



Updated Water Quality Criterion for PCBs for the Delaware Estuary and its Proposed Implementation

Rutgers Ecocomplex
Bordentown, NJ
October 6, 2009



Presentation Outline

- ✓ Background
 - Historical context
 - Relationship to Stage 2 TMDLs
- ✓ Proposed Water Quality Criterion for PCBs for Zones 2 – 6
- ✓ Proposed TMDL Implementation Plan for PCBs

Presentation Outline

- ✓ Background
 - Historical context
 - Relationship to Stage 2 TMDLs
- ✓ Proposed Water Quality Criterion for PCBs for Zones 2 – 6
- ✓ Proposed TMDL Implementation Plan for PCBs

Background



- Delaware Estuary portion of the Basin is 133 miles long and is bordered by DE, NJ and PA.
- It consists of 5 water quality management units called Zones.
- EPA Regions II & III establish Stage 1 TMDLs for PCBs
 - Zones 2 – 5 in December 2003.
 - Zone 6 in December 2006.



Background (cont.)



- ❑ These TMDLs were based upon the current criteria of either the states or DRBC.
- ❑ A new methodology for deriving human health water quality criteria had been issued by U.S. EPA in 2000.
- ❑ In March 2003, the Commission directed staff to develop revised human health criteria based upon this new methodology.
- ❑ In December 2005, the Commission directed the Executive Director to proceed with rulemaking on a revised PCB criterion of 16 pg/L.

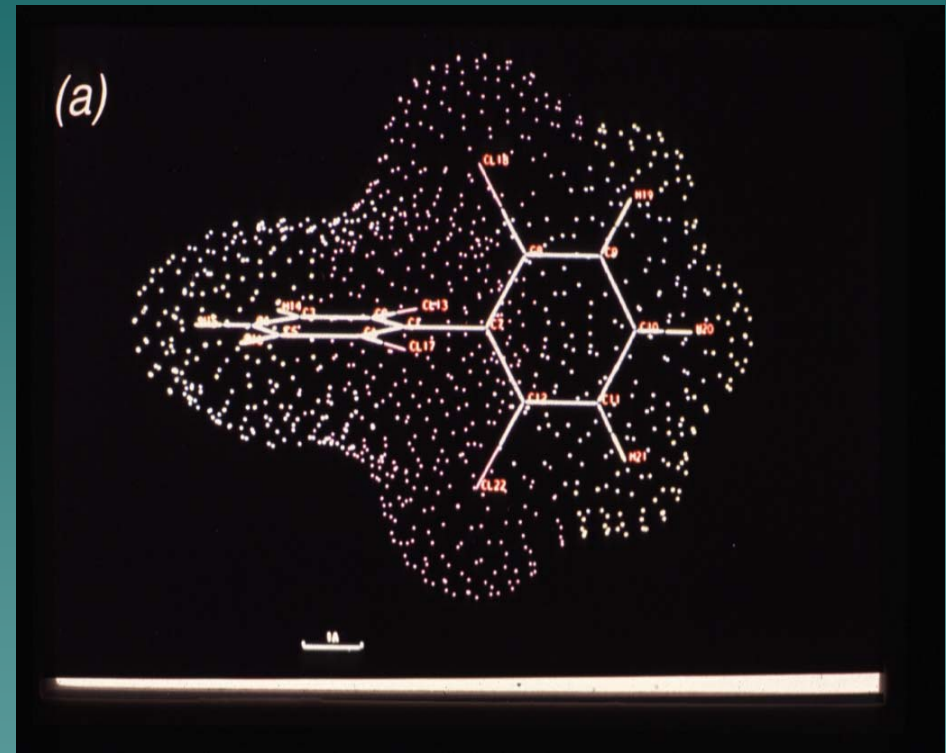
Background (cont.)



- ❑ In December 2005 resolution, the Commission also requested the Executive Director to work with other federal and state regulatory agencies develop recommendations for implementing criteria for bioaccumulative pollutants.
- ❑ These recommendations should be consistent with the existing Clean Water Act NPDES framework while also reflecting principles of adaptive management.
- ❑ The proposed TMDL Implementation Plan is the result of this effort.

PCBs

- ◆ Man-made organic chemicals with a biphenyl base structure and 209 possible chlorine substitution patterns.
- ◆ Terminology: Aroclors, congeners, homologs.
- ◆ Properties: hydrophobic, tend to accumulate in sediments and tissues.



Effects of PCBs

- ◆ Probable Human Carcinogen
- ◆ Developmental Effects
- ◆ Neurobehavioral Effects
- ◆ Reproductive Effects
- ◆ Immunosuppressant

Presentation Outline

- ✓ Background
 - Historical context
 - Relationship to Stage 2 TMDLs
- ✓ Proposed Water Quality Criterion for PCBs for Zones 2 – 6
- ✓ Proposed TMDL Implementation Plan for PCBs

Background



- ◆ In October 2000, the U.S. EPA issued a revised methodology for deriving human health water quality criteria. The Commission's TAC recommended that this new methodology be used.
- ◆ Five factors are utilized in the new methodology:
 - ① Risk-specific dose,
 - ② Body weight,
 - ③ Drinking water intake per day,
 - ④ Fish intake at various trophic levels, and
 - ⑤ Bioaccumulation factor at each trophic level.

$$AWQC = RSD \left[\frac{BW}{DI + \sum_{i=2}^4 (FI_i \bullet BAF_i)} \right]$$

Where:

AWQC – Ambient Water Quality Criterion

RSD – Risk-specific Dose

BW – Body Weight

DI – Drinking water Intake

FI – Fish Intake

BAF – Bioaccumulation Factor

Risk-specific Dose



- ◆ This factor can also be expressed as **Risk Level / Cancer Potency Factor**
- ◆ The risk level chosen is risk management policy. The DRBC and the states bordering the Delaware Estuary all utilize a risk of 10^{-6} in establishing water quality criteria.
- ◆ Although the U.S. EPA's IRIS presents a range of CPFs, the subcommittee recommended the use of the upper bound estimate of **2.0** (mg/KG)/day.

