



# TMDL for PCBs for Delaware Bay (DRBC Zone 6)

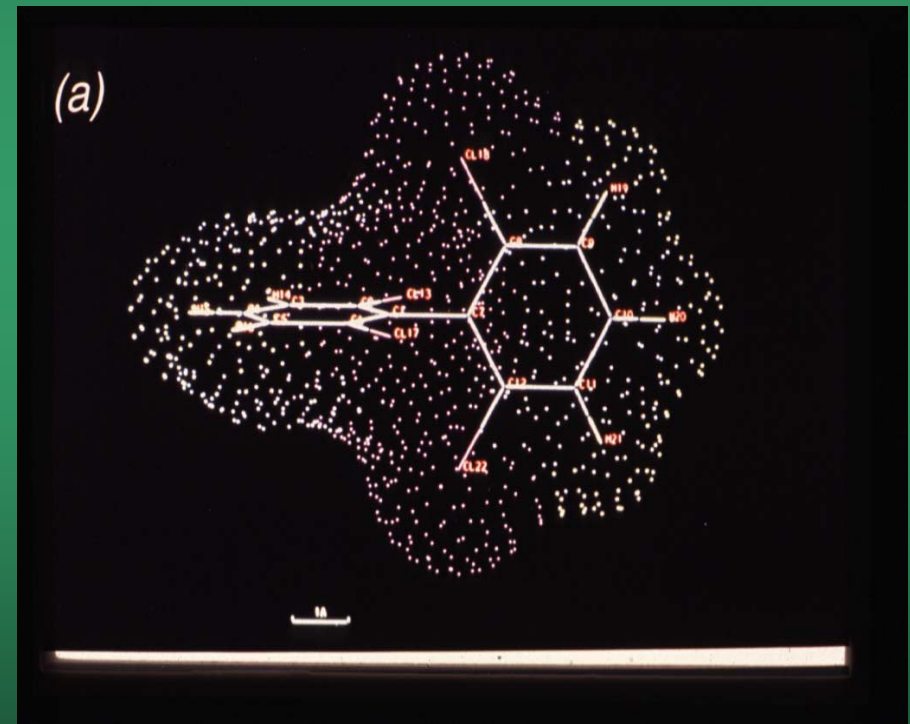
Dover, DE

September 26, 2006



# 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

# Sources of PCBs

- ❑ Manufacture of PCBs was banned in the U.S. in 1979.
- ❑ Electrical Applications:
  - ✓ Transformers and Capacitors
- ❑ Hydraulic and heat transfer systems, lubricants, gasket sealers, paints, plasticizers, adhesives, carbonless copy paper, flame retardants, brake linings, asphalt and etc.
- ❑ By-products of industrial processes.

# History

- ❑ This TMDL is an extension of the Commission's and State's efforts to control toxic pollutants in Zones 2 to 5. 
- ❑ TMDLs for PCBs were established for Zones 2 - 5 by EPA Regions II and III in December 2003.
- ❑ Both Delaware and New Jersey have listed Zone 6 as impaired by PCBs requiring the development of a TMDL.



# Zone Designations for the Delaware Estuary



# History (cont.)

- ❑ Spring 2005 – DRBC meets with EPA and state representatives to discuss development of TMDL for Zone 6. DRBC agrees to establish TMDL on behalf of EPA and States.
- ❑ January 2006 - DRBC requests concurrence from EPA Regions II and III on the use of existing state and DRBC criteria to form the basis of the Zone 6 TMDL.
- ❑ February 2006 - Both EPA Regions II and III concur with DRBC's recommendation.

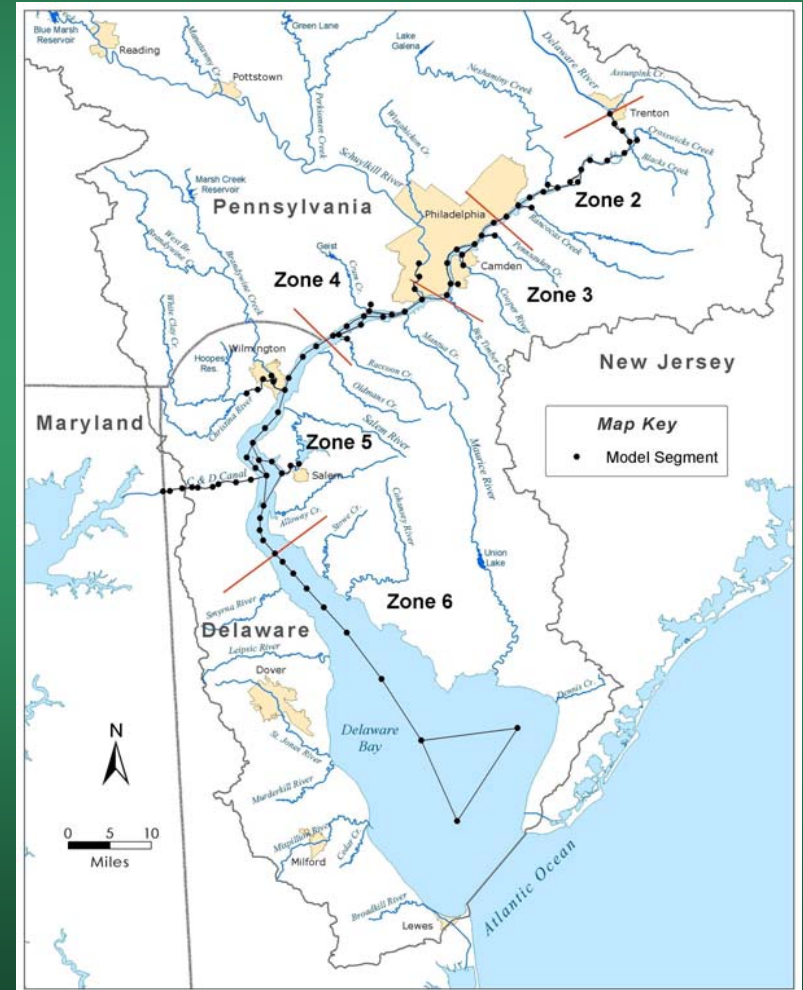
# History (cont.)

