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**PHASE 2B  
SAMPLING AND ANALYSIS/QUALITY ASSURANCE PROJECT  
PLAN**

**VOLUME 5: TSS/TOC WATER SAMPLING**

**HUDSON RIVER PCB REASSESSMENT RI/FS**

USEPA WORK ASSIGNMENT NO. 013-2N84

REVISION 0

APRIL 26, 1994

Prepared for

USEPA Region II

Alternative Remedial Contracting Strategy (ARCS)  
for  
Hazardous Waste Remedial Services

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**Hudson River PCB Reassessment  
RI/FS Phase 2B SAP/QAPjP - Volume 5  
TSS/TOC Water Sampling  
April 26, 1994**

**Revision 0**

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## TSS/TOC WATER SAMPLING PLAN

This plan covers the proposed sampling and analysis of selected Hudson River and tributary locations for total suspended solids (TSS), weight loss on ignition (WLOI) and total organic carbon (TOC); the field work and the associated TSS and WLOI analyses will be performed by the Rensselaer Polytechnic Institute (RPI). TOC analyses will also be done by a commercial laboratory.

### 1. Rationale

The purpose of this sampling program is obtain a data set specifically for the calibration of an Upper Hudson River sediment scour and transport model. This program represents an addition to the original Phase 2 Investigation and is intended to address data requirements for the current modelling program. The additional data requirements to be addressed by this program are largely the result of the increased sophistication of the Hudson River modelling effort. The evolution of the modelling effort has been a direct result of the participation of the many public, private, government and scientific entities in the Hudson River PCB Reassessment process.

The principal PCB transport model to be used for the Reassessment is structured around the USEPA "WASP" model and requires an extensive suspended solids data set for calibration and validation of suspended solids transport calculations. The proposed TSS sampling will be used in conjunction with the other Phase 2 results and the existing (historical) data base for this purpose. These data are important to the model calibration because of the high affinity of PCBs for suspended solids, and sediments in general. The proposed sampling period was selected to provide a detailed data set on both spatial and short-term temporal variability in suspended solids. The time frame selected for this study should include the annual high flow event of 1994, which generally corresponds to the spring thaw. It is anticipated, given the substantial snow accumulation in the Northeast during the winter of 1993-94, that water flow velocities occurring during this event should be sufficient to generate substantial sediment resuspension and transport. Thus, the TSS data obtained by the program should aid in describing the resuspension of bottom sediments as a function of water flow velocity. The location and number of the proposed sampling stations in the river were selected to provide a level of detail comparable with the proposed model effort. It is anticipated that these data will be used directly for model calibration and validation with a minimum of processing.

The organic carbon (TOC) content of suspended solids in the water column and sediments has been shown to influence the sorption of PCBs in many environmental settings; therefore a subset of the TSS samples will be analyzed for TOC. During the earlier Phase 2 sampling programs, weight-loss-on-ignition (WLOI) was determined as a surrogate for TOC. In addition, a significant historical data base exists on WLOI for suspended solids and sediments in the

Hudson. In order to satisfy the current modelling requirements for TOC measurements and for a large data set of historic conditions, a means of relating the historic WLOI analyses to TOC is needed. To this end, both properties will be measured on the subset of suspended solids samples so as to provide an empirical relationship between the two properties for the Hudson.

The Phase 2 data suggest significant variability in the WLOI of suspended solids along the main axis of the Upper Hudson River. Therefore, suspended solids samples for TOC/WLOI analysis will be collected from the main axis stations and major tributaries nominally once per week. By measuring these properties in this fashion, it should be possible to examine their spatial and temporal variations.

## 2. Sampling Locations and Frequency

### 2.1 Sample Locations

The proposed program consists of 15 primary locations, sampled approximately 5 times a week for 5 weeks; two additional Thompson Island Pool locations will be sampled about twice a week. Eleven of these locations are at or near stations previously used for Phase 2 water quality monitoring (i.e., water quality monitoring stations as used for the water transect sampling); these stations will use the same numbers previously assigned to these stations. The Mohawk River station (0013) is shown as "modified"; the location to be sampled is about a half mile downstream from the previously used Mohawk River station, at the Route 35 bridge. Nine of these stations are shown on Figure 3-3 of the Phase 2A SAP/QAPjP; the tenth of these stations is at Stillwater, which was used occasionally as a replacement station for the Champlain Canal location in winter months; and the eleventh is south of the range of figure 3-3, at Troy). Six new locations will be added. One of the new stations, Coveville, is intended to supplement data from the Schuylerville station. (Data generated during this RI indicate that the main channel river conditions at Schuylerville may not completely represent the addition of Fish Creek and the Batten Kill; however, Schuylerville is being retained for comparability with previously generated data.) Of the 10 stations in the river itself, six will be shoreline stations and 4 are collected from a bridge. The sampling locations are listed in Table 1 and shown on Figure 1.

