

**TEMPORAL EVOLUTION OF THE CONTAMINANTS  
IN SUSPENDED SOLIDS UPSTREAM OF LAKE  
SAINT-FRANÇOIS BETWEEN 1994 AND 1999**

Report ST-228E



# **Temporal Evolution of the Contaminants in Suspended Solids Upstream of Lake Saint- François between 1994 and 1999**

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State of the St. Lawrence

St. Lawrence Centre  
Environmental Conservation Branch  
Environment Canada

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## **Management Perspective**

A long-term monitoring study was initiated in 1994 on the quality of the suspended solids (SS) in the Cornwall–Massena region, in the western part of Lake Saint-François, as a joint project between Environment Canada (Quebec and Ontario regions), Quebec’s environment ministry (Ministère de l’Environnement et de la Faune du Québec – MEF), and the Ontario Ministry of the Environment and Energy (OMEE). This study is related to the dredging of contaminated sediment at three Superfund sites in the river at Massena. It aimed in particular to assess the effects of the restoration measures on the quality of the SS migrating downstream and currently contributing to the contamination of sediment in Lake Saint-François.

## **Perspective de gestion**

Un suivi à long terme de la qualité des matières en suspension a été entrepris en 1994 dans le secteur Cornwall-Massena, dans la portion ouest du lac Saint-François, dans le cadre d’un projet conjoint d’Environnement Canada (régions du Québec et de l’Ontario), du ministère de l’Environnement et de la Faune du Québec (MEF) et du ministère de l’Environnement et de l’Énergie de l’Ontario (OMEE). Ce suivi était relié aux activités de dragage de sédiments contaminés à trois sites SUPERFUND localisés dans le secteur fluvial de Massena, dans l’État de New York. Ce projet visait en particulier à évaluer les effets des mesures de restauration sur la qualité des matières en suspension qui migrent vers l’aval et qui contribuent actuellement à la contamination des sédiments du lac Saint-François.

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## Abstract

Upstream of Lake Saint-François, the industrial region of Cornwall–Massena brought intense pressure to bear on the fluvial environment of the St. Lawrence River by discharging contaminants like mercury and polychlorinated biphenyls (PCBs) mainly during the second half of the 20th century. This region, recognized as an area of concern by the International Joint Commission (IJC), has been the subject of restoration plans for contaminated sediment. Dredging and treatment projects for approximately 16 000 m<sup>3</sup> of contaminated sediment were undertaken by the GM and ALCOA plants in 1995, while in 2001, the Reynolds Metals Company/Alcoa dredged 65 750 m<sup>3</sup> of contaminated sediment containing more than 10 000 kg of PCBs.

As these restoration programs contained no provisions for long-term monitoring to assess the effectiveness of the measures undertaken, Environment Canada launched a long-term suspended solids (SS) monitoring program in the fall of 1994. A network of monitoring stations was established in the depositional zones in Lake Saint-François in order to assess the level of activity of pollution sources and the possible influence of the restoration work on the transport of contaminants.

The monitoring results show that the water masses circulating in the Massena and Cornwall regions each have a completely different geochemistry. The water mass flowing past Massena on the south shore of the lake collects what appear to be re-suspended solids contaminated by PCBs. For its part, the water mass that flows along the north shore tends to capture SS contaminated by mercury in the Cornwall area. Finally, sampling stations located further downstream indicate that the waters that flow along the two shores tend to mix progressively.

It was revealed that during the study period from 1994 to 1999, PCB concentrations in the SS circulating in Lake Saint-François did not vary substantially. This is particularly true of the north shore of the lake, which is essentially fed by Lake Ontario. On the south shore, concentrations measured at the Saint-François south station show that contamination has not decreased significantly since the 1995 dredging. These results illustrate the influence of the contaminated sediment that was still on the Reynolds Metals site and was dredged in 2001, after the end of the sampling associated with the long-term monitoring project.

## Résumé

En amont du lac Saint-François, principalement durant la seconde moitié du 20<sup>e</sup> siècle, le secteur industriel de Cornwall-Massena a occasionné de fortes pressions sur l'environnement fluvial du Saint-Laurent par le déversement de substances contaminantes telles que le mercure et les BPC. Ce secteur, qui a été reconnu par la Commission mixte internationale comme un secteur préoccupant, a fait l'objet de plans de restauration des sédiments contaminés. Des projets de dragage et de traitement d'environ 16 000 m<sup>3</sup> de sédiments contaminés ont été entrepris aux usines GM et ALCOA en 1995, tandis qu'en 2001, la Reynolds Metals/Alcoa draguait 65 750 m<sup>3</sup> de sédiments contaminés contenant plus de 10 000 kg de BPC.

Comme les programmes de restauration ne prévoyaient aucun mécanisme de suivi à long terme pour évaluer l'efficacité des mesures entreprises, un suivi à long terme de la qualité des matières en suspension et des sédiments a été entrepris par Environnement Canada à l'automne 1994. L'établissement d'un réseau de stations de suivi dans les zones d'accumulation du lac Saint-François avait pour objectif d'évaluer le niveau d'activité des sources de pollution et l'influence possible des travaux de restauration sur le transport des contaminants.

L'interprétation des résultats du suivi montre que les masses d'eau circulant dans le secteur de Massena et de Cornwall possèdent une géochimie complètement différente. La masse d'eau au sud du lac longe le secteur de Massena et recueille au passage des matières en suspension provenant vraisemblablement de la remise en suspension de sédiments contaminés par des BPC. Par ailleurs, la masse d'eau s'écoulant le long de la rive nord a tendance à capter au passage des matières en suspension contaminées par du mercure dans le secteur de Cornwall. Enfin, les stations d'échantillonnage situées plus en aval montrent que les eaux longeant les deux rives ont tendance à se mélanger progressivement.

Par rapport à la période d'étude de 1994-1999, il ressort que les teneurs en BPC des matières en suspension qui circulent dans le lac Saint-François n'ont pas varié de façon marquée. Cela est particulièrement vrai dans le secteur nord du lac, où l'eau provient essentiellement du lac Ontario. Du côté sud, les teneurs mesurées à la station Saint-François sud montrent qu'il n'y a pas eu de baisse importante de la contamination à la suite des dragages de 1995. Ces résultats dénotent l'influence des sédiments contaminés qui étaient toujours présents sur le site de la Reynolds Metals et qui ont été dragués en 2001, après la fin de l'échantillonnage associé au projet de suivi à long terme.



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# 1 Introduction

It is a well-known fact that the Cornwall–Massena industrial sector, upstream of Lake Saint-François, exerted strong pressure on the fluvial section of the St. Lawrence River through its discharge of contaminants like mercury and polychlorinated biphenyls (PCBs). As a result, the International Joint Commission designated this portion of the river as an Area of Concern and sediment remediation plans were drawn up by both Canadian and U.S. authorities (NYSDEC 1990; 1992a; 1992b; St. Lawrence RAP Team 1988; 1992; 1995).

Whereas in the Massena area, sediments are contaminated primarily with PCBs, mercury contamination is the main concern in the Cornwall area. Transboundary inputs are known to exist for both of these substances (Lum 1991; Lorrain et al. 1993; Vanier et al. 1996; Richard et al. 1997). Three projects involving chemical characterization of the surficial sediments of Lake Saint-François—one undertaken in 1979-1981 (Sloterdijk 1985; 1991), a second in 1989 (Fortin and Desrochers 1990; Lorrain et al. 1993) and the third in 1999 (Pelletier and Lepage 2002), showed that the levels of these two contaminants had declined substantially over the time interval between these three sampling campaigns, specifically 50% for mercury and 95% for PCBs (Pelletier and Lepage 2002). These decreases are primarily attributable to treatment of the many industrial effluents discharged to this part of the river. Nonetheless, highly contaminated sediments are still present in deeper layers of the St. Lawrence River bed, and that is why the U.S. Environmental Protection Agency forced a number of industrial plants on the southern side of Lake Saint-François to decontaminate their property and zones adjacent to the river. Dredging and contaminated sediment treatment projects were carried out in 1995 at the GM and ALCOA facilities, with nearly 16 000 m<sup>3</sup> of PCB-contaminated sediments being excavated in the Massena area (U.S. Environmental Protection Agency 2001). In 2001, Reynolds Metals/Alcoa dredged and removed 65 750 m<sup>3</sup> of contaminated sediments containing more than 10 000 kg of PCBs (U.S. Environmental Protection Agency and Environment Canada 2002). These site remediation initiatives contributed to a significant reduction in the PCB loads transported by the Grasse River to the St. Lawrence River (Alcoa 2001).

Since the remediation programs did not provide a mechanism for long-term monitoring to assess the effectiveness of measures implemented on both sides of the border (changes in industrial processes, plant closures, effluent treatment, legislation, changes in equipment, dredging), long-term monitoring of the quality of suspended solids and sediments was initiated in the fall of 1994. A network of stations was established to collect suspended solids in the depositional zones of Lake Saint-François with the aim of assessing the levels of pollution sources in the Cornwall–Massena area. Another aim was to assess the effect that remediation measures had had on the long-range transport of contaminants, to the extent permitted by the resolution limits of analytical techniques. Beginning in the spring of 1997, the initial findings were disseminated at various conferences in Canada and abroad, including the 5th annual meeting of Sharing Knowledge, Linking Sciences, held at Cornwall in 1998, and the 66th ACFAS Congress held the same year in Quebec City. In addition, a scientific and technical report (Lepage 1999) and a paper (Lepage et al. 2000) describe the work done and the key results obtained during the first three years of research on contaminant levels, transport mechanisms for suspended solids and sediment resuspension.

This document follows up on the report by Serge Lepage (1999) and gives an overview of the geochemical data collected during the long-term monitoring project, with a focus on the contaminants found in suspended solids and their sources. The effects of the dredging operations of 1995 in the Massena region are also described.

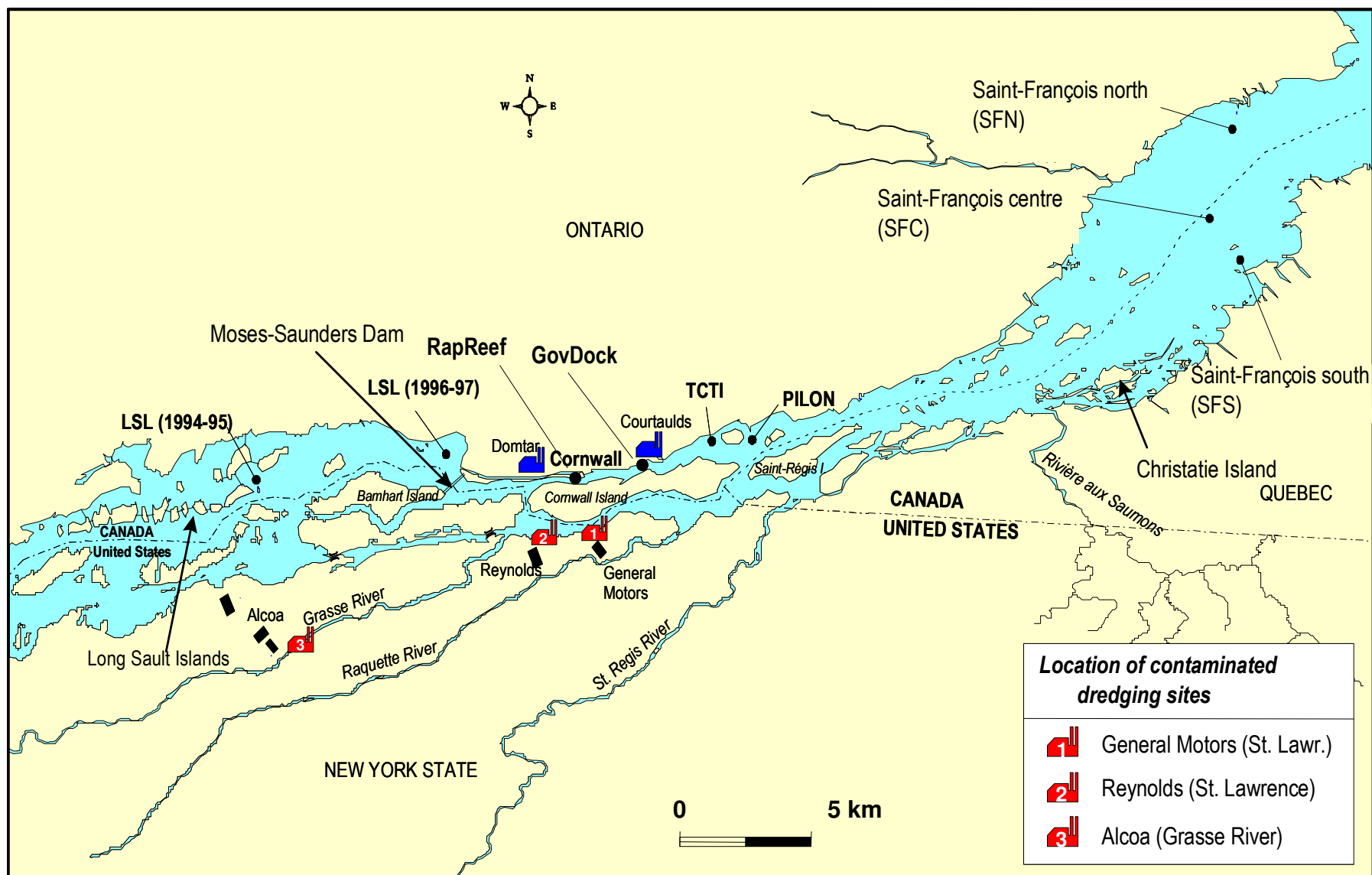
## **2 Methodology**

### **2.1 SAMPLING STRATEGY**

Sampling was carried out at the long-term monitoring stations from November 1994 to May 1999. During this period, 23 site visits were made to collect suspended solids from the sediment traps installed at six permanent sampling stations (Saint-François north, Saint-François centre, Saint-François south, Pilon, TCTI and Lake St. Lawrence) and at two temporary stations (RapReef and GovDock) located between Long Sault, in Lake St. Lawrence, and Point Dupuis, in Lake Saint-François (Figure 1). Cylindrical Kenney (1985) sediment traps with an internal volume of 3520 cm<sup>3</sup> were deployed at each of the stations. As a result, over the 55-month period of this program, 370 samples of suspended solids were collected and analysed to track the spatial evolution of the mercury and polychlorinated biphenyls. Table 1 gives the complete sequence of the suspended solids sampling dates and the number of samples taken at each of the stations. The report by Lepage (1999) and the paper by Lepage et al. (2000) provide detailed information on the scientific equipment used at the stations and on the sampling methods.

### **2.2 ANALYSIS OF SUSPENDED SOLIDS**

The samples of suspended solids intended for inorganic analysis were kept in polypropylene containers conditioned with nitric acid, while those intended for organic analyses were held in Teflon® or glass containers that had been rinsed successively with sulphochromic acid, acetone and hexane according to the methods described in Duval (1995).



**Figure 1** Map of the sampling stations used for long-term monitoring in Lake Saint-François



**Table 1**  
**Stations and sampling dates for suspended solids**

Sampling dates	Sampling stations							
	LSL	TCTI	PILON	SFN	SFC	SFS	RapReef	GovDock
November 3, 1994	-	-	-	2	1	-	-	-
December 21, 1994	-	-	-	2	2	2	-	-
March 9, 1995	2	-	-	2	2	2	-	-
June 6, 1995	2	-	-	2	2	3	-	-
July 4-6, 1995	2	-	-	2	2	2	-	-
August 9-10, 1995	3	-	-	3	3	3	-	-
September 6-7, 1995	4	-	-	2	3	3	-	-
October 3-4, 1995	4	-	-	2	3	4	-	-
November 8-9, 1995	2	-	-	-	4	3	-	-
December 5-8, 1995	-	3	3	4	4	3	-	-
March 14-28, 1996	2	2	2	-	2	2	-	-
July 30-31, 1996	2	3	4	3	4	4	-	-
September 10-11, 1996	2	2	4	2	2	2	-	-
November 6-7, 1996	2	4	4	2	3	5	-	-
February 26-March 1, 1997	2	4	4	3	3	5	-	-
May 14-15, 1997	2	2	4	4	3	6	-	-
July 7-8, 1997	2	4	5	4	4	4	-	-
September 18-19, 1997	2	4	5	3	4	4	-	-
November 6-7, 1997	2	3	4	2	4	4	-	-
May 21-22, 1998	2	3	4	4	5	6	1	2
July 21-22, 1998	2	4	6	4	3	4	2	2
November 17-19, 1998	4	4	6	4	4	6	2	2
May 18-20, 1999	4	4	4	4	4	2	2	2
Total number of samples between 1994 and 1999	49	46	59	56	68	77	7	8

*Legend* – Stations: GovDock (Government Dock), LSL (Lake St. Lawrence), RapReef (station located near an artificial reef installed under the Cornwall Remedial Action Plan [RAP]), SFC (Saint-François centre), SFN (Saint-François north), SFS (Saint-François south), TCTI (Transport Canada Training Institute).

*Note* – The numbers denote the number of samples collected.

Total metal analyses were performed on 144 samples at the National Water Research Institute (NWRI) using the atomic absorption method for copper, iron, manganese, lead and zinc, and cold vapour atomic absorption for mercury determination (Appendix 1 and Table 2). Organic and inorganic mercury were extracted and oxidized by sequential digestion using sulphuric, nitric and hydrochloric acids and potassium persulphate and permanganate (Environment Canada 1979). Polychlorinated biphenyl (40 to 83 congeners) analyses were performed on 128 samples (Appendix 2 and Table 2) at the Centre d'expertise en analyse environnementale du Québec (CEAEQ) using gas chromatography coupled with tandem mass spectrometry (GC-MS-ion trap) or high resolution mass spectrometry (GC-HRMS). The samples were first subjected to toluene extraction and to purification using acidified silica and sulphuric acid (Moore, 1996). Total PCBs were calculated by summing the following 27 congeners: 17, 18, 28, 31, 52, 70, 74, 87, 95, 99, 101, 105, 110, 118, 138, 149, 151, 158, 177, 180, 183, 194, 195, 199, 206, 208 and 209.

