WHO ARE WE?

CA DRINKING WATER PROGRAM

Our program promotes and maintains a physical, chemical, and biological environment that contributes positively to health, prevents illness, and assures protection of the public. We regulate public water systems; oversee water recycling projects; permit water treatment devices; certify drinking water operators; support and promote security; provide support for small water systems; oversee a treatment and research fund; and provide subsidized funding for water system improvements.

Role: convey information from the experts in a responsible way
WHAT ARE WE FACING?

HAB from Drinking Water Perspective

• **Public Health Quandary:** *unregulated* contaminants that pose *potentially significant health risks* and the *public interest/concern* is growing

• **Lack of a strong authority** to describe the following:
  – Analytical methods
  – Monitoring strategies
  – Treatment approaches
  – DW Health Risks

• **Limited resources** → Karen Larsen/Stefan Cajina established workgroup in Fall 2014 to prioritize & formalize
Toledo Tipping Point
Lake Erie: 25 public water systems serving 2.6M people

- Robust program - Ohio had Response Strategy in place since 2010
- August 1, 2014, 11 PM: microcystin > 1 ug/L drinking water advisory threshold for confirmed result (sampling issues)
- August 2, 2014, 2:00 AM: 400,000+ people informed of a DO NOT DRINK advisory
- August 4, 9:35 AM: lifted the advisory
- Lessons cited: 1940s treatment, single source, questionable protocols
- Next steps: inform, analytical, $, source improvements
These terms are used when there is a high degree of uncertainty associated with toxicology, health risks, difficulties in treatment or chemical analysis.

- **WHO guideline (most referenced)** – 1 ug/L microcystin-LR
- **New Zealand/Australians/Brazil/Canada/Ohio/Oregon+**
- **Federal level** – EPA is developing methods for cyanotoxins and is developing drinking water advisories for the 3 cyanotoxins listed in final CCL3 (microcystin-LR, anatoxin-a, cylindrospermopsin) → UCMR4 (Jan2018)
- **State level** – evaluating process
  - Recommendation → OEHHA → Establish
To date (2011+), no cyanotoxins detected in finished water in Clear Lake (however still waiting for Labor Day results from CDPH lab)

- WHO (most referenced) established guideline for DW <1 µg/L microcystin-LR
  - Proposed bill: EPA may have DW advisory, methods, & treatment in 2015

- If detected in finish water, treatment available
- Minimize health impacts – HOW?
  - Need comparable results between laboratories/groups sampling
  - If detected in source waters, need recommendations for water purveyors
  - If detected in drinking water, provide informed support

WHAT’S THE CLIMATE LIKE? as it relates to water treatment
# Cyanotoxin Results

Total Microcystin concentrations, µg/L

Samples collected August 20-21, 2013

## SOURCE WATER @ INTAKE

<table>
<thead>
<tr>
<th>Location</th>
<th>Concentration (µg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Arm</td>
<td>&lt;RL (Nice) 0.16 (CalW) 0.41 (Lake-NL) 0.15 (Lake-SB) 2.36 (City of Lakeport)</td>
</tr>
<tr>
<td>Oaks Arm</td>
<td>0.1 (Oaks) 0.19 (Buck)</td>
</tr>
<tr>
<td>Lower Arm</td>
<td>0.76 (CW) &lt;RL (Rich) 0.12 (Hi) &lt;RL (MK) 0.16 (KCWD) &lt;RL (WW) 0.67 (GS) 0.77 (CB) 0.23 (HarbV)</td>
</tr>
</tbody>
</table>

## PROCESS WATER

<table>
<thead>
<tr>
<th>Concentration (µg/L)</th>
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</thead>
<tbody>
<tr>
<td>&lt;RL</td>
</tr>
<tr>
<td>0.15 (City LP)</td>
</tr>
</tbody>
</table>

## FINISHED WATER RESULTS

<table>
<thead>
<tr>
<th>Concentration (µg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;RL</td>
</tr>
<tr>
<td>0.24 (CW)</td>
</tr>
</tbody>
</table>

No detections in finished water including at dialysis centers.

RL – reporting limit.
Cyanotoxin Results
Clearwater Mutual Water Company Treatment
Clarifier acting as an incubator? (since REPLACED)
Hypothetical Cyanotoxin Treatment Assessment @ City of Lakeport

Highest cyanotoxin concentration detected at intake

INTAKE
ACID
Pre-Ozone
ACH
Alt Tech 2.5 log G
Post-Ozone
GAC
NaOCl
Contact Tank 0.5 log G
To Dist

Raw:
Monitoring pH? Change in intake depths available? Possible to adapt to behave like a DAF? Recycled water introduced?
Acid addition: in operation? Target pH at what point
Pre-Ozone: Restrict dosage? Or crank it? Effective?
US Filter: evaluate time between flushes; consider using filter aids; consider adding intermediate sample point
Monitor number of backwashes; look for breakthrough
Nature of the charge going on to the filter bed
Post-Ozone: In operation? Effective?
GAC: Know that it is possible for cyanotoxin breakthrough to happen before traditional indicators for spent media are used
Know CT: 99.9% Giardia lamblia cyst reduction is required

Tip #1: Use tools to answer questions
Fluorometer? SCM?

Tip #2: Know what stage the bloom is in
GOT ANSWERS?
I wish. How do we get there?

