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PCB Content of Sediments Collected at Manistique Harbor, Michigan

by Karl Gustavson

SUMMARY: Sediments at the Manistique River and Harbor Great Lakes Area of Concern (AOC) were analyzed to evaluate the influence of wood waste on polychlorinated biphenyl (PCB) content in sediment. Sediments were fractionated by density and size to isolate the wood waste, fine organic, and mineral fractions of the sediment. Results showed that the primary repository of PCBs was the coarse wood waste fraction. This suggests that the wood waste is a target for remediation and helps explain the observation of sporadic, high concentrations seen in previous site sampling. The origins of the wood waste material and the location and length of the association between the contamination and the wood warrants further investigation.

INTRODUCTION: Sediments at the Manistique River and Harbor Great Lakes AOC are contaminated with PCBs from historical discharges by industrial operations. Besides contamination, harbor sediments also contain substantial wood waste ranging from degraded sawdust to slab wood resulting from historical logging and milling operations. Fish collected at the site have elevated levels of PCBs, indicating bioaccumulation of contaminants from the sediment. The influence of the wood waste on PCB dynamics is unclear, but the waste is a potentially significant feature considering the propensity of carbon-rich matrices to sorb and accumulate PCBs. Understanding the dynamics between PCBs and wood waste will inform the conceptual site model of PCB contamination, and identify whether wood waste represents an important target for remediation in the harbor.

The wood waste material needs to be separated from the sample to evaluate the PCB concentration. Mineral fractions have a density close to 2.65 g/cm^3 , while organic fractions have a density closer to 1.5 g/cm^3 . Therefore, a density fractionation is useful for separating the organic, “light” constituents from inorganic (or mineral) “heavy” constituents (Arnarson and Keil 2001, Ghosh et al. 2000). Further size fractionation of the light, organic fraction can effectively separate the coarse wood waste material from the fine fraction. In this study, density and size fractionation techniques were used in conjunction with contaminant and organic content analysis to evaluate distribution of PCBs among the fractions in samples from the Manistique Harbor.

OBJECTIVE: The objective of this study was to evaluate the influence of wood waste on the concentration of PCBs in sediment.

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METHODS

Sampling. Sediments were sampled by the U.S. Army Corps of Engineers (USACE) Detroit District (USACE-LRE) in October 2011, a year after dredging the navigation channel in the harbor. As described in USACE-LRE (2011), sediment samples were collected using Vibracore sampling equipment. A solid rod was used to determine the soft sediment thickness by pushing the rod into the sediment. The Vibracore sampling equipment was then used to collect a sample for analysis. Large amounts of wood waste material were obvious in some of the samples (e.g., Figure 1). Where there were layers of sediment or wood chips, the core was split into multiple samples based on those layers.



Figure 1. Representative core containing wood waste
(Photo from USACE-LRE).

Sample selection. PCB and organic carbon results from the USACE sampling were used to select samples for this analysis. Four subsets of samples were selected that generally corresponded with high PCB/high organic carbon (OC), high PCB/low OC, low PCB/high OC, and low PCB-low OC values. Absolute thresholds were not used to establish “high” or “low” OC or PCB because of the variation in results. For example, since PCBs are typically associated with OC, when present, the low OC/high PCB samples had lower relative PCB values than high OC/high PCB samples. Sample designations and characteristics are presented in Table 1. Sampling locations are presented in Figure 2.

Density and size separation. Samples were sent to the U.S. Army Engineer Research and Development Center (ERDC) in Vicksburg, Mississippi to undergo size and density fractionation. A sodium polytungstate (SPT) solution (Sigma Aldrich, 80% solution in water; sp.gr. 2.89, diluted with water to a density of 2.0 g/ml) was used as a heavy medium to achieve density separation. Oversize material, $>1/4$ in., was first removed by sieving. The $<1/4$ -in. sediment fraction was placed in a 500-ml centrifuge bottle with sufficient SPT to allow space between the light organic fraction (floats) and heavy mineral fraction (sinks). The sample and media were mixed, sonicated to allow separation of individual particles, and then centrifuged to

Table 1. Characteristics of selected samples.				
PCB/Organic Carbon	Location	Sample Designation	Total Organic Carbon (ppb)	Total PCB ¹ (ppb)
Low/High	B7A	019C	380,000	<25.3
Low/High	B8A	043A	93,000	<22.0
Low/High	D4A	016A	170,000	251
High/High	F3A	084C	230,000	33200
High/High	F4A	087C	190,000	11400
High/High	E6A	064C	110,000	9450
High/High	C8C	033C	140,000	6440
High/Low	E5A	062C	96,000 ²	1810
High/Low	B4	007A	34,000	1740
High/Low	D6	031C	3,800	1060
Low/Low	E2B	058C	790	29.4
Low/Low	B14B	020C	960	12.9

¹ Sum of Aroclors analyzed with Method 8082.

²A transcription error in the lab report listed this sample as 58 ppb total organic carbon (TOC), which is why it was selected as a “low” TOC sample. The corrected value is reported here.

