Briefing on Draft Report to Legislature for Feasibility of Developing Uniform DPR Criteria

2016

State Water Resources Control Board

WELCOME
&
INTRODUCTIONS

OVERVIEW OF STATE WATER BOARD PROCESS

Mark Bartson P.E.
Division of Drinking Water
Chief – Technical Operations Section

Statutory Requirements

Task	Deadline	Status
Adopt Groundwater Recharge Regulations	Dec 31, 2013	✓
Adopt Surface Water Augmentation Regulations	Dec 31, 2016	On track
Prepare Draft Report on Expert Panel Recommendations & Research Status	June 30, 2016	✓
Release Public Review Draft Report on Feasibility of Developing Direct Potable Reuse Criteria	Sept 1, 2016	✓
Submit Final Report to the Legislature	Dec 31, 2016	On track

Schedule

- Public Comment Period for Draft Report
  - 45 days per CWC § 13563
  - Draft Report posted Sept 8, 2016
  - Comments are due **Oct 25, 2016, at noon**
- Public Workshops
  - Oct 4, 2016 at Metropolitan WD, Los Angeles
  - Oct 6, 2016 at CalEPA HQ, Sacramento
- Final Report to the Legislature: Dec 31, 2016

Submission of Written Comments

- Written comments are due **Oct 25, 2016, at noon**
- Send comment letters addressed to:
  Jeanine Townsend, Clerk to the Board
- Indicate on subject line:
  "Comment Letter – Report to the Legislature on DPR"
- By e-mail: (PDF format, max 15 MB)
  commentletters@waterboards.ca.gov
- By fax: (916) 341- 5620
- By mail:

Hand/ Courier Delivery	U.S. Mail
1001 I Street, 24th Floor	P.O. Box 100
Sacramento, CA 95814	Sacramento, CA 95812-0100

Subscribe to SWRCB Listserve for updates:

http://www.waterboards.ca.gov/resources/email_subscriptions/swrcb_subscribe.shtml

Drinking Water → "Recycled Surface Water Augmentation & Direct Potable Reuse"

DDW Report to the Legislature:

http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/rw_dpr_criteria.shtml

DDW Contact

Randy Barnard, (619) 525-4022

randy.barnard@waterboards.ca.gov

Investigation must include

1. Recommendations of the Expert Panel;

2. Recommendations of the Advisory Group;

3. Regulations and guidelines on DPR from jurisdictions in other states, federal government, and other countries;

Investigation must include

4. Research by the State Water Board regarding unregulated pollutants (Recycled Water Policy)

5. Water quality and health risk assessments associated with existing potable water supplies subject to discharge from municipal wastewater, storm water, and agricultural runoff;

Investigation must include

6. Results of the State Board's investigations pursuant to CWC §13563
   - Reliability of treatment to protect public health.
   - Multiple barriers that may be appropriate.
   - Health effects.
   - Mechanisms to protect public health if problems occur.
   - Monitoring needed to ensure protection of public health.
   - Any other scientific or technical issues, including the need for additional research.

Expert Panel Charge

Advise State Water Board on public health issues and scientific and technical matters regarding:

- Development of uniform water recycling criteria for indirect potable reuse through surface water augmentation
- Investigation of the feasibility of developing uniform water recycling criteria for DPR
- Assess needs for additional research and recommend an approach for completion

Tasks of the Advisory Group

- Advise the Expert Panel regarding investigation of the feasibility of developing uniform water recycling criteria for DPR
- Make recommendations to DDW on any other relevant topics such as:
  - Practical considerations for regulations that are protective of public health and achievable by project proponents

ADVISORY GROUP

Highlights and Recommendations

Advisory Group Members

- **Chair:** Garry Brown, Orange County Coastkeeper
- Randy Barnard, SWRCB Division of Drinking Water
- Amy Dorman, City of San Diego
- Conner Everts, Environmental Justice Coalition for Water
- Jim Fiedler, Santa Clara Valley Water District
- Julie Labonte, San Diego Regional Chamber of Commerce
- Al Lau, Padre Dam Municipal Water District
- Bruce Macler, U.S. EPA
- Traci Minamide, LA Sanitation
- Edward Moreno, MD, MPH, Health Officer, Monterey County Health Dept.
- Keith Solar, San Diego County Taxpayers Association
- Fran Spivy-Weber, State Water Resources Control Board
- Ray Tremblay, Sanitation Districts of Los Angeles County
- Andria Ventura, Clean Water Action
- Mike Wehner, Orange County Water District

Advisory Group Recommendations

- Consensus on 19 recommendations
- DPR, when implemented appropriately, has the potential to provide a reliable source of water supply that is protective of public health for communities in California
- Two types of recommendations:
  - Related to the feasibility of developing criteria
  - Not related to the feasibility of developing criteria

Advisory Group Recommendations Examples by Type

Related to the Feasibility of Developing Criteria	Not Related to the Feasibility of Developing Criteria
• Wastewater source control, operation optimization, and planning requirements for DPR • Operator training and certification • Technical, Managerial, and Financial (TMF) capacity • Changes to Consumer Confidence Report • Research priorities	• Communications and public outreach • Phasing of potable reuse regulations • Potable reuse terminology • Environmental justice • Environmental impact • Impact to water rates

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

Operator Certification Recommendations

- Reflected in the white paper entitled “Potable Reuse Operator Certification Framework” 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

