FIVE-YEAR REVIEW OF THE 2012 RECREATIONAL WATER QUALITY CRITERIA (RWQC)

US EPA
Office of Water
Office of Science and Technology
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DISCLAIMER

The views expressed in this presentation are those of the authors and do not necessarily represent the views or policies of the U.S. Environmental Protection Agency.

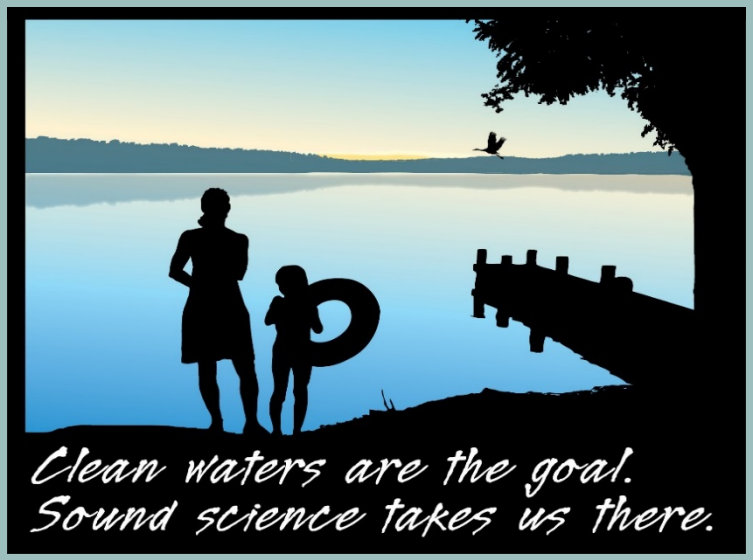
TODAY'S AGENDA

- Introduction
- Background & Objectives
- Approach to the Review
- Initial Findings: Science Review
- Initial Findings: Implementation Review
- Milestones
- Q and A

INTRODUCTION

Speakers and Presenters – EPA's Office of Science & Technology

- **Sara Hisel-McCoy**, Director, Standards & Health Protection Division
- **Betsy Behl**, Director, Health & Ecological Criteria Division
- **John Wathen**, Science Advisor, Standards & Health Protection Division
- **John Ravenscroft**, Microbiologist, Health & Ecological Criteria Division
- **Sharon Nappier**, Senior Microbiologist, Health & Ecological Criteria Division



BACKGROUND & OBJECTIVES

RECREATIONAL WATER QUALITY CRITERIA (RWQC)

Clean Water Act (CWA), Section 304(a)

- Congress requires EPA to publish recommendations that reflect the latest science to be used by states adopting water quality standards to protect the designated use of primary contact recreation.

RWQC recommendations protect public health:

- **Prevent illness**
  - By preventing fecal contamination and/or pathogens from entering surface waters from point sources
    - NPDES discharge permits
- **Identify & restore impaired waters**
  - 303(d) Listing, Total Maximum Daily Loads (TMDLs)
- **Identify potentially hazardous conditions**
  - Beach notifications

2017 REVIEW OF THE 2012 RWQC

BEACH Act amendment (CWA Section 304(a)(9)(B)) requires a 5-year review of the RWQC

Goal: Review the latest science and determine if there is a need to revise the RWQC.

Output: Report summarizing the findings of the review

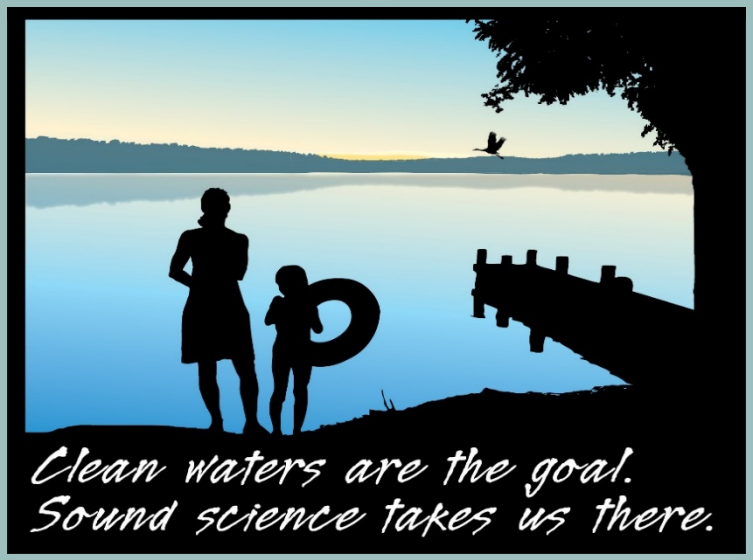
- Will inform subsequent decision on whether any revisions are necessary and appropriate.
- To be published late CY2017

