Chapter II

POINT SOURCE DISCHARGES

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2.1 Introduction

In order to characterize the input of EPA priority pollutants and selected special categories of organic contaminants from point sources along the Niagara River, sampling surveys were conducted at industrial and municipal dischargers and urban drainage systems on both the Canadian and U.S. sides of the river. The four agencies involved in the 1981-82 study were: the New York State Department of Environmental Conservation (DEC), the United States Environmental Protection Agency (EPA), the Ontario Ministry of the Environment (MOE), and Environment Canada's Environmental Protection Service - Ontario Region (EPS).

This chapter outlines the historical development of pollution control programs for the Niagara Basin. The point source investigations undertaken as part of the 1981-82 study are then discussed, including sampling and analytical methods and data limitations. Finally, a summary of the results is presented. Individual descriptions of significant point sources (listed by sub-area) are contained in Appendix A.

2.2 Historical Pollution Control Development

Parallel historical pollution control development has occurred on both sides of the Niagara River. Although the regulatory statutes and mechanisms by which pollution control has been achieved differ, the goals are common as evidenced by the 1978 Great Lakes Water Quality Agreement between Canada and the United States.

2.2.1 New York

In the mid 1960's, studies were initiated to formulate plans for the integration of collection and treatment systems in Erie and Niagara counties and to upgrade the level of municipal treatment to a minimum of secondary, with phosphorus removal for those facilities having flows greater than 1.0 million U.S. gallons per day. With the New York State Pure Waters Bond Issue of 1965, the New York State Environmental Quality Bond Issue of 1972, and the Federal Water Pollution Control Act Construction Grant Program initiated in 1956, state and federal assistance was provided to implement these regional plans. Twenty-six existing municipal wastewater facilities, providing only primary treatment, were consolidated into 9 major municipal wastewater collection and treatment systems. In the design of the treatment facilities, specific consideration was given to the contributing industrial discharges to these systems. To maximize the compatibility of municipal treatment with industrial discharges and to assure effective operation of the wastewater treatment plants (WWTP), industrial process modifications and pretreatment were also required. Over one billion dollars have been expended in the construction of these municipal facilities. Several hundred million dollars were also expended on industrial treatment facilities.

As early as 1950, New York State adopted regulations for the establishment of standards for the quality and purity of the state waters. With the passage of the 1972 Federal Water Pollution Control Act Amendments, discharges to New York State waters were controlled on the basis of effluent and water quality standards. The State Pollutant Discharge Elimination System (SPDES) adopted in 1973 facilitated the delegation of the federal effluent standards program to the state. Permits issued under this system require municipal and industrial facilities to provide a minimum of best practicable treatment prior to discharge to surface waters in the state. The first-round of permits primarily addressed conventional pollutants with only limited attention to toxic substances. Municipal and industrial facilities along the Niagara River are currently in general compliance with their permits.

In 1976, the DEC initiated the Industrial Chemical Survey as a major part of the strategy for the trackdown of toxic chemicals. The survey requires industries to identify and report the quantity, use, production, or storage of a very broad range of organic and inorganic chemicals. It is updated through SPDES permit renewals and local pretreatment programs developed by municipalities.

As SPDES permits are redrafted, the Industrial Chemical Survey is reviewed to determine the need for special sampling and follow-up to identify and track down toxic substances. As a result, a number of Niagara River industries have completed short term, high intensity toxic chemical monitoring programs to assess the presence of toxic substances in their discharges. Requirements for such programs are incorporated in SPDES permits issued by DEC.

The Clean Water Act Amendments of 1977 (CWA) greatly increased the scope of industrial water pollution control by requiring EPA to establish discharge standards for 129 toxic pollutants for 21 types of industry. The CWA mandates that industries comply with discharge standards for toxic substances which are to be promulgated by EPA. These discharge standards constitute the "best available treatment technology economically achievable" (BAT).

DEC has drafted SPDES permit renewals and modifications for major industries and municipal facilities along the Niagara River employing Best Professional Judgment (BPJ) where EPA has not promulgated BAT standards. These permits have been issued, each with its own schedule of compliance, to assure that the statutory deadlines are met. In all instances, the data developed from the Niagara River Toxics Project point source measurements were available to the Division of Water staff for reference in establishing toxic effluent limitations or special requirements for monitoring toxic substances in the permits.

Industrial Pretreatment Programs have been under development for the service areas of the Buffalo Sewer Authority (BSA), Town of Amherst, Town of Tonawanda, City of North Tonawanda, Niagara County Sewer District No. 1, and the City of Niagara Falls. These Programs regulate the discharge of toxic substances from industries to the WWTP's. The primary objectives of the pretreatment regulations are to prevent the discharge of pollutants which, due to their toxicity, interfere with the operation of municipal wastewater treatment facilities and may pass through these facilities and enter the waterways of the state untreated, or will prevent or severely limit disposal options for large volumes of municipal sludge.

2.2.2 Ontario

Since the late 1950's, the Ontario Ministry of the Environment (MOE) and its predecessors have instituted pollution control programs in the Niagara Region. Significant clean-up of sanitary wastewater and liquid industrial discharges has been achieved. This has been accomplished through joint MOE/municipality and MOE/industry cooperation, and mechanisms such as Control Orders (e.g., Atlas Steels, Cyanamid Welland Plant, and Holiday Farms), Program Approvals (Canadian Oxy-Chemicals, B.F. Goodrich Chemicals), Certificates of Approval for process modifications or wastewater treatment systems, and, in the extreme, prosecution. The MOE has established abatement programs to bring facilities into compliance with discharge objectives for conventional pollutants, phenolics, and metals. However, toxic substances present at trace levels are generally not included in present Control Orders or Certificates of Approval.

For municipal sources, remedial efforts have included the construction of new sewage treatment works, the upgrading of existing facilities, and sewer rehabilitation. The Ontario Water Resources Act of 1957 gave the Ontario Government the power to construct and operate sewage treatment works in Ontario. The Act also prohibited the discharge of sewage from sewage works which were not constructed and operated in accordance with the approval of the Ministry of the Environment (initially Ontario Water Resources Commission (OWRC) approval). Control efforts have centered on BOD, suspended solids, and phosphorus removal from municipal sewage treatment plants. Phosphorus was a targeted substance in the Great Lakes Water Quality Agreement of 1972, although Ontario's efforts in phosphorus control actually started in the late 1960's.

Ontario pretreatment programs have, up to this time, been based upon municipal sewer use by-laws, which stipulate limits for the discharge of conventional pollutants, heavy metals, and some organics into sewage works. Pretreatment is carried out to meet these limits. In the case of BOD and suspended solids, the discharger can pay a sewer surcharge for treatment of overstrength wastes, which are subject to permits issued by the municipality. The municipal primary water pollution control plants (WPCP) at Fort Erie (Anger Avenue) and Niagara Falls were constructed in 1962-64.

Industrial abatement has addressed both conventional and other contaminants specific to the industrial operation including heavy metals, cyanide, and phenols. Abatement programs in the past have not been directed towards trace organic pollutants (as a category) in industrial and municipal discharges, but have addressed specific organic pollutants (e.g., vinyl chloride, phenols) where knowledge of the process indicates these compounds may be present. However, the findings of recent surveys designed to address this aspect and the recommendations of this report will assist in the evolution of further abatement and monitoring activities, where appropriate, in the Niagara Region.

2.3 Investigative Programs

2.3.1 Determination of Significant Point Sources

Significant point sources have been defined as those individual discharges which equal or exceed cutoff levels for at least one individual parameter in any of the following categories:

	Category	Cutoff Level kg/day (lb/day)
1.	Total Cyanide; 4AAP phenols; volatile, acid, base/neutral EPA priority pollutants	0.227 (0.5)
2.	Mercury; pesticides/PCBs	0.045 (0.1)
3.	EPA priority pollutant metals	0.454 (1.0)

Cutoffs on loading levels from point sources were arbitrarily selected by the Committee. This was done to limit the number of facilities described in detail in this report to a manageable level. The cutoff levels established by the Committee, however, accounted for approximately 95% of total EPA Priority Pollutants from all facilities sampled during the project. (For the complete list of EPA Priority Pollutants, please refer to Table A.1 in Appendix A).

2.3.2 Point Source Surveys

A breakdown of the categories of facilities surveyed and the number and types of samples collected by EPA, DEC, EPS, and MOE is presented in Tables 2.1 and 2.2.

TABLE 2.1

NUMBER OF POINT SOURCE FACILITIES SURVEYED DURING 1981-1982

TYPE OF FACILITY	U.S.			CANADIAN		
	Total	by EPA	by DEC	Total	by EPS	by MOE
Industrial	43	7	42	12	5	12
Municipal WWTPs[1] WPCPs[2]	9	5	9	3	3	3
Municipal CSOs[3]	1	0	1	2	2	2
Urban Storm Sewers	37	0	37	16	16*	
Discharge to Municipal WWTP (U.S. only)	28	1	27			

1 Wastewater Treatment Plant
2 Water Pollution Control Plant
3 Combined Sewer Overflow
* Urban Drainage Study carried out by NWRI; jointly funded by EPS/MOE.

TABLE 2.2

NUMBER OF POINT SOURCE SAMPLES COLLECTED

SAMPLE TYPE	U.S. EPA	U.S. DEC	CANADIAN EPS	CANADIAN MOE
Final Effluents - Municipal	5	15	11	6
Final Effluents - Industrial	21	102	23	36
Final Effluents - Indirect[1]	1	39	-	-
Industrial Water Intakes	4	14	6	8
Municipal Influents	-	16	9	3
Municipal Sludges	-	12	-	-
Urban Storm Sewer - Water	-	34	113	
Urban Storm Sewer - Sediment	1	32	104	
Receiving Water - Upstream	-	-	-	2
Receiving Water - Downstream	-	-	-	2
CSOs	-	1	12	4
Sample Blanks	30	220	10	-

1 Indirect industrial discharges to a municipal WWTP collection system.

With the exception of the samples collected for the U.S. and Canadian Urban Storm Sewer studies, each of the above listed samples was analyzed for EPA priority pollutants (organics and inorganics) and other selected contaminants. For the U.S. urban storm sewer studies, water samples were analyzed for phenols (4AAP), halogenated organics, and EPA priority pollutant volatiles. Sediment samples were analyzed for phenols (4AAP) and all the EPA priority pollutants except asbestos. Canadian urban runoff samples were analyzed for PCBs, organochlorine pesticides, PAHs, chlorinated benzenes, and metals. Asbestos was analyzed at 12 U.S. industrial outfalls and two industrial discharges to the Niagara Falls, New York WWTP. The analytical laboratories also tentatively identified many non-priority pollutant organics by GC/MS.

Concurrent with the New York chemical sampling activities, five gallon grab samples of most municipal and industrial effluents were collected by aquatic biologists from the DEC Bureau of Environmental Protection. These samples were transported to the biological laboratory within eight hours of collection, and were subjected to a 24-hour static screening bioassay test.

If the sample was determined to be acutely toxic, a definitive static bioassay was undertaken, with positive results reported as 48-hour LC50 (lethal concentration to 50 percent of the organisms), expressed as a percent of the effluent after serial dilution. Results of the acute toxicity tests are discussed for each facility. These tests were screening tests only, and followed EPA protocol. They do not determine chronic toxicity or bioaccumulation in aquatic species. Furthermore, the absence of an acute toxicity effect in the 24-hour screening assay does not necessarily imply that the samples would not exhibit toxic effects in a longer test.

A program of sampling of municipal storm sewer outfalls was included in the DEC point source project. The objective was to determine if there was any evidence that the selected storm sewers have served as conduits for toxic pollutants entering the river system. Sampling was conducted during dry weather conditions. A total of 37 storm outfalls were sampled from which 34 water samples and 32 sediment samples were collected.

2.3.3 Sampling Methods

The loadings reported for U.S. point sources represent the results of one to six 24-hour composite time or flow proportioned samples. Incremental samples were collected in a single glass container by automatic samplers over the 24-hour period. A series of four grab samples was collected over the 24-hour period for the analyses of purgeable compounds, total cyanides, and 4AAP phenols. The samples were preserved appropriately and grab samples were composited in the laboratory. At one site, it was not possible to use an automatic sampler. In this instance, a series of four grab samples was collected, for all parameter groups, over the 24-hour period. Wastewater treatment plant influent samples and industrial intake water samples were collected in a similar fashion, again with one exception. Grab samples only were collected at Olin Corporation's north and south production wells. Flow measurements were carried out at the time of sampling. A 40 ml vial field blank containing distilled water accompanied the sampling equipment throughout the sampling period and was transported to the laboratory with the other samples upon completion of monitoring.

The loadings reported for Canadian sources represent the results of one to eight composite or grab samples. The duration and type of sampling carried out by the Canadian agencies during individual point source surveys was dictated by the nature and location of the source. Composite samples were collected continuously, intermittently, or were made up of three to four grab samples of a discharge collected at different times. The compositing period ranged from six to 24 hours. The flows used to calculate point source loadings may have been measured at the time of sampling or based on weekly, monthly, or annual averages. Intake samples were collected for a limited number of sources, and grab samples were usually deemed sufficient. Field blanks containing distilled water were transported to the field, handled in the same manner as the samples collected, and transported to the laboratory for analysis as part of the EPS surveys. Details for each sampling location are provided in a separate report on the EPS/MOE surveys.

With the exception of samples for purgeable parameters, total cyanide, and 4AAP phenols, 99% of the American samples collected were composites. Except for purgeable parameters, 80% of the Canadian samples were composites. In general, composite samples are preferred except for purgeables, phenol, and cyanide samples. Also, flow data obtained during sampling are preferred for loading calculations.