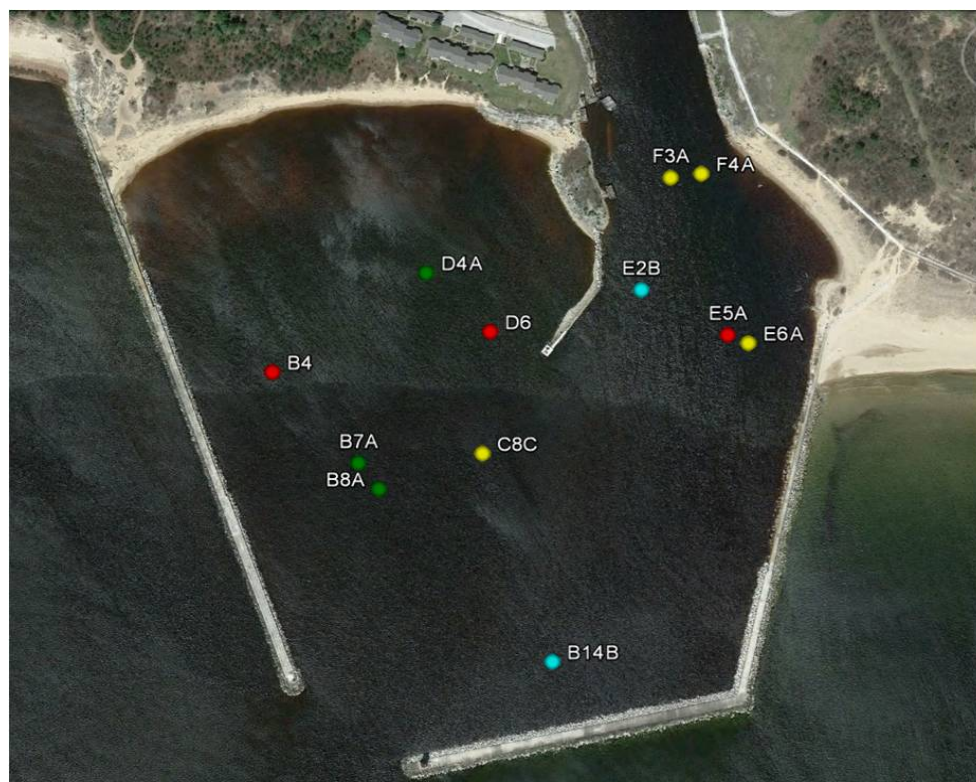


Figure 2. Sample locations (imagery from Google Earth). Colors are those used in Table 1.

achieve clear separation. The float fraction was carefully removed using a wire screen scoop. The remaining sinks and SPT were re-mixed, sonicated, and centrifuged again to separate any additional floats that may have been trapped. The float fraction was placed onto a 425-um sieve

where it was subsequently rinsed with water to remove fines and SPT (<2.0 SG, >425 μm). The fine organic fraction (<2.0 SG, <425 μm) passing through the sieve was captured on a 0.45 - μm membrane and rinsed. Water was added to the sink fraction remaining in the centrifuge bottle, then mixed, centrifuged and decanted. That process was repeated to remove SPT prior to collecting the >2.0 SG sample for analysis. The full procedure is provided in Appendix A. A representative photograph of the density fractionation is shown in Figure 3. As described in an earlier report (US Army Engineer Research and Development Center (ERDC) 2012), a size cutoff of 425 μm (the size of medium sand) was used to separate wood-waste constituents from fine organic constituents.

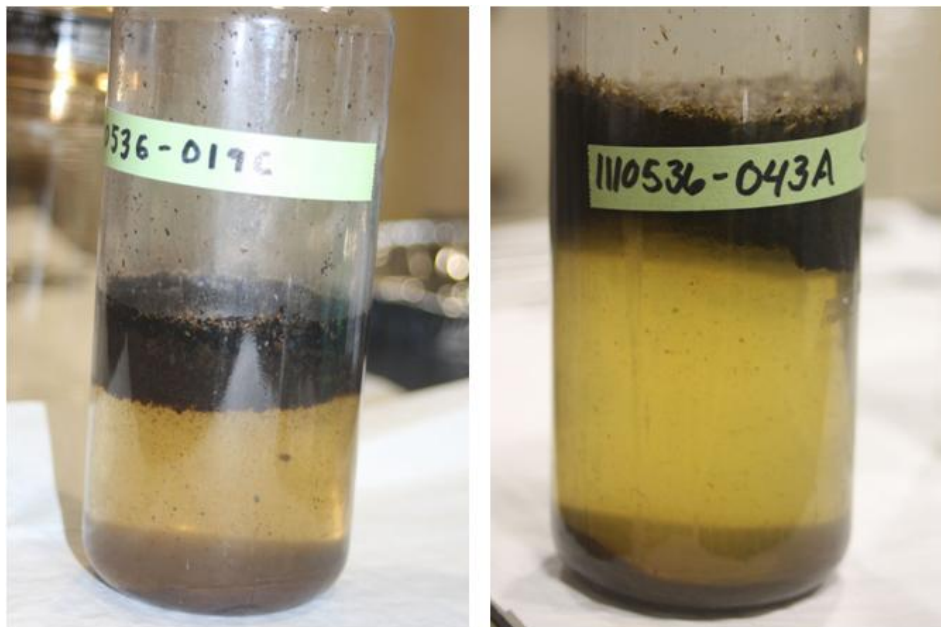


Figure 3. Fractionation of heavy, mineral fraction (bottom layer) from light, organic fraction (top layer).

Organic matter. The samples were dried at 105 $^{\circ}\text{C}$ to determine water content and then dried further at 180 $^{\circ}\text{C}$ to remove water bound to the wood and mineral materials and yield the dry solids content. Thermal gravimetric analysis was then used to assess the proportions of volatile solids lost at 350 $^{\circ}\text{C}$ (presumably “soft” carbon) and at 650 $^{\circ}\text{C}$ (presumably “hard” carbon) in the various fractions. The combined fraction lost upon ignition (i.e., the sum of the soft and hard carbon) represents the total organic matter.

Contaminant analysis. Fractions were shipped to RTI laboratories (via overnight courier to Livonia, Michigan) for the analysis of 26 PCB congeners (Table 2) using EPA Method 8082 (see Appendix B for a full description of chemistry). Some fractions had a smaller-than-typical mass available for extraction and analysis. For those samples, the detection limits were elevated accordingly (See Appendix B). Total PCBs are presented as the sum of the congener concentrations (non-detects were treated as zero). It should be noted that the Total PCBs shown in Table 1 (used to select samples for this study) are the sum of Aroclor values, which are not directly comparable to the sum of congeners presented in this report.

