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Albany, New York

ANOMALOUS PCB LOAD ASSOCIATED WITH THE THOMPSON ISLAND POOL: POSSIBLE EXPLANATIONS AND SUGGESTED RESEARCH

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SECTION 1

INTRODUCTION

In 1991, the General Electric Company (GE) initiated an extensive investigation of the PCB's in the Upper Hudson River. As part of this program, samples of water were collected from various locations in the river and analyzed for PCB composition and level. The program continues today with samples having since been collected at a number of locations, on approximately a weekly basis, since March 1991 (General Electric, Co., 1993; 1994; 1995).

An analysis of these data indicates that an anomalous load of PCBs has been entering the river since September 1991 and that this load has persisted through the most recent measurements in August, 1995. The load is indicated by a PCB mass flux measured at the Thompson Island Dam that is greater than the flux at Ft. Edward. It is anomalous for the following reasons:

- Its magnitude varies seasonally
- It increased in late 1991 following a large influx of PCBs to the river from upstream of Ft. Edward
- It has decreased since the large infuxes of PCBs to the river from upstream of Ft. Edward ended
- It is greater than can be accounted for by known mechanisms of PCB flux from sediments contaminated at levels observed in 1991
- Data from the inception of sampling in 1977 to 1982 indicate the presence of an anomalous PCB load between Ft. Edward and Schuylerville; 1982 to 1989 USGS data at Ft. Edward and Schuylerville do not exhibit evidence of this load.

To adequately predict the future course of natural recovery in the Hudson River and to understand the potential impacts of any proposed remedial actions (e.g., sediment removal, upstream source control, etc.) a proper understanding of the location and behavior of the anomalous PCB source in the Thompson Island Pool is necessary. For example, if the anomalous PCB load is attributed to PCB release from the "old", buried sediments and this is not the case, than any remedial program involving dredging of sediments will show potential benefits that will ultimately not be realized.

This paper has three purposes:

1. Demonstrate the existence of a PCB load of unknown origin.
2. Present hypotheses regarding sources of the unknown load.
3. Propose research and data collection efforts to evaluate the hypotheses presented.

As explained herein, the most logical hypothesis is that the anomalous load is derived from PCBs recently deposited at the sediment surface in Thompson Island Pool (TIP) from upstream of Ft. Edward. The PCBs reached Thompson Island Pool either in a single event associated with the failure of a wooden gate structure within the Allen Mill or over time in the form of a Dense Non-Aqueous Phase Liquid (DNAPL) that enters the river near Bakers Falls and escapes detection at the Ft. Edward sampling station. We believe that failure of the Allen Mill gate structure is the most likely cause for the anomalous PCB load. This conclusion is supported by the following observations:

- The increased load from the TIP began immediately after the failure of the Allen Mill gate structure.

- The PCB load at Ft. Edward decreased in early 1993, when the raceway and tunnel in Allen Mill were dewatered, and has remained at low levels.

However, there may also be a smaller component of this anomalous PCB load which arises from ongoing seepage of DNAPL into the river.

The data available for studying the anomalous PCB load to TIP will be discussed in detail in Section 3. These data answer some questions and raise other questions. Recommendations for additional field and laboratory investigations are therefore included in Section 4.

SECTION 2

CHARACTERIZATION OF THE ANOMALY

2.1 EVIDENCE OF ITS EXISTENCE

The existence of a PCB loading from an unknown source is indicated by a simple mass balance analysis of the TIP. The mass balance involves comparison of the difference in the mass fluxes of PCBs into and out of the pool with estimates of known internal sources and sinks of PCBs. Generally, the mass flux out of the pool at Thompson Island Dam is greater than the mass flux into the pool at Ft. Edward (Figure 1, middle panel), indicating a net source of PCBs to the water passing through the pool. During periods of high flow, most of this net source can be accounted for by estimates of PCB contaminated sediment erosion. During periods of low river flow, when sediment erosion is minimal (i.e., flows less than about 10,000 cfs), this unknown source cannot be accounted for by known processes. For example, the only known source of PCBs within the TIP during periods of low river flow is diffusion from sediment pore water. Based on 1991 measurements of pore water PCB concentrations (OB&G, 1994), the pore water source is estimated to have been about 0.2 lb/d[1]. However, the extensive water column monitoring data at Ft. Edward and Thompson Island Dam show that during low flow periods in 1993 and 1994 approximately 2 lbs/d of PCBs appears to be originating in TIP (Figure 1, bottom panel). Therefore the PCB load from TIP appears to be anomalously high in summer low flow periods by about tenfold. Given that the PCB mass flux into the pool during low flow periods is about 0.5 lb/d (1993-95 time period at Ft. Edward; middle panel of Figure 1), the 2 lb/d anomaly dominates the mass balance of PCB in the upper Hudson River.

The anomaly does not appear to extend to the region between Thompson Island Dam and the next downstream sampling Station at Schuylerville, a distance of about 8

[1]Diffusive flux was calculated using the following expression: Flux = $K_L A c_p$ (Calamari, 1992). This expression is evaluated with a diffusive mass transport coefficient of K_L = 1 cm/d, a pool surface area of A = 1.8×10^6 m^2 and the average pore water PCB concentration measured in Thompson Island Pool surface sediments collected in 1991 of about c_p = 5 ug/l.

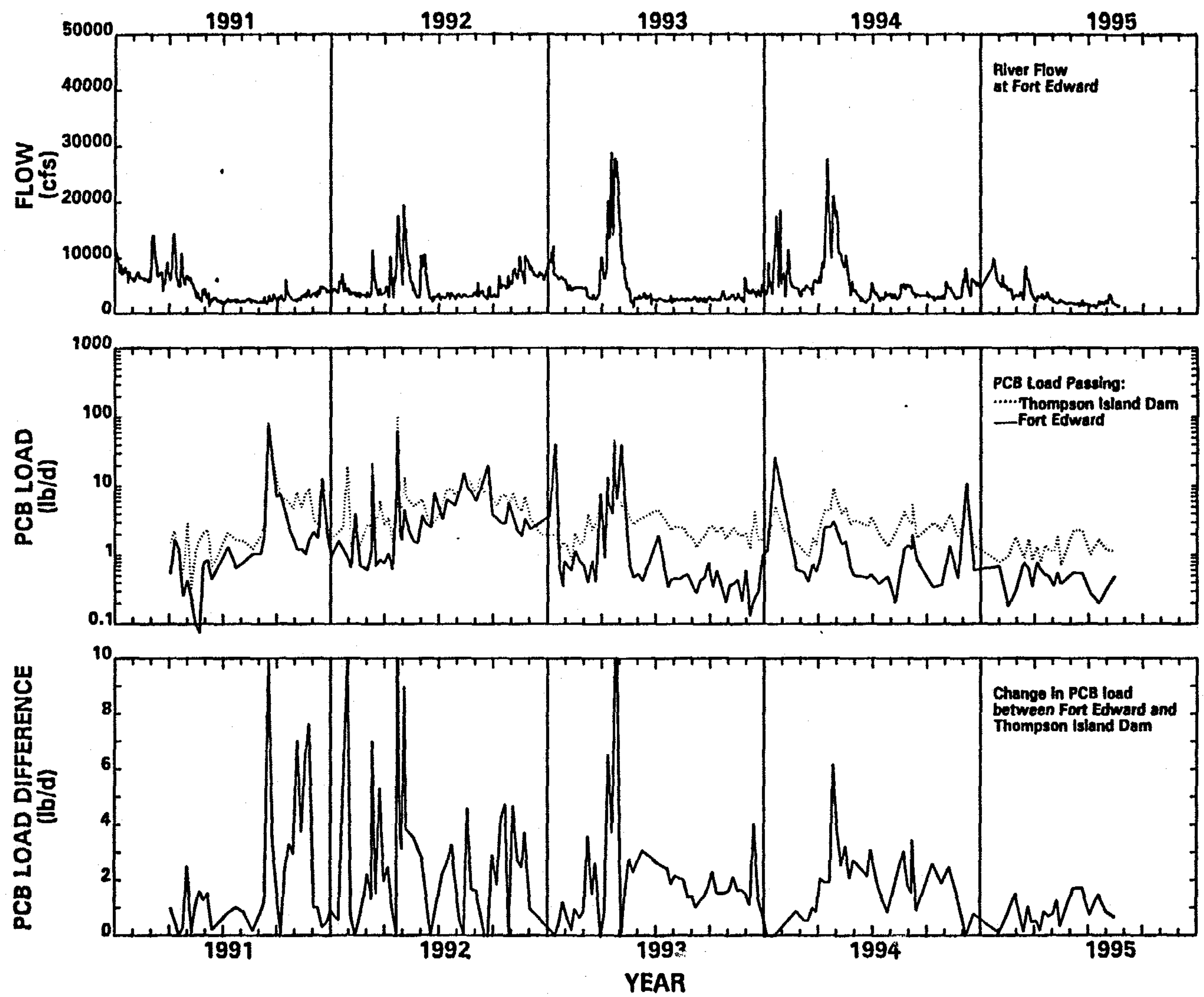

FIGURE 1. RIVER FLOW AND PCB LOADS (FORT EDWARD AND THOMPSON ISLAND DAM, 1991-1995).
DATA SOURCES: USGS FLOWS AND GE PCB CONCENTRATIONS.