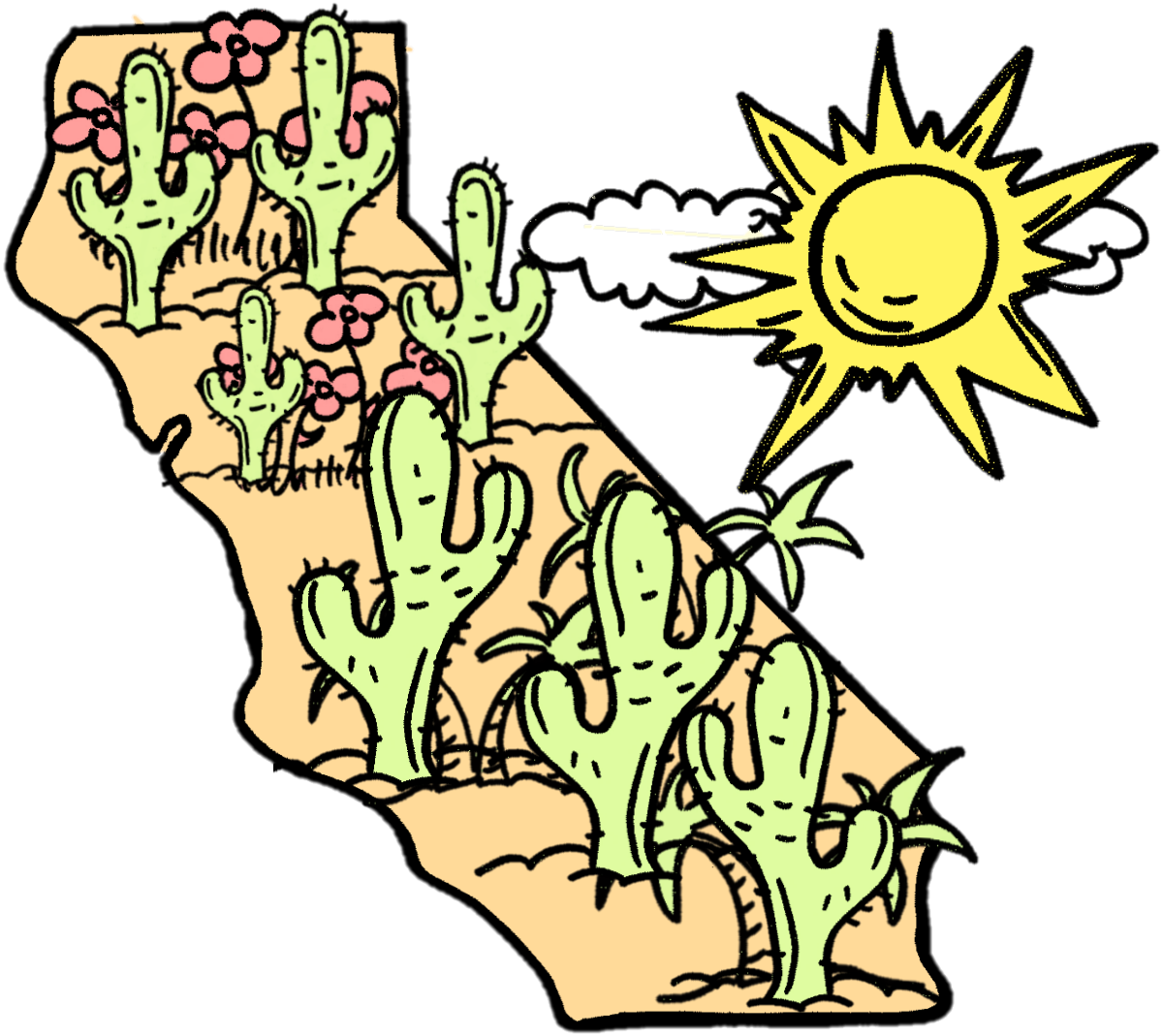
DRAFT DPR FEASIBILITY REPORT

Randy Barnard, P.E.
Chief – Recycled Water Unit
Division of Drinking Water

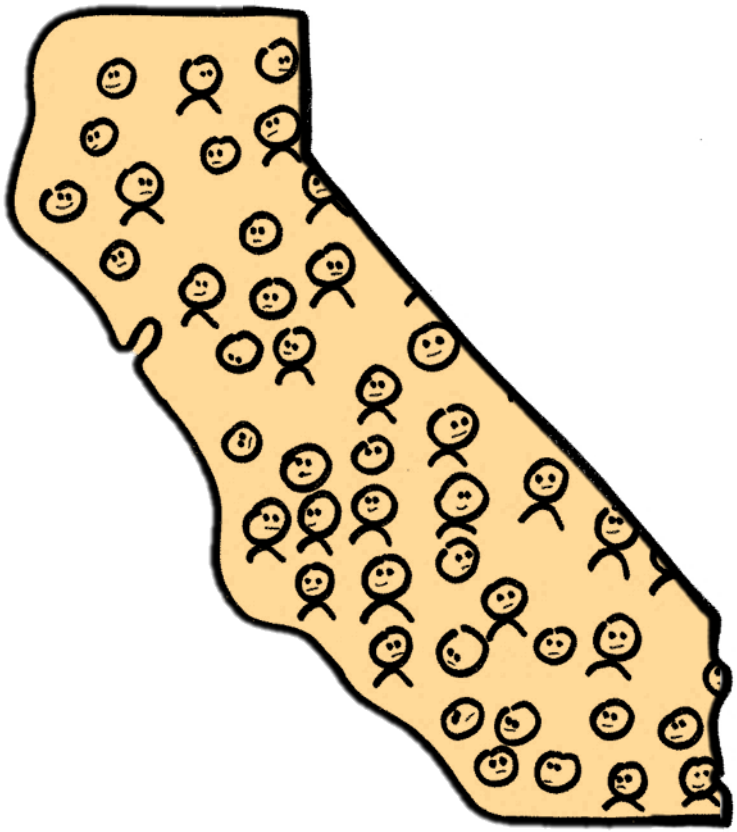
Report Contents

- Exec summary
- Introduction, history, projects
- Independent input
- Feasibility
- Conclusions
- Implementation plan
- Appendix