Fish Consumption Rate



- ◆ The revised methodology recommends the use of local data on fish consumption patterns.
- ◆ Two sources of data were available for the Delaware Estuary:
 - ✓ A 1994 study commissioned by the State of Delaware in Zones 5 and 6.
 - ✓ A 2003 study of catch and consumption patterns in Zones 2, 3 and 4.
- ◆ In Zones 5 and 6, the average consumption of all species was 17.46 grams/day.

Fish Consumption Rate



- ◆ In Zones 2, 3 and 4, the most frequently consumed species was channel catfish, striped bass, and white perch.
- ◆ Calculated consumption rates for channel catfish and white perch were 17.9 and 21.7 grams/day, respectively.
- ◆ The subcommittee recommended that a rate of 17.5 grams/day be used in establishing the revised criteria.

Bioaccumulation Factor



- ◆ BAFs represent the accumulation of a chemical in an aquatic species through all routes of exposure rather than uptake from water only (BCFs).
- ◆ Use of BAFs in the revised criteria was directed by the Commission in March 2003.
- ◆ The revised methodology requires the use of separate BAFs for each of the trophic levels consumed.
- ◆ Two trophic levels were selected, represented by channel catfish and white perch.

Bioaccumulation Factor



- ◆ The revised methodology recommends the use of field measurements in ambient water and tissue to derive the BAFs.
- ◆ Zone-specific data from studies conducted in the fall of 2001 and the spring of 2002 were used.
- ◆ Data on the freely dissolved fraction of PCBs in the ambient water and the fraction of lipid in the tissue was also available from these studies.

Bioaccumulation Factor



Trophic Level	Fraction Freely-Dissolved	Fraction Lipid	BAF (L/KG-lipid)
Channel catfish			
Fall 2001	0.122	0.0387	167,200
Spring 2002	0.095	0.0387	162,465
White perch			
Fall 2001	0.122	0.0248	68,190
Spring 2002	0.095	0.0248	83,281

Intake from equal proportions of each trophic level were assumed in the criterion calculation.

Probabilistic Analyses of Criteria Parameters



- ◆ In order to assess the uncertainty in the parameters used to calculate the revised criterion, a probabilistic analyses was conducted using @Risk software.
- ◆ 11 of the 15 direct and intermediate parameters were assigned distributions determined from the data source or statistical analyses of the data.

Results



- ✓ Utilizing the parameter values in the equation results in a criterion value due to exposure from drinking water and fish of:

15.9 picograms per liter

- ✓ The results of the probabilistic analyses indicated a 50th percentile value for the criterion of:

16.4 picograms per liter

Conclusion

- ◆ Based upon the recommendations of the subcommittee tasked to develop the revised criteria, the TAC recommended that the Commission adopt a criterion of

16 picograms per liter

for Zones 2 through 6 of the Delaware Estuary

Compliance Schedule Language



- ◆ Language is also proposed to provide for the use of compliance schedules where reductions in pollutant loading is necessary to achieve stream quality objectives established by the Commission.
- ◆ Allow Basin states to defer to the Commission's water quality criterion for PCBs and compliance schedule language in establishing approvable effluent limitations and other NPDES permit requirements.

Questions on Proposed Water Quality Criterion

Presentation Outline

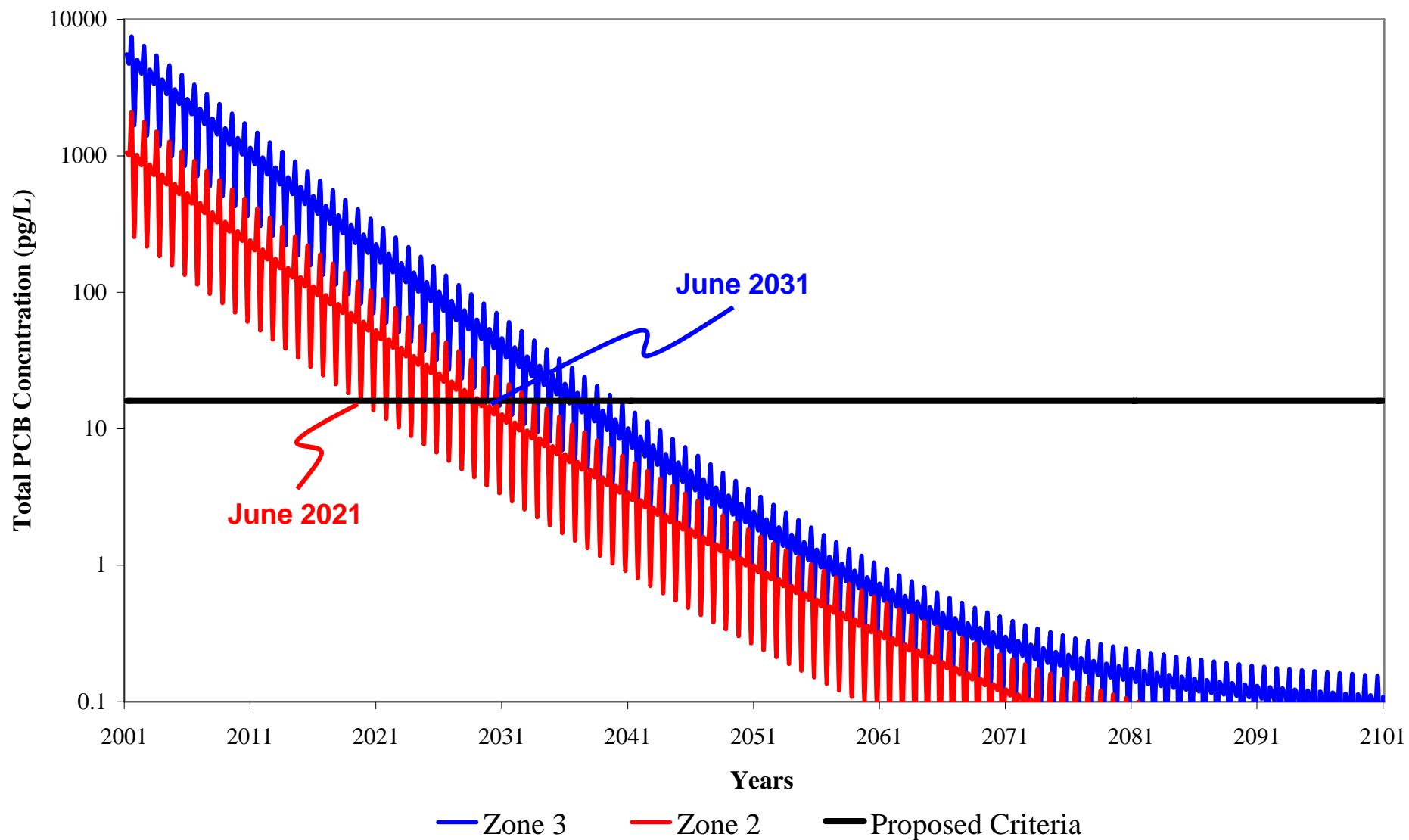
- ✓ Background
 - Historical context
 - Relationship to Stage 2 TMDLs
- ✓ Proposed Water Quality Criterion for PCBs for Zones 2 – 6
- ✓ Proposed TMDL Implementation Plan for PCBs

