

# EPA's Methylmercury Water Quality Criterion and Implementation

Katherine Sciera, Ph.D.

EPA, Region 4

Water Protection Division



# Outline of Discussion

- Water quality & Mercury (Hg)
- Past and Present Mercury Guidance
- Methylmercury (MeHg) Criterion
- Implementation Guidance



# Water Quality & Mercury

- 2006 Section 303(d) list:
  - >9,000 waters impaired due to mercury
  - 42 states and Puerto Rico
- December 2006
  - Fish consumption advisories for:
    - 883,000 river miles
    - 14.2 million lake acres
    - 48 states, 1 territory, 2 tribes

# Past & Present Mercury Regulations

- State specific water column total Hg criteria
  - CMC: 1.4 ug/L
  - CCC: 0.77 ug/L
- Update to fish-tissue based MeHg criterion
  - 2001: 0.3 mg MeHg/kg fish
  - Science Advisory Board: Bioaccumulation factors (BAFs) are variable across the nation, one water column value is not protective

# The Criterion

- 0.3 mg MeHg/kg fish tissue
- Can be translated to water column value
- Options for adoption by state:
  - Fish tissue value adoption without water column translator
  - Water column value after state translates fish tissue value using Bioaccumulation Factor
  - BOTH fish tissue and water column values

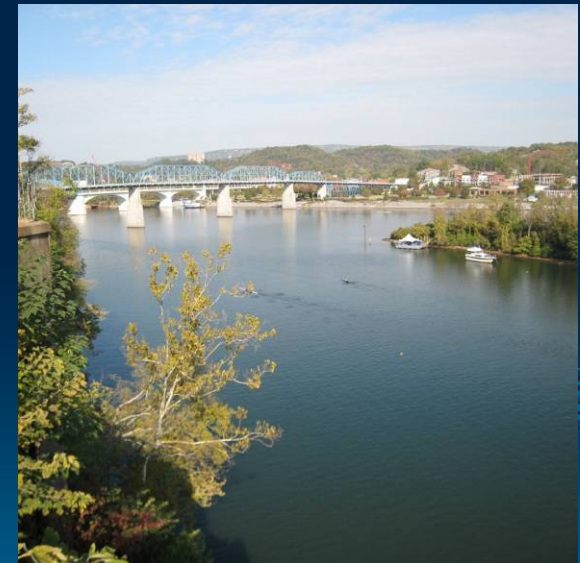
# The Criterion

- Needs to be adopted by the State/Tribe
  - Implementation plan encouraged by EPA
  - Number of mercury impairments nationwide expected to increase after criterion adoption
  - EPA methylmercury implementation guidance:

[http://www.epa.gov/waterscience/criteria/  
methylmercury/guidance-final.html](http://www.epa.gov/waterscience/criteria/methylmercury/guidance-final.html)

# The Guidance

- Status as “under review;” anticipate as final
- Set up as a Q&A document
- Sections:
  - Standards
  - Monitoring and Assessment
  - TMDLs
  - NPDES



# Standards

- Fish tissue value (0.3 mg/kg)
- Translator to water column value

$$AWQC \text{ (mg MeHg/L*)} = TRC / BAF$$

*TRC*=tissue residue concentration (0.3 mg/kg)

*BAF*=bioaccumulation factor;  $BAF = C_t / C_w$

$C_t$ =concentration MeHg in fish tissue (mg/kg)

$C_w$ = concentration of MeHg in the water column (mg/L)

\*Convert to total Hg in mg/L using MeHg to Hg ratios or methylation rate

# Bioaccumulation Factors (BAFs)

- Use site-specific MeHg BAFs derived from field studies
  - Reflects an organism's exposure to a chemical
  - Tropic level and species specific
  - Reflects site specific conditions
  - Pros: Simplicity, wide-spread applicability
  - Cons: Cost, empirical nature

# Bioaccumulation Factors (BAFs)

- Use scientifically defensible bioaccumulation model
  - Empirically or mechanistically based
  - Spatial scale
  - Level of detail
- Use BAFs derived using field studies that are not site specific (appendix A of *Water Quality Criterion for the Protection of Human Health: Methylmercury*, USEPA 2001).