2.3.4 Analytical Methods

The United States analytical data for organic priority pollutants are based upon methods and detection limits (D.L's) published by EPA in December 1979 and updated in July 1982 (the 600 series of EPA Analytical Methods). The EPA analytical protocols for the purgeables and the acid and base/neutral extractable fractions call for packed column GC with MS confirmation. If contaminant identification is not confirmed by MS, then the data must be considered tentative.

All of the EPA results and most of the DEC data were developed using the 1979 protocols. All purgeables and extractables reported, other than the pesticide/PCB fraction parameters, were confirmed by computer comparison to a reference mass spectrum in a reference library of priority pollutants. All of the EPA and the DEC pesticide/PCB results were obtained using a gas chromatograph with a single packed column and an electron capture detector using the 1979 protocol (Method 608). An attempt was made subsequent to the original analyses to qualitatively confirm the original sample data by reanalyzing frozen extracts. Second analyses for those extracts provided qualitative confirmation for only four pesticide parameters above the cutoff value in one sample. The confirmed values are noted in the general discussion of the Niagara Falls, N.Y. WWTP.

EPA protocols promulgated in July 1982 introduced method detection limits (MDL's). These MDL's, where determined, are significantly lower than the detection limits published in 1979 but are based on replicate analyses of solutions of a single parameter in reagent water. The DEC contract laboratory determined that these detection limits could be achieved in representative wastewater matrices and reported quantitative results at the MDL's beginning in the fall of 1982.

The Canadian analytical data for organic priority pollutants were based on the EPA methods published in December 1979, with the modifications outlined below. The MOE laboratory analysed volatile organics by purging 100 ml of sample, as opposed to the 5 ml volume required by EPA. In this way, MOE was able to achieve much lower detection limits for this group of compounds. The EPS laboratory analyzed the volatiles by GC-FID (Flame Ionization Detector). The FID is a non-specific detector. The EPA protocol allows GC analysis without MS confirmation, only when a specific detector is used. Since EPS volatiles data were not confirmed, some compounds may have been misidentified. Also, the EPS extractables data were not all confirmed, with one of three samples from each site confirmed by GC/MS. The U.S. and Canadian pesticides data were not confirmed by GC/MS, since EPA method 608 achieves lower detection limits at the expense of MS confirmation. However, this method employs a rigorous clean-up procedure and dual column analysis to minimize false identifications.

The EPS laboratory filtered all acid and base/neutral samples through a glass fiber filter prior to extraction to remove large suspended solids which interfere with the extraction procedure. This is a deviation from the Standard EPA protocol. The result may be a low estimate of some acid and base/neutral pollutant concentrations, especially those which are most adsorbable to suspended solids, such as the PAHs.

Many analytical laboratories have converted to the use of capillary columns in preference to packed columns. The capillary column is much more efficient in separating contaminants prior to their arrival at the instrument's detector and, if the correct detector is used, minimizes false positives when the data are not confirmed by MS. The packed column tends to crowd contaminant peaks and may cause an inaccurate estimation of pollutant concentrations. Packed columns were used for all volatiles. The MOE and EPS methods for pesticides/PCBs were essentially the same as the EPA methods; however this fraction was analyzed using capillary columns, though MOE analyzed selected pesticides by packed column. The improved response factors which resulted allowed for lower detection limits. EPS analyzed this fraction using a single capillary column. Retention times were compared with reference standard data with a narrow tolerance for retention time variability. Canadian acid and base/neutral extractables were analyzed by capillary column. The American acid and base/neutral compounds were analyzed using packed columns up to the fall of 1982 when a capillary column was adopted.

Both the MOE and EPS laboratories improved on the EPA protocols for acid and base/neutral priority pollutants by analyzing with capillary columns. However, the EPS laboratory filtered the samples prior to extraction, and extrapolated GC/MS data for one sample from each site to the remaining site samples analysed by GC alone. The MOE laboratory achieved lower detection limits by concentrating the sample extracts to 0.1 ml, as opposed to 1 ml, and by increasing the injection volume.

2.3.5 Data Limitations

The Data Quality Sub-Committee, was established by the Niagara River Toxics Committee, to review the analytical methods associated with the point source and other sub-projects. In its report to the Committee (Final Report to the Niagara River Toxics Committee, 1984) it has recommended specific limitations on the use of the point source data. While recognizing the limitations pointed out by the DQS, the NRTC believed that the quality of the data were sufficient for the purposes of this study. The reader who is interested in using the data or results in the Chapter should refer to the Sub-Committee report for their cautions on the use of the data from these sub-projects.

The point source surveys collected small numbers of samples (1-6 samples per outfall during the U.S. studies, 1-8 samples during Canadian studies). In the Canadian studies where more than one sample was collected, results have been reported as the sampling means. In the U.S. studies, although both DEC and EPA results are reported in the text, only the DEC results are reported in the table of loadings, except for one case (Republic Steel) where only EPA data were available. Concentration of trace organics and metals are known to be variable in wastewaters and may sometimes vary significantly on different sampling dates. In the case of one facility sampled, this variation exceeded 400% on three consecutive days of sampling for total metals and cyanide. As a review, an audit was conducted to compare the representativeness of the 1981 agency survey data with the historic data that were available for a number of the U.S. facilities. In general, there were insufficient historic data available to make a clear assessment. In the case of the Niagara Falls WWTP where significantly more data were available, the only assessment that could be made was that the agency data fell between the historic maximums and minimums. Despite the limited data from each point source, the results have been used as indicators to characterize the discharge and to estimate loadings from each facility during the 1981/82 sampling period.

The loading data reported here represent only the relative contaminant contributions of the various point sources in the Niagara River area at the time of sampling. The loadings to the river reported for all point sources measured in the study are total loadings and may include contaminants present in the intake water. Loadings are also expected to vary with the level of production at the time of sampling. It should be noted that during the 1981-82 sampling period, a number of the industries sampled were not operating at full capacity. Based on the above observations, the loading data cannot be used to project the annual loadings from these facilities.

The various laboratories involved in the point source surveys had different detection limits, though none was determined on a sample-by-sample basis. The Canadian detection limits were generally lower than the U.S.. Where compounds were identified but were reported at or below the D.L., a value equal to the detection limit was used to determine the maximum additional loadings potentially present (see individual New York and Ontario Results sections).

This chapter is, for the most part, restricted to EPA priority pollutants, although additional compounds were qualitatively identified by GC/MS. Information on these additional compounds is presented in the individual agency survey reports.

Because of the high volume of flows from some facilities that discharge treated wastewaters and cooling waters, reasonably large amounts of certain pollutants might be discharged without being detected at analytical detection levels used on the project. This may be particularly significant for municipal wastewater treatment plants that treat industrial wastes.

To illustrate the possible range of such undetected loads the following table shows the possible amount of undetected load at certain analytical detection limits and at certain flows. The detection limits and flows are in the range pertinent to this project.

POTENTIAL LOAD UNDETECTED (Kg/day)

Analytical Detection Limit (ug/L)	Flow (MGD) 50	100	200
0.01	0.0019	0.0038	0.0076
0.1	0.019	0.038	0.076
1.0	0.19	0.38	0.76
10.0	1.90	3.80	7.60
100.0	19.00	38.00	76.00

Project detection limits for wastewaters ranged from 0.5-10 ug/L for purgeables and base neutral extractables, 0.5-25 ug/L for acid extractables, 1.0-100 ug/L for metals, and 0.001-0.011 ug/L for pesticides. A flow of 50 MGD is typical for the Niagara Falls WWTP, while 100-200 MGD is typical for the Buffalo Sewer Authority.

2.4 Point Source Facilities Sampled

2.4.1 General

Figure 2.1 illustrates the location of the U.S. and Canadian significant point source discharges to the Niagara River, as well as the sub-area and segment boundaries on both sides of the River. Table 2.3 gives the names of facilities represented by numbers in Figure 2.1.

2.4.2 New York

2.4.2.1 Buffalo-Lackawanna Sub-Area

The Buffalo-Lackawanna sub-area is dominated by the steel industry and associated activities. The sub-area was divided into 4 river segments: the Lake Erie segment, the Buffalo River segment, the Bird Island-Riverside

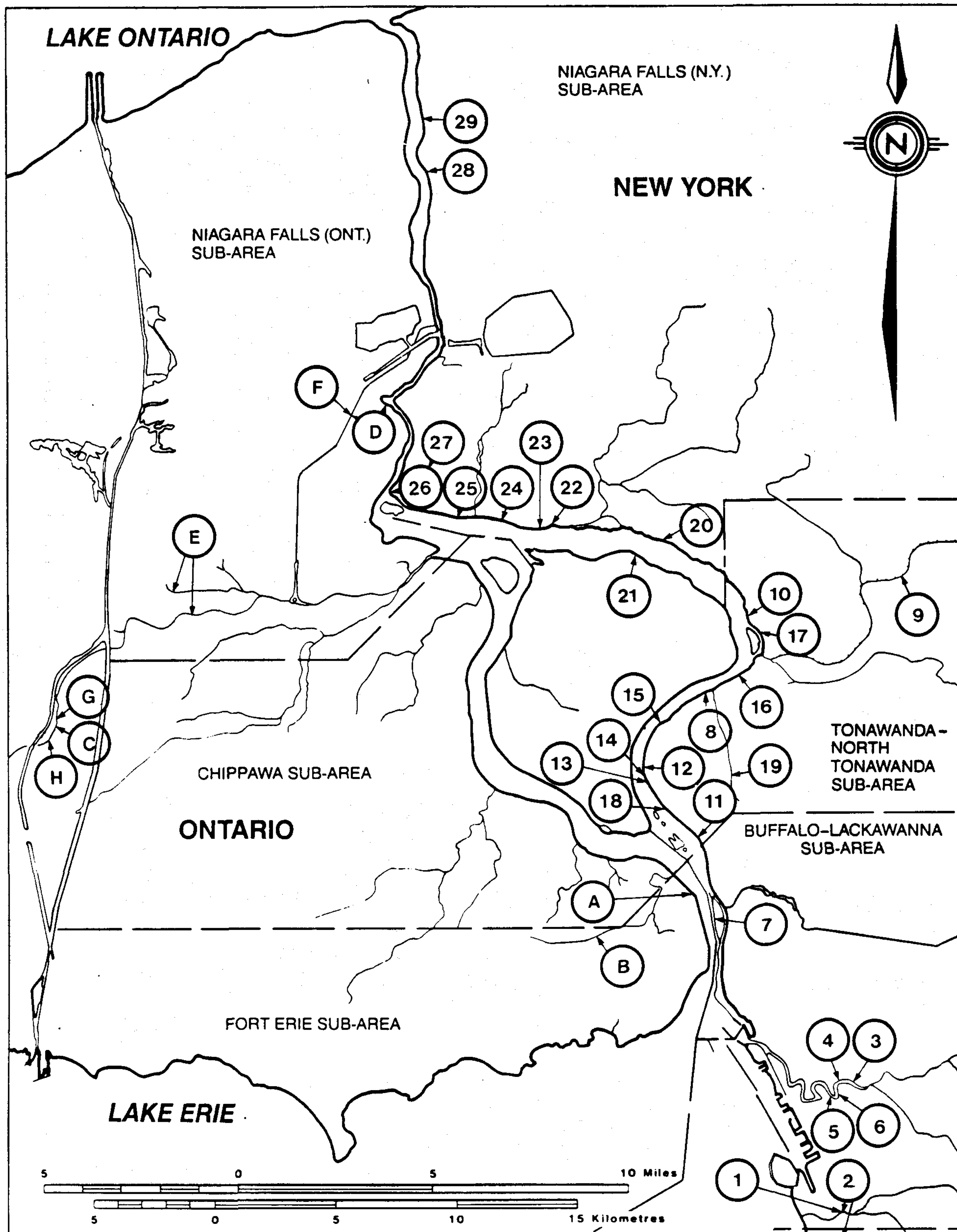

FIGURE 2.1 DISCHARGERS WITH SIGNIFICANT LOADINGS TO THE NIAGARA RIVER (See Table 2.3 for site identification.)

TABLE 2.3

SIGNIFICANT DISCHARGERS OF EPA PRIORITY AND SPECIAL POLLUTANTS TO THE NIAGARA RIVER
(Key to Facilities Shown in Figure 2.1)

MAP REFERENCE*	FACILITY
	Buffalo-Lackawanna Sub-Area
1.	City of Lackawanna WWTP
2.	Bethlehem Steel Corp.
3.	PVS Chemical Corp.
4.	Buffalo Color Corp.
5.	Donner-Hanna Coke Joint Venture
6.	Republic Steel Corp.
7.	Buffalo Sewer Authority
	Fort Erie Sub-Area
A.	Fort Erie WPCP
B.	Fleet Manufacturing
	Tonawanda-North Tonawanda Sub-Area
8.	Town of Tonawanda WWTP
9.	Town of Amherst WWTP
10.	City of North Tonawanda WWTP
11.	General Motors Corp.
12.	Niagara Mohawk Power Corp.
13.	Dunlop Tire & Rubber Corp.
14.	FMC Corp.
15.	Ashland Oil Inc.
16.	Spaulding Fibre Co.
17.	Occidental Chemical Co. Durez Div.
18.	E.I. duPont deNemours & Co. (Tonawanda Plant)
19.	Union Carbide Corp. Linde Div.