Achieving PCB WQ Criterion

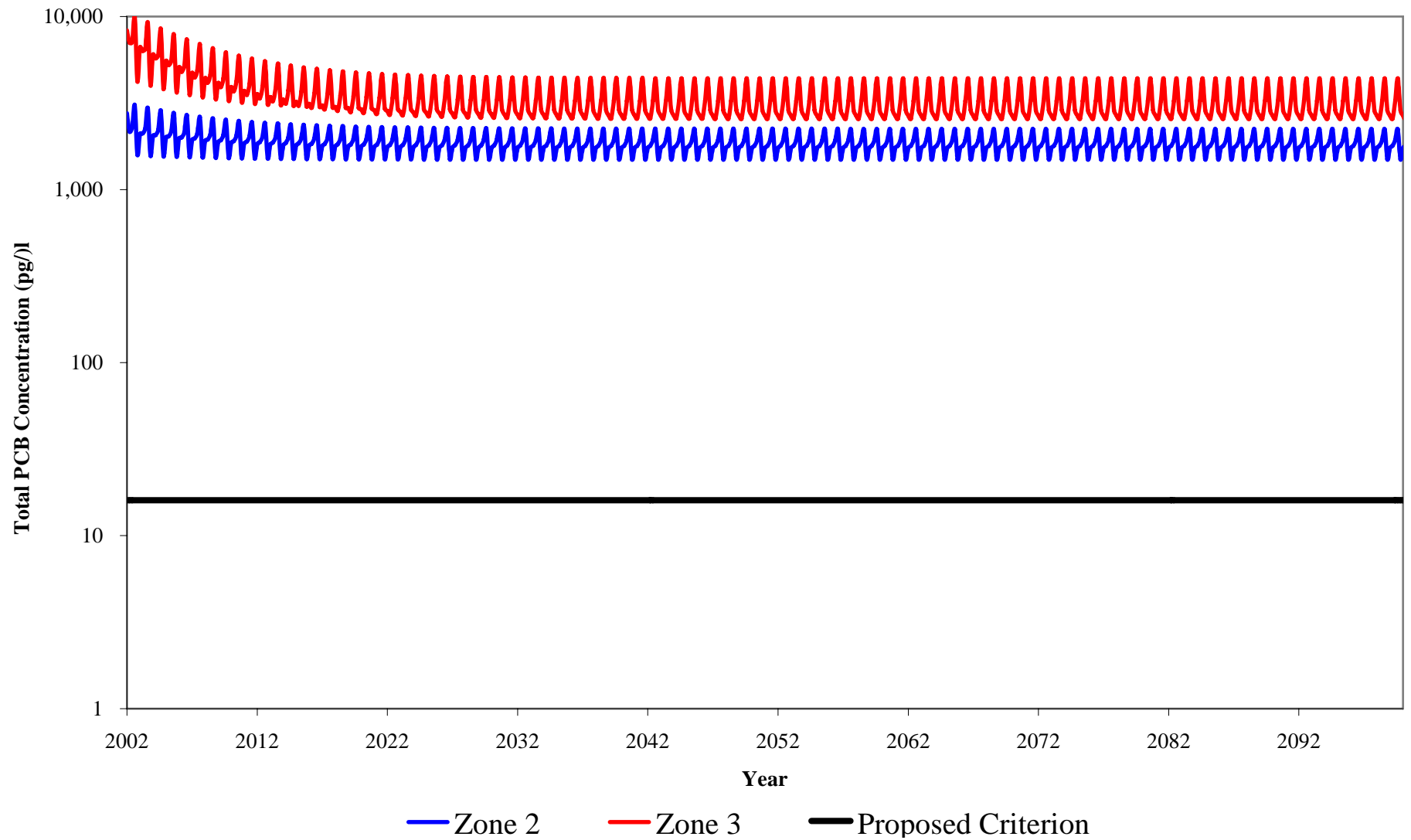


- ◆ Reductions in PCB loadings will not immediately result in lower ambient water concentrations or in reduced tissue levels of PCBs in resident fish species.
- ◆ This is due to the continuing flux of PCBs from the sediments to the water column. As solids uncontaminated by PCBs settle to the bottom, this flux will ultimately reach equilibrium with the water column. ▶

