UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029
3/20/2001

Mr. Robert Hoyt
Assistant Secretary
Maryland Department of the Environment
2500 Broening Highway
Baltimore, Maryland 21224

Dear Mr. Hoyt:

The Environmental Protection Agency (EPA) Region III, has reviewed the report "Total Maximum Daily Load (TMDL) Documentation for Chlordane in Lake Roland" which was submitted by the Maryland Department of the Environment (MDE) for final agency review on November 9, 2000. Pursuant to 40 CFR Part 130.7(d), EPA is approving the Lake Roland TMDL.

It is the EPA's understanding that fish tissue collection and analysis for chlordane is either underway or will begin shortly and this data will be shared with EPA and U.S. Fish and Wildlife Service. If this future fish tissue data collection does not show a declining trend for chlordane, EPA would expect the state to conduct a source assessment for chlordane, and if this assessment indicates that the TMDL needs revision, the state will need to address this issue.

The definition of Load Allocation (LA) at 40 CFR Section 130.2 states, in part, that "Load allocations are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading." Further, a wasteload allocation (WLA), according to 40 CFR Section 130.2(h), is "The portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality-based effluent limitation." In addition, a TMDL is defined at 40 CFR Section 130.2(i) as "The sum of the individual WLAs for point sources and LAs for nonpoint sources and natural background."

Thus, EPA has determined that the TMDL and technical report are consistent with the regulations and requirements of 40 CFR Section 130 (see enclosed Decision Rationale). Pursuant to 40 CFR Sections 130.6 and 130.7(d)(2), the TMDL and the supporting documentation, should be incorporated into Maryland's's current water quality management plan.

If you have any questions or concerns, please contact Tom Henry at 215 814-5752.

Sincerely,

/S/

Rebecca Hanmer, Director
Water Protection Division

Enclosure

Decision Rationale

Total Maximum Daily Load
Documentation for Chlordane in Lake Roland

I. Introduction

This document sets forth the U.S. Environmental Protection Agency's (EPA) Decision Rationale for approving the Total Maximum Daily Load (TMDL) for Chlordane in Lake Roland submitted by the Maryland Department of the Environment (MDE) on November 9, 2000. The decision rationale is based on information provided in the TMDL document to determine if the TMDL meets the following eight regulatory requirements:

1. The TMDLs are designed to implement 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 contribution.
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 and Summary

Lake Roland is a 100-acre impoundment lake in the middle portion of Jones Falls, which is a tributary to the Patapsco River. Two smaller tributaries, Roland Run and Towson Run, also feed the lake. Lake Roland lies in the Patapsco/Back River Basin within the Jones Falls watershed (Maryland Eight-Digit Watershed Code: 02-13-09-04). The Jones Falls watershed lies within the Piedmont Plateau geological formation and occupies 37,132 non-water acres. Land use in this watershed is primarily urban with a mix of residential and commercial uses. The Jones Falls area was a major industrial textile center in the 18th century. Mills along the river manufactured as much as 80 percent of the cotton used for the sails of merchant marine clipper ships importing and exporting goods. The former mills are now occupied by various other businesses.

Lake Roland was placed on Maryland's 1996 303(d) list of water quality limited segments (WQLS) for chlordane; the lake was listed based exclusively on fish tissue sample data collected by the Office of Environmental Programs (OEP) in 1983 and 1984. The Baltimore City Department of Water and Wastewater requested that OEP test the fish in Lake Roland in

1983, after results from surveys by Maryland's fish tissue monitoring program indicated a potential for problems in selected urban areas.

Chlordane concentrations in composite samples collected from Lake Roland in 1983 were found to exceed the U.S. Food and Drug Administration (USFDA) action level for chlordane (0.3 milligrams per kilogram [mg/kg]). In 1984, a more intensive survey of Lake Roland led to a fish consumption advisory for carp (*Cyprinus carpio*) and black crappie (*Pomoxis nigromaculatus*). As a result of chlordane concentrations that exceeded the action level, the waterbody was considered to be impaired.

