – proper procedures takes skill
- Preventative maintenance – don't ignore
- Complacency - communication
- Proper interpretation of info

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Management

- Structural - Appropriate level of institutional capability / commitment to quality
- Criteria must be developed regarding technical and managerial capacity of an agency to verify it is qualified to undertake a Potable Reuse project
- Authority – clear lines communication and understanding of roles
- Who makes decisions?
  - Shift operator at night?
  - Chief operator?
  - The mayor?
  - Leave it up to the regulator?

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Monitoring to ensure protection of public health

- The **ideal** monitoring system possesses a number of characteristics*:
  - **Specific** to public health: detection of the pathogen of interest alone without interference from other organisms or the sample matrix
  - **Rapid**/continuous: on-line, real-time measurements provide the highest level of process control
  - **Sensitive**: able to detect contaminants below the level at which they could have a public health impact
  - **Accurate**: provides accurate information about performance, without false-negative or false-positive results
  - **Reliable**: low rates of failure

Ideal would be sensitive online pathogen detection

*From draft report *Guidelines for Engineered Storage for Direct Potable Reuse*, #12-06

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Multiple barriers

- Multiple redundant barriers minimize the chance of a complete failure of treatment - **how do we determine the necessary number and capability of the redundant barriers**?
- We could assure safe water by providing:
  - **Real-time monitoring** of **pathogenic organism** reduction for each barrier, or, possibly
  - **Best available monitoring** and **redundant barriers to provide extra log reduction** capacity to compensate for monitoring limitations
- Is the available monitoring **sensitive enough** to tell us when the organism reduction goal is not being met?

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Is Monitoring Sensitive Enough?

- The real-time pathogen monitors currently available that are being evaluated in Project 11-01, entitled *Monitoring for Reliability and Process Control of Potable Reuse Applications*, suggest:
- General findings to date indicate that large-scale on-line monitoring of pathogens, with the ability to detect pathogens down to the levels of interest in public health, have not yet been realized.
- These technologies require further development to overcome issues with robustness, sensitivity, precision, and reliability.

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Best available monitoring

common

- Turbidimeters
- Pressure decay tests
- Conductivity (TDS)
- Residual analyzers
- UV intensity sensors
- A_{254} / UVT monitors
- Online pH monitors
- Flow meters

NOT common

- Particle Counters
- Online TOC monitors
- Fluorescence
- Online ammonia
- nitrate monitors
- Other integrity tests
- Dye tests?
- TRASAR

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Monitoring Example – UV

How will the system be operated to meet the water quality objectives?

Typical monitoring required for compliance:

- calibrated flow meter
- on-line transmittance (UVT)
- bench top UVT Spectrophotometer for weekly verification check
- online UV intensity sensors
- calibrated reference intensity sensor for monthly verification check

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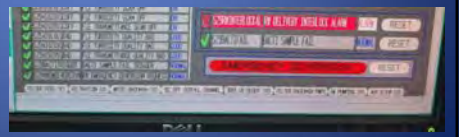
UV Alarms For Example

UV units should have the following alarms that immediately initiate a response (redundant reactors on):

- Low warning dose (typically 105% of minimum),
- Lamp failure,
- Loss of sensor signal,
- Power failure

Alarms that immediately triggers diversion of off-spec water for that train or shuts down the plant:

- Low UV dose,
- Low Intensity,
- High Flow rate,
- Low UVT



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UV Uninterruptible Power Supply (UPS)

- UPS provides assurance that all flows are adequately disinfected and sufficient power is supplied until the emergency generator is fully operational,
- UPS system will keep the UV bulbs running while the generators power up or during power sags/surges.
- Generator not enough

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Membrane Resolution & Sensitivity

- USEPA Long Term 2 Surface Water Treatment Rule
- Membrane Filtration Guidance Manual (MFGM) defines the following concepts:
  - Resolution: the size of the smallest integrity breach that contributes to a response from a direct integrity test (DIT)
  - Sensitivity: max log removal value (LRV) that can be reliably verified by the membrane system DIT

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Membrane Resolution & Sensitivity -2

- From MFGM
- The sensitivity of a membrane DIT is expressed in terms of a Log Removal Value (LRV), which must = or > the Cryptosporidium removal credit awarded
- Resolution needed is 3 µm, which is the low Cryptosporidium size range.
- But Virus resolution requirement = 0.01 µm
  - test pressure needed = 4,000 psi (+/-) vs. 15 psi for 3 µm

