IMPLEMENTATION PLAN FOR POLYCHLORINATED BIPHENYLS (PCBs) FOR ZONES 2 - 6 OF THE DELAWARE ESTUARY

DELAWARE RIVER BASIN COMMISSION
WEST TRENTON, NEW JERSEY

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Acknowledgments

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EXECUTIVE SUMMARY

Background

Section 303(d) of the Clean Water Act establishes Total Maximum Daily Loads or TMDLs as one of the tools to address those situations where the technology-based controls are not sufficient to meet applicable water quality standards for a water body (U.S. EPA, 1991). A TMDL is defined as the maximum amount of a pollutant that can be assimilated by a water body without causing the applicable water quality criteria to be exceeded.

Water quality standards applicable to the tidal portion of the Delaware River and Bay currently include those of the states bordering these bodies of water (Delaware, New Jersey and Pennsylvania) and those established by the Delaware River Basin Commission (DRBC or "Commission") for DRBC Water Quality Management Zones 2 through 6 ("Zones 2 through 6"). Regulations adopted by Delaware and New Jersey either defer to or incorporate by reference duly adopted criteria of the Commission, whereas Pennsylvania's rules provide that the more stringent of the Commission's or the Commonwealth's criteria apply. Current DRBC criteria are 44.4 pg/l for Zones 2 and 3, 44.8 pg/l for Zones 4 and the upper portion of Zone 5, and 7.9 pg/l for the lower portion of Zone 5. The lower criterion in Zone 5 is due to a higher fish consumption rate being used while only Zones 2 and 3 are designated as a drinking water source. DRBC does not have criteria for PCBs for Zone 6. The Commission is proposing to act on a recommended revised water quality criterion of 16 pg/l for Zones 2 through 6 following notice and comment rulemaking.

Under Section 303(d) of the Clean Water Act, States are required to identify, establish a priority ranking, and develop TMDLs for those waters that do not achieve or are not expected to achieve water quality standards approved by the U.S. EPA. Federal regulations implementing this section of the Clean Water Act provide that a TMDL must be expressed as the sum of the individual wasteload allocations for point sources (WLA) plus the load allocation for nonpoint sources (LA) plus a margin of safety (MOS). TMDLs for PCBs for Zones 2 - 5 were established by U.S. EPA Regions 2 and 3 on December 15, 2003 (http://www.epa.gov/reg3wapd/tmdl/pa_tmdl/DelawareRiver/index.htm). A TMDL for Zone 6 (Delaware Bay) was established by U.S. EPA Regions 2 and 3 on December 14, 2006 (http://www.epa.gov/reg3wapd/tmdl/de_tmdl/Zone6DelRvPCB/index.html).

Attainment of the water quality criteria is normally achieved through, as a minimum, the use of effluent requirements in NPDES permits. In accordance with federal regulations at 40 CFR Part 122.4(d), an NPDES permit must include a water quality-based effluent permit limitation ("WQBEL") for any parameter for which a TMDL has been established by a state or the U.S. EPA. If the permittee cannot meet the WQBEL for the parameter upon issuance of the permit, then a schedule of compliance of a reasonable length of time may be authorized specifying the steps that the permittee will take to meet the permit limit. Typically, schedules of compliance require compliance by the permit expiration date. If a permittee cannot meet the WQBEL within the duration of the permit, then permitting authorities have typically required an administrative consent order setting forth a schedule for complying with the effluent limitation.

Several characteristics of PCBs as well as other hydrophobic pollutants, however, may preclude the attainment of WQBELs and implementation of water quality criteria in waters impaired for these pollutants prevent this traditional approach from achieving compliance within a five year NPDES permit cycle, and from ensuring that ambient levels of PCBs will not exceed the water quality criteria. These include: 1) sources of PCBs other than sources controlled under the NPDES program, 2) lack of data on the concentrations of PCBs in the numerous sources due to the past use of less sensitive analytical methodologies for commercial PCB mixtures, 3) the reservoir of PCBs in the sediments of the estuary resulting from past loadings of PCBs from point and non-point sources, and 4) insufficient evidence of the effectiveness of wastewater treatment technologies that can achieve reductions of PCBs to the levels anticipated for permit limitations.

Recognizing the need for an alternative approach to permitting hydrophobic pollutants such as PCBs, representatives of the Commission, U.S. EPA and the states of Delaware, New Jersey and Pennsylvania initiated a collaborative effort to develop an alternative approach that would be consistent with current federal regulations for both water quality standards and NPDES permitting. The key components of this approach are the application of the principles of adaptive management in view of the characteristics of hydrophobic pollutants in general including PCBs, the issuance of permits with final effluent limits which must be met as soon as possible through compliance schedules that, under certain circumstances, may extend beyond the five (5) year permit term , and the development of a TMDL Implementation Plan for PCBs. The latter would describe how the water quality criterion for PCBs will be attained in Zones 2 through 6 of the Delaware River through a phased approach that includes requirements for NPDES discharges as well as strategies and recommendations for reductions from non-point sources.

The objective of this implementation plan is to effectuate the Commission's Comprehensive Plan and to provide Basin states with the means to ensure Clean Water Act compliance for state-issued NPDES permits limiting discharges of these pollutants. More specifically, the provisions of this plan will allow those Basin states that defer to the Commission’s regulations for the mainstem Delaware River (including Zones 2 through 6) to establish approvable effluent limitations and other permit requirements. These requirements will be consistent with established TMDLs for PCBs and with applicable federal and state regulations governing the issuance of NPDES permits. A unique aspect of the plan is that it also addresses sources of PCBs other than those from NPDES-regulated sources. These sources include tributaries to the estuary, contaminated sites (sites covered under CERCLA, RCRA and state hazardous wastes regulations), air sources and sediments.

Proposed Action

The Commission is proposing to adopt regulations to establish a revised water quality criterion for PCBs of 16 picograms per liter (pg/L), to develop Stage 2 TMDLs for PCBs for Zones 2 through 6, and to authorize compliance schedules, including schedules that could encompass two or more NPDES permits cycles. These regulations would be contained in Article 3 and Article 4 of the Commission’s Water Quality Regulations, respectively, and would 1) establish the basis for Stage 2 TMDLs for PCBs for Zones 2 through 6 of the Delaware River and Bay, and 2) allow the Basin states of Delaware, New Jersey and Pennsylvania to defer to these regulations in establishing approvable effluent limitations and other NPDES permit requirements. The key components of these permit requirements are:

a) a final wasteload allocation established in the Stage 2 TMDLs that will be used to establish a final effluent limitation and compliance date by a state permitting authority,
b) an interim effluent limitation derived from monitoring data collected by the permittee,
c) a requirement to develop and implement a Pollutant Minimization Plan (PMP) or if a PMP is currently being implemented, a requirement to continue to implement a PMP until the final wasteload allocation is achieved,
d) a targeted PCB loading goal that will be achieved by the expiration date of the permit, if compliance with the final effluent limit is scheduled after the permit expiration date, and

e) a monitoring requirement using Method 1668A to track progress toward the achievement of the final WLA and to determine compliance with any final or interim permit limitation.

Details on each of these requirements are described below.

TMDL Implementation Plan

The implementation plan is intended to supplement the Stage 2 TMDLs that will be established in December 2009 by the U.S. EPA, and provide the detailed requirements and strategies for point and non-point sources that will be employed to reduce PCB loadings to the Delaware Estuary and Bay to acceptable levels. In addition, the plan provides the basis for compliance schedules which may extend beyond the five year permit term, if necessary, in order to incorporate adaptive management principles into the compliance process, and includes a requirement for a report to be prepared every 10 years describing the progress that has been made to reduce PCB loadings from all sources and achieve the water quality criterion. A reporting period of 10 years was chosen to encompass the 5 year permit cycle that is typical of NPDES permits for discharges to Zones 2 through 6, and acknowledge the staggered effective dates of these permits. A ten year reporting period will thus capture between one to two complete permit cycles for all of the NPDES discharges identified in the Stage 2 TMDLs.

The plan specifies reporting periods of 10 years in length starting from the establishment of the Stage 1 TMDLs by the U.S. EPA Regions II and III on December 15, 2003. Thus, the first reporting period will end on December 15, 2013, and the second period will end on December 15, 2023. Subsequent reporting periods will be established until the designated uses and water quality criteria are attained, or the Commission concludes that the water quality criterion and its associated designated use is not attainable, and modifies the designated use and water quality criterion and its water quality regulations accordingly,

NPDES Sources

As discussed above, the plan contains several requirements for NPDES permits for point sources identified in the Stage 2 TMDLs. The core requirements are:

a. The **final Wasteload Allocation** (WLA) assigned to discharges covered by the NPDES permit and identified in the Stage 2 TMDLs. The WLA is in the form of a mass loading reflective of the loading from the facility that will not cause or contribute to an exceedance of the water quality criterion for PCBs assigned to the Zone receiving the discharge. A final effluent limitation will be established by the NPDES permitting authority based on this WLA. This WLA and associated effluent limitation will not be effective at the time of permit issuance should a schedule of compliance be granted to the permittee. An effective date for the final effluent limitation will be included in any schedule of compliance.
b. An **Interim Effluent Limitation** reflecting loading reductions achieved prior to permit reissuance. This limitation will be determined using the data available at the end of each reporting period, and may, at the discretion of the permitting authority, include monitoring data collected after the end of the previous reporting period but before permit reissuance. This requirement is intended to place a cap on the loading of PCBs from each discharge and prevent backsliding from load reductions achieved.
c. A requirement to develop and implement a Pollutant Minimization Plan (PMP) or if a PMP is currently being implemented, a requirement to continue to implement a PMP until the final wasteload allocation is achieved. An important aspect of this requirement is the assignment of a targeted PCB loading goal for each permit cycle that will lead to achievement of the final WLA. This goal will be achieved by the expiration date of the permit. In addition, the PMP

must identify specific actions and operations with associated milestones that will be undertaken to reach the final WLA as soon as possible. Procedures for establishing the targeted loading goals will be developed prior to the end of the first reporting period and are expected to become more discharge- and site-specific in NPDES permits issued in subsequent reporting periods as the process of adaptive management proceeds. A permit will not contain a targeted PCB loading goal if compliance with the final effluent limitation is scheduled prior to the permit expiration date.

d. Sampling and analytical methods including the use of Method 1668A for PCB congeners and project-specific requirements as specified by the Commission.
e. Specific requirements for Combined Sewer Overflows (CSOs) and Municipal Separate Strom Sewer Systems (MS4s) that are based on the principles of system/source identification followed by the imposition of PMP requirements in a specific NPDES permit for the system. These requirements will first be imposed upon larger systems (systems serving a population greater that 100,000 - Phase I MS4s) during the first reporting period. Smaller systems (Phase II MS4s) will receive these requirements following the prioritization of these smaller systems, and the evaluation of the success of minimization measures employed by Phase I MS4s.

The permit requirements would be implemented in stages with some requirements included in permits reissued prior to December 2013, and the remaining requirements included in permits reissued after the close of the first reporting period in December 2013.

Non-Point Sources

The plan also contains PCB load reduction strategies for each non-point source category identified in the TMDLs for Zones 2 - 6. Addressing non-point sources of PCBs is more difficult due to the lack of focus by the federal and state programs that regulate pollutants from these sources on water quality impacts. The strategies focus on identifying and prioritizing sources of PCBs in each non-point source category and then utilizing existing authorities to focus on water quality impacts and achieve the load allocations assigned to these sources. The plan specifically addresses the categories of tributaries and boundaries, contaminated sites and air sources.

The strategy for tributaries and boundaries (e.g., the mouth of Delaware Bay and the C&D Canal) enhances the TMDL approach utilized for Zones 2 - 6. Loadings are assigned to each tributary and boundary to ensure that the water quality criterion for PCBs is not exceeded in the mainstem Delaware River. This loading is usually based upon the water quality criterion adopted by the state agency for that water body. All three states bordering the estuary, however, have criteria that are greater than the current DRBC criterion and the proposed DRBC criterion of 16 picograms per liter. Section 4.20.4, " Tributaries to Interstate Waters", of the DRBC regulations provides that wastewater discharged into an intrastate tributary of interstate water be treated so that the assimilation of such wastes by the interstate waters will not result in a violation of the water quality criterion of the receiving interstate water. Therefore, the assigned loadings will generally be based upon the applicable DRBC criterion for the estuary (i.e., 16 pg/L). This assigned loading should be included in any TMDL for PCBs that is established for the tributary by the state permitting authority or the U.S. EPA. The two largest tributaries to the estuary, the mainstem Delaware River above the head of the tide and the Schuylkill River, have both been listed by PADEP and NJDEP, respectively, as impaired by PCBs. A TMDL for the Schulykill River was established by U.S. EPA Region III on April 7, 2007. NJDEP listed the non-tidal Delaware River from Easton, PA to Trenton. NJ (DRBC Management Zone 1E) as impaired by PCBs in 2004. The

Commission will coordinate with state agencies regarding the listing and development of TMDLs for those minor tributaries that have been shown to have loadings greater than their load allocations.

Contaminated sites are the fifth highest non-point source category of PCB loadings. Factors contributing to the assessment of loadings from sites in this category include a lack of focus on PCBs in developing site remediation alternatives, and the lack of assessment of water quality impacts from a site including the identification of pathways for pollutants to the estuary. Recognizing the importance of this source category, the Commission initiated the Delaware Toxics Reduction Program or DelTRiP following the establishment of the Stage 1 TMDLs in 2004 (http://www.state.nj.us/drbc/DelTRiP/index.htm). This program is a cooperative effort of the Commission, the states bordering the estuary and the U.S. EPA to identify, prioritize, track the progress in reducing PCB loadings, and report the status of sites contributing toxic pollutants to the Delaware River Basin. A high degree of uncertainty was associated with the loading estimate for this source category in the Stage 1 TMDLs. This can be attributed to the lack of congener-specific data on PCB concentrations and site-specific information on soil and slope characteristics of many of the sites. The strategy for contaminated sites consists of three components: continued revision of loadings from contaminated sites with direct pathways to the estuary (i.e., those located on or near the estuary or below the head of tide on tributaries), prioritization of the sites based upon the revised loadings, and coordination with the lead federal or state agencies responsible for overseeing the remediation of a site.

Air sources of PCBs influence PCB concentrations through wet and dry deposition, and through the exchange of PCBs between the gaseous component of PCBs in the atmosphere and the dissolved fraction of PCBs in the estuarine waters. This latter exchange, called a flux, is bidirectional with the direction of the flux determined by the relative concentrations of PCBs in each media. At this time, the ambient waters are a source of PCBs to the atmosphere. This is significant since reductions in the ambient water concentrations in the absence of reductions in the gaseous air concentrations will eventually result in a net influx of PCBs to estuarine waters. One finding during development of the Stage 1 TMDLs was that the exchange due to the flux of PCBs was more important that the wet and dry deposition of PCBs. The strategy for air sources of PCBs consists of three components: identification of air sources of PCBs, prioritization of the sources based upon their relative concentrations of PCB homologs bioaccumulated by aquatic biota, and application of applicable federal and state regulations for controlling emissions. The Commission initiated monitoring to identify and prioritize air sources in 2001 when it established three long-term monitoring sites in Northeast Philadelphia; Swarthmore, PA; and at Lums Pond State Park in Delaware. These sites complemented an ongoing monitoring network in New Jersey operated by Rutgers University for the NJDEP. The results of this monitoring effort indicated that air concentrations of PCBs reflected local influences rather than a regional signature. In 2005 and 2008, the Commission and Rutgers University conducted passive air sampling studies involving deployment of passive monitoring devices for 90 days. These studies indicated that elevated concentrations of gaseous PCBs were very localized with locations in Camden, NJ and Swarthmore, PA showing the highest concentrations. While the analysis of the 48 samplers deployed in 2008 across the estuary is ongoing, this technique shows great promise in identifying sources on large to small spatial scales.

Reporting of Progress

The final component of this implementation plan is the evaluation and reporting of progress in achieving the necessary reductions in PCB loadings to attain the applicable DRBC water quality criterion. Under the plan, a report will be prepared at the close of each 10 year reporting period and issued by the Commission. The report will document the ambient concentrations and reductions of PCBs achieved in the water column, air, sediment and in the tissues of resident and anadromous fishes for each water quality zone covered by the TMDLs. For the point source category, the report will contain the PCB concentrations and loadings for each point source discharge (and for CSOs and MS4s respectively, in the aggregate) that has been assigned a WLA in the TMDLs, the current effluent limitations and targeted PCB loading goals for each discharge, a listing by water quality management zone of the instances in which interim effluent limitations were triggered and/or targeted PCB loading goals were not attained during the reporting period. For the non-point source categories, the report will contain concentrations and loadings of PCBs for individual non-point sources (where available) and/or for categories of non-point sources by water quality management zone, and the baseline loadings and load reduction goals for individual and categorical non-point sources for the next reporting period. The daily cumulative point and non-point source loading of PCBs for each water quality management zone achieved at the close of the reporting period will also be reported.

Since ambient concentrations will be moderated by the sediment concentrations of PCBs, a useful measure of the progress achieved is a projection of the concentration of PCBs in ambient waters for each water quality management zone at the point when estuary waters are at equilibrium with sediments and air under the PCB loads achieved for each individual and categorical source by the close of each reporting period. The projected concentrations in each water quality management zone can be obtained using the PCB water quality models developed by the Commission. Additionally, where feasible, the report will include the projected date of attainment of the water quality criterion and designated use for each water quality management zone, based upon the rate of progress to date.

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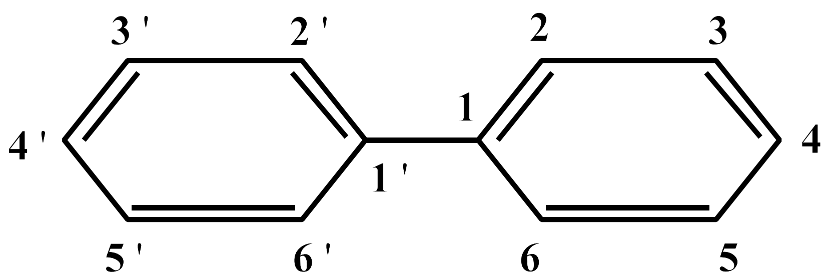
1. INTRODUCTION

1.1 Polychlorinated biphenyls (PCBs)

Polychlorinated biphenyls (PCBs) are a class of man-made compounds that were manufactured and used extensively in electrical equipment such as transformers and capacitors, paints, printing inks, pesticides, hydraulic fluids and lubricants. Individual PCB compounds called congeners can have up to 10 chlorine atoms on a basic structure consisting of two connected rings of carbon atoms. There are 209 possible patterns where chlorine atoms can occur resulting in 209 possible PCB compounds. PCB compounds can be grouped by the number of chlorine atoms attached to the carbon rings. These groups are called homologs. PCB compounds containing five chlorine atoms, for example, are referred to as the pentachlorobiphenyls or penta-PCBs.