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miles. This segment of river also contains PCB contaminated sediments, including the reach between Thompson Island Dam and Ft. Miller Dam which has the highest sediment PCB levels in the river. The PCB mass flux passing Schuylerville is generally slightly lower than that passing Thompson Island Dam (Figure 2). This slight negative change can be attributed to volatilization and dilution. Thus, the anomaly appears to be unique to the TIP.

2.2 TEMPORAL CHANGES

The magnitude of the PCB load from TIP has changed over the period from 1991 to 1995 (Figure 3). From March to late-summer 1991 the load averages about 1 lb/d. In September the load increases. This increase was coincident with an increase in PCB levels originating near Bakers Falls. This increase in PCB levels is attributed to a sudden flow increase through the Allen Mill structure at Baker's Falls (likely due to failure of a wooden gate) that mobilized PCBs from sediments in the tailrace tunnel below Allen Mill and transported it to the river (OB&G, 1994). This event resulted in an increase in PCB mass and concentration in Hudson River water by approximately two orders of magnitude for approximately two weeks, followed by a period of gradual decline. Elevated PCB concentrations in the river (above levels seen prior to September 1991) persisted until flow through the Allen Mill was stopped in April of 1993. Since April 1993, PCB concentrations measured at Ft. Edward have been at low levels, with the exception of a few short term increases.

As shown on Figure 3, the elevated PCB load from TIP (the "anomaly") has persisted through the summer of 1995, though it is gradually decreasing in magnitude. Beginning in the winter of 1992 through the most recent data, the anomaly is characterized by a maximum in early summer and a minimum in winter. Mean values range from about 2 to 3 lb/d in the summers of 1993 and 1994 to near zero in winter. This seasonal pattern may not be evident in the 1991 and 1992 data because the data during this period are characterized by short term concentration variability that may sometimes invalidate the pairing of measurements from the two stations.

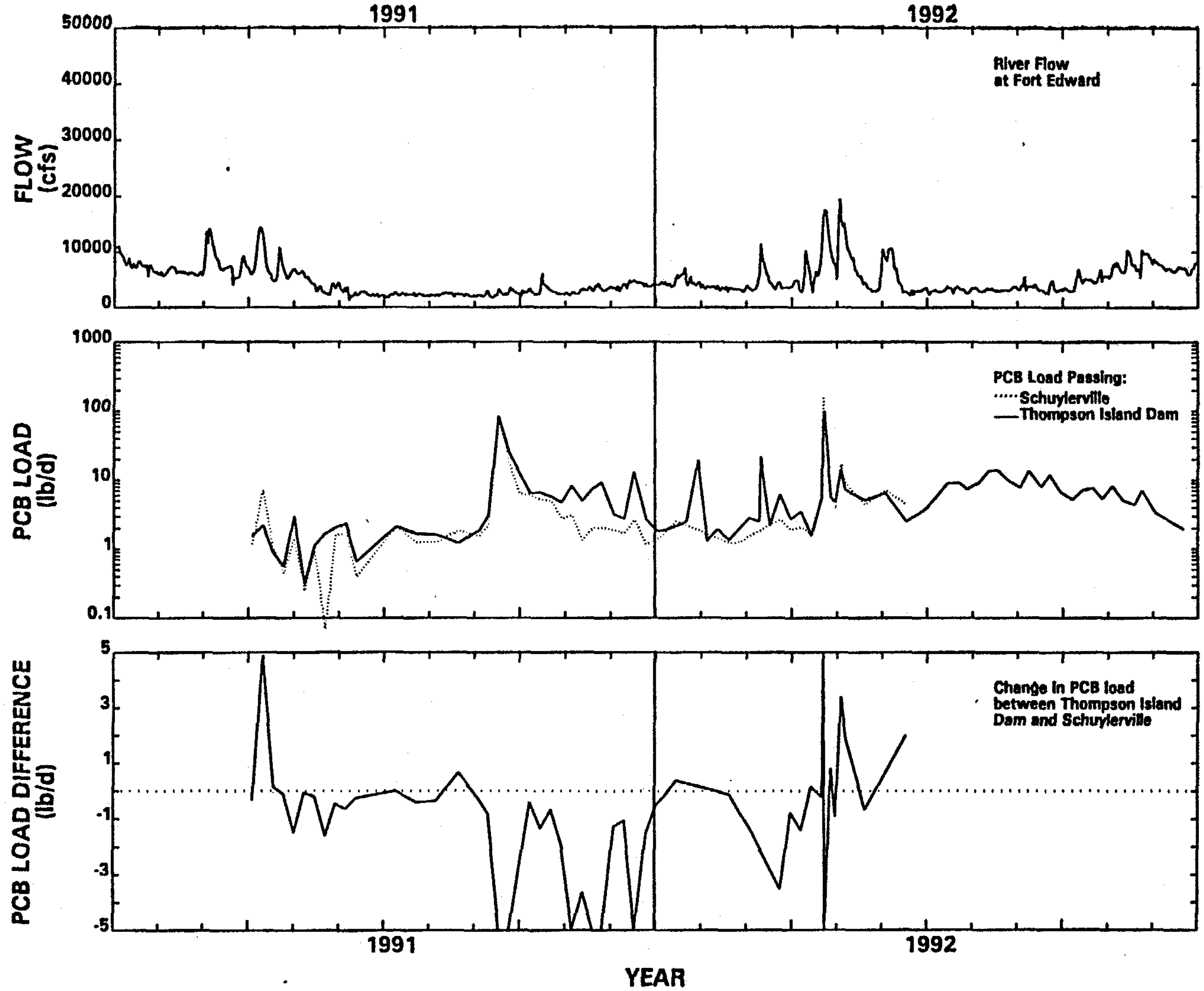

FIGURE 2. RIVER FLOW AND PCB LOADS (THOMPSON ISLAND DAM AND SCHUYLERVILLE, 1991-1992).
DATA SOURCES: USGS FLOWS AND GE PCB CONCENTRATIONS.

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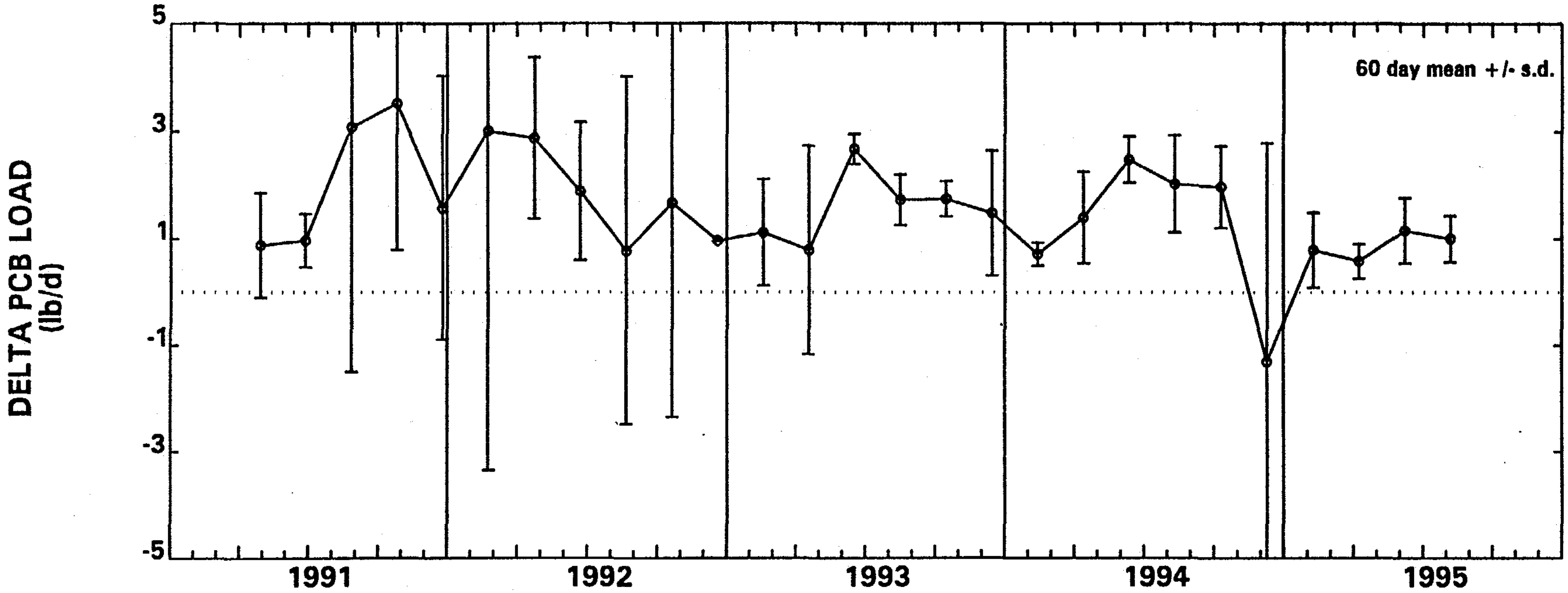