MAP REFERENCE	FACILITY
	Chippawa Sub-Area
	No Significant Sources
	Niagara Falls, New York Sub-Area
20.	Niagara County S.D. #1 WWTP
21.	Town of Grand Island S.D. #2 WWTP
22.	Occidental Chemical Corp. Niagara Plant
23.	Union Carbide Corp. Welding Flux
24.	E.I. duPont deNemours & Co. (Niagara Plant)
25.	Carborundum Corp.
26.	City of Niagara Falls WWTP
27.	Olin Corp.
28.	Town of Lewiston MSIA WWTP
29.	SCA Chemical Services
	Niagara Falls Ontario Sub-Area
C.	Atlas Steels
D.	Cyanamid Canada Ltd. (Niagara Plant)
E.	Cyanamid Canada Ltd. (Welland Plant)
F.	Niagara Falls WPCP
G.	Welland WPCP
H.	McMaster Ave. Combined Sewer

*See Figure 2.1 for location of dischargers.

segment, and the Black Rock Canal segment. Three facilities were sampled in the Lake Erie segment: the City of Lackawanna Wastewater Treatment Plant (WWTP), Bethlehem Steel Corporation, and Ferro Corporation. No significant loadings were identified in the Ferro Corporation discharge. The Hanna Furnace Corporation had been a major industrial discharger to this segment; but, it terminated operations in 1982 prior to sampling.

In the Buffalo River segment, five major industrial facilities were sampled. These were the Buffalo Color Corporation, PVS Chemicals Incorporated, Allied Chemical Corporation - Industrial Chemical Division (all part of the former Allied Chemical Corporation complex), Republic Steel Corporation, and Donner Hanna Coke Joint Venture (Republic Steel Corporation and Hanna Furnace Corporation). Mobil Oil Corporation maintains a mothballed gasoline refinery and an active petroleum products distribution terminal along this segment. There is no petroleum processing at this site, and Mobil has no current discharge to the Buffalo River. No priority pollutant loadings above cutoff values were identified in the discharges from Allied Chemical Corporation.

All of the above firms obtain process and cooling water from the Buffalo River Improvement Corporation (BRIC) created by the City of Buffalo to provide a designed flow augmentation of the Buffalo River of 454,000 m^3/day (120 million gallons per day) through an intake located in the Buffalo Outer Harbor.

The Dresser Transportation Equipment Division of Dresser Industries, Incorporated discharged treated process wastes to Cayuga Creek, a tributary of the Buffalo River. "Zero discharge" has been mandated in the state discharge permit for this currently inactive facility; and, it was not sampled.

Three minor industrial facilities were sampled in this segment including the Consolidated Rail Corporation (Conrail) - Bison Yard; Worthington Group, McGraw-Edison Company, and Airco Industrial Gases. None of these facilities had loadings of toxic substances above cutoff levels in their discharges, and all three had negative results from acute toxicity screening tests.

There are no major municipal wastewater treatment plant discharges to this segment; but, combined sewer overflows from the Buffalo Sewer Authority (BSA) collection system are located along this waterway.

There are no major direct industrial or municipal discharges to the Black Rock Canal segment; but, combined sewer overflows from the Buffalo Sewer Authority collection system are located along the Canal and Scajaquada Creek, a tributary to the Black Rock Canal.

Sampling was undertaken at three minor industrial discharges in the Town of Cheektowaga (east of Buffalo) which enter Scajaquada Creek. These discharges include Westinghouse Electric Corporation - Buffalo Division, Arcata Graphics - Buffalo Division, and Spencer Kellogg Division of Textron, Incorporated. No loadings of toxic substances were identified in these discharges above cutoff values.

The only facility to discharge into the Bird Island-Riverside segment is the Buffalo Sewer Authority WWTP. Combined sewer overflows from the Buffalo Sewer Authority collection system are also located along this reach.

2.4.2.2 <u>Tonawanda-North Tonawanda Sub-Area</u>

This sub-area consists of one segment, the Tonawanda Channel (east channel) of the Niagara River around Grand Island.

Three municipal facilities were sampled in this segment: the Town of Tonawanda WWTP, the Town of Amherst WWTP, and the City of North Tonawanda WWTP.

Seven major industries were sampled, including Chevrolet Division of General Motors Corporation, Niagara Mohawk Power Corporation, Dunlop Tire and

Rubber Corporation, FMC Corporation - Industrial Chemical Group, Spaulding Fibre Company Incorporated, Occidental Chemical Corporation - Durez Resins and Molding Materials Division, and Ashland Oil Incorporated.

Seven other industrial dischargers were also sampled: E.I. du Pont de Nemours and Company, Buffalo Film Division (acute toxicity only), Polymer Applications Incorporated, Tonawanda Coke Corporation, Bisonite Company Incorporated, Union Carbide Corporation (Linde Division), the Exolon Company, and Columbus McKinnon Corporation. No loadings of toxic substances above cutoff levels were identified in five of these discharges. Union Carbide Corporation (Linde Division) and E.I. du Pont de Nemours and Company (Tonawanda Plant) were considered significant dischargers and are discussed in this chapter. E.I. du Pont de Nemours and Company, which was not sampled for priority pollutants by DEC, is discussed on the basis of its permit renewal application data.

2.4.2.3 Niagara Falls, New York Sub-Area

The Niagara Falls sub-area is the focal point for the chemical industry along the Niagara River. This sub-area is comprised of the Wheatfield-Upper River segment and the Lower River segment.

Two municipal facilities were sampled in the Wheatfield-Upper River segment: the Niagara County Sewer District No. 1 WWTP and the Town of Grand Island Sewer District No. 2 WWTP.

Four major industrial facilities were sampled including Occidental Chemical Corporation-Hooker Industrial and Specialty Chemicals (Niagara Plant), Union Carbide (Linde Division), Welding Flux Plant, E.I. du Pont de Nemours and Company (Niagara Falls), and the Carborundum Company (Buffalo Avenue Complex).

The minor industrial dischargers sampled were Bell Aerospace Textron, Carborundum (Coated Abrasives Division), Kennecott Graphite Process

Company, Newco Wastes Systems, Incorporated, Great Lakes Carbon Corporation, and Occidental Chemical Corporation (Corporate Technical and Services Center). No toxic loadings above the cutoff were identified in these discharges.

The two municipal dischargers sampled in the Lower River segment were the City of Niagara Falls WWTP and the Town of Lewiston Master Sewer Improvement Area WWTP.

Five major industrial dischargers were sampled including the Occidental Chemical Corporation-Hooker Industrial and Specialty Chemicals (Niagara Plant)-Outfall #004 via the City Diversion Sewer, E.I. du Pont de Nemours and Company (Niagara Plant)-Outfall #001 via the City Diversion Sewer, Olin Corporation-all outfalls via the City Diversion Sewer, Carborundum Company-Outfall #004 via the City Diversion Sewer, and SCA Chemical Service, Incorporated.

2.4.2.4 Results

Organic EPA priority pollutants accounted for 17.5% of the total priority pollutants from New York point sources measured in the study. The following is a listing by order of magnitude of loadings of the 15 most prevalent organic compounds quantified:

	Substance	kg/day	lbs/day
1.	Phenol	42.6	94.0
2.	Trichloroethylene	36.6	80.8
3.	Methylene chloride	24.4	53.7
4.	Chloroform	21.4	47.6
5.	Tetrachloroethylene	15.7	34.6
6.	Bis(2-ethylhexyl) phthalate	9.6	21.2
7.	Toluene	8.6	18.9
8.	Trans-1,2-dichloroethylene	6.2	13.6
9.	Pyrene	5.3	11.6
10.	1,2-Dichlorobenzene	5.2	11.5

TABLE (continued)

	Substance	kg/day	lbs/day
11.	Anthracene	4.5	9.9
12.	1,1,1-Trichloroethane	4.4	9.7
13.	1,1,2,2-Tetrachloroethane	4.3	9.4
14.	Ethylbenzene	4.2	9.2
15.	1,2,4-Trichlorobenzene	4.1	9.1
TOTAL		197.1	434.8

These parameters represent 90.3% of the total measured New York loading of organic priority pollutants. The majority of the organics 61% being discharged from New York point sources are purgeable fraction compounds.

Municipal and industrial discharges constitute the following percentages of identified and quantified loadings to the river from New York sources.

Pollutant Category	Municipal	Industrial
EPA Priority Pollutants		
Organics	46.8%	53.2%
Metals	56.3%	43.7%
Cyanides	59.9%	40.1%
Phenols (4AAP)	54.6%	45.4%

Table 2.4 summarizes the categories of loadings of toxic substances on the New York side of the river by sub-area and river segments. The Black Rock Canal segment was not included as there are no significant point source discharges to this segment with the exception of combined sewer overflows from the Buffalo Sewer Authority collection system.

Polycyclic aromatic hydrocarbons (PAHs) are inherent in the wastewaters of the iron and steel industry coking operations. The PAH loading to the Buffalo River is about ten times greater than PAH loading to the Lake Erie segment, illustrated in Table 2.4. Donner Hanna Coke, now closed, accounted for all of the PAH loading to the Buffalo River as measured

TABLE 2.4

EPA PRIORITY POLLUTANT AND SPECIAL CATEGORY LOADINGS
FOR PARAMETERS QUANTIFIED FROM DEC 1981-82 SAMPLING
kg/d(lb/d)

Sub-Area	Buffalo - Lackawanna			Tona.-N. Tona.	Niagara Falls, N.Y.		
Segment	Lake Erie	Buffalo R.	Bird Island - Riverside		Wheatfield-Upper River	Lower River	Totals
POLLUTANTS/CATEGORIES							
EPA PRIORITY POLLUTANTS							
Acid Extractables	13.4(29.5)	-	-	5.6(12.4)	1.7(3.8)	25.0(55.2)	45.8(100.9)
Base/Neutral Extractables							
PAHs	1.2(2.6)	14.9(32.8)	0.7(1.5)	0.4(0.9)	-	-	17.1(37.7)
PCBs	0.1(0.2)	-	-	-	-	-	0.1(0.2)
Pesticides	0.1(0.3)	0.1(0.2)	0(0.1)	0.1(0.2)	0(0.1)	1.1(2.4)	1.4(3.3)
Other B/Ns	4.9(10.8)	-	4.1(9.0)	1.5(3.3)	1.8(3.9)	8.7(19.2)	21.0(46.3)
Total B/Ns	6.3(13.9)	15.0(33.0)	4.8(10.6)	2.0(4.4)	1.8(4.0)	9.8(21.6)	39.7(87.5)
Purgeables	0.7(1.5)	1.6(3.5)	18.5(40.7)	8.3(18.2)	1.6(3.6)	102.5(226.1)	133.2(293.6)
Metals, Total	158.4(349.2)	14.4(31.7)	401.6(885.5)	250.7(552.7)	41.4(91.3)	125.7(277.2)	992.2(2187)
Cyanides, Total	2.0(4.5)	7.6(16.7)	12.7(27.9)	19.1(42.1)	0.1(0.2)	1.3(2.9)	42.6(93.9)
SPECIAL ORGANIC POLLUTANT CATEGORIES							
Phenols (4AAP)	3.9(8.7)	4.8(10.6)	4.7(10.3)	36.1(79.6)	1.2(2.6)	107.2(236.3)	157.9(348.1)
Chlorobenzenes	-*	-*	0.4(0.8)*	4.7(10.3)**	1.6(3.5)**	8.3(18.2)**	15.0(32.8)
Chlorotoluenes	-***	-***	-***	-**	3.0(6.6)**	47.7(105.2)**	50.7(111.8)

Notes: Loadings include significant and other discharges monitored. Dash (-) indicates none detected. * Values indicated are EPA-priority pollutant chlorobenzenes only. ** Special scan conducted including 4 non-priority pollutant chlorobenzenes and 20 chlorotoluenes for the following facilities only: Occidental Durez Div. (Tona.-N. Tona. Sub-area); Occidental Niagara Plant (Wheatfield-Upper River Segment); Niagara Falls (C) WWTP, Occidental Niagara Plant (Lower River Segment). Values include both non-priority and priority pollutant chlorobenzenes, quantified parameters only. *** No special scan conducted.

in the DEC/EPA point source surveys. Wastewaters from the coking operation at Bethlehem Steel were employed to quench slag, with no discharge of quench water.

Metals loadings by dischargers to the Tonawanda-North Tonawanda sub-area include elevated levels of nickel, 135.1 kg/day (298 lbs/day) from the Niagara Mohawk Huntley Station and 34.7 kg/day (76.7 lbs/day) of zinc from Spaulding Fibre. Both discharges are under investigation by DEC.

Lower river loadings of organics 137.4 kg/day (303 lbs/day), phenols 107.2 kg/day (236.3 lbs/day), and chlorotoluenes 47.7 kg/day (105.2 lbs/day) were the highest of all the segments. These loadings will be reduced by the restoration of activated carbon treatment at the City of Niagara Falls WWTP which is expected in 1985 along with implementation of BAT/BPJ limits for renewed SPDES permits for the chemical industries in Niagara Falls.

For the DEC and EPA data, those compounds at or below the detection limit were assumed to be zero in the calculation of loadings. A maximum additional loading potentially present was then added, which, for those compounds found to be present but not quantified, was based on the assumption that the compound was at the detection level.

Table 2.5 contains the maximum additional loadings potentially present based on the semi-quantitative results. This amounts to a maximum potential increase in total loading for the U.S. point sources of 56 kg/d (123 lb/d), which represents 4.5% of the respective quantified priority pollutant loadings. The actual priority pollutant loads may therefore be greater by this amount.