REVIEW OBJECTIVES (1)

1. Inventory and evaluate health study information published since 2010;
2. Identify additional indicators and methods, including those that have become more refined or feasible since the issuance of the 2012 criteria and assess their applicability;
3. Provide information on the state of the science with respect to: molecular and source tracking methods (MST), sanitary survey design, predictive modeling, and other implementation tools;

REVIEW OBJECTIVES (2)

4. Include relevant information pertaining to the development of other criteria that have the potential to protect the recreational use (i.e., coliphage and cyanotoxin criteria);
5. Review the 2012 RWQC based on internal EPA input on the science and the broader scientific literature;
6. Assess perceived barriers to state/tribal adoption.



APPROACH TO THE REVIEW

SCIENCE REVIEW OF THE 2012 RWQC

1. Health Studies
   - Epidemiology, exposure, and quantitative microbial risk assessment (QMRA) studies
2. Performance of qPCR Methods –
   - *Enterococcus* spp. and *E. coli*
3. Microbial source tracking (MST)
4. Developments of additional RWQC
   - Cyanotoxins: microcystin and cylindrospermopsin
   - Coliphage

IMPLEMENTATION REVIEW: TOOLS AND ADOPTION

Implementation Tools Provided in the 2012 RWQC

- Sanitary Surveys
- Alternative enumeration methods
- Alternative health and fecal source relationships
- Predictive Modeling
- Process/Mechanistic Modeling

OUTREACH AND INFORMATION GATHERING (1)

- Stakeholder Outreach

- Internal EPA consultations
- Ongoing external stakeholder outreach, including this webinar today!

- OW/ORD Two-day Meeting (April 2017)

- Consult other agency sources of expertise

- Southern California Coastal Waters Research Project (SCCWRP)
- Michigan DOH; City of Racine DOH
- USGS Great Lakes Beach Group

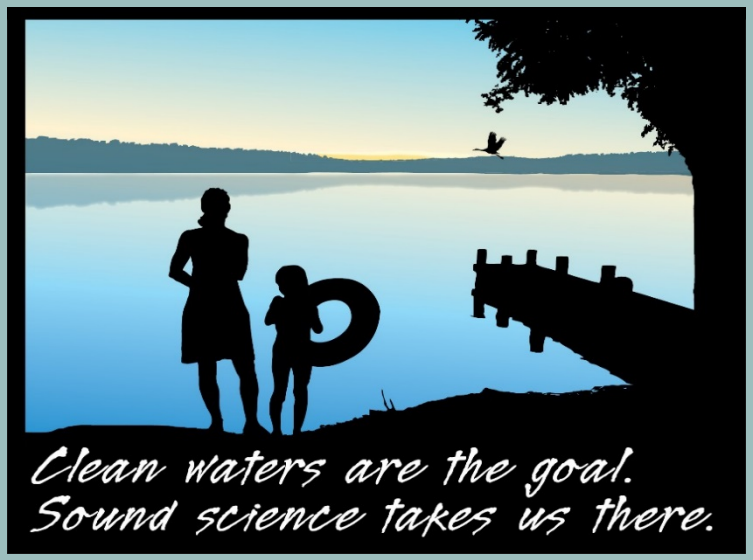
- Consult academic sources of expertise

- Univ Puerto Rico, Univ North Carolina, Univ Hawaii

- Consultation calls with 8 EPA BEACH Act Regions and their respective state beach coordinators

