



Current and Future Water Regulatory Issues Affecting Electric Utilities

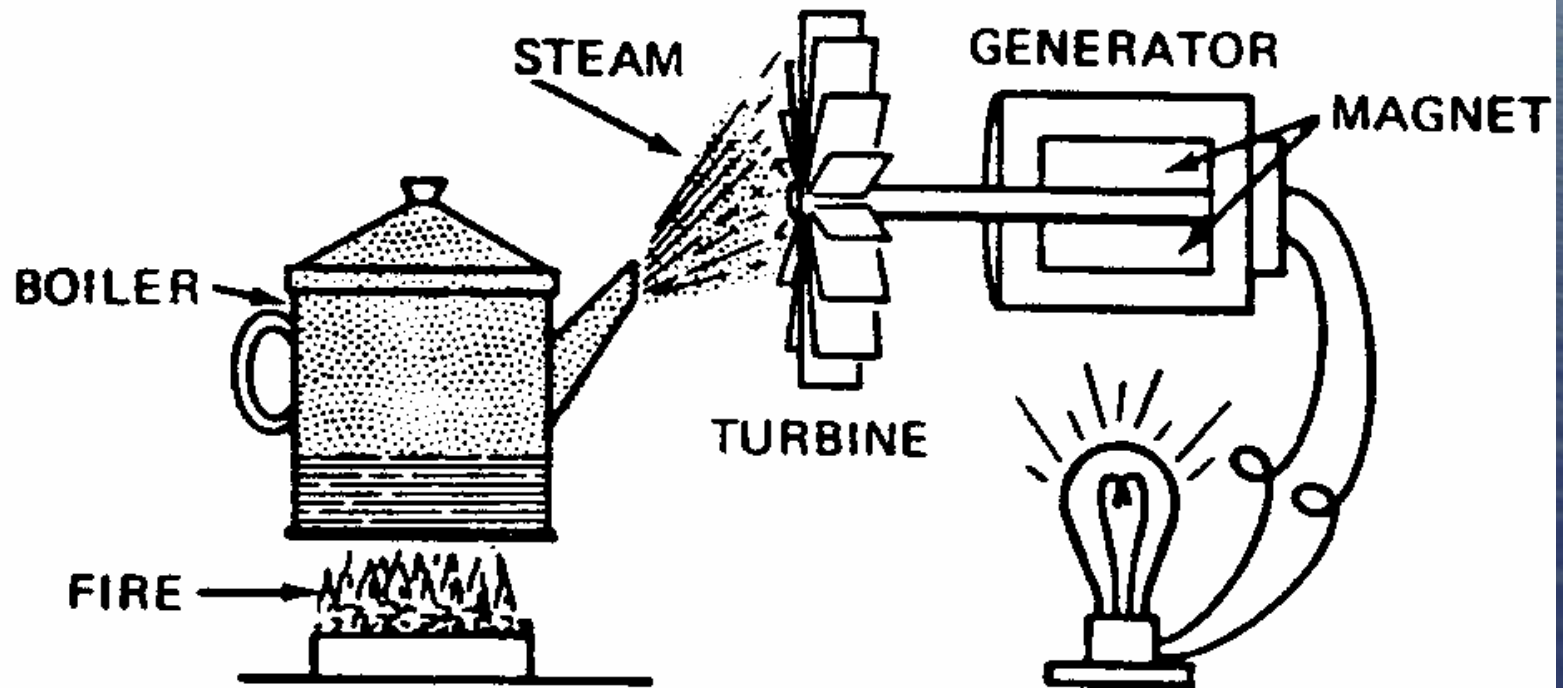
Ron Hix - March 10, 2003

Items to Be Covered

- **Water Use in Power Plants**
- **Water Quantity Issues**
- **Water Quality Issues**

