

**FINAL REPORT
TOXICS REDUCTION
FOR THE
U.S. EASTERN GREAT LAKES BASIN
Work Assignment: C02130
(Ref. No. 1-635-390)**

**Prepared for:
U.S. Environmental Protection Agency**

Contract: 68-W9-0003

TRC

TRC Environmental Corporation

**FINAL REPORT
TOXICS REDUCTION
FOR THE U.S. EASTERN GREAT LAKES BASIN**

Prepared for

**U.S. ENVIRONMENTAL PROTECTION AGENCY
Emergency and Remedial Response Division
26 Federal Plaza
New York, New York 10278**

Work Assignment No.:	C02130
EPA Region:	II
EPA Site/Facility I.D. No.:	N/A
Contract No.:	68-W9-0003 (TES-6)
TRC Document No.:	L93-839
TRC Project No.:	1-635-390-0-2PZZ-0
TRC Project Manager:	Susan Stoloff
TRC Project Engineer:	Alison Miller
TRC Telephone No.:	(508) 970-5600
Subcontractor:	N/A
Subcontract No.:	N/A
Subcontractor Project Manager:	N/A
Telephone No.:	N/A
EPA Work Assignment Manager:	Elizabeth Lonoff
Telephone No.:	(212) 264-1332
Date Prepared:	September 30, 1993

**TRC ENVIRONMENTAL CORPORATION
291 Broadway, Suite 1206
New York, New York 10007
(212) 349-4616**

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

Section	Page
1.0 INTRODUCTION	1
1.1 Background	1
1.2 Organization of Final Report	4
2.0 EASTERN GREAT LAKES BASIN OVERVIEW	6
2.1 Geographic Description	6
2.2 Land Use/Contaminant History	7
3.0 CHEMICAL PROFILES	8
4.0 IDENTIFICATION OF SOURCES AND QUANTIFICATION OF LOADINGS ..	8
4.1 Industrial and Municipal Discharges	9
4.1.1 Methodology	9
4.1.2 Sources and Loadings	13
4.1.3 Data Gaps and Limitations	16
4.1.4 Summary	18
4.2 Spills	19
4.2.1 Methodology	19
4.2.2 Sources and Loadings	19
4.2.3 Data Gaps and Limitations	22
4.2.4 Summary	23
4.3 Hazardous Waste Sites	24
4.3.1 Methodology	24
4.3.2 Sources and Loadings	26
4.3.3 Data Gaps and Limitations	33
4.3.4 Summary	34
4.4 Sediments	35
4.4.1 Methodology	35
4.4.2 Sources and Loadings	36
4.4.3 Data Gaps and Limitations	43
4.4.4 Summary	44
4.5 Surface Water Runoff	45
4.5.1 Direct Surface Water Runoff	45
4.5.2 Combined Sewer Overflows	53
4.6 Atmospheric Deposition	61
4.6.1 Methodology	61
4.6.2 Sources and Loadings	63
4.6.3 Data Gaps and Limitations	67
4.6.4 Summary	69

TABLE OF CONTENTS (CONTINUED)

Section	Page
5.0 INTERVENTION PROPOSALS	70
5.1 Methodology	70
5.2 Chemical Tables	71
5.3 Intervention Proposals	109
5.3.1 Spills	109
5.3.2 Hazardous Waste Sites	110
5.3.3 Sediments	114
5.3.4 Surface Runoff	117
5.3.4.1 Direct Surface Runoff	117
5.3.4.2 Combined Sewer Overflows	118
5.3.5 Atmospheric Deposition	119
5.4 Analysis of Contamination by County	120
6.0 SUMMARY	122
7.0 BIBLIOGRAPHY	124
 Appendices	 Page
A Chemical Profiles	A-1
B Industrial and Municipal Discharges	B-1
C Spills	C-1
D Hazardous Waste Sites of Potential Concern	D-1
E Sample of Region I Stabilization Collaboration Initiative (SCI) Organization Chart	E-1
F Cumulative Status Report	F-1
G Lake Ontario Basin and Major Sub-Basins	G-1

TABLE OF CONTENTS (CONTINUED)

TABLES

Number	Page
4.1.1 Distribution of Identified Loadings from Industrial, Municipal and Spill Sources . .	14
4.3.1 Available Estimated Loadings from Hazardous Waste Sites	27
4.3.2 Total Available Estimated Loadings from Hazardous Waste Sites by Chemical . . .	31
4.3.3 Additional Sites of Potential Concern by County	31
4.4.1 Sediment Contamination in New York Tributaries	37
4.5.1 Projected Buffalo River Basin Watershed Annual Toxic Loadings	48
4.5.2 Total Annual Yields of Lead at Sites Located in the Irondequoit Creek Basin . . .	50
4.5.3 Combined Sewer Overflow (CSO) Discharges	55
4.6.1 Annual PCB and Lead Inputs to Eastern Great Lakes and the Fractions Attributed to Atmospheric Pathways	66
4.6.2 Estimated Atmospheric Deposition of Various Contaminants	68
5.4.1 Total Annual Loading for each Chemical by County	121

FIGURES

Number	Page
1.1.1 Regional Map - Great Lakes Region	2
1.1.2 Study Area Map	3
4.2.1 Spill Location Map - by Facility	20
4.5.1 Combined Sewer Overflow Locations for Buffalo, New York	57
4.5.2 Combined Sewer Overflow Locations for Tonawanda and North Tonawanda, New York	58
4.5.3 Combined Sewer Overflow Locations for Niagara Falls, New York	59
4.5.4 Combined Sewer Overflow Locations for Rochester, New York	60
4.6.1 Atmospheric Loading of PCBs, Benzo(a)Pyrene, and Lead to the Eastern Great Lakes	65
5.3.1 The Superfund Process	111
5.3.2 RCRA Corrective Action Process	112

THIS PAGE INTENTIONALLY LEFT BLANK

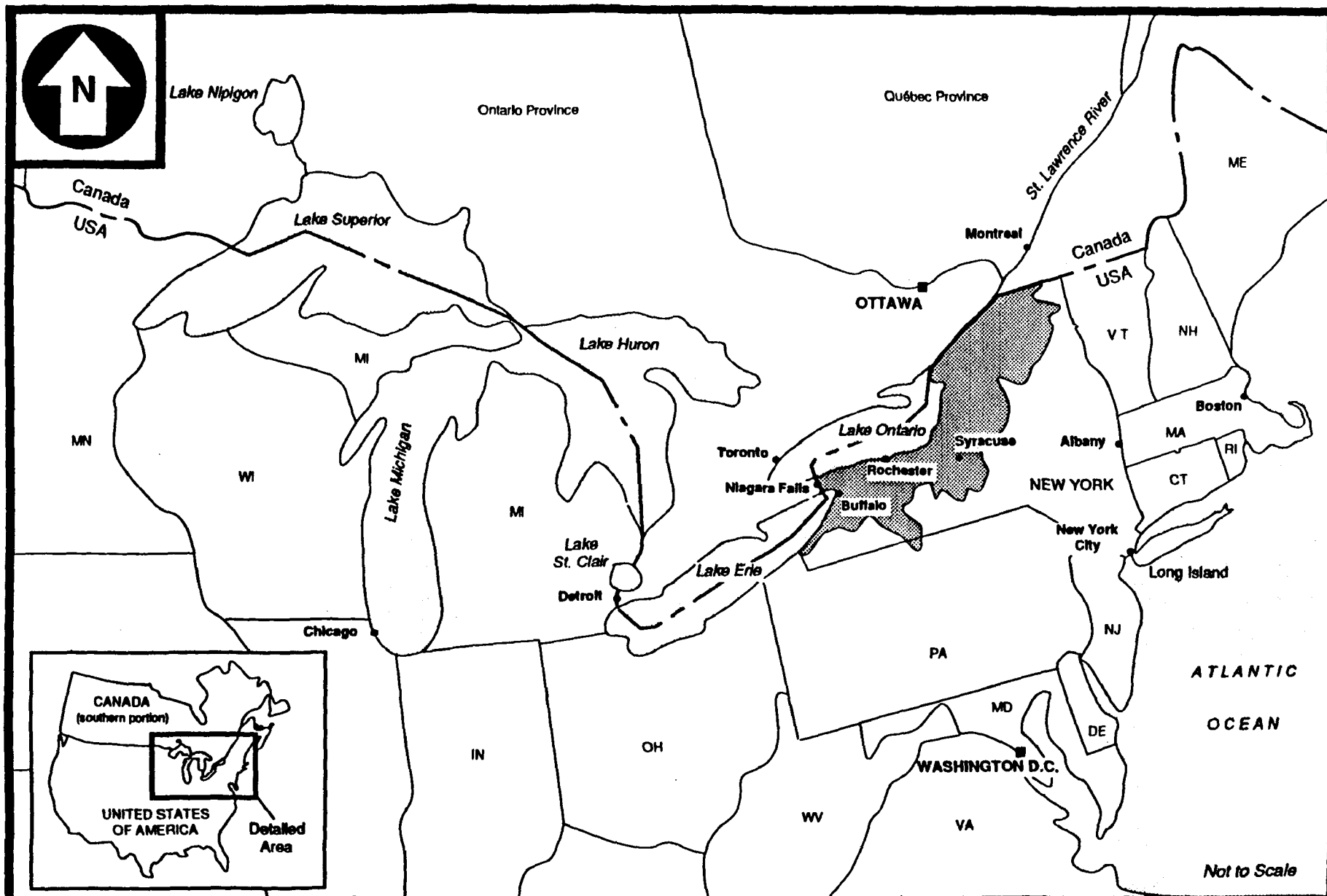
1.0 INTRODUCTION

1.1 Background

The U.S. Environmental Protection Agency (EPA) has requested TRC Environmental Corporation (TRC - formerly Alliance Technologies Corporation), under EPA Contract No. 68-W9-0003 (TES-6), Work Assignment No. C02130, to provide technical support to the Niagara Frontier Programs Section in compiling information on sources of toxic loadings to the U.S. portion of the Eastern Great Lakes Basin and avenues for reducing the identified inputs. As shown on Figures 1.1.1 and 1.1.2, the Eastern Great Lakes Basin is comprised of the eastern portion of Lake Erie, the Buffalo and Niagara Rivers and their tributaries, Lake Ontario, and part of the St. Lawrence River.

EPA, the New York State Department of Environmental Conservation (NYSDEC), the Ontario Ministry of the Environment and Energy (MOE), and Environment Canada (EC) are working together to reduce the level of toxics in the Great Lakes Basin. These agencies, known as the Four Parties, have been focusing on activities to reduce the toxic chemical loadings to these waterbodies from known sources in the Basin. To identify additional opportunities for toxics reduction and elimination, they have agreed to develop a chemical-specific database consisting of information about the loadings, pathways, and opportunities for reduction. This report represents an EPA effort towards this goal.

Eighteen persistent toxic chemicals have been targeted for reductions under either the Lake Ontario or the Niagara River Toxic Management Plan (NRTMP): arsenic, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chlordane, chrysene, DDT and metabolites (DDE, DDD), dieldrin, dioxin (2,3,7,8-TCDD), hexachlorobenzene, lead, mercury, mirex, octachlorostyrene, PCBs, tetrachloroethylene, and toxaphene.

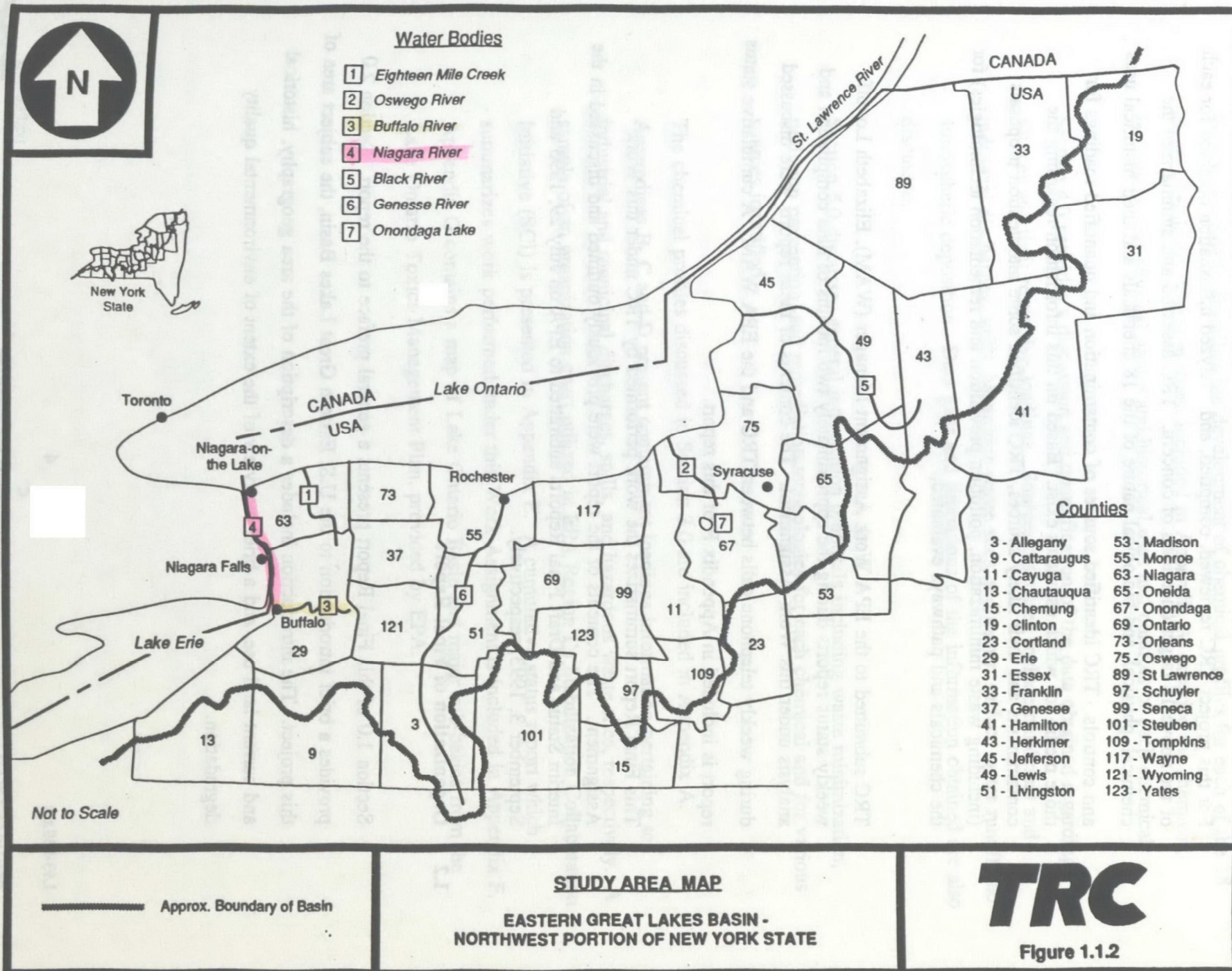


Study Area - Eastern Great Lakes Basin, New York
(see Figure 1.1-2 for details)

REGIONAL MAP
GREAT LAKES REGION

TRC

Figure 1.1.1.



For this project TRC reviewed, compiled, and analyzed information obtained for each of the above 18 target chemicals of concern. TRC assessed and summarized the chemical, physical, and biological nature of the 18 chemicals and their historical uses and controls. TRC identified sources of contamination and quantified loadings for those media for which estimates exist. Based on this information regarding the contaminants and their likely sources, TRC identified some intervention proposals (including waste minimization, pollution prevention and remediation technologies) for the chemicals and pathways evaluated.

TRC submitted to the EPA Work Assignment Manager (WAM), Elizabeth Lonoff, weekly status reports during the approximately two months of data compilation and analysis under this Work Assignment. The contents of these reports were discussed during weekly telephone calls between TRC and the EPA WAM. A cumulative status report is included in Appendix F of this report.

This Final Report summarizes the work performed by TRC under this Work Assignment. The contents of the report were previously outlined and discussed in the Interim Status and Draft Final Reports submitted to EPA on July 29, 1993 and September 3, 1993, respectively.

1.2 Organization of Final Report

Section 1.0 of this Final Report presents a general preface to the report. Section 2.0 provides a brief introduction to the U.S. Eastern Great Lakes Basin, the subject area of this project. The introduction includes a description of the area geography, historical and current land use, and a brief overview of the extent of environmental quality degradation.

Section 3.0 briefly describes the development of chemical profiles for each of the 18 target chemicals. These profiles, included in Appendix A, describe the chemical, biological, and physical nature and historical uses and controls of each chemical.

Section 4.0 provides a discussion and quantification of the data obtained regarding sources and their respective loadings. Sources discussed include municipal and industrial discharges, spills, hazardous waste sites, sediments, surface water runoff and atmospheric deposition. Data gaps and limitations of the information obtained are also discussed.

Section 5.0 discusses general intervention proposals including waste minimization, pollution prevention, and remediation technologies for each chemical and for various sources identified.

The chemical profiles discussed in Section 3.0 are included in Appendix A. Appendices B, C and D present contaminant loadings information pertaining to industrial and municipal discharges, spills, and hazardous waste sites, respectively. A sample of an organization chart utilized in EPA Region I's Stabilization Collaboration Initiative (SCI) is presented in Appendix E. A cumulative status report which summarizes work performed under this Work Assignment is included in Appendix F. Appendix G contains a map of Lake Ontario Basin and major sub-basins from the Lake Ontario Toxics Management Plan, provided by EPA.

2.0 U.S. EASTERN GREAT LAKES BASIN OVERVIEW

Information contained in Subsections 2.1 and 2.2 was obtained from a draft document produced by EPA's Great Lakes National Program Office and entitled "Great Lakes Basin Risk Characterization Study."

2.1 Geographic Description

The geographic area addressed under this Work Assignment is being called the U.S. Eastern Great Lakes Basin for the purposes of this report. This area is comprised of the Buffalo River and the U.S. side of the eastern portion of Lake Erie, the Niagara River, Lake Ontario, and a portion of the Saint Lawrence River. The U.S. side of the Eastern Great Lakes Basin is located entirely in New York State and includes the metropolitan areas of Buffalo, Rochester, and Syracuse. The Basin includes 32 counties, 561 miles of shoreline, and a population of 4.38 million people (based on U.S. Bureau of the Census county population estimates for 1988). The Basin contains 14.5 percent of the population of the entire Great Lakes Basin which includes all of the Great Lakes and has a population density of 180.74 people per square mile.

Six major drainage basins are located within the Eastern Great Lakes Basin and include the following:

- The Lake Erie-Niagara River drainage basin, which drains 2,300 square miles of eastern New York and includes the metropolitan areas of Buffalo and Niagara Falls.
- The Lake Ontario drainage basin, which drains approximately 2,450 square miles and includes the Syracuse and portions of the Rochester metropolitan areas.
- The Genesee River Basin, which drains into Lake Ontario and contains portions of the Rochester metropolitan area.

- The Seneca-Oneida-Oswego drainage basin, which drains 5,120 square miles in central New York and includes 200 square miles of inland lakes.
- The Black River Basin, which drains 1,900 square miles and is heavily forested and sparsely populated.
- The St. Lawrence River Basin, which drains 5,540 square miles of forested land and is sparsely populated.

A diagram of the Lake Ontario Basin and major sub-basins in the study area is provided in Appendix G.

2.2 Land Use/Contaminant History

The U.S. Eastern Great Lakes Basin is largely rural; the primary land uses are forestry and agriculture. Land use and contaminant history for each of the six major drainage basins are briefly summarized below:

- The Lake Erie-Niagara River drainage basin contains the largest concentration of heavy industry in the state. However, over 50 percent of this basin consists of agricultural land.
- The Lake Ontario drainage basin also contains metropolitan areas. Over 3,560 square miles of Lake Ontario are moderately impaired by contaminated sediments.
- The Genesee River Basin contains primarily rural and agricultural land. Sixty-five stream miles and 670 acres of inland lakes are stressed, threatened, or environmentally impaired.
- Land in the Seneca-Oneida-Oswego drainage basin is primarily used for agriculture, followed by woodlands.
- The Black River Basin is heavily forested and sparsely populated. Acid rain is regarded as the predominant cause of impairment with over 5,000 acres of lakes severely impacted.
- The St. Lawrence River Basin is also heavily forested and sparsely populated; acid rain is regarded as severely impairing 160 inland lakes.

3.0 CHEMICAL PROFILES

Chemical-specific profiles for each of the 18 target chemicals are presented in Appendix A of this report. The profiles present each chemical's chemical, physical, and biological properties and historical uses and controls. The chemical properties researched and discussed in each profile include volatilization rate, bioaccumulation rate, and partitioning coefficients. The profiles summarize toxicity to human and ecological receptors and the fate and transport of the chemical through the environment. The historical use(s) and production of each target chemical, the types of industries that produce or utilize the chemical, and regulatory and engineering controls governing the discharge of the chemical are also presented.

The EPA's Integrated Risk Information System (IRIS), and the Hazardous Substance Data Bank were among the major sources used to develop these profiles. References are included at the end of each chemical profile.

4.0 IDENTIFICATION OF SOURCES AND QUANTIFICATION OF LOADINGS

TRC identified both point and non-point sources that discharge the 18 chemicals of concern. Point source discharges are those discharges that can be specifically linked to a point of release. Water point sources include National Pollutant Discharge Elimination System (NPDES) discharges, stormwater sewers, or combined sewer overflows. Air point sources include releases from stacks, vents, ducts, or other confined air streams; storage tank emissions are also considered point sources. Examples of non-point sources include fugitive leaks from equipment or evaporative losses from surface impoundments. Non-point sources are generally sources with no definitive point of discharge (e.g., hazardous waste sites).

The sources identified during this project include industrial and municipal discharges, spills, hazardous waste sites, sediments, surface water runoff and atmospheric deposition. Each of these source categories is discussed separately in the following subsections.

4.1 Industrial and Municipal Discharges

4.1.1 Methodology

TRC obtained information on industrial and municipal discharges to water and air from the following databases:

- The Toxic Release Inventory (TRI);
- The Permit Compliance System (PCS); and
- AIRCHIEF.

The TRI database retrieval provided a listing of facilities which released arsenic, chlordane, hexachlorobenzene, lead, mercury, PCBs, tetrachloroethylene, and toxaphene in excess of threshold reporting levels to water or air during calendar year 1991. This is the most recent year for which data are available. The list identified a total of 27 facilities within the 32 Eastern Great Lakes Basin Counties.

The air emissions identified in TRI are for point and non-point (fugitive) emissions. Although atmospheric deposition of air emissions from facilities within the Eastern Great Lakes Basin may occur outside the basin, it was considered necessary to include all known emissions, even though their precise point of deposition is unknown. Similarly, air emission sources outside the Eastern Great Lakes Basin are undoubtedly responsible for atmospheric deposition within the basin. Air pollution is therefore considered under two separate subsections of Section 4.0 (4.1, Industrial and Municipal Discharges and 4.6, Atmospheric Deposition). Identified sources of

emissions are discussed in this section as their sources may be controlled, reduced or even eliminated through the use of alternative chemicals or treatment technologies. Atmospheric deposition from indeterminate sources is discussed in Section 4.6 in general terms, with limited information about typical sources and some loadings data.

The PCS database includes all industrial and municipal facilities permitted under the National Pollutant Discharge Elimination System (NPDES), including electric utilities and metal finishing, pulp and paper processing, chemical production, and iron and steel production facilities¹. Municipal point source discharges include discharges from public-owned treatment works (POTWs) and privately-owned wastewater treatment facilities that manage domestic waste. TRC reviewed and evaluated the data for NPDES discharges for the U.S. Eastern Great Lakes Basin for New York State fiscal years (April 1 to March 31) 1991/92 and 1992/93.

The PCS data were received by TRC from EPA in the form of average daily loadings for each chemical for the portion of each calendar year comprising the New York State fiscal year (i.e., nine months in 1992 and three months in 1993 for the 1992/93 fiscal year). TRC assumed that facilities discharged for the full number of months in each partial calendar year within the fiscal year. TRC then calculated a weighted average of the daily loadings to obtain a mean daily loading for a fiscal year. Multiplying this mean daily loading by 365 days gave an estimated total loading for the fiscal year.

TRC obtained a listing of municipal solid waste (MSW) incinerators from AIRCHIEF from a contact at the EPA library. Wastewater treatment plants thought to be using sewage sludge incinerators and conventional municipal waste incinerators were included in this listing. TRC also obtained a listing of hazardous waste incinerators in the U.S. Eastern Great Lakes Basin and a separate list of sewage sludge incinerators in

¹Great Lakes Basin Risk Characterization Study (GLBRCS). Great Lakes National Program Office. Page III-1.

New York State. Information obtained from these lists is summarized in Tables B-4-1 and B-4-2 in Appendix B. None of these listings, however, included any information on loadings or discharges.

TRC also reviewed and obtained information on industrial and municipal discharges from several other documents:

- "Lake Ontario Toxics Management Plan: 1991 Update," prepared by Lake Ontario Secretariat, September 11, 1991.
- "Buffalo River Remedial Action Plan", NYSDEC, November 1989.
- "Draft Niagara River Remedial Action Plan", Vols I and II NYSDEC. March 1993.
- "Oswego River Remedial Action Plan 1992 Update", NYSDEC Division of Water, June 1992.
- "Rochester Embayment Remedial Action Plan," Stage I, edited by Monroe County Department of Planning and Development, June 1993.
- "Information Summary, Area of Concern, Buffalo River, NY." U.S. Army Waterways Experiment Station, Army Corps of Engineers, Miscellaneous Paper, EL-91-9, March 1991, Final Report.
- "1989-1990 Toxic Substance Discharges from Point Sources to the Niagara River," NYSDEC, August 1991.
- "Great Lakes Basin Risk Characterization Study" (GLBRCS), Great Lakes National Program Office, undated.

The Remedial Action Plans (RAPs) and other documents provided information on industrial facilities that discharge the 18 chemicals of concern and also identified total contaminant discharge figures which may or may not include any of the 18 target chemicals. The information varied from specific loadings to maximum allowable loadings and sometimes included discharge concentrations.

The Lake Ontario Toxic Management Plan (LOTMP) also provided information on sources of loadings. The LOTMP identifies the location of facilities that discharge into the basin, but does not provide information about loadings or chemicals discharged. Facilities identified on the LOTMP maps for which TRC has obtained loadings information are included in Appendix B of this Final Report in Tables B-1 or B-2. Facilities for which no reported loadings of any of the 18 toxic chemicals were identified have not been included in this Final Report.

TRC obtained literature and contacted personnel familiar with the 33/50 Program. This program is based on a voluntary commitment by a corporation to reduce the "generation of 17 high-priority industrial toxic wastes by 50 percent by 1995, with an interim goal of a 33 percent reduction by 1992".² Of the 17 chemicals in the 33/50 Program, only lead, mercury and tetrachloroethylene are among the 18 chemicals of concern for this project. The 33/50 Program is clearly of benefit to environmental control in the region and is a useful means of encouraging industries to become more environmentally responsible. The program "aims to demonstrate that voluntary reduction programs can augment the Agency's traditional regulatory approach by achieving targeted reductions more quickly than would regulations alone."²

TRC has identified a NYSDEC database of air emissions within New York State; however, TRC did not receive this information in time for inclusion in this report.

All industrial facilities identified and their respective loadings are tabulated in Appendix B, Table B-1. Table B-2 presents the municipal discharges. Table B-3 presents a list of Standard Industry Classification (SIC) codes for the industrial and municipal discharges. The locations of the identified incinerators within the Eastern Great Lakes Basin are presented in Tables B-4-1 and B-4-2.

²EPA's 33/50 Program, Second Progress Report. Office of Pollution Prevention and Toxics. Feb. 1992. Page 1.

4.1.2 Sources and Loadings

In order to evaluate the annual loadings of the 18 chemicals of concern, TRC identified the years for which the most recent and comprehensive data were available. For water effluent discharges the most recent data obtained are for New York State fiscal year 1992/93, obtained from PCS. For air emissions, the most recent data obtained are for calendar year 1991, obtained from TRI. TRC summed all loadings to water and air for these periods from the facilities identified in Appendix B, Tables B-1 and B-2. Water effluent discharge data were also included for New York State fiscal year 1991/92. In general, water discharges were either fairly similar for the two periods or showed a marked decrease from the 1991/92 amount to the 1992/93 amount. The greatest decrease was in the municipal point source discharge of mercury, which decreased from an estimated 1231.5 kg in 1991/92 to 53.6 kg in 1992/93 (PCS). It should be noted that there are significant limitations associated with the available PCS data; these limitations are discussed in Section 4.1.3.

A summary of the total loadings for each of the 18 chemicals of concern is presented in Table 4.1.1. This table also includes spills data from industrial sources, discussed in Section 4.2 of this report. Total loadings (excluding spills) were calculated as the sum of all industrial and municipal water loadings from the 1992/93 New York State fiscal year plus the air loadings from calendar year 1991. Tetrachloroethylene (PCE) was identified as having the largest loading of 120,531.5 kilograms (kg) annually to the U.S. Eastern Great Lakes Basin, with lead (11,119.9 kg) and arsenic (1,340.5 kg) also currently having large loadings. As would be expected with the chemicals banned from current use, the pesticides and PCBs appear to have minimal loadings from industrial and municipal discharges.

TABLE 4.1.1 DISTRIBUTION OF LOADINGS FROM INDUSTRIAL, MUNICIPAL AND IDENTIFIED SPILL SOURCES					
	Industrial Discharges (kg)		Municipal Discharges (kg)	Spills (kg or liters) (average per year)**	Total (excluding spills) kg
Target Chemicals	Water (point sources) (1992/93 and 1991/92 New York State fiscal years)	Air point and non-point sources (1991 calendar year)	Water (point sources) (1992/93 New York State fiscal year)		(1992/93 fiscal year and 1991 calendar year)
Arsenic	816.5 (438.1)*		524 (696)	23.7 liters	1,340.5
Benzo(a)anth.	0.07		(6.7)		0.07
Benzo(a)pyr.	31 (30)				31
Benzo(b)fluor.	10 (16)				10
Benzo(k)fluor.	0.07				0.07
Chlordane					
Chrysene	0.07		(6.7)		0.07
DDT and metabolites					
Dieldrin	0.04				0.04
Dioxin					
Hexachloro- benzene			(24.9)		
Lead	2,500 (2,808.3)	2,430.7	6,189 (5,999.3)		11,119.9
Mercury	34.6 (30.7)		53.6 (1231.5)	1.86 kg	88.2
Mirex	0.4		(0.5)		0.4
Octochloro- styrene					
PCBs (total)	(7.8)		(4.6)	3,839.1 liters	
PCE	270 (213.1)	119,367.5	894 (1181.6)	136.4 kg	120,531.5
Toxaphene					

* Numbers in parentheses are loadings for 1991/92 New York State fiscal year.

** Spills are reported as volumes spilled; these data do not necessarily represent loadings to the environment (see Section 4.2.3).

Sources: PCS, TRI, and ERNS databases.

Ninety-nine percent of the PCE discharges from industrial and municipal sources identified in the PCS and TRI databases are in the form of air emissions. Twenty-two percent of the lead discharges identified in these databases are in the form of air emissions. It should be clarified that these percentages do not necessarily represent loadings from air sources to the U.S. Eastern Great Lakes Basin. Factors governing the dispersion of air contaminants will determine the actual deposition of these contaminants in the U.S. Eastern Great Lakes Basin. Point sources of air emissions located outside of the basin and non-point sources such as vehicular traffic may also contribute to total loadings to the basin.

TRC utilized the databases discussed above to obtain information on loadings from individual facilities. However, other documents reviewed provided general loading information. In particular, the Great Lakes Basin Risk Characterization Study reports information from the International Joint Commission (IJC) Municipal Pretreatment Task Force. The information is applicable to all the Great Lakes, and is useful in developing an overview for the Eastern Great Lakes in particular.

As of 1985, the predominant toxic substances being discharged to the Great Lakes from municipal point sources included zinc, lead, chromium, copper, nickel and cyanide. In addition the IJC reports that greater than 50 tons (metric)/year of several organic compounds were discharged in 1985, including phenol, ethylbenzene, tetrachloroethane, and tetrachloroethylene. Furthermore, although the IJC estimates that less than one ton of PCBs is discharged from municipal point sources per year, this substance poses a substantially greater risk than other compounds. Therefore, PCB discharges may often pose a greater risk than larger volume discharges of other toxic substances.³

According to the Great Lakes Basin Risk Characterization Study, the 1990 annual flow to Lake Ontario from municipal point sources was 59,248 million gallons.⁴

³GLBRCS. Page III-24.

⁴GLBRCS. Page III-26.

4.1.3 Data Gaps and Limitations

TRC has presented the loadings information from the most recent data obtained; that is, 1992/93 and 1991/92 fiscal years for water effluent loadings (PCS) and 1991 calendar year for air emissions (TRI).

At the time of the Draft Final Report submittal, TRC had conducted a preliminary review of all the data provided by the PCS computer program printout. One facility, the Ginna Nuclear Power Plant in Wayne County, appeared to be responsible for a significant percentage of the total water discharge loadings of arsenic, lead, and mercury to the entire U.S. Eastern Great Lakes Basin. The data were presented in the Draft Final Report with the caveat that "further information is required to determine the precise source of the contaminants." Since the Draft Final Report was submitted, TRC has investigated this facility's apparent discharges in further detail. TRC obtained a copy of the facility's NPDES permit for the period 7/1/92 to 7/1/97 and also contacted several EPA and NYSDEC representatives familiar with the facility and with the PCS computer program. It became apparent that the loadings for the Ginna Nuclear Power Plant were incorrect and overestimated.

The PCS computer program is best suited to determined loadings for facilities with continuous discharges and measurable concentrations in the effluent.⁵ In the case of the Ginna Nuclear Power Plant, two factors probably contributed to the overestimated loading. The first is that the discharges from the outfalls at the plant tend to be sporadic, not continuous. It is therefore not representative for this facility to assume that the average daily discharges which appear in the database can be multiplied by 365 days to determine an annual discharge. However, the PCS computer program automatically follows this assumption when calculating discharges, since for most facilities with continuous discharges, this method is accurate.

⁵Personal communication, Alison Miller, TRC and Chuck Haugh, NYSDEC, dated September 13, 1993.

Secondly, the Ginna Nuclear Power Plant is not required to monitor for lead and mercury under its permit conditions, and is required to monitor only for arsenic at one discharge point. However, the facility has established action levels for arsenic, lead, and mercury,⁶ and regularly analyzes for these chemicals. Should detected levels exceed the action levels, the facility is required to notify NYSDEC and the permit conditions may be amended. TRC hypothesized that the facility may have reported the results of these analyses as "less than the detection limit." NYSDEC permit regulators considered this a likely possibility, noting that the data presented in the PCS raw data printout are accompanied by "less than" indicators.⁷ The PCS computer program printout may not recognize the "less than" indicators, and may therefore assume the detection limits to be the concentrations measured, resulting in overestimated discharges.

This scenario shows how invalid flow rate and concentration assumptions could result in distorted loadings, a potential limitation of the PCS computer program. It should be noted that the NPDES permit program is designed to protect the environment and not necessarily to enable the determination of loadings from permitted facilities. However, for most facilities with continuous flow rates and measurable concentrations in the effluent, the loadings data can be assumed to be reliable. The estimates should be reasonably accurate for most of the facilities detailed in this report.⁸

As a result of the data limitations described above, TRC could not reliably determine loadings for the Ginna Nuclear Power Plant from the available PCS data. No loadings for the facility are presented in Table B-1, although the facility has still been included with a footnote explanation. A cursory review by representatives at NYSDEC who are familiar with the limitations of the PCS database identified five other facilities with

⁶Ginna Nuclear Power Plant NPDES permit for period 7/1/92 - 7/1/97.

⁷PCS raw data printout for Ginna Nuclear Power Plant dated 9/2/93.

⁸Personal communication, Alison Miller, TRC and Roger Vann, EPA dated September 13, 1993.

loadings above expected amounts; NYSDEC is currently examining the information on these facilities in greater detail. However, the majority of the loadings information obtained from the PCS computer program printout are assumed to be reliable. The precise loadings are less important for the purposes of this report than the identification of the sources and apparent trends within discharges.

Although the water effluent loadings (PCS) are current, the air emissions data (TRI) are two years old; some facilities may have since introduced waste minimization and pollution prevention techniques to reduce their emissions. Other facilities identified in the 1991 data may no longer be operating. In the current climate of environmental controls, it is likely that air emissions have decreased since 1991.

A considerable data gap exists for air emissions. TRI, the only source of information on air emissions obtained, is limited to facilities classified in SIC codes 20 through 39, which manufacture, process, or otherwise use certain toxic chemicals in quantities greater than threshold reporting amounts. Other facilities which do not manufacture, process, or otherwise use chemicals in quantities greater than the threshold reporting amounts may still generate significant emissions and may collectively be responsible for a significant loading to the U.S. Eastern Great Lakes Basin. TRC requested additional air emissions information from NYSDEC; however, these data were not available for inclusion in this report.

TRC has obtained no loadings information from incinerators, although several incinerators have been identified by location (Appendix B, Tables B-4-1 and B-4-2).

4.1.4 Summary

Based on the information obtained by TRC, the chemicals currently being discharged in the highest quantities in industrial and municipal discharges identified in PCS

and/or TRI are arsenic (1,340.5 kg/yr); lead (11,119.9 kg/yr); mercury (88.2 kg/yr) and tetrachloroethylene (PCE) (120,531 kg/yr). Of these, only lead and PCE are reported to be discharged to both air and water. Air emissions account for 99 percent of all PCE discharges, while only 22 percent of all lead discharges from industrial and municipal facilities are air emissions.

4.2 Spills

4.2.1 Methodology

TRC reviewed a printout of all reported spill occurrences in New York State since 1986 for the 18 target chemicals from the following database:

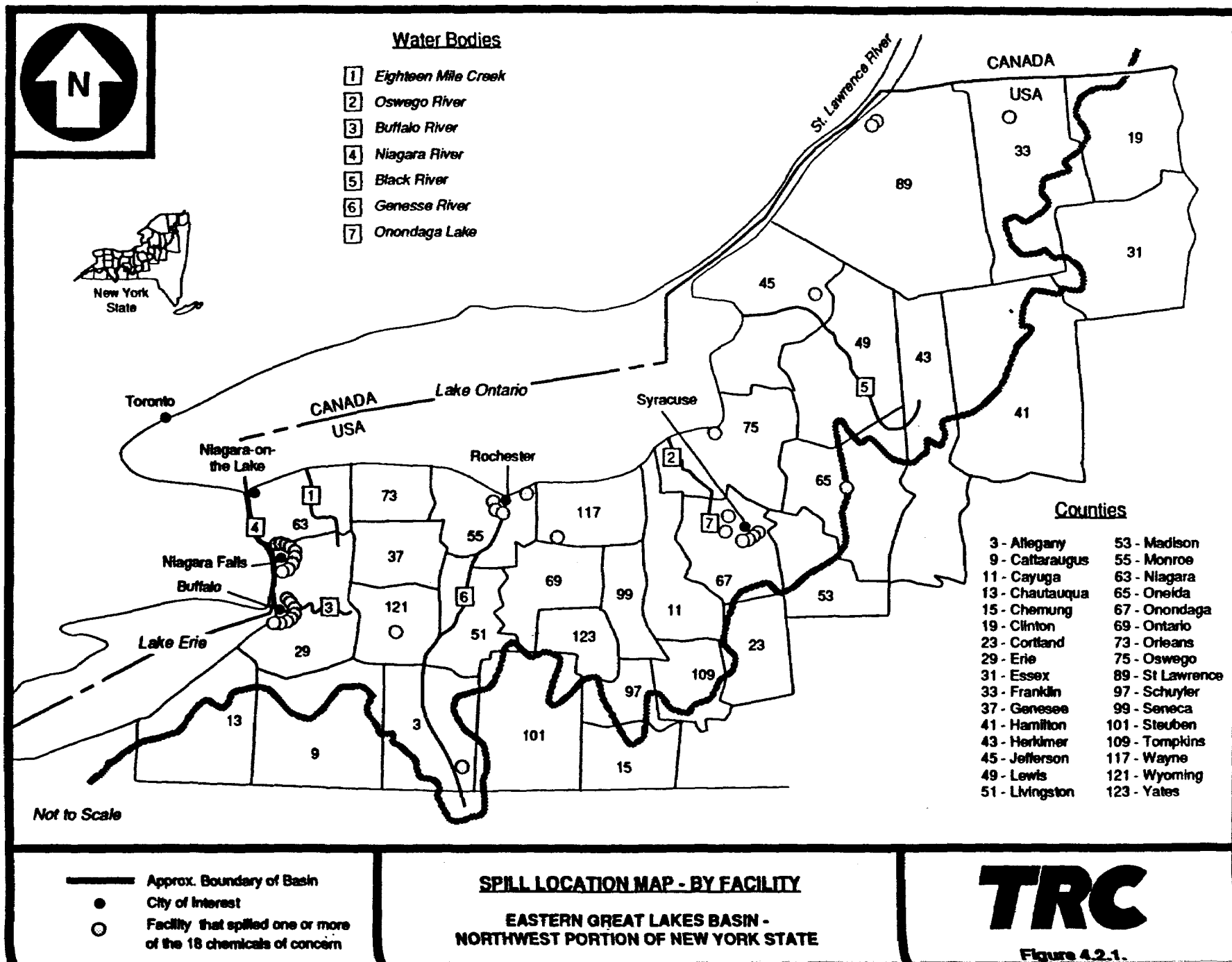
- ERNS

4.2.2 Sources and Loadings

Table C-1 lists all spill events reported in the ERNS database for the 18 target chemicals in the 32 Eastern Great Lakes Counties in New York State since 1986. The location of these spill events are plotted on Figure 4.2.1.

Most of the spills reported in the ERNS database appear to be located in five major cities in four counties: Buffalo, Erie County; Niagara Falls, Niagara County; Rochester, Monroe County; Syracuse, Onondaga County; and Solway, Onondaga County.

Thirteen spills of PCBs occurred in Erie County, 12 of which were in Buffalo and one of which was in Sloan. Eight of the 12 spills in Buffalo were from one facility, the Niagara Mohawk Power Corporation.



Seventeen spills occurred in Niagara County. Twelve of the 17 spills occurred in Niagara Falls, eight of which were PCBs and four of which were mercury-contaminated wastewater. Three of the 17 occurred in Niagara, two of which were PCBs and one of which was mercury-contaminated wastewater. The remaining two spills, both of PCBs occurred in Model City. Of the 17 total spills, four were by Carbon Graphite Co., three were by Chemical Waste Management, three were by Olin Corp., two were by Airco Carbon, and the remaining five were by various different companies.

Ten spills occurred in Monroe County. Three of the spills occurred in Webster and were by one facility, Xerox Corporation. Two of those spills were of PCBs and one spill was of arsenic. Seven spills occurred in Rochester, two of which consisted of tetrachloroethylene and five of which consisted of PCBs. Four of these seven were by Eastman Kodak, two were by Rochester Gas and Electric and one was by General Motors.

Thirty-two spills occurred in Onondaga County. Twenty-one of the spills occurred in Syracuse, all of which were PCBs, and 18 of which were by Niagara Mohawk Power. Nine spills occurred in Solvay, all of which were of mercury by LCP chemicals. The remaining two spills occurred in Liverpool and were of PCBs by Niagara Mohawk Power.

There appear to be three major trends in relation to the occurrence of spills reported in the ERNS database. The first trend is for companies such as Niagara Mohawk Power Corporation and Xerox Corporation that had spills of PCBs consistently over the years (1986-1993) indicating there is a recurring problem; the second is companies such as Vibratex and Olean Corporation, that had only one spill (of PCBs and mercury-contaminated wastewater respectively), indicating an isolated incident; and the third trend is companies such as LCP Chemicals, which had several spills of mercury within

a single year and no spills reported in following years, indicating a problem that has probably been resolved.

The average annual spill totals (in liters per year) over the past eight years for arsenic, mercury, PCBs, and tetrachloroethylene for each of the four counties with major spill events are presented in the table below:

Annual Average Spill Totals (liters per year)*				
	Erie	Monroe	Niagara	Onondaga
Arsenic		23.66		
Mercury				15.61
PCBs	581.94	8.42	2,398.40	675.74
Tetrachloroethylene		136.66		

*Spills are reported as volumes spilled; these data do not necessarily represent loadings to the environment (see Section 4.2.3).

PCBs were the most frequently spilled of the 18 target chemicals between 1986 and 1993.

4.2.3 Data Gaps and Limitations

It is important to recognize that the ERNS database information does not indicate what *media were impacted by the spills, nor the degree of environmental degradation* which may have occurred. Spills that were contained and immediately cleaned up may have posed no threat to the environment. Therefore, the spill totals presented in this report do not necessarily represent loadings to the U.S. Eastern Great Lakes Basin.

Data gaps and limitations of the ERNS database are also associated with the quantity code of the spill. One spill of PCB-contaminated transformer oil with a quantity code

of "drums" was not used in calculating average spill totals since no information was available on the quantity spilled. Those spills with a quantity code of "other" were also not included since no unit was specified. Five spills of mercury-contaminated wastewater and sludge were excluded from the totals since the concentration of mercury within the wastewater or sludge was unknown. Likewise, four spills of PCBs, PCB-contaminated oil and PCB-contaminated soil were discounted since the concentration of PCBs was also unknown. One spill with a quantity code of "L" was not included since the quantity code "L" was undefined and did not apparently stand for liters. For those spills with no quantity specified, a unit was assumed based on the unit associated with similar spills. Several spills of a number of the 18 target chemicals appeared in the ERNS retrieval, but were not included in the totals or Table C-1 because the quantity of the spill was listed as 0.00. The quantity "0.00" appears on the database when the quantity of the spill was not specified at the time the spill was reported.

4.2.4 Summary

The spills identified are predominantly of mercury and PCBs, with one arsenic spill and two tetrachloroethylene spills. Eight mercury spills were from one source, LCP chemicals in Onondaga County; they occurred during a period of three consecutive months. Twenty-nine PCB spills were also from one corporation, although in two separate locations: Niagara Mohawk Power Corporation in Onondaga and Erie Counties.

The annual average quantity spilled of arsenic was 23.66 L/yr, of mercury 1.86 kg/yr, of PCBs 3,839.08 L/yr and of tetrachloroethylene 136.38 kg/yr.

4.3 Hazardous Waste Sites

4.3.1 Methodology

TRC collected and tabulated information on hazardous waste sites in the Eastern Great Lakes Basin. As a first step in identifying sites of concern in the Basin, TRC reviewed the EPA/NYSDEC Progress Reports on the Reduction of Toxics Loadings to the Niagara River from hazardous waste sites in the U.S. (March 1993 and July 1993); the Remedial Action Plans (RAPs) for the Niagara, Buffalo, and Oswego Rivers and Rochester Embayment; and the Lake Ontario Toxics Management Plan. The March and July Progress Reports summarize work accomplished towards achieving the goals of Niagara River Toxics Management Plan. The RAPs were prepared by NYSDEC and various citizens' committees at the recommendation of the International Joint Commission Water Quality Board. The purpose of the RAPs is to restore and maintain the chemical, physical, and biological integrity of each area of concern, to restore important uses of water bodies, and to move toward the elimination of pollutant sources⁹. These documents identified and discussed sites which are currently suspected to be impacting the U.S. Eastern Great Lakes Basin through ground water discharge, surface water runoff, sediment contamination, or other media.

TRC also reviewed the following studies to obtain data on toxics loadings from hazardous waste sites in the region.

- "Estimated Toxic Loading from Selected Hazardous Waste Sites to the Niagara River, Niagara Falls, New York," Alliance Technologies Corporation (now TRC);
- "Estimated Ground Water-Transported Load of Chemicals from Waste Disposal Sites to the Niagara River," EPA-Robert S. Kerr Environmental Research Laboratory (RSKERL), March 21, 1991;

⁹Buffalo River Remedial Action Plan, NYSDEC, November 1989, p. 5-1.

- "Draft Model Data Requirements and Mass Loading Estimates for the Buffalo River Mass Balance Study," SUNY Buffalo Department of Civil Engineering Great Lakes Program, April 1993; and
- "Potential Contaminant Loadings to the Niagara River from U.S. Hazardous Waste Sites," Gradient/Geotrans, February 1988.

To calculate loadings from inactive hazardous waste sites, modeling is generally required to determine the ultimate effect of ground water transport, surface water runoff, and other means of contaminant transport from each site to a water body in the basin. Such modeling typically integrates data concerning the extent and nature of contamination and local geologic and hydrologic conditions. As specified by EPA, TRC did not perform any modelling under this Work Assignment. However, loading modelling for several sites of concern performed under a previous Work Assignment and presented in the Alliance Technologies Corporation (now TRC) document has been included in this report.

The following references provided lists of potential and confirmed hazardous waste sites in the 32 New York State counties located entirely or at least partially within the Eastern Great Lakes Basin. While these documents did not contain any information on the nature of contamination or loading data, they identified numerous additional sources potentially impacting the basin through ground water migration, surface runoff, or atmospheric deposition.

- Region II CERCLIS List, EPA Headquarters, August 1993;
- "National Priorities List Sites: New York," EPA/540/4-90/032, September 1990; and
- "ROD Annual Report: FY1989," EPA/540/8-90/006, April 1990.

4.3.2 Sources and Loadings

Based on the EPA/NYSDEC Progress Reports for the Niagara River, the RAPs for the Niagara, Buffalo, and Oswego Rivers and Rochester Embayment, and the Lake Ontario Toxics Management Plan, TRC identified over 150 hazardous waste sites in New York State which are known or suspected to be impacting the Eastern Great Lakes system as described in the documents reviewed. These sites are listed in Table D-1, Hazardous Waste Sites of Potential Concern (provided in Appendix D).

Very limited quantitative information is available regarding toxics loadings from hazardous waste sites. Quantitative loadings estimates were available for only 25 of the 150 sites; these 25 sites are all located in Erie or Niagara Counties. These sites and their loadings are summarized in Table 4.3.1 below.

Total loadings for the basin from the 25 sites listed in Table 4.3.1 were calculated for each of the 18 target chemicals for which data existed. These totals are summarized in Table 4.3.2. It is important to note that the data sets for some sites from which loadings have been determined did not always include analyses for all 18 target chemicals for this study. These loadings are only estimates based on the limited data available. Loadings from additional chemicals on the target list of 18 may be occurring.

Using the Region II CERCLIS list and other sources, TRC identified hundreds of additional confirmed and possible hazardous waste sites in the 32 Great Lakes counties. No information was obtained regarding the nature and extent of contamination or their respective impacts on the Great Lakes system; therefore, no distinction could be made as to which potential sites are of particular concern. These sites are grouped in Table 4.3.3 by county and National Priorities List (NPL) status (as listed on the Region II CERCLIS database retrieval).

**TABLE 4.3.1. AVAILABLE ESTIMATED LOADINGS FROM 25
HAZARDOUS WASTE SITES**

Site Name	Distance to Surface Water	Remediation Status	Estimated Loadings (kg/yr)
ERIE COUNTY			
West Seneca Transfer Station	200 ft. from Buffalo River.	Phase I Investigation completed; Phase II planned. NPL Status: N	Lead: 2.135
Mobil Oil Corp.	Adjacent to Buffalo River.	Phase I and II Investigations completed. NPL Status: N	Arsenic: 0.329 Lead: 0.493
Buffalo Color Corp.	Adjacent to Buffalo River.	Field Investigation completed. RFI underway. NPL Status: N/A (RCRA)	B(a)a: 36.628 B(a)p: 3.121 B(b)f: 11.662 B(k)f: 1.314 Chrysene: 4.928 Arsenic: 2.464 Lead: 5.420 Mercury: 0.164
Allied Chemical, Ind. Chemical Div. (currently PVS)	50 ft. from Buffalo River.	Phase II Investigation underway. NPL Status: N	Lead: 0.214
Madison Wire Works Co. Inc.	Adjacent to stream; 3800 ft. from Buffalo River.	Phase I and II Investigations completed. RI/FS underway in 1988. Interim removal measure completed. NPL Status: N	Lead: 0.312
Niagara County Refuse Disposal	1000 ft. north of Niagara River.	RI/FS completed. ROD: 9/93 NPL Status: F	Arsenic: 0.329 Lead: 1.643 Mercury: 0.023

TABLE 4.3.1. (CONTINUED)

Site Name	Distance to Surface Water	Remediation Status	Estimated Loadings (kg/yr)
Bell Aerospace Textron	2.5 miles north of Niagara River.	Interim remedial measures completed. RFI and CMS completed. NPL Status: N/A (RCRA)	18 COCs: 0.0
Bethlehem Steel Corporation	Adjacent to Buffalo Harbor.	RFI Work Plan completed. NPL Status: N/A (RCRA)	Arsenic: 4.271 Lead: 14.618
Buffalo Harbor Containment	Adjacent to Lake Erie.	Not listed on NY State Registry--no remediation schedule.	Arsenic: 0.986 Mercury: 4.673
INS Equipment (a.k.a. River Road)	Adjacent to Niagara River.	RI underway. NPL Status: N	Total EPA Priority Pollutants:* 443.475
NIAGARA COUNTY			
Hooker/Occidental/ Olin: 102nd Street	Adjacent to Niagara River.	Remedial Design underway. NPL Status: F ROD: 9/26/90	0.0**
Hooker/Occidental: Hyde Park	0.5 miles from Niagara River via Bloody Run Creek.	Interim remedial measures completed. Remedial Action underway. NPL Status: F ROD: 11/26/85	0.0**
Hooker/Occidental: S-Area	600 ft. from Niagara River.	RD/RA underway. NPL Status: F ROD: 9/21/90	Mercury: 0.164 Mirex: 1.624 PCE: 130.907 Lead: 6.406**

TABLE 4.3.1. (CONTINUED)

Site Name	Distance to Surface Water	Remediation Status	Estimated Loadings (kg/yr)
Occidental: Buffalo Ave.	Adjacent to Niagara River.	Interim remedial measures completed. RFI completed. NPL Status: N/A (RCRA)	Mercury: 0.164 PCBs: 0.164 PCE: 1.971 Lead: 2.300 Arsenic: 5.585 Mirex: 0.821
Olin Corporation: Buffalo Ave.	Adjacent to Gill Creek; 0.25 miles from Niagara River.	RFI underway. NPL Status: N/A (RCRA)	Total EPA Priority Pollutants: 1166.175
DuPont: Buffalo Ave.	Adjacent to Niagara River.	ROD and RD/RA completed. NPL Status: N	PCE: 356.587 PCBs: 6.57
DuPont: Necco Park	1.5 miles from Niagara River.	Interim remedial measures completed. RI due 9/93. NPL Status: N	PCE: 133.207 HCB: 0.329
CECOS Intl.	1.5 miles from Niagara River.	RFI underway. CMS due 9/93. NPL Status: N/A (RCRA)	18 COCs: 0.0
SKW Alloys/U.S. Vanadium Corporation	1.5 miles from Niagara River.	Phase I Investigation completed. Phase II Investigation due 8/93. NPL Status: N	Total EPA Priority Pollutants: 1412.55
Solvent Chemical Corp.	0.25 miles north of Niagara River.	RI completed. NPL Status: N	PCE: 0.821 Arsenic: 0.164 Lead: 3.450
Stauffer Chemical Plant/PASNY	0.25 miles east of Niagara River.	RI/FS and ROD completed. RD/RA underway. NPL Status: N	PCE: 29.729 Lead: 0.164 Dieldrin: 0.164

TABLE 4.3.1. (CONTINUED)			
Site Name	Distance to Surface Water	Remediation Status	Estimated Loadings (kg/yr)
Occidental Durez: North Tonawanda	1.25 miles east of Niagara River.	Interim remediation completed. RI/FS and ROD completed. NPL Status: Unknown	18 COCs: 0.0
Gratwick/Riverside Park	Adjacent to Niagara River.	RI/FS and ROD completed. NPL Status: N	HCB: 0.164 PCE: 3.285 Lead: 0.493
Frontier Chemical: Pendleton	Adjacent to Bull Creek; 4.25 miles from Niagara River.	RI/FS and ROD completed. NPL Status: N	PCE: 0.164

NPL Status Codes:

N - Not yet proposed to NPL - the site has been listed on CERCLIS as a potential hazardous waste site but has not been proposed to the NPL

F - Listed on NPL - the site may undergo further investigation and/or remediation under Superfund

N/A - Not applicable - facility handled under RCRA.

*A list of 129 contaminants, including all 18 chemicals of concern, except mirex and octochlorostyrene.

**Loading is based on a data set which did not include all 18 chemicals of concern.

References:

"Reduction of Toxics Loadings to the Niagara River from U.S. Hazardous Waste Sites: A Progress Report," EPA/NYSDEC. March 1993.

"Estimate of Toxic Loading from Hazardous Waste Sites to the Niagara River, Niagara Falls, New York." TRC Work Assignment C02112.

"Draft Model Data Requirements and Mass Loading Estimates for the Buffalo River Mass Balance Study." SUNY Buffalo. April 1993.

"Estimated Ground Water-Transported Load of Chemicals from Waste Disposal Sites to the Niagara River." EPA-RSKERL. March 1991.

TABLE 4.3.2. TOTAL AVAILABLE ESTIMATED LOADINGS FROM HAZARDOUS WASTE SITES BY CHEMICAL

Chemical	Total Estimated Loading (kg/year)
Arsenic	14.128
Lead	37.648
Mercury	5.278
Chrysene	4.928
Benzo(a)anthracene	36.628
Benzo(a)pyrene	3.121
Benzo(b)fluoranthene	11.662
Benzo(k)fluoranthene	1.314
Tetrachloroethylene	656.671
PCBs	6.734
Mirex	2.445
Hexachlorobenzene	0.493
Dieldrin	0.164

TABLE 4.3.3. ADDITIONAL SITES OF POTENTIAL CONCERN BY COUNTY*

County	Not Yet Proposed to NPL	Listed on NPL	Record of Decision Date
Allegany	8	--	
Cattaraugus	24	1	
Cayuga	9	--	
Chautauqua	15	--	
Chemung	22	2	9/30/86; 9/28/90
Clinton	3	1	
Cortland	16	1	
Erie	122	2**	
Essex	4	--	
Franklin	2	2	2/9/88

TABLE 4.3.3. (CONTINUED)			
County	Not Yet Proposed to NPL	Listed on NPL	ROD Date
Genesee	11	1	
Hamilton	--	--	
Herkimer	19	--	
Jefferson	12	--	
Lewis	13	--	
Livingston	11	--	
Madison	6	1	3/29/91
Monroe	36	--	
Niagara	126	--	
Oneida	36	2	
Onandaga	49	--	
Ontario	7	--	
Orleans	7	--	
Oswego	27	--	
Schuyler	1	--	
St. Lawrence	11	2	9/28/90; 12/17/90
Seneca	9	2	
Steuben	13	--	
Tompkins	10	--	
Wayne	13	--	
Wyoming	7	--	
Yates	9	--	
TOTAL	658	17**	

* Not including facilities handled under the RCRA Program.

** Including one site which has been proposed to the NPL but not yet approved

References: Region II CERCLIS List, EPA Headquarters, August 1993.

"National Priorities List Sites: New York," EPA/540/4-90/032, September 1990.

"ROD Annual Report: FY1989," EPA/540/8-90/006, April 1990.

After a potential hazardous waste site is discovered, preliminary investigations are conducted to evaluate the disposal history, present conditions at the site, and possible human and ecological receptors of site contamination. The site may then be scored using the Hazard Ranking System (HRS). Depending on its HRS score, a site may qualify for the NPL and further investigation under Superfund.

4.3.3 Data Gaps and Limitations

It is important to note that loading estimates are based both on sampling results, which indicate the nature and extent of contamination at a site, and on modeling of the hydrologic and chemical conditions at the site that affect contaminant fate and transport. Uncertainties associated with sampling methods, such as detection limits and nonhomogeneous media, therefore also affect the loading estimates.

Similarly, modeling techniques and mass balance calculations depend on a series of assumptions concerning hydrology and chemical degradation. The accuracy of these initial assumptions greatly affects the reliability of the resulting data. For example, a poor understanding of site hydrogeology could result in the use of sampling data from upgradient wells to calculate loadings to a downgradient surface water body.

The studies from which all chemical-specific loading estimates listed in Tables 4.3.1 and 4.3.2 were obtained considered ground water-transported contamination only in calculating these numbers. Other pathways for contaminant transport, such as surface water runoff or ongoing releases from contaminated sediment or soil, were not assessed; examining other pathways could result in a higher total loadings estimate from a given site.

Loading breakdowns by chemical were not available for several of the 25 sites in Table 4.3.1. For these sites, TRC obtained estimated total loadings of EPA Priority

Pollutants, a list of 129 organic and inorganic contaminants including all 18 target chemicals of concern, with the exception of mirex and octochlorostyrene. Identifying whether any of the 18 chemicals of concern are even present in these loadings would be helpful in targeting sites of particular concern.

Loading data presented in this report were obtained from different sources spanning a several-year period. Due to the aggressive remediation schedules set by EPA and NYSDEC, interim remedial measures and removals have taken place at many of the 25 sites of particular concern listed in Table 4.3.1. Actual current loadings for a given site depend on its remedial status. For example, interim remedial actions may have involved the removal of contaminated soils or sediments which were serving as a continuing source of loadings; their removal may have reduced or eliminated the site's contribution to the Eastern Great Lakes Basin. Sampling indicates that toxics loading have indeed been significantly reduced by these interim actions. For example, NYSDEC estimated that loadings from Dupont-Necco Park have decreased by 37 percent as a result of interim remedial measures¹⁰. Sites which have been subject to remediation or natural attenuation of contamination may therefore contribute lower loadings than are listed in this report.

4.3.4 Summary

Hazardous waste sites may serve as a considerable non-point source of contamination to the Eastern Great Lakes Basin. Although estimated loading data are only available for 25 sites in Erie and Niagara Counties, those numbers alone indicate loadings as high as 656.671 kg/year of tetrachloroethylene.

¹⁰"Reduction of Toxics Loadings to the Niagara River from U.S. Hazardous Waste Sites: A Progress Report," EPA/NYSDEC, March 1993, p. 7.

There is documentation for most of the 150 existing or proposed hazardous waste sites listed in Table D-1 regarding their likely contaminants of concern. Nearly all are thought to contain at least one of the 18 target chemicals of concern. Even if the loading from each site is very small, their total contribution to the Eastern Great Lakes Basin could potentially be significant.

Because the vast majority of potential hazardous waste sites in the 32 counties of concern have not been investigated, it is impossible at this time to even qualitatively assess their potential impact on the basin. However, it appears that Erie and Niagara Counties are the most significant contributors, due to the sheer number of sites (nearly 300 in these two counties alone). In addition, EPA and NYSDEC have identified 24 sites (most of which are included in Table 4.3.1) that contribute a high percentage of total contaminant loadings to the Niagara and Buffalo Rivers¹¹.

4.4 Sediments

4.4.1 Methodology

TRC reviewed several documents pertaining to sediment contamination in the New York tributaries that flow into the Eastern Great Lakes Basin. TRC gathered information regarding sources of contaminants, concentrations of contaminants, and contaminant pathways. TRC also included all available information on aqueous-phase contaminant concentrations, which are directly causal in increasing sediment contamination. TRC also attempted to identify "hot spots" along specific rivers or tributaries to determine which portions warranted further investigation. Documents reviewed include the following:

- "Niagara River Remedial Action Plan," Draft, Volume I, March 1993, NYSDEC.

¹¹EPA/NYSDEC, March 1993.

- "Oswego River Remedial Action Plan 1992 Update", NYSDEC Division of Water, June 1992.
- "Chemical Contaminants in Sediments of New York Tributaries to Lake Ontario", S. Litten, NYSDEC Division of Water, October 1988.
- "Report on Great Lakes Confined Disposal Facilities", EPA Planning and Management Division, August 1990.
- "Application of Passive Samplers (PISCES) to Locating a Source of PCBs on the Black River, New York", Environmental Toxicology and Chemistry, Volume 12.
- "The Search For Dioxin - Eighteen Mile Creek", S. Litten, NYSDEC Division of Water, January 1992.
- "Reduction of Toxics Loadings to the Niagara River From Waste Sites in the U.S.: A Progress Report", EPA and NYSDEC, March 1993.
- "Model Data Requirements and Mass Loading Estimates for the Buffalo River Mass Balance Study (ARCS/RAM Program)," draft report, Great Lakes Program, State University of New York at Buffalo, April 1993.

The last document supports the mass balance modeling work being conducted for the Assessment and Remediation of Contaminated Sediments (ARCS) program on the Buffalo River. Created and initiated by the Great Lakes National Program Office (GLNPO), ARCS will be used to guide the development of RAPs for the areas of concern in Great Lakes.