- ❑ DRBC used existing hydrodynamic models of the estuary and water quality models for PCBs in developing the TMDL.
- ❑ Modeling Objectives
  - ① Gain understanding:
    - ✓ Determine PCB load-response relationships.
    - ✓ Determine principal controlling processes.
  - ② Address management questions:
    - ✓ Determine PCB TMDL for each zone.
    - ✓ Allocate TMDL among sources.
    - ✓ Assess the impact of load reduction strategies.

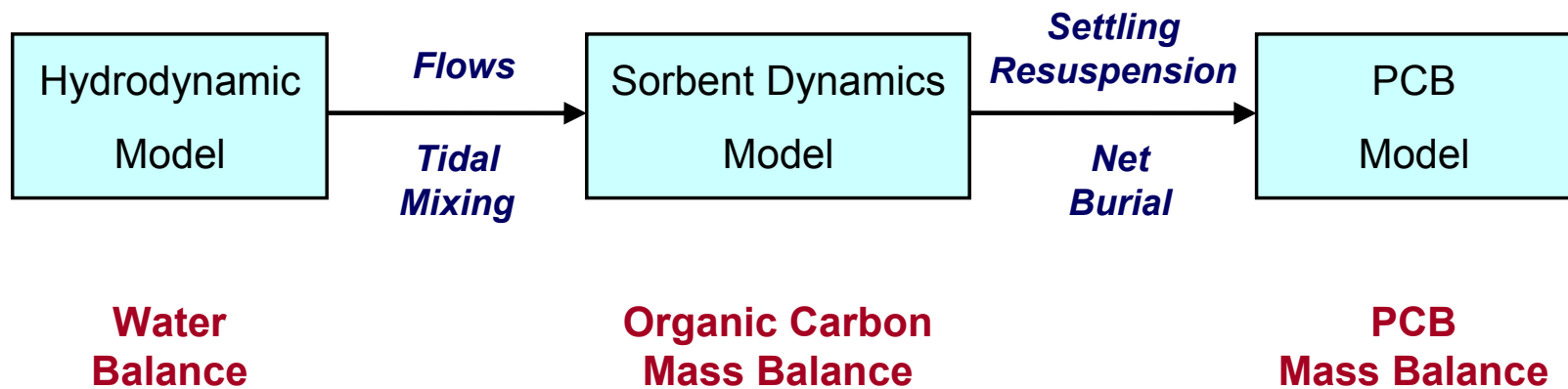


# Delaware River PCB Model (DELPCB)

- ❑ Represents water column and 4 sediment layers
- ❑ One-dimensional in longitudinal
  - ✓ 87 spatial segments
- ❑ Time-variable
- ❑ Hydrodynamics
  - ✓ Tidal heights
  - ✓ Salinity mass balance
- ❑ Organic carbon sorbent dynamics
  - ✓ Particulate carbon (biotic and detrital)
  - ✓ Dissolved organic carbon
- ❑ Penta PCB homolog



# Integrated Modeling Framework



[http://www.state.nj.us/drbc/toxics\\_info.htm](http://www.state.nj.us/drbc/toxics_info.htm)