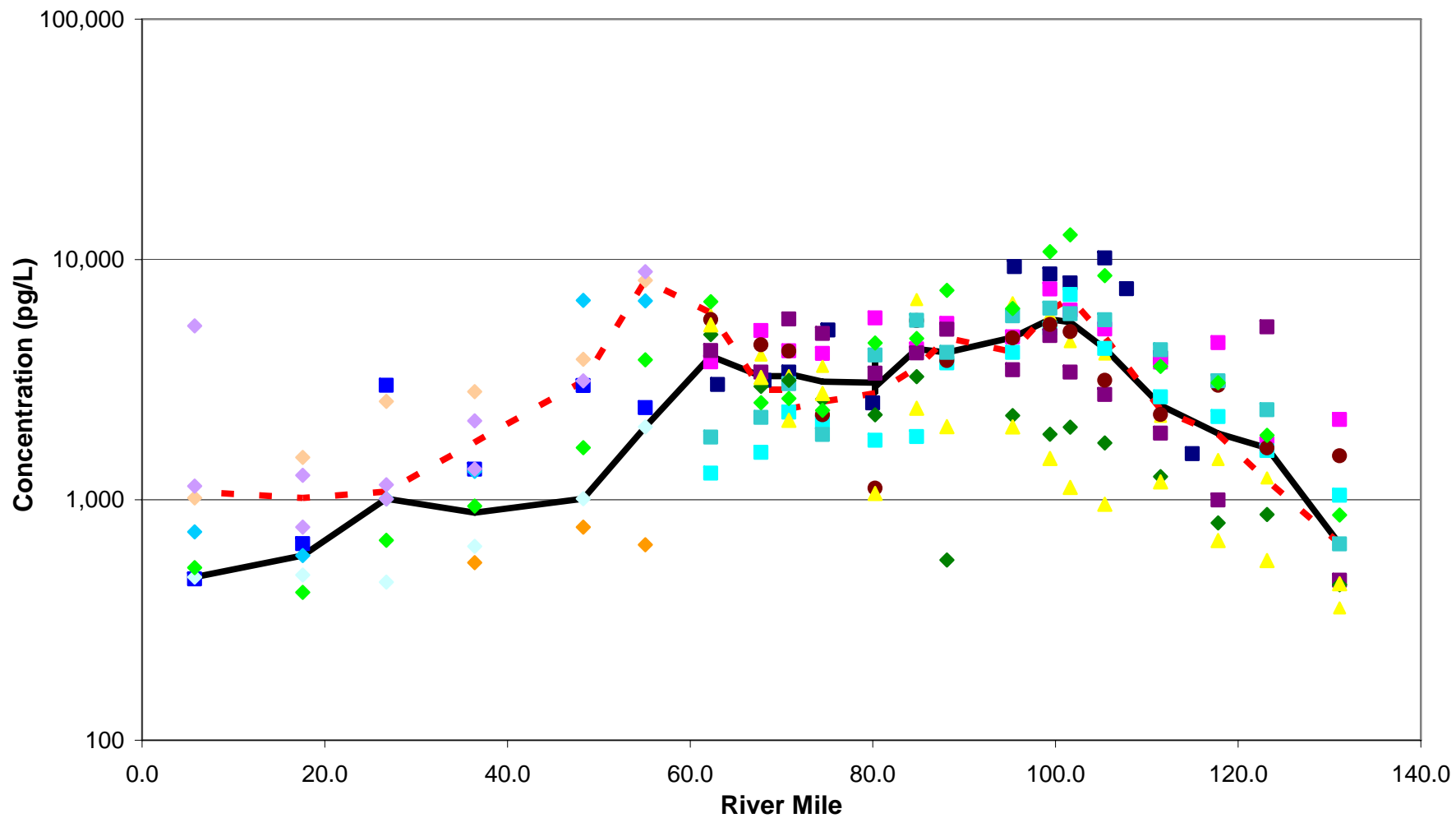
100 year projection with all sources set to zero



Projected Total PCB concentrations in Zones 2 & 3 of Delaware Estuary under the 2003 Stage 1 Loading Condition



Ambient Water Concentrations of Total PCBs 2001 to 2007



- | | | | |
|------------------|--------------------|-------------|----------------|
| ■ 9/18/2001 | ■ 3/15/2002 | ▲ 4/11/2002 | ■ 4/22/2002 |
| ■ 5/6/2002 | ● 6/19/2002 | ◆ 9/3/2002 | ■ 9/23/2002 |
| ■ 10/8/2002 | ◆ 11/21/2002 | ◆ 3/19/2003 | ▲ 4/2/2003 |
| ◆ 11/12/2003 | ◆ 11/15/2005 | ◆ 6/20/2006 | ◆ 9/19-20/2007 |
| — Stage 1 Median | - - Stage 2 Median | | |

The Problem



- ◆ Federal regulations require permits to be consistent with WLAs established with TMDLs, and achieve the underlying WQ criteria within a permit cycle (5 years).
- ◆ A long-term strategy for permitting point source discharges and addressing non-point sources such as contaminated sites and air sources is needed to gain acceptance by stakeholders and ensure continued progress in reducing PCBs.

Approach



- ◆ At the direction of the Commission, DRBC staff convened a workgroup of regulatory agencies to develop recommendations for implementing criteria for bioaccumulative pollutants.
- ◆ After consideration of several options, this workgroup recommended an approach that would be implemented with the Stage 2 TMDLs.
- ◆ This approach is called the TMDL Implementation Plan.

TMDL Implementation Plan



- ◆ This plan is intended to supplement the Stage 2 TMDLs to be established by the U.S. EPA by describing how the TMDLs and the associated allocations will be achieved.
- ◆ Under current federal regulations regarding TMDLs, EPA does not approve implementation plans as part of their establishment of TMDLs.

TMDL Implementation Plan



◆ The plan provides:

- ① detailed requirements and strategies for both point and non-point sources.
- ② for the establishment of final effluent limitations for NPDES sources that must be met *as soon as possible*, but may encompass several NPDES permit cycles.
- ③ the basis for compliance schedules, if appropriate, that are imposed in NPDES permits.
- ④ a requirement for a report to be prepared every 10 years regarding the progress in achieving the criterion.

NPDES Permit Requirements



- ◆ Under the plan, permits for point sources identified in the Stage 2 TMDLs will include:
 - ✓ The final Wasteload Allocation (WLA) contained in the TMDL report.
 - ✓ A Final Effluent Limitation (WQBEL) based upon this WLA.
 - ✓ An Interim Effluent Limitation reflecting load reductions achieved prior to permit issuance. This limitation will be based upon monitoring data collected by the permittee.

NPDES Permit Requirements (cont.)



The Interim Effluent Limitation is intended to cap the loading from each discharge, and prevent backsliding from load reductions already achieved.

- ✓ A requirement to develop and implement a Pollutant Minimization Plan (PMP) until the final WLA is achieved.
- ✓ A targeted PCB loading goal for each permit cycle if compliance with the final WLA is not expected during the term of the permit.
- ✓ Sampling and analysis using Method 1668A.

Compliance Schedules



- ◆ If the permittee is not expected to meet the final effluent limitation upon permit issuance, a compliance schedule is included in the permit.
- ◆ The compliance schedule:
 - Must require compliance as soon as possible,
 - Include a specific, enforceable sequence of actions and operations that will lead to compliance with the final WQBEL.
 - Specify a final compliance date.