# Monitoring & Assessment

- Guidance contains advice on analytical methods and recommends 5 methods for implementation
- Two methods are EPA approved under 40 CFR part 136:
  - Method 1631: 0.5 ng Hg/L
  - Method 245.7: 5.0 ng Hg/L
- EPA Method 1630: 0.06 ng MeHg/L

# Monitoring & Assessment

- Fish species should be commonly eaten in the study area and have commercial, recreational, or subsistence fishing value
- Sample skinless, fillets of larger (older) fish
- Without consumption data:
  - Use generalized consumption data for species selection
  - Use trophic level 4 fish only (predator species)

# TMDL Section

- Section 303(d) requires states and authorized tribes to identify and establish priority ranking for waters that do not achieve water quality standards
- Total Maximum Daily Load (TMDL) must be established
- Subcategory 5M
- Air deposition is the predominant source to many waterbodies

# Air Deposition Data

- National Emissions Inventory (2002): measurements & estimates for 188 hazardous air pollutants
- Mercury Deposition Network (MDN)
- Regional Langrangian Model of Air Pollution (RELMAP; 1997)
- Regional Modeling System for Aerosols and Deposition (REMSAD)
- Community Multi-Scale Air Quality Model (CMAQ)

# Other sources to consider

## ➤ Point sources

- Mining activity, industrial discharges

## ➤ Sediments

- Historical mining or industrial activities
- Historical air deposition

## ➤ Natural or background levels of mercury in soils



# Modeling Tools for Water Quality

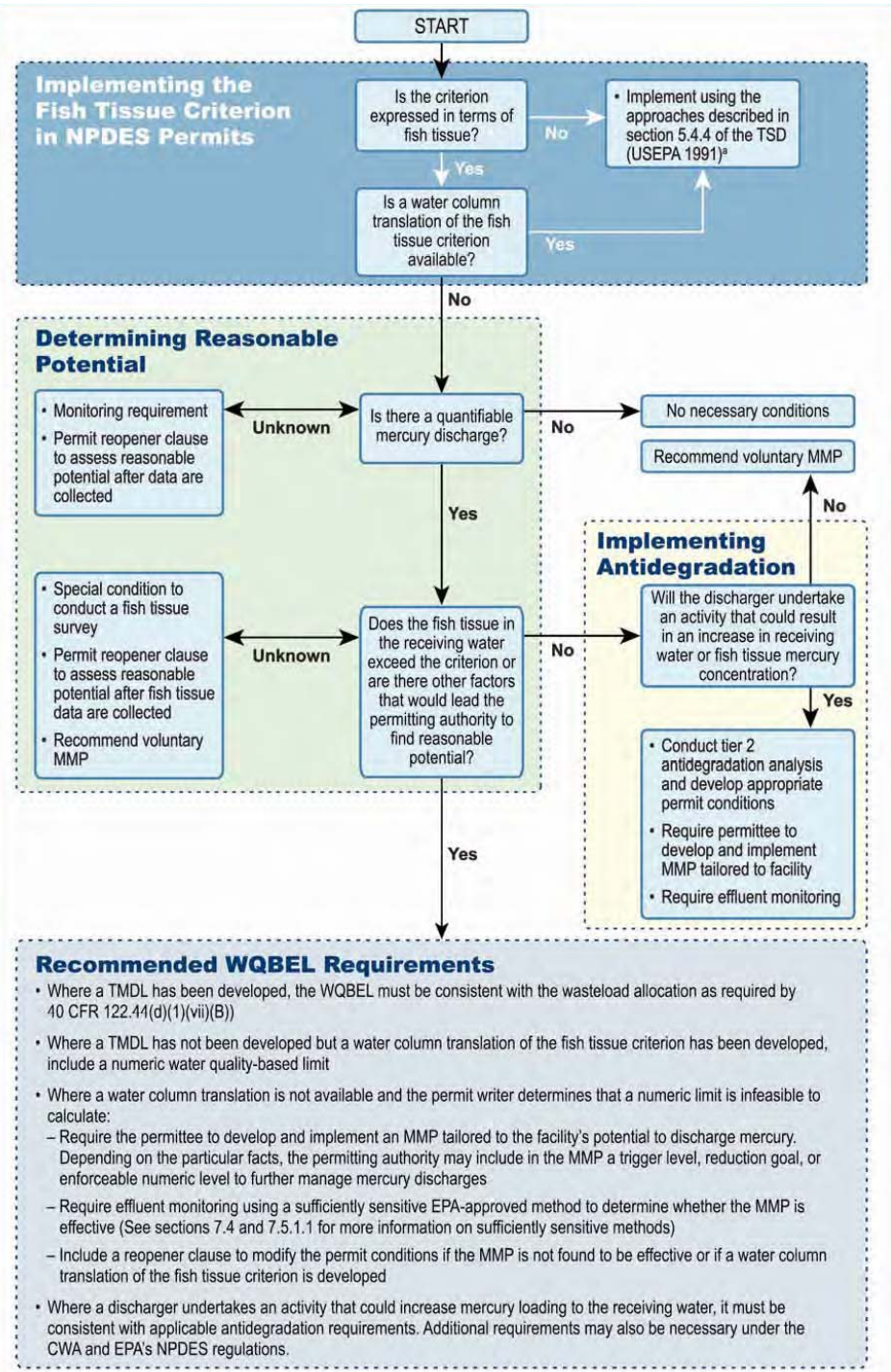
- Link water column values to fish tissue concentrations
- Grid-based Watershed Mercury Model (GBMM) + Water Quality Analysis Simulation Program (WASP) + Bioaccumulation Model (BASS)
- Will the models effectively simulate the management action(s) under consideration?
  - Steady state vs. comprehensive simulation models
  - Useable output for air, NPDES, multi-programmatic implementation