4.4.2 Sources and Loadings

The results of the review are presented in tabular form in Table 4.4.1. The most significant results are discussed in this section. Eighteen Mile Creek contained the highest concentrations of dioxin of any body of water during a study conducted in 1987.¹⁰ The highest concentrations were discovered downstream of the New York

TABLE 4.4.1. SEDIMENT CONTAMINATION IN NEW YORK TRIBUTARIES

Location	Receiving Bodies of Water	Contributing Bodies of Water	Contaminants	Contaminant Sediment and Aqueous Phase Concentrations	Contaminant Loading from River Body	Possible Sources	Comments
Eighteen Mile Creek	Lake Ontario	Elliot Creek Petit Flume Erie Canal Red Creek Barge Canal	Dioxin PCBs Lead	361.35 ng/g PCBs in sediments (1).	NI	Harrison Radiator Co. Van de Mark Chemical Co. Lockport STP	Highest concentrations of dioxin in New York surface waters were found below the Barge Canal in Eighteen Mile Creek.
Genesee River	Lake Ontario	Black Creek Canaseraga Creek Oatka Creek Honeoye Creek	Lead PCBs Mercury	NI	NI	Brewing and chemical companies.	Lower portion of the river showed the highest concentrations of mercury.
Black River	Lake Ontario	Beaver River Independence River Moose River Perch River	Lead PCBs	NI	Approximately 8 kilograms of PCBs are discharged to Lake Ontario per year (2).	Paper Mills	Source of majority of PCB contamination has been determined to be a paper mill located near the Carthage dam

TABLE 4.4.1. SEDIMENT CONTAMINATION IN NEW YORK TRIBUTARIES

Location	Receiving Bodies of Water	Contributing Bodies of Water	Contaminants	Contaminant Sediment and Aqueous Phase Concentrations	Contaminant Loading from River Body	Possible Sources	Comments
Niagara River	Lake Ontario	Lake Erie	PCBs	NI	Approximately 350 kilograms per year of PCBs are discharged to Lake Ontario (2). Hexachlorobenzene 0.11 kg/day, dieldrin 0.162 kg/day, benzo(a)anthracene 2.23 kg/day (3).	NI	According to EPA sources, the Niagara River itself harbors no contaminated sediment, but carries contaminated sediment to Lake Ontario, where it clusters around the mouth of the Niagara River (7).
Oswego Harbor	Lake Ontario	Oswego River Onondaga Lake	Pesticides PCBs	NI	NI	Onondaga Lake; Bristol-Meyers Squibb Co.; Syracuse Metropolitan Treatment Plant; Roth Brothers Smelting Co.	Onondaga Lake is itself a listed hazardous waste site. The sediments are contaminated with mercury, pesticides, and PCBs.

TABLE 4.4.1. SEDIMENT CONTAMINATION IN NEW YORK TRIBUTARIES

Location	Receiving Bodies of Water	Contributing Bodies of Water	Contaminants	Contaminant Sediment and Aqueous Phase Concentrations	Contaminant Loading from River Body	Possible Sources	Comments
Pettit Flume	Eighteen Mile Creek Little Niagara River to Niagara River to Lake Ontario	Pettit Creek Flume	Volatile and semi-volatile chlorobenzenes PCBs Mirex	Aqueous phase PCBs-22.93 ng/l. (4) 12,644 ng/g PCBs in sediments (1) 750,000 ng/g hexachlorobenzene in sediment; 20 ng/g mirex in sediments	Total of all contaminants is 1.8 lbs/day ⁽¹⁾	Former Occidental; Durez; urban runoff from N. Tonawanda	RI/FS completed 12/91. ROD issued 3/92. RD/RA underway.
Ellicott Creek	Niagara River to Lake Ontario	Smaller unnamed tributaries	PCBs	Aqueous-phase PCBs: upper 2.2 ng/l, lower (screened)-3.27 ng/l (4) 167.3 ng/g PCBs in sediment (1)	NI	Unknown	
Smoke Creek	Lake Erie to Niagara River to Lake Ontario	NI	PCBs	Aqueous-phase PCBs: upper-12.06 ng/l lower-2.12 ng/l lower (screened)-1.91 ng/l (5)	NI	Bethlehem Steel	
Gill Creek	Niagara River to Lake Ontario	NI	PCBs Hexachlorobenzene Tetrachloroethylene Mercury (now remediated) (7)	NI	PCBs-0.20 kg/day (4)	DuPont Olin Corp.	Aqueous-phase PCBs also detected at 117.56 ng/l screened and at 251.29 ng/l in samples from Gill Creek (4). Gill Creek was remediated in 1992 and 1993(7).

TABLE 4.4.1. SEDIMENT CONTAMINATION IN NEW YORK TRIBUTARIES

Location	Receiving Bodies of Water	Contributing Bodies of Water	Contaminants	Contaminant Sediment and Aqueous Phase Concentrations	Contaminant Loading from River Body	Possible Sources	Comments
Bloody Run Creek	Niagara River to Lake Ontario	NI	Dioxins (now remediated) (7)	NI	NI	Hooker/ Occidental: Hyde Park	Received leachate from landfill. Due to remediation, creek is responsible for contaminated seep to Niagara Gorge. Remedy for sediments scheduled for completion by 1/93.
Two Mile Creek	NI	NI	PCBs	Aqueous phase PCBs: 23.22 ng/l (5)	NI	Unknown	
Cayuga Creek (Niagara County)	Niagara River to Lake Ontario	Black Creek Bergholtz Creek	PCBs	Aqueous phase PCBs: 2.34 ng/l (5)	NI	Unknown	
Cayuga Creek (Eric County)	Buffalo River to Niagara River to Lake Ontario	Buffalo Creek	PCBs	Aqueous phase PCBs: 0.75 ng/l (5)	NI	Unknown	
Woods Creek	NI	NI	PCBs	Aqueous phase PCBs: 3.74 ng/l (5)	NI	Unknown	
Scajaquada Creek	Niagara River to Lake Ontario	NI	PCBs	Aqueous phase PCBs: upper-12.06 ng/l lower-6.57 ng/l (5)	NI	Unknown	

TABLE 4.4.1. SEDIMENT CONTAMINATION IN NEW YORK TRIBUTARIES

Location	Receiving Bodies of Water	Contributing Bodies of Water	Contaminants	Contaminant Sediment and Aqueous Phase Concentrations	Contaminant Loading from River Body	Possible Sources	Comments
Buffalo River Sediments	Niagara River to Lake Ontario	Cayuga Creek Buffalo Creek Scajaquada Creek Smoke Creek	PAHs* PCBs** DDT Chlordane Dieldrin Lead	PCBs - 924.73 µg/g*** B(a)A - 1,155,996 µg/kg Chrysene - 950,302 µg/kg Dieldrin - 14.2 µg/kg DDT - 71 µg/kg B(b)f - 687,429 µg/kg B(k)f - 696,481 µg/kg B(a)p - 819,231 µg/kg (6)	PCBs-.00263 kg/day Chlordane-.000304 kg/day Dieldrin-.0000893 kg/day DDT-.00178 kg/day B(a)a-.0545 kg/day B(b)f-.146 kg/day B(k)f-.0627 kg/day B(a)p-.0831 kg/day Chrysene-.120 kg/day Lead-.0887 kg/day (6)	Buffalo Color (6) PVS Chemical	Contaminant loadings reported on April 22, 1992

References

- (1) "The Search for Dioxin - Eighteen Mile Creek," S. Litten, NYSDEC, January, 1992, p. 4.
 - (2) "Applications of Passive Samplers To Locating Sources of PCBs On the Black River", Environmental Toxicology & Chemistry, Vol. 12, p 647.
 - (3) Personal communication between A. Miller (TRC) and S. Litten, NYDEC Water Division, July 12, 1993.
 - (4) "Reduction of Toxics Loadings to the Niagara River From Waste Sites in the U.S.: A Progress Report", EPA and NYSDEC, March, 1993 p 8.
 - (5) "Sources of PCBs to the Niagara River, Interim Report", S. Litten, NYSDEC, Division of Water, p6.
 - (6) "Model Data Requirements and Mass Loadings Estimates for the Buffalo River Mass Balance Study (ARCS/RAM Program)," Draft Report, April 1993, pp. 9, 34-36, 49, 66.
 - (7) Fax communication, E. Lonoff, Waste Management Division, Niagara Frontier Programs to S. Stoloff, TRC, dated 8/30/93.
- *Concentrations reported in (6) did not exceed the Sediment Quality Criteria values for PAHs found in "Interim Sediment Criteria Values for Nonpolar Hydrophobic Organic Contaminants," U.S. EPA, Office of Water Regulations and Standards, May 1988.
- **Concentrations reported in (6) exceeded the Sediment Quality Criteria values for PCBs found in "Interim Sediment Criteria Values for Nonpolar Hydrophobic Organic Contaminants," U.S. EPA, Office of Water Regulations and Standards, May 1988.
- ***Concentrations reflect the highest concentrations detected.
- NI - No information found.

State Barge Canal that contributes to the creek's flow. Several industrial dischargers have been identified, although no definitive links can be made between them and the dioxin contamination.

The Niagara River and its tributaries were found to have the highest concentrations of PCBs of any other river in the literature reviewed by TRC. Approximately 350 kilograms per year of PCBs are discharged into Lake Ontario via the Niagara River.¹² Due to the scouring action of the Niagara River, sediment deposits are not prevalent along the river's main channel.¹³ The largest single source appears to have been Gill Creek which discharged nearly 70 kilograms per year to the Niagara River. Aqueous-phase water samples collected from Gill Creek contained nearly 252 nanograms per liter (ng/l) of PCBs.¹⁴ Concentrations at this level in the aqueous phase would be expected to contribute to sediment contamination. It should be noted that Gill Creek was remediated in 1992 and 1993.¹⁵

Onondaga Lake discharges to the Oswego River which eventually discharges to Oswego Harbor in Lake Ontario. Onondaga Lake has been identified as a "hot spot." The sediments at the bottom of the lake have been contaminated with mercury, pesticides, and PCBs. The lake is listed as a hazardous waste site.

Pettit Flume contained the highest concentrations of PCBs in sediments of any other tributary to Eighteen Mile Creek. Concentrations of 12,600 nanograms per gram

¹²"Application of Passive Samplers to Locating Source of PCBs on the Black River." Environmental Technology and Chemistry, Vol. 12, p. 647.

¹³Draft Niagara River Remedial Action Plan, Volume I, NYSDEC, March 1993.

¹⁴Personal communication between A. Miller, TRC, and S. Litten, NYDEC Water Division, July 12, 1993.

¹⁵Fax communication, E. Lonoff, EPA Waste Management Division, Niagara Frontier Program, to S. Stoloff, TRC, dated 8/30/93.

(ng/g) have been recorded.¹⁶ Sediments also contained extremely high concentrations of hexachlorobenzene (750,000 ng/g) and mirex (20 ng/g). A Remedial Design/ Remedial Action is currently underway to contain the contamination. The Occidental Durez Plant is named as the likely source of contamination.

The Buffalo River discharges to the Niagara River which ultimately flows into Lake Ontario. While contaminant loadings for PAHs and pesticides were negligible, PCB concentrations exceeded the Sediment Quality Criteria Value, developed by EPA's Office of Water Regulations and Standards in 1988.¹⁷

4.4.3 Data Gaps and Limitations

TRC has not obtained any information on loadings from sediments. No study available to TRC has attempted to model these data as the uncertainties and assumptions would render the model of limited value. However, studies reviewed by TRC have modelled the loading of contaminants from a surface water body as a whole by utilizing sediment and particularly aqueous-phase concentrations, known flow rates, and loadings from industrial and municipal discharges to the river. TRC has included all available concentration loading information in Table 4.4.1.

There are several rivers for which no data on aqueous-phase or sediment concentrations could be obtained, including the Genesee River, Black River, and Oswego Harbor. These water bodies may have been sampled; this possibility should be investigated further.

¹⁶"The Search for Dioxin-Eighteen Mile Creek," S. Litten, NYSDEC Water Division, January 1992. p. 4.

¹⁷"Model Data Requirements and Mass Loading Estimates for the Buffalo River Mass Balance Study (ARCS/RAM Program)," Great Lakes Program, SUNY at Buffalo, April 1993, pp. 34-36.

Clearly, the more contaminated the aqueous phase, the more contamination is likely to settle in the sediments, but specific information in this area appears to be limited. It may be possible to use the STORET database to identify sampling locations in any of these rivers. TRC's research of the STORET information did not provide any useful data on ambient concentrations due to the use of varied and elevated analytical method detection limits. A study similar to EPA's ARCS program on the Buffalo River should be considered for other major rivers in the U.S. Eastern Great Lakes Basin. Simon Litten, of the NYSDEC Division of Water, is performing several studies of sediment contamination in the area using PISCES passive samplers. These units are designed to resemble the ingestion of sediments by fish; sediments cross a membrane and then remain within the body of the samplers until analyzed.

4.4.4 Summary

TRC has reviewed several documents listed in Section 4.4.1 which summarize sediment contamination in the U.S. Eastern Great Lakes Basin area. However, the data set from these sources is relatively limited. In addition, because some studies' models are either in the process of being fully developed or are based on inadequate data sets, TRC cannot draw definitive conclusions regarding total sediment contamination. According to the sources reviewed by TRC, the Buffalo River contains significant sediment contamination. This is to be expected, as this river is used as a receiving body for many industrial and municipal discharges. The Onondaga Lake is also significantly contaminated with mercury, pesticides, and PCBs and is itself considered a hazardous waste site. The predominant contaminants within sediments throughout the U.S. Eastern Great Lakes Basin appear to be PCBs.

Reliable data on ambient conditions in the U.S. Eastern Great Lakes Basin should be obtained. Sampling and analysis programs which utilize low method detection limit analytical procedures should be employed, such as that used by Battelle Ocean

Sciences in their "Study of PCBs in New York/New Jersey Point Sources," prepared for EPA and dated January 29, 1993.

4.5 Surface Water Runoff

For the purposes of this report, surface water runoff has been defined to include all surface water runoff which eventually enters Lake Ontario and Lake Erie or a tributary to the lakes. In rural areas, surface water is typically allowed to enter surface water bodies directly. Surface water runoff in urban areas is typically diverted into combined sewer systems and mixed with the city's sanitary sewage. Certain facilities or areas of each city may operate collection and discharge systems of their own. However, due to the significant efforts involved in identifying each of these areas or facilities they are not specifically addressed in this report.

Under normal conditions the combined flow enters a treatment plant, but under increased flow conditions, such as those due to storm events, the sewer systems are allowed to overflow to prevent overloading the treatment plant. These overflows allow contaminants from both the surface water runoff and the sanitary sewer to enter an adjacent body of water. Due to the varying characteristics of direct surface water runoff and flow from combined sewer overflows, this section addresses each separately.

4.5.1 Direct Surface Water Runoff

4.5.1.1 Methodology

TRC has reviewed a number of documents pertaining to direct surface water runoff quality for the Eastern Great Lakes Basin. These documents include the following:

- "Nonpoint Source Loading Study, Buffalo River Segment, Niagara River Basin," Alliance Technologies Corporation (now TRC), December 1991;
- "Quantity and Quality of Urban Storm Water Runoff in the Irondequoit Creek Basin near Rochester, New York," U.S. Geological Survey, 1986;
- "New Techniques for Modelling the Management of Stormwater Quality Impacts," Lewis Publishers, 1993; and
- "Great Lakes Basin Risk Characterization Study," Chapter L-Pesticide Discharges and Environmental Risk, Page III-54.

TRC reviewed each of these documents and extracted all pertinent information regarding source locations and loading quantities for each of the 18 identified chemicals of concern. Non-point source loadings to the Buffalo River Basin from surface water runoff were evaluated as part of a study previously performed by TRC (formerly Alliance Technologies Corporation).¹⁸ As part of this study, toxic loadings were determined based on land-use characteristics. Research performed in Canada^{19,20,21} provided contaminant loadings for each land-use classification. The drainage basin for the Buffalo River was divided into sub-basins and areas of each particular land-use category (i.e., commercial, industrial, residential, etc.) were identified. This method was applied throughout the study area, however, it does not account for the presence of storm water collection systems. Therefore, TRC could not identify specific areas of concern for surface water runoff.

Based on these data sets contaminant loadings were estimated for each sub-basin. After compiling this database, the EPA Storm Water Management Model (SWMM)

¹⁸Nonpoint Source Loading Study, Buffalo River Segment, Niagara River Basin.

¹⁹Loadings of Toxic Contaminants from Urban Nonpoint Sources to the Great Lakes from Ontario Communities. Schroeter and Associates. 1991.

²⁰Evaluation of pollution loadings. J. Great Lakes Res. Marsalek and Ng, 1989.

²¹Toxic Substances in Urban Runoff. Marsalek and Greek. 1983.

was utilized to model the transport of these contaminants through the river basin. This model is capable of modeling all aspects of urban hydrology, including runoff, transport through a drainage network, storage and treatment. TRC has reviewed the entire project file for this study and extracted final loadings quantities for which data were found (i.e., arsenic, lead, mercury, chlordane, dieldrin, mirex, and hexachlorobenzene).

TRC obtained information pertaining to lead loadings to the Irondequoit Creek basin from a published study performed by the U.S. Geological Study (USGS). The USGS conducted this study between August 1980 and August 1981. This study consisted of collecting water samples and obtaining flow measurements at 16 locations throughout the basin. Samples and measurements were collected during a total of 23 storm events. Lead was the only one of the 18 chemicals of concern which was analyzed in this study. Using the information obtained from these activities, flow-weighted daily average loadings were calculated for each sampling area along the creek.

For agricultural surface water runoff, no loadings have been obtained. Although the pesticides among the 18 target chemicals have been banned from use, depending on their specific concentration and persistence in the environment, they may continue to contaminate surface water runoff from areas of former application.

4.5.1.2 Sources and Loadings

Due to the size of the area covered and the methodology adopted by Alliance Technologies Corporation (now TRC) in performing the 1991 study, specific sources of contaminants were not identified. Instead, loadings were estimated based on land use within the Buffalo River Basin, as compared to similar river basins for which data were available. Table 4.5.1 presents projected annual loadings for the Buffalo River Watershed for each of the identified chemicals of concern. The most significant

TABLE 4.5.1. PROJECTED BUFFALO RIVER BASIN WATERSHED ANNUAL TOXIC LOADINGS		
Contaminant	Total Load (kg/yr)	Load per Hectare (kg/yr/ha)
Arsenic	830	0.0012
Lead	43,445	0.062
Mercury	17.5	0.00003
Benzo(a)anthracene	NM	-
Benzo(b)fluoranthene	NM	-
Benzo(k)fluoranthene	NM	-
Chrysene	NM	-
Total PAHs	NM	-
Chlordane	2.20	0.000003
Alpha-chlordane	NM	-
Gamma-chlordane	NM	-
Dieldrin	0.359	0.0000005
Total DDT	1.44	0.000002
pp DDD	NM	-
pp DDE	NM	-
pp DDT	NM	-
Mirex	0.108	0.00000015
Toxaphene	NM	-
Dioxin	NM	-
Hexachlorobenzene	3.59	0.000005
Tetrachloroethylene	NM	-
Octachlorostyrene	NM	-

Note: NM = not modelled

Reference: Nonpoint Source Loading Study, Buffalo River Segment, Niagara River Basin, Alliance Technologies Corporation, December 30, 1991 - Page 3-13.

loading identified was for lead (43,445 kg/yr). Arsenic also was found to have significant loadings due to surface runoff (830 kg/yr).

From the completion of the USGS study, it was determined that snowmelt and spring runoff periods account for nearly 70 percent of the annual lead load to the Irondequoit Creek basin. Storms were found to contribute another 20 percent. The results of the study found urbanized areas to produce the highest annual yield. During storm events, the high-density residential area of East Rochester was found to be a major contributor, supplying 150 kilograms per square kilometer (kg/km²) of lead. Annual yields of lead determined during the USGS study for each sampling site in the creek basin are presented in Table 4.5.2. The three sites which had loadings in excess of 20 kg/km² (Cranston Road, Southgate Road and East Rochester) were the more urbanized areas.

A predominant land use in the Eastern Great Lakes Basin is agriculture, which is associated with the application of a significant amount of pesticides and herbicides. In the late 1980s, the total amount of pesticides applied in the Eastern Great Lakes Basin was 3,268 billion lbs/year.²² There are also several other primary sources of pesticides in the basin:

- lawn care and household uses;
- manufacture and blending of pesticides;
- storage of pesticides; and
- accidental releases and spills.

There is little available information on these sources; however, of the 18 chemicals of concern identified for investigation under this Work Assignment, DDT, dieldrin, dioxin, mirex, mercury, arsenic, toxaphene, and chlordane are all either pesticides themselves or associated with pesticides. DDT and dieldrin were banned in the 1970s, although concentrations are still found in fish samples. The remaining pesticides were

²²Great Lakes Basin Risk Characterization Study, Page III-54.

TABLE 4.5.2 TOTAL ANNUAL YIELDS OF LEAD AT SITES LOCATED IN THE IRONDEQUOIT CREEK BASIN

Site Name	Yield (kg/km²)
Thornell Road	2.19
Thomas Creek	2.49
Linden Avenue	2.92
Allen Creek	17.9
Blossom Road	8.1
Cranston Road	24.8
Southgate Road	25.2
East Rochester	153.0

References: Quantity and Quality of Urban Storm Runoff in the Irondequoit Creek Basin near Rochester, New York, USGS, 1986 - Page 34.

banned in the 1980s. Concentrations which persist in the environment, however, may still be impacting areas of former use.

4.5.1.3 Data Gaps and Limitations

Overall, very limited data were found regarding surface water runoff quality. Somewhat detailed information was only found for the Buffalo River Basin, as well as lead data for the Irondequoit Creek Basin. Therefore, in order to adequately characterize and prioritize the need for surface water runoff controls, modelling similar to the study performed by TRC (formerly Alliance Technologies Corporation) described above should be conducted for the entire U.S. Eastern Great Lakes Basin. Such modelling should then be performed in conjunction with sampling throughout the study area to confirm the model's predictions.

TRC attempted to validate the results of the 1991 non-point source loadings study by comparing the estimated loadings with ambient data contained in the STORET Database. However, the database only provided information for lead and mercury and a complete evaluation could not be performed. Additionally, the input values for the model were obtained from research performed in Canada and are not necessarily representative of conditions in the U.S., although the values were obtained from areas of similar characteristics. The values obtained by the TRC study should be considered estimated "order of magnitude" values as opposed to actual concentrations.

The data presented in the USGS report are limited mainly by the fact that the study was conducted over ten years ago. Waste disposal and material handling practices have changed significantly since the time of the study, due to more stringent controls under both the CERCLA and RCRA programs. It is expected that these concentrations have reduced since the time period of the study; however, this projection should be verified with a similar study.

Regulations issued by EPA on November 16, 1990 establish NPDES permit application requirements for stormwater associated with industrial activity. Issuance of such permits should provide more accurate information about contaminant loadings due to surface water runoff. Contaminant concentration limits set forth in these new NPDES permits will require certain industries to identify and reduce their respective loadings. However, as reported on page 60446 of the Federal Register for Friday, December 18, 1992, EPA has experienced problems in promulgating these regulations. For this reason, the deadlines for permit approvals or denials have been delayed, the first deadline being October 1, 1993 for most discharges associated with industrial activity. Information pertaining to discharges subject to these permits has therefore not been included in this report.

4.5.1.4 Summary

From the modelling performed to date, direct surface runoff has been shown to be a potentially significant source of contaminant loadings to the Eastern Great Lakes and their tributaries, especially for lead. In order to fully evaluate this source, additional investigations, similar to that performed for the Buffalo River Segment, should be undertaken for the entire Eastern Great Lakes Basin. In addition to performing modelling, a limited sampling and analysis program should also be considered to validate or confirm the results of the model. Low method detection limit analytical procedures, such as those used in Battelle's "Study of PCBs in New York/New Jersey Point Sources" dated January 29, 1993 should be considered.

In addition to these efforts, NPDES permit requirements for stormwater discharges must be established to achieve adequate environmental protection in all areas of the U.S. Eastern Great Lakes Basin. In fulfilling these permit requirements a facility will be obligated to evaluate any contaminant loadings which contribute to surface runoff by that facility. Imposing stormwater discharge limits on such facilities should result in significant reductions in contaminant loadings due to surface water runoff.

4.5.2 Combined Sewer Overflows

4.5.2.1 Methodology

Combined sewer overflows (CSOs) are strategically located overflow pipes that will accommodate any excess capacity from a wastewater or sewage treatment plant during a storm event. During a storm event, the CSO routes the excess influent that the treatment plant is no longer able to treat to the nearest surface water body or river. Untreated influent is, therefore, directly discharged to the surface water body. By definition, this situation would occur infrequently, only when there are storm events with maximum precipitation. However, in older cities, where treatment plant capacities were based on a smaller population, CSOs may be more frequently utilized.

Urban stormwater sewers and CSOs have been identified as sources of contamination to the Eastern Great Lakes Basin. In order to determine loadings from these two sources, it is necessary to model storm event frequencies and intensities with the influent concentration to wastewater treatment plants. TRC has not been able to obtain information on studies that have modelled the loadings. However, TRC has obtained some sampling information for the influent to the Buffalo Sewer Authority Wastewater Treatment Plant. This provides an indication of the contaminant loading from the CSOs during an overflow situation. It is noted that these concentrations may not accurately reflect concentrations which would be discharged to the river during an overflow event. Stormwater runoff may be expected to dilute these concentrations as well as potentially introduce additional contaminants due to transport of contaminants during overland flow and sediment scouring within the sewer system. TRC also obtained data from samples of discharges from several CSOs in the Buffalo River.

TRC reviewed the following documents while assessing the impact of CSOs as a source of contamination:

- "Rochester Embayment Remedial Action Plan, Stage I," edited by the Monroe County Department of Planning and Development, June 1993;
- "Combined Sewer Overflow Loadings Inventory for Great Lakes Basin, Final Report," prepared for EPA by GCA Corporation, March 1983;
- "Model Data Requirements and Mass Loading Estimates for the Buffalo River Mass Balance Study (ARCS/RAM Program), Draft Report," Great Lakes Program SUNY at Buffalo, April 1993;
- "Draft Niagara River Remedial Action Plan, Volume II," New York State Department of Environmental Conservation, March 1993; and
- "Great Lakes Basin Risk Characterization Study," Great Lakes National Program Office, undated.

4.5.2.2 Sources and Loadings

The Great Lakes Basin Risk Characterization Study states that "CSO loadings to the Niagara River have (also) been found to be significant."²³ In addition to reviewing the Great Lakes Basin Risk Characterization Study, TRC has obtained CSO sampling information from the Model Data Requirements and Mass Loading Estimates for the Buffalo River Mass Balance Study. This study was released in draft form in April 1993 by the Great Lakes Program, Department of Civil Engineering at the State University of New York at Buffalo. The study summarizes data collected from CSOs in South Buffalo Sewer Districts. Table 4.5.3, Combined Sewer Overflow Discharges, provides dissolved and particulate phase concentrations of several PAHs and pesticides in the CSOs of South Buffalo in August, 1991. PCB concentrations are noted for 1990 and 1991. The study cautions, however, that "many of the smaller outfalls to the Buffalo River were not included ... especially for discharges to Cazenovia Creek," and that "development of a new model ... which will more accurately model water quality ... will be inserted for the final draft of this report"²⁴. TRC was informed that the

²³Great Lakes Basin Risk Characterization Study, Page III-28.

²⁴"Model Data Requirements and Mass Loading Estimates for the Buffalo River Mass Balance Study" (ARCS/RAM Program), Draft Report, Great Lakes Program SUNY at Buffalo, April 1993.

TABLE 4.5.3 COMBINED SEWER OVERFLOW (CSO) DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources															PCBs (total)	Tetrachloro-ethylene	Toxaphene
	Aromatic	Benz(o)anthracene	Benz(o)pyrene	Benz(b)fluoranthene	Benz(k)fluoranthene	Chlordane	Chrysene	DDT & Metabolites	Dieldrin	Dioxin	Hexachlorobenzene	Lead	Mercury	Mirex	Octachlorostyrene			
1. Influent concentration sampling data for Buffalo Sewer Authority Wastewater Treatment Plant Ref #1		Dissolved Phase 46.3748 mg/l	Dissolved Phase 4.5081 mg/l	Dissolved Phase 19.9116 mg/l	Dissolved Phase 3.33751 mg/l	Dissolved Phase .10534 mg/l chlordane .10565 mg/l	Dissolved Phase 28.8495 mg/l	4,4'-DDT 0.10 µg/L	Particulate Phase 1.4074 mg/l (1991)			10/15-16/85 17 µg/L 10/36-17/85 18 µg/L 10/17-18/85 14 µg/L 9/17-18/86 19 µg/L 3/19-20/87 20 µg/L 6/2-3/87 67 µg/L 9/17-18/87 38 µg/L	6/2-3/87 0.4 µg/L			Dissolved Phase 23.2 mg/l (1990) Particulate Phase 152.66 mg/l (1990)	10/15-16/85 17 µg/L 10/16-17/85 23 µg/L 10/17-18/85 14 µg/L 9/17-18/86 19 µg/L 3/19-20/87 4 µg/L 9/17-18/87 12 µg/L	
2. CSOs along the Buffalo River Ref #2		Particulate Phase 17.29 mg/l (1991)	Particulate Phase 6.914 mg/l (1991)	Particulate Phase 21.286 mg/l (1991)	Particulate Phase 5.24 mg/l (1991)	Particulate Phase g-chlordane .0423 mg/L (1991)	Particulate Phase 22.151 mg/l (1991)									Particulate Phase (1991) 2.56 mg/l		

Ref #1: Buffalo River Remedial Action Plan, NYSDRC 11/89.

Ref #2: Model Data Requirements and Mass Loading Estimates for the Buffalo River Mass Balance Study (ARCS/GRAM Program), draft report, Great Lakes Program, SUNY at Buffalo 4/93.

new model would be available in the Fall of 1993²⁵. Figure 4.5.1 shows the CSO locations along the Buffalo River where samples were obtained. Figures 4.5.2 to 4.5.4 show the location of CSOs in Tonawanda, Niagara Falls, and Rochester, respectively.

4.5.2.3 Data Gaps and Limitations

TRC has obtained sampling information for the Buffalo River CSOs, both discharges from the several CSOs on the Buffalo River, as well as the influent sampling data to the Buffalo Sewer Authority Wastewater Treatment Plant. TRC has not been able to obtain loading information about any other CSOs, although the locations of CSOs in several areas have been identified.

4.5.2.4 Summary

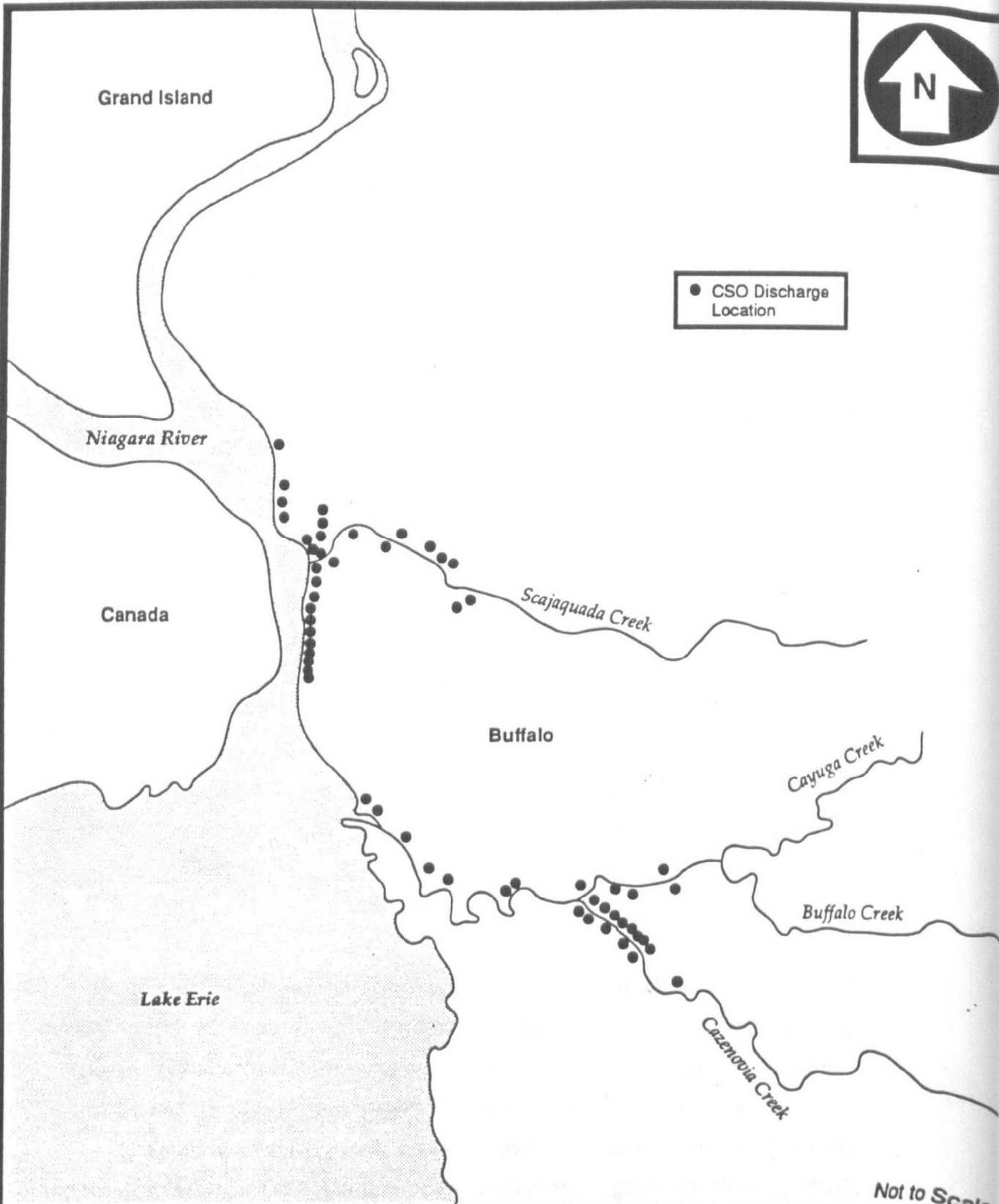
CSOs facilitate direct discharges of potentially contaminated surface water runoff and sanitary sewage into surface water bodies. Although these discharges may occur infrequently, the volumes water discharged and the associated contaminant concentrations may be significant. A detailed evaluation of the frequency, volumes, and chemical characteristics of discharges from CSOs into receiving water bodies is necessary to evaluate the magnitude of increased risks to human health and the environment due to these discharges.

However, based on the very nature of CSOs, it may be desirable to promote the reduction and/or elimination of CSOs within the Eastern Great Lakes Basin. Special cases may exist in which extreme economic burden would be incurred by certain communities in eliminating CSOs. For such cases it may be appropriate to install control devices which reduce the frequency in which overflows are allowed to discharge to the receiving water bodies. As an example, CSOs have been identified

²⁵Personal communication between S. Stoloff, TRC, and Kim Irvine, State University of Buffalo, July 20, 1993.



● CSO Discharge Location



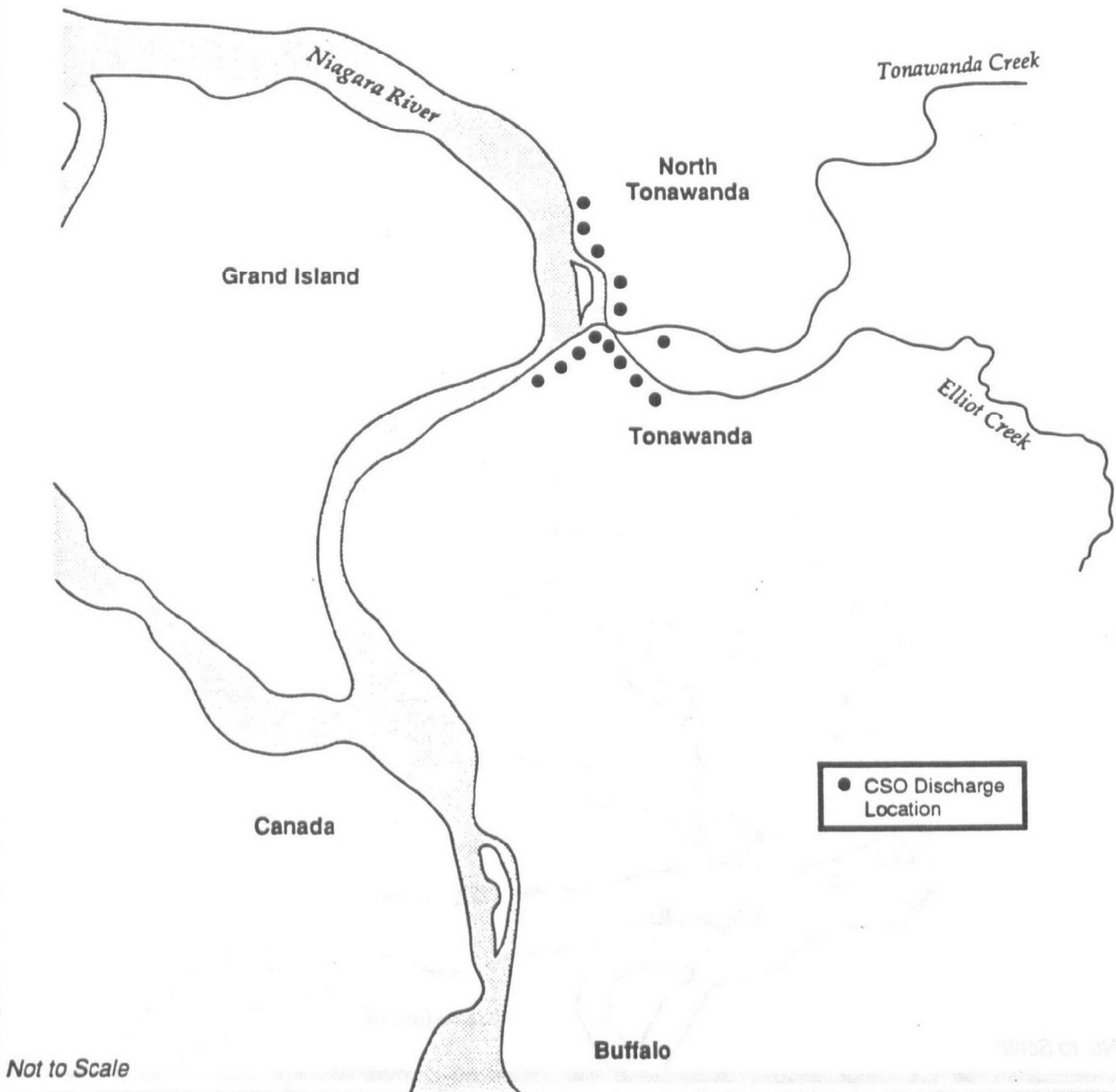
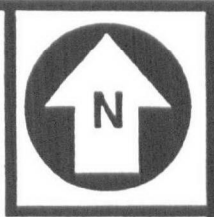
Not to Scale

COMBINED SEWER OVERFLOW LOCATIONS FOR
BUFFALO, NEW YORK

TRC

Figure 4.5.1

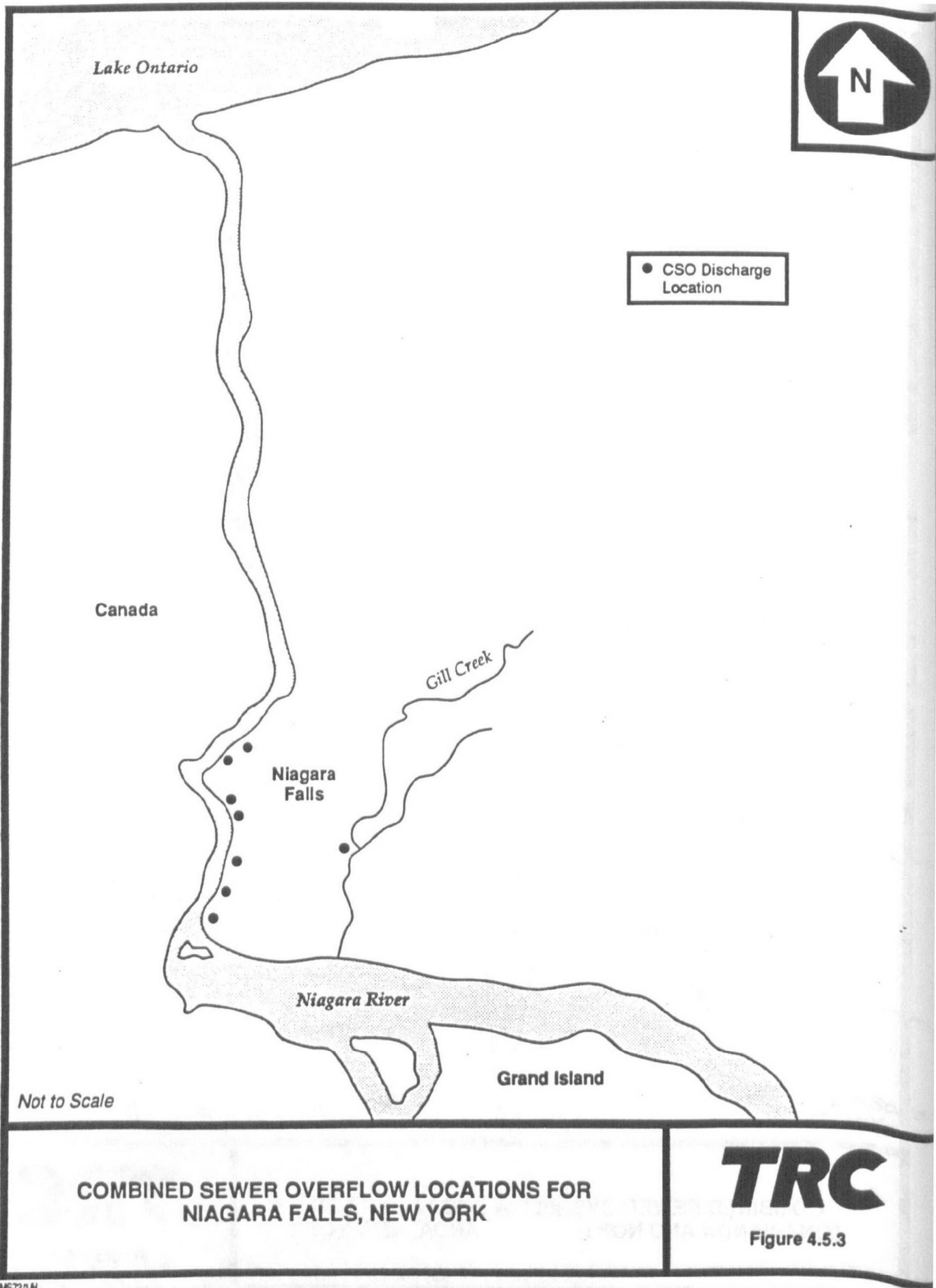
Niagara Falls

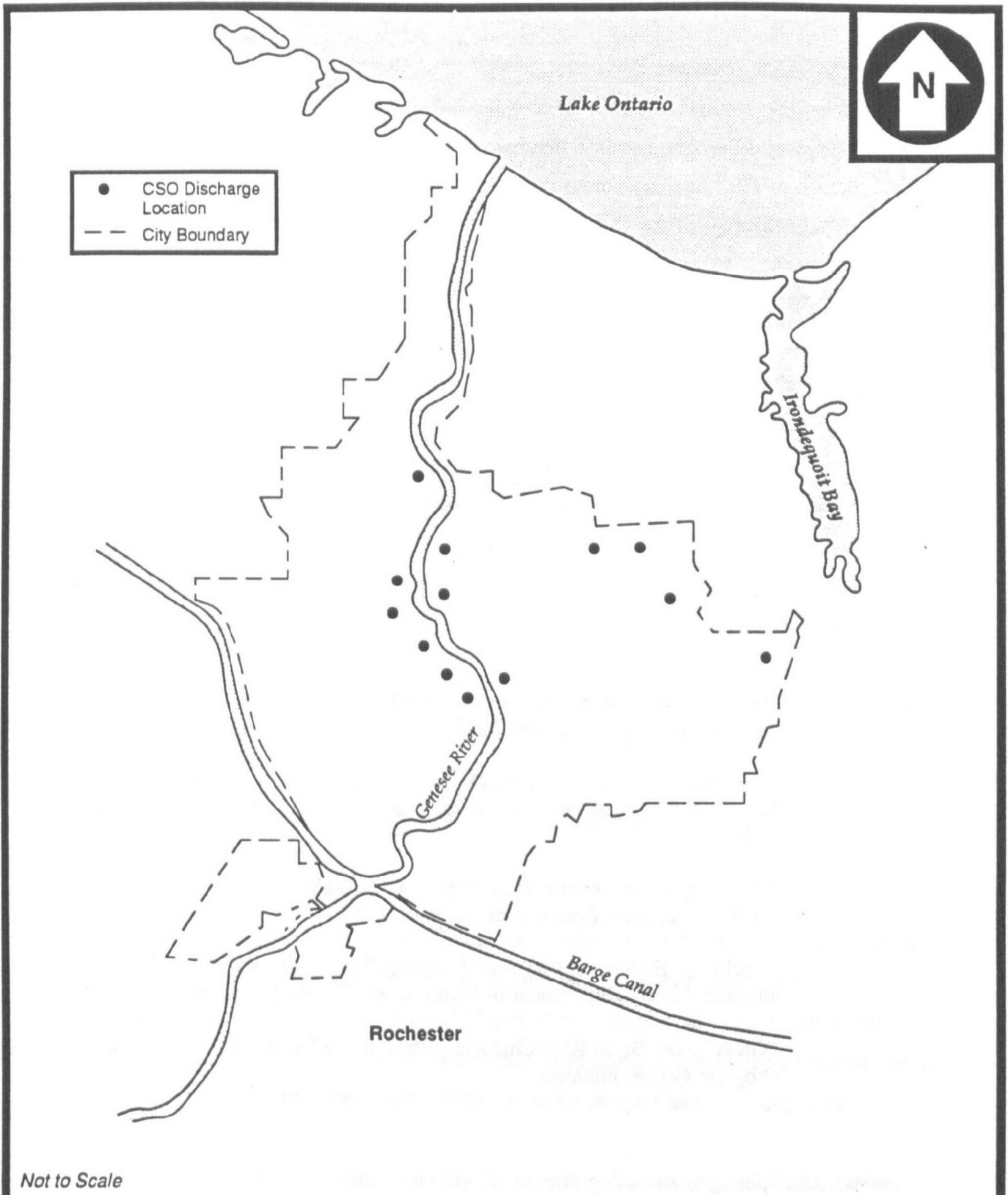


COMBINED SEWER OVERFLOW LOCATIONS FOR
TONAWANDA AND NORTH TONAWANDA, NEW YORK

TRC

Figure 4.5.2





**COMBINED SEWER OVERFLOW LOCATIONS FOR
ROCHESTER, NEW YORK**

TRC

Figure 4.5.4

within the Rochester Embayment which are designed to overflow twice per year, on average. It may be feasible to construct containment features (e.g., surge chambers) which could reduce overflow frequency. The removal of sewer sediments and the repair of CSO structures to minimize infiltration are additional methods which may reduce loadings of the 18 target chemicals into surface water bodies.

4.6 Atmospheric Deposition

4.6.1 Methodology

Atmospheric deposition results in loadings of contaminants from the air onto the water. Direct deposition involves direct contact of air contaminants with water, while indirect deposition results from the outflow of upstream lakes. TRC reviewed the following documents for pertinent information regarding atmospheric deposition in the Great Lakes area:

- "Great Lakes Atmospheric Deposition (GLAD) Network, 1982 and 1983," EPA-905/4-88-002, February 1988;
- "New Source Identification of Mercury Contamination in the Great Lakes," Gary E. Glass et. al., *Environmental Science Technology*, Volume 24, No.7, 1990;
- "Summary Report of the Workshop on Great Lakes Atmospheric Deposition," International Joint Commission, October 1986;
- "Rochester Embayment Remedial Action Plan (RAP), Stage I," edited by the Monroe County Department of Planning and Development, June 1993; and
- "Great Lakes Basin Risk Characterization Study," Great Lakes National Program Office, undated.

TRC has also accessed the following database for information about air contamination:

- AIRS

The Summary Report of the workshop on Great Lakes Atmospheric Deposition (GLAD) documents the results developed by a panel of approximately 40 technical and scientific experts assembled for the purpose of reaching a consensus as to the nature of atmospheric loadings of 14 chemicals of concern to the Great Lakes. This list of chemicals included approximately half of the 18 chemicals of concern addressed within this report. Chemicals such as PAHs, octachlorostyrene, and PCE were not addressed by the GLAD workshop.

The estimates of chemical loadings to the Great Lakes were based on the use of a mass balance approach. However, in order to perform a mass balance, several properties of each chemical were required. These properties include concentrations of each chemical in the various phases, mass transfer coefficients, deposition velocities of air-borne particles, settling velocities, Henry's Law constants, etc. Due to the lack of sufficient information for several of the chemicals of concern the workshop focused on the following chemicals for which sufficient information was available: PCBs, DDT, benzo(a)pyrene, and lead.

The Rochester RAP presents information on atmospheric deposition to Lake Ontario, the Rochester Embayment, the Genesee Basin, and the Rochester Embayment Watershed. Data obtained from a 1992 report on a study conducted by the Canada Center for Inland Waters (CCIW) were utilized to produce this information based on a comparison of embayment characteristics to those of the Canadian study area.

AIRS includes air emissions data only for criteria pollutants (e.g. sulphates, carbon dioxide, lead, etc.) and with the exception of lead, provides no information on any of

the 18 chemicals of concern. TRC obtained an AIRS database retrieval for lead emissions within the 32 Eastern Great Lakes counties. No emissions information was provided in this retrieval. TRC understands that lead was only recently added to the database as a separate parameter, this may explain why no emissions were identified.

4.6.2 Sources and Loadings

The primary sources of atmospheric loadings as identified in the Great Lakes Basin Risk Characterization Study are the following:

- industrial sources (mercury, PCBs, hexachlorobenzene, and mirex);
- transportation sources, especially cars, trucks, airplanes, and trains (lead and benzo(a)pyrene); and
- agricultural sources, including volatilization and suspension of agricultural chemicals (pesticides and organochlorides).

As discussed in this study, "airborne toxics can be transported over very long distances in the atmosphere. Therefore, sources of pollutants that pose risks in the basin may be very far upwind of the basin and sources within the Great Lakes Basin may contribute to problems in distant downwind locations."²⁶ *Identifying a particular source is therefore highly complex, although categories of sources may be identified as major contributors. Control measures for these sources are identified in Section 5.0.*

Atmospheric deposition of PCBs was noted to be more significant on a percentage basis in the western Great Lakes than in Lakes Erie and Ontario. This is thought to be due in part to the greater surface area of the western lakes.²⁷ Atmospheric deposition

²⁶Great Lakes Basin Risk Characterization Study. Page III-33.

²⁷Summary Report of the Workshop on General Lake Atmospheric Deposition. Page 15.

was identified as an important if not the dominant source of lead loadings. As an example, Lake Ontario receives 23 percent of its annual lead loading from atmospheric deposition on upstream sources (indirect deposition) and 50 percent from direct atmospheric deposition. This results in a total of 73 percent of Lake Ontario's annual lead loading originating from atmospheric deposition.²⁰ Similar results were noted for benzo(a)pyrene, for which 79 percent of total annual inputs are attributed to atmospheric deposition.²⁰

The percentage of total inputs of t-DDT to the lakes attributed to atmospheric deposition is reported to be 22 to 97 percent annually.²⁰ The models of atmospheric deposition for PCBs, benzo(a)pyrene, and lead are illustrated in Figure 4.6.1. The panel concluded that atmospheric deposition is suspected to be most significant from wet deposition (i.e., rainfall, snowfall), dry deposition of particulate matter, vapor exchange, connecting channels, and tributaries.

One identified source of lead in the atmosphere is from the use of leaded fuels in automobiles. Government restrictions on the use of such fuels has been noted as having resulted in a marked reduction of lead in the atmosphere. Reported total annual input along with percentages of atmospheric deposition for PCB and lead are provided in Table 4.6.1.

Additional sources may be present in the form of incinerators located within the Eastern Great Lakes Basin. These include hazardous waste as well as domestic waste incinerators. Stack emission particulate matter, released into the atmosphere in a heated state, may be deposited onto the lakes when the emissions are allowed to cool. Locations of incinerators within the Eastern Great Lakes Basin are presented in Appendix B, Tables B-4-1 and B-4-2, although no emissions data have yet been received by TRC from NYSDEC. TRC has ascertained that there are three air monitoring stations located at Niagara, Buffalo, and Rochester. These stations have,

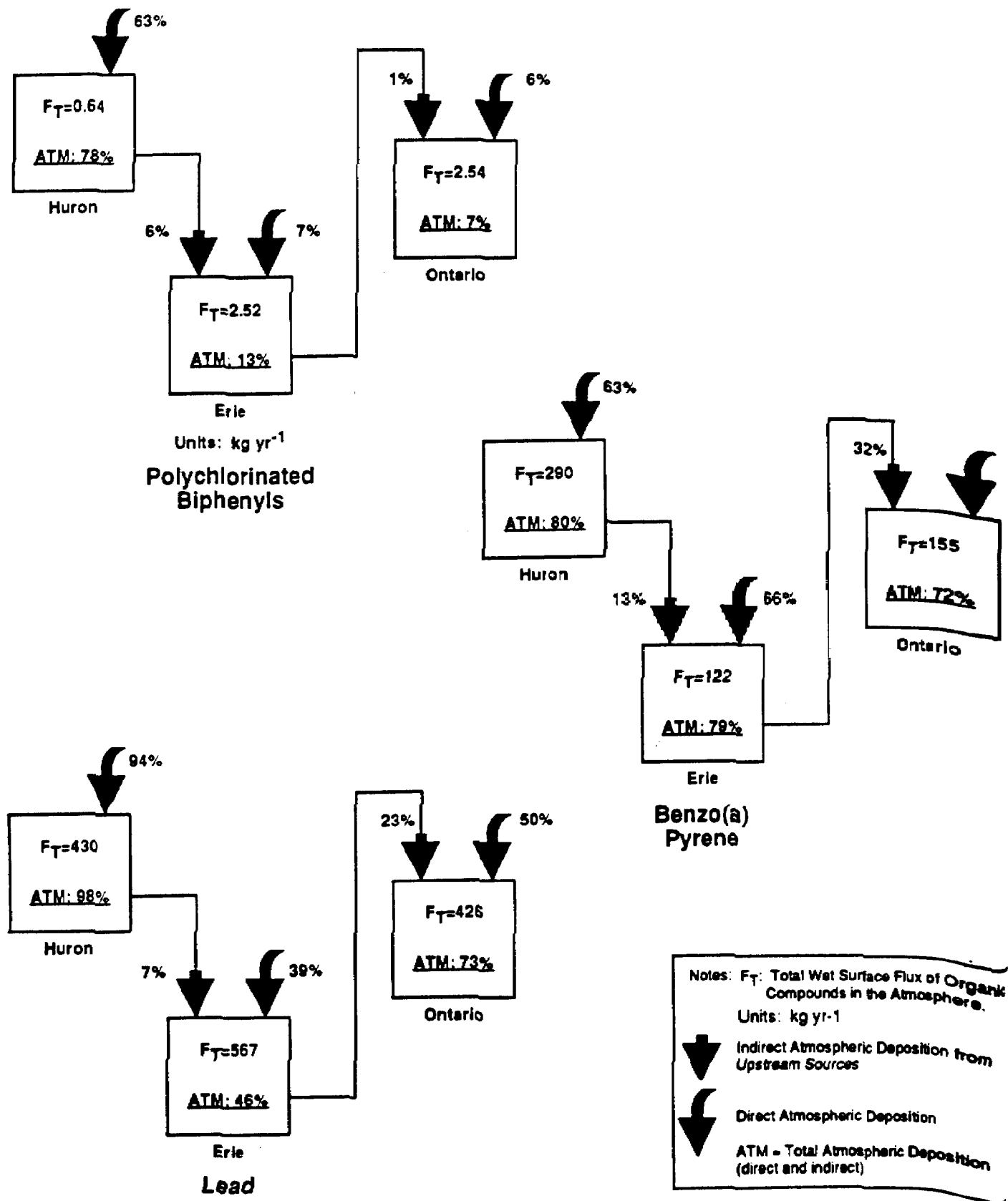


Figure 4.6.1. Atmospheric Loading of PCBs, Benzo(a) Pyrene, and Lead to the Eastern Great Lakes.

Reference: Summary Report of the Workshop on Great Lakes Atmospheric Deposition. International Joint Commission, October 1986.

TABLE 4.6.1 ANNUAL PCB AND LEAD INPUTS TO EASTERN GREAT LAKES AND THE FRACTIONS ATTRIBUTED TO ATMOSPHERIC PATHWAYS

	PCBs			Lead		
		% Atmospheric			% Atmospheric	
	Total Inputs kg/yr	Direct	Indirect	Total Inputs kg/yr	Direct	Indirect
Lake Erie	2.52	7	6	567	39	7
Lake Ontario	2.54	6	1	426	50	23

Reference: Summary Report of the Workshop on Great Lakes Atmospheric Deposition, International Joint Commission, October 1986.

however, traditionally monitored for the environmental conditions, such as acid rain. Only recently have toxic chemicals been monitored; no data are yet available.²⁸ With time, these stations will generate data that may be used to more accurately assess and model the effect of atmospheric deposition in the Eastern Great Lakes Basin.

Very limited discussion is provided in the Rochester RAP regarding suspected sources of atmospheric deposition. However, it could be expected that the general source types would be similar to those identified for other areas of the Great Lakes region. Estimated loadings for each chemical are provided in Table 4.6.2. The data for lead and PCBs presented in this table (obtained from the Rochester RAP, prepared in 1993) differ from the data presented in Table 4.6.1 (obtained from the GLAD Workshop conducted in 1986). The difference may be due to obtaining information from different sources and databases, from different modelling studies or due to the fact that the studies were conducted seven years apart and conditions have changed over this time period. A review of these data shows that lead is subject to the greatest degree of atmospheric deposition of all the 18 chemicals of concern. Atmospheric deposition of lead is approximately ten times greater than the second highest contaminant, arsenic.

4.6.3 Data Gaps and Limitations

TRC obtained limited information on atmospheric deposition for the Great Lakes region. The Rochester RAP has attempted to provide data for all identified chemicals of concern; however, this provides information for only a small area. Also, the data provided in the Rochester RAP are based on data obtained from a Canadian study. Although this study may have evaluated areas of similar characteristics, it does not provide actual data which pertain directly to the Rochester Embayment.

²⁸Personal communication, A. Miller, TRC with G. Mikol, July 12, 1993.

TABLE 4.6.2 ESTIMATED ATMOSPHERIC DEPOSITION OF VARIOUS CONTAMINANTS

Parameter	Deposition on Lake Ontario kg/yr	Dep. on the Rochester Embayment kg/yr	Dep. on Genesee Basin kg/yr	Dep. on Embayment Watershed kg/yr
Arsenic*	4,580	21.3	185	225
Benzo(a)pyrene	68.4	0.145	9.98	12.5
Benzo(b)fluoranthene	130	0.272	19.0	23.7
Benzo(k)fluoranthene	110	0.231	16.3	2.01
Chlordane	3.51	0.018	1.14	1.41
Chrysene	90.4	0.190	13.2	16.5
DDT and metabolites	9.48	0.045	3.09	3.80
Dieldrin	1.35	0.0045	0.440	0.544
Hexachlorobenzene	1.09	0.0045	0.358	0.440
Lead		944	66,445	80,932
Mercury*	568	2.72	185	225
PCBs	42.0	0.195	13.6	16.8
Toxaphene	4.72	0.023	1.53	1.89

* Wet deposition only.

Surface areas: Lake Ontario, 7,340 sq. mi.; Embayment 35 sq. mi.; Genesee Basin 2,463 sq. mi.; Embayment Watershed 3,000 sq. mi.

Reference: Rochester Embayment RAP, Stage I, Edited by the Monroe County Department of Planning and Development, June 1993.

The GLAD Summary Report states that uncertainties associated with values used in the workshop range from a factor of two to a factor of ten. Uncertainties of this magnitude may cause large variations from actual values.

Evaluation of incinerator emissions on the lakes would require identification of emissions from all incinerators located within the basin, followed by modelling efforts to quantify potential effects on the lakes. Information may be obtained from the individual hazardous waste and municipal solid waste incinerator permits which would identify maximum allowable emissions of chemicals. However, without some form of modelling, it is not possible to determine the effects these emissions are having on the Eastern Great Lakes.

Although the tables note absolute loadings of contaminants, these should not be directly related to toxicity; for example, lesser loadings of mercury are in effect more toxic than larger loadings of lead.

4.6.4 Summary

Based on the results of the GLAD workshop, atmospheric deposition appears to be a significant source of contamination to the Great Lakes. For lead and benzo(a)pyrene, the GLAD workshop has found atmospheric deposition to be the predominant source of loadings. The information provided in the Rochester RAP shows atmospheric deposition to be a source for most of the contaminants of concern. However, the relative contribution of atmospheric deposition to other sources has not been determined for these contaminants. Information available is limited and, for the majority of the contaminants of concern, only estimated information is available. Additional information pertaining to sources of atmospheric contamination and loadings rates for all chemicals of concern should be defined. Appropriate methods through which to address this problem should be identified.

5.0 INTERVENTION PROPOSALS

TRC has identified a number of sources that contribute to the total loading of each chemical into the Eastern Great Lakes Basin. These have been discussed in detail in Section 4.0, and include industrial discharges to air and water; municipal discharges to water; spills; hazardous waste sites; sediments; surface runoff; and atmospheric deposition. Section 5.0 discusses intervention proposals including waste minimization, pollution prevention, and remediation technologies for each chemical and also for the various sources identified above.

5.1 Methodology

Industrial and municipal NPDES discharges, air discharges and spills are recorded regularly on the PCS, TRI and ERNS databases respectively (see Sections 4.1 and 4.2). Due to the quantitative loading information available it has been possible to determine annual average identified loadings for each chemical:

- by each of these sources (industrial, municipal, and spills);
- by industry types; and
- by county.

TRC then used this information to access literature sources, the PIES database, environmental textbooks, regulatory manuals, and experienced professional expertise to complete the individual intervention tables for each chemical. The literature references and textbooks consulted have included:

- "Air Pollution Engineering Manual," Air and Waste Management Association, 1992;
- Handbook: "Remedial Action at Waste Disposal Sites," Office of Research and Development, U.S. Environmental Protection Agency, October 1985;

- Water Environment Research, Research Journal of the Water Pollution Control Federation, Volumes 59 - 65;
- "Suspect Chemicals Sourcebook: A Guide to Industrial Chemicals Covered Under Major Regulatory and Advisory Programs," Roytech Publications, Updated to April 1, 1993; and
- TRI database.

Additional sources include contaminant loadings from sediments, hazardous waste sites, surface runoff (CSOs and stormwater), and atmospheric deposition. In order to determine accurate and quantifiable loadings information, considerable modelling using complex computer programs is required. TRC has included all information obtained from existing studies. However, the available information is insufficient to perform a quantitative analysis of each of the non-point source loadings. TRC has therefore performed a qualitative analysis of these sources.

5.2 Chemical Tables

Individual profiles are presented for each chemical, with the exception of the PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and chrysene) which were analyzed together. Each table identifies the loadings identified from industrial and municipal discharges, spills, sediments, hazardous waste sites, surface water runoff and atmospheric deposition. The industrial discharges are broken down further by SIC codes. The tables briefly summarize the data gaps and limitations associated with each loading presented. The intervention proposals include waste minimization, pollution prevention and remediation technologies appropriate for each source. Waste minimization techniques may include add-on treatment to waste streams to reduce the volume of waste generated, or process changes that similarly reduce waste production. Pollution prevention techniques may include proposals for

Arsenic (1)

Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals ^a	Feasibility	Regulatory Controls/Policies
Industrial Discharges - Pulp and Paper Mills (SIC #2611/2621)	Water = 43 ^A (1992/93)	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	Oxidation of arsenite to arsenate (with hydrogen peroxide) followed by precipitation with ferric iron has been proven to be effective at removing arsenic from effluent. ^b Effluent can be treated for arsenic removal via activated alumina and anion exchange resins. Activated carbon is an effective treatment technology for effluent, although activated carbon impregnated with metallic copper may result in an increase in adsorption capacity of the carbon for arsenic. ^c	Demonstrated and reliable technologies. Demonstrated and reliable technologies.	GLWQC: ^c Aquatic Life: 150 µg/L AWQC: ^b Chronic Fresh Water Aquatic Life: 190 µg/L MCL: ^a N/A NYSDEC Sediment Guidelines: ^d N/A Air Criteria: ^e SGC: 2.0×10^{-1} µg/m ³ AGC: 2.3×10^{-4} µg/m ³ SARA 313: ^f Y RQ: ^g 0.45 kg TPQ: ^h N/A
- Chemicals, Allied Products (SIC #2800)	Water = 7 ^A (1992/93)				
- Porcelain Electrical Supplies (SIC #3264)	Water = 0.11 ^A (1992/93)				
- Primary Metal Industries (SIC #3300)	Water = 19 ^A (1992/93)				
- Transportation Equipment (SIC #3700)	Water = 60 ^A (1992/93)				
- Misc Manufacturing (SIC #3999)	Water = 372 ^A (1992/93)				
- Electric Power Services (SIC #4911)	Water = 298 ^A (1992/93)				

Arsenic (2)

Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
- Refuse System Services (SIC #4953)	Water = 11.1 ^A (1992/93)	(see previous page)	(see previous page)	(see previous page)	(see previous page)
- Commercial Physical/ Biological Research (SIC #8731)	Water = 2 ^A (1992/93)				
- Environmental Quality Programs (SIC #9511)	Water = 2 ^A (1992/93)				
Municipal Discharges - Sewerage Systems (SIC #4952)	Water = 524 ^A (1992/93)	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	Treatments are described on previous page.	(see previous page)	
Spills	23.7 (l/yr) (average) ¹	Spill loadings have been obtained from the ERNS database. TRC obtained data for spills since 1986 and averaged this to obtain an annual average loading. Some spills were included without reported quantities which means that average annual loadings would be higher than those reported (see Section 4.2.3 of this report).	The main intervention proposal is to ensure safe chemical handling practices are established and performed by a trained workforce. All chemicals should be handled or transferred in a contained (bermed) area to prevent migration in the event of a spill (see Section 5.3 of this report).	Safe handling practices should be established.	
Sediments	No information found.	Sediment loadings to rivers or the lakes would require extensive modeling and numerous assumptions, would render the final information of limited value. Aqueous phase and sediment concentrations have been reported where identified (see Section 4.4.3 of this report).	Main intervention proposals for contaminated sediments include: <ul style="list-style-type: none">• removal of sediments by dredging• covering sediments• solidification• extraction of contaminant• relocate navigation routes (see Section 5.5 of this report)	Demonstrated at varying rates of success.	