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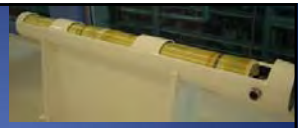
RO Integrity



- A DIT for RO should be developed to enable daily confirmation of membrane integrity
- MWH 2005 potable reuse study by the City of San Diego examined sulfate monitors and FD&C Red Dye.
- In that pilot study, four different RO membranes were piloted and both tools illustrated the ability to detect different performance of the 4 RO membranes.
  - Sulfate monitors measured about 2.0-3.0 LRVs.
  - FD&C Red Dye seeding illustrated 2.5-4.0 LRVs.
- There are other parameters that have been piloted, but need more demonstration work (TRASAR/Fluorescence)

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Implementation

- Practice response drills
- Regular audits by panels made up of independent specialists in the various fields
- Regulators must also have an appropriate level of institutional capability to ensure a meaningful role in enabling that the scheme is a success.
- Process controls to clearly tell the water system, especially the duty operator essential information
- As simple and fool-proof we want to engineer the technology, the last barrier providing public health protection is the water treatment plant operator

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Summary of Meeting #2 of the DPR Advisory Committee

Mike Wehner, OCWD
Advisory Committee Member

July 24, 2014

Committee Members

- Chair: Garry Brown, Orange County Coastkeeper
- Ray Tremblay, Los Angeles County Sanitation Districts
- Jim Fiedler, Santa Clara Valley Water District
- Marsi Steirer, City of San Diego
- Mike Wehner, Orange County Water District
- Al Lau, Padre Dam Municipal Water District
- Keith Solar, San Diego County Taxpayers Association
- Traci Minamide, LASAN Bureau of Sanitation
- Andria Ventura, Clean Water Action
- Conner Everts, Environmental Justice Coalition for Water
- Fran Spivy-Weber, SWRCB
- Alisa Reinhardt, San Diego Regional Chamber of Commerce
- Charles Mosher, Mariposa County Health Department
- Bruce Macler, U.S. EPA
- Randy Barnard, DDW

Meeting Overview

- Public meeting held on July, 11, 2014, at the Orange County Water District
- 12 out of 16 committee members attended
- Chaired by Garry Brown, Orange County Coastkeeper
- Attended by committee members, DDW, NWRI, local water and wastewater agencies, consultants, and general public
- Product: Meeting minutes

Panel Activity Comments

- Motion passed unanimously to approve Panel member changes
  - Additions of Joan Rose, Kara Nelson, and Jim Crook
- Role of liaison will not be limited to committee Chair
  - Various committee members will attend expert panel meetings based on availability
- Interest expressed in Panel Members attending Advisory Committee meetings

Meeting Schedule

- Committee meetings will vary in location throughout CA
- Committee would like to coordinate their meeting schedule with the expert panel meeting schedule (next 2-3 meetings)
- Next committee meeting will focus on communications with the public and possible presentation on WRRF 13-02

WRRF Research Activities Comments

- Clarify if the Expert Panel went through in detail the scope of work for each WRRF project discussed
- What effort is being made by the Panel to gather information on projects undertaken by others than WRRF?
  - Need to better understand what WRRF and other groups are doing so we can better communicate and collaborate with them.
- The public will be interested in how broadly the research community has been brought into the Expert Panel effort.

Research Plan Comments

- Regulatory Concerns:
  - Does Expert Panel realize that most of the questions they are asking regarding research do not have existing answers?
- Health Research:
  - Was the Panel recommending a project on infectious disease rates?
- Peer Review Publications:
  - Expert Panel should identify studies that should be peer-reviewed articles.

Research Plan Comments

- Out-of-Spec Behavior:
  - Does the Panel need more in-depth information about out-of-spec behavior than what has been provided by DDW?
- Regarding chemical exposure and disease:
  - Consider low-dose impacts
- Community Concerns:
  - The Committee is concerned with the examples suggested by the Panel in considering how other industries address questions of safety and public confidence – there is a difference between a public entity protecting public health and a corporation protecting their bottom line

Public Comments

- A framework exists that defines what is "safe" in the Safe Drinking Water Act
  - A body of knowledge already exists regarding safety, risk, failure, etc. for IPR projects
  - A presentation on what "safe" means to the researchers would be useful
- Having a bibliography or compendium on all the reports, documents, and regulations mentioned in the report would be useful

Questions?