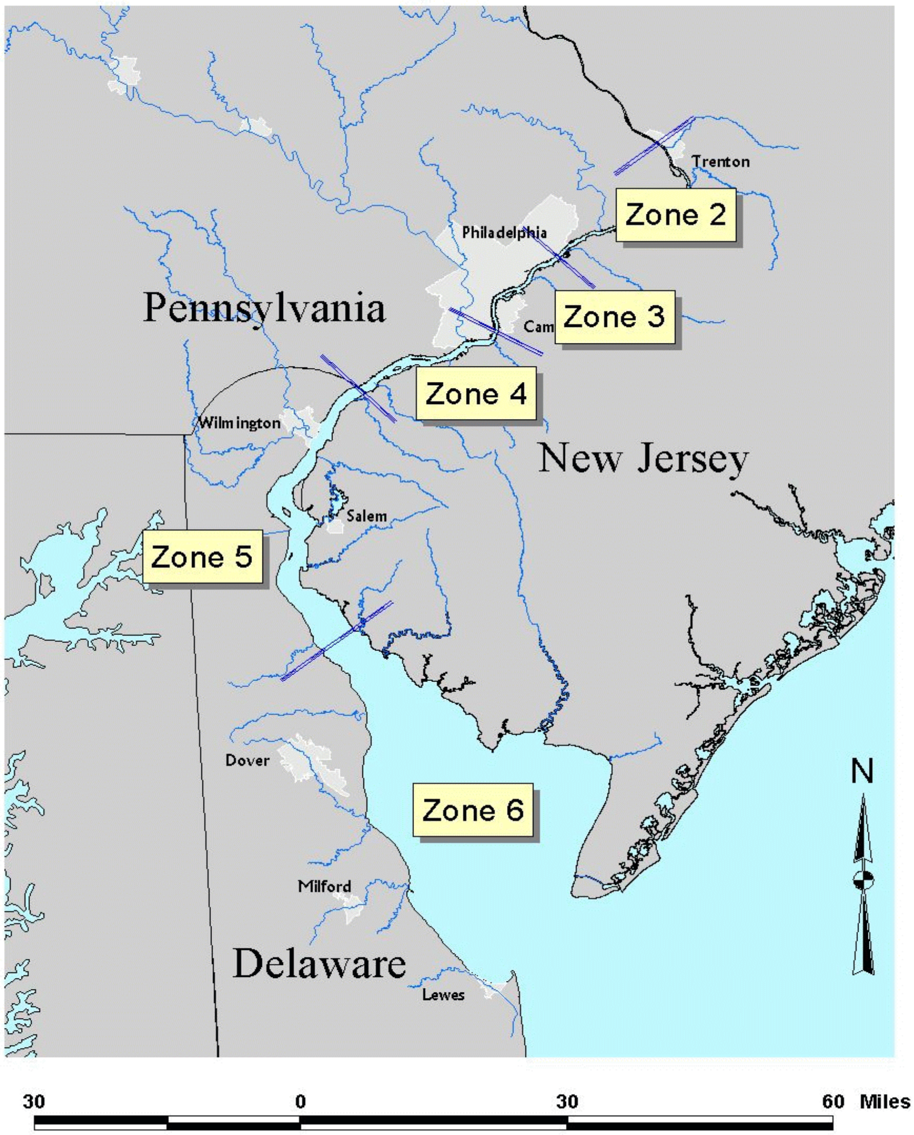
Although their manufacture and use were generally banned by federal regulations in the late 1970s, existing uses in electrical equipment and certain exceptions to the ban were allowed. In addition, PCBs may also be created as a by-product in certain manufacturing processes such as dye and pigment production. PCBs are hydrophobic, sorbing to organic particles such as soils and sediments and concentrating in the tissues of aquatic biota either directly or indirectly through the food chain.

1.2 Study Area

Zones 2 through 6 of the Delaware River (Figure 1) have been designated by the Delaware River Basin Commission as that section of the mainstem of the Delaware River and the tidal portions of the tributaries thereto, between the mouth of Delaware Bay (River Mile 0.0) and the head of the tide at Trenton, New Jersey (River Mile 133.4). Zones 2 to 4 are bordered by the State of New Jersey and the Commonwealth of Pennsylvania. Zones 5 and 6 are bordered by the States of Delaware and New Jersey. Zone 2 encompasses the area from the head of the tide at Trenton to River Mile (RM) 108.4. Zone 3 encompasses the area from RM 108.4 to RM 95.0. Zone 4 encompasses the area from RM 95.0 to RM78.8, and Zone 5 encompasses the area from RM 78.8 to Liston Point at the head of Delaware Bay at RM 48.2. Zone 6 encompasses the area from the head of Delaware Bay to its mouth at RM 0.0.

In 1989, the Delaware River Basin Commission created the Estuary Toxics Management Program to address the impact of toxic pollutants in the tidal Delaware River (also called the Delaware Estuary. The mission of this program was to develop policies and procedures to control the discharge of substances toxic to humans and aquatic biota from point sources discharging to this water body. In 1993, Commission staff identified several classes of pollutants and specific chemicals that were likely to exceed water quality criteria currently being developed under the program. These included polychlorinated biphenyls (PCBs), volatile organics, metals, chlorinated pesticides, chronic toxicity and acute toxicity. This list was subsequently included in the Delaware Estuary Programs's Comprehensive Conservation and Management Plan in 1996.

ESTUARY ZONES



Beginning in the late 1980's, concern regarding the possible contamination of fish populations that were rebounding as dissolved oxygen levels improved resulted in a number of investigations of contaminant levels in resident and anadromous fish species. These species included the white perch, channel catfish and striped bass. Studies by DRBC and the three states bordering the estuary subsequently identified PCBs and several chlorinated organics at elevated levels, resulting in fish consumption advisories being issued by all three states beginning in 1989. These advisories were principally based upon PCB contamination; and to a lesser degree, chlorinated pesticides such as DDT and its metabolites DDE and DDD, and chlordane.

1.3 Applicable Water Quality Standards for PCBs

Water quality criteria for toxic pollutants including Total PCBs for Zones 2 - 5 of the tidal Delaware River were adopted on October 23, 1996 by the Commission and are included in Section 3.30 of Article 3 of the Commission's water quality regulations. These criteria are 44.4 pg/l for Zones 2 and 3, 44.8 pg/l for Zones 4 and the upper portion of Zone 5, and 7.9 pg/l for the lower portion of Zone 5. The lower criterion in Zone 5 is due to a higher fish consumption rate being used while only Zones 2 and 3 are designated as a drinking water source. At that time, the criteria were based upon recommendations of the U.S. Environmental Protection Agency with the exception of the higher consumption rate in Zone 5. In December 2000, the U.S. EPA issued a revised methodology for deriving ambient water quality criteria for the protection of human health (U.S. EPA, 2000). This methodology includes several new recommendations on the fish consumption rate to be used in criteria development, and the use of a bioaccumulation factor (BAF) rather than a bioconcentration factor (BCF). In addition, the agency's Integrated Risk Information System (IRIS) incorporated a change to the cancer potency factor for total PCBs from 7.7 to 2.0 milligram/ kilogram-day for a risk level of one additional cancer case in an population of one million people (10^{-6}).

A subcommittee of the Delaware River Basin Commission's Toxic Advisory Committee was tasked with developing revised human health criteria for four zones of the Delaware Estuary. Values for five factors were needed to develop the revised criteria. Three of the factors used EPA-recommended default values. These three factors were 1) risk-specific dose (2.0 mg/kg-day at a risk level of 10^{-6}), 2) body weight (70 KG), and 3) drinking water intake (2 liters/day). Site-specific data was needed to develop appropriate values for the other two factors: fish consumption at each trophic level, and BAF at each trophic level.

Site-specific data for fish consumption in Zone 5 and Delaware Bay indicated an average consumption rate for all species of 17.46 grams per day. This value is remarkably close to the national default value of 17.5 grams per day. Field studies were conducted to provide PCB congener data on fish tissue concentrations of PCBs in species representative of trophic level 3 (channel catfish) and trophic level 4 (white perch). Ambient water concentrations of PCB congeners and organic carbon were determined using low level sampling and analytical techniques for use in calculating the BAF in the new methodology. Data on the percent lipid of consumed fish were also determined from routine monitoring conducted by state agencies and the Commission since 1990. Data on the proportion of each trophic level consumed was assumed to be 50% based upon data from all zones that indicated roughly equal proportions for the two trophic levels. The revised ambient water quality criterion for the protection of human health from carcinogenic effects from exposure through drinking water and fish consumption using these parameter values is 16 picograms/L. This criterion was recommended for Zones 2 - 6 of the Delaware River by the Toxics Advisory Committee in the summer of 2005. By Resolution 2005-19, the Commission authorized and requested the Executive Director to proceed with notice and comment rulemaking to revise the current human health criteria for PCBs for Zones 2 - 6 to 16 pg/L.

1.4 Regulatory Background

Total Maximum Daily Loads or TMDLs are one of the approaches defined in the Clean Water Act (CWA) for addressing water pollution. The first approach of the CWA that was implemented by the U.S. EPA was the technology-based approach to controlling pollutants (Section 301). This approach was implemented in the mid-1970s through the issuance of permits authorized under Section 402 of the Act.

The approach specified minimum levels of treatment for sanitary sewage and for various categories of industries. The other water quality-based approach was implemented in the 1980s. This approach includes water quality-based permitting and planning to ensure that standards of water quality established by States are achieved and maintained.

Section 303(d) of the Act establishes TMDLs as one of the tools to address those situations where the technology-based controls are not sufficient to meet applicable water quality standards for a water body (U.S. EPA, 1991). They are defined as the maximum amount of a pollutant that can be assimilated by a water body without causing the applicable water quality standard to be exceeded. The basis of a TMDLs is thus the water quality standard. This standard may be established for the protection of aquatic life, human health through ingestion of drinking water and/or resident fish, and wildlife. Under Section 303(d), States are required to identify, establish a priority ranking, and to develop TMDLs for those waters that do not achieve or are not expected to achieve water quality standards approved by the U.S. EPA. Federal regulations implementing Section 303(d) of the Clean Water Act provide that a TMDL must be expressed as the sum of the individual wasteload allocations for point sources (WLA) plus the load allocation for nonpoint sources (LA) plus a margin of safety (MOS). This definition may be expressed as the equation:

$$TMDL = WLA + LA + MOS$$

TMDLs for PCBs for Zones 2 - 5 were established by U.S. EPA Regions 2 and 3 on December 15, 2003 (http://www.epa.gov/reg3wapd/tmdl/pa_tmdl/DelawareRiver/index.htm). A TMDL for Zone 6 (Delaware Bay) was established by U.S. EPA Regions 2 and 3 on December 15, 2006 (http://www.epa.gov/reg3wapd/tmdl/de_tmdl/Zone6DelRvPCB/index.html).

2. ATTAINING THE WATER QUALITY CRITERION

2.1 Conditions Precluding Attainment Within 5 Years

Attainment of the water quality criteria is normally achieved through, as a minimum, effluent requirements in NPDES permits. These requirements (40 CFR Part 122.44(b)(1) and (d)(1)) include the establishment of water quality-based effluent permit limitations for those parameters that have the reasonable potential to exceed water quality criteria. If the permittee cannot meet the limitation for that parameter, then a schedule of compliance is required in the permit that specifies the steps that the permittee will take to meet the permit limit, and a timetable for completing those steps. If a permittee cannot meet the permit limit within the duration of the permit, then permitting authorities have typically required an administrative consent order specifying a schedule for complying with the permit limitation.

Several characteristics of PCBs as well as other hydrophobic pollutants, however, prevent this approach from achieving compliance with a five year NPDES permit cycle, and from ensuring that ambient levels of PCBs will not exceed the water quality criteria. These include:

1 Sources of PCBs other than sources controlled under the NPDES program including contaminated sites (including National Priority List sites and state hazardous waste sites), stormwater runoff, tributary inputs and atmospheric deposition .
2 Lack of data on the concentrations of PCBs in the numerous sources due to the past use of analytical methodologies for commercial PCB mixtures with high detection limits combined

with the limited use of new analytical methods that can detect picogram/liter levels of all 209 PCB congeners.

3 The reservoir of PCBs in the sediments of the estuary resulting from past loadings of PCBs from point and non-point sources.

4 Lack of sufficient evidence of the effectiveness of wastewater treatment technologies that can achieve reductions of PCBs to the levels anticipated for permit limitations.

Each of these characteristics are discussed in more detail below.

Sources of PCBs to the Delaware Estuary include both point and non-point sources. Fikslin and Suk (2003) identified several point source categories in developing the Stage 1 TMDLs including direct discharges (wastewater treatment plant and stormwater) CSOs and MS4; and several non-point source categories including contaminated sites major and minor tributaries, non-point source runoff, and dry and wet atmospheric deposition. Figure 2 depicts the relative contribution of penta-PCBs from these source categories.

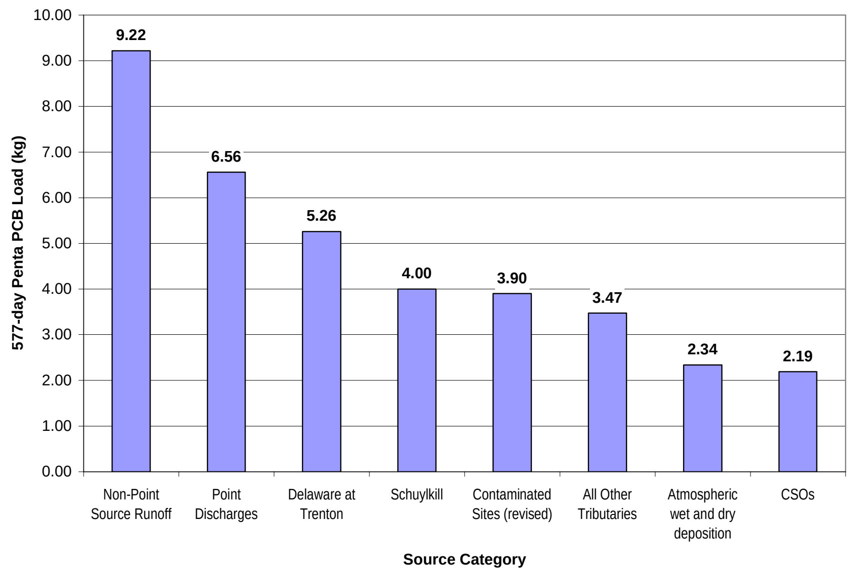


Figure 2: Loadings of penta-PCBs from point and non-point source categories to Zones 2 - 5 of the Delaware Estuary during the model calibration period (September 2001 to March 2003).

Limited data is available for both point and non-point sources of PCBs due to the historical use (and for many regulatory programs, current use) of analytical methods for the commercial mixtures of PCBs called Aroclors. Eight Aroclors were produced which varied in the percent of chlorine by weight. Typically, the Aroclors are named by using the percent chlorine by weight preceded by the numeral 12 (e.g. the Aroclor produced with 54% chlorine by weight is named Aroclor 1254). Higher numbered Aroclors have a greater percentage of chlorine by weight. In 1984, the U.S. EPA promulgated guidelines on analytical methodologies to be used for monitoring water and wastewater under the Clean Water Act (U.S. EPA, 1984). These guidelines specified Method 608 for seven Aroclors; a gas chromotographic method using an electron capture detector (GC-ECD). This method, however, has several disadvantages for measuring PCBs that have been released into the environment. First, the method detection limit for Aroclor 1242 was listed as 65 nanograms per liter in reagent grade water. In wastewater mixtures, detection limits in the hundreds of nanograms/L were typically reported. These levels are 1000 times greater than the water quality criteria adopted by states. Second, once released to the environment, these Aroclor mixtures were subject to degradation generally by volatilization of the less chlorinated congeners. This would produce a GC-ECD chromatogram that would not match any of the chromatograms for the Aroclors resulting in a reporting of non-detection of any of the “Aroclors”. Third, regulatory programs including those under the Clean Water Act, CERCLA, RCRA have been slow to require the use of a method that was developed in the 1990's, and published by the U.S. EPA in 1999. This method is called Method 1668A, a analytical procedure using a high resolution gas chromatograph coupled with a high resolution mass spectrometer which can achieve single picogram per liter detection and quantitation in ambient water and wastewater (U.S. EPA, 1999). The U.S. EPA recently revised this method based upon the results of an interlaboratory validation study, and a peer review of the study (U.S. EPA, 2008). This method replaces the single lab quality control acceptance criteria with interlaboratory criteria and includes several other minor revisions.

Attaining the revised water quality criterion of 16 pg/L will require a period of time much longer than the five year duration of a typical NPDES permit. The hydrophobic nature of contaminants like PCBs results in their adsorption to carbon present in the water column in both dissolved and particulate forms. Particulates will settle to the bottom of the water column at a rate that is dependent on the size of the particle. PCBs associated with these particles will then accumulate in the sediments, providing PCBs to the water column through either diffusion from the pore water into the water column, or through resuspension of the particulates (Chapra, 1997). Past and current loadings of PCBs to the Delaware Estuary have resulted in elevated concentrations of PCBs in the sediments of the estuary. Suspension of the current loading of PCBs to the estuary will not result in the attainment of the water quality criterion in a short time since PCBs will continue to be supplied by the sediments until particulates without PCBs are contributed to the sediments by the estuarine processes. Figure 3 presents the trajectory of the ambient concentrations of PCBs in Zones 2 and 3 following the termination of all current PCB loadings to the estuary. Zone 2 has a lower concentration of PCBs in the sediment compared to Zone 3 which has the highest sediment concentrations. Freshwater inflow and tidal forcings cause the annual variation about the trend line for each zone. Note that ambient PCB concentrations are projected to first reach the water quality criterion in June of 2021, while the ambient concentration in Zone 3are projected to first reach the water quality criterion in June of 2031. Thus, the expected slower rate of reductions in PCB loadings will extend the date to attain the water quality criterion.