Arsenic (3)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Hazardous Waste Sites	14.13 ^{1K}	Loading data were obtained for a total of 25 sites. Hundreds of other confirmed and potential hazardous waste sites in the 32 counties of concern may also be impacting the basin. Loading estimates are based on sampling results and modeling, and consider ground water-transported contamination only (see Section 4.3.3 of this report).	(see industrial discharges)	(see industrial discharges)	(see previous page)
Surface Runoff (inc. stormwater and CSOs)	831 ^L	The majority of surface runoff contaminant loadings information was found for the Buffalo River Basin only. Data available are estimates and not actual loadings (see Section 4.5.3 of this report).	NPDES permit limits to be set in the future should result in the requirement for certain industries to treat surface runoff prior to leaving the property. CSO abatement programs will aid in reducing discharges from CSOs. (Refer to Section 5.6 of this report.)	Demonstrated at varying rates of success.	
Atmospheric Deposition - Lake Ontario - Rochester Embayment - Genesee Basin - Embayment Watershed	4,580 21.3 185 225 ^M	Wet deposition for Lake Ontario only. Indirect contribution from other Great Lakes not quantified. Available atmospheric deposition information is based on modelled estimates. Actual loadings data were only available for lead, PCBs, and benzo(a)pyrene (see Section 4.6.3 of this report).	Control devices located at the source of contamination such as wet scrubbers and electrostatic precipitators have been proven effective in reducing emissions. (Refer to Section 5.7 of this report.)	Demonstrated and reliable technologies.	

*Includes suggested methods for pollution prevention, waste minimization, and remediation technology.

References:

- ^{1K}Permit Compliance System (PCS) Database Retrieval, Fiscal Years 1991/92 and 1992/93.
- ^LWater Envir. Res. 1993
- ^MReport to the International Joint Commission Great Lakes Water Quality Board. 1989.
- ^NWater Quality Criteria Summary. EPA Office of Science and Technology. May 1, 1991.
- ^ODrinking Water Guidelines and Health Advisories. EPA Office of Water. December 1992.
- ^PNYSD&C Sediment Criteria, December 1989, Division of Fish and Wildlife, Bureau of Environmental Protection, 29 pp.
- ^QNew York State Air Guide -1: Guidelines for the Control for Toxic Ambient Air Contaminants, 1991 Edition (Draft).
- ^RTitle III List of Lists, Consolidated List of Chemicals Subject to Reporting Under the Emergency Planning and Community Right-to-Know Act. U.S. EPA Office of Solid Waste and Emergency Response. January 1991. EPA 560/4-91-011.
- ^SEKRS Database Retrieval, 1986-1993.
- ^TEstimated Ground Water-Transported Load of Chemicals from Waste Disposal Sites to the Niagara River." EPA-Robert S. Kerr Environmental Research Laboratory. March 1991.
- ^UEstimated Toxic Loading from Selected Hazardous Waste Sites to the Niagara River, Niagara Falls, New York." TRC Work Assignment C02112.
- ^VNonpoint Source Loading Study, Buffalo River Segment, Niagara River Basin." Alliance Technologies Corporation. December 1991.
- ^W"Summary Report of the Workshop on Great Lakes Atmospheric Deposition." International Joint Commission, October 1986.
- Suspect Chemicals Sourcebook, Edition 1992-1. Kenneth B. Cluskey, Editor. April 1, 1992.
- Hazardous Substance Data Bank. National Library of Medicine. 1993.
- Standard Handbook of Hazardous Waste Treatment and Disposal. Harry M. Freeman, Editor in Chief. 1989.

Chlordane (1)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Industrial Discharges	No information found.	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	EPA canceled commercial production and use in 1983.		GLWQG: ^C Human Health: 2.0×10^{-4} µg/L AWQC: ^D Chronic Freshwater Aquatic Life: 4.3×10^{-3} µg/L MCL: ^E 0.002 µg/L
Municipal Discharges	No information found.	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	Granulated activated carbon treatment of effluent is the best available technology. ⁸	Demonstrated and reliable technology.	NYSDEC Sediment Guidelines: ⁹ Aquatic Toxicity: 0.006 µg/g OC Human Health: 8.0×10^{-4} µg/g OC Wildlife: 0.006 µg/g OC Air Criteria: ¹⁰ SGC: 50.0 µg/ha ¹ AGC: 1.2 µg/m ³
Spills	No spills recorded on ERNS database retrieval for period 1986-1993. ^A	Spill loadings have been obtained from the ERNS database. TRC obtained data for spills since 1986 and averaged this to obtain an annual average loading. Some spills were included without reported quantities which means that average annual loadings would be higher than those reported (see Section 4.2.3 of this report).	The main intervention proposal is to ensure safe chemical handling practices are established and performed by a trained workforce. All chemicals should be handled or transferred in a contained (bermed) area to prevent migration in the event of a spill (see Section 5.3 of this report).	Safe handling practices should be established.	SARA 313: ¹¹ Y RQ: ¹² 0.45 kg TPQ: ¹³ 450 kg
Hazardous Waste Sites	No information found.	Loading data were obtained for a total of 25 sites. Hundreds of other confirmed and potential hazardous waste sites in the 32 counties of concern may also be impacting the basin. Loading estimates are based on sampling results and modeling, and consider ground water-transported contamination only (see Section 4.3.3 of this report).	Granulated activated carbon treatment of effluent is the best available technology. ⁸	GAC is a demonstrated and reliable technology.	

Chlordane (2)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Sediments - Present in Buffalo River sediments and possibly Oswego Harbor	No information found.	Sediment loadings to rivers or the lakes would require extensive modeling and numerous assumptions, which would render the final information of limited value. Aqueous phase and sediment concentrations have been reported where identified (see Section 4.4.3 of this report).	Pesticide-contaminated sediment treated by using submerged-quench incinerator. ¹ Main intervention proposals of contaminated sediments include: <ul style="list-style-type: none"> • removal of sediments by dredging • covering sediments • solidification • extraction of contaminant • relocate navigation routes (see Section 5.5 of this report)	Conducted at Rocky Mountain Arsenal. Demonstrated at varying rates of success.	(see previous page)
Surface Runoff (i.e. stormwater and CSOs) Buffalo River	2.2 ¹	The majority of surface runoff contaminant loadings information was found for the Buffalo River Basin only. Data available are estimates and not actual loadings (see Section 4.5.3 of this report).	NPDES permit limits to be set in the future should result in the requirement for certain industries to treat surface runoff prior to leaving the property. CSO abatement programs will aid in reducing discharges from CSOs. (Refer to Section 5.6 of this report.)	Activated carbon treatment currently performed at existing treatment facilities.	
Atmospheric Deposition - Lake Ontario - Rochester Embayment - Genesee Basin - Embayment Watershed	3.51 0.018 1.14 1.41 ^{1C}	Available atmospheric deposition information is based on modelled estimates. Actual loadings data were only available for lead, PCBs, and benzo(a)pyrene (see Section 4.6.3 of this report).	Incineration: Dissolve into flammable solvent and incinerate with afterburner and an acid scrubber. ¹ Control devices located at the source of contamination such as wet scrubbers and electrostatic precipitators have been proven effective in reducing emissions. (Refer to Section 5.7 of this report.)	Demonstrated and reliable technologies.	

*Includes suggested methods for pollution prevention, waste minimization, and remediation technology.

References:

- ¹ERMS Database Retrieval, 1986-1993.
²Safe Drinking Water Act (SDWA)
³Report to the International Joint Commission Great Lakes Water Quality Board. 1989.
⁴Water Quality Criteria Summary. EPA office of Science and Technology May 1, 1991.
⁵Drinking Water Guidelines and Health Advisories. EPA office of Water. December 1992.
⁶NYSDEC Sediment Criteria, December 1989, Division of Fish and Wildlife, Bureau of Environmental Protection, 29 pp.
⁷New York State Air Guide -1: Guidelines for the Control for Toxic Ambient Air Contaminants. 1991 Edition (Draft).
⁸Title III List of Lists, Consolidated List of Chemicals Subject to Reporting Under the Emergency Planning and Community Right-to-know Act. U.S. EPA office of Solid Waste and Emergency Response January 1991 EPA 560/4-91-011.
⁹Tischler et al., "Selecting State-of-the-Art Incinerators for Complex Aqueous Wastes: The Rocky Mountain Arsenal Basin F Liquids Treatment Action," *Hazardous Materials Control*, Vol. 4, No. 5. 1992.
¹⁰Nonpoint Source Loading Study, Buffalo River Segment, Niagara River Basin." Alliance Technologies Corporation. December 1991.
¹¹"Summary Report of the Workshop on Great Lakes Atmospheric Deposition." International Joint Commission, October 1986.
¹²Agency of Toxic Substances and Diseases Registry (ATSDR), Toxicological Profile for Chlordane, 1992.
¹³Suspect Chemicals Sourcebook, Edition 1992-1. Kenneth B. Clowsky, Editor. April 1, 1992.
¹⁴Hazardous Substance Data Bank. National Library of Medicine. 1993.
¹⁵Standard Handbook of Hazardous Waste Treatment and Disposal. Harry M. Freeman, Editor in Chief. 1989.

DDT and Metabolites (1)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Industrial Discharges	No information found.	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	In actions dated 1/15/71 and 7/7/72, EPA canceled all uses of DDT products except for the U.S. Public Health Services and other Health Service organizations for the control of vector diseases.		GLWQC: ^a Human Health: 7.0×10^{-1} µg/L Wildlife: 8.7×10^{-2} µg/L AWQC: ^c Chronic Freshwater Aquatic Life: 1.0×10^{-3} µg/L
Municipal Discharges	No information found.	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	Granulated activated carbon (GAC) treatment of effluent is best available technology. Filtration prior to GAC adsorption will remove DDT adsorbed to suspended solids.	Existing STPs have activated carbon treatment.	MCL: ^b N/A NYSDEC Sediment Guidelines: ^b Aquatic Toxicity: <50 µg/g OC Human Health: 0.01 µg/g OC Wildlife: 1.0 µg/g OC Air Criteria: ^b N/A
Spills	No spills recorded on ERNS database retrieval for period 1986-1993. ⁴	Spill loadings have been obtained from the ERNS database. TRC obtained data for spills since 1986 and averaged this to obtain an annual average loading. Some spills were included without reported quantities which means that average annual loadings would be higher than those reported (see Section 4.2.3 of this report).	The main intervention proposal is to ensure safe chemical handling practices are established and performed by a trained workforce. All chemicals should be handled or transferred in a contained (bermed) area to prevent migration in the event of a spill (see Section 5.3 of this report).	Safe handling practices should be established.	SARA 313: ^d N RQ: ^d 0.45 kg TPQ: ^d N/A
Hazardous Waste Sites	No information found.	Loading data were obtained for a total of 25 sites. Hundreds of other confirmed and potential hazardous waste sites in the 32 counties of concern may also be impacting the basin. Loading estimates are based on sampling results and modeling, and consider ground water-transported contamination only (see Section 4.3.3 of this report).	(see municipal discharges)	Demonstrated and reliable technology.	

DDT and Metabolites (2)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Sediments - Present in Buffalo River sediments and possibly Oswego Harbor sediments.	No information found.	Contribution to environment from sediment resuspension and biotic activity unknown. Sediment loadings to rivers or the lakes would require extensive modeling and numerous assumptions, which would render the final information of limited value. Aqueous phase and sediment concentrations have been reported where identified (see Section 4.4.3 of this report).	Pesticide-contaminated sediment treated by using submerged-quench incinerator. ⁸ Main intervention proposals for sediments include: <ul style="list-style-type: none"> • removal of sediments by dredging • covering sediments • solidification • extraction of contaminant • relocate navigation routes (see Section 5.5. of this report)	Demonstrated at varying rates of success.	(see previous page)
Surface Runoff (inc. stormwater and CSOs) Buffalo River	1.44 ⁴	The majority of surface runoff contaminant loadings information was found for the Buffalo River Basin only. Data available are estimates and not actual loadings (see Section 4.5.3 of this report).	NPDES permit limits to be set in the future should result in the requirement for certain industries to treat surface runoff prior to leaving the property. CSO abatement programs will aid in reducing discharges from CSOs. Refer to Section 5.6 of this report. Granulated activated carbon (GAC) treatment of effluent is best available technology. Filtration prior to GAC adsorption will remove DDT adsorbed to suspended solids.	Activated carbon treatment currently performed at existing STPs.	
Atmospheric Deposition - Lake Ontario - Rochester Embayment - Genesee Basin - Embayment Watershed	9.48 0.045 3.09 3.80 ⁷	Available atmospheric deposition information is based on modelled estimates. Actual loadings data were only available for lead, PCBs, and benzo(a)pyrene (see Section 4.6.3 of this report).	Control devices located at the source of contamination such as wet scrubbers and electrostatic precipitators have been proven effective in reducing emissions. Refer to Section 5.7 of this report.	Demonstrated and reliable technologies.	

*Includes suggested methods for pollution prevention, waste minimization, and remediation technology.

References:

- ¹ERMS Database Retrieval, 1986-1995.
²Report to the International Joint Commission Great Lakes Water Quality Board. 1989.
³Water Quality Criteria Summary. EPA office of Science and Technology May 1, 1991.
⁴Drinking Water Guidelines and Health Advisories. EPA office of Water. December 1992.
⁵NYSDEC Sediment Criteria. December 1989. Division of Fish and Wildlife, Bureau of Environmental Protection. 29 pp.
⁶New York State Air Guide -1: Guidelines for the Control for Toxic Ambient Air Contaminants. 1991 Edition (Draft)
⁷Title III List of Lists, Consolidated List of Chemicals Subject to Reporting Under the Emergency Planning and Community Right-to-know Act. U.S. EPA office of Solid Waste and Emergency Response. January 1991. EPA 560M-91-011.
⁸Tiesler et al., "Selecting State-of-the-Art Incinerators for Complex Aqueous Wastes: The Rocky Mountain Arsenal Basin F Liquids Treatment Action," *Hazardous Materials Control*, Vol. 4, No. 5. 1992.
⁹Nonpoint Source Loading Study, Buffalo River Segment, Niagara River Basin." Alliance Technologies Corporation. December 1991.
¹⁰Summary Report of the Workshop on Great Lakes Atmospheric Deposition." International Joint Commission, October 1986.
 Superfund Chemical Sourcebook Edition 1993-1. Kenneth B. Cluskey, Editor. April 1, 1992.
 Hazardous Substance Data Book. National Library of Medicine. 1993.
 Standard Handbook of Hazardous Waste Treatment and Disposal. Harry M. Fromman, Editor in Chief. 1989.

Dieldrin (1)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals ^a	Feasibility	Regulatory Controls/Policies
Industrial Discharges - Miscellaneous Pesticides and Agricultural Chemicals (SIC = 2879)	0.04 ^a	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	EPA restricted pesticide use of dieldrin in U.S. in 1974. Granulated activated carbon (GAC) effective at removing dieldrin from effluent. Filtration prior to GAC adsorption may remove dieldrin adsorbed to suspended solids.	Demonstrated and reliable technology.	GLWQG: ^b Human Health: 1.0×10^{-4} µg/L Chronic Aquatic: 5.6×10^{-2} µg/L AWQC: ^a Chronic Freshwater Aquatic Life: 1.9×10^{-7} µg/L MCL: ^c N/A
Municipal Discharges	No information found.	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	(See above.)	(See above.)	NYSDEC Sediment Guidelines: ^e Aquatic Toxicity: 19.5 µg/g OC Human Health: 0.13 µg/g OC Air Criteria: ^h N/A SARA 313: ⁱ N RQ: ^j 0.45 kg TPQ: ^j N/A
Spills	No spills recorded on ERNS database retrieval for period 1986-1993. ^a	Spill loadings have been obtained from the ERNS database. TRC obtained data for spills since 1986 and averaged this to obtain an annual average loading. Some spills were included without reported quantities which means that average annual loadings would be higher than those reported (see Section 4.2.3 of this report).	The main intervention proposal is to ensure safe chemical handling practices are established and performed by a trained workforce. All chemicals should be handled or transferred in a contained (bermed) area to prevent migration in the event of a spill (see Section 5.3 of this report).	Safe handling practices should be established.	
Sediments	Present in Buffalo River sediments.	Contribution to environment from sediment resuspension and biotic activity unknown. Sediment loadings to rivers or the lakes would require extensive modeling and numerous assumptions, would render the final information of limited value. Aqueous phase and sediment concentrations have been reported where identified (see Section 4.4.3 of this report).	Pesticide-contaminated sediments may be treated by submerged-quench incinerator. ^c Main intervention proposals for contaminated sediments include: <ul style="list-style-type: none"> • removal of sediments by dredging • covering sediments • solidification • extraction of contaminant • relocate navigation routes (see Section 5.5 of this report)	Conducted at Rocky Mountain Arsenal. Demonstrated at varying rates of success.	

Dieldrin (2)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Hazardous Waste Sites	0.164 ¹	Loading data were obtained for a total of 25 sites. Hundreds of other confirmed and potential hazardous waste sites in the 32 counties of concern may also be impacting the basin. Loading estimates are based on sampling results and modeling, and consider ground water-transported contamination only (see Section 4.3.3 of this report).	See industrial discharges which discusses GAC treatment for removal of dieldrin from waste streams.	Demonstrated and reliable technology.	(see previous page)
Surface Runoff (inc. stormwater and CSOs)	0.359 ² (Buffalo River)	The majority of surface runoff contaminant loadings information was found for the Buffalo River Basin only. Data available are estimates and not actual loadings (see Section 4.5.3 of this report).	NPDES permit limits to be set in the future should result in the requirement for certain industries to treat surface runoff prior to leaving the property. CSO abatement programs will aid in reducing discharges from CSOs. Refer to Section 5.6 of this report. Stormwater flows can be directed into the STP collection system where effluent can be treated by GAC filtration.	Existing STPs have GAC treatment but may need to increase capacity.	
Atmospheric Deposition - Lake Ontario - Rochester Embayment - Genesee Basin - Embayment Watershed	1.35 0.0045 0.440 0.544 ³	Available atmospheric deposition information is based on modelled estimates. Actual loadings data were only available for lead, PCBs, and benzo(a)pyrene (see Section 4.6.3 of this report).	Control devices located at the source of contamination such as wet scrubbers and electrostatic precipitators have been proven effective in reducing emissions. Refer to Section 5.7 of this report.	Demonstrated and reliable technologies.	

*Includes suggested methods for pollution prevention, waste minimization, and remediation technology.

References:

- ¹Permit Compliance System (PCS) Database Retrieval, Fiscal Years 1991/92 and 1992/93.
- ²ERNS Database Retrieval, 1986-1993.
- ³Tieckler et al., "Selecting State-of-the-Art Incineration for Complex Aqueous Wastes: The Rocky Mountain Arsenal Basin F Liquids Treatment Action," *Hazardous Materials Control*, Vol. 4, No. 5, 1992.
- ⁴Report to the International Joint Commission Great Lakes Water Quality Board, 1989.
- ⁵Water Quality Criteria Summary. EPA office of Science and Technology May 1, 1991.
- ⁶Drinking Water Guidelines and Health Advisories. EPA office of Water, December 1992.
- ⁷NYSDEC Sediment Criteria, December 1989, Division of Fish and Wildlife, Bureau of Environmental Protection, 29 pp.
- ⁸New York State Air Guide -1: Guidelines for the Control for Toxic Ambient Air Contaminants. 1991 Edition (Draft).
- ⁹Title III List of Lists, Consolidated List of Chemicals Subject to Reporting Under the Emergency Planning and Community Right-to-know Act. U.S. EPA office of Solid Waste and Emergency Response January 1991 EPA 560/4-91-011.
- ¹⁰"Estimated Ground Water-Transported Load of Chemicals from Waste Disposal Sites to the Niagara River." EPA-Robert S. Kerr Environmental Research Laboratory. March 1991.
- ¹¹"Nonpoint Source Loading Study, Buffalo River Segment, Niagara River Basin." Alliance Technologies Corporation. December 1991.
- ¹²"Summary Report of the Workshop on Great Lakes Atmospheric Deposition." International Joint Commission, October 1986.
- ¹³Suspect Chemicals Sourcebook Edition 1992-1. Kenneth B. Chaney, Editor. April 1, 1992.
- ¹⁴Hazardous Substances Data Bank. National Library of Medicine. 1993.
- ¹⁵Standard Handbook of Hazardous Waste Treatment and Disposal. Harry M. Freeman, Editor in Chief. 1989.

Dioxin (2,3,7,8-TCDD) (1)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Industrial Discharges - TCDD is a by-product in the manufacture of chlorophenols. Another major industrial source of dioxin is pulp and paper mills which use chlorine to bleach pulp.	No information found.	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	The following chemicals can be substituted for chlorine in the pulp-bleaching process. - chlorine dioxide-minimizes dioxin production - oxygen - eliminates dioxin production - hydrogen peroxide - eliminates dioxin production ^a Another method which can be used to minimize dioxin formation is to add chlorine in several quick charges to keep its concentration and time in use low. Also, conducting the process at higher pHs (>1.6-1.8) results in the formation of hypochlorous acid and inhibits dioxin formation. ^c	Being increasingly substituted in industry.	GLWQG: ^b Wildlife: 9.6×10^3 μ g/L Human health: 1.0×10^4 μ g/L Dioxin is also listed as a bioaccumulative chemical of concern by the GLWQG. AWQC: ^a Chronic Freshwater Aquatic Life: $<1.0 \times 10^3$ μ g/L MCL: ^f 3.0×10^4 mg/L
Municipal Discharges TCDD can be discharged from any incinerator or WWTP which receives effluent from the paper industry.	No information found.	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	(see above.)	(see above.)	NYSDEC Sediment Guidelines: ^g Aquatic Toxicity: <10 μ g/g OC Human Health: 2×10^4 μ g/g OC Wildlife: 2×10^4 μ g/g OC Air Criteria: ^a N/A SARA 313: ^d N RQ: ^e N/A TPQ: ^f N/A
Spills	No spills recorded on ERNS database retrieval for period 1986-1993. ^a	Spill loadings have been obtained from the ERNS database. TRC obtained data for spills since 1986 and averaged this to obtain an annual average loading. Some spills were included without reported quantities which means that average annual loadings would be higher than those reported (see Section 4.2.3 of this report).	The main intervention proposal is to ensure safe chemical handling practices are established and performed by a trained workforce. All chemicals should be handled or transferred in a contained (bermed) area to prevent migration in the event of a spill (see Section 5.3 of this report).	Safe handling practices should be established.	
Hazardous Waste Sites	No information found.	Loading data were obtained for a total of 25 sites. Hundreds of other confirmed and potential hazardous waste sites in the 32 counties of concern may also be impacting the basin. Loading estimates are based on sampling results and modeling, and consider ground water-transported contamination only (see Section 4.3.3 of this report).	Thermal treatment to eliminate dioxin in soil and sediments include incineration in a mobile rotary-kiln or infrared incinerator, a high-temperature fluid wall reactor, or supercritical-water oxidation. Non-thermal methods include decoloration, UV radiation, biodegradation, solvent extraction, and stabilization/fixation. ¹	Incineration is being tested on a pilot scale.	

Dioxin (2,3,7,8-TCDD) (2)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Sediments - A "hot spot" of dioxin was identified in Eighteen Mile Creek. No specific loading data were available, but the "highest dioxin concentration in New York State surface waters was found below Barge Canal in Eighteen Mile Creek". ⁶ - A hot spot of dioxin was also identified in Bloody Run Creek (remedy scheduled for 1993).	No information found.	Sediment loadings to rivers or the lakes would require extensive modeling and numerous assumptions, which would render the final information of limited value. Aqueous phase and sediment concentrations have been reported where identified (see Section 4.4.3 of this report).	Main intervention proposals for contaminated sediments include: <ul style="list-style-type: none"> • removal of sediments by dredging • covering sediments • solidification • extraction of contaminant • relocate navigation routes (see Section 5.5 of this report)	Demonstrated at varying rates of success.	(see previous page)
Surface Runoff (inc. stormwater and CSOs)	No information found.	The majority of surface runoff contaminant loadings information was found for the Buffalo River Basin only. Data available are estimates and not actual loadings (see Section 4.5.3 of this report).	NPDES permit limits to be set in the future should result in the requirement for certain industries to treat surface runoff prior to leaving the property. CSO abatement programs will aid in reducing discharges from CSOs. (Refer to Section 5.6 of this report.)	Demonstrated at varying rates of success.	
Atmospheric Deposition - Atmospheric deposition is a significant source of TCDD, which adsorbs to suspended particles and can be transported considerable distance.	No information found.	Available atmospheric deposition information is based on modelled estimates. Actual loadings data were only available for lead, PCBs, and benzo(a)pyrene (see Section 4.6.3 of this report).	Control devices located at the source of contamination such as wet scrubbers and electrostatic precipitators have been proven effective in reducing emissions.	Demonstrated technology.	

*Includes suggested methods for pollution prevention, waste minimization, and remediation technology.

References:

- ¹ERNS Database Retrieval, 1986-1993.
²Personal communication between T. Jones, TRC, and S. Jones, Customs Papers Group, August 20, 1993.
³"Chemmaster" Chemical Engineering March 20, pp. 17-18.
⁴Report to the International Joint Commission Great Lakes Water Quality Board, 1989.
⁵Water Quality Criteria Summary. EPA Office of Science and Technology. May 1, 1991.
⁶Drinking Water Guidelines and Health Advisories. EPA Office of Water. December 1992.
⁷NYSDEC Sediment Criteria, December 1989, Division of Fish and Wildlife, Bureau of Environmental Protection, 29 pp.
⁸New York State Air Guide -1: Guidelines for the Control for Toxic Ambient Air Contaminants. 1991 Edition (Draft).
⁹Title III List of Lists, Consolidated List of Chemicals Subject to Reporting Under the Emergency Planning and Community Right-to-Know Act. U.S. EPA Office of Solid Waste and Emergency Response. January 1991. EPA 560/4-91-011.
¹⁰Standard Handbook of Hazardous Waste Treatment and Disposal. Harry M. Freeman, Editor in Chief, 1989.
¹¹"The Search for Dioxin - Eighteen Mile Creek." S. Litten. NYSDEC Summary, 1992.
¹²Suspect Chemicals Sourcebook Edition 1992-1. Kenneth B. Chensky, Editor. April 1, 1992.
¹³Hazardous Substances Data Bank, National Library of Medicine. 1993.

Hexachlorobenzene (1)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Industrial Discharges Typical uses include: - wood preservatives - electrodes - intermediate in dye manufacturing	No information found.	Water discharge data have been obtained determined from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	Chemical dechlorination including direct waste, aqueous waste and in-situ treatment. Activated sludge may be treated biologically. Granulated activated carbon (GAC) and/or air stripping are effective at removing hexachlorobenzene from effluent. Filtration prior to GAC adsorption/air stripping may remove hexachlorobenzene absorbed to suspended solids.	Both methods feasible-already demonstrated/practiced.	GLWQG: ² Human Health: 1.0×10^{-4} µg/L AWQC: ² N/A MCL: ⁶ .001 mg/L NYSEDEC Sediment Criteria: ⁸ Aquatic Toxicity <7,568 µg/g OC Human Health - 0.15 µg/g OC Wildlife - 12.0 µg/g OC
Municipal Discharges - Niagara Falls WWTP water effluent	Water = 24.90 (1991/92) ⁴	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	(as above) Portable Gas Chromatograph ("Photovac") measures PCBs in fluids and soils. Useful for utility transformer sites.	Method already employed or being employed by plants including Niagara Falls, Canastota, Fulton, Seneca Falls, and Leroy.	Air Criteria: ¹ N/A SARA 313: ⁷ Y RQ: ⁷ N/A TPQ: ⁷ N/A
Spills	No spills recorded on ERNS database retrieval for the period 1986-1993. ⁵	Spill loadings have been obtained from the ERNS database. TRC obtained data for spills since 1986 and averaged this to obtain an annual average loading. Some spills were included without reported quantities which means that average annual loadings would be higher than those reported (see Section 4.2.3 of this report).	The main intervention proposal is to ensure safe chemical handling practices are established and performed by a trained workforce. All chemicals should be handled or transferred in a contained (bermed) area to prevent migration in the event of a spill (see Section 5.3 of this report).	Safe handling practices should be established.	Regulated under TSCA, CWA, SDWA, CAA, RCRA, CERCLA, SARA, DOT Hazardous Materials
Hazardous Waste Sites Deposit: Necco Park Gratiwick/Riverside Park	0.493 ^{3D}	Loading data were obtained for a total of 25 sites. Hundreds of other confirmed and potential hazardous waste sites in the 32 counties of concern may also be impacting the basin. Loading estimates are based on sampling results and modeling, and consider ground water-transported contamination only (see Section 4.3.3 of this report).	Remediation technologies include: dechlorination, activated sludge biological treatment, adsorption, absorption, anaerobic biodegradation.	Technologies demonstrated at varying rates of success.	

Hexachlorobenzene (2)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Sediments	No information found.	Sediment loadings to rivers or the lakes would require extensive modeling and numerous assumptions, which would render the final information of limited value. Aqueous phase and sediment concentrations have been reported where identified (see Section 4.4.3 of this report).	Main intervention proposals for contaminated sediments include: <ul style="list-style-type: none"> • removal of sediments by dredging • covering sediments • solidification • extraction of contaminant • relocate navigation routes (see Section 5.5 of this report)	Demonstrated at varying rates of success.	(see previous page)
Surface Runoff (inc. stormwater and CSOs) - Water influent to Buffalo Sewer Authority WWTP	3.99 ^k	The majority of surface runoff contaminant loadings information was found for the Buffalo River Basin only. Data available are estimates and not actual loadings (see Section 4.5.3 of this report).	NPDES permit limits to be set in the future should result in the requirement for certain industries to treat surface runoff prior to leaving the property. CSO abatement programs will aid in reducing discharges from CSOs. (Refer to Section 5.6 of this report.) Sedimentation, filtration, berras, diversions, ditches.	Already demonstrated at varying rates of success.	
Atmospheric Deposition - Lake Ontario - Embayment - Genesee - Embayment Watershed	1.09 0.0045 0.358 0.440	Available atmospheric deposition information is based on modelled estimates. Actual loadings data were only available for lead, PCBs, and benzo(a)pyrene (see Section 4.6.3 of this report).	Control devices located at the source of contamination such as wet scrubbers and electrostatic precipitators have been proven effective in reducing emissions. Emission controls include electrostatic precipitated and scrubbers.	Already demonstrated and reliable technology.	

*Includes suggested methods for pollution, prevention, waste minimization, and remediation technologies.

References:

^aPermit Compliance System (PCS) Database Retrieval, Fiscal Years 1991/92 and 1992/93.

^bERNS Database Retrieval, 1986-1993.

^cEstimated Ground Water-Transported Load of Chemicals from Waste Disposal Sites to the Niagara River." EPA-Robert S. Kerr Environmental Research Laboratory. March 1991.

^dEstimated Toxic Loading from Selected Hazardous Waste Sites to the Niagara River, Niagara Falls, New York." TRC Work Assignment C02112.

^eReport to the International Joint Commission. Great Lakes Water Quality Board. 1989.

^fWater Quality Criteria Summary. EPA office of Science and Technology May 1, 1991.

^gDrinking Water Guidelines and Health Advisories. EPA office of Water. December 1992.

^hNYSDEC Sediment Criteria, December 1989. Division of Fish and Wildlife, Bureau of Environmental Protection, 29 pp.

ⁱNew York State Air Guide - 1, Guidelines for the Control of Toxic Ambient Air Contaminants, 1991.

^jTitle III List of Lists, Consolidated List of Chemicals Subject to Reporting Under the Emergency Planning and Community Right-to-know Act. U.S. EPA office of Solid Waste and Emergency Response January 1991 EPA 560M-91-011.

^k"Nonpoint Source Loading Study, Buffalo River Segment, Niagara River Basin." Alliance Technologies Corporation. December 1991.

Suspect Chemicals Sourcebook Edition 1992-1. Kenneth B. Chanzy, Editor. April 1, 1992.

Hazardous Substance Data Book. National Library of Medicine. 1993.

Standard Handbook of Hazardous Waste Treatment and Disposal. Harry M. Freeman, Editor in Chief. 1989.

Lead (1)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals ^a	Feasibility	Regulatory Controls/Policies
Industrial Discharges - Mining (SIC #1000)	Water = 253 (1992/93) ^A	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	Source Reduction includes: • Process Solutions: Increase Solution Life • Material Substitution • Process Substitution Nonchelated and non-cyanide process chemicals • Chemical Coating • Mechanical Cladding and Coating	Most techniques discussed have been demonstrated to be successful. However, this does depend on the individual industry and the particular facility involved.	GLWQG: ^c N/A MCL: ^D Action Level: 0.015 mg/L AWQC: ^E Chronic Freshwater Aquatic Life: 3.2 µg/L (based on water hardness of 100 µg/L) NYSDEC Sediment Guidelines: ^F N/A Air Criteria: ^G N/A SARA 313: ^H Y RQ: ^I N/A TPQ: ^J N/A
- Mining and Quarrying of Nonmetallic Minerals Except Fuels (SIC #1400)	Water = 4 (1992/93) ^A	Air emissions data have been obtained from the TRI database, which records all facilities which handle certain chemicals in excess of threshold levels. Air emissions are reported for point and non-point (fugitive) emissions. The latest data available for calendar year 1991. TRC is awaiting information from NYSDEC air emissions database which includes all facilities with air emissions (see Section 4.1.3 of this report).	Contamination of rinsewater may be reduced by reducing dragout of process chemicals. Techniques include:		
- Paper and Allied Products (SIC #2600)	Water = 18 (1992/93) ^A		• Reduce Speed of Withdrawal • Surface Treatment • Lower Plating Bath Concentrations • Surfactant used to lower surface tension • Increase Plating Solution Temperature - lowers surface tension • Work piece Positioning • Drag-Out Recovery - Drip tank		
- Chemicals, Allied Products (SIC #2800)	Water = 3.7 (1992/93) ^A				
- Rubber, Miscellaneous Plastic Products (SIC #3000)	Water = 14.1 (1992/93) ^A		System Design Considerations include:		
- Leather, Leather Products (SIC #3100)	Water = 8 (1992/93) ^A		• Rinsetank Designs - Ensure complete mixing of rinsewaters to utilize entire tank volume • Multiple Rinsing Tanks • Reactive Rinsing • Fog nozzles and sprays-rinse contaminants • Automatic flow controls-reduce water demand • Rinse bath agitation		
- Stone, Clay, Glass, Concrete (SIC #3200)	Water = 14 (1992/93) ^A Air = 225 (1991) ^B				
- Primary Metal Industries (SIC #3300)	Water = 498.6 (1992/93) ^A Air = 2062 (1991) ^B				
- Fabricated Metal Products (SIC #3400)	Water = 41.6 (1992/93) ^A Air = 9.45 (1991) ^B				

Lead (2)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
- Machinery, Except Electrical (SIC #3500)	Air = 21.7 (1991) ^B	(see previous page)	<p>Metal Recovery from Rinsewater and Process Bath Recycling include:</p> <ul style="list-style-type: none"> • Evaporation • Reverse Osmosis • Ion Exchange • Electrolysis • Electrodialysis <p>Remediation Technologies for water:</p> <ul style="list-style-type: none"> • ferric sulfate coagulation • alum coagulation • lime softening • Hydroxide precipitation • Sulfide precipitation • Carbonate precipitation • Sodium Borohydride precipitation • Trivalent chromium use - reduces sludge production • Waste segregation - reduces sludge production • Sludge dewatering - reduces final sludge volume for disposal <p>Exchange resins chelating functional groups (EDTA)</p>	(see previous page)	(see previous page)
- Transportation Equipment (SIC #3700)	Water = 583 (1992/93) ^A Air = 112.5 (1991) ^B				
- Miscellaneous Manufacturing (SIC #3900)	Water = 916.5 (1992/93) ^A				
- Wholesale Trade, Nondurable Goods (SIC #5100)	Water = 19 (1992/93) ^A				
- General Merchandise Stores (SIC #5300)	Water = 1 (1992/93) ^A				
- Engineering, Accounting, Research Management and Related Services (SIC #8700)	Water = 1 (1992/93) ^A				
- Administration of Environmental Quality and Housing Programs (SIC #9500)	Water = 0.8 (1992/93) ^A				
- National Security and International Affairs (SIC #9700)	Water = 2 (1992/93) ^A				
- Nonclassifiable Establishments (SIC #9999)	Water = 109.4 (1992/93) ^A				
- Electric, Gas and Sanitary Services (SIC #4900)	Water = 35 (1992/93) ^A				
Municipal Discharges					
- Water Supply (SIC #4941)	Water = 417 (1992/93) ^A	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	(see previous page)	(see previous page)	
- Sewerage Systems (SIC #4952)	Water = 5772 (1992/93) ^A				

Lead (3)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals ^a	Feasibility	Regulatory Controls/Policies
Spills	No spills recorded on ERNs database retrieval for period 1986-1993. ¹	Spill loadings have been obtained from the ERNS database. TRC obtained data for spills since 1986 and averaged this to obtain an annual average loading. Some spills were included without reported quantities which means that average annual loadings would be higher than those reported (see Section 4.2.3 of this report).	The main intervention proposal is to ensure safe chemical handling practices are established and performed by a trained workforce. All chemicals should be handled or transferred in a contained (bonded) area to prevent migration in the event of a spill (see Section 5.3 of this report).	Safe handling practices should be established.	(see previous page)
Hazardous Waste Sites	37,684 ^{2,3}	Loading data were obtained for a total of 25 sites. Hundreds of other confirmed and potential hazardous waste sites in the 32 counties of concern may also be impacting the basin. Loading estimates are based on sampling results and modeling, and consider ground water-transported contamination only (see Section 4.3.3 of this report).	(see remediation technologies discussed above under industrial discharges)	(see industrial discharges)	
Sediments	No information found.	Sediment loadings to rivers or the lakes would require extensive modeling and numerous assumptions, which would render the final information of limited value. Aqueous phase and sediment concentrations have been reported where identified (see Section 4.4.3 of this report).	Main intervention proposals for contaminated sediments include: <ul style="list-style-type: none"> • removal of sediments by dredging • covering sediments • solidification • extraction of contaminant • relocate navigation routes (see Section 5.5 of this report)	Demonstrated at varying rates of success.	
Surface Runoff (inc. Stormwater and CSOs)	43,493 ^{4,5}	The majority of surface runoff contaminant loadings information was found for the Buffalo River Basin only. Lead data were also found for Irondequoit Creek Basin. Data available are estimates and not actual loadings (see Section 4.5.3 of this report).	NPDES permit limits to be set in the future should result in the requirement for certain industries to treat surface runoff prior to leaving the property. CSO abatement programs will aid in reducing discharges from CSOs. (Refer to Section 5.6 of this report.)	Demonstrated at varying rates of success.	

Lead (4)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Atmospheric Deposition	993 ^o	73 percent of the total annual loading for lead to Lake Ontario is due to atmospheric deposition. Available atmospheric deposition information is based on modelled estimates. Actual loadings data were only available for lead, PCBs, and benzo(a)pyrene (see Section 4.6.3 of this report).	Control devices located at the source of contamination such as wet scrubbers and electrostatic precipitators have been proven effective in reducing emissions. Stack emissions control technologies for lead including scrubbers and electrostatic precipitators. Alternate fuel sources may also reduce lead emissions.	Demonstrated technology.	(See previous page.)

*Includes suggested methods for waste minimization, pollution, prevention, and remedial technologies.

References:

- ^oToxic Compliance System (PCS) Database Retrieval, Fiscal Years 1991/92 and 1992/93.
- ¹Toxic Release Inventory (TRI) Database Retrieval, 1991.
- ²Report to the International Joint Commission Great Lakes Water Quality Board. 1989.
- ³Water Quality Criteria Summary. EPA office of Science and Technology May 1, 1991.
- ⁴Drinking Water Guidelines and Health Advisories. EPA office of Water. December 1992.
- ⁵NYSDOC Settlement Criteria, December 1989, Division of Fish and Wildlife, Bureau of Environmental Protection, 29 pp.
- ⁶New York State Air Guide - I: Guidelines for the Control for Toxic Ambient Air Contaminants. 1991 Edition (Draft).
- ⁷Title III List of Lists, Consolidated List of Chemicals Subject to Reporting Under the Emergency Planning and Community Right-to-know Act. U.S. EPA office of Solid Waste and Emergency Response January 1991 EPA 560/4-91-011.
- ⁸EDRS Database Retrieval, 1986-1993.
- ⁹Estimated Toxic Loading from Selected Hazardous Waste Site to the Niagara River, Niagara Falls, New York." TRC Work Assignment C02112.
- ¹⁰"Dust Model Data Requirements and Mass Loading Estimates for the Buffalo River Mass Balance Study." Great Lakes Program, Department of Engineering, State University of New York at Buffalo. April 1993
- ¹¹Estimated Ground Water-Transported Load of Chemicals from Waste Disposal Sites to the Niagara River." EPA-Robert S. Kerr Environmental Research Laboratory. March 1991.
- ¹²"Nonpoint Source Loading Study, Buffalo River Segment, Niagara River Basin." Alliance Technologies Corporation. December 1991.
- ¹³"Quantity and Quality of Urban Storm Water Runoff in the Irondequoit Creek Basin Near Rochester, New York." U.S. Geological Survey, 1986.
- ¹⁴"Summary Report of the Workshop on Great Lakes Atmospheric Deposition." International Joint Commission, October 1986.
- Suspense Chemicals Sourcebook Edition 1992-1. Kenneth E. Chaskey, Editor. April 1, 1992.
- Hazardous Substance Data Bank. National Library of Medicine. 1993.
- Standard Handbook of Hazardous Waste Treatment and Disposal. Harry M. Freeman, Editor in Chief, 1989.

Mercury (I)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Industrial Discharges - Metal Mining (SIC #1000)	Water = 0.4 ^A (1992/93)	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	For effluent containing 1 to 100 ppm mercury Chemical precipitation (sulfide), and filtration have been documented to achieve a removal efficiency of up to 99.95 percent. ^B Currently utilized at Occidental Chemical Corp., Niagara Falls, NY	Demonstrated and reliable technology.	GLWQC: ^B Human Health: 2.0×10^3 µg/L Chronic Aquatic Life: 0.44 µg/L Wildlife: 1.8×10^4 µg/L AWQC: ^B Chronic Freshwater Aquatic Life: 0.012 µg/L MCL: ^D 0.002 mg/L NYSDep Sediment Guidelines: ^B N/A
- Chemicals, Allied Products (SIC #2800)	Water = 9.34 ^A (1992/93)		Non-thermal dewatering of sludges/solids has been documented to achieve a removal efficiency of up to 90.0 percent. ^B Currently utilized at Occidental Chemical Corp., Niagara Falls, NY.	Demonstrated and reliable technology.	
- Miscellaneous Manufacturing (SIC #9999) (Eastman Kodak Corp.)	Water = 10.4 ^A (1992/93)		Carbon adsorption has been documented to achieve a removal efficiency of 99.80 percent for effluents containing 1 ppb to 1 ppm mercury. ^B Currently utilized at Ofin Chemicals, Niagara Falls, NY.	Demonstrated and reliable technology.	
- Refuse System Services (SIC #4953)	Water = 0.5 ^A (1992/93)		Film batteries containing mercury have been reduced by new carbon/zinc technology that reduced battery mercury content to less than 0.000005 percent of battery weight. ^C Technology has been implemented at Polaroid Corp., MA.	Relatively new technology.	
- Electric Power Services (SIC #4911)	Water = 15.3 ^A (1992/93)		Effluent (0.2 to 70 ppm mercury) has been treated with ion exchange resin to reduce mercury content to <5 ppb. Mercury-laden resin was then suitable for disposal in a landfill as non-hazardous waste. ^B Successfully demonstrated at Integrated Defense Waste Processing Facility, Aiken, SC.	Demonstrated technology.	
					Air Criteria: ^I SQC: 12.0 µg/m ³ AGC: 3.0×10^4 µg/m ³ SARA 313: Y ^I RQ: 0.45 kg ^I TPQ: N/A ^I

Mercury (2)					
Source/Pathway	Loadings (lg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Municipal Discharges Sewage Systems (SIC #4952)	Water = 53.6 ^A (1992/93)	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	Retorting of sludge containing mercury can increase mercury recovery and recycling. ¹ A retort is a vessel in which substances are subjected to distillation or decomposition by heat and which may be made in various forms and of various uses.	Considered to be technically feasible at chloralkali plants.	(see previous page)
Spills	1.86 ^B (average)	Spill loadings have been obtained from the ERNS database. TRC obtained data for spills since 1986 and averaged this to obtain an annual average loading. Some spills were included without reported quantities which means that average annual loadings would be higher than those reported (see Section 4.2.3 of this report).	The main intervention proposal is to ensure safe chemical handling practices are established and performed by a trained workforce. All chemicals should be handled or transferred in a contained (bermed) area to prevent migration in the event of a spill (see Section 5.3 of this report).	Safe handling practices should be established.	
Sediments Detected in sediment from Cassano River, Gill Creek, and Otandego Lake, NY.	No information found.	Sediment loadings to rivers or the lakes would require extensive modeling and numerous assumptions, which would render the final information of limited value. Aqueous phase and sediment concentrations have been reported where identified (see Section 4.4.3 of this report). Contribution to the environment from release of methylmercury from sediments unknown.	Main intervention proposals for contaminated sediments include: <ul style="list-style-type: none"> • removal of sediments by dredging • covering sediments • solidification • extraction of contaminants • relocate navigation routes (see Section 5.5 of this report)	Demonstrated at varying rates of success.	

Mercury (3)

Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Hazardous Waste Sites	5.28 ^{60F}	Loading data were obtained for a total of 25 sites. Hundreds of other confirmed and potential hazardous waste sites in the 32 counties of concern may also be impacting the basin. Loading estimates are based on sampling results and modeling, and consider ground water-transported contamination only (see Section 4.3.3 of this report).	(see industrial discharges)	(see industrial discharges)	(see previous page)
Surface Runoff (inc. stormwater and CSOs)	17.5 ⁹	The majority of surface runoff contaminant loadings information was found for the Buffalo River Basin only. Data available are estimates and not actual loadings (see Section 4.5.3 of this report).	NPDES permit limits to be set in the future should result in the requirement for certain industries to treat surface runoff prior to leaving the property. CSO abatement programs will aid in reducing discharges from CSOs. (Refer to Section 5.6 of this report.)	Demonstrated at varying rates of success.	
Atmospheric Deposition - Lake Ontario - Rochester Embayment - Genesee Basin - Embayment Watershed	568 2.72 185 225 ⁹	Available atmospheric deposition information is based on modelled estimates. Actual loadings data were only available for lead, PCBs, and benzo(a)pyrene (see Section 4.6.3 of this report).	Control devices located at the source of contamination such as wet scrubbers and electrostatic precipitators have been proven effective in reducing emissions. (Refer to Section 5.7 of this report.)	Demonstrated and reliable technologies.	

* Includes suggested methods for pollution prevention, waste minimization, and remediation technology.

References:

- ^{60F}Toxic Compliance System (TCS) Database Retrieval, Fiscal Years 1991/92 and 1992/93.
- ⁶¹Toxic Release Inventory (TRI) Database Retrieval, 1991.
- ⁶²TIES Database Retrieval, August 1993.
- ⁶³Ritter and Biber, 1992.
- ⁶⁴Report to the International Joint Commission Great Lakes Water Quality Board. 1989.
- ⁶⁵Water Quality Criteria Summary. EPA Office of Science and Technology. May 1, 1991.
- ⁶⁶Drinking Water Guidelines and Health Advisories. EPA Office of Water. December 1992.
- ⁶⁷WYSEBC Sediment Criteria, December 1989, Division of Fish and Wildlife, Bureau of Environmental Protection, 29 pp.
- ⁶⁸New York State Air Guide -1: Guidelines for the Control of Toxic Ambient Air Contaminants. 1991 Edition (Draft).
- ⁶⁹Title III List of Lists, Consolidated List of Chemicals Subject to Reporting Under the Emergency Planning and Community Right-to-know Act. U.S. EPA office of Solid Waste and Emergency Response. January 1991. EPA 560/4-91-011.
- ⁷⁰TWIS Database Retrieval, 1996-1993.
- ⁷¹DeBello, M., and E. Rimmann. 1988. Waste Minimization Audit Report: Case Studies of Minimization of Mercury-Bearing Wastes at a Mercury Cell Chloroalkali Plant. EPA/600/2-88/011. 104 pp.
- ⁷²Estimated Ground Water-Transported Load of Chemicals from Waste Disposal Sites to the Niagara River. EPA-Robert S. Kerr Environmental Research Laboratory. March 1991.
- ⁷³Estimated Toxic Loading from Selected Hazardous Waste Sites to the Niagara River, Niagara Falls, New York. TRC Work Assignment C02112.
- ⁷⁴Nonpoint Source Loading Study, Buffalo River Segment, Niagara River Basin. Alliance Technologies Corporation. December 1991.
- ⁷⁵Summary Report of the Workshop on Great Lakes Atmospheric Deposition. International Joint Commission, October 1986.
- ⁷⁶Superfund Chemical Sourcebook, Edition 1993-1. Kenneth B. Chaney, Editor. April 1, 1992.
- ⁷⁷Hazardous Substance Data Book. National Library of Medicine. 1993.
- ⁷⁸Standard Handbook of Hazardous Waste Treatment and Disposal. Harry M. Freeman, Editor in Chief. 1989.

Mirex (1)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals ^a	Feasibility	Regulatory Controls/Policies
Industrial Discharges - Miscellaneous Industrial Organic Chemicals (SIC = 2869)	Water = 0.4 ^d (1992/93)	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	<ul style="list-style-type: none"> The use of mirex in the U.S. was banned by the EPA in 1988. Granulated activated carbon (GAC) and/or air stripping are effective at removing mirex from effluent. Filtration prior to GAC adsorption/air stripping may remove mirex absorbed to suspended solids. 	Demonstrated and reliable technology.	GLWQG: ^c N/A AWQC: ^b N/A MCL: ^b N/A NYSDEC Sediment Guidelines: ^b Human Health: 0.0001 µg/g OC Wildlife: 3.7 µg/g OC Air Criteria: ^d N/A SARA 313: ^e N RQ: ^e N/A TPQ: ^e N/A
Municipal Discharges	Water = 0.53 ^d (1991/92)	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	(See above.)	(See above.)	
Spills	No spills recorded on ERNS database retrieval for period 1986-1993. ^b	Spill loadings have been obtained from the ERNS database. TRC obtained data for spills since 1986 and averaged this to obtain an annual average loading. Some spills were included without reported quantities which means that average annual loadings would be higher than those reported (see Section 4.2.3 of this report).	The main intervention proposal is to ensure safe chemical handling practices are established and performed by a trained workforce. All chemicals should be handled or transferred in a contained (bermed) area to prevent migration in the event of a spill (see Section 5.3 of this report).	Safe handling practices should be established.	
Sediments	No information found.	Sediment loadings to rivers or the lake would require extensive modeling and numerous assumptions, which would render the final information of limited value. Aquatic phase and sediment concentrations have been reported where identified (see Section 4.4.3 of this report).	Main intervention proposals for contaminated sediments include: <ul style="list-style-type: none"> removal of sediments by dredging covering sediments solidification extraction of contaminant relocate navigation routes (see Section 5.5 of this report)	Demonstrated at varying rates of success.	

Mirex (2)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Hazardous Waste Sites	2.445 ^f	Loading data were obtained for a total of 25 sites. Hundreds of other confirmed and potential hazardous waste sites in the 32 counties of concern may also be impacting the basin. Loading estimates are based on sampling results and modeling, and consider ground water-transported contamination only (see Section 4.3.3 of this report).	(see industrial discharges)	GAC treatment is a demonstrated and reliable technology.	(see previous page)
Surface Runoff (inc. stormwater and CSOs)	0.106 (Buffalo River) ^f	The majority of surface runoff contaminant loadings information was found for the Buffalo River Basin only. Data available are estimates and not actual loadings (see Section 4.5.3 of this report).	NPDES permit limits to be set in the future should result in the requirement for certain industries to treat surface runoff prior to leaving the property. CSO abatement programs will aid in reducing discharges from CSOs. (Refer to Section 5.6 of this report.)	Existing STPs have GAC treatment but may need to increase maximum treatment capacity.	
Atmospheric Deposition	No information found.	Air deposition quantity unknown but may be a significant input source. Available atmospheric deposition information is based on modeled estimates. Actual loadings data were only available for lead, PCBs, and benzo(a)pyrene (see Section 4.6.3 of this report).	Control devices located at the source of contamination such as wet scrubbers and electrostatic precipitators have been proven effective in reducing emissions. (Refer to Section 5.7 of this report.)	Demonstrated and reliable technologies.	

*Includes suggested methods for waste minimization, pollution prevention, and remedial technology.

References:

- ^aFacility Compliance System (FCS) Database Retrieval, Fiscal Year 1991/92 and 1992/93.
- ^bIRIS Database Retrieval, 1986-1993.
- ^cReport to the International Joint Commission Great Lakes Water Quality Board. 1989.
- ^dWater Quality Criteria Summary. EPA office of Science and Technology May 1, 1991.
- ^eDrinking Water Guidelines and Health Advisories. EPA office of Water. December 1992.
- ^fNYDEC Sediment Criteria, December 1989, Division of Fish and Wildlife, Bureau of Environmental Protection, 29 pp.
- ^gNew York State Air Guide - 1: Guidelines for the Control for Toxic Ambient Air Contaminants. 1991 Edition (Draft).
- ^hTitle III List of Lists, Consolidated List of Chemicals Subject to Reporting Under the Emergency Planning and Community Right-to-know Act. U.S. EPA office of Solid Waste and Emergency Response January 1991 EPA 560/4-91-011.
- ⁱEstimated Ground Water-Transported Load of Chemicals from Waste Disposal Sites to the Niagara River. EPA-Robert S. Kerr Environmental Research Laboratory. March 1991.
- ^jNearpoint Source Loading Study, Buffalo River Segment, Niagara River Basin. Alliance Technologies Corporation. December 1991.
- ^kSuperfund Chemical Sourcebook Edition 1992-1. Kenneth B. Chanley, Editor. April 1, 1992.
- ^lHazardous Substance Data Bank. National Library of Medicine. 1993.
- ^mStandard Handbook of Hazardous Waste Treatment and Disposal. Barry M. Freeman, Editor in Chief. 1989.

Octochlorostyrene (1)

Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Industrial Discharges - No commercial use. Produced as an accidental by-product of high-temperature processes involving chlorine. Associated with aluminum smelting and magnesium, niobium, and tantalum production.	No information found.	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	A high organic carbon coefficient and data indicate that octochlorostyrene will be immobile in soil and will partition to organic material contained in sediments and suspended solids. Volatilization from surface water may occur. Based on these characteristics, likely treatment technologies for disposed octochlorostyrene include air stripping and adsorption using granular activated carbon. Filtration may remove the compound from water if it is adsorbed to suspended solids.	These technologies are demonstrated and effective.	GLWQG: ^a N/A Octochlorostyrene is listed as a bioaccumulative chemical of concern by the GLWQG AWQC: ^c N/A MCL: ^b N/A NYSDEC Sediment Guidelines: ^a Wildlife: 0.5 µg/g OC Air Criteria: ^d N/A
Municipal Discharges Releases have been reported from fly ash from waste incinerators.	No information found.	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	A high organic carbon coefficient and data indicate that octochlorostyrene will be immobile in soil and will partition to organic material contained in sediments and suspended solids. Volatilization from surface water may occur. Based on these characteristics, likely treatment technologies for disposed octochlorostyrene include air stripping and adsorption using granular activated carbon. Filtration may remove the compound from water if it is adsorbed to suspended solids.	These technologies are demonstrated and effective.	SARA 313: ^e N RQ: ^g N/A TPQ: ^g N/A Octochlorostyrene is also regulated under TSCA.
Spills	No spills recorded on ERNs database retrieval for period 1986-1993. ^A	Spill loadings have been obtained from the ERNS database. TRC obtained data for spills since 1986 and averaged this to obtain an annual average loading. Some spills were included without reported quantities which means that average annual loadings would be higher than those reported (see Section 4.2.3 of this report).	The main intervention proposal is to ensure safe chemical handling practices are established and performed by a trained workforce. All chemicals should be handled or transferred in a contained (banned) area to prevent migration in the event of a spill (see Section 5.3 of this report).	Safe handling practices should be established.	

Octochlorostyrene (2)

Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Hazardous Waste Sites	No information found.	Loading data were obtained for a total of 25 sites. Hundreds of other confirmed and potential hazardous waste sites in the 32 counties of concern may also be impacting the basin. Loading estimates are based on sampling results and modeling, and consider ground water-transported contamination only (see Section 4.3.3 of this report).	A high organic carbon coefficient and data indicate that octochlorostyrene will be immobile in soil and will partition to organic material contained in sediments and suspended soils. Volatilization from surface water may occur. Based on these characteristics, likely treatment technologies for disposed octochlorostyrene include air stripping and adsorption using granular activated carbon. Filtration may remove the compound from water if it is absorbed to suspended solids.	These technologies are demonstrated and effective.	(see previous page)
Sediments	No information found.	Sediment loadings to rivers or the lakes would require extensive modeling and numerous assumptions, which would render the final information of limited value. Aqueous phase and sediment concentrations have been reported where identified (see Section 4.4.3 of this report).	Main intervention proposals for contaminated sediments include: <ul style="list-style-type: none">• removal of sediments by dredging• covering sediments• solidification• extraction of contaminant• relocate navigation routes (see Section 5.5. of this report)	These technologies are demonstrated and effective.	
Surface Runoff (inc. stormwater and CSOs)	No information found.	The majority of surface runoff contaminant loadings information was found for the Buffalo River Basin only. Data available are estimates and not actual loadings (see Section 4.5.3 of this report).	NPDES permit limits to be set in the future should result in the requirement for certain industries to treat surface runoff prior to leaving the property. CSO abatement programs will aid in reducing discharges from CSOs. (Refer to Section 5.6 of this report.)	Demonstrated at varying rates of success.	
Atmospheric Deposition Releases have been reported from fly ash from waste incinerators.	No information found.	Available atmospheric deposition information is based on modeled estimates. Actual loadings data were only available for lead, PCBs, and benzo(a)pyrene (see Section 4.6.3 of this report).	Control devices located at the source of contamination such as wet scrubbers and electrostatic precipitators have been proven effective in reducing emissions.	Demonstrated technology.	

*Includes suggested methods for pollution prevention, waste minimization, and remediation technologies.

References:

*EPCRS Database Retrieval, 1985-1993.

*Report to the International Joint Commission. Great Lakes Water Quality Board. 1999.

*Water Quality Criteria Summary. EPA office of Science and Technology May 1, 1991.

*Drinking Water Guidelines and Health Advisories. EPA office of Water. December 1992.

*NYSDBC Sediment Criteria, December 1989, Division of Fish and Wildlife, Bureau of Environmental Protection, 29 pp.

References: (Continued)

¹New York State Air Guide - 1, Guidelines for the Control of Toxic Ambient Air Contaminants. 1991 Edition.

²Title III List of Lists, Consolidated List of Chemicals Subject to Reporting Under the Emergency Planning and Community Right-to-know Act. U.S. EPA office of Solid Waste and Emergency Response January 1991 EPA 560/4-91-011.

Suspect Chemicals Sourcebook Edition 1992-1. Kenneth B. Chauly, Editor. April 1, 1992.

Standard Handbook of Hazardous Waste Treatment and Disposal. Harry M. Freeman, Editor in Chief, 1989.

Hazardous Substance Data Bank. National Library of Medicine, 1993.

"Mutagenicity, Acute Toxicity, and Bioaccumulation Potential of Six Chlorinated Styrenes" Bulletin of Environmental Contaminant Toxicology. 1985. 35:525-530

Polycyclic Aromatic Hydrocarbons (PAHs) (1) (including: benzo(a)anthracene (B(a)A); benzo(a)pyrene (B(a)P); benzo(b)fluoranthene (B(b)F); benzo(k)fluoranthene (B(k)F); and chrysene)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Industrial Discharges - Petroleum Bulk Stations and Terminals (SIC #5171)	Water = B(a)A = 0.07 Water = B(a)P = 0.07 Water = B(k)F = 0.07 Water = Chrysene = 0.07 (1992/93) ^A	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	Flocculation or coagulation followed by sedimentation is generally applicable for removal of PAHs bound to particulate matter. Filtration may increase removal efficiency. Granular activated carbon (GAC) has proven to be an effective means of treatment for dissolved concentrations of PAHs.	Demonstrated and reliable technologies	B(a)P: GLWQG: ^B N/A AWQC: ^C N/A MCL: ^D 0.0002 mg/L NYSDEC Sediment Guidelines: ^B N/A Air Criteria: ^F AGC: 2.0×10^{-3} $\mu\text{g}/\text{m}^3$ SARA 313: ^G N RQ: ^G 0.45 kg TPQ: ^G N/A
- Primary Production of Aluminum (SIC #3334)	B(a)P = 27 B(b)F = 6 (1992/93) ^A				
Municipal Discharges - Wastewater Treatment Plants (WWTP) (SIC #4952)	B(a)A = 6.67 Chrysene = 7.35 (1991/92) ^A	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	(See above.)	(See above.)	B(a)A: GLWQG: ^B N/A AWQC: ^C N/A MCL: ^D 0.000 mg/L NYSDEC Sediment Guidelines: ^B N/A Air Criteria: ^F N/A SARA 313: ^G N RQ: ^G 0.45 kg TPQ: ^G N/A
Spills	No spills recorded on ERNS database retrieval for period 1986-1993. ^H	Spill loadings have been obtained from the ERNS database. TRC obtained data for spills since 1986 and averaged this to obtain an annual average loading. Some spills were included without reported quantities which means that average annual loadings would be higher than those reported (see Section 4.2.3 of this report).	The main intervention proposal is to ensure safe chemical handling practices are established and performed by a trained workforce. All chemicals should be handled or transferred in a contained (bunded) area to prevent migration in the event of a spill (see Section 5.3 of this report).	Safe handling practices should be established.	B(b)F: GLWQG: ^B N/A AWQC: ^C N/A MCL: ^D 0.0002 mg/L

Polycyclic Aromatic Hydrocarbons (PAHs) (2) (including: benzo(a)anthracene (B(a)A); benzo(a)pyrene (B(a)P); benzo(b)fluoranthene (B(b)F); benzo(k)fluoranthene (B(k)F); and chrysene)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Hazardous Waste Sites	B(a)A = 36.6 ² B(a)P = 3.121 B(b)F = 11.7 B(k)F = 1.314 Chrysene = 4.93	Loading data were obtained for a total of 25 sites. Hundreds of other confirmed and potential hazardous waste sites in the 32 counties of concern may also be impacting the basin. Loading estimates are based on sampling results and modeling, and consider ground water-transported contamination only (see Section 4.3.3 of this report).	Pump and treat systems may be useful to address contaminated ground water. The treatment methods could be similar to those listed for industrial discharges. Soils contaminated with PAHs may be effectively contained through solidification/stabilization such as batch asphaltting. On a site-specific basis capping contaminated areas may be a viable option.	Demonstrated and reliable technologies.	NYSDEC Sediment Guidelines: ⁸ N/A Air Criteria: ² N/A SARA 313: ⁹ N RQ: ⁹ 0.45 kg TPQ: ⁹ N/A <u>B(b)F:</u>
Sediments - PAHs reported in Buffalo River sediments.	No information found.	Sediment loadings to rivers or the lakes would require extensive modeling and numerous assumptions, would render the final information of limited value. Aqueous phase and sediment concentrations have been reported where identified (see Section 4.4.3 of this report).	PAH-contaminated sediments may be amenable to solidification/stabilization or disposal in an approved landfill.	Demonstrated and reliable technologies.	GLWQG: ⁸ N/A AWQC: ⁶ N/A MCL: ⁹ 0.0002 mg/L NYSDEC Sediment Guidelines: ⁸ N/A Air Criteria: ² N/A
Surface Runoff (inc. stormwater and CSOs)	No information found.	The majority of surface runoff contaminant loadings information was found for the Buffalo River Basin only. Data available are estimates and not actual loadings (see Section 4.5.3 of this report).	NPDES permit limits to be set in the future should result in the requirement for certain industries to treat surface runoff prior to leaving the property. CSO abatement programs will aid in reducing discharges from CSOs. (Refer to Section 5.6 of this report.)	Demonstrated at varying rates of success.	SARA 313: ⁹ N RQ: ⁹ 2,250 kg TPQ: ⁹ N/A <u>Chrysene</u> GLWQG: ⁸ N/A AWQC: ⁶ 0.0002 mg/L
Atmospheric Deposition - Lake Ontario - Rochester Embayment - Genesee Basin - Embayment Watershed	B(a)P 398.4 0.838 58.5 54.7 ¹	Available atmospheric deposition information is based on modeled estimates. Actual loadings data were only available for lead, PCBs, and benzo(a)pyrene (see Section 4.6.3 of this report).	Control devices located at the source of contamination such as wet scrubbers and electrostatic precipitators have been proven effective in reducing emissions.	Demonstrated and reliable technologies.	MCL: ⁹ N/A NYSDEC Sediment Guidelines: ⁸ N/A Air Criteria: ² N/A SARA 313: ⁹ N RQ: ⁹ 90 kg TPQ: ⁹ N/A

*Includes suggested methods for waste minimization, pollution prevention, and remedial technology.