Figure 3 Mean PCB load difference between Fort Edward and Thompson Island Dam. (1991-1995, flow < 10,000cfs).
Data sources: USGS flows and GE PCB concentrations.

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The 1995 data indicate a reduction in the PCB load from TIP, suggesting that it may be dissipating. Mean values are now about 1 lb/d. Of note is that the 1995 values are similar to values measured in 1991 prior to the large influx of PCBs to the river that occurred in September.

The magnitude and behavior of the PCB load from TIP prior to March 1991 cannot be directly evaluated because of the absence of historical water column PCB data at Thompson Island Dam. However, water column PCB data are available at the next downstream monitoring station (Schuylerville) from 1977 - 1992. These data not only overlap with the monitoring data available for TIP, but also provide information on PCB levels before the increased PCB load of 1991. Since PCB levels are similar at TIP and Schuylerville (See Section 2.1) and the TIP is included in the section of river between the Ft. Edward and Schuylerville stations, PCB mass loadings for the section of river between Schuylerville and Ft. Edward provide a basis for evaluation of the PCB load from TIP for a longer period of time than is possible by only using TIP data.

Review of the annual average incremental PCB load between Ft. Edward and Schuylerville (Figure 4) indicates that elevated PCB loads have not been a constant feature of the PCB dynamics within Thompson Island Pool. At the beginning of the sampling program in 1977 a large anomaly existed. The apparent PCB load was about 12 lb/d, whereas, diffusion of pore water PCB to the water column could only account for about 0.9 lb/d at that time[2]. This source declined rapidly to about 1 lb/d by 1980. From the mid-1980s to 1989 the anomaly was not evident. The load increase between stations was about 0.2 to 0.4 lb/d; the level expected for diffusive flux from sediment pore water (See Section 2.1). The PCB data from Schuylerville also shows an increased PCB load in 1991 and 1992 consistent with the PCB data from Ft. Edward and Thompson Island Dam.

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[2]Based on pore water PCB concentrations estimated from the 1977 surface sediment PCB concentrations.

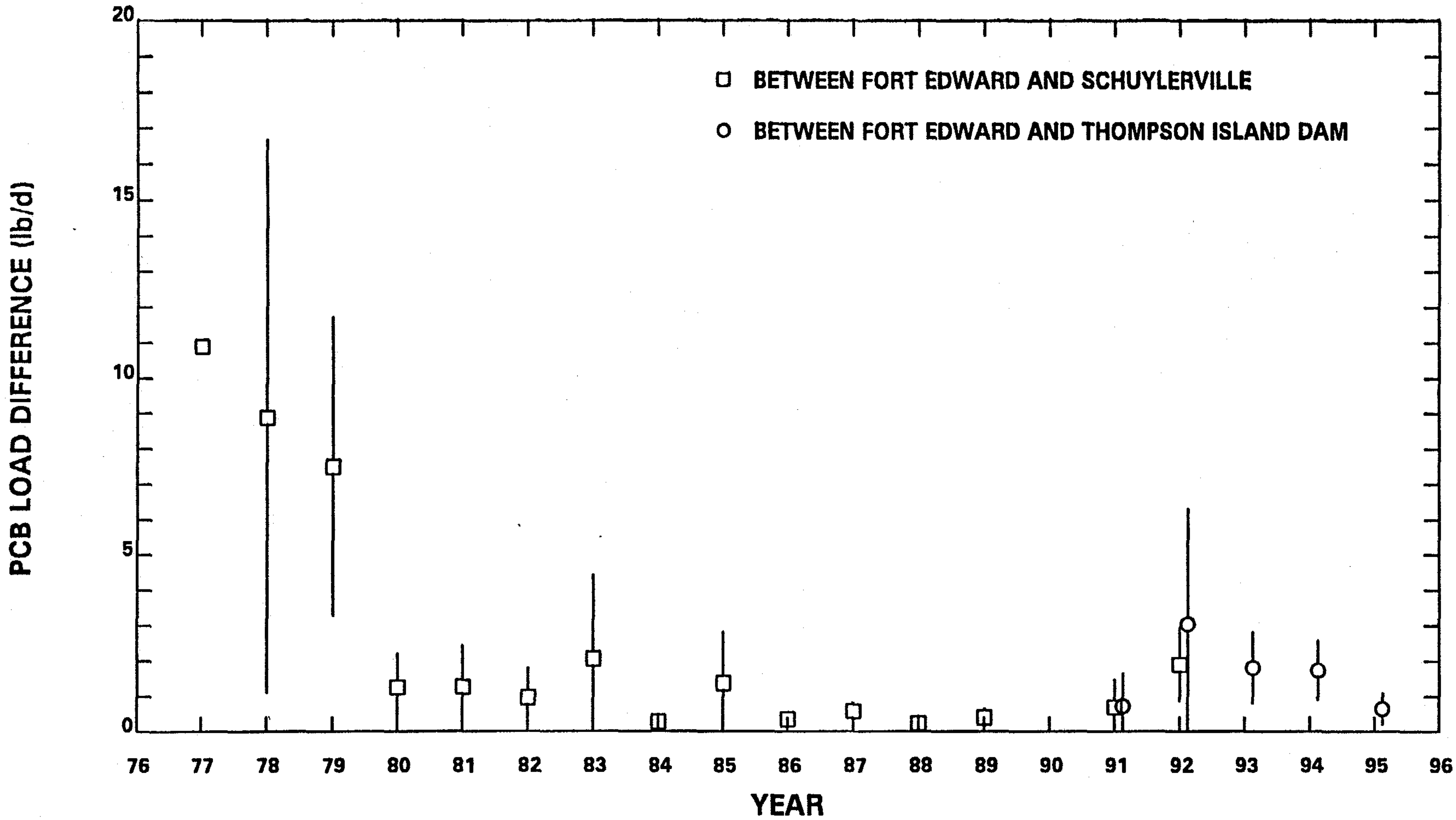

Figure 4 Annual average PCB load difference between Fort Edward and Schuylerville (1977-1995, flow < 10,000cfs).
Data sources: USGS flows with USGS (1977-1989) and GE (1991-1995) PCB concentrations.

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2.3 COMPOSITION

The composition of the PCB load within Thompson Island Pool changes with flow and differs from the homolog composition of PCBs entering the pool at Ft. Edward. The homolog composition of ΣPCB[3] is shown for the summer low flow periods (Figure 5) and spring high flow periods (Figure 6) for 1992, 1993 and 1994. The composition of PCBs entering the pool at Ft. Edward during these periods is shown on the panels on the left and the composition of the PCB load originating within TIP is shown on the right. During either high or low flow periods, the PCBs at Ft. Edward resemble Aroclor 1242, being composed principally of tri- and tetrachlorinated biphenyls. In contrast to this, during the low flow periods (Figure 5) the PCB load originating within the pool is predominantly mono-, di- and trichlorobiphenyl. At high flows (Figure 6) the distribution shifts such that there is a greater proportion of more highly chlorinated congeners such as those found in Aroclor 1242. Thus, the anomalous PCB load evident at low flows has a high percentage of less chlorinated congeners. Of particular significance are 2-monochlorobiphenyl and 2,2'- and 2,6-dichlorobiphenyl, which constitute a major fraction of the PCB load (Figure 7). These are the principal products of biological reductive dechlorination of Aroclor 1242.

