

Rationale of Approval
Total Maximum Daily Loads
of Chlordane and Polychlorinated BiPhenyls
for the Allegheny River

I. Introduction

This document will set forth the Environmental Protection Agency's (EPA) rationale for approving the Total Maximum Daily Load (TMDL) of Chlordane and Polychlorinated Biphenyls (PCBs) for the Allegheny River submitted by the Pennsylvania Department of Environmental Protection (DEP) on March 15, 1999. Our rationale is based on information provided in the document which will be used to determine if the TMDL meets the following 8 regulatory conditions:

- 1) The TMDLs are designed to implement the applicable water quality standards.
- 2) The TMDLs include a total allowable load as well as individual waste load allocations and load allocations.
- 3) The TMDLs consider the impacts of background pollutant contributions.
- 4) The TMDLs consider critical environmental conditions.
- 5) The TMDLs consider seasonal environmental variations.
- 6) The TMDLs include a margin of safety.
- 7) The TMDLs have been subject to public participation.
- 8) There is reasonable assurance that the TMDLs can be met.

II. Background

The Allegheny River (Stream Code 42122)¹ was placed under a fish consumption advisory on June 26, 1986 based on data on carp and channel catfish which indicated that fish tissue samples exceeded the Food and Drug Administration's (FDA) Action Level of 0.3 mg/kg for chlordane and 2 parts per million (ppm) for PCBs. The "Do Not Eat" advisory has remained in place since 1986 based on data collected in cooperation with the Ohio River Valley Water Sanitation Commission (ORSANCO) and was expanded to include smallmouth and spotted bass. Based on this information, Pennsylvania listed this segment of the Allegheny River (9915) from Lock and Dam 3 (River Mile 14.5) to the mouth (River Mile 0.0) on the 1996 and 1998 Clean Water Act (CWA) Section 303(d) list of impaired waters. Chlordane and PCBs were identified as the causes of impairment. The CWA at Section 303(d) and its implementing regulations require that a TMDL must be developed for those waterbodies identified as impaired by the State where technology-based and other required controls did not provide for the attainment of water quality standards. The TMDL submitted by DEP is designed to address acceptable levels of chlordane and PCBs in the water column which will not cause bioaccumulation of chlordane and

¹State Water Plan Watershed 18-A on the 1996 CWA 303(d) list.

PCBs by aquatic organisms to levels which would present a human health consumption risk². Table 1 below is a summary of the PCB and Chlordane TMDLs.

Table 1, Chlordane and PCBs TMDL summary (lbs/day)

Parameter	TMDL ^a	WLA ^b	LA ^c	MOS
PCB	0.0022730	0.0000303	0.0020154	0.0002273
Chlordane	0.0284122	0	0.025571	0.0028412

^aThe TMDL was calculated by multiplying the segment harmonic mean flow times the human health water quality criterion for chlordane or PCB. See table 2 below.

^bDEP indicates that there are no known current point sources of chlordane in the Allegheny River basin.

^cDEP indicates that the load allocation for both PCB and chlordane is solely attributable to contaminated instream sediments.

Table 2, TMDL Calculation for PCB and Chlordane

Parameter	Segment Harmonic Mean Flow (cfs)	Human Health Water Quality Criterion (ug/l)	Conversion Factor	TMDL (lbs/day)
PCB	10,542	0.00004	0.00539	0.0022730
Chlordane	10,542	0.0005	0.00539	0.0284122

(Segment harmonic mean flow) x (Human health water quality criterion) x (conversion factor) = TMDL

III. Discussion of Regulatory Conditions

EPA finds that the TMDLs of chlordane and PCB for the Allegheny River meets the regulatory requirements of the Clean Water Act. Our approval is outlined according to the regulatory requirements listed below.