Available technology for treating PCBs in wastewater was recently assessed by a consultant for the U.S. Environmental Protection Agency, Region 2 as part of a feasibility study of proposed water quality criteria for New Jersey (SAIC, 2005). This report provides a review of the performance of existing treatment technologies for reducing PCBs, DDT and mercury in wastewater to proposed values for wildlife criteria. For PCBs, the proposed wildlife criteria was 72 pg/L. The report concluded that theoretically (i.e., based on the literature), there are treatment technologies for mercury, PCBs, and DDT that could achieve the proposed criteria end-of-pipe. For PCBs, the report summarizes their findings as follows:

Treatment Process	***Feasibility Summary***
PCBs	
Granular Activated Carbon (GAC)	*Data indicate that GAC, when operated properly, should be able to achieve PCB levels near the proposed criterion. However, sensitive analytical methods are not available to confirm that the proposed criterion can be met. Also, because GAC is an adsorptive process, residuals disposal may be costly.*
UV Oxidation	*PCBs can be almost completely destroyed in wastewater through oxidation (99.99% destruction efficiency). UV oxidation using strong oxidants or a catalyst is an effective process for destroying PCBs. Testing is necessary to determine which oxidation process best destroys PCBs for a particular type of wastewater. However, sensitive analytical methods are not available to confirm that the proposed criterion can be met.*
Sonochemical Degradation	*Employs same mechanisms as UV oxidation (i.e., radical chemistry) to destroy PCBs, however, ultrasound is much more energy intensive. Also, the technology has not been proven effective for PCBs in wastewater outside of the laboratory.*

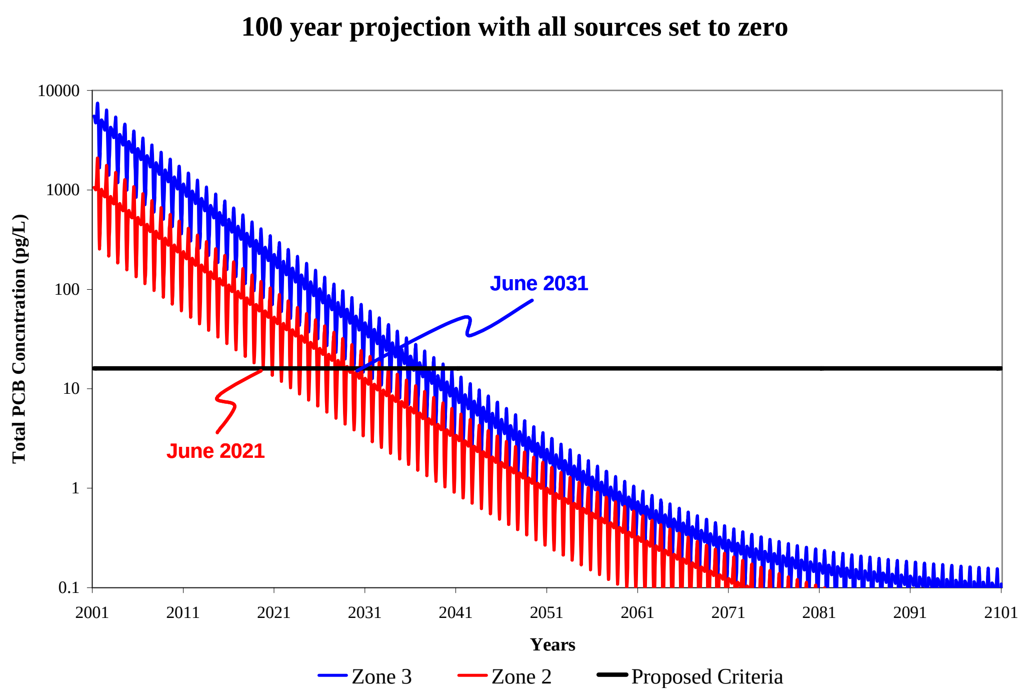


Figure 3: Projected total PCB concentrations in Zones 2 and 3 of the Delaware Estuary following termination of PCB loadings from all sources.

The report concluded that additional testing of available end-of-pipe treatment technologies is necessary to ensure that installation of a particular technology will achieve the proposed criteria, but that pollution prevention approaches may result in identifying sources of pollutants to municipal and industrial treatment works, and implementing reduction programs that may show progress toward achieving criteria concentrations in the effluent. Also, in some cases, treatment that is not feasible for larger discharges is feasible and effective for small waste flows (i.e., indirect dischargers), and that data demonstrating the treatment technologies can achieve the criteria in the effluent may become available in the future.

2.2 Phased Attainment of Water Quality Criterion for PCBs

This implementation plan describes how the water quality criterion for PCBs will be attained through a phased approach that includes requirements for NPDES discharges as well as strategies and recommendations for reductions from other non-point sources. The objective of this plan is to effectuate the Commission's Comprehensive Plan and to provide Basin states with the means to ensure Clean Water Act compliance for state-issued NPDES permits limiting discharges of these pollutants. More specifically, the provisions of this plan, a revised PCB water quality criterion of 16 picograms/L for Zones 2 through 6, and regulatory language authorizing schedules of compliance will allow those Basin states that defer to the Commission's regulations for the tidal Delaware River and Bay in establishing effluent limitations and other permit requirements. The permit requirements will also be consistent with established TMDLs for PCBs and with applicable regulations governing the issuance of NPDES permits.

The implementation plan is intended to supplement the Stage 2 TMDLs that will be established in December 2009 by the U.S. EPA, and provide the detailed requirements and strategies for point and non-point sources that will be employed to reduce PCB loadings to the Delaware Estuary and Bay to acceptable levels. In addition, the plan provides the basis for compliance schedules which may extend beyond the five year permit term, if necessary, in order to incorporate adaptive management principles into the compliance process, and includes a requirement for a report to be prepared every 10 years describing the progress that has been made to reduce PCB loadings from all sources and achieve the water quality criterion. The first reporting period starts from the establishment of the Stage 1 PCBs by the U.S. EPA Regions II and III on December 15, 2003, and ends on December 15, 2013. The second period will end on December 15, 2023. A reporting period of 10 years was chosen to encompass the 5 year permit cycle that is typical of NPDES permits for discharges to Zones 2 through 6, and acknowledge the staggered effective dates of these permits. A ten year reporting period will thus capture between one to two complete permit cycles for all of the NPDES discharges identified in the Stage 2 TMDLs. Subsequent reporting periods will be established until the designated uses and water quality criteria are attained.

Each of the components of the implementation plan is discussed in more detail below.

3. NPDES PERMITTING

Federal regulations require effluent limits in NPDES permits issued by a state or federal permitting authority to be consistent with the assumptions and requirements of any available wasteload allocation for the discharge contained in an established TMDL (40 CFR 122.44(d)(1)(vii)(B)). The Stage 2 TMDLs for PCBs to be established by the U.S. EPA Regions II and III for Zones 2 through 6 of the Delaware River will include wasteload allocations (WLAs) for individual point sources discharges identified as a source of PCBs. The complexities of controlling PCBs that are discussed above in Section 2, however, warrant the use of an adaptive management approach for achieving these WLAs. When a NPDES permittee exceeds the effluent limit based upon the assigned wasteload allocation for its discharge(s), schedules of compliance may be established to allow the permittee time to implement their Pollutant Minimization Plan (PMP), identify PCB sources contributing to their discharge(s), reduce or eliminate PCBs reaching their discharge(s) and achieve their WLAs. These schedules of compliance may range from several years to several NPDES permit cycles (typically 5 years).

This adaptive management approach to controlling PCBs and the proposed permitting strategy incorporates two components: 1) maintaining PCB reductions achieved (a baseline component), and 2) continuing to demonstrate progressive reductions in PCB loadings through the implementation of a PMP (a progressive improvement component). The key to this approach is the establishment of sufficient monitoring data for each of the discharges assigned a WLA in the Stage 2 TMDLs, and identification of management actions. While these practices and management actions will be specific to each permittee, the identification of successful measures that may be applied within or across industrial categories and municipal wastewater systems is also anticipated.

NPDES permits issued for discharges of PCBs to Zones 2 - 6 of the Delaware River by state permitting authorities in the three states with jurisdiction over these zones will contain a core set of requirements. These requirements are:

- The final WLA from the Stage 2 TMDLs established by the U.S. EPA and associated final effluent limitation set by permitting authority.
- An interim effluent limitation implementing the baseline component of this approach based upon that would be effective on the permit effective date. This interim effluent limitation would be based upon monitoring data available at the time of permit reissuance. A threshold amount of monitoring data collected at a discharge or representative discharge is necessary to establish this limitation.
- A PMP requirement with an annual reporting requirement and annual milestones that implements the progressive improvement component of this approach. This requirement may be based upon the Delaware River Basin Commission Water Quality Regulations, and incorporated by reference in the permit. The permit shall require the submission of an PMP Annual Progress Report as a permit requirement.
- A targeted PCB loading goal to be achieved by the expiration date of the permit. This goal will be set by the permitting authority based upon the experience of the permittee with implementing its PMP and the load reduction measures proposed in the PMP during the term of the permit.
- A monitoring requirement using Method 1668A - Chlorinated Biphenyls Congeners in Water Soil, Sediment and Tissue by HRGC/HRMS. This method has been required in monitoring requests issued to dischargers by the DRBC since 2004, and in permits reissued by state permitting authorities as part of the implementation of the Stage 1 TMDLs.
- A schedule of compliance with a final date for complying with an effluent limitation consistent with the assumptions and requirements of the final WLA assigned in the Stage 2 TMDLs, if necessary.

The actual conditions imposed in NPDES permits will differ depending upon availability of sufficient monitoring data to establish the interim effluent limitation, the experience and success of the measures employed in the PMP, and the ultimate achievement of the wasteload allocation assigned to the discharge. In general, permits issued before the close of the first reporting period that ends in December 2013 will incorporate the implementation requirements specified for the Stage 1 TMDLs: monitoring using Method 1668A and the requirement to develop and implement a PMP. Permits issued after 2013 will be permittee-specific with requirements based upon information on discharge concentrations of PCBs and loading reductions achieved during the term of the previous permit.

Specific guidelines for permit requirements are described in the following sections. Section 3.1 describes the requirements for permits issued during the first reporting period that will end in 2013. Section 3.2 describes the requirements for permits issued after 2013. Section 3.3 describes the principles to be used to establish final compliance dates in permits with schedules of compliance. Section 3.4 describes the recommended permit requirements following achievement of the assigned wasteload allocation. Section 3.5 describes the recommended permit requirements for Combined Sewer System Overflows (CSOs). Section 3.6 describes the recommended permit requirements for Municipal Separate Storm Sewer Systems (MS4s). The requirements for the last two categories differ from those for the traditional point sources (industrial and municipal wastewater treatment plant discharges) due to the lack of data on concentrations of PCBs and contributing sources, and the more recent emphasis on permitting these discharges.

3.1 Permit Requirements during the First Reporting Period

For those permittees with discharges assigned a WLA in the Stage 2 TMDLs, permit requirements for the first reporting period will be limited to 1) the final WLA from the Stage 2 TMDLs established by the U.S. EPA and a final effluent limitation set by a permitting authority based upon the WLA, 2) A schedule of compliance with a final date for complying with the final WLA assigned in the Stage 2 TMDLs, if necessary, 3) monitoring requirements for 209 PCB congeners, and 4) a requirement to submit and implement a Pollutant Minimization Plan containing all of the elements specified in Section 4.30.9.E of the Commission's Water Quality Regulations. The latter two requirements may be imposed by the Commission or by inclusion of the requirements in NPDES permits issued or reissued by state permitting authorities during the first reporting period.

Sampling and analytical requirements for monitoring of the 209 PCB congeners are described in detail at http://www.state.nj.us/drbc/PCB_info.htm. The requirements include sample labeling and identification, sample size, required blanks, specific analytical and quality control requirements, and reporting requirements. The latter specify conventions for reporting coeluting congeners and data flagging, decision rules for dealing with blank contamination, and hardcopy and electronic data deliverable (EDD) formats. Permits issued by state authorities will include these requirements at a minimum. Sampling frequency will be based upon the relative contribution of the discharge to the total loading of PCBs from all NPDES point sources. Those discharges that contribute to the 99^{th} percentile of the total cumulative loading of total PCBs will be subject to a minimum of two sampling events per year. If the flow of the discharge is influenced by precipitation events, then these discharges will also be subject to a minimum of two additional wet weather sampling events per year following the onset of a precipitation event of 0.1 inches or greater and an increase in wastewater flow, provided that no rainfall (defined as less than 0.1 inches) has occurred within the previous 72 hours. A sampling frequency of one dry weather sample per year and, if the discharge is influenced by precipitation events, one additional wet weather sample per year will be required of all other discharges. Stormwater discharges will only be required to sample during wet weather. Appendix Table 1 lists the discharges covered by this plan and the required dry and wet weather sampling frequency.

A requirement to develop, submit and implement a Pollutant Minimization Plan (PMP) is a key component of the TMDL Implementation Plan. It should be noted that while the concentration of PCBs in a single discharge is sufficient to require a PMP submittal by a permittee, the PMP must address the entire facility including all other discharges and pathways to the receiving water.

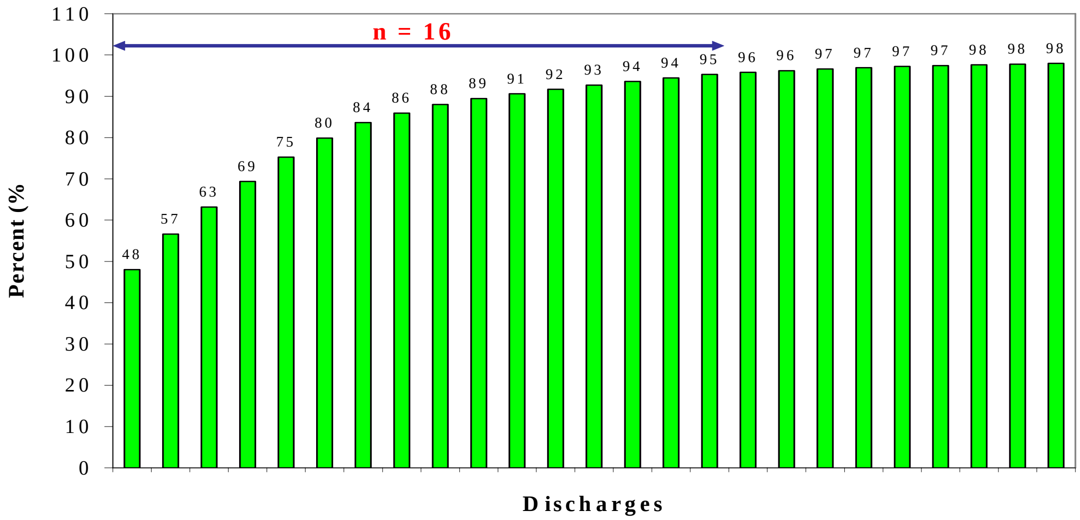


Figure 4: Cumulative Penta-PCB Loadings from 128 NPDES discharges based upon data collected in 2005 and 2006 for 209 PCB congeners using Method 1668A.

PMPs were one of two requirements that implemented the Stage 1 TMDLs that were established in 2003. The Commision under regulations adopted in May 2005 initially required 42 of the 94 NPDES permittees to develop, submit and implement PMPs. The remaining permittees and several additional permittees identified either in the Stage 1 TMDL for Zone 6 (Delaware Bay) or subsequent to the establishment of the Stage 1 TMDLs were required to conduct additional monitoring of their discharges using Method 1668A for 209 congeners to determine the need for a PMP requirement. Analysis of this additional monitoring data indicated the presence of PCBs and the need for PMPs for most of these permittees. The data did indicate, however, that 95% of the cumulative loading of penta-PCBs to Zones 2 through 6 was attributable to only 16 of the 128 discharges for which data were available, and that 99% of the cumulative loading of penta-PCBs to Zones 2 through 6 was attributable to only 36 of the 128 discharges (Figure 4).

Specific requirements for the content, submittal, review and implementation of a PMP are contained in Section 4.30.9 of the Commission's Water Quality Regulations. Subsequent submittal of an annual report describing the measures and associated reductions in PCB loadings achieved is also required under the regulations. Section 4.30.9.I discusses the relationship of the Commission's regulations governing PMPs and PMPs required in NPDES permits. Essentially, the Commission will cease to administer a PMP for a NPDES permittee upon the date that PMP requirements in an initial, renewed or modified permit consistent with the Commission's regulations become effective.

During the first reporting period, the Commission and the respective state permitting agency will be responsible for ensuring that NPDES permittees with discharges that contribute to the 99th percentile of the cumulative loading of total PCBs are required to conduct the required monitoring and submit and implement a PMP as soon as possible. NPDES permittees with discharges that contribute to the remaining cumulative loading of total PCBs will receive the two requirements upon reissuance of their NPDES permit. The date of reissuance of these permits will be determined by each state permitting authority. A flowchart establishing the monitoring frequency for NPDES discharges is presented in

Figure 5. A flowchart depicting the permitting process during the first reporting period is presented in Figure 6.

Figure 5: Flowchart for establishing the monitoring frequency for point source discharges covered under the TMDLs for PCBs for the Delaware Estuary.