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[3]Σ PCB equals the sum of congener concentrations, to distinguish it from total PCB which equals the sum of dissolved PCB and particulate PCB

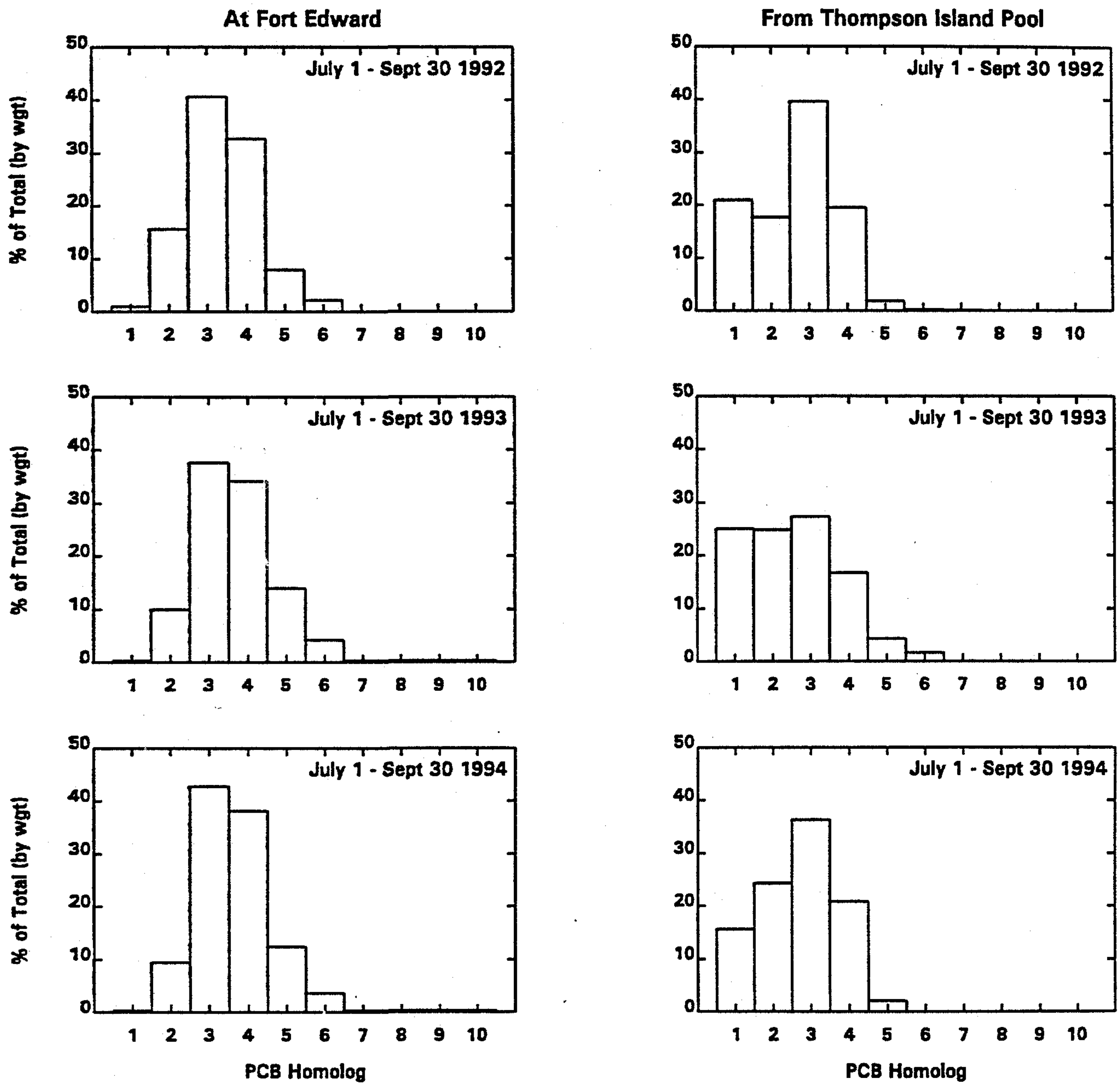

FIGURE 5. PCB COMPOSITION BY HOMOLOG DURING SUMMER LOW FLOW PERIODS (1992-1994)

DATA SOURCES: USGS FLOWS AND GE PCB CONCENTRATIONS.

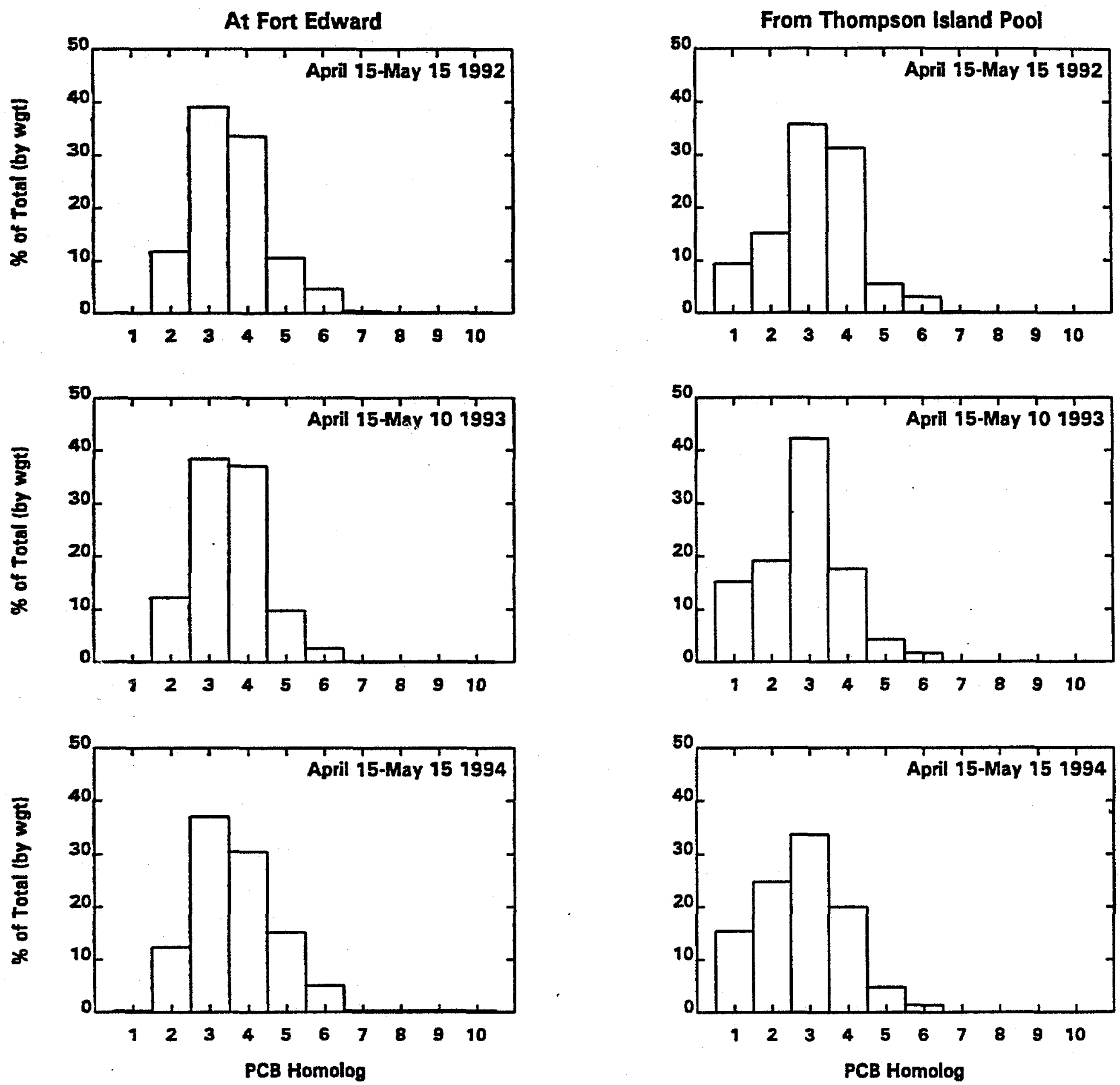

FIGURE 6. PCB COMPOSITION BY HOMOLOG DURING SPRING HIGH FLOW PERIODS (1992-1994)

DATA SOURCES: USGS FLOWS AND GE PCB CONCENTRATIONS.