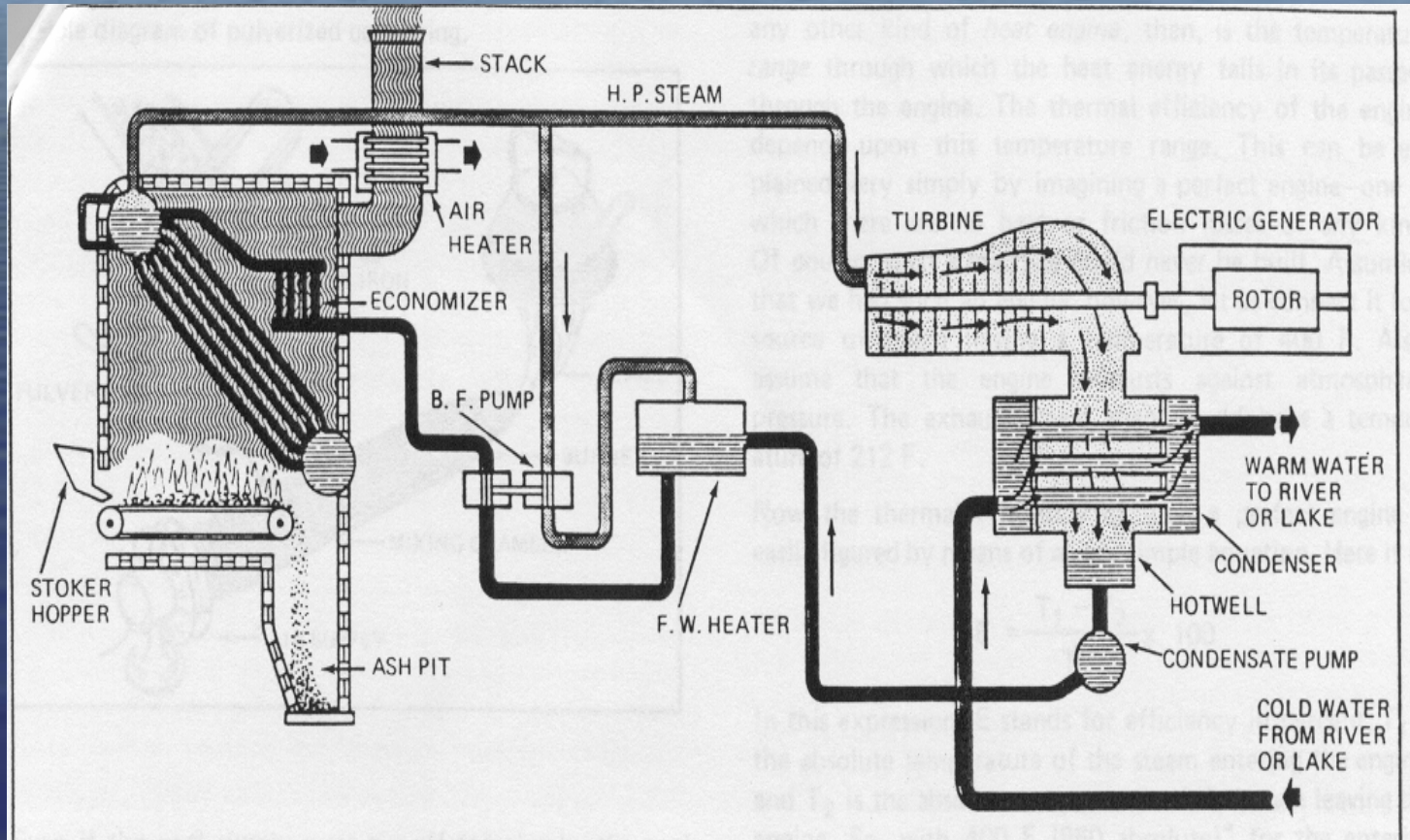
Water Use in Power Plants

How Electricity is Made



Water Use in Power Plants

Simplified Coal Plant



Water Flow Diagram



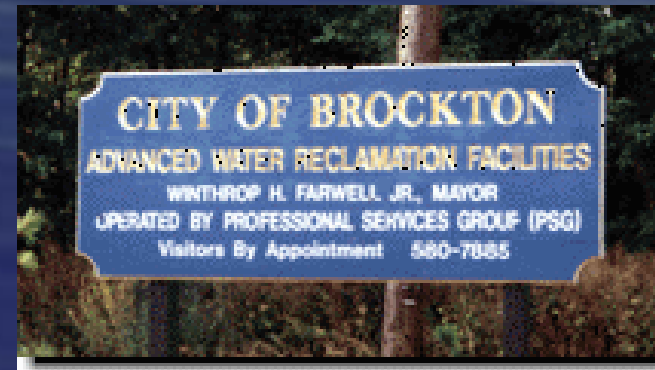
Water Quantity Issues

- Fresh water is becoming an increasingly scarce resource.
 - Both groundwater and surface water
- Power Plants are in competition with:
 - Agriculture
 - Other industries
 - Potable uses
 - Natural Resources
 - Minimum Flows
 - Minimum Levels



Water Quantity Issues

- Power Plants are often forced to use poorer quality water
 - Poorer quality aquifers
 - Reclaimed (Grey) or recycled water
- Extensive treatment is required
 - New technologies needed
 - Generally very expensive



Water Quantity Issues

- Water Conservation becomes very important
 - Recycle in-plant waste streams
 - Zero Discharge
 - Dry cooling towers



Water Quantity Issues

- Many research and development opportunities:
 - New or improved water treatment methods
 - Recycle
 - Zero discharge
 - Improved efficiency from cooling towers
 - Wet Cooling Towers
 - Dry Cooling Towers
 - Hybrid Cooling Towers (Wet/Dry)

Water Quality Issues

- **Brief History of the Clean Water Act (CWA)**
- **Major Current Water Quality Issues**
- **Future Water Quality Issues**

Brief History of the CWA

- Rivers and Harbors Act of 1899
 - Also known as the “Refuse Act”
 - Prohibited the dumping of “materials” into “navigable” “waters of the United States”
- 1948 Federal Water Pollution Control Act (FWPCA) or “Clean Water Act”
 - Waste disposal was a fundamental use of water
 - For a violation to occur, another state must be impacted



4 Acres of Carp

Brief History of the CWA



