• California DPH develops reuse criteria
• Wastewater or reclaimed water activities that involve releases to the environment are permitted by the State Water Boards
• Potable reuse - Sections 13560-13569
  • Code requires a CDPH study of DPR feasibility by the end of 2016
  • Consider health effects, available treatment and reliability, monitoring needed, research needed, et cetera
• Consult
  • Expert panel (water quality technical experts)
  • Advisory group (representing community interests)
CALIFORNIA LEGAL FRAMEWORK
HEALTH AND SAFETY CODE

• Calif. Safe Drinking Water Act
  • CDPH permits Public Water Systems
  • Permit addresses individual water sources and prescribes suitable controls and treatment
  • CDPH has experience with:
    • Good water sources – standard treatment for source
    • Impaired sources - need extra evaluation/ treatment
    • Extremely impaired sources (Policy 97-005) – extensive study and treatment
    • Planned indirect potable reuse
  • DPR must comply with the State and Federal Safe Drinking Water Acts
SOURCE QUALITY

Chemical Contamination

Pathogen Contamination

Extremely Impaired

Impaired

DPR


**DRINKING WATER STANDARDS**

- **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 determined as part of source approval process
TRANSITION: WATER CODE TO SDWA WHEN “APPROVED SOURCE”? 

- Raw sewage
- Secondary/tertiary effluent
- Advanced treatment product
- Engineered storage outlet
- Drinking Water
A REGULATORY SCHEME FOR DPR

• Clean Water Act regulators could regulate what they have the authority, expertise, and operator certification program for:
  • Source control for the collection system
  • Treatment through secondary or tertiary
  • Disposition of inadequately treated wastewater

• Drinking Water Regulators could:
  • Approve secondary or tertiary effluent meeting the SWB permit as the “approved” surface water source
  • Specify advanced treatment and monitoring in the water system permit as it would for any impaired or extremely impaired source
PRINCIPLES

- Make a “safe” drinking water
- Low tolerable risk
  - $10^{-4}$ annual risk of infection
  - Drinking water standards
  - Unregulated chemical controlled to match good existing supplies
- No degradation of an existing drinking water supply
- Multiple barriers for contaminants
THREATS IN THE SOURCE WATER

Pathogens
Nitrate, Nitrite, ...
TOrCs?
PATHOGENIC MICROORGANISMS

• Acute risk
• Set a log reduction requirement
  • Raw sewage to drinking water
  • 12-log Virus
  • 10-log Giardia
  • 10-log Cryptosporidium
PATHOGENIC MICROORGANISMS - 2

- Start from highest levels found in wastewater

- End point is USEPA allowable drinking water levels (based on $10^{-4}$ annual risk of infection goal)

- Multi-barrier treatment required
PATHOGENS CONTROL ISSUES

• How consistently must the treatment meet the organism log-reduction goal?
  • mean time between failures or 6σ?

• Is the monitoring sensitive enough to tell us when the organism reduction is not being met?

• Multiple barriers minimize the chance of a complete failure of treatment.
  • How do we determine the necessary number and capability of the barriers?
• DPR is “unacceptable ... because of the lack of reliable real-time water quality monitoring methods and lack of time to react to accidental emergencies or system upsets.”
A PATHOGEN CONTROL APPROACH

• We can assure safe water by providing:
  • Reliable, real-time treatment monitoring for the required barriers, or
  • Best available monitoring and redundant barriers to provide extra log reduction capacity to compensate for monitoring limitations
    • How do we determine the amount of redundant capacity?
TREATMENT FOR TO\textsubscript{r}Cs

- Chronic risk

- CDPH is happy with the effectiveness of the full advanced treatment called for in the IPR draft regulation where 100\% reclaimed water reaches a drinking water source.

- Full advanced treatment is continuous treatment of the entire flow with RO and AOP

- Alternatives may be allowed if they “assure at least the same level of protection to public health”
TREATMENT MONITORING AND CONTROL

• On-line monitoring with real-time control for each treatment barrier for acute contaminants

• Fault tolerant design of monitoring and control systems with a high availability (4+nines)

• HAACP and other system reliability approaches should be investigated
RESPONSE: FAIL ➔ SAFE

• A failure:
  • Treatment efficacy falls below some specified level
  • A loss of monitoring capability

• The response to a failure:
  • go to a safe condition – halt drinking water production
  • Identify and correct the fault
  • Restart per a start-up procedure
CONCLUSIONS

• Focus on acute risks (pathogens)

• Continuously verify treatment performance

• Provide sufficient barriers with:
  • Reliable, real-time monitoring, or
  • Best available monitoring and redundant barriers to strictly restrict the chance of inadequately treated product

• Fail-safe response to a system problem