2.4.3 Ontario

2.4.3.1 Fort Erie Sub-Area

One municipal and three industrial facilities were sampled in this sub-area. The Fort Erie Anger Ave. WPCP is a primary plant and, based on the

TABLE 2.5

MAXIMUM ADDITIONAL EPA PRIORITY POLLUTANT AND SPECIAL CATEGORY LOADINGS FOR PARAMETERS IDENTIFIED BELOW QUANTIFIABLE LIMITS FROM DEC 1981-82 SAMPLING
kg/d(lb/d)

Sub-Area	Buffalo - Lackawanna			Tona.-N. Tona.	Niagara Falls, N.Y.		
Segment	Lake Erie	Buffalo R.	Bird Island - Riverside		Wheatfield-Upper River	Lower River	Totals
POLLUTANTS/CATEGORIES							
EPA PRIORIOTY POLLUTANTS							
Acid Extractables	-	-	-	0.1(0.2)	0.2(0.5)	-	0.3(0.7)
Base/Neutral Extractables							
PAHs	1.5(3.3)	14.0(30.9)	6.1(13.3)	1.1(2.5)	0.1(0.2)	0.8(1.8)	23.6(52.0)
PCBs	-	-	-	-	-	-	0(0)
Pesticides	-	-	0.1(0.2)	-	-	-	0.1(0.2)
Other B/Ns	0(0.1)	-	3.2(7.1)	0.9(2.0)	0.6(1.3)	0.4(0.9)	5.2(11.4)
Total B/Ns	1.5(3.4)	14.0(30.9)	9.3(20.6)	2.0(4.4)	0.7(1.5)	1.2(2.7)	28.7(63.5)
Purgeables	0.1(0.3)	0.4(0.8)	15.3(33.7)	1.6(3.6)	2.3(5.0)	7.3(16.0)	27.0(59.4)
Metals	-	-	-	-	-	-	-
Cyanides, Total	-	-	-	-	-	-	-
SPECIAL ORGANIC POLLUTANT CATEGORIES							
Phenols (4AAP)	-	-	-	-	0.2(0.4)	-	0.2(0.4)
Chlorobenzenes	0(0.1)*	-*	2.2(4.9)*	5.5(12.2)**	1.7(3.8)**	10.3(22.7)**	19.7(43.7)
Chlorotoluenes	-***	-***	-***	0(0)**	1.2(2.6)**	0.4(0.9)**	1.6(3.5)

Notes: Loadings include significant and other discharges monitored and consist of identified parameters reported as "less than or equal to" the parameter detection limit at the concentration value of the detection limit. Dash (-) indicates none detected.
* Values indicated are EPA-priority pollutant chlorobenzenes only. ** Special scan conducted including 4 non-priority pollutant chlorobenzenes and 20 chlorotoluenes for the following facilities only: Occidental Durez Div. (Tona.-N. Tona. Sub-area); Occidental Niagara Plant (Wheatfield-Upper River Segment); Niagara Falls (C) WWTP, Occidental Niagara Plant (Lower River Segment). Values include both non-prioritiy and priority pollutant chlorobenzenes, quantified parameters only. *** No special scan conducted.

cutoff values previously defined, has been designated a significant municipal source. Fleet Manufacturing, Canadian Oxy Chemicals-Durez Division, and Gould Manufacturing were the industrial facilities sampled. Fleet Manufacturing has been designated a significant industrial source.

No significant (i.e., above cutoff) levels of pollutants of interest were identified in the other two discharges. These have, therefore, been designated as minor sources.

2.4.3.2 Chippawa Sub-Area

There is only one point source discharger in this sub-area: Holiday Farms. Based on the cutoff values established, Holiday Farms has been designated a minor industrial source.

2.4.3.3 Niagara Falls, Ontario Sub-Area

The Niagara Falls sub-area contains the bulk of point sources on the Canadian side of the Niagara River. Four municipal sources were sampled in this area including the Niagara Falls WPCP, the Welland WPCP, Stanley Ave. Sewer, and McMaster Ave. combined sewer. Eight industrial facilities were sampled including Stelco-Welland Tube, Atlas Steels, B.F. Goodrich, Cyanamid (Welland Plant), Ford Glass Plant, Norton Company, Canadian Carborundum, and Cyanamid (Niagara Falls Plant).

Based on the cutoff values defined, Niagara Falls WPCP (a primary plant), Welland WPCP (a secondary plant), and McMaster Ave. Combined Sewer have been designated significant municipal sources.

On the same basis, Atlas Steels, Cyanamid Welland Plant, and Cyanamid Niagara Falls Plant have been designated significant industrial sources.

Stanley Ave. sewer, Stelco-Welland Tube, B.F. Goodrich, Ford Glass, Norton, and Canadian Carborundum have been designated minor sources as pollutants of interest have not been detected above cutoff values in their discharges.

2.4.3.4 Results

Organic EPA priority pollutants accounted for 11% of the total priority pollutants from Canadian point sources. The top fifteen individual compounds, listed below, accounted for 96% of the point source organics loading. This list is dominated by phthalate plasticizers and purgeable compounds. All of these compounds were above the cutoff of 0.227 kg/d (0.5 lb/d) used to determine a significant industrial source.

	Substance	kg/day	lbs/day
1.	Di-n-butyl phthalate	5.3	11.6
2.	Trichloroethylene	3.3	7.22
3.	trans-1,2-Dichloroethylene	1.9	4.2
4.	Diethyl phthalate	1.1	2.4
5.	Bis(2-ethylhexyl) phthalate	0.93	2.1
6.	Methylene chloride	0.91	2.0
7.	Dimethyl phthalate	0.75	1.7
8.	Toluene	0.57	1.3
9.	Butylbenzyl phthalate	0.43	0.95
10.	1,2-Dichloroethane	0.40	0.88
11.	2,4-Dichlorophenol	0.39	0.86
12.	Chloroform	0.34	0.75
13.	Benzene	0.25	0.55
14.	1,1,1-Trichloroethane	0.25	0.55
15.	1,2-Dichlorobenzene	0.24	0.52

The three municipal water pollution control plants (WPCPs) accounted for 98% of the total point source loading of acid extractables with 2,4-dichlorophenol and phenol the major pollutants (97% of total). Low levels of PAHs were discharged, with naphthalene making up 60% of the total. The major sources were the municipal WPCPs, which discharged 81%.

PCBs were detected in five effluents including the Welland WPCP. The total Canadian loading of PCBs was 0.0063 kg/day. Pesticides were ubiquitous, low level contaminants with 74% of the total found in municipal WPCPs and the McMaster Ave. Combined Sewer. The major parameters discharged were: alpha-BHC, heptachlor and p,p'-DDT which together accounted for 77%. The extractables category, "other base/neutrals", was dominated by phthalates which accounted for 97% of the loading. The three municipal plants and the McMaster Ave. Combined Sewer discharged 86% of the total other base neutrals. Cyanamid Niagara Falls and Cyanamid Welland discharged an additional 7%.

Purgeable priority pollutants are the most frequent on the top fifteen organics list. The three municipal plants discharged 51% of the total volatiles and Atlas Steels an additional 40%. Three compounds made up 75% of the loading: trans-1,2-dichloroethylene, methylene chloride, and trichloroethylene.

Metals made up the major portion of point source loadings of EPA Priority Pollutants (132.8 kg/d). Five metals, nickel, chromium, lead, zinc, and copper were responsible for 99% of the total metals from Canadian point sources. Atlas Steels alone discharged 53%, with the three WPCPs and the McMaster Ave. Combined Sewer contributing an additional 37%. Nickel and chromium were discharged in the greatest amounts.

The majority of the total cyanide loading was attributed to the two Cyanamid plants at Niagara Falls and Welland (83%). The municipal WPCPs discharged an additional 15%. The discharge of phenols (4AAP) was due mainly to the three municipal plants and the McMaster Ave. Combined Sewer (83%) and Atlas Steels and Cyanamid Welland (a further 14%).

The following table shows that of all Canadian point sources, 8 significant dischargers account for 95-99% of the total loadings for four pollutant categories. This is further categorized as municipal vs industrial sources in the table.

Pollutant Category	% of Total Canadian Point Source Loading		
	Municipal	Industrial	M & I
	Fort Erie, (Anger Ave.) Welland, Niagara Falls WPCPs, McMaster Ave. Sewer	Atlas Steels, Cyanamid (Welland and Niagara Falls), Fleet Mfg.	Total
1. EPA Priority Pollutants			
Organics	69%	28%	97%
Metals	37%	62%	99%
Cyanides	15%	83%	98%
2. Phenols (4AAP)	83%	14%	97%

The majority of priority pollutants from Canadian sources are discharged to the Niagara Falls sub-area (Table 2.6). This includes: 98% of the acid extractables, 78% of the PAHs, 99.4% of the PCBs, 90% of the pesticides, 75% of the "other base neutrals", 65% of the purgeables, 97% of the cyanides, 97% of the metals, and 85% of the phenols (4AAP).

Some data for three pollutant categories were only semiquantified (PAHs, other base neutrals, and purgeables). Based on these semi-quantified results, a minimum was calculated for use in the loadings table. An additional amount that could potentially be present was calculated based on the difference between the upper limit of the semi-quantified result and the detection limit. Compared with the quantified loadings, the total PAH load may be up to 5.0% higher. Other base-neutrals may be 0.4% higher and purgeables 1.3% higher than calculated.

For the purposes of calculating point source loadings based on EPS and MOE data, the following procedures were followed: i) for compounds not detected, the loading was assumed to be zero; ii) for compounds reported as "trace" the loading was calculated at the detection limit. A "maximum

TABLE 2.6

EPA PRIORITY POLLUTANT AND SPECIAL CATEGORY LOADINGS FOR PARAMETERS QUANTIFIED FROM MOE/EPS 1981-82 SAMPLING
kg/d (lb/d)

PARAMETER CLASS		RIVER SEGMENT			TOTAL LOADING FROM CANADIAN POINT SOURCES
Category	Sub-category	Fort Erie	Chippawa	Niagara Falls	
Acid Extractable	-	0.012 (0.026)	0.00014 (0.0031)	0.50 (1.1)	0.52 (1.1)
Base/Neutral Extractable	Polynuclear Aromatics	0.56 (0.12)	0	0.20 (0.44)	0.25 (0.57)
	Polychlorinated Biphenyls (PCBs)	0.0000009 (0.0000020)	0.000038 (0.0001)	0.0063 (0.014)	0.0063 (0.014)
	Pesticides	0.0047 (0.010)	0.00001 (0.000022)	0.041 (0.090)	0.045 (0.10)
	Other Base Neutrals	2.2 (4.8)	0	6.6 (14.)	8.8 (19.)
Purgeable Compounds	-	2.8 (6.2)	0.0028 (0.0062)	5.3 (12.)	8.1 (18.)
Metals and Cyanides	Cyanides	0.10 (0.22)	0.00063 (0.0014)	3.8 (8.4)	3.9 (8.6)
	Metals	3.5 (7.7)	0.041 (0.090)	130 (290)	130 (290)
Special Organic Pollutant Categories	Phenols (4AAP)	0.31 (0.68)	0.00063 (0.0014)	1.7 (3.7)	2.0 (4.4)
	Chlorinated Benzenes	0.0032 (0.007)	0	0.076 (0.167)	0.079 (0.17)
	Chlorinated Toluenes	0	0	0	0

additional loading potentially present" was then added, which was based on the difference between the upper limit for "trace" (generally 2 times the detection limit) and the detection limit. Since the MOE extractables data were reported as ranges (i.e., 1-10 ug/L, 10-50 ug/L, etc.), the logarithmic midpoint of the range was used for the loading calculation.

Table 2.7 contains the maximum additional priority pollutant loadings potentially present based on the semi-quantitative results. This amounts to a maximum potential increase in total loading for the Canadian point sources of 0.27 kg/d (0.6 lb/d), which represents 0.2% of the respective quantified priority pollutant loadings. The actual priority pollutant loads may therefore be greater by this amount.

2.4.4 Summary and Comparison of New York and Ontario Results

This summary identifies the significant sources of EPA priority pollutants to the Niagara River as well as the major individual priority pollutant contaminants. The data are presented for the most part in terms of loading and are used to assess the relative magnitude of Canadian and U.S. point source contributions.

Data on the total loading of priority pollutants to the Niagara River include all point source loadings measured. However, only the significant sources have been individually identified and presented here. Detailed information on point sources will be available in facility reports by DEC and MOE/EPS. The analytical data contain both quantitative and semiquantitative results. The majority of this discussion dwells on the quantitative results. Additional potential loadings tabulated for New York and Ontario were presented in Sections 2.4.2.3 and 2.4.3.4. These are based on the assumption that the substance was present at the "method detection limit" or "quantifiable level" when it was detected but not quantified.