1) *The TMDLs are designed to implement the applicable water quality standards.*

Chlordane and PCBs have been classified as probable human carcinogens (B2)^A (*see endnotes*) and are also known Bioaccumulative Chemicals of Concern (BCC) which means that even at very low concentrations these chemicals have the propensity to accumulate in aquatic organisms to levels which could adversely affect human health if consumed. Pennsylvania has therefore identified the human health water quality criterion for chlordane of 0.0005 µg/l³ and PCB of 0.00004 µg/l³ as the basis of the TMDL. These criteria represent ambient pollutant

² Pennsylvania has designated a risk level of 10⁻⁶, which translates into an increased probability for an individual to get cancer of 1 in 1 million.

³ As listed in Title 25-Environmental Protection, Chapter 16-Water Quality Toxics Management Strategy-Statement of Policy. These numbers are consistent with the EPA recommended human health water quality criterion pursuant to Clean Water Act Section 304(a), revised to reflect new information from IRIS.

concentrations in the water column which are not likely to pose a significant risk of cancer to the exposed human population. More specifically, the human health criteria relies on an assessment of risks related to surface water exposure which includes exposure due to ingestion of water and contaminated fish and shellfish to determine acceptable ambient concentrations. The TMDL is calculated by multiplying the segment harmonic mean flow times the human health water quality criterion⁴. In the case of the Allegheny River chlordane and PCB TMDLs, using the human health criterion for chlordane and PCB will ensure, with an acceptable risk level, that aquatic organisms will not bioaccumulate chlordane and PCBs to levels which could adversely affect human health.

In order to identify the current concentration of chlordane and PCBs in the Allegheny River, Pennsylvania utilizes a back-calculation method to estimate the water column concentration from fish tissue samples. The method is listed below:

$$TC/BCF=WC \times 1000$$

where: TC=tissue concentration in mg/kg
 BCF⁵=EPA bioconcentration factor in l/kg
 WC=water column concentration in mg/l
 1000 is used to convert into µg/l

Using the average PCB fish tissue concentrations⁶ from species collected in the Allegheny River, an estimated PCB water column concentration of 0.02433 µg/l was calculated. The estimated chlordane water column concentration based on carp tissue samples of 0.30 ppm is 0.02128 µg/l. Both of these estimated instream concentrations exceed the human health criteria for chlordane and PCBs.

Table 3, Percent Reductions needed to achieve Chlordane and PCB TMDLs

Parameter	Existing Load	TMDL	Percent Reduction Needed
PCB	1.383 lbs/day	0.0022730 lbs/day	99.8%
Chlordane	1.209 lbs/day	0.0284122 lbs/day	97.6%

2) *The TMDLs include a total allowable load as well as individual waste load allocations and load allocations.*

In order to identify potential sources of chlordane, the DEP Southwest Field Office was

⁴See Section III, Part 4 for discussion of segment harmonic mean flow.

⁵ Ambient Water Quality Criteria for Chlordane (EPA 440/5-80-027, 1980) indicates a BCF of 14,100 and Ambient Water Quality Criteria for PCBs (EPA 440/5-80-068, 1980) indicates a BCF of 31,200.

⁶The estimated PCB water column concentration is an average of the back-calculated PCB water column concentrations from fish tissue levels of carp (1.32 ppm), channel catfish (0.812 ppm), and bass (0.145 ppm).

asked to provide information on any known or current sources of chlordane or PCBs. In addition, a search of the EPA Permit Compliance System (PCS) database was conducted to determine if any chlordane or PCB effluent limitations were imposed on any major permits. Pennsylvania found no known or existing sources of chlordane in the Allegheny River basin.

A. Wasteload Allocations

As stated above, Pennsylvania found no known historic or current sources of chlordane in the Allegheny River basin. However, one National Pollutant Discharge Elimination System (NPDES) permitted discharge of PCBs was identified in the basin. The Texas Eastern Transmission Corporation Delmont Compressor Station discharges treated groundwater to Beaver Run, a tributary of the Kiskiminetus River which flows into the Allegheny River. The NPDES permit (PA0216607) was issued as part of a separate settlement between Pennsylvania and Texas Eastern Transmission Corporation. The actual discharge point flows into Beaver Run approximately 5 miles upstream of the Beaver Run Reservoir. The stream then flows from the reservoir 8.8 miles to the Kiskiminetus River and eventually into the Allegheny River.