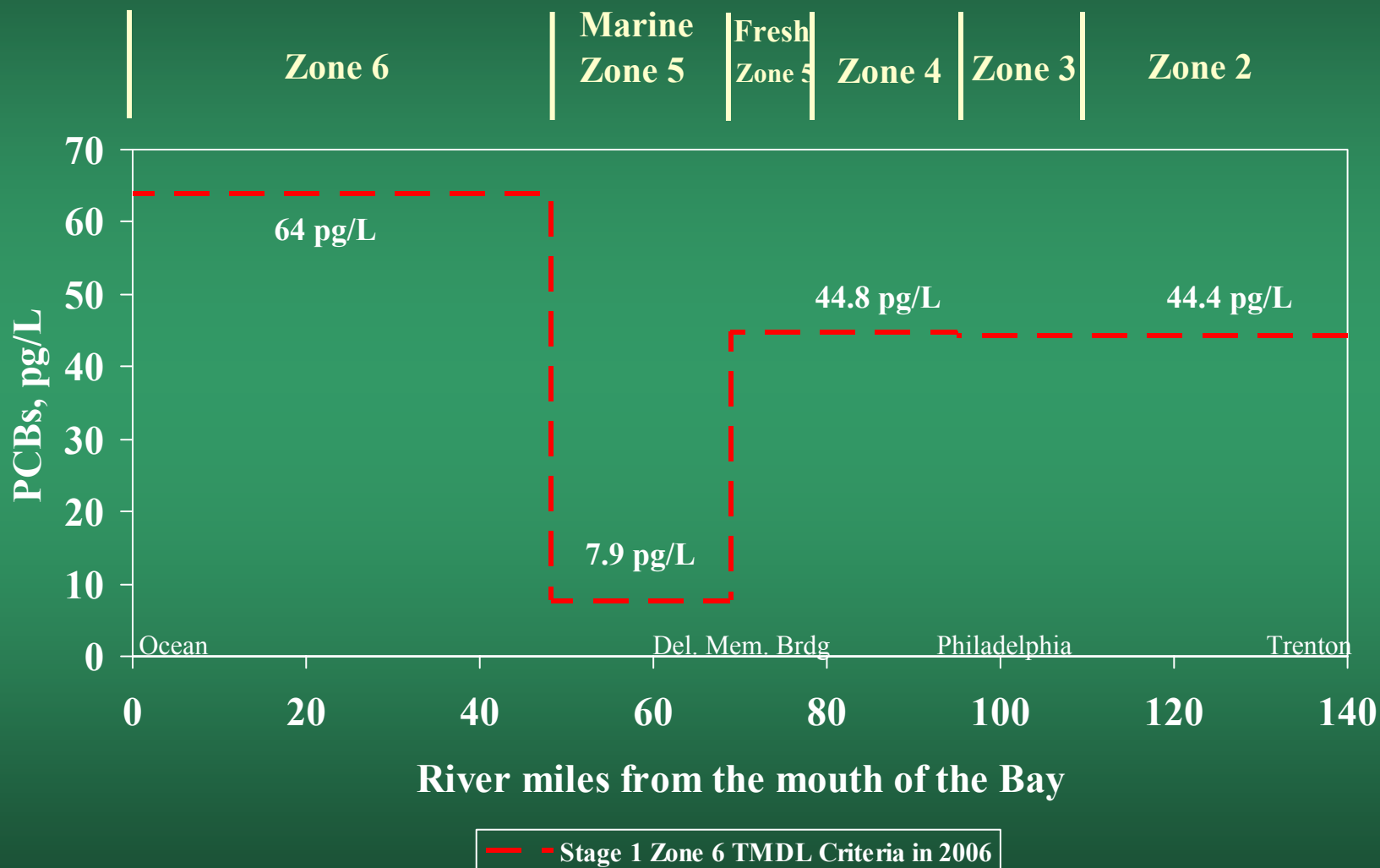
# Establishing TMDLs

TMDLs are estimates of the loadings of each of the PCB homologs that can enter the Bay and still meet the current water quality criterion.

They are *projected loadings* from all sources based upon assumptions called design conditions.

$$TMDLs = WLAs + LAs + MOS$$

# Total PCB criteria for the Delaware Estuary



# Guiding Principles and Policy Decisions



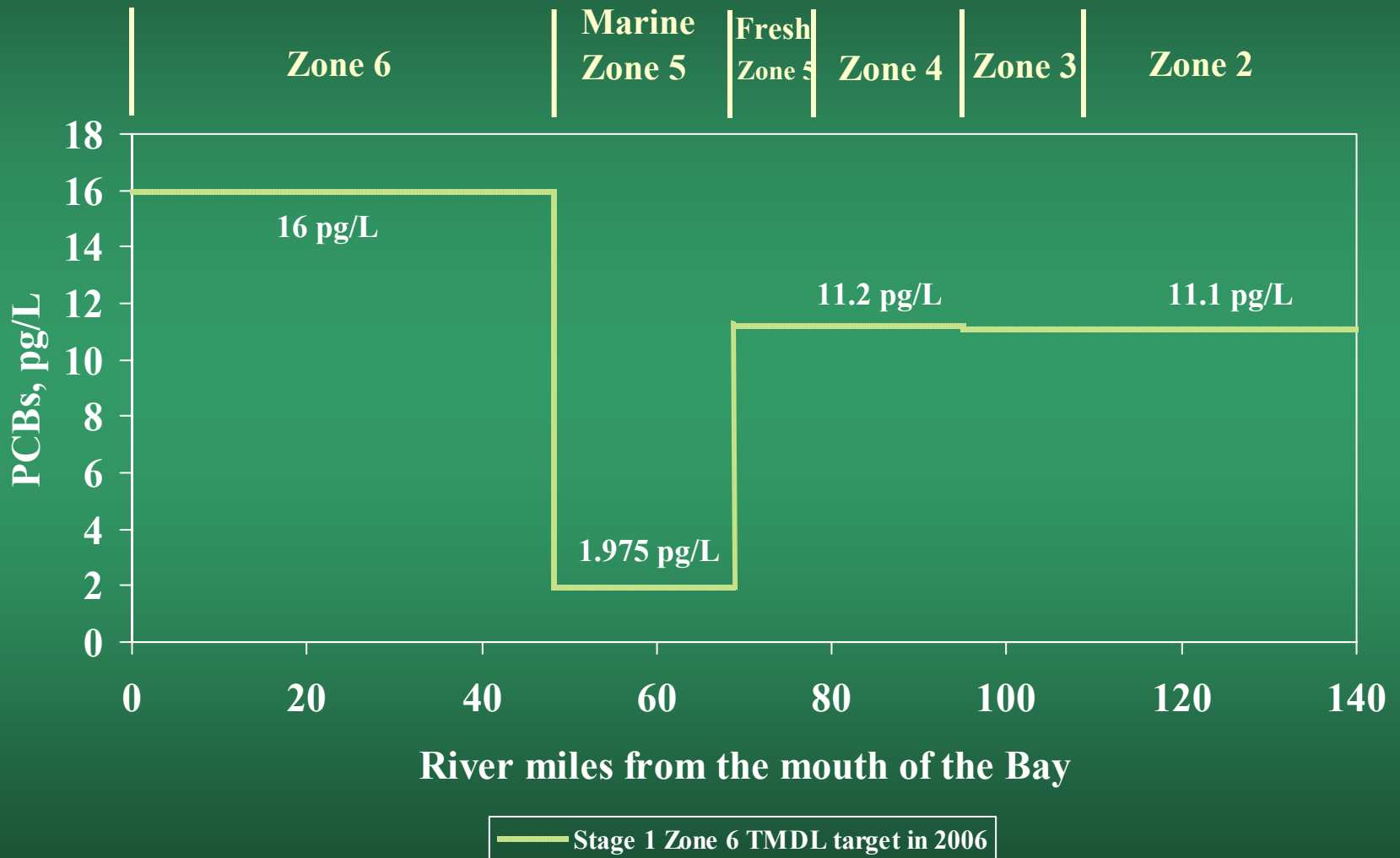
- Build upon TMDLs developed for Zones 2 to 5 in 2003.
- Use a representative one year hydrologic condition.
- Calculate annual median TMDL loadings to be consistent with both the model simulations and the 70 year exposure for human health criteria.
- Point and non-point sources in Zone 6 are allowed to discharge at the applicable water quality criterion of 64 pg/L (Zone 6) before removing a Margin of Safety.