- Infamous fires on the Cuyahoga river in Cleveland, Ohio
 - 1952
 - 1969

Brief History of the CWA

- 1972 FWPCA amendments
 - Start of the NPDES permit program
 - Emphasized control on the amount of pollutants allowed to be discharged by a source
- 1977 Amendments
- Water Quality Act of 1987



Discharges to Surface Water

- EPA set up the National Pollutant Discharge Elimination System (NPDES) permitting program to control discharges to surface WUS.
 - “E” is for “Elimination”
 - Goal was to eliminate all point source discharges by 1987.
 - Still continue to strive for elimination
 - Have settled to control particular pollutants
 - Often require “treatment”

Discharges to Groundwater

- These discharges are usually not considered to be discharges to WUS
 - Are regulated by state regulations
 - Have different standards (must meet “drinking water” standards)
- Compliance monitoring is conducted in wells that surround the discharge area.



Discharges to POTW's

- POTW
 - = Publicly Owned Treatment Works
 - = Sewage Treatment Plant
 - Must meet federal and local “Pretreatment Standards”
 - Specific standards for Steam Electric Power Plants



Current Water Quality Issues

- Major Current Water Quality Issues
 - Sections 316(a) of the CWA
 - Section 316 (b) of the CWA
 - TMDL's
 - Mercury “challenges”
 - Nutrient Issues

Summary of 316(a) Impacts

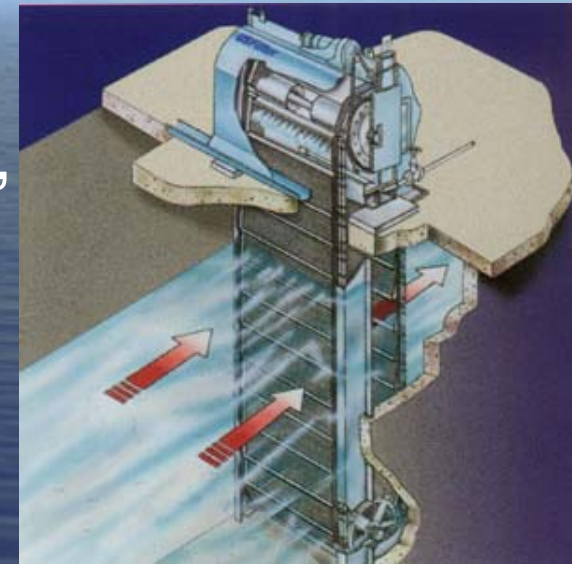
- Facilities existing on July 1, 1972:
 - Shall not cause substantial damage to aquatic life or vegetation therein or interfere with beneficial use
 - May require conversion to off-stream cooling if they cause substantial damage
- Facilities built after July 1, 1972:
 - Must meet specific temperature limits