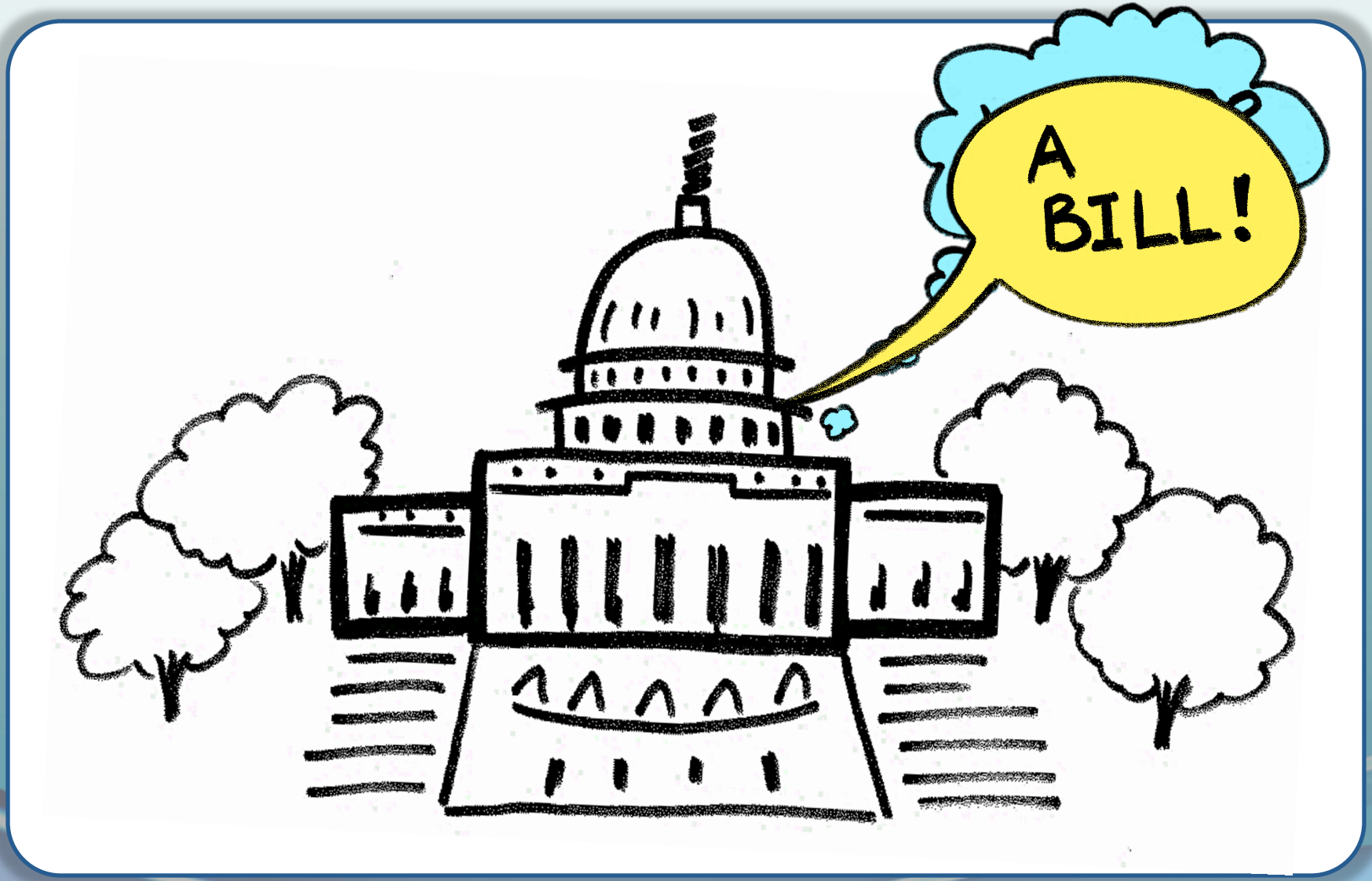
Background



Background



New Water Sources

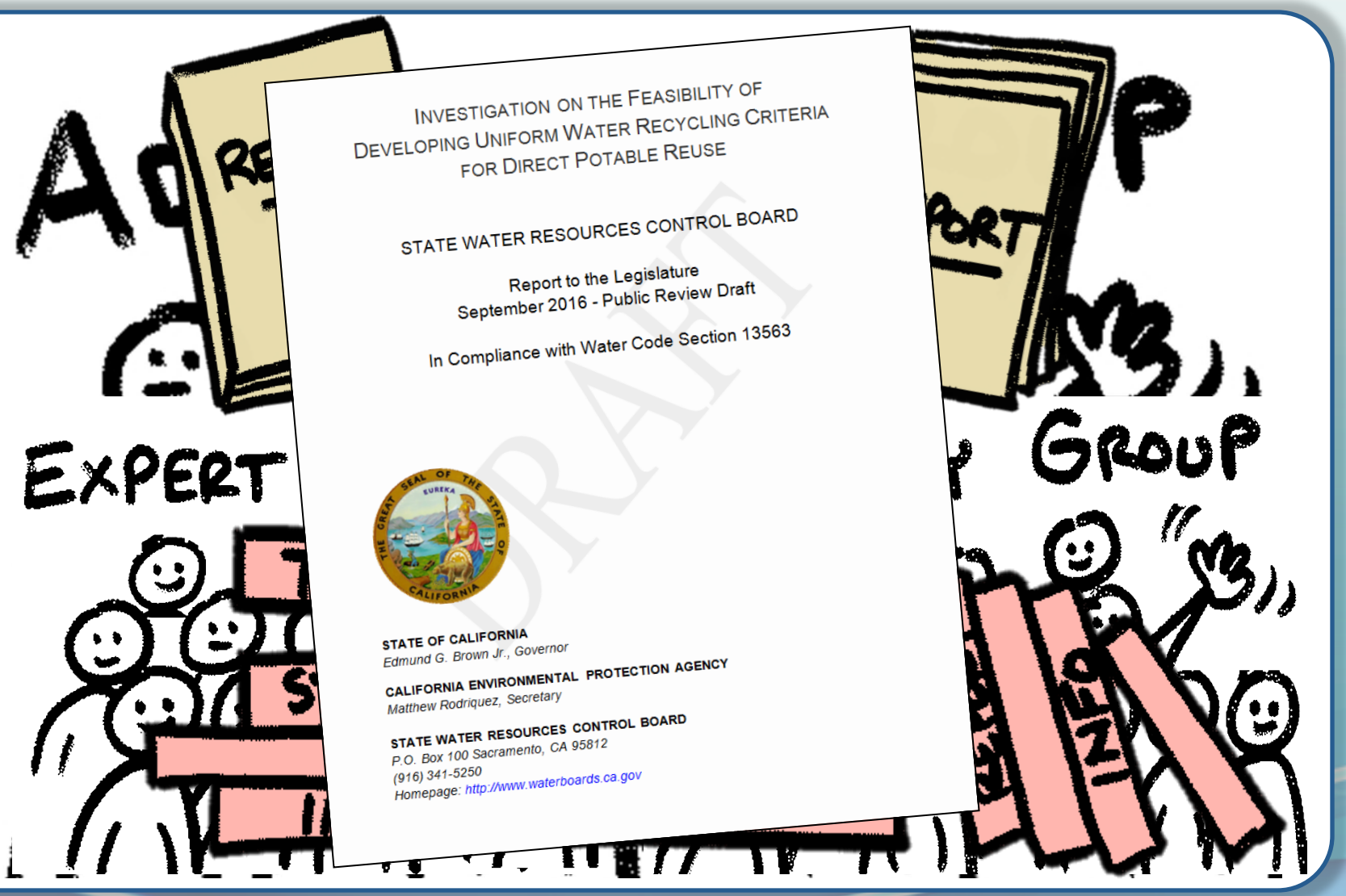


Other Parts of the Bill

- GRRP Regs
  - ✓ – Done July 2014

- SWA Regs
  - ✓ – Drafted
  - – Expert Panel review
  - – Public review
  - – Adopt

Report Development



EP Findings

Multiple barriers (A+B+C+D=Good)