References: ¹Tenach Compliance System (FCS) Database Retrieval, Fiscal Years 1991/92 and 1992/93.

References: (Continued)

- ¹Report to the International Joint Commission Great Lakes Water Quality Board. 1989.
- ²Water Quality Criteria Summary. EPA office of Science and Technology May 1, 1991.
- ³Drinking Water Guidelines and Health Advisories. EPA office of Water. December 1992.
- ⁴NYSDDEC Sediment Criteria, December 1989, Division of Fish and Wildlife, Bureau of Environmental Protection, 29 pp.
- ⁵New York State Air Guide -1: Guidelines for the Control for Toxic Ambient Air Contaminants. 1991 Edition (Draft).
- ⁶Title III List of Lists, Consolidated List of Chemicals Subject to Reporting Under the Emergency Planning and Community Right-to-know Act. U.S. EPA office of Solid Waste and Emergency Response January 1991 EPA 560/4-91-011.
- ⁷ERNS Database Retrieval, 1986-1993.
- ⁸Draft Model Data Requirements and Mass Loading Estimates for the Buffalo River Mass Balance Study." Great Lakes Program, Department of Engineering, State University of New York at Buffalo. April 1993.
- Suspect Chemicals Sourcebook, Edition 1992-1. Kenneth B. Clauerty, Editor. April 1, 1992.
- Hazardous Substance Data Bank. National Library of Medicine. 1993.
- Standard Handbook of Hazardous Waste Treatment and Disposal. Harry M. Freeman, Editor in Chief. 1989.

Polychlorinated Biphenyls (PCBs) (1)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Industrial Discharges - Refuse Systems, Electric, Gas and Sanitary Services (SIC #4953) Typical sources include: - transformers - electrical capacitors - lubricants - flame retardants - plasticizers - paper printing inks - adhesives - water proofing materials	Water = 1.20 (1992/93) ^A	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	Banned for use except in totally enclosed systems July 1979 (TSCA). • Waste streams may be treated using chemical dechlorination - direct waste, aqueous waste and in-situ treatment. • PCB containing oil may be reacted with metallic sodium and a proprietary compound. • Incineration. • Anaerobic biodegradation. • Absorption/Adsorption.	Dechlorination of aqueous wastes has been demonstrated; <i>in situ</i> application in developmental stage. Successfully developed and used by Sunohio, Inc. In place throughout U.S. proper emissions controls.	GLWQG: ^C Human Health: 3.0×10^4 µg/L Wildlife: 1.7×10^3 µg/L AWQC: ^D Chronic Freshwater Aquatic Life: 1.4×10^3 µg/L MCL: ^E 0.5 µg/L NYSDEC Sediment Criteria: ^F Aquatic Toxicity - <276 µg/g OC Human Health - 0.008 µg/g OC Wildlife - 0.6 µg/g OC Air Criteria: ^G SGC: 1.0×10^4 µg/m ³ AGC: 4.5×10^4 µg/m ³
Municipal Discharges - Niagara Falls WWTP	Water = 4.63 (1991/92) ^A	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	(As above.) • Portable Gas Chromatograph ("Photovac") measures PCBs in fluids and soils. Useful for utility transformer sites. • Upgrade existing WWT facilities.	Method already employed or being employed by other plants including Canastota, Fulton, Seneca Falls, and Leroy.	SARA 313: ^H Y RQ: ^I 0.45 kg TPQ: ^J N/A Regulated under TSCA, CWA, CAA, SDWA, RCRA, CERCLA, SARA, DOT Hazardous Materials
Spills	460.49 ^B	Spill loadings have been obtained from the ERNS database. TRC obtained data for spills since 1986 and averaged this to obtain an annual average loading. Some spills were included without reported quantities which means that average annual loadings would be higher than those reported (see Section 4.2.3 of this report).	The main intervention proposal is to ensure safe chemical handling practices are established and performed by a trained workforce. All chemicals should be handled or transferred in a contained (bermed) area to prevent migration in the event of a spill (see Section 5.3 of this report).	Safe handling practices should be established.	

Polychlorinated Biphenyls (PCBs) (2)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Hazardous Waste Sites	6.57 ^U	Loading data were obtained for a total of 25 sites. Hundreds of other confirmed and potential hazardous waste sites in the 32 counties of concern may also be impacting the basin. Loading estimates are based on sampling results and modeling, and consider ground water-transported contamination only (see Section 4.3.3 of this report).	Remediation technologies include: aqueous waste treatment, reverse osmosis, membrane filtration, solidification/stabilization, and anaerobic biodegradation. GAC is also useful for aqueous phase treatment.	Techniques demonstrated at varying rates of success.	(see previous page)
Sediments - Eighteen Mile Creek - Genesee River - Niagara River - Oswego River - Pontic Phase - Elliott Creek - Snake Creek - Gill Creek (now remediated) - Two Mile Creek - Cayuga Creek - (Erie City) - Woods Creek - Seneca Creek - Buffalo River	361.35 ng/g Unknown 8 kg/yr 350 kg/yr Unknown Aqueous Phase: 167.3 ng/g Aqueous Phase: 12.06 ng/L .44 lb/day Aqueous Phase: 23.22 ng/L Aqueous Phase: 2.34 ng/L Aqueous Phase: .75 ng/L Aqueous Phase: 3.74 ng/L Aqueous Phase: 12.06 ng/L Aqueous Phase: .00263 kg/day ^{KL}	Sediment loadings to rivers or the lakes would require extensive modeling and numerous assumptions, which would render the final information of limited value. Aqueous phase and sediment concentrations have been reported where identified (see Section 4.4.3 of this report).	Main intervention proposals for contaminated sediments include: <ul style="list-style-type: none"> removal of sediments by dredging covering sediments solidification extraction of contaminant relocate navigation routes (see Section 5.5 of this report)	Demonstrated at varying rates of success.	
Surface Runoff (inc. stormwater and CSOs) - Inflow to Buffalo Sewer Authority WWTP	Dissolved Phase: 23.2 ng/L (1990) Particulate Phase: 152.66 ng/L (1990) ^{KL}	The majority of surface runoff contaminant loadings information was found for the Buffalo River Basin only. Data available are estimates and not actual loadings (see Section 4.5.3 of this report).	NPDES permit limits to be set in the future should result in the requirement for certain industries to treat surface runoff prior to leaving the property. CSO abatement programs will aid in reducing discharges from CSOs. (Refer to Section 5.6 of this report.) Berms, diversions, ditches, sedimentation basins, hay bales.	Demonstrated at varying rates of success.	

Polychlorinated Biphenyls (PCBs) (3)

Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Atmospheric Lake Ontario Embayment Genesee Embayment Watershed	42.0 0.195 13.6 16.8 ^o	Available atmospheric deposition information is based on modelled estimates. Actual loadings data were only available for lead, PCBs, and benzo(a)pyrene (see Section 4.6.3 of this report).	Control devices located at the source of contamination such as wet scrubbers and electrostatic precipitators have been proven effective in reducing emissions. Emissions controls such as electrostatic precipitators and scrubbers.	Demonstrated technologies.	(see previous page)

* Includes suggested methods for pollution prevention, waste minimization, and remediation technologies.

References:

¹Permit Compliance System (PCS) Database Retrieval, Fiscal Years 1991/92 and 1992/93.

²ERIS Database Retrieval, 1986-1993.

³Report to the International Joint Commission Great Lakes Water Quality Board. 1989.

⁴Water Quality Criteria Summary. EPA office of Science and Technology May 1, 1991.

⁵Drinking Water Guidelines and Health Advisories. EPA office of Water. December 1992.

⁶NYSDEC Sediment Criteria, December 1989, Division of Fish and Wildlife, Bureau of Environmental Protection, 29 pp.

⁷New York State Air Guide -1: Guidelines for the Control for Toxic Ambient Air Contaminants. 1991 Edition (Draft).

⁸Title III List of Lists, Consolidated List of Chemicals Subject to Reporting Under the Emergency Planning and Community Right-to-know Act. U.S. EPA office of Solid Waste and Emergency Response January 1991 EPA 560/4-91-011.

⁹Estimated Ground Water-Transported Load of Chemicals from Waste Disposal Sites to the Niagara River." EPA-Robert S. Kerr Environmental Research Laboratory. March 1991.

¹⁰Estimated Toxic Loading from Selected Hazardous Waste Sites to the Niagara River, Niagara Falls, New York." TRC Work Assignment C92112.

¹¹Applications of Passive Samplers to Locating Sources of PCBs on the Black River," Environmental Toxicology and Chemistry. Vol. 12.

¹²"Sources of PCBs to the Niagara River" Intakes Report S. Litten, NYSDEC Water Division.

¹³Buffalo River Remedial Action Plan, NYSDEC, November 1989.

¹⁴"Draft Model Data Requirements and Mass Loading Estimates for the Buffalo River Mass Balance Study." Great Lakes Program, Department of Engineering, State University of New York at Buffalo. April 1993

¹⁵"Summary Report of the Workshop on Great Lakes Atmospheric Deposition." International Joint Commission, October 1986.

¹⁶Suspect Chemicals Sourcebook Edition 1992-1. Kenneth B. Cluskey, Editor. April 1, 1992.

Hazardous Substance Data Bank. National Library of Medicine. 1993.

Standard Handbook of Hazardous Waste Treatment and Disposal. Harry M. Freeman, Editor in Chief, 1989.

Tetrachloroethylene (1)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals ^a	Feasibility	Regulatory Controls/Policies
Industrial Discharges	Water = 180.2 (1992/93) ^a Air _(P-10) = 39,150 (1991) ^b	<p>Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).</p> <p>Air emissions data have been obtained from the TRI database, which records all facilities which handle certain chemicals in excess of threshold levels. Air emissions are reported for point and non-point (fugitive) emissions. The latest data available for calendar year 1991. TRC is awaiting information from NYSDEC air emissions database which includes all facilities with air emissions (see Section 4.1.3 of this report).</p>	Tetrachloroethylene can be replaced in the solvent-based coating process for pharmaceutical tablets with an aqueous coating process. ^c	Being gradually substituted in industry.	GLWQG: ⁵ N/A AWQC ⁶ (Chronic Freshwater Aquatic Life): N/A MCL: ⁹ 0.005 mg/L NYSDEC Sediment Guidelines: ⁸ 0.8 µg/g OC Air Criteria: ¹ SQC: 81,000 µg/m ³ AGC: 7.5 x 10 ³ µg/m ³ SARA 313: ¹ Y RQ: ¹ 45.4 kg TPQ: ¹ N/A Tetrachloroethylene is also regulated under TSCA, CWA (Sections 304 and 307), CAA (Section 11), RCRA (including land disposal restrictions), and DOT regulations.
- Industrial Organic Chemical/Pharmaceutical Production (SIC #2834, 2869)			Tetrachloroethylene is used in the textile industry for dry-cleaning applications. Methods to reduce solvent volume in the process include refrigeration units, transfer printing to reduce the loss of dry materials, and hyperfiltration of effluent. ^b	Being increasingly tested and implemented	
- Clothing/Apparel Manufacture (SIC #2389)	Air _(P-10) = 5,067 (1991) ^b		Tetrachloroethylene is commonly used as a degreaser in metal parts production. Using an enclosed device such as a Safety-Kleen unit eliminates effluent waste - the used solvent remains inside the unit which is removed periodically for solvent reclamation.	Safety-Kleen units are frequently used in industrial facilities in Connecticut.	
- Rubber/Plastic Production (SIC #3081)	Air _(P-10) = 16,087 (1991) ^b		Substitute degreasers may also be used, including aqueous cleaners and even organic substances such as citric acid.	Being slowly developed and used in industry	
- Porcelain Electrical Supplies (SIC #3264)	Water = 0.5 (1992/93) ^a Air _(P-10) = 25,538 (1991) ^b		Tetrachloroethylene is also used as a maskant in coating/etching operations. Substitute high-solids/low-solvent base maskants have been developed to reduce fugitive emissions from dipping and spraying. The equipment can then be cleaned with water instead of solvents. This technique has been shown to reduce VOC emissions by up to 95%. ^b	Technology available - being implemented gradually	
- Primary Metal Industries (SIC #3364)	Air _(P-10) = 39,150.0 (1991) ^b		Distillation units have been found to recover tetrachloroethylene in photographic production and developing operations. ^b	Being increasingly implemented in industry	
- Fabricated Metal Products/Coating and Engraving (SIC #3329, 3714)	Water = 46.0 (1992/93) ^a Air _(P-10) = 12,600 (1991) ^b		Tetrachloroethylene can be removed from an effluent stream by air stripping and subsequent granular activated carbon adsorption. ^c	Demonstrated and reliable	
- Transportation Equipment/Machinery (SIC #3511, 3599, 3728, 3749)	Air _(P-10) = 225.0 (1991) ^b				
- Photographic Equipment (SIC #3561)	Water = 2.0 (1992/93) ^a				
- Public Administration (SIC #9311)	Water = 0.04 (1992/93) ^a				

Tetrachloroethylene (2)

<i>Source/Pathway</i>	<i>Loadings (kg/yr)</i>	<i>Data Gaps/Limitations</i>	<i>Intervention Proposals*</i>	<i>Feasibility</i>	<i>Regulatory Controls/Policies</i>
Municipal Discharges - Wastewater Treatment Plants/Utilities (SIC #4952)	Water = 894.0 (92/93) ^A	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	Tetrachloroethylene can be removed from an effluent stream by air stripping and subsequent granular activated carbon adsorption. ^C	- Demonstrated and reliable	(see previous page)
Spills	136.4 (average over eight years) ^E	Spill loadings have been obtained from the ERNS database. TRC obtained data for spills since 1986 and averaged this to obtain an annual average loading. Some spills were included without reported quantities which means that average annual loadings would be higher than those reported (see Section 4.2.3 of this report).	The main intervention proposal is to ensure safe chemical handling practices are established and performed by a trained workforce. All chemicals should be handled or transferred in a contained (bermed) area to prevent migration in the event of a spill (see Section 5.3 of this report).	Safe handling practices should be established.	
Hazardous Waste Sites	656.7 ND	Loading data were obtained for a total of 25 sites. Hundreds of other confirmed and potential hazardous waste sites in the 32 counties of concern may also be impacting the basin. Loading estimates are based on sampling results and modeling, and consider ground water-transported contamination only (see Section 4.3.3 of this report).	Frequently used remedial technologies for tetrachloroethylene in ground water include pump-and-treat systems. Treatment may be air or steam stripping, granular activated carbon adsorption, or ultraviolet radiation/oxidation. ^C A method has been studied to recover tetrachloroethylene by distillation from NAPL which also contains PCBs. At least 80% of solvent contamination can be recovered by this method. ^L	- Demonstrated and reliable technology for remediation of volatile organic compound - contaminated sites - Being developed	

Tetrachloroethylene (3)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Sediments - A "hot spot" of tetrachloroethylene contamination was identified in Gill Creek. However, specific loading data were not available.	No information found.	Sediment loadings to rivers or the lakes would require extensive modeling and numerous assumptions, which would render the final information of limited value. Aqueous phase and sediment concentrations have been reported where identified (see Section 4.4.3 of this report).	Sediments containing VOCs such as tetrachloroethylene are typically incinerated. Controls such as activated carbon filters are used to remove the contaminant from the air emissions. Main intervention proposals for contaminated sediments include: <ul style="list-style-type: none"> removal of sediments by dredging covering sediments solidification extraction of contaminant relocate navigation routes (see Section 5.5 of this report)	- Demonstrated and reliable technology for remediation of volatile organic compound - contaminated sites - Being developed - Demonstrated at varying rates of success	(see previous page)
Surface Runoff (inc. stormwater and CSOs)	4 µg/L to 23 µg/L	Influent concentration sampling data to Buffalo Sewer Authority WWTP from 6 sampling events between 10/85 and 9/87. The majority of surface runoff contaminant loadings information was found for the Buffalo River Basin only. Data available are estimates and not actual loadings (see Section 4.5.3 of this report).	NPDES permit limits to be set in the future should result in the requirement for certain industries to treat surface runoff prior to leaving the property. CSO abatement programs will aid in reducing discharges from CSOs. (Refer to Section 5.6 of this report.)	Demonstrated at varying rates of success.	
Atmospheric Deposition - Municipal sewage treatment plants release tetrachloroethylene to the atmosphere.	No information found.	Available atmospheric deposition information is based on modelled estimates. Actual loadings data were only available for lead, PCBs, and benz(a)pyrene (see Section 4.6.3 of this report).	Tetrachloroethylene can be filtered from air emissions by using activated carbon filters. This method has been found to be up to 95% effective. ⁸	Demonstrated and reliable technology already used by many facilities including GMC Harrison. ⁹	

*Includes suggested methods for pollution prevention, waste minimization, and remediation technologies.

References:

- ¹Permit Compliance System (PCS) Database Retrieval, Fiscal Years 1991/92 and 1992/93.
- ²Toxic Release Inventory (TRI) Database Retrieval, 1991.
- ³Standard Handbook of Hazardous Waste Treatment and Disposal. Harry M. Freeman, Editor in Chief. 1989.
- ⁴YES Abstracts Data Base
- ⁵Report to the International Joint Commission. Great Lakes Water Quality Board. 1988.
- ⁶Water Quality Criteria Summary. EPA office of Science and Technology May 1, 1991.
- ⁷Drinking Water Guidelines and Health Advisories. EPA office of Water. December 1992.
- ⁸NYSED's Sediment Criteria, December 1989, Division of Fish and Wildlife, Bureau of Environmental Protection, 29 pp.
- ⁹New York State Air Guide - I, Guidelines for the Control of Toxic Ambient Air Contaminants. 1991 Edition.

References: (Continued)

¹Title III List of Lists, Consolidated List of Chemicals Subject to Reporting Under the Emergency Planning and Community Right-to-know Act. U.S. EPA office of Solid Waste and Emergency Response January 1991 EPA 560/4-91-011.
²ERNS Database Retrieval, 1986-1993.

³"Assessment of Solvent Recovery from Ground Water Containing Nonaqueous Phase Liquid with PCBs" Back & Dworzanski, Hazardous Waste and Hazardous Materials. Vol. 10, No. 1, 1993. pp. 49-57.

⁴"Estimated Ground Water-Transported Load of Chemicals from Waste Disposal Sites to the Niagara River." EPA-Robert S. Kerr Environmental Research Laboratory. March 1991.

⁵"Estimated Toxic Loading from Selected Hazardous Waste Sites to the Niagara River, Niagara Falls, New York." TRC Work Assignment C02112.

Suspect Chemicals Searchbook Edition 1992-1. Kenneth B. Clowsky, Editor. April 1, 1992.

Hazardous Substances Data Bank. National Library of Medicine. 1993.

Toxaphene (1)					
Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Industrial Discharges	No information found.	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	Use of toxaphene was severely restricted by EPA in 1986.		GLWQC: ² Human Health: 2.0×10^3 µg/L AWQC: ³ Chronic Freshwater Aquatic Life: 2.0×10^4 µg/L MCL: ² 0.003 mg/L
Municipal Discharges	No information found.	Water discharge data have been obtained from the PCS database which records all facilities with NPDES permits. Loadings have been determined on the basis of the New York State fiscal year April 1 to March 31 (see Section 4.1.3 of this report).	Activated carbon is effective at removing toxaphene from effluent. Filtration is effective for removing toxaphene adsorbed to suspended solids. ⁵	Existing STPs have activated carbon treatment.	NYSDEC Sediment Guidelines ⁶ Aquatic Toxicity: 0.01 µg/g OC Human Health: 0.02 µg/g OC Air Criteria: ⁸ SGC: 50.0 µg/m ³ AGC: 1.2 µg/m ³ SARA 313: ⁷ Y RQ: ⁷ 0.45 kg
Spills	No spills recorded on ERNS database retrieval for period 1986-1993. ⁴	Spill loadings have been obtained from the ERNS database. TRC obtained data for spills since 1986 and averaged this to obtain an annual average loading. Some spills were included without reported quantities which means that average annual loadings would be higher than those reported (see Section 4.2.3 of this report).	The main intervention proposal is to ensure safe chemical handling practices are established and performed by a trained workforce. All chemicals should be handled or transferred in a contained (bermed) area to prevent migration in the event of a spill (see Section 5.3 of this report).	Safe handling practices should be established.	TPQ: ⁷ 500 for powder <10µ or solution or molten. 10,000 for other
Hazardous Waste Sites	No information found.	Loading data were obtained for a total of 25 sites. Hundreds of other confirmed and potential hazardous waste sites in the 32 counties of concern may also be inspecting the basin. Loading estimates are based on sampling results and modeling, and consider ground water-transported contamination only (see Section 4.3.3 of this report).	(see municipal discharges)	GAC treatment is a demonstrated and reliable technology.	

Toxaphene (2)

Source/Pathway	Loadings (kg/yr)	Data Gaps/Limitations	Intervention Proposals*	Feasibility	Regulatory Controls/Policies
Sediments	No information found.	Sediment loadings to rivers or the lakes would require extensive modeling and numerous assumptions, would render the final information of limited value. Aqueous phase and sediment concentrations have been reported where identified (see Section 4.4.3 of this report).	Pesticide-contaminated sediments may be treated by submerged-quench incinerator. ^c Main intervention proposals for contaminated sediments include: <ul style="list-style-type: none">• removal of sediments by dredging• covering sediments• solidification• extraction of contaminant• relocate navigation routes (see Section 5.5 of this report)	Conducted at Rocky Mountain Arsenal. Demonstrated at varying rates of success.	
Surface Runoff (inc. stormwater and CSOs)	No information found.	The majority of surface runoff contaminant loadings information was found for the Buffalo River Basin only. Data available are estimates and not actual loadings (see Section 4.5.3 of this report).	NPDES permit limits to be set in the future should result in the requirement for certain industries to treat surface runoff prior to leaving the property. CSO abatement programs will aid in reducing discharges from CSOs. (Refer to Section 5.6 of this report.)	Demonstrated at varying rates of success.	(see previous page)
Atmospheric Deposition • Lake Ontario • Rochester Embayment • Genesee Basin • Embayment Watershed	4.72 0.023 1.53 1.89 ^d	Available atmospheric deposition information is based on modelled estimates. Actual loadings data were only available for lead, PCBs, and benzo(a)pyrene (see Section 4.6.3 of this report).	Control devices located at the source of contamination such as wet scrubbers and electrostatic precipitators have been proven effective in reducing emissions.	Demonstrated reliable technologies.	

*Includes suggested methods for pollution, prevention, waste minimization, and remediation technology.

References:

- ^aERDS Database Retrieval, 1986-1993.
- ^bSafe Drinking Water Act (SDWA)
- ^cTischler et al., "Selecting State-of-the-Art Incineration for Complex Aqueous Wastes: The Rocky Mountain Arsenal Basin F Liquid Treatment Action," *Hazardous Materials Control*, Vol. 4, No. 5. 1992.
- ^dReport to the International Joint Commission Great Lakes Water Quality Board. 1989.
- ^eWater Quality Criteria Summary. EPA office of Science and Technology May 1, 1991.
- ^fDrinking Water Guidelines and Health Advisories. EPA office of Water. December 1992.
- ^gNYSDRC Sediment Criteria, December 1989, Division of Fish and Wildlife, Bureau of Environmental Protection, 29 pp.
- ^hNew York State Air Guide -1: Guidelines for the Control for Toxic Ambient Air Contaminants. 1991 Edition (Draft).
- ⁱTitle III List of Lists, Consolidated List of Chemicals Subject to Reporting Under the Emergency Planning and Community Right-to-know Act. U.S. EPA office of Solid Waste and Emergency Response January 1991 EPA 560/4-91-011.
- ^jSummary Report of the Workshop on Great Lakes Atmospheric Deposition. International Joint Commission, October 1986.
- ^kSuperfund Chemicals Sourcebook Edition 1992-1. Kenneth B. Chaney, Editor. April 1, 1992.
- ^lHazardous Substances Data Bank. National Library of Medicine. 1993.
- ^mStandard Handbook of Hazardous Waste Treatment and Disposal. Harry M. Freeman, Editor in Chief. 1989.

use of alternative chemicals that may achieve the same desired end result for a particular industry. Remediation technologies identify suitable treatment technologies that will render the waste disposable or prevent any further risk to human health and the environment. The tables also identify the feasibility of each intervention proposal identified. Finally the current regulatory criteria and guidance are presented. The tables present a summary of the current status with regard to loadings, sources and appropriate reduction techniques for each chemical.

5.3 Intervention Proposals

5.3.1 Spills

This section discusses both prevention of spills and containment should a spill occur. Ideally all facilities should be able to prevent or minimize spill events and should have established practices for chemical storage and handling as well as spill clean-up.

The prevention of spills relies on personnel practices including management initiatives and employee training for operating procedures, material handling and storage, preventive maintenance and emergency preparedness. Prevention also includes safety containment features such as dikes and berms to contain releases should they occur.

The two main methods of spill control are absorption and dispersion. Absorption of spills with such materials as fabrics, rags, pillows, clays and "Speedi-Dri" produces large volumes of contaminated material that require disposal through incineration or landfilling. Dispersion, which can cause additional environmental damage, involves spraying dispersants which break up particles for biodegradation and evaporation. Additional intervention technologies include excavation, skimmers, and separators.

5.3.2 Hazardous Waste Sites

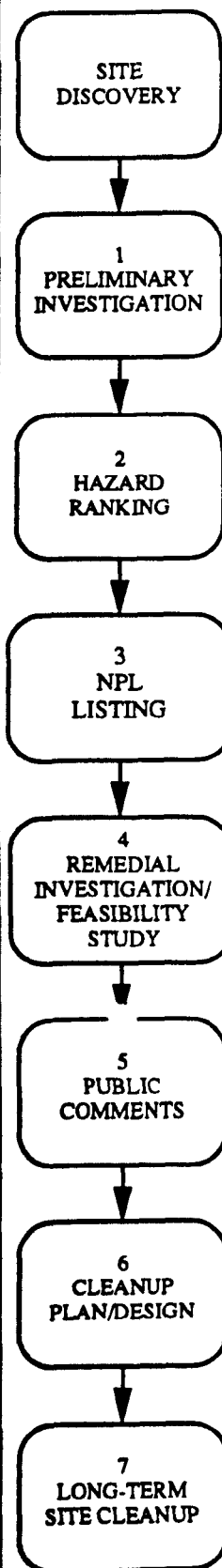
EPA has established intervention systems for hazardous waste sites under two major Federal legislations, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and the Resource Conservation and Recovery Act (RCRA). These programs enable EPA to address potentially contaminated areas through the CERCLA Superfund investigation and remediation process and the RCRA Corrective Action process.

CERCLA deals primarily with active and inactive hazardous waste disposal areas. EPA uses a multimedia approach to investigate potentially contaminated sites, assess the nature and extent of contamination, evaluate risks to human health and the environment posed by the site, and identify and implement remedies to address the contamination. The Superfund process serves both as a remedial response to past waste disposal practices and as an emergency response to situations that pose an immediate hazard. Figure 5.3.1 summarizes the Superfund process.

RCRA is intended as a preventive policy to regulate hazardous waste management. The legislation provides "cradle-to-grave" control over hazardous substances by imposing regulations on generators, transporters, treaters, storers, and disposers of these substances. The RCRA Corrective Action process enables EPA to investigate and rectify contaminated areas caused by a facility's mismanagement of hazardous materials. This process is summarized in Figure 5.3.2.

Both the Superfund and RCRA investigation processes involve a preliminary evaluation of the site or facility in the early stages to determine the urgency of further study and/or remedial action. Under CERCLA, after a Preliminary Assessment (PA)

Figure 5.3.1. The Superfund Process



In 1980, Congress passed a law called the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLA created a tax on the chemical and petroleum industries. The money collected from this tax, known as the Superfund, goes toward the cleanup of abandoned or uncontrolled hazardous wastes sites. The discovery of a potential hazardous waste site can occur in the course of required reporting or routine inspections or when there is physical evidence of contamination (drums, odors). The Superfund process then begins. The basic steps of the Superfund process are discussed below.

(1) Preliminary investigations, usually conducted by state environmental agencies, provide preliminary information regarding the history of disposal and present conditions at the site.

(2) If EPA decides that there is a potential for contamination at the site, a Hazard Ranking Study is conducted (this often uses information from the preliminary investigations). A site is ranked using a scoring system that evaluates many factors, among them:

- Possible harm to human populations or the environment from hazardous substances leaving the site through ground water, surface water, surface soil, or air;
- Possible harm to individuals coming in contact with hazardous substances at the site itself (from inhalation, direct contact, fire, explosion, and accidental ingestion of substances at the site); and
- Potential for substances at the site to contaminate drinking water wells and the number of people potentially affected by well contamination;

If a site is considered to present a potentially serious hazard, the site is placed on the National Priorities List (NPL). Sites on the NPL present the most serious problems among hazardous waste sites nationwide and are eligible for Superfund money.

(3) Once a site is placed on the NPL, a Remedial Investigation (RI) is conducted. An RI assesses the nature and extent of contamination on site and determines the potential risks to the community and the environment. In addition to the RI, a Feasibility Study (FS) is conducted. The FS examines the pros and cons of various cleanup options (e.g. removal of contaminated soil, installation of water purification systems, or containment of contaminants).

(4) Before choosing one or a combination of cleanup methods, EPA addresses public comments. The purpose of this is to determine which of the proposed cleanup alternatives would most effectively meet the desires of the local community.

(5) The optimal cleanup alternative is documented in the Record of Decision, after which a cleanup plan is designed.

(6) Cleanup is the last step of the process. The method of cleanup may vary according to the type and amount of contamination present at a site, the possible receptors of contamination near the site, and the concerns of the community.

The time it takes to complete the Superfund process varies with each site. In general, the RI/FS stage can take between one and two years. The design of the chosen cleanup alternative takes approximately six months. The actual cleanup may take another one to three years but may be significantly prolonged if ground water has been affected.

Throughout the Superfund Process, several activities are continuously being conducted, including:

- **Site Monitoring.** If a site is thought to be an immediate threat to public health or the environment, continuous monitoring of onsite conditions occurs. Under severe conditions, EPA may conduct an emergency cleanup (called immediate removal or initial remedial measures).
- **Community Relations.** EPA actively informs the community and community officials of the status of the remediation process. In addition, EPA encourages public input throughout the process. Specific activities may vary from site to site depending on the level and nature of public concern. Activities often include public meetings, press releases, and community interviews.
- **Enforcement.** After a site is included on the NPL, EPA determines who is responsible for the contamination at the site. The potentially responsible parties (PRPs) are legally obligated to either conduct or pay for the cleanup of the site and to reimburse EPA and state agencies for oversight costs and costs incurred during any previous remediation.

Figure 5.3.2.
RCRA Corrective Action Process

RCRA Facility Assessment (RFA)

Identify potential releases of hazardous waste requiring further investigation.

EPA Issues Corrective Action Permit

Work Plan (Proposal) Development

Prepare plan for RCRA Facility Investigation for EPA approval.

RCRA Facility Investigation (RFI) Phase I

Study the environmental setting at the plant.

Determine what wastes have been released.

Preliminarily determine concentration and movement of contamination.

Complete Public Health and Environmental Risk Evaluation.

RCRA Facility Investigation (RFI) Phase II

Establish Media Protection Standards (cleanup levels) for each contaminant.

Further define extent of contamination and screen possible corrective measures.

Corrective Measures Study (CMS)

Evaluate corrective measures that could achieve Media Protection Standards.

Recommend and justify corrective measures.

Solicit public input on recommended cleanup method and resulting contaminant levels.

EPA Modifies Permit

Corrective Measures Implementation

Design and perform cleanup.

Completion of Remedy

EPA certifies that Corrective Action is complete.

Monitor site conditions.

and a Site Investigation (SI) are conducted, a Hazard Ranking System (HRS) score is calculated for a site. The HRS score enables EPA to prioritize sites and identify those which present the most serious contamination and the greatest threat to human health and the environment. The RCRA process has a similar component, known as the RCRA Facility Assessment (RFA) and National Corrective Action Prioritization System (NCAPS) score.

Because thorough site investigation and remediation is costly and time-consuming, prioritization is a crucial factor in the success of these programs. This is particularly true for the area of concern in this study, where in Niagara and Erie Counties alone there are over 300 sites which are still in the preliminary stages of investigation. Accelerating these initial evaluations would aid EPA in identifying those sites which need to be addressed in order to reduce toxics loadings to the Eastern Great Lakes Basin.

EPA Region I has developed the Stabilization Collaboration Initiative (SCI) to accelerate the prioritization process. Under the SCI, all available information on a potential hazardous waste site is collected and organized in a way that highlights significant information regarding likely contaminants of concern at the site, disposal history, and potential human and environmental receptors. This information is obtained from EPA, state, and local files, and from the facility or site itself when possible. A sample of a file organization sheet is presented in Appendix E.

The files are reviewed by a panel of experts who are familiar with site assessment and ranking criteria and with remediation alternatives. Their review and consultation provides EPA with a synopsis of the site, an evaluation of the urgency of further investigation and remediation, and suggested measures to address contamination.

Under the SCI, up to 50 sites have been handled in a period of several months. The SCI results in quick initial evaluations of large numbers of sites to aid EPA in allocating resources and personnel within a specific area. A similar program could be very useful for several of the 32 counties of concern, including Erie, Niagara, Monroe, Onandaga, and Oswego Counties, where there are hundreds of potential hazardous waste sites which have not yet been well investigated. An initial evaluation could identify whether any of the 18 target chemicals of concern are likely site contaminants, and whether the site's location and other factors suggest that it is impacting the Great Lakes, for example, the Niagara River Remedial Action Plan (RAP) suggested that stream-quality monitoring near potential sites of concern could serve as an early determination of surface water impact. The SCI could also identify sites where immediate remedial actions could significantly reduce the off-site migration of contamination.

Within the established CERCLA and RCRA investigation and remediation programs, TRC recommends assessing the benefits of accelerating the process and performing a cost-benefit analysis to allocate further resources and personnel.

5.3.3 Sediments

The International Joint Commission (IJC), established in 1909 under the Boundary Waters Treatment, has designated 42 locations around the Great Lakes as "Areas of Concern" (AOCs), or locations where environmental problems have been identified. Thirty-eight of these AOCs have contaminated bottom sediments.²⁹ In the Eastern Great Lakes Basin, there are several AOCs: a portion of the Saint Lawrence River; the Oswego River; the Rochester Embayment; Eighteen Mile Creek; the Buffalo River; and Lake Ontario near the mouth of the Niagara River. According to the Great Lakes

²⁹"Management of Bottom Sediments Containing Toxic Substances:" Proceedings of the U.S./Japan Experts Meeting (13th) held in Baltimore, MD, 3-5 Nov. 1987, pp. 87-89.

National Program Office "sediments contaminated with toxic materials in the Great Lakes basin remain one of the most significant issues in the basin."³⁰ Although stringent controls over some sources of pollution have been implemented and seem to be reducing loadings to sediments, further remedial actions need to be performed.

Dredging has been traditionally used as a means of removing contaminated sediments. Two types of dredging, mechanical and hydraulic, are commonly utilized. Mechanical dredging traditionally removes contaminated sediments by using an excavator. However, residual contaminated sediments if disturbed may enter the water column as suspended solids and thereby increase toxicity risk. Hydraulic dredging, however, removes contaminated sediments more efficiently causing less disturbance to surrounding sediments, and thus reduces the likelihood of contaminated sediments becoming resuspended and entering the water column.

The Water Quality Agreement, signed by the United States and Canada in 1972, mandated that a Dredging Subcommittee develop dredging and disposal guidelines for activities in the Great Lakes. The IJC created such a subcommittee, which published appropriate guidelines in 1982. However, in 1986, this body was restructured as the Sediment Subcommittee and tasked to address all types of contaminated sediment issues, rather than focusing on only one type of remediation technology.³¹

One of the first efforts undertaken by the Sediment Subcommittee was to assist RAP authors both in designing proper studies to assess the extent of sediment contamination and in selecting appropriate remedies. In November 1987, the Subcommittee prepared a draft guidance document for presentation at a meeting of the Remedial Action Plan Coordinators. This document outlined appropriate tools to be used in assessing

³⁰ Ibid., p. 267.

³¹ Ibid., p. 93.

contamination, and provided remedial/removal action and disposal options.³² The Subcommittee identified the following as effective remedial action alternatives:

- Remove contaminated sediments from the water body (i.e., dredge).
- Cover the contaminated sediments to isolate the contaminants from the water column.
- Solidify the sediments to reduce the contaminants' mobility.
- Decontaminate the sediments using some extraction process.
- Relocate navigation so that dredging and navigation do not disturb the contaminated sediments.
- Take no action; allow natural water flow processes to reduce the severity of the problem over time.³³

Disposal alternatives considered were:

- In-water unconfined disposal.
- In-water confined disposal or disposal inside a diked area of the lake.
- Upland disposal or disposal in a bermed facility above the water table.
- Capping with clean sediments to isolate the contaminants from the water column and to prevent the erosion and transport of capped contaminated material.
- Agricultural land application (similar to sewage sludge disposal).
- Beach nourishment, where mildly contaminated coarsely-grained materials are used to rebuild an eroding beach.³⁴

³² Ibid., pp. 93-94.

³³ Ibid., p. 94.

³⁴ Ibid., pp. 94-95.

Although not recommended by the Sediment Subcommittee as a remedial/removal option, another alternative is dredging, dewatering, and incineration. Disposing of dewatered sediments on land may result in contamination of a previously clean area or may contribute to an already existing problem. Incineration is an alternate option, although emission standards must be adhered to strictly in order to avoid polluting the air.

5.3.4 Surface Runoff

5.3.4.1 Direct Surface Runoff

It appears evident even from the results of the limited number of studies performed to date that surface runoff may be a significant pathway of contaminant deposition in the Eastern Great Lakes Basin. As noted in Section 4.5 of this report, direct surface runoff is considered to be runoff, typically found in rural areas, which enters a surface water body directly. This varies from surface runoff in more urban areas where flow is directed into a sewer system and allowed to overflow to surface water bodies only on a periodic basis, as in the case of CSOs.

EPA has recently instigated a requirement for facilities to apply for NPDES permits for surface water runoff discharges. Implementation of these permitting efforts should enable the quantification of the loading from surface water runoff emanating from industrial facilities. This will enable regulatory agencies to require industries to reduce their respective loadings to surface runoff or at least treat such waste streams prior to release to the stormwater drain. This reduction, in turn, will reduce the overall loadings to surface water bodies. In approving permitted discharge limits for surface water runoff within the U.S. Eastern Great Lakes Basin, it may be advantageous to consider the recently proposed Great Lakes Water Quality Criteria. Utilizing these limits in developing discharge limits should act to ensure that surface

water runoff will not be adversely impacting water quality within the U.S. Eastern Great Lakes Basin.

For facilities which will be required to treat surface water runoff to reduce contaminant concentrations, relatively inexpensive treatment methods may be available. For contaminants such as lead (found to have the most significant loading due to runoff) simple sedimentation and/or filtration may provide sufficient treatment. Detention ponds with appropriate bedding material to provide adequate filtration may also provide sufficient treatment.

5.3.4.2 Combined Sewer Overflows

TRC has found that certain communities are implementing programs to reduce or eliminate the potential for CSO discharge into surface water bodies. For example, Monroe County is implementing a Combined Sewer Overflow Abatement Program (CSOAP), which is attempting to reduce CSO discharges within the Rochester Embayment.

The Buffalo Sewer Authority (BSA) and the City of Niagara Falls have been identified as having active CSOs which discharge to the Niagara River during storm events. The BSA initiated a program in the early 1980s which involves upgrades to the structural features of the system, an overflow structure backflow prevention program, and a sewer cleaning program.

Additional investigation may be warranted to identify and evaluate any similar programs for other portions of the Eastern Great Lakes Basin. A potential source of information about CSOs in each major town or city may be the local town sewer and water officials. Clearly the elimination of all CSOs is desirable from the environmental protection standpoint, and current construction standards and new towns

will be achieving this. Additional investigations to identify and evaluate CSOs, should be focused on older cities and towns where CSOs may still be utilized on a more frequent basis. For such cases, it may be appropriate to install control devices which significantly reduce the frequency in which overflows are allowed to discharge to the receiving water bodies. For example, CSOs have been identified within the Rochester Embayment which are designed to overflow twice per year, on average. It may be feasible to construct containment features which could reduce overflow frequency to every five to ten years or longer. These features could be constructed so as to allow the excess flow to be reintroduced into the sewer system when flow conditions abate, without overloading the treatment plant.

5.3.5 Atmospheric Deposition

It is commonly accepted that the best approach for treatment of air contamination is to treat discharges at the source. Atmospheric deposition has been identified as potentially a significant contributing pathway of several contaminants (lead, PCBs, PAHs).³⁵ Sources within and around the Eastern Great Lakes Basin are responsible for deposition in this area. Major sources of lead and PAHs have been determined to be automobile emissions. Reduction of lead emissions has been accomplished through the implementation of government regulations regarding the use of leaded fuels. Additional reductions in emissions may be produced through incentives to increase carpooling and the use of public transportation, thereby reducing the number of automobiles producing the emissions.

Industrial sources contribute to atmospheric contamination through smoke stack emissions. The reduction of contaminants being emitted by this source could be accomplished through the use of wet scrubbers or electrostatic precipitators. Both of these technologies are generally proven methods of reducing emissions prior to

³⁵Summary Report of the Workshop on General Lake Atmospheric Deposition. Page 15.

discharge into the atmosphere. Wet scrubbing involves the transfer of contaminants from the gaseous phase and introducing them into the aqueous phase. By forcing the contaminated air stream through an appropriate liquid (i.e., water or solvents) contaminants are captured in the aqueous phase. This aqueous solution may, in turn, require treatment prior to discharge, or may be acceptable for direct discharge into a publicly-owned treatment works (POTW).

Electrostatic precipitation is a process in which particulate matter is removed from the air stream using electrical forces. Charged particles are accumulated on plates or electrodes and are eventually knocked from the plates and allowed to fall into a hopper. This solid material can then be properly characterized and disposed of in accordance with appropriate RCRA regulations.

Atmospheric contamination may also originate from industries located in Canada or Mexico, and be transported to the Eastern Great Lakes Basin via air currents.

Environmental controls to be implemented as part of the North American Free Trade Agreement (NAFTA) may serve to control emissions from industrial sources in these countries.

5.4 Analysis of Contamination by County

Table 5.4.1 presents the breakdown of loadings from municipal and industrial discharges presented in Appendix B for each of the 18 chemicals of concern, by each of the 32 Eastern Great Lakes Counties. The counties which contribute the majority of the total loadings are Erie (31,055 kg/yr); Genesee (25,574 kg/yr); Jefferson (20,838 kg/yr); Niagara (25,131 kg/yr); and Wayne (16,450 kg/yr). These five counties represent 92 percent of the total loading to the basin.

Table 5.4.1. Total Annual Loading^(a) for Each Chemical by County (kg)

Counties

Chemicals	Allegany (3)	Cattaraugus (9)	Chautauque (11)	Chemung (13)	Clinton (15)	Cortland (19)	Erle (23)	Essex (29)	Franklin (31)	Genesee (33)	Hamilton (37)	Herkimer (41)	Jefferson (43)	Livingston (45)	Lewis (49)	Madison (51)	Monroe (53)	Niagara (55)	Oranida (59)	Oronogo (63)	Ontario (67)	Orleans (69)	St. Lawrence (73)	Cassago (75)	Schuyler (89)	Seneca (97)	Steuben (99)	Tompkins (101)	Wayne (109)	Wyoming (117)	Yates (121)	Total	
Arsenic				28			218	22			0.1			1	14		2	373	105		252			34	7					8		276	26,092.1
B(a)a																									0.1								0.1
B(a)p								4																	27								31
B(b)l								4																	6								10
B(k)l																									0.1								0.1
Chlordane																																	
Chrysene																									0.1								0.1
DDT																																	
Dieldrin																																	
Dioxin																																	
Hex. chl. b.																																	
Lead		8	122	12			14	1,770			36		0.2	123			0.8	2,430	1,957	336	1,137	58		208	2,253		17	43	153	362	0.5		32,478.5
Mercury				0.1				5						14				14	33	4	5	1		6	6		0.1					0.1	681.2
Mirex																			0.4														0.4
O. ch. sty.																																	
PCBs																																	
PCE								29,250			25,538			20,700				161	23,036		440								252	16,088	5,067		120,532
Toxaphene																																	
Total		8	122	40.1			232	31,056			25,574.1		0.2	20,820	14		2.8	2,578	23,014	340	1,634	58		238	2,260.3		17.1	43	413	53,153	16,650	276.1	170,625.5

Source: Loadings were obtained for water and air. Water loadings were obtained for fiscal year 1992/93 from PCS and air loadings for calendar year 1991 from TRI.

^(a)Includes annual loadings for industrial and municipal discharges to air and water.

Nine counties had no apparent discharges from industrial or municipal facilities for the time periods reviewed. These counties tend to be either remote or predominantly outside the Eastern Great Lakes Basin.

Erie and Niagara Counties include the major cities of Niagara Falls and Buffalo, as well as the Buffalo and Niagara Rivers. There are major industrial and municipal dischargers located along these rivers and in these towns.

TRC contacted the pollution prevention office for Erie County. This pollution prevention office assists facilities within the county to reduce their emissions and use of toxic chemicals by providing information on technological advancements and process changes. TRC was unable to ascertain if the other counties (Niagara, Genesee, Jefferson, and Wayne) have similar offices, but this method of disseminating information to local facilities from an organization that is familiar with the locale, would appear to be an effective means of reducing industrial discharges.

6.0 SUMMARY

TRC investigated sources of the 18 target chemicals within the 32 New York State Counties that constitute the U.S. Eastern Great Lakes Basin. Sources investigated represented both point and non-point sources and included industrial and municipal discharges, spills, hazardous waste sites, sediments, surface water runoff and atmospheric deposition.

TRC obtained loadings data for industrial and municipal discharges from the PCS and TRI databases. The PCS database provided loadings data for facility wastewater streams discharged directly into Lake Ontario or its tributaries. The TRI database provided loadings data on wastewater discharges and air emissions from facilities subject to TRI reporting requirements. Information from the PCS and TRI databases

indicate that, of the 18 target chemicals, lead, arsenic, mercury, and PCE are discharged in the greatest quantities by identified industrial and municipal dischargers.

It is important to note that at the time of completion of this Work Assignment, TRC received only limited data on air emissions. Air emissions may represent a significant source of loadings into the U.S. Eastern Great Lakes Basin.

TRC also obtained information on spills of the 18 target chemicals within the basin during the last seven years from the ERNS database. This data indicates that PCBs in the form of transformer oil, have been the predominant chemicals spilled.

The other identified sources - hazardous waste sites, sediments, surface water runoff, and atmospheric deposition - are considered non-point sources; they require extensive modeling to reasonably determine loadings. Where previous modeling studies have been obtained by TRC, loadings data have been presented. However, there are considerable data gaps in this area.

From the loadings data obtained and presented in this report, TRC identified the industries responsible for discharging each chemical and suggested appropriate intervention proposals to reduce these loadings. Intervention proposals include waste minimization, pollution prevention and remediation technologies. TRC also identified potential intervention proposals for the other non-point sources identified.

This report presents identified loadings of the 18 target chemicals into the U.S. Eastern Great Lakes Basin. In order to evaluate the impact of these loadings to human and ecological receptors, factors such as each chemical's toxicity and fate and transport in the environment must be considered.

7.0 BIBLIOGRAPHY

Air and Waste Management Association Air Pollution Engineering Manual. 1992.

Alliance Technologies Corporation. Estimated Toxic Loading from Selected Hazardous Waste Sites to the Niagara River, Niagara Falls, New York. EPA Work Assignment No. C02112.

Alliance Technologies Corporation. Nonpoint Source Loading Study, Buffalo River Segment, Niagara River Basin. December 30, 1991.

Atkinson, J.F., et al. Model Data Requirements and Mass Loading Estimates for the Buffalo River Mass Balance Study (ARCS/RAM Program), Draft Report. Great Lakes Program, State University of New York at Buffalo Department of Civil Engineering. April 1993.

Atkinson, J.F., et al. Model Data Requirements and Mass Loading Estimates for the Buffalo River Mass Balance Study (ARCS/RAM Program), Final Report. Great Lakes Program, State University of New York at Buffalo Department of Civil Engineering. August 1993.

Atmospheric Deposition Monitoring Task Force. A Plan for Assessing Atmospheric Deposition to the Great Lakes. Report to the Great Lakes Water Quality Board. International Joint Commission, Great Lakes Regional Office. Windsor, Ontario. July 1988.

Baek, N.H., and Dworzanski, G.M. Assessment of Solvent Recovery from Ground Water Containing Nonaqueous Phase Liquid with Polychlorinated Biphenyls. *Hazardous Waste and Hazardous Materials*. Vol. 10, No. 1, pp. 49-57. 1993.

Battelle Ocean Sciences. Study of PCBs in New York/New Jersey Point Sources. January 29, 1993.

Clansky, Kenneth B., Editor. *Suspect Chemicals Sourcebook, Edition 1992-1*. Roytech Publications. April 1, 1992.

Empire Soils Investigations, Inc./Thomsen Associates. Environmental Study: Niagara Frontier Transportation Authority Diked Disposal Area, Buffalo, New York. BTA-86-94. Hamburg, New York. February 1987.

Environment Canada/Health and Welfare Canada. Toxic Chemicals in the Great Lakes and Associated Effects, Vols. I and II. March 1991.

Freeman, Harry, Editor in Chief. *Standard Handbook of Hazardous Waste Treatment and Disposal*. McGraw Hill, Inc. 1989.

GCA Corporation. Combined Sewer Overflow Loadings Inventory for Great Lakes Basin, Final Report. Bedford, Massachusetts. March 1983.

Glass, G.E., et al. New Source Identification of Mercury Contamination in the Great lakes. *Environmental Science and Technology*. Vol. 24, No. 7, pp. 1059-1069. 1990.

Gradient/Geotrans Corporation. Potential Contaminant Loadings to the Niagara River from U.S. Hazardous Waste Sites. February 1988.

Great Lakes Water Quality Board. 1989 Report on Great Lakes Water Quality. Report to the International Joint Commission. Hamilton, Ontario. October 1989.

International Joint Commission. Revised Great Lakes Water Quality Agreement of 1978, as amended by protocol. Signed November 18, 1987.

International Joint Commission. Summary Report of the Workshop on Great Lakes Atmospheric Deposition. October 1986.

Johnston, Richard H. Ground Water in the Niagara Falls Area, New York, with Emphasis on the Water-Bearing Characteristics of the Bedrock. U.S. Geological Survey Bulletin GW-53. 1964.

Kappel et al. Quantity and Quality of Urban Stormwater Runoff in the Irondequoit Creek Basin near Rochester, New York. U.S. Geological Survey Water Resources Investigations Report 85-4113. 1986.

Lake Ontario Secretariat. Lake Ontario Toxics Management Plan, 1991 Update. September 11, 1991.

Lewis Publishers. New Techniques for Modelling the Management of Stormwater Quality Impacts. 1993.

Litten, S. Chemical Contaminants in Sediments of New York Tributaries to Lake Ontario. NYSDEC Division of Water, Bureau of Technical Services and Research. October 1988.

Litten, S. The Search for Dioxin -- Eighteen Mile Creek. NYSDEC Division of Water. January 1992.

Litten, S. Sources of PCBs to the Niagara River, Interim Report. NYSDEC Division of Water. February 1992.

Litten, S., Mead, B., and Hassett, J. Application of Passive Samplers (PISCES) to Locating a Source of PCBs on the Black River, New York. *Environmental Toxicology and Chemistry*. Vol. 12, pp. 639-647. 1993.

Marsalek, J., and Ng, H.Y.F. Evaluation of Pollution Loadings from Urban Nonpoint Sources: Methodology and Applications. *Journal of Great Lakes Research*. Vol. 15, No. 3, pp. 444-451. 1989.

Marsalek, J., and Greck, B. Toxic Substances in Urban Land Runoff in the Niagara River Area. National Water Research. Burlington, Ontario. September 1983.

Miller, T.S., and Kappel, W.M. Effect of Niagara Power Project on Ground-Water Flow in the Upper Part of the Lockport Dolomite, Niagara Falls Area, New York. U.S. Geological Survey Water-Resources Investigations Report 86-4130. Ithaca, New York. 1987.

Monroe County Department of Planning and Development. Rochester Embayment Remedial Action Plan, Stage I. June 1993.

National Library of Medicine. Hazardous Substance Data Bank. 1993.

New York State Department of Environmental Conservation (NYSDEC). Buffalo River Remedial Action Plan. November 1989.

NYSDEC. *Geographic Data Source Directory*. Division of Management Planning and Information Systems Development. May 1990.

NYSDEC. New York State Air Guide - 1, Guidelines for the Control of Toxic Ambient Air Contaminants, Draft Edition. Division of Air Resources. 1991.

NYSDEC. New York State and Persistence Toxic Substances: Options for Bans and Phaseouts. Great Lakes and Groundwater Section, Division of Water. Albany, New York. December 1992.

NYSDEC. New York State Sediment Criteria. Division of Fish and Wildlife, Bureau of Environmental Protection. December 1989.

NYSDEC. Niagara River Remedial Action Plan, Draft Report, Volume I. Division of Water. March 1993.

NYSDEC. Nonpoint Source Assessment Report. Division of Water, Bureau of Water Quality Management. February 1989.

NYSDEC. Oswego River Remedial Action Plan, 1992 Update. Division of Water. Albany, New York. June 1992.

NYSDEC. Rotating Intensive Basin Studies (RIBS) Water Quality Assessment Program. Division of Water, Bureau of Monitoring and Assessment. 1989-90.

NYSDEC. Water Quality Standards and Guidance Values. Division of Water. Albany, New York. November 1991.

NYSDEC. 1989-90 Toxic Substance Discharges from Point Sources to the Niagara River. Division of Water. August 1991.

Niagara River Data Interpretation Group. Joint Evaluation of Upstream/Downstream Niagara River Monitoring Data, 1988-89, Final Report. Environment Canada, Water Quality Branch, Ontario Region. December 1990.

Niagara River Data Interpretation Group. Joint Evaluation of Upstream/Downstream Niagara River Monitoring Data, 1989-90, Final Report. Environment Canada, Water Quality Branch, Ontario Region. March 9, 1992.

Niagara River Secretariat. Niagara River Toxic Management Plan, 1990 Update. September 1990.

Planning Research Corporation. Waste Audit Study: Printed Circuit Board Manufacturers. San Jose, California. June 1987.

PRC Environmental Management, Inc. Waste Audit Study: Metal Finishing Industry. San Francisco, California. May 1988.

Schroeter & Associates. Loadings of Toxic Contaminants from Urban Nonpoint Sources to the Great Lakes from Ontario Communities. Burlington, Ontario. Contract No. KE405-0-2069. March 31, 1991.

Tischler, J., et al. Selecting State-of-the-Art Incinerators for Complex Aqueous Wastes: The Rocky Mountain Arsenal Basin F Liquids Treatment Action. *Hazardous Materials Control*, Volume 4, No. 5. 1992.

Smith, D., and Carr, B. Designing Goals for the Great Lakes. *Water Environment and Technology*. pp. 47-51. June 1993.

U.S. Army Corps of Engineers. Information Summary, Area of Concern: Buffalo River, New York, Final Report. Waterways Experiment Station Environmental Laboratory. Miscellaneous Paper EL-91-9. Vicksburg, Mississippi. March 1991.

U.S. Environmental Protection Agency. AIRCHIEF Database Retrieval.

U.S. Environmental Protection Agency. AIRS Database Retrieval.

U.S. Environmental Protection Agency. CERCLIS Characterization Project. EPA/540/8-91/082. November 1991.

U.S. Environmental Protection Agency. CERCLIS List: Region II. Retrieval dated July 27, 1993.

U.S. Environmental Protection Agency. Drinking Water Guidelines and Health Advisories. Office of Water. December 1992.

U.S. Environmental Protection Agency. EPA Guides to Pollution Prevention: The Fabricated Metal Products Industry. EPA/675/7-90/006. July 1990.

U.S. Environmental Protection Agency. ERNS Database Retrieval: 1986 - 1993. Region II Water Management Division.

U.S. Environmental Protection Agency. Estimated Groundwater Transported Load of Chemicals from Waste Disposal Sites to the Niagara River. Robert S. Kerr Environmental Research Laboratory. Ada, Oklahoma. March 21, 1991.

U.S. Environmental Protection Agency. Great Lakes Atmospheric Deposition (GLAD) Network, 1982 and 1983. EPA/905/4-88/002. February 1988.

U.S. Environmental Protection Agency. Great Lakes Basin Risk Characterization Study, Draft Report. Great Lakes National Program Office. Undated.

U.S. Environmental Protection Agency. Handbook: Remedial Action at Waste Disposal Sites. Office of Research and Development. October 1985.

U.S. Environmental Protection Agency. Health Effects Summary Tables (HEAST). 1992.

U.S. Environmental Protection Agency. Integrated Risk Information System. 1993.

U.S. Environmental Protection Agency. Interim Sediment Criteria Values for Nonpolar Hydrophobic Organic Contaminants. Office of Water Regulations and Standards. May 1988.

U.S. Environmental Protection Agency. Investigation of Polycyclic Aromatic Hydrocarbon Discharges to Water in the Vicinity of Buffalo, New York. Great Lakes National Program Office. EPA/905/4-85/002. February 1985.

U.S. Environmental Protection Agency. National Priorities List Sites: New York. EPA/540/4-90/032. September 1990.

U.S. Environmental Protection Agency. NPL Characterization Project. EPA/540/8-91/071. November 1991.

U.S. Environmental Protection Agency. Permit Compliance System Database Retrievals dated September 30, 1992, and August 10, 1993.

U.S. Environmental Protection Agency. Permit Compliance System Data Element Dictionary. Document Number PCS-DD92-2.02. June 21, 1993.

U.S. Environmental Protection Agency. Report on Great Lakes Confined Disposal Facilities. Environmental Review Branch Planning and Management Division, Region V. EPA/905/9-90/003. August 1990.

U.S. Environmental Protection Agency. ROD Annual Report FY1989. EPA/540/8-90/006. April 1990.

U.S. Environmental Protection Agency. STORET Database Retrieval dated July 1993.

U.S. Environmental Protection Agency. Title III List of Lists, Consolidated List of Chemicals Subject to Reporting under the Emergency Planning and Community Right-to-Know Act. Office of Solid Waste and Emergency Response. EPA/560/4-91/011. January 1991.

U.S. Environmental Protection Agency. Toxic Release Inventory Database Retrieval dated August 11, 1993.

U.S. Environmental Protection Agency. Waste Minimization Audit Report: Case Studies of Minimization of Mercury-Bearing Wastes at a Mercury Cell Chloralkali Plant. EPA/600/2-88/011. 1988.

U.S. Environmental Protection Agency. Water Quality Criteria Summary. Office of Science and Technology. May 1, 1991.

U.S. Environmental Protection Agency. 33/50 Program, Second Progress Report. Office of Pollution Prevention and Toxics. February 1992.

U.S. EPA/NYSDEC. Reduction of Toxics Loadings to the Niagara River from Hazardous Waste Sites in the United States: A Progress Report. March 1993.

U.S./Japan Experts. Management of Bottom Sediments Containing Toxic Substances, in Proceedings of the Thirteenth Meeting. Baltimore, Maryland. November 3-5, 1987.

Virginia Department of Waste Management. Waste Reduction Fact Sheet: Lead-Acid Batteries. Vol. 1, Issue 12. Virginia Waste Minimization Program. Undated.

Virtual Elimination Task Force. Three Background Reports on the Subject of Chlorine and Organochlorines. 1993.

Water Environment Research. Research Journal of the Water Pollution Control Federation. Research Journal, Volumes 59 - 65.

Whitaker, J.B. Launching the Great Lakes Initiative. *Water Environment and Technology*. pp. 40-46. June 1993.

**APPENDIX A
CHEMICAL PROFILES**

L93-839.app

RECYCLED PAPER

ENFORCEMENT CONFIDENTIAL

TRC

ARSENIC

Use

Arsenic is a silver-grey, brittle and crystalline metal occurring naturally in the environment at low concentrations. It is used as a constituent in the manufacture of copper and lead alloys; in the production of gallium arsenide for electronic devices; in the manufacture of pharmaceuticals; as a radioactive tracer (As^{76}), and as a catalyst in the manufacture of ethylene oxide (HSDB, 1993). It is also used in pigment production, glass manufacturing, textile printing, tanning, and in antifouling paints (Sittig, 1991). Arsenic-based pesticides were formerly heavily used to control insects and vegetation, particularly in orchards (Eisler, 1988).

Chemical and Physical Properties

Chemical symbol: As
Boiling Point: N/A
Melting Point: 817°C at 28 atm
Atomic Weight: 74.92
Corrosivity: N/A
Specific Gravity: 5.727 at 14°C

Octanol/Water Partition Coefficient: N/A
Solubilities: Soluble in nitric acid,
insoluble in water and
nonoxidizing acids
Vapor Density: N/A
Vapor Pressure: 1 mm Hg at 372°C
Other: Sublimes at 613°C

Control

Two primary treatments for removal of arsenic are activated alumina and anion exchange resins. Solvent extraction with high molecular weight amines and quaternary ammonium compounds may be a promising technique for the removal of arsenic from industrial effluents. Arsenic is a toxic pollutant designated pursuant to Section 307(a)(1) of the Clean Water Act and is subject to effluent limitations. Inorganic arsenic has been designated as a hazardous air pollutant, pursuant to Section 112 of the Clean Air Act (HSDB, 1993).

Source

Arsenic is introduced to the waters of the Great Lakes through atmospheric deposition (fossil fuel burning), runoff from fly-ash storage areas, and through release to the overlying water from sediments which have accumulated arsenic (GLBRCS). Municipal sewer treatment plants (STP) also release arsenic to the Great Lakes via effluent (66 percent of STP total) and sludge disposal (34 percent of STP total). Arsenic is also released into aquatic environments through the natural weathering of arsenic minerals.

Fate and Transport

Arsenic is generally quite mobile in the environment; however, because it occurs in four valence states, it cannot be characterized easily. The most common fate processes of arsenic in the environment are speciation between the +3 and +5 valence states, volatilization, sorption, and biotransformation (EPA, 1984).

In surface waters, arsenic is significantly influenced by the presence of biota. Arsenic is readily bioaccumulated but is often biotransformed to methylated arsenical, volatile compounds that evaporate from surface waters (EPA, 1985).

In surface soils, arsenic is known to sorb to clays, iron oxides, and particulate matter. The presence of these materials greatly retards arsenic's leachability (EPA, 1984). In soils with low sorptive capacity, arsenic leaches into ground water, where it is transported readily.

The primary means of removal of atmospheric arsenic are wet and dry precipitation (EPA, 1984).

Biological Properties

Human Toxicity - Noncarcinogenic Effects

Arsenic is known to be highly toxic to humans. Case studies have shown that short-term ingestion of amounts of arsenic as low as 0.6 mg/kg/day can be lethal (ATSDR, 1989). Effects of long-term exposure include paresthesia, weakness, anorexia, bronchitis, and various skin disorders (EPA, 1985). Both dermal and oral exposure sodium arsenate in pregnant rats, mice, and hamsters have been reported to increase the frequency of birth defects (ATSDR, 1989). Arsenic is also known to have mutagenic effects in several cell types in laboratory animals and humans (ATSDR, 1989).

Human Toxicity - Carcinogenic Effects

Studies show that ingestion of elevated levels of arsenic in drinking water unequivocally increases the risk of several types of skin cancer (Tseng, et al., 1968). In addition, numerous studies of smelter workers have indicated that occupational exposure to arsenic is directly associated with lung cancer (IRIS, 1993).

Other types of cancer that appear to be related to arsenic exposure in humans include bladder, lung, kidney, and colon cancer. All evidence from human case studies indicates that chronic exposure to arsenic causes cancer.

Ecotoxicity

Arsenic compounds are acutely toxic to both freshwater and saltwater species of organisms, with early life stages being the most susceptible (ICF, 1985). In general, inorganic trivalent forms of arsenic are more toxic than organic forms and pentavalent arsenic. Arsenic poisoning in wildlife is usually acute or subacute-chronic; cases of arsenic poisoning are rare (Eisler, 1988). Although arsenic is bioconcentrated by biota, it is not biomagnified within the food chain.

Damaging Effects

Potential carcinogenic human health effects are possible due to exposure of arsenic through contaminated air, drinking water soils or aquatic organisms. Although elevated arsenic concentrations surface waters and sediments at localized areas may result in adverse impacts to aquatic biota, effects to upper trophic level species are unlikely because arsenic has not been observed to biomagnify on the food chain.