Compliance Schedules (Cont.)



- Include milestones if the duration of the compliance schedule is greater than 1 year,
 - Final compliance date may extend beyond the 5 year term of the permit, and
 - Will be discharger-specific.
- ◆ The plan presents general guidelines and factors to be considered in establishing the schedule for each permittee.

Compliance Schedules (Cont.)



- ◆ Factors to be considered include:
 - Experience/success with the implementation of a PMP,
 - Type of Facility,
 - Complexity of the wastewater collection system,
 - Magnitude of the loading reduction required to meet the final WQBEL, and
 - Amount of monitoring data available to establish a loading trend.

Are We Making Progress?

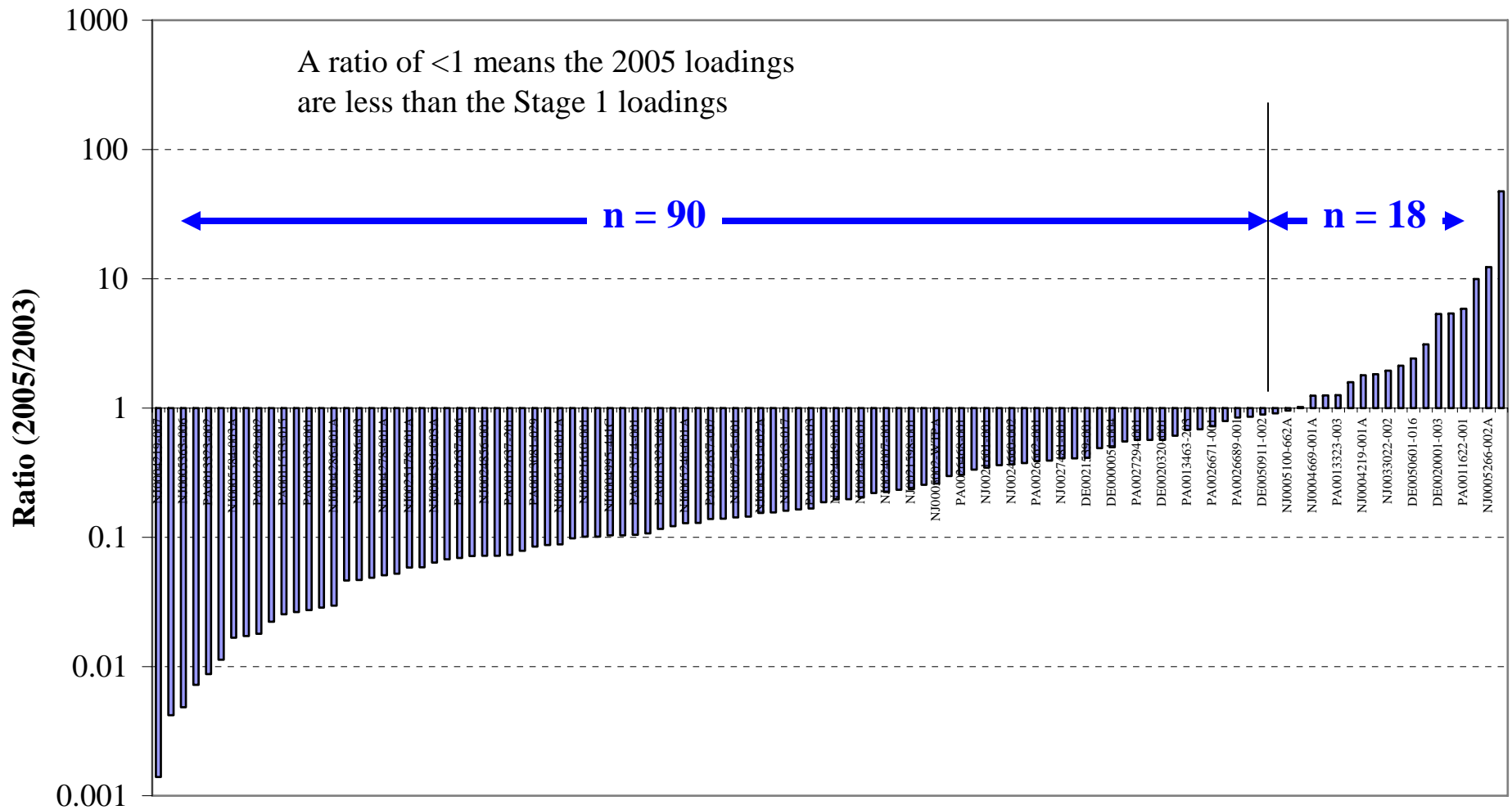
- ◆ Progress in achieving the PCB WQ criterion is expected to be slow due to the modulating effects of estuary sediments and the adaptive management approach of identifying sources and reducing PCB loadings.
- ◆ Adoption of the Stage 1 TMDLs and regulations requiring point sources to conduct Pollutant Minimization Plans (PMPs) may, however, be driving source reduction.