Diverse treatment processes

Parallel trains →

Parallel trains

CHEMICALS => **CHEMICALS**

Diversion of off-spec water

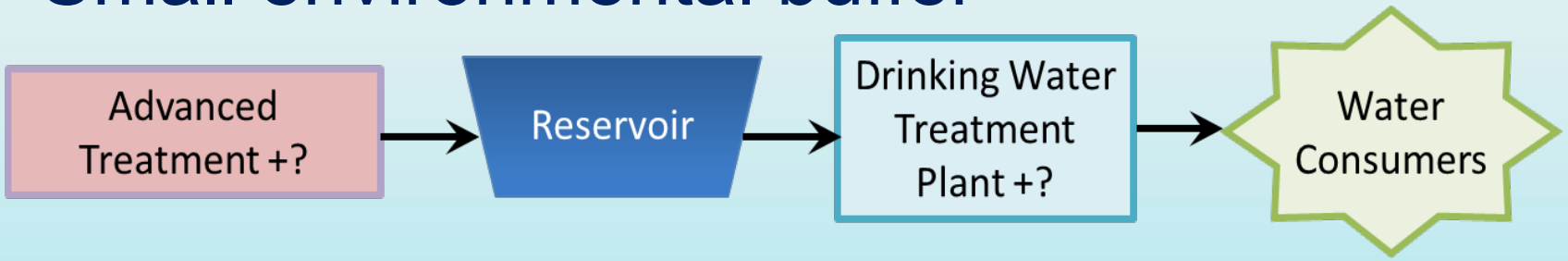
IT'S TECHNICALLY FEASIBLE

Further Research

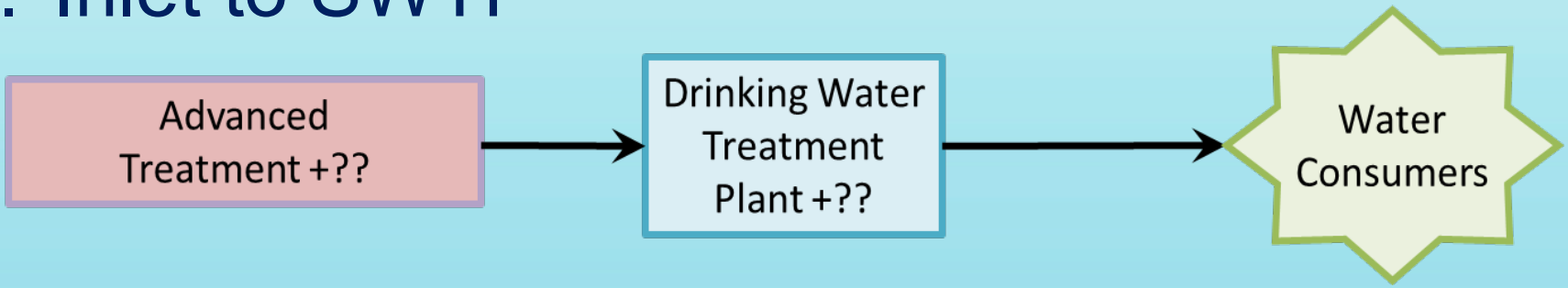
1. Source control and monitoring
2. LRV risk assessment
3. Confirm wastewater data
4. Outbreak data
5. Average peaks
6. Identify unknowns

DPR Types

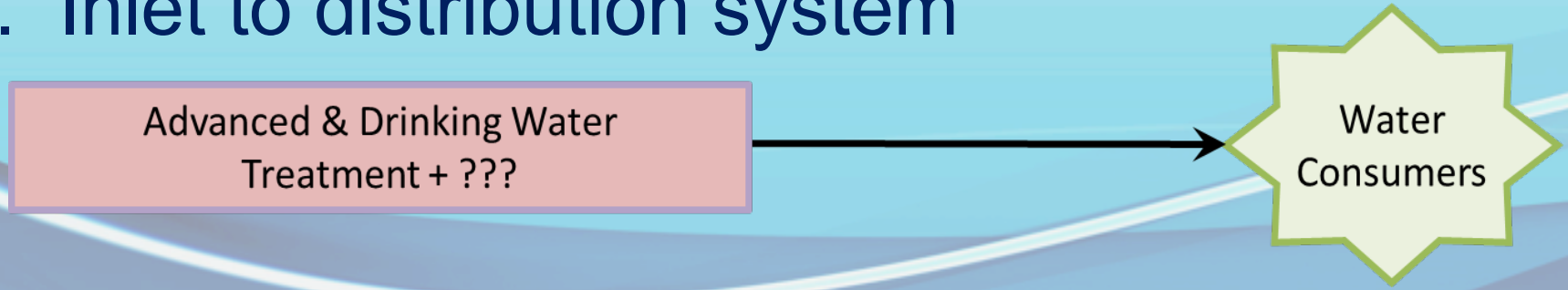
1. Small environmental buffer



2. Inlet to SWTP



3. Inlet to distribution system



AG Findings

Conclusions

Path Forward

- [illegible]

MOVING TOWARD CRITERIA

Bob Hultquist, P.E.
Retired Annuitant
Division of Drinking Water

A Good Basis

- Expert Panel, Advisory Group, WateReuse DPR research initiative, other research products, and experience with IPR have provided an understanding of how DPR might be done safely
- Panel identified the critical aspects of criteria and have described research areas that could inform criteria development

Safe Practice to Criteria

- Our experience with the development of IPR criteria has shown that it is a sizable step, however,
  - from being confident that something can be safe
  - to producing criteria that assure that it will be accomplished safely, 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.

Criteria Development Questions

- We posed several questions to the Panel we would face when developing criteria - questions that relate to writing objective criteria to address system reliability

- The questions have been pared down and the Panel has provided us with scientifically valid means to evaluate the efficacy of barriers

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?

DPR Criteria Framework

- Criteria framework that encompasses the three possible types of DPR and recognizes the foundation of *de facto* potable reuse and IPR.
  The three forms are:
  - What the Expert Panel calls “reduced environmental buffer” (<IPR)
  - Delivering water to a surface water treatment plant
  - Delivering finished water to the distribution system

Framework Purpose

- 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

Finally …

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

POTABLE REUSE PUBLIC HEALTH PROTECTION RESEARCH

Brian Bernados, P.E.
Technical Operations Section
Division of Drinking Water (DDW)

Scope

- Cover research related to public health protection:
  - Recently completed and published
  - Recently completed and will be published soon
  - Projects in progress
  - These may or may not directly relate to the Expert Panel's 6 Research Recommendations
- Referenced research agencies:
  - WateReuse Research Foundation (WRRF, now WE&RF)
  - Water Research Foundation (AWWA WRF)
  - National Water Research Institute (NWRI)
  - City of San Diego and LA demonstration projects

Coordination with Division of Water Quality

- Recycled Water Research Workshop:
- Monitoring and Treatment
- Performance for 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