Two additional locations within the Thompson Island Pool will also be sampled, but only twice per week. These stations will be sampled (from the shore) to obtain additional data on scour and re-suspension within the Thompson Island Pool. One of the TIP stations (0021) will be above Snook Kill, and the other station (0023) will be below Snook Kill.

## 2.2 Sampling Frequency

The 15 primary locations will be sampled nominally 5 times a week over a 5-week period which is expected to include the spring thaw runoff (high flow). All 15 stations (plus the two additional Thomson Island Pool stations, when appropriate) will be occupied on a given sampling day. Sampling may be less frequent during periods of lower flow, but more frequently (daily, or even two or three times a day) during high flow periods. Flow conditions will be determined by observations (at least once/day) of staff gauges at both Fort Edward and Waterford. Samples for TSS and conductivity analyses will be collected for every sampling event. Samples for TOC/WLOI analysis will be collected approximately once per week (i.e., five times during the five week TSS sampling program).

The two locations within the Thompson Island Pool will be sampled approximately 10 times during the program (for a total of 20 samples). These samples will be analyzed for TSS (and WLOI, during events that coincide with other samples being analyzed for WLOI, as discussed below). The TIP samples will be collected at or near maxima in flow, to the extent possible based on availability of sampling personnel and sample handling and analytical capability.

## 2.3 Sample Collection Procedure

Collection of shoreline samples (stations 0002, 0004, 0005, 0011, 0012, 0013, 0019, 0021, 0022, 0024, and 0025): Collected as described in the Phase 2B SAP/QAPjP, Volume 1 (Revision 1, May 1993), Section 6.2.1, step 4 (sampling from shore).

Collection of samples from bridges (stations 0006, 0007, 0008, 0014, 0020, and 0023): Collected as described in the Phase 2B SAP/QAPjP, Volume 1 (Revision 1, May 1993), Section 6.2.1, step 4 (sampling from bridges).

## 2.4 Sample bottles

Samples for TSS analysis and subsequent analysis of the suspended solids for WLOI are collected in 1-liter (nominal volume) glass wide mouth bottles cleaned according to EPA-CLP protocol (Eagle Picher Level 3). (Glass, instead of plastic, bottles are being used for consistency with previous events in which the filtered water was subsequently analyzed for dissolved organic carbon.) Samples for conductivity analysis must be collected in a separate glass bottle. Samples collected during high flow periods (when TSS is expected to be 10 mg/l or greater) may be collected in 500-ml glass bottles to reduce the number of filters needed to complete the analysis (since the method requires that the entire sample be filtered for the TSS determination). A separate 1000 ml glass bottle will be collected as necessary for TOC analysis.

## 2.5 Preservation

No chemical preservation is applicable to any of the analyses being conducted for this program. For all analyses, samples will be held at 4°C ( $\pm$  2°C) between collection and analysis.

## 3. Analyses:

All samples will be analyzed for TSS. The standard EPA method (160.2) reports a detection limit of 4 mg/l TSS for a 250-milliliter (ml) sample, which corresponds to a 1 mg/l detection limit; utilizing the same method, the RPI laboratory reports a detection limit of about 1.6 mg/l for a 1-liter sample. The expected concentrations are in the 5 to 50 mg/l range; therefore, adequate sensitivity will be achieved on a 1-liter sample. However, during high flow conditions, the 42 mm glass fiber filters tend to clog after only about 100 to 150 ml has been filtered; therefore, during high flow conditions 500 ml samples may be collected. These bottles will meet the same cleanliness and documentation criteria as the 1-liter bottles.

Samples for TSS will be filtered through a pre-weighed, 42 mm diameter glass fiber filter. The filter will be dried at 103°-105° C to constant weight. The analysis will be preformed under the direction of Dr. Richard Bopp at RPI, using the methods previously established for this project (i.e., EPA method 160.2; reprinted as Appendix D to the Phase 2A SAP/QAPjP). The holding time for this analysis is seven days from time of collection. Samples will be held at 4°C ( $\pm$  2°C) from collection until analysis.

Weight loss on ignition (WLOI) will be analysis will be performed from samples collected at 10 stations (plus the two TIP stations). The WLOI method in the Phase 2A SAP/QAPjP (Revision 2; May, 1992) (Appendix F) specifies analysis at 375°; however, the first set of data generated for this project were ignited at 450°, and subsequent TSS determinations by RPI have been at both 375° and 450°. Therefore it is planned to continue to generate WLOI data at both temperatures. No holding time is applicable to WLOI analyses.

Direct analysis of TOC will be performed by a commercial laboratory on the 1 liter suspended solids samples. Samples will be filtered for the determination of TSS (EPA method 160.2; reprinted as Appendix D to the Phase 2A SAP/QAPjP) with an expected yield of 5 to 50 mg suspended solids on one or more 125-mg filters. TOC will be determined directly on the filtered, dried residue by the Lloyd Kahn (EPA Region II) method.