- Variations may be allowed



Section 316 (b) of the CWA

- Section 316 (b) of the CWA requires that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact.
- Biggest “water” challenge to power industry at present time



History of the Implementation of 316 (b)

- 1993
 - Hudson Riverkeeper sues EPA to promulgate 316 (b) rule
- 1995
 - EPA enters into consent decree
 - **Required proposed regulations by July 1999**
 - **Required final action by August 2001**
 - **EPA negotiated, delayed, bi(tri)furcated process**



History of the Implementation of 316 (b)

- Implementation in 3 phases
 - Phase I - New Facilities Rule
 - Phase II - Existing Facilities Rule
 - Phase III - Other Facilities

Phase I - New Facility Rule

- Governs new facilities that employ a cooling water intake structure
- Became effective 1/17/02
 - Is applied to all facilities that commence construction after that date
 - Does not apply to new units built at existing sites if the amount of cooling water capacity is not increased
 - Employs a “two-track” approach

Phase I - New Facility Rule

– Two track approach:

- Track 1

- Applies to facilities withdrawing more than 2 MGD

- Requires minimum of wet cooling towers

- 0.5 fps through-screen velocity

- Restrictions on % water withdrawn

 - » 5% freshwater river; 1% tidal excursion

- Other design and construction technologies to minimize impingement and entrainment

- Intended for faster permitting of new plants



Phase I - New Facility Rule

- Two track approach:
 - Track 2
 - Reduce “adverse environmental impacts” to same as Track 1
 - Same % withdrawal restrictions
 - Requires several additional extensive “studies”
 - Not many new plants currently planning to use this approach

Phase II - Existing Facility Rule

- Proposed rule was published 4/9/02
- Will be final by 2/16/04
- Governing, at a minimum, existing utilities and non-utility power producers that:



Phase II - Existing Facility Rule

- Were in existence before 1/17/02 and they have:
 - Point source discharge with intake withdrawing from Waters of the US
 - Have an NPDES permit
 - Withdraw more than 50 MGD from WUS
 - Use 25% of water withdrawn for cooling purposes

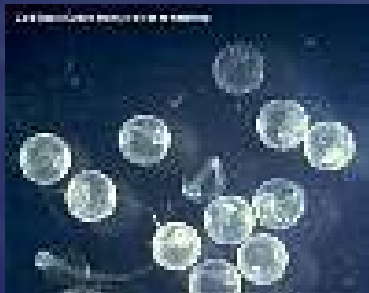
Phase II - Existing Facility Rule

- **Summary of Potential Impact**
 - 539 Power Plant Facilities
 - 275,000 MW Total
 - Account for 92% of all cooling water flow in the United States
 - Total cooling water flow over 279 Billion Gallons per Day

Phase II - Existing Facility Rule

- Preferred Approach

- Technology-based approach with performance standards based on plant flow and waterbody type
- Requires 80-95% reduction in impingement mortality (ignoring survival) and, for most plants, 60-90% entrainment reduction