Table 2. Analyzed PCB congeners.		
Congener	IUPAC Number	Synonym
2,4'-Dichlorobiphenyl	IUPAC 8	2,4'-DiCB
2,2',5-Trichlorobiphenyl	IUPAC 18	2,2',5-TrCB
2,4,4'-Trichlorobiphenyl	IUPAC 28	2,4,4'-TrCB
2,2',3,5'-Tetrachlorobiphenyl	IUPAC 44	2,2',3,5'-TeCB
2,2',4,5'-Tetrachlorobiphenyl	IUPAC 49	2,2',4,5'-TeCB
2,2',5,5'-Tetrachlorobiphenyl	IUPAC 52	2,2',5,5'-TeCB
2,3',4,4'-Tetrachlorobiphenyl	IUPAC 66	2,3',4,4'-TeCB
3,3',4,4'-Tetrachlorobiphenyl	IUPAC 77	3,3',4,4'-TeCB
2,2',3,4,5'-Pentachlorobiphenyl	IUPAC 87	2,2',3,4,5'-PeCB
2,2',4,5,5'-Pentachlorobiphenyl	IUPAC 101	2,2',4,5,5'-PeCB
2,3,3',4,4'-Pentachlorobiphenyl	IUPAC 105	2,3,3',4,4'-PeCB
2,3,3',4',6-Pentachlorobiphenyl	IUPAC 110	2,3,3',4',6-PeCB
2,3',4,4',5-Pentachlorobiphenyl	IUPAC 118	2,3',4,4',5-PeCB
3,3',4,4',5-Pentachlorobiphenyl	IUPAC 126	3,3',4,4',5-PeCB
2,2',3,3',4,4'-Hexachlorobiphenyl	IUPAC 128	2,2',3,3',4,4'-HxCB
2,2',3,4,4',5'-Hexachlorobiphenyl	IUPAC 138	2,2',3,4,4',5'-HxCB
2,2',4,4',5,5'-Hexachlorobiphenyl	IUPAC 153	2,2',4,4',5,5'-HxCB
3,3',4,4',5,5'-Hexachlorobiphenyl	IUPAC 169	3,3',4,4',5,5'-HxCB
2,2',3,3',4,4',5-Heptachlorobiphenyl	IUPAC 170	2,2',3,3',4,4',5-HpCB
2,2',3,4,4',5,5'-Heptachlorobiphenyl	IUPAC 180	2,2',3,4,4',5,5'-HpCB
2,2',3,4,4',5',6-Heptachlorobiphenyl	IUPAC 183	2,2',3,4,4',5',6-HpCB
2,2',3,4,4',6,6'-Heptachlorobiphenyl	IUPAC 184	2,2',3,4,4',6,6'-HpCB
2,2',3,4',5,5',6-Heptachlorobiphenyl	IUPAC 187	2,2',3,4',5,5',6-HpCB
2,2',3,3',4,4',5,6-Octachlorobiphenyl	IUPAC 195	2,2',3,3',4,4',5,6-OcCB
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	IUPAC 206	2,2',3,3',4,4',5,5',6-NoCB
Decachlorobiphenyl	IUPAC 209	DeCB

RESULTS

Sediment fractionation. As seen in Figure 3, the SPT fractionation technique was successful at separating sediment components based on the density. Figure 4 presents the relative proportions (by mass) of the fractions in each sample (i.e., heavy, mineral fraction, >2.0 specific gravity [SG]; coarse organic fraction <2.0 SG, >425 μM ; and the fine organic fraction <2.0 SG, <425 μM). Not surprisingly, the heavy mineral fraction comprises the majority of the mass in most samples. However, the mass of organic matter nears or exceeds 50% in several of the “high OC” samples (even with a density approximately half that of the mineral fraction).

Total organic matter values of the bulk sediment are presented in Table 3. Figure 5 shows the percent organic matter for all fractions in each sample. As expected, the >2.0 SG fraction has very low organic matter content. The organic matter content of the <2.0 SG fraction is substantially greater, indicating effective separation of the organic from inorganic constituents by the density fractionation. Note that the <2.0 SG, >425 μM fraction organic matter contents range from 45-70% organic matter. These values are likely underestimated – the lower values in particular should be higher. These coarse, organic fractions clearly consisted of organic matter and the expected values are approximately 90% or greater. Upon drying, these fractions were a

yellowish color (the color associated with the SPT solution), indicating that the rinsing of the fraction to remove the polytungstate solution (a dense salt) was incomplete. The presence of polytungstate would interfere with the gravimetric analysis by contributing a non-volatile mass to the dried and combusted masses (ash fraction), biasing the fraction organic matter values low. However, all fractions would be subject to this process, lessening the impact of the incomplete rinsing. Overall, the lower-than-expected organic matter values do not affect the conclusions of this analysis and still indicate that, as expected, the light fractions were substantially enriched with organic matter. However, the issue limits the ability to normalize PCB concentrations on an organic matter basis.

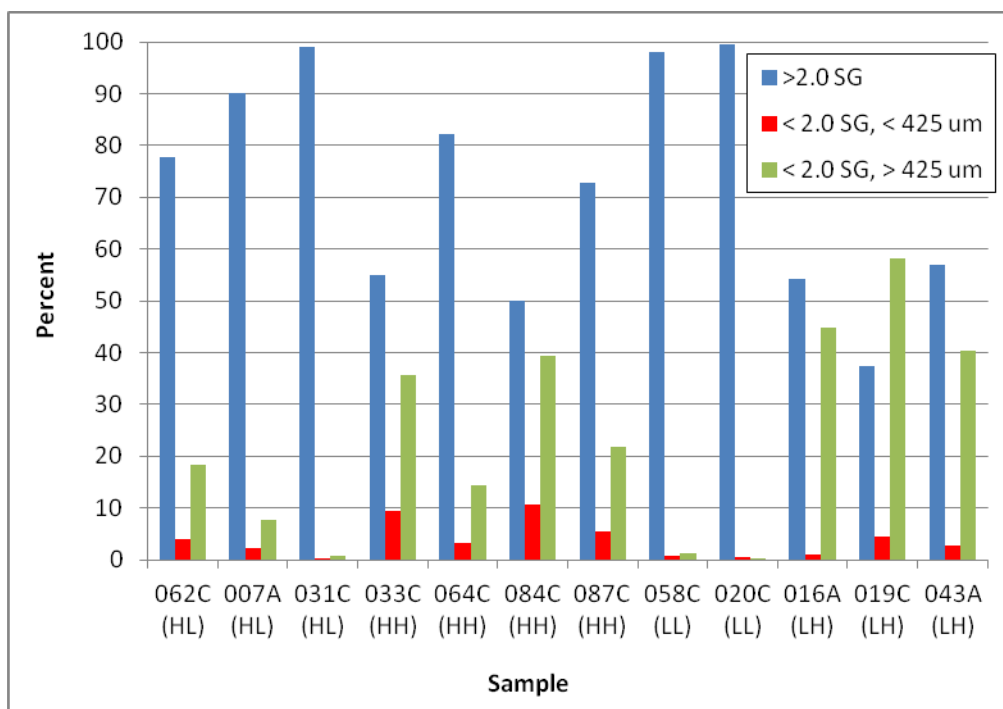


Figure 4. Percent (by mass) of each fraction.