In addition, 144 samples of suspended solids were analysed for organic ( $C_{org.}$ ) and inorganic carbon ( $C_{inorg.}$ ) and organic nitrogen ( $N_{org.}$ ) (Appendix 1). These analyses were performed with a carbon-hydrogen-nitrogen analyser at the National Water Research Institute in Burlington.

Quality control of the analyses was ensured by incorporating subsamples into the analytical sequences. Table 3 presents the mean relative deviations derived from the metal and PCB analyses. Although the mercury results exhibited greater analytical variability, the mean relative deviation of the different elements and the PCBs is considered satisfactory.

**Table 2**  
**Detection limits of the analytical methods**

Analysis	Method	Detection limit ( $\mu\text{g/g}$ )
Total copper	Atomic absorption	1.0
Total iron	Atomic absorption	5.0
Total manganese	Atomic absorption	1.0
Total mercury	Atomic absorption with cold vapour	$2 \times 10^{-3}$
Total lead	Atomic absorption	5.0
Total zinc	Atomic absorption	1.0
PCBs	Ion trap (GC-MS-MS) and GC-HRMS	Varies with volume of sample and congener analysed: between $10^{-6}$ and $5 \times 10^{-4}$ ; always lower than $3 \times 10^{-3}$

**Table 3**  
**Mean relative deviations of the metal and PCB subsamples**

Elements and substance	Number of subsamples	Mean relative deviation (%)
Total copper	21	13.1
Total iron	21	3.7
Total manganese	21	4.5
Total mercury	21	21.7
Total lead	21	5.5
Total zinc	21	4.1
Total PCBs	10	7.9

### **2.3 TERNARY DIAGRAM OF THE RELATIVE PROPORTIONS OF CONGENERS IN FOUR AROCLORS**

In this study, we used a ternary diagram to aid in interpreting and distinguishing between the sources of the PCBs released into the St. Lawrence River. The diagram incorporates the different screening levels for PCB congeners, thereby permitting simultaneous comparison of the associated relative proportions (IUPAC No. 52, 101 and 138).

Some studies conducted on Lake Saint-François sediments indicated that the composition of PCBs from Great Lakes sources is consistent with that of commercial PCB mixtures such as Aroclor 1254 and Aroclor 1260, whereas PCBs discharged directly to the river in the Massena area consist primarily of Aroclor 1242 and 1248 (Vanier et al. 1996; Lorrain et al. 1993; Carignan et al. 1994; Cossa et al. 1998). In the past, a number of studies were conducted on these commercial mixtures to determine the relative proportion of each of the 209 PCB congeners they comprise (Manchester-Neesvig and Andren 1989). The results showed that Aroclor 1242 and 1248 contain a larger proportion of the lower chlorinated congeners than is the case for Aroclor 1254 and 1260. Some congeners can therefore be used to differentiate the PCBs discharged to the river and to determine their sources.

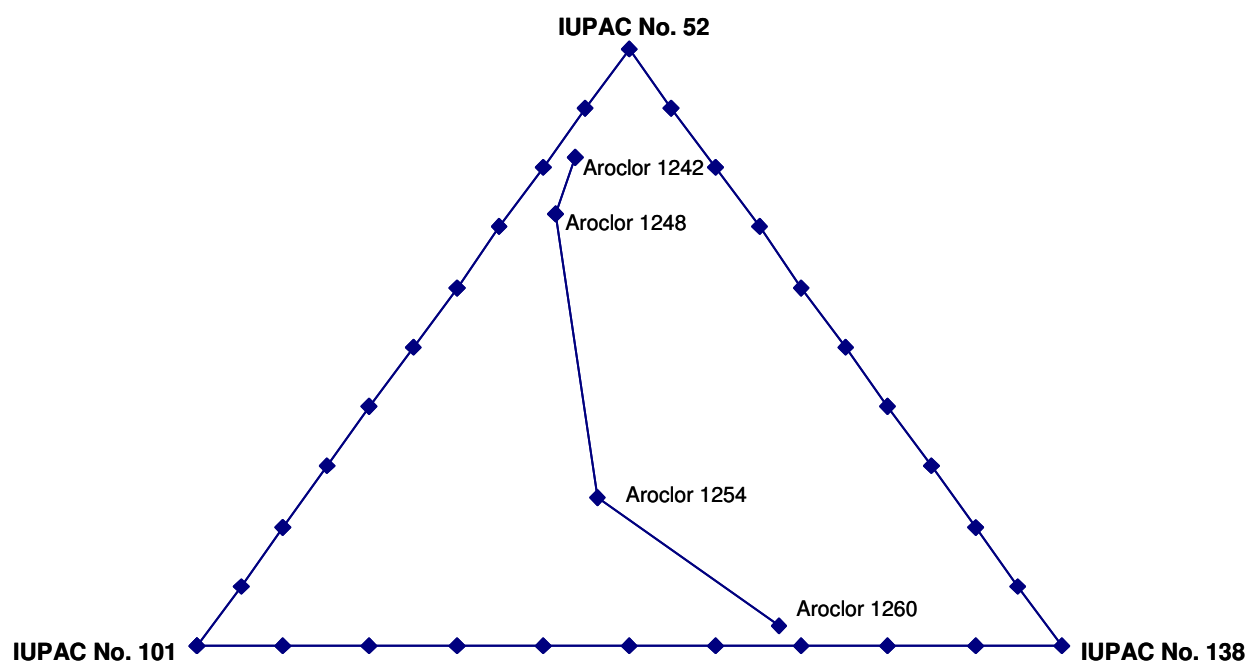
Of the 209 congeners analysed in the Aroclors, IUPAC congener No. 52 (a tetrachlorobiphenyl), 101 (a pentachlorobiphenyl) and 138 (a hexachlorobiphenyl) are present in different relative proportions, thus permitting differentiation of the four Aroclors (Table 4). Furthermore, these three congeners are abundant in the St. Lawrence system, easy to detect by analytical means and almost always analysed in environmental studies. The ternary diagram makes it easier to differentiate the four commercial mixtures based on the relative proportions of their constituent congeners (Figure 2).

**Table 4**  
**Relative proportions of three congeners in four Aroclors**

Aroclors	IUPAC No. 52 – tetrachlorobiphenyl (%)	IUPAC No. 101 – pentachlorobiphenyl (%)	IUPAC No. 138 – hexachlorobiphenyl (%)
1242	2.33	0.44	0.09
1248	3.85	1.19	0.29
1254	4.21	7.06	5.85
1260	0.25	2.46	5.23

*Legend* – IUPAC: International Union of Pure and Applied Chemistry.

*Source* – Manchester-Neesvig and Andren 1989.



*Legend* – IUPAC: International Union of Pure and Applied Chemistry.

**Figure 2 Ternary diagram of screening levels of congener No. 52, 101 and 138 and their relative proportions in four Aroclors**

### **3 Temporal evolution of contamination**

The initial results of the long-term program to monitor suspended solids were published in a scientific report (Lepage 1999) and a paper (Lepage et al. 2000). These documents contain the results of the geochemical analyses of suspended solids samples collected between November 1994 and November 1996, along with the analytical results for several physical parameters characterizing the lacustrine environment of the St. Lawrence River. The present report on the temporal evolution of contaminant levels add to the previously published geochemical information by providing the results for February 1997 through May 1999.

#### **3.1 POLYCHLORINATED BIPHENYLS**

Lepage's research (1999) using the analytical results for suspended solid samples collected between November 1994 and November 1996 clearly shows that the water flowing on the south side of Lake Saint-François transports a larger quantity of PCBs than the water on the north side. During this period, the lowest, highest and average levels were 8 to 13 times higher on the south side. Table 5 presents a set of statistical parameters calculated based on the analytical results obtained between November 1994 and May 1999.

These parameters show that there was little variation in total PCB levels at the stations on the north side of Lake Saint-François (Lake St. Lawrence, Pilon, TCTI, Saint-François north) between the two periods of interest (1994–1996 and 1997–1999), which suggests that PCB inputs from the fluvial section of the St. Lawrence River are homogeneous. However, on the northern side of the navigation channel, the average PCB levels exhibit an increasing gradient from upstream to downstream, with values of about 0.020 µg/g to 0.030 µg/g. This 30% increase is probably linked to the passage of the water through the Cornwall–Massena area, which is known for its high PCB levels (Lum 1991; Lorrain et al. 1993; Vanier et al. 1996; Richard et al. 1997). Furthermore, the average total PCB levels (0.028 µg/g) in suspended solids are almost identical to those in sediments deposited on the north side of the lake, (Pelletier and Lepage, 2002).

The difference between the north and the south, as shown by the levels measured at the Saint-François north and Saint-François south stations, is much greater. In fact, between 1994

and 1996, the average total PCB level was 0.030 µg/g on the north side and 0.147 µg/g on the south side, a difference of 400%. Although the difference between north and south was smaller between 1997 and 1999 (250%), it was also significant, with average values of 0.028 µg/g and 0.100 µg/g, respectively. These differences clearly indicate that suspended solids are enriched with PCBs as the water flows along the south shore of the lake near Massena.

**Table 5**  
**Statistical parameters related to total PCB levels at the sampling stations**

			Minimum	Maximum	Mean	Standard	C.V.
Location	Station	Period	(µg/g)	(µg/g)	concentration	deviation	(%)
Upstream North	LSL	Nov. 1994 to Nov. 1996	0.008	0.031	0.017	0.0076	45
		Feb. 1997 to May 1999	0.016	0.025	0.020	0.0028	14
		Nov. 1994 to May 1999	0.008	0.031	0.019	0.0061	33
	TCTI	Nov. 1994 to Nov. 1996	0.025	0.050	0.031	0.0097	31
		Feb. 1997 to May 1999	0.017	0.050	0.029	0.0129	45
		Nov. 1994 to May 1999	0.017	0.050	0.030	0.0118	40
	Pilon	Nov. 1994 to Nov. 1996	0.015	0.027	0.021	0.0043	21
		Feb. 1997 to May 1999	0.012	0.035	0.020	0.0079	39
		Nov. 1994 to May 1999	0.012	0.035	0.020	0.0066	33
Downstream North	SFN	Nov. 1994 to Nov. 1996	0.017	0.045	0.030	0.0071	23
North		Feb. 1997 to May 1999	0.022	0.037	0.028	0.0044	16
		Nov. 1994 to May 1999	0.017	0.045	0.029	0.0061	21
		SFC	Nov. 1994 to Nov. 1996	0.011	0.053	0.032	0.0105
		Feb. 1997 to May 1999	0.024	0.049	0.036	0.0080	23
		Nov. 1994 to May 1999	0.011	0.053	0.034	0.0097	29
		SFS	Nov. 1994 to Nov. 1996	0.051	0.367	0.147	0.0851
		Feb. 1997 to May 1999	0.073	0.148	0.100	0.0256	26
		Nov. 1994 to May 1999	0.051	0.367	0.127	0.0701	55
	South						

*Legend* – C.V.: coefficient of variation. Stations: GovDock (Government Dock), LSL (Lake St. Lawrence), RapReef (station located near an artificial reef of the Cornwall Remedial Action Plan [RAP]), SFC (Saint-François centre), SFN (Saint-François north), SFS (Saint-François south), TCTI (Transport Canada Training Institute).

However, the average concentrations in suspended solids calculated for the Saint-François south station exceed the average total PCB level ( $0.078 \mu\text{g/g}$ ) recorded in sediments in the southern part of the lake (Pelletier and Lepage 2002). This difference between the levels in sediments and those in suspended solids suggests that the latter tend not to settle out near the Saint-François south station but are instead transported further downstream.

The largest temporal variations are recorded at the Saint-François south station (Figure 3). Between October 1995 and March 1996, total PCB levels in suspended solids rose more than 600%, from  $0.051 \mu\text{g/g}$  to  $0.367 \mu\text{g/g}$ . This dramatic increase appears to be linked to two decontamination operations in the Massena area in 1995.

At its waterfront site, General Motors conducted major dredging operations between late June and early November 1995, removing more than  $13\,000 \text{ m}^3$  of contaminated sediments from the riverbed and capping an area of contaminated sediment, in November and December. This work was carried out inside a sheet pile enclosure, which was removed around the end of November. While these dredging operations were under way, Alcoa dredged a number of PCB-contaminated sites along the Grasse River, excavating approximately  $3000 \text{ m}^3$  of sediments (U.S. Environmental Protection Agency 2001).

Thus, the analytical results for PCBs in suspended solids from the Saint-François south station show that substantial resuspension of contaminated sediments occurred between fall 1995 and spring 1996. This resuspension may have been caused by reworking of sediments in connection with the removal of the sheet pile structure, by current-induced flattening of riverbed sediments in the areas dredged by General Motors and by a short period of heavy rainfall in late January 1996, possibly inducing reworking of sediments in the Grasse, Raquette, St. Regis and Salmon rivers.

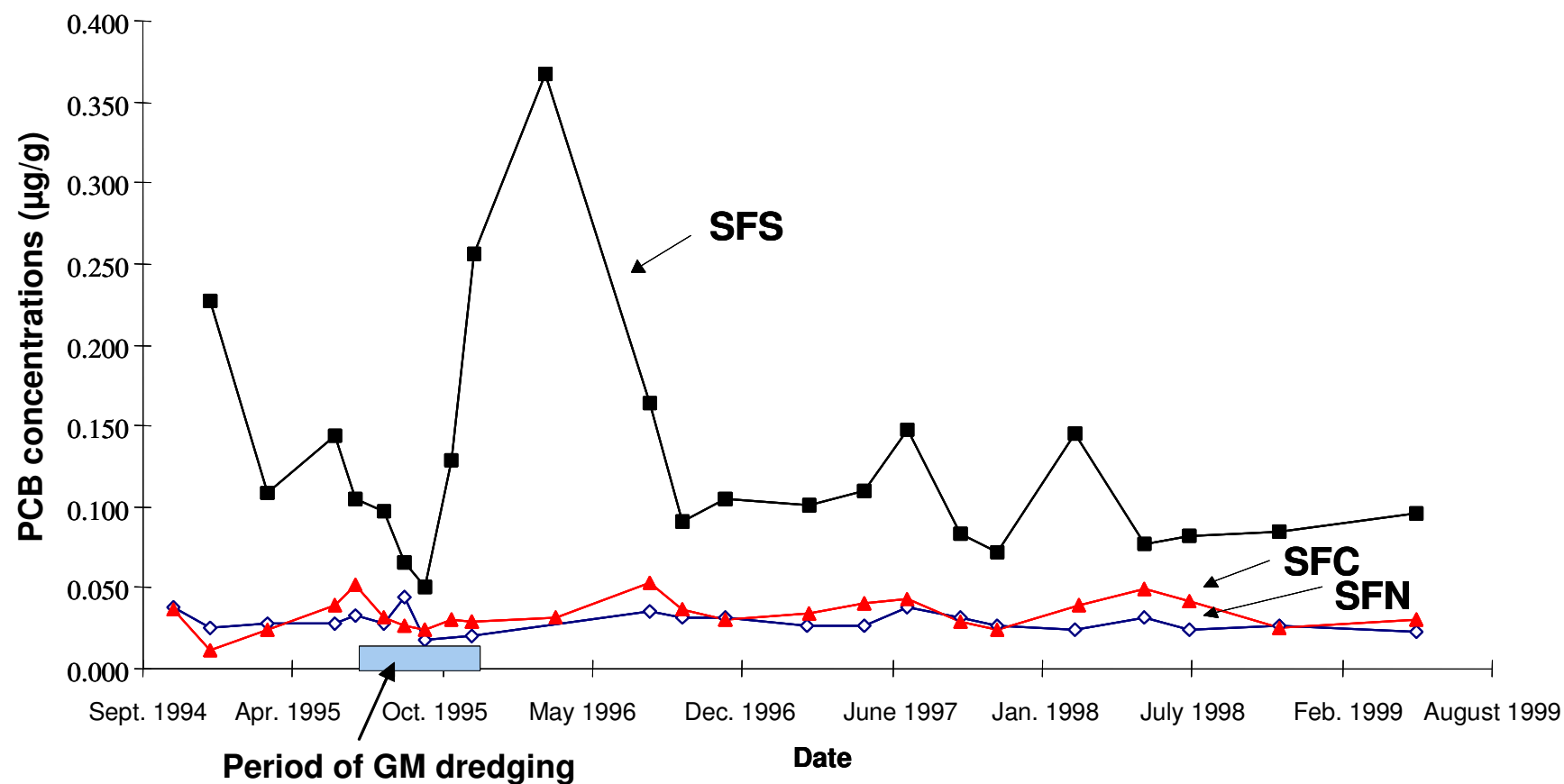
The discharge of the St. Regis River, as measured by the U.S. Geological Survey at the Parishville, N.Y. station, exhibited a sharp increase, exceeding  $100 \text{ m}^3/\text{s}$ , in late January 1996 (Figure 4). This peak flow, which was more than double the rate observed the following spring and 15 times greater than summer flow, occurred under the ice cover on Lake Saint-François, at a time when flow in these rivers is very restricted and channelled along the south shore (Lepage et al. 2000). A similar event in January 1998 caused an increase in the PCB levels at the Saint-François south station.