Standards, Criteria and Guidelines

EPA Class A Carcinogen

Oral Slope Factor:	$1.8 \times 10^0 \text{ (mg/kg/day)}^{-1a}$
Inhalation Slope Factor:	$1.5 \times 10^{+1} \text{ (mg/kg/day)}^{-1b}$
Chronic Oral RfD:	$3.0 \times 10^{-4} \text{ mg/kg/day}^c$
Subchronic Oral RfD:	$1.0 \times 10^{-3} \text{ mg/kg/day}^d$
MCL:	0.05 mg/L
AWQC (Federal):	Water and Organism Consumption - 0.0022 µg/L
	Organism Consumption - 0.018 µg/L
	Acute Freshwater Aquatic Life - 360 µg/L
	Chronic Freshwater Aquatic Life - 190 µg/L

^aFrom IRIS. Oral Slope Factor = Oral Unit Risk × Conversion Factor.
Oral Unit Risk = $5.0 \times 10^{-5} \text{ L/µg}$
Conversion Factor = $3.6 \times 10^{+3}$

^bFrom IRIS. Inhalation Slope Factor = Inhalation Unit Risk × Conversion Factor.
Inhalation Unit Risk = $4.3 \times 10^{-3} \text{ m}^3/\mu\text{g}$

^cFrom IRIS. Conversion Factor = $3.5 \times 10^{+3}$

^dFrom HEAST.

GLWQG: Chronic Aquatic Life - 150 µg/L (Arsenic III)
Sediment Guidelines
Ontario MOE: Lowest Effect Level - 6 µg/g
Severe Effect Level - 33 µg/g

BIBLIOGRAPHY

ATSDR, 1989. *Toxicity Profile for Arsenic*. Agency for Toxic Substance and Disease Registry.

Eisler, R. 1988. *Arsenic Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review*. U.S. Fish Wildlife Service Biol. Rep. (85(1.12) 92 pp.

EPA, 1984. Office of Drinking Water. *Health Advisory for Arsenic*.

EPA, 1985. *Health Effects Assessment for Arsenic*.

GLBRCS (Great Lakes Basin Risk Characterization Study). Great Lakes Basin National Program.

HSDB, 1993. National Library of Medicine, *Hazardous Substance Data Bank*.

ICF, 1985. *Chemical, Physical and Biological Properties of Compounds Present at Hazardous Waste Sites*. Clement Associates.

IRIS, 1993. U.S. EPA Integrated Risk Information System.

Sittig, M., 1991. *Handbook of Toxic and Hazardous Chemicals and Carcinogens*.

Tseng, W.P., et al. 1968. Prevalence of skin cancer in an endemic area of chronic arsenicism in Taiwan. *J. Natl. Cancer Inst.* 40:453-463. (Cited in IRIS).

BENZO(A)ANTHRACENE

Background

Benzo(a)anthracene (B(a)A) belongs to a naturally occurring set of compounds called polycyclic aromatic hydrocarbons (PAHs). PAHs are produced by the incomplete combustion of organic compounds in both industrial and natural processes and are characterized as having more than one benzene ring. B(a)A has been reported to be present in cigarette smoke condensate, automobile exhaust gas, soot and the emissions from coal and gas works and electric plants. B(a)A can also be found in mineral oil, commercial-solvents, waxes, creosote, coal tar and petroleum asphalt. Certain foods, such as charcoal broiled, barbecued or smoked meats; certain vegetables; and roasted coffee and coffee powders contain microgram quantities of B(a)A. Because of the similarities among all PAHs and the information on individual compounds is scarce, the following discussions deal with PAHs as a group unless compound specific information exists.

Use

There is no commercial use of B(a)A in the United States. B(a)A is used in chemical research (HSDB, 1993).

Chemical and Physical Properties

Chemical symbol: $C_{18}H_{12}$	Solubilities: 0.014 mg/L water at 25°C
Boiling Point: N/A	Soluble in ether, alcohol,
Melting Point: 162°C	acetone, benzene, and
Atomic Weight: 228.29	organic solvents.
Corrosivity: N/A	Vapor Density: N/A
Specific Gravity: N/A	Vapor Pressure: 5×10^{-9} torr at 20°C
Octanol/Water Partition Coefficient: N/A	Other: Sublimes at 435°C

Control

The particle-bound portion of PAHs can be removed by sedimentation, coagulation, flocculation, and filtration processes since PAHs are bound to soil/suspended solids. PAHs may also be removed, in conjunction with filtration, by granular activated carbon. Remaining PAHs require oxidation for partial removal/transformation. B(a)A is a toxic pollutant designated pursuant to section 307(a)(1) of the Clean Water Act and is subject to effluent limitations (HSDB, 1993).

Source

It is likely that B(a)A enters aquatic environments of Lakes Erie and Ontario in a similar manner as reported for benzo(a)pyrene (i.e., primarily atmospheric deposition with sewer treatment plant effluent and sludge disposal, petroleum spills, and urban runoff also contributing PAHs to the aquatic environment).

Fate and Transport

In general, PAHs are expected to exist as vapor and particulates in the atmosphere. Once in the atmosphere, PAHs may be removed through photochemical reactions, chemical reactions, or by wet and dry deposition. In aquatic media, PAHs are expected to volatilize, react photochemically, and be degraded microbially. In high water and wind flow conditions, volatilization occurs readily. In water, PAHs adsorb to organic matter and most likely fall out of the water column into sediments (EPA, 1984).

In soils, PAHs are subject to microbial degradation and adsorption. Because of their affinity to organic matter, PAHs are not expected to be highly mobile in soils; therefore, leaching to ground water is not considered to be a significant fate process.

Biological Properties

Human Toxicity - Noncarcinogenic Effects

B(a)A is known to cause skin disorders in workers exposed occupationally (ICF, 1985). Studies have shown B(a)A to have mutagenic effects in bacterial and cultured mammalian cells.

Human Toxicity - Carcinogenic Effects

Several studies indicate that both oral and dermal exposure to B(a)A is related to increased tumor and adenomas in laboratory animals (Klein, 1963; IARC, 1982). It is also known that many carcinogenic PAHs, such as B(a)A, impact the immune system, although specific studies on B(a)A have not been conclusive (ICF, 1985).

Ecotoxicity

The ecotoxic effects of PAHs have not been widely studied. It appears as though the effects of PAHs on aquatic organisms are more variable than the effects on mammals. Although PAHs exhibit a high lipid solubility, they show little tendency to biomagnify in the food chain because most PAHs are rapidly metabolized by organisms (Eisler, 1987).

Damaging Effects

The majority of PAHs entering aquatic environments remain near the site of deposition (Eisler, 1987). Therefore, aquatic sites near urban areas generally exhibit the highest PAH levels. Brown bullheads exposed to elevated concentrations of PAHs within sediments of the Buffalo River in New York showed epidermal hyperplasia and neoplasia (Eisler, 1987). PAH levels in fish, however, are usually low. Therefore, upper trophic level species, including humans, are not likely to be exposed to PAHs from fish consumption. Molluscs are generally incapable of metabolizing PAHs, therefore, people consuming these organisms are more likely to be exposed to PAHs (Eisler, 1987).

Standards, Criteria and Guidelines

EPA Class B2 Carcinogen

Oral Slope Factor:	$7.3 \times 10^{-1} \text{ (mg/kg/day)}^{-1}$ ^a
Inhal Slope Factor:	N/A
Chronic Oral RfD:	N/A
Subchronic Oral RfD:	N/A
MCL:	0.0001 mg/L
AWQC (Federal):	Water and Organism Consumptions - 0.0028 µg/L Organism Consumption - 0.0311 µg/L Acute Freshwater Aquatic Life - N/A Chronic Freshwater Aquatic Life - N/A
GLWQG:	N/A
Sediment Guidelines	
NYSDEC:	Human Health - 1.3 µg/gOC
Ontario MOE:	Lowest Effect Level - 0.32 µg/g Severe Effect Level - 1,480 µg/gOC

BIB. IOGRAPHY

Eisler, R. 1987. *Polycyclic aromatic hydrocarbon hazards to fish, wildlife, and invertebrates: a synoptic review*. U.S. Fish Wildl. Serv. Biol. Rep. 85(1.11). 81 pp.

HSDB, 1993. National Library of Medicine, *Hazardous Substances Data Bank*.

^aValue derived by using Oral Slope Factor from IRIS for benzo(a)pyrene and applying a Toxic Equivalency Factor (TEF) of 0.10 (communication with Marina Stefanidis, U.S. EPA Superfund Health Risk Technical Support Section, March 5, 1992).

IARC (International Agency for Research in Cancer), 1982. *Chemicals, Industrial Processes and Industries Associated with Cancer in Humans*, In: *IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans*. WHO, IARC, Lyon, France. Suppl. 4. (Cited in EPA, 1984a).

ICF, 1985. *Chemical, Physical and Biological Properties of Compounds Present at Hazardous Waste Site*. Clement Associates.

Klein, M., 1963. *Susceptibility of strain B6AF/J Hybrid infant mice to tumorigenesis with 1,2-benzanthracene, deoxycholic acid, and 3-methyl-cholanthrene*. *Cancer Res.* 23: 1701-1707 (cited in IRIS).

EPA, 1984. *Health Effects Assessment for Polycyclic Aromatic Hydrocarbons*. EPA 540/1-86/013.

IRIS, 1993. U.S. EPA *Integrated Risk Information System*.

BENZO(A)PYRENE

Background

Benzo(a)pyrene (B(a)P) belongs to a naturally occurring set of compounds called polycyclic aromatic hydrocarbons (PAHs). PAHs are produced by the incomplete combustion of organic compounds in both industrial and natural processes, and are characterized as having more than one benzene ring. B(a)P has been detected in cigarette smoke and in certain foods (Sittig, 1991). Because of the similarities among all PAHs and information on individual compounds is scarce, the following discussions deal with PAHs as a group unless compound specific information exists.

Use

There is no evidence of commercial use of B(a)P in the United States. B(a)P is used extensively in chemical research (HSDB, 1993).

Chemical and Physical Properties

Chemical symbol: $C_{20}H_{12}$
Boiling Point: $>360^{\circ}C$
Melting Point: $179^{\circ}-179.3^{\circ}C$
Atomic Weight: 252.30
Corrosivity: N/A
Specific Gravity: 1.351
Octanol/Water Partition Coefficient: 6.04

Solubilities: 3.8 $\mu g/L$ water at $25^{\circ}C$
Soluble in benzene, toluene,
xylene, and ether.
Vapor Density: 8.7
Vapor Pressure: > 1 mm Hg at $20^{\circ}C$
Other: Readily undergoes nitration and
halogenation.

Control

The particle-bound portion of PAHs can be removed by sedimentation, coagulation, flocculation and filtration processes since PAHs are bound to soil/suspended solids. PAHs may also be removed, in conjunction with filtration, by granular activated carbon. Remaining PAHs require oxidation for partial removal/transformation. B(a)P can be removed from water by 50 to 60 percent by chlorination, at B(a)P concentrations greater than 10 ppt. B(a)P is a toxic pollutant designated pursuant to section 307(a)(1) of the Clean Water Act and is subject to effluent limitations (HSDB, 1993).

Source

It has been estimated that 79 percent of the B(a)P loading into Lake Erie is from atmospheric deposition (66 percent and 13 percent from direct and indirect sources, respectively). Lake Ontario is estimated to receive 72 percent of B(a)P loading from atmospheric deposition, 40 percent from direct sources and 32 percent from indirect sources (GLBRCS). PAHs have

also accumulated within the sediments of some locations. Treatment plants (effluent and sludge disposal), urban runoff, and petroleum spills also contribute PAHs to waters of the Great Lakes.

Fate and Transport

In general, PAHs are expected to exist as vapor and particulates in the atmosphere. Once in the atmosphere, PAHs may be removed through photochemical reactions, chemical reactions, or by wet and dry deposition. In aquatic media, PAHs are expected to volatilize, react photochemically, and be degraded microbially. In high water and wind flow conditions, volatilization occurs readily. In water, PAHs would adsorb to organic matter and most likely fall out of the water column into sediments (EPA, 1984a).

In soils, PAHs are subject to microbial degradation and adsorption. Because of their affinity to organic matter, PAHs are not expected to be highly mobile in soils; therefore, leaching to ground water is not considered to be a significant fate process.

Biological Properties

Human Toxicity - Noncarcinogenic Effects

From laboratory studies performed on mice, it appears that B(a)P toxicity to organisms is dependent upon a specific gene which determines whether a certain enzyme which alters the chemical makeup of aromatic hydrocarbons, is easily released (induced) into the body (EPA, 1984b). Those animals that cannot easily induce the release of this enzyme are more susceptible to B(a)P's toxic effects. These effects include anemia, infertility and birth defects, and genetic mutations (IARC, 1982).

Human Toxicity - Carcinogenic Effects

PAH mixtures containing B(a)P have been shown to induce lung cancer in humans as a result of chronic exposure to cigarette smoke, roofing tar, and coke oven emissions (IRIS). Animal studies indicate that mice exposed to B(a)P orally develop increased stomach tumors, and that hamsters inhaling B(a)P exhibit tumors throughout the respiratory tract (Neal and Rigdon, 1967; Thyssen, et al., 1981).

Ecotoxicity

The ecotoxic effects of PAHs have not been widely studied. It appears that the effects of PAHs on aquatic organisms are more variable than the effects on mammals. B(a)P is listed as a potential bioaccumulative chemical of concern by the Great Lakes Water Quality Guidance (GLWQG).

Damaging Effects

Liver tumors were observed in brown bullheads at Great Lakes sites containing heavily contaminated sediment PAH concentrations. However, PAH levels in fish are generally low. Therefore, upper trophic level species, including humans, are unlikely to be significantly exposed to PAHs from fish consumption. Humans (or wildlife) consuming molluscs are more likely to be exposed to PAHs as these organisms are generally incapable of metabolizing PAHs (Eisler, 1987). Drinking water contributes only a small proportion of the average total PAH human intake (Eisler, 1987).

Standards, Criteria and Guidelines

EPA Class B2 Carcinogen

Oral Slope Factor:	$7.3 \times 10^0 \text{ (mg/kg/day)}^{-1f}$
Inhal. Slope Factor:	$6.1 \times 10^0 \text{ (mg/kg/day)}^{-1g}$
Chronic Oral RfD:	N/A
Subchronic Oral RfD:	N/A
MCL:	0.0002 mg/L
AWQC (Federal):	Water and Organism Consumption $2.8 \times 10^{-3} \text{ } \mu\text{g/L}$ Organism Consumption - $3.1 \times 10^{-2} \text{ } \mu\text{g/L}$ Acute Freshwater Aquatic Life - N/A Chronic Freshwater Aquatic Life - N/A
GLWQG:	N/A
Sediment Guidelines	
NYSDEC:	Human Health - $1.3 \text{ } \mu\text{g/gOC}$
Ontario MOE:	Lowest Effect Level - $0.37 \text{ } \mu\text{g/g}$ Severe Effect Level - $1,440 \text{ } \mu\text{g/gOC}$

BIBLIOGRAPHY

Eisler, R. 1987. *Polycyclic aromatic hydrocarbon hazards to fish, wildlife, and invertebrates: a synoptic review*. U.S. Fish Wildl. Serv. Biol. Rep. 85(1.11). 81 pp.

GLBRCS (Great Lakes Basin Risk Characterization Study). Great Lakes National Program Office. Page III-35.

HSDB, 1993. National Library of Medicine, Hazardous Substance Data Bank.

^fFrom IRIS.

^gFrom HEAST.

IARC (International Agency for Research in Cancer). 1982. Chemicals, Industrial Processes and Industries Associated with Cancer in Humans, In: *IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans*. WHO, IARC, Lyon, France. Suppl. 4. (Cited in EPA, 1984b).

Neal, J. and R.H. Rigdon. 1967. Gastric Tumors in Mice Fed Benzo(a)pyrene: A quantitative Study. *Tex. Rep. Boil. Med.*, 25: 553. (Cited in EPA, 1984b).

Thyssen, J., J. Althoff, G. Kimmerle, and U. Mohr. 1981. Inhalation Studies with Benzo(a)Pyrene in Syrian Golden Hamsters. *J. Natl. Cancer Inst.* 66(3): 575-577. (Cited EPA, 1984b).

EPA, 1984a. *Health Effects Assessment for Polycyclic Aromatic Hydrocarbons*. EPA 540/1-86/013.

EPA, 1984b. *Health Effects Assessment for Benzo(a)pyrene*. Final Draft.

IRIS, 1993. U.S. EPA Integrated Risk Information System.

Sittig, M., 1991. *Handbook of Toxic and Hazardous Chemicals and Carcinogens*.

BENZO(B)FLUORANTHENE

Background

Benzo(b)fluoranthene (B(b)F) belongs to a naturally occurring set of compounds called polycyclic aromatic hydrocarbons (PAHs). PAHs are produced by the incomplete combustion of organic compounds in both industrial and natural processes, and are characterized as having more than one benzene ring. B(b)F is a component of coal tar pitch and creosote (Sittig, 1991). Because of the similarities among all PAHs and information on individual compounds is scarce, the following discussions deal with PAHs as a group unless compound specific information exists.

Use

There is no commercial production of B(b)F in the United States. B(b)F is used in chemical research (HSDB, 1993).

Chemical and Physical Properties

Chemical Formula: $C_{20}H_{12}$	Solubilities: 0.0012 mg/L in water.
Boiling Point: N/A	Slightly soluble in acetone and benzene.
Melting Point: 168°C	
Molecular Weight: 252.32	Vapor Density: N/A
Corrosivity: N/A	Vapor Pressure: 5.0×10^{-7} mm Hg
Specific Gravity: N/A	Other: N/A
Octanol/Water Partition Coefficient: 6.124	

Control

The particle-bound portion of PAHs can be removed by sedimentation, coagulation, flocculation and filtration processes since PAHs are bound to soil/suspended solids. PAHs may also be removed, in conjunction with filtration, by granular activated carbon. Remaining PAHs require oxidation for partial removal/transformation. B(b)F is a toxic pollutant designated pursuant to section 307(a)(1) of the Clean Water Act and is subject to effluent limitations (HSDB, 1993).

Source

It is likely that B(b)F enters Lakes Erie and Ontario in a similar manner as reported for benzo(a)pyrene (i.e., primarily atmospheric deposition with sewer treatment plant effluent and sludge disposal, petroleum spills, and urban runoff also contributing PAHs to the aquatic environment).

Fate and Transport

In general, PAHs are expected to exist as vapor and particulates in the atmosphere. Once in the atmosphere, PAHs may be removed through photochemical reactions, chemical reactions, or by wet and dry deposition. In aquatic media, PAHs are expected to volatilize, react photochemically, and be degraded microbially. In high water and wind flow conditions, volatilization occurs readily. In water, PAHs adsorb to organic matter and most likely fall out of the water column into sediments (EPA, 1984).

In soils, PAHs are subject to microbial degradation and adsorption. Because of their affinity to organic matter, PAHs are not expected to be highly mobile in soils; therefore, leaching to ground water is not considered to be a significant fate process.

Biological Properties

Human Toxicity

There is some evidence that B(b)F has mutagenic effects on bacteria and mammalian cells (IARC, 1982). Dermal exposure to B(b)F is known to be carcinogenic to laboratory mice and rats (IARC, 1982; Deutsch-Wenzel et al., 1983).

Ecotoxicity

The ecotoxic effects of PAHs have not been widely studied. It appears that the effects of PAHs on aquatic organisms are more variable than the effects on mammals. B(b)F is listed as a potential bioaccumulative chemical of concern by the Great Lakes Water Quality Guidance (GLWQG).

Damaging Effects

Liver tumors were observed in brown bullheads at Great Lakes sites containing heavily contaminated sediment PAH concentrations (Eisler, 1987). However, PAH levels in fish are generally low because they are rapidly metabolized. Therefore, upper trophic level species including humans are unlikely to be significantly exposed to PAHs from fish consumption. Humans (or wildlife) consuming molluscs are more likely to be exposed to PAHs as these organisms are generally incapable of metabolizing PAHs (Eisler, 1987). Drinking water contributes only a small proportion of the average total PAH human intake (Eisler, 1987).

Standards, Criteria and Guidelines

EPA Class B2 Carcinogen

Oral Slope Factor:	$7.3 \times 10^{-1} \text{ (mg/kg/day)}^{-1b}$
Inhal Slope Factor:	N/A
Chronic Oral RfD:	N/A
Subchronic Oral RfD:	N/A
MCL:	0.0002 mg/L
AWQC (Federal):	Water and Organism Consumption - $2.8 \times 10^{-3} \text{ } \mu\text{g/L}$ Organism Consumption - $3.1 \times 10^{-2} \text{ } \mu\text{g/L}$ Acute Freshwater Aquatic Life - N/A Chronic Freshwater Aquatic Life - N/A
GLWQG:	N/A
Sediment Guidelines	
NYSDEC:	Human Health - $1.3 \text{ } \mu\text{g/gOC}$

BIBLIOGRAPHY

Deutsch-Wenzel, R., et al. 1983. *Experimental studies in rat lungs on the carcinogenicity and dose-response relationships of eight frequently occurring environmental polycyclic aromatic hydrocarbons.* J. Nat'l. Cancer Inst. 71 (3): 539-543. (cited in IRIS).

Eisler, R. 1987. *Polycyclic aromatic hydrocarbon hazards to fish, wildlife, and invertebrates: a synoptic review.* U.S. Fish Wildl. Serv. Biol. Rep. 85(1.11). 81 pp.

HSDB, 1993. National Library of Medicine, *Hazardous Substances Data Bank.*

IARC (International Agency for Research in Cancer), 1982. *Chemicals, Industrial Processes and Industries Associated with Cancer in Humans*, In: *IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans*. WHO, IARC, Lyon, France. Suppl. 4. (Cited in EPA, 1984).

EPA, 1984. *Health Effects Assessment for Polycyclic Aromatic Hydrocarbons.* EPA 540/1-86/013.

EPA, 1993. *Integrated Risk Information System (IRIS).*

Sittig, M., 1991. *Handbook of Toxic and Hazardous Chemicals and Carcinogens.*

^bValue derived by using Oral Slope Factor from IRIS for benzo(a)pyrene and applying a Toxic Equivalency Factor (TEF) of 0.1 (communication with Marina Stefanidis, U.S. EPA Superfund Health Risk Technical Support Section, March 5, 1992).

BENZO(K)FLUORANTHENE

Background

Benzo(k)fluoranthene (B(k)F) belongs to a naturally occurring set of compounds called polycyclic aromatic hydrocarbons (PAHs). PAHs are produced by the incomplete combustion of organic compounds in both industrial and natural processes and are characterized as having more than one benzene ring. Because of their similarities and the information on individual compounds is scarce, discussions deal with PAHs as a group unless compound specific information exists.

Use

There is no commercial use of B(k)F in the United States (HSDB, 1993).

Chemical and Physical Properties

Chemical Formula: $C_{20}H_{12}$	Solubilities: 0.76 ppb at 25°C in water.
Boiling Point: 480°C at 760 mm Hg	Soluble in alcohol, benzene, and acetic acid
Melting Point: 217°C	
Molecular Weight: 252.32	Vapor Density: N/A
Corrosivity: N/A	Vapor Pressure: 5×10^{-7} mm Hg at 20°C
Specific Gravity: N/A	Other: N/A
Octanol/Water Partition Coefficient: 6.84 (estimated)	

Control

The particle-bound portion of PAHs can be removed by sedimentation, coagulation, flocculation and filtration processes since PAHs are bound to soil/suspended solids. PAHs may also be removed, in conjunction with filtration, by granular activated carbon. Remaining PAHs require oxidation for partial removal/transformation. B(k)F is a toxic pollutant designated pursuant to section 307(a)(1) of the Clean Water Act and is subject to effluent limitations (HSDB, 1993).

Source

It is likely that B(k)F enters Lakes Erie and Ontario in a similar manner as reported for benzo(a)pyrene (i.e., primarily through atmospheric deposition with sewer treatment plant effluent and sludge disposal, petroleum spills, and urban runoff also contributing PAHs to the aquatic environment).

Fate and Transport

In general, PAHs are expected to exist as vapor and particulates in the atmosphere. Once in the atmosphere, PAHs may be removed through photochemical reactions, chemical reactions, or by wet and dry deposition. In aquatic media, PAHs are expected to volatilize, react photochemically, and be degraded microbially. In high water and wind flow conditions, volatilization occurs readily. In water, PAHs would adsorb to organic matter and most likely fall out of the water column into sediments (EPA, 1984).

In soils, PAHs are subject to microbial degradation and adsorption. Because of their affinity to organic matter, PAHs are not expected to be highly mobile in soils; therefore, leaching to ground water is not considered to be a significant fate process.

Biological Properties

Human Toxicity

B(k)F has been reported to have mutagenic effects in bacteria such as *Salmonella typhimurium* (IARC, 1982).

The International Agency for Research on Cancer (IARC) has determined that there is sufficient evidence to prove that B(k)F is carcinogenic to laboratory animals. Rats and mice exhibited increased incidences of tumors after dermal exposure to B(k)F (IARC, 1982; Deutsch-Wenzel, et al., 1983).

Ecotoxicity

The ecotoxic effects of PAHs have not been widely studied. It appears that the effects of PAHs on aquatic organisms are more variable than the effects on mammals. B(k)F is listed by the Great Lakes Water Quality Guidance (GLWQG) as a potential bioaccumulative chemical of concern.

Damaging Effects

Although liver tumors and elevated PAH body burdens were reported at Great Lakes sites containing heavily contaminated sediment PAH concentrations (Eisler, 1987), PAH levels in fish are generally low because they are rapidly metabolized. Therefore, upper trophic level species, including humans, are unlikely to be significantly exposed to PAHs from fish consumption. Humans (or wildlife) consuming molluscs are more likely to be exposed to PAHs as these organisms are generally incapable of metabolizing PAHs (Eisler, 1987). Drinking water contributes only a small proportion of the average total PAH human intake (Eisler, 1987).

Standards, Criteria and Guidelines

EPA Class B2 Carcinogen

Oral Slope Factor:	$7.3 \times 10^{-1} \text{ (mg/kg/day)}^{-1}$ ¹¹
Inhal Slope Factor:	N/A
Chronic Oral RfD:	N/A
Subchronic Oral RfD:	N/A
MCL:	0.0002 mg/L
AWQC (Federal):	Water and Organism Consumption - $2.8 \times 10^{-3} \text{ } \mu\text{g/L}$ Organism Consumption - $3.1 \times 10^{-2} \text{ } \mu\text{g/L}$ Acute Freshwater Aquatic Life - N/A Chronic Freshwater Aquatic Life - N/A
GLWQG:	N/A
Sediment Guidelines	
NYSDEC:	Human Health - $1.3 \text{ } \mu\text{g/gOC}$
Ontario MOE:	Lowest Effect Level - $0.24 \text{ } \mu\text{g/g}$ Severe Effect Level - $1,340 \text{ } \mu\text{g/gOC}$

BIBLIOGRAPHY

Deutsch-Wenzel, R., et al., 1983. Experimental studies in rat lungs on the carcinogenicity and dose-response relationships of eight frequently occurring environmental polycyclic aromatic hydrocarbons. *J. Nat'l. Cancer Inst.* 71 (3): 539-543. (cited in IRIS).

Eisler, R. 1987. *Polycyclic aromatic hydrocarbon hazards to fish, wildlife, and invertebrates: a synoptic review*. U.S. Fish Wildl. Serv. Biol. Rep. 85(1.11). 81 pp.

HSDB, 1993. National Library of Medicine, Hazardous Substances Data Bank.

IARC (International Agency for Research in Cancer). 1982. Chemicals, Industrial Processes and Industries Associated with Cancer in Humans, In: *IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans*. WHO, IARC, Lyon, France. Suppl. 4. (Cited in EPA, 1984e).

EPA, 1984. *Health Effects Assessment for Polycyclic Aromatic Hydrocarbons*. EPA 540/1-86/013.

IRIS, 1993. U.S. EPA Integrated Risk Information System.

¹¹Value derived by using Oral Slope Factor from IRIS for benzo(a)pyrene and applying a Toxic Equivalency Factor (TEF) of 0.1 (communication with Marina Stefanidis, U.S. EPA Superfund Health Risk Technical Support Section, March 5, 1992).

CHLORDANE

Use

Chlordane is a broad spectrum insecticide. It has been used extensively since the 1950s for termite control, as an insecticide for homes and gardens, and as a control for soil insects. The use and production volume of chlordane decreased dramatically after the issuance of a registration suspension notice for all food crops and home and garden uses by the EPA in 1978. However, commercial use of chlordane for underground termite control was permitted until 1988 when its registration for commercial production and use was cancelled by the EPA.

Chemical and Physical Properties

Chemical symbol: $C_{10}H_6Cl_8$
Boiling Point: 175°C at 2 mm Hg
Melting Point: 107-109°C (cis),
103°-105° (trans)

Atomic Weight: 409.80

Corrosivity: N/A

Specific Gravity: 1.59 - 1.63 at 25°C

Octanol/Water Partition Coefficient: 2.78-5.16

Solubilities: 0.1 ppm in water at 20°-
30°C.

Vapor Density: 14

Vapor Pressure: 1×10^{-5} mm Hg at 25°C

Other: N/A

Control

Chlordane is a toxic pollutant designated pursuant to section 307(a)(1) of the Clean Water Act and is subject to effluent emissions. A primary treatment technology for removal of chlordane from waters is granular activated carbon. Filtration prior to GAC adsorption will remove DDT adsorbed to suspended solids. It is designated as a hazardous substance under section 311(b)(2)(A) of the Federal Water Pollution Control Act (HSDB, 1993).

Source

Atmospheric deposition and surface water runoff (urban areas where chlordane was formerly used for termite control) represent the primary modes of chlordane introduction into the aquatic environment (Eisler, 1990). Chlordane may also be released into the overlying water column from contaminated sediments.

Fate and Transport

In outdoor air, chlordane is expected to exist in the vapor phase (ATSDR, 1990). In indoor air, chlordane is expected to exist in vapor form and as a constituent of dust particles. Chlordane present in water adsorbs to particles and volatilizes. The rate of volatilization is influenced by the composition of the matrix, temperature, wind and the turbulence of the water. Chlordane bioconcentrates in both marine and freshwater species (ATSDR, 1990). In soil, chlordane adsorbs to organic matter and volatilizes slowly. It does not leach

significantly, generally remaining in the top layers of soils for as long as 20 years (ATSDR, 1990). Chlordane degrades under natural environmental conditions to photoisomers such as photo-cis-chlordane, which are more toxic to certain species than chlordane and also show higher bioaccumulation (IRIS, 1993).

Biological Properties

Human Toxicity - Noncarcinogenic Effects

Chlordane is considered a moderate to highly toxic substance. Ingestion of chlordane can be fatal to humans at levels between 6 and 60 grams. Symptoms usually occur within 45 minutes to several hours after ingestion, and include increased sensitivity to stimuli, tremors, muscular incoordination, and convulsions (IRIS, 1993). There is also some evidence that exposure to chlordane results in reduced fertility in male and female animals (ATSDR, 1990).

Human Toxicity - Carcinogenic Effects

Studies by the National Cancer Institute and others indicate that long-term oral exposure to chlordane is related to increased incidence of liver cancer (IRIS; Becker and Sell, 1979).

Ecotoxicity

Chlordane is toxic to freshwater and saltwater aquatic life (EPA, 1980). Birds and mammals are also adversely effected by relatively low concentrations of chlordane in their diet (Eisler, 1990). As a result of its very hydrophobic characteristic, chlordane tends to accumulate in aquatic biota at much greater concentrations than the surrounding water. The Great Lakes Water Quality Guidance (GLWQG) lists chlordane as a bioaccumulative chemical of concern.

Damaging Effects

Due to the bioaccumulation potential of chlordane, fish may potentially accumulate concentrations of chlordane which may be hazardous to humans consuming contaminated fish. Although a health advisory was formerly issued to a tributary to Lake Michigan due to elevated concentrations of chlordane (and PCB) within carp (GLWQB, 1989), health advisories on fish consumption due to elevated chlordane levels within the Niagara River Basin have not been reported. Levels of chlordane within forage fish have declined significantly within Lake Erie and Lake Ontario since the 1970s (Allan et al., 1991).

Standards, Criteria, and Guidelines

EPA Class B2 Carcinogen

Oral Slope Factor:	$1.3 \times 10^0 \text{ (mg/kg/day)}^{-1j}$
Inhal. Slope Factor:	$1.3 \times 10^0 \text{ (mg/kg/day)}^{-1k}$
Chronic Oral RfD:	$6.0 \times 10^{-5} \text{ mg/kg/day}^l$
Subchronic Oral RfD:	$6.0 \times 10^{-5} \text{ mg/kg/day}^m$
MCL:	0.002 mg/l
AWQC (Federal):	Water and Organism Consumption $5.7 \times 10^{-4} \text{ } \mu\text{g/L}$ Organism Consumption - $5.9 \times 10^{-4} \text{ } \mu\text{g/L}$ Acute Freshwater Life - $2.4 \text{ } \mu\text{g/L}$ Chronic Freshwater Aquatic Life - $4.3 \times 10^{-3} \text{ } \mu\text{g/L}$
GLWQG:	Human Health - $2.0 \times 10^{-4} \text{ } \mu\text{g/L}$
Sediment Guidelines	
NYSDEC:	Aquatic Toxicity - $0.006 \text{ } \mu\text{g/gOC}$ Human Health - $8.0 \times 10^{-3} \text{ } \mu\text{g/gOC}$ Wildlife - $0.006 \text{ } \mu\text{g/gOC}$
Ontario MOE:	Lowest Effect Level - $0.007 \text{ } \mu\text{g/g}$ Severe Effect Level - $6.0 \text{ } \mu\text{g/gOC}$

BIBLIOGRAPHY

Allan, R.J. et al. 1991. *Toxic Chemicals in the Great Lakes and Associated Effects. Vol. I - Contaminant Levels and Trends.* Envir. Canada, Dept. Fish. Oceans, Health Welfare Canada. 480 pp.

ATSDR, 1990. *Toxicological Profile of Chlordane.* Agency for Toxic Substances and Disease Register.

Becker, F.F. and Sell, S. 1979. *Fetoprotein levels and hepatic alterations during chemical carcinogenesis in C57BL/6N mice.* *Cancer Res.* 39:3491-3494.

Eisler, R. 1989. *Chlordane hazards to fish, wildlife, and invertebrates: a synoptic review.* U.S. Fish Wildl. Serv. Biol. Rep. 85(1.21). 49 pp.

EPA, 1980. *Ambient Water Quality Criteria for Chlordane.*

EPA, 1992. *Drinking Water Regulations and Health Advisories.*

^jFrom IRIS.

^kFrom IRIS.

^lFrom IRIS.

^mFrom HEAST.

GLWQB (Great Lakes Water Quality Board). 1989. Report on Great Lakes Water Quality to the International Joint Commission.

HEAST, 1992. U.S. EPA *Health Effects Assessment Summary Tables*.

HSDB, 1993. National Library of Medicine, *Hazardous Substance Data Bank*.

IRIS, 1993. U.S. EPA *Integrated Risk Information System*.

CHRYSENE

Background

Chrysene belongs to a naturally occurring set of compounds called polycyclic aromatic hydrocarbons (PAHs). PAHs are produced by the incomplete combustion of organic compounds in both industrial and natural processes and are characterized as having more than one benzene ring. It is found in gasoline, diesel exhaust, cigarette smoke, and coal tar (Sittig, 1991). Because of the similarities among all PAHs and information on individual compounds is scarce, the following discussions deal with PAHs as a group unless compound specific information exists.

Use

Chrysene is used in the synthesis of organic compounds and in chemical research (HSDB, 1993).

Chemical and Physical Properties

Chemical symbol: $C_{18}H_{12}$

Boiling Point: 484°C

Melting Point: 255-256°C

Atomic Weight: 228.28

Corrosivity: N/A

Specific Gravity: 1.274 at 20°C

Octanol/Water Partition Coefficient: 5.61-5.91

Solubilities: 0.0020 µg/L in water.

Soluble in hot benzene,
slightly soluble in ether,
acetone, alcohol, and carbon
disulfide.

Vapor Density: N/A

Vapor Pressure: 6.3×10^{-7} mm Hg

Other: Sublimes easily under a vacuum

Control

The particle-bound portion of PAHs can be removed by sedimentation, coagulation, flocculation and filtration processes since PAHs are bound to soil/suspended solids. PAHs may also be removed, in conjunction with filtration, by granular activated carbon. Remaining PAHs require oxidation for partial removal/transformation. Chrysene is a toxic pollutant designated pursuant to section 307(a)(1) of the Clean Water Act and is subject to effluent limitations (HSDB, 1993).

Source

It is likely that chrysene enters Lakes Erie and Ontario in a similar manner as reported for benzo(a)pyrene (i.e., primarily through atmospheric deposition with sewer treatment plant effluent and sludge disposal, petroleum spills, and urban runoff also contributing PAHs to the aquatic environment).

Fate and Transport

In general, PAHs are expected to exist as vapor and particulates in the atmosphere. Once in the atmosphere, PAHs may be removed through photochemical reactions, chemical reactions, or by wet and dry deposition. In aquatic media, PAHs are expected to volatilize, react photochemically, and be degraded microbially. In high water and wind flow conditions, volatilization occurs readily. In water, PAHs adsorb to organic matter and most likely fall out of the water column into sediments (EPA, 1984).

In soils, PAHs are subject to microbial degradation and adsorption. Because of their affinity to organic matter, PAHs are not expected to be highly mobile in soils; therefore, leaching to ground water is not considered to be a significant fate process.

Biological Properties

Human Toxicity - Noncarcinogenic Effects

Although the toxic effects of chrysene to humans and animals have not been studied extensively, there is some evidence that chrysene may cause damage to skin tissues in exposed workers (Sittig, 1991). Numerous studies indicate that PAHs impact the immune system (IARC, 1982). In addition, animal studies suggest that exposure to chrysene may be related to embryonic and genetic aberrations (IARC, 1982).

Human Toxicity - Carcinogenic Effects

Although some studies have indicated chrysene to be weakly carcinogenic to laboratory animals (Wislocki et al., 1986), IARC has determined that only limited evidence of chrysene's carcinogenicity exists (IARC, 1982).

Ecotoxicity

The ecotoxic effects of PAHs have not been widely studied. It appears that the effects of PAHs on aquatic organisms are more variable than effects on mammals. Although PAHs exhibit a high lipid solubility, they show little tendency to biomagnify in the food chain as most PAHs are rapidly metabolized by organisms.

Damaging Effects

Although liver tumors and elevated PAH body burdens were reported at Great Lakes sites containing heavily contaminated sediment PAH concentrations (Eisler, 1987), PAH levels in fish are generally low because they are rapidly metabolized. Therefore, upper trophic level species, including humans, are unlikely to be significantly exposed to PAHs from fish consumption. Humans (or wildlife) consuming molluscs are more likely to be exposed to

PAHs as these organisms are generally incapable of metabolizing PAHs (Eisler, 1987). Drinking water contributes only a small proportion of the average total PAH human intake (Eisler, 1987).

Standards, Criteria and Guidelines

EPA Class B2 Carcinogen

Oral Slope Factor:	$7.3 \times 10^{-2} \text{ (mg/kg/day)}^{-1a}$
Inhal Slope Factor:	N/A
Chronic Oral RfD:	N/A
Chronic Inhal RfD:	N/A
Subchronic Oral RfD:	N/A
Subchronic Inhal RfD:	N/A
MCL:	0.0002 mg/L
AWQC (Federal):	Water and Organism Consumption - $2.8 \times 10^{-3} \text{ } \mu\text{g/L}$ Organism Consumption - $3.1 \times 10^{-2} \text{ } \mu\text{g/L}$ Acute Freshwater Aquatic Life - N/A Chronic Freshwater Aquatic Life - N/A
GLWQG:	N/A
Sediment Guidelines	
NYSDEC:	Human Health - $1.3 \text{ } \mu\text{g/gOC}$
Ontario MOE:	Lowest Effect Level - $0.34 \text{ } \mu\text{g/g}$ Severe Effect Level - $460 \text{ } \mu\text{g/gOC}$

BIBLIOGRAPHY

Eisler, R. 1987. Polycyclic aromatic hydrocarbon hazards to fish, wildlife, and invertebrates: a synoptic review. U.S. Fish Wildl. Serv. Biol. Rep. 85(1.11). 81 pp.

HSDB, 1993. National Library of Medicine, Hazardous Substances Data Bank.

IARC (International Agency for Research in Cancer), 1982. *Chemicals, Industrial Processes and Industries Associated with Cancer in Humans*, In: *IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans*. WHO, IARC, Lyon, France. Suppl. 4. (Cited in EPA, 1984a).

Sittig, M., 1993. *Handbook of Toxic and Hazardous Chemicals and Carcinogens*.

^aValue derived by using Oral Slope Factor for benzo(a)pyrene from IRIS and applying a Toxic Equivalency Factor (TEF) of 0.01 (communication with Marina Stefanidis, U.S. EPA Superfund Health Risk Technical Support Section, March 5, 1992).

EPA, 1984. *Health Effects Assessment for Polycyclic Aromatic Hydrocarbons*. EPA 540/1-86/013.

EPA, 1993. U.S. EPA *Integrated Risk Information System*.

Wislocki, P.G., et al., 1986. *Tumorigenicity of nitrated derivatives of pyrene, benzo(a)anthracene, chrysene, and benzo(a)pyrene in the newborn mouse assay. Carcinogenesis*. 7(8):1317-1322. (cited in IRIS).

DDT

Use

In actions dated January 15, 1971 and July 7, 1972, the EPA canceled all uses of DDT products except for the U.S. Public Health Services and other Health Service Officials for the control of vector diseases; the USDA or military for health quarantine; and in the formulation of prescription drugs for controlling body lice. Former uses in the United States included the control of malaria, typhus and other insect transmitted-diseases (HSDB, 1993).

Chemical and Physical Properties

Chemical symbol: $C_{14}H_9Cl_5$

Boiling Point: 260°C

Melting Point: 108.5°C

Atomic Weight: 354.50

Corrosivity: Slightly corrosive to
iron and aluminum

Specific Gravity: 0.98 - 0.99

Octanol/Water Partition Coefficient: 6.36

Solubilities: 0.01 µg/100 ml water at
27°C. Highly lipid soluble.

Vapor Density: N/A

Vapor Pressure: 1.5×10^{-7} mm Hg at 20°C

Other: N/A

Control

Activated carbon was found to be effective in achieving levels of less than 1 mg/L of DDT in effluents from five industrial plants. It is capable of achieving removal of DDT to much lower concentrations in surface and ground waters. Filtration prior to GAC adsorption will remove DDT adsorbed to suspended solids. DDT is a toxic pollutant designated pursuant to section 307(a)(1) of the Clean Water Act and is subject to effluent limitations (HSDB, 1993).

Source

Although the use of DDT has been restricted since the early 1970s, it continues to enter the aquatic environment through atmospheric deposition and from the regional use of dicofol and methoxychlor which contain trace amounts or photolytic products consisting of DDT and metabolites (Allan et al., 1991). DDT and metabolites have also accumulated in bottom sediments within some areas of Lake Ontario and Lake Erie which represents a source to the overlying water column or benthic biota (and species that consume these benthic species).

Fate and Transport

DDT is an organic pesticide which is generally a combination of several organochlorinated pesticides. Technical grade DDT is a mixture of DDT (1,1,1 trichloro-2,2-bis(4-chlorophenyl)ethane), DDD (1,1 dichloro-2-(2-chlorophenyl)-2(4-chlorophenyl)ethane, and

DDE (1,1 dichloro-2,2-bis(4-chlorophenyl)ethene). The latter two compounds are frequent degradation products of DDT, and the three are often detected together (ICF, 1985). Since DDT, DDD, and DDE are structurally similar, their behavior in the environment is expected to be comparable.

DDT is known to be very persistent in soils. It sorbs well to organic matter and is bioaccumulated by plants and animals (ICF, 1985). DDT does not leach rapidly and has a residence time of over 10 years (IARC, 1975).

In aquatic media, DDT isomers are subject primarily to photolysis. Biotransformation to bis(2-chlorophenol)methadone is usually the ultimate fate of DDT (ICF, 1985).

In the atmosphere, DDT is generally subjected to wet and dry deposition and photochemical degradation. The atmospheric half-life of DDT is estimated to be 17 days (ICF, 1985).

Biological Properties

Human Toxicity - Noncarcinogenic Effects

Short-term effects include dizziness, skin and eye irritation, nausea, vomiting, headache, numbness of face and extremities, and tremors. Long-term exposure effects include skin and eye irritation. The effect of chronic exposure to humans is uncertain, based on the available literature (ACGIH, 1984). Studies in rats indicate that ingestion of DDT causes toxic effect to the liver (Laug, et al., 1950).

There is also evidence that exposure to DDT causes decreased fertility in mice and genetic mutations in insect and mammalian cells (EPA, 1984; McLachlan and Dixon, 1972; Schmidt, 1973).

Human Toxicity - Carcinogenic Effects

Although the existing human epidemiological studies on DDT are considered inadequate or inconclusive by EPA, several studies link higher tissue concentrations of DDT with incidences of cancer in humans (IRIS, 1993; NCI, 1978).

Liver tumors have been linked to oral DDT exposure in numerous animal studies. Studies also indicate that inhalation of DDT causes lung tumors in mice (IRIS, 1993).

Ecotoxicity

DDT is known to be highly toxic to most freshwater and saltwater organisms (ICF, 1985). DDT isomers are bioaccumulated by most organisms, and particularly by fish; as a result, DDT has caused decreased reproduction and death in many species of fish.

eating birds (ICF, 1985). DDT (and the metabolites DDD and DDE) are listed as bioaccumulative chemicals of concern by the Great Lakes Water Quality Guidance (GLWQG).

Damaging Effects

DDT and its metabolites biomagnify within the food chain. DDT generally accumulates at highest concentrations in fish species that have a high proportion of body fat and are long-lived top predators (e.g., trout and salmon). Therefore, fish consumption by humans (and wildlife) may present a hazard. A significant decline in the Great Lakes cormorant population, which occurred in the 1960s and mid 1970s, was attributed to DDE-induced eggshell thinning. The Great Lakes Water Quality Agreement (GLWQA) identified a whole fish concentration limit of 1.0 ppm DDT (and metabolites) as an objective. This objective has been exceeded in Lake Ontario as recently as 1986. However, fish and wildlife concentrations of DDT (and metabolites) have decreased significantly from levels observed in the 1970s and have equilibrated to levels near the GLWQA objective (Allan et al., 1991).

Standards, Criteria and Guidelines

EPA Class B2 Carcinogen

Oral Slope Factor:	$3.4 \times 10^{-1} \text{ (mg/kg/day)}^{-10}$
Inhalation Slope Factor:	$3.4 \times 10^{-1} \text{ (mg/kg/day)}^{-1p}$
Chronic Oral RfD:	$5.0 \times 10^{-4} \text{ mg/kg/day}^q$
Subchronic Oral RfD:	$5.0 \times 10^{-4} \text{ mg/kg/day}^r$
MCL:	N/A
AWQC (Federal):	Water and Organism Consumption - $5.9 \times 10^{-4} \text{ } \mu\text{g/L}$ Organism Consumption - $5.9 \times 10^{-4} \text{ } \mu\text{g/L}$ Acute Freshwater Aquatic Life - $1.1 \text{ } \mu\text{g/L}$ Chronic Freshwater Aquatic Life - $1.0 \times 10^{-3} \text{ } \mu\text{g/L}$
GLWQG:	Human Health - $7.0 \times 10^{-5} \text{ } \mu\text{g/L}$ Wildlife - $8.7 \times 10^{-7} \text{ } \mu\text{g/L}$

^oFrom IRIS.

^pFrom IRIS. Inhalation Slope Factor = Inhalation Unit Risk \times Conversion Factor
Inhalation Unit Risk = $9.7 \times 10^{-5} \text{ m}^3/\mu\text{g}$
Conversion Factor = $3.5 \times 10^{+3}$

^qFrom IRIS.

^rFrom HEAST.

Sediment Guidelines

NYSDEC:	Aquatic Toxicity - $\leq 50 \mu\text{g/gOC}$ Human Health - $0.01 \mu\text{g/gOC}$ Wildlife - $1.0 \mu\text{g/gOC}$
Ontario MOE:	Lowest Effect Level - $0.007 \mu\text{g/g}$ Severe Effect Level - $12.0 \mu\text{g/gOC}$

BIBLIOGRAPHY

ACGIH, 1984. American Conference of Governmental Industrial Hygienists, *Documentation of the Threshold Limit Values*.

Allan, R.J. et al. 1991. *Toxic Chemicals in the Great Lakes and Associated Effects. Vol. I-Contaminant Levels and Trends*. Environment Canada, Dept. Fisheries and Oceans, Health and Welfare Canada. 488 pp.

EPA, 1984. *Health Effects Assessment for DDT*. EPA 540/1-86/026.

EPA, 1986. *Quality Criteria for Water* EPA 440/5-86-001.

EPA, 1992. *Health Effects Assessment Summary Tables (HEAST)*.

EPA, 1993. *Integrated Risk Information System (IRIS)*.

HSDB, 1993. National Library of Medicine, Hazardous Substances Data Bank.

ICF, 1985. Chemical, Physical and Biological Properties of Compounds Present at Hazardous Waste Sites. Clement Associates.

International Agency for Research on Cancer (IARC). 1975. *IARC Monographs. Volume 5*.

Laug, E.P., A.A. Nelson, O.G. Fitzhugh and F.M. Kunze. 1950. *Liver Cell Alteration and DDT Storage in the Fat of the Rat Induced by Dietary Levels of 1-50 ppm DDT*. *J. Pharmacol. Exp. Ther.* 98:268-273. (Cited in EPA, 1984).

McLachlan, J.A. and R.L. Dixon, 1972. *Gonadal Function in Mice Exposed prenatally to pp-DDT*. *Toxicol. Appl. Pharmacol.* 22:327 (Cited in EPA, 1984).

Schmidt, R. 1973. *Effect of DDT on prenatal development of the mouse (under consideration of Distribution of Tritium - Labelled and Carbon - 14 - labelled DDT in Pregnant Mice)*. *Biol. Rundsch.* 11:316-317. (Cited in EPA, 1984).

Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals and Carcinogens*.

DIELDRIN

Use

Prior to 1974, dieldrin was a broad spectrum insecticide used primarily in the control of corn pests. In 1974, EPA restricted its use under the Federal Insecticide, Fungicide and Rodenticide Act to termite control by direct soil injection and non-food seed and plant treatment. Dieldrin is also used in the wool processing industry (HSDB, 1993).

Chemical and Physical Properties

Chemical Formula: $C_{12}H_8Cl_6O$

Boiling Point: N/A

Melting Point: 175-176°C

Molecular Weight: 380.93

Corrosivity: N/A

Specific Gravity: 1.75

Octanol/Water Partition Coefficients: 3.87

Solubilities: 186 µg/L of water at 25°C

Insoluble in methanol and
aliphatic hydrocarbons

Vapor Density: 13.2

Vapor Pressure: 7.78×10^{-7} mm Hg at 25°C

Other: N/A

Control

Activated carbon was found to be effective in achieving levels lower than 1 mg/L of dieldrin in effluents from five industrial plants. It is capable of achieving removal of dieldrin to much lower concentrations in surface and ground waters. Filtration prior to GAC adsorption will remove dieldrin adsorbed to suspended solids. Dieldrin is a toxic pollutant designated pursuant to section 307(a)(1) of the Clean Water Act and is subject to effluent limitations (HSDB, 1993).

Source

Dieldrin inputs into Lakes Erie and Ontario are primarily from atmospheric deposition or resuspension of contaminated sediments (Allan et al., 1991).

Fate and Transport

Dieldrin is a common degradation product of the insecticide aldrin in all aerobic and biologically active soils. Dieldrin sorbs tightly to soils, and therefore volatilizes slowly. ATSDR (1989) reports that several studies indicate that microbial degradation in soils is probably a minor fate process for dieldrin. Although several studies report that movement of dieldrin in waterborne sediments is a major fate process, leaching is minimal (ATSDR, 1989).

Glotfelt (1978) reports that evidence supports the view that much of dieldrin used in agriculture reaches the atmosphere. Baldwin et al. (1977), however, states that atmospheric degradation probably prevents significant accumulation of dieldrin in the air.

In aquatic systems, the presence of dieldrin in ground water is rare. In fact, Spalding et al. (1980) and Richard et al. (1975) detected no dieldrin in ground water samples. ATSDR (1989) reports that the lack of leaching of dieldrin from soils may explain its absence from ground water. However, small amounts of dieldrin have been detected in surface waters (Richard et al., 1975; Hindin et al., 1964), suggesting the potential for surface runoff of dieldrin from soils (ATSDR, 1989). Dieldrin is converted to photodieldrin, a stereoisomer, upon exposure to sunlight. It is unlikely, however, that photodieldrin occurs widely in the environment (ATSDR, 1989). Volatilization of dieldrin from water is slow. Mackay and Leinonen (1975) report that evaporation of dieldrin from a one-meter column of 25°C water had a half-life of 539 days.

ATSDR (1989) reports that bioaccumulation and biomagnification are significant fate processes in the environment. In a study by Metcalf et al. (1973), biomagnification of dieldrin was 5,957 in fish and 11,149 in snails.

Biological Properties

Human Toxicity - Noncarcinogenic Effects

Laboratory studies indicate that chronic oral exposure to dieldrin may impact the liver, affect the developing fetus, and produce genetic mutations in mammals (ATSDR, 1989, EPA 1987).

Numerous studies in mice reported have shown that long-term oral exposure to dieldrin caused increased incidences of liver cancer (IRIS, 1993). Significant increases in the incidence of tumors in the lungs and lymphatic system have also been reported in mice (Walker et al. 1972).

Ecotoxicity

The acute toxicity of dieldrin has been evaluated for freshwater species in all major functional and taxonomic classifications. Bioconcentration factors cover a wide range in freshwater systems. Yearling lake trout which may not have reached steady state had a bioconcentration factor of 68,286; EPA (1980) reports that this value may be even higher in older, larger lake trout. Dieldrin is listed as a bioaccumulative chemical of concern by the Great Lakes Water Quality Guidance (GLWQG). Freshwater plants appear to be more resistant to dieldrin than freshwater animals.

Damaging Effects

As a result of the high bioaccumulation potential of dieldrin, consumers of contaminated fish (humans and piscivorous wildlife) may be exposed to dieldrin. Body burden concentrations of dieldrin within fish have generally been below the Great Lakes Water Quality Agreement (GLWQA) objective of 0.3 ppm although dieldrin levels have not declined as rapidly as other organochlorines (Allan et al., 1991). Dieldrin levels within herring gull eggs have fluctuated within Lake Erie, Lake Ontario, and Niagara River since 1980 which suggests that inputs of dieldrin may still be occurring (Allan et al., 1991).

Standards, Criteria, and Guidelines

EPA Class B2 Carcinogen

Oral Slope Factor:	$1.61 \times 10^1 \text{ (mg/kg/day)}^{-1s}$
Inhalation Slope Factor:	$1.61 \times 10^{-1} \text{ (mg/kg/day)}^{-1t}$
Chronic Oral RfD:	$5 \times 10^{-5} \text{ mg/kg/day}^u$
Subchronic Oral RfD:	$5 \times 10^{-5} \text{ mg/kg/day}^v$
MCL:	N/A
AWQC (Federal):	Water and Organism Consumption - $1.4 \times 10^{-4} \text{ } \mu\text{g/L}$ Organism Consumption - $1.4 \times 10^{-4} \text{ } \mu\text{g/L}$ Acute Freshwater Aquatic Life - $2.5 \text{ } \mu\text{g/L}$ Chronic Freshwater Aquatic Life - $1.9 \times 10^{-3} \text{ } \mu\text{g/L}$
GLWQG:	Human Health - $1.0 \times 10^{-4} \text{ } \mu\text{g/L}$ Chronic Aquatic Life - $5.6 \times 10^{-2} \text{ } \mu\text{g/L}$
Sediment Guidelines	
NYSDEC:	Aquatic Toxicity - $19.5 \text{ } \mu\text{g/gOC}$ Human Health - $0.13 \text{ } \mu\text{g/gOC}$
Ontario MOE:	Lowest Effect Level - $0.002 \text{ } \mu\text{g/g}$ Severe Effect Level - $91 \text{ } \mu\text{g/gOC}$

BIBLIOGRAPHY

^sFrom IRIS.

^tFrom IRIS. Inhalation Slope Factor = Inhalation Unit Risk \times Conversion Factor
Inhalation Unit Risk = $4.6 \times 10^{-3} \text{ m}^3/\mu\text{g}$
Conversion Factor = 3.5×10^{-3}

^uFrom IRIS.

^vFrom HEAST.

Allan, R.J. et al. 1991. *Toxic Chemicals in the Great Lakes and Associated Effects. Vol. I-Contaminant Levels and Trends.* Environment Canada, Dept. Fisheries and Oceans, Health and Welfare Canada. 488 pp.

ATSDR, 1989. *Toxicological Profile for Aldrin/Dieldrin*, Agency for Toxic Substances and Disease Registry.

Baldwin, M.K., et al. 1977: *The concentrations of aldrin and dieldrin and their photoisomers in the atmosphere.* *Pestic. Sci.* 8:431-445. (cited in ATSDR).

Hindin, E., et al. 1964. *Collection and analysis of synthetic organic pesticides from surface and ground water.* *Residue Rev.* 7:130-156 (cited in ATSDR, 1989).

HSDB, 1993. National Library of Medicine, Hazardous Substances Data Bank.

Metcalf, R.L., et al. 1973. *Model ecosystem studies of environmental fate of six organochlorine pesticides.* *Environ. Health Perspec.* 4:35-44. (cited in ATSDR).

Richard, J.J., et al. 1975. *Analysis of various Iowa waters for selected pesticides: atrazine, DDE, and dieldrin - 1974.* *Pestic. Monit. J.* 9:117-123. (cited in ATSDR).

Spalding, R.F., et al. 1980. *Pesticides in ground water beneath irrigated farmland in Nebraska, August 1978.* *Pestic. Monit. J.* 4:560-566. (cited in ATSDR).

EPA, 1980. *Ambient Water Quality Criteria for Aldrin/Dieldrin.*

EPA, 1987. *Dieldrin: Health Advisory.* Office of Drinking Water, Wash., D.C. (cited in IRIS).

Glotfelt, D.E., 1978. *The atmosphere as a site for applied pesticides.* *J. Air Pollut. Control Assoc.* 28:817-821 (cited in ATSDR, 1989).

Mackay, D. and P.J. Leinonen, 1975. *Rate of evaporation of low-solubility contaminants from water bodies to atmosphere.* *Environ. Sci. Technol.* 9:1178-1180 (cited in ATSDR, 1989).

HEAST, 1992. *U.S. EPA Health Effects Assessment Summary Tables.*

IRIS, 1993. U.S. EPA Integrated Risk Information System.

Walker, A.J.T., et al. 1972. *The toxicology of dieldrin (HEOD). I. Long-term oral toxicity studies in mice.* *Food Cosmet. Toxicol.* 11:415-432. (cited in IRIS).

2,3,7,8-TETRACHLORODIBENZODIOXIN (TCDD)

Background

Chlorinated dibenzo-p-dioxins and dibenzofurans constitute a family of 210 structurally related chemical compounds. During the late 1970s and early 1980s, EPA's focus regarding dioxins/furans was solely on 2,3,7,8-TCDD, which is produced as a low-level by-product in the manufacture of certain herbicides. More recently, however, EPA has found many cases where the concentrations of the other 209 dioxins/furans greatly exceed those of 2,3,7,8-TCDD. Much less is known about the toxicity of these compounds.

Use

TCDD is formed during the manufacturing of chlorophenols (Sittig, 1991). There is no commercial use of TCDD in the United States. TCDD is used in chemical research (HSDB, 1993).

Chemical and Physical/Properties

Chemical Formula: $C_{12}H_4Cl_4O_2$	Solubilities: 0.2 $\mu\text{g/L}$ in water
Boiling Point: N/A	1.4 g/L in dichlorobenzene
Melting Point: 305-306°C	Vapor Density: N/A
Molecular Weight: 322	Vapor Pressure: 7.4×10^{-10} mm Hg at 25°C
Corrosivity: N/A	Other: N/A
Specific Gravity: N/A	
Octanol/Water Partition Coefficient: 7.02	

Control

TCDD is a toxic pollutant designated pursuant to Section 307(a)(1) of the Clean Water Act and is subject to effluent limitations. However, TCDD is not normally found in water due to its low solubility and adsorbance to soils. Control is usually through stack emissions control devices such as scrubbers or electrostatic precipitators.

Source

The primary sources of TCDD to the Great Lakes are atmospheric deposition from industrial and municipal combustion of waste containing chlorinated organic contaminants (Allan et al., 1991) and from effluent from municipal treatment plants and the pulp and paper industry (GLWQB, 1989). Historical manufacturing of chlorophenol on the Niagara River represented an important source of TCDD to Lake Ontario (Allan et al., 1991).

Fate and Transport

The majority of atmospheric TCDD is probably particulate-bound. The likely fate for particulate-bound TCDD in air is photolysis followed by removal by wet or dry deposition, with ultimate fate in surface soils (EPA, 1984). The half-life of particulate-bound atmospheric TCDD is probably a few days, long enough for transport over considerable distances (ATSDR, 1989).

Due to its low solubility, TCDD does not often appear in water samples except at low levels in surface water samples, where it is bound to suspended material. Some photolysis or vaporization may occur. The half-life of aquatic TCDD is greater than one year. The ultimate sink for TCDD is in sediments (ATSDR, 1989).

Vaporization and photodegradation are likely processes for TCDD in soils. The half-life in surface soils is one to three years, while for deeper soil levels the half-life increases to 10 to 12 years (ATSDR, 1989). TCDD is immobile in most soils but may move horizontally in runoff water during flooding. Minimal movement may occur in soil with low organic content (EPA, 1984).

TCDD can bioaccumulate in the fatty tissues of fish and mammals. It has also been found in rice grown with phenolic herbicides and in the fat of animals that graze on pastures treated with these herbicides (EPA, 1985a).

Biological Properties

Human Toxicity - Noncarcinogenic Effects

There is no evidence of death in humans as a result of oral or dermal exposure to TCDD. Sensitivity to TCDD seems to vary greatly among species. The only definitively identified effect of TCDD in humans is the condition chloracne, which results in persistent, deforming face and upper-body lesions (ATSDR, 1989).

Studies of guinea pigs, rats, monkeys, pigs and rabbits indicates that TCDD causes liver damage and, at high levels, death. Animal studies also indicate that oral exposure to TCDD may cause fetal death and birth defects. TCDD has also been shown to result in the wasting syndrome (progressive weight loss and degeneration) and decreased immunity in many species (ATSDR, 1989).

Human-Toxicity - Carcinogenic Effects

There is limited evidence that exposure to TCDD-related chemicals increase the risk of some soft-tissue sarcomas (EPA, 1985b, 1988b).

Ecotoxicity

Due to its long half-life, low solubility in water, and high lipophilicity, TCDD is expected to bioaccumulate in fatty animal tissues. TCDD is listed as a bioaccumulative chemical of concern (BCC) in the Great Lakes Water Quality Guidance (GLWQG). Acute toxicity results to some forms of aquatic life at relatively low concentrations of TCDD (Eisler, 1986).

Damaging Effects

TCDD can bioaccumulate within fish at concentrations that represent a potential hazard to humans and piscivorous wildlife that consume contaminated fish. The highest levels of TCDD in the Great Lakes were reported in fish collected from Lake Ontario where TCDD concentrations have fluctuated since 1979. TCDD concentrations in Lake Ontario, Lake Erie, and Niagara River herring gull eggs generally declined in the early 1980s, but continue to fluctuate.

Standards, Criteria and Guidelines

EPA Class B2 Carcinogen

Oral Slope Factor:	$1.5 \times 10^5 \text{ (mg/kg/day)}^{-1w}$
Inhal. Slope Factor:	$1.5 \times 10^5 \text{ (mg/kg/day)}^{-1x}$
Chronic Oral RfD:	N/A
Subchronic Oral RfD:	N/A
MCL:	$3 \times 10^{-8} \text{ mg/L}$
AWQC (Federal):	Water and Organism Consumption $1.3 \times 10^{-8} \text{ } \mu\text{g/L}$ Organism Consumption $1.4 \times 10^{-8} \text{ } \mu\text{g/L}$ Acute Freshwater Aquatic Life - $<0.01 \text{ } \mu\text{g/L}$ Chronic Freshwater Aquatic Life 0 $<0.00001 \text{ } \mu\text{g/L}$
GLWQG:	Wildlife - $9.6 \times 10^{-9} \text{ } \mu\text{g/L}$ Human Health - $1.0 \times 10^{-8} \text{ } \mu\text{g/L}$
Sediment Guidelines	
NYSDEC:	Aquatic Toxicity - $< 10 \text{ } \mu\text{g/gOC}$ Human Health - $2.0 \times 10^{-6} \text{ } \mu\text{g/gOC}$ Wildlife - $0.0002 \text{ } \mu\text{g/gOC}$

*From HEAST.

*From HEAST.

BIBLIOGRAPHY

Allan, R.J., et al. 1991. *Toxic Chemicals in the Great Lakes and Associated Effects. Vol. I-Contaminant Levels and Trends*. Environment Canada, Dept. Fisheries and Oceans, Health and Welfare Canada. 488 pp.

ATSDR, 1989. *Toxicological Profile for 2,3,7,8-TCDD*, Agency for Toxic Substance and Disease Registry.

Eisler, R. 1986. *Dioxin hazards to fish, wildlife, and invertebrates: a synoptic review*. U.S. Fish Wildl. Serv. Biol. Rep. 85(1.8). 37 pp.

GLWQB (Great Lakes Water Quality Board). 1989. Report on Great Lakes Water Quality to the International Joint Commission.

EPA, 1984. *Health Effects Assessment for 2,3,7,8-TCDD*.

EPA, 1985a. *Office of Drinking Water Health Advisory for 2,3,7,8-TCDD*.

EPA, 1985b. *Health Assessment Document for Polychlorinated Dibenzo-p-Dioxins*.