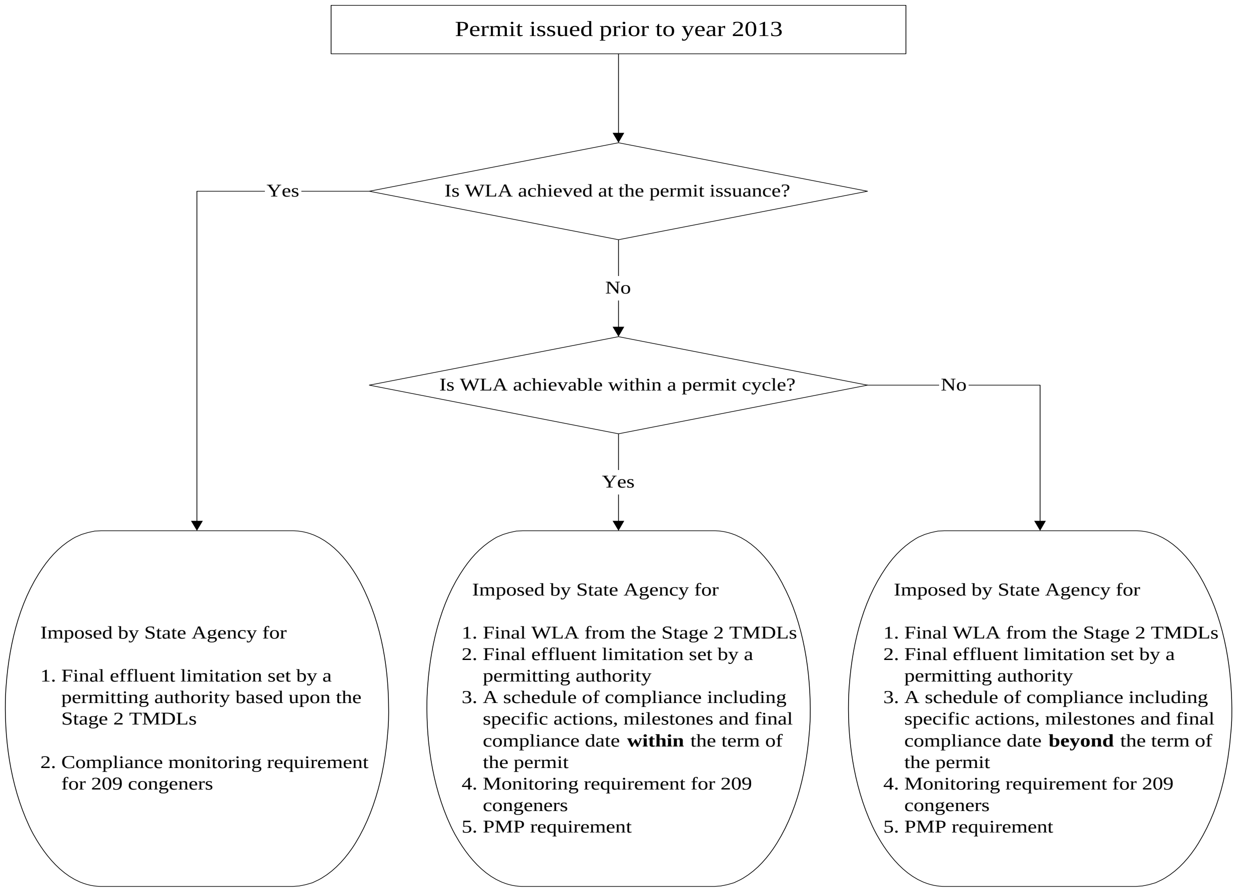


Figure 6: Flowchart for establishing NPDES permit requirements for point source discharges during the first reporting period - TMDL Implementation Plan for PCBs for the Delaware Estuary.

Table 2 summarizes the number of permittees and outfalls by state. Appendix Table 1 indicates the lead agency currently assigned to require and administer the monitoring and PMPs for each NPDES permittee.

Table 2: NPDES Permittees and associated outfalls by state to be considered in the Stage 2 TMDLs as of January 2009.

	Group 1		**Group 2**		**Others (Zone 6 and new additions)**		**Total**	
	NPDES Permits	Outfalls	NPDES Permits	Outfalls	NPDES Permits	Outfalls	NPDES Permits	Outfalls
Delaware	4	12	7	12	4	8	15	32
New Jersey	22	40	25	30	5	5	52	75
Pennsylvania	16	38	9	9	6	8	31	55
Total	43	92	41	51	15	21	98	162

3.2 Permit Requirements during Subsequent Reporting Periods

Requirements for permits issued during subsequent reporting periods will contain all of the core permitting elements listed above. Requirements added at permit renewal include an **Interim Effluent Limitation** to implement the baseline component and a **Targeted PCB Loading Goal** to implement the progressive improvement component of the TMDLIP. These additional permit requirements are further described below. All of the core permit requirements shall remain in effect until the permittee has achieved its assigned wasteload allocation. A flowchart depicting the permitting process during the first reporting period is presented in Figure 7. Permit requirements following attainment of a permittee's wasteload allocation are described in Section 3.4.

The Interim Effluent Limitation is intended to ensure that the loadings from point sources remain at or below the loadings achieved during the preceding term of the permit. This requirement is intended to prevent backsliding from load reductions achieved, and to trigger additional permit requirements should this level be exceeded during the term of the current permit . Additional requirements include increased frequency of monitoring, preparation of a non-compliance report, and other actions to bring the PCB loadings back below the Interim Effluent Limitation. Except in a few cases where sufficient monitoring data is not available, Interim Effluent Limitations for each discharge assigned a WLA will be calculated using the data available at the end of the first reporting period, at each subsequent renewal of the respective permit or when sufficient monitoring data becomes available. The monitoring frequency requirements depicted in Figure 5 is intended to result in a minimum of 10 data points for each discharge identified in the TMDLs. The actual number of data points available for each discharge for any reporting period will vary depending on its contribution to the 99^{th} percentile of the cumulative loading of total PCBs, the effective date of the reissued permit for the discharge, and changes in the monitoring frequency effected by the state permitting authority. The cumulative total PCB Loadings and the discharges that contribute to the 99^{th} percentile cumulative load of total PCBs will be updated at the end of each reporting period to guide the monitoring frequencies.

The Interim Effluent Limitation will be calculated as the upper 95^{th} confidence interval of the median of the available data for a discharge. This statistic was chosen since it is an estimate of the upper bound of the PCB loadings for a discharge, and it does not require the normality assumption of parametric statistics such as the 95th confidence interval of the mean. Appendix A presents a discussion of the statistical basis of this approach.

The **Targeted PCB Loading Goal** is intended to partially implement the progressive improvement component of the TMDLIP that progressive load reductions be achieved over the course of each permit cycle and reporting period. This component of the TMDLIP is also implemented through the requirement to develop and implement a PMP as discussed in Section 3.1. The procedure for establishing the Targeted PCB Loading Goals will be developed prior to the end of the first reporting period and is expected to become more discharge- and site-specific in subsequent reporting periods as the process of adaptive management proceeds. Options for establishing Targeted PCB Loading Goals include a fixed percentage of the median value for the PCB loadings from a discharge, a sliding scale based upon a discharge's contribution to the cumulative loading of total PCBs, or sliding scale based upon the ratio of median effluent quality to the individual wasteload allocation. Table 3 contains an example of the use of monitoring data from a hypothetical discharge to develop an Interim Effluent Limitation and a Targeted PCB Loading Goal.

In subsequent reporting periods, permit requirements will vary between permittees depending on the requirements contained in previous NPDES permits, and the timing and reissuance of their permit. When reissuing subsequent permits, the permitting authority will review the progress made and compliance with the targeted PCB loading goal, review the need for continuing with a compliance schedule and associated final compliance date, set a new targeted PCB loading goal, and review other management measures to achieve the WLA. Other management measures that may be considered include adjustment of the discharge's WLA from either the Reserve WLA or offsets from other discharges, or revision of the TMDL to reallocate loads between point and non-point sources, among others.

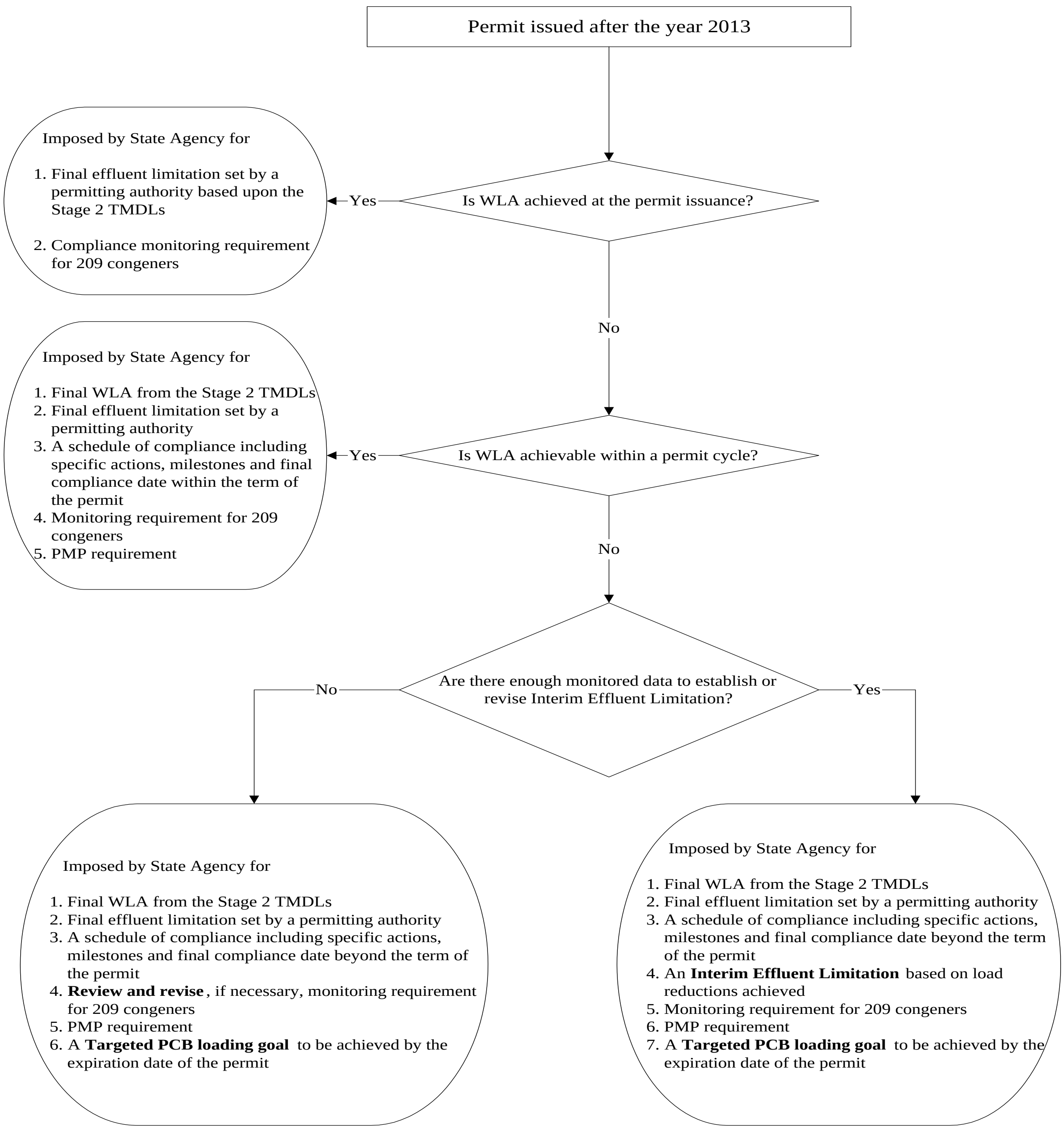


Figure 7: Flowchart for establishing NPDES permit requirements for point source discharges during subsequent reporting periods - TMDL Implementation Plan for PCBs for the Delaware Estuary.

Table 3: Use of monitoring data to calculate permit requirements for a hypothetical discharge.

Monitoring Data		Summary Statistics	
Year	**Total PCB ug/day**	**Statistic**	**Value ug/day**
2004	30,000	N	10
2005	6518	Minimum	2,439
2006	6546	Maximum	30,000
2007	5400	Median	5,050
2008	4700	Mean	7,277
2009	6100	Std. Dev.	8,109
2010	3057	Coefficient of Variation (CV)	111 **%**
2011	4205	95th Confidence Interval of the median	± 6,546
2012	3800	Final WLA (fWLA)	10
2013	2439	Interim Effluent Limitation (median + 95th C.I.)	11,596
		Targeted PCB Loading Goals (set at 10% of median value or a 90% reduction)	505

3.3 Establishing Final Compliance Dates in Schedules of Compliance

The approach frequently utilized for establishing schedules of compliance assumes that a known sequence of actions involving deployment of treatment technologies can be specified that will lead to compliance with a WQBEL. Therefore, a final compliance date can be established once the time constraints of completing these actions are considered.

This is simply not the case for hydrophobic pollutants like PCBs for which the principle of adaptive management is a more appropriate approach. Imposition of treatment technology is constrained by the uncertainty in the level of performance of the available technologies, and the low concentrations and associated WLAs that must be achieved. Alternatively, source identification and minimization or elimination is the preferred strategy with compliance dates that are established based upon an individual discharger’s situation and which may, in some cases, require revision for several permit cycles.

The following is the proposed process for imposing a final compliance date in a schedule of compliance:

1. If the permittee can meet its WLA upon permit issuance, impose a final effluent limitation effective upon permit issuance.

2. If the permittee can meet its WLA and associated final effluent limitation during the term of the permit, impose a final compliance date within the five year term of the permit based upon known specific actions to be completed by the permittee. Annual, or more frequent, milestones must be included in any compliance schedule with a duration of more than one (1) year after the permit issuance.

3. If the compliance schedule must go beyond the permit term (normally 5 years), set the final compliance date at a date after the expiration date of the permit with interim compliance dates that reflect an adaptive management approach to achieving the assigned WLA.

   The NPDES permit would then include:
   - the final WLA from the TMDL and associatedfinal effluent limitation set by permitting authority,
   - an interim effluent limitation ("the cap") establishing a baseline based upon monitoring data that would be effective on the permit effective date,
   - a PMP requirement with an annual reporting requirement and annual milestones,
   - a targeted PCB loading goal to be achieved by the expiration date of the permit,
   - a monitoring requirement using Method 1668A, and
   - a schedule of compliance with a final compliance date.

   The final compliance date will be discharger-specific and will be established by the permitting authority based upon the following factors:
   a the success of the permittee in terms of sources identified and loading reductions achieved with the implementation of its PMP - permittees who have not previously developed and implemented a PMP would be given additional time;
   b. the type of facility such as municipal sewage treatment plant versus industrial facility - municipal STPs may be given additional time to conduct trackdown studies to identify sources and determine available compliance authorities;
   c. the scope and complexity of the wastewater collection system - larger municipal and complex industrial sites may be given additional time;
   d. the magnitude of the loading reduction required to meet the final WLA - permittees with discharges that are orders of magnitude above their respective WLAs will have aggressive schedules of compliance to initially reduce PCB loadings. Permittees with discharges near their WLAs may have difficulty achieving the remaining load reduction and may require additional time; and
   e. the amount of monitoring data available to establish a loading reduction trend.

   Table 4 presents a matrix of factors and general guidelines that can be used to establish final compliance dates in NPDES permits. A discharge may be afforded the time it requires to achieve final compliance based on a balance of the factors specified and any other factors applicable to the discharge.

This process would be consistent with the permitting authorities requirement to make a reasonable finding that an extended compliance schedule is "appropriate", will require compliance "as soon as possible" and includes an enforceable final limit that will meet water quality standards and a date for achieving this limitation.

Table 4: General Guidelines for Establishing Final Compliance Date in NPDES Permits

Factor	Short (<1 permit cycle)	Intermediate (>1 permit cycle)	Long (>2 permit cycles)
1. Experience/Success with PMP Implementation	• Successful implementation of PMP • Source identification substantially complete • Substantial reduction in PCB loading from baseline loading	• Some success with PMP implementation • Difficult source identification/ reduction • Expected target loading goal achieved • Final load reductions difficult to achieve	• No experience with PMP (review at second permit reissuance) • Final load reductions difficult to achieve
2. Type of facility	Municipal Industrial		
3. Complexity of Wastewater Collection System	• **Municipal -** small service area with sources identified; mostly residential • **Industrial -** few possible sources and wastewater streams identified; actions to reduce loadings identified	• **Municipal -** small to large service area; some industrial; source identification ongoing; effective pretreatment program in place • **Industrial -** multiple possible sources and wastewater streams; need to develop alternative actions	• **Municipal -** intermediate to large service area with multiple land uses; source identification ongoing; no pretreatment program in place • **Industrial -** complex wastewater streams; need to develop alternative actions
4. Magnitude of the loading reduction required to meet the final WLA	• Actual loading is close to assigned WLA.	• Actual loading is greater than 2 orders of magnitude above WLA.	• Actual loading is greater than 2 orders of magnitude above WLA.
5. Amount of monitoring data available to establish a loading reduction trend	• More than 10 data points available* to set interim permit limit and set targeted PCB loading goal	• Greater than 5 data points available* to set interim permit limit and set targeted PCB loading goal	• No monitoring or fewer than 5 data points available (review at second permit reissuance)

* - Or variability of data collected is small.

If the final compliance date is beyond the current permit expiration data, the permitting authority, at the time of the next permit renewal, will review the progress made and compliance with the targeted PCB loading goal, and review other management measures to achieve the WLA.

3.4 Attainment of a permittee's wasteload allocation

Once a permittee has demonstrated that the loading of PCBs is less than its assigned wasteload allocation, the permitting authority may remove the PMP requirement and associated Targeted PCB Loading Goal, the Interim Effluent Limitation and compliance schedule from the permit. The permit would then contain an effective final effluent limitation and a compliance monitoring requirement consistent with its permitting policies.

3.5 Permit Requirements for Combined Sewer Overflows

Combined Sewer Overflows or CSOs occur from municipal wastewater sewerage systems designed to collect stormwater runoff along with domestic sewage and industrial wastewater (U.S. EPA, 2009). Generally, wastewater collected by each of these systems is conveyed to a treatment plant except during periods when the contribution of stormwater causes the capacity of the collection system to be exceeded. When this occurs, these systems are designed to discharge from the collection system through outfalls called overflows. These CSO discharges contain not only stormwater but also untreated human and industrial waste, toxic materials, and debris (U.S. EPA, 2009).

Combined sewerage systems discharging to the Delaware Estuary occur in the City of Philadelphia, City of Wilmington, Camden, and a portion of Delaware County served by the Delaware County Regional Authority. The combined sewer systems serving the three sewage treatment plants operated by the Philadelphia Water Department alone have 164 CSO outfalls that discharge to the Delaware River, Schuylkill River, Darby Creek, and other smaller tributaries (PWD, 2009).

CSO discharges are regulated as point sources under the NPDES program and are included in permits issued to the municipalities or authorities listed above. In 1994, EPA issued a Combined Sewer Overflow Control Policy for the control of CSOs through the National Pollutant Discharge Elimination System (NPDES) permitting program. The first requirement under this CSO Policy was a January 1, 1997, deadline for implementing nine minimum technology-based controls. The nine minimum controls are measures that can reduce the prevalence and impacts of CSOs and that are not expected to require significant engineering studies or major construction. Permittees are also required to develop long-term control plans that will ultimately provide for full compliance with the Clean Water Act, including attainment of water quality standards (U.S. EPA, 2009b).

