Rationale of Approval

Total Maximum Daily Load
of Chlordane for the Cheat 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 for the Cheat River submitted by the Pennsylvania Department of Environmental Protection (DEP) on March 3, 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 Cheat River (Stream Code 41885)[1] was placed under a fish consumption advisory on January 19, 1990 based on data collected which indicated that fish tissue samples from white bass exceeded the Food and Drug Administration's (FDA) Action Level of 0.3 mg/kg for chlordane. Continued sampling in 1991 and 1992 indicated that white bass still exhibited tissue levels in excess of the action level. Some recent data indicates that levels of chlordane in white bass are below the Action Level, however, consecutive samples are needed in order to lift the "Do Not Eat" advisory. Based on this information, Pennsylvania listed the segment of the Cheat River (9920) from the Cheat Lake Dam (River Mile 3.6) to the mouth (River mile 0) on the Clean Water Act (CWA) Section 303(d) list of impaired waters. Chlordane was identified as the cause of impairment. The CWA at Section 303(d) and its implementing regulations require a TMDL to 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 in the water column which will not cause bioaccumulation of chlordane by aquatic organisms to

[1] This segment of the Cheat River was mistakenly identified by PA DEP in State Water Plan Watershed 19-F and was not identified by a specific DEP stream code on the 1996 303(d) list. PA DEP correctly identified this segment as SWP 19-G and by stream code 41885 in the 1998 303(d) list. Completion of this TMDL satisfies PA DEP's commitment to establish a TMDL for the impaired segments identified on the 1996 and 1998 303(d) lists.

a level which would present a human health consumption risk[2]. Table 1 below is a summary of the Chlordane TMDL.

Table 1, Chlordane TMDL summary (lbs/day)

Parameter	TMDL[a]	WLA[b]	LA[c]	MOS
Chlordane	0.0026569	0	0.0023912	0.0002657

[a] The TMDL was calculated by multiplying the segment harmonic mean flow times the human health water quality criterion for chlordane. See Table 2 below.
[b] DEP indicates that there are no known current point sources of chlordane in the Cheat River basin
[c] DEP indicates that the load allocation is solely attributable to contaminated instream sediments

Table 2, TMDL Calculation for Chlordane

Parameter	Segment Harmonic Mean Flow (cfs)	Human Health Water Quality Criterion (ug/l)	Conversion Factor	TMDL (lbs/day)
Chlordane	985.87	0.0005	0.00539	0.0026569
(Segment harmonic mean flow) x (Human health water quality criterion) x (conversion factor) = TMDL				

III. Discussion of Regulatory Conditions

EPA finds that the TMDL of chlordane for the Cheat River meets the regulatory requirements of the CWA. Our approval is outlined according to the regulatory requirements listed below.

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

Chlordane has been classified as a probable human carcinogen (B2)[A] *(see endnotes)* and is also a known Bioaccumulative Chemical 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/l[3] as the TMDL endpoint. This criterion represents ambient pollutant concentrations in the water column that is not likely to pose a significant risk of cancer to the exposed human population. More specifically, the human health criterion relies on an assessment of risks related to surface water exposure which includes exposure due to ingestion of water and contaminated fish and shellfish. The TMDL is calculated by multiplying the segment harmonic mean flow times the human

[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. This number is consistent with the EPA recommended human health water quality criterion pursuant to Clean Water Act Section 304(a) which was revised to reflect new information from the Integrated Risk Information System (IRIS).

health water quality criterion[4]. In the case of the Cheat River chlordane TMDL, using the human health criterion for chlordane will ensure, with an acceptable risk level, that aquatic organisms will not bioaccumulate chlordane to levels which could adversely affect human health.

In order to identify the current concentration of chlordane in the Cheat 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 x 1000(to convert into µg/l)

where: TC=tissue concentration in mg/kg
BCF[5]=EPA bioconcentration factor in l/kg
WC=water column concentration in mg/l

Using an average tissue concentration of 0.252 mg/kg from white bass collected in the Cheat River, an esitmated water column concentration of 0.01787 µg/l was calculated. This is 100 times greater than the human health water quality criterion.

Table 3, Percent Reduction Needed to Achieve TMDL

Parameter	Existing Load	TMDL	Percent Reduction Needed
Chlordane	0.095 lbs/day	0.0026569 lbs/day	97.2%

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 asked to provide information on any known or surrent sources of chlordane. In addition, a search of the EPA Permit Compliance System (PCS) database was conducted to determine if any chlordane effluent limitations were imposed on any major permits. The West Virginia Division of Environmental Protection was contacted to determine if there were any known chlordane sources in the West Virginia portion of the watershed. No known or existing sources of chlordane were identified in the Cheat River basin.

A. Wasteload Allocations

With no known point sources in the Cheat River basin and the ban on chlordane use in 1988, Pennsylvania has indicated a Wasteload Allocation of zero.

B. Load Allocations

[4] See Section III, Part 4 for a 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.

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. As such, Pennsylvania indicates that natural background concentrations are zero.

While chlordane 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 sources of chlordane in the basin. Therefore, Pennsylvania assumes that the nonpoint source contribution is zero.

Once in a waterbody, chlordane becomes associated with solids and enters the sediments. Therefore the entire load allocation, minus an explicit margin of safety, is attributed to contaminated instream sediments in Cheat River. Table 4 below is a summary of the load allocation.

Table 4, Load allocation summary

Parameter	**Load Allocation[1]**
Chlordane	0.0023912 lbs/day

[1] The 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-occuring parameters. Chlordane is a man-made organochlorine which is not expected to occur naturally in the environment. Therefore, no background pollutant contribution is expected.

4) The TMDLs considers 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 qulaity 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 standards[6]. In specifiying 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 the Cheat River. The TMDL was calculated by multiplying the human health water quality criterion times the segment harmonic

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

mean flow[7] for the Cheat River. The following language is taken from the *Technical Support Document for Water Quality-based Toxics Control* (EPA 505/2-90-001, March 1990, 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 reccommendation of long-term harmonic mean flow has been derived from the 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 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 periods[8]. 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 TMDL as 0.0002657 lbs/day.

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.

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

[8] 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).

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 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.

The proposed action alternative to ensure that the TMDL is met is the natural attenuation approach. 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.

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	Data
Group A Human Carcinogen	1 Human Data
Group B Probable Human Carcinogen	2 Animal Data
Group C Possible Human Carcinogen	3 Supporting Data (e.g., DNA damage, metabolism)
Group D Not Classifiable	
Group E Evidence of Noncarcinogenicity	