Table 2.8 summarizes the total priority pollutant loading to the Niagara River. Results include loadings from the significant dischargers

TABLE 2.7

MAXIMUM ADDITIONAL EPA-PRIORITY POLLUTANT AND SPECIAL CATEGORY LOADINGS FOR PARAMETERS IDENTIFIED BELOW QUANTIFIABLE LIMITS FROM MOE/EPS 1981-82 SAMPLING
kg/d (lb/d)

PARAMETER CLASS		RIVER SEGMENT			TOTAL LOADING FROM CANADIAN POINT SOURCES
Category	Sub-category	Fort Erie	Chippawa	Niagara Falls	
Acid Extractable	-	0	0	0	0
Base/Neutral Extractable	Polynuclear Aromatics	0.0032 (0.0070)	0	0.0093 (0.020)	0.13 (0.029)
	Polychlorinated Biphenyls (PCBs)	0	0	0	0
	Pesticides	0	0	0	0
	Other Base Neutrals	0.0030 (0.0066)	0	0.036 (0.079)	0.039 (0.086)
Purgeable Compounds	-	0.0043 (0.0095)	0.0000023 (0.0000051)	0.097 (0.21)	0.10 (0.22)
Metals and Cyanides	Cyanides	0	0	0	0
	Metals	0	0	0	0
Special Organic Pollutant Categories	Phenols (4AAP)	0	0	0	0
	Chlorinated Benzenes	0	0	0	0
	Chlorinated Toluenes	0	0	0	0

TABLE 2.8

COMPARISON OF EPA-PRIORITY POLLUTANT AND SPECIAL CATEGORY LOADINGS FOR PARAMETERS QUANTIFIED
U.S. AND CANADIAN POINT SOURCES
kg/d (lb/d)

PARAMETER CLASS Category	Sub-category	U.S. SOURCES	% OF TOTAL	CANADIAN SOURCES	% OF TOTAL	U.S. & CAN. SOURCES
Acid Extractable	-	45.8 (100.9)	98.9	0.52 (1.1)	1.1	46.3 (102.0)
Base/Neutral Extractable	Polynuclear Aromatics	17.1 (37.7)	98.3	0.25 (0.55)	1.7	17.4 (38.4)
	Polychlorinated Biphenyls (PCBs)	0.1 (0.2)	94.1	0.0063 (0.014)	5.9	0.106 (0.23)
	Pesticides	1.1 (2.4)	96.1	0.045 (0.10)	3.9	1.15 (2.5)
	Other Base Neutrals	21.0 (46.3)	70.5	8.8 (19)	29.5	29.8 (65.7)
Purgeable Compounds	-	133.2 (293.6)	94.3	8.1 (17.9)	5.7	141.3 (311.4)
Metals and Cyanides	Cyanides (Total)	42.6 (93.9)	91.6	3.9 (8.6)	8.4	46.5 (102.5)
	Metals (Total)	992.2 (2187)	88.2	132.8 (293)	11.8	1125 (2479.5)
Total Priority Pollutants	All Categories	1253.1 (2761.8)	89.0	154.4 (341)	11.0	1407.6 (3102.2)
Special Organic Pollutant Categories	Phenols (4AAP)	157.9 (348.1)	98.8	2.0 (4.4)	1.2	159.9 (352.4)
	Chlorinated Benzenes	14.9 (32.8)*	98.2	0.28 (0.62)*	1.8	15.2 (33.5)**
	Chlorinated Toluenes	50.7 (111.8)**	100	0**	0	50.7 (111.8)**

* Values indicated are EPA-priority pollutant chlorobenzenes only.

** Special chlorotoluene scan conducted including 4 non-priority pollutant chlorobenzenes and 20 chlorotoluenes for the following facilities only: Occidental Durex Div. (Tona.-N. Tona. Sub-area); Occidental Niagara Plant (Wheatfield-Upper River Segment); Niagara Falls (C) WWTP and Occidental Niagara Plant (Lower River Segment). Values include both non-priority and priority pollutant chlorobenzenes, quantified parameters only.

listed in the foregoing text and also all other dischargers monitored during this study. The total loadings have been divided into contaminant groups such as acid extractables and metals. The contaminant group loads have been further divided into U.S. and Canadian point source totals and converted to percentages to indicate the relative contribution.

The total loading of priority pollutants from all point sources sampled, was 1408 kg/d (3102 lb/d), 89.0% from U.S. sources and 11% from Canadian. The data for the individual compound groups are also presented in Table 2.8.

Tables 2.4 and 2.6 present the U.S. and Canadian quantifiable loadings by river sub-area and segment where applicable, showing the areas where point sources have the greatest impact. For U.S. sources, the Buffalo-Lackawanna sub-area has the highest input, though total priority pollutant loadings from the Tonawanda-North Tonawanda and Niagara Falls, N.Y. sub-areas are also significant. From Canadian sources the majority of the effluent loading is discharged to the Niagara Falls, Ontario sub-area.

Tables 2.5 and 2.7 contain the maximum additional priority pollutant loadings potentially present based on the semi-quantitative results as discussed in the individual New York and Ontario Results sections.

The point source data identified 29 U.S. and 8 Canadian significant point sources. Table 2.9 provides a listing of these sources by sub-area and includes the effluent flow as well as the individual point source priority pollutant loadings for each pollutant category. Each point source has been given a numerical or alphabetical label which corresponds to Figure 2.1 where their locations are shown.

Based on the data presented in Table 2.9 the relative pollutant loading for each significant point source becomes evident. Of the 37 significant point sources to the Niagara River, the 10 with the highest total priority pollutant loading accounted for 90% of the loading from all point sources. The most significant 10 sources are tabulated below in Table 2.10.

TABLE 2.9

SIGNIFICANT DISCHARGERS OF EPA PRIORITY AND SPECIAL CATEGORY POLLUTANTS TO THE NIAGARA RIVER BASED ON QUANTITATIVE DATA

		FLOW		EPA PRIORITY POLLUTANT CATEGORY LOADINGS(kg/d)[1]												
MAP #	FACILITY	m^3/d	US MGD	Acid Extract-ables	PAHs	Other B/Ns	Pesti-cides	PCBs	Purge-ables	Total Priority Organics	Cyanides	Metals	Total Priority Pollutants	4-AAP Phenols [2]	Chlorinated Benzenes [2]	Chlorinated Toluenes [2]
	Buffalo-Lackawanna Sub-Area															
1.	City of Lackawanna WWTP	8,700	2.3	-	-	-	-	-	-	-	0.1	2.1	2.2	0	-*	N.A.
2.	Bethlehem Steel Corp. [3]	259,000	68.4	13.4	1.1	4.9	0.1	0.1	0.7	20.3	1.9	156.2	178.4	3.9	-*	N.A.
3.	PVS Chemical Corp.	31,000	8.3	-	-	-	-	-	-	0	0.1	1.4	1.5	-	-*	N.A.
4.	Buffalo Color Corp.	42,000	11.3	-	-	-	0	-	0.4	0.4	0.4	3.6	4.4	0	-*	N.A.
5.	Donner-Hanna Coke [4] Joint Venture	28,000	7.4	-	14.9	-	0	-	1.2	16.1	7.0	2.1	25.2	4.2	-*	N.A.
6.	Republic Steel Corp.[4]	53,700	14.2	-	-	-	-	-	0.2	0.2	-	7.4	7.6	0.6	-*	N.A.
7.	Buffalo Sewer Authority	645,000	17.0	-	0.7	4.1	0	-	18.4	23.2	12.7	401.6	437.5	4.7	0.4*	N.A.
	Fort Erie Sub-Area															
A.	Fort Erie WPCP	11,400	3.0	0	0.1	2.1	0	-	2.8	5.0	0.1	2.0	7.1	0.3	0*	N.A.
B.	Fleet Manufacturing	900	0.2	-	0	0.02	0	-	0.1	0.12	-	1.2	1.3	-	-*	N.A
	Tonawanda-North Tonawanda Sub-Area															
8.	Town of Tonawanda WWTP	81,800	21.6	-	-	-	0	-	-	0	12.1	14.7	26.8	2.9	-*	N.A.
9.	Town of Amherst WWTP	74,900	19.8	-	-	-	-	-	-	0	0.1	25.5	25.6	-	-*	N.A.
10.	City of North Tonawanda WWTP	17,000	4.4	-	-	-	-	-	0.3	0.3	0.7	3.9	4.9	0.4	-*	N.A.
11.	General Motors Corp.	93,500	24.7	-	-	-	-	-	-	0	0.6	14.0	14.6	1.5	-*	N.A.
12.	Niagara Mohawk Power Corp.	2,777,000	733.8	-	-	-	-	-	1.1	1.1	5.4	148.0	154.5	9.0	-*	N.A.
13.	Dunlop Tire & Rubber Corp.	9,500	2.5	-	-	-	-	-	-	0	0.1	4.6	4.7	-	-*	N.A.
14.	FMC Corp.	23,000	6.1	-	-	-	-	-	-	0	0	2.4	2.4	-	-*	N.A.
15.	Ashland Oil Inc. [4]	74,900	19.8	-	-	-	-	-	-	0	0.1	-	0.1	1.0	-*	N.A.

Notes: Dash (-) indicates none detected at or above quantification limit. N.A. indicates not analyzed. Zero (0) indicates parameter identified and quantified at less than 0.1 kg/day.

[1] Multiply by 2.205 to arrive at lb/d.

[2] Special organic pollutant category, not a priority pollutant.

[3] Facility's steel-making terminated in 1983.

[4] Facility now closed.

* Values indicated are EPA priority pollutant chlorobenzenes only.

** Special scan conducted, including 4 non-priority pollutant chlorobenzenes and 20 chlorotoluenes for the following facilities only: Occidental Durez Div.; Occidental Niagara Plant; Niagara Falls (C) WWTP. Values include both non-priority and priority pollutant chlorobenzenes.

TABLE 2.9 (CONTINUED)

MAP #	FACILITY	FLOW m³/d	FLOW US MGD	Acid Extract-ables	PAHS	Other B/Ns	Pesti-cides	PCBs	Purge-ables	Total Priority Organics	Cyanides	Metals	Total Priority Pollutants	4-AAP Phenols [2]	Chlorinated Benzenes [2]	Chlorinated Toluenes [2]
				EPA PRIORITY POLLUTANT CATEGORY LOADINGS (kg/d) [1]												
16.	Spaulding Fibre Co.	8,300	2.2	-	-	-	-	-	-	0	0	35.7	35.7	0.1	-*	N.A.
17.	Occidental Chemical Co. Durez Div.	1,500	0.4	5.6	0	1.5	0	-	5.3	12.4	0	0.8	13.2	21.3	4.7**	-**
18.	E.I. duPont deNemours & Co. (Tonawanda Plant)	9,100	2.4	-	-	-	-	-	1.4	1.4	-	0.1	1.5	-	-*	N.A.
19.	Union Carbide Corp. Linde Div.	1,500	0.4	-	0.4	-	0	-	0	0.4	-	0.7	1.1	-	-*	N.A.
	Chippawa Sub-Area															
	No Significant Sources															
	Niagara Falls, New York Sub-Area															
20.	Niagara County S.D. #1 WWTP	12,000	3.1	-	-	-	-	-	0.2	0.2	-	3.0	3.2	1.0	-*	N.A.
21.	Town of Grand Island S.D. #2 WWTP	9,500	2.5	-	-	-	-	-	-	0	0	3.4	3.4	-	-*	N.A.
22.	Occidental Chemical Corp. Niagara Plant	121,000	32.1	1.7	-	2.5	0.6	-	2.6	7.4	0.5	14.5	22.4	0	1.6**	6.9**
23.	Union Carbide Corp. Welding Flux	6,800	1.8	-	-	-	0	-	0.4	0.4	0	2.5	2.9	0	-*	N.A.
24.	E.I. duPont deNemours & Co. (Niagara Plant)	47,300	12.3	-	-	-	0	-	0.1	0.1	0	9.9	10.0	0.1	-*	N.A.
25.	Carborundum Corp.	13,000	3.5	-	-	-	0	-	-	0	-	2.3	2.3	0.8	-*	N.A.
26.	City of Niagara Falls WWTP[1]	209,000	55.1	25.0	-	8.0	0.4	-	49.3	82.7	0.1	107.3	190.1	106.3	8.2**	43.8**
27.	Olin Corp.	30,000	7.9	-	-	-	0	-	51.6	51.6	0.6	2.9	55.1	0.1	-*	N.A.
28.	Town of Lewiston MSIA WWTP	6,100	1.6	-	-	-	0	-	-	0	-	2.8	2.8	-	-*	N.A.
29.	SCA Chemical Services	3,000	0.8	-	-	-	0	-	-	0	0.1	10.3	10.4	-	-*	N.A.
	Niagara Falls Ontario Sub-area															
C.	Atlas Steels	53,700	14.2	-	0	0.5	0	-	3.2	3.7	-	70.0	73.7	0.1	-*	N.A.
D.	Cyanamid Canada Ltd. (Niagara Plant)	39,300	10.4	-	-	0.35	0	-	0	0.35	1.0	0.7	2.0	-	-*	N.A.
E.	Cyanamid Canada Ltd. (Welland Plant)	24,900	6.6	-	0	0.27	0	0	0.2	0.47	2.3	10.0	12.6	0.2	-*	N.A.
F.	Niagara Falls WPCP	40,700	10.8	0.5	0.1	4.6	0	-	1.1	6.3	0.3	17.0	23.6	0.9	0*	N.A.
G.	Welland WPCP	36,900	9.8	0	0.1	0.18	0	0	0.3	0.58	0.2	17.0	17.8	0.2	0*	N.A.
H.	McMaster Ave. Combined Sewer	12,400	3.3	-	0	0.6	0	-	0.1	0.7	-	13.0	13.7	0.4	0*	N.A.
Total of Significant Sources				46.2	17.4	29.6	1.1	0.1	141	235.5	46.5	1114.6	1396.3	159.9	14.9	50.7

[1] Includes Gorge Pump Station

TABLE 2.10

10 MOST SIGNIFICANT POINT SOURCES OF TOTAL EPA PRIORITY POLLUTANTS TO THE NIAGARA RIVER

FACILITY	LOADING	
	kg/d	lb/d
1. Buffalo Sewer Authority WWTP	438	965
2. Niagara Falls, N.Y. WWTP	190	419
3. Bethlehem Steel Corp. 1/	178	392
4. Niagara Mohawk Power Corp	155	341
5. Atlas Steels	73.7	162
6. Olin Corp.	55.1	121
7. Spaulding Fibre Co.	35.7	78.7
8. Town of Tonawanda WWTP	26.8	59.1
9. Town of Amherst WWTP	25.6	56.5
10. Donner-Hanna Coke Joint Venture 2/	25.2	55.6
TOTAL	1203	2650

1/ Basic steel making operations ceased in 1983.
2/ Facility closed.