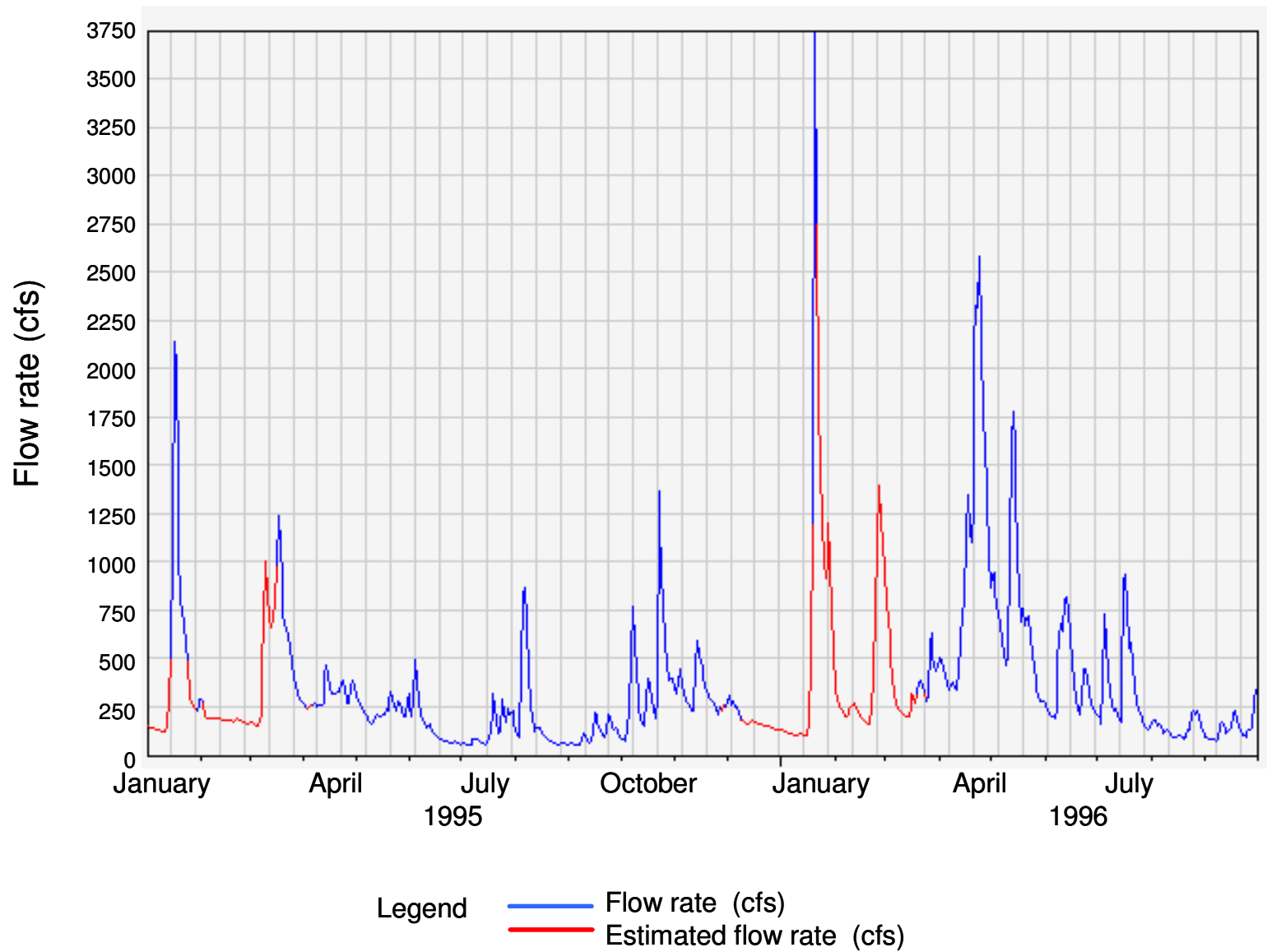
Current-induced flattening of the riverbed seems to have had an effect on sediment resuspension as well. Resuspension appears to have occurred during the removal of the sheet pile enclosure and after the dredging operations. Thus, the currents in this area may have contributed to the levelling of the sediment layers, particularly those more susceptible to resuspension. This physical process is a natural mechanism of sediment dynamics which allows the current to minimize the amount of friction encountered on the bottom of a watercourse.

The temporal diagram of PCB concentrations at the Saint-François centre station shows the spring freshet period for each of the sampling years (Figure 5). The PCB concentrations in sediment samples rise roughly 50% during or immediately after the spring, from about 0.030 µg/g to over 0.045 µg/g. These results seem to indicate that the increased flow of the Grasse, Raquette and St. Regis rivers plays an important role in the sediment dynamics of this area, primarily during the spring freshet.

As some studies have shown (Lorrain et al. 1993; Lepage et al. 2000; Lepage 1999) and as the PCB data show, the contaminants transported by suspended solids in the waters flowing on the south side of Lake Saint-François differ from those transported on the north side of the lake. Moreover, the ternary diagram of the relative proportions (screening levels) of three PCB congeners (IUPAC No. 52, 101 and 138) can be used to differentiate these two water masses on the basis of the relative proportions of the congeners in the Aroclor commercial products present in the water masses. Figure 6 contains the ternary diagram for Aroclors 1242, 1248, 1254 and 1260, which shows the mean proportional concentrations measured at each of the sampling stations (Lake St. Lawrence, Pilon, TCTI, Saint-François north, Saint-François centre and Saint-François south) and the proportional concentrations measured in sediments near the General Motors and Reynolds plants (Pelletier and Lepage 2002).



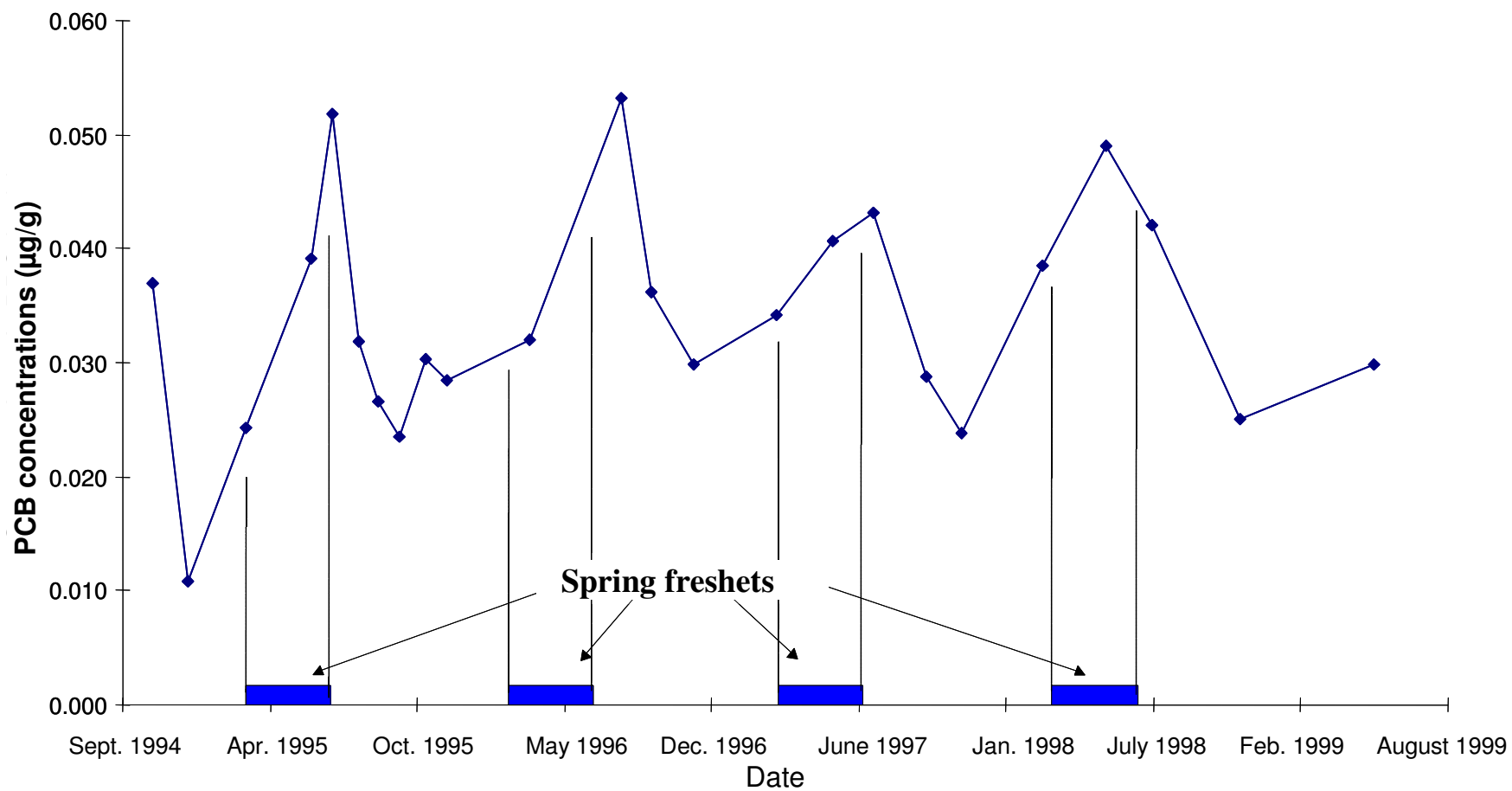
**Figure 3** Trends in total PCB concentrations in suspended solids at the Saint-François south, centre and north stations between 1994 and 1999



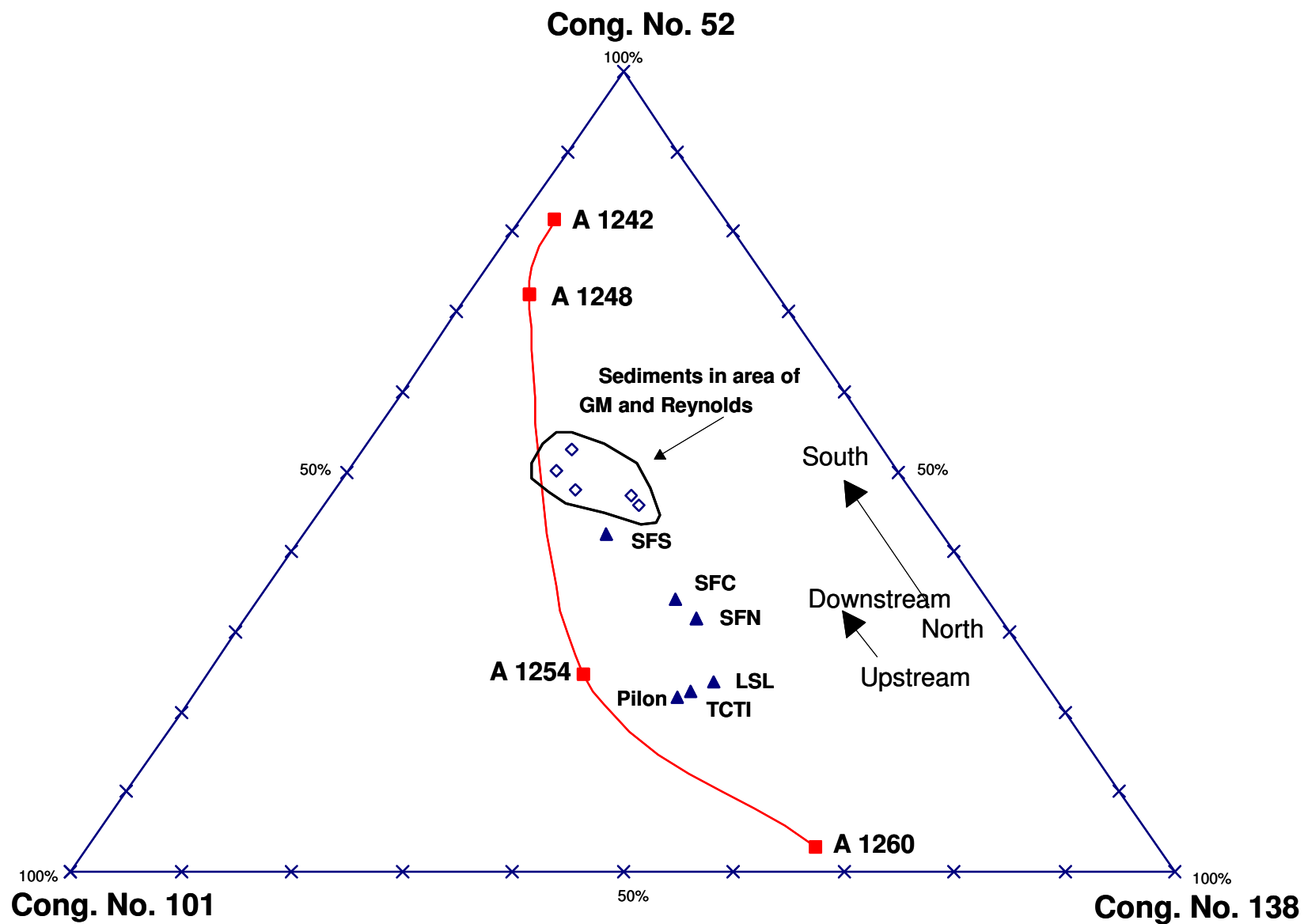
*Legend* – Flow is expressed in cubic feet per second (cfs).

*Source:* Reproduced from the Web site of the U.S. Geological Survey 1988.

**Figure 4 Trends in daily flow rates on the St. Regis River between January 1995 and October 1996**



**Figure 5 Trends in total PCB concentrations in suspended solids at the Saint-François centre station between 1994 and 1999**

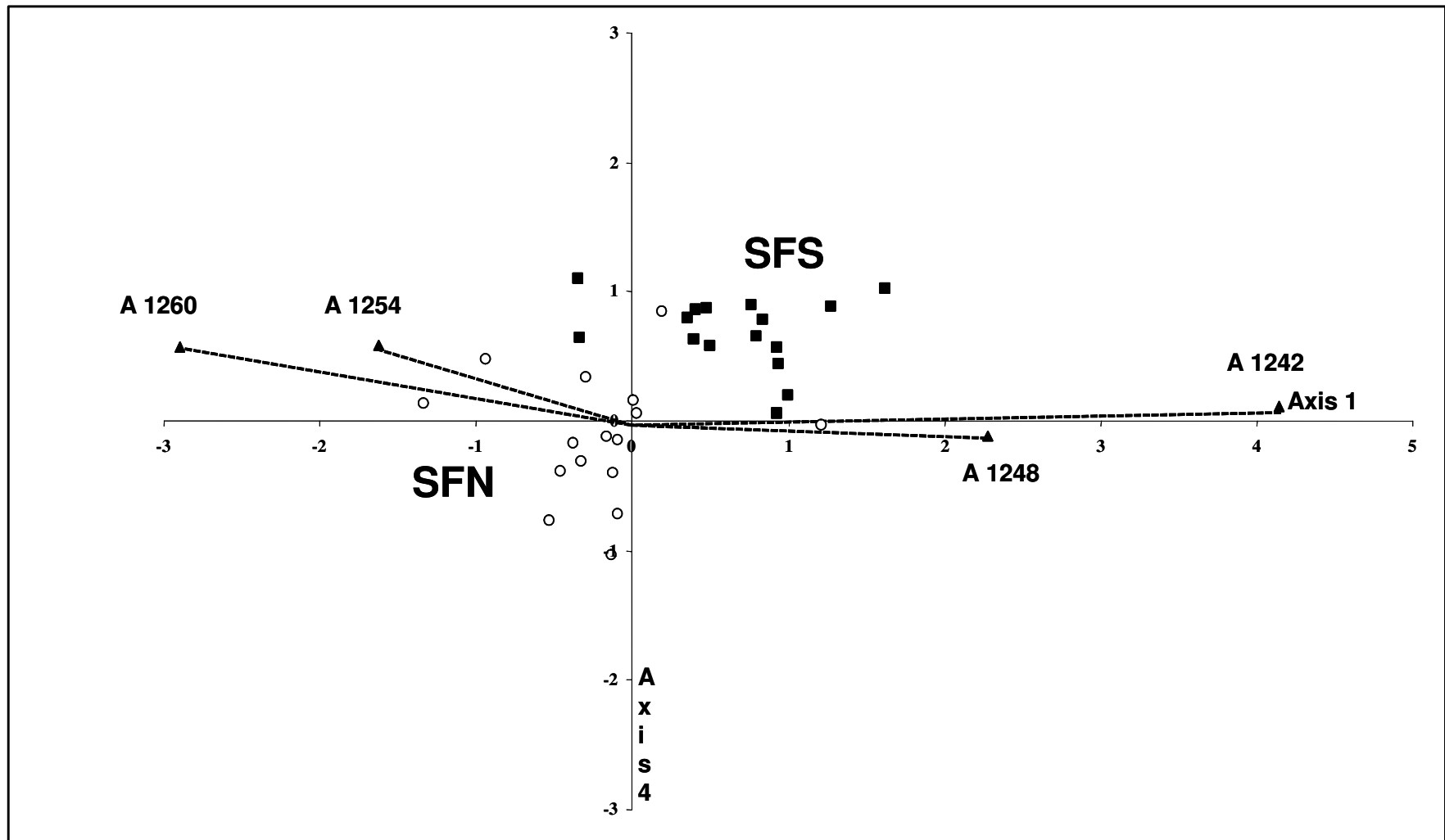


**Figure 6** Relative proportions of PCB congener No. 52, 101 and 138 in suspended solids at the Lake Saint-François stations and in sediments from the area around the General Motors and Reynolds facilities