Point Source Loading Trends

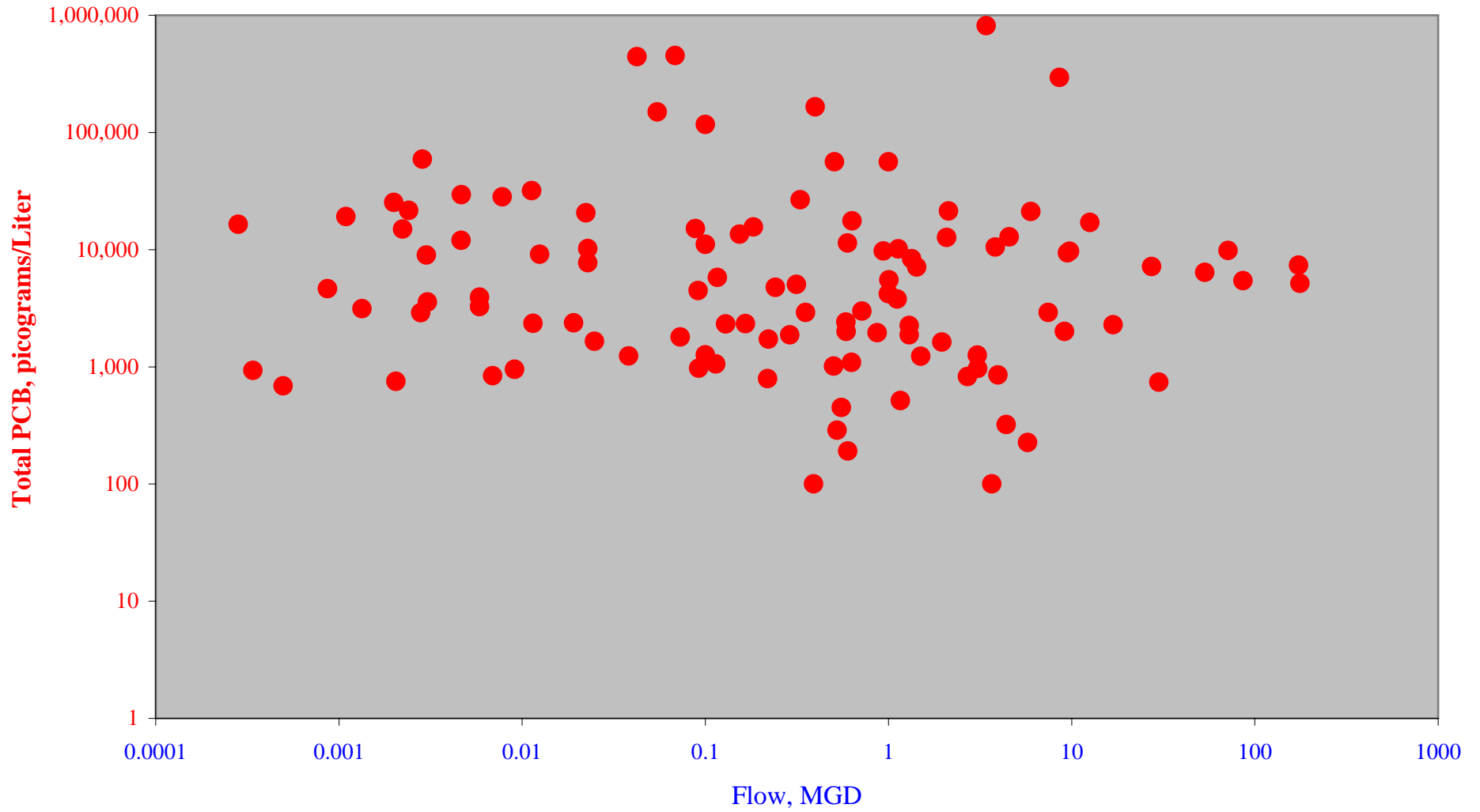


- During 2005 and 2006, point source discharges were monitored using Method 1668A under a DRBC requirement.
 - Loadings calculated from monitoring data collected during 2005 – 2006 indicate that 90 of 108 discharges have reduced loadings compared to Stage 1 loadings. ▶
 - No relationship was observed between discharge flow and PCB concentrations. Effluent concentrations ranged between 100 pg/L and ~800,000 pg/L.

Ratio of Stage 1 penta-PCB loads to 2005 loads (Total n=108)



**Total PCB Concentrations in Point Source Discharges
by Discharge Flow**



Non-Point Sources

- ◆ The plan also includes PCB load reduction strategies for each non-point source category identified in the Stage 2 TMDLs.
- ◆ The plan specifically addresses tributaries and boundaries, contaminated sites and air sources.
- ◆ The strategies focus on identifying and prioritizing sources in each category, and then utilizing existing authorities to reduce PCB loadings.

Tributaries and Boundaries

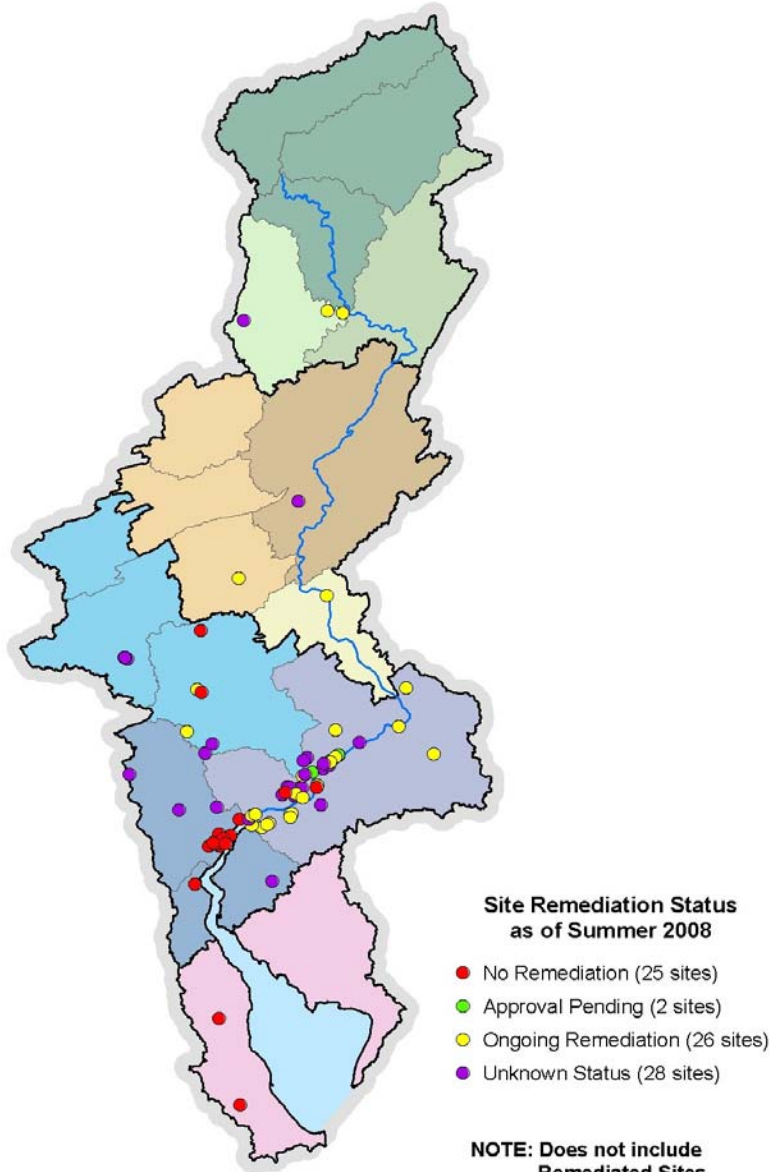
- ◆ 31 tributaries and 2 open boundaries are included in the Stage 2 TMDLs.
- ◆ Implementation of the load allocations assigned in the Stage 2 TMDLs will involve the designation of all or a portion of these water bodies as impaired as part of the biennial listing process required by §303(d).
- ◆ TMDLs will then be scheduled and will ensure that the criterion for Zones 2 – 6 is not exceeded.