Phase II - Existing Facility Rule

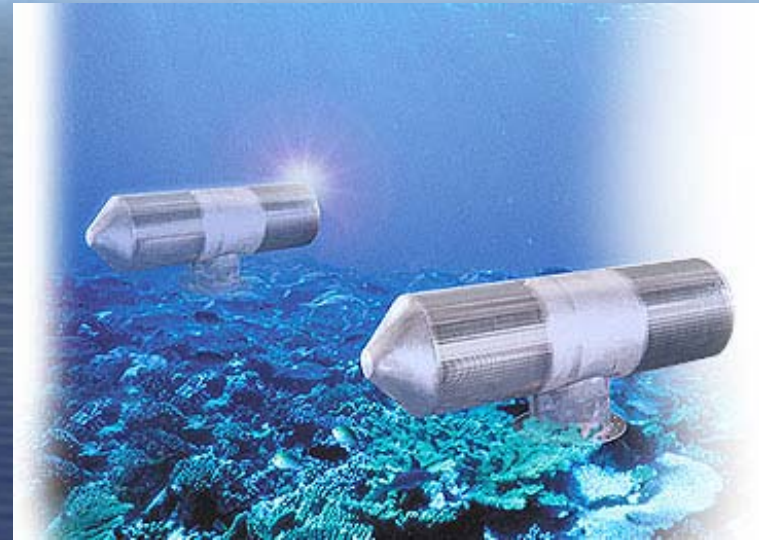
- Three potential methods for compliance:
(1) closed-cycle cooling or otherwise meet performance standards