NWRI IAP

- *Examining the Criteria for Direct Potable Reuse*

WateReuse Research Foundation Project 11-02

- Independent calculations for 10^{-4} annual risk

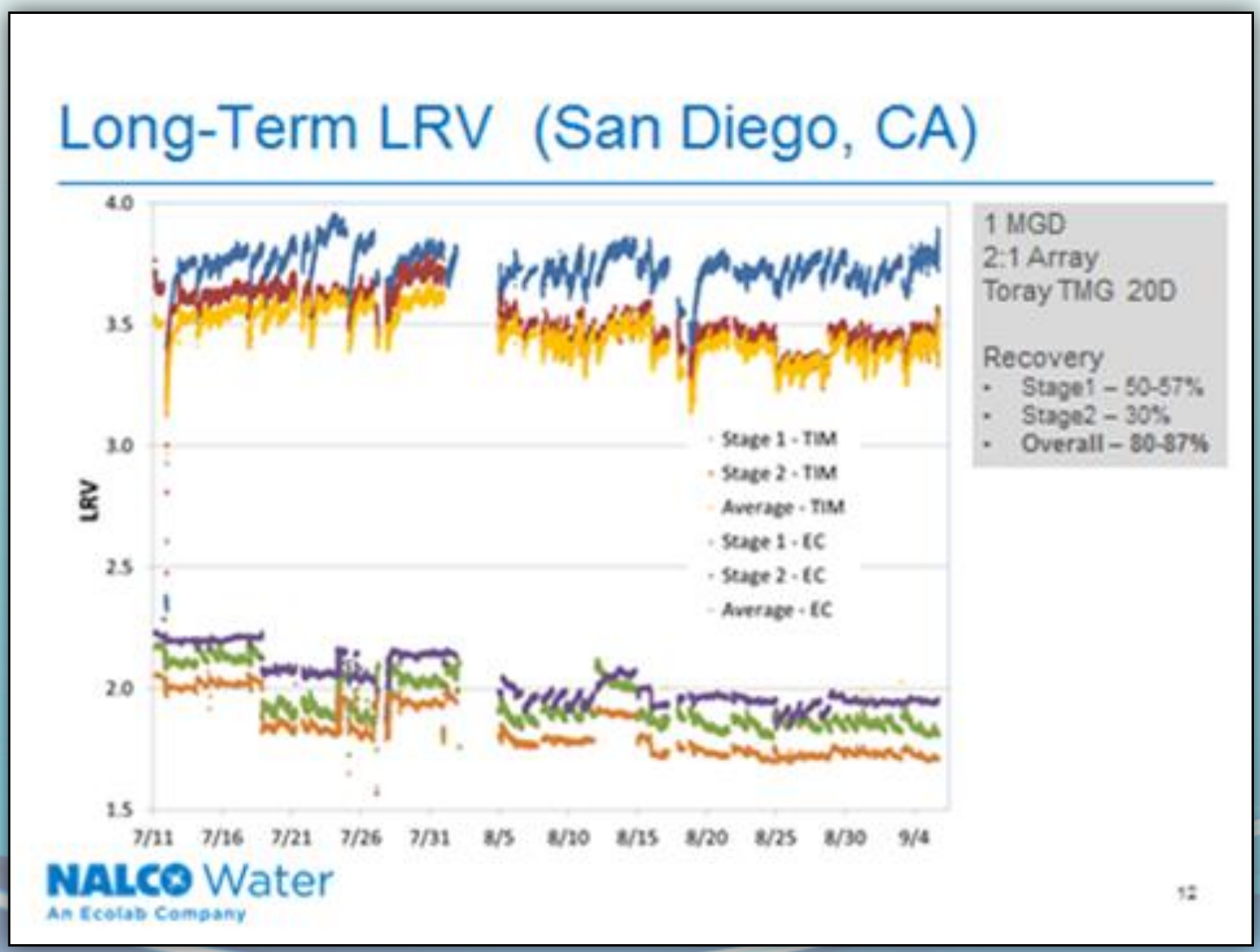
Microbial Group	Log Removal Criterion
Enteric Virus	12
Cryptosporidium [a]	10
Total Coliform Bacteria [b]	9

[a] Addresses Giardia and other protozoa as well.

[b] Addresses enteric pathogenic bacteria, such as Salmonella

TRASAR RO Demonstration

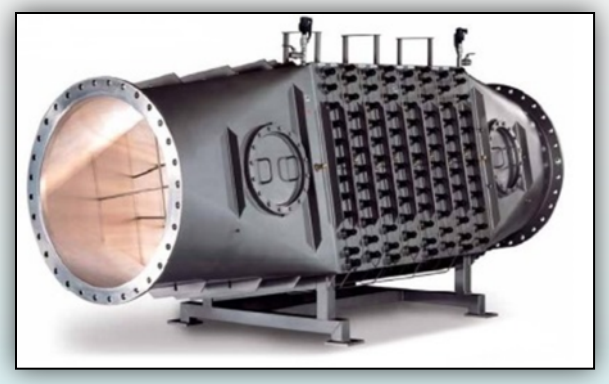
- TRASAR Log Removal Values (LRVs) >3



Molecular Markers City of San Diego Demonstration Pilot 14-12

- USEPA membrane guidance manual molecular markers are suitable for RO systems
- Dyes (Rhodamine or TRASAR) high LRVs, but
  - Drawbacks: adsorption? & necessity of spiking
  - Pulsed-spikes may resolve adsorption issue
- Monitoring of naturally occurring ions/metals have not been explored much,
  - LRV limited by presence of constituent in feed
  - Lower detection limits could widen possibilities
  - Strontium - San Diego up to LRV of 3.5
  - Sugar - San Diego up to LRV of 3
  - Sulfate - LRV about 2.5

City of LA Terminal Island Approved LRVs for UV/AOP



- LRV credit = 6 Virus,

6 Cryptosporidium, 6 Giardia

- For Advanced Oxidation Processes (AOP), a lot of photons are required compared to UV disinfection
  - To get 1.4-dioxane reduction of 0.5 log, Terminal Island demonstration work set the UV dose at > 920 mJ/cm^2
- 6-log credit can be assumed if the UV dose delivered is >300 mJ/cm^2 (dose depends on validation factors)
- Adenoviruses are also inactivated, because US EPA LT2 rule set a UV dose of 186 mJ/cm^2 for 4-log (protozoa requires much, much less)

2012 National Research Council report

Water Reuse: Potential for Expanding the Nation's Water Supply through Reuse of Municipal Wastewater

Two safe alternatives for DPR:

1. Replace the environmental buffer with a tightly monitored *engineered storage buffer (*ESB) - time to ensure water quality before distribution
   - Continuously monitor actual contaminants to ensure that it protects public health.
2. Increase amount of treatment beyond what is minimum.