Table 3. Total organic matter of bulk (non-fractionated) sediment samples.	
Sample	Organic Matter (Percent)
016A (LH)	23.6
019C (LH)	83.1
043A (LH)	40.2
033C (HH)	30.7
064C (HH)	13.7
084C (HH)	29.8
087C (HH)	18.4
062C (HL)	8.5
007A (HL)	7.1
031C (HL)	1.1
058C (LL)	0.7
020C (LL)	0.8

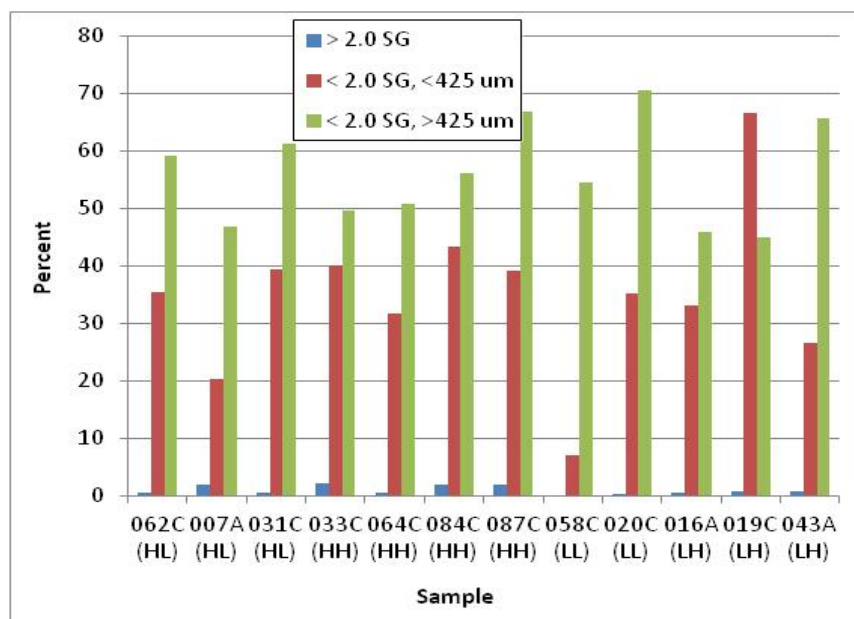


Figure 5. Percent organic matter in fractions of analyzed samples.

Contaminant analysis of sediment fractions. The PCB content of the fractions is depicted in Figures 6a and 6b below. The “low” and “high” PCB content samples are presented in separate figures with different y-axis scales.

As expected, results indicate that the heavy mineral fraction contains minimal PCB, while the light organic fraction is much enriched. Within the light organic fraction, the coarse particulates were preferentially enriched with PCB. Of the seven “high” PCB samples, six had the highest concentrations in the coarse fraction, and these were often several fold higher. The “low PCB/low OC” samples also had highest concentrations in the coarse fraction. Interestingly, the “low PCB/high OC” samples possessed greater PCB concentration in the fine organic fraction than the coarse organic fraction (although these samples were comparatively quite low in contamination). The coarse fractions from two of the three samples were below 2 ppb PCB, indicating the presence of a clean coarse fraction in the system.

The percent of the PCB in each fraction (based on the sum of all fractions) is examined further in Figure 7. This figure presents data from the eight sediments with the highest concentration (i.e., >250 ppb PCB in bulk sediment; two non-detects and two samples below 30 ppb were not included). On average, the coarse fraction contains 84% of a sample’s PCB.¹ This finding is important from a remediation perspective (where repositories of PCB in the system are targeted), as it indicates the importance of contaminated wood waste as both a remediation target and a mechanism for PCB transport throughout (and out of) the system.

¹ This is an approximation due to incomplete rinsing of the SPT from the fractions. The residual SPT inflates the mass multiplied by the PCB concentration used to obtain the percent PCB in a fraction; however, the mass of all the fractions would be biased in the same direction, thus minimizing the influence on the final result (SPT would have added mass to each of the fractions). The exact influence of this issue is unknown, but a worst-case assumption is that the wood fraction *should* be 90% organic matter. If that is true, then the maximum over-estimate is two-fold; typically less. Based on this discussion, the overall conclusion that the wood waste contains the highest mass of PCB remains valid.

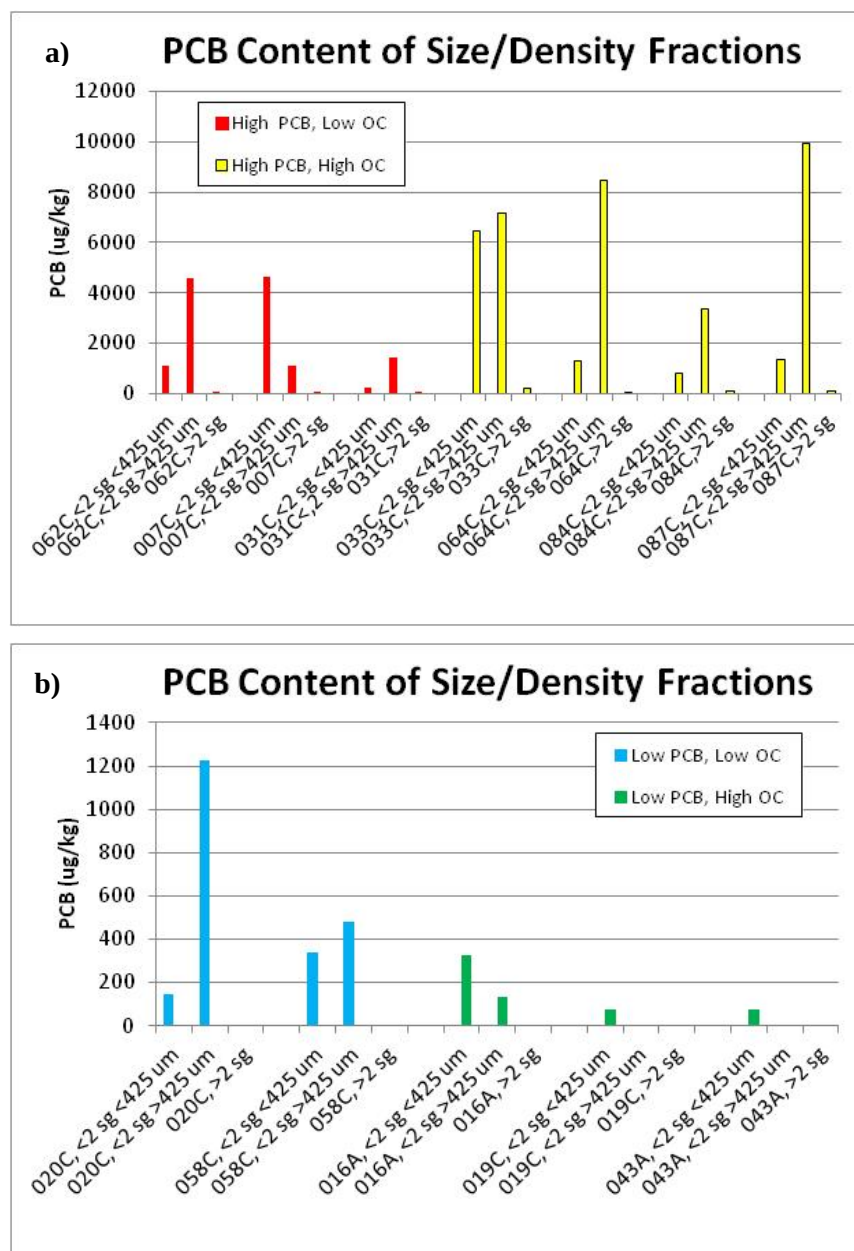


Figure 6. PCB content of the "High" (a) and "Low" (b) PCB content samples.

