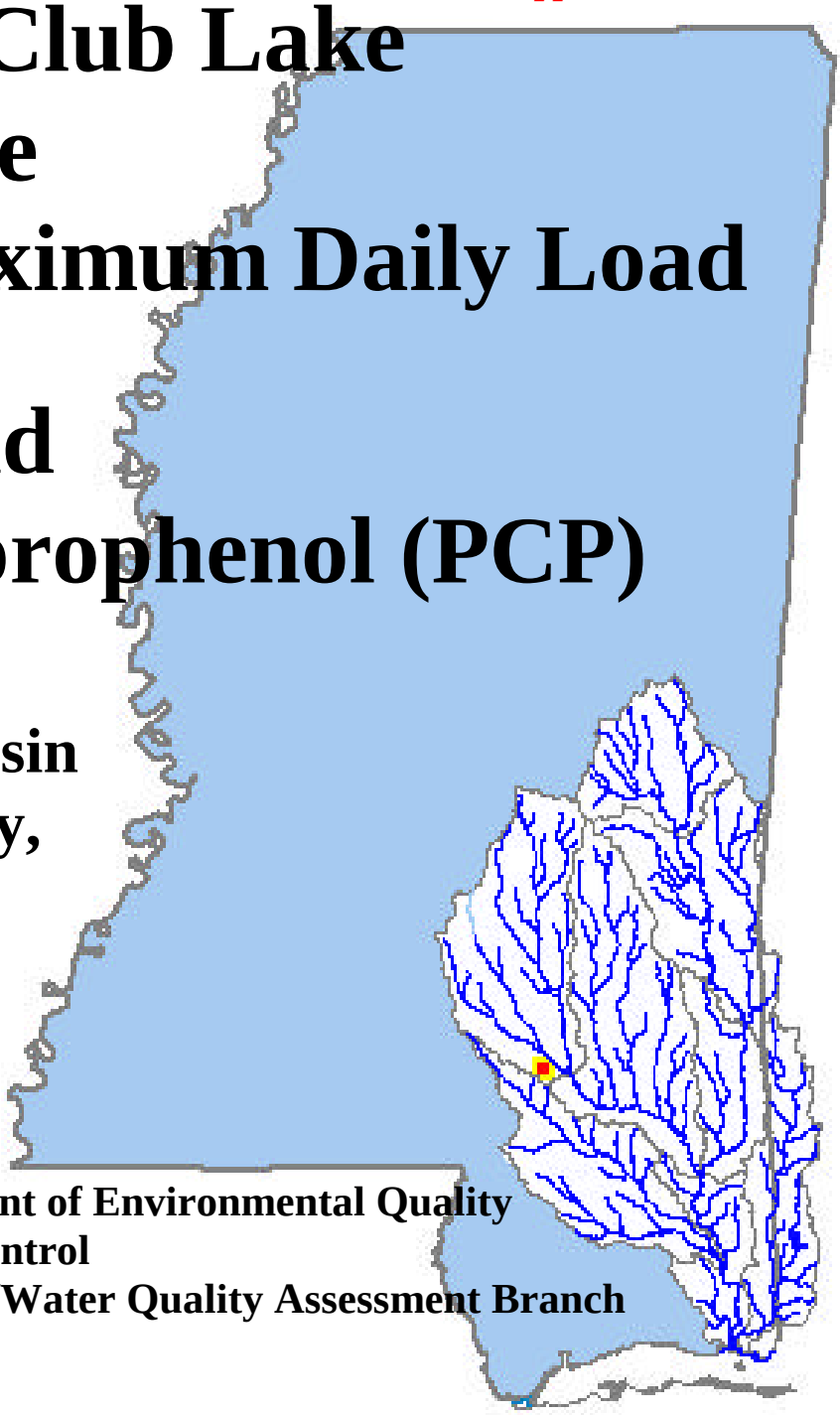
June 27, 2000
***Approved* TMDL**

Country Club Lake Phase One Total Maximum Daily Load

For

Dioxin and Pentachlorophenol (PCP)



Pascagoula Basin
Forrest County, Mississippi

Prepared By
Mississippi Department of Environmental Quality
Office of Pollution Control
TMDL/WLA Section/Water Quality Assessment Branch

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FOREWORD

This report has been prepared in accordance with the schedule contained within the federal consent decree dated December 22, 1998. *(Sierra Club v. Hankinson, No. 97-CV-3683 (N.D> Ga.)*) The report contains one or more Total Maximum Daily Loads (TMDLs) for waterbody segments found on Mississippi's 1996 Section 303(d) List of Impaired Waterbodies. Because of the accelerated schedule required by the consent decree, many of these TMDLs have been prepared out of sequence with the State's rotating basin approach. The segments addressed are comprised of monitored segments that have data indicating impairment. The implementation of the TMDLs contained herein will be prioritized within Mississippi's rotating basin approach.

The amount and quality of the data on which this report is based are limited. As additional information becomes available, the TMDLs may be updated. Such additional information may include water quality and quantity data, changes in pollutant loadings, or changes in landuse within the watershed. In some cases, additional water quality data may indicate that no impairment exists.

Prefixes for fractions and multiples of SI units

Fraction	Prefix	Symbol	Multiple	Prefix	Symbol
10^{-1}	deci	d	10	deka	da
10^{-2}	centi	c	10^{2}	hecto	h
10^{-3}	milli	m	10^{3}	kilo	k
10^{-6}	micro	μ	10^{6}	mega	M
10^{-9}	nano	n	10^{9}	giga	G
10^{-12}	pico	p	10^{12}	tera	T
10^{-15}	femto	f	10^{15}	peta	P
10^{-18}	atto	a	10^{18}	exa	E

Conversion Factors

To convert from	To	Multiply by	To Convert from	To	Multiply by
Acres	Sq. miles	0.0015625	Days	Seconds	86400
Cubic feet	Cu. Meter	0.028316847	Feet	Meters	0.3048
Cubic feet	Gallons	7.4805195	Gallons	Cu feet	0.133680555
Cubic feet	Liters	28.316847	Hectares	Acres	2.4710538
cfs	Gal/min	448.83117	Miles	Meters	1609.344
cfs	MGD	.6463168	Mg/l	ppm	1
Cubic meters	Gallons	264.17205	μg/l * cfs	Gm/day	2.45

CONTENTS

EXECUTIVE SUMMARY

Country Club Lake is located northwest of Hattiesburg in Forrest County near Highway 49. This 30-year old lake was constructed for the residents of Country Club Estates for neighborhood recreation. The two forks of Mineral Creek are the main tributaries of the lake. Runoff from the lake flows into the Bowie River north of Hattiesburg.