Lake Roland's WQLS designation is based on violations of the use designation for the waterbody and the narrative standard for toxic substances in Maryland's regulations. Specifically, Lake Roland is designated as a Use I water. The Code of Maryland Regulations (COMAR) Title 26.08.02.01 B (2) (a), requires that all Use I waters of the state "shall be protected for the basic uses of water contact recreation, fish, other aquatic life, wildlife, and water supply." COMAR 26.08.02.01 C states that waters of the state "may not be polluted by . . . high temperature; toxic, corrosive or other deleterious substances attributable to sewage; industrial wastes; or other waste in concentrations or combinations which . . . are harmful to human, animal, plant, or aquatic life." Because the fish inhabiting the waters cannot be consumed without restriction, Lake Roland does not comply with the Use I designation and is considered impaired.

Clean Water Act (CWA) Section 303(d) and its implementing regulations require that a TMDL be developed for waterbodies identified as impaired where technology-based and other required controls will not provide attainment of water quality standards. The TMDL submitted by the Maryland Department of the Environment (MDE) is designed to ensure an acceptable level of chlordane in the water column and sediments to prevent bioaccumulation of chlordane by aquatic organisms to a level that presents a human health risk[1]. Furthermore, this TMDL is designed to restore the designated uses[2] of Lake Roland and allow for the attainment of narrative water quality criteria; both criteria are not currently being met. Table 1 below summarizes the TMDL for chlordane in the Lake Roland.

[1] Maryland has designated a risk level of 10^{-5}, which translates into an increased probability for effects from cancer of 1 in 100,000.

[2] The Code of Maryland Regulations at Sections 26.08.02.02(B) and 26.08.02.07(A) lists the designated uses of Lake Roland as Use I - Water Contact Recreation and Protection of Aquatic Life.

Table 1, Chlordane TMDL summary (in ug/l)

Parameter	TMDL	WLA[a]	LA[b]	MOS[c]
Chlordane	0.00059	0	0.00059	implicit

[a] Maryland states that there are no significant point sources of chlordane in Lake Roland.

[b] Maryland states that there are no overland runoff sources of chlordane to the Lake Roland watershed; the entire TMDL is allocated to in-lake sediments.

[c] Maryland utilizes a numeric endpoint of 0.00059ug/l for chlordane, which is more stringent than EPA's CWA Section 304(a) recommended human health water quality criterion of 0.0022ug/l and results in an implicit margin of safety.

EPA notes that the TMDL of 0.00059 ug/l is a concentration in the water column, as opposed to an actual mass load. This is acceptable because 40 CFR Part 130.2(i) states that "TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measure." Given the nature of the source and the type of waterbody, expressing the TMDL as a concentration is necessary (see discussion below under critical conditions).

III. Discussion of Regulatory Conditions

EPA finds that Maryland has provided sufficient information to meet all eight basic requirements for establishing a chlordane TMDL for Lake Roland. This approval is outlined according to the regulatory requirements listed below.

1. The TMDL is designed to implement the applicable water quality standards.

Maryland does not currently have a numeric water quality criterion for chlordane. Therefore, Maryland has interpreted its General Water Quality Criteria[3] to establish a numerical endpoint of 0.00059 ug/l of chlordane for the TMDL, so that designated uses of Lake Roland will be restored. In addition, this endpoint will comply with the applicable narrative water quality criteria and is more stringent than the recommended water quality criteria for chlordane (0.0022 ug/l), pursuant to CWA Section 304(a). The value of 0.00059 ug/l used by Maryland represents the previous CWA Section 304(a) recommendation before the value was reevaluated using information from the Integrated Risk Information System (IRIS) on February 7, 1998. EPA published the new 304(a) human health water quality criteria recommendation for chlordane of 0.0022 ug/l in the *Federal Register* Notice (Volume 63, Number 237) on December 10, 1998. Because the endpoint for this TMDL is more stringent than current recommended human health water quality criteria, EPA believes Maryland's interpretation of its narrative water quality standards is adequate and conservative.

[3] The Code of Maryland Regulations at Section 26.08.02.03B.