As shown previously (ERDC 2012), the elevated PCB concentration in the coarse, woody fraction is likely a function of the high carbon content of the wood waste rather than, for example, preferential partitioning to wood waste compared to other forms of carbon. Based on equilibrium partitioning of PCBs to carbon, this is expected.

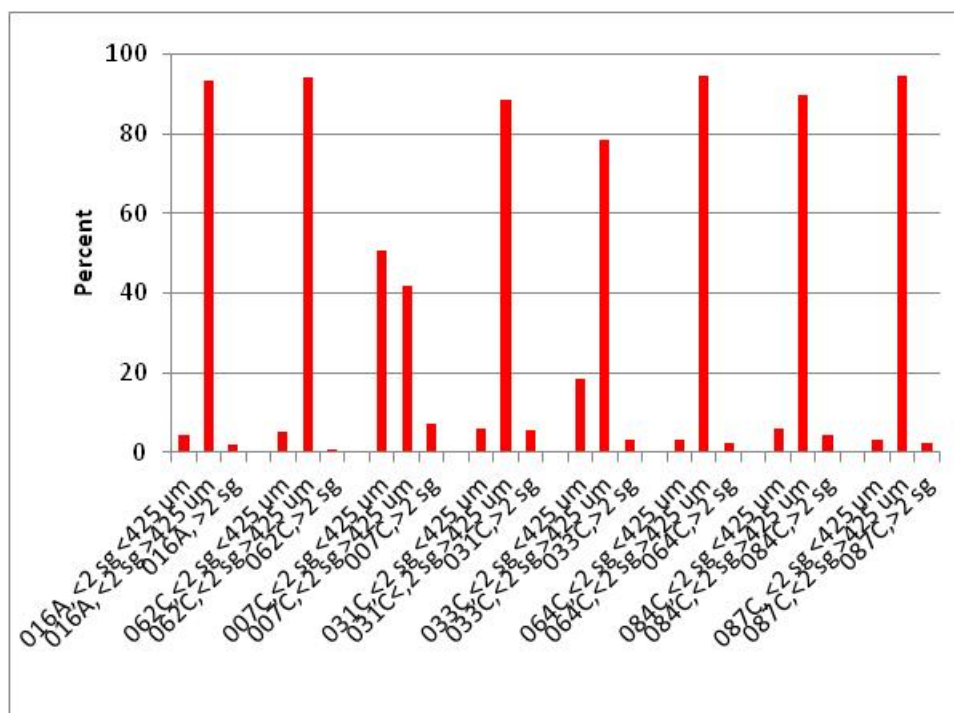


Figure 7. Percent of PCB mass in each fraction from sediment samples with PCB concentrations greater than 250 ppb.

DISCUSSION: Results show that organic fractions can be effectively separated from mineral fractions for analysis at the lab scale. When the organic fraction of contaminated samples is separated by size into a coarse and fine fraction, the primary repository of the PCBs is the coarse, wood waste fraction. This suggests that the wood waste is a target for remediation. The observation of relatively high contamination in the wood waste helps explain the generally low-level, but sporadic, high concentrations found in sampling at the site. This analysis suggests that the high-concentration samples have contaminated wood waste. However, it is not universally true that wood waste is contaminated, as evidenced by the “Low PCB/High OC” samples, where the wood fraction has very low levels of PCB contamination. The environmental processes driving this dichotomy are unclear (i.e., Are there two populations of woody materials? Where do they reside and originate? Are they distinct or intermixed?). Contaminated and uncontaminated wood waste materials appear to be coarse sawdust with no visible differences noted by lab personnel. Questions remain as to whether the sawdust is historical (from the logging era of the late 1800s) or more recent. The location of the contamination and the length of the association between the contamination and wood are not known (i.e., From where has the wood accumulated PCB? Over what time frame?). These questions warrant further investigation.

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Appendix A: Density Fractionation Procedure

Manistique Harbor, MI - Wood Waste Study, Density Fractionation and Analysis

Susan Bailey, x 3932

Samples for analysis:

1110536	062C	1110686	033C	1110536	058C	1110536	016A
1110536	007A	1110536	064C	1110686	020C	1110536	019C
1110686	031C	1110536	084C			1110536	043A
		1110536	087C				

HL	High PCB. Low OC
HH	High PCB, High OC
LL	Low PCB, Low OC
LH	Low PCB, High OC

For each sample:**1. Bulk Samples - Remove > 1/4" fraction**

- 1a. Weigh sample container with sample A _____ g container + sediment
- 1b. Place sample onto 1/4" sieve; weigh empty container B _____ g empty container
- 1c. Sieve through 1/4" sieve to remove clumps, adding as little water as possible.
- If possible, sieve directly into centrifuge bottle that will be used in Step 4. Obtain empty weight of bottle, recorded in **F**.
 - Describe and photograph > 1/4" material (i.e. woody, coal, gravel, etc.)
 - Retain > 1/4", weigh. C _____ g > 1/4" sample (wet weight)
 - Dry > 1/4" material at 105°C and re-weigh. D _____ g > 1/4" sample (dry weight)

2. Homogenize bulk < 1/4" sample

- 2a. Centrifuge < 1/4" slurry from sieving. Pour off clear supernatant into water container that will later be analyzed for PCBs.
- 2b. Obtain mass of wet < 1/4" sample. E _____ g container + sediment
- F _____ g empty container
- 2c. Homogenize < 1/4" sample. This may be done with a spatula.
- 2d. Take a small subsample for water content analysis, ~~and a small subsample (<50 g) for potential analysis.~~ G _____ % % water content
- 2e. Weigh the remaining sample that will be used for density separation.
- Weigh mixing bowl (or whatever container the sample is in) with material. I* _____ g container + sediment
 - After placing sample in the centrifuge bottle (Step 3 below) weigh empty bowl. H* _____ g empty container
 - * Preferentially, the material will be sieved directly into the centrifuge bottle used in step 4, thus these will be the same weights as in step 4.