Phase II - Existing Facility Rule

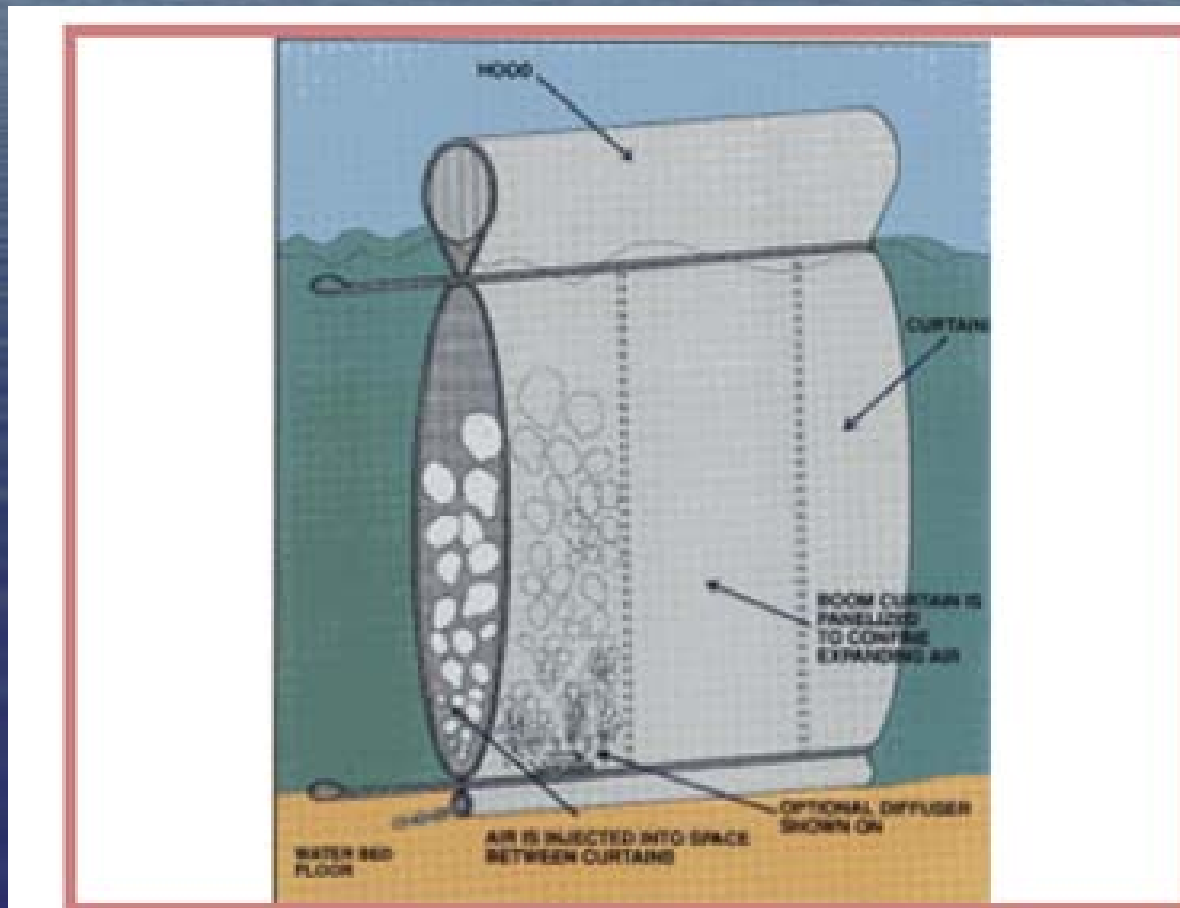
(2a) Deploy Technologies

- Fine and wedgewire screens
- Aquatic filter barriers
 - **Gunderbooms**



Phase II - Existing Facility Rule

Gunderboom

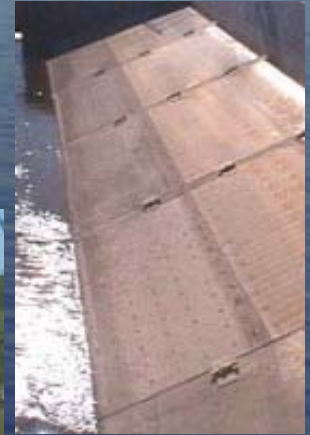


Phase II - Existing Facility Rule

- Barrier Nets
- Modified Screens and Fish Return Systems

- Behavioral Technologies

- Noise
- Bubble Curtains
- Lights



Phase II - Existing Facility Rule

(2b) Operational Measures (voluntary)

- Reduce flow
- Shut down at peak times



(2c) Restoration (voluntary)

- Fish stocking
- Wetlands restoration
- Other approaches



Phase II - Existing Facility Rule

(3) Site Specific Alternative due to economic criteria

– Cost to Cost

- BTA costs significantly greater than EPA costs

– Cost to Benefit

- Cost of compliance significantly greater than benefit derived

Cost to Benefits





Cost Versus Benefits

- **Desalination Plant -**
 - Can be “collocated” with power plants
 - Brine from desalination plant is “mixed” with once-through cooling water
 - No additional intake is required
 - Warm effluent makes desalination process more efficient
 - Long term power customer

Phase II - Existing Facility Rule

- Other Options (other than “Preferred”)
 - Basically involve refitting units with cooling towers, or other technology, depending on location.
- Some basic requirements
 - Calculate baseline
 - Submit a “comprehensive demonstration study”

Phase III - Other Facility Rule

- Existing facilities that employ a cooling water intake structure:
 - that are not covered by the Phase II rule
 - and whose intake flow levels exceed a minimum threshold to be determined by EPA.
- Effects all other facilities with CWIS and power plants under 50 MGD
- Final rule due June 1, 2006
- EPA is currently collecting data to determine the impact these facilities might have.

TMDL's

- Section 303 (d) of the Clean Water Act requires States to identify water bodies:
 - not meeting water quality standards
 - for which effluent controls are not adequate to correct (Impaired waters)
- States did not adequately address these issues
 - Litigation followed
 - States must now establish “TMDL’s”

TMDL's

- What is a TMDL?
- Too
- Many
- Darn
- Lawyers!!!!!!



TMDL's

- Total Maximum Daily Load (TMDL)
- TMDL equals the wasteload allocation (point source) plus the load allocation (non-points) plus a margin of safety.
 - Represents the limit of pollutant loading that an impaired water body can assimilate without exceeding a water quality standard.

TMDL's

- Mercury, nutrients and dissolved oxygen are the primary pollutants causing impairments of water bodies
 - 40% of US waterbodies are impaired
 - Florida alone has over 700 impaired water bodies

TMDL's

- How does this impact power plants (particularly coal burning plants)?
- In 1998:
 - 33 states reported at least one waterbody as being impaired due to mercury
 - 41 states had fish consumption advisory to to high mercury levels

TMDL's

- Major challenges for developing mercury TMDL's
 - Identifying sources of mercury
 - Natural sources
 - Soils, Volcanoes, forest fires
 - Man-made sources
 - Combustion and manufacturing
 - Historic sources in sediments
 - Sources cross state, regional and global lines (70% of air deposition from global)