Ten facilities accounted for 85% of the total organic priority pollutant load from all U.S. and Canadian point sources. One of these facilities has closed since the time of the surveys (Donner-Hanna Coke), and basic steel making operations ceased in 1983 at Bethlehem Steel. Table 2.11 lists the 10 most significant discharges of total organic EPA priority pollutants.

TABLE 2.11

10 MOST SIGNIFICANT DISCHARGES OF TOTAL ORGANIC EPA PRIORITY POLLUTANTS TO THE NIAGARA RIVER

FACILITY	LOADING	
	kg/d	lb/d
1. City of Niagara Falls, N.Y. WWTP	82.7	182
2. Olin Corp.	51.6	114
3. Buffalo Sewer Authority WWTP	23.2	51.2
4. Bethlehem Steel Corp. 1/	20.3	44.8
5. Donner-Hanna Coke 2/	16.1	35.5
6. Occidental Chemical Corp. - Durez Division	12.4	27.3
7. Occidental Chemical Corp. - Niagara Plant	7.4	16.3
8. Niagara Falls, Ontario WPCP	6.3	13.9
9. Fort Erie, Ontario WPCP	5.0	11.0
10. Atlas Steels	3.7	8.2
TOTAL	229	504

1/ Basic steel making operations ceased in 1983.
2/ Facility closed.

The point source loadings can be further broken down to identify the major sources of inorganic priority pollutants (heavy metals and cyanides). Table 2.12 lists the 10 sources which together were responsible for 88% of the total inorganic priority pollutant loading from all point sources. Bethlehem Steel was responsible for 11% of the heavy metals discharged from all point sources, however the steel making operations of this facility have ceased.

TABLE 2.12

10 MOST SIGNIFICANT DISCHARGES OF INORGANIC EPA PRIORITY POLLUTANTS (HEAVY METALS AND CYANIDES) TO THE NIAGARA RIVER

FACILITY	LOADING kg/d	LOADING lb/d
1. Buffalo Sewer Authority WWTP	414	913
2. Bethlehem Steel Corp.1/	158	348
3. Niagara Mohawk Power Corp.	154	340
4. City of Niagara Falls, N.Y. WWTP	107	236
5. Atlas Steels	70	154
6. Spaulding Fiber Co.	35.7	78.7
7. Town of Tonawanda WWTP	26.8	59.0
8. Town of Amherst WWTP	25.6	56.4
9. Niagara Falls, Ontario WPCP	17.3	38.1
10. Welland, Ontario WPCP	17.2	37.9
TOTAL	1026	2261

1/ Basic steel making operations ceased in 1983.

Fifteen compounds made up 90% of the individual organic priority pollutant loading (Table 2.13). Eight of the 15 are Group I chemicals, (Chapter VI, chemicals requiring immediate action) developed for the Niagara River. The major sources of the Group I compounds are highlighted in the discussion which follows.

Bis(2-ethylhexyl) phthalate, 10.5 kg/d (23.1 lb/d), was discharged mainly from Buffalo Sewer Authority WWTP and Bethlehem Steel, which were responsible for 78% of the total loading.

TABLE 2.13

EPA PRIORITY POLLUTANT ORGANICS DISCHARGED IN GREATEST AMOUNT TO THE NIAGARA RIVER FROM POINT SOURCES (kg/d)*

	COMPOUNDS	TOTAL U.S. SOURCES	TOTAL CDN. SOURCES	TOTAL TO RIVER
1.	Phenol**	42.6	0.11	43
2.	Trichloroethylene	36.6	3.3	40
3.	Methylene chloride**	24.4	0.90	25
4.	Chloroform**	21.4	0.34	22
5.	Tetrachloroethylene**	15.7	0.13	16
6.	Bis(2-Ethylhexyl) Phthalate**	9.6	0.92	11
7.	Toluene	8.6	0.56	9.2
8.	Trans-1,2-dichloroethylene	6.2	1.9	8.1
9.	Di-n-butyl phthalate	0.4	5.3	5.7
10.	1,2-Dichlorobenzene**	5.2	0.24	5.4
11.	Pyrene**	5.3	0.0020	5.3
12.	1,1,1-Trichloroethane	4.4	0.25	4.7
13.	Anthracene	4.5	0.00098	4.5
14.	1,1,2,2-Tetrachloroethane**	4.3	0.045	4.3
15.	Ethylbenzene	4.2	0.032	4.2

* Multiply by 2.205 to arrive at lb/d.
** Group I chemical (Chapter VI, chemicals requiring immediate action).

Phenol, 42.7 kg/d (94.1 lb/d), was detected in the discharges of the Niagara Falls, N.Y. WWTP, Bethlehem Steel, and Occidental Chemical (Durez Division) who, combined, contributed 99.7% of the total.

Chloroform, 21.7 kg/d (47.8 lb/d), was found mainly at the Niagara Falls, N.Y. WWTP, the Buffalo Sewer Authority WWTP, and Olin Corporation. These comprised of 94.3% the total chloroform loading. Tetrachloroethylene was discharged at a rate of 15.8 kg/d (34.8 lb/d). Olin Corporation and the Niagara Falls, N.Y. WWTP accounted for 92.6% of the loading.

Methylene chloride, 25.3 kg/d (55.8 lb/d), was found primarily at the Buffalo Sewer Authority WWTP and the Niagara Falls N.Y. WWTP which accounted for 81% of the total discharged.

The majority of 1,2-dichlorobenzene (72%) was found in the Niagara Falls, N.Y. WWTP effluent with a further loading (11%) from Occidental Chemical Corp. (Durez Division) and 12% from Occidental Chemical Corp. (Niagara). The total 1,2-dichlorobenzene was 5.4 kg/d (11.9 lb/d).

Pyrene, 5.3 kg/d (11.7 lb/d), was found almost exclusively at Donner-Hanna Coke (90.6%) and Bethlehem Steel (9.4%). However, Donner-Hanna has since closed and steel making operations at Bethlehem Steel have ceased.

The last Group I compound is 1,1,2,2-tetrachloroethane, 4.3 kg/d (9.5 lb/d), virtually all of which was discharged by Olin Chemical (92.0%) and Niagara Falls, N.Y. Gorge Pump Station (7%) effluents.

The individual loadings from significant point sources are presented in Tables 2.14 (U.S.) and 2.15 (Canadian).

TABLE 2.14

EPA PRIORITY POLLUTANT AND SPECIAL CATEGORY LOADINGS FROM SIGNIFICANT SOURCES BY CATEGORIES/PARAMETERS
FROM DEC 1981-82 SAMPLING (QUANTIFIED PARAMETERS ONLY)
kg/day(lb/day)

Sub-Area	BUFFALO - LACKAWANNA							
Segment	Lake Erie		Buffalo River				Bird Island-Riverside	Black Rock Canal
Facility	City of Lackawanna WWTP	Bethlehem Steel Corp.	PVS Chemical Corp.	Buffalo Color Corp.	Donner-Hanna Coke	Republic Steel Corp.	BSA WWTP	None
CATEGORIES/PARAMETERS								
ACID EXTRACTABLES								
2,4-Dimethylphenol	-	0.3(0.7)	-	-	-	-	-	
2,4-Dinitrophenol	-	-	-	-	-	-	-	
2-Nitrophenol	-	0.3(0.6)	-	-	-	-	-	
4-Nitrophenol	-	0.8(1.8)	-	-	-	-	-	
Phenol	-	12.0(26.4)	-	-	-	-	-	
2,4,6-Trichlorophenol	-	-	-	-	-	-	-	
BASE/NEUTRAL EXTRACTABLES								
Anthracene	-	-	-	-	4.5(9.9)	-	-	
Benzo(a)anthracene	-	0(0.1)	-	-	2.8(6.2)	-	0.7(1.5)	
Bis(2-ethylhexyl)phthalate	-	4.9(10.8)	-	-	-	-	3.3(7.3)	
1,2-Dichlorobenzene	-	-	-	-	-	-	-	
1,4-Dichlorobenzene	-	-	-	-	-	-	0.4(0.8)	
Di-n-butylphthalate	-	-	-	-	-	-	0.4(0.9)	
Fluoranthene	-	0.6(1.4)	-	-	2.8(6.2)	-	-	
Pyrene	-	0.5(1.1)	-	-	4.8(10.5)	-	-	
1,2,4-Trichlorobenzene	-	-	-	-	-	-	-	
Hexachlorobutadiene	-	-	-	-	-	-	-	
PURGEABLES								
Bromodichloromethane	-	-	-	-	-	-	0.3(0.7)	
Benzene	-	0.6(1.3)	-	-	-	-	-	
Carbon tetrachloride	-	-	-	-	-	-	-	
Chlorobenzene	-	-	-	-	-	-	-	
Chloroform	-	-	-	-	-	0.2(0.4)	3.2(7.1)	
Ethylbenzene	-	-	-	-	-	-	-	
Methylene chloride	-	-	-	0.4(0.8)	1.2(2.7)	-	12.9(28.4)	
1,1,2,2-Tetrachloroethane	-	-	-	-	-	-	-	
Tetrachloroethylene	-	-	-	-	-	-	-	
Toluene	-	0.1(0.2)	-	-	-	-	2.0(4.5)	
Trans-1,2-dichloroethylene	-	-	-	-	-	-	-	
1,1,1-Trichloroethane	-	-	-	-	-	-	-	
Trichloroethylene	-	-	-	-	-	-	-	
Trans-1,3-dichloropropene	-	-	-	-	-	-	-	
PESTICIDES, TOTAL	-	0.1(0.3)	-	0(0.1)	0(0.1)	-	0(0.1)	
PCB #1248	-	0.1(0.2)	-	-	-	-	-	
METALS, TOTAL								
Arsenic	-	0.2(0.4)	-	-	-	-	-	
Beryllium	0.2(0.4)	0.1(0.3)	-	-	-	-	5.6(12.4)	
Cadmium	-	-	-	-	-	-	6.0(13.2)	
Chromium	-	-	-	1.5(3.2)	-	-	96.7(213.3)	
Copper	0.4(1.0)	0.8(1.8)	-	-	-	1.5(3.2)	45.7(100.7)	
Lead	0.9(1.9)	31.8(70.2)	-	-	-	3.2(7.0)	47.8(105.3)	
Mercury	-	0(0)	-	-	-	-	0(0.1)	
Nickel	-	0.9(2.0)	-	1.4(3.1)	-	-	55.1(121.4)	
Selenium	-	2.3(5.1)	-	-	0.7(1.5)	-	-	
Silver	-	0.4(1.0)	0.6(1.4)	-	-	-	8.2(18.0)	
Thallium	-	-	-	-	-	-	-	
Zinc	0.6(1.4)	119.6(263.7)	0.8(1.7)	0.7(1.6)	1.4(3.1)	2.7(5.9)	136.6(301.1)	
CYANIDES, TOTAL	0.1(0.2)	1.9(4.3)	0.1(0.3)	0.4(1.0)	7.0(15.4)	-	12.7(27.9)	
PHENOLS (4AAP)	0(0.1)	3.9(8.7)	-	0(0)	4.2(9.3)	0.6(1.3)	4.7(10.3)	
CHLORINATED BENZENES	-*	-*	-*	-*	-*	-*	0.4(0.8)*	
CHLORINATED TOLUENES	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	

NOTES: Dash (-) indicates parameter analyzed but not quantified. N.A. indicates parameter not analyzed. Zero (0) indicates parameter identified and quantified at less than 0.1 kg/day. *EPA-priority pollutant chlorobenzenes. ** Special scan conducted for four non-priority pollutant chlorobenzenes and twenty chlorotoluenes.

TABLE 2.14 (CONTINUED)

EPA PRIORITY POLLUTANT AND SPECIAL CATEGORY LOADINGS FROM SIGNIFICANT SOURCES BY CATEGORIES/PARAMETERS
FROM DEC 1981-82 SAMPLING (QUANTIFIED PARAMETERS ONLY)
kg/day (lb/day)

Sub-Area	TONAWANDA - NORTH TONAWANDA						
Segment	Tonawanda - North Tonawanda						
Facility	Town of Tonawanda WWTP	Town of Amherst WWTP	City of N. Tonawanda WWTP	GMC Chevrolet Tonawanda	Niagara Mohawk	Dunlop Tire	FMC Corp.
CATEGORIES/PARAMETERS							
ACID EXTRACTABLES							
2,4-Dimethylphenol	-	-	-	-	-	-	-
2,4-Dinitrophenol	-	-	-	-	-	-	-
2-Nitrophenol	-	-	-	-	-	-	-
4-Nitrophenol	-	-	-	-	-	-	-
Phenol	-	-	-	-	-	-	-
2,4,6-Trichlorophenol	-	-	-	-	-	-	-
BASE/NEUTRAL EXTRACTABLES							
Anthracene	-	-	-	-	-	-	-
Benzo(a)anthracene	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	-	-	-	-	-	-	-
1,2-Dichlorobenzene	-	-	-	-	-	-	-
1,4-Dichlorobenzene	-	-	-	-	-	-	-
Di-n-butylphthalate	-	-	-	-	-	-	-
Fluoranthene	-	-	-	-	-	-	-
Pyrene	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	-	-	-	-	-	-	-
Hexachlorobutadiene	-	-	-	-	-	-	-
PURGEABLES							
Bromodichloromethane	-	-	-	-	-	-	-
Benzene	-	-	-	-	-	-	-
Carbon tetrachloride	-	-	-	-	-	-	-
Chlorobenzene	-	-	-	-	-	-	-
Chloroform	-	-	0.3(0.6)	-	-	-	-
Ethylbenzene	-	-	-	-	-	-	-
Methylene chloride	-	-	-	-	1.1(2.4)	-	-
1,1,2,2-Tetrachloroethane	-	-	-	-	-	-	-
Tetrachloroethylene	-	-	-	-	-	-	-
Toluene	-	-	-	-	-	-	-
Trans-1,2-dichloroethylene	-	-	-	-	-	-	-
1,1,1-Trichloroethane	-	-	-	-	-	-	-
Trichloroethylene	-	-	-	-	-	-	-
Trans-1,3-dichloropropene	-	-	-	-	-	-	-
PESTICIDES, TOTAL	0(0.1)	0(0)	-	0(0)	-	0(0)	0(0)
PCB #1248	-	-	-	-	-	-	-
METALS, TOTAL							
Arsenic	-	-	-	-	-	-	-
Beryllium	1.6(3.6)	-	-	-	-	-	-
Cadmium	-	-	0.5(1.1)	-	-	-	-
Chromium	8.2(18.0)	-	1.7(3.7)	-	5.6(12.4)	-	-
Copper	-	-	-	-	-	-	1.2(2.6)
Lead	-	15.0(33.0)	-	-	7.3(16.1)	3.7(8.2)	-
Mercury	-	-	-	-	-	-	-
Nickel	-	6.8(14.9)	-	-	135.1(297.9)	0.5(1.0)	-
Selenium	-	-	-	-	-	-	-
Silver	-	-	-	-	-	-	-
Thallium	-	-	-	-	-	-	-
Zinc	4.9(10.8)	3.8(8.3)	1.7(3.7)	14.0(30.9)	-	0.5(1.0)	1.2(2.6)
CYANIDES, TOTAL	12.1(26.6)	0.1(0.3)	0.7(1.4)	0.6(1.2)	5.4(12.0)	0.1(0.2)	0(0.1)
PHENOLS (4AAP)	2.9(6.3)	-	0.4(1.0)	1.5(3.3)	9.0(19.8)	-	-
CHLORINATED BENZENES	-*	-*	-*	-*	-*	-*	-*
CHLORINATED TOLUENES	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