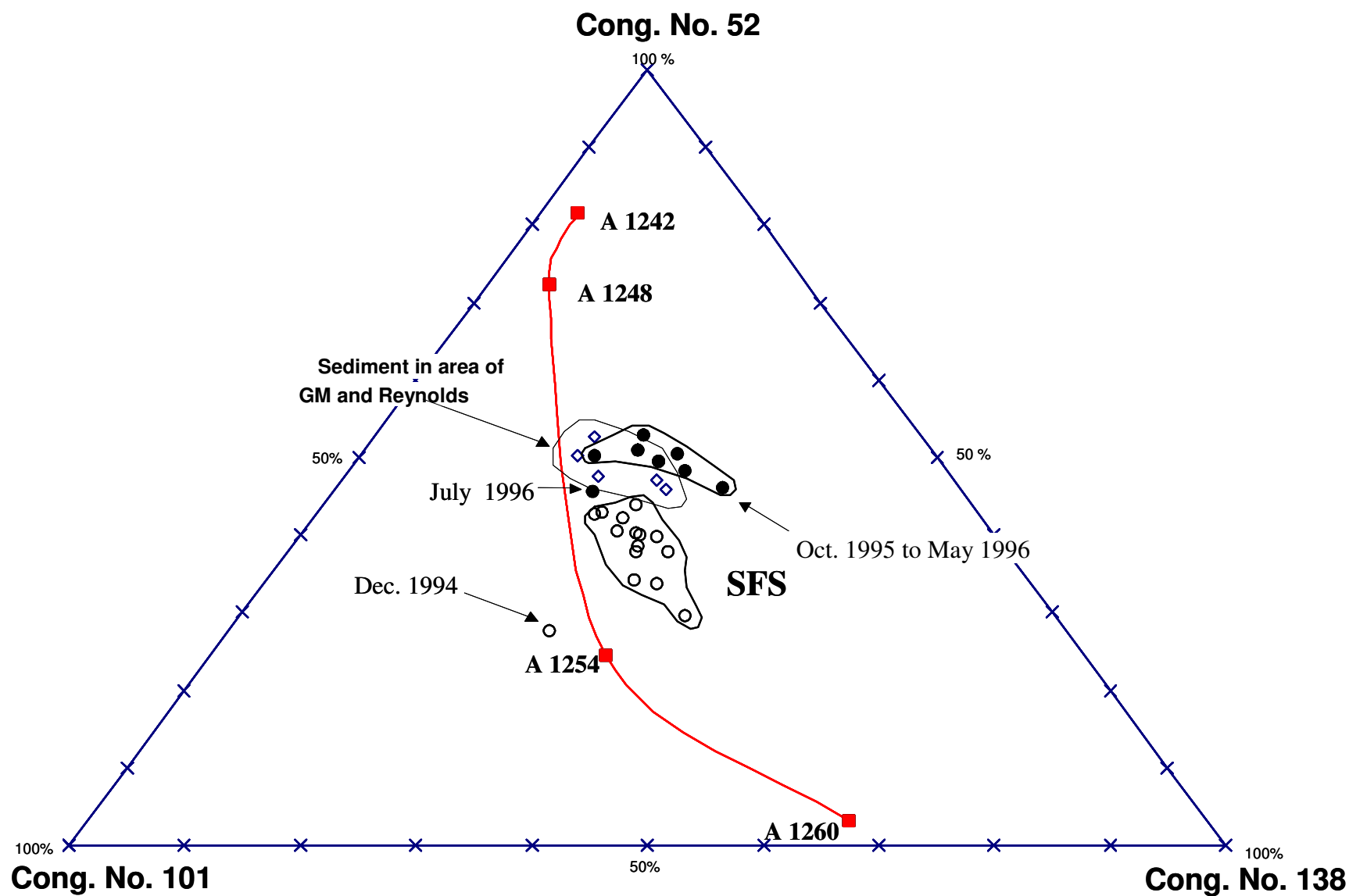
The positions of the points on this diagram, which represent the mean values for the congeners, show that the water from the fluvial section (Lake St. Lawrence station) that flows along the north shore of Lake Saint-François (Pilon, TCTI and Saint-François north stations) contains PCBs in proportions similar to the congener mixture in Aroclor 1254, whereas the PCBs in suspended solids transported by the water in the southern portion of the lake (Saint-François south) and those in sediments around the industrial plants contain a mixture enriched with Aroclor 1248. Principal component analysis performed on the results from the Lake St. Lawrence and Saint-François south stations revealed a link between these stations and the different Aroclors (Figure 7).

The ternary diagram of the screening levels for congeners also points to Aroclor 1248 enrichment proceeding upstream to downstream and north to south. These results suggest that as river water leaves the Moses-Saunders Dam and flows through the Massena industrial sector, it is enriched with PCB congeners from the Aroclor 1248 in resuspended sediments. However, this influx has little effect on the PCB concentrations in suspended solids, owing to the simultaneous increase in the quantity of suspended solids in the water mass.

Using the ternary diagram, the suspended solids from the 1995 dredging zone can be identified at the Saint-François south station (Figure 8). The high concentrations recorded between October 1995 and July 1996 (Figure 3) cluster together in this diagram near the relative proportions identified for the sediments in the vicinity of the General Motors and Reynolds plants, thus attesting to the source of the suspended solids measured at the Saint-François south station during this period.



**Figure 7** Diagram of the principal component analysis for the Saint-François south and Saint-François north stations in relation to the different Aroclors (axes 1 and 4)



**Figure 8** Relative proportions of PCB congeners No. 52, 101 and 138 in suspended solids at the Saint François south station versus sediments in the area of the General Motors and Reynolds plants



Overall, the total PCB results at the stations vary little and are at or very near the no-effect level of 0.02 µg/g for benthic organisms (St. Lawrence Centre and Ministère de l'Environnement du Québec 1992). Saint-François south is the only station that has levels at or exceeding the minimal effect level (0.1 µg/g), even when the period from November 1995 to May 1996 is excluded. Despite the absence of geochemical information on the southern part of the upstream area, it is likely, judging from the levels observed at Saint-François south, that the suspended solids there have a PCB level greatly exceeding the minimal effect level set out in the interim sediment quality criteria

### **3.2 MERCURY**

Unlike the total PCB concentrations, the highest mercury levels were found in suspended solids transported by the water flowing on the northern side of Lake Saint-François (Lepage 1999; Lepage et al. 2000). This trend, observed between June 1995 and November 1996, was corroborated by the sampling results for the February 1997 to May 1999 period. Table 6 presents some statistical parameters calculated based on the analytical results for mercury at the different sampling stations. It should be noted that the GovDock and RapReef stations were added to the normal sampling sequence in November 1997 to better define the inputs possibly coming directly from the Cornwall industrial sector. Based on the statistical calculations, the mean mercury levels on the north side of the lake (GovDock, RapReef, TCTI, Pilon and Saint-François north) were 2 to 10 times higher than those on the south side (Saint-François south) and those in the fluvial section upstream of the Moses-Saunders Dam (Lake St. Lawrence). The highest mercury concentrations were recorded in May 1998 on the north side, at RapReef (4.97 µg/g) and at TCTI (4.18 µg/g); a concentration 100 times smaller (0.045 µg/g) was recorded at the Lake St. Lawrence station during this period.

**Table 6**  
**Statistical parameters related to total mercury levels at the sampling stations**

Location	Station	Period	Minimum (µg/g)	Maximum (µg/g)	Mean concentration (µg/g)	Standard deviation (µg/g)	C.V. (%)
Upstream	LSL	July 1995 to Nov. 1996	0.125	0.235	0.169	0.0392	23
		Feb. 1997 to May 1999	0.045	0.654	0.199	0.1606	81
		July 1995 to May 1999	0.045	0.654	0.185	0.1205	65
	RapReef	Nov. 1997 to May 1999	0.646	4.970	1.845	1.6450	89
	GovDock	Nov. 1997 to May 1999	0.283	2.558	1.151	0.8225	71
	TCTI	Dec. 1995 to Nov. 1996	0.540	1.440	1.007	0.3387	34
		Mars 1997 to May 1999	0.408	4.180	1.361	1.1399	84
		Dec. 1995 to May 1999	0.408	4.180	1.235	0.9513	77
	Pilon	Dec. 1995 to Nov. 1996	0.261	1.100	0.499	0.3098	62
		Feb. 1997 to May 1999	0.266	1.215	0.442	0.2890	65
		Dec 1995 to May 1999	0.261	1.215	0.462	0.2979	64
Downstream North	SFN	July 1995 to Nov. 1996	0.273	0.377	0.343	0.0354	10
		Feb. 1997 to May 1999	0.126	0.905	0.352	0.2085	59
		July 1995 to May 1999	0.126	0.905	0.348	0.1572	45
	SFC	June 1995 to Nov. 1996	0.148	0.229	0.202	0.0266	13
		Feb. 1997 to May 1999	0.175	0.919	0.312	0.2239	72
		June 1995 to May 1999	0.148	0.919	0.254	0.1649	65
South	SFS	June 1995 to Nov. 1996	0.127	0.186	0.148	0.0172	12
		Feb. 1997 to May 1999	0.105	0.352	0.200	0.0879	44
		June 1995 to May 1999	0.105	0.352	0.173	0.0671	39

*Legend* – C.V.: coefficient of variation. Stations: GovDock (Government Dock), LSL (Lake St. Lawrence), RapReef (station located near an artificial reef of the Cornwall Remedial Action Plan [RAP]), SFC (Saint-François centre), SFN (Saint-François north), SFS (Saint-François south), TCTI (Transport Canada Training Institute).

Regardless of the time period, the mean mercury concentrations increase rapidly by about 500% between the Lake St. Lawrence station and the Cornwall sector (GovDock, RapReef and TCTI), hence in an upstream-to-downstream direction, and then gradually decline to a mean level of 0.35 µg/g at the Saint-François north station. This sharp increase in mean mercury concentrations provides evidence of the ongoing resuspension of underlying sediments that became heavily contaminated in the past by industrial activities in the Cornwall region. The

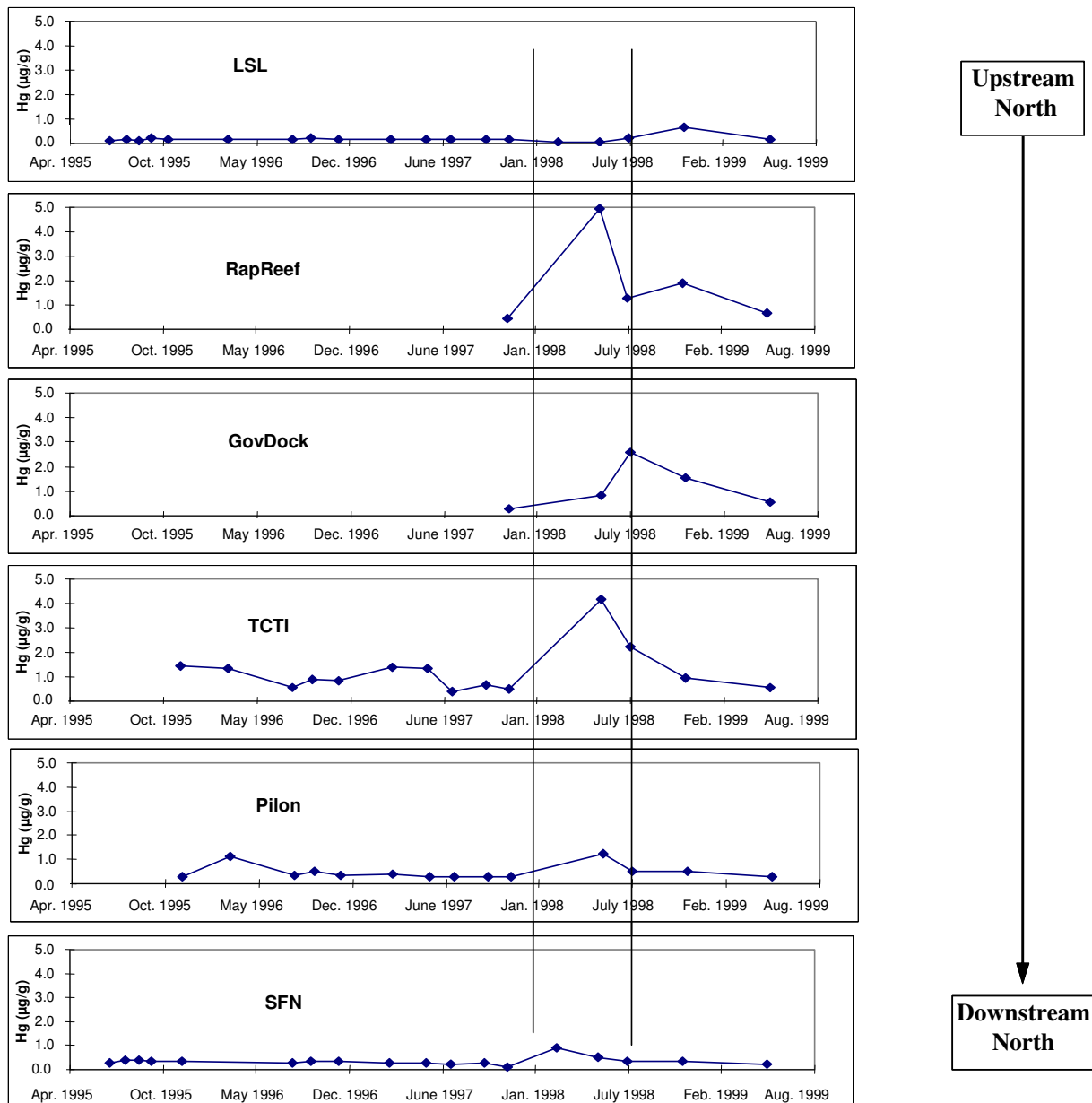
decrease in mercury levels in suspended solids between Cornwall and the Saint-François north station suggests that these contaminants tend to become increasingly diluted with cleaner suspended solids and/or they are deposited on the riverbed. Moreover, the sediment geochemistry results show that in 1999 the area between Cornwall and the Lancaster basin was one of the main zones of mercury contamination in Lake Saint-François (Pelletier and Lepage 2002).

Although much of the suspended solids are likely deposited on the surface of the sediments, the mean mercury concentrations measured in suspended solids at the stations in the northern portion of Lake Saint-François are all higher than the mean concentrations measured in the sediment here. This discrepancy suggests that part of the suspended solids transported by the St. Lawrence near Cornwall is transported farther downstream and may exit the lake basin through canals and locks.

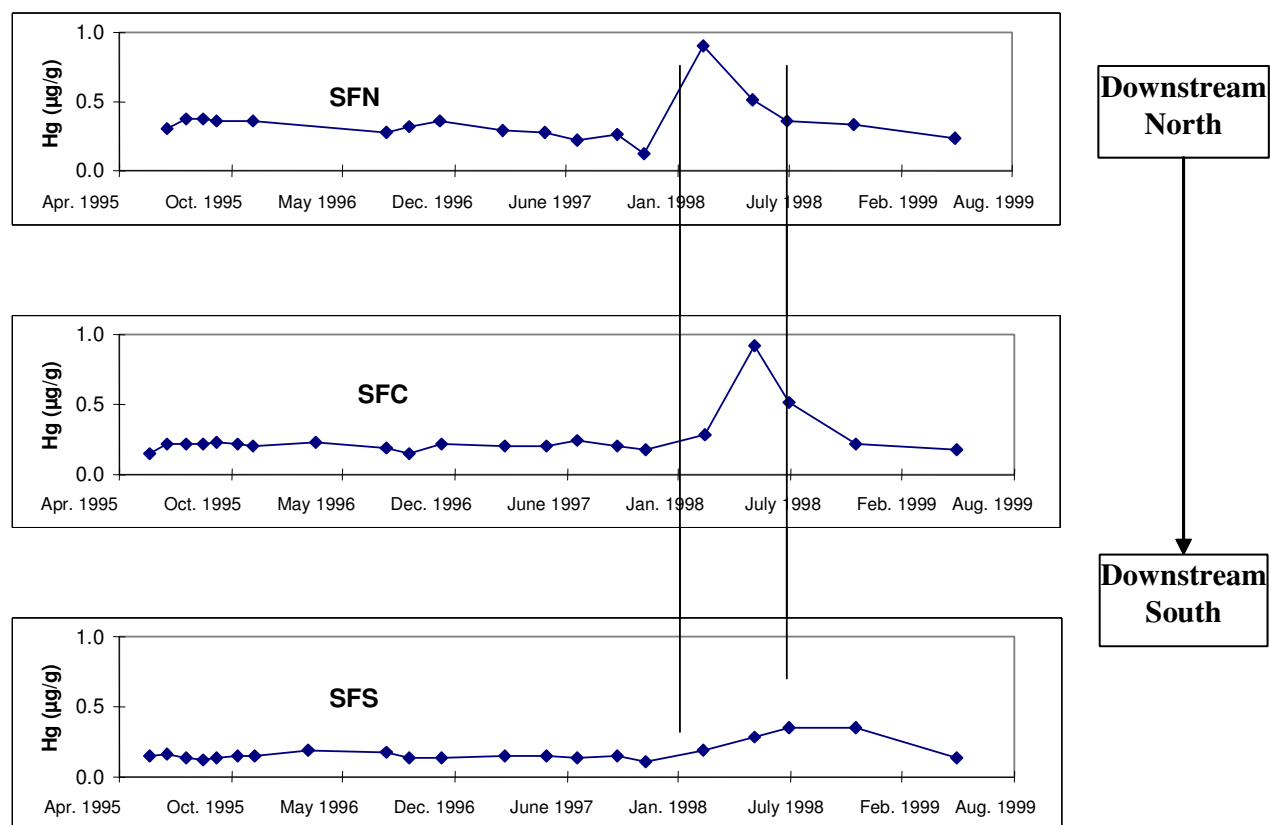
Figures 9 and 10 show the temporal trends in mercury levels at the sampling stations. There was little variation in mercury concentrations during the period from 1994 to 1999 in an upstream to downstream and north to south direction. However, between January 1998 and July 1998, all of the samples collected downstream from the GovDock station contained high concentrations compared with the levels recorded before or after this period. According to Dreier (2000), the increase in mercury levels may be linked to construction of the Rotary Club of Cornwall's Eco Garden, which took place primarily in January and February 1997, during the summer of 1997 and in the spring of 1998. This upward trend may be associated with erosion of contaminated soil and subsequent runoff into the river during any of these three periods.