The lake is impaired with dioxin and pentachlorophenol (PCP). Davis Timber Company was originally located between the two forks of Mineral Creek. Part of the wood treatment process at the company involved soaking the timber with creosote. In the 1970s and 1980s, runoff from this creosote process contaminated the surface water, the sediment, and the groundwater at this industrial site. The contamination of the site also led to the contamination in Country Club Lake.

Several fish kills in Country Club Lake have been attributed to the PCP contamination from Davis Timber Company. Also, fish tissue samples have shown concentrations of dioxin elevated above safe levels for consumption. This industrial pollution problem will be a handled by MDEQ as a Superfund cleanup site. Also, in order to protect human health, fish consumption advisories have been placed on this waterbody.

The waterbody was listed as impaired on the 1996 Section 303(d) List of Impaired Waterbodies. This Phase One TMDL has been prepared to meet the requirements of the 1998 Consent Decree regarding TMDL work in Mississippi. The Superfund evaluation is only just beginning. Once monitoring has been completed, the Superfund process will establish the feasibility of the ultimate cleanup.

This TMDL has been developed as a phased TMDL project due to the uncertainty of the type of cleanup that will be recommended by the Superfund process. More data are required to make these decisions. The TMDL and the Superfund cleanup process will work in conjunction to highlight the problems associated with this pollution site, and they will help MDEQ and EPA reach the best solution for implementing the cleanup of this site.

Introduction

Section 303(d) of the Clean Water Act (CWA) and the Environmental Protection Agency's (EPA) Water Quality Planning and Management Regulations [Title 40 of the Code of Federal Regulation (40 CFR), Part 130] require the State to identify those waters within its boundaries not meeting water quality standards. Total maximum daily loads (TMDLs) for all pollutants violating or causing violation of applicable water quality standards are established for each identified water. Such loads are established at levels necessary to restore the applicable water quality standards with seasonal variations and a margin of safety. The TMDL process establishes the allowable loadings of pollutants or other quantifiable parameters for a waterbody, based on the relationship between pollution sources and in-stream water quality conditions, so that states can establish water-quality based controls to reduce pollution from both point and nonpoint sources and restore and maintain the quality of their water resources.

Country Club Lake was listed on the 1996 Section 303d List of Waterbodies for priority organics due to a fish consumption advisory. Country Club Lake is currently listed on the 1998 Section 303d List of Waterbodies for dioxin due to a fish consumption advisory. This was issued because fish tissue samples exceeded the fish tissue criterion of 5.0 ng/kg. Country Club Lake is also listed on the 303(d) list due to measured levels of pentachlorophenol (PCP) that exceed the State of Mississippi's aquatic life standard. There is documented evidence of fish kills in the lake due to elevated levels of PCP.

The Davis Timber Company Site, the source of the dioxin and PCP, was proposed for listing to the National Priorities List (NPL) on May 11, 2000, in the Federal Register, Proposed Rule #32 and Final Rule #28. This is under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and in accordance with the *Hazardous Ranking System, Final Rule*. The site was proposed for listing to the NPL because of investigations conducted while the facility was operating and after operations had ceased. The investigations indicated that hazardous substances associated with the wood treating process, PCP, chlorodibenzofurans, and dioxins, have caused fish kills and contaminated fisheries in Country Club Lake and its tributaries.

Problem Definition

Mississippi's 1998 Section 303(d) list identified Country Club Lake near Hattiesburg, MS as impaired for the use of fish consumption due to elevated levels of dioxin and PCP in fish tissue samples. The source of dioxin and PCP to Country Club Lake is from an abandoned wood preservative site that closed in the early 1990s and is currently being investigated by the Superfund program. Past operations at the site have contaminated soil, surface water, and groundwater. This Phase One TMDL will establish the concentration of both dioxin and PCP that can be transported into Country Club Lake from the Superfund site without exceeding the water quality standards in the lake.