Conductivity measurements will be made in the laboratory. Previous project data have shown good agreement (less than 20% RPD) between field and laboratory measurements of conductivity, except at water temperatures at 4° C or less. The procedure is essentially identical

to EPA method 120.1. Conductivity measurements will be made as close as possible to the method-specified reporting temperature of 25° to minimize corrections; Also, research by Dr. Bopp has determined a more accurate matrix-specific correction factor for Hudson River water (2.2%/°C, as opposed to the 2%/°C correction factor cited in method 120.1). Conductivity measurements will be made on filtered samples within 7 days of sample collection (USEPA method 120.1 states 24 hr holding time for unfiltered sample, 7 days for filtered sample).

Temperature measurements will be made at shoreline sample stations only; temperature measurements from bridge locations would not be meaningful due to the time the sample is exposed to ambient air temperatures before the temperature could be measured.

#### 4. Quality control:

Laboratory QC will be in accordance with the requirements of the specific methods, as specified in Appendix D and Appendix F of the Phase 2A SAP/QAPjP (revision 2, May 1992). In addition, one field duplicate will be taken for TSS and WLOI analysis each day samples are collected (resulting in a field duplicate frequency of 1 in 15 for TSS (about 6.7%), and 1 in 10 for WLOI (a frequency of 10%)). Validation of these data will be in accordance with the method-specific validation protocols already established for these analyses for this project.

Replicate and duplicate precision goals are  $\pm 20\%$  Relative Percent Difference (RPD). Accuracy goals for Laboratory Control Sample or other independent check standard are 90% to 110% Recovery. These QC analyses will be run at a minimum frequency of one per event for each analytical method. For TOC, one sample per SDG (i.e., one per event where TOC analysis is performed) will be analyzed in quadruplicate. The relative standard deviation (RSD) of the quadruplicate must be within the laboratory-specific RSD for this method (which is determined prior to the analysis of environmental samples).

Field Blanks are not required for these parameters. However, for both TSS and WLOI, two types of laboratory blanks will be run. One blank will be a filter blank, which consists of a preweighed (tared) filter, heated along with the field samples (to 103-105°, or to 375°, depending on the method), and then reweighed along with the samples. The second blank will be treated similarly, except that one liter of the laboratory water will be run through the filter prior to its being dried and reweighed. These blanks will also be run at a minimum frequency of one per event, one per analytical batch, or one per 20 samples, whichever is more frequent. For TOC, the laboratory blank will consist of a new filter.

TABLE 1  
SAMPLING LOCATIONS

| Station<br>Number | Location   | Type      | Analyses***    |
|-------------------|--|-----------|----------------|
| 0002              | Bakers Falls (shore at Fennimore Br)                       | Existing  | TSS, WLOI, TOC |
| 0004              | Rogers Island (shore)                                      | Existing  | TSS, WLOI, TOC |
| 0005              | Thompson Island Dam (shore)                                | Existing  | TSS, WLOI, TOC |
| 0006              | Schuylerville at Route 29 (bridge)                         | Existing  | TSS, WLOI, TOC |
| 0007              | Stillwater (bridge)  | Existing  | TSS, WLOI, TOC |
| 0008              | Waterford (bridge)   | Existing  | TSS, WLOI, TOC |
| 0011              | Batten Kill  | Existing  | TSS            |
| 0012              | Hoosic River   | Existing  | TSS            |
| 0013              | Mohawk River   | Modified* | TSS, WLOI, TOC |
| 0014              | Troy below Federal Dam (bridge)                            | Existing  | TSS, WLOI, TOC |
| 0019              | Mechanicville (shore)                                      | New**     | TSS, WLOI, TOC |
| 0020              | Thomson at Lock 5 Bridge                                   | New       | TSS, WLOI, TOC |
| 0021              | Coveville (RM 176) (shore)                                 | New       | TSS            |
| 0022              | Thompson Is. Pool above Snook Kill                         | New       | TSS, WLOI, TOC |
| 0023              | Snook Kill   | New       | TSS            |
| 0024              | Moses Kill   | New       | TSS            |
| 0025              | Thompson Is. Pool at McDonald's Dock<br>(below Snook Kill) | New       | TSS, WLOI, TOC |

\* Station 0013 (Mohawk) has been moved about 1/2 mile from previously used location

\*\* Station 0019 (Mechanicville) is a new station to this RI/FS, but has been monitored by RPI, and the RPI data is in the Hudson River RI/FS database under this station designation.

\*\*\* Conductivity analysis will also be conducted on all samples. WLOI and TOC analyses will be conducted on the designated samples approximately once every five events (approximately once per week during the five week program). TOC analyses will be performed on separate aliquots of the same samples analyzed for WLOI.

Tributary stations 0011 and 0012 will be sampled from the same location as currently in use (i.e., for water column transect sampling). Tributary stations 0023 and 0024 will be established based on field reconnaissance prior to the onset of sampling. Exact locations of Thompson Island Pool stations 0022 and 0025 will be field determined, based on accessibility.