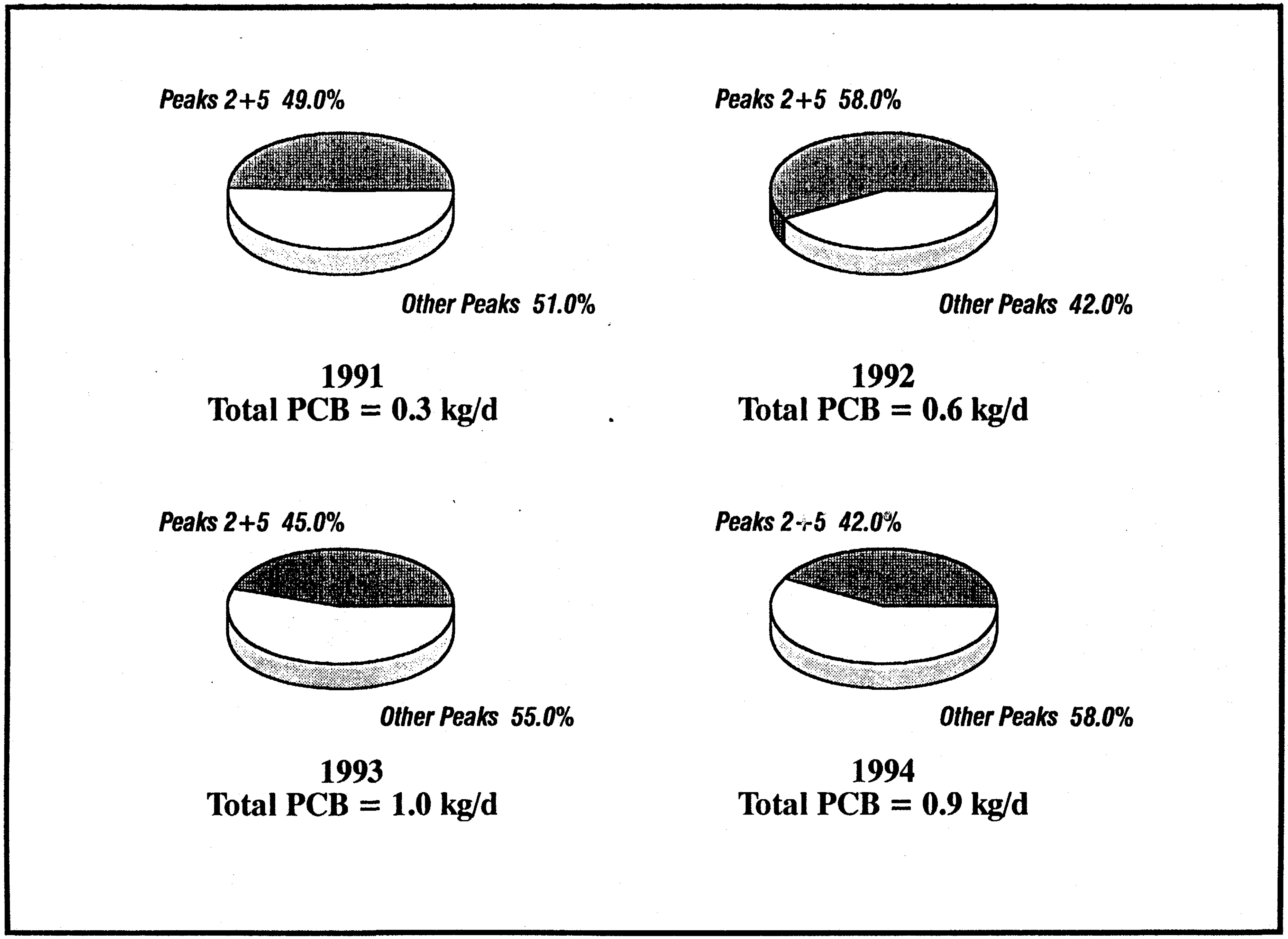

Figure 7 Contribution of 2-monochlorobiphenyl and 2,2'- and 2,6-dichlorobiphenyl to the PCB load added between Fort Edward and Thompson Island Dam (1991-1994).

SECTION 3

POTENTIAL SOURCES OF THE ANOMALY AND IMPLICATIONS OF ALTERNATIVE EXPLANATIONS

Based on the preceding results, it is evident that the PCB mass flux at Thompson Island Dam is anomalously high during summer low flow periods. A loading of PCBs exists in the Thompson Island Pool beyond that measured at the Ft. Edward sampling station or explained by known methods of PCB transfer from sediments during low flow periods. Two questions need to be considered with regard to this PCB load:

(1) Where does it originate?

(2) How does it enter the water column of Thompson Island Pool?

The possible alternative answers to these questions have different implications with regard to the significance of the incremental PCB load in the future. A review of these implications highlights why an understanding of this phenomenon is a prerequisite to realistic evaluation of future PCB levels.

3.1 WHERE DOES THE ANOMALOUS PCB LOAD ORIGINATE?

The apparent PCB load within Thompson Island Pool could have any of several origins. Of note is that both periods during which an anomalous PCB load is evident (late 1970's and post-1991) follow large inputs of PCBs from upstream of Ft. Edward. The removal of the Ft. Edward Dam in 1973 and a flood event in 1976 facilitated the release and distribution of large quantities of PCB contaminated sediment which had accumulated behind the dam. In September 1991, a significant amount of PCBs entered the river when flow increased through the Allen Mill structure at Bakers Falls, mobilizing PCB contaminated sediment and transporting it to the river, as described previously. The temporal correspondence of the commencement of the increased PCB load from within Thompson Island Pool and the failure of the Allen Mill gate at Bakers Falls suggests the gate failure as the causative factor. For this hypothesis to be true, PCBs must have passed the Ft. Edward sampling station undetected and then been deposited on the sediments and rapidly dechlorinated. This could have occurred if a large mass of PCBs entered the pool between sampling dates; for example as a pulse of oil contaminated sediments eroded from the tailrace tunnel located below the mill when the intake gate collapsed. Alternatively, PCB oils entering the river at Bakers Falls could possibly be transported downstream along the river bottom as DNAPL and pass under the devices used to collect samples and hence not be reflected in the water column measurements of PCB at Ft. Edward.

Sediment bound or dense oil phase PCBs passing the Ft. Edward station undetected are likely to be deposited in Thompson Island Pool because it is the first significant depositional zone downstream of Bakers Falls. Indeed, preliminary USEPA RRI/FS data (obtained by GE through Freedom of Information Act) indicate that water column particulate PCB levels do in fact decline through the TIP.

If a short term event caused the downstream transport and deposition of PCB contaminated solids or DNAPL, it is expected that irregularly located areas of relatively highly PCB contaminated surficial sediments would result. Only limited sediment data exist from after the 1991 event. In 1992, EPA collected three cores from TIP and finely segmented them for high resolution PCB analysis. The 2 cm surface layer in two of the cores shows increased PCB levels (Figure 8), indicating a recent PCB depositional event may have occurred. Although, the third core does not show an increase, this may be due to the heterogeneous PCB distribution. While limited, these data do tend to support a short term event hypothesis. The newly contaminated surface sediments would initially be in direct contact with the water and would serve as a source of PCB to the water column.

What are the long term implications of the preceding scenario? Since the initial deposition of contaminated material probably occurred in areas susceptible to deposition, it is reasonable to assume that burial will be a significant mechanism for reducing the magnitude of this input to the water column. Because the potential for further releases of contaminated sediment from the Allen Mill source has been eliminated, the PCB load to