OUTREACH AND INFORMATION GATHERING (2)

- **Conducted systematic literature review and analysis of health studies published since 2010**
  - Epidemiology, children's health, alternative indicator relationships, risk assessment, outbreaks
- **Conducted systematic literature review and analysis of qPCR methods published since 2010**
  - *E. coli*
  - *Enterococcus* spp.
- **Conducted Review and summation of external MST literature, approaches, and methods since 2010**



INITIAL FINDINGS: SCIENCE REVIEW

HEALTH STUDIES (1)

- Both epidemiology and QMRA-based studies provide scientifically defensible estimates of human health effects from exposure to waters contaminated by feces.
- In waters affected by human fecal contamination, GI illness is the most sensitive health endpoint reported in epidemiological studies
- Further evidence that children can be more highly exposed and have greater susceptibility to swimming-associated GI illness

HEALTH STUDIES(2)

- Waters affected by some non-human sources may pose less risk compared to human fecal contamination
- Evidence that Enterococcus qPCR and coliphage are associated with GI illness at sites impacted by human sources
- Norovirus infection and transmission are associated with swimming

PERFORMANCE OF QPCR METHODS:

EPA Method 1609 for *Enterococcus* spp.

- Provides same results as Method 1611 but with less sample interference rates in most situations
- Recommended over Method 1611

EPA method for *E. coli* (draft Method C)

- Incorporates the same interference control modifications as Method 1609
- Field studies indicated similar low frequencies of interference as with Method 1609
- Final results of multi-lab study are pending

MICROBIAL SOURCE TRACKING

Source Identification Protocol Project (SIPP)

- 5 organizations formed technical lead team
- Public challenge via blinded study
- 27 expert laboratories; 41 methods

Majority of experts (>90%) favor a PCR-based methodology for MST

- qPCR methods are highly reproducible across labs when **protocol is standardized**

Identification of top human-associated fecal markers

- HF183/BacR287
- HumM2

COLIPHAGE: RWQC DEVELOPMENTS

- Literature Reviews
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- *Review of Coliphages as Possible Indicators of Fecal Contamination for Ambient Water Quality* (US EPA, 2015)
- Systematic Literature Reviews of viruses in raw sewage and ambient waters (Eftim et al., 2017; McMinn et al., 2017; Presentations at 2016/2017 UNC Water Microbiology Conferences)

- Methods Development
- Draft Method 1642 – ultrafiltration + single agar layer
- Draft Method 1643 – single agar layer
- Application of methods to 2015 Great Lakes Study (Presentation at 2016 Recreational Waters Conference)

- 2016 Coliphage Experts Workshop
- Fact Sheet and Peer-reviewed Meeting Proceedings

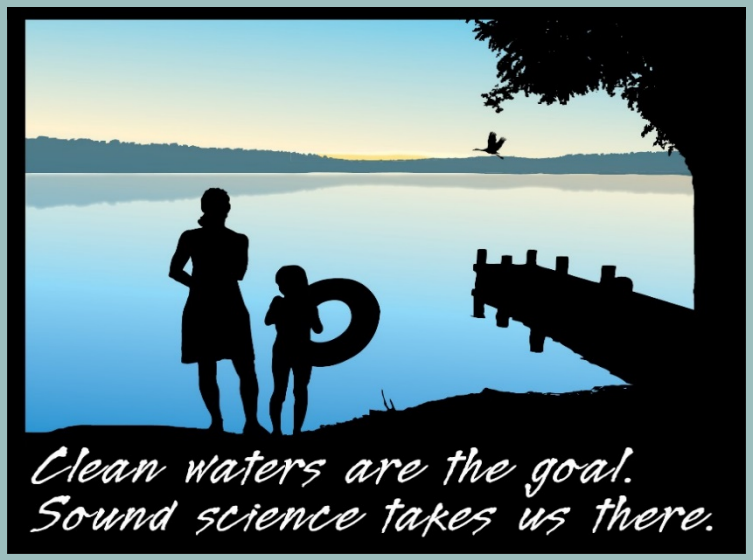
CYANOTOXIN: RWQC/SWIMMING ADVISORIES

Human Health Recreational Ambient Water Quality Criteria or Swimming Advisories for Microcystins and Cylindrospermopsin