# Guiding Principles and Policy Decisions – Cont.



- ❑ Additional reduction is only applied to the Ocean boundary.
- ❑ 5 percent of loads from all source categories is reserved for a Margin of Safety.
- ❑ The penta-PCB homolog group is used as a surrogate for Total PCBs in developing the TMDL and allocations.

# Penta-PCB Targets for the Delaware Estuary



# 7 Steps to Develop Stage 1 PCB TMDL for Delaware Bay (Zone 6)



1. Confirm validity of 2003 TMDLs under revised model codes and input conditions.
2. Determine usable assimilative capacity for Zone 6.
3. Calculate WLAs and LAs excluding ocean boundary.
4. Determine ocean boundary concentration by trial and error.
5. Determine equilibrium gas phase PCB concentrations.
6. Convert Ocean boundary concentration to loading.
7. Allocate 5 percent of margin of safety from WLAs and LAs.



# 7 Steps to Develop Stage 1 PCB TMDL for Delaware Bay (Zone 6)

Step 1: Use the revised model codes and revised input conditions to re-confirm that the TMDLs developed in 2003 are still valid.



Step 2: Determine usable assimilative capacity for Stage 1 Zone 6 PCB TMDL at the critical locations.



# Calculating TMDL



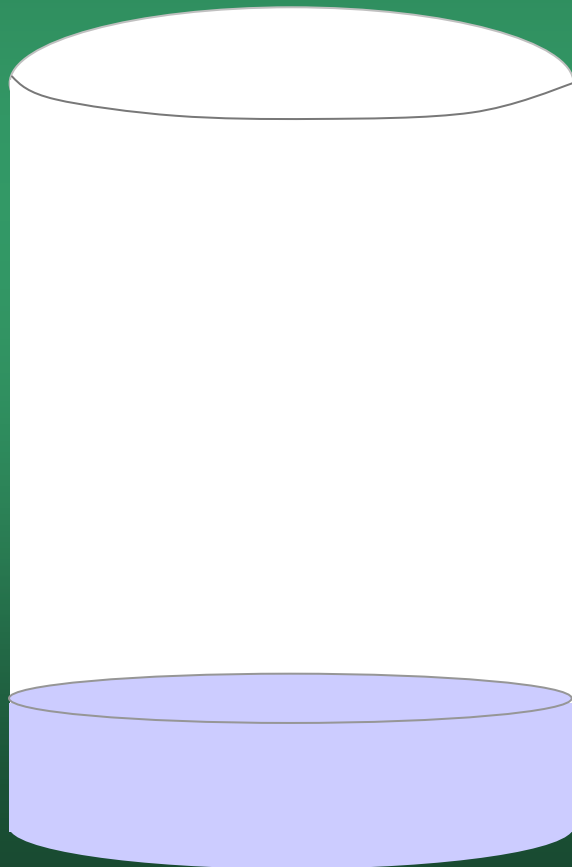
**Assimilative capacity**

# Calculating TMDL



**Loads from upstream  
(2003 Zones 2 – 5 TMDLs)**

# Calculating TMDL



**Assimilative Capacity  
for Zone 6**

**Loads from upstream  
(2003 Zones 2 – 5 TMDLs)**

# 7 Steps to Develop Stage 1 PCB TMDL for Delaware Bay (Zone 6)

Step 1: Use the revised model codes and revised input conditions to re-confirm that the TMDLs developed in 2003 are still valid.



Step 2: Determine usable assimilative capacity for Stage 1 Zone 6 PCB TMDL at the critical locations.



Step 3: Calculate allowable loadings from all point and non-point sources having inflows into Zone 6 excluding ocean influence:



## Step 3: Calculate allowable loads for point and non-point sources excluding ocean boundary

- Allowable loadings for point and non-point sources excluding ocean influence

$$= (\text{Inflow}) \times (\text{WQ target for penta-PCB})$$

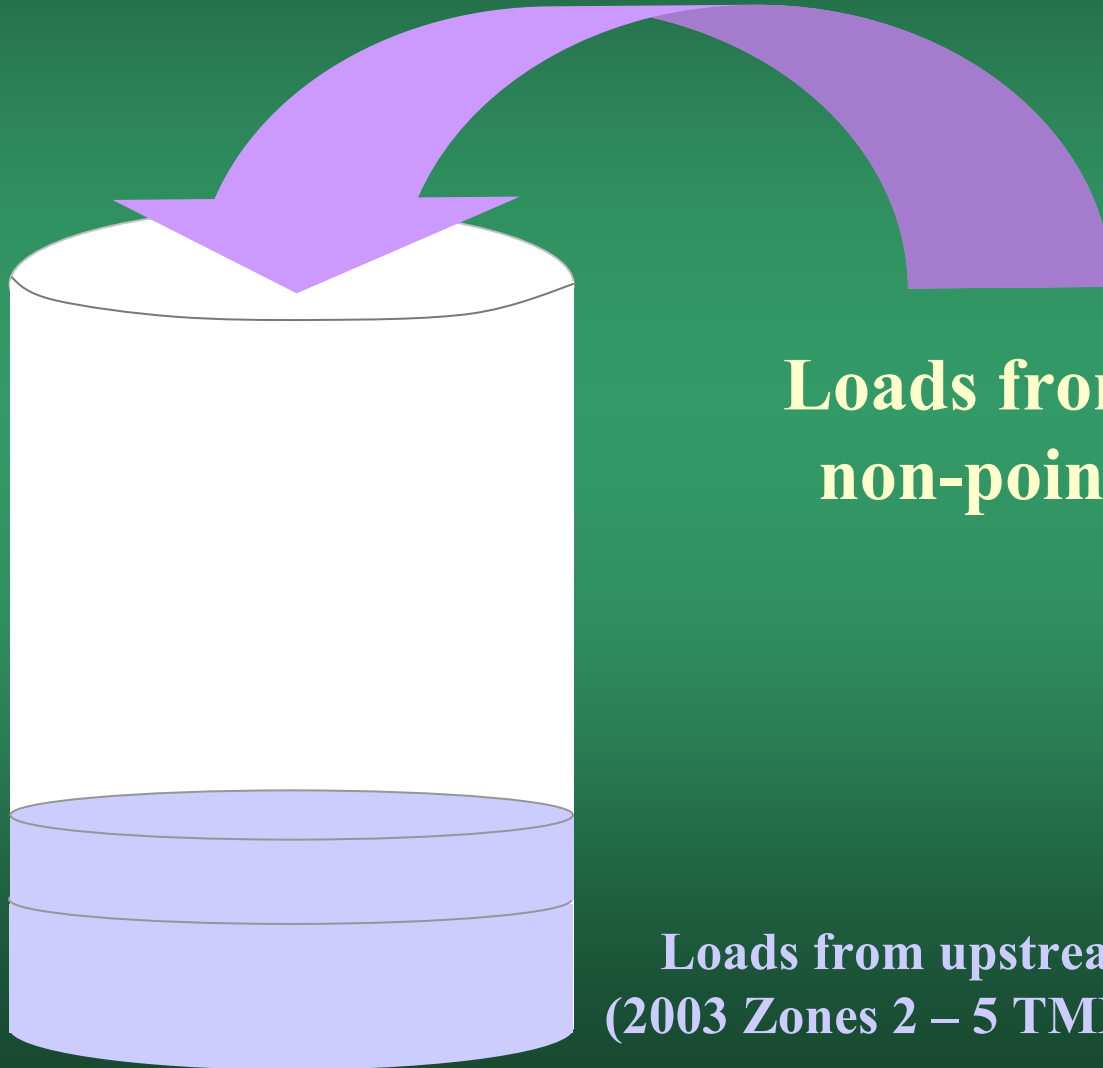
- $17.84 \text{ m}^3/\text{sec} \times 16 \text{ pg/L} = 24.66 \text{ mg/day}$  for penta-PCB

- Allocations for point and non-point sources are also based on inflow rates.

- Point sources =  $3.451 \text{ mg/day}$

- Non-point sources =  $21.21 \text{ mg/day}$

# Calculating TMDL



**Loads from point &  
non-point sources**

**Loads from upstream  
(2003 Zones 2 – 5 TMDLs)**

# 7 Steps to Develop Stage 1 PCB TMDL for Delaware Bay (Zone 6)



Step 4: Determine the allowable ocean boundary by trial and error simulations using the penta-PCB model



Step 5: Calculate and assign equilibrium gaseous PCB concentrations in the model under the TMDL conditions developed in Steps 3 and 4.



Step 6: Convert the ocean boundary concentration to a load and add it to the gross load allocation portion to finalize individual WLAs and the gross LAs.



# Calculating TMDL



**Loads from ocean boundary**

**Loads from point &  
non-point sources**

**Loads from upstream  
(2003 Zones 2 – 5 TMDLs)**

# 7 Steps to Develop Stage 1 PCB TMDL for Delaware Bay (Zone 6)



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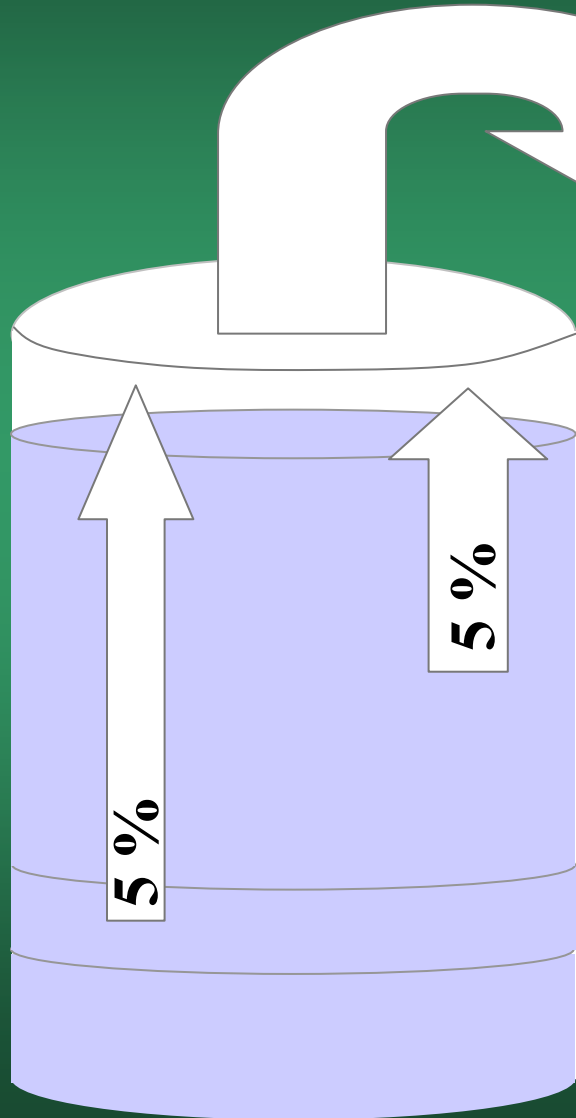


Step 6: Convert the ocean boundary concentration to a load and add it to the gross load allocation portion to finalize individual WLAs and the gross LAs.