Contaminated Sites



- ◆ Following the establishment of Stage 1 TMDLs, DRBC initiated the Delaware Toxics Reduction Program or DelTRiP.
- ◆ This program is a cooperative effort of the DRBC, states and the U.S. EPA.
- ◆ 112 sites with PCB contamination were identified in the 2007 report.
- ◆ **Program Goal:**

To identify, prioritize, report the remediation status, and track the progress in reducing PCB loading from sites in the Delaware River Basin.



- This map shows the location and status of remediation at 53 sites and 28 unknown status sites.
- 49 sites have direct pathways to the estuary.
- Note: loadings from sites above the head of the tide will be included in the tributary allocations.

Contaminated Sites



- ◆ Loadings estimated in the Stage 1 TMDLs had considerable uncertainty due to the lack of PCB congener data, and information on the soils and slope characteristics of many sites.
- ◆ Implementation of the allocations for this category will involve:
 1. Revision of loadings using RUSLE2,
 2. Prioritization of the sites, and
 3. Coordination with the lead federal/state agency responsible for site remediation.

Air Sources

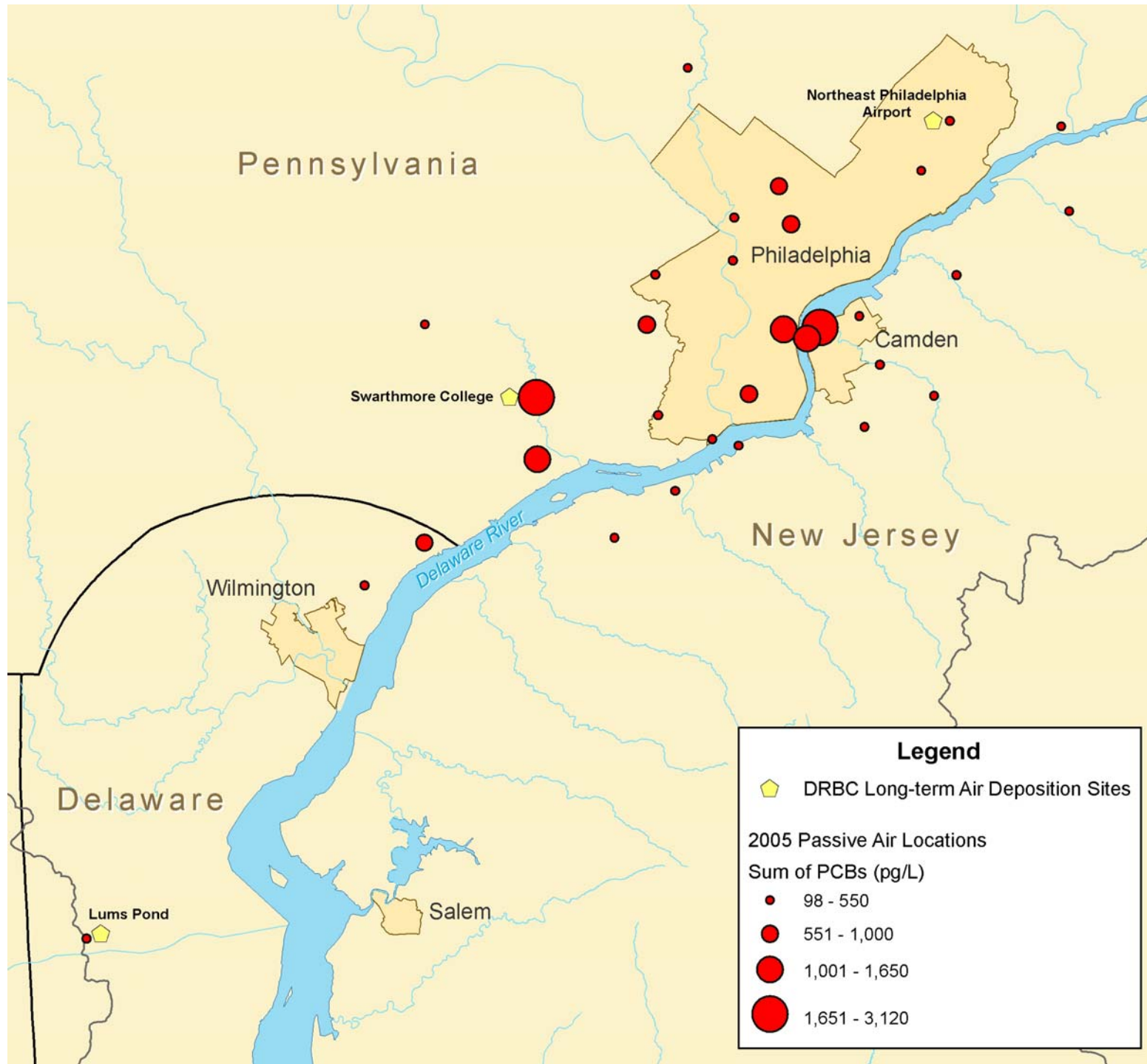


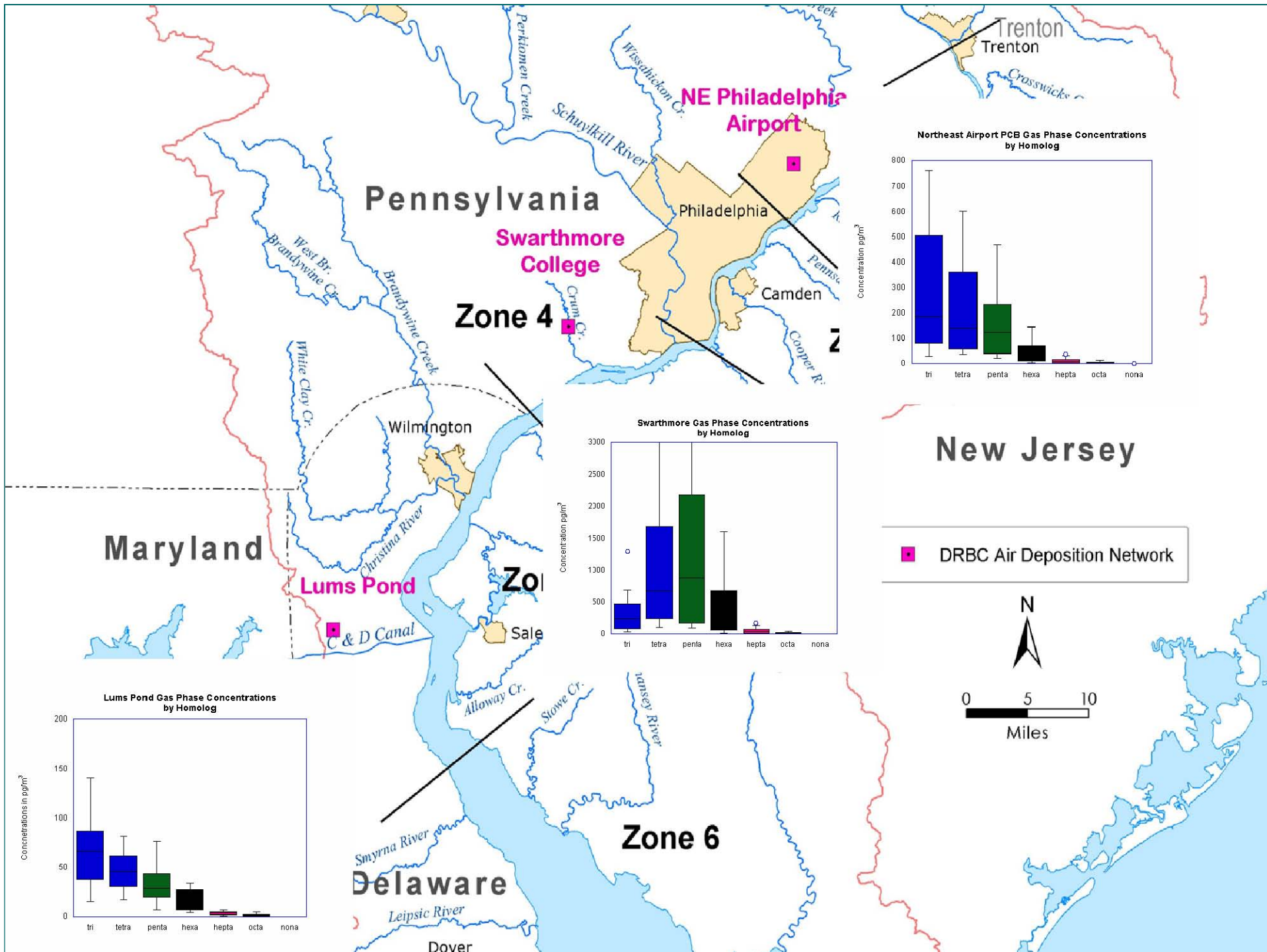
- ◆ Air sources influence ambient estuary concentrations of PCBs through wet and dry deposition, and exchange of PCBs between the gas phase in the atmosphere and dissolved PCBs in the water column.
- ◆ The flux exchange is more important than the wet or dry deposition.
- ◆ Air sources are not assigned an individual allocation; but when TMDL conditions are achieved, there can be no net exchange between the atmosphere and ambient water.

Air Sources



- ◆ Implementation activities for this category will involve:
 1. Identification of sources of PCBs to the air,
 2. Prioritization of sources based upon their contribution to the four PCB homologs bioaccumulated by aquatic biota, and
 3. Application of relevant federal /state regulation for controlling emissions.
- ◆ Two passive air surveys conducted to date indicate that gas phase PCBs reflect local influences rather than a regional signature.