TABLE 2.14 (CONTINUED)

EPA PRIORITY POLLUTANT AND SPECIAL CATEGORY LOADINGS FROM SIGNIFICANT SOURCES BY CATEGORIES/PARAMETERS
FROM DEC 1981-82 SAMPLING (QUANTIFIED PARAMETERS ONLY)
kg/day (lb/day)

Sub-Area	TONAWANDA - NORTH TONAWANDA					NIAGARA FALLS, NEW YORK	
Segment	Tonawanda - North Tonawanda					Wheatfield - Upper River	
Facility	Ashland Oil, Inc.	Spaulding Fibre Co.	OCC-Durez Division	E.I. duPont Tonawanda	UCC-Linde Tonawanda	NCSD #1 WWTP	Town of Grand Island WWTP
CATEGORIES/PARAMETERS							
ACID EXTRACTABLES							
2,4-Dimethylphenol	-	-	-	-	-	-	-
2,4-Dinitrophenol	-	-	-	-	-	-	-
2-Nitrophenol	-	-	-	-	-	-	-
4-Nitrophenol	-	-	-	-	-	-	-
Phenol	-	0(0)	5.6(12.4)	-	-	-	-
2,4,6-Trichlorophenol	-	-	0(0)	-	-	-	-
BASE/NEUTRAL EXTRACTABLES							
Anthracene	-	-	-	-	0(0)	-	-
Benzo(a)anthracene	-	-	-	-	0(0)	-	-
Bis(2-ethylhexyl)phthalate	-	-	-	-	-	-	-
1,2-Dichlorobenzene	-	-	0.6(1.3)	-	-	-	-
1,4-Dichlorobenzene	-	-	0.9(2.0)	-	-	-	-
Di-n-butylphthalate	-	-	-	-	-	-	-
Fluoranthene	-	-	0(0)	-	0(0)	-	-
Pyrene	-	-	-	-	0(0)	-	-
1,2,4-Trichlorobenzene	-	-	0(0)	-	-	-	-
Hexachlorobutadiene	-	-	-	-	-	-	-
PURGEABLES							
Bromodichloromethane	-	-	-	-	-	-	-
Benzene	-	-	2.2(4.8)	0.7(1.6)	-	-	-
Carbon tetrachloride	-	-	-	-	-	-	-
Chlorobenzene	-	-	3.1(6.9)	-	-	-	-
Chloroform	-	-	-	-	-	-	-
Ethylbenzene	-	-	0(0)	-	-	-	-
Methylene chloride	-	-	0(0)	0.7(1.6)	-	-	-
1,1,2,2-Tetrachloroethane	-	-	0(0)	-	-	-	-
Tetrachloroethylene	-	-	0(0.1)	-	-	-	-
Toluene	-	-	0(0.1)	-	-	-	-
Trans-1,2-dichloroethylene	-	-	0(0)	-	-	-	-
1,1,1-Trichloroethane	-	-	-	-	-	-	-
Trichloroethylene	-	-	0(0.1)	-	0(0)	0.2(0.4)	-
Trans-1,3-dichloropropene	-	-	-	-	-	-	-
PESTICIDES, TOTAL	0(0)	0(0)	0(0.1)	-	0(0)	0(0)	0(0)
PCB #1248	-	0(0)	-	-	-	-	-
METALS, TOTAL							
Arsenic	-	-	0(0)	-	-	-	-
Beryllium	-	0.1(0.3)	0(0.1)	-	0(0)	0.2(0.5)	-
Cadmium	-	-	-	-	-	0.2(0.5)	-
Chromium	-	0.7(1.5)	0(0.1)	-	-	-	-
Copper	-	0.1(0.2)	0.4(0.9)	-	0(0.1)	-	0.5(1.1)
Lead	-	0.1(0.3)	0.2(0.5)	-	0.2(0.5)	1.1(2.5)	1.9(4.2)
Mercury	-	-	0(0)	0.1(0.2)	-	-	-
Nickel	-	-	0.1(0.2)	-	0.2(0.4)	0.9(2.0)	0.5(1.1)
Selenium	-	0(0)	-	-	-	-	-
Silver	-	-	0(0)	-	0(0.1)	-	-
Thallium	-	-	-	-	-	-	-
Zinc	-	34.7(76.6)	0.1(0.2)	-	0.3(0.7)	0.6(1.3)	0.5(1.1)
CYANIDES, TOTAL	0.1(0.3)	0(0)	0(0)	-	-	-	0(0.1)
PHENOLS (4AAP)	1.0(2.1)	0.1(0.2)	21.3(46.9)	-	-	1.0(2.1)	-
CHLORINATED BENZENES	-*	-*	4.7(10.3)**	-*	-*	-*	-*
CHLORINATED TOLUENES	N.A.	N.A.	-**	N.A.	N.A.	N.A.	N.A.

TABLE 2.14 (CONTINUED)

EPA PRIORITY POLLUTANT AND SPECIAL CATEGORY LOADINGS FROM SIGNIFICANT SOURCES BY CATEGORIES/PARAMETERS
FROM DEC 1981-82 SAMPLING (QUANTIFIED PARAMETERS ONLY)
kg/day (lb/day)

Sub-Area	NIAGARA FALLS, NEW YORK						
Segment	Wheatfield - Upper River				Lower River		
Facility	OCC Niagara	UCC-Linde Welding Flux	E.I. duPont Niagara	Carborundum Co. Buffalo Ave.	City of Niagara Falls WWTP	City of N.F. Gorge Pump Station	Town of Lewiston WWTP
CATEGORIES/PARAMETERS							
ACID EXTRACTABLES							
2,4-Dimethylphenol	-	-	-	-	-	-	-
2,4-Dinitrophenol	1.7(3.8)	-	-	-	-	-	-
2-Nitrophenol	-	-	-	-	-	-	-
4-Nitrophenol	-	-	-	-	-	-	-
Phenol	-	-	-	-	25.0(55.2)	-	-
2,4,6-Trichlorophenol	-	-	-	-	-	-	-
BASE/NEUTRAL EXTRACTABLES							
Anthracene	-	-	-	-	-	-	-
Benzo(a)anthracene	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	0.6(1.3)	-	-	-	-	-	-
1,2-Dichlorobenzene	0.2(0.5)	-	-	-	3.9(8.7)	0.5(1.0)	-
1,4-Dichlorobenzene	0.1(0.3)	-	-	-	-	-	-
Di-n-butylphthalate	-	-	-	-	-	-	-
Fluoranthene	-	-	-	-	-	-	-
Pyrene	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	0.6(1.3)	-	-	-	3.4(7.4)	0.2(0.4)	-
Hexachlorobutadiene	0.2(0.5)	-	-	-	-	-	-
PURGEABLES							
Bromodichloromethane	0.1(0.2)	-	-	-	-	-	-
Benzene	-	-	-	-	-	-	-
Carbon tetrachloride	-	-	-	-	-	-	-
Chlorobenzene	-	-	-	-	-	-	-
Chloroform	0(0.1)	0.2(0.4)	0(0)	-	10.0(22.1)	0.5(1.2)	-
Ethylbenzene	-	-	-	-	4.2(9.2)	-	-
Methylene chloride	-	-	-	-	7.7(17.0)	0.2(0.4)	-
1,1,2,2-Tetrachloroethane	-	-	-	-	-	0.3(0.6)	-
Tetrachloroethylene	0.4(0.8)	-	-	-	2.3(5.1)	0.3(0.6)	-
Toluene	-	-	-	-	5.4(12.0)	-	-
Trans-1,2-dichloroethylene	0.3(0.6)	-	-	-	2.5(5.5)	0.8(1.7)	-
1,1,1-Trichloroethane	-	-	-	-	4.4(9.7)	-	-
Trichloroethylene	0(0)	0.2(0.4)	0.1(0.2)	-	9.2(20.2)	1.5(3.4)	-
Trans-1,3-dichloropropene	0.2(0.5)	-	-	-	-	-	-
PESTICIDES, TOTAL	0(0.1)	0(0)	0(0)	-	0.4(0.9)	0(0)	0(0)
PCB #1248	-	-	-	-	-	-	-
METALS, TOTAL							
Arsenic	0(0.1)	0(0)	-	-	2.1(4.6)	-	-
Beryllium	0(0.1)	-	-	-	-	0.3(0.7)	-
Cadmium	0.1(0.3)	-	-	-	-	-	-
Chromium	3.3(7.3)	0(0.1)	-	-	20.9(46.0)	1.6(3.5)	-
Copper	0.1(0.3)	-	-	-	27.1(59.8)	3.0(6.7)	0.3(0.7)
Lead	2.3(5.0)	2.5(5.5)	6.7(14.9)	1.6(3.5)	-	1.6(3.5)	2.4(5.3)
Mercury	0(0.1)	-	-		-	-	-
Nickel	2.4(5.3)	0(0.1)	1.8(4.0)	0.3(0.6)	-	-	-
Selenium	-	-	-	-	3.5(7.8)	0.1(0.2)	-
Silver	0.8(1,7)	-	-	-	-	0.3(0.7)	0.1(0.3)
Thallium	4.5(10.0)	-	-	-	-	-	-
Zinc	0.1(0.2)	0(0.1)	0.2(0.5)	-	43.8(96.5)	3.0(6.7)	-
CYANIDES, TOTAL	-	0(0.1)	-	-	-	0.1(0.3)	-
PHENOLS (4AAP)	0(0)	0(0.1)	0.1(0.3)	0(0.1)	106.3(234.4)	-	-
CHLORINATED BENZENES	1.6(3.5)**	-*	-*	-*	7.6(16.8)**	0.6(1.4)*	-*
CHLORINATED TOLUENES	3.0(6.6)**	N.A.	N.A.	N.A.	43.8(96.5)**	N.A.	N.A.

TABLE 2.14 (CONTINUED)

EPA PRIORITY POLLUTANT AND SPECIAL CATEGORY LOADINGS FROM SIGNIFICANT SOURCESS BY CATEGORIES/PARAMETERS
FROM DEC 1981-82 SAMPLING (QUANTIFIED PARAMETERS ONLY)
kg/day (lb/day)

Sub-Area	NIAGARA FALLS, NEW YORK				
Segment	Lower River				
	City of Niagara Falls Diversion Sewer				
Facility	OCC Niagara	E.I. du Pont	Olin Corp.	Carborundum	SCA
ACID EXTRACTABLES					
2,4-Dimethylphenol	-	-	-	-	-
2,4-Dinitrophenol	-	-	-	-	-
2-Nitrophenol	-	-	-	-	-
4-Nitrophenol	-	-	-	-	-
Phenol	-	-	-	-	-
2,4,6-Trichlorophenol	-	-	-	-	-
BASE/NEUTRAL EXTRACTABLES					
Anthracene	-	-	-	-	-
Benzo(a)anthracene	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	0.8(1.8)	-	-	-	-
1,2-Dichlorobenzene	-	-	-	-	-
1,4-Dichlorobenzene	-	-	-	-	-
Di-n-butylphthalate	-	-	-	-	-
Fluoranthene	-	-	-	-	-
Pyrene	-	-	-	-	-
1,2,4-Trichlorobenzene	-	-	-	-	-
Hexachlorobutadiene	-	-	-	-	-
PURGEABLES					
Bromodichloromethane	-	-	-	-	-
Benzene	-	-	-	-	-
Carbon tetrachloride	-	-	0.2(0.5)	-	-
Chlorobenzene	-	-	-	-	-
Chloroform	-	-	7.1(15.7)	-	-
Ethylbenzene	-	-	-	-	-
Methylene chloride	-	-	0.2(0.4)	-	-
1,1,2,2-Tetrachloroethane	-	-	4.0(8.8)	-	-
Tetrachloroethylene	0.6(1.4)	-	12.1(26.6)	-	-
Toluene	1.0(2.1)	-	-	-	-
Trans-1,2-dichloroethylene	-	-	2.6(5.8)	-	-
1,1,1-Trichloroethane	-	-	-	-	-
Trichloroethylene	-	-	25.4(56.1)	-	-
Trans-1,3-dichloropropene	-	-	-	-	-
PESTICIDES, TOTAL	0.6(1.4)	0(0)	0(0.1)	0(0)	0(0)
PCB #1248	-	-	-	-	-
METALS, TOTAL					
Arsenic	-	-	-	-	0.3(0.6)
Beryllium	-	-	-	-	-
Cadmium	-	-	-	-	0.1(0.1)
Chromium	-	-	-	-	0.3(0.7)
Copper	-	-	-	-	0.2(0.4)
Lead	-	1.2(2.6)	0.9(1.9)	-	3.2(7.1)
Mercury	-	-	-	-	-
Nickel	-	-	-	0.4(0.9)	5.8(12.7)
Selenium	-	-	-	-	0.1(0.2)
Silver	0.9(1.9)	-	0.2(0.4)	-	-
Thallium	-	-	-	-	-
Zinc	-	-	1.8(4.1)	-	0.3(0.6)
CYANIDES, TOTAL	0.5(1.1)	0(0.1)	0.6(1.3)	-	0.1(0.1)
PHENOLS (4AAP)	-	-	0.1(0.2)	0.8(1.7)	-
CHLORINATED BENZENES	-**	-*	-*	-*	-*
CHLORINATED TOLUENES	3.9(8.7)**	N.A.	N.A.	N.A.	N.A.