EPA, 1988. *A Cancer Risk-Specific Dose Estimate for 2,3,7,8-TCDD*.

HEAST, 1992. U.S. EPA *Health Effects Assessment Summary Tables*.

HSDB, 1993. National Library of Medicine, *Hazardous Substance Data Bank*.

IRIS, 1993. U.S. EPA *Integrated Risk Information System*.

Sittig, M., 1991. *Handbook of Toxic and Hazardous Chemicals and Carcinogens*.

HEXACHLOROBENZENE

Use

Hexachlorobenzene (HCB) is used as an additive to pyrotechnic compounds for military uses, a porosity controller in the manufacture of electrodes, an intermediate in dye manufacture, in inorganic synthesis, and as a wood preservative (Sittig, 1991).

Chemical and Physical Properties

Chemical symbol: C_6Cl_6	Solubilities: 0.035 ppm in water. Soluble in benzene, chloroform, ether, carbon disulfide.
Boiling Point: 323-326°C	
Melting Point: 231°C	
Atomic Weight: 284.80	Vapor Density: 9.83
Corrosivity: N/A	Vapor Pressure: 1.09×10^{-5} mm Hg at 20°C
Specific Gravity: 1.5691 at 23.6°C	Other: Sublimes at 322°C
Octanol/Water Partition Coefficient: 5.31	

Control

A primary treatment technology for HCB is GAC. Air stripping is also effective. HCB was removed at a rate of 96 percent from the effluent of four industrial plants using a biologic wastewater treatment process that included accumulation of the compound in activated sludge in aeration and decantation tanks. HCB adsorbed to suspended solids may be removed by filtration. HCB is covered under a Federal action (40 CFR 60.489) which sets standards of performance for equipment leaks of volatile organic compounds in the synthetic organic chemical manufacturing industry (SOCMI). The intent of these standards is to require all newly constructed, modified, and reconstructed SOCMI process units to use the best demonstrated system of continuous emission reduction for equipment leaks of VOCs, considering cost, air quality, health and environmental impact, and energy requirements (HSDB, 1993).

Source

HCB is introduced to aquatic environment through atmospheric deposition originating from industrial and municipal (sewer treatment plants) sources and through disposal of treatment plant sludge (GLWaB, 1989). HCB has also accumulated in bottom sediments within areas of Lake Erie and Lake Ontario (GLBRCS).

Fate and Transport

HCB is very persistent in the environment. Because of its low solubility, HCB is not expected to move through soil, and because of its high specific gravity, it is not likely to

travel with ground water. The primary fate of HCB is temporary sorption to organic material in soils and sediments. Since its binding to organic material is not permanent, low levels of HCB will be released in the surrounding media. Organisms bioaccumulate HCB, but it is unclear whether biomagnification occurs in the food chain (ICF, 1985).

HCB degrades in the environment very slowly. The two possible degradation routes are photolysis and biodegradation by soil and aquatic organisms (ICF, 1985).

Biological Properties

Human Toxicity - Noncarcinogenic Effects

Ingestion of high doses of HCB may result in loss of muscle control, loss of sensory perception, convulsions, and coma. Inhalation of large doses of HCB may result in coughing and shortness of breath. HCB may also cause irritation to the skin and eyes (Sittig, 1991).

In an epidemic of HCB poisoning in Turkey, the individuals affected displayed severe skin manifestations including photosensitivity, increased pigmentation, deep scarring, permanent increase in body hair, and atrophy of the skin (ICF, 1985). Breast-fed infants were particularly affected and exhibited a mortality rate of 95 percent (ICF, 1985).

Animal studies suggest that HCB is related to adverse effects on reproduction in mammals (ICF, 1985).

Human Toxicity - Carcinogenic Effects

Ingestion of hexachlorobenzene has been shown to cause tumors in the liver, thyroid and kidney in three rodent species (IRIS, 1993).

Ecotoxicity

Birds and mink fed HCB in their diets exhibited liver and kidney damage and reproductive effects including decreased egg size, less frequent hatching, increased stillbirth, increased fetal mortality and decreased postnatal growth. HCB tends to bioaccumulate in aquatic biota at concentrations considerably greater than the surrounding water. The Great Lakes Water Quality Guidance (GLWQG) identifies HCB as a bioaccumulative chemical of concern.

Damaging Effects

Potential carcinogenic human health effects are possible due to exposure to hexachlorobenzene through contaminated drinking water. HCB has the potential to bioaccumulate within fish at concentrations that present a hazard to people and piscivorous wildlife. Although data on fish HCB body burdens are incomplete, an apparent decline in HCB fish levels has occurred from the late 1970s to mid-1980s. Herring gull eggs have also shown a significant decline in HCB concentrations in Lake Erie, Lake Ontario, and the Niagara River from the mid-1970s to 1986 where they have since leveled off (Allan et al., 1991).

Standards, Criteria and Guidelines

EPA Class B2 Carcinogen

Oral Slope Factor:	1.6×10^0 (mg/kg/day) ^{-1y}
Inhal Slope Factor:	N/A
Chronic Oral RfD:	8.0×10^{-4} (mg/kg/day) ^z
Subchronic Oral RfD:	N/A
MCL:	0.001 mg/L
AWQC (Federal):	Water and Fish Consumption - 7.5×10^{-4} µg/L Fish Consumption - 7.7×10^{-4} µg/L Acute Freshwater Aquatic Life - N/A Chronic Freshwater Aquatic Life - N/A
GLWQG:	Human Health - 1.0×10^{-4} µg/L
Sediment Guidelines	
NYSDEC:	Aquatic Toxicity - < 7,568 µg/gOC Human Health - 0.15 µg/gOC Wildlife - 12.0 µg/gOC

BIPLIOGRAPHY

Allan, R.J., et al. 1991. *Toxic chemicals in the Great Lakes and associated effects. Vol. I-Contaminant levels and trends.* Environ. Canada, Dept. Fish. Oceans, Health Welfare, Canada. 488 pp.

Sittig, Marshall. 1991. *Handbook of Toxic and Hazardous Chemicals.* Noyes Publications, Park Ridge, New Jersey.

^yFrom IRIS.

^zFrom IRIS.

Clement Associates, Inc. (ICF). 1985. *Chemical, Physical and Biological Properties of Compounds Present at Hazardous Waste Sites*. Arlington, Virginia.

GLBRCS (Great Lakes Basin Risk Characterization Study). Great Lakes National Program Office.

GLWQB (Great Lakes Water Quality Board). 1989. Report on Great Lakes Water Quality to the International Joint Commission. 128 pp.

HSDB, 1993. National Library of Medicine, *Hazardous Substances Data Bank*.

IRIS, 1993. U.S. EPA *Integrated Risk Information System*.

LEAD

Use

Lead is used in the manufacture of tank linings, piping and equipment for handling corrosive gases and liquids. It is a component in the manufacture of sulfuric acid, in petroleum refining and in halogenation, sulfonation, extraction and condensation processes. Lead is also used for atomic radiation protection, in metallurgy, in batteries, and in the manufacture of pigments for paint, organic and inorganic lead compounds, ceramics, plastics, and electronic devices (HSDB, 1993).

Chemical and Physical Properties

Chemical Symbol: Pb

Boiling Point: 1740°C

Melting Point: 327.4°C

Atomic Weight: 207.19

Corrosivity: N/A

Specific Gravity: 11.34 at 20°C

Octanol/Water Partition Coefficient: N/A

Solubilities: Insoluble in hot or cold water.
Soluble in nitric acid and hot concentrated sulfuric acid.

Vapor Density: N/A

Vapor Pressure: 1.77 mm Hg at 1000°C

Other: Very soft and malleable.

Control

Water spills can be neutralized with agricultural lime (CaO), crushed limestone (CaCO₃), or sodium bicarbonate (NaHCO₃). Inorganic lead in wastewaters can be effectively treated by coagulation with ferric and ferrous sulfate. Solid lead and lead oxide can be recovered following sedimentation in a holding basin (Patterson, 1985). Precipitation processes that include hydroxide, lime and/or sulfide treatment are the preferred methods for removing toxic heavy metals such as lead from electroplating waters. Adsorption using activated carbon, activated aluminum and iron fillings have shown potential for treating aqueous metal-bearing wastes. Waste reduction and recovery techniques for metal-bearing hazardous streams include evaporation, ion-exchange, reverse-osmosis, electrodialysis and electrolytic recovery (Grosse, 1986).

Source

It is estimated that 46 percent of the lead loading into Lake Erie is from atmospheric deposition (39 percent and seven percent from direct and indirect sources) while an estimated 73 percent direct of the lead input into Lake Ontario is from atmospheric deposition (50 percent and 23 percent attributed to direct and indirect sources, respectively) (GLBRCS).

Other significant sources of lead include municipal effluent and sludge disposal (GLBRCS). Lead has also accumulated within bottom sediments at some locations in Lakes Erie and Ontario.

Fate and Transport

Lead is a heavy metal that exists in three oxidation states (0, +2, and +4). In addition to their natural occurrence, lead and its compounds may enter and contaminate the environment at any stage during mining, smelting, processing, and use. Lead is artificially introduced into the environment primarily through the combustion of lead-containing fossil fuels and from lead mining operations (EPA, 1984). Photolysis of lead fumes occurs readily (ICF, 1985) and therefore fumes that are present around gas stations and in heavily travelled areas are not a significant avenue of contamination. Particulate lead, carried in the atmosphere, is removed by either wet or dry deposition. Rainfall is not as significant in the deposition of lead particles as would be expected (EPA, 1984).

The transport of lead in ground water and surface water is highly variable based on its oxidation state. In polluted waters, organic complexation of lead is the primary factor in the determination of toxicity. Lead is adsorbed strongly to organic materials in soils but is not easily absorbed by living plants (EPA, 1984).

Biological Properties

Human Toxicity - Noncarcinogenic

The majority of the studies concerned with the effects of lead exposure in humans are based on blood lead levels, not ambient lead levels (EPA, 1984). Decreased hemoglobin production is seen at low blood lead levels in children. Chronic exposure to lead may affect the heart (EPA, 1984). In high doses, lead compounds have been used to induce abortions. Oliver (1911) noted that the miscarriage rate among British women occupationally exposed to lead was elevated. Several other studies have reported that increases in spontaneous abortions, premature delivery, and early membrane rupture have been associated with lead exposure. In addition, there is some evidence that lead has mutagenic effects (IRIS, 1993). Studies for which sufficient data is available are consistent in identifying a link between low-level lead exposure during early development and later neurobehavioral performance. These studies also point to the prenatal period of exposure as the most critical, although postnatal exposures may still be important and even override the effect of prenatal conditions under some conditions (ATSDR, 1988). Davis and Suendsgaavd (1987) have concluded that the duration of gestation and biota weight is affected by exposure to lead during pregnancy. Recent studies indicate that delays in developmental milestones (e.g., walking or speaking) are related to lead blood levels in children (Schwartz and Otto, 1987).

Human Toxicity - Carcinogenic Effects

Laboratory studies in rats indicate that long-term oral exposure to lead increases the incidence of kidney tumors (EPA, 1984; IRIS, 1993).

Ecotoxicity

Lead is toxic to all phyla of freshwater and saltwater aquatic life (Eisler, 1988). Acute and chronic toxicity studies of lead in freshwater organisms indicate that soft water increases sensitivity to lead toxicity. Organic lead compounds are generally more toxic than inorganic lead with early life stages of organisms being the most susceptible. Although lead is bioaccumulated with increasing age of a species, biomagnification of lead is negligible (Eisler, 1988).

Damaging Effects

Lead may bioaccumulate within aquatic organisms at concentrations which present a hazard to wildlife species. Concentrations were much higher within Lake Ontario forage fish (e.g. perch and smelt) than in top predators (e.g. trout) as biomagnification of lead within the food chain does not occur (Allan et al., 1991). Levels of lead reported in Lake Erie and Lake Ontario fish are generally below guidelines reported in Eisler (1988).

Standards, Criteria and Guidelines

EPA Class B2 Carcinogen

Oral Slope Factor:	N/A
Inhalation Slope Factor:	N/A
Chronic Oral RfD:	N/A
Subchronic Oral RfD:	N/A
MCL:	Action Level: 0.015 mg/L
AWQC (Federal):	Water and Organism Consumption - N/A Organism Consumption - N/A Acute Freshwater Aquatic Life - 82 µg/L (based on water hardness of 100 µg/L) Chronic Freshwater Aquatic Life - 3.2 µg/L (based on water hardness of 100 µg/L)
GLWQG:	N/A
Sediment Guidelines	
Ontario MOE:	Lowest Effect Level - 31 µg/g Severe Effect Level - 250 µg/g

CDC blood lead level (child): 10-14 µg/L

BIBLIOGRAPHY

ATSDR, 1988. The Nature and Extent of Lead Poisoning in Children in the United States: A Report to Congress, Agency for Toxic Substances and Disease Register, July 1988.

Davis, J.M.; Svendsgaavd, D.J., 1987. Low-level exposure and child development. *Nature* (London) 329: 297-300.

Eisler, R. 1988. *Lead hazards to fish, wildlife and invertebrates: a synoptic review*. U.S. Fish Wildl. Serv. Biol. Rep. 85(1.14). 134 pp.

EPA. 1984. *Health Effects Assessment for Lead*, EPA 540/1-86/055.

EPA. 1992. *Health Effects Assessment Summary Tables (HEAST)*. FY1992.

GLBRCS (Great Lakes Basin Risk Characterization Study). Great Lakes National Program Office. Page III-35.

Grosse, D.W., 1986. 12th Annual Research Symposium on Land Disposal, Remedial Action, Incineration and Treatment of Hazardous Wastes. (Cited in HSDB).

HSDB, 1993. National Library of Medicine, *Hazardous Substances Data Bank*.

ICF, 1985. *Chemical, Physical and Biological Properties of Compounds Present at Hazardous Waste Sites*. Clement Associates, Inc.

IRIS, 1993. U.S. EPA *Integrated Risk Information System*.

Oliver, T., 1911. *Lead Poisoning and the Race*. *Br. Med. J.* 1: 1096-1098. (Cited in EPA, 1984).

Patterson, J.W., 1985. *Industrial Wastewater Treatment Technology*, 2nd Edition, p. 75. (Cited in HSDB).

Schwartz, J.; Otto, D.A., 1987. Blood lead, heaving threshold, and neurobehavioral development in children and youth. *Arch. Environ. Health.* 42: 153-160.

MERCURY

Use

Mercury is used in thermometers, batteries, mercury arc lamps, switches, and electronic devices. It is used in the manufacture of mercury salts, mirrors, electric rectifiers, and plastics. Mercury is also used in pharmaceuticals, agricultural fungicides, and paints (HSDB, 1993).

Chemical and Physical Properties

Chemical Symbol: Hg	Solubilities: 0.28 micromoles/L water at 25°C
Boiling Point: 356.72°C	Soluble in nitric acid and to some extent in lipids.
Melting Point: -38.87°C	Vapor Density: N/A
Atomic Weight: 200.59	Vapor Pressure: 2×10^{-3} mm Hg at 25°C
Corrosivity: highly corrosive to other metals.	Other: N/A
Specific Gravity: 13.534 at 25°C	
Octanol/Water Partition Coefficient: N/A	

Control

Mercury is a toxic pollutant designated pursuant to Section 307 (a)(1) of the Clean Water Act and is subject to effluent limitations. Mercury removal from wastewater can be accomplished by the BMS process and the TMR IMAC process. The BMS process includes the following measures: chlorine is added to the wastewater, oxidizing mercury to the ionic state. The BMS absorbent, an activated carbon concentrate of sulfur compound on its surface, is used to collect the ionic mercury. The spent adsorbent is then distilled to recover the mercury, leaving a carbon residue for reuse or disposal. The TMR IMAC process includes the following steps: Wastewater is fed into a reactor, where an excess of chlorine is maintained, oxidizing mercury to the ionic state. The liquid is then passed through the TMR IMAC ion exchange resin where mercury ions are adsorbed. The mercury is then stripped from the spent resin with hydrochloric acid solution (Environment Canada, 1982). Chemical coagulation and lime softening may also remove up to 90 percent of mercury in water. Inorganic mercury may also be removed by ferric sulfate coagulation followed by precipitation and filtration. Mercury may also be removed from water by granular activated carbon absorption at low pH.

Source

Principal historical sources of mercury have included paper mills and chlor-alkali plants. Atmospheric deposition resulting from the burning of municipal sludge/refuse (Glass et al.,

1990) and fossil fuels (primarily coal) and to a lesser degree from mining and smelting operations is now thought to be a significant source of mercury to aquatic systems. Mercury has also accumulated within sediments at some locations within Lakes Erie and Ontario. These contaminated sediments also represent a source of mercury to the environment (GLBRCS).

Fate and Transport

Mercury is expected to be present in the atmosphere primarily as Hg(O) from electrical industries and from the burning of fossil fuels. Elemental mercury, several inorganic species, and dimethyl mercury can volatilize to the atmosphere when released to surface waters and soils (ICF, 1985). Once released to the atmosphere, mercury is removed primarily by precipitation (EPA, 1984), but certain compounds can also be photolyzed (ICF, 1985).

In aquatic environments, mercury readily adsorbs to organic matter. In waters with high organic content, sedimentation and subsequent bioaccumulation are likely to occur (ICF, 1985). All forms of mercury present in aquatic environment can be converted into the more toxic forms of methylmercury by natural processes (Eisler, 1987).

Mercury binds strongly to soils with high organic matter and, as a result, remains relatively immobile. Mercury does not transport well in ground water except when combined with leachate from municipal landfills (EPA, 1984).

Biological Properties

Human Toxicity - Noncarcinogenic Effects

Chronic exposure to organic mercury results mainly in adverse effects to the central nervous system in humans, resulting in tremors, sensory loss, and ataxia (EPA, 1984). Studies in animals also indicate weight loss and kidney damage as possible effects of mercury exposure (Fitzhugh, et al., 1950). There is some evidence that mercury may cause genetic mutations (Ramel, 1972). Exposure to methyl mercury is known to cause brain damage and retardation in humans (EPA, 1984).

Human Toxicity - Carcinogenic Effects

No form of mercury, either elemental, organic or inorganic, has been shown to cause cancer in humans or laboratory animals or to induce changes in cultured cells (EPA, 1984).

Ecotoxicity

Organomercury compounds, especially methylmercury, appears to be more toxic to organisms than inorganic forms. Mollusks and crustaceans, both filter feeders, appear to be more sensitive to the toxic effects of inorganic mercury than do planktonic species (ICF, 1985). Freshwater plants show a wide range of sensitivity to mercury but are generally less sensitive than freshwater animals. For all organisms tested, early developmental stages were the most sensitive. Mercury (particularly methylmercury) tends to bioconcentrate in aquatic animals at higher concentrations than are present in the surrounding water and is biomagnified through the food chain (Eisler, 1987). Mercury is listed as a bioaccumulative chemical of concern by the Great Lakes Water Quality Guidance (GLWQG).

Damaging Effects

Due to mercury's biomagnification potential, species located at upper trophic levels (including humans) are most at risk from mercury exposure. The Great Lakes Water Quality Agreement (GLWQA) objective for a whole fish mercury concentration limit is 0.5 ppm. Concentrations of mercury within large fish collected from Lakes Erie and Ontario have exceeded the GLWQA guideline which resulted in the issuance of fish consumption advisories (Allan et al., 1991). Piscivorous wildlife and people not following fish advisories are most at risk from mercury.

Standards, Criteria and Guidelines

EPA Class D Carcinogen

Oral Slope Factor:	N/A
Inhalation Slope Factor:	N/A
Chronic Oral RfD:	3.0×10^{-4} mg/kg/day ^{aa}
Chronic Inhalation RfD:	8.58×10^{-5} mg/kg/day ^{bb}
Subchronic Oral RfD:	3.0×10^{-4} mg/kg/day ^{cc}

^{aa}From HEAST.

^{bb}From HEAST. Inhalation RfD derived from Inhalation RfC.
Inhalation RfD = Inhalation RfC \times Conversion Factor
Inhalation RfC = 3×10^{-4} mg/m³
Conversion Factor = 2.86×10^{-1}

^{cc}From HEAST.

Subchronic Inhalation RfD: 8.58×10^{-5} mg/kg/day^{dd}
MCL: 0.002 mg/l
AWQC (Federal): Water and Organism Consumption - 0.14 µg/l
Organism Consumption - 0.15 µg/l
Acute Freshwater Aquatic Life - 2.4 µg/L
Chronic Freshwater Aquatic Life - 0.012 µg/L
GLWQG: Human Health - 2.0×10^{-3} µg/L
Chronic Aquatic Life - 0.44 µg/L
Wildlife - 1.8×10^{-4} µg/L

Sediment Guidelines
Ontario MOE: Lowest Effect Level - 0.2 µg/g
Severe Effect Level - 2.0 µg/g

BIBLIOGRAPHY

Eisler, R. 1987. *Mercury hazards to fish, wildlife, and invertebrates: a synoptic review*. U.S. Fish Wildl. Serv. Biol. Rep. 85(1.10). pp. 90.

Environmental Canada, 1982. *Tech Info for Problem Spills: Mercury* (Draft) p. 59 (cited in HSDB).

Fitzhugh, O.G., A.A. Nelson, E.P. Laug, and F.M. Kunze. 1950. *Chronic Oral Toxicities of Mercuri-phenyl and Mercuric Salts*. *Arch. Ind. Hyg. Occup. Med.* 2: 433-441. (Cited in EPA, 1984).

Glass, G.E., J.A. Sorensent, K.W. Schmidt, and G.R. Rapp, Jr. 1990. New Source Identification of Mercury Contamination in the Great Lakes. *Environ. Sci. Technol.* 24:1059-1069.

GLBRCS (Great Lakes Basin Characterization Study). Great Lakes National Program Office.

HSDB, 1993. National Library of Medicine, *Hazardous Substances Data Bank*.

ICF, 1985. *Chemical, Physical and Biological Properties of Compounds Present at Hazardous Waste Sites*. Clement Associates, Inc.

^{dd}From HEAST. Inhalation RfD derived from inhalation RfC.
Inhalation RfD = Inhalation RfC \times Conversion Factor
Inhalation RfC = 3×10^{-4} mg/m³
Conversion Factor = 2.86×10^{-1}

Ramel, C. 1972. Genetic Effects. In: *Mercury in the Environment - An Epidemiological and Toxicological Appraisal*. L. Frieburg and J. Vostal, Ed. CRC Press, Cleveland, Ohio. p. 169-181. (Cited in IRIS)

EPA. 1984. *Health Effects Assessment for Mercury*, EPA 540/1-86/042.

IRIS, 1993. U.S. EPA *Integrated Risk Information System*.

HEAST, 1992. U.S. EPA *Health Effects Assessment Summary Tables*.

MIREX

Use

Mirex is a dimer of hexachlorocyclopentadiene used as a fire retardant in plastics, rubber, paint, paper and electrical goods, and as an insecticide (HSDB, 1993). Despite its ban in the United States in 1978, mirex is expected to persist in the environment.

Chemical and Physical Properties

Chemical Formula: $C_{10}Cl_{12}$

Boiling Point: N/A

Melting Point: 485°C

Molecular Weight: 545.59°C

Corrosivity: Practically noncorrosive to metal

Specific Gravity: N/A

Octanol/Water Partition Coefficient: 5.28

Solubilities: Practically insoluble in water.

Vapor Density: N/A

Vapor Pressure: 3×10^{-7} mm Hg at 25°C

Other: Highly lipophilic.

Control

Mirex is unaffected by hydrochloric, nitric and sulfuric acids. It is expected to be extremely resistant to oxidation except at high temperatures. Incineration and storage are recommended methods of disposal (HSDB, 1993). Based upon its organic carbon partitioning coefficient and its Henry's Law Constant, Mirex may be amenable to removal by granular activated carbon and air stripping.

Source

Mirex detected in Niagara River sediments was attributed to a production facility located on the Niagara River and a distribution plant at Oswego, New York (Allan et al., 1991). Although mirex production ceased in 1976 within the Niagara River basin, the extent of mirex-contaminated sediments within Lake Ontario increased and is likely due to resuspension of contaminated sediments (Allan et al., 1991).

Fate and Transport

Mirex is a highly stable chemical. Release into the environment has occurred via effluents from manufacturing plants and sites where mirex was utilized as a fire-resistant additive to polymers, and at points of application where it was used as a insecticide (primarily for fire ant control). For the most part, mirex is resistant to biological and chemical degradation. Photolysis of mirex may occur. However, sorption is likely to be a more important fate process. Persistent compounds such as kepone and monohydro- and dihydro- derivatives of

mirex have been identified as products of extremely slow transformation of mirex. Mirex has also been shown to bioconcentrate in aquatic organisms.

A organic carbon coefficient (Koc) value of 2.4×10^{-7} indicates mirex will strongly adsorb to organic materials in soils and sediments. Therefore, mirex is expected to be immobile in soil and partition from the water column to sediments and suspended material. A Henry's Law Constant for mirex of 5.16×10^{-4} atm-cu m/mole at 22°C suggests rapid volatilization may occur from environmental waters and moist soils where absorption does not dominate. Based on this Henry's Law Constant, the volatilization half-life from a model river (22°C; 1 meter deep flowing 1 m/sec with a wind speed of 3 m/sec) has been estimated to be 10.7 hours; however, this estimation neglects the potentially important effect of adsorption. The volatilization half-life from an environmental pond model, which considers the effect of adsorption, can be estimated to be about 1143 years (HSDB, 1993).

Biological Properties

Human Toxicity - Noncarcinogenic Effects

Ingestion of Mirex may cause tremors, weight loss, nervous system and liver abnormalities, skin rash, and reproductive failure, although no cases of human toxicity have been reported (Sittig, 1991). Long term exposure to Mirex has produced cataracts, liver and thyroid damage in mice and rats (NTP, 1990; IRIS, 1993).

Human Toxicity - Carcinogenic Effects

Mirex has been shown to cause cancer in rats and mice (Sittig, 1991). Mirex is classified as a possible human carcinogen by IARC (IARC, 1987).

Ecotoxicity

Mirex has caused acute and chronic toxic effects in many freshwater fishes and invertebrates at very low concentrations. Birds do not appear to be as sensitive to mirex although poor reproductive success of herring gulls within Lake Ontario was attributed to exposure to mirex (Eisler, 1985). Bioaccumulation and biomagnification within organisms exposed to mirex occurs within aquatic and terrestrial ecosystems. Mirex is listed as a bioaccumulative chemical of concern by the Great Lakes Water Quality Guidance (GLWQG).

Damaging Effects

Mirex contamination within the Great Lakes Basin is primarily limited to downstream areas below the Niagara River (particularly Lake Ontario). Although levels of mirex within fish in Lake Ontario have declined since the 1970s, levels remain above the guideline of

"substantially absent" as an objective of the Great Lakes Water Quality Agreement (GLWQA). Mirex concentrations within Lake Ontario herring gulls have declined significantly since the early 1970s when decreased reproduction was attributed to mirex (Eisler, 1985).

Standards, Criteria and Guidelines

Classified as B1 carcinogen in HEAST, 1992.

Oral Slope Factor:	1.8×10^0 (mg/kg/day) ^{1ee}
Chronic Oral RfD:	2.0×10^{-4} mg/kg/day ^{ff}
Subchronic Oral RfD:	2.0×10^{-4} mg/kg/day ^{gg}
MCL:	N/A
AWQC (Federal):	Water and Organism Consumption - N/A Organism Consumption - N/A Acute Freshwater Aquatic Life - N/A Chronic Freshwater Aquatic Life - N/A
GLWQG:	N/A
Sediment Guidelines	
NYSDEC:	Human Health - 0.07 µg/gOC Wildlife - 3.7 µg/gOC
Ontario MOE:	Lowest Effect Level - 0.007 µg/g Severe Effect Level - 130 µg/gOC

BIBLIOGRAPHY

- Allan, R.J., et al. 1991. *Toxic chemicals in the Great Lakes and associated effects. Vol. I - contaminant levels and trends.* Environ. Canada, Dept. Fish. Oceans, Health Welf. Canada. pp. 488.
- Eisler, R. 1985. *Mirex hazards to fish, wildlife, and invertebrates: a synoptic review.* U.S. Fish Wildl. Serv. Biol. Rep. 85(1.1). 42 pp.
- HSDB. 1993. National Library of Medicine, *Hazardous Substances Data Bank.*
- IARC. 1987. *IARC Monographs* (cited in HSDB).

^{ee}From HEAST.

^{ff}From IRIS.

^{gg}From HEAST.

NTP. 1990. *National Toxicology Program, Toxicology and Carcinogenesis Studies of MIREX in F344 in rats (Feed Studies)*. NTP TR 313.

Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals and Carcinogens, Third Edition*, Noyes Publications, New Jersey.

IRIS, 1993. U.S. EPA *Integrated Risk Information System*.

OCTACHLOROSTYRENE

Use

Octachlorostyrene is not produced or used commercially for any application. Octachlorostyrene is mainly an accidental by-product of high temperature industrial processes involving chlorine.

Chemical and Physical Properties

Chemical Formula: C_8Cl_8	Solubilities: N/A
Boiling Point: N/A	Vapor Density: N/A
Melting Point: N/A	Vapor Pressure: N/A
Atomic Weight: 379.68	Other: N/A
Corrosivity: N/A	
Specific Gravity: N/A	
Octanol/Water Partition Coefficient: N/A	

Control

Various treatment technologies are viable for control of octachlorostyrene depending upon media and construction. Air stripping and granular activated carbon are likely technologies for dissolved concentrations. Filtration may remove the compound adsorbed to suspended solids.

Source

No information was found in the reviewed literature.

Fate and Transport

Documented releases of octachlorostyrene into the environment have largely occurred via wastewater effluents from chlorine gas; magnesium, niobium, and tantalum production; and the smelting of aluminum. Releases of octachlorostyrene to the environment have also been reported from leachate from an industrial landfill and fly ash from waste incinerators. Sufficient data are not available to predict the importance of biodegradation and chemical degradation of octachlorostyrene in the environment. However, limited evidence suggests that octachlorostyrene may undergo direct photolysis in the environment. Dechlorinated styrenes have been identified to be direct transformation products of direct photolysis.

Bioconcentration of octachlorostyrene has been shown to be important in aquatic systems. A high organic carbon coefficient (K_{oc}) and extensive monitoring data indicate octachlorostyrene will be immobile in soil and can partition from the water column to organic

matter contained in sediments and suspended solids. A Henry's Law Constant of 1.3×10^{-4} atm/cu m/mole at 25°C suggests that volatilization of octachlorostyrene from environmental waters may be important. The volatilization half-lives from a model river and a model pond have been estimated to be 18 hours and five years, respectively. The pond model considered the effect of adsorption. If released to the atmosphere, reactions with photochemically produced hydroxyl radicals may be significant (estimated half-life of about 17 days) (HSDB, 1993).

Biological Properties

Human Toxicity - Noncarcinogenic Effects

Octachlorostyrene appears to affect the liver when ingested; it has also been found to induce stimulation of porphyrin in humans, which may be a sign of abnormal liver function (Strik, 1978). Studies in pregnant rats indicate damage to the placenta and fetuses as a result of octachlorostyrene exposure (Karcew et al., 1986). No information regarding the carcinogenicity of octachlorostyrene was found in the reviewed literature.

Ecotoxicity

Fish bioaccumulate octachlorostyrene (HSDB, 1993). Nordheim reported that the apparent half-life of octachlorostyrene in rainbow trout was approximately 143 days. Octachlorostyrene is listed as a bioaccumulative chemical of concern by the Great Lakes Water Quality Guidance (GLWQG).

Damaging Effects

Due to the potential of octachlorostyrene to bioaccumulate within fish, humans and wildlife species may potentially be exposed to octachlorostyrene through the consumption of fish. However, recent forage fish analyses detected only very low concentrations in western Lake Ontario and on detected levels within Lake Erie and the Niagara River (GLWQB, 1989).

Standards, Criteria and Guidelines

Unclassified as to carcinogenicity by EPA

Oral Slope Factor:	N/A
Inhalation Slope Factor:	N/A
Chronic Oral RfD:	N/A
Chronic Inhalation RfD:	N/A
Subchronic Oral RfD:	N/A
Subchronic Inhalation RfD:	N/A

MCL: N/A
AWQC (Federal): Water and Organism Consumption - N/A
Organism Consumption - N/A
Aquatic Freshwater Aquatic Life - N/A
Chronic Freshwater Aquatic Life - N/A
GLWQG: N/A

Sediment Guideline

NYSDEC: Wildlife - 0.5 µg/gOC

BIBLIOGRAPHY

GLWQB (Great Lakes Water Quality Board). 1989. Report to the International Joint Commission.

HSDB. 1993. National Library of Medicine, *Hazardous Substances Data Bank*.

IRIS, 1993. U.S. EPA *Integrated Risk Information System*.

Karcew et. al. 1986. (cited in Kitchin and Karcew, 1987).

Kitchin, K.T., Karcew, Sam. 1987. *Some pharmacokinetic and metabolic factors affecting the neonatal toxicity of chlorinated hydrocarbons found in the Great Lakes*, Dept. of Pharmacology, University of Ottawa, Ontario, Canada.

Strik. 1978. (cited in Kitchin and Karcew, 1987).

Tarkpea, Maria, Hagen, I., Carlberg, G.E., Kolsaker, P., Storflor, H., *Metagenicity, Acute Toxicity and Bioaccumulation Potential of Six Chlorinated Styrenes*. *Bull. Environ. Contam. Toxicol.* (1985) 35:525-530.

POLYCHLORINATED BIPHENYLS

Background

The name polychlorinated biphenyl (PCB) categorizes any compound that is made up of a biphenyl ring in which one or more hydrogen atom is replaced by a chloride atom. In commercial PCB mixtures, 40 to 70 different PCB compounds may be present. The number following the name of a PCB compound indicates the degree of chlorination, with increasing numbers indicating higher chlorination. The chemical, physical, and biological properties of these materials depend to a large extent on the amount and location of the chlorine atoms on each specific PCB and on the particular combination of PCBs that comprise the mixture. This profile is concerned with PCB-1260, PCB-1254, and PCB-1248, also known by the trade name "Aroclor". Any statements made, unless specified, characterize these three compounds.

Use

The fire-resistant nature of PCBs combined with outstanding thermal stability make them excellent choices as hydraulic and heat transfer fluids. They have been used to improve the water-proofing characteristics of surface coatings and in the manufacture of carbonless copy paper printing inks, plasticizers, special adhesives, lubricating additives, vacuum pump fluids, electrical capacitors, and transformers. PCBs are widely used as enzyme inducers in research laboratories (HSDB, 1993).

Chemical and Physical Properties

Chemical Formula: $(C_6H_5Cl)_2$
Boiling Point: $>267^{\circ}C$
Melting Point: $54-310^{\circ}C$
Molecular Weight: 189-399*
Corrosivity: N/A
Specific Gravity: 1.44 at $30^{\circ}C$
Octanol/Water Partition Coefficient: N/A

Solubility: Extremely low in water.
Soluble in oils and organic solvents.
Vapor Density: N/A
Vapor Pressure: $6.0 \times 10^{-5} - 1.0 \times 10^{-3}$ mm Hg **
Other: Strong oxidizers

* increases with chlorination

**decreases with chlorination

Control

PCBs are toxic pollutants designated pursuant to Section 307(a)(1) of the Clean Water Act and is subject to effluent limitations. Primary treatment for PCBs is thermal destruction (incineration). Low concentrations in water may be treated with granular activated carbon. Some research suggests that PCBs may be treated by stabilization/solidification.

Source

It is estimated that only 13 and 7 percent of the total PCB loadings into Lake Erie and Lake Ontario respectively, originate from atmospheric deposition (GLBRCS). PCBs are primarily released into these lakes and the Niagara River from industrial and municipal effluents, disposal of sludge, land and urban runoff, landfills, and resuspension and translocation of contaminated sediments (Allan et al., 1991).

Fate and Transport

PCBs are extremely persistent in soils containing moderate to high levels of organic matter. Heavily chlorinated PCBs persist longer and degrade slower than lightly chlorinated PCBs. PCBs are known to bioaccumulate readily in adipose tissues, especially in interstitial organs.

In aquatic media, PCBs tend to volatilize, after which they may be slowly photolyzed in the atmosphere. Aquatic invertebrates are important in the cycling of PCBs within the aquatic environment and between aquatic and terrestrial ecosystems (Eisler, 1986).

Biological Properties

Human Toxicity - Noncarcinogenic Effects

Exposure to PCB fumes results in acneform eruptions, irritation to the respiratory passages, and injury to the liver (ACGIH, 1984). Studies in monkeys have indicated that oral exposure to Aroclor 1248 results in birth defects and fetal death (EPA, 1984). A study of rabbits involving Aroclor 1254 had similar results (EPA, 1985). In addition, there is evidence that Aroclor 1221 produces mutagenic effects (EPA, 1985).

Human Toxicity - Carcinogenic Effects

Studies on laboratory animals indicate an increase in liver cancer. From most studies, it appears as though exposure to the more heavily chlorinated PCBs results in an increased risk of cancer (Norback and Weltman, 1985). IRIS reports that there is some evidence that mixtures containing more highly chlorinated biphenyls are more potent inducers of hepatocellular carcinoma in rats than mixtures containing less chlorine by weight.

Ecotoxicity

PCBs are bioaccumulated and can be biomagnified; therefore, their toxicity increases with length of exposure and position of the exposed species on the food chain (ICF, 1985). PCBs are listed as a bioaccumulative chemical of concern by the Great Lakes Water Quality Guidance (GLWQG). Invertebrate species are also adversely affected

(ICF, 1985). Present data imply that, in general, juvenile organisms appear more susceptible to the effects of PCBs than either eggs or adults (ICF, 1985), and lower chlorinated biphenyls are more toxic to aquatic organisms than higher chlorinated biphenyls (Eisler, 1986). It is clear that based on the chronic values available in the literature, PCBs are highly toxic to both freshwater and saltwater aquatic life. Diet is an important exposure route for PCB accumulation within terrestrial species. Sensitive bird species are susceptible to PCB poisoning, mainly as a result of eating contaminated fish or bivalves. Mammals (particularly mink) are generally more sensitive to PCB toxicity than birds (Eisler, 1986).

Damaging Effects

PCBs bioaccumulate within organisms and biomagnify within the food chain. Highest concentrations generally occur in long lived upper trophic level species (e.g. trout and salmon). Therefore, consumption of these fish species may present a hazard to people and wildlife. The Great Lakes Water Quality Agreement (GLWQA) identified a whole fish concentration limit of 0.1 ppm PCB as an objective. This level has been consistently exceeded in large predator and forage fish in Lake Ontario, Lake Erie, and the Niagara River which necessitated the issuance of fish consumption advisories. Although PCB concentrations in fish and wildlife have declined significantly from the 1970s, levels appear to have reached equilibrium in the 1980s (Allan et al., 1991).

Standards, Criteria and Guidelines

EPA Class B2 Carcinogen

Oral Slope Factor:	7.7×10^0 (mg/kg/day) ⁻¹ ^{hh}
Inhalation Slope Factor:	N/A
Chronic Oral RfD:	N/A
Subchronic Oral RfD:	N/A
MCL:	0.5 µg/l
AWQC (Federal):	Water and Organism Consumption - 4.4×10^{-5} µg/L Organism Consumption - 4.5×10^{-5} µg/L Acute Freshwater Aquatic Life - N/A Chronic Freshwater Aquatic Life - 1.4×10^{-2} µg/L
GLWQC:	Human Health - 3.0×10^{-6} µg/L Wildlife - 1.7×10^{-5} µg/L

^{hh}From IRIS. Value is based on an Aroclor-1260 study.

Sediment Guidelines

NYSDEC:

Aquatic Toxicity - < 276 µg/gOC

Human Health - 0.008 µg/gOC

Wildlife - 0.6 µg/gOC

Ontario MOE:

Lowest Effect Level - 0.07 µg/g

Severe Effect Level - 530 µg/gOC

BIBLIOGRAPHY

ACGIH, 1984. *Documentation of Threshold Limit Values*. American Conference of Governmental Industrial Hygienists.

Allan, R.J. et al. 1991. *Toxic Chemicals in the Great Lakes and Associated Effects. Vol. I - Contaminant Levels and Trends*. Environment Canada, Dept. Fisheries and Oceans, Health and Welfare Canada. 488 pp.

Eisler, R. 1986. *Polychlorinated Biphenyl Hazards to Fish, Wildlife, and Invertebrates: a Synoptic Review*. U.S. Fish and Wildl. Serv. Biol. Rep. 85 (1.7) 72 pp.

GLBRCS (Great Lakes Basin Risk Characterization Study). Great Lakes National Program Office. Pg. III-35.

HSDB, 1993. National Library of Medicine, *Hazardous Substance Data Bank*.

ICF Clement, *Chemical, Physical and Biological Properties of Compounds Present at Hazardous Waste Sites*, 1985.

Norback, D.H. and R.H. Weltman, *Polychlorinated Biphenyl Induction of Hepatocellular Carcinoma in the Sprague-Dawley Rat*, 1985, *Environ. Health Perspect.*, 60: 97-105, (Cited in IRIS).

IRIS, 1993. U.S. EPA *Integrated Risk Information System*.

EPA, 1985. Office of Drinking Water, *Health Advisory for PCBs*.

TETRACHLOROETHYLENE

Use

Tetrachloroethylene or perchloroethylene (PCE) is used in the textile industry for dry cleaning processing and finishing; in both cold cleaning and vapor degreasing of metals; and as a heat exchange fluid. PCE was formerly used but is no longer approved in mixtures with grain protectants and liquid grain fumigants (HSDB, 1993).

Chemical and Physical Properties

Chemical Formula: C_2Cl_4
Boiling Point: 121°C at 760 mm Hg
Melting Point: -19°C
Molecular Weight: 165.83
Corrosivity: Corrosive to aluminum
iron and zinc in the
presence of water.

Specific Gravity: 1.6227 of 20°C
Octanol/Water Partition Coefficient: 3.40
Solubilities: 0.015 g/100 mL water of 25°C
Vapor Density: 5.7
Vapor Pressure: 18.47 mm Hg at 25°C
Other: N/A

Control

PCE is a toxic pollutant designated pursuant to Section 307(a)(1) of the Clean Water Act and is subject to effluent limitations (HSDB, 1993). Primary treatment for tetrachloroethylene is air stripping, granular activated carbon and ultra violet radiation/oxidation.

Source

Municipal sewer treatment plants (STP) release significant quantities of PCE to the Great Lakes through atmospheric release (64 percent of STP release) and effluent discharge (36 percent of total STP release) (GLWQB, 1989). Other sources of PCE include industrial discharges and ground water discharge from landfills and hazardous waste sites.

Fate and Transport

PCE volatilizes rapidly when released to surface waters and soils. In the atmosphere, tetrachloroethylene interacts with hydroxyl radicals to produce carbon dioxide, carbon monoxide, and hydrogen chloride (ICF, 1985).

In soils, PCE adsorbs to the organic material present. In soils of low organic content, PCE leaches and is transported readily in the ground water (EPA, 1985). PCE is known to degrade slowly in ground water, where it can remain for months to years. Its degradation products in aquatic media are reported to be vinyl chloride and dichloroethylene (EPA, 1985).

Biological Properties

Human Toxicity - Noncarcinogenic Effects

Chronic exposure to PCE is reported to affect the central nervous system, mucous membranes, eyes, skin, liver and kidneys (EPA, 1985). However, some studies performed on rabbits, guinea pigs, and monkeys have indicated no adverse effects (Rowe et al., 1952). Several human fatalities have been reported as a result of massive accidental exposure (unspecified concentrations) (ACGIH, 1984).

PCE is also known to cause increased fetal resorption and birth defects in mice and rats (Schwetz et al., 1975). There is limited evidence that PCE may have mutagenic effects.

Human Toxicity - Carcinogenic Effects

Tetrachloroethylene has been found to be carcinogenic in mice and rats NCI (1977). No studies with definitive findings are available showing the carcinogenic effects of tetrachloroethylene on humans, although Blair et al. (1979) observed an excess of lung, cervical, and skin cancers and leukemia in laundry and dry-cleaning workers, who were also exposed to carbon tetrachloride and trichloroethylene.

Ecotoxicity

Tetrachloroethylene is considered to be moderately toxic to aquatic organisms (ICF, 1985). In general, bioaccumulation within organisms exposed to PCE does not occur.

Damaging Effects

Bioaccumulation of PCE within biota does not generally occur; therefore, consumption of fish by humans and wildlife does not provide significant PCE exposure. Direct contact and ingestion of PCE contaminated water appear to represent the primary modes of human exposure to PCE.

Standards, Criteria and Guidelines

Unclassified as to carcinogenicity by EPA

Oral Slope Factor:	N/A
Inhalation Slope Factor:	N/A

Chronic Oral RfD:	1×10^{-2} mg/kg/day ⁱⁱ
Subchronic Oral RfD:	1×10^{-1} mg/kg/day ⁱⁱ
MCL:	0.005 mg/l
AWQC (Federal):	Water and Organism Consumption - 0.8 µg/L Organism Consumption - 8.85 µg/L Acute Freshwater Aquatic Life - N/A Chronic Freshwater Aquatic Life - N/A
GLWQG:	N/A
Sediment Guidelines	
NYSDEC:	Human Health - 0.8 µg/gOC

BIBLIOGRAPHY

ACGIH, 1984. *Documentation of the Threshold Limit Values*. American Conference of Governmental Industrial Hygienists.

Blair, A., P. Decoufle and D. Grauman, 1979. *Causes of death among laundry and dry cleaning workers*, *Am. J. Publ. Health*, 69: 508-511. (Cited in EPA, 1988).

GLWQB (Great Lakes Water Quality Board). 1989. Report to the International Joint Commission 128 pp.

HSDB, 1993. National Library of Medicine, *Hazardous Substances Data Bank*.

ICF, 1985. *Chemical, Physical and Biological Properties of Compounds Present at Hazardous Waste Sites*. Clement Associates, Inc.

NCI (National Cancer Institute). 1977. *Bioassay of Tetrachloroethylene for Possible Carcinogenicity*, *NCI Carcinogenesis Tech. Rep. Ser. Co.*, NCI-CGTR-13. (Cited in EPA, 1985).

Rowe, U.K., D.D. McCollister, H.C. Spencer, E.M. Adams and D.D. Irish, 1952. *Vapor Toxicity of Tetrachloroethylene for Laboratory Animals and Human Subjects*, *AMA Arch. Ind. Hyg. Occup. Med.*, 5:566-579. (Cited in EPA, 1985).

ⁱⁱFrom IRIS.

ⁱⁱFrom HEAST.

Schwetz, B.A., B.K.J. Leong, and P.J. Gehring, 1975. *The Effect of maternally inhaled trichloroethylene, perchloroethylene, methyl chloroform, and methylene chloride on embryonal and fetal development in mice and rats*, *Toxicol. Appl. Pharmacol.*, 32: 84-96. (Cited in EPA, 1985).

U.S. EPA, 1985. *Health Advisory for Tetrachloroethylene*, Office of Drinking Water.

IRIS, 1993. U.S. EPA *Integrated Risk Information System*.

TOXAPHENE

Use

Toxaphene is used as an insecticide for a wide range of crops (particularly cotton), in the control of animal parasites (HSDB, 1993), and was formerly used as a piscide (Eisler, 1985). In 1982, the EPA cancelled most registration uses of toxaphene existing stocks could be used through 1986. Canada had already banned its use in that country in 1971.

Chemical and Physical Properties

Chemical Formula: $C_{10}H_{10}Cl_8$

Boiling Point: N/A

Melting Point: 65-90°C

Molecular Weight: 414

Corrosivity: Corrosive to iron.

Specific Gravity: 1.65 at 25°C

Octanol/Water Partition Coefficients: 3.3

Solubilities: 3 mg/L water at room temperature.
Soluble in alcohol, acetone, and hexane.

Vapor Density: 14.3

Vapor Pressure: 0.4 mm Hg at 25°C

Other: N/A

Control

Filtration is effective for removing toxaphene adsorbed to suspended solids. Activated carbon is recommended for treatment of mixtures containing toxaphene. Effluents from five industrial plants were reduced to levels of less than 1 mg/L of toxaphene using activated carbon treatment (Bernardin, F.E., Froelich, E.M., 1975). Polyolefin or polyisobutylene or amberlite xad resin are also recommended for use in the cleanup of toxaphene (PTR, 1979). Effluent standards for toxaphene manufacturers are set at 1.5 µg/L for existing facilities and 0.1 µg/L for new facilities. Toxaphene is a toxic pollutant designated pursuant to Section 307(a)(1) of the Clean Water Act and is subject to effluent limitations (HSDB, 1993).

Source

The primary source of toxaphene throughout the Great Lakes is from atmospheric deposition (Allan et al., 1991).

Fate and Transport

Toxaphene, the final reaction product of camphene and chlorine, has a chlorine percent of 67 to 69 percent. According to Casida et. al. (1974), toxaphene contains at least 175 different C_{10} polychloro compounds.

Because toxaphene is a complex mixture of polychlorinated camphene derivatives, an inclusive assessment of its environmental transport and fate is difficult. Photolysis, oxidation, and hydrolysis do not appear to be important fate processes in aquatic systems. It is persistent in the environment and transport through soil water and air can occur relatively easily. Although little information is available, it appears that volatilization may be an important transport process.

Toxaphene is very stable in biological and chemical degradation processes in aerobic environmental systems, but it does undergo reduction of chlorination in anaerobic environments. Therefore, biodegradation of toxaphene is dependent on transport to anaerobic environments. A dominant process in aquatic systems is direct sorption on sediments or adsorption onto particulates, followed by deposition into sediment where biological and chemical reduction may occur. Bioaccumulation is an important environmental process for toxaphene. Adsorption by biota is rapid and significant uptake can occur in natural systems (ICF, 1985).

Biological Properties

Human Toxicity - Noncarcinogenic Effects

Acute exposure to toxaphene has been reported to produce congestion and edema of the lungs, dilation of the heart and petechial hemorrhages in the brain. Subchronic exposure results in kidney changes as well as changes in blood chemistry. Symptoms of acute oral toxaphene intoxication in humans include vomiting, convulsions, cyanosis and coma (ICF, 1985). There is also some evidence that toxaphene may cause genetic mutations (Hill, 1977; Sittig, 1991).

Human Toxicity - Carcinogenic Effects

Long-term carcinogenicity bioassays have shown that toxaphene is carcinogenic in rats and mice. Increased liver and thyroid tumors were observed in rats and mice exposed to toxaphene (NCI, 1979).

Ecotoxicity

Acute and chronic toxicity values for toxaphene have been determined for a range of freshwater and saltwater organisms. Toxaphene is considered extremely toxic to aquatic organisms and has resulted in fish kills and adverse effects on fish development and reproduction (Eisler, 1985). Bioconcentration factors among aquatic organisms range from about 1,200 to more than 50,000. Toxaphene is listed as a bioaccumulative chemical of concern by the Great Lakes Water Quality Guidance

(GLWQG). Although toxaphene is relatively less toxic to birds and mammals, bioaccumulation may result in exposure to excessive concentrations. Toxaphene is also reported to cause adverse effects in aquatic plant species.

Damaging Effects

Since toxaphene is biomagnified within the food chain, long-lived aquatic predators (e.g. trout and salmon) and people who consume these fish species would be most at risk from toxaphene exposure. Toxaphene concentrations reported in lake trout from Lake Ontario are generally below the Food and Drug Administration "action level" of 5 ppm but are above the whole body concentration of 0.4 ppm reported to result in acute and chronic effect to freshwater fish (Eisler, 1985).

Standards, Criteria, and Guidelines

EPA Class B2 Carcinogen

Oral Slope Factor:	1.1×10^0 (mg/kg/day) ^{1kk}
Inhal. Slope Factor:	1.1×10^0 (mg/kg/day) ^{1ll}
Chronic Oral RfD:	N/A
Subchronic Oral RfD:	N/A
MCL:	0.003 mg/l
AWQC (Federal):	Water and Organism Consumption: 7.3×10^{-4} µg/L Organism Consumption: 7.5×10^{-4} µg/L Acute Freshwater Aquatic Life - 7.3×10^{-1} µg/L Chronic Freshwater Aquatic Life - 2.0×10^{-4} µg/L Human Health - 2.0×10^{-5} µg/L
GLWQC:	
Sediment Guidelines	
NYSDEC:	Aquatic Toxicity - 0.01 µg/gOC Human Health - 0.02 µg/gOC

^{1k}From IRIS.

^{1l}From IRIS. Inhalation Slope Factor = Inhalation Unit Risk × Conversion Factor
Inhalation Unit Risk = 3.2×10^{-4} m³/µg
Conversion Factor = $3.5 \times 10^{+3}$

BIBLIOGRAPHY

Allan, R.J. et al. 1991. *Toxic chemicals in the Great Lakes and Associated Effects. Vol. I - Contaminant Levels and Trends.* Environment Canada, Dept. Fisheries and Oceans, Health and Welfare Canada. 488 pp.

Bernardin, F.E., Froelich, E.M., 1975. Purdue University 30th Industrial Waste Conference (cited in HSDB).

Casida, J.E., R.C. Holmstead, S. Khalifa, J.R. Knox, T. Ohsawc, K.J. Palmer, and R.J. Wong, 1974. *Science* 183, 520. (cited in Patty, 1981).

Eisler, R., and J. Jacknow. 1985. *Toxaphene hazards to fish, wildlife, and invertebrates: a synoptic review.* U.S. Fish and Wildl. Serv. Biol. Rep. 85(1.4). 26 pp.

Hill, R.N. 1977. Memorandum to Fred Hageman. Off. Spec. Pestic. Rev. U.S. EPA. December 15 (cited in IRIS).

HSDB. 1993. National Library of Medicine, *Hazardous Substances Data Bank.*

ICF. 1985. *Chemical Physical and Biological Properties of Compounds Present at Hazardous Waste Sites.* Clement Associates, Inc.

IRIS, 1993. U.S. EPA *Integrated Risk Information System.*

NCI. 1979. National Cancer Institute Bioassay of Toxaphene for possible carcinogenicity. Carcinogenesis Testing Program. Division of Cancer Cause and Prevention. NCI National Institute of Health, Bethesda, Maryland, 20014. U.S. Department of Health, Education, and Welfare. DHEW Publication No. (NIH) 79-837 (cited in IRIS).

Patty, F.A. 1981. *Patty's Industrial Hygiene and Toxicology.*

PTR. 1979. "Procedures Leading to Cleanup", *Pollution Technology Review* 59:23-86 (cited in HSDB).

Sittig, M., 1991. *Handbook of Toxic and Hazardous Chemicals and Carcinogens.*

APPENDIX B
INDUSTRIAL AND MUNICIPAL DISCHARGES

TABLE B-1. INDUSTRIAL POINT AND NON-POINT SOURCE DISCHARGES

Legend

(P)No loadings are presented for this facility, as this information cannot be accurately determined from the PCS computer program printout. However, there may be loadings of these chemicals from this facility. See Section 4.1.3 of this report for a detailed explanation.

Air (PS) = Point source emissions to air (Point source loadings determined by measurement or mass balance calculations)

Air (NPS) = Non-point source emissions to air (Non-point source loadings determined by mass balance calculations, erosion factors, or monitoring data)

Water = Point source emissions to surface water (Water discharge loadings determined by monitoring data)

Lead = Lead release - diploid method output

Lead (ED) = Lead release to surface water (Loadings determined by monitoring data)

Lead (OL) = Lead release to on-site landfills

MAL = Maximum Allowable Loading

MDPL = Maximum Daily Pollut. Level

Per SIC codes - see Table B-3

Re. Body refers to the surface water body to which the waste effluent is discharged. NA (not applicable) is noted for air discharges.

Blank boxes represent chemicals for which no loadings data were obtained for a given facility. The chemical may not have been detected in effluent, or analysis for that chemical may not have been performed.

Facility Name and Address	Toxic Chemical Loadings and Sources																
	Aromatics	Barbiturates	Benzene	Benzene	Benzene	Chlorobenzene	Chloroform	DDT #	Dieldrin	Heptachlor	Heptachlor	Lead	Mercury	Misc.	Octachloro-	PCBs (Total)	Tetrachloro-
Cattaraugus County 1. Monarch Tanning Company 265 Palmer St. Gettysburg Lat/Long: 42°27'00"/78°55'12" SIC = 3199 Re. Body = Cattaraugus Creek Ref #4												Water = 36 kg (91/92) Water = 8 kg (92/93)					
Chautauque County 1. Republic Inc. Barnes St. P.O. Box A Westfield Lat/Long: 42°19'20"/79°34'42" SIC = 3566 Re. Body = NA Ref #4												Air (NPS) = 2.25 kg (1991) Air (PS) = 2.25 kg (1991)					
2. Dunkirk Solid Waste Management Facility Lat/Long: 42°26'34"/79°25'46" SIC = 4911 Re. Body = Van Buren Bay Creek Ref #4	Water = 88 kg (91/92) Water = 13 kg (92/93)											Water = 48 kg (91/92) Water = 7 kg (92/93)	Water = 0.1 kg (91/92) Water = 0.1 kg (92/93)				
3. Dunkirk Steam Station 106 Point Drive North Dunkirk Lat/Long: 42°29'24"/79°20'55" SIC = 4911 Re. Body = Lake Erie Ref #4	Water = 0.2 kg (91/92) Water = 0.3 kg (92/93)											Water = 0.1 kg (91/92)					

TABLE B-1. INDUSTRIAL POINT AND NON-POINT SOURCE DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Aroclor	Benz(a)anthracene	Benz(a)pyrene	Benz(b)fluoranthene	Benz(k)fluoranthene	Chlordane	Chrysene	DDE & Metabolites	Dieldrin	Dioxin	Hexachlorobenzene	Lead	Mercury	Mirex	Octachlorostyrene	PCBs (total)	Tetrachloroethylene	Toxaphene
Erie County 1. PVS Chemical Inc. (10 mgd to Buffalo Creek) Ref #2							0.6 mg/l (.000058 gpd) Ref #3 Table 34					MAL = 1.14 kg/day Ref #2 pp. 5-34 MDPL = .03 mg/l Ref #2						
2. Buffalo Color Corp. Buffalo Lat/Long: 42°51'33"/78°50'36.9" Rec. Body = Buffalo River Ref #2,10												0.5 kg/day Ref #5 pp. B-4, B-1 0.5 mg/l Ref #2 pp. 5-11, 86- 87 data Total Metals 2.1 lbs/day Ref #5 pp. B-4, B-1						
3. Seneca Platers, Inc. Elma Lat/Long: 42°47'27.6"/78°39'21.4" Rec. Body = Canaserota Creek Ref #10 ~0.1 lbs/day total loading Ref #5 pp. 3-11	Water = 0.0048 kg (91/92), Ref #10											Water = 0.06 kg (91/92) Ref #10						
4. Occidental Technology Center, Long Rd. Grand Island Lat/Long: 43°03'02"/78°59'48" SIC = 8731 Rec. Body = Niagara River Ref #4	Water = 2.1 kg (91/92) Water = 2 kg (92/93)											Water = 2 kg (91/92) Water = 1 kg (92/93)					Water = 0.4 kg (91/92) Water = 1.6 kg (92/93)	
5. Tonawanda Coke Corp. Box A-500 Tonawanda Lat/Long: 42°58'54"/78°55'41" SIC = 3312 Rec. Body = Niagara River Ref #4	Water = 3.4 kg (91/92) Water = 8 kg (92/93)		Water = 4 kg (91/92) Water = 4 kg (92/93)															

TABLE B-1. INDUSTRIAL POINT AND NON-POINT SOURCE DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Aroclor	Benz(a)anthracene	Benz(a)pyrene	Benz(b)fluoranthene	Benz(k)fluoranthene	Chlordane	Chrysene	DDT & Metabolites	Dieldrin	Endrin	Hexachlorobenzene	Lead	Mercury	Mirex	Octachlorostyrene	PCBs (total)	Tetrachloroethylene	Toxaphene
6. Union Carbide Industrial Gases P.O. Box 44 Tonawanda Lat/Long: 42°58'35"/78°53'31" SIC = 3443 Rec. Body = Two Mile Creek Ref #4				Water = 3 kg (91/92) Water = 4 kg (92/93)								Water = 4 kg (91/92) Water = 7 kg (92/93)						
7. Tonawanda Engine Fit GM PWTRN P.O. Box 21 Tonawanda Lat/Long: 42°57'45"/78°54'55" SIC = 3714 Rec. Body = Niagara River Ref #4	Water = 8 kg (92/93)															Water = 6.56 kg (91/92)		
8. C.R. Huntley Generating Station Tonawanda Lat/Long: 42°58'13.0"/78°55'40.0" Rec. Body = Niagara River Ref #10												Water = 0.21 kg (91/92)						
9. Siveco New York Tonawanda Lat/Long: 42°58'56.6"/78°56'03.9" Rec. Body = Niagara River Ref #10	Water = 0.23 kg (91/92)											Water = 1.62 kg (91/92)						
10. Montrolsten Co. Inc. 1360 Niagara Street Buffalo Lat/Long: 41°53'86"/106°45'14" SIC = 2834 Rec. Body = NA Ref #6																	Air (PS) = 28,980 kg (1991)	
11. Olin Steel Corp. 2553 Walden Avenue Buffalo Lat/Long: 42°54'30"/78°44'25" SIC = 3316 Rec. Body = NA Ref #6												Air (PS) = 112.5 kg (1991)						

TABLE B-1. INDUSTRIAL POINT AND NON-POINT SOURCE DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Arsenic	Benzene(s) anthracene	Benzene(s) pyrene	Benzene(s) fluoranthene	Benzene(s) fluoranthene	Chloridane	Chrysene	DDT & Metabolites	Dieldrin	Dioxin	Hexachloro- benzene	Lead	Mercury	Mirex	Octachloro- styrene	PCBs (total)	Tetrachloro- ethylene	Toluene
12. Lackawanna Facilities 2558 Hamburg Turnpike Lackawanna Lat/Long: 42°48'55"/78°51'05" SIC = 3312 Rec. Body = Snake Creek Ref 04	Water = 4 kg (92/93)											Water = 449 kg (92/93)						
13. Bethlehem Steel Corp. Lackawanna Ref 05 p. B-1, B-4												0.5 kg/day						
												Total Metals 65.2 kg/day						
Genesee County 1. Lapp Insulator Co. Gilbert St. Leroy Lat/Long: 42°58'00"/78°08'00" SIC = 3264 Rec. Body = Outlin Creek Ref 04,6	Water = 0.1 kg (91/92) Water = 0.11 kg (92/93)											Water = 1 kg (91/92) Water = 1 kg (92/93)					Air (NPS) = 17,762 kg (1991) Air (PS) = 7,776 kg (1991) Water = 0.9 kg (1991) Water = 0.8 kg (91/92) Water = 0.5 kg (92/93)	
Eschschuer County Chicago Pneumatic Tool Co. Lat/Long: 43°05'05"/75°10'38" SIC = 9999 Rec. Body = Mohawk River Ref. 04												Water = 0.2 kg (92/93)						
Jefferson County 1. Fisher Gage Inc. Fisher Road Watertown Lat/Long: 43°59'32"/75°55'30" SIC = 3364 Rec. Body = NA Ref 06																	Air (PS) = 20,700 kg (1991)	

TABLE B-1. INDUSTRIAL POINT AND NON-POINT SOURCE DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Aromatic	Benz(a)anthracene	Benz(a)pyrene	Benz(b)fluoranthene	Benz(k)fluoranthene	Chlordane	Chrysene	DDE & Metabolites	Dieldrin	Dioxin	Hexachlorobenzene	Lead	Mercury	Misc.	Octachlorostyrene	PCBs (total)	Tetrachloroethylene	Toxaphene
2. Champion International Corp. Anderson Ave. Deerist Lat/Long: 44°02'20"/115°40'53" SIC = 2611 Rec. Body = Black River Ref #1A	Water = 1.2 kg (91/92) Water = 1 kg (92/93)																	
3. Fort Drum HTW Cogen Facility Lat/Long: 44°02'16"/115°46'10" SIC = 4911 Rec. Body = Black River Ref #4	Water = 0.2 kg (92/93)											Water = 17 kg (92/93)	Water = 0.06 kg (92/93)					
Lewis County 1. Lyonsdale Division 501 East Main Street Little Falls Lat/Long: 43°37'08"/55°18'24" SIC = 2621 Rec. Body = Mason River Ref #4	Water = 14 kg (92/93)																	
Madison County 1. Northeast Environmental Services Lat/Long: 43°05'00"/75°43'00" SIC = 9511 Rec. Body = Dutch Settles Creek Ref #4	Water = 0.3 kg (91/92) Water = 2 kg (92/93)											Water = 0.3 kg (91/92) Water = 0.8 kg (92/93)					Water = 0.04 kg (92/93)	
Monroe County 1. Eastman Kodak Co. 1609 Lake Ave. Rochester Lat/Long: 43°11'57"/77°44'55" SIC = 3999 Rec. Body = Genesee River Ref #1A	Water = 265 kg (91/92) Water = 372 kg (92/93)											Water = 995 kg (91/92) Water = 894 kg (92/93)	Water = 9.4 kg (91/92) Water = 10.4 kg (92/93)					
2. Babcock Generating Station 254 Mill St. Rochester Lat/Long: 43°09'43"/77°37'03" SIC = 4911 Rec. Body = Genesee River Ref #1A	Water = 0.7 kg (91/92) Water = 0.8 kg (92/93)											Water = 1.5 kg (91/92) Water = 1 kg (92/93)	Water = 0.04 kg (91/92) Water = 0.04 kg (92/93)					