- Draft published 12/19/16
- Public comment period closed 3/20/17
- Next steps: revise and publish a final document in 2017

Implementation Support

- **Materials for Recreational Water Managers (available now)**
  - Public messaging and notification
  - Monitoring plans
  - Networking with key partners
- **Water Quality Criteria Materials (with final criteria)**
  - FAQs for assessment/listing/TMDLs/NPDES permits
  - Adoption and Implementation Flexibilities for Criteria



INITIAL FINDINGS: IMPLEMENTATION REVIEW

IMPLEMENTATION REVIEW: TOOLS (1)

- **Sanitary Surveys**
  - Marine Beach Sanitary Survey
  - Marine Beach Sanitary Survey App
- **Alternative Enumeration Methods**
  - Technical Support Material (TSM) published
- **Alterative Health and Fecal Source Relationships**
  - TSMs externally peer-reviewed
  - Include the use of QMRA-based tools, which provides an approach for developing water quality criteria for non-traditional fecal indicators and for waters not typically included in epidemiological studies.

IMPLEMENTATION REVIEW: TOOLS (2)

Predictive/Statistical Modeling

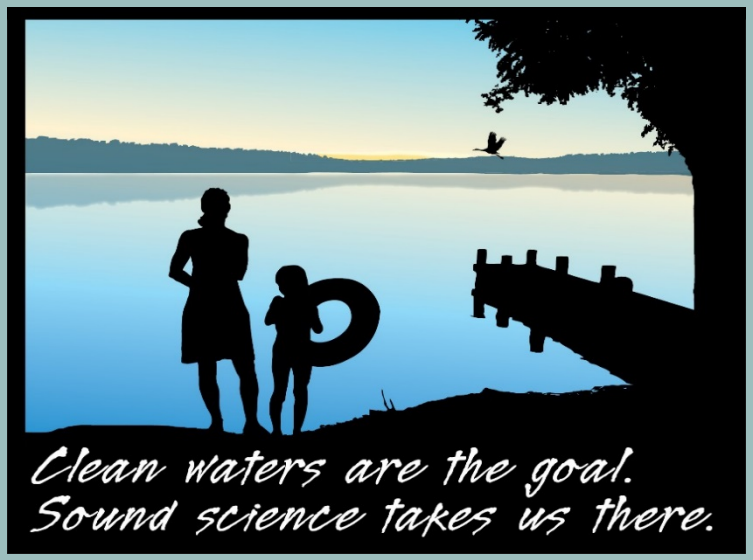
- Virtual Beach has been enhanced with data acquisition (EnDDaT), and partial least squares regression (PLS) and a gradient boosting machine (GBM) predictive calculation capabilities
- EPA released new guidance "Six Key Steps to Developing and Using Predictive Tools at Your Beach" (March 2016)
  - Includes case studies of model development and implementation in fresh and marine waters

Process/Mechanistic Modeling

- Developing several new modules related to microbial sources, release, and inactivation
- New QMRA software infrastructure developed to provide risk estimates within a standard microbial watershed assessment