3. Prepare Sodium Polytungstate Solution

- 3a. ***Prior to working with sodium polytungstate, read safety information below.
- 3b. Prepare bulk sodium polytungstate solution in 1 - 2 liter batches by mixing with DDI as per the following ratio:
- Mass_{total} = Mass_{SPT-2.89} * (0.8180/0.625) or - Mass_{water} = Mass_{SPT-2.89} * (0.8180/0.625 - 1)

4. Density fractionation

- 4a. For each of the 12 samples separate the organic and mineral fractions using sink-swim density separation procedure at SG 2.0.
- 4b. Weigh empty 500-ml polycarbonate (PC) centrifuge bottle. Place bulk sediment (from Step 1c) into centrifuge bottle.
- Note multiple centrifuge bottles may be needed if there is a large volume of sediment. Record individual weights for each bottle separately.
- Record weight of: empty bottle, bottle + sediment. H _____ g empty centrifuge bottle
- 4c. Calculate weight of SPT_{2.89} to add to account for water in the sample. I _____ g centrifuge bottle + sediment
- $J \text{ _____ g} = (3.23834) (I - H) / (1 + 100/G)$ (see Sheet "Density")
- 4d. Add SPT (SG = 2.89) to sample in centrifuge bottle; record weight of SPT added.
- 4e. Add SPT (SG = 2.0) to centrifuge bottle; should be sufficient volume to achieve a clear separation between sinks and floats.
- 4f. Density separation
- Shake sample in order to suspend the solids. (May need to place on a shaker table for a period of time.)
 - Sonicate sample in sonication bath for 10 min in order to break up macro- and micro-aggregates.
 - Centrifuge sample at 40,000 rcf for 20 min. Check to see if clear separation between sinks/floats.
 - Pour supernatant containing floats (lights) onto a 0.5 um membrane filter (PTFE, Millipore); rinse thoroughly with DDI.
 - Add more SPT (SG=2) if necessary.
 - Repeat steps 4e - 4f until no floats are apparent in the supernatant.
- 4g. Place rinsed, filtered floats into sample jar; Record weight of empty jar and weight of jar and floats. K _____ g empty jar
- Note that if the sample is being stored for later processing via Step 5, then place sample into an appropriate glass jar and store at 4°C; otherwise, obtain a weight (placing sample in a weigh dish or other container and proceed to Step 5. L _____ g jar + floats
- 4h. Remove sinks (heavy fraction, > 2.0 SG)
- Add DDI water to the sinks in the centrifuge bottle
 - Shake as necessary to suspend solids
 - Centrifuge sample at 40,000 rcf for 20 min. Decant supernatant as waste.
 - Repeat addition of water, shaking and centrifuging at least 3 times to thoroughly rinse sample.
- 4i. Place rinsed, centrifuged sinks into sample jar; Record weight of empty jar and weight of jar and sinks. M _____ g empty jar
- (Label as Manistique, *Sample name* - >2.0 SG, *Date*) N _____ g jar + sinks

4j. Take water content and organic of sinks (as shown in Step 6a).

Store sample in appropriate glass jar at 40C until further analysis.

O _____ %

water content sinks
(Use sheet "Density" to record water content data)

5. Size fractionation (wet sieve)

5a. For each of the 12 light samples (floats, <2.0 SG), wet sieve the samples through the 425 um sieve, to separate "small light" from "large light" fractions

- Weigh bulk sediment (done in step 4g above)
- Wet sieve: place sample on sieve, use tap water as necessary (but sparingly) to wash undersize material through the sieve.
- Obtain fractions, filtering or decanting (clear) excess water as necessary

5b. For >425 um sample, rinse the coarse organic off the sieve into a pan. Drain off clear water, without losing solids.

- Weigh sample. This can be done by either transferring the material to a preweighed or tared container, or by weighing it in the existing container and subtracting container weight.
- Ensure sample is homogenized; take subsamples, including water content as specified below in Step 6a.

P _____ g

empty jar

Q _____ g

jar + <2.0 SG, >425 um

5c. For < 425 um sample, as excess water may not be clear, the slurry may have to be centrifuged.

- If sample water is clear, then process as in 5b: drain off water, weigh sample, homogenize sample, subsample as in Step 5a. Otherwise centrifuge as follows:
- Weigh each empty centrifuge bottle that will be used.
- Place slurry in centrifuge bottle. Note opposite centrifuge bottles (of different samples) will require balanced weights.
- Centrifuge for a sufficient time as to obtain a clear supernatant.
- Decant (and dispose) clear supernatant. Refill centrifuge bottle with additional slurry. Centrifuge again.
- Continue to centrifuge, decant and refill until all slurry has been centrifuged. At this point all the < 425 um solids should be captured in the centrifuge bottle, with little free water.
- Weigh centrifuge bottle and sample in order to obtain the (wet) weight of < 425 um solids.
- Either homogenize the sample inside the centrifuge bottle, or remove it to another container to be homogenized.
- Take subsamples including water content as specified below in Step 6a.

R _____ g

empty jar

S _____ g

jar + <2.0 SG, < 425 um

6. Analysis

6a. Sample and analyze each fraction as per table below.

- All samples should be stored in glass containers and maintained at 4 degree C until analysis.

Analysis	Bulk < 1/4"	> 2.0 SG	<2.0 SG, >425um	<2.0 SG, < 425 um	Take to
PCB cong. TOC	4 oz	4 oz	4 oz	4 oz	Contract Lab
Organic Water Cont.	~ 50 g	~ 50 g	~ 50 g	~ 50 g	EP-E

Safety and Laboratory Considerations:

A. SPT Handling

Sodium Polytungstate (SPT), $3\text{Na}_2\cdot\text{WO}_4\cdot\text{WO}_3\cdot\text{H}_2\text{O}$, (chemical name sodium metatungstate) is generally considered non hazardous.

The MSDS sheets should however be consulted before working with SPT. A few important items are listed here.

1. Avoid inhalation of SPT dust. Wear a dust mask or respirator when working with the powder. In case of inhalation, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.
2. Detrimental to health when swallowed. If swallowed, wash mouth out with water provided person is conscious. Drink plenty of water. Induce vomiting.
3. In case of contact with skin, immediately flush with soap and copious amounts of water.
4. In case of contact with eyes, immediately flush eyes, keeping the eyelids open, with copious amounts of water for at least 15 minutes. Call a physician.
5. In case of spill, wet powder with water or absorb on sand or vermiculite. Place material in closed, labeled containers for disposal. Wash spill site after material pickup. Ventilate area.
6. Store in cool dry place at room temperature in closed original containers. Subject to dust explosions.
7. Solution decomposes at 175°F. Sodium oxide fumes can occur upon decomposition.
8. Incompatible with strong oxidizing agents.
9. Tungsten may react with some fluoride compounds and lead dioxide.