TMDL's

- Major challenges for developing mercury TMDL's (Continued)
 - Much of the science is just being developed
 - **Modeling**
 - **Form/toxicity**
 - **Pathways**
- Different states and EPA Regions are trying different approaches

TMDL's

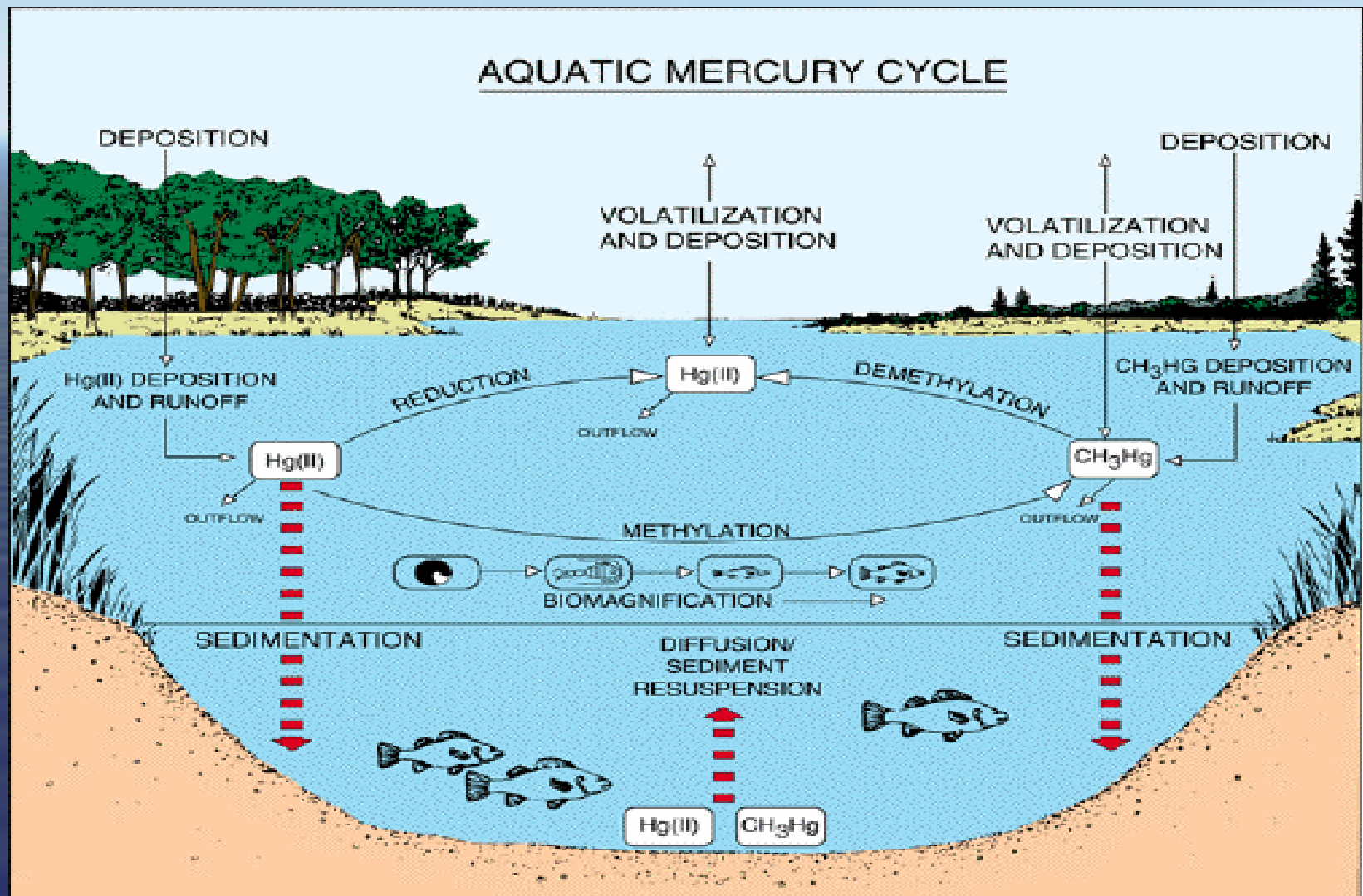


Figure 6. Mercury cycling pathways in aquatic environments are very complex. The various forms of mercury can be converted from one to the next; most important is the conversion to methylmercury (CH₃Hg⁺), the most toxic form. Ultimately, mercury ends up in the sediments, fish and wildlife, or evades back to the atmosphere by volatilization. Reprinted with permission from *Mercury Pollution: Integration*