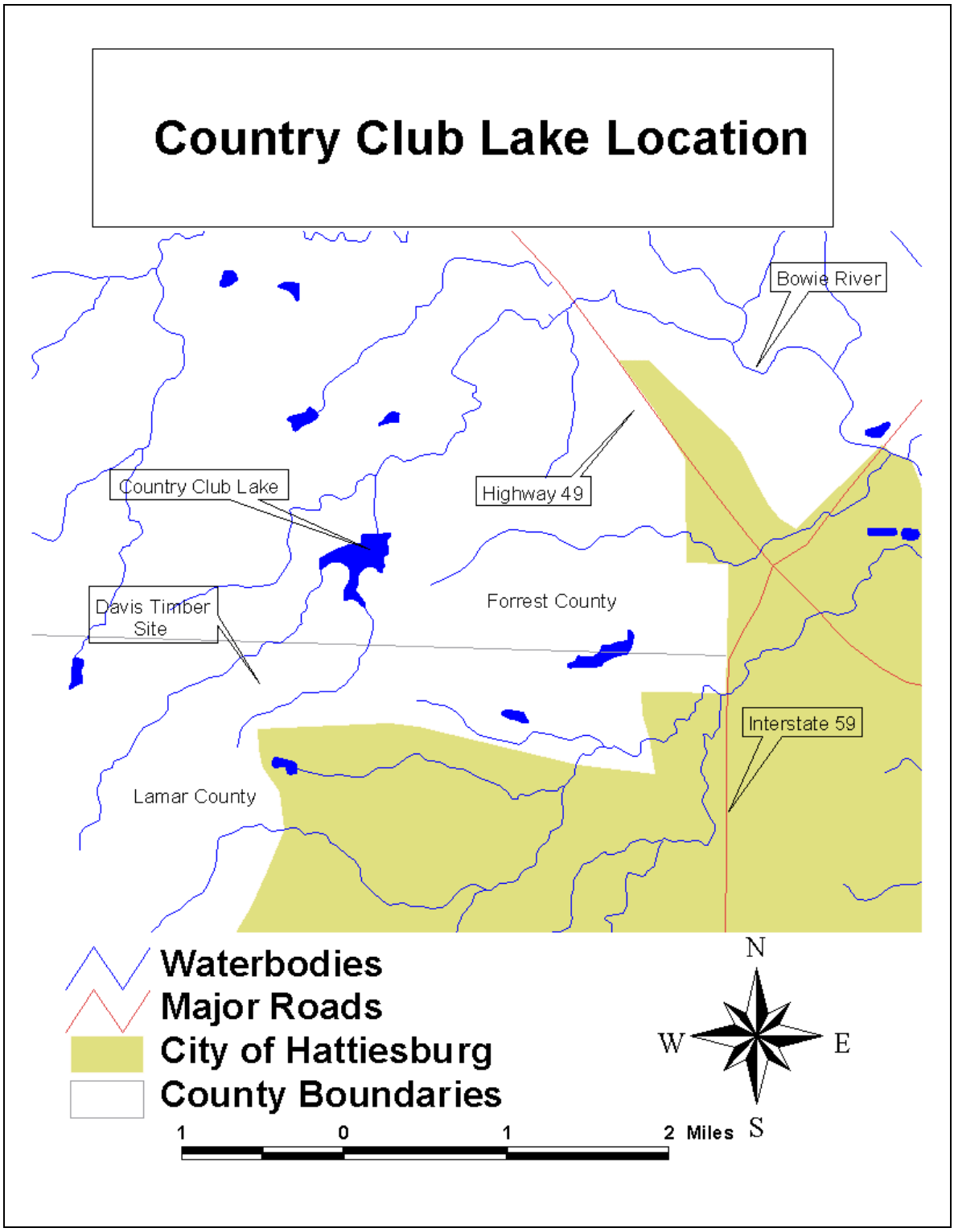
Country Club Lake Location
Bowie River
Highway 49
Country Club Lake
Davis Timber Site
Forrest County
Interstate 59
Lamar County
Waterbodies
Major Roads
City of Hattiesburg
County Boundaries
N
W
E
S
1 0 1 2 Miles

Figure 1

Target Identification

This Phase One TMDL is being proposed for Country Club Lake for dioxin in fish tissue because concentrations above safe consumption levels set by the State of Mississippi were detected. Also, concentrations of PCP in the water column exceed the state's water quality standard. The appropriate target concentrations for dioxin and PCP will be used to establish the end points for this Phase One TMDL.

The applicable numeric target for the Country Club Lake Phase One TMDL for dioxin (2,3,7,8-TCDD) is the Mississippi water quality standard of 1.0 pg/l. Given that the State has listed this waterbody for fish tissue contamination and such a determination was made on the toxic equivalency quotient (TEQ) approach, the appropriate target is 1.0 pg/l dioxin TEQ.

The applicable numeric criteria for the Country Club Lake TMDL for PCP are 2.1 µg/l (fresh water chronic aquatic life at pH=7), 3.32 µg/l (fresh water acute aquatic life at pH=7), and 30 µg/l (human health). Due to the human health concerns and the history of fish kills in the lake, the more protective criterion of 2.1µg/l standard is the appropriate target for this TMDL.

Site Description

Country Club Lake is a 46-acre freshwater impoundment in northwest Forrest County, Mississippi near Hattiesburg. The 30-year old lake was constructed near the headwaters of Mineral Creek as a recreational waterbody for the residents of Country Club Lake Estates, a residential development surrounding the lake. The landuse distribution is shown in Table 1 below. Soil type in the region is dominated by the Hattiesburg formation of the Miocene age, consisting of thickly bedded clays and silty clays. Primary tributaries to the reservoir are East Fork Mineral Creek and West Fork Mineral Creek. Outflow from the reservoir forms Mineral Creek, continuing downstream to a privately owned lake, and finally to the Bowie River.

Table 1 Country Club Lake Watershed Landuse Distribution

	Urban	Forest	Wetlands	Pasture	Cropland	Barren	Total
Acres	0	627	0	519	89	40	1275
Percent	0%	49%	0%	41%	7%	3%	