CSO discharges are essentially covered under PMPs required for all of the entities listed above. Under these plans, the permittee is required to characterize the concentration and loading of PCBs from these overflows, and reduce the loading to that allocated under the Stage 2 TMDLs. Permits reissued during the first reporting period shall ensure that sufficient monitoring of the individual discharges, discharges representing all or a portion of the combined sewer systems covered by the permit, or influent wastewater to the collection system during times of stormwater influence is conducted. Information on the land uses and potential direct and indirect PCB sources within the combined sewerage system service area should be obtained. Priority areas identified in these efforts should be targeted for additional monitoring in subsequent permits to quantify PCB loadings, and should be the focus of source trackdown and identification efforts under the PMPs.

Permits issued during subsequent reporting periods will also contain an **Interim Effluent Limitation** to implement the baseline component and a **Targeted PCB Loading Goal** to implement the progressive improvement component of the TMDLIP. The form of these requirements shall be established by the NPDES permitting authority and may consist of individual loadings or categorical loadings. A schedule of compliance and final compliance date consistent with the CSO policy requirement to implement the long-term control plan may also be established by the permitting authority.

3.6 Permit Requirements for Municipal Separate Storm Sewer Systems (MS4s)

The 1987 amendments to the federal Clean Water Act included requirements to address the issue of stormwater runoff including municipal systems that collect and discharge stormwater. These systems have been designated as Municipal Separate Storm Sewer Systems (MS4s), and are classified based upon the size of the population in the area where the system is located. Large and medium systems are included in Phase 1 of a regulatory program to address these discharges. A large MS4 is a system that is located in an area with a population of 250,000 or more. A medium MS4 is a system that is located in an area with a population between 100,000 - 249,999. Small MS4s serve a population of fewer than 100,000.

The first phase of a program to regulate these discharges (Phase I), adopted in 1990, required certain industrial dischargers, medium and large municipal separate storm sewer systems (MS4s), and operators of construction sites greater than five acres to obtain National Pollutant Discharge Elimination System (NPDES) permits. The second phase of the program (Phase II) directed EPA to designate certain categories of dischargers for regulation under the NPDES program. In response, EPA determined that the owners and operators of small MS4s in urbanized and certain other areas should be regulated under the NPDES program, often by general permits.

Since the regulation of these sources under the NPDES program is more recent with less experience on effective control strategies, a staged approach is proposed based on the principles of system/source identification followed by the imposition of PMP requirements in a specific NPDES permit for individual systems. This will allow the process of adaptive management for controlling PCB loadings from these sources to proceed using the experience of larger systems that have a greater potential for larger PCB loadings based upon their greater volume and proximity to water quality management zones (Zones 3 and 4) that exhibit higher ambient PCB concentrations.

Specific permit requirements for larger MS4s will initially include the identification and mapping of the stormwater system and associated outfalls, land uses, point and non-point sources, and stormwater management infrastructure (e.g., retention/detention basins); ambient and/or outfall monitoring using Method 1668A; and a requirement to prepare, submit and implement a PMP. Monitoring may consist of either ambient receiving water sampling water for system outfalls or the sampling of specific MS4 outfalls. The type of monitoring will depend on available instream and outfall data on PCB concentrations, and information on the land uses and potential PCB sources within the system service area. Priority areas identified in this initial effort should be targeted for additional monitoring in subsequent permits to quantify PCB loadings, and should be the focus of source trackdown and identification efforts under the PMP.

These permit requirements will first be imposed upon large and medium systems (systems serving a population greater that 100,000 - Phase I MS4s) during the first reporting period. Smaller systems (Phase II MS4s) are anticipated to receive these requirements near the end of the first reporting period in 2013 following the prioritization of these smaller systems, and the evaluation of the success of minimization measures employed by Phase I MS4s. A workgroup of federal/state representatives responsible for permitting Phase II MS4s and DRBC staff will be formed to develop the procedures for prioritizing these systems and the specific NPDES permit requirements.

4. NON-POINT SOURCES

4.1 Tributaries and Boundaries

The Stage 2 TMDLs will include the assignment of load allocations to tributaries to Zones 2 through 6, and to the open water boundaries to these water management zones. Specifically, 31 tributaries are identified in the Stage 2 TMDLs (Table 5) along with two open water boundaries, the C&D Canal linking the Delaware River with upper Chesapeake Bay and the Atlantic Ocean at the mouth of Delaware Bay. The two open boundaries are assigned a loading based upon the net flux of PCBs when the TMDLs are achieved. The tributaries are assigned either individual load allocations or are assigned to a categorical allocation for several tributaries. These allocations are based upon the allocation procedure called equal effluent concentration. This procedure involves assigning the same concentrations to each tributary that enters a Zone and using the flows during the one year cycling period to develop the loading.

Table 5: Tributaries included in the Stage 2 TMDLs

Name	Zone	River Mile	State	PCB data available using Method 1668A
Delaware River at Trenton	2	133.40	NJ	Yes
Crosswicks Creek	2	128.41	NJ	Yes
Neshaminy Creek	2	115.63	PA	Yes
Poquessing Creek	2	111.66	PA	Yes
Rancocas Creek	2	111.06	NJ	Yes
Pennypack Creek	2	109.75	PA	Yes
Pennsauken Creek	3	105.40	NJ	Yes
Frankford Creek	3	104.60	PA	Yes
Cooper River	3	101.58	NJ	Yes
Big Timber Creek	3	95.46	NJ	Yes
Schuylkill River	4	92.47	PA	Yes
Mantua Creek	4	89.66	NJ	Yes
Darby Creek	4	85.28	PA	Yes
Chester Creek	4	82.93	PA	Yes
Raccoon Creek	4	80.66	NJ	Yes
Christina River	5	70.73	DE	Yes
Brandywine Creek	5	70.73	DE	Yes
White Clay Creek	5	70.73	DE	Yes
Red Clay Creek	5	70.73	DE	Yes
Salem River	5	58.37	NJ	Yes
Alloways Creek	5	54.45	NJ	Yes
Smyrna River	6	44.56	DE	No
Stowe Creek	6	41.57	NJ	No
Cohansey River	6	37.80	NJ	Yes
Leipsic River	6	34.40	DE	No
Cedar Creek	6	31.73	NJ	No
St. Jones River	6	23.70	DE	Yes
Murderkill River	6	23.14	DE	Yes
Maurice River	6	21.03	NJ	Yes
Mispillion River	6	12.02	DE	Yes
Broadkill River	6	3.50	DE	No

Implementation of these load allocations essentially involves the designation of all or a portion of these tributaries as impaired by the respective state environmental agency during the biennial impaired water listing process required under Section 303 (d) of the federal Clean Water Act. This section of the Act requires States to identify those waters within its boundaries for which technology-based effluent limitations are not stringent enough to implement any water quality standard applicable to such waters, establish a priority ranking for such waters, and in accordance with the priority ranking, establish a total maximum daily load (TMDL). A listing of a water body or segment thereof (i.e., the assessment unit) under this process requires the agency to assign the assessment unit to one of five categories. The assignment is based upon the amount of data available for a particular tributary. This data may include ambient water, fish tissue or sediment data; and will likely not include all of the watershed draining to the tributary. The Commission has collected ambient water data at the head of the tide of most of the tributaries listed in Table 5 using the sensitive Method 1668A. While this method is needed to detect PCB congener concentrations in water in the picogram per liter range of water quality criteria for PCBs, fish tissue and sediment concentrations are often high enough to permit detection of PCBs as either Aroclors or congeners by other analytical methods. Fish tissue and sediment data may be available from state monitoring programs to permit an assessment.

Depending upon the amount of data available, there are several possible assignments of all or a portion of a tributary. Possible categories for listing a segment include Category 3 (insufficient data to make a use assessment), Category 4 (available data indicate that a designated use is not being supported, but a TMDL has been established such as for the Schuylkill River) and Category 5 (available data indicate that a designated use is not being supported, and a TMDL is needed such as for the non-tidal Delaware River). If a tributary segment is listed in Category 5, a schedule for completion of a TMDL must be established.

The approach to achieving the load allocations for tributaries in this non-point source category will likely involve the following steps:

- Evaluation of available ambient water, fish tissue and sediment data to identify tributary segments impaired by PCBs.
- Collection of additional ambient water and fish tissue data to provide data or supplement existing data for impairment assessment.
- Listing by state agency of tributary segments impaired by PCBs and requiring a TMDL.
- Establishment of a TMDL for the tributary segments assigned to Category 5.
- Implementation of the TMDL should follow the approach used for the Stage 2 TMDLs for the Delaware Estuary and Bay.
- Monitoring at the head of tide of the tributary by either the Commission as part of the required reporting of progress or by the state agency.

The approach for achieving the assigned fluxes from the two open water boundaries, the C&D Canal linking the Delaware River with upper Chesapeake Bay and the Atlantic Ocean at the mouth of Delaware Bay will differ from that applied in the tributaries given the larger geographic scope and additional regulatory agencies that will need to be involved. The C&D Canal links upper Chesapeake Bay with Zone 5 of the Delaware River. The C&D Canal and the adjacent tributary, the Elk River, has been included in Category 5 (waterbodies requiring TMDLs) in the State of Maryland’s list of impaired waters for PCBs (Maryland Department of the Environment, 2009) and in the State of Delaware’s list of impaired waters for PCBs (Delaware DNREC, 2009). Delaware DNREC has set a target date of 2011 for completing the TMDL.

Sources of PCBs to the Atlantic Ocean include point sources such as ocean outfalls and non-point sources including atmospheric gaseous and particulate PCBs from local and regional sources. Other PCB contaminated waterbodies including the New York/New Jersey Harbor Complex may also be contributing to PCB levels in the coastal waters near the mouth of Delaware Bay (Panero et al, 2005).

Achieving the allocations for these two boundaries will require a regional effort to reduce PCB loadings. The NJDEP began a state-wide effort patterned after the Delaware Estuary effort to require PCB monitoring of point sources to PCB impaired waters and preparation of a PMP, if necessary, following a review of the data (NJDEP, 2009). The Commission will continue its coordination efforts with the U.S. EPA Regions II and III to pursue such a regional approach.

4.2 Contaminated Sites

Contaminated sites including sites managed under the federal Comprehensive Environmental Response, Compensation, and Liability Act CERCLA), the federal Resource Conservation and Recovery Act (RCRA), and state hazardous waste disposal statutes often list PCBs as a contaminant of concern due to their widespread use in electrical equipment as a dielectric fluid, and in paints, printing inks, lubricants, hydraulic fluids and pesticides. Although the manufacture, processing and distribution of PCBs was banned in 1979 under the Toxic Substances Control Act (TSCA), PCBs can still be released into the environment from poorly remediated maintained hazardous waste sites that contain PCBs; illegal or improper dumping of PCB wastes; leaks or releases from electrical transformers containing PCBs; and disposal of PCB-containing consumer products into municipal or other landfills not designed to handle hazardous waste. PCBs may also be released into the environment by the burning of some wastes in municipal and industrial incinerators (U.S. EPA, 2009c).

Following establishment of the Stage 1 TMDLs by the U.S. EPA Region s II and III, the Delaware River Toxics Reduction Program (DelTRiP) was created in 2004 as a joint effort between the Delaware River Basin Commission, United States Environmental Protection Agency (U.S. EPA), Pennsylvania Department of Environmental Protection (PADEP), New Jersey Department of Environmental Protection (NJDEP), and Delaware Department of Natural Resources and Environmental Control (DNREC). The New York State Department of Environmental Conservation joined in 2007. The goal of DelTRiP is to identify, prioritize, track, and report the status of sites within the basin that significantly contribute or have the potential to significantly contribute toxic pollutant loadings to the Delaware River Basin (DRBC, 2009). While this effort is directed at all toxic pollutants, DelTRiP has, since its inception, been focused on identifying sites contaminated with PCBs.

In 2006, the DRBC compiled and published the first DelTRiP annual report identifying 263 sites within the Delaware River Basin as containing PCBs from about 1,000 sites submitted by the U.S. EPA, NJDEP, PADEP, and DNREC (DRBC, 2006b). In 2007, the second annual report was issued by the Commission addressing the 263 sites referenced in the previous report (DRBC, 2007). In researching the sites for the 2007 report, DRBC staff found that some of the 263 sites some sites were duplicates, some were actually located outside of the basin, some were erroneously identified as having PCB contamination, and others were reportedly remediated to their respective state standards. The 2007 DelTRiP report details the remediation history of 53 sites with ongoing PCB remediation (which includes ongoing site investigation and active remediation) and 59 sites within unknown remedial status. Several site histories were unavailable during the preparation of the 2007 report, and these will be addressed in future reports. Figure 8 depicts the location and status of the 53 sites along with 28 unknown status sites as of the summer of 2008.

Some of these sites are located above the head of the tide at Trenton NJ or above the head of tide on tributaries to the tidal Delaware River and Bay. Loadings from these sites are captured in the PCB loadings established for each tributary at the head of tide. Therefore, loads from only 49 contaminated sites within the direct drainage area to the estuary are explicitly considered. Loadings from these sites are the focus of this implementation plan.

Allocations to the contaminated site category in both the Stage 1 and Stage 2 TMDLs are categorical allocations by zone. As information from each of these sites receives further review and as monitoring data is collected at those sites that have been remediated, PCB loadings from these sites will be refined and individual allocations established to track progress.

The approach to achieving the load allocations for this non-point source category focuses on each of the 49 individual sites. The approach will likely involve the following steps:

1. Characterization of the levels and spatial distribution of PCB contamination in soils in terms of PCB congeners at each site. PCB data for many sites are in terms of Aroclors, the commercial trade name for PCBs. PCB congener data is needed since Aroclor analysis does not detect all of the congeners (such as PCB 209), and degradation of the original congeners may have occurred.
2. Identify the direct and indirect pathways for PCBs to migrate from the site to the estuary.
3. Utilizing the Revised Universal Soil Loss Equation to determine soil losses from each site (USDA, 2009).
4. Evaluate possible remediation measures that could achieve the individual load allocation for the site. This evaluation should include measures that will reduce PCB concentrations in the soil, soil management practices that will reduce offsite migration of PCBs to the estuary or a combination of measures/practices.

This approach was applied by Bierman et al (2007) to 49 contaminated sites within the direct drainage area to the estuary to evaluate selected remediation measures needed to achieve Stage 1 TMDL allocations for contaminated sites. These measures included: 1) soil PCB cleanup alone (i.e., reduce PCB site concentrations), 2) soil management alone (reduce off-site migration by eliminating or reducing pathways to adjacent waterbodies), and 3) combinations of soil cleanup and soil management measures. This preliminary evaluation indicated that the most stringent soil management scenario evaluated (a combination of soil cleanup with vegetated buffer strips and retention basins) could achieve the TMDL load allocations at soil PCB cleanup concentrations within the ranges of current state cleanup objectives.

DRBC will work with federal and state agencies to implement this approach for sites that are currently being evaluated, sites where remedial measures are being developed, and sites that have completed their remedial actions through review of monitoring data collected following completion of the remedial actions.

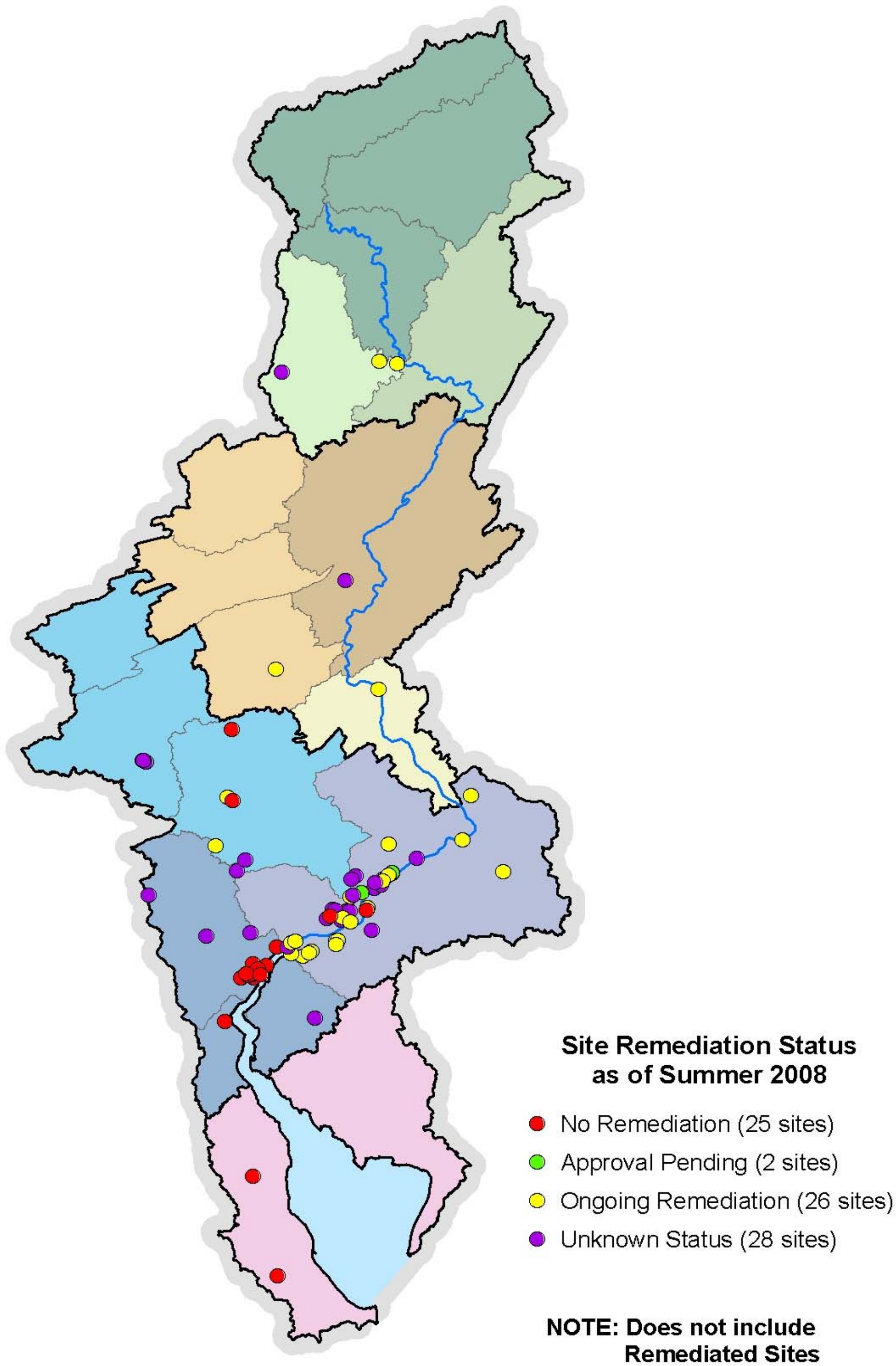


Figure 8: Contaminated sites in the Delaware River Basin with either ongoing PCB remediation or unknown status of PCB remediation, January 2007.