Step 7: Allocate 5% of margin of safety by removing 5% of ocean boundary and 5% of WLA/LA loading.

# Calculating TMDL



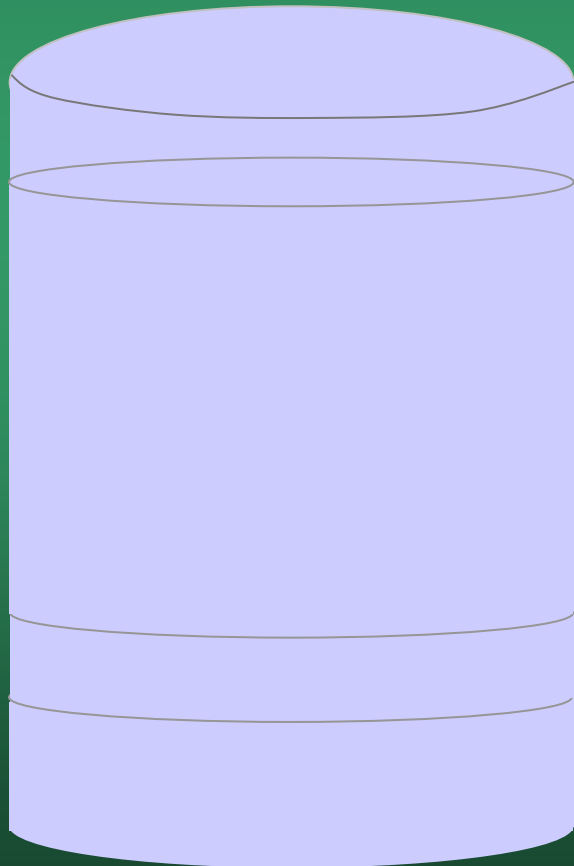
**Loads reserved for the  
Margin of Safety**

**Loads from ocean  
boundary**

**Loads from point &  
non-point sources**

**Loads from upstream  
(2003 Zones 2 – 5 TMDLs)**

# Calculating TMDL



Loads reserved for the  
Margin of Safety

Loads from ocean  
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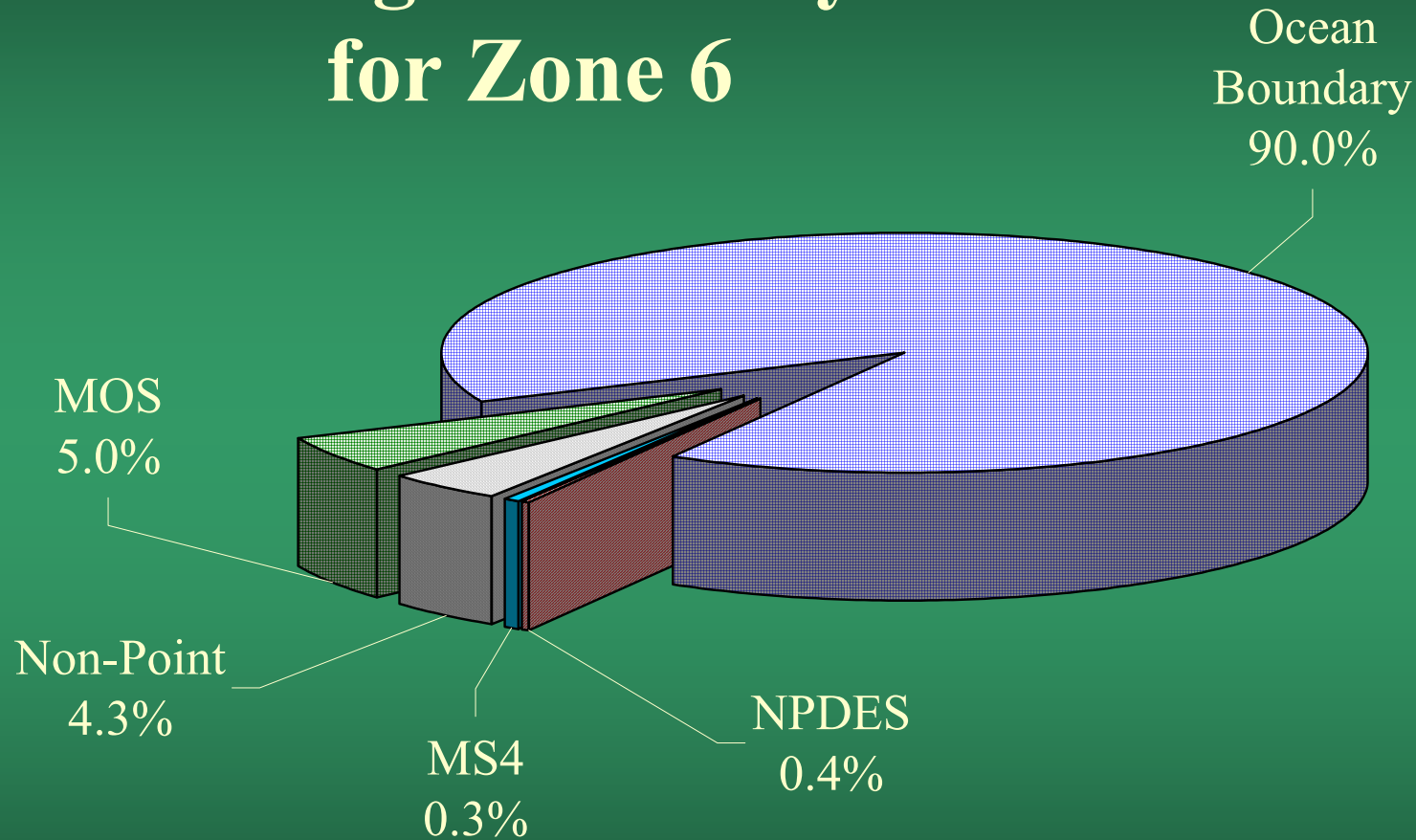
Loads from upstream  
(2003 Zones 2 – 5 TMDLs)