At the GovDock station, mercury levels rose in July 1998, whereas the increase at the Lake St. Lawrence and Saint-François south stations occurred later, at the end of 1998. The increase in concentrations at the GovDock station appears to be the direct result of surface erosion caused by a heavy rainfall event (90 mm in two days) in early summer 1998 just upstream of the station (Dreier 2000).

With respect to the Lake St. Lawrence and Saint-François south stations, the increase in concentrations remains unexplained as yet. It may be connected with one or more events, for example, fluctuation in the sediment discharge of the St. Lawrence or the resuspension of surficial sediments, possibly in fall 1998 upstream of the study area (Dreier 2000).



**Figure 9** Temporal and spatial trends (upstream–downstream) in mercury concentrations at the stations on the north side of Lake Saint-François



**Figure 10 Temporal and spatial trends (north–south) in mercury concentrations at the stations in Lake Saint-François**

### 3.3 OTHER METALS AND ORGANIC COMPOUNDS

Beginning in June 1995, whenever the sediment traps contained enough suspended solids, analyses for metals (copper, zinc, lead, iron and manganese), organic and inorganic carbon, and organic nitrogen were performed at all the stations. Table 7 gives the mean concentrations obtained for these metals and compounds between June 1995 and May 1999.

**Table 7**  
**Mean metal and organic compound levels at the sampling stations**

Station	Period	Cu (µg/g)	Zn (µg/g)	Pb (µg/g)	Fe (µg/g)	Mn (µg/g)	Org. C (%)	Inorg. C (%)	Org. N (%)
LSL	July 1995 to May 1999	555	173	36	34 842	945	5.69	0.46	0.62
GovDock	Nov. 1997 to May 1999	38	138	34	28 630	801	5.54	0.68	0.51
RapReef	Nov. 1997 to May 1999	40	138	33	27 170	695	5.91	0.98	0.60
TCTI	March 1996 to May 1999	209	221	39	31 458	835	5.84	0.68	0.61
Pilon	March 1996 to May 1999	73	189	35	30 700	798	5.07	0.72	0.52
SFN	Sept. 1995 to May 1999	73	197	39	32 107	870	7.49	0.57	0.83
SFC	June 1995 to May 1999	124	172	33	29 647	880	7.03	0.66	0.82
SFS	June 1995 to May 1999	72	196	32	33 617	1 293	6.96	0.45	0.65

*Legend* – Inorg. C.: inorganic carbon. Org. C.: organic carbon. Cu: copper. Fe: iron. Mn: manganese. Org. N.: organic nitrogen. Pb: lead. Zn: zinc.

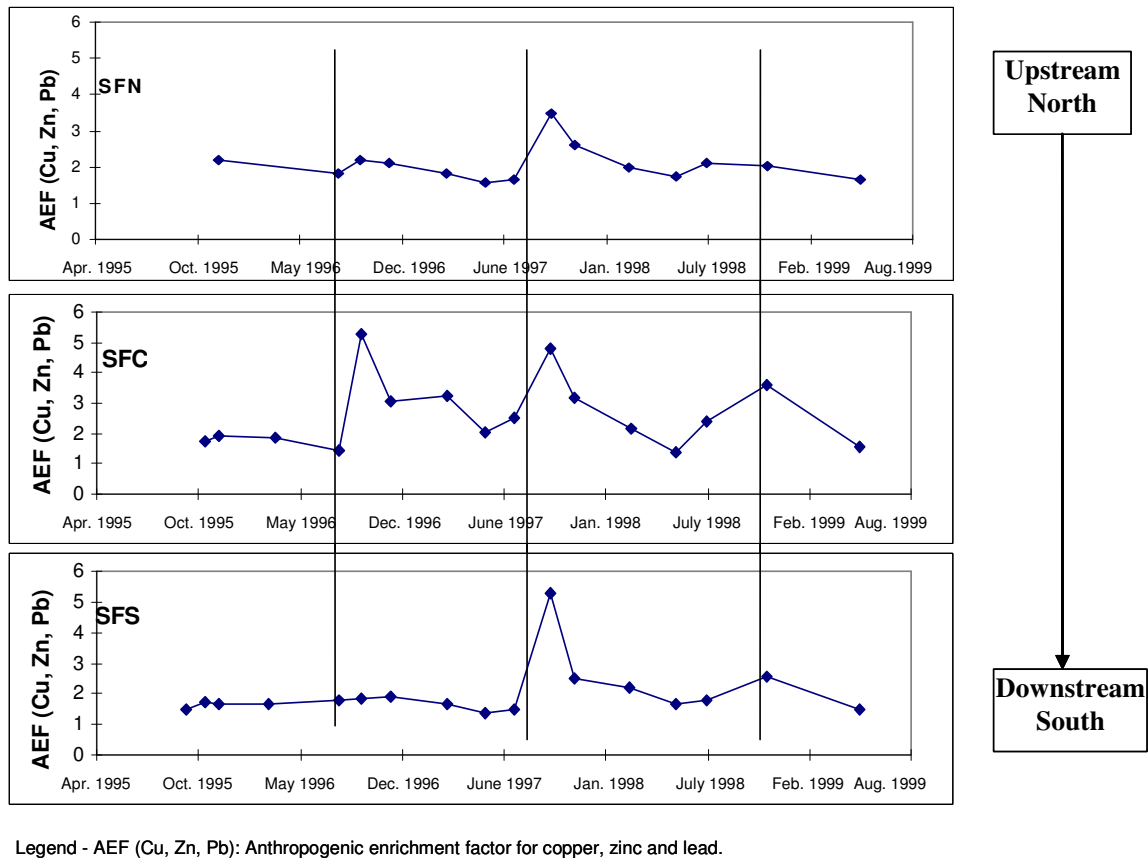
Stations GovDock (Government Dock), LSL (Lake St. Lawrence), RapReef (station located near an artificial reef of the Cornwall Remedial Action Plan [RAP]), SFN (Saint-François north), SFC (Saint-François centre), SFS (Saint-François south), TCTI (Transport Canada Training Institute).

Among the metals, copper is the geochemical element that exhibits the largest temporal and spatial variations. Mean levels at the Lake St. Lawrence and TCTI stations were particularly high, exceeding 550 µg/g and 200 µg/g respectively. At the Lake St. Lawrence station, copper concentrations exceeded 200 µg/g seven out of 18 times, whereas at the TCTI station, this level was exceeded six out of 13 times (Appendix 1). By contrast, the mean concentrations at the GovDock and RapReef stations were much lower and did not exceed 40 µg/g. These mean concentrations are consistent with the levels recorded in Lake Saint-François sediments, which range from 22 µg/g on the south side and 30 µg/g on the north side (Pelletier and Lepage, 2002). The highest concentrations were recorded at the Lake St. Lawrence station upstream of Moses-Saunders Dam, specifically 3380 µg/g in July 1997 and 2400 µg/g in May 1998. These extreme copper levels show no correlation, either spatially or temporally, with the other stations, although some stations show very high concentrations during other sampling periods. The present results

do not allow us to explain these high copper values, which are inconsistent with the other geochemical results, especially since there are no known local sources of copper. It is possible, therefore, that the high copper levels are the result of accidental contamination during sample collection or analysis.

For the other metals and for organic carbon, there is very little between-station or within-sampling period variation in the mean levels. The observed trends rarely exceed twice the computed means. However, if all the stations are considered collectively over the entire sampling period (1995-1999), the mean levels measured in suspended solids generally exceed the mean levels measured in sediments on both the north and south sides of Lake Saint-François.

To gain a better understanding of the temporal evolution of the metals data, the anthropogenic enrichment factor (AEF) was calculated for copper, zinc and lead (Lorrain et al. 1993; Fortin et al. 1994). Although this factor is mainly used in evaluating sediment quality, here it was adopted as a general indicator for data interpretation. The mean anthropogenic enrichment factor for the three metals concerned is given in Figure 11. At the Saint-François north, centre and south stations, the variations in levels correspond to an annual cycle. More specifically, they increase by about 50 % in the fall and winter, then drop in spring and reach their lowest point at the end of summer. This cyclical variation in metal concentrations in suspended solids is probably linked to fluctuations in river flow and the enrichment of concentrations through a decline in the amount of organic solids. These seasonal fluctuations are reflected in the suspended solids measured at the permanent station in Quebec City (Rondeau et al. 2000).



**Figure 11 Temporal and spatial trends (north–south) in the anthropogenic enrichment factor at the sampling stations in Lake Saint-François**



## 4 Conclusion

The interpretation of the results of the long-term monitoring of suspended solids in Lake Saint-François shows that the water masses that flow through the Massena–Cornwall area differ radically in their geochemistry. The PCB and mercury data suggest that the water flowing upstream of the Moses-Saunders Dam divides into two separate water masses near Cornwall Island, with one water mass then moving along the south shore of the lake and the other along the north shore. The water mass on the south side flows through the Massena industrial sector and picks up suspended solids that likely include resuspended sediments contaminated by PCBs. As a result of similar hydrodynamic processes, the water mass that moves along the north shore tends to collect suspended solids contaminated by mercury in the Cornwall area. Data from the sampling stations further downstream indicate that these two water masses tend to mix. Although the rate of mixing has not been determined, PCB congener analyses provide a means of differentiating the water masses and assessing their quality in relation to PCB contamination sources.

Temporal variations in the quality of suspended solids at the Lake Saint-François south (SFS) station show that a sharp increase in total PCB concentrations occurred between October 1995 and March 1996. This increase, which occurred after the General Motors dredging operations, is probably linked partly to sediment resuspension in the vicinity of the dredging zone, caused by the levelling action of currents on the river bottom. However, the effect of the tributaries on the south shore of the St. Lawrence (Grasse, Raquette, St. Regis and Salmon rivers) must also be taken into consideration; their combined flow increased dramatically in January 1996, contributing to an influx of suspended solids contaminated by PCBs in the southern portion of Lake Saint-François.

In the Cornwall area, temporal trends in the quality of suspended solids provide evidence of strong mercury enrichment between January and July 1998. This rise in mercury concentrations probably resulted from runoffs of eroded contaminated soil during construction of the Rotary Eco Garden and from a heavy rainfall event in the area.

In general, the long-term monitoring results aid in tracking the movement of suspended solids in the water upstream of Lake Saint-François and in evaluating their level of contamination by total PCBs and mercury. During the study period from 1994 to 1999, PCB levels in the suspended sediments transported in Lake Saint-François showed no marked upward or downward trends. This is particularly true in the northern part of the lake, where the inflows of water come mainly from Lake Ontario. In the southern portion, where local influences can be detected more readily, the levels recorded at the Saint-François south station have decreased little since the dredging operations of 1995. These findings are indicative of the effect of contaminated sediments that were still present at the Reynolds Metals site but were subsequently dredged, in 2001, after the long-term monitoring program ended. It would be helpful to return to Lake Saint-François in a few years, after all the remediation work has been completed, to assess the effect of this work on the quality of the suspended solids in Lake Saint-François. Finally, to ensure more effective environmental monitoring in Lake Saint-François, research should be undertaken to determine the rate of mixing of the suspended solids in the different water masses that flow upstream of the lake. Knowledge of this mixing rate will enable researchers to identify the most significant sedimentation zones in the lake, thereby permitting more optimal monitoring in the future.

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## **Appendices**

# 1 Analytical results for mercury and metals

## Lake St. Lawrence station

Date	AEF (Cu-Zn-Pb)	Tot. Cu (mg/kg)	Tot. Fe (mg/kg)	Tot. Mn (mg/kg)	Tot. Pb (mg/kg)	Tot. Zn (mg/kg)	Tot. Hg (mg/kg)	Tot. org. C (% weight)	Tot. inorg. C (% weight)	Tot. org. N (% weight)
July 1995	1.4	44	30 000	742	30	138	0.125	3.19	0.84	0.39
August 1995							0.151	4.81	0.45	0.51
Sept. 1995	1.6	52	32 850	747	34	153	0.135	4.67	0.68	0.54
Oct. 1995	1.6	53	33 800	912	33	158	0.235	4.85	0.59	0.56
Nov. 1995	1.7	59	33 500	718	34	155	0.147	5.44	0.61	0.60
March 1996	1.9	67	36 700	1 080	38	170	0.142			
July 1996	2.1	86	35 600	838	35	182	0.162	5.63	0.75	0.55
Sept. 1996	10.2	726	38 300	1 290	39	296	0.234	6.15	0.12	0.50
Nov. 1996	2.3	91	35 900	1 020	42	191	0.194	6.12	0.15	0.64
Feb. 1997	5.0	323	34 500	796	40	177	0.179	6.45	0.43	0.73
May 1997	8.9	675	32 900	905	21	169	0.165	6.35	0.42	0.70
July 1997	41.3	3 380	35 000	930	31	176	0.147	5.79	0.32	0.61
Sept. 1997	1.9	93	32 300	887	20	149	0.192	5.87	0.35	0.69
Nov. 1997	18.6	1 470	35 900	960	39	167	0.166	6.04	0.35	0.70
Feb. 1998	3.7	215	37 500	1 030	42	172	0.056	6.24	< 0.01	0.63
May 1998	29.8	2 400	35 100	631	48	149	0.045	5.81	0.50	0.61
July 1998	2.1	76	36 200	1 480	42	173	0.217	5.88	0.40	0.68
Nov. 1998	2.5	115	35 700	1 240	42	169	0.654	6.24	0.27	0.65
May 1999	1.8	58	35 400	800	39	170	0.165	6.94	0.56	0.83

*Legend* – AEF: anthropogenic enrichment factor.



## TCTI station

Date	AEF (Cu-Zn-Pb)	Tot. Cu (mg/kg)	Tot. Fe (mg/kg)	Tot. Mn (mg/kg)	Tot. Pb (mg/kg)	Tot. Zn (mg/kg)	Tot. Hg (mg/kg)	Tot. org. C (% weight)	Tot. inorg. C (% weight)	Tot. org. N (% weight)
Dec. 1995							1.440	5.27	0.32	0.50
March 1996	2.6	89	30 400	891	47	271	1.350	6.54	0.21	0.60
July 1996	2.1	71	34 300	813	37	208	0.540	5.26	1.28	0.63
Sept. 1996	5.8	361	33 400	861	40	263	0.886	6.23	0.01	0.50
Nov. 1996	4.5	255	33 100	891	39	256	0.818	6.88	0.01	0.65
March 1997	2.6	92	28 900	738	38	284	1.400	5.66	1.09	0.59
May 1997	4.4	254	27 200	665	47	215	1.350	4.98	0.86	0.52
July 1997	3.3	180	33 500	998	34	196	0.408	5.41	0.93	0.61
Sept. 1997	6.8	480	30 600	834	27	195	0.658	5.59	0.52	0.63
Nov. 1997	2.6	125	31 900	901	33	203	0.480	6.06	1.04	0.71
May 1998	4.4	259	29 050	663	45	187	4.180	4.48	2.08	0.53
July. 1998	5.4	346	34 000	901	44	202	2.245	5.72	0.64	0.68
Nov. 1998	2.9	146	31 300	853	34	188	0.957	6.04	0.33	0.63
May 1999	2.0	58	31 300	851	41	208	0.572	7.58	0.20	0.77

*Legend* – AEF: anthropogenic enrichment factor. TCTI station (located near the Transport Canada Training Institute).

## Pilon station

Date	AEF (Cu-Zn-Pb)	Tot. Cu (mg/kg)	Tot. Fe (mg/kg)	Tot. Mn (mg/kg)	Tot. Pb (mg/kg)	Tot. Zn (mg/kg)	Tot. Hg (mg/kg)	Tot. org. C (% weight)	Tot. inorg. C (% weight)	Tot. org. N (% weight)
Dec. 1995							0.261	5.68	0.11	0.56
March 1996	1.7	46	29 400	829	42	157	1.100			
July 1996	1.7	50	32 700	796	33	194	0.319	4.31	1.71	0.50
Sept. 1996	2.1	78	34 050	862	35	206	0.487	5.56	0.28	0.39
Nov. 1996	2.1	75	33 800	886	35	195	0.327	6.25	0.08	0.61
Feb. 1997	1.7	68	28 200	773	28	149	0.372	4.42	0.59	0.45
May 1997	3.0	152	26 500	614	47	153	0.288	3.68	0.93	0.40
July 1997	1.7	61	31 300	858	28	172	0.274	4.92	0.70	0.52
Sept. 1997	1.8	63	33 100	894	32	174	0.281	4.38	1.32	0.53
Nov. 1997	2.8	79	33 000	965	33	412	0.266	5.39	1.29	0.62
May 1998	1.9	70	25 850	560	42	132	1.215	4.35	1.16	0.48
July. 1998	1.9	67	31 300	789	39	173	0.490	5.14	0.44	0.51
Nov. 1998	2.0	74	31 100	837	34	175	0.527	5.80	0.78	0.66
May 1999	1.7	60	28 800	706	32	161	0.266	6.00	0.04	0.59

*Legend* – AEF: anthropogenic enrichment factor.