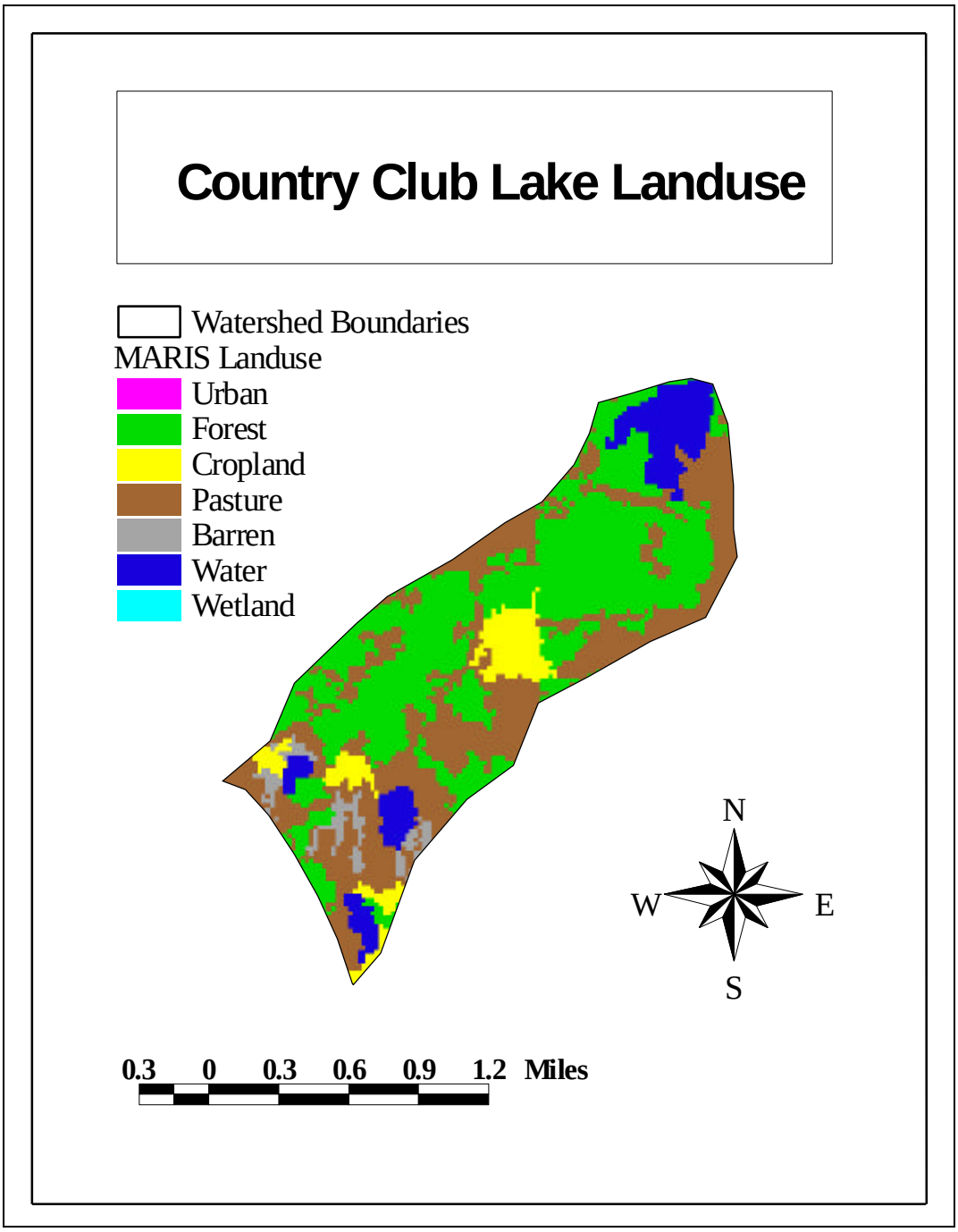
Country Club Lake Landuse
Watershed Boundaries
MARIS Landuse
Urban
Forest
Cropland
Pasture
Barren
Water
Wetland
N
W
E
S
0.3 0 0.3 0.6 0.9 1.2 Miles

Figure 2

Background

The primary source of PCP and its associated toxic contaminants is the Davis Timber Company site, a wood-processing site that used creosote as a wood preservative. This site is located approximately one mile upstream of Country Club Lake. The site encompasses portions of both the East and West Forks of Mineral Creek. The technical grade PCP used at this site from 1972 to 1987 is known to contain a number of impurities and contaminants including polychlorinated furans and polychlorinated dioxins. A wastewater holding pond designed as an evaporation pond on the Davis Timber site intermittently released wastewater into West Fork Mineral Creek. In addition, contamination in the East Fork Mineral Creek has been linked to the area around the site's treatment cylinders. A series of fish kills in Country Club Lake occurred in the 1970s and 1980s, and were directly related to the discharge of PCP from the Davis Timber site. Use of this chemical at this site ceased in 1987 by order of the Mississippi Commission on Natural Resources, but studies conducted in the late 1980s and early 1990s demonstrated contamination of the site, the streambeds and sediments downstream of the site, the local groundwater, as well as the sediments of Country Club Lake. There are no other known significant sources of PCP or dioxin in the area.

Available Monitoring Data

There are limited data available for the development of this Phase One TMDL. The lake and surrounding area have been monitored in years past. Most of the data used in the development of this TMDL are over 10 years old. Prior to more definitive clean up plans, new data are required. Because of the analytical detection limit for dioxin and PCP, water column concentration values were not quantified.

Data included sediment, fish tissue, surface water, and groundwater monitoring for PCP, polychlorinated furans, and dioxins. Much of these data are summarized in reference (ATSDR, 1992). In addition, data are summarized in spreadsheet form along with the TEQ calculations and are included in the TMDL administrative record at EPA Region 4. Lake morphometry was estimated based on data contained in the dams coverage associated with the BASINS database product. Additional morphometric data were obtained from the MDEQ Dam Safety program.

The TMDL Approach

The approach to the Phase One TMDL is to use the available, but limited, data to calculate a total load of dioxin and PCP that can be transported into the lake and achieve the appropriate water quality target for the lake. The flow through the lake (needed to determine the TMDL) was estimated from watershed information since no data were available. Also, data do not exist to determine the current overland loading of these contaminants into the Lake from the Superfund site. Therefore, the load reduction needed from the Superfund site cannot be determined at this time. It is assumed that all loading of these contaminants is due to the Superfund site, and existing loadings will be determined in the near future through the Superfund site investigation and the Phase Two TMDL. The Phase One TMDL established here may be used to determine the load reduction necessary to meet the appropriate water quality targets.

Existing water column concentration data indicate concentrations of dioxin and PCP to be below the analytical detection limit. However, water column concentrations below the detection limit can lead to fish tissue contamination above health-based levels. In the Phase One TMDL, existing sediment data are used to predict the water column concentration assuming sediment/water interactions and sorption/desorption of dioxin and PCP.

The TMDL established here is the allowable loading of dioxin and PCP from overland flow off the Superfund site that will attain the appropriate water quality targets. The Phase Two TMDL and the Superfund Program will determine the extent of the remediation needed to meet the water quality targets.

Numeric Targets and Sources - Model Development

A water quality model was developed by EPA Region 4 to link sediment contamination from both dioxin and PCP to the fish consumption advisories for Country Club Lake. The model determines the current impact of contaminated sediments on overlying water column concentrations for both dioxin and PCP; furthermore the model can be used to estimate the sediment concentrations needed to achieve the water quality standards for both dioxin and PCP.

The Water Quality Analysis Simulation Program--5 (WASP5), was used to determine water column concentrations for Country Club Lake. This model estimates and predicts water quality responses to natural phenomena and man-made pollution for various pollution management decisions. WASP5 is a dynamic compartment-modeling program for aquatic systems, including simulations for both the water column and the underlying benthos. The time-varying processes of advection, dispersion, point and diffuse mass loading, and boundary exchange are represented in the basic program.

Water quality processes are represented in special kinetic subroutines that are either chosen from a library or written by the user. WASP is structured to permit easy substitution of kinetic subroutines into the overall package to form problem-specific models. WASP5 comes with two such models -- TOXI5 for toxicants and EUTRO5 for conventional water quality.