DW SUPPORT

- DW Workgroup – public, water systems, and staff
- Workshops – inform public water systems & partners
  - Dialysis centers integrated
- Technical resource to troubleshoot treatment issues – still learning (e.g. calls, blitz jar test workshop)
- Use fluorometers to evaluate what the cells are doing as they pass through the plants (have a handheld)
- Collect periodic samples to evaluate treatment in HAB sources
- Inform water systems on regulations & options
  - public health officer authority
GOT ANSWERS?
I wish. How do we get there?

**DW PROGRAM NEEDS:**

- If cyanotoxin monitoring in a reservoir occurs, communicate with utilities. ([http://drinc.ca.gov/DWW/index.jsp](http://drinc.ca.gov/DWW/index.jsp))
- What ability do utilities have to control blooms at the source? Guidance on algaecides?
- What does the long term monitoring picture look like & how do we continue to support it?
- Vehicle to keep public informed (what does it all mean?)
- Vehicle to keep water purveyors informed
- Laboratory information & Monitoring framework (big!)
- I found something, now what? Public notice?
- Input on structuring Sanitary Survey (next)
Based on the EPA CCL3 list (constituents below) and regulations from New Zealand, this is the preferred method of analysis:

• **Microcystins**, expressed as MC-LR toxicity equivalents
  – Preferred: HPLC-UV/PDA
  – Alternative: LC-MS, ADDA-ELISA, PP2A

• **Anatoxin-a**
  – Preferred: LC-MS
  – Alternative: HPLC-FLD, HPLC-UV

• **Cylindrospermopsin**
  – Preferred: LC-MS
  – Alternative: HPLC-PDA

Source: *Drinking Water Standards for New Zealand 2005 (Revised 2008)*
Clear Lake Cyanotoxin Monitoring Framework

What should it look like? Trigger based? Ops based?

CONCEPTUAL ONLY

Based on cell counts or fluorometric units?

Source (weekly): ID type and cell counts [fluorometer?]
move to next level of monitoring IF > 2,000 cells/mL
move to next level of monitoring [pigment] IF > ?? µg/L

Source (2x/week): ID type, cyanotoxins
add sampling at entrance to distribution (>0.5 µg/L MC-LR)
Entrance to distribution (2x/week): cyanotoxins
move to next level of monitoring (> 1 µg/L MC-LR)

Immediate Public notification?
Source: ID type?
Entrance to distribution (2x/week): cyanotoxins
@ dialysis centers (2x/week): cyanotoxins

Based on finished water cyanotoxin concentrations?
(c) The survey and report shall include physical and hydrogeological description of the watershed, a summary of source water quality monitoring data, a description of activities and sources of contamination, a description of any significant changes that have occurred since the last survey which could affect the quality of the source water, a description of watershed control and management practices, an evaluation of the system's ability to meet requirements of this chapter, and recommendations for corrective actions.

In other words, systems shall have a watershed control program which works to help reduce the potential for contamination in the source water

- All systems combined spent $130,000 for 2012 report
- How many of you were involved?
- Information is utility heavy?
- How many of you know this is an impaired source for mercury and nutrients?

‘impaired source’ – on agency list as impaired or threatened by a pollutant and needing corrections
AWWA (M57) – authority on safe drinking water
- Land Use Inventory
- BMPs
- Hydrology
- Landfilling
- Excavations
- Sludge disposal
- Septic systems
- Industrial WW discharge
- NPDES (Permitted Sources)
- Ag/landscapes/Golf Course activities
- Special activities
- Impervious cover
- Natural Sources
- Water depth
- Construction
- Recreation
- Impaired Waters

New Zealand uses Catchment Risks
- Land Use
- Livestock
- Human/Animal Waste
- Management practices
- Available Data

This is an important step of your multi-barrier approach to ensure clean safe water!
• Nutrient loading focused survey?
• Meet with district office to discuss scope of work?
• Get a liaison? Start earlier to get informed?
• Invest in early detection systems at your source?
  – Cyanobacteria blooms, sewage leaks, hazardous runoff, and fish kills (Glasgow et al., 2004)
How would you like to get support with treating algal blooms?
(From the RSVP)

From the utilities:

- “Sample testing throughout the summer season.”
- “more research done to determine best practices for optimal treatment performance during algal blooms”
- “Information sharing between agencies and CA DW program. Also, any information on BMPs relating to specific blooms.”
- “Acceptable treatment of algae prior to bloom/die off”
RSVP Poll Results From 13 Utilities

• Did you experience any problems with algae last year as it relates to water treatment?
  - Impacted Operations (↑BW) (11)
  - ↑ Chlorine demand (8)
  - Sig. altered chemical apps (6)
  - Sig. Impaired Water Treatment (4)
  - ↑ Taste & Odor compliants (4)

We have the necessary tools to adequately treat water during significant algal blooms

<table>
<thead>
<tr>
<th>Fully equipped</th>
<th>Not equipped</th>
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<tbody>
<tr>
<td>9 (2)</td>
<td>2 (1)</td>
</tr>
<tr>
<td>8 (2)</td>
<td></td>
</tr>
<tr>
<td>6.7 avg</td>
<td>5 (3)</td>
</tr>
<tr>
<td>7 (6)</td>
<td></td>
</tr>
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<td>5 (3)</td>
<td></td>
</tr>
<tr>
<td>2 (1)</td>
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</table>
Got Questions?
I do. We do.

Presented by: Amy Little, MS, PE, Engineer, amy.little@waterboards.ca.gov, 707-576-2147

References: AWWA M57 (2010) – Algae Source to Treatment (CT information)
Carolyn Ruttan, Lake County – Department of Water Resource (Cyanobacteria genera information)
Betsy Cawn, Lake County Clean Water Program – storm water discharge permit outreach

THANK YOU!!!