### Saint-François north station

Date	AEF (Cu-Zn-Pb)	Tot. Cu (mg/kg)	Tot. Fe (mg/kg)	Tot. Mn (mg/kg)	Tot. Pb (mg/kg)	Tot. Zn (mg/kg)	Tot. Hg (mg/kg)	Tot. org. C (% weight)	Tot. inorg. C (% weight)	Tot. org. N (% weight)
July 1995							0.306	6.77	1.11	0.85
August 1995							0.376	5.66	1.13	0.58
Sept. 1995	2.4	63	31 900	653	53	262	0.377	4.89	0.68	0.48
Oct. 1995							0.361	8.36		0.94
Dec. 1995	2.2	71	34 600	1 055	40	238	0.359	8.93	0.26	0.93
July 1996	1.8	56	33 700	683	35	198	0.273	5.97	1.20	0.75
Sept. 1996	2.2	85	29 600	599	32	217	0.324	10.00	0.10	1.01
Nov. 1996	2.1	73	32 800	916	37	217	0.367	9.92	0.05	0.99
Feb. 1997	1.8	54	33 800	1 190	35	202	0.293	7.32	0.01	0.74
May 1997	1.6	59	29 100	738	21	165	0.276	6.16	0.98	0.70
Juill. 1997	1.6	50	32 400	910	29	187	0.219	6.37	0.52	0.73
Sept. 1997	3.5	128	33 000	933	92	185	0.261	7.50	0.67	0.91
Nov. 1997	2.6	118	35 000	1 110	32	222	0.126	9.05	0.15	1.10
Feb. 1998	2.0	75	34 800	1 050	36	177	0.905	7.41	1.63	0.92
May 1998	1.7	62	27 300	621	35	147	0.517	6.33	0.33	0.64
July 1998	2.1	88	28 300	661	38	154	0.365	6.30	0.68	0.73
Nov. 1998	2.0	74	32 300	993	36	188	0.327	9.51	0.01	1.05
May 1999	1.7	43	33 000	944	36	190	0.232	8.41	0.24	0.88

*Legend* – AEF: anthropogenic enrichment factor.

### Saint-François centre station

Date	AEF (Cu-Zn-Pb)	Tot. Cu (mg/kg)	Tot. Fe (mg/kg)	Tot. Mn (mg/kg)	Tot. Pb (mg/kg)	Tot. Zn (mg/kg)	Tot. Hg (mg/kg)	Tot. org. C (% weight)	Tot. inorg. C (% weight)	Tot. org. N (% weight)
June 1995	1.6	48	27 400	872	32	162	0.148	4.38	1.91	0.63
July 1995	1.9	61	30 900	953	36	192	0.222	5.93	0.53	0.63
August 1995							0.220	7.04	0.63	0.85
Sept. 1995							0.214	9.01		0.99
Oct. 1995							0.223	8.04	0.14	0.95
Nov. 1995	1.8	56	27 750	1135	33	182	0.212	7.79	0.56	0.82
Dec. 1995	1.9	73	27 950	806	31	186	0.199	8.78	1.05	1.07
March 1996	1.8	72	26 200	580	27	180	0.229	8.49	1.21	1.12
July 1996	1.5	42	28 700	677	30	159	0.189	4.53	1.04	0.56
Sept. 1996	5.3	353	30 800	1120	32	178	0.154	10.60	0.10	1.36
Nov. 1996	3.1	153	33 700	1090	44	186	0.217	8.78	0.13	0.96
Feb. 1997	3.2	183	31 300	1060	33	174	0.201	6.99	0.08	0.72
May 1997	2.0	88	27 900	832	30	160	0.197	5.07	0.09	0.45
July 1997	2.5	126	29 700	901	29	172	0.242	4.65	1.51	0.56
Sept. 1997	4.8	314	31 400	837	29	184	0.196	6.33	0.76	0.79
Nov. 1997	3.2	182	32 550	937	30	173	0.175	8.36	0.17	0.96
Feb. 1998	2.1	86	32 600	870	38	167	0.278	6.24	1.08	0.70
May 1998	1.4	39	24 700	669	30	136	0.919	5.34	0.43	0.55
July 1998	2.4	103	29 800	778	41	167	0.515	4.56	1.38	0.59
Nov. 1998	3.6	217	29 000	739	31	163	0.217	9.18	0.13	1.06
May 1999	1.6	43	31 300	983	32	173	0.176	7.65	0.23	0.83

*Legend* – AEF: anthropogenic enrichment factor.

### Saint-François south station

Date	AEF (Cu-Zn-Pb)	Tot. Cu (mg/kg)	Tot. Fe (mg/kg)	Tot. Mn (mg/kg)	Tot. Pb (mg/kg)	Tot. Zn (mg/kg)	Tot. Hg (mg/kg)	Tot. org. C (% weight)	Tot. inorg. C (% weight)	Tot. org. N (% weight)
June 1995	1.5	40	28 600	1 020	31	168	0.148	7.50	0.25	0.64
July 1995							0.160	6.44	0.83	0.65
August 1995							0.136	5.70	0.76	0.57
Sept. 1995							0.127	5.79	0.02	0.55
Oct. 1995	1.5	44	34 500	1 490	28	171	0.135	4.96	0.96	0.56
Nov. 1995	1.7	50	37 200	1 600	33	193	0.153	7.10	0.39	0.70
Dec. 1995	1.7	46	33 100	1 450	31	204	0.150	7.11	0.62	0.64
March 1996	1.7	38	35 700	1 590	35	211	0.186	7.85	0.72	0.77
July 1996	1.8	45	36 300	944	36	214	0.170	7.03	0.84	0.73
Sept. 1996	1.8	60	34 800	1 520	30	203	0.134	5.57	0.16	0.34
Nov. 1996	1.9	58	35 500	1 160	30	236	0.134	6.43	0.13	0.63
Feb. 1997	1.7	52	33 400	1 470	30	189	0.153	7.70	0.06	0.68
May 1997	1.4	35	31 800	1 380	30	160	0.149	7.17	< 0.01	0.57
July 1997	1.5	42	32 100	1 270	27	179	0.136	6.58	0.32	0.64
Sept. 1997	5.3	321	36 050	1 460	29	312	0.154	5.46	0.66	0.58
Nov. 1997	2.5	125	34 300	1 370	28	189	0.105	6.59	0.61	0.74
Feb. 1998	2.2	87	33 600	1 410	34	194	0.187	8.82	< 0.01	0.78
May 1998	1.7	39	30 800	1 180	44	169	0.283	8.78	0.49	0.70
July 1998	1.8	46	34 200	1 100	45	176	0.352	7.32	0.23	0.62
Nov. 1998	2.6	135	32 000	1 110	29	164	0.350	6.58	0.54	0.60
May 1999	1.5	35	31 150	744	31	188	0.133	9.73	0.01	0.87

*Legend* – AEF: anthropogenic enrichment factor.

### GovDock station

Date	AEF (Cu-Zn-Pb)	Tot. Cu (mg/kg)	Tot. Fe (mg/kg)	Tot. Mn (mg/kg)	Tot. Pb (mg/kg)	Tot. Zn (mg/kg)	Tot. Hg (mg/kg)	Tot. org. C (% weight)	Tot. inorg. C (% weight)	Tot. org. N (% weight)
Nov. 1997	1.3	36	31 700	1 035	29	149	0.283	4.94	0.27	0.47
May 1998	1.4	37	27 700	730	37	132	0.821	5.00	1.01	0.55
July 1998	1.6	42	29 350	737	43	144	2.558	4.51	1.56	0.53
Nov. 1998	1.5	46	29 450	764	33	140	1.555	7.72	0.01	0.46
May 1999	1.2	29	24 950	738	29	128	0.537	5.54	0.59	0.54

*Legend* – AEF: anthropogenic enrichment factor. GovDock station (station located near a government dock).

### RapReef station

Date	AEF (Cu-Zn-Pb)	Tot. Cu (mg/kg)	Tot. Fe (mg/kg)	Tot. Mn (mg/kg)	Tot. Pb (mg/kg)	Tot. Zn (mg/kg)	Tot. Hg (mg/kg)	Tot. org. C (% weight)	Tot. inorg. C (% weight)	Tot. org. N (% weight)
Nov. 1997	1.4	41	29 400	917	29	143	0.423	3.76	1.21	0.42
May 1998	1.4	42	23 700	552	32	120	4.970	5.89	1.71	0.57
July 1998	1.5	38	27 500	616	40	135	1.295	6.02	0.83	0.57
Nov. 1998	1.5	43	29 450	732	34	140	1.890	6.16	0.21	0.58
May 1999	1.3	35	25 800	656	29	152	0.646	7.73	0.94	0.85

*Legend* – AEF: anthropogenic enrichment factor. RapReef station (station located near an artificial reef that is part of the Cornwall Remedial Action Plan [RAP]).

## 2 Analytical results for PCBs

### Lake St. Lawrence station

Date of sampling	March 1995	June 1995	July 1995	August 1995	Sept. 1995	Oct. 1995	Nov. 1995	March 1996
Total PCBs (µg/g)	0.027	0.017	0.011	0.013	0.008	0.010	0.008	0.031
Polychlorinated biphenyls	Concentrations (pg/g)							
Trichlorobiphenyls								
IUPAC No. 18	260	110	130	140	DNR	280	DNR	600
IUPAC No. 17	210	75	80	DNR	DNQ	130	ND	280
IUPAC No. 31 + 28	2 620	1270	1310	1 570	800	1 200	DNR	3 500
Tetrachlorobiphenyls								
IUPAC No. 52	1 640	1050	680	1 015	830	580	370	1 500
IUPAC No. 74	800	ND	ND	ND	410	520	570	3 700
IUPAC No. 70*	1 980	ND	620	1220	740	1 100	DNR	6 900
Pentachlorobiphenyls								
IUPAC No. 95	2 430	770	460	ND	DNQ	420	450	840
IUPAC No. 101	3 290	2 200	690	780	DNR	240	240	1 300
IUPAC No. 99	1 810	1 300	590	670	DNR	560	660	860
IUPAC No. 87	1 520	770	290	340	DNQ	290	310	500
IUPAC No. 110	3 240	1 750	760	850	640	730	900	1 800
IUPAC No. 118	2 780	2 170	1 190	1590	1 110	670	920	2 000
IUPAC No. 105	790	630	490	570	440	460	650	1 200
Hexachlorobiphenyls								
IUPAC No. 151	340	330	115	150	DNQ	150	120	DNQ
IUPAC No. 149	1 300	1 000	420	520	380	430	420	210
IUPAC No. 138 + 158	2 030	2 150	1 280	1640	1 180	1 400	1100	1 700
Heptachlorobiphenyls								
IUPAC No. 183	ND	ND	ND	ND	ND	280	DNR	230
IUPAC No. 177	DNQ	DNR	160	DNQ	ND	DNR	DNR	240
IUPAC No. 180	DNR	670	610	720	780	DNR	510	1 100
Octachlorobiphenyls								
IUPAC No. 199	DNQ	290	290	320	DNQ	70	60	90
IUPAC No. 195	ND	DNR	DNQ	ND	ND	DNR	DNR	DNR
IUPAC No. 194	DNQ	DNQ	160	DNQ	ND	DNR	DNR	450
Nonachlorobiphenyls								
IUPAC No. 208	ND	DNQ	DNQ	ND	ND	DNR	110	DNR
IUPAC No. 206	ND	DNQ	230	190	ND	DNR	200	490
Decachlorobiphenyl								
IUPAC No. 209	DNQ	240	245	260	250	530	70	1 200

Legend – ND: Not detected. DNQ: Detected, but not quantified. DNR: Detected, but does not meet isotope ratio.

**Lake St. Lawrence (cont'd)**

Date of sampling	July 1996	Sept. 1996	Nov. 1996	Feb. 1997	May 1997	July 1997	Sept. 1997	Nov. 1997
Total PCBs (µg/g)	0.018	0.024	0.021	0.016	0.022	0.020	0.025	0.023
Polychlorinated biphenyls	Concentrations (pg/g)							
Trichlorobiphenyls								
IUPAC No. 18	240	550	350	270	660	320	300	410
IUPAC No. 17	120	200	140	120	220	150	130	180
IUPAC No. 31 + 28	2 100	3 600	3 000	2 900	3 800	3 300	3 400	3 500
Tetrachlorobiphenyls								
IUPAC No. 52	1 100	1 200	1 000	640	1 100	830	960	1 000
IUPAC No. 74	1 400	740	690	590	760	720	970	990
IUPAC No. 70*	2 300	2 600	2 400	1 300	1 700	1 700	2 100	2 000
Pentachlorobiphenyls								
IUPAC No. 95	490	940	670	350	570	630	600	510
IUPAC No. 101	1 300	690	1 100	850	1 000	980	1 300	1 400
IUPAC No. 99	720	880	710	490	620	620	810	900
IUPAC No. 87	320	700	550	430	540	440	640	740
IUPAC No. 110	1 100	1 800	1 500	1 100	1 400	1 100	1 800	1 200
IUPAC No. 118	2 000	1 800	1 900	1 500	1 900	1 700	2 500	1 700
IUPAC No. 105	860	1 000	910	650	770	640	1 100	1 000
Hexachlorobiphenyls								
IUPAC No. 151	130	240	210	140	220	200	260	260
IUPAC No. 149	280	1 100	860	650	1 100	1 200	1 100	930
IUPAC No. 138 + 158	930	2 100	1 800	1 583	2 450	2 360	2 550	2 400
Heptachlorobiphenyls								
IUPAC No. 183	140	230	210	180	310	290	310	270
IUPAC No. 177	140	360	370	210	280	260	340	340
IUPAC No. 180	810	1 200	1 000	720	990	860	1 200	1 300
Octachlorobiphenyls								
IUPAC No. 199	100	450	460	390	530	380	780	580
IUPAC No. 195	130	130	91	92	120	88	150	110
IUPAC No. 194	280	420	330	230	310	250	380	370
Nonachlorobiphenyls								
IUPAC No. 208	180	65	65	89	130	110	160	170
IUPAC No. 206	430	430	360	180	270	250	300	500
Decachlorobiphenyl								
IUPAC No. 209	550	440	320	310	330	330	580	590

*Legend* – ND: Not detected. DNQ: Detected, but not quantified. DNR: Detected, but does not meet isotope ratio.



**Lake St. Lawrence station (cont'd)**

Date of sampling	Feb. 1998	May 1998	July 1998	Nov. 1998	May 1999
Total PCBs (µg/g)	0.020	0.018	0.024	0.017	0.020
Polychlorinated biphenyls	Concentrations (pg/g)				
Trichlorobiphenyls					
IUPAC No. 18	410	490	340	310	330
IUPAC No. 17	190	DNR	DNQ	130	160
IUPAC No. 31 + 28	3 400	3 200	5 700	2 600	2 800
Tetrachlorobiphenyls					
IUPAC No. 52	920	900	840	810	930
IUPAC No. 74	1 100	940	1 100	830	820
IUPAC No. 70*	1 900	1 700	2 000	1 700	1 700
Pentachlorobiphenyls					
IUPAC No. 95	510	440	490	430	650
IUPAC No. 101	1 200	1 100	1 300	1 100	1 500
IUPAC No. 99	830	650	840	690	810
IUPAC No. 87	DNR	550	710	550	740
IUPAC No. 110	1 000	830	1 000	880	1 100
IUPAC No. 118	1 600	1 200	1 500	1 100	1 500
IUPAC No. 105	860	700	870	680	770
Hexachlorobiphenyls					
IUPAC No. 151	220	290	270	190	230
IUPAC No. 149	870	900	990	750	1 000
IUPAC No. 138 + 158	2 110	2 010	2 330	1 668	2 020
Heptachlorobiphenyls					
IUPAC No. 183	170	180	240	140	180
IUPAC No. 177	260	240	300	230	250
IUPAC No. 180	1 100	1 000	1 100	770	920
Octachlorobiphenyls					
IUPAC No. 199	500	330	410	280	320
IUPAC No. 195	170	DNR	110	70	68
IUPAC No. 194	350	270	310	210	230
Nonachlorobiphenyls					
IUPAC No. 208	210	DNR	130	87	110
IUPAC No. 206	470	280	380	230	290
Decachlorobiphenyl					
IUPAC No. 209	DNR	DNR	300	270	320

*Legend* – ND: Not detected. DNQ: Detected, but not quantified. DNR: Detected, but does not meet isotope ratio.