Replacing the Environmental Barrier

- WRRF 12-06: *Guidelines for Engineered Storage for Direct Potable Reuse*
- "DPR has inherent risks that differ from . . . indirect potable reuse (IPR).
- In particular, DPR is a more closely coupled system, in which there is less time to monitor process water quality and to respond to water quality concerns."

Real-Time Pathogen Monitoring Technologies

- *WateReuse Research Foundation (WRRF) Project 11-01, "Monitoring for Reliability and Process Control of Potable Reuse Applications*".
- Generally, the ability to detect virus and protozoa to the levels needed to ensure 10^{-4} risk of illness, are not yet available.
- Need to overcome issues with
  - robustness,
  - sensitivity,
  - precision, and
  - reliability.

Analytical Methods

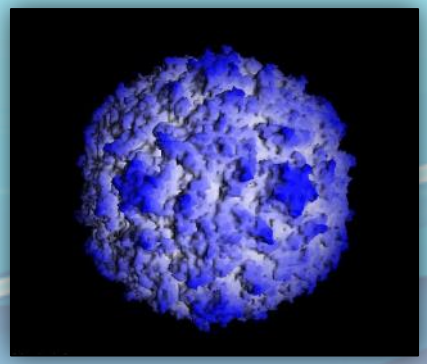
- WRF Project 4508/ WRRF Project 13-14 *Assessment of Techniques to Evaluate and Demonstrate the Safety of Water from Direct Potable Reuse Treatment Facilities*
- **Literature Review** ". . . to identify the target constituents with greatest potential human health risk in DPR . . ."
- Goal is to develop a ". . . DPR guidance framework . . . help facilitate the development of a proactive DPR monitoring process that is protective of public health."

WRF 4508 - Bulk Indicators and Analytical Methods

- “Online monitoring for pathogens is particularly crucial to capture acute threats to public health
- but remains problematic because true online pathogen monitoring methods have not been established . . .”
- Commonly used bulk indicators, such as
  - electrical conductivity (EC) and
  - total organic carbon (TOC) are used;
- however, these bulk indicators may or may not directly correlate to the safety of the water.”

Research Molecular Methods

- WRF Project 4508/ WRRF Project 13-14 Literature Review describes in detail the status of newer analytical methods.
- Some of these are mentioned in the Expert Panel report.
- It recommends collecting pathogen concentration data via:
  - quantitative polymerase chain reaction (qPCR),
  - digital droplet PCR (ddPCR) and
  - flow cytometry.



Flow Cytometry (FC)

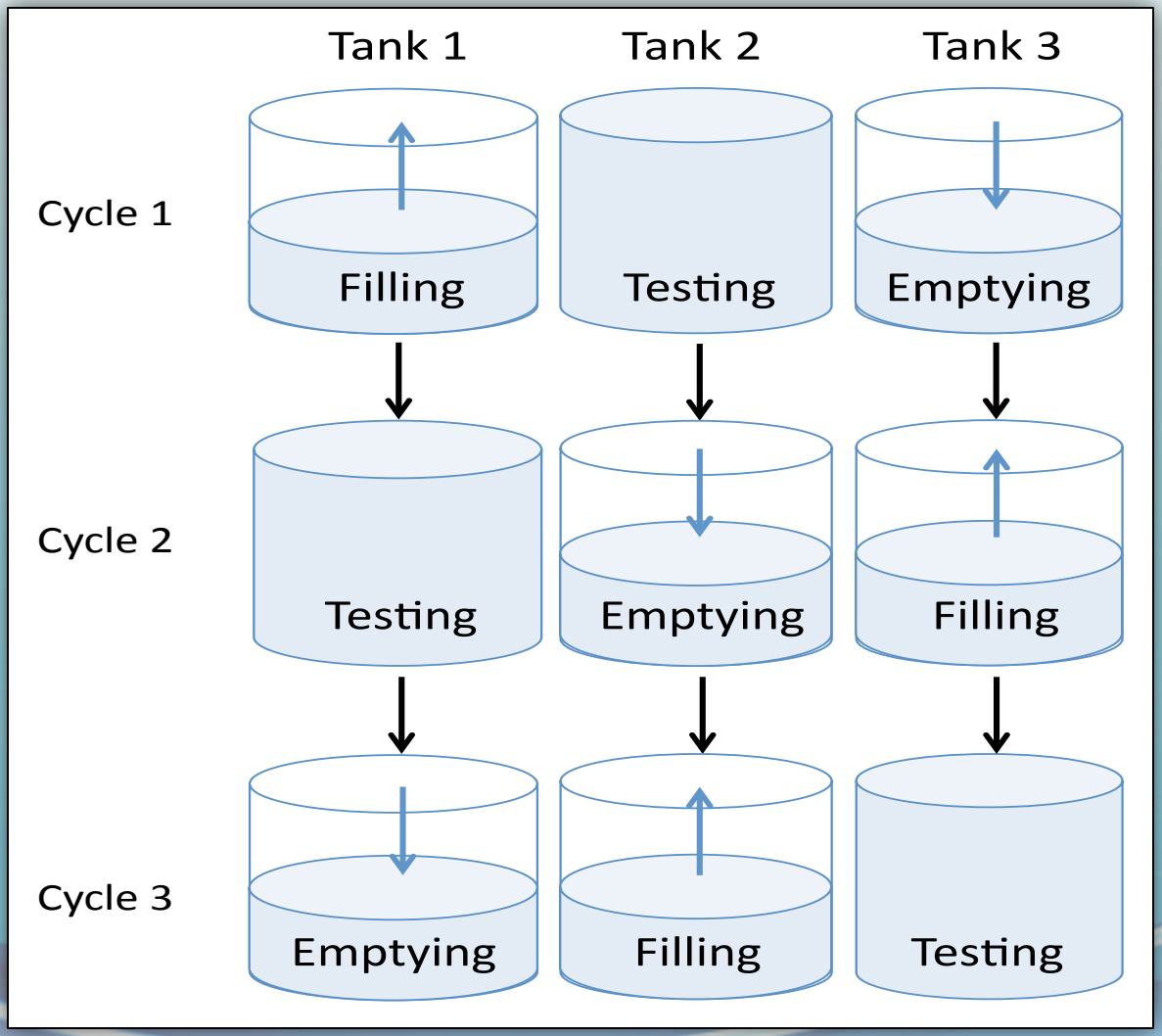
- Physical detection via FC goes beyond turbidity.
- “Researchers have presented methods to identify
  - pathogenic E. coli O157:H7,
  - C. parvum, and
  - non-pathogenic E. coli in water.”