Reporting of Progress



- ◆ The plan provides for reporting of the progress toward achieving the water quality criterion and Zone TMDLs through the preparation of a report every 10 years.
- ◆ A reporting period of 10 years was chosen to encompass the 5 year term of NPDES permits, acknowledging the staggered effective dates of these permits.

Reporting of Progress (cont.)



- ◆ The first report will be prepared by the Commission in 2013, closing the first reporting period that starts with the establishment of the Stage 1 TMDLs.
- ◆ The report will:
 - ① Document loading reductions achieved from various source categories.
 - ② Provide data summaries for point sources that can be used to establish interim effluent limitations and load reduction goals.

Reporting of Progress (cont.)



- ③ Document PCB concentrations in ambient water, sediment, airshed and fish tissue.
- ④ Using the Commission's water quality model for PCBs, include projections of the impact of the loading reductions and ambient conditions at the end of each reporting period on the ambient water concentrations in the future.

Summary



- ❑ DRBC is proposing to adopt a revised water quality criterion of 16 pg/L for Zones 2 – 6 of the Delaware Estuary.
- ❑ Regulatory language authorizing the use of compliance schedules in NPDES permits and Commission regulatory actions is also proposed.
- ❑ DRBC, in cooperation with the U.S. EPA and state agencies, has developed a proposed plan for implementing the Stage 2 TMDLs.
- ❑ Comments are solicited on this TMDL Implementation Plan which is intended to be included as an appendix to the Stage 2 TMDLs when they are established.

Summary (cont.)



- ◆ A public hearing is scheduled for **Thursday October 8, 2009** at 1:30 PM at the Commission's offices.
- ◆ The public comment period closes on **Monday October 19, 2009** at 5:00 PM.
- ◆ Comments may be submitted to:
 - Commission Secretary, DRBC
 - P.O. Box 7360
 - West Trenton, NJ 08628-0360or by email to: paula.schmitt@drbc.state.nj.us
or fax to: (609) 883-9522

Questions on Proposed Implementation Plan for Stage 2 PCB TMDLs