WASP5 was used to estimate the impacts of loads of PCP and dioxin in the lake sediments and on the water quality and biota of the lake. WASP/TOXI is a time variable organic chemical fate and transport model that was developed to evaluate the long-term effects of organic chemicals that accumulate in sediments of lakes, rivers, and estuaries. WASP/TOXI considers the movement of sediment between the overlying water column and the benthos. The settling and re-suspension of sediments play an important role in the water column PCP and dioxin concentrations.

Flow Analysis

The flows used in the modeling analysis were estimated because there are no flow monitoring data for the Country Club Lake basin. The flow was estimated by comparing flow information from other streams in the immediate area of Country Club Lake. A basin area weighted average was used to approximate the mean daily flow of 2.0 cfs.

Sediment Settling/Re-suspension

A critical component in determining the impacts of contaminated sediments on the water quality of overlying water columns is the movement of sediments. Lakes are typically depositional (accumulate solids), and the sediment movement in the model is parameterized in such a way as to maintain a net depositional system. Several factors influence the settling and re-suspension of solids between the benthos and water column.

Currently, there is very little site-specific data that could be used to provide settling and re-suspension rates to the WASP model. Because of the lack of data, literature values were used to determine the settling rate of 1 meter/day. A mass balance equation was used to back calculate the re-suspension rate and still maintain a net depositional system.

Chemical Parameterization

The WASP/TOXI model was parameterized as given in Table 2. The chemical constants and parameters were obtained from the literature (Schnoor, 1987). Because of the lack of site specific data, the most conservative estimates of the constants found in the literature were used in the model. As part of the margin of safety in this TMDL no degradation processes (photolysis, volatilization, or hydrolysis) were considered in the modeling exercise. As the Superfund program continues to collect site-specific data this modeling effort will be re-visited in Phase Two.

Table 2 Octanol/Water Partition Coefficients used in WASP/TOXI

Chemical Constant	Dioxin	PCP
K_{OW}	6.84	5.01

Model Segmentation

Little site-specific morphometry data are available for County Club Lake. USGS Quad sheets and GIS coverage were used to approximate the dimensions of the lake. This information was then used to segment the lake into 11 segments (6 water column and 5 benthic sediment). Figure 3 depicts the segmentation scheme used in the WASP model.

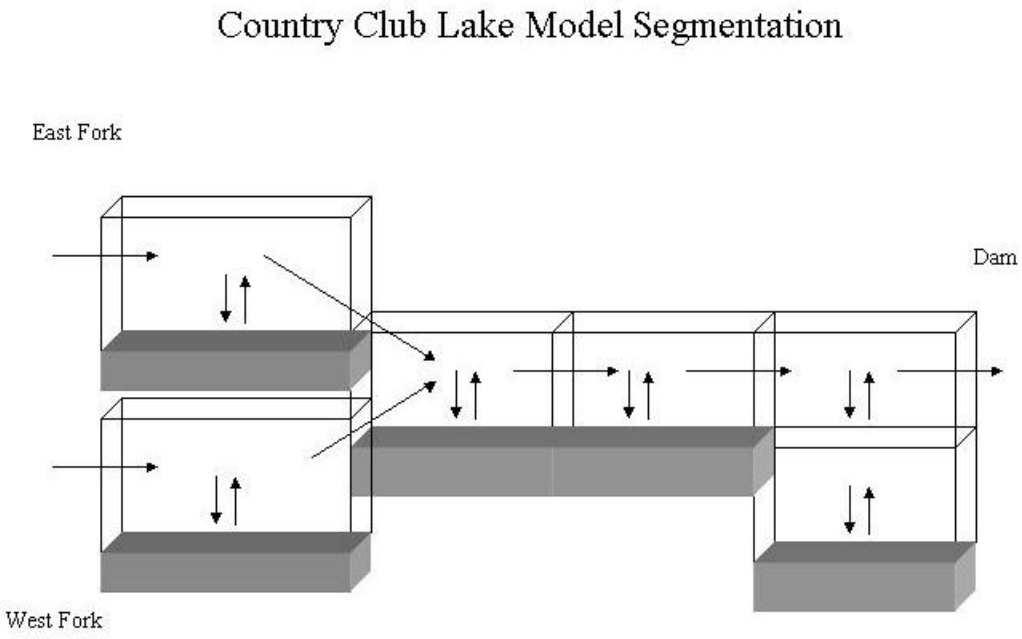

Figure 3

Initial Conditions

Because of the lack of data and full understanding of the sources of dioxin and PCP, this Phase One TMDL computer modeling effort only considers the chemical contamination that was found to be in the lake sediments. Table 3 lists the initial dioxin and PCP sediment concentrations used in this study. These values represent the maximum values measured since the closing of the Davis Timber site in 1987. By using these maximum values and not accounting for degradation of the pollutants, there is an implicit margin of safety in the calculations

Table 3 Initial Conditions for Sediments

Dioxin (pg/mg Sediment)	PCP (mg/kg Sediment)
313	1600

The WASP model estimated the overlying water column concentrations given the current sediment concentrations and estimates of flow and sediment re-suspension and settling. The model predicts that the current water column dioxin concentration is approximately 4 pg/l, which is four times the Mississippi criterion. The model also predicts that the current water column PCP concentration is approximately 6 µg/l, which is almost three times the Mississippi State water quality standard.

Total Maximum Daily Load

The TMDL is the total amount of a pollutant that can be assimilated by the receiving waterbody while achieving the water quality target that is protective of the designated use. In this case, the impaired use is fish consumption. The TMDL calculation will assume that the Superfund cleanup process will establish the best remedy for the pollution problem in Country Club Lake.

Critical Condition Determination

Critical conditions for Country Club Lake are difficult to determine given the lack of data. The critical condition used in the TMDL calculation considers an estimated average flow and no pollutant degradation. The values used for pollutant loading are also set to the maximum value found in the original data.

Seasonal Variation

This TMDL determination does not consider seasonal influences on dioxin or PCP concentrations in Country Club Lake. It is not expected that changes in water temperature or light regimes would significantly affect the water column concentrations.