4.3 Air Sources

Air sources of PCBs present a unique problem in implementing the Stage 2 TMDLs. PCBs in the atmosphere exist in both gaseous and particulate phases, and contribute PCBs to the Delaware Estuary through several processes (Van Ry et al, 2002). The first of these processes is direct deposition via dry particle deposition and precipitation. The second and more important of these processes is the exchange between gaseous PCBs in the atmosphere and dissolved PCBs in the ambient waters of the estuary. Totten et al (2006) estimated that dry deposition, wet deposition and gaseous absorption deposition contribute about 0.6 kilograms, 1.8 kilograms and 6.5 kilograms per year, respectively, to the estuary. While the first two processes are essentially loadings of PCBs from the regional airshed to the estuary, the gaseous absorption deposition estimate, however, is a flux (i.e., the rate of mass flow across a unit area in mass/unit area/unit time) and is bidirectional. Thus depending on the concentrations of gaseous phase PCBs in the atmosphere and truly dissolved PCBs in estuarine waters, this flux may be from the air to the water (depositional flux) or from the water to the atmosphere (volatilization flux). Rowe et al (2007) reported that based upon data collected in 2002, there is currently net volatilization of PCBs from the estuarine waters to the atmosphere in all zones of the estuary. This observation was confirmed in model simulations of penta-PCBs performed by the DRBC which found that 44% of the loss of PCBs from Zones 2 through 5 was from volatilization (DRBC, 2006). As ambient levels of PCBs approach the revised water quality criterion of 16 pg/L, however, the direction of this flux will reverse if the gaseous phase PCB concentrations are not reduced. If fact, reduction in the gaseous air PCB concentrations are essential to the achievement of the water quality criterion.

In 2001, four active air sampling stations were established in New Jersey, Pennsylvania and Delaware in order to provide data on the spatial and temporal concentrations of PCBs in the estuary airshed. These stations were located at Northeast Philadelphia Airport; Swarthmore College, PA; Lums Pond State Park, DE and Alloways Creek, NJ (Totten et al, 2006) . These stations supplemented three sites maintained under the New Jersey Atmospheric Deposition Network (NJADN): Washington Crossing, NJ; Camden, NJ and Cape May, NJ. One objective of this expanded network was to determine the PCB congener distributions at all sites and establish whether atmospheric concentrations of PCBs exhibited a regional signal or reflected more local sources of PCBs (Figure 9). This expanded network was reduced to three sites (Lums Pond, DE; Camden, NJ and New Brunswick, NJ) early in 2003 with the objective of assessing long-term trands. Data collected in this active sampling network indicated that atmospheric concentrations of PCBs were elevated at the Camden and Swarthmore sites and appeared to represent background concentrations at the Lums Pond, Washington Crossing, Alloways Creek and Cape May sites. PCB congener distributions suggested that local sources were a more significant contributor to the observed PCB concentrations. In 2005, 32 sites in Camden County, NJ; Philadelphia County, PA and Delaware County, PA were selected for deployment of passive air samplers (Du et al, 2009). These samplers differ from the active samplers where 24 hour air samples are collected every 12 days since they employ a polyurethane foam disk encased in a sampler that is exposed for three months (Harner et al, 2004). The results of this study confirmed the localized nature of gaseous phase PCB concentrations and suggested that this passive technique can be useful in identifying local PCB sources (Figure 10).

Achieving reductions in PCB air concentrations will involve the identification of sources of PCBs to the estuary airshed. The Commission plans to continue active air sampling at the three sites in future years to evaluate the trend in atmospheric gas phase concentrations and particulate PCB concentrations in the estuary airshed. The Commission will also conduct passive air surveys if sufficient funding is available to isolate and identify sources. The Commission’s 2008 passive air survey at 45 sites from Trenton, NJ to the mouth of Delaware Bay is an example of the latter. This survey also involved the deployment of a number of samplers in Delaware County, PA to attempt to identify the source of the high concentrations of PCBs observed in the vicinity of Swarthmore and Chester.

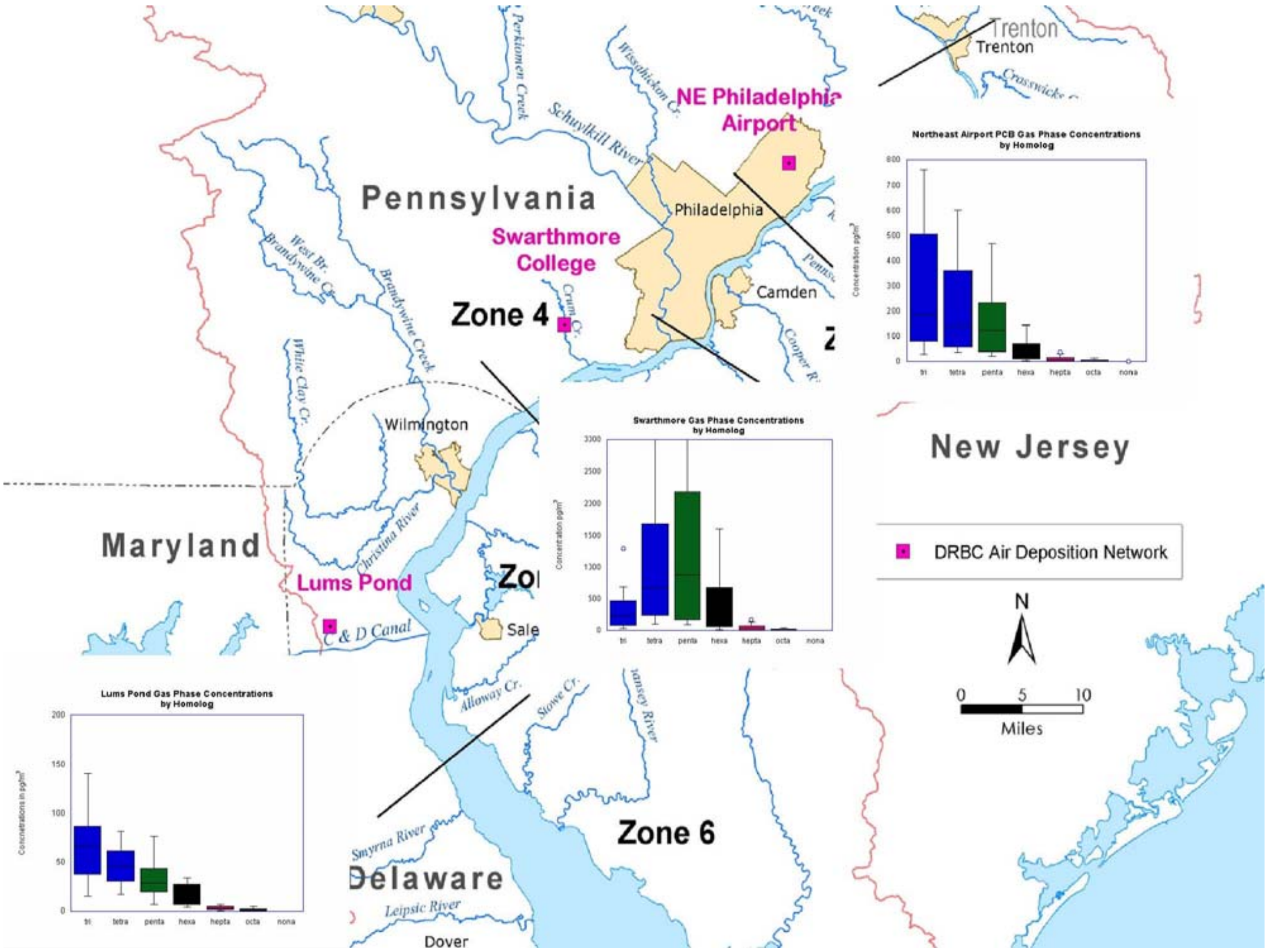


Figure 9: PCB homolog concentrations and distributions at three active air sampling sites, November 2001 to January 2003.

Some air sources may also be contributing PCBs to the estuary through direct discharges (NPDES discharges), indirect discharges to local sewage collection systems, or non-point source runoff. The requirement for pollutant minimization plans for NPDES sources typically results in an evaluation of air deposition as a source that is contributing to PCB concentrations in the wastewater. This type of evaluation has been conducted by a number of NPDES permittees and typically involves comparison of congener distributions observed in wastewater samples to congener distributions in the air samples collected nearest the facility or sewershed. As the PMP requirement is imposed in more NPDES permits as they are reissued, this type of an evaluation should become more common.

For those sources that are principally contributing PCBs to the estuary via the atmosphere, local and state authorities (e.g., statutes and ordinances) will be evaluated to determine if they can be used to reduce or eliminate these emissions. Furthermore, the Commission's water quality regulations at Section 4.30.9A. -

Pollutant Minimization Plans for Toxic Pollutants may also provide a mechanism for requiring entities that discharge or release a toxic pollutant to “prepare pollutant minimization plans (PMPs) to reduce or prevent releases of a toxic pollutant to Basin waters.” This would require, however, a determination by the Commission following public notice and hearing that the facility has an adverse impact on the water resources of the Basin.

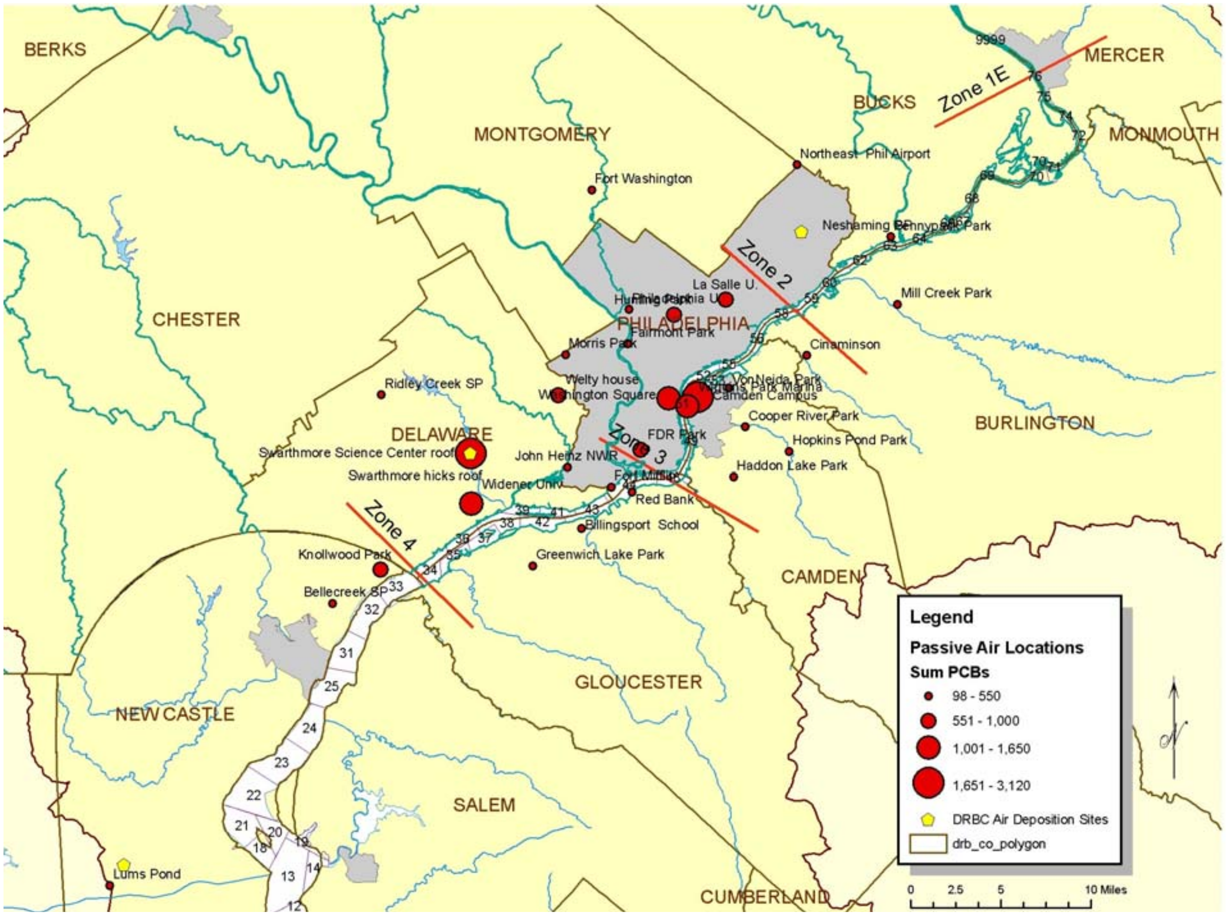


Figure 10: Gaseous PCB concentrations estimated from passive samplers deployed between April and July 2005 in urban areas near the Delaware River Estuary.

5. REPORTING PROGRESS IN ACHIEVING WATER QUALITY CRITERION

Essential to the success of this adaptive management approach to controlling PCBs is the evaluation and reporting of progress in attaining the applicable DRBC water quality criterion. As discussed in Section 2.2, the process of adaptive management proposed in this plan will continue until either the protected use is attained or the Commission concludes that the highest use attainable is not the protected use and modifies the designated uses and associated water quality criterion accordingly. Thus, the preparation of a progress report at periodic intervals is essential to continuing an adaptive management process to attain the water quality criterion for PCBs.

Under this plan, the Commission will prepare a report every 10 years describing the progress that has been made to reduce PCB loadings from all sources and achieve the water quality criterion. The first reporting period starts from the establishment of the Stage 1 PCBs by the U.S. EPA Regions II and III on December 15, 2003, and ends on December 15, 2013. The second period will end on December 15, 2023. A reporting period of 10 years was chosen to encompass the 5 year permit cycle that is typical of NPDES permits for discharges to Zones 2 through 6, and acknowledge the staggered effective dates of these permits.

The report will not only document the progress achieved in reducing PCB loadings from the various sources and the concentrations of PCBs in ambient water, sediment, airshed, and tissues of resident and anadromous fishes, but will provide data summaries that can be used to establish interim effluent ;imitations for NPDES sources and reduction goals for both point and non-point sources. In addition, loadings from various sources and ambient conditions at the end of each reporting period will be used in the numerical model to project the impact of the achieved reductions in the future. Preparation of the report will be the responsibility of the Commission staff in consultation with the Commission's Toxics Advisory Committee. Public meetings are planned to present the draft report and its findings, and solicit public comment.

5.1 Ambient Water, Sediment and Air Concentrations

Concentrations of PCBs in the water column, sediment and air in each water quality zone covered by the TMDLs will be reported. As discussed in Section 2.1, concentrations in all three of these media will respond more slowly to reductions in PCB loadings from point and non-point sources. The sediments and air are in flux with the water column such that dissolved PCBs equilibrate with gaseous PCBs in the estuary's airshed and also equilibrate with dissolved PCBs in the sediment pore water. PCBs associated with particulates also settle from the water column and are resuspended depending on current velocity of the estuary waters. As a result, PCB concentrations in the water column will lag behind reductions achieved from sources, but will still be an important measure of progress.

Surveys of the ambient water and sediments in Zones 2 through 6 are planned for 2012 to document the PCB concentrations at that time. Data obtained from these surveys can be compared to ambient water surveys conducted by the Commission in Zones 2 through 6 in 2002, 2003, 2006 and 2007. Figure 11 summarizes the results of the 2002 and 2003 ambient water surveys for the four PCB homologs that comprise the majority of PCBs found in fish tissue. Figure 12 summarizes the sediment concentrations in Zones 2 through 6 that were used in the Stage 1 TMDLs in 2003. Sediment surveys conducted in 2001 and 2008 by the Commission and partners such as the U.S. EPA and the Partnership for the Delaware Estuary are also available for comparison. Other sediment data are also available from probabilistic surveys conducted in the Delaware River and Bay as part of the U.S. EPA's National Coastal Assessment from 2000 to 2006.

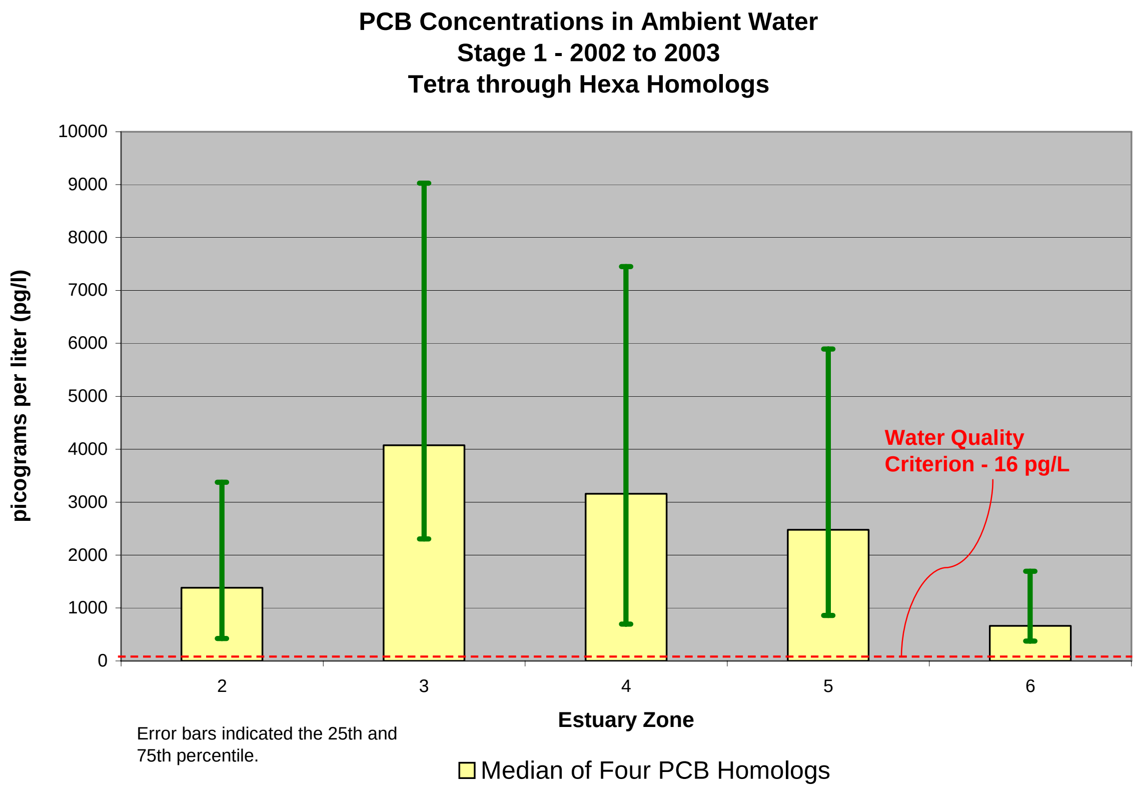


Figure 11: Ambient water concentrations of four PCB homologs (tetra-, penta-, hexa- and hepta-PCB) during surveys conducted in 2002 and 2003.