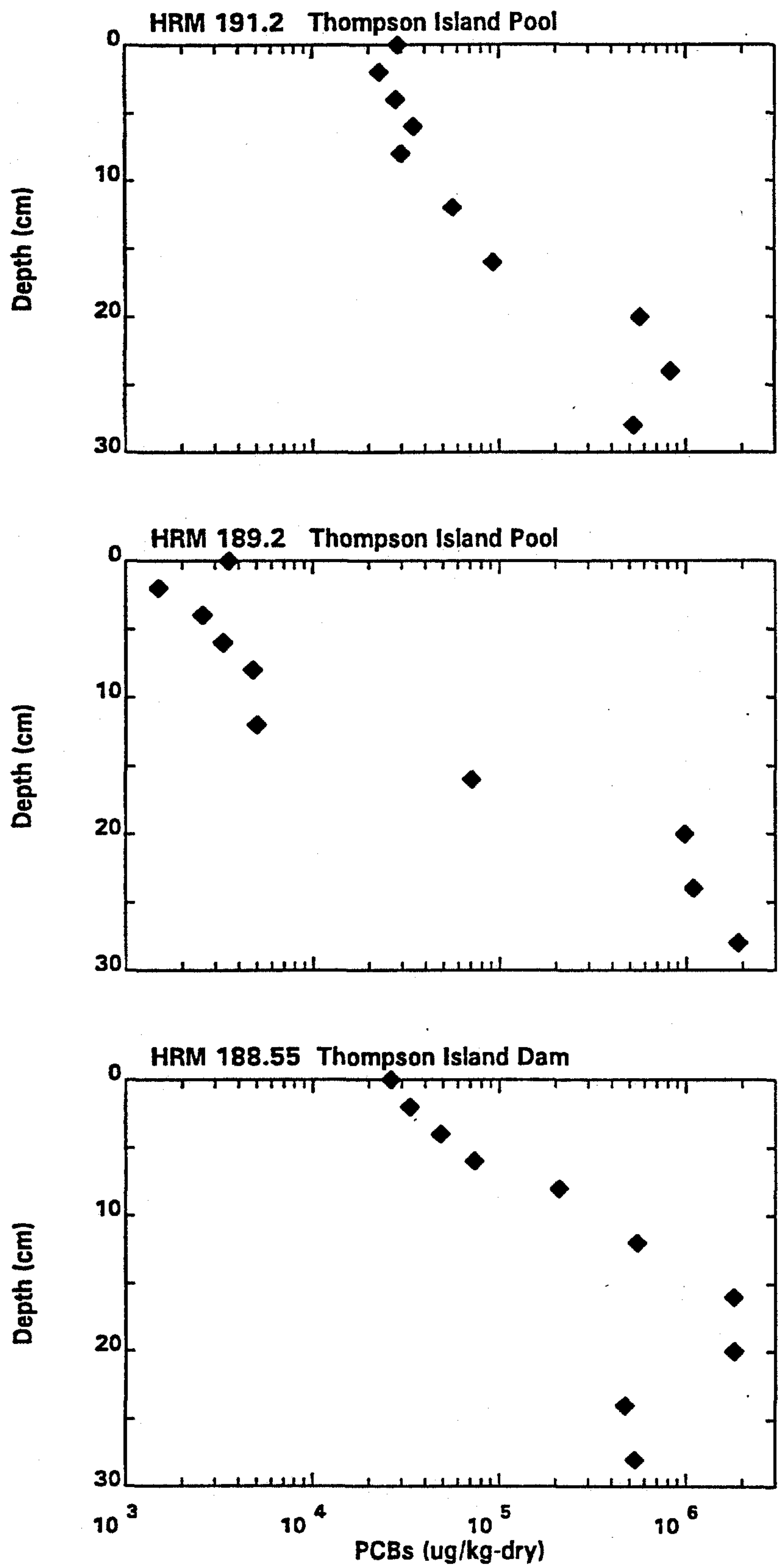

FIGURE 8. VERTICAL PROFILE OF PCB IN 1992 SEDIMENT CORES FROM THOMPSON ISLAND POOL

DATA SOURCE: USEPA

the water column in the TIP should decrease steadily over time. This trend is consistent with the recently reported decrease in the magnitude of the anomalous TIP PCB load (see Figure 3).

A second possibility is that a continuous migration of DNAPL is entering the pool and passing the Ft. Edward monitoring station undetected because of the manner of sample collection. Samples at this station are collected from both the east and west channels of the Hudson River at Ft. Edward. The samples are vertically stratified composites collected from near the center of the bridge across each channel. Upon collection, the samples from each channel are combined into an equal volume composite sample. The vertically stratified composites do not include the bottom one foot (approximately) of the water column. Hence, if the DNAPL is transported along the sediment-water interface, it would not be reflected in the current or historical water column sampling. Also, if the DNAPL is not fully mixed across the river, the single sampling points in each channel may not properly account for it. Within Thompson Island Pool, any unmeasured DNAPL may subsequently become progressively mixed and/or dissolved into the water column or incorporated in the surface sediment.

What are the implications if this scenario is correct? First, the upstream source must be controlled. Once this is achieved, a decrease in the anomalous TIP PCB load should result. This will yield a relatively rapid improvement in PCB levels in the water column, and a less rapid but steady improvement in the biota over time.

It should be noted that a sampling bias at Thompson Island Dam could also be misinterpreted as an increase in PCB flux across Thompson Island Pool. There is no evidence of such a bias. Thompson Island Dam samples are grab samples collected from the surface of the water column from the western wing wall of Thompson Island Dam. A limited number of samples were collected on the eastern shore of the river at Thompson Island Dam in February of 1992. The results of these samples were consistent with samples collected from the western shore at the routine monitoring location suggesting that the western wing wall is a representative sampling location. Moreover, the Thompson

Island Dam sampling location appears to be representative when compared to data obtained downstream of the dam. The slight decrease in PCB levels in samples obtained from the Route 29 Bridge in Schuylerville is likely due to volatilization and dilution from tributaries, including the Batten Kill. Additionally, in February of 1992, a limited number of samples were collected from the Lock 6 Dam, located approximately one mile downstream of Thompson Island Dam. Data from these samples were again consistent both in concentration and composition with Thompson Island Dam data. Hence the observed increase in PCB load across the Thompson Island Pool is not expected to reflect an artifact of sampling at this location.

3.2 HOW DO THE PCBs ENTER THE WATER COLUMN IN THE THOMPSON ISLAND POOL?

Once the PCBs are in the Thompson Island Pool, several alternative processes could be taking place which result in PCBs entering the water column. The observed shift in the homolog distribution suggests that the processes taking place within the pool are in some way related to the bottom sediment. Specifically, it is postulated that two processes may be occurring, either independently or in combination. They are:

(1) PCB mixing in the near surface anaerobic layer, where dechlorination and subsequent release of lower chlorinated homologs to the water column takes place, or

(2) A chromatographic separation resulting from differential sorption of PCB homolog groups to sediments is occurring.

The first process listed above is illustrated on Figure 9. The hypothesized PCB dynamics in Thompson Island Pool following the deposition of PCB from upstream sources are summarized as follows:

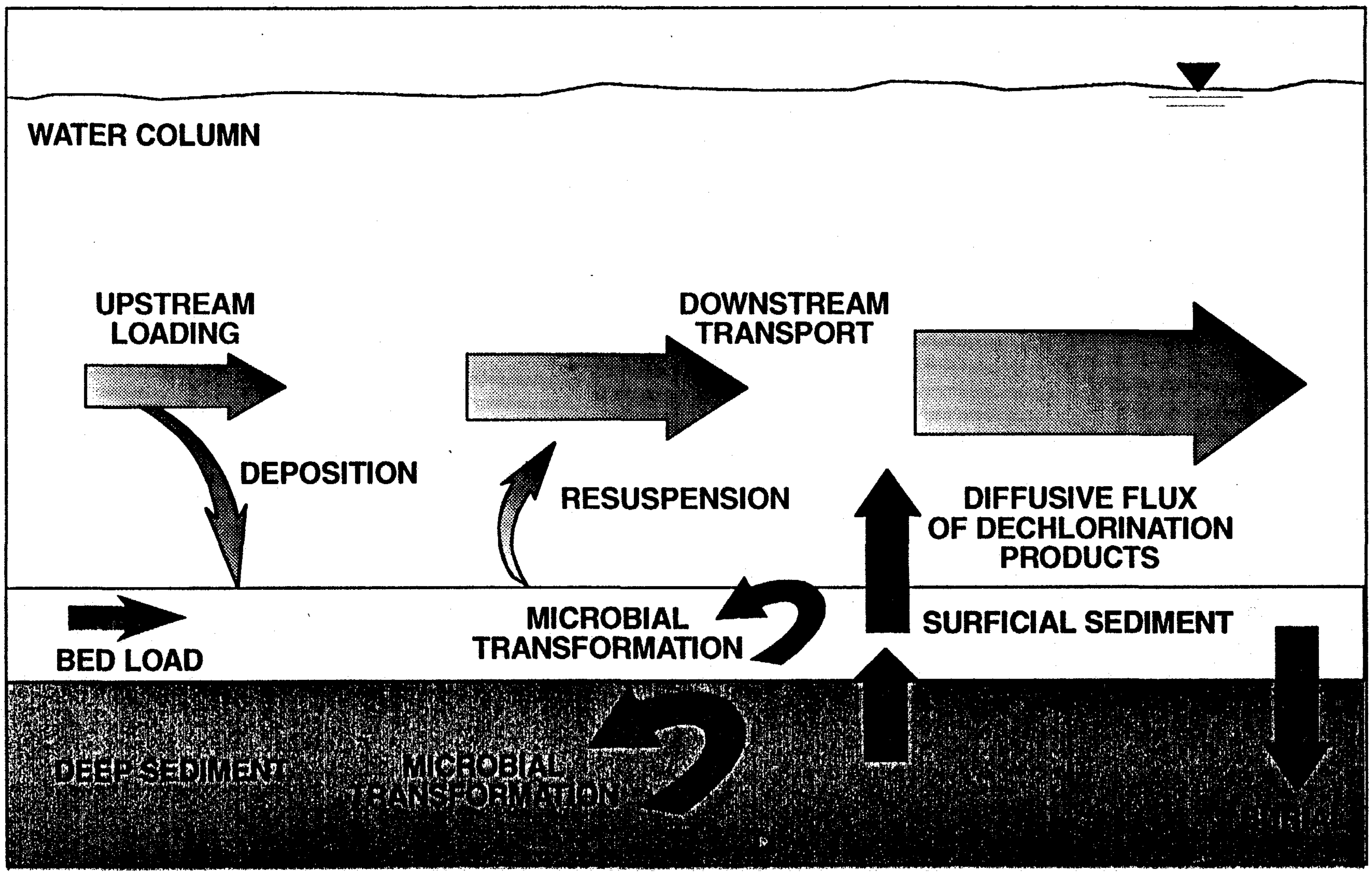

Figure 9 Hypothesized PCB dynamics in Thompson Island Pool.

- PCBs enter the head waters of Thompson Island Pool either as PCB sorbed to particulate material, as an oil phase PCB transported with the bed load, or both;
- sorbed and oil phase PCBs settle and are incorporated along with the bed load PCBs into the surficial sediments;
- the microbial community present in the surficial sediments dechlorinates the recently deposited PCBs into more soluble products (mono- and di-chlorinated biphenyls that have a lesser tendency to sorb to organic matter (specifically peaks 2,5,8).
- these reductive dechlorination products, facilitated by short diffusion distances and higher water solubilities, diffuse into the water column and are transported downstream;
- some of the deposited PCBs are buried as a result of continued deposition of water column particulates; and
- buried PCBs in deeper sediments continue to undergo reductive dechlorination and the soluble end products slowly diffuse through the sediment and into the water column.

The second process, "chromatographic separation," arises from the tendency of the more highly chlorinated homolog groups to be more strongly bound to sediments than the mono and dichlorobiphenyls. As a result, the less chlorinated homolog groups are relatively enriched in the pore water where they are available for diffusion into the water column.

The fact that both of the preceding mechanisms tend to enrich the pore water with mono and dichlorobiphenyl is consistent with observed pore water distributions in the Thompson Island Pool (OB&G, 1992). However, the predominance of ortho-chlorinated congeners (specifically peaks 2,5,8) in the lower chlorinated homologs strongly indicates the involvement of microbial dechlorination.

Laboratory microcosm experiments being conducted by the General Electric Corporate Research and Development (GE CRD) group have demonstrated dechlorination and biodegradation of PCBs at significant rates. In these experiments Hudson River sediments were spiked with PCB Aroclor 1242 and then incubated at either a constant temperature of 25°C or a variable temperature that simulates the annual temperature cycle in the river. PCBs were measured in samples from a 2 mm interfacial layer and a 1 cm subsurface layer. PCBs in the 1 cm layer were rapidly dechlorinated in both the constant and variable temperature experiments (Figure 10). Most of the meta chlorines were removed within the first 30 to 40 days of the experiment. Following this, a reduction of para chlorines occurred in the 25°C experiment, but not in the variable temperature experiment. Note that similar dechlorination was observed in previous isothermal experiments at 25, 20, and 15°C, but not at or below 10°C. Presumably, the lower temperatures do not support the activity of the microorganisms responsible for attack at para chlorines. Within the interfacial layer, essentially all of the added PCBs were eliminated in the 25°C experiment (Figure 11). Only a small fraction (about 5) percent of this loss can be attributed to physical processes (sterile controls in Figure 11). Time course measurements of PCB composition (not shown) indicate that a combination of dechlorination and degradation was responsible for the PCB loss. Much less PCB was lost in the variable temperature experiment because no loss occurred after the temperature declined below about 10°C.

At least two aspects of the lab experiments are consistent with the field observations. First, the rapid dechlorination explains how the anomalous load could be dominated by dechlorination products even if it is derived from recently introduced PCBs. Second, the evident temperature dependency of the biological processes is consistent with the seasonal variability of the anomalous load. A slow-down or cessation of dechlorination activity during the winter months would affect the production of the more soluble congeners and reduce the diffusive flux to the water column.

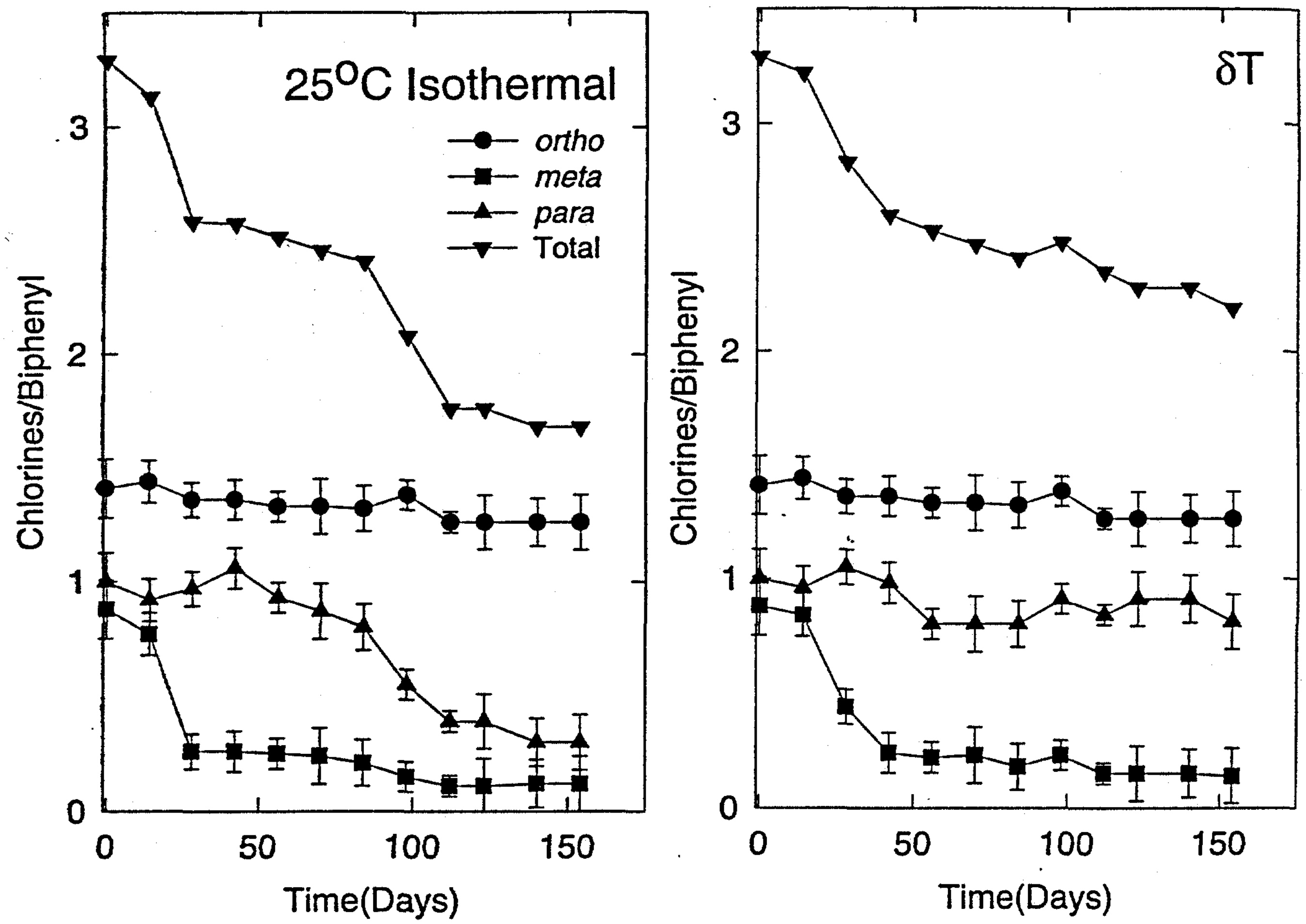

FIGURE 10. PCB CHLORINE CONTENT AND POSITION IN SUBSURFACE SEDIMENTS DURING CONSTANT (25°C ISOTHERMAL) OR VARIABLE (δT) TEMPERATURE INCUBATIONS. SEE FIGURE 11 FOR CORRESPONDING TEMPERATURE DATA.
(GE CRD UNPUBLISHED DATA)