Margin of Safety

The margin of safety is implicit in the TMDL calculation. Several conservative assumptions were made when the WASP model was parameterized. Because there is very little site-specific data available for Country Club Lake and the pollutants have not been totally parameterized throughout the lake, conservative estimates of mean annual flow, solids concentration, organic content of the solids, and the partition coefficients used in the calculations provide a margin of safety.

TMDL Determination

The TMDL calculation will utilize the conservation of mass principle, where the load can be calculated by using the following relationship:

Concentration = Load / Flow

Rearranging this equation, the maximum load can be calculated as follows:

Load = Concentration (Water Quality Target) * Flow

The TMDLs for dioxin and PCP for Country Club Lake are given in Table 4.

Table 4 TMDL for Dioxin and PCP

Flow (cfs)	Dioxin (g/day)	Pentachlorophenol (PCP) (g/day)
2.00	4.894 E-06	10.28

Allocation of Responsibility and Recommendations

Based on old monitoring data, the loads of dioxin and PCP entering Country Club Lake in overland flow from the Superfund site need to be reduced for the lake to meet the appropriate water quality targets as described in the target definition section of this document. Further monitoring is needed to determine the loading from the Superfund site. Because the area surrounding Country Club Lake is an active Superfund site in the initial stages of investigation, this Phase One TMDL is used to describe the allowable loading of dioxin and PCP that will attain the appropriate water quality targets.

This Phase One TMDL does not attempt to quantify the level of soil contamination on the Superfund site or determine the loads that are currently entering the lake via surface runoff or groundwater seepage. Therefore, the load reduction needed from the Superfund site cannot be determined at this time.

It is assumed that all loadings of dioxin and PCP are due to the Superfund site, and existing loadings will be determined in the near future through the Superfund site investigation. The Phase One TMDL established here can then be used to determine the load reductions necessary to meet the appropriate water quality targets once more monitoring has been completed.

The CERCLA process is currently in the Remedial Investigation (RI) phase, which is ongoing. The intent of the RI is to define the extent of the contamination in all pathways (surface water, sediments, soils, and groundwater) and to conduct the Baseline Risk Assessment to determine whether the site poses a substantial threat to human health and the environment. In May 2000,

EPA collected surface water and sediment samples in the vicinity of the site and plans to collect site soil and groundwater samples to determine the extent of contamination.

Based on the results, EPA may limit, if sampling defines the extent of the contamination, or continue the RI with a phased approach until the extent of contamination is determined. Upon completion of the RI, a Feasibility Study (FS) will be conducted to evaluate all applicable remedial alternatives and to select the best remedial alternative based on criteria set forth in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). After selection of the remedial alternative in the Proposed Plan (PP) a Record of Decision (ROD) will be written to outline the procedures of the Remedial Design/Remedial Action (RD/RA).

REFERENCES

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Ambrose Jr. R.B., Wool, T.A., Connolly J.P. and Schanz R.W. (1988) *WASP4, A Hydrodynamic and Water Quality Model – Model Theory, User's Manual, and Programmer's Guide*. U.S. Environmental Protection Agency. Environmental Research Laboratory, Athens, Georgia. EPA/600/3-87/039.

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Pierce, R.H., *Fate and Impact of Pentachlorophenol in Freshwater Ecosystem*. U.S. Environmental Protection Agency. Environmental Research Laboratory, Athens, Georgia. EPA/600/3-78-063.

Pinson, J.W. and Hatton, R.L. *Polychlorinated Dibenzo-p-Dioxin and Dibenzofuran Contaminants in Dr. Phillips' Lake Report No. 1*. American Laboratories and Research Services, Inc. Hattiesburg, MS. March 1990.

Schnoor, J.L., Sato, C., McKechnie, D., Sahoo. *Processes, Coefficients, and Models for Simulating Toxic Organics and Heavy Metals in Surface Waters*. U.S. Environmental Protection Agency. Environmental Research Laboratory, Athens, Georgia. EPA/600/3-87/015. 1987.

USEPA. *Guidance for Water Quality-based Decisions: The TMDL Process*. U.S. Environmental Protection Agency, Office of Water, Washington, D.C. EPA/440/4-91-001, April 1991.

Appendix A DATA

The following pages are copies of the data sheets showing the impairment in Country Club Lake. They are scanned copies of the originals.

Miss. Dept of Environmental Quality

TLI Project: **43850** — Method 8290 PCDD/PCDF Analysis (b)
Client Sample: **DF97025** — Analysis File: **S977575**

Client Project:	**Country Club Lake**				
Sample Matrix:	**FISH**	Date Received:	**11/04/97**	Spike File:	**SPX23725**
TLI ID:	**189-28-1**	Date Extracted:	**11/06/97**	ICal:	**SF56117**
		Date Analyzed:	**11/16/97**	ConCal:	**S977570**
Sample Size:	**25.112 g**	Dilution Factor:	**n/a**	% Moisture:	**n/a**
Dry Weight:	**n/a**	Blank File:	**S977574**	% Lipid:	**0.4**
GC Column:	**DB-5**	Analyst:	**BR**	% Solids:	**n/a**

Analytes	Conc. (ppt)	DL	EMPC	Ratio	RT	Flags
2,3,7,8-TCDD	EMPC		0.29			
1,2,3,7,8-PeCDD	1.8			1.48	26:06	
1,2,3,4,7,8-HxCDD	1.0			1.31	29:19	
1,2,3,6,7,8-HxCDD	EMPC		2.6			
1,2,3,7,8,9-HxCDD	0.65			1.15	29:43	
1,2,3,4,6,7,8-HpCDD	3.2			0.99	32:14	
1,2,3,4,6,7,8,9-OCDD	3.8			0.97	34:45	
2,3,7,8-TCDF	0.29			0.73	20:45	
1,2,3,7,8-PeCDF	ND	0.2				
2,3,4,7,8-PeCDF	EMPC		0.48			
1,2,3,4,7,8-HxCDF	EMPC		0.23			PR
1,2,3,6,7,8-HxCDF	0.42			1.11	28:42	
2,3,4,6,7,8-HxCDF	1.0			1.15	29:11	B
1,2,3,7,8,9-HxCDF	ND	0.2				
1,2,3,4,6,7,8-HpCDF	EMPC		1.5			
1,2,3,4,7,8,9-HpCDF	EMPC		0.28			
1,2,3,4,6,7,8,9-OCDF	2.0			0.94	34:51	