TABLE 2.15

EPA PRIORITY POLLUTANT AND SPECIAL CATEGORY LOADINGS FROM SIGNIFICANT SOURCES BY CATEGORIES (PARAMETERS) FROM MOE/EPS 1981-82 SAMPLING (QUANTIFIED PARAMETERS ONLY)
kg/d (lb/d)

Sub-Area	FORT ERIE		CHIPPAWA	NIAGARA FALLS			
Facility	Fort Erie Anger Ave.WPCP	Fleet Mfg	None	Niagara Falls WPCP	Welland WPCP	Atlas Steels	McMaster Ave. Combined Sewer
CATEGORIES/PARAMETERS							
ACID EXTRACTABLES							
2,4-Dichlorophenol	-	-	-	0.39(0.86)	-	-	-
Phenol	0.012(0.026)	-	-	0.051(0.11)	0.041(0.090)	-	-
BASE/NEUTRAL EXTRACTABLES							
Butylbenzyl phthalate	0.081(0.18)	-	-	-	-	-	-
Di-n-butyl phthalate	0.99(2.18)	-	-	3.4(7.5)	0.067(0.15)	0.38(0.84)	0.26(0.57)
Diethyl phthalate	0.16(0.35)	-	-	0.79(1.74)	0.023(0.051)	-	0.057(0.13)
Dimethyl phthalate	0.75(1.65)	-	-	-	-	-	-
Bis(2-ethylhexyl) phthalate	0.10(0.22)	-	-	0.30(0.66)	0.021(0.05)	0.13(0.29)	0.27(0.60)
Naphthalene	0.053(0.11)	0.0005(0.0011)	-	0.078(0.18)	0.013(0.029)	0.0045(0.0099)	-
1,2-Dichlorobenzene	0.043(0.095)	0.020(0.044)	-	0.11(0.24)	0.055(0.12)	-	0.009(0.02)
PURGEABLES							
Benzene	0.057(0.13)	-	-	0.077(0.18)	0.031(0.068)	-	-
Chloroform	0.096(0.21)	0.0019(0.0042)	-	0.11(0.24)	0.031(0.068)	-	0.0182(0.040)
1,2-Dichloroethane	0.32(0.71)	-	-	0.06(0.13)	-	-	0.01(0.02)
Trans-1,2-Dichloroethylene	1.79(3.95)	0.01(0.02)	-	0.06(0.13)	-	0.0091(0.020)	0.02(0.04)
Methylene chloride	0.16(0.35)	-	-	0.40(0.88)	0.05(0.11)	-	-
1,1,2,2-Tetrachloroethane	0.01(0.02)	-	-	0.02(0.04)	-	-	0.01(0.02)
1,1,2,2-Tetrachloroethylene	0.04(0.09)	-	-	0.04(0.09)	0.04(0.09)	-	-
Toluene	0.05(0.11)	0.0002(0.0004)	-	0.18(0.40)	0.10(0.22)	0.095(0.21)	0.01(0.02)
1,1,1-Trichloroethane	0.06(0.13)	0.01(0.02)	-	0.11(0.24)	0.01(0.02)	0.026(0.079)	-
Trichloroethylene	0.15(0.33)	0.02(0.04)	-	0.01(0.02)	0.01(0.02)	3.0(6.6)	0.02(0.04)
PESTICIDES	0.0047(0.010)	-	-	0.017(0.037)	0.011(0.024)	0.0047(0.010)	0.0007(0.0015)
PCBs	-	-	-	-	0.0058(0.013)	-	-
METALS							
Chromium	0.082(0.18)	1.1(2.4)	-	3.57(7.87)	0.41(0.90)	33(73)	2.2(4.9)
Copper	0.49(1.08)	0.020(0.04)	-	0.93(2.05)	0.70(1.54)	1.4(3.1)	1.0(2.2)
Lead	-	0.032(0.070)	-	0.57(1.26)	13(29)	4.6(10)	4.6(10)
Nickel	0.040(0.088)	0.0014(0.0031)	-	0.33(0.73)	0.35(0.77)	27(59)	3.6(7.9)
Zinc	1.3(2.9)	0.064(0.14)	-	11(25)	1.7(3.8)	4.4(9.7)	1.4(3.0)
CYANIDES, TOTAL	0.10(0.22)	-	-	0.34(0.75)	0.16(0.35)	-	-
PHENOLS (4AAP)	0.27(0.59)	-	-	0.87(1.9)	0.16(0.36)	0.11(0.24)	0.37(0.81)

NOTE: These parameters listed accounted for 99% of the total loading.

TABLE 2.15 (Continued)

Sub-Area	NIAGARA FALLS	
Facility	Cyanamid Niagara Falls Plant	Cyanamid Welland Plant
CATEGORIES/PARAMETERS		
ACID EXTRACTABLES		
2,4-Dichlorophenol	-	-
Phenol	-	-
BASE/NEUTRAL EXTRACTABLES		
Butylbenzyl phthalate	0.35(0.77)	-
Di-a-butyl phthalate	-	0.14(0.31)
Diethyl phthalate	-	0.044(0.097)
Dimethyl phthalate	-	-
Bis (2-ethyl hexyl) phthalate	-	0.091(0.20)
Napththalene	-	0.0013(0.0029)
1,2-Dichlorobenzene	-	-
PURGEABLES		
Benzene	-	0.028(0.062)
Chloroform	0.0057(0.013)	0.045(0.099)
1,2-Dichloroethane	-	0.01(0.02)
Trans-1,2-Dichloroethylene	-	-
Methylene chloride	0.03(0.07)	0.02(0.04)
1,1,2,2-Tetrachloroethane	-	-
1,1,2,2-Tetrachloroethylene	-	-
Toluene	0.0022(0.0048)	0.07(0.15)
1,1,1-Trichloroethane	0.0015(0.0033)	0.0017(0.0028)
Trichloroethylene	-	0.0040(0.0088)
PESTICIDES	0.0029(0.0064)	0.0031(0.0068)
PCBs	-	0.0004(0.0008)
METALS		
Chromium	-	4.9(11)
Copper	0.11(0.24)	0.65(1.4)
Lead	-	-
Nickel	-	2.3(5.2)
Zinc	0.60(1.3)	2.0(4.5)
CYANIDES, TOTAL	0.96(2.12)	2.3(5.1)
PHENOLS (4AAP)	-	0.17(0.37)

2.5 Storm Sewer and Urban Runoff Studies

2.5.1 New York Storm Sewers

Water samples were analyzed for phenols (4AAP), halogenated organics, and the volatile fraction of the EPA priority pollutants. The analytical results indicated that no significant levels of toxic pollutants were present in any of the water samples.

Sediment deposit samples were analyzed for phenols (4AAP) and all of the EPA priority pollutants except asbestos. Results are reported on a dry weight basis (ug/g) in Table A.2 in Appendix A. Quantified values are presented with their numerical result expressed in ug/g. Parameters identified in the sediment deposit samples but at a level below the method detection limit are indicated in the table by the symbol LT.

Metals were most frequently detected in the sediment deposit samples. Chromium, copper, and lead were found in all of the sediment deposit samples. Arsenic, cadmium, and nickel were detected in greater than 90% of the samples. Additional metals found in 60-75% of the samples included beryllium, mercury, silver, and zinc.

Phenols (4AAP) were found in approximately 80% of the samples. The organic priority pollutants were found at a much lower frequency. Considering only quantified values, toluene was found in 37% of the sediment deposit samples, aldrin in 34%, PCB-1260 in 28%, and anthracene in 25%.

The concentrations of metals in the sediment deposits were generally in the range of 1-1000 ug/g, while the volatile and pesticide organic fractions were quantified in the 0.01-1.0 ug/g range. Base/neutral compounds were frequently identified but rarely quantified.

The individual sites varied widely as to the number and concentrations of organic parameters found. The Pettit Flume and Robinson Street storm sewers in North Tonawanda contained the greatest variety as well as the highest concentrations or organic parameters.

High total metals concentrations were found in sediments at a number of sites, including the City of Tonawanda State Street storm sewer, the City of Tonawanda Franklin Street storm sewer, the Buffalo Sewer Authority storm sewer at Smith and Seneca Streets, a Town of Cheektowaga 42" storm sewer to the U-Crest ditch, the City of North Tonawanda Pettit Flume, the Buffalo Sewer Authority Hamburg Drain, the City of Tonawanda Wheeler Street storm sewer, and the Town of Tonawanda Masefield Avenue storm sewer.

In general, only one or two parameters were responsible for the high total metals concentrations. Lead was the predominant metal found in the State Street, Smith Street, U-Crest Ditch, and Masefield Avenue storm sewer sediment deposits. Copper was predominant in the Franklin Street, Pettit Flume, and Wheeler Street sediments. The sediment deposits in the Hamburg Drain contained high levels of both lead and zinc.

2.5.2 Ontario Urban Runoff Studies[1]

Urban runoff contribution of toxic substances to the Niagara River was evaluated in a selected study area. The study area which represents the Canadian drainage basin of the Niagara River contains three major urban centres: Fort Erie, Niagara Falls, and Welland.

Although the general list of priority pollutants established by the U.S. EPA includes 129 substances, only some of these could be studied using the available analytical laboratories and adopted sampling protocols. In

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1 Excerpts (edited) from "Toxic Substances in Urban Land Runoff in the Niagara River Area", Marsalek, J. and B. Greck, NWRI, Environment Canada, January, 1984.

total, 51 substances representing polychlorinated biphenyls, organochlorine pesticides, polyaromatic hydrocarbons, chlorinated benzenes, and metals were studied.

To determine the levels and frequency of occurrence of the substances studied, field investigations of urban runoff were undertaken at a number of sites in all three urban centres. Samples of stormwater and urban sediments were collected, documented, and submitted for analysis. The stormwater samples represented flow-proportional composite samples for entire storm events.

For estimates of annual loadings of toxic substances, it was necessary to calculate the annual volume of runoff and the annual discharge of solids transported by runoff. The annual runoff from the study area was determined as 21×10^6 m^3/yr. The loading of solids in urban runoff from the study area was estimated as 6,000 tonnes/yr.

Analytical results were further processed and analyzed with regard to the frequencies of exceedance of detection limits, estimates of mean concentrations, and annual loadings of toxic substances.

The determination of frequency of occurrence was affected by the detection limits for toxic substances. In general, the frequencies for sediment samples were higher than those for stormwater samples.

In sediment samples, the most frequently detected substances were metals (arsenic, copper, lead, selenium, and zinc-100%), PCBs, some organochlorine pesticides (p,p'-DDE - 59%, alpha-BHC - 53%, alpha-chlordane - 50%, gamma-chlordane - 40%, and p,p'-DDT - 35%), and several chlorinated benzenes (1,2, dichlorobenzene - 40%). Polycydicaromatic hydrocarbons were rarely detected.

In stormwater samples, the most frequently detected substances were metals (mercury, zinc - 100%), two pesticides (alpha-BHC - 98%, lindane

87%), and 1,2-dichlorobenzene (65%). The remaining substances were observed very infrequently. It should be emphasized that relatively high detection limits affected the frequency with which some chemicals were seen.

Mean concentrations for the entire data set were determined by considering only the data above detection limits and the frequencies of exceedance. To account for concentrations below the detection limit, lower and upper estimates were calculated. For the lower limit, the concentrations below the detection limit were set equal to zero and for the upper limit, they were set equal to the detection limit. Where all data exceeded the detection limit, only the mean concentration was calculated.

In general, the mean concentrations of toxic substances in water samples were several orders of magnitude lower than those in sediment. In water samples, the highest concentrations were observed for metals (zinc, copper, lead, nickel, and mercury), followed by 1,2-dichlorobenzene, polyaromatic hydrocarbons, alpha-BHC, and PCBs. It was noted that none of the average metal or pesticide concentrations exceeded the (1978) IJC Water Quality Objectives; however, this does not preclude exceedance for individual events.

In sediment samples, the highest concentrations were observed for metals (lead, zinc, chromium, copper, and nickel), followed by some polycydicaromatic hydrocarbons (pyrene, fluoranthene, and phenanthrene), some chlorinated benzenes, and PCBs.

Total estimated loadings of toxic substances (water and sediment) in urban runoff on an annual basis are presented in Section A.7 in Appendix A.