- “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.”

Value of the Environmental Barrier WRRF 12-06:

- "The environmental buffer . . . provides a number of benefits, including
  - contaminant removal,
  - dilution and blending, and
  - time to detect and respond to failures before final treatment and distribution."
- "Eliminating the environmental buffer . . . requires replacement of the
  - treatment,
  - monitoring, and
  - response time benefits."

Frequent Monitoring for Failure Identification 11-10 "*Application of Risk Reduction Principles to Direct Potable Reuse*"



City of LA Case Study in 12-06 "*Guidelines for Engineered Storage for Direct Potable Reuse*"

- For example, City of LA could utilize 4 unused 7 MG tanks, in which 12 hours of time could be provided for each drop of water.
- A flow of 42 million gallons per day could be held for 12 hours by cycling the tanks in a rotating fashion of filling, holding and emptying.

LADWP Valley Generating Station has four 7 MG tanks unused

Redundant Treatment 12-06

- “Another approach to mitigating the inevitable process failures in a DPR scenario is to build in redundant treatment.
- The challenge with allowing redundancy to stand in for process monitoring is that,
- if improperly monitored, redundant processes may fail unnoticed and simultaneously,
- thus process redundancy alone does not provide for failsafe operations.”

Rapid Response to a Failure

From “Application of Risk Reduction Principles to Direct Potable Reuse,” WRRF 11-10

Critical characteristics of monitoring are:

- **Independence**. Dependence on the performance of other elements creates risk. So, need to adequately monitor each process step independently.
- **Response Time**. Need to identify the failure, make a decision about the response & implement the response.
- **Sensitivity**. The monitoring method must confirm the level of treatment achieved by the process.

Hazard Analysis Critical Control Point (HACCP)

- 13-03 "*Critical Control Point Assessment to Quantify Robustness and Reliability of Multiple Treatment Barriers of a DPR Scheme*"
- HACCP was developed by the food industry
- Specific monitoring for each process:
  - Critical control points.
  - Parameters for each.
  - Failure mode = at what point has it stopped functioning?
  - Follow-up actions – automatic or operator initiated?
  - Hazards – what can go wrong upstream?
  - Plans tailored to each site.

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.

Operations

- DPR depends on the capability of the operator
- Specialized initial and on-going training
- 15-05 *Developing Curriculum and Content for DPR Operator Training*
- High level of expertise needed
- Appropriate setpoints - meaningful
- Verification – frequent checks to a bench unit
- Proper interpretation of info

Maintenance

- DPR also depends on the capability of the equipment technician.
- Also, Special training.
- Calibration – proper procedures take skill.
- Preventative maintenance – don’t ignore.
- Spare parts on hand;
- UV lamps are expensive,
- Can be a hassle;
- But must be replaced periodically.

DPR Expert Panel Report Chapter 8 Chemicals Source control

In progress, is WRRF 13-12,

Evaluation of Source Water Control Options and the Impact of Selected Strategies on DPR

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

Contaminants that are difficult to remove . . . such as acetone, methyl ethyl ketone, and methanol . . . “

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

EXPERT PANEL
OVERVIEW AND FINDINGS

Adam Olivieri, Ph.D., P.E.
Co-Chair of Expert Panel

QUESTION AND ANSWER

All Speakers

COMMENT SUBMISSIONS

Mark Bartson P.E.
Division of Drinking Water
Chief – Technical Operations Section

Submission of Written Comments

- Written comments are due **Oct 25, 2016, at noon**
- Send comment letters addressed to:
  Jeanine Townsend, Clerk to the Board
- Indicate on subject line:
  "Comment Letter – Report to the Legislature on DPR"
- By e-mail: (PDF format, max 15 MB)
  commentletters@waterboards.ca.gov
- By fax: (916) 341- 5620
- By mail:

Hand/ Courier Delivery	U.S. Mail
1001 I Street, 24th Floor	P.O. Box 100
Sacramento, CA 95814	Sacramento, CA 95812-0100