IMPLEMENTATION REVIEW: ADOPTION

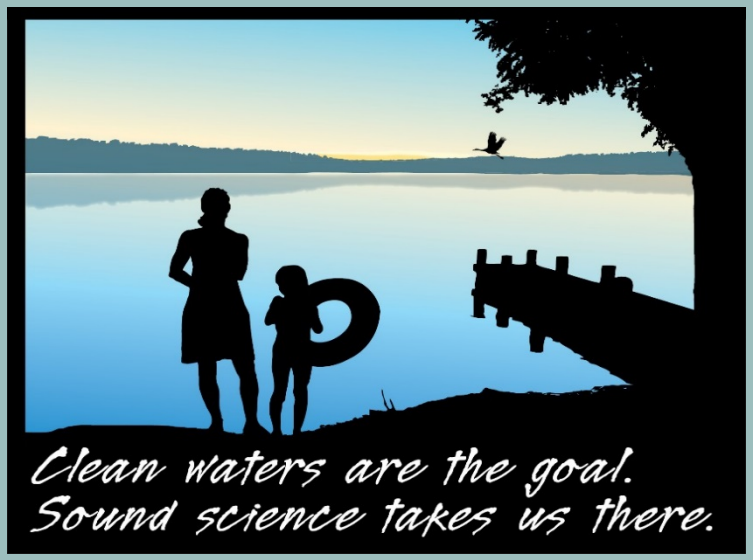
- States have used the flexibility of the RWQC to adopt a variety of protective approaches
- Great Lakes states had only minor adjustments to beach implementation
- Adoption in some states lagging due to states processes such as involvement of two agencies and/or legislative approval being required



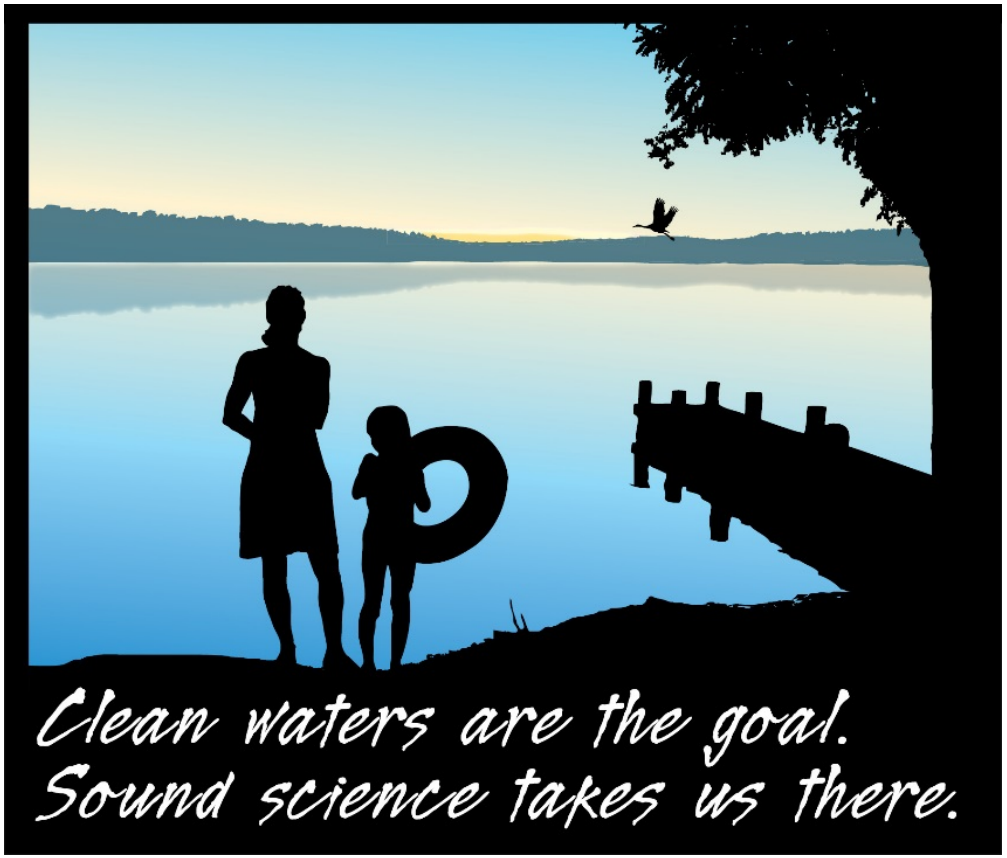
MILESTONES

2017 REVIEW MILESTONES

Initial Stakeholder Outreach	March
Information Transfer with ORD	April
Stakeholder Webinar	July (Today!)
Complete Review Report	December



Q AND A



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