Chlordane[4] has been classified as a probable human carcinogen (B2)[A] *(see endnote)* and is also a known bioaccumulative chemical of concern (BCC). Chemicals in this category have the propensity, even at very low concentrations, to accumulate in aquatic organisms at levels that could adversely affect human health if consumed. As previously mentioned, Maryland has identified an endpoint of 0.00059 ug/l of chlordane as the basis of the TMDL. Under CWA Section 304(a), this water quality criterion recommendation represents the ambient pollutant concentration in the water column below which a significant risk of cancer to the exposed human population is not likely. More specifically, the human health criterion relies on an assessment of risks related to surface water exposure, including exposure due to ingestion of water and contaminated fish and shellfish. In addition, this water quality criterion or endpoint is more stringent than the freshwater criterion maximum concentration (acute) and the criterion continuous concentration (chronic). Thus, the endpoint chosen by Maryland will ensure that the TMDL adequately protects aquatic life from short-term, long-term, and bioaccumulative effects and protects human health from adverse effects due to consumption of potentially contaminated aquatic organisms and water.

2. *The TMDL includes a total allowable load as well as individual waste load allocations and load allocation.*

As previously mentioned, Maryland establishes a concentration of 0.00059 ug/l as the TMDL for chlordane. Due to Maryland's determination that sediment is the dominant source of chlordane in Lake Roland, the entire load is allocated to in situ sediments. Achieving a water column concentration of 0.00059 ug/l will prevent adverse effects to human health and aquatic life, including bioaccumulation.

Wasteload Allocations

Point source discharges exist within the watershed, however, none of the point sources are expected to contribute significant amounts of chlordane. Municipal point sources include Villa Julie and St. Timothy's School Waste Water Treatment Plants. If chlordane were to occur in municipal discharges, it would be through intermittent, illicit, and generally untraceable sources. Efforts to reduce any such contributions are being promoted by local governments that offer special disposal options for household hazardous chemical waste including spent or out-of-date pesticides. Local governments have offered these programs since the late 1980s and are continuing to provide local citizens with an environmentally acceptable means of disposal. Similar efforts have been extended to farmers to dispose of agricultural chemicals no longer suitable for use. Based on the previous discussion, MDE proposes a WLA of zero.

[4] Chlordane is broad spectrum insecticide of the group polycyclic chlorinated hydrocarbons called cyclodiene insecticides. Ambient Water Quality Criteria for Chlordane, 1980, EPA 440/5-80-027.

Load Allocations

The load allocation represents the amount of pollutant that reaches the waterbody through non-point source contributions, as well as any natural background levels in the waterbody itself. Chlordane is a man-made organochlorine compound and does not exist naturally in the environment. Therefore, no allocation of chlordane is made to natural background contributions.

Maryland expects that most chlordane loading ceased in 1988 with the end of authorized commercial use. However, stocks held by homeowners could be a continuing source, as well as erosion and transport of existing soils previously contaminated by chlordane. Data from an unpublished 1994 urban runoff study conducted by MDE suggest that the occurrence of chlordane is unpredictable in spatial and temporal scope and difficult to predict and control.

Once it enters a waterbody, chlordane will both rapidly adsorb to sediments and volatilize. However, most chlordane probably enters water as runoff from urban and agricultural soils and is adsorbed to particulates before entering a waterbody[5]. Chlordane adsorbs to sediments almost completely over a period of about 6 days[6]. Huang (1970)[7] found that chlordane volatilizes reasonably rapidly from water, perhaps indicating that volatilization kinetics may proceed faster than adsorption kinetics; nevertheless, monitoring data indicate that sediment concentrations of chlordane are much higher than the overlying water, suggesting that volatilization from water may not be as fast as predicted.[8]

Based on the available information, Maryland allocates the entire load to in situ sediments. Table 2 summarizes the load allocation.

Table 2, Load allocation summary (in ug/l)

Parameter	Load allocation[a]
Chlordane	0.00059

[a] The entire load allocation is attributed to in situ sediments.

3. The TMDL considers the impacts of background pollutant contributions.

---

[5] Toxicological Profile for Chlordane, Syracuse Research Corporation, Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, ATSDR/TP-89/06, December 1989.

[6] Oloffs PC, Albright LJ, Szeto SY. 1972. Fate and Behavior of five chlorinated hydrocarbons in three natural waters. Can J Microbiol 18:1393-1398.

[7] Huang JC. 1970. Fate of organic pesticides in the aquatic system. Eng Bull Purdue Univ Eng Ext Series, 449-457.

[8] EPA Graphical Exposure Modeling System (GEMS). CLOGP Computer Program, Version PC 1,2, Augus 1, 1986.