Discharge Monitoring Reports (DMRs) for this facility show an average effluent flow of 0.0056247 cubic feet per second (cfs) and PCB concentrations of less than 0.5 µg/l. Pennsylvania determined the wasteload allocation by setting the discharge concentration equal to the permitted discharge limitation of 1µg/l and multiplying this times the average flow of 0.0056247 cfs. Table 4 below is a summary of the PCB wasteload allocation.

Table 4, Summary of PCB Wasteload Allocation.

Parameter	Wasteload Allocation
PCBs	0.0000303 lbs/day

B. Load Allocations

The load allocation is the amount of pollutant that reaches the waterbody through nonpoint source contributions as well as any natural background in the waterbody itself. Chlordane is a man-made organochlorine compound and would not exist naturally in the environment. PCBs are synthetic, man-made oils used in electrical transformers and carbonless paper. As such, Pennsylvania indicates that natural background concentrations for chlordane and PCBs are zero.

While chlordane and PCBs could be introduced to a waterbody through nonpoint source runoff from contaminated sites or groundwater, Pennsylvania has stated that there are no known historic or current nonpoint sources of chlordane and PCBs in the basin. Therefore, Pennsylvania assumes that the nonpoint source contribution is zero.

Once in a waterbody, chlordane and PCBs become associated with solids and enter the sediments. Therefore the entire load allocation for chlordane and PCBs, minus an explicit margin of safety, are attributed to contaminated instream sediments in the Allegheny River.

Table 5 below is a summary of the load allocation.

Table 5, Load allocation summary

Parameter	Load Allocation ^a
PCB	0.0020154 lbs/day
Chlordane	0.025571 lbs/day

^aThe entire load allocation is attributed to contaminated instream sediment.

3) *The TMDLs consider the impacts of background pollutant contributions.*

This requirement is most applicable to naturally-occurring parameters. Chlordane and PCBs are man-made pollutants which are not expected to occur naturally in the environment. Therefore, no background pollutant contribution is expected.

4) *The TMDLs consider critical environmental conditions.*

EPA regulations at 40 CFR 130.7(c)(1) require TMDLs to take into account critical conditions for streamflow, loading, and water quality parameters. The intent is to ensure that the TMDL is protective of human health.

Critical conditions are those conditions which must be met in order to determine attainment of water quality standards⁷. In specifying critical conditions in a waterbody, an attempt is made to use a reasonable “worst-case” condition. For example, stream analysis often uses a low-flow (7Q10) design condition as critical because the ability of the waterbody to assimilate pollutants without exhibiting adverse impacts is at a minimum. Pennsylvania has determined the critical condition as the harmonic mean flow of Allegheny River. The TMDL was calculated by multiplying the human health water quality criterion times the segment harmonic mean flow⁸ for Allegheny River. The following excerpts were taken from the *Technical Support Document for Water Quality-based Toxics Control* (EPA 505/2-90-001, March 1991, p. 88) which supports use of the harmonic mean flow as the correct critical condition:

“The human health criteria for carcinogens are derived assuming lifetime exposure. The upper-bound risk is directly proportional to the lifetime arithmetic mean dose. The criteria thus apply to the ambient water concentrations averaged over a 70-year period.”

“The long-term harmonic mean flow is recommended as the design flow for carcinogens. The recommendation of long-term harmonic mean flow has been derived from the

⁷ According to the Guidance for Water Quality-based Decisions: The TMDL Process (EPA, 440/4-91-001, April 1991, pg 48).

⁸ Segment harmonic mean flow is determined according to the Pennsylvania Implementation Guidance-Design Stream Flow (391-2000-023, p.4).

definition of the human health criteria for carcinogenic pollutants. The adverse impact of carcinogenic pollutants is estimated in terms of human lifetime intakes.”

EPA believes that the use of harmonic mean flow as the critical condition is acceptable and consistent with EPA guidance and regulation.

5) The TMDLs consider seasonal environmental variations.