TABLE B-1. INDUSTRIAL POINT AND NON-POINT SOURCE DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Arsenic	Benzene(s) and/or toluene	Benzene(s) pyrene	Benzene(s) fluoranthene	Benzene(s) fluoranthene	Chlorobenzene	Chrysene	DPT & Metabolites	Dieldrin	Endrin	Hexachloro- benzene	Lead	Mercury	Mirex	Octachloro- styrene	PCBs (total)	Tetrachloro- ethylene	Toxaphene
3. Sabin Metal Corp. 1647 Whetland Center Rd. Scottsville Lat/Long: 43°00'17"/77°49'12" SIC 3341 Rec. Body = Onaka Creek Ref 06												Air (PS) = 53.6 kg (1991) Air (NPS) = 6.3 kg (1991) Water = 5 kg (1991)						
4. Union Processing Corp. Union Street N. Chili Lat/Long: 43°06'25"/77°47'48" SIC = 5171 Rec. Body = Black Creek Ref 04												Water = 6 kg (91/92) Water = 3 kg (92/93)						
5. Xerox Corp. Wilson Center Xerox Square, Building 317 Rochester Lat/Long: 43°13'32"/77°24'40" SIC = 3861 Rec. Body = Mill Creek Ref 04																	Water = 1.5 kg (91/92) Water = 2 kg (92/93)	
Niagara County 1. GMC Harrison Radiator Div. 200 Upper Mountain Rd. Lockport Lat/Long: 43°10'00"/78°44'33" SIC = 3714, 3479 Rec. Body = The Gulf Ref 04,6	Water = 44 kg (91/92) Water = 52 kg (92/93)											Air (PS) = 112.5 kg (1991) Water = 121.5 kg (1991) Water = 644 kg (91/92) Water = 583 kg (92/93)					Air (PS) = 450 kg (1991) Air (NPS) = 12,150 kg (1991) Water = 34.7 kg (1991) Water = 75 kg (91/92) Water = 86 kg (92/93)	

TABLE B-1. INDUSTRIAL POINT AND NON-POINT SOURCE DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Arsenic	Benz(a)anthracene	Benz(a)pyrene	Benz(b)fluoranthene	Benz(k)fluoranthene	Chlordane	Chrysene	DBT & Metabolites	Dieldrin	Disin	Hexachlorobenzene	Lead	Mercury	Mirex	Octachlorostyrene	PCBs (total)	Tetrachloroethylene	Toxaphene
2. Olin Chemicals 2400 Buffalo Avenue Niagara Falls Lat/Long: 43°04'39"/79°02'00" SIC = 2819 Rec. Body = Niagara River Ref #6													Water = 1.4 kg (1991)					
3. Stauffer Management Co. Lewington Lat/Long: 43°08'50"/79°03'30" Rec. Body = Niagara River Ref #10																	Water = 0.65 kg (91/92)	
4. Frontier Stone, Inc. P.O. Box 467 Himman Rd. Lockport Lat/Long: 43°09'15"/78°43'35" SIC = 1429 Rec. Body = Barge Canal Ref #4												Water = 4 kg (92/93)						
5. Great Lakes Carbon Corp. Niagara Falls Lat/Long: 43°03'28.7"/78°59'46.3" Rec. Body = Niagara River Ref #10												Water = 96.88 kg (91/92)						
6. Olin Corp. Niagara Falls Plant Niagara Falls Lat/Long: 43°04'35.5"/79°01'46.4" Rec. Body = Niagara River Ref #10 Ref #5 p. 5-2													Water = 0.01 kg (91/92)					
7. E.I. DuPont de Nemours Co. Niagara Falls Lat/Long: 43°04'47"/79°01'37" SIC = 2869 Rec. Body = Niagara River Ref #4												Water = 50 kg (91/92) Water = 0.8 kg (92/93)	Water = 8 kg (91/92) Water = 0.4 kg (92/93)				Water = 3 kg (91/92) Water = 8.2 kg (92/93)	

TABLE B-1. INDUSTRIAL POINT AND NON-POINT SOURCE DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Arsenic	Benz(a)anthracene	Benz(a)pyrene	Benz(b)fluoranthene	Benz(k)fluoranthene	Chlorides	Chrysene	DOT & Metabolites	Dibenz(a,h)anthracene	Dibenz(b,h)anthracene	Dibenz(f,h)anthracene	Lead	Mercury	Miscellaneous	Polychlorinated biphenyls	PCBs (total)	Tetrachloroethylene	Triphenyl
8. Occidental Chemical Corp. 47th Street at Buffalo Ave. Niagara Falls Lat/Long: 43°04'46"/79°00'32" SIC = 2869, 2812, 2819, 2865 Rec. Body = Niagara River Ref #4,6												Water = 31 kg (91/92) Water = 2 kg (92/93)	Water = 0.45 kg (1991) Water = 12 kg (91/92) Water = 7 kg (92/93)	Water = 0.4 kg (91/92) Water = 0.4 kg (92/93)			Air (NPS) = 2,970 kg (1991) Air (PS) = 7,200 kg (1991) Water = 288 kg (1991) Water = 131 kg (91/92) Water = 172 kg (92/93)	
												Total Metals 9.0 lbs/day Ref #5 p. B-1						
9. Niagara Recycling Inc. Packard Rd. Niagara Falls Lat/Long: 43°03'53"/78°59'27" SIC = 4953 Rec. Body = Niagara River Ref #4	Water = 2 kg (91/92) Water = 2 kg (92/93)											Water = 3.4 kg (91/92) Water = 4 kg (92/93)	Water = 0.1 kg (91/92) Water = 0.2 kg (92/93)					
10. Occidental Chemical - Dana Div. Walck Rd. N. Tonawanda Lat/Long: 43°02'48"/78°51'34" SIC = 2821 Rec. Body = Niagara River Ref #4													Water = 0.4 kg (92/93)				Total VOCs 0.2 lbs/day Ref #5 p. B-1	
												Total Metals 0.3 lbs/day Ref #5 p. B-1						

APPENDIX G

**LAKE ONTARIO BASIN
AND MAJOR SUB-BASINS**

TABLE B-1. INDUSTRIAL POINT AND NON-POINT SOURCE DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Arsenic	Benzene (nitrated)	Benzene (pyrene)	Benzene (fluorinated)	Benzene (chlorinated)	Chlorobenzene	Chrysene	DBP & Microbicides	Endrin	Dieldrin	Heptachloro- benzene	Lead	Mercury	Mirex	Octachloro- styrene	PCBs (total)	Tetrachloro- ethylene	Toxaphene
11. CWM Chemical Services Inc., 1550 Bolmer Rd. Medford City Lat/Long: 43°13'24"/78°58'29" SIC = 0953 Rec. Body = Niagara River Ref 04, 10	Water = 6 kg (91/92) Water = 9 kg (92/93)											Water = 6 kg (91/92) Water = 6 kg (92/93)	Water = 0.2 kg (91/92) Water = 0.3 kg (92/93)			Water = 1.2 kg (91/92)		
12. PMC Corp. 100 Niagara St. Middle Port Lat/Long: 43°12'29"/78°28'21" SIC = 2879 Rec. Body = Jordan Creek Ref 01A	Water = 7 kg (92/93)								Water = 0.04 kg (92/93)			Water = 0.9 kg (92/93)						
13. Sigi Great Lakes Carbon P.O. Box 667 Niagara Falls Lat/Long: 43°05'28"/78°59'47" SIC = 9999 Rec. Body = Niagara River Ref 04												Water = 107 kg (91/92) Water = 109 kg (92/93)						
14. Somerset Generating Station Lake and Homer Rd. Somerset Lat/Long: 43°21'00"/78°34'00" SIC = 4911 Rec. Body = Lake Ontario Ref 04													Water = 0.3 kg (91/92) Water = 15 kg (92/93)					
Quebec County 1. Ontario Ltd. Main Plant E. Source Street Shawville Lat/Long: 43°04'39"/75°30'06" SIC = 3914 Rec. Body = Scummon Creek Ref 06												Water = 22.5 kg (1991)						

TABLE B-1. INDUSTRIAL POINT AND NON-POINT SOURCE DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Aromatic	Benzene(s) anthracene	Benzene(s) pyrene	Benzene(s) fluoranthene	Benzene(s) fluoranthene	Chlordane	Chrysene	DDT & Metabolites	Dieldrin	Dioxin	Hexachloro- benzene	Lead	Mercury	Mirex	Octachloro- styrene	PCBs (total)	Tetrachloro- ethylene	Toluene
2. Camden Wire Co. Inc. 12 Masonic Ave Camden Lat/Long: 43°20'10"/75°45'02" SIC = 3357, 3479, 3471 Rec. Body = West Branch Fish Creek Ref 04,6												Air (NPS) = 2.25 kg (1991) Air (PS) = 112.5 kg (1991) Water = 2.25 kg (1991) Water = 2 kg (92/93)						
3. Indiana Corp. of America 1676 Lincoln Avenue Utica Lat/Long: 43°05'36"/75°15'38" SIC = 3341 Rec. Body = NA Ref 06												Air (PS) = 5.4 kg (1991)						
4. Indiana Corp. of America 23 Robinson Rd. Clinton Lat/Long: 43°03'56"/75°22'12" SIC = 3341 Rec. Body = NA Ref 06												Air (PS) = 18.5 kg (1991)						
5. Rovers Copper Products, Inc. Sonoma St Rome Lat/Long: 43°12'37"/75°26'05" SIC = 3351 Rec. Body = Barge Canal/ Mohawk River Ref 04,6												Air (NPS) = 2.25 kg (1991) Air (PS) = 6.75 kg (1991) Water = 63 kg (1991) Water = 19 kg (91/92) Water = 7 kg (92/93)						

TABLE B-1. INDUSTRIAL POINT AND NON-POINT SOURCE DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Aromatic	Benz(a)anthracene	Benz(a)pyrene	Benz(b)fluoranthene	Benz(k)fluoranthene	Chlordane	Chrysene	DDT & Metabolites	Dieldrin	Dioxin	Hexachlorobenzene	Lead	Mercury	Mirex	Octachlorostyrene	PCBs (total)	Tetrachloroethylene	Toxaphene
6. Rome Cable Corp. 421 Ridge St. Rome Lat/Long: 43°12'45"/75°28'10" SIC = 3351 Rec. Body = Wood Creek Ref #4												Water = 36 kg (92/93)						
7. U.S. Dept. of Air Force 416 CSO/CC Rome Lat/Long: 43°13'23"/75°24'23" SIC = 9711 Rec. Body = Six Mile Creek Ref #4												Water = 0.4 kg (91/92) Water = 2 kg (92/93)						
8. Onondaga Silvermith Main Plant Lat/Long: 43°04'42"/75°35'59" SIC = 3479 Rec. Body = Scammonden Creek Ref #4												Water = 32 kg (91/92) Water = 34 kg (92/93)						
Onondaga County 1. Allied Chemical - Syracuse Works P.O. Box 6 Solvay Lat/Long: 43°03'43"/76°12'13" SIC = 2812 Rec. Body = Onondaga Lake Ref #1,4													Water = 0.1 kg (91/92) Water = 0.07 kg (92/93)					
2. Production Products Co. 133 W. Seneca Street Madison Lat/Long: 42°59'59"/75°59'01" SIC = 3451 Rec. Body = Limestone Creek Ref #6												Land = 1.4 kg (1991)						

TABLE B-1. INDUSTRIAL POINT AND NON-POINT SOURCE DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Aroclors	Benz(a)anthracene	Benz(a)pyrene	Benz(b)fluoranthene	Benz(k)fluoranthene	Chlordane	Chrysene	DDT & Metabolites	Dieldrin	Dioxin	Hexachlorobenzene	Lead	Mercury	Mirex	Octachlorostyrene	PCBs (total)	Tetrachloroethylene	Toxaphene
3. Adconia Wire 6176 E. Molloy Rd E. Syracuse Lat/Long: 43°05'56"/16°05'33" SIC = 3398 Rec. Body = NA Ref 86												Air (NPS) = 0.45 kg (1991) Air (PS) = 40.5 kg (1991)						
4. Syracuse China Corp. 2980 Court Street Syracuse Lat/Long: 43°05'33"/16°07'49" SIC = 3262 Rec. Body = Ley Creek Ref 84,6												Air (NPS) = 112.5 kg (1991) Air (PS) = 112.5 kg (1991) Water = 5.9 kg (1991) Water = 21 kg (91/92) Water = 13 kg (92/93) Land (OL) = 12.6 kg (1991)						
5. Standif Chemical Co. Jordan Rd. Skaneateles Falls Lat/Long: 42°59'23"/16°27'01" SIC = 4952 Rec. Body = Skaneateles Creek Ref 84	Water = 0.1 kg (91/92) Water = 0.1 kg (92/93)											Water = 0.3 kg (91/92)					Water = 0.7 kg (91/92)	
6. Carousel Center Lat/Long: 43°04'00"/16°18'30" SIC = 5311 Rec. Body = Barge Canal Ref 84												Water = 2 kg (91/92) Water = 1 kg (92/93)						
7. Jordan Road Industrial Division Jordan Rd. Skaneateles Falls Lat/Long: 42°59'41"/16°27'29" SIC = 3479 Rec. Body = Skaneateles Creek Ref 84												Water = 0.6 kg (92/93)						

TABLE B-1. INDUSTRIAL POINT AND NON-POINT SOURCE DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Aroclor	Benzo(a)anthracene	Benzo(a)pyrene	Benzofluranthenes	Benzofluoranthene	Chlordane	Chrysene	DDT & Metabolites	Dieldrin	Dibutyltin	Hexachlorobenzene	Lead	Mercury	Mirex	Octachlorostyrene	PCBs (total)	Trichloroethylene	Tetraphene
8. Oberdorfer Industries, Inc. Thompson Rd. Syracuse Lat/Long: 43°04'28"/76°05'41" SIC = 9999 Rec. Body = Ley Creek Ref 84												Water = 0.2 kg (92/93)						
9. Roth Brothers Smelting Corp. Lat/Long: 43°04'22"/76°05'41" SIC = 3341 Rec. Body = Ley Creek Ref 84												Water = 21 kg (91/92) Water = 4 kg (92/93)						
10. Syron, Inc. State Fair Boulevard Baldwinsville Lat/Long: 43°08'09"/76°18'08" SIC = 3009 Rec. Body = Seneca River Ref 84	Water = 0.2 kg (91/92)											Water = 12 kg (91/92) Water = 14 kg (92/93)						
11. Thompson Road Site Thompson Road Dewitt Lat/Long: 43°04'38"/76°05'04" SIC = 3585 Rec. Body = Sandlers Creek Ref 84												Water = 17 kg (91/92)						
Ontario County 1. Eldredge Inc. 729 Cross Road Oaks Corners Lat/Long: 42°55'55"/77°00'34" SIC = 3479, 3441, 3993 Rec. Body = NA Ref 86												Air (NPS) = 2.25 kg (1991) Air (PS) = 7.2 kg (1991)						

TABLE B-1. INDUSTRIAL POINT AND NON-POINT SOURCE DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Arsenic	Benzene(a) anthracene	Benzene(a) pyrene	Benzene(b) fluoranthene	Benzene(b) fluoranthene	Chlordane	Chrysene	DDT & Metabolites	Dieldrin	Dioxin	Hexachlorobenzene	Lead	Mercury	Mirex	Orthochlorobenzene	PCBs (total)	Tetrachloroethylene	Toxaphene
Oswego County 1. Armstrong World Industries P.O. Box 250 Route 57 Fulton Lat/Long: 42°21'15"/76°25'34" SIC = 2621 Rec. Body = Oswego River Ref #14	Water = 30 kg (92/93)											Water = 18 kg (92/93)						
2. Omega Wire, Inc. Northside Rte. 13 Williamstown Lat/Long: 43°25'36"/75°53'34" SIC = 3471 Rec. Body = Fish Creek Ref #4												Water = 0.1 kg (92/93)						
3. Schoeller Technical Papers, Inc. P.O. Box 250 Palski Lat/Long: 43°33'29"/76°06'30" SIC = 2621 Rec. Body = Salmon River Ref. #4												Water = 234 kg (91/92)						
St. Lawrence County 1. Newton Falls Paper Mill Ref #7																10,001 - 100,000 lbs/ yr (1988 TRI Data)		
2. Alcoa Park Ave E. P.O. Box 150 Massena Lat/Long: 44°57'17"/74°52'58" SIC = 3334, 3354, 3355 Rec. Body = Grasse River Ref #6												Air (NPS) = 171 kg (1991) Air (PS) = 1530 kg (1991) Water = 180 kg (1991) Land (SI) = 166.5 kg (1991)						

TABLE B-1. INDUSTRIAL POINT AND NON-POINT SOURCE DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Arsenic	Benz(a)anthracene	Benz(a)pyrene	Benz(b)fluoranthene	Benz(k)fluoranthene	Chlordane	Chrysene	DDT & Metabolites	Dieldrin	Heptachlor Epoxide	Heptachloro-benzene	Lead	Mercury	Mirex	Octachloro-styrene	PCBs (total)	Tetrachloro-ethylene	Toxaphene
3. St. Lawrence Reduction Plant Southgras River Rd. Massena Lat/Long: 44°58'56"/74°45'08" SIC = 3334 Rec. Body = St. Lawrence River Ref #4	Water = 11 kg (91/92) Water = 7 kg (92/93)		Water = 5 kg (91/92) Water = 5 kg (92/93)	Water = 13 kg (91/92) Water = 6 kg (92/93)														
4. Bohmat Mine #4 & Mill No 4 Tailings Fowler Lat/Long: 44°15'49"/75°24'33" SIC = 1031 Rec. Body = Oswegatchie River Ref #4												Water = 101 kg (91/92) Water = 60 kg (92/93)						
05. Hyatt Mine Lat/Long: 44°18'23"/75°18'57" SIC = 1031 Rec. Body = Oswegatchie River Ref #4												Water = 314 kg (91/92) Water = 193 kg (92/93)	Water = 0.2 kg (91/92) Water = 0.4 kg (92/93)					
6. Port St. Lawrence Lat/Long: 44°57'50"/75°54'10" SIC = 5171 Rec. Body = St. Lawrence River Ref #4		Water = 0.07 kg (92/93)	Water = 0.07 kg (92/93)		Water = 0.07 kg (92/93)		Water = 0.07 kg (92/93)					Water = 16 kg (92/93)						
7. Massena Operations P.O. Box 150 Massena Lat/Long: 44°57'08"/74°53'39" SIC = 3334 Rec. Body = Grass River Ref #4			Water = 21 kg (91/92) Water = 22 kg (92/93)															

TABLE B-1. INDUSTRIAL POINT AND NON-POINT SOURCE DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Arsenic	Benz(a)anthracene	Benz(a)pyrene	Benz(b)fluoranthene	Benz(k)fluoranthene	Chlordane	Chrysene	DDT & Metabolites	Dibahin	Dieldrin	Hexachlorobenzene	Lead	Mercury	Mirex	Octachlorostyrene	PCBs (total)	Tetrachloroethylene	Toxaphene
Seneca County 1. Evans Chromatics Div. P.O. Box 460 228 East Main St. Waterloo Lat/Long: 42°54'04"/76°51'10" SIC = 2869 Rec. Body = Seneca River Ref #14													Water = 0.07 kg (92/93)					
2. Gould Pumps, Inc. Engineered Products, Div. 240 Fall St Seneca Falls Lat/Long: 42°55'13"/76°47'58" SIC = 3561 Rec. Body = Seneca River Ref #4,6												Air (NPS) = 7.7 kg (1991) Air (PS) = 9.5 kg (1991) Land = 3.6 kg (1991)	Water = 0.1 kg (91/92) Water = 0.06 kg (92/93)					
Tompkins County 1. Milliken Ash Disposal Site Lat/Long: 42°36'20"/76°37'30" SIC = 4911 Rec. Body = Cayuga Lake Ref #14	Water = 8 kg (91/92) Water = 8 kg (92/93)												Water = 0.04 kg (92/93)					
2. Thorma, Inc. Hudson St Extension Ithaca Lat/Long: 42°25'47"/76°29'23" SIC = 3511, 3728, 3724, 3599 Rec. Body = NA Ref #6																	Air (PS) = 112.5 kg (1991) Air (NPS) = 112.5 kg (1991)	
Wayne County 1. Glisan Nuclear Power Plant Station 13 2640 Lake Rd. Ontario Lat/Long: 43°16'40"/77°18'32" SIC = 4911 Rec. Body = Lake Ontario Ref #14	(*)											(*)	(*)					

TABLE B-1. INDUSTRIAL POINT AND NON-POINT SOURCE DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Arsenic	Benzene(s) anthracene	Benzene(s) pyrene	Benzene(s) fluoranthene	Benzene(s) fluoranthene	Chlorobenzene	Chrysene	DDT & Metabolites	Dibenz(a,h) anthracene	Dibenz(a,h) anthracene	Hexachloro- benzene	Lead	Mercury	Mirex	Octachloro- styrene	PCBs (total)	Tetrachloro- ethylene	Toxaphene
2. Mobil Chemical Co. Design Products Rte 31 Macdon Lat/Long: 43°04'08" / 77°19'53" SIC = 3481 Rec. Body = NA Ref 06																	Air (NPS) = 337.5 kg (1991) Air (FS) = 15,750 kg (1991)	
3. Macdon Complex Macdon Lat/Long: 43°04'16" / 77°17'43" SIC = 3089 Rec. Body = Barge Canal Ref 04												Water = 0.2 kg (91/92) Water = 0.1 kg (92/93)						
Wyoming County 1. Champion Products, Inc. 208 N. Main St. Perry Lat/Long: 42°43'33" / 77°39'33" SIC = 2389 Rec. Body = NA Ref 06																	Air (NPS) = 5,067 kg (1991)	
2. Martin Tubing, Inc. Pearl Creek Rd. Wyoming Lat/Long: 42°50'33" / 78°03'19" SIC = 3498 Rec. Body = GW Ref 04												Water = 0.3 kg (91/92) Water = 0.5 kg (92/93)						
Yates County 1. Greenridge Generating Station Dresden Lat/Long: 42°40'46" / 76°56'55" SIC = 4911 Rec. Body = Keston Outlet Ref 01,4	Water = 266 kg (92/93)																	

TABLE B-1. INDUSTRIAL POINT AND NON-POINT SOURCE DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Arsenic	Benzo(a)anthracene	Benzo(a)pyrene	Benz(b)fluoranthene	Benz(k)fluoranthene	Chlordane	Chrysene	DDT & Metabolites	Dieldrin	Dioxin	Hexachlorobenzene	Lead	Mercury	Mirex	Octachlorostyrene	PCBs (total)	Tetrachloroethylene	Toxaphene
2. Lockwood Ash Disposal Facility Swarthout Rd. Torrey Lat/Long: 42°40'45"/16°57'40" SIC = 4931 Rec. Body = Koska Outlet Ref #4	Water = 0.6 kg (91/92) Water = 10 kg (92/93)												Water = 0.1 kg (91/92) Water = 0.1 kg (92/93)					
Proctor county location unknown 1. PVS Chemical Corp. Ref #5 p. B-1, B-4												0.3 lbs/day						
												Total Metals 2.5 lbs/day						
2. General Motors Corp. Ref #5 p. B-1, B-4													0.1 lbs/day					
												Total Metals 4.2 lbs/day						
3. Spaulding Fibre Co. Ref #5 p. B-1											Total Other BNAs 0.2 lbs/ day	Total Metals 9.0 lbs/day						

References

- Ref #1: Lake Ontario Toxic Management Plan Industrial Discharge.
 Ref #2: Buffalo River Remedial Action Plan, NYDEC 11/88.
 Ref #3: Information Summary, Area of Concern, Buffalo River, NY. U.S. Army Waterways Experiment Station Army Corps of Engineers, Miscellaneous Paper EL-91-3, March 1991. Final Report.
 Ref #4: Permit Compliance System, Retrieved dated 8/16/93. Data designated (92/93), and (91/92), means data reported are for each respective fiscal year.
 Ref #5: NYDEC, 1991. 1988-1990 Toxic Substances Discharges from Point Sources to the Niagara River. August 1991.
 Ref #6: TRI received for 1991 (latest year available). Data designated (1991) means data reported are for calendar year 1991.
 Ref #7: Great Lakes Basin Risk Characterization Study, Great Lakes National Programs Office.
 Ref #8: Oswego River Remedial Action Plan 1991 Update.
 Ref #9: Lake Ontario Toxic Management Plan Municipal Discharge.
 Ref #10: Permit Compliance System, Retrieved dated 9/30/92.

TABLE B-2. MUNICIPAL POINT SOURCE DISCHARGES

For SIC codes - see Table B-1

Air (P2) = Point source emissions to air (Point source loadings determined by measurements or mass balance calculations)

Air (P2S) = Non-point source emissions to air (Non-point source loadings determined by mass balance calculations, emissions factors, or monitoring data)

Water = Point source emissions to surface water (Water discharge loadings determined by monitoring data)

Land = Land release - digested method unknown

Land (SD) = Land release to surface impoundment (loadings determined by monitoring data)

Land (DL) = Land release to on-site landfill

MAF = Maximum Allowable Loading

MDPL = Maximum Daily Permit Limit

Rec. Body refers to the surface water body to which the water effluent is discharged. NA (not applicable) is used for air discharges.

Blank boxes represent chemicals for which no loading data was obtained for a given facility. The chemicals may not have been detected in effluent, or analysis for that chemical may not have been performed.

Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Arsenic	Benz(a)anthracene	Benz(a)pyrene	Benz(b)fluoranthene	Benz(k)fluoranthene	Chlordane	Chrysene	DDT & Metabolites	Dieldrin	Dibutyl	Dibutyltin	Lead	Mercury	Misc.	Octachloro-styrene	PCBs (total)	Tetrachloro-ethylene	Toxaphene
Cayuga County 1. Auburn (C) STP Bradley St. Auburn Lat/Long: 42°56'39"76°35'57" SIC = 4952 Rec. Body = Oswego Outlet Ref #4,9												Water = 54 kg (91/92) Water = 122 kg (92/93)						
Chautauque Dunkirk (C) WWTP Wright Park Drive Dunkirk Lat/Long: 42°29'55"79°19'06" SIC = 4952 Rec. Body = Lake Erie Ref #4	Water = 15 kg (92/93)																	
Cortland County La Roy R. Sanborn WWTP 251 Port Watson St. Cortland Lat/Long: 42°35'47"76°09'30" SIC = 4952 Rec. Body = Tioughnioga River Ref #4	Water = 5 kg (91/92) Water = 218 kg (92/93)											Water = 444 kg (91/92) Water = 14 kg (92/93)						

TABLE B-2. MUNICIPAL POINT SOURCE DISCHARGES

TABLE B-2. MUNICIPAL POINT SOURCE DISCHARGES																		
Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Arsenic	Benzene(s) anthracene	Benzene(s) pyrene	Benzene(s) fluoranthene	Benzene(s) benzofluoranthene	Chlorobenzene	Chrysene	DDT & Metabolites	Dibenz(a,h) anthracene	Dibenz(a,h) fluoranthene	Hexachloro- benzene	Lead	Mercury	Mirex	Octachloro- styrene	PCBs (total)	Tetrachloro- ethylene	Triphenyl
Erie County 1. Erie County SD #3 WWTP 260 Lehigh Ave. Lackawanna Lat/Long: 42°48'01"/78°51'03" SIC = 4952 Rec. Body = Snake Creek Ref #4													Water = 5 kg (92/93)					
2. Amherst SD #16 STP Amherst Lat/Long: 43°02'55"/78°48'40" SIC = 4952 Rec. Body = Tonawanda Creek Ref #10													Water = 7 kg (91/92) Water = 2.5 kg (91/92)					
3. Bird Island WWTP Foot of Ferry St. Buffalo Lat/Long: 42°55'27"/78°54'12" SIC = 4952 Rec. Body = Niagara River Ref #4												Water = 1059 kg (92/93)					Water = 315 kg (91/92) Water = 268 kg (92/93)	
4. Grand Island SD #2 WWTP Grand Island Lat/Long: 43°03'25"/78°58'10" SIC = 4952 Rec. Body = Niagara River Ref #10												Water = 50.53 kg (91/92) Ref #10 2.8 lbs/day Ref #5 pp. B-1, B-5, B-6					Water = 6.4 kg (91/92) Ref #10 0.3 lbs/day Ref #5 pp. B-1, B-5, B-6	
												Total Metals 55.9 lb/day Ref #5 pp. B-1, B-5, B-6						

TABLE B-2. MUNICIPAL POINT SOURCE DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Arsenic	Benz(e)a anthracene	Benz(a) pyrene	Benz(b) fluoranthene	Benz(k) fluoranthene	Chlordane	Chrysene	DDT & Metabolites	Dieldrin	Endrin	Heptachloro- epoxide	Lead	Mercury	Mirex	Octachloro- styrene	PCBs (total)	Tetrachloro- ethylene	Toxaphene
5. Tonawanda (T) SD#2 STP 750 Two Mile Creek Rd. Tonawanda Lat/Long: 42°59'40"/78°54'11" SIC = 4952 Rec. Body = Niagara River Ref #4												Water = 520 kg (91/92) Water = 141 kg (92/93)						
6. Erie County Sewer Dist. #6 WWTP (Lackawanna WWTP) Ref #5 p. B-1												Total Metals 5.4 lbs/day					Total VOCs 0.2 lbs/day	
7. Town of Tonawanda WWTP Ref #5 p. B-1												Total Metals 15.2 lbs/day					Total VOCs 2.5 lbs/day	
8. Town of Amherst WWTP Ref #5 p. B-1												Total Metals 8.9 lbs/day					Total VOCs 21.2 lbs/day	
Geneese County 1. Batavia (C) WPCP South Main St. Batavia Lat/Long: 42°59'55"/78°11'24" SIC = 4952 Rec. Body = Tonawanda Creek Ref #4												Water = 37 kg (91/92) Water = 35 kg (92/93)						
Jefferson County 1. Watertown WPCP 700 W.T. Field Drive Watertown Lat/Long: 43°59'24"/75°55'44" SIC = 4952 Rec. Body = Black River Ref #4.9												Water = 250 kg (91/92) Water = 106 kg (92/93)	Water = 14 kg (91/92) Water = 14 kg (92/93)					

TABLE B-2. MUNICIPAL POINT SOURCE DISCHARGES

TABLE B-2. MUNICIPAL POINT SOURCE DISCHARGES																		
Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Arsenic	Benz(a)anthracene	Benz(b)pyrene	Benz(k)fluoranthene	Benz(a)fluoranthene	Chlordane	Chrysene	DDT & Metabolites	Dib(d)in	Dioxin	Benz(b)fluoranthene	Lead	Mercury	Mirex	Octachloro-styrene	PCBs (total)	Tetrachloro-ethylene	Toxaphene
Monroe County 1. Gates - Chili Ogden S.D. WWTP Rochester Lat/Long: 43°06'16"/77°41'04" SIC = 4952 Rec. Body = Genesee River Ref 64,9												Water = 109 kg (92/93)						
2. Frank Van Lare STP Pine Grove Ave. Rochester Lat/Long: 43°14'14"/77°34'40" SIC = 4952 Rec. Body = Lake Ontario Ref 64,9												Water = 772 kg (91/92) Water = 928 kg (92/93)					Water = 387 kg (91/92) Water = 159 kg (92/93)	
3. Monroe County Water Authority 4799 Dewey Ave. Rochester Lat/Long: 43°16'05"/77°38'52" SIC = 4941 Rec. Body = Round Pond Ref 64												Water = 359 kg (91/92) Water = 417 kg (92/93)						
4. Walter W. Bradley WPCF 226 Phillips Rd. Webster Lat/Long: 43°15'39"/77°24'51" SIC = 4952 Rec. Body = Lake Ontario Ref 64												Water = 11 kg (91/92) Water = 18 kg (92/93)	Water = 3 kg (91/92) Water = 4 kg (92/93)					
Niagara County 1. Lockport (C) WWTP Plank Rd. Lockport Lat/Long: 43°11'07"/78°42'22" SIC = 4952 Ref 64,9												Water = 65 kg (91/92) Water = 68 kg (92/93)	Water = 2.5 kg (91/92) Water = 3.2 kg (92/93)					

TABLE B-2. MUNICIPAL POINT SOURCE DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources																
	Arsenic	Benz(e)a anthracene	Benz(a) pyrene	Benz(b) fluoranthene	Benz(k) fluoranthene	Chlordane	Chrysene	DDT & Metabolites	Dieldrin	Diurich	Heptachlor- epoxide	Lead	Mercury	Mirex	Octachloro- styrene	PCBs (total)	Tetrachloro- ethylene
2. Niagara Falls (c) WWTP, Niagara Falls Lat/Long: 43°04'54"/79°02'44" Rec. Body = Niagara River Ref #10		Water = 6.67 kg (91/92)					Water = 6.67 kg (91/92)				Water = 24.9 kg (91/92)	Water = 1153.74 kg (91/92)	Water = 1153.74 kg (91/92)	Water = 0.53 kg (91/92)		Water = 4.63 kg (91/92)	Water = 267.21 kg (91/92)
												Total Metals 28.0 lbs/day Ref #5 pp. B-1, B-7					3.0 lbs/day Ref #5 pp. B-1, B-7
3. N. Tonawanda (c) WWTP 830 River Rd. Tonawanda Lat/Long: 43°02'41"/78°53'21" SIC = 4952 Rec. Body = Niagara River Ref #4											Total Other BNAs 4.0 lbs/ day Ref #5 pp. B-1, B-6	Water = 760 kg (91/92) Water = 1005 kg (92/93) 2.4 lbs/day Ref #5 pp. B-1, B-6					Total VOCs 0.8 lbs/day Ref #5 pp. B-1, B-6
												Total Metals 57.8 lbs/day Ref #5 pp. B-1, B-6					
4. Niagara County SD #1 WWTP 2255 River Rd. Niagara Falls Lat/Long: 43°04'12"/78°53'32" SIC = 4952 Rec. Body = Niagara River Ref #4	Water = 25 kg (91/92) Water = 35 kg (92/93)											Water = 26 kg (91/92) Water = 11 kg (92/93)	Water = 7.5 kg (91/92) Water = 6 kg (92/93)				Total VOCs 6.7 lbs/day Ref #5 pp. B-1, B-6
												Total Metals 32.9 lbs/day Ref #5 pp. B-1, B-6					

TABLE B-2. MUNICIPAL POINT SOURCE DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Aroclor	Benz(a)anthracene	Benz(b)pyrene	Benz(k)fluoranthene	Benz(a)fluoranthene	Chlordane	Chrysene	BOT & Metabolites	Bisphenol	Dieldrin	Heptachlor-epoxide	Lead	Mercury	Mirex	Octachloro-styrene	PCBs (total)	Tetrachloro-ethylene	Toxaphene
5. Middleport (V) WWTP N. Harkland St. Middleport Lat/Long: 43°13'31"/78°28'46" SIC = 4952 Rec. Body = Judds Creek Ref 64												Water = 29 kg (92/93)						
Oswego County 1. Rome Municipal STP 7180 Dominick St. Rome Lat/Long: 43°12'06"/75°24'41" SIC = 4952 Rec. Body = Mohawk River/Barge Canal Ref 64												Water = 46 kg (91/92) Water = 107 kg (92/93)	Water = 5.8 kg (91/92) Water = 3.5 kg (92/93)					
Oswego County 1. Watzel Rd WWTP Watzel Rd. N. Syracuse Lat/Long: 43°08'52"/76°14'12" SIC = 4952 Rec. Body = Seneca River Ref 64.9												Water = 86 kg (91/92) Water = 107 kg (92/93)						
2. Oak Orchard STP Oak Orchard Rd. Chap Lat/Long: 43°12'05"/76°13'00" SIC = 4952 Rec. Body = Oswego River Ref 64.9												Water = 154 kg (91/92) Water = 222 kg (92/93)					Water = 31 kg (91/92) Water = 18 kg (92/93)	

TABLE B-2. MUNICIPAL POINT SOURCE DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Arenas	Benz(a)anthracene	Benz(b)pyrene	Benz(k)fluoranthene	Benz(h)fluoranthene	Chlordane	Chrysene	DDT & Metabolites	Dieldrin	Dioxin	Hexachlorobenzene	Lead	Mercury	Mirex	Octachlorostyrene	PCBs (total)	Tetrachloroethylene	Toxaphene
3. Metropolitan Syracuse WWTP 650 West Hawatha Boulevard Syracuse Lat/Long: 43°03'51"/76°10'41" SIC = 4952 Rec. Body = Onondaga Lake Ref 84.9	Water = 666 kg (91/92) Water = 252 kg (92/93)											Water = 355 kg (91/92) Water = 384 kg (92/93)	Water = 33 kg (91/92) Water = 5 kg (92/93)				Water = 149 kg (91/92) Water = 422 kg (92/93)	
4. Mendotrac/Limestone WWTP Mendota Center Rd. Mendota Lat/Long: 43°03'16"/76°00'31" SIC = 4952 Rec. Body = Limestone Creek Ref 84.9												Water = 105 kg (91/92) Water = 125 kg (92/93)						
Ontario County 1. Marsh Creek WWTP Dunn Ave. Geneva Lat/Long: 43°52'22"/76°58'30" SIC = 4952 Rec. Body = Seneca Lake Ref 84												Water = 49 kg (92/93)	Water = 1.3 kg (92/93)					
Orwigo County 1. Orwigo West Side STP City Hall Orwigo Lat/Long: 43°27'39"/76°30'49" SIC = 4952 Rec. Body = Lake Ontario Ref 84	Water = 4 kg (92/93)											Water = 7 kg (91/92) Water = 6 kg (92/93)	Water = 1.9 kg (91/92) Water = 2.2 kg (92/93)					

TABLE B-2. MUNICIPAL POINT SOURCE DISCHARGES

TABLE B-2. MUNICIPAL POINT SOURCE DISCHARGES																		
Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Arsenic	Benz(a) anthracene	Benz(a) pyrene	Benz(b) fluoranthene	Benz(k) fluoranthene	Chlorides	Chrysene	DDT & Metabolites	Dibenz	Dibenz	Dibenzofluorene	Lead	Mercury	Misc	Octachloro-styrene	PCBs (total)	Tetrachloro-ethylene	Toxaphene
2. Oswego (C) East Side STP City Hall Oswego Lat/Long: 43°28'28"/76°30'05" SIC = 4952 Rec. Body = Lake Ontario Ref 84												Water = 24 kg (91/92) Water = 4 kg (92/93)						
3. Fulton (C) West River Rd. North Fulton Lat/Long: 43°30'06"/76°25'19" SIC = 4952 Rec. Body = Oswego River Ref 84.5												Water = 146 kg (91/92) Water = 260 kg (92/93)	Water = 0.4 kg (91/92) Water = 3.4 kg (92/93)					
St. Lawrence County 1. Ogdensburg Secondary WWTP Railroad St. Ogdensburg Lat/Long: 44°42'16"/79°29'11" SIC = 4952 Rec. Body = St. Lawrence River Ref 84												Water = 108 kg (91/92) Water = 283 kg (92/93)	Water = 2.7 kg (91/92) Water = 6 kg (92/93)					
Staten County Wayland (V) WWTP Milton Street Extension Wayland Lat/Long: 42°33'37"/71°35'33" SIC = 4952 Rec. Body = Marl Bed Pond Ref 84												Water = 43 kg (92/93)						

TABLE B-2. MUNICIPAL POINT SOURCE DISCHARGES

Facility Name and Address	Toxic Chemical Loadings and Sources																	
	Arsenic	Benz(a) anthracene	Benz(a) pyrene	Benz(b) fluoranthene	Benz(k) fluoranthene	Chlordane	Chrysene	DPT & Metabolites	Dieldrin	Hechlo	Hexachlorobenzene	Lead	Mercury	Mirex	Octachlorostyrene	PCBs (total)	Tetrachloroethylene	Toxaphene
Tompkins County 1. Ithaca Area WWT Facilities First/Franklin Streets Ithaca Lat/Long: 42°27'06"/76°30'24" SIC = 4952 Rec. Body = Cayuga Lake Ref #4,9												Water = 466 kg (91/92) Water = 153 kg (92/93)					Water = 26 kg (91/92) Water = 27 kg (92/93)	
Wayne County 1. Newark WWTP 271 Murray St. Newark Lat/Long: 43°03'12"/77°05'14" SIC = 4952 Rec. Body = Genesee Creek Ref #4,9												Water = 362 kg (92/93)						

References:

Ref #1: Lake Ontario Toxic Management Plan Industrial Discharges.

Ref #2: Buffalo River Remedial Action Plan, NYSDRC 11/89.

Ref #3: Information Summary, Area of Concern, Buffalo River, NY. U.S. Army Waterways Experiment Station Army Corps of Engineers, Miscellaneous Paper EL-91-9, March 1991. Final Report.

Ref #4: Permit Compliance System, Retrieved dated 8/10/93. Data designated (92/93), (91/92), and (90/91) means data reported are for each respective fiscal year.

Ref #5: NYSDRC, 1991. 1989-1990 Toxic Substance Discharges from Point Sources to the Niagara River. August 1991.

Ref #6: TRI archival for 1991 (latest year available). Data designated (1991) means data reported are for calendar year 1991.

Ref #7: Great Lakes Basin Risk Characterization Study, Great Lakes National Program Office.

Ref #8: Oswego River Remedial Action Plan 1991 Update.

Ref #9: Lake Ontario Toxic Management Plan Municipal Discharges.

TABLE B-3. SIC CODES FOR INDUSTRIAL AND MUNICIPAL DISCHARGERS

1031 = lead and zinc ores

1429 = crushed and broken stone, not elsewhere classified

2389 = apparel and accessories

2611 = pulp mills

2621 = paper mills

2812 = alkalies and chlorine

2819 = industrial inorganic chemicals

2821 = plastics mat./syn resins/nv elast

2865 = cyclic crudes and intermediates

2869 = industrial organic chemicals

2879 = pesticides & agricultural chem

3081 = unsupported plastics film and sheet

3089 = plastics products,

3199 = leather goods

3262 = vitreous china table & kitchen articles

3264 = porcelain electrical supplies

3312 = blast furn/steel works/rolling

3316 = cold finishing of steel shapes

3334 = primary production of aluminum

3341 = secondary smelting/nonferrous metals

3351 = copper rolling, drawing, extending

3354 = aluminum extruded products

3355 = aluminum rolling and drawing

3357 = nonferrous wire drawing and insulating

3364 = nonferrous die - castings, except aluminum

3398 = metal heat treating

3441 = fabricated structural metal

TABLE B-4-1. HAZARDOUS WASTE INCINERATOR LOCATIONS, U.S. EASTERN GREAT LAKES BASIN	
Incinerator	Location
Laidlaw Environmental Services (NYD000632372) (formerly BDT) (a commercial facility)	Clarence, Erie County
Eastman Kodak (NYD980592497)	Rochester, Monroe County
Occidental Chemical (NYD000824482)	Niagara Falls, Niagara County
Occidental Chemical (NYD002103216)	Niagara Falls, Niagara County

Source: Fax communication from K. Randolph, EPA - Waste Management Division, to A. Miller, TRC, dated 8/5/93.

TABLE B-4-2. (CONTINUED)				
Incinerator	Location	No. of Units	Total Capacity	Control Devices
Town of Tonawanda WWTP*	Tonawanda, Erie County	2	NI	NI
Two Mile Creek STP*	Tonawanda, Erie County	NI	NI	NI
Watertown WPCP*	300 William R. Field Drive, Watertown, Jefferson County	1	21	Scrubber

*Wastewater treatment plants using sewage sludge incinerators.

**Not currently operating incinerator.

NI = No information found

Sources: AIRCHIEF Retrieval, Table A-1, U.S. Sewerage Sludge and Table 41. Received 8/93 from E. Goodman, EPA Library.
Fax communication from E. Lonoff, EPA Water Management Division, to S. Stoloff, TRC dated 9/22/93.

APPENDIX C

SPILLS

TABLE C-1.

Quantity Codes:

l = liter

Kg = kilogram

D = drums

F = equipment failure

Cause Codes:

T = transportation

E = operational error

O = other

N = natural phenomenon

U = unknown

*Quantity "Other" is unknown; therefore quantity was not used in totals.

*Size of drums is unknown; therefore quantity was not used in totals.

*Concentration of mercury is unknown; therefore quantity was not used in totals.

*Concentration of PCBs is unknown; therefore quantity was not used in totals.

*Quantity code not listed - assumed to be liters.

*Quantity code "L" is undefined; therefore quantity was not used in totals.

*Spills are reported as volumes spilled; these amounts do not necessarily represent loadings to the environment (see Section 4.2.3 in the report). Database quantities were reported in pounds and gallons; however, to be consistent the units were converted to kilograms and liters.

Facility	Spill Location	Spill City	County	Spill DT	Case No.	Material	Quantity*	Cause
Village of Wellsville		Wellsville	Alleghany	12/04/89	90-0230	Transformer Oil	7.57 l	F
ADM Corn Sweeteners		Monta Zuma	Cayuga	11/01/88	90-1081	PCB	37.85 l	
Ford Motor		Buffalo	Erie	06/18/87	87-0842	PCB Oil	7.57 l	F
Vibratech		Buffalo	Erie	10/03/88	89-0022	PCB Oil (500,000 ppm)	2.00 O*	F
Conrail		Sloan	Erie	04/28/89	89-0727	PCB Transformer Oil	5.00 D ^b	O
Worthy Business Center		Buffalo	Erie	07/12/89	89-1103	Transformer Oil w/700 ppm PCBs	113.55 l	O

Environmental Services		Buffalo	Erie	09/11/92	92-1121	PCBs	459.20	1	
------------------------	--	---------	------	----------	---------	------	--------	---	--

TABLE C-1. (CONTINUED)

Facility	Spill Location	Spill City	County	Spill DT	Case No.	Material	Quantity*	Cause
Niagara Mohawk Power Co.	Town of Olean, Pole No. 27 off Route 417	Buffalo	Erie	04/04/93	93-0574	Oil, Misc. Transformer	17.57 1	
Niagara Mohawk Power Co.		Buffalo	Erie	04/08/92	92-1197	Oil, Misc. Transformer	3,785.00 1	
Niagara Mohawk Power Co.	45 Best Street Station No. 49	Buffalo	Erie	06/15/93	93-0830	PCBs	18.92 1	
Niagara Mohawk Power Co.		Buffalo	Erie	07/26/92	92-0945	PCBs	18.925 1	
Niagara Mohawk Power Co.		Buffalo	Erie	08/09/92	92-0995	PCBs	37.85 1	
Niagara Mohawk Power Co.	1621 Niagara Falls Blvd.	Buffalo	Erie	11/02/92	93-0104	Oil, Misc. Transformer	75.70 1	
Niagara Mohawk Power Co.	Island Park 5585 Main Street	Buffalo	Erie	11/15/92	93-0149	Oil, Misc. Transformer	132.48 1	
Niagara Mohawk Power Co.	Pole No. 72 Chandler Street	Buffalo	Erie	12/03/92	93-0198	Oil, Misc. Transformer	3.18 1	
Niagara Mohawk Power Co.	Rt. 30 S. Line No. 23 Zone 222-19 Pole No. 237	Malone	Franklin	11/29/92	93-0192	Oil, Misc. Transformer	75.70 1	
USA - Ft. Drum		Ft. Drum	Jefferson	09/14/91	91-1118	500 ppm PCBs	454.20 1	E
Xerox Corp.		Webster	Monroe	05/28/87	87-0756	Arsenic	189.25 1	E

TABLE C-1. (CONTINUED)

Facility	Spill Location	Spill City	County	Spill DT	Case No.	Material	Quantity*	Cause
Xerox Corp.		Webster	Monroe	07/24/89	89-1166	Transformer Oil w/PCBs	3.78 l	F
Xerox Corp.		Webster	Monroe	01/21/91	91-0350	PCB Contaminated Oil	10.60 l	F
Eastman Kodak Corp.		Rochester	Monroe	03/09/89	89-0510	Transformer Oil	7.57 l	F
Eastman Kodak Corp.		Rochester	Monroe	06/27/89	89-1042	Tetrachloro-ethylene	945.00 Kg	O
Eastman Kodak Corp.		Rochester	Monroe	05/10/91	91-0690	PCBs	15.14 l	E
Eastman Kodak Corp.		Rochester	Monroe	05/24/91	91-0731	PCBs	18.92 l	
General Motors Corp.		Rochester	Monroe	05/09/90	90-1052	Tetrachloro-ethylene	94.62 l	E
Rochester Gas & Electric		Rochester	Monroe	07/06/92	92-0872	PCBs	3.78 l	
Rochester Gas & Electric	1018 Rt. 104	Rochester	Monroe	03/31/93	93-0551	PCBs	7.57 l	
SCA Chemical Services		Model City	Niagara	03/04/87	87-0435	PCB Mineral Oil	7.57 l	E
Airco Carbon		Niagara Falls	Niagara	08/07/87	87-1057	PCB Transformer Oil	1,514.00 l	F
Airco Carbon		Niagara Falls	Niagara	06/13/88	88-0967	Aroclor 1016 (PCB)	7.57 l	F

TABLE C-1. (CONTINUED)

Facility	Spill Location	Spill City	County	Spill DT	Case No.	Material	Quantity*	Cause
Olean Corp.		Niagara Falls	Niagara	03/13/88	88-0616	Mercury Contaminated Wastewater	585.00 Kg ^c	E
Olin Corp.		Niagara Falls	Niagara	03/15/88	88-0627	Mercury Contaminated Wastewater	757.00 l ^r	F
Olin Corp.		Niagara	Niagara	12/20/88	89-0252	Mercury Contaminated Wastewater	378.50 l ^r	F
Olin Corp.		Niagara Falls	Niagara	05/17/89	89-0814	Mercury Contaminated Sludge	4.50 Kg ^d	E
SKW Allies		Niagara Falls	Niagara	07/19/88	88-1119	Oils, Misc. Transformer	11,355.00 l	O
Allen Kapteina Corp.		Niagara Falls	Niagara	09/18/88	88-1364	Mercury Contaminated Waste	473.12 l ^r	E
Chemical Waste Management		Model City	Niagara	12/28/88	89-0272	PCB Contaminated Soil	9,000.00 Kg ^d	T
Chemical Waste Management	1550 Balmer Road	Niagara	Niagara	11/02/92	93-0139	PCBs	1.80 Kg ^d	
Chemical Waste Management	1550 Balmer Road	Niagara	Niagara	11/05/92	93-0140	PCBs	6,056.00 l	
Occidental Chemical		Niagara Falls	Niagara	05/17/89	89-0809	PCB Contaminated Capacitor Oil	4.50 Kg ^d	F

TABLE C-1. (CONTINUED)

Facility	Spill Location	Spill City	County	Spill DT	Case No.	Material	Quantity*	Cause
Carbon Graphite Group		Niagara Falls	Niagara	09/23/88	88-1389	Oil-PCB	151.40 l	O
Carbon Graphite Co.		Niagara Falls	Niagara	07/11/91	91-0907	190 ppm PCBs	94.62 l	
Carbon Graphite Co.		Niagara Falls	Niagara	03/25/92	92-0525	PCBs	0.49 l	
Carbon Graphite Co.		Niagara Falls	Niagara	04/09/92	92-0589	PCBs	0.49 l	
Griffiss Air Force Base		Rome	Oneida	09/10/87	87-1208	PCB Oil	378.50 l	F
Niagara Mohawk Power Co.		Syracuse	Onondaga	04/01/86	469-86	PCB Transformer Oil	11.35 l	
Niagara Mohawk Power Co.		Syracuse	Onondaga	07/06/86	86-0847	Transformer Oil	113.55 l	U
Niagara Mohawk Power Co.		Syracuse	Onondaga	09/11/86	86-1094	Transformer Oil, PCBs	143.83	N
Niagara Mohawk Power Co.		Syracuse	Onondaga	10/31/86	87-0070	PCB Transformer Oil	378.50 l	U
Niagara Mohawk Power Co.		Syracuse	Onondaga	03/04/87	87-0443	PCB Oil	11.35 l	F
Niagara Mohawk Power Co.		Syracuse	Onondaga	04/08/87	87-0569	PCB Oil	7.57 l	F
Niagara Mohawk Power Co.		Syracuse	Onondaga	03/23/88	88-0651	Oils, Misc. Transformer	37.85 l	O
Niagara Mohawk Power Co.		Syracuse	Onondaga	07/31/88	88-1188	Oils, Misc. Transformer	52.99 l	T

TABLE C-1. (CONTINUED)

Facility	Spill Location	Spill City	County	Spill DT	Case No.	Material	Quantity*	Cause
Niagara Mohawk Power Co.		Syracuse	Onondaga	10/05/88	89-0023	PCB Transformer Oil	18.92 l	F
Niagara Mohawk Power Co.		Syracuse	Onondaga	11/10/88	89-0148	Transformer Oil	151.40 l	T
Niagara Mohawk Power Co.		Syracuse	Onondaga	05/03/89	89-0745	Transformer Oil	227.10 l	E
Niagara Mohawk Power Co.		Syracuse	Onondaga	05/17/89	89-0812	Transformer Oil	3.78 l	T
Niagara Mohawk Power Co.		Syracuse	Onondaga	11/18/91	92-0177	PCBs	170.32 l	T
Niagara Mohawk Power Co.		Syracuse	Onondaga	11/22/91	92-0192	Transformer Oil	0.95 l	F
Niagara Mohawk Power Co.		Syracuse	Onondaga	02/10/92	92-0407	Oil, Misc. Transformer	113.55 l	
Niagara Mohawk Power Co.		Syracuse	Onondaga	03/10/92	92-0491	Oil, Misc. Transformer	3.78 l	
Niagara Mohawk Power Co.		Syracuse	Onondaga	05/05/92	92-0665	Oil, Misc. Transformer	37.85 l	
Niagara Mohawk Power Co.		Liverpool	Onondaga	05/09/92	92-1212	Oil, Misc. Transformer	3,785.00 l	
Niagara Mohawk Power Co.		Liverpool	Onondaga	06/07/92	92-0784	Oil, Misc. Transformer	11.35 l	
Niagara Mohawk Power Co.		W. Syracuse	Onondaga	09/08/92	92-1101	PCBs	3.78 l	

TABLE C-1. (CONTINUED)

Facility	Spill Location	Spill City	County	Spill DT	Case No.	Material	Quantity*	Cause
Fischer Guide of GM		Syracuse	Onondaga	06/16/86	782-86	Hydraulic Fluid w/PCBs	3.78 l	
LCP Chemicals		Solvay	Onondaga	04/05/88	88-1016	Mercury	6.30 Kg	F
LCP Chemicals		Solvay	Onondaga	05/18/88	88-0847	Mercury	0.90 Kg	E
LCP Chemicals		Solvay	Onondaga	05/18/88	88-0993	Mercury	0.90 Kg	U
LCP Chemicals		Solvay	Onondaga	05/24/88	88-1021	Mercury	0.45 Kg	E
LCP Chemicals		Solvay	Onondaga	05/31/88	88-1015	Mercury	0.45 Kg	F
LCP Chemicals		Solvay	Onondaga	06/01/88	88-1029	Mercury	4.50 Kg	E
LCP Chemicals		Solvay	Onondaga	06/28/88	88-1020	Mercury	0.45 Kg	U
LCP Chemicals		Solvay	Onondaga	06/29/88	88-1037	Mercury	2.25 Kg	
LCP Chemicals		Solvay	Onondaga	06/29/88	89-0440	Mercury Revised Amount	0.90 Kg	F
Barrett Paving Material		E. Syracuse	Onondaga	12/08/89	90-0243	Transformer Oil	113.55	F
Onondaga City Dept. of Drain		Syracuse	Onondaga	01/18/90	90-0409	Transformer Oil w/PCBs	3.78 l	F
Alcan Rolled Products		Oswego	Oswego	09/24/86	86-1141	PCB Contaminated Oil	7.57 l	F
General Motors		Massena	St. Lawrence	09/19/86	86-1127	PCB Contaminated Oil	18.92 l	F

TABLE C-1. (CONTINUED)

Facility	Spill Location	Spill City	County	Spill DT	Case No.	Material	Quantity*	Cause
General Motors		Massena	St. Lawrence	02/28/89	89-0498	PCB Sludge	0.45 P ^d	U
GM Central Foundry Div.		Massena	St. Lawrence	05/01/90	90-0889	PCB	7.00 L ⁱ	E
Garlock Inc.		Palmyra	Wayne	08/16/91	91-1021	PCBs	113.55 I	F
Village of Silver Springs		Silver Springs	Wyoming	06/27/90	90-1136	Transformer Fluid	1.00 O ^a	T

APPENDIX D
HAZARDOUS WASTE SITES

L93-839.app

RECYCLED PAPER

ENFORCEMENT CONFIDENTIAL

TRC

TABLE D-1: HAZARDOUS WASTE SITES OF POTENTIAL CONCERN

Site Name	Approximate Distance to Surface Water	Contents/Contaminants	Remediation Status	Comments	Estimated Loadings (kg/year)*	References: Doc. Page/Fig.
NOTES:						
NPL Status Codes:						
N Not yet proposed to NPL.						
P Proposed to NPL.						
F Listed on NPL.						
a, b: These letters link each estimated loading figure to its source in the References column.						
* All chemical-specific data are estimated ground water-transported loadings to surface water.						
** From original (1988) data. RI data indicate a loading as low as 16,425 kg/yr.						
ALLEGANY COUNTY (all in Genesee Basin)						
Sinclair Refinery S. Brooklyn Ave. Wellsville, NY		PCBs, lead, nickel, pesticides, petroleum.	RI/FS completed; RD/RA underway. NPL Status: F (First ROD: 9/30/85; Second ROD: 9/30/91)			4 9 11 13 Table 1
Wellsville-Andover Landfill Snyder Hill Rd. Wellsville, NY		Cyanide, methylene chloride, chromium, zinc, VOCs, SVOCs, metals, resins, solvents.	NPL Status: N			9 11
Deming Electroplating Route 305 New Hudson, NY		Cadmium, lead, heavy metal sludges.	NPL Status: N			9 11
Cuba Municipal Waste Disposal Jackson Hill Rd. Cuba, NY		Cyanide, PCBs, chlorinated solvents, paint sludges.	NPL Status: N			9 11
Friendship Foundries 10 Howard St. Friendship, NY		PCBs, ignitable liquid waste, solvents.	NPL Status: N			9 11
W. Almond Pesticide Storage Site N. of County Rt. 2A W. Almond, NY		DDT, dieldrin, chlordane, cyanide, arsenic, mercury, lead.	NPL Status: Unknown			9
ERIE COUNTY						
Stocks Pond Broadway and Transit Depew, NY	50 ft. from Cayuga Creek.	Lube oil, brick, bentonite clay, sludge, foundry sand.	Phase I Investigation completed. NPL Status: N			1 figs. 5.4, 5.5 11
Land Reclamation Indian Rd Depew, NY	Less than 50 ft. from Cayuga Creek.	Foundry sands, pine tar pitch, inks, lab chemicals, colors, acids.	Phase I Investigation completed. NPL Status: N	Ground water and surface water sampling confirm contaminant migration from site.		1 figs. 5.4, 5.5 11

TABLE D-1: HAZARDOUS WASTE SITES OF POTENTIAL CONCERN

Site Name	Approximate Distance to Surface Water	Contents/Contaminants	Remediation Status	Comments	Estimated Loadings (kg/year)*	References: Doc. Page/Fig.
Old Land Reclamation Depew, NY	50 ft. from Cayuga Creek.	Foundry sand, slag, flyash, oil, sludge, inks, waste colors.	Phase I Investigation completed. Phase II Investigation planned. NPL Status: N	Soil and leachate sampling indicate inorganic and organic contamination.		1 figs. 5.4, 5.5 11
Union Road Site Lisson Rd Cheektowaga, NY	200 ft. from Slate Bottom Creek.	Tar containing heavy metals.	Phase I Investigation completed. RI/FS planned. NPL Status: N	Surface water and sediment sampling confirm migration of lead from the site.		1 figs. 5.4, 5.5 11
Village of Depew Landfill 315 Borden Rd Depew, NY	50 ft. from Cayuga Creek.	Unknown. Foundry sand with phenolics used as cover.	Phase I Investigation in draft form. Portion of site has been excavated. NPL Status: N			1 figs. 5.4, 5.5 11
Lancaster Reclamation 403 Pavement Rd Lancaster, NY	1000 ft. from tributary of Plum Bottom Creek.	Bentonite clay slurry, foundry sand, asbestos and glass fiber slurry, surface print wastes, prepaste polymer, alkali.	Phase I Investigation completed. Phase II Investigation scheduled. NPL Status: N	Limited analyses of groundwater and surface water have shown presence of phenols.		1 figs. 5.4, 5.5 11
Dresser Industries 2 Main St Depew, NY	2000 ft. from Cayuga Creek.	Foundry sand with phenolics, slag, bentonite clay sludge, oil.	Phase I Investigation completed. NPL Status: N			1 figs. 5.4, 5.5 11
Town of Marilla Landfill Eastwood Rd Marilla, NY	4000 ft. from Little Buffalo Creek.	Unknown.	Phase I Investigation in draft form. Phase II Investigation planned. NPL Status: N	Leachate seeps noted at site.		1 figs. 5.4, 5.5 11
Northern Demolition French Road (or 3020 Clinton St) W. Seneca, NY	1000 ft. from a tributary to Buffalo Creek.	Scrap metal and rubble from Buffalo Color.	Phase I Investigation completed. NPL Status: N			1 figs. 5.4, 5.5 11
High View Terrace 100 High View Terrace W. Seneca, NY	100 ft. from Cazenovia Creek.	Cyanide-bearing wastes.	Phase I Investigation in final form. NPL Status: N	Storm sewer passes through waste, providing a migration avenue.		1 figs. 5.4, 5.5 11
CID (Chaffee Landfill) Hend Road Chaffee, NY	1/2 mi. from a tributary to Cazenovia Creek.	Cyanide salts, solvents, and PCBs (prior to 1965).	Leachate collection system installed. NPL Status: N			1 figs. 5.4, 5.5 11
West Seneca Transfer Station Mineral Springs Rd W. Seneca, NY	200 ft. from Buffalo River.	Incinerator ash, lead.	Phase I Investigation completed. Phase II Investigation planned. NPL Status: N		Lead: 2,135	1 figs. 5.4, 5.5 10 p. 65 11
Houghton Park Landfill Clinton Street Buffalo, NY	100 ft. from Buffalo River.	Foundry sand with phenolic binders.	Phase I investigation completed. Buffalo Urban Renewal Agency investigated site in 1983. NPL Status: N	Data show contamination of soil and ground water with heavy metals and phenols.		1 figs. 5.4, 5.5 10 p. 65 11

TABLE D-1: HAZARDOUS WASTE SITES OF POTENTIAL CONCERN

Site Name	Approximate Distance to Surface Water	Contents/Contaminants	Remediation Status	Comments	Estimated Loadings (kg/year)*	Doc.	References: Page/Fig.
Mobil Oil Corp. 635 Elk St Buffalo, NY	Adjacent to Buffalo River.	Tetraethyl lead and lube sludges, spent catalysts.	Phase I Investigation completed. Phase II Investigation completed. NPL Status: N		Arsenic: 0.329 a Lead: 0.493 a	1 5 11 a 12	figs. 5.4, 5.5 p. 61 App. D
Buffalo Color Corp. (Sites A & B) South Park Ave. Buffalo, NY	Adjacent to Buffalo River.	Iron oxide and metal sludges, PAHs, chlorinated benzenes, and metals.	Field Investigation completed. RI/FS planned. NPL Status: N		Chrysene: 4.928 a B(a)a: 36.628 a B(b)f: 11.662 a B(k)f: 1.314 a B(a)p: 3.121 a Arsenic: 2.464 b Lead: 5.420 b Mercury: 0.164 b	1 5 a 10 11 b 12	figs. 5.4, 5.5 p. 44 p. 65 App. D
Allied Chemical, Inc. Chemical Div. (Currently PVS) 55 Lee St Buffalo, NY	50 ft. from Buffalo River.	Spent vanadium pentoxide catalyst, sulfur sludges, salts of sulfuric and nitric acids, polymerized sulphur, lead.	Phase II Investigation underway. NPL Status: N	Low pH of ground water could enhance mobilization of heavy metals.	Lead: 0.214 a	1 a 10 11	figs. 5.4, 5.5 p. 65
Lehigh Valley Railroad Tiff Street Buffalo, NY	500 ft. from Buffalo River.	Sludges, foundry sand, iron.	Phase II Investigation planned. NPL Status: N			1 11	figs. 5.4, 5.5
MacNaughton-Brooks 717 Elk St Buffalo, NY	600-800 ft. from Buffalo River.	Paints, sludges, solvents, xylol, toluol, iron.	Phase II Investigation underway. NPL Status: N	Silt and sand underlying site may promote contaminant migration.		1 6 11	figs. 5.4, 5.5 pp. 5-16
U.S. Steel: Eastern Division Foot of Katherine St. Buffalo, NY	100 ft. from Buffalo River.	Waste oils and limestone sediment.	Phase I Investigation completed. NPL Status: N			1 11	figs. 5.4, 5.5
Tiff Farm Wildlife Preserve Ohio St. Buffalo, NY	500 ft. from Buffalo River.	Incinerator ash and refuse from Squaw Island, flyash, pit sludge, and foundry sand.	Phase II Investigation in final form. NPL Status: N			1 11	figs. 5.4, 5.5
Honner-Hanna Coke Abby and Mystic Sts. Buffalo, NY	2000 ft. from Buffalo River.	Calcium carbonate, slag.	Phase I Investigation completed. Phase II Investigation planned. NPL Status: N			1 11	figs. 5.4, 5.5
Mollenber-Betz Machine 300 Scott St Buffalo, NY	2000 ft. from Buffalo River.	Waste oil and grease.	Phase I Investigation completed. NPL Status: N			1 11	figs. 5.4, 5.5
Clinton-Bailey Clinton Street and Bailey Buffalo, NY	3500 ft. from Buffalo River.	Arsenic, heavy metals, organic compounds.	Phase I Investigation completed. Niagara Frontier Transportation Authority investigated site. NPL Status: N			1 11	figs. 5.4, 5.5