This requirement is most applicable to naturally-occurring parameters. Chlordane is a man-made organochlorine pesticide which is not expected to occur naturally in the environment. Therefore, no background pollutant contribution is expected.

4. The TMDL 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 quality parameters. The intent is to ensure that the TMDL is protective of human health.

Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards.[9] In specifying critical conditions in the waterbody, an attempt is made to use a reasonable "worst-case" scenario condition. Critical conditions are the combination of environmental factors (e.g., flow, temperature, etc.) that results in attaining and maintaining the water quality criterion and has an acceptably low frequency of occurrence. 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. Given the lack of flow and other considerations within the estuary itself, consideration of the "traditional" critical conditions is not applicable.

Critical conditions for Lake Roland occur during precipitations events which increases the delivery of sediments and pollutants into the waterbody. This increases the likelihood that chlordane contaminated sediments from urban and agricultural runoff will be transported into Lake Roland. Other critical conditions include environmental conditions which could facilitate the release of chlordane from bottom sediments into the water column. MDE appropriately considers critical environmental conditions by assigning a TMDL concentration of 0.00059ug/l, which is protective of both human health and aquatic life.

5. The TMDL considers seasonal environmental variations.

Seasonal variations involve changes in stream flow as a result of hydrologic and climatological patterns. In the continental United States, seasonal high flow normally occurs during the colder period of winter and in early spring as a result of snowmelt and spring rains; seasonal low flow typically occurs during the warmer summer and early fall drought periods.[10]

Similar to the discussion regarding critical conditions, consideration of seasonal variation

---

[9] EPA Memorandum regarding EPA Actions to Support High Quality TMDLs from Robert H. Wayland III, Director, Office of Wetlands, Oceans, and Watersheds to the Regional Water Management Division Directors, August 9, 1999.

[10] 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).

involves recognizing that precipitation events will increase the likelihood that chlordane contaminated sediments from nonpoint sources will reach Lake Roland. Again, MDE appropriately considers seasonal variations be assigning a TMDL concentration of 0.00059ug/l.

6. The TMDL includes a margin of safety.

This requirement is intended to add a level of conservatism to the modeling process to account for any uncertainty. Maryland uses an implicit margin of safety by establishing an endpoint for the TMDL of 0.00059 ug/l. This endpoint is more stringent than the current CWA Section 304(a) human health water quality criterion of 0.0022 ug/l. EPA believes that this approach incorporates an acceptable margin of safety.

7. The TMDL has been subject to public participation.

Maryland provided an opportunity for public review and comment on the TMDL of chlordane for Lake Roland which extended from September 27, 2000 to October 27, 2000. One set of written comments were received by MDE. Those comments and responses were provided with the TMDL document.

8. There is reasonable assurance that the TMDL can be met.

There are essentially two options available to remedy the delivery of chlordane from in-situ estuary sediments in the Lake Roland. These two options are dredging and natural recovery/attenuation. Dredging could potentially cause resuspension of the contaminated sediments as well as cause possible habitat destruction. In addition, dredging is very costly and not regarded as a viable option at this point. The only other option, natural recovery/attenuation, appears to be proceeding in the form of declining sediment concentrations of chlordane as indicated by recent observed data from Eskin[11] (1996). Maryland is also proposing an iterative monitoring and evaluation process in the form of routine sediment and fish tissue monitoring, with occasional stream and water column samples. Maryland is proposing triennial monitoring of fish and surface sediments with yearly reevaluation regarding the sampling frequency.

A Phase II project of the Clean Lakes Program for Lake Roland has been undertaken in an effort to address problems, such as excess nutrients, sediments from development and street runoff, and poor fish habitat. These problems were addressed through management measures, including agricultural best management practices, sediment controls in the watershed, and a stream restoration project, respectively.

Since the late 1980s, local governments have promoted efforts to reduce pollutant

[11] Eskin R.A., Rowland, K.H., Alegre, D.Y. 1996. "Contaminants in Chesapeake Bay Sediments 1984-1991", Chesapeake Bay Program, CBP/TRS 145/96.

loading in Lake Roland by offering household hazardous chemical waste collection programs. Similar efforts have been extended to farmers for disposal of agricultural chemicals.

Endnote:

A. Hazard identification is a qualitative determination of how likely 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 for the classification. This judgement is made independently of any consideration of the chemical's potency. Classifications are as follows:

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