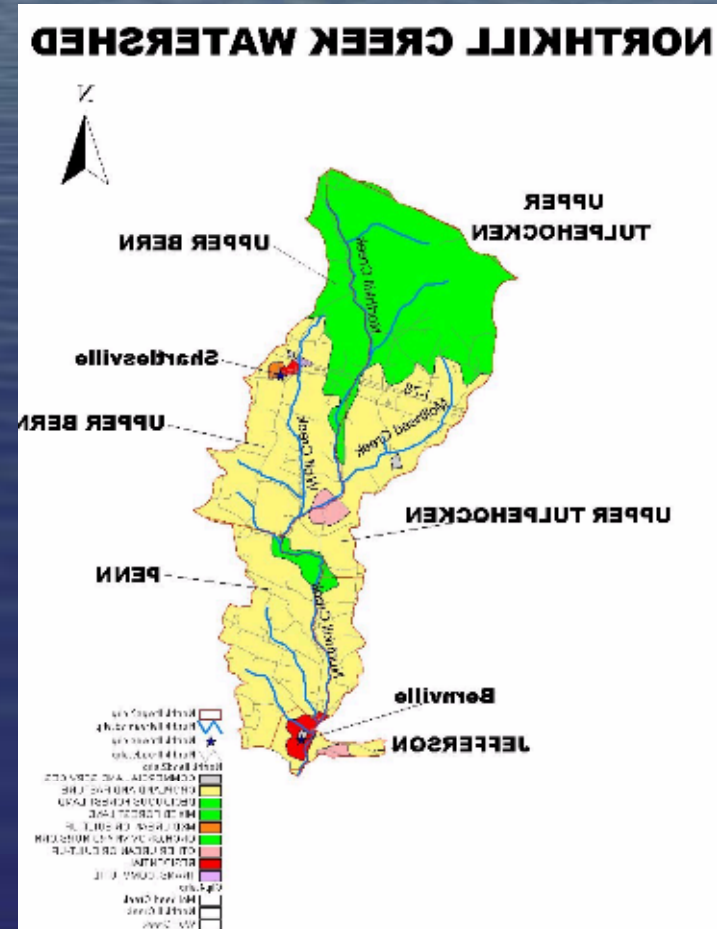
TMDL's

- Nutrient TMDL's
 - Major sources of nutrients are “non-point” sources
 - Air deposition (NO_x)
 - Stormwater runoff (agriculture)



Future Issues

- Watershed-Based NPDES Permitting Policy
- Effluent Trading



Watershed-Based NPDES Permitting

- January 2003
 - final “Watershed-Based NPDES Permitting Policy Statement” released by EPA
 - Produces NPDES permits
 - **issued to point sources in a geographic or watershed basis**
 - **to meet watershed goals**
 - Is a holistic watershed management approach
 - can address all stressors in a drainage basin
 - rather than individual discharges

Watershed Permitting

- Benefits
 - More “environmentally” effective results
 - Reduce cost to improve water quality
 - Greater opportunities for trading
 - More effective implementation of watershed plans (including TMDL’s)
- By early 2004, EPA will develop and issue guidance addressing this approach

Effluent Trading

- Would likely be similar to air emissions trading
 - Could reduce cost of compliance
 - Encourage treatment beyond minimum compliance
 - Some states already are developing programs
- Problems agreeing on many facets
 - Many “accounting” and long term liability issues

Effluent Trading

- Examples of some “pilot” trading programs:
 - Oysters for nutrients
 - Farmland for nutrients
 - Connecticut - Nitrogen currently \$1.65/pound



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Questions????

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