TABLE D-1: HAZARDOUS WASTE SITES OF POTENTIAL CONCERN

Site Name	Approximate Distance to Surface Water	Contents/Contaminants	Remediation Status	Comments	Estimated Loadings (kg/year)*	References:	
						Doc.	Page/Fig.
Madison Wire Works Co. Inc. 324 Indian Church Road W. Seneca, NY	Adjacent to intermittent stream; 3800 ft. from Buffalo River.	Heavy metals, cyanide, organic compounds.	Phase I and II Investigations completed. RI/FS underway in 1988. Drum, liquid removal completed. NPL Status: N		Lead: 0.312 a	a 10 11	figs. 5.4, 5.5 p. 65
Tift-Hopkins St. Tift & Hopkins St. Buffalo, NY	0.75 mi. from Buffalo River.	Chlorobenzenes.	Phase I Investigation underway. NPL Status: N			11	figs. 5.4, 5.5
Houdaille's Ind.: Manzel Division 12975 Clarence Ctr. Akron, NY	4000 ft. from Buffalo River.	Cutting oils, cooling compounds, benzene, solvents, heavy metals.	Negotiations for remediation Consent Order are underway. NPL Status: N			11	figs. 5.4, 5.5
Bengart and Memel Buffalo, NY	5000 ft. from Buffalo River.	PCBs.	Removal of PCB-contaminated soils completed. NPL Status: Unknown			11	figs. 5.4, 5.5
Eric-Lackawanna Railroad 1107 Bailey Dr. Buffalo, NY	5700 ft. from Buffalo River.	Unknown.	Phase I Investigation completed. NPL Status: N			11	figs. 5.4, 5.5
Ameron Buffalo, NY	1.25 mi. from Buffalo River.	Solvents, xylene, methyl ethyl ketone.	Investigation by Ameron has been completed and remedial system is installed and operating. NPL Status: Unknown			11	figs. 5.4, 5.5
Times Beach Disposal Site Fuhmann Ave Buffalo, NY	Adjacent to Outer Harbor and mouth of Buffalo River.	Dredge spoil from the Buffalo River, Blackrock Canal and Outer Harbor, containing PCBs, anilines, chlorobenzenes, PAHs, arsenic, lead, and mercury.	Phase I Investigation completed. Corps of Engineers currently investigating the site. NPL Status: N			11	figs. 5.4, 5.5
Niagara County Refuse Disposal Witmer Rd. Wheatfield, NY	1000 ft. north of Niagara River.	PCE, mercury, and sludges.	RI completed. NPL Status: F		Arsenic: 0.329 a Lead: 1.643 a Mercury: 0.023 b	a 5 a 8 b 11 b 12	p. 4 App. D
Bell Aerospace Texton Route 62 and Walmore Wheatfield, NY	2.5 mi. north of Niagara River.	TCE and DCE.	Some remediation completed. RI and CMS completed. NPL Status: N		18 COCs: 0.0 a,b	a 5 a 8 b 11 b 12	p. 18 App. D
Bethlehem Steel Corp. 3555 Lake Shore Rd. Lackawanna, NY	Adjacent to Buffalo Harbor.	Metals.	RI workplan completed. NPL Status: N		Arsenic: 4.271 a Lead: 14.618 a	a 5 a 11 a 12	p. 45 App. D

TABLE D-1: HAZARDOUS WASTE SITES OF POTENTIAL CONCERN

Site Name	Approximate Distance to Surface Water	Contents/Contaminants	Remediation Status	Comments	Estimated Loadings (kg/year)*	Doc.	References: Page/Fig.
Buffalo Harbor Containment (a.k.a. Con Disposal Facility) Lackawanna, NY	Adjacent to Lake Erie.	Unknown.	Not listed on NY State Registry of Inactive Haz. Waste Sites--no remediation schedule.		Arsenic: 0.986 a Mercury: 4.763 a	5 a 12	p. 48 App. D
INS Equipment (a.k.a. River Road) River Road Tonawanda, NY	Adjacent to Niagara River.	Solvents and metals.	RI underway. NPL Status: N		Total EPA Priority Pollutants: 443,475 ** a	a 5 11	p. 48
Tonawanda Coke Co., 3875 River Rd. Tonawanda, NY	Adjacent to Niagara River.	PAHs, flyash, phenols, cyanide, single ring aromatic hydrocarbons.	Phase II Investigation completed. NPL Status: Unknown			7 11	pp. 326-328
Columbus McKinnon Corp. Fillmore & Fremont St. Tonawanda, NY	Adjacent to Ellicott Creek, 1.0 mi. east of Niagara River.	PCBs, vinyl chloride, and trans-1,2-dichloromethylene.	NPL Status: N			7 11	pp. 380-381
Dunlop Tire and Rubber Sheridan Dr. Tonawanda, NY	0.25 mi. from Niagara River.	Sulfur, amines, solvents, acetone, phenols, and volatiles.	NPL Status: N			7 11	pp. 394-396
Altift Realty Tift Street Buffalo, NY	1.1 mi. from Lake Erie.	Industrial fill, metal sludges, naphthalene, monochlorobenzene, dye, oil sludges, phenolic compounds, auto shredder waste, fly ash, sand wastes, demolition debris, NAPL, methylene chloride, barium, manganese, and aluminum.	Phase II Investigation completed. NPL Status: N			7 11	pp. 439-443
Huntley Power Station (a.k.a. Cherry Farm) River Road Tonawanda, NY	Adjacent to Niagara River.	Mercury, nickel, zinc, arsenic, phenols, aromatics, benzene, and bis(2-ethylhexyl)phthalate.	Phase II Investigation completed. NPL Status: N			7 11	pp. 455-457
City of Tonawanda Landfill Wales Ave. Tonawanda, NY	1000 ft. south of Erie-Barge Canal; 1600 ft. north of Ellicott Creek; 1.5 mi. east of Niagara River.	Incinerator ash, sewage sludge, industrial and municipal wastes, phenol, 2,4-D, iron, other inorganics.	NPL Status: N			7 11	pp. 468-469

TABLE D-1: HAZARDOUS WASTE SITES OF POTENTIAL CONCERN

Site Name	Approximate Distance to Surface Water	Contents/Contaminants	Remediation Status	Comments	Estimated Loadings (kg/year)*	Doc.	References: Page/Fig.
GENESEE COUNTY (all in Genesee Basin)							
Lehigh Valley RR Derailment Gulf Rd. & Lehigh Valley Route 5 LeRoy, NY		Trichloroethene, cyanide.	NPL Status: N				9 11
Byron Barrel and Drum Town Line Road Byron Township, NY	Potential impact to Lake Ontario.	Unknown.	RI/FS completed. Remedial Design underway. NPL Status: F (ROD: 9/29/89)				11 13 Table 1
Route 19 Drum Disposal (McGinnis) Route 19 LeRoy, NY		Solvents.	NPL Status: N				9 11
LIVINGSTON COUNTY (all in Genesee Basin)							
Atochem N. America Formerly Pennwalt Corp./ Lucidol Route 63 York, NY		Ash, sludges, chloroformates.	NPL Status: N				9 11
Enarc-O Machine Products 1175 Dragg St. Lima, NY		1,1,1-trichloromethane, trichloroethene, other solvents.	NPL Status: Unknown				9
Foster - Wheeler Energy Corp. Mt. Morris Rd. RD #3 N. Dansville, NY		Chloroform, methylene chloride, bis(2ethylhexyl)phthalate, PCBs, waste paint.	NPL Status: N				9 11
Jones Chemical Inc. 100 Sunny Sol Blvd. Caledonia, NY		Methylene chloride, tetrachlorethylene, 1,1,1-trichloroethane, trichloroethene.	NPL Status: F (NPL: 2/90)				3 9 11
Tennessee Gas Pipeline Station 233 Dow Rd. & Federal Rd. York, NY		PCBs.	NPL Status: Unknown				9

TABLE D-1: HAZARDOUS WASTE SITES OF POTENTIAL CONCERN

Site Name	Approximate Distance to Surface Water	Contents/Contaminants	Remediation Status	Comments	Estimated Loadings (kg/year)*	References: Doc. Page/Fig.
MADISON COUNTY						
Canastota Landfill Old Erie Canal Lenox, NY		Unknown	Phase II Investigation completed NPL Status: N			
MONROE COUNTY						
GiMC Rochester Prod. Div. 1000 Lexington Ave. Rochester, NY		Benzene, PCE, 1,1,1-TCA, TCE, toluene.	NPL Status: N			9 11
Autobaus of Rochester 99 Marsh Road Perinton, NY		Acetone, benzene, methyl ethyl ketone, methylene chloride, PCE, 1,1,1-TCA, TCE.	NPL Status: Unknown			9
Bausch & Lomb Frame Center 465 Paul Rd. Rochester, NY		Benzene, toluene, 1,1,1-TCA, TCE, PAHs, cadmium, chromium, lead, mercury, nickel, silver, vanadium, zinc.	NPL Status: N			9 11
Formerly Black & Decker, also formerly General Electric (Currently Kleenbrite) 200 State St. Brockport, NY		TCE, chromium, iron, nickel.	NPL Status: N			9 11
Brighton Town Dump Browncroft Blvd. Brighton, NY		4,4'-DDB, acetone, benzo(k)fluorethene, bis(2 ethylhexyl) phthalate, chrysene, di-n-octylphthalate, barium, chromium, copper, lead, zinc.	Phase I Investigation completed. NPL Status: N			2 9 11
Brockport Landfill East Canal Rd. Sweden, NY		Acetone, benzene, di-n-octyl phthalate, TCE, toluene, aluminum, arsenic, barium, cadmium, cobalt, copper, iron, lead, manganese, vanadium, zinc.	NPL Status: N			9 11
Eastman Kodak Co., Kodak Park Division 1669 Lake Ave. Rochester, NY		Acetone, benzene, chloroform, hexane, methylene chloride, methyl ethyl ketone, toluene, silver.	NPL Status: N			4 9 11

TABLE D-1: HAZARDOUS WASTE SITES OF POTENTIAL CONCERN

Site Name	Approximate Distance to Surface Water	Content/Contaminants	Remediation Status	Comments	Estimated Loadings (kg/year)*	References: Doc. Page/Fig.
Emerson St. Landfill Emerson St. Rochester, NY		Chlordane, 4,4'-DDT, acetone, benzene, bis(2-ethylhexyl)phthalate, di-n-octyl phthalate, toluene, TCE, aluminum, chromium, iron, lead, manganese, zinc.	NPL Status: N			9 11
Enlle Perforating 100 Pixley Industrial Parkway Gates, NY		TCE, PCE.	NPL Status: N			9 11
Greece Landfill Flynn Road Greece, NY		4,4'-DDT, acetone, benzene, toluene, benzo(a)pyrene, fluoranthene, pyrene, arsenic, cadmium, lead, mercury.	NPL Status: N			9 11
Gates Dump Hinchey Road Gates, NY		Aldrin, endosulfan, methoxychlor, cyanide, benzo(a)anthracene, benzo(a)pyrene, benzo(h)fluoranthene, benzo(k)fluoranthene, chrysene, pyrene, cadmium, chromium, copper, lead, mercury, zinc.	NPL Status: N			9 11
General Circuits 95 Mt. Read Blvd.		Acetone, tetrachloromethylene, trichloroethene, toluene.	NPL Status: Unknown			9
Genesee Gorge Upper Falls to Lower Falls Rochester, NY		Benzene, benzo(a)anthracene, benzo(h)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, bis(2-ethylhexyl)phthalate, dibenzofuran, fluoranthene, hexachlorobutadiene, tetrachloroethene, toluene, arsenic, barium, cadmium, chromium, lead, mercury, zinc.	NPL Status: N			9 11
Burroughs/Unisys Site 1225 Ridgeway Ave. Rochester, NY		Acetone, methyl ethyl ketone.	NPL Status: Unknown			9
Carter St. Dump 56 Brambury Dr. Rochester, NY		Lead.	NPL Status: N			9 11

TABLE D-1: HAZARDOUS WASTE SITES OF POTENTIAL CONCERN

Site Name	Approximate Distance to Surface Water	Contents/Contaminants	Remediation Status	Comments	Estimated Loadings (kg/year)*	References: Doc. Page/Fig.
Chemical Sales Corp. 150 Lee Rd. Gates, NY		Acetone, hexane, methylene chloride, methyl ethyl ketone, tetrachloroethylene, toluene, 1,1,1-trichloroethane, trichloroethene.	NPL Status: Unknown			9
Clarkson Town Landfill Redman Rd. Clarkson, NY		4,4'-DDD, 4,4'-DDT, benzene, bis(2ethylhexyl)phthalate, methylene chloride, aluminum, barium, lead, manganese, mercury.	NPL Status: N			9 11
Davis Howland Oil Corp. 200 Anderson Ave. Rochester, NY		Acetone, methylene chloride, methyl ethyl ketone, toluene, 1,1,1-trichloroethane, cadmium, lead.	NPL Status: Unknown			9
Dearcop Farm Dearcop Dr./ Varian Lane Rochester, NY		Benzene, trichloroethene, aluminum, arsenic, calcium, lead, manganese, silver.	NPL Status: N			9 11
Former Dollinger Corp. (Currently American Filtrona Corp.) 1 Townline Circle Brighton, NY		Trichloroethene.	NPL Status: Unknown			9
Eastman Kodak Co., Kodak Park East Weiland Rd. Rochester, NY		Acetone, benzene, methylene chloride.	NPL Status: N			9 11
Ogden Town Dump Lyell St. Ogden, NY		Iron, manganese.	NPL Status: N			9 11
Old Rochester City Rochester, NY		Benzene.	NPL Status: N			9 11
Rochester Landfill Pattonwood Dr. Rochester, NY		PCBs, toluene, lead.	NPL Status: N			9 11

TABLE D-1: HAZARDOUS WASTE SITES OF POTENTIAL CONCERN

Site Name	Approximate Distance to Surface Water	Contents/Contaminants	Remediation Status	Comments	Estimated Loadings (kg/year)*	References: Doc. Page/Fig.
Olin Chemical Corp. 100 McKee Road Rochester, NY		Benzene, carbon tetrachloride, chloroform, dibromochloromethane, dichlorobenzenes, methylene chloride, tetrachloroethylene, toluene, 1,1,1 trichloroethane.	NPL Status: N			9 11
Parma Dump 4618 Ridge Rd. Parma, NY		Toluene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, pyrene, arsenic, selenium.	NPL Status: N			9 11
Tom Paxton Chevrolet 3722 Scottsville Rd. Wheatland, NY		Acetone, benzene, toluene.	NPL Status: N			9 11
Pittsford Town Dump Marsh Road Pittsford, NY		Cyanide, arsenic, barium, lead, manganese, zinc.	NPL Status: N			9 11
Railroad Car Shops Despatch Drive East Rochester, NY		Bis(2 ethylhexyl)phthalate, methylene chloride, aluminum, barium, chromium, iron, lead, mercury, nickel, vanadium, zinc.	NPL Status: N			9 11
R.D. Specialties Salt Road Webster, NY		Chromium.	NPL Status: Unknown			9
George A. Robinson & Co., Inc. 477 Whitney Rd. E. Rochester, NY		Trichloroethene.	NPL Status: N			9 11
Golden Rd. Disposal Site Golden Road Chili, NY		Benzene, 1,1,1-trichloroethane, tetrachloroethylene, toluene, arsenic, barium, chromium, lead, manganese, zinc.	NPL Status: N			9 11
High Acres Sanitary Landfill 425 Perinton Pkwy. Perinton, NY		Acetone, benzene, phenol, toluene, cyanide.	NPL Status: N			9 11

TABLE D-1: HAZARDOUS WASTE SITES OF POTENTIAL CONCERN

Site Name	Approximate Distance to Surface Water	Contents/ Contaminants	Remediation Status	Comments	Estimated Loadings (kg/year)*	References: Doc. Page/Fig.
Former Jarl Extrusions, Inc. (Alcan Aluminum Corp.) 860 W. Linden Ave. Pittsford, NY		Aluminum, chromium, copper, iron, lead, nickel, zinc	NPL Status: N			9 11
Little League Lyndon Road Fairport, NY		Cyanide, acetone, chloroform, PCBs, aluminum, cadmium, copper, iron, lead, zinc.	NPL Status: N			9 11
Lipari/Monarch Sand and Gravel Pine Hill Rd. Spencerport, NY		Dieldrin, DDT, DDE, DDD, bis(2 ethylhexyl)phthalate, benzo(a)pyrene, benzo(h)fluoranthene, benzo(k)fluoranthene, fluoranthene, pyrene, aluminum, arsenic, cadmium, copper, iron, lead, manganese, vanadium, zinc.	NPL Status: N			9 11
NYSDOT Pittsford 3837 Monroe Ave. Pittsford, NY		Pyrene, toluene.	NPL Status: N			9 11
NYSDOT Pittsford 938 N. Linden Ave. E. Rochester, NY		Endosulfan, acetone, benzene, methylene chloride, toluene, fluoranthene, phenanthrene, pyrene, chromium, iron, lead, manganese.	NPL Status: N			9 11
Taylor Instrument Co. 95 Ames St. Rochester, NY		Mercury.	NPL Status: N			9 11
Former 3M/Dynacolor (Currently Brockport Cold Storage) 98 Springs St. Sweden, NY		Cyanide, cadmium, silver, zinc.	NPL Status: N			9 11
Trimmer Rd. Landfill Trimmer Road Parma, NY		Acetone, benzene, bis(2 ethylhexyl)phthalate, chloroform, arsenic, barium, iron, manganese.	NPL Status: N			9 11
Village of Spencerport Dump 500 W. Ave. Ogden, NY		Beta BHC, iron, manganese.	NPL Status: N			9 11

TABLE D-1: HAZARDOUS WASTE SITES OF POTENTIAL CONCERN

Site Name	Approximate Distance to Surface Water	Contents/Contaminants	Remediation Status	Comments	Estimated Loadings (kg/year)*	References: Doc. Page/Fig.
Xerox Landfill 800 Phillips Rd. Webster, NY		Acetone, chloroform, carbon tetrachloride, tetrachloromethylene, 1,1,1-trichloroethane, toluene, arsenic, selenium.	NPL Status: Unknown			9
Xerox - Salt Rd. 600 Phillips Rd. Webster, NY		Tetrachloroethylene, trichloroethene, toluene.	NPL Status: Unknown			9
Xerox - Wilson Ctr. 800 Phillips Rd. Webster, NY		Tetrachloromethylene, 1,1,1-trichloroethane, trichloroethene, arsenic, chromium, nickel, selenium.	NPL Status: N			9 11
Xerox - Henrietta 1350 Jefferson Rd. Henrietta, NY		Methylene chloride, tetrachloroethylene, 1,1,1-trichloroethane.	NPL Status: Unknown			9
Xerox - Nursery Area San Jose Blvd. Webster, NY		Tetrachloroethylene, trichloroethene, 1,1,1-trichloroethane, toluene.	NPL Status: Unknown			9
Rochester Fire Academy Scottsville Rd. Rochester, NY		Benzene, bis(2ethylhexyl)phthalate, chloroform, methyl ethyl ketone, PCBs, tetrachloroethylene, toluene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, pyrene, cadmium, copper, lead, silver, zinc.	NPL Status: N			9 11
Roehlen Engraving 701 Jefferson Rd. Henrietta, NY		Methylene chloride, trichloroethene, chromium, lead.	NPL Status: Unknown			9
Rush Landfill Route 251 Industry, NY		Benzene, PCBs, phenol, toluene, cyanide, aluminum, chromium, iron, lead, manganese, vanadium, zinc.	NPL Status: N			9 11
Scobell Chemical 1 Rockwood Place Brighton, NY		Tetrachloromethylene, toluene.	NPL Status: Unknown			9
Scottsville Rd. - Chili 2 Scottsville Road Chili, NY		Acetone, barium, chromium, copper, iron, manganese, mercury, nickel, silver, zinc.	NPL Status: N			9 11

TABLE D-1: HAZARDOUS WASTE SITES OF POTENTIAL CONCERN

Site Name	Approximate Distance to Surface Water	Contents/Contaminants	Remediation Status	Comments	Estimated Loadings (kg/year)*	References: Doc. Page/Fig.
Sigismundi Landfill 870 Linden Ave. Pittsford, NY		1,1,1-trichloroethane, chromium, lead.	NPL Status: N			9 11
Stuart-Oliver-Holtz 39 Commerce Dr. Henrietta, NY		Methylene chloride, tetrachloroethylene, 1,1,1-trichloroethane, trichloroethene.	NPL Status: Unknown			9
Sweden-3 Chapman N. Beadle Rd. Sweden, NY		4,4'-DDT, acetone, benzene, bis(2-ethylhexyl)phthalate, methylene chloride, tetrachloroethylene, trichloroethene, toluene, cyanide, cadmium, chromium, lead, mercury.	NPL Status: N			9 11
Haigh Farm 4879 Upper Holley Rd. Clarendon, NY		Trichloroethene, other solvents.	NPL Status: N			9 11
NIAGARA COUNTY						
Hooker/Occidental/Ofin: 102nd Street Niagara Falls, NY	Adjacent to Niagara River.	Hexacyclochlorohexanes.	Some remediation completed. NPL Status: F (ROD: 9/26/90)		18 COCs: 0.0 a	4 5 11 12 p. 16 a App. D
Hooker/Occidental Chem: Hyde Park Hyde Park Blvd. Niagara Falls, NY	0.5 mi. from Niagara River via Bloody Run Creek	Dioxin, chlorinated organics.	Some remediation completed. NPL Status: F (ROD: 11/26/85)		18 COCs: 0.0 a	5 8 11 12 p. 12 a App. D
Love Canal 96 Street Niagara Falls, NY		Unknown.	NPL Status: F (First ROD: 5/6/85; Second ROD: 10/26/87; Third ROD: 9/30/88; Fourth ROD: 5/15/91)			4 11
Forest Glen Mobile Subdivision Lisa Lane/Carrie Dr. Niagara Falls, NY		Unknown.	NPL Status: F (ROD: 12/29/89)			4 11
Hooker/Occidental Chem.: S-Area Buffalo Ave. Niagara Falls, NY	600 ft. from Niagara River.	Chlorinated benzenes.	RD/RA underway. NPL Status: F (ROD: 9/21/90)		Mercury: 0.164 a Mirex: 1.624 a PCE: 130.907 a Lead: 6.406 a	4 5 11 12 p. 12 a App. D

TABLE D-1: HAZARDOUS WASTE SITES OF POTENTIAL CONCERN

Site Name	Approximate Distance to Surface Water	Contents/Contaminants	Remediation Status	Comments	Estimated Loadings (kg/year)*	Doc.	References: Page/Fig.
Occidental Chem.: Buffalo Ave. Niagara Falls, NY	Adjacent to Niagara River	Halogenated benzenes, mercury, and dioxin	Some remediation completed. RI completed. NPL Status: N		Mercury: 0.164 a PCBs: 0.164 a PCE: 1.971 a Lead: 2,300 a Arsenic: 5,585 a Mirex: 0.821 b	5 8 11 12	p. 2 App. D
Ohm Corporation: Buffalo Ave. Niagara Falls, NY	Adjacent to Gill Creek. 0.25 mi. from Niagara River.	Chlorinated benzenes, mercury, and PCBs.	RI workplan completed. NPL Status: N		Total EPA Priority Pollutants: 1166.175 a	5 11	p. 33
DuPont: Buffalo Ave. Buffalo Ave & 26th St. Niagara Falls, NY	Adjacent to Niagara River.	PCE and PCBs.	ROD and RI/RA completed. NPL Status: N		PCE: 356,587 a PCBs: 6,57 b	5 8 11 12	p. 3 App. D
DuPont: Necco Park 56th & Pine Niagara Falls, NY	1.5 mi. from Niagara River	Hexachlorobenzene and PCE.	Some remediation completed. RI scheduled for 1991 completion. NPL Status: N		PCE: 133,207 a HCB: 0.329 b	5 8 11 12	pp. 6-7 App. D
CECOS Intl. Niagara Falls Blvd. Niagara Falls, NY	1.5 mi. from Niagara River	Hexachlorobenzene and PCE.	RI scheduled for 1993 completion. CMS workplan completed. NPL Status: N		18 COCs: 0.0 a	5 11 12	p. 9 App. D
SKW Alloys Inc. Wimer Rd. Niagara Falls, NY	1.5 mi. from Niagara River.	Cr is the major contaminant.	Phase I Investigation completed. NPL Status: N		Total EPA Priority Pollutants: 1412.55 a	5 11	p. 31
Solvent Chemical Corp. 3163 Buffalo Ave. Niagara Falls, NY	0.25 mi. north of Niagara River.	Chlorinated benzenes.	RI completed. NPL Status: N		PCE: 0.821 a Arsenic: 0.164 a Lead: 3,450 a	5 8 11 12	p. 12 App. D
Stauffer Chemical Plant/ PASNY S. of Upper Mtn. Rd Lewiston, NY	0.25 mi. east of Niagara River.	PCE.	RI/RS and ROD completed. NPL Status: N		PCE: 29,729 a Lead: 0.164 a Dieldrin: 0.164 b	5 8 11 12	p. 27 App. D
Occidental Durez: North Tonawanda North Tonawanda, NY	1.25 mi. east of Niagara River	Chlorinated benzenes.	Some remediation completed. RI/RS and ROD completed. NPL Status: Unknown		18 COCs: 0.0 a	5 8	p. 55
Gratwick/Riverside Park River Road North Tonawanda, NY	Adjacent to Niagara River.	Metals, organics.	RI/RS and ROD completed. NPL Status: N		HCB: 0.164 a PCE: 3,285 a Lead: 0.493 a	5 8 11 12	p. 59 App. D
Frontier Chemical: Pendleton Town Line & Beach Rd. Pendleton, NY	Adjacent to Bull Creek. 4.25 mi. from Niagara River.	Solvents, metals, and paint wastes.	RI/RS and ROD completed. NPL Status: N		PCE: 0.164 a	5 8 11	p. 50

TABLE D-1: HAZARDOUS WASTE SITES OF POTENTIAL CONCERN

Site Name	Approximate Distance to Surface Water	Contents/Contaminants	Remediation Status	Comments	Estimated Loadings (kg/year)*	References: Doc. Page/Fig.
Frontier Chemical: Royal Ave. Niagara Falls, NY	Less than 1.0 mi. from Niagara River.	PCE and solvents.	RII completed. NPL Status: N			5 11 p. 54
Great Lakes Carbon 5700 Niagara Falls Blvd. Niagara Falls, NY		Chloroform, trichloroethylene, and vinyl chloride.	Phase I Investigation completed. NPL Status: N			7 11 pp. 111-112
Reichhold-Vacuum Niagara Falls, NY	1.5 mi. from Niagara River.	Phenols, ethylbenzene, toluene, xylenes, and solvents.	Remediation plans awaiting approval. NPL Status: Unknown			7 11 pp. 248-249
Charles Gibson Pine & Tuscarora Niagara Falls, NY	Adjacent to Cayuga Creek; 1.0 mi. from Niagara River.	Hexachlorobenzene, HHC, formaldehyde, metals, mercury, and organics.	NPL Status: N			7 11 pp. 495-498
ONONDAGA COUNTY						
Old Salina Landfill Route 11 & Wolfe St. Salina, NY		Unknown.	Phase I Investigation completed. NPL Status: N			2 11
Onondaga Lake Syracuse, NY	Site is water body.	Mercury in sediments.	RI/IS underway. NPL Status: P			2 11
Syracuse Fire Training Syracuse, NY		Unknown.	RI/IS underway. NPL Status: Unknown			2
Ley Creek PCB Dredgings Factory Ave. Salina, NY	Adjacent to Ley Creek.	PCBs in soil.	RI/IS underway. NPL Status: N			2 11
Old Syracuse Die Casting Salina, NY		PCBs in soil.	Interim Removal Measure: 12/01. NPL Status: Unknown			2
Quanta Resources Corp. 2802-2810 Lodi St. Syracuse, NY		Unknown.	Phase II Investigation completed. NPL Status: N			2 11
Val's Dodge/ Crucible, Inc. State Fair Blvd. Lakeland, NY		Unknown.	Phase II Investigation completed. NPL Status: N			2 11

TABLE D-1: HAZARDOUS WASTE SITES OF POTENTIAL CONCERN

Site Name	Approximate Distance to Surface Water	Contents/Contaminants	Remediation Status	Comments	Estimated Loadings (kg/year)*	Doc. References: Page/Fig.
Peter Winkelman Co., Inc. (US Army) Teall Ave. Syracuse, NY		Unknown.	NPL Status: N			2 11
Alpha Portland Cement Rock Cut Rd. Jamesville, NY		Unknown.	NPL Status: N			2
Clay Landfill		Unknown.	RI/FS underway. NPL Status: Unknown			2
ONTARIO COUNTY						
Genesee Sand & Gravel 748 Phillips Rd. Fishers, NY		Phenols, volatile organics, heavy metals, waste paint, flammable liquids.	NPL Status: N			9 11
ORLEANS COUNTY						
FMC Corp - Dublin Rd. Dublin Rd. Shelby, NY	Potential impact to Lake Ontario.	DIT, arsenic, mercury, lead, other pesticides.	RI/FS, Remedial Design completed. Remedial Action underway. NPL Status: F (1/93)			9 11 13 Table I
McKenna Landfill Yeager Rd. Alton, NY		Benzene, barium, manganese, cleaning solvents, other industrial waste.	NPL Status: N			9 11
OSWEGO COUNTY						
Volney Landfill Silk Rd. Volney, NY	Potential impact to Lake Ontario.	Unknown.	RI/FS completed. Remedial Design underway. NPL Status: F (ROD: 7/31/87)			2 4 11 13 Table I
Clothier Disposal Co. S. Granby Road Granby, NY	Potential impact to Lake Ontario via Ox Creek.	Unknown.	RI/FS, Remedial Design completed. Remedial Action underway. NPL Status: F			2 11 13 Table I
Culture Property W. Fifth & Schuler Fulton, NY		Unknown.	Phase II Investigation completed. NPL Status: N			2 11
Columbia Mills Off Rte. 48 Minetto, NY		Solvents and metals in ground water.	RI/FS completed. NPL Status: F (ROD: 9/26/90)			2 4 11

TABLE D-1: HAZARDOUS WASTE SITES OF POTENTIAL CONCERN

Site Name	Approximate Distance to Surface Water	Contents/Contaminants	Remediation Status	Comments	Estimated Loadings (kg/year)*	References: Doc. Page/Fig.
Miller Brewing Co. Rte. 57 Fulton, NY		Leaking containment tank.	RI/FS underway. NPL Status: N			2 11
Pollution Abatement Services 55 Seneca St. Oswego, NY	Lake Ontario via Wine Creek.	Unknown.	RI/FS underway. NPL Status: F			11 13 Table 1
Fulton Terminals Rte. 57 Fulton, NY	Potential impact to Lake Ontario via Oswego River.	Unknown.	Remedial Design underway NPL Status: F (ROD: 9/29/89)			2 3 4 11 13 Table 1
WYOMING COUNTY (all in Genesee Basin)						
ETE Sanitation and Landfill Broughton Rd. Gainseville, NY		Carbon tetrachloride, lead.	NPL Status: N			9 11
Warsaw Village Landfill Industrial St. Warsaw, NY		Toluene, lead, plating waste.	NPL Status: N			9 11
Robeson Industries, Inc. Buffalo Rd. Castile, NY		1,1,1-trichloroethane.	NPL Status: Unknown			9

Documents/Sources:

- 1 Buffalo River Remedial Action Plan. NYSDEC. November 1989.
- 2 Oswego River Remedial Action Plan. NYSDEC. 1992 Update.
- 3 National Priority List (NPL). U.S. EPA. February 1992.
- 4 Records of Decision (RODs) Database. U.S. EPA.
- 5 "Reduction of Toxics Loadings to the Niagara River from Hazardous Waste Sites in the U.S.: A Progress Report." EPA/NYSDEC. March 1993.
- 6 Niagara River Remedial Action Plan. Draft Version. NYSDEC. March 1993.
- 7 "Potential Contaminant Loadings to the Niagara River from U.S. Hazardous Waste Sites." Gradient/Gentrans Corp. February 1988.
- 8 "Estimated Toxic Loading from Selected Hazardous Waste Sites to the Niagara River, Niagara Falls, New York." TRC Work Assignment C02112.
- 9 Rochester Employment Remedial Action Plan. June 1993.
- 10 "Draft Model Data Requirements and Mass Loading Estimates for the Buffalo River Mass Balance Study." Great Lakes Program, SUNY Buffalo. April 1993.
- 11 Region II CERCLIS List. U.S. EPA. August 1993.
- 12 "Estimated Ground Water-Transported Load of Chemicals from Waste Disposal Sites to the Niagara River." EPA-RSKERL. March 1991.
- 13 "Draft Lake Ontario Toxics Management Plan." August 11, 1993.

APPENDIX E

SAMPLE OF EPA REGION I STABILIZATION COLLABORATIVE INITIATIVE (SCI) ORGANIZATION CHART

STABILIZATION INFORMATION SEARCH SCREENING CHECKLIST

Person's Name: _____
 Date of EPA File Search: _____
 Date of State File Search: _____
 Facility: _____
 Address: _____

PART A - To be filled out during files searches.

Information	Report Dates	EPA Files	State Files	Contractor File Number
RFA Report (PA-Plus Report)	_____	_____	_____	A1
RCRA Permit and Revisions	_____	_____	_____	A2
Spill Reports	_____	_____	_____	A3
Inspection Reports	_____	_____	_____	A4
RFI Report	_____	_____	_____	A5
Field Sampling Reports	_____	_____	_____	A6
Hazardous Waste Storage Reports	_____	_____	_____	A7
Complaint Letters	_____	_____	_____	A8
Facility Hazardous Waste Annual Report	_____	_____	_____	A9
RCRA Part A Permit Application	_____	_____	_____	A10
_____	_____	_____	_____	A11
_____	_____	_____	_____	A12
_____	_____	_____	_____	A13

PART B - To be filled out during review of file information.

Data	Information Located?		Contractor File Number
	Yes	No	
Bedrock Depth*	_____	_____	B1
Hydraulic Conductivity*	_____	_____	B2
Areas of Concern (AOCs) Contamination Chemistry*	_____	_____	B3
Ground Water Chemistry/ Plume Characteristics*	_____	_____	B4
Ground Water Data Trend Analysis*	_____	_____	B5

*Note: These information items were identified as critical data for technical stabilization evaluations conducted during the Stabilization Collaborative Initiative project. (Page 2 includes some of these items also).

Data (cont.)	Yes	No	Contractor File Number
Offsite Contamination			
Data*	_____	_____	<u>B6</u>
Sampling Information*	_____	_____	<u>B7</u>
Spill Records	_____	_____	<u>B8</u>
Raw Material Usage	_____	_____	<u>B9</u>
Facility Map/Drawing	_____	_____	<u>B10</u>
Waste Generation Information	_____	_____	<u>B11</u>
Facility Activities History	_____	_____	<u>B12</u>
Well Location Information	_____	_____	<u>B13</u>
Waste Disposal Information	_____	_____	<u>B14</u>
Waste Handling/Storage Information	_____	_____	<u>B15</u>
Geological Information	_____	_____	<u>B16</u>
Ground Water Flow Direction	_____	_____	<u>B17</u>
Ground Water Use Classification	_____	_____	<u>B18</u>
Ground Water Flow	_____	_____	<u>B19</u>
Soil Boring Information	_____	_____	<u>B20</u>
Soil Types/Classifications	_____	_____	<u>B21</u>
Previous Corrective Actions Taken	_____	_____	<u>B22</u>
Wetland Locations	_____	_____	<u>B23</u>
Other Sensitive Environments	_____	_____	<u>B24</u>
Endangered Species	_____	_____	<u>B25</u>
Topographic Maps	_____	_____	<u>B26</u>
Site Description Information	_____	_____	<u>B27</u>
Areas of Concern Identified/Description	_____	_____	<u>B28</u>
Surface Water Use Classification	_____	_____	<u>B29</u>
_____	_____	_____	<u>B30</u>
_____	_____	_____	<u>B31</u>
_____	_____	_____	<u>B32</u>

Identification of Potential AOCs:

AOC #	Area Description	Potential Contamination**			
		<u>Surface Water</u>	<u>Ground Water</u>	<u>Soil</u>	<u>Sediment</u>
AOC 1	_____	_____	_____	_____	_____
AOC 2	_____	_____	_____	_____	_____
AOC 3	_____	_____	_____	_____	_____
AOC 4	_____	_____	_____	_____	_____
AOC 5	_____	_____	_____	_____	_____
AOC 6	_____	_____	_____	_____	_____
AOC 7	_____	_____	_____	_____	_____
AOC 8	_____	_____	_____	_____	_____
AOC 9	_____	_____	_____	_____	_____
AOC 10	_____	_____	_____	_____	_____
AOC 11	_____	_____	_____	_____	_____
AOC 12	_____	_____	_____	_____	_____

☐ Check this block if a Part B continuation sheet was used.

Recommendation:

Based upon the file search information, does it appear that sufficient technical information is available to conduct a technical stabilization evaluation?

___ Yes ___ No

PART C - To be filled out by contractor project manager and EPA Work Assignment Manager. AOCs to be evaluated for technical stabilization action are noted below on page 4.

****Note:** Use "Y" for Yes or "U" for Unknown. Answering "No" is inappropriate at this time due to having insufficient information.

AOCs to be evaluated for stabilization:

AOC #	Area Description	Assumptions (if any)
AOC ____	_____	_____ _____ _____ _____
AOC ____	_____	_____ _____ _____ _____
AOC ____	_____	_____ _____ _____ _____
AOC ____	_____	_____ _____ _____ _____
AOC ____	_____	_____ _____ _____ _____
AOC ____	_____	_____ _____ _____ _____
AOC ____	_____	_____ _____ _____ _____
AOC ____	_____	_____ _____ _____ _____

STABILIZATION INFORMATION SEARCH SCREENING CHECKLIST

PART B CONTINUATION SHEET

Identification of Potential AOCs:

AOC #	Area Description	Potential Contamination**			
		<u>Surface Water</u>	<u>Ground Water</u>	<u>Soil</u>	<u>Sediment</u>
AOC 13	_____	_____	_____	_____	_____
AOC 14	_____	_____	_____	_____	_____
AOC 15	_____	_____	_____	_____	_____
AOC 16	_____	_____	_____	_____	_____
AOC 17	_____	_____	_____	_____	_____
AOC 18	_____	_____	_____	_____	_____
AOC 19	_____	_____	_____	_____	_____
AOC 20	_____	_____	_____	_____	_____
AOC 21	_____	_____	_____	_____	_____
AOC 22	_____	_____	_____	_____	_____
AOC 23	_____	_____	_____	_____	_____
AOC 24	_____	_____	_____	_____	_____
AOC 25	_____	_____	_____	_____	_____
AOC 26	_____	_____	_____	_____	_____
AOC 27	_____	_____	_____	_____	_____

***Note: Use "Y" for Yes or "U" for Unknown - Answering "No" is inappropriate at this time due to having insufficient information.

APPENDIX F
CUMULATIVE STATUS REPORT

L93-839.app

RECYCLED PAPER

ENFORCEMENT CONFIDENTIAL

TRC

TABLE 1. DATA COLLECTION PLAN FOR ALL 18 TARGET CHEMICALS: ENVIRONMENTAL CONDITIONS			Date: 8/25/93
Aspect	Status	Next Steps/Barriers	
Biological Properties and Damaging Effects	Draft generic profiles completed for all 18 chemicals.	Specific information on sources and damaging effects has been summarized and included in the individual chemical profiles. Information has been obtained from the Draft Great Lakes Basin Risk Characterization Study, the Lake Ontario Toxic Management Plan, and Toxic Chemicals in the Great Lakes and Associated Effects, Volumes I and II.	
Chemical and Physical Properties	Draft generic profiles completed for all 18 chemicals.		
Use and Control	Draft generic profiles completed for all 18 chemicals.	Use and control information contained in profiles has been reviewed and revised as necessary.	

Note: As agreed with the EPA WAM during a conference call on July 1, 1993, the profiles will follow the format in the sample profile faxed to the EPA for review on June 30, 1993. Also as agreed with the WAM, profiles generated will be generic in nature. Site-specific information may be added later if available and appropriate. Generic profiles will be included in the July 31 Interim Status Report.

**TABLE 2. DATA COLLECTION PLAN FOR 18 CHEMICALS:
SOURCES AND LOADINGS**

Date: 8/25/93

Data Type/ Source	Status	Next Steps/Barriers
Water Sources		
PCS	<p>TRC received a report on 8/12/93, of the average daily loadings per month for New York State fiscal years 92/93; 91/92; and 90/91. Loadings have been computed from this report for each chemical and for each facility for fiscal year 92/93. This required considerable effort as each chemical was listed separately. The daily loadings for each month were averaged for fiscal year 92/93 and a total loading for the year was computed. The facility location was not included in this report and TRC had to obtain this information from a separate file.</p> <p>TRC received a full set of data on 8/9/93. The data are raw data, including flowrates, concentrations sampled, monitoring dates, full details of each facility's location, and a considerable number of other parameters about the NPDES permit.</p> <p>In the meantime, TRC received a printout from PCS for the Niagara River, dated 09/30/92. TRC has performed an analysis of the discharges reported for the period 4/1/91 - 3/31/92. A total of 27 sources have been identified. Of the 18 chemicals of concern, arsenic, lead, mercury, PCBs, tetrachloroethylene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, hexachlorobenzene, mirex, DDT and metabolites all have identified loadings from different outfalls at the facilities. TRC has tabulated these sources and their respective loadings.</p>	<p>For fiscal year 92/93, TRC has completed the industrial and municipal point-source discharge table; assessed the contribution of each source by medium; evaluated those counties that are the major contributors; and determined the primary industries responsible for discharging each chemical. This represents the most recent loadings information available for NPDES discharges.</p> <p>TRC computed the same information for fiscal years 91/92. The information for fiscal year 92/93 required considerable effort and manpower to compute. TRC performed this task for the previous fiscal year to evaluate trends. This did not affect the total annual loading determined for fiscal year 92/93.</p>

TABLE 2. (CONTINUED)

Date: 8/25/93

Data Type/ Source	Status	Next Steps/Barriers
Stormwater and CSOs	<p>All information available has been used to complete Task 2 for this section.</p> <p>TRC has reviewed a report from Kim Irvine which describes the model used to estimate CSO discharges in the Buffalo River.</p> <p>As recommended by Steve Garbaziack at GLNPO, TRC has contacted Mr. Kim Irvine, State University of Buffalo, who is currently performing a study under contract to EPA on CSOs in the Buffalo River. Report will be ready on the loadings in October. Report will contain modeled and sampled information on flow rates & loadings of eleven of the 18 target chemicals. Ambient river data will also be included. Much of these data will be finalized in the next two weeks. Kim also referred us to an additional study by the city of Buffalo entitled "Buffalo River Combined Sewer Outfall Study" Contact is Greg McCorkhill (716-847-1630). He is sending an excerpt. This study contains loadings for 2 of the 18 target chemicals.</p> <p>TRC discussed status of stormwater discharge permits in NYS with Jose Riviera (212-264-2911) at EPA. Jose stated that the first two general permits in NYS were issued only last week, so monitoring data collected as part of the stormwater program are not available. He suggested PCS and STORET might have some stormwater information.</p>	<p>TRC reviewed documents and extracted applicable information on CSO loadings into the Buffalo River.</p> <p>TRC has obtained some loadings information from CSOs on the Buffalo River. TRC has also identified the locations of other CSOs within the Eastern Great Lakes Basin - namely Niagara River and Rochester Embayment, but has no loadings information. TRC evaluated CSOs separately from municipal point-source discharges due to the following:</p> <ul style="list-style-type: none"> - lack of available modelled loadings information for CSOs (concentrations entering WWTP and storm event frequency should be evaluated to determine loadings). - intervention plans and CSO elimination could be addressed as a separate subject for intervention proposals. TRC has a contact at Monroe County who has information on CSO elimination schemes.

TABLE 2. (CONTINUED)

Date: 8/25/93

Data Type/ Source	Status	Next Steps/Barriers
Stormwater and CSOs (Continued)	TRC has evaluated two reports with information pertaining to CSOs and stormwater sewers for the Buffalo and Niagara River Basins. These are: "Sources of PCBs to the Niagara River, Interim Report, February 1992, Simon Litten, NYSDEC" and "Information Summary, Area of Concern: Buffalo River, New York, by Department of the Army, March 1991, Final Report".	
Surface Runoff	<p>TRC has utilized all information available to date to complete Task 2 for surface runoff.</p> <p>TRC has retrieved WA# C02060 files from archives. However, these contained only limited information on surface water runoff loadings and sediment loadings. The data obtained have been included in the loadings evaluation.</p> <p>TRC has identified that there is a significant amount of agricultural activity in rural areas within the Eastern Great Lakes Basin. As a result of this, pesticides enter surface water bodies through overland runoff.</p> <p>TRC has contacted the World Wildlife Fund (WWF), which has launched a project to test pesticide reduction programs in the Great Lakes Region. "WWF is working with farmers and government officials there to determine what kind of reduction program is appropriate for the United States." Focus, July/August, 1993.</p>	<p>TRC contacted "Resources for the Future" (RFF) organization. They have considerable information on current pesticide usage. The pesticides included with the 18 target chemicals are no longer utilized. However, RFF did provide some general historical usage information.</p> <p>The EPA Library does not have access to Pestbank per Eveline Goodman.</p>

TABLE 2. (CONTINUED)

Date: 8/25/93

Data Type/ Source	Status	Next Steps/Barriers
Surface Runoff (Continued)	This organization (WWF) is currently involved, determining the effectiveness of pesticide reduction techniques for pesticides currently employed in agricultural activities. This is therefore not applicable to any of the target pesticides included in this work assignment.	
Spills (ERNS)	<p>TRC received a printout for all spills in Region II since 1986. TRC has determined and tabulated those spills involving any of the 18 target chemicals, within the 32 Eastern Great Lakes counties. TRC has computed total loadings for each chemical and for each county.</p> <p>TRC received a printout from E. Lonoff (EPA) containing spill information since 1986 for lead, arsenic and mercury.</p> <p>TRC has tabulated the spill activities by county, in order to identify if a particular area of concern exists.</p> <p>TRC has also obtained data on all the large quantity generators of the 18 chemicals that transfer these chemicals off-site, from the TRI database. TRC has tabulated and plotted these generators to compare the density of these generators with the incidence of spill occurrences, in order to determine if a correlation exists.</p>	TRC has plotted and tabulated all spills in the Eastern Great Lakes Basin for all 18 target chemicals. TRC has obtained an explanation of the codes used in the printout.

TABLE 2. (CONTINUED)

Date: 8/25/93

Data Type/ Source	Status	Next Steps/Barriers
Sediments and Dredging Spoils	<p>TRC contacted Mario Paula and Audrey Massa of WMD-MWPB, who recommended the GLNPO ARCS program as the best source of information on contaminated sediments. This office has a contaminated sediments section, but it is relatively new and is currently working on dioxin contamination in New York Harbor.</p> <p>TRC has reviewed the "Assessment and Remediation of Contaminated Sediments (ARCS) Work Plan" from the US EPA Great Lakes National Program Office.</p> <p>TRC has reviewed information on sediment loadings and movement from WA# C02060 files.</p> <p>TRC has evaluated the report "Report on Great Lakes Confined Disposal Facilities (EPA/905/9-90/003)" which identifies CDFs in the Great Lakes Region, the contaminants within sediments and the sources of the contamination.</p> <p>Three CDFs have been identified in the Lake Ontario Basin. These are Times Beach, Small Boat and Dike 4. All three sites are now Superfund sites and at various stages of the remediation process.</p> <p>TRC has evaluated "chemical contaminants in sediments of New York Tributaries to Lake Ontario."</p> <p>TRC has tabulated all sediment contamination data obtained to date. Several rivers have been identified which are particularly contaminated. These are Eighteen Mile Creek, Genesee River, Black River, Niagara River, Buffalo River and Oswego River. The main contaminants are PCBs, Lead, mercury, dioxins and pesticides.</p>	<p>TRC has evaluated and tabulated all information obtained to date on sediments within the Eastern Great Lakes Basin.</p>

TABLE 2. (CONTINUED)

Date: 8/25/93

Data Type/ Source	Status	Next Steps/Barriers
Air Sources		
AIRS (Air Emissions)	<p>TRC has attempted to expedite the NYSDEC request, but discovered that the responsible person is away on vacation until 8/23/93. TRC has therefore had to use TRI data alone to obtain information on air emissions for this report.</p> <p>TRC contacted Gordon Howe, and has submitted a request to NYSDEC for information on all air emissions of the 18 target chemicals within the 32 Great Lakes counties. He warned that this request may take two weeks to address. TRC copied the request to E. Lonoff who will attempt to expedite it.</p> <p>From data obtained from the "Great Lakes Basin Risk Characterization Study" TRC has identified that 73% of all the lead loading to Lake Ontario is through atmospheric deposition. Similarly 72% of all benzo(a)pyrene loading is also from atmospheric loadings. These figures compare with only 7% for the total PCB loading through atmospheric deposition. Atmospheric deposition includes both direct and indirect deposition, the latter being from the outflow flux of upstream Great Lakes.</p> <p>As in 1986, the total lead deposition from the atmosphere was 153 metric tons. The major sources are transportation sources (cars, trucks, airplanes and trains).</p>	TRC did not receive NYSDEC air information in time to be included in the Final Report.

TABLE 2. (CONTINUED)

Date: 8/25/93

Data Type/ Source	Status	Next Steps/Barriers
AIRS (Air Emissions)	TRC has identified that lead is the only one of the 18 chemicals that is individually listed on the AIRS database. However no facilities have recorded emissions of lead on the database. TRC has obtained a list of facilities and their respective SIC codes for particulate emissions. This information may be utilized in identifying facilities which may be sources of other contaminants, such as PAHs.	
Long-Range Air Deposition	TRC contacted Gerry Mikol, NYSDEC. He identified that there are currently three air monitoring stations at Niagara, Buffalo, and Rochester. These stations have traditionally monitored for other environmental conditions, such as acid rain. Only recently have toxic chemicals been monitored. Gerry Mikol stated that there is no method for determining the sources of the chemicals.	<p>*TRC contacted NYSDEC again to obtain all data available to date on toxic loadings from the monitoring stations. According to NYSDEC sources, this information would be included in the air emissions data awaited from a separate section of NYSDEC. Air emissions data were not received from NYSDEC in time to be included in the Final Report.</p> <p>TRC has received the "Great Lakes Atmospheric Deposition (GLAD) Network", 1982 and 1983 Report from the Great Lakes National Program Office. This contained information on lead, PCBs, and benzo(a)pyrene.</p>

TABLE 2. (CONTINUED)

Date: 8/25/93

Data Type/ Source	Status	Next Steps/Barriers
Hazardous Waste Incinerators	<p>Information obtained from Karen Randolph identifies four hazardous waste incinerators in the Eastern Great Lakes Basin (a total of 8 in the whole of NY State); they are the following:</p> <ul style="list-style-type: none"> - Eastman Kodak, Rochester - Occidental Chemical, Niagara Falls - Occidental Durez, Niagara Falls - Laidlaw Environmental Services, Clarence (formerly BDT) (a commercial facility) 	TRC has not been able to identify if the emissions from these incinerators include the 18 target chemicals. Air emissions data were not received from NYSDEC in time to be included in the Final Report.
Med. Waste Incinerators	TRC contacted Daisy Mather, AWM - ACB, who stated that medical waste incinerators are not permitted by EPA, but by the state only.	TRC is awaiting air emissions data from NYSDEC. Air emissions data were not received from NYSDEC in time to be included in the Final Report.
MSW Incinerators	<p>TRC has obtained a listing of the following MSW incinerators:</p> <ul style="list-style-type: none"> - wastewater treatment plants thought to be using sewage sludge incinerators. - conventional municipal waste incinerators. <p>The information was obtained from Air Chief by Nancy O'Brien at the EPA Library. The information does not include emissions data, which are awaited from NYSDEC.</p>	TRC is awaiting air emissions data from NYSDEC. Air emissions data were not received from NYSDEC in time to be included in the Final Report.

TABLE 2. (CONTINUED)

Date: 8/25/93

Data Type/ Source	Status	Next Steps/Barriers
Multimedia Sources		
TRI	<p>TRI has obtained a printout of all facilities within the 32 Great Lakes Counties that have reported releases of any of the 18 chemicals of concern. There are 27 facilities identified. These are currently being tabulated.</p>	
<p>Haz. Waste Sites (TSDFs), Except Incinerators</p>	<p>TRC has summarized the information and included all known loading information for hazardous waste sites.</p> <p>TRC has reviewed the CERCLIS listing and has tabulated all known and suspected hazardous waste sites in the Eastern Great Lakes Basin.</p> <p>TRC has identified several hazardous waste sites along the Buffalo, Niagara and Oswego Rivers. These sites are located in varying degrees of proximity to the rivers, but undoubtedly are a major cause of contamination within the rivers. The sites are all in various stages of remediation.</p> <p>TRC has obtained the NPL listing for September 1990, as well as several other documents with information pertaining to hazardous waste sites. These are: "CERCLIS Characterization Project", EPA/540/8-91/082, November 1991; "NPL Characterization Project", EPA/540/8-91/071, November 1991; a printout from a recent project performed by TRC with hazardous waste site loadings.</p> <p>TRC has reviewed the Lake Ontario Toxic Management Plan, which contains a list of 48 haz. waste sites in the Lake Ontario Basin.</p>	<p>TRC has received the BRS data and has reviewed the files. However, these data do not include any information on emissions only waste handlers and therefore do not contribute to total loadings in the Eastern Great Lakes Basin.</p>

TABLE 2. (CONTINUED)

Date: 8/25/93

Data Type/ Source	Status	Next Steps/Barriers
MSW Landfills	TRC has contacted several people at NYSDEC who have no information on MSW landfills. TRC has identified the locations of some MSW incinerators and sludge incinerators in New York State.	
Ambient/ STORET	TRC received a significant amount of data from the STORET database. This includes ambient water sampling results with specific location information. TRC is currently analyzing the sampling results to identify hot spots and then determine the nearest facility outfall or other potential source.	Most of the data for the 18 target chemicals in the STORET database are reported to be below detection limits; as a result, this database does not provide useful information on ambient conditions.
Miscellaneous		
PADS	<p>The PADS database provides information on PCBs. Dave Greenlaw has been contacted by TRC. He suggested calling the TSCA hotline for information.</p> <p>TRC called the TSCA hotline and obtained names and numbers of further contacts. However, TRC has not identified any PCB-specific database and has been advised that all information on PCBs should be covered by the databases already accessed by TRC.</p>	

TABLE 2. (CONTINUED)

Date: 8/25/93

Data Type/ Source	Status	Next Steps/Barriers
PISCES	<p>TRC has a report on PISCES sampling in the Niagara River, "Sources of PCBs to the Niagara River, Interim Report, February 1992, Simon Litten, NYSDEC."</p> <p>TRC contacted Simon Litten, who was helpful in providing information on PISCES and other sediment sampling efforts in various rivers in the Lake Ontario Basin.</p> <p>He sent two reports: "Application of Passive Samplers (PISCES) to locating a source of PCBs on the Black River" and "Niagara River Cross Channel Homogeneity and Analysis of Upstream/Downstream Monitoring Data." These papers provided information on potential sources, but have limited value in identifying specific loadings other than to identify that a particular hot spot exists.</p>	TRC has utilized the PISCES data in conjunction with the sediment information.
Community Right-to-Know		TRC has EPA's "List of Lists" and has compiled applicable information.
RAP Reports	<p>TRC has obtained a copy of the articles in the June 1993 issue of Water Environment and Technology titled: "Great Lakes Initiative - Launching the Great Lakes Initiative; Designing Goals for the Great Lakes; Great Lakes RAPs are a hit." The latter identifies all the RAPs in the Great Lakes Region.</p> <p>These are for the Niagara River, Buffalo River, Oswego River, Eighteen Mile Creek and Rochester Embayment. TRC has copies of the Niagara, Buffalo, Oswego River and Rochester Embayment RAPs. The Eighteen Mile Creek RAP is currently in progress and will not be available for at least a year. At this stage, only sampling data are available.</p>	The RAPs have been a good source of information on hazardous waste sites, other sources, and to some extent, loadings. TRC has tabulated the information obtained from the Niagara, Buffalo and Oswego River RAPs, and is currently the Rochester Embayment Phase I RAP.

TABLE 2. (CONTINUED)

Date: 8/25/93

Data Type/ Source	Status	Next Steps/Barriers
Other?	<p>TRC has obtained the "Niagara Falls Storage Site Annual Environmental Report for calendar year 1991." This site is part of the FUSRAP program. There are no emissions from this site, although ground water data are provided (for lead and mercury).</p> <p>TRC will attempt to identify other FUSRAP sites in the area. FUSRAP sites are not subject to chemical release reporting provisions. However, if a TPQ is exceeded at a site, the Toxic Chemical Release Inventory Reporting Form (Form R) under 40 CFR 372.85 is filed with EPA. TRC is investigating obtaining any Form Rs filed. This may be useful in identifying potential sources.</p> <p>TRC has also investigated the 33/50 Program as a source of information. This program encourages companies to voluntarily commit to reductions in emissions and waste transfers. TRC has obtained a copy of EPA document "EPA's 33/50 Program Second Progress Report", dated February 1992.</p> <p>Although this document identifies companies in New York that have committed to the program, individual facilities are not listed. TRC contacted Nora Lopez, ESD-PTS who is sending information on all the facilities in New York that are part of the program and a breakdown of their loadings. She will also send the third progress report, dated March 1993.</p>	<p>TRC has received and reviewed "Toxic Chemicals in the Great Lakes and Associated Effects, Vol. I and II."</p> <p>TRC has received and reviewed the "1989 Report in Great Lakes Water Quality".</p> <p>Greg Allande, EPA, has informed TRC that no specific format for entry into GIS currently exists. Data should be provided in ASCII format with a clear explanation of how cells are organized. TRC's data format complies with this guidance.</p> <p>TRC has received an updated version of Table I from the Lake Ontario Toxics Management Plan, and utilized this information when suggesting intervention proposals.</p>

TABLE 2. (CONTINUED)			Date: 8/25/93
Data Type/ Source	Status	Next Steps/Barriers	
Other? (cont.)	TRC received the listing of facilities in New York from the EPA's 33/50 Program. However this only contains information on total loadings and does not identify individual chemicals.		

* - New information since last report submitted.

TABLE 3. INTERVENTION PROPOSAL DEVELOPMENT

Date: 8/25/93

Areas of Analysis	Status	Next Steps/Barriers
Screen and Prioritize Known Sources	TRC has tabulated known point and non-point sources for the 18 chemicals. These identify industrial discharges, municipal discharges, spills, atmospheric deposition, surface runoff, incinerators, hazardous waste sites, and sediments.	TRC has summarized the main sources for each chemical, to identify which source area should be primarily addressed. For industrial point source discharges, TRC has identified the industry types (by SIC code) that are found to be the major source for each chemical. TRC used this information to propose remedial technologies, waste minimization and pollution prevention strategies that may be implemented for each industry.
Identify Data Gaps	As an ongoing part of the data collection, TRC is identifying the limitations of the data collected. This will assist in identifying data gaps.	TRC identified further reports to be obtained and databases to be accessed. TRC also discussed the data gaps and limitations of the data obtained to date.

TABLE 3. (CONTINUED)

Date: 8/25/93

Areas of Analysis	Status	Next Steps/Barriers
<p>Identify Immediate Reduction Actions</p>	<p>TRC has identified types of industries that discharge the bulk of the loading for each of the 18 chemicals and has used this information to evaluate applicable waste minimization and pollution prevention technologies.</p> <p>*Pollution prevention techniques may include proposing alternative chemicals to perform the same function within a particular industry. Waste minimization techniques include add-on waste stream treatment technologies or process alterations.</p> <p>TRC has already contacted the county pollution prevention office in Erie County which provides information on pollution prevention techniques for particular industries.</p> <p>TRC will identify the counties that contribute the majority of the loadings to the Basin. The individual pollution prevention offices within each county will then be contacted, if time permits.</p> <p>TRC has access to PIES, a database of publications related to pollution prevention.</p>	<p>TRC reviewed the Lake Ontario Toxics Management Plan and extracted applicable information on recommended/planned remedial actions.</p>
<p>Make FY94 Budget Commitments</p>	<p>TRC will identify sources where the remediation process may be accelerated. In particular, TRC has identified hazardous waste sites, particularly in Erie and Niagara Counties, that have over 200 sites identified on the CERCLIS list, but not yet investigated. Directing additional budget allowances to investigate these sites would accelerate the remediation process.</p>	

TABLE 3. (CONTINUED)

Date: 8/25/93

Areas of Analysis	Status	Next Steps/Barriers
Other?	<p>TRC has completed the material matrix for each chemical identifying the sources, their respective loadings, any regulatory controls currently proposed and promulgated, pollution prevention and waste minimization techniques, and the feasibility of the intervention alternative.</p> <p>TRC has also included a discussion of the following non-point sources separately to propose specific intervention/remediation proposals:</p> <ul style="list-style-type: none">- surface runoff, including stormwater and CSOs- hazardous waste sites- sediments- atmospheric deposition- spills	

APPENDIX G
LAKE ONTARIO BASIN
AND MAJOR SUB-BASINS

Source: Lake Ontario Toxics Management Plan.

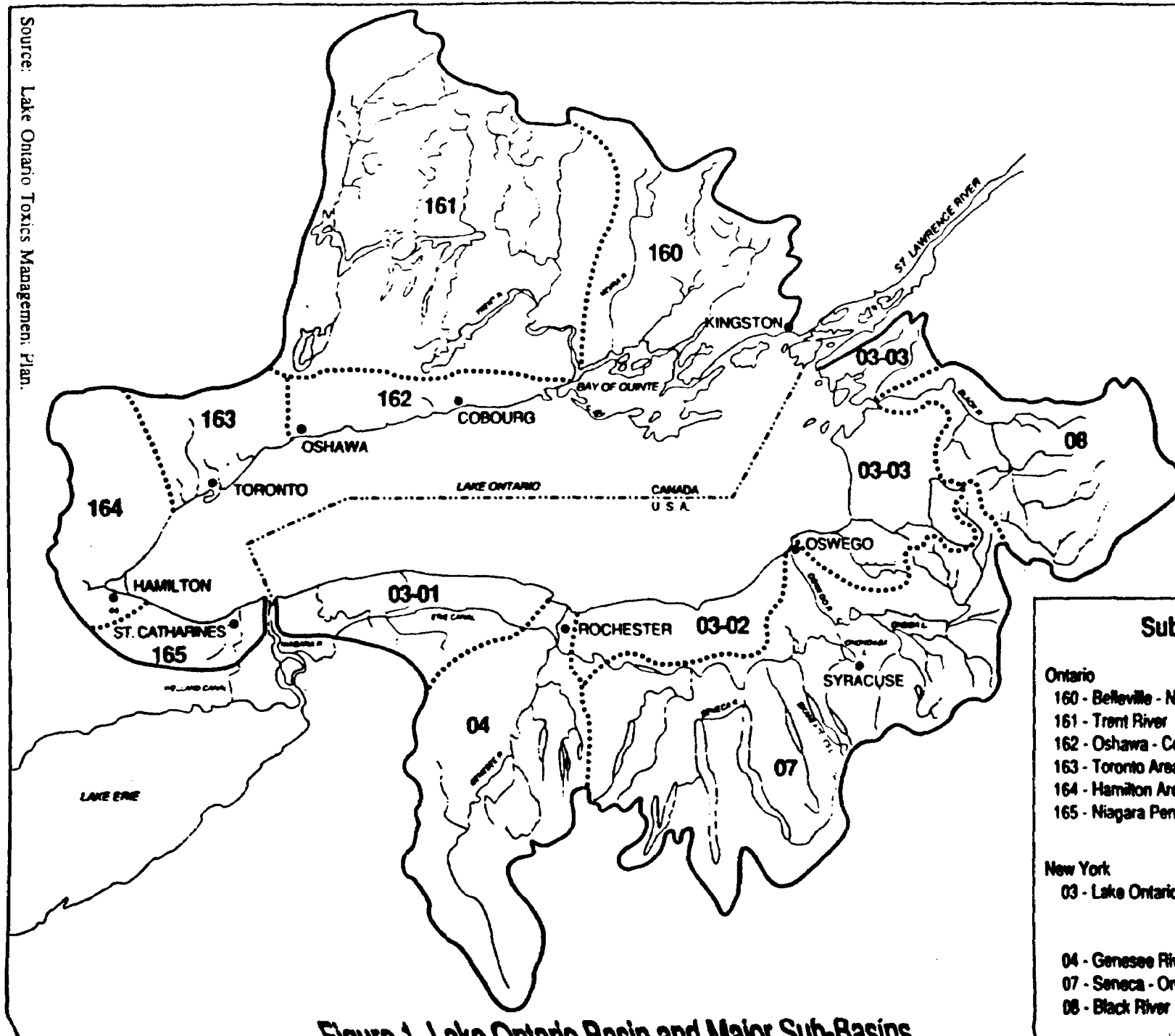


Figure 1. Lake Ontario Basin and Major Sub-Basins