

# **VDH Guidelines for Microcystins in Virginia's Recreational Waters**

**Rebecca LePrell, MPH**  
**Virginia Department of Health**  
**Division of Environmental  
Epidemiology**

# Microcystins - Background

- Most are hepatotoxins (liver toxins)
- Produced by Microcystis, Anabaena, Oscillatoria, and others
  - Most microcystins associated with *Microcystis aeruginosa*
- Also skin, eye and throat irritants
- No federally established guideline or criteria value for microcystin in drinking or recreational water

# Microcystins - Toxicity

- When cyanobacteria dies, cell walls burst, releasing the toxin into the water
  - In humans, digestive juices destroy cell wall and toxin is released into GI tract then travels to liver
  - In mice, liver damage and cell death seen within 20 min following injection of lethal dose
- While there have been impacts on human health, no human deaths from ingestion in scientific literature
- *Microcystis* blooms do not uniformly yield microcystins in response to their environment

# Methodology – Literature Review

- **Cohort study of 852 people in Australia in 1995 (Pilotto et al. 1997)**
  - Exposed individuals had an elevated OR for symptoms seven days following exposure
  - Forms the basis of the WHO guidance related to Microcystis cell counts of 20,000/mL
- **13-week mice study (Fawell et al 1994)**
  - Based on liver histopathology and serum enzyme changes in mice exposed to microcystin, 40 µg/kg body weight/day NOAEL of was derived
  - Forms the basis of the WHO drinking water guideline of 1 ppb
- **Other state guidance documents (MA, WA)**

# VDH Guidance

- **Based on:**
  - Routine water quality monitoring
  - Evaluation of toxin concentrations in water
  - Microcystis cell concentrations in water
- **Protective of at-risk populations**
  - Small children
- **Assumes incidental ingestion during swimming or other recreational water activities such as kayaking, wind surfing, jet skiing, or water skiing**

# VDH Guidance - Derivation

$$\text{Guidance Value (GV)} = \frac{\text{TDI} \times \text{BW}}{\text{IR}}$$

Where:

TDI (tolerable daily intake) = 0.04 ug  
microcystin/kg/day

BW (body weight) = 15 kg child

IR (ingestion rate) = 0.1 L/day, assuming 1  
hour swimming per day

Resulting guidance value for recreational  
exposure is 6  $\mu\text{g/L}$

# Provisional VDH Guidance

<b>5,000 to &lt;20,000 Microcystis cells/mL</b>	<b>Local agency notification; initiate bi-weekly sampling</b>
<b>20,000 to 100,000 Microcystis cells/mL</b>	<b>Public notification indicating a harmful algal bloom is present in recreational water; initiate weekly sampling</b>
<b>&gt; 100,000 Microcystis cells /mL,  OR &gt; 6 µg/L microcystin concentration,  OR blue-green algal scum or mats on surface</b>	<b>Immediate public notification to avoid all recreational water contact where bloom may be present; continue weekly sampling</b>

# Other Considerations

- **Partial water body advisory**
  - Depending on size of water body and bloom intensity
  - Undesignated area should remain under observation for the spread of blooms into new areas
- **Lifting advisories**
  - Consider discontinuing response sampling after two sampling events, a week apart, show low or no cell / toxin concentrations
  - If direct testing for microcystin is not practical, advisories should public notification/advisory decisions should be based on cell concentrations and presence of surface scum

# Public Health Advisories

- **Generally issued by state or local health department**
- **Intended to limit or avoid direct contact with the identified recreational water body during various stages of a bloom event**
  - **Use advisory signs and media releases with accurate and timely information**
  - **Hold pre-release discussion with jurisdictional leadership and other key stakeholder groups**
  - **Provide advisory information on website, and consider use of social networking tools**

# Signage (Example)



For more information call:

Peninsula Health Department – (757) 594-7305

VDH, Harmful Algal Bloom (HAB) Hotline – (888) 238-6154

<http://www.vdh.virginia.gov/epidemiology/DEE/habs/cyanobacteria/index.htm>

**FOR IMMEDIATE RELEASE**

For More Information Contact

Contact name and number (and title if not a PIO--PIO contact preferred)

Month, XX, 2012

Release #

**TOXIC HARMFUL ALGAL BLOOM OCCURRING IN X WATER BODY**

**Public advised to avoid contact with water**

(**RICHMOND, Va.**)— High levels of toxic algae have been found in the ABC Lake/River. A harmful algal bloom of *Microcystis aeruginosa* is occurring in the X area of the ABC Lake/River. This blue – green algae produces a toxin that can cause rashes and other illness. The Virginia Department of Health is warning lake-goers to stay out of the water and to keep their pets and children out as well. Due to low body weight, children and pets are at greater risk of severe illness if lake water is ingested.

Harmful algal blooms occur when warm water and nutrients combine to make conditions favorable for algae growth. The algae become so abundant that they can turn the water green and eventually produce a toxin. Microcystin, one of the types of toxins, can develop in green clumps on the surface of the water. It may also look like thick, green paint in the lake.

“The Department of Environmental Quality and the Department of Health will continue to monitor water quality in ABC Lake/River during the harmful algal bloom,” said a VDH representative.

# Microcystins and Fish

- **Boiling does not decrease microcystin fish concentration**
- **Potential for biomagnification**
  - **Some studies show microcystin in perch is eliminated in a few days**
  - **Some studies show no evidence of biomagnification**
- **Research suggests regular consumption of most fish not expected to exceed WHO TDI**

# Shellfish

- **Sepeetiba Bay (highest MC concentration)**
  - Crab (0.100 µg/g) > Fish (0.040 µg/g) > Shrimp (< 0.010 µg/g)
  - Microcystin levels elevated in January
- **James River**
  - Risk assessment for blue crab consumption performed by Virginia Dept of Environmental Quality

**Questions?**