# NPDES Permits

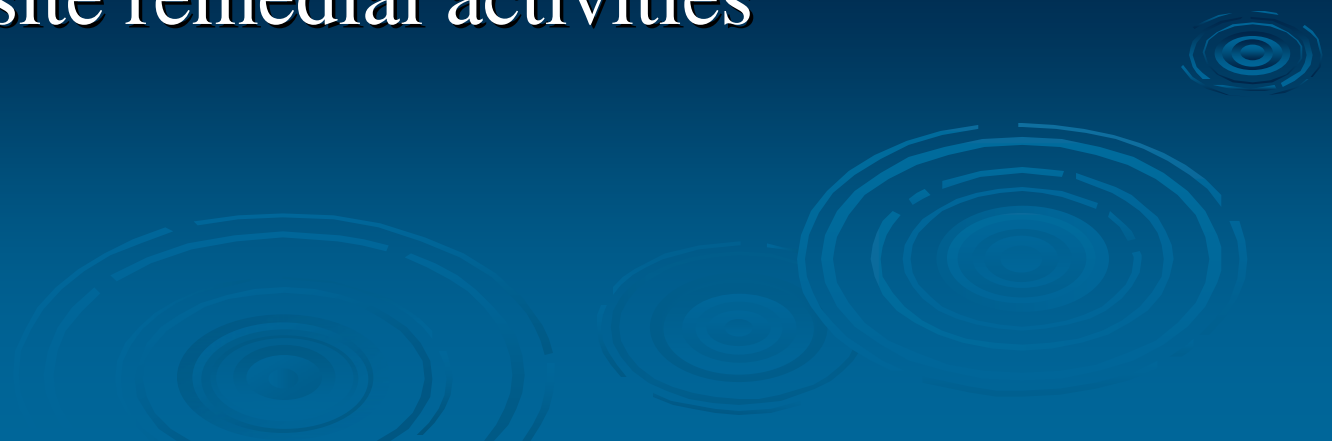
Reasonable Potential (RP) determination:

- Is there quantifiable mercury in the discharge?
- If yes, permits must contain
  - 1) Technology based effluent limitations
  - 2) More stringent limitations, water quality based effluent limitations (WQBELs) to ensure WQS are met

# Implementing Fish Tissue Criterion in NPDES Permit Limits



# Oak Ridge Issues

- Y-12 permit renewal in FY10
  - TMDL development for East Fork Poplar Creek with goal completion in 2011-2012
  - Superfund site remedial activities
- 

# Questions?

Katherine Sciera, TMDLs

[sciera.katherine@epa.gov](mailto:sciera.katherine@epa.gov)

Joel Hansel, WQ Standards

[hansel.joel@epa.gov](mailto:hansel.joel@epa.gov)