**Zone 6  
TMDL**

# Stage 1 TMDL for Total PCBs for Zone 6

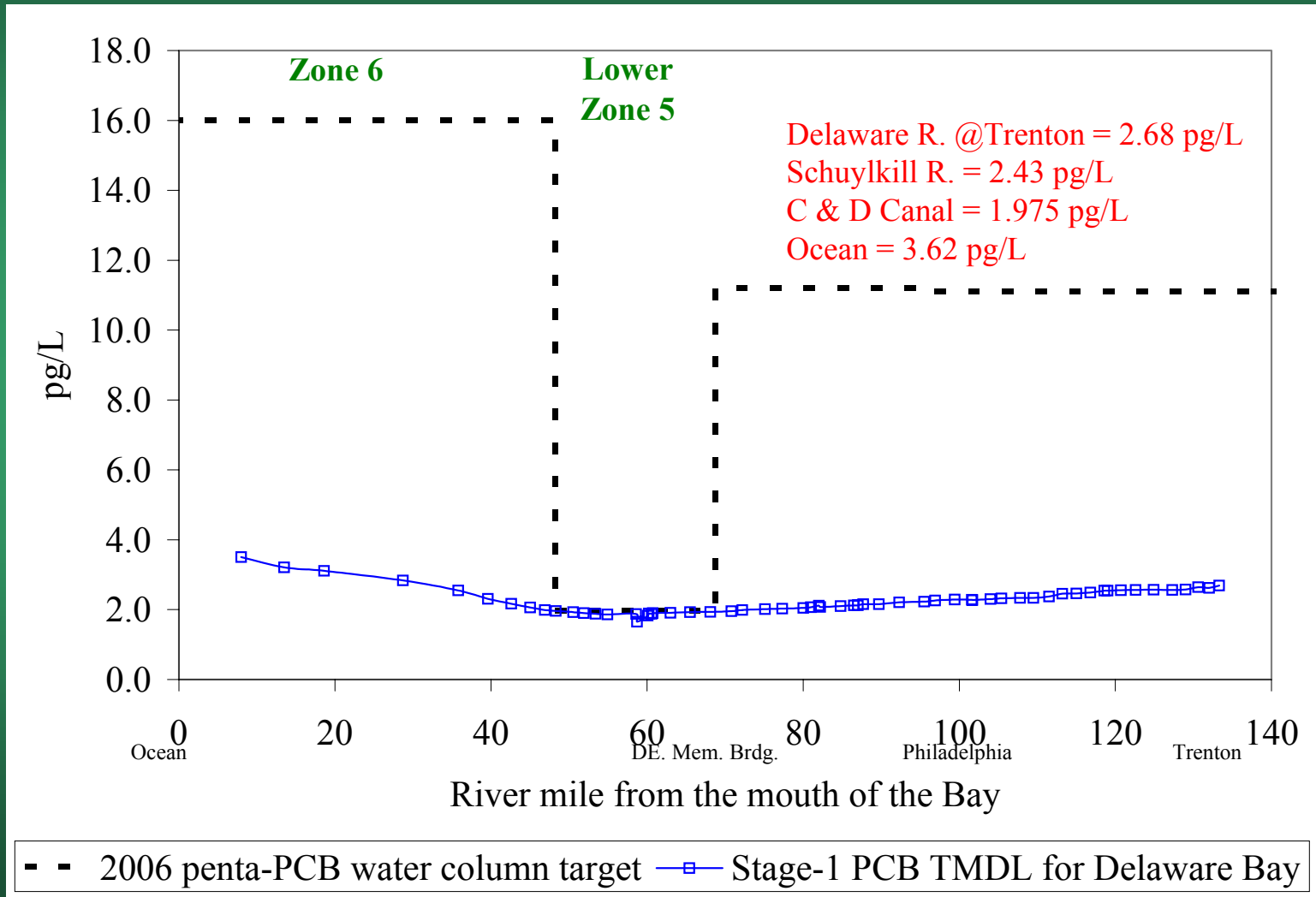
TMDL mg/day	WLA		LA		MOS
	NPDES	MS4s	Non-Point	Ocean	
1876.5	6.86	6.25	80.60	1688.91	93.82