A. Dilution of SPT to desired density

Solution	DENSITY (g/ml)	SPT (Grams)	H ₂ O (ml)	M _{SPT} /M _{H₂O}
1000	2	1250	750	1.6666667

Appendix B: Chemistry Report



RTI Laboratories
31628 Glendale St.
Livonia, MI 48150
TEL: (734) 422-8000
Website: www.rtilab.com

Thursday, January 24, 2013

Pam Horner
USACE- Detroit District
Environmental Analysis Branch
Detroit District, 477 Michigan Ave.
Detroit, MI 48150-1827
TEL: (313) 226-6748
FAX:

RE: Manistique Harbor 0004

Work Order #: 1211282

Dear Pam Horner:

RTI Laboratories received 18 sample(s) on 11/7/2012 for the analyses presented in the following report. There were no problems with the analytical events associated with this report unless noted in the Case Narrative.

This report may only be reproduced in its entirety. Individual pages, reproduced without supporting documentation, do not contain related information and may be misinterpreted by other data reviewers.

Quality control data is within laboratory defined or method specified acceptance limits except if noted.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

A handwritten signature in black ink that reads "Fred J. Hoitash". The signature is written in a cursive style with a large, stylized "F" and "H".

Fred J Hoitash
Director, Environmental Sciences

CC:
Amanda McCallister

RTI Laboratories - Workorder Sample Summary

WO#: 1211282

Date Reported: 1/24/2013
Original

Client: USACE- Detroit District
Project: Manistique Harbor 0004

Lab Sample ID	Client Sample ID	Tag No	Date Collected	Date Received	Matrix
1211282-001A	087C, >2 sg		11/7/2012 1:16 PM	11/7/2012 1:15 PM	Solid
1211282-002A	087C, <2 sg >425 um		11/7/2012 1:16 PM	11/7/2012 1:15 PM	Solid
1211282-003A	087C, <2 sg <425 um		11/7/2012 1:16 PM	11/7/2012 1:15 PM	Solid
1211282-004A	058C, >2 sg		11/7/2012 1:16 PM	11/7/2012 1:15 PM	Solid
1211282-005A	058C, <2 sg >425 um		11/7/2012 1:16 PM	11/7/2012 1:15 PM	Solid
1211282-006A	058C, <2 sg <425 um		11/7/2012 1:16 PM	11/7/2012 1:15 PM	Solid
1211282-007A	020C, >2 sg		11/7/2012 1:16 PM	11/7/2012 1:15 PM	Solid
1211282-008A	020C, <2 sg >425 um		11/7/2012 1:16 PM	11/7/2012 1:15 PM	Solid
1211282-009A	020C, <2 sg <425 um		11/7/2012 1:16 PM	11/7/2012 1:15 PM	Solid
1211282-010A	016A, >2 sg		11/7/2012 1:16 PM	11/7/2012 1:15 PM	Solid
1211282-011A	016A, <2 sg >425 um		11/7/2012 1:16 PM	11/7/2012 1:15 PM	Solid
1211282-012A	016A, <2 sg <425 um		11/7/2012 1:16 PM	11/7/2012 1:15 PM	Solid
1211282-013A	019C, >2 sg		11/7/2012 1:16 PM	11/7/2012 1:15 PM	Solid
1211282-014A	019C, <2 sg >425 um		11/7/2012 1:16 PM	11/7/2012 1:15 PM	Solid
1211282-015A	019C, <2 sg <425 um		11/7/2012 1:16 PM	11/7/2012 1:15 PM	Solid
1211282-016A	043A, >2 sg		11/7/2012 1:16 PM	11/7/2012 1:15 PM	Solid
1211282-017A	043A, <2 sg >425 um		11/7/2012 1:16 PM	11/7/2012 1:15 PM	Solid
1211282-018A	043A, <2 sg <425 um		11/7/2012 1:16 PM	11/7/2012 1:15 PM	Solid

Client: USACE- Detroit District**Project:** Manistique Harbor 0004

Concentrations reported with a J flag in the Qual field are values below the reporting limit (RL) but greater than the established method detection limit (MDL). There is greater uncertainty associated with these results and data should be considered as estimated. These analytes are not routinely reviewed nor narrated below as to their potential for being laboratory artifacts.

Concentrations reported with an E flag in the Qual field are values that exceed the upper quantification range. There is greater uncertainty associated with these results and data should be considered as estimated.

Any comments or problems with the analytical events associated with this report are noted below.

Prep Comments for SW_3550CON, Sample 1211282-015A: Sonication done in sample jar
Prep Comments for SW_3550CON, Sample 1211282-013A: Sonication done in sample jar
Prep Comments for SW_3550CON, Sample 1211282-012A: Sonication done in sample jar
Prep Comments for SW_3550CON, Sample 1211282-009A: Sonication done in sample jar
Prep Comments for SW_3550CON, Sample 1211282-008A: Sonication done in sample jar/ Very limited sample.
Prep Comments for SW_3550CON, Sample 1211282-006A: Sonication done in sample jar
Prep Comments for SW_3550CON, Sample 1211282-005A: Sonication done in sample jar

Analytical Comments for METHOD SW_8082S-CON , SAMPLE 1211282-001A, Batch ID 28649: Second column RPD >40% for IUPAC 28 and IUPAC 66

Analytical Comments for METHOD SW_8082S-CON , SAMPLE 1211282-002A, Batch ID 28649: Second column RPD >40% for IUPAC 28, IUPAC 153 and IUPAC 183

Analytical Comments for METHOD SW_8082S-CON , SAMPLE 1211282-003A, Batch ID 28649: Second column RPD >40% for IUPAC 28 and IUPAC 180

Analytical Comments for METHOD SW_8082S-CON , SAMPLE 1211282-004A, Batch ID 28649: Second column RPD >40% for IUPAC 28

Analytical Comments for METHOD SW_8082S-CON , SAMPLE 1211282-005A, Batch ID 28649: Second column RPD >40% for IUPAC 28 and IUPAC 52