**Pilon station**

Date of sampling	Dec. 1995	March 1996	July 1996	Sept. 1996	Nov. 1996	Feb. 1997	May 1997	Nov. 1997
Total PCBs (µg/g)	0.017	0.027	0.019	0.015	0.025	0.029	0.035	0.014
Polychlorinated biphenyls	Concentrations (pg/g)							
Trichlorobiphenyls								
IUPAC No. 18	DNR	470	310	280	190	440	580	210
IUPAC No. 17	60	170	180	120	80	170	230	85
IUPAC No. 31 + 28	1200	2400	2300	2200	2250	3 000	3 800	2 000
Tetrachlorobiphenyls								
IUPAC No. 52	910	1 800	1 200	740	880	1 400	1 700	670
IUPAC No. 74	900	1 300	840	410	730	840	1 000	550
IUPAC No. 70*	1 400	2 200	1 500	1 100	1 600	1 900	2 100	1 100
Pentachlorobiphenyls								
IUPAC No. 95	940	1 100	750	600	920	1 400	1 300	390
IUPAC No. 101	770	2 500	1 600	750	1 700	2 600	2 400	960
IUPAC No. 99	1 400	1 400	990	550	850	1 300	1 200	560
IUPAC No. 87	610	810	440	460	690	1 100	1 200	500
IUPAC No. 110	1 600	2 200	1 200	1 300	1 700	2 900	2 900	830
IUPAC No. 118	1 800	2 800	1 900	1 400	1 800	3 000	3 200	1 000
IUPAC No. 105	960	1 200	700	640	770	1 100	1 500	550
Hexachlorobiphenyls								
IUPAC No. 151	210	270	230	280	270	330	420	200
IUPAC No. 149	790	610	680	1 000	630	1 500	1 700	760
IUPAC No. 138 + 158	2 100	2 100	1 800	1 600	2 340	3 250	3 570	1 584
Heptachlorobiphenyls								
IUPAC No. 183	230	310	240	DNR	550	270	520	160
IUPAC No. 177	270	DNR	DNR	DNR	600	310	490	210
IUPAC No. 180	DNR	1 200	890	940	2 900	1 300	2 200	680
Octachlorobiphenyls								
IUPAC No. 199	80	75	62	280	1 200	350	810	250
IUPAC No. 195	DNR	270	110	57	450	100	240	63
IUPAC No. 194	250	290	230	290	890	290	650	190
Nonachlorobiphenyls								
IUPAC No. 208	70	310	150	50	100	70	130	76
IUPAC No. 206	330	420	320	200	300	200	480	210
Decachlorobiphenyl								
IUPAC No. 209	260	320	310	120	290	200	180	250

*Legend* – ND: Not detected. DNQ: Detected, but not quantified. DNR: Detected, but does not meet isotope ratio.

**Pilon station (cont'd)**

<b>Date of sampling</b>	<b>May 1998</b>	<b>July 1998</b>	<b>Nov. 1998</b>	<b>May 1999</b>
<b>Total PCBs (µg/g)</b>	0.018	0.018	0.015	0.012
<b>Polychlorinated biphenyls</b>	<b>Concentrations (pg/g)</b>			
Trichlorobiphenyls				
IUPAC No. 18	370	320	300	220
IUPAC No. 17	120	120	130	90
IUPAC No. 31 + 28	2 400	2 110	2 230	1 490
Tetrachlorobiphenyls				
IUPAC No. 52	910	870	720	680
IUPAC No. 74	790	590	660	490
IUPAC No. 70*	1 400	1 100	1 300	870
Pentachlorobiphenyls				
IUPAC No. 95	620	730	490	440
IUPAC No. 101	1 400	1 400	1 000	960
IUPAC No. 99	820	680	680	570
IUPAC No. 87	700	690	550	490
IUPAC No. 110	1 100	1 100	880	760
IUPAC No. 118	1 200	1 100	1 000	830
IUPAC No. 105	660	640	610	480
Hexachlorobiphenyls				
IUPAC No. 151	300	320	210	170
IUPAC No. 149	1 000	1 200	820	700
IUPAC No. 138 + 158	1 800	2 020	1 565	1 259
Heptachlorobiphenyls				
IUPAC No. 183	150	160	150	130
IUPAC No. 177	290	490	230	170
IUPAC No. 180	770	770	720	600
Octachlorobiphenyls				
IUPAC No. 199	210	370	250	180
IUPAC No. 195	71	84	66	49
IUPAC No. 194	160	250	160	150
Nonachlorobiphenyls				
IUPAC No. 208	60	69	65	39
IUPAC No. 206	130	190	150	130
Decachlorobiphenyl				
IUPAC No. 209	120	130	210	110

*Legend* – ND: Not detected. DNQ: Detected, but not quantified. DNR: Detected, but does not meet isotope ratio.

**Saint-François centre station**

Date of sampling	Nov. 1994	Dec. 1994	March 1995	June 1995	July 1995	August 1995	Sept. 1995	Oct. 1995
Total PCBs (µg/g)	0.037	0.011	0.024	0.039	0.052	0.032	0.027	0.023
Polychlorinated biphenyls	Concentrations (pg/g)							
Trichlorobiphenyls								
IUPAC No. 18	1 175	200	ND	740	630	450	DNR	860
IUPAC No. 17	1 610	190	ND	710	640	410	580	790
IUPAC No. 31 + 28	5 710	1 360	1 190	4 990	5 690	3 900	2 990	3 800
Tetrachlorobiphenyls								
IUPAC No. 52	4 300	1 290	2 410	3 580	3 970	3 010	2 550	1 500
IUPAC No. 74	1 720	610	720	2 200	2 870	1 430	1 270	1 300
IUPAC No. 70*	3 260	1 000	1 880	3 670	4 600	3 250	2 200	2 200
Pentachlorobiphenyls								
IUPAC No. 95	1 560	500	1 250	1 500	2 430	1 500	1 500	1 100
IUPAC No. 101	2 110	625	1 870	2 220	3 450	1 740	1 640	DNQ
IUPAC No. 99	1 650	560	1 370	1 875	2 690	1 610	1 330	1 300
IUPAC No. 87	870	280	880	890	1 500	DNQ	DNQ	600
IUPAC No. 110	2 210	760	2 120	2 710	4 130	2 370	2 060	1 700
IUPAC No. 118	2 170	800	2 720	3 380	5 580	3 040	2 600	1 200
IUPAC No. 105	1 200	410	860	1 500	2 250	1 330	1 270	1 000
Hexachlorobiphenyls								
IUPAC No. 151	470	140	380	475	540	420	ND	370
IUPAC No. 149	1 290	440	1 170	1 245	1 690	1 210	1 280	1 000
IUPAC No. 138 + 158	2 530	840	2 580	2 910	4 240	2 920	3 100	2 700
Heptachlorobiphenyls								
IUPAC No. 183	ND	DNR	DNQ	DNQ	ND	ND	ND	700
IUPAC No. 177	DR	DNQ	380	530	670	620	ND	DNR
IUPAC No. 180	1 110	370	1 190	1 650	2 150	1 590	1 480	DNR
Octachlorobiphenyls								
IUPAC No. 199	710	220	480	780	910	700	760	150
IUPAC No. 195	165	ND	ND	200	DNQ	ND	ND	DNR
IUPAC No. 194	420	DNQ	350	480	560	ND	ND	DNR
Nonachlorobiphenyls								
IUPAC No. 208	DNQ	ND	ND	ND	ND	ND	ND	DNR
IUPAC No. 206	430	120	300	490	610	DNQ	ND	370
Decachlorobiphenyl								
IUPAC No. 209	270	90	250	365	DNR	380	DNR	850

*Legend* – ND: Not detected. DNQ: Detected, but not quantified. DNR: Detected, but does not meet isotope ratio.

**Saint-François centre station (cont'd)**

<b>Date of sampling</b>	Nov. 1995	Dec. 1995	March 1996	July 1996	Sept. 1996	Nov. 1996	Feb. 1997	May 1997
<b>Total PCBs (µg/g)</b>	0.030	0.028	0.032	0.053	0.036	0.030	0.034	0.041
<b>Polychlorinated biphenyls</b>	<b>Concentrations (pg/g)</b>							
Trichlorobiphenyls								
IUPAC No. 18	680	840	850	1 000	750	380	1 000	920
IUPAC No. 17	910	1 200	830	1 200	880	520	1 100	920
IUPAC No. 31 + 28	4 800	4 600	6 300	6 700	6 000	4 200	5 900	7 000
Tetrachlorobiphenyls								
IUPAC No. 52	2 600	2 400	2 200	3 800	2 200	1 700	1 600	2 200
IUPAC No. 74	1 800	1 600	2 900	2 600	1 500	1 300	1 300	1 700
IUPAC No. 70*	DNR	2 400	4 600	4 100	3 100	2 700	2 700	3 400
Pentachlorobiphenyls								
IUPAC No. 95	1 300	1 100	1 200	2 000	1 300	1 200	1 200	1 400
IUPAC No. 101	1 100	920	1 500	3 800	1 500	2 000	2 000	2 300
IUPAC No. 99	1 600	1 400	1 100	2 200	1 100	1 000	1 000	1 200
IUPAC No. 87	810	670	600	890	850	880	970	1 100
IUPAC No. 110	2 200	1 800	2 300	3 000	2 700	2 400	2 600	3 100
IUPAC No. 118	2 700	2 400	1 700	4 400	2 500	2 400	2 400	3 000
IUPAC No. 105	1 200	1 000	1 300	1 600	1 200	1 100	1 200	1 400
Hexachlorobiphenyls								
IUPAC No. 151	500	310	250	1 200	520	410	510	560
IUPAC No. 149	1 200	800	360	2 400	1 900	1 000	1 300	1 700
IUPAC No. 138 + 158	3 000	2 200	1 500	3 400	3 000	2 750	2 660	3 520
Heptachlorobiphenyls								
IUPAC No. 183	620	340	DNQ	790	380	260	370	430
IUPAC No. 177	DNR	DNR	260	1 100	DNR	430	520	510
IUPAC No. 180	1 600	1 100	910	3 500	2 100	1 400	1 600	1 900
Octachlorobiphenyls								
IUPAC No. 199	130	70	94	250	950	510	710	1 000
IUPAC No. 195	130	200	DNR	530	250	190	240	270
IUPAC No. 194	DNR	430	430	1 100	640	480	590	530
Nonachlorobiphenyls								
IUPAC No. 208	220	150	200	280	81	100	120	120
IUPAC No. 206	350	DNR	260	790	470	260	270	220
Decachlorobiphenyl								
IUPAC No. 209	830	520	310	500	360	300	290	320

Legend – ND: Not detected. DNQ: Detected, but not quantified. DNR: Detected, but does not meet isotope ratio.

**Saint-François centre station (cont'd)**

Date of sampling	July 1997	Sept. 1997	Nov. 1997	Feb. 1998	May 1998	July 1998	Nov. 1998	May 1999
Total PCBs (µg/g)	0.043	0.029	0.024	0.039	0.049	0.042	0.025	0.030
Polychlorinated biphenyls	Concentrations (pg/g)							
Trichlorobiphenyls								
IUPAC No. 18	790	550	560	1 200	1 300	780	600	870
IUPAC No. 17	740	510	510	1 500	1 200	660	560	770
IUPAC No. 31 + 28	7 100	4 800	4 500	6 600	8 400	6 300	4 300	5 700
Tetrachlorobiphenyls								
IUPAC No. 52	2 200	1 500	1 400	3 200	3 600	2 300	1 400	2 000
IUPAC No. 74	2 300	1 400	1 000	1 600	2 400	1 900	1 100	1 400
IUPAC No. 70*	4 600	2 900	1 900	2 700	4 200	3 200	1 900	2 700
Pentachlorobiphenyls								
IUPAC No. 95	1 500	930	580	1 600	1 900	1 200	750	1 000
IUPAC No. 101	2 800	1 800	1 400	2 500	3 400	2 600	1 500	2 000
IUPAC No. 99	1 500	980	820	1 200	1 800	1 600	850	1 100
IUPAC No. 87	1 300	850	790	1 200	1 800	1 400	780	980
IUPAC No. 110	3 500	2 200	1 300	2 000	2 800	2 400	1 200	1 700
IUPAC No. 118	3 400	2 200	1 500	1 800	2 600	2 400	1 400	1 600
IUPAC No. 105	1 500	1 100	920	1 000	1 500	1 400	830	1 000
Hexachlorobiphenyls								
IUPAC No. 151	500	340	300	750	690	730	410	440
IUPAC No. 149	1 600	990	1 100	2 200	2 400	2 400	1 400	1 500
IUPAC No. 138 + 158	2 880	2 220	2 100	2 620	3 860	3 730	2 200	2 110
Heptachlorobiphenyls								
IUPAC No. 183	370	260	250	430	400	600	310	230
IUPAC No. 177	510	380	370	700	620	850	510	390
IUPAC No. 180	1 700	1 200	1 000	1 600	1 900	2 600	1 500	1 000
Octachlorobiphenyls								
IUPAC No. 199	690	640	480	700	780	1 000	530	380
IUPAC No. 195	210	160	110	180	200	320	150	110
IUPAC No. 194	540	380	300	540	600	880	390	300
Nonachlorobiphenyls								
IUPAC No. 208	130	110	82	110	110	130	86	83
IUPAC No. 206	360	190	220	390	370	410	240	250
Decachlorobiphenyl								
IUPAC No. 209	380	240	270	240	250	240	210	210

Legend – ND: Not detected. DNQ: Detected, but not quantified. DNR: Detected, but does not meet isotope ratio.

**Saint-François north station**

<b>Date of sampling</b>	Nov. 1994	Dec. 1994	March 1995	June 1995	July 1995	August 1995	Sept. 1995	Oct. 1995
<b>Total PCBs (µg/g)</b>	0.038	0.026	0.028	0.027	0.033	0.028	0.045	0.017
<b>Polychlorinated biphenyls</b>	<b>Concentrations (pg/g)</b>							
Trichlorobiphenyls								
IUPAC No. 18	800	530	460	530	540	DNR	605	DNR
IUPAC No. 17	550	DNR	430	480	440	DNQ	620	DNR
IUPAC No. 31 + 28	3 700	3 800	3 260	4 210	4 520	3 840	4 620	DNR
Tetrachlorobiphenyls								
IUPAC No. 52	3 900	2 630	2 350	2 540	2 780	3 190	5 280	670
IUPAC No. 74	1 940	1 270	1 370	DNQ	1 210	1 550	ND	1 200
IUPAC No. 70*	3 220	2 200	2 060	750	2 970	2 630	3 810	2 100
Pentachlorobiphenyls								
IUPAC No. 95	3 250	1 070	1 230	DNR	1 600	ND	2 490	1 300
IUPAC No. 101	3 910	1 730	1 950	1 790	1 780	1 390	3 290	360
IUPAC No. 99	2 690	1 320	1 310	1 590	1 860	1 650	2 700	1 600
IUPAC No. 87	DNQ	730	710	860	DNQ	DNQ	1 220	840
IUPAC No. 110	3 780	1 760	2 150	2 670	2 290	2 260	3 390	2 400
IUPAC No. 118	2 670	1 640	2 470	3 270	3 450	3 060	4 430	620
IUPAC No. 105	1 450	980	910	1 340	1 280	1 390	1 830	1 500
Hexachlorobiphenyls								
IUPAC No. 151	DNQ	420	470	435	560	DNQ	ND	DNQ
IUPAC No. 149	2 330	1 140	1 070	1 160	1 240	1 210	1 830	1 100
IUPAC No. 138 + 158	4 200	2 410	2 340	2 770	3 230	2 940	4 290	2 700
Heptachlorobiphenyls								
IUPAC No. 183	ND	DNR	330	DNR	ND	ND	DNR	340
IUPAC No. 177	DNQ	470	450	DNQ	DNQ	DNQ	DNQ	DNR
IUPAC No. 180	DNR	960	1370	1580	1700	2130	2230	DNR
Octachlorobiphenyls								
IUPAC No. 199	DNQ	520	560	590	830	DNQ	960	110
IUPAC No. 195	ND	ND	120	DNQ	ND	ND	ND	230
IUPAC No. 194	DNQ	280	380	DNQ	DNR	ND	DNQ	DNR
Nonachlorobiphenyls								
IUPAC No. 208	ND	ND	DNQ	DNR	ND	ND	ND	DNR
IUPAC No. 206	ND	DNR	330	340	DNR	570	550	420
Decachlorobiphenyl								
IUPAC No. 209	DNQ	DNR	DNR	330	500	510	560	DNR

Legend – ND: Not detected. DNQ: Detected, but not quantified. DNR: Detected, but does not meet isotope ratio.

**Saint-François north station (cont'd)**

Date of sampling	Dec. 1995	July 1996	Sept. 1996	Nov. 1996	Feb. 1997	May 1997	July 1997	Sept. 1997
Total PCBs (µg/g)	0.021	0.035	0.032	0.031	0.026	0.026	0.037	0.032
Polychlorinated biphenyls	Concentrations (pg/g)							
Trichlorobiphenyls								
IUPAC No. 18	270	660	720	310	370	510	930	330
IUPAC No. 17	DNR	630	460	280	340	520	810	290
IUPAC No. 31 + 28	2 300	4 800	4 600	3 500	4 100	5 800	9 900	4 400
Tetrachlorobiphenyls								
IUPAC No. 52	1 400	3 300	1 900	1 400	1 200	1 500	2 500	1 300
IUPAC No. 74	1 400	1 900	1 300	1 200	1 200	960	1 500	1 100
IUPAC No. 70*	DNR	3 300	2 900	2 500	2 400	2 100	2 900	2 500
Pentachlorobiphenyls								
IUPAC No. 95	1 100	1 300	1 300	1 300	1 000	870	1 200	1 000
IUPAC No. 101	930	2 800	1 500	2 300	1 700	1 500	2 000	2 000
IUPAC No. 99	1 500	1 600	1 100	1 100	900	980	1 100	1 100
IUPAC No. 87	710	650	870	1 000	820	680	960	910
IUPAC No. 110	2 100	2 100	2 700	2 500	2 100	1 900	2 500	2 300
IUPAC No. 118	2 700	3 300	2 400	2 500	2 100	1 900	2 200	2 600
IUPAC No. 105	1 200	1 200	1 200	1 100	960	990	1 100	1 000
Hexachlorobiphenyls								
IUPAC No. 151	280	420	520	470	370	300	470	510
IUPAC No. 149	950	930	2 000	1 100	880	930	1 500	1 900
IUPAC No. 138 + 158	2 200	1 700	3 000	3 490	2 430	2 260	2 250	3 100
Heptachlorobiphenyls								
IUPAC No. 183	330	230	380	300	240	480	340	400
IUPAC No. 177	DNR	250	DNR	490	350	300	330	610
IUPAC No. 180	DNR	1 700	1 700	1 800	1 100	DNR	1 200	1 700
Octachlorobiphenyls								
IUPAC No. 199	140	120	810	790	560	480	630	900
IUPAC No. 195	230	230	ND	220	140	160	160	210
IUPAC No. 194	510	650	610	530	230	320	370	510
Nonachlorobiphenyls								
IUPAC No. 208	120	240	160	170	96	100	100	170
IUPAC No. 206	410	540	DNQ	340	150	170	230	380
Decachlorobiphenyl								
IUPAC No. 209	DNR	560	DNQ	440	290	290	310	490

*Legend* – ND: Not detected. DNQ: Detected, but not quantified. DNR: Detected, but does not meet isotope ratio.