Seasonal variations involve changes in stream flow as result of hydrologic and climatological patterns. In the continental United States, seasonally high flow normally occurs during the colder period of winter and in early spring from snowmelt and spring rains, while seasonally low flow typically occurs during the warmer summer and early fall drought periods⁹. Use of the harmonic mean flow, which adequately represents the long-term mean dilution available when considering lifetime exposure, will effectively consider any variations due to seasonality.

6) The TMDLs include a margin of safety.

This requirement is intended to add a level of conservatism to the modeling process to account for any uncertainty. Margins of Safety may be implicit, built into the modeling process, or explicit, taken as percentage of the wasteload allocation, load allocation or TMDL. Pennsylvania calculated the MOS as 10% of the TMDLs for PCB and Chlordane or 0.0002273 lbs/day and 0.0028412 lbs/day, respectively.

Furthermore, an additional level of conservatism was added during calculation of the wasteload allocation. The TMDL wasteload allocation was determined assuming direct discharge to the Allegheny River. However, the discharge from the Texas Eastern site actually discharges to a tributary of a tributary of the Allegheny River which flows through a reservoir prior to confluence. The implied assumption is that the level of PCBs in Beaver Run will not exceed the wasteload allocation at the confluence with the Allegheny River and most likely will be less than the WLA.

7) The TMDLs have been subject to public participation.

Pennsylvania published a notice of availability for the initial PCB and Chlordane TMDLs for public review and comment in the Pennsylvania Bulletin, Volume 29, No. 4, on January 23, 1999. The public comment period extended from January 23, 1999 to February 23, 1999. A public meeting was also scheduled on February 11, 1999 at the DEP Southcentral Field Office. No members of the public or any group attended the public meeting.

Comments were received from the Specialty Steel Industry of Pennsylvania, the Chesapeake Bay Foundation, the Delaware River Keeper Network, and the U.S. Fish and

⁹ Section 2.3.3 of the Technical Guidance Manual for Developing Total Maximum Daily Loads, Book 2, Part 1 (EPA 823-B-97-002, 1997).

Wildlife Service. In general, EPA believes DEP has adequately responded to those organizations which submitted comments on the TMDLs.

8) *There is reasonable assurance that the TMDLs can be met.*

EPA agrees with DEP that natural attenuation is an appropriate action alternative to ensure that the TMDLs are met and water quality standards are achieved. This involves allowing natural processes such as burial and flushing of sediment during high flow events to decrease the instream sediment levels of chlordane. The alternative, mechanical or vacuum dredging, is not currently justified as a viable approach given the possible habitat destruction, resuspension of pollutants, and cost. In order to assess the progress made towards achieving the TMDL, Pennsylvania will continue to conduct fish tissue monitoring. EPA suggests that DEP increase the frequency of monitoring to provide better feedback on achieving the TMDL goal.

In addition, the DEP will continue to review the Discharge Monitoring Reports from the Texas Eastern Delmont discharge to ensure that the discharge complies with the TMDL WLA. Pennsylvania has also monitored fish tissue concentrations in Beaver Run Reservoir to determine the impact of the Texas Eastern site to aquatic life and human health. Fish tissue samples from largemouth bass, a species which is expected to accumulate PCBs due to its predation habits, showed PCB concentrations of less than 0.051 µg/L, which is less than the FDA Action Level. Pennsylvania should continue to monitor this site as well as the aquatic life upstream of the reservoir and downstream of the discharge to determine the impacts of the PCB discharge.

Endnotes

A. Hazard identification is a qualitative determination of how likely it is that a chemical will increase the incidence of cancer. It involves a judgement in the form of a weight-of-evidence classification of the likelihood that the chemical is a human carcinogen and includes the type of data (human, animal, supporting) used as the basis of the classification. This judgement is made independently of considerations of chemical potency.

Weight of evidence

Group A Human Carcinogen

Group B Probable Human Carcinogen

Group C Possible Human Carcinogen

Group D Not Classifiable

Group E Evidence of Noncarcinogenicity

Data

1 Human Data

2 Animal Data

3 Supporting Data (e.g., DNA damage, metabolism)