TEQ 1.2738

Totals	Conc. (ppt)	Number	DL	EMPC	Flags
Total TCDD	EMPC			0.29	
Total PeCDD	1.8	1			
Total HxCDD	1.7	2		4.3	
Total HpCDD	3.6	2			
Total TCDF	0.29	1		0.92	
Total PeCDF	1.1	2		3.2	X
Total HxCDF	4.5	6		6.0	X
Total HpCDF	4.8	1		6.6	

X237_PSR v2.01, LARS 6.10.07c

Triangle Laboratories, Inc.®
801 Capitola Drive • Durham, North Carolina 27713
Phone: (919) 544-5729 • Fax: (919) 544-5491

Printed: 12:11 11/21/97

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Miss. Dept of Environmental Quality

TLI Project: 43850 Method 8290 PCDD/PCDF Analysis (b)
Client Sample: DF97025 Analysis File: S977575

Internal Standards	Conc. (ppt)	% Recovery	QC Limits	Ratio	RT	Flags
$^{13}C_{12}$-2,3,7,8-TCDF	69.1	69.4	40%-130%	0.74	20:43	—
$^{13}C_{12}$-2,3,7,8-TCDD	62.2	62.4	40%-130%	0.86	21:31	—
$^{13}C_{12}$-1,2,3,7,8-PeCDF	61.1	61.4	40%-130%	1.43	24:58	—
$^{13}C_{12}$-1,2,3,7,8-PeCDD	62.0	62.3	40%-130%	1.45	26:05	—
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	86.5	86.9	40%-130%	0.49	28:42	—
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	82.9	83.3	40%-130%	1.20	29:24	—
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	74.4	74.8	25%-130%	0.42	31:24	—
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	81.8	82.1	25%-130%	1.03	32:14	—
$^{13}C_{12}$-1,2,3,4,6,7,8,9-OCDD	133	67.0	25%-130%	0.78	34:44	—

Surrogate Standards (Type B)	Conc. (ppt)	% Recovery	QC Limits	Ratio	RT	Flags
$^{37}Cl_4$-2,3,7,8-TCDD	7.4	73.8	40%-130%		21:32	—
$^{13}C_{12}$-2,3,4,7,8-PeCDF	63.4	63.7	40%-130%	1.48	25:43	—
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	89.2	89.6	40%-130%	0.49	28:36	—
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	83.1	83.5	40%-130%	1.20	29:19	—
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	84.6	85.0	25%-130%	0.41	32:36	—

Alternate Standards (Type B)	Conc. (ppt)	% Recovery	QC Limits	Ratio	RT	Flags
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	82.7	83.1	40%-130%	0.49	29:55	—
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	96.8	97.3	40%-130%	0.49	29:12	—

Recovery Standards	Ratio	RT	Flags
$^{13}C_{12}$-1,2,3,4-TCDD	0.84	21:18	—
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	1.19	29:42	—

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TLI Project: **43850** — Method 8290 PCDD/PCDF Analysis (b)
Client Sample: **DF97026** — Analysis File: **S977576**

Client Project:	**Country Club Lake**				
Sample Matrix:	**FISH**	Date Received:	**11/04/97**	Spike File:	**SPX23725**
TLI ID:	**189-28-2**	Date Extracted:	**11/06/97**	ICal:	**SF56117**
		Date Analyzed:	**11/16/97**	ConCal:	**S977570**
Sample Size:	**25.089 g**	Dilution Factor:	**n/a**	% Moisture:	**n/a**
Dry Weight:	**n/a**	Blank File:	**S977574**	% Lipid:	**0.2**
GC Column:	**DB-5**	Analyst:	**BR**	% Solids:	**n/a**

Analytes	Conc. (ppt)	DL	EMPC	Ratio	RT	Flags
2,3,7,8-TCDD	0.25			0.89	21:32	
1,2,3,7,8-PeCDD	0.81			1.49	26:05	
1,2,3,4,7,8-HxCDD	0.33			1.11	29:20	
1,2,3,6,7,8-HxCDD	1.1			1.10	29:24	
1,2,3,7,8,9-HxCDD	0.26			1.30	29:42	
1,2,3,4,6,7,8-HpCDD	1.9			0.93	32:15	
1,2,3,4,6,7,8,9-OCDD	4.2			0.96	34:44	
2,3,7,8-TCDF	0.19			0.89	20:43	
1,2,3,7,8-PeCDF	ND	0.07				
2,3,4,7,8-PeCDF	ND	0.07				
1,2,3,4,7,8-HxCDF	EMPC		0.12			
1,2,3,6,7,8-HxCDF	0.18			1.27	28:43	
2,3,4,6,7,8-HxCDF	0.75			1.25	29:11	B
1,2,3,7,8,9-HxCDF	ND	0.07				
1,2,3,4,6,7,8-HpCDF	1.2			1.14	31:24	
1,2,3,4,7,8,9-HpCDF	EMPC		0.22			
1,2,3,4,6,7,8,9-OCDF	2.3			0.89	34:51	

TEQ 0.7235

Totals	Conc. (ppt)	Number	DL	EMPC	Flags
Total TCDD	0.25	1			
Total PeCDD	0.81	1			
Total HxCDD	1.7	3			
Total HpCDD	1.9	1		2.2	
Total TCDF	0.44	3		0.73	X
Total PeCDF	EMPC			1.8	X
Total HxCDF	2.6	5		3.6	X
Total HpCDF	5.8	2		6.0	

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TLI Project: **43850** Method 8290 PCDD/PCDF Analysis (b)
Client Sample: **DF97026** Analysis File: **S977576**