**Saint-François north station (cont'd)**

<b>Date of sampling</b>	<b>Nov. 1997</b>	<b>Feb. 1998</b>	<b>May 1998</b>	<b>July 1998</b>	<b>Nov. 1998</b>	<b>May 1999</b>
<b>Total PCBs (µg/g)</b>	0.027	0.024	0.032	0.024	0.026	0.022
<b>Polychlorinated biphenyls</b>	<b>Concentrations (pg/g)</b>					
Trichlorobiphenyls						
IUPAC No. 18	580	600	900	550	540	520
IUPAC No. 17	380	540	840	460	380	390
IUPAC No. 31 + 28	4 100	4 200	5 400	3 000	4 400	3 900
Tetrachlorobiphenyls						
IUPAC No. 52	1 500	1 500	2 200	1 300	1 400	1 300
IUPAC No. 74	960	950	1 400	1 100	1 200	970
IUPAC No. 70*	2 000	1 700	2 300	2 000	2 200	2 000
Pentachlorobiphenyls						
IUPAC No. 95	700	690	1 200	810	830	680
IUPAC No. 101	1 700	1 500	2 000	1 500	1 600	1 400
IUPAC No. 99	1 000	890	1 100	950	980	790
IUPAC No. 87	920	750	1 000	830	840	720
IUPAC No. 110	1 500	1 300	1 600	1 300	1 400	1 200
IUPAC No. 118	1 800	1 400	1 600	1 400	1 500	1 200
IUPAC No. 105	1 000	850	920	850	930	730
Hexachlorobiphenyls						
IUPAC No. 151	330	350	560	400	390	290
IUPAC No. 149	1 300	1 200	1 800	1 400	1 300	1 100
IUPAC No. 138 + 158	2 640	2 200	2 650	2 520	2 410	2 800
Heptachlorobiphenyls						
IUPAC No. 183	310	260	360	200	260	160
IUPAC No. 177	450	390	550	400	440	280
IUPAC No. 180	1 400	1 100	1 600	1 200	1 200	820
Octachlorobiphenyls						
IUPAC No. 199	580	480	690	700	530	290
IUPAC No. 195	140	120	190	190	140	79
IUPAC No. 194	380	360	560	360	360	220
Nonachlorobiphenyls						
IUPAC No. 208	130	92	110	110	110	64
IUPAC No. 206	430	290	330	330	320	170
Decachlorobiphenyl						
IUPAC No. 209	490	310	270	310	360	170

*Legend* – ND: Not detected. DNQ: Detected, but not quantified. DNR: Detected, but does not meet isotope ratio.

**Saint-François south station**

Date of sampling	Dec. 1994	March 1995	June 1995	July 1995	August 1995	Sept. 1995	Oct. 1995	Nov. 1995
Total PCBs (µg/g)	0.228	0.109	0.144	0.104	0.098	0.065	0.051	0.128
Polychlorinated biphenyls	Concentrations (pg/g)							
Trichlorobiphenyls								
IUPAC No. 18	3 190	DNR	3 000	1 920	1 660	850	1 500	6 100
IUPAC No. 17	4 730	3 640	5 210	1 840	2 330	1 490	1 800	DNR
IUPAC No. 31 + 28	18 800	13 360	21790	12 160	14 020	9 750	8 800	27 000
Tetrachlorobiphenyls								
IUPAC No. 52	16 840	9 990	12 700	6 700	9 850	6 860	4 300	13 000
IUPAC No. 74	9 350	5 190	5 885	7 300	6 385	4 250	3 100	9 400
IUPAC No. 70*	16 400	9 990	12 090	10 100	10 070	5 870	4 800	13 000
Pentachlorobiphenyls								
IUPAC No. 95	14 270	5 420	6 650	3 720	4 260	2 750	2 100	6 100
IUPAC No. 101	27 130	7 770	9 320	7 200	4 830	3 020	1 900	5 900
IUPAC No. 99	14 720	5 830	6 760	6 000	4 930	3 110	2 400	5 800
IUPAC No. 87	9 900	3 070	3 760	3 400	2 360	1 590	1 100	3 200
IUPAC No. 110	21 660	9 130	11 290	9 700	6 310	4 590	3 200	7 800
IUPAC No. 118	21 920	10 800	13 490	12 700	9 390	6 210	3 900	9 300
IUPAC No. 105	7 960	4 660	5 480	7 000	3 850	2 690	1 800	4 300
Hexachlorobiphenyls								
IUPAC No. 151	3 360	1 250	1 510	1 900	860	760	530	930
IUPAC No. 149	10 840	3 310	3 780	3 900	2 430	1 910	1 300	2 400
IUPAC No. 138 + 158	16 740	5 650	8 010	8 700	5 200	3 710	3 100	5 700
Heptachlorobiphenyls								
IUPAC No. 183	1 330	910	1 230	ND	810	DNQ	800	1 200
IUPAC No. 177	1 930	1 210	1 550	ND	1 060	DNR	DNR	1 700
IUPAC No. 180	3 730	3 870	4 890	DNR	3 110	2 560	2000	3 300
Octachlorobiphenyls								
IUPAC No. 199	1 480	1 420	1 990	ND	1 490	1 300	180	230
IUPAC No. 195	DNR	400	510	ND	DNQ	DNQ	510	ND
IUPAC No. 194	1 025	1 170	1 340	ND	1 210	910	660	1 100
Nonachlorobiphenyls								
IUPAC No. 208	ND	ND	120	ND	ND	DNQ	140	220
IUPAC No. 206	DNQ	620	870	ND	760	690	340	ND
Decachlorobiphenyl								
IUPAC No. 209	200	320	340	ND	350	290	520	550

*Legend* – ND: Not detected. DNQ: Detected, but not quantified. DNR: Detected, but does not meet isotope ratio.

**Saint-François south (cont'd)**

<b>Date of sampling</b>	<b>Dec. 1995</b>	<b>Mars 1996</b>	<b>July 1996</b>	<b>Sept. 1996</b>	<b>Nov. 1996</b>	<b>Feb. 1997</b>	<b>May 1997</b>	<b>July 1997</b>
<b>Total PCBs (µg/g)</b>	0.257	0.367	0.164	0.091	0.105	0.101	0.110	0.148
<b>Polychlorinated biphenyls</b>	<b>Concentrations (pg/g)</b>							
Trichlorobiphenyls								
IUPAC No. 18	9 400	7 500	3 700	2 400	2 400	2 100	3 000	4 900
IUPAC No. 17	16 000	19 000	6 300	3 800	4 400	3 300	4 100	5 000
IUPAC No. 31 + 28	55 000	56 000	29 000	18 000	18 400	17 000	22 300	29 000
Tetrachlorobiphenyls								
IUPAC No. 52	24 000	30 000	14 000	6 800	7 600	6 800	8 200	11 000
IUPAC No. 74	17 000	23 000	9 900	5 300	5 800	4 600	5 200	7 800
IUPAC No. 70*	23 000	24 000	14 000	8 300	9 300	8 100	9 100	14 000
Pentachlorobiphenyls								
IUPAC No. 95	11 000	15 000	6 800	3 600	4 900	5 100	4 300	6 000
IUPAC No. 101	14 000	14 000	9 800	4 500	6 400	6 500	6 300	8 800
IUPAC No. 99	11 000	11 000	7 800	2 700	3 700	3 700	3 300	4 900
IUPAC No. 87	5 600	6 100	3 400	2 000	3 100	3 600	3 300	4 200
IUPAC No. 110	15 000	28 000	11 000	7 100	8 700	9 200	8 600	12 000
IUPAC No. 118	18 000	22 000	14 000	5 800	7 000	6 400	7 700	10 000
IUPAC No. 105	7 700	8 100	5 600	2 800	3 300	3 600	3 900	4 400
Hexachlorobiphenyls								
IUPAC No. 151	1 700	7 000	2 300	1 200	1 200	1 600	1 200	1 600
IUPAC No. 149	4 200	13 000	4 800	3 500	2 700	3 400	4 000	4 800
IUPAC No. 138 + 158	9 700	18 000	6 900	4 200	6 020	6 830	7 090	7 400
Heptachlorobiphenyls								
IUPAC No. 183	2 000	7 000	1 500	790	740	770	880	1 000
IUPAC No. 177	2 700	6 900	1 700	NDR	1 300	1 000	1 100	1 400
IUPAC No. 180	5 200	20 000	5 300	3 400	3 800	3 400	3 400	4 400
Octachlorobiphenyls								
IUPAC No. 199	370	2 900	460	1 600	1 500	1 800	1 300	1 600
IUPAC No. 195	630	7 200	1 000	450	570	600	390	580
IUPAC No. 194	1 600	1 3000	2 400	1 200	1 300	970	710	1 600
Nonachlorobiphenyls								
IUPAC No. 208	340	1 500	410	87	180	160	160	210
IUPAC No. 206	710	5 900	1 500	750	550	280	300	720
Decachlorobiphenyl								
IUPAC No. 209	690	930	430	250	280	250	320	440

Legend – ND: Not detected. DNQ: Detected, but not quantified. DNR: Detected, but does not meet isotope ratio.

**Saint-François south station (cont'd)**

Date of sampling	Sept. 1997	Nov. 1997	Feb. 1998	May 1998	July. 1998	Nov. 1998	May 1999
Total PCBs (µg/g)	0.084	0.073	0.146	0.077	0.082	0.085	0.096
Polychlorinated biphenyls	Concentrations (pg/g)						
Trichlorobiphenyls							
IUPAC No. 18	1 900	2 100	8 600	2 600	2 400	2 800	3 200
IUPAC No. 17	3 000	3 300	7 100	3 100	2 400	3 000	3 200
IUPAC No. 31 + 28	14 200	15 200	29 000	14 100	14 400	17 000	19 500
Tetrachlorobiphenyls							
IUPAC No. 52	5 200	5 700	17 000	6 700	6 600	6 800	8 300
IUPAC No. 74	4 900	3 500	5 400	4 200	4 700	4 900	5 900
IUPAC No. 70*	8 600	5 800	7 400	6 000	7 600	7 800	9 900
Pentachlorobiphenyls							
IUPAC No. 95	3 700	2 300	6 200	3 000	3 100	3 000	3 800
IUPAC No. 101	5 200	4 200	8 400	5 100	5 400	5 200	6 300
IUPAC No. 99	2 800	2 600	3 900	2 700	3 200	3 200	3 700
IUPAC No. 87	2 400	2 400	4 000	2 600	3 000	2 800	3 400
IUPAC No. 110	6 600	3 900	7 100	4 100	4 700	4 700	5 500
IUPAC No. 118	6 000	3 900	5 400	3 800	4 400	4 500	5 000
IUPAC No. 105	2 900	2 500	3 200	2 400	2 800	2 900	3 200
Hexachlorobiphenyls							
IUPAC No. 151	870	800	2 400	1 100	1 100	1 000	980
IUPAC No. 149	2 600	2 600	7 600	3 800	3 600	3 400	3 600
IUPAC No. 138 + 158	4 830	4 420	7 900	4 780	5 110	4 960	4 770
Heptachlorobiphenyls							
IUPAC No. 183	590	600	1 400	540	670	600	480
IUPAC No. 177	980	950	2 100	860	960	1 000	820
IUPAC No. 180	2 900	2 500	5 400	2 500	2 600	2 600	2 200
Octachlorobiphenyls							
IUPAC No. 199	1 300	1 100	2 100	1 100	990	980	740
IUPAC No. 195	400	310	670	310	320	320	260
IUPAC No. 194	1 100	940	1 900	870	860	820	660
Nonachlorobiphenyls							
IUPAC No. 208	150	130	240	120	120	130	96
IUPAC No. 206	390	460	830	470	410	470	380
Decachlorobiphenyl							
IUPAC No. 209	230	310	270	180	220	290	190

*Legend* – ND: Not detected. DNQ: Detected, but not quantified. DNR: Detected, but does not meet isotope ratio.

**TCTI station**

Date of sampling	Dec. 1995	March 1996	July 1996	Sept. 1996	Nov. 1996	March 1997	May 1997	Nov. 1997
Total PCBs (µg/g)	0.026	0.050	0.028	0.025	0.027	0.045	0.050	0.018
Polychlorinated biphenyls	Concentrations (pg/g)							
Trichlorobiphenyls								
IUPAC No. 18	260	680	470	420	240	510	630	290
IUPAC No. 17	DNR	260	240	150	93	190	230	110
IUPAC No. 31 + 28	2 000	3 300	2 900	3 000	2 400	3 600	4 000	2 390
Tetrachlorobiphenyls								
IUPAC No. 52	1 700	3 700	1 700	1 200	1 100	2 100	1 900	810
IUPAC No. 74	1 100	2 400	1 200	730	760	1 400	1 200	580
IUPAC No. 70*	1 900	4 600	2 300	2 300	2 000	3 200	2 700	1 200
Pentachlorobiphenyls								
IUPAC No. 95	1 700	2 800	1 300	970	1 700	2 500	2 100	510
IUPAC No. 101	2 300	4 700	2 700	1 400	2 800	4 100	3 700	1 300
IUPAC No. 99	1 600	2 100	1 600	850	1 300	1 700	1 500	710
IUPAC No. 87	790	1 600	730	730	1 000	1 700	1 300	640
IUPAC No. 110	2 300	4 700	2 200	2 200	2 900	4 600	3 800	1 100
IUPAC No. 118	2 800	5 600	3 000	2 200	2 300	4 300	3 400	1 300
IUPAC No. 105	930	2 100	1 100	950	1 000	1 700	1 300	750
Hexachlorobiphenyls								
IUPAC No. 151	390	530	370	390	360	650	1 300	260
IUPAC No. 149	1 000	1 300	980	1 500	860	2 600	3 800	1 100
IUPAC No. 138 + 158	3 100	4 700	2 500	2 600	2 530	5 640	6 590	2 220
Heptachlorobiphenyls								
IUPAC No. 183	390	650	420	260	260	390	1 100	230
IUPAC No. 177	DNR	DNR	DNR	DNR	370	470	1 200	300
IUPAC No. 180	DNR	2 200	1 200	1 300	1 300	1 800	4 700	970
Octachlorobiphenyls								
IUPAC No. 199	90	170	95	380	600	490	1 100	390
IUPAC No. 195	170	340	130	77	200	150	430	97
IUPAC No. 194	370	510	290	450	300	400	1 100	250
Nonachlorobiphenyls								
IUPAC No. 208	140	260	190	DNR	DNR	100	190	91
IUPAC No. 206	340	580	430	290	230	300	670	280
Decachlorobiphenyl								
IUPAC No. 209	300	640	270	200	300	230	360	340

Legend – ND: Not detected. DNQ: Detected, but not quantified. DNR: Detected, but does not meet isotope ratio.

TCTI station (located near the Transport Canada Training Institute).

**TCTI station (cont'd)**

Date of sampling	May 1998	July 1998	Nov. 1998	May 1999
Total PCBs (µg/g)	0.032	0.017	0.018	0.021
Polychlorinated biphenyls	Concentrations (pg/g)			
Trichlorobiphenyls				
IUPAC No. 18	870	340	310	380
IUPAC No. 17	250	140	140	150
IUPAC No. 31 + 28	3 400	2 300	2 600	2 500
Tetrachlorobiphenyls				
IUPAC No. 52	2 400	820	800	1 100
IUPAC No. 74	1 400	760	780	770
IUPAC No. 70*	2 900	1 500	1 600	1 500
Pentachlorobiphenyls				
IUPAC No. 95	1 600	610	600	850
IUPAC No. 101	2 800	1 200	1 300	1 700
IUPAC No. 99	1 400	710	720	890
IUPAC No. 87	1 400	630	610	810
IUPAC No. 110	2 300	990	1 000	1 400
IUPAC No. 118	2 000	1 100	1 100	1 400
IUPAC No. 105	1 200	650	640	720
Hexachlorobiphenyls				
IUPAC No. 151	450	270	260	350
IUPAC No. 149	1 700	890	1 000	1 400
IUPAC No. 138 + 158	3 010	1 800	1 787	2 320
Heptachlorobiphenyls				
IUPAC No. 183	250	200	180	230
IUPAC No. 177	330	240	260	290
IUPAC No. 180	1 100	720	880	1 000
Octachlorobiphenyls				
IUPAC No. 199	300	290	310	320
IUPAC No. 195	99	71	86	86
IUPAC No. 194	240	150	230	200
Nonachlorobiphenyls				
IUPAC No. 208	72	67	85	70
IUPAC No. 206	200	190	230	180
Decachlorobiphenyl				
IUPAC No. 209	160	180	280	210

*Legend* – ND: Not detected. DNQ: Detected, but not quantified. DNR: Detected, but does not meet isotope ratio.