Air monitoring has been an essential component of the studies to support the PCB TMDLs since 2001. This monitoring is necessary since atmospheric concentrations of PCBs, particularly in the gaseous phase, significantly influence the ambient water concentrations in the estuary. PCBs in the gaseous phase are exchanged with the truly dissolved PCBs in the ambient estuarine water. The direction of this exchange or flux is determined by the gradient of the gas phase concentrations and the truly dissolved PCB concentrations. At the present time, concentrations of truly dissolved PCBs are high enough to result in the estuary waters being a source of PCBs to the atmosphere. It is expected to see the reversed effect, i.e., airshed will become a source of PCBs to the ambient water, as PCB concentrations in ambient water is continuously lowered through this adaptive management process. Reductions in sources of PCBs to the estuary airshed are therefore necessary if the ambient water quality criterion is to be achieved. Figure 13 compares the 2003 gas phase penta-PCB concentrations to the concentrations that would be in equilibrium with the ambient water concentrations at the criterion. As illustrated in the graph, gas phase penta-PCB concentrations are currently 10 to 100 times higher than the levels needed to reach equilibrium. The Commission in cooperation with Rutgers University currently operates three fixed air monitoring sites to track the long-term trends in the airshed concentrations of PCBs. The sites are located at New Brunswick, NJ, Camden, NJ and Lums Pond, DE. Samples for gaseous and particulate phase PCBs are collected every 12 to 24 days for analysis for PCB congeners. The Commission plans to

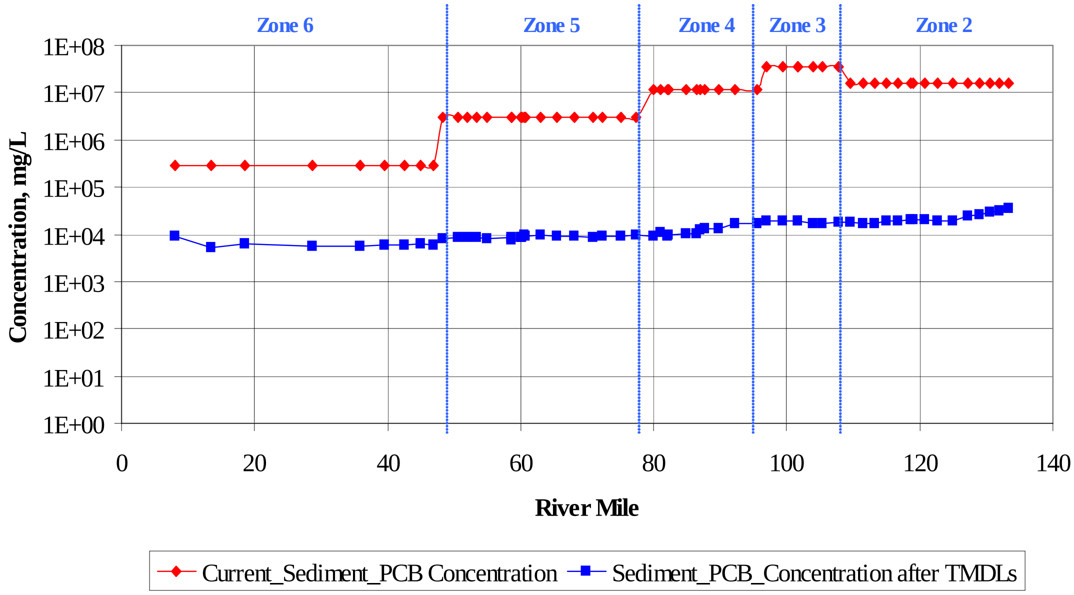


Figure 12: Comparison of current ambient sediment concentrations of penta-PCBs used in the Stage 1 TMDLs in 2003 to sediment concentrations that would be in equilibrium with penta-PCB water concentration when the water quality criterion is achieved. (Note that Y axis scale is logarithmic and concentration is on a volume basis)

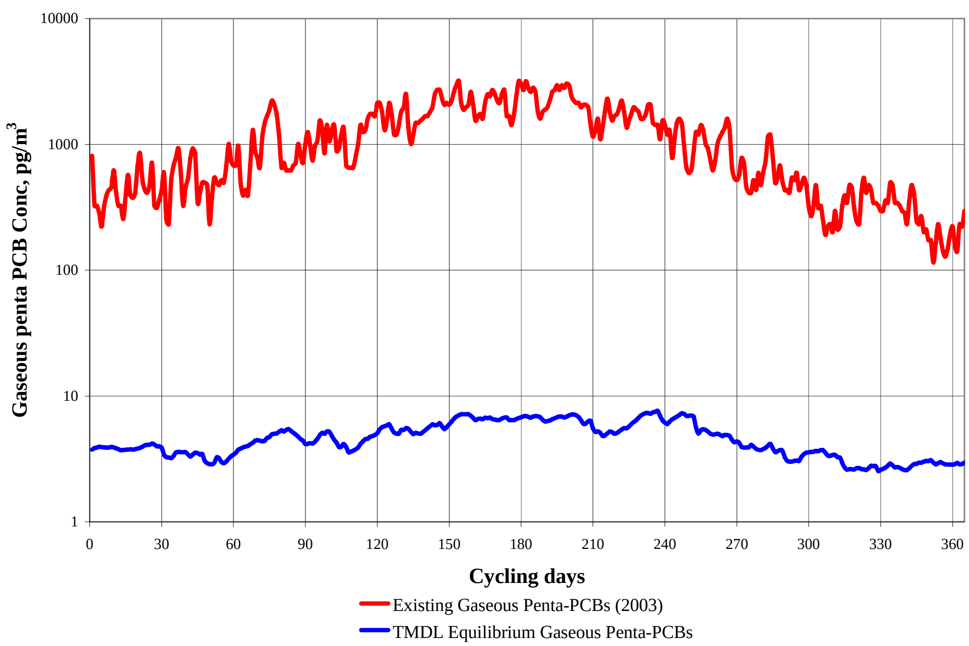


Figure 13: Comparison of current ambient gas phase air concentrations of penta-PCBs in Zone 3 used in the Stage 1 TMDLs in 2003 to gaseous air concentrations that would be in equilibrium with truly dissolved penta-PCB water concentration when the water quality criterion is achieved. (Note that Y axis scale is logarithmic)

continue this monitoring subject to the availability of funding to provide data to report progress in reducing atmospheric deposition and gaseous concentrations of PCBs.

5.2 Concentrations in Tissues of Resident and Anadromous Fish

Concentrations of PCBs in the tissues of resident and anadromous fish will be reported for each water quality zone covered by the TMDLs. The Commission has conducted yearly surveys for PCBs and other contaminants at five (5) sites located in Zones 2 through 5 from 2000 to 2007. At each site, 5 fish composite fillet samples were collected of a benthic species, channel catfish, and a pelagic species, white perch. From 2000 through 2003, samples were analyzed for 124 PCB congeners. From 2004 through 2007, all 209 PCB congeners were analyzed in the samples. Figure 14 presents the historical trend in the results of the sample collections of these two target species. Sample collection of these two target species is planned for 2012 at the five locations, and samples will also be collected at several locations in Zone 6 to document the PCB tissue concentrations at that time. Target species for the Zone 6 collections will be selected from species that have previously been monitored for PCBs. These species include white perch, striped bass and weakfish.

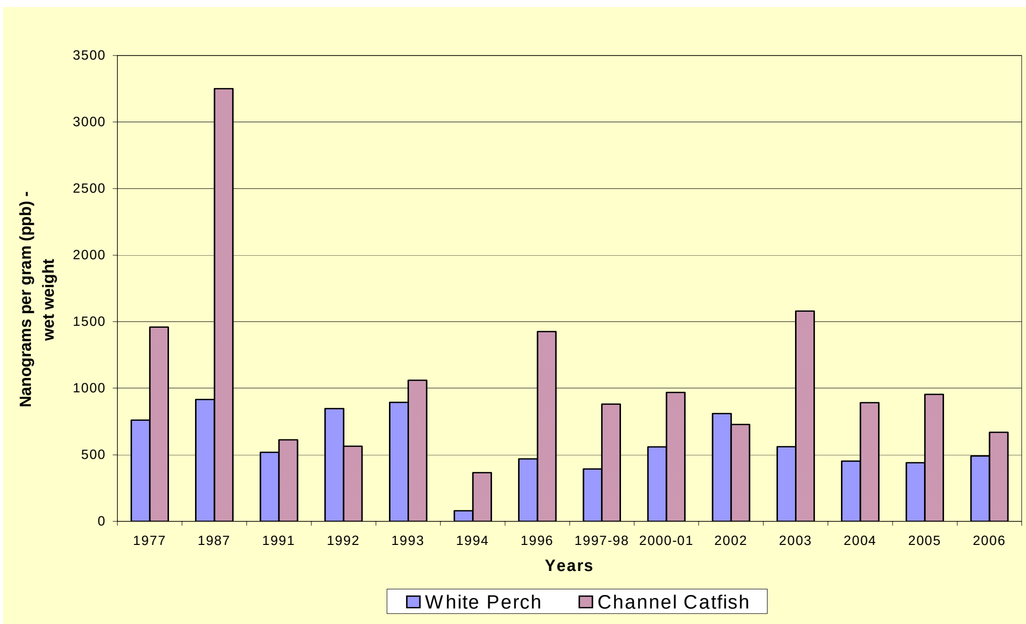


Figure 14: Historical trend in concentrations of Total PCBs in tissue collected from channel catfish and white perch at five locations in Zones 2 through 5.

5.3 Concentrations and Loadings in Point Source Discharges

The report will summarize the PCB concentrations and associated loadings reported by NPDES permittees during each reporting period for each point source discharge that has been assigned a WLA in the Stage 2 TMDLs. The amount of data available for each discharge will vary depending on the contribution of the discharge to the cumulative loadings of PCBs to the estuary (i.e., discharges contributing to the 99th percentile of the cumulative loading are typically required to monitor two times per year during the first reporting period), and whether the discharge is influenced by precipitation (i.e., monitoring is then required during both dry and wet weather periods). Statistical metrics including the mean, median, coefficient of variation (CV), standard deviation and 95% confidence interval of the median will be calculated from the available data on each discharge. As discussed in Section 3.2 and presented in Table 3, the statistical analysis of the available data will be used to establish the Interim Effluent Limitation for each discharge for future permitting decisions.

Tabular and graphical summaries will be presented to allow the assessment of the progress in reducing loadings from this source category. Summaries will include:

1. Trends in the loadings of PCBs from point source discharges by Zone.
2. Comparisons of the loadings from each discharge at the end of each reporting to the initial baseline loadings for the discharge that was determined for the Stage 1 TMDLs.
3. Comparisons of the loadings from each discharge at the end of each reporting period to the final WLA for the discharge.
4. Listings by Zone of the number and percentage of discharges that have attained their final wasteload allocations.

The point source categories of CSOs and MS4s will be reported as either individual discharges, or in the aggregate. Concentrations (either measured directly or estimated) and loadings for discharge events and for the historical hydrological conditions used in the PCB water quality model (February 1, 2002 to January 31, 2003; DRBC, 2003) will be reported. Similar to the traditional point source discharges, comparisons of the loadings from each discharge and/or discharge category at the end of each reporting period to the initial baseline loadings that was determined for the Stage 1 TMDLs, and trends by Zones will also be reported.

5.4 Concentrations and Loadings in Non-Point Sources

PCB concentrations and loadings in individual non-point sources, where available, and source categories during each reporting period will be reported. The degree to which loadings for individual sources are reported will depend on the source category, and the data available at the end of each reporting period. Each of the 31 tributaries included in the TMDL report (DRBC, 2003a) are likely to have more monitoring data than individual contaminated sites or air sources.

Concentrations (either measured directly or estimated) and loadings for continuous or intermittent release events and for the historical hydrological conditions used in the PCB water quality model (February 1, 2002 to January 31, 2003; DRBC, 2003) will be reported. Comparisons of the loadings from each source category and individual sources within each category, where available, at the close of each reporting period to the initial baseline loadings that was determined for the Stage 1 TMDLs, and trends by Zones will also be reported.

5.5 Prediction of Target Date to Achieve the PCB Water Quality Criterion

As discussed in Section 2.1, attainment of the revised water quality criterion of 16 pg/L will require a period of time much longer than the five year duration of a typical NPDES permit due to the hydrophobic nature of PCBs. This characteristic results in the partitioning of these chemicals into dissolved and particulate phases in the water column. Particulate PCBs will settle to the bottom of the water column at a rate that is dependent on the size of the particle, and accumulate in the sediments. PCBs are then contributed to the water column through either diffusion from the pore water into the water column, or through resuspension of the particulates. PCBs will continue to be supplied by the sediments until particulates without PCBs are contributed to the sediments from watershed sources and estuarine processes.

DRBC (2003b, 2006) has developed a water quality model for penta-PCBs that can be used to predict the ambient water column and sediment concentrations at any point in the future given PCB loadings from the various individual sources and source categories, sediment concentrations, and airshed concentrations. Figure 3 presents an example of the predicted water column concentrations in Zones 2 and 3 for the next 100 years following the termination of all current PCB loadings to the estuary. Similar model simulations will be conducted using the loadings and concentrations observed at the end of each reporting period to predict the ambient water and sediment concentrations if no further PCB reductions are achieved, and project a date when the attainment of the water quality criterion and the reporting of the protected use for each water quality management zone will be achieved based upon the rate of progress to date. These simulations will provide important information on the progress being achieved through adaptive implementation that cannot be ascertained through ambient water, fish tissue and sediment data collected at the end of each reporting period.

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Appendix A
Derivation of the Binomial Confidence Interval for the Median

(expansion on Rice 1995, pgs. 364-365)

Background

We are trying to estimate the median as well as the uncertainty around our estimate for the median. To do this, we are looking for a confidence interval around our estimate for the population median.

A standard and long-established approach uses the definition of the true population median as a value such that 50% of the data is greater than or equal to that value (MacKinnon 1964, Conover 1980, Gilbert 1987, Snedecor and Cochran 1989, Zar 1999). Likewise, the population median is also that value such that 50% of the data is less than or equal to that value (i.e., the cumulative probability is 0.5 on either side of the median). As a result, any randomly selected observation has a probability equal to 0.5 of being below the median, and the probability that exactly k of the n observations in any sample will be less than the median is just the binomial probability with p=0.5. As will be shown below, the confidence interval problem can thus be re-defined in terms of the probability that some number of observations falls below a true (but unknown) population median (a question of binomial probabilities), and similarly that some number of observations falls above the true population median (again binomial).

Derivation

The derivation of this statistical statement begins, in a way, with the solution. We seek two "order statistics" (i.e., particular ranks in a rank-ordered sample) to satisfy the following confidence interval statement:

$$\text{Prob}\ (X_{(k)} \leq M \leq X_{(n-(k-1))}) = 1 - \alpha \qquad (1)$$

where $X_{(k)}$ is the k^{th} rank-ordered value
M is the true (and unknown) population median
α is the Type I statistical error rate (traditionally set to 0.05)
n is the sample size, or number of observations

Equation (1) can be re-written as the complement, since the probability of an event occurring is (1- the probability that it will not occur):

$$\text{Prob}\ (X_{(k)} \leq M \leq X_{(n-(k-1))}) = 1\ -\ \text{Prob}\ (X_{(k)} > M \quad \textit{or} \quad X_{(n-(k-1))} < M) \qquad (2)$$

and because the two parts of this right-hand-side "*or*" statement are mutually exclusive, this can be re-written as:

$$\text{Prob}\ (X_{(k)} \leq M \leq X_{(n-(k-1))}) = 1\ -\ \text{Prob}\ (X_{(k)} > M)\ -\ \text{Prob}(X_{(n-(k-1))} < M) \qquad (3)$$

Now comes the clever parts where we re-define the random variable we are considering, and equate this with a binomial random variable. Although the order statistics, $X_{(k)}$, have their own distributions that depend on the original distribution of the parent random variables, we can by-pass any requirement for knowing that parent distribution by recognizing the following fact:

$$\text{Prob } (X_{(k)} > M) \;=\; \sum_{j=0}^{k-1} \text{Prob } (j \text{ observations are less than or equal to M}) \qquad (4)$$

since the event ($X_{(k)} > M$) could imply a series of events where between 0 and (k-1) observations fall at or below the true population median, M. In other words, less than (k-1) observations could fall at or below M and the event ($X_{(k)} > M$) is still true (e.g., all the observations, along with $X_{(k)}$, could be above M). This observation also holds for the other portion of equation (3):

$$\text{Prob } (X_{(n-(k-1))} < M) = \sum_{j=0}^{k-1} \text{Prob } (j \text{ observations are greater than or equal to M}) \qquad (5)$$

Equations (4) and (5) make the first step in recognizing how $X_{(k)}$ is a binomial variable by getting away from thinking of $X_{(k)}$ at all; now we are focused on how many observations fall below the true unknown population median (instead of $X_{(k)}$ itself).