Internal Standards	Conc. (ppt)	% Recovery	QC Limits	Ratio	RT	Flags
$^{13}C_{12}$-2,3,7,8-TCDF	82.2	82.5	40%-130%	0.74	20:43	—
$^{13}C_{12}$-2,3,7,8-TCDD	73.8	74.1	40%-130%	0.82	21:30	—
$^{13}C_{12}$-1,2,3,7,8-PeCDF	72.6	72.8	40%-130%	1.41	24:57	—
$^{13}C_{12}$-1,2,3,7,8-PeCDD	75.8	76.1	40%-130%	1.47	26:04	—
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	89.0	89.3	40%-130%	0.49	28:41	—
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	88.2	88.5	40%-130%	1.23	29:24	—
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	76.3	76.6	25%-130%	0.42	31:23	—
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	89.3	89.7	25%-130%	1.01	32:14	—
$^{13}C_{12}$-1,2,3,4,6,7,8,9-OCDD	130	65.3	25%-130%	0.81	34:44	—

Surrogate Standards (Type B)	Conc. (ppt)	% Recovery	QC Limits	Ratio	RT	Flags
$^{37}Cl_4$-2,3,7,8-TCDD	9.0	90.2	40%-130%		21:31	—
$^{13}C_{12}$-2,3,4,7,8-PeCDF	78.9	79.2	40%-130%	1.45	25:43	—
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	88.5	88.8	40%-130%	0.48	28:35	—
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	83.0	83.3	40%-130%	1.22	29:19	—
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	93.5	93.9	25%-130%	0.41	32:35	—

Alternate Standards (Type B)	Conc. (ppt)	% Recovery	QC Limits	Ratio	RT	Flags
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	90.0	90.3	40%-130%	0.49	29:55	—
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	95.6	95.9	40%-130%	0.48	29:12	—

Recovery Standards	Ratio	RT	Flags
$^{13}C_{12}$-1,2,3,4-TCDD	0.82	21:18	—
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	1.19	29:41	—

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TLI Project: 43850 — Method 8290 PCDD/PCDF Analysis (b)
Client Sample: DF97029 — Analysis File: S977577

Client Project:	Country Club Lake				
Sample Matrix:	FISH	Date Received:	11/04/97	Spike File:	SPX23725
TLI ID:	189-28-3	Date Extracted:	11/06/97	ICal:	SF56117
		Date Analyzed:	11/16/97	ConCal:	S977570
Sample Size:	25.112 g	Dilution Factor:	n/a	% Moisture:	n/a
Dry Weight:	n/a	Blank File:	S977574	% Lipid:	4.8
GC Column:	DB-5	Analyst:	BR	% Solids:	n/a

Analytes	Conc. (ppt)	DL	EMPC	Ratio	RT	Flags
2,3,7,8-TCDD	1.9			0.89	21:31	
1,2,3,7,8-PeCDD	15.7			1.54	26:05	
1,2,3,4,7,8-HxCDD	15.9			1.23	29:20	
1,2,3,6,7,8-HxCDD	69.9			1.23	29:24	
1,2,3,7,8,9-HxCDD	11.1			1.19	29:42	
1,2,3,4,6,7,8-HpCDD	39.7			1.06	32:14	
1,2,3,4,6,7,8,9-OCDD	28.3			0.93	34:44	
2,3,7,8-TCDF	0.38			0.83	20:43	
1,2,3,7,8-PeCDF	1.3			1.41	24:57	
2,3,4,7,8-PeCDF	3.2			1.32	25:43	
1,2,3,4,7,8-HxCDF	2.0			1.20	28:35	PR
1,2,3,6,7,8-HxCDF	2.8			1.26	28:41	
2,3,4,6,7,8-HxCDF	7.3			1.21	29:12	PR
1,2,3,7,8,9-HxCDF	EMPC		0.24			
1,2,3,4,6,7,8-HpCDF	11.8			1.10	31:23	
1,2,3,4,7,8,9-HpCDF	EMPC		1.3			
1,2,3,4,6,7,8,9-OCDF	14.2			0.79	34:51	

TEQ 21.0105

Totals	Conc. (ppt)	Number	DL	EMPC	Flags
Total TCDD	2.7	4			
Total PeCDD	16.8	3		17.2	
Total HxCDD	100	7			
Total HpCDD	40.7	2			
Total TCDF	2.2	6		9.0	X
Total PeCDF	17.2	7		27.7	X
Total HxCDF	30.4	8		40.6	X
Total HpCDF	52.3	2		53.6	

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TLI Project: **43850** Method 8290 PCDD/PCDF Analysis (b)
Client Sample: **DF97029** Analysis File: **S977577**

Internal Standards	Conc. (ppt)	% Recovery	QC Limits	Ratio	RT	Flags
$^{13}C_{12}$-2,3,7,8-TCDF	80.7	81.1	40%-130%	0.74	20:43	—
$^{13}C_{12}$-2,3,7,8-TCDD	74.3	74.6	40%-130%	0.81	21:30	—
$^{13}C_{12}$-1,2,3,7,8-PeCDF	71.2	71.5	40%-130%	1.41	24:57	—
$^{13}C_{12}$-1,2,3,7,8-PeCDD	75.4	75.8	40%-130%	1.47	26:04	—
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	83.4	83.7	40%-130%	0.48	28:41	—
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	86.2	86.5	40%-130%	1.19	29:24	—
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	74.1	74.4	25%-130%	0.43	31:23	—
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	87.1	87.5	25%-130%	0.99	32:14	—
$^{13}C_{12}$-1,2,3,4,6,7,8,9-OCDD	135	67.8	25%-130%	0.81	34:44	—

Surrogate Standards (Type B)	Conc. (ppt)	% Recovery	QC Limits	Ratio	RT	Flags
$^{37}Cl_4$-2,3,7,8-TCDD	8.9	89.6	40%-130%		21:31	—
$^{13}C_{12}$-2,3,4,7,8-PeCDF	74.9	75.3	40%-130%	1.41	25:42	—
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	88.5	88.9	40%-130%	0.50	28:35	—
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	78.6	79.0	40%-130%	1.20	29:19	—
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	86.0	86.4	25%-130%	0.41	32:35	—

Alternate Standards (Type B)	Conc. (ppt)	% Recovery	QC Limits	Ratio	RT	Flags
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	87.0	87.3	40%-130%	0.48	29:55	—
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	89.3	89.7	40%-130%	0.48	29:11	—

Recovery Standards	Ratio	RT	Flags
$^{13}C_{12}$-1,2,3,4-TCDD	0.84	21:18	—
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	1.20	29:41	—

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