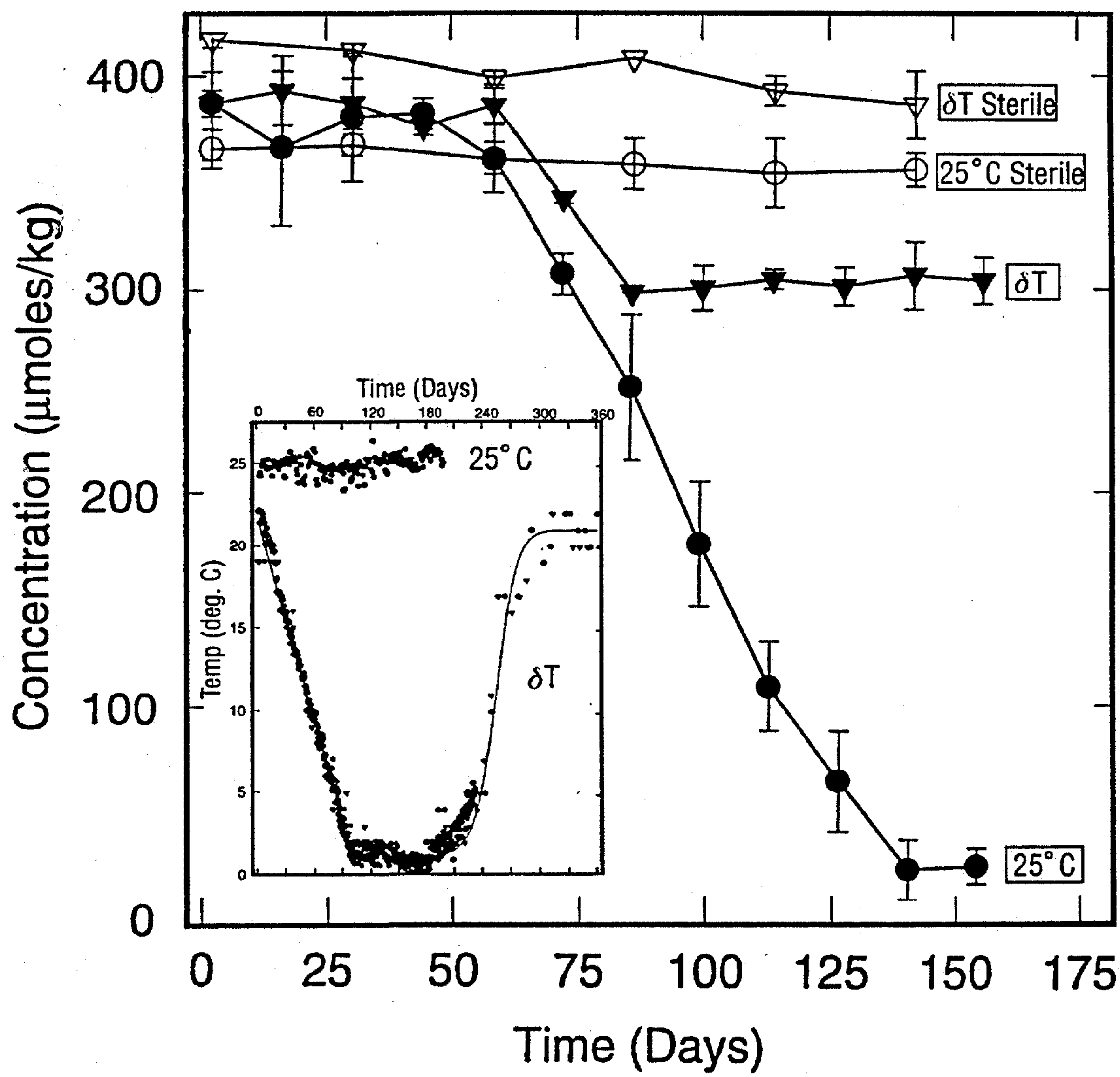

FIGURE 11. PCB CONCENTRATION AND TEMPERATURE (INSERT) IN INTERFACIAL SEDIMENTS DURING CONSTANT (25°C) OR VARIABLE (δT) TEMPERATURE INCUBATIONS.
(GE CRD UNPUBLISHED DATA)

In summary, evidence supporting the hypotheses presented above includes the following:

(1) predominance of PCB congeners associated only with biological processes;

(2) potential temperature effects (Figure 3) related to biological activity on deposits of Aroclor 1242;

(3) decrease in PCB load over time, suggesting surface sediment concentrations are decreasing;

(4) recent EPA sediment data show surficial sediment PCB levels increased in 1991; and

(5) results of ongoing laboratory microcosm experiments.

Failure of the Allen Mill gate structure appears to be the most likely cause for the anomalous PCB load. This conclusion is supported by the following observations:

- The increased load from the TIP began immediately after the Allen Mill gate structure failed.

- The PCB load at Ft. Edward decreased in early 1993, when the raceway and tunnel in Allen Mill were dewatered, and has remained at low levels.

However, there may also be a component of this anomalous PCB load which arises from an ongoing seepage of DNAPL into the river.

Even though the available data provide support for the aforementioned lines of reasoning, the data are not perfect and implementation of a water and sediment quality monitoring program would be necessary to verify that these processes and trends are in fact occurring.

SECTION 4

SUMMARY AND RECOMMENDATIONS

Since September 1991 the PCB load from the TIP in the upper Hudson River has been elevated beyond what would be expected from PCB movement from the old buried sediments to the water column by diffusion. The occurrence of this high PCB load coincides in time with the increased PCB levels in the water column originating upstream of the TIP. It appears that the increased water column PCB levels detected in September 1991 resulted from the collapse of a portion of an abandoned mill adjacent to the GE plant site in Hudson Falls. Highly contaminated sediment within a tunnel below the site appears to have been scoured from the tunnel and into the Hudson River.

Given the probable sudden movement of material from the tunnel and the frequency of river monitoring (weekly), the peak loading from this event was not detected. When material from the Allen Mill first entered the river, sediment bound PCB entered the TIP undetected and, since TIP is the first significant quiescent area downstream of Hudson Falls, PCB contaminated sediment was deposited on the surface of the old TIP sediments. Limited post-1991 sediment sampling suggests that there have been areas in TIP with elevated surface PCB concentrations.

Temporal trends in PCB loading from TIP in the 1990's indicate that, after the initial load increase in September 1991, the PCB load from the pool declined. It has decreased from approximately 2 to 3 pounds per day during the summer of 1993 to approximately 1 pound per day during the summer of 1995. If the decline continues, it will provide further support for the theory that the surface sediments were contaminated in 1991. Subsequent burial, microbial mediated dechlorination, and dissolution of the sediment bound PCB into the water column are reducing the surface sediment concentrations such that loading from the TIP should return to pre-1991 levels.

Understanding the cause of this phenomena in TIP is important for the EPA reassessment program in general, and for EPA's PCB fate and transport model in particular.

If EPA incorrectly assumes that PCB levels in TIP are due to diffusion from the old sediments, then it is probable that overestimation of the contribution of PCB to the water column from these old buried sediments will be made. As a result, the model would overpredict the benefits of a remedial program focused on these sediments. To make sound regulatory judgment on the Hudson River will require that the PCB dynamics within TIP be understood.

While the data collected to date suggest the TIP anomaly is transitory, additional data collection will be required to confirm this. Currently, GE has implemented a program (OB&G, 1995) to ensure that the water column monitoring data routinely generated are of sufficient quality to allow reasonable estimation of PCB mass passing a given point in the river. This will include measurement and analysis of river mixing dynamics (dye study) as well as a study of the behavior of dense plastic beads, intended to simulate the movement of DNAPL in the river. This program was initiated in September 1995 and should be completed in June 1996.

GE also plans to continue to monitor PCB levels routinely between TIP and Hudson Falls. Data from this program collected during low flow periods in 1996 will be critical to assess whether the PCB load from TIP is continuing to decrease and is expected to provide data to estimate when the anomalous PCB load will cease to be significant.

The laboratory microcosm experiments referenced in Section 3 will be completed in 1995. These results will yield valuable information on how temperature changes over time in the river impact the PCB dechlorination and degradation processes that affect PCB deposited in surface sediments with in TIP.

SECTION 5

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