We now recognize that the probability of any observation in a random sample falling below the true population median is a Bernoulli random variable with probability of success at p=0.5:

$$\text{Prob } (X_i \le M) = 0.5 \qquad \text{(simple definition of the Median; half the data are less than or equal to the median)} \qquad (6)$$

A Binomial random variable is simply defined as the sum of n independent and identically distributed Bernoulli trials, so we have:

$$Y \;=\; I(X_1 \le M) + I(X_2 \le M) + I(X_3 \le M) + \ldots + I(X_n \le M) \qquad (7)$$

where the Indicator variable (I) is defined as:

$$I(X_i \le M) \;\; \begin{aligned} &= 0 \;\; \text{if} \;\; (X_i > M) \\ &= 1 \;\; \text{if} \;\; (X_i \le M) \end{aligned} \qquad (8)$$

Equation (7) is a basic definition of a Binomial Random Variable, so we now have:

$$Y \sim \text{Bin } (n, p=0.5) \qquad (9)$$

where Y = the number of X_i values less than or equal to the median (actually a count now rather than the original continuous random variable, X; see equation (7) for mathematical version)

Equation (9) just means that Y is distributed as a Binomial random variable with n trials and probability of "success" of 0.5.

Returning now to equation (4), the right hand side of this equation:

$$\sum_{j=0}^{k-1} \text{Prob } (j \text{ observations are less than or equal to M})$$

is simply a statement of the cumulative distribution function of a Binomial random variable:

$$\text{CDF of Binomial R.V.} = F_Z(z) = \text{Prob } (Z \leq z) = \sum_{j=0}^{z} \binom{n}{j} \; p^j \; (1-p)^{n-j}$$

For our definition of the random variable Y, the CDF implied in equation (4) becomes:

$$\begin{aligned} \text{Prob } (X_{(k)} > M) &= \sum_{j=0}^{k-1} \text{Prob } (j \text{ observations are less than or equal to M}) \qquad (4) \\ &= \text{Prob } (Y \leq k-1) \text{ by equation (7)} \\ &= F_Y(k-1) \end{aligned}$$

therefore

$$\text{Prob } (X_{(k)} > M) = \sum_{j=0}^{k-1} \binom{n}{j} \; p^j \; (1-p)^{n-j} \qquad (10)$$

Now because we have p=0.5 for our random variable Y (see equations (6) and (9)), equation (10) simplifies substantially for us to:

$$\begin{aligned} \text{Prob } (X_{(k)} > M) &= \sum_{j=0}^{k-1} \binom{n}{j} \; 0.5^j \; (1-0.5)^{n-j} \\ &= 0.5^n \sum_{j=0}^{k-1} \binom{n}{j} \qquad (11) \end{aligned}$$

Since equation (11) holds true for both equation (4) and equation (5) by symmetry, our original probability statement (as re-worked in equation (3)) can now be re-stated as:

$$\begin{aligned} \text{Prob } (X_{(k)} \leq M \leq X_{(n-(k-1))}) &= 1 - 0.5^n \sum_{j=0}^{k-1} \binom{n}{j} - 0.5^n \sum_{j=0}^{k-1} \binom{n}{j} \\ &= 1 - 2 \bullet 0.5^n \sum_{j=0}^{k-1} \binom{n}{j} \qquad (12) \end{aligned}$$

This quantity can be determined relatively easily from numerical computation, but the second term in equation (12) is again our cumulative distribution function for a Binomial random variable with p=0.5, and statistical texts and software commonly give look-up tables for the CDF of the Binomial distribution. Thus, we can easily determine the coverage probability for the confidence interval of the median for various values of k. To use such tables, we re-state the central result:

$$\text{Prob}\ (X_{(k)} \leq M \leq X_{(n-(k-1))}) = 1\ -\ 2 \bullet 0.5^{n} \sum_{j=0}^{k-1} \binom{n}{j} \tag{12}$$

and recall that

$$0.5^{n} \sum_{j=0}^{k-1} \binom{n}{j}\ = \text{Prob}(Y \leq k\text{-}1)\ \text{ for } Y\text{\textasciitilde}\text{Bin}(n,\ 0.5)$$

In this pair of equations, it is important to note that, in selecting the k^{th} order statistic, $X_{(k)}$, for the lower confidence limit, the cumulative density that results is determined by looking up the cumulative probability to (k-1) rather than to (k) itself. This slight mismatch is the result of the re-definition of our problem in equation (4) from a probability statement about $X_{(k)}$ to a probability statement about the number of observations being less than the median (maximum of (k-1)).

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Appendix Table 1: List of permittees, discharge serial numbers (DSN) and corresponding monitoring frequencies

Serial No. for permittee	Serial No. for outfall	Facility Name	NPDES	DSN	ZONE	Lead Agency to Request Monitoring	Monitoring Frequency (per year) DRY	Monitoring Frequency (per year) WET
1	1	Hoeganaes Corp.	NJ0004375	001	2		1	1
2	2	Colorite Polymers	NJ0004391	002	2	NJDEP	1	1
2	3	Colorite Polymers	NJ0004391	003	2	NJDEP	1	0
3	4	PSEG-Mercer	NJ0004995	441C	2		1	1
3	5	PSEG-Mercer	NJ0004995	441E	2		1	0
4	6	PSEG-Burlington	NJ0005002	WTP	2		1	0
5	7	US Pipe & Foundry	NJ0005266	002	2		0	1
5	8	US Pipe & Foundry	NJ0005266	004	2		0	1
6	9	Trenton	NJ0020923	001	2	NJDEP	2	2
7	10	Riverton Borough	NJ0021610	001	2		1	0
8	11	Burlington Township	NJ0021709	001	2	NJDEP	1	0
9	12	Riverside Sewerage Authority	NJ0022519	001	2		2	0
10	13	Willingboro Municipal Utilities Authority	NJ0023361	001	2	*DRBC*	2	0
11	14	Delran Sewerage Authority	NJ0023507	001	2		2	0
12	15	Florence Township	NJ0023701	001	2	NJDEP	1	0
13	16	Cinnaminson Sewerage Authority	NJ0024007	001	2		1	1
14	17	Mt. Holly Municipal Utilities Authority	NJ0024015	001	2		1	0
15	18	City of Burlington	NJ0024660	001	2		2	0
16	19	Bordentown Sewerage Authority	NJ0024678	001	2		1	1
17	20	Mt. Laurel Municipal Utilities Authority	NJ0025178	001A	2		1	0
18	21	Hamilton Township	NJ0026301	001	2	*DRBC*	2	0
19	22	Beverly Sewerage Authority	NJ0027481	001	2		2	0
20	23	Rohm&Haas-Bristol	PA0012769	009	2	DRBC	1	0
20	24	Rohm&Haas-Bristol	PA0012769	SW9	2	DRBC	0	1
21	25	U.S. Steel	PA0013463	002	2	PADEP	2	2
21	26	U.S. Steel	PA0013463	103	2	PADEP	1	0
21	27	U.S. Steel	PA0013463	203	2	PADEP	1	1
22	28	Bristol Township	PA0026450	001	2	PADEP	2	2
23	29	Lower Bucks County Municipal Authority	PA0026468	001	2	PADEP	2	2
24	30	Morrisville WWTP	PA0026701	001	2	PADEP	2	2

Serial No. for permittee	Serial No. for outfall	Facility Name	NPDES	DSN	ZONE	Lead Agency to Request Monitoring	Monitoring Frequency (per year) DRY	Monitoring Frequency (per year) WET
25	31	Bristol Borough	PA0027294	001	2	PADEP	2	2
26	32	Waste Management Grows Landfill	PA0043818	001	2	PADEP	2	0
27	33	Brightsmith Finish LLC(MSC Pre Finish Metals)	PA0045021	001	2	PADEP	1	0
28	34	Exelon-Fairless	PA0057088	TBD	2	PADEP	1	1
29	35	Georgia Pacific	NJ0004669	001	3		1	1
30	36	Palmyra Borough	NJ0024449	001	3		1	0
31	37	Moorestown WWTP	NJ0024996	001	3	NJDEP	2	0
32	38	CCMUA	NJ0026182	001	3	DRBC	2	2
33	39	Riverfront Recycling and Aggregate LLC	NJ0169185	001	3		0	1
34	40	Exelon-Delaware	PA0011622	001	3	PADEP	0	1
34	41	Exelon-Delaware	PA0011622	004	3	PADEP	0	1
35	42	Rohm&Haas-Philadelphia	PA0012777	001	3	PADEP	0	2
35	43	Rohm&Haas-Philadelphia	PA0012777	007	3	PADEP	0	1
36	44	PWD-SE	PA0026662	001	3	PADEP	2	2
37	45	PWD-NE	PA0026689	001	3	PADEP	2	2
38	46	Dupont-Repauno	NJ0004219	001A	4	NJDEP	2	0
38	47	Dupont-Repauno	NJ0004219	007B	4	NJDEP	TBD	TBD
38	48	Dupont-Repauno	NJ0004219	010A	4	NJDEP	0	2
39	49	Air Products	NJ0004278	001	4	NJDEP	1	0
40	50	Valero Refining	NJ0005029	001	4	NJDEP	2	2
41	51	Solutia (Ferro)	NJ0005045	001	4	*DRBC*	2	0
42	52	Ausimont	NJ0005185	001A	4	NJDEP	1	0
42	53	Ausimont	NJ0005185	002A	4	NJDEP	0	1
43	54	Safety Kleen (Bridgeport Disposal)	NJ0005240	001A	4		1	0
43	55	Safety Kleen (Bridgeport Disposal)	NJ0005240	002A	4		0	1
44	56	Coastal Mart / Coastal Eagle Point Oil	NJ0005401	001A	4		1	0
44	57	Coastal Mart / Coastal Eagle Point Oil	NJ0005401	003A	4		0	1
45	58	BP Paulsboro	NJ0005584	002A	4		0	1
45	59	BP Paulsboro	NJ0005584	003A	4		1	0
46	60	Harrison Township-Mullica Hill	NJ0020532	001	4	NJDEP	1	0
47	61	Swedesboro	NJ0022021	001	4	NJDEP	1	0
48	62	GCUA	NJ0024686	001	4	DRBC	2	0

Serial No. for permittee	Serial No. for outfall	Facility Name	NPDES	DSN	ZONE	Lead Agency to Request Monitoring	Monitoring Frequency (per year) DRY	Monitoring Frequency (per year) WET
49	63	Logan Township	NJ0027545	001	4		1	1
50	64	Greenwich Township	NJ0030333	001	4	NJDEP	1	0
51	65	Colonial Pipeline (General Permit)	NJ0033952	001A	4		0	1
52	66	Chevron Texaco	NJ0064696	001	4		1	0
53	67	Sunoco - Marcus Hook	PA0011096	020	4	PADEP	0	1
54	68	Sunoco-GirardPoint	PA0011533	015	4	PADEP	1	1
55	69	Exelon-Schuylkill	PA0011657	001	4	PADEP	1	1
56	70	Sunoco-PointBreeze	PA0012629	002	4	PADEP	1	1
57	71	Tosco Refining L.P.	PA0012637	006	4	PADEP	0	1
57	72	Tosco Refining L.P.	PA0012637	007	4	PADEP	0	1
57	73	Tosco Refining L.P.	PA0012637	008	4	PADEP	0	1
57	74	Tosco Refining L.P.	PA0012637	201	4	PADEP	1	0
58	75	PQ Corporation	PA0013021	001	4	PADEP	2	2
58	76	PQ Corporation	PA0013021	004	4	PADEP	0	2
58	77	PQ Corporation	PA0013021	007	4	PADEP	0	2
59	78	Kimberly Clark	PA0013081	029	4	DRBC	0	1
60	79	Boeing	PA0013323	001	4	PADEP	1	1
60	80	Boeing	PA0013323	002	4	PADEP	0	1
60	81	Boeing	PA0013323	003	4	PADEP	0	1
60	82	Boeing	PA0013323	007	4	PADEP	0	1
60	83	Boeing	PA0013323	016	4	PADEP	0	1
61	84	Exelon-Eddystone	PA0013714	001	4	PADEP	0	1
61	85	Exelon-Eddystone	PA0013714	005	4	PADEP	0	2
61	86	Exelon-Eddystone	PA0013714	107	4	PADEP	1	0
62	87	PWD-SW	PA0026671	001	4	PADEP	2	2
63	88	DELCORA	PA0027103	001	4	PADEP	2	2
64	89	Tinicum Township	PA0028380	001	4	PADEP	2	2
65	90	AMTRAK Race St./Penn Coach	PA0050202	001	4	PADEP	0	2
66	91	Evonik Degussa Corporation	PA0051713	001	4	PADEP	1	0
67	92	Philadelphia Authority Of Industrial Dev.	PA0057479	DD2	4	PADEP	2	0
68	93	AKER Phila Ship Yard (Kvaerner)	PA0057690	012	4	PADEP	1	0
68	94	AKER Phila Ship Yard (Kvaerner)	PA0057690	019	4	PADEP	0	1

Serial No. for permittee	Serial No. for outfall	Facility Name	NPDES	DSN	ZONE	Lead Agency to Request Monitoring	Monitoring Frequency (per year) DRY	Monitoring Frequency (per year) WET
68	95	AKER Phila Ship Yard (Kvaerner)	PA0057690	021	4	PADEP	0	1
68	96	AKER Phila Ship Yard (Kvaerner)	PA0057690	047	4	PADEP	0	1
69	97	Philadelphia Authority Of Industrial Dev.	PA0058483	008	4	PADEP	2	0
70	98	PennShip Service LLC	PA0244431	DD3	4	PADEP	2	0
71	99	FPL Energy - Marcus Hook, L.P.	PA0244449	001	4	PADEP	1	0
72	100	Dupont-Edgemoor	DE0000051	001	5	DNREC	12	0
72	101	Dupont-Edgemoor	DE0000051	002	5	DNREC	0	1
72	102	Dupont-Edgemoor	DE0000051	003	5	DNREC	0	1
72	103	Dupont-Edgemoor	DE0000051	004	5	DNREC	0	1
72	104	Dupont-Edgemoor	DE0000051	005	5	DNREC	0	1
72	105	Dupont-Edgemoor	DE0000051	007	5	DNREC	0	1
72	106	Dupont-Edgemoor	DE0000051	008	5	DNREC	0	1
73	107	Motiva (Valero):DE City Refinery (DCR)	DE0000256	301	5	DNREC	1	0
73	108	Motiva (Valero):DE City Refinery (DCR)	DE0000256	101	5	DNREC	2	2
73	109	Motiva (Valero):DE City Refinery (DCR)	DE0000256	601	5	DNREC	1	0
74	110	Conectiv-Edgemoor	DE0000558	020	5	DNREC	0	1
74	111	Conectiv-Edgemoor	DE0000558	041	5	DNREC	0	1
75	112	Formosa Plastics	DE0000612	001	5	DNREC	1	0
76	113	General Chemical	DE0000655	001	5	TBD	TBD	TBD
77	114	Former Standard Chlorine Removal Site	DE0020001	002	5	EPA	0	2
77	115	Former Standard Chlorine Removal Site	DE0020001	003	5	EPA	0	2
78	116	City of Wilmington	DE0020320	001	5	DRBC	2	2
79	117	Port Penn STP (New Castle Co.)	DE0021539	001	5	DNREC	1	0
80	118	Delaware City STP (New Castle Co.)	DE0021555	001	5	DNREC	1	0
81	119	Premcor (Valero):DE. City Power Plant(DCPP)	DE0050601	013	5	DNREC	2	0
81	120	Premcor (Valero):DE. City Power Plant(DCPP)	DE0050601	016	5	DNREC	0	1
81	121	Premcor (Valero):DE. City Power Plant(DCPP)	DE0050601	036	5	DNREC	0	1
82	122	Occidental	DE0050911	001	5	DNREC	2	2
82	123	Occidental	DE0050911	002	5	DNREC	2	0
82	124	Occidental	DE0050911	003	5	DNREC	0	1
82	125	Occidental	DE0050911	004	5	DNREC	0	1
82	126	Occidental	DE0050911	006	5	DNREC	0	1

Serial No. for permittee	Serial No. for outfall	Facility Name	NPDES	DSN	ZONE	Lead Agency to Request Monitoring	Monitoring Frequency (per year) DRY	Monitoring Frequency (per year) WET
83	127	AMTRAK	DE0050962	002	5	DNREC	0	1
83	128	AMTRAK	DE0050962	006	5	DNREC	0	1
83	129	AMTRAK	DE0050962	007	5	DNREC/DRBC	0	1
84	130	CitiSteel	DE0051021	TBD	5	DRBC/DNREC	TBD	TBD
85	131	Geon Company (Pedricktown) Polyone	NJ0004286	001	5	NJDEP	1	0
85	132	Geon Company (Pedricktown) Polyone	NJ0004286	003	5	NJDEP	0	1
86	133	Dupont-ChamberWorks	NJ0005100	001A	5	DRBC	2	0
86	134	Dupont-ChamberWorks	NJ0005100	662A	5	DRBC	2	0
87	135	Conectiv-Deepwater	NJ0005363	002	5	NJDEP	0	1
87	136	Conectiv-Deepwater	NJ0005363	005	5	NJDEP	0	1
87	137	Conectiv-Deepwater	NJ0005363	017	5	NJDEP	0	1
88	138	PSEG-Salem	NJ0005622	489	5		1	1
88	139	PSEG-Salem	NJ0005622	48C	5		1	0
89	140	Pennsville Sewerage Authority	NJ0021598	001	5		2	0
90	141	Carney's Point	NJ0021601	001	5		1	0
91	142	Penns Grove Sewer Authority	NJ0024023	001	5		1	0
92	143	City of Salem	NJ0024856	001	5		1	0
93	144	PSEG-HopeCreek	NJ0025411	461C	5	NJDEP	1	1
93	145	PSEG-HopeCreek	NJ0025411	462B	5	NJDEP	1	0
94	146	Harrington STP	DE0020036	001	6	DRBC/DNREC	2	0
95	147	Kent County STP	DE0020338	001	6	DRBC/DNREC	2	0
96	148	City of Dover, McKee Run	DE0050466	001	6	DNREC	0	1
97	149	Glass Tubing Americas - Millville Tubing	NJ0004171	005A	6		1	0
98	150	Cumberland County UA (CCUA)	NJ0024651	001A	6	NJDEP	2	0
99	151	Millville City	NJ0029467	001A	6		1	0
100	152	Lower Alloways Creek - Canton Village	NJ0062201	001	6		1	0