# TMDL Allocations and Margin of Safety for Zone 6



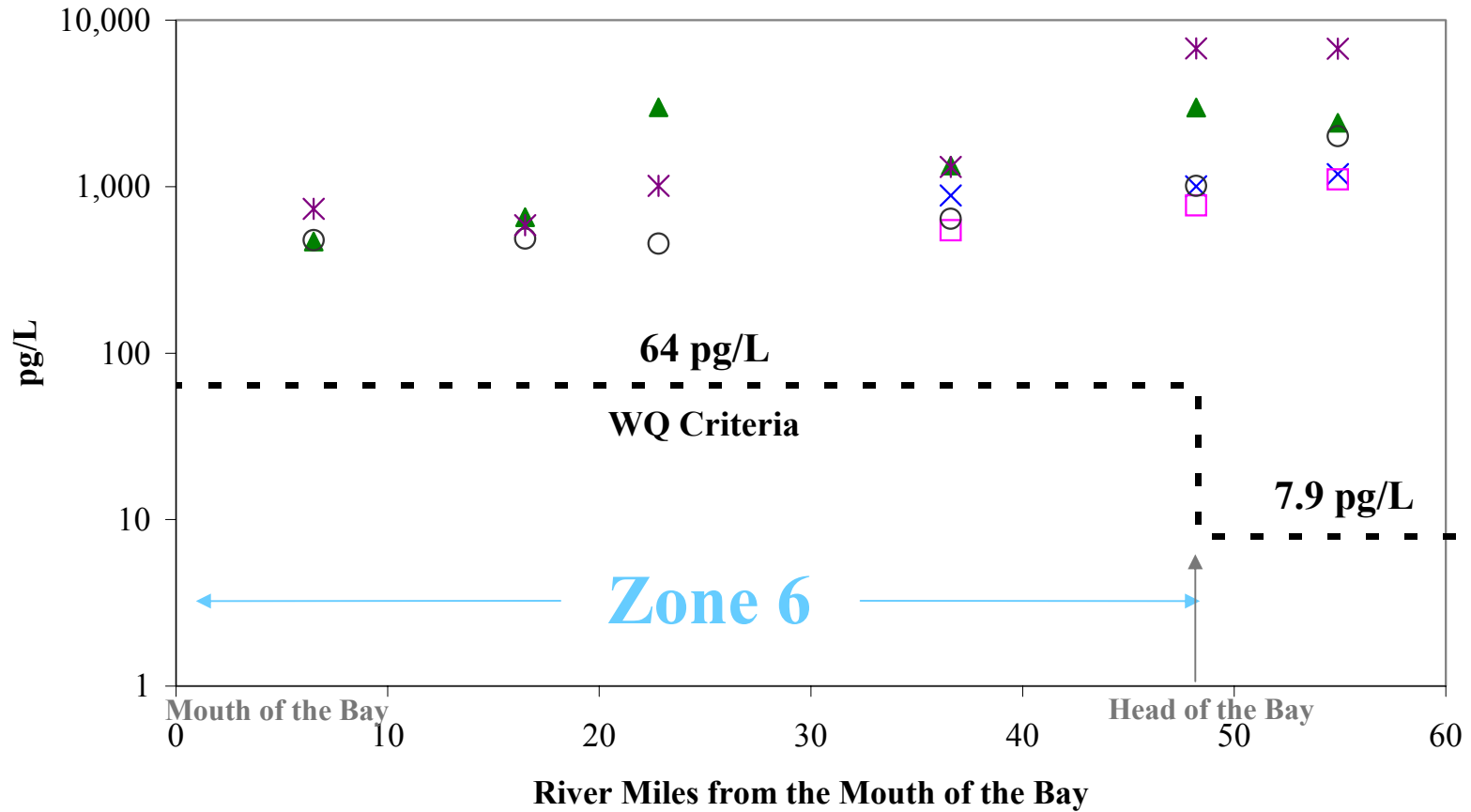
■ NPDES ■ MS4 ■ Non-Point ■ MOS ■ Ocean Boundary

# Simulation Results for Zone 2-6 TMDLs (using penta-PCBs)



# Where we are and where we need to go

### Delaware Bay Total PCB Survey Results



× 08/19/02   
 □ 09/03/02   
 ▲ 09/23/02   
 ○ 11/21/02   
 × 11/12/03   
 - - WQ Criteria



# Implementation of Zone 6 TMDL

- ❑ Implementation requirements for this stage of the TMDL will be the same as that used for Zone 2 - 5:
  - ✓ Required monitoring by point sources using Method 1668A.
  - ✓ Based on monitoring results, some dischargers will have to develop a Pollution Minimization Plan (PMP) to reduce loads from their facility.
- ❑ Remediation of sediment PCBs is not necessary to achieve the water quality criteria, but would potentially shorten the time frame required for achievement

# Point source discharges considered in Zone 6 PCB TMDL in Delaware

1. Dover, City of McKee Run (DE0050466)
2. Harrington STP (DE0020036)
3. Kent County STP (DE0020338)
4. Reichhold Chemicals (DE0000591)

# Summary

- ❑ Four documents have been prepared for use by the U.S. EPA in establishing Zones 2-5 TMDLs in 2003
- ❑ Two additional documents have been prepared for use by the U.S. EPA in establishing Zone 6 TMDL:
  - ① PCB TMDL for Zone 6 (Delaware Bay) Draft Report.
  - ② Revised Calibration of the Water Quality Model for the Delaware Estuary for penta-PCBs and Carbon.
- ❑ These documents are available on the DRBC website:  
[www.drbc.net](http://www.drbc.net)

# Summary (cont.)

- ❑ A public hearing is also scheduled for Thursday October 5, 2006 at Millville, NJ from 1:00 to 4:00 PM.
- ❑ The public comment period closes on Friday October 20, 2006. Comments shall be submitted to Lenka Berlin, Office of Watersheds (3WP10), U.S. EPA, 1650 Arch St., Philadelphia, PA 19103-2029. Email address: [berlin.lenka@epamail.epa.gov](mailto:berlin.lenka@epamail.epa.gov).

# Approach for Establishing Stage 2 TMDLs



- ❑ The approach for establishing Stage 2 TMDLs is expected to be different than that used in Stage 1.
- ❑ Some of the reasons for this are:
  - ❶ The proposed human health criteria for total PCBs does not produce a sharp transition between zones.
  - ❷ An alternative allocation procedure for both the aggregate WLAs and LAs, and the individual WLAs and LAs that is more equitable will be needed.

# Approach for Establishing Stage 2 TMDLs

- ③ TMDLs for total PCBs for each zone will be the sum of the TMDLs for a set of homologs without extrapolation from the penta-PCB homolog.
- ④ Alternative source reduction strategies that result from either the PCB Minimization Plans required in Stage 1 or the efforts of the PCB Implementation Committee will need to be implemented in the apportioning of the zone TMDLs, where appropriate.