Analytical Comments for METHOD SW_8082S-CON , SAMPLE 1211282-006A, Batch ID 28649: Second column RPD >40% for IUPAC 31, IUPAC 66, IUPAC 87 and IUPAC 101

Analytical Comments for METHOD SW_8082S-CON , SAMPLE 1211282-008A, Batch ID 28649: Second column RPD >40% for IUPAC 31 and IUPAC 101

Analytical Comments for METHOD SW_8082S-CON , SAMPLE 1211282-009A, Batch ID 28649: Second column RPD >40% for IUPAC 28

Analytical Comments for METHOD SW_8082S-CON , SAMPLE 1211282-010A, Batch ID 28649: Second column RPD >40% for IUPAC 8, IUPAC 87 and IUPAC 101

Analytical Comments for METHOD SW_8082S-CON , SAMPLE 1211282-011A, Batch ID 28649: Second column RPD >40% for IUPAC 28, IUPAC 66 and IUPAC 153

Analytical Comments for METHOD SW_8082S-CON , SAMPLE 1211282-012A, Batch ID 28649: Second column RPD >40% for IUPAC 118

Analytical Comments for METHOD SW_8082S-CON , SAMPLE 1211282-014A, Batch ID 28649: Second column RPD >40% for IUPAC 49 and IUPAC 52

Analytical Comments for METHOD SW_8082S-CON , SAMPLE 1211282-015A, Batch ID 28649: Second column RPD >40% for IUPAC 8, IUPAC 49 and IUPAC 52

Analytical Comments for METHOD SW_8082S-CON , SAMPLE 1211282-016A, Batch ID 28649: Second column RPD >40% for IUPAC 8

Analytical Comments for METHOD SW_8082S-CON , SAMPLE 1211282-017A, Batch ID 28649: Second column RPD >40% for IUPAC 49

Analytical Comments for METHOD SW_8082S-CON , SAMPLE 1211282-018A, Batch ID 28649: Second column RPD >40% for IUPAC 110

RTI Laboratories - Analytical Report

WO#: 1211282

Date Reported: 1/24/2013

Original

Client: USACE- Detroit District
 Project: Manistique Harbor 0004
 Lab ID: 1211282-001
 Client Sample ID: 087C,>2 sg

Collection Date: 11/7/2012 1:16:52 PM

Matrix: Solid

Analysis	Result	Qual	DL	LOD	LOQ	Units	DF	Date Analyzed
Polychlorinated Biphenyl Congeners			Method: SW8082		SW3550C		Analyst: cr	
2,2',3,3',4,4',5,5',6-NoCB	0	U	0.097	0	1.1	µg/Kg	1	1/14/2013 1:58 AM
2,2',3,3',4,4',5,6-OcCB	0	U	0.11	0	1.1	µg/Kg	1	1/14/2013 1:58 AM
2,2',3,3',4,4',5-HpCB	0.38	Jm [DL 1]	0.18	0	2.2	µg/Kg	2	1/17/2013 10:52 PM
2,2',3,3',4,4'-HxCB	0.64	J [DL 1]	0.16	0	2.2	µg/Kg	2	1/17/2013 10:52 PM
2,2',3,4,4',5,5'-HpCB	0.42	J [DL 1]	0.21	0	2.2	µg/Kg	2	1/17/2013 10:52 PM
2,2',3,4,4',5',6-HpCB	0	U	0.16	0	1.1	µg/Kg	1	1/14/2013 1:58 AM
2,2',3,4,4',5'-HxCB	3.2	m [DL 1]	0.20	0	2.2	µg/Kg	2	1/17/2013 10:52 PM
2,2',3,4,4',6,6'-HpCB	0	U	0.13	0	1.1	µg/Kg	1	1/14/2013 1:58 AM
2,2',3,4,5'-PeCB	2.2	[DL 1]	0.19	0	2.2	µg/Kg	2	1/17/2013 10:52 PM
2,2',3,4',5,5',6-HpCB	0.39	Jm [DL 1]	0.31	0	2.2	µg/Kg	2	1/17/2013 10:52 PM
2,2',3,5'-TeCB	5.0	m [DL 1]	0.32	0	2.2	µg/Kg	2	1/17/2013 10:52 PM
2,2',4,4',5,5'-HxCB	3.0	[DL 1]	0.32	0	2.2	µg/Kg	2	1/17/2013 10:52 PM
2,2',4,5,5'-PeCB	4.6	[DL 1]	0.36	0	2.2	µg/Kg	2	1/17/2013 10:52 PM
2,2',4,5'-TeCB	7.5	[DL 1]	0.34	0	2.2	µg/Kg	2	1/17/2013 10:52 PM
2,2',5,5'-TeCB	12	[DL 1]	0.42	0	2.2	µg/Kg	2	1/17/2013 10:52 PM
2,2',5-TrCB	8.5	m [DL 1]	0.37	0	2.2	µg/Kg	2	1/17/2013 10:52 PM
2,3,3',4,4'-PeCB	2.3	[DL 1]	0.20	0	2.2	µg/Kg	2	1/17/2013 10:52 PM
2,3,3',4',6-PeCB	6.3	[DL 1]	0.19	0	2.2	µg/Kg	2	1/17/2013 10:52 PM
2,3',4,4',5-PeCB	3.1	[DL 1]	0.30	0	2.2	µg/Kg	2	1/17/2013 10:52 PM
2,3',4,4'-TeCB	3.8		0.13	0	1.1	µg/Kg	1	1/14/2013 1:58 AM
2,4,4'-TrCB	6.2	[DL 1]	0.16	0	2.2	µg/Kg	2	1/17/2013 10:52 PM
2,4'-DiCB	4.1	[DL 1]	0.51	0	2.2	µg/Kg	2	1/17/2013 10:52 PM
3,3',4,4',5,5'-HxCB	0	U	0.18	0	1.1	µg/Kg	1	1/14/2013 1:58 AM
3,3',4,4',5-PeCB	0	U	0.15	0	1.1	µg/Kg	1	1/14/2013 1:58 AM
3,3',4,4'-TeCB	0	U	0.21	0	1.1	µg/Kg	1	1/14/2013 1:58 AM
DeCB	0	U	0.11	0	1.1	µg/Kg	1	1/14/2013 1:58 AM
Surr: Tetrachloro-m-xylene	78.5	[DL 1]		70-130		%REC	2	1/17/2013 10:52 PM

RTI Laboratories - Analytical Report

WO#: 1211282

Date Reported: 1/24/2013

Original

Client:	USACE- Detroit District	Collection Date:	11/7/2012 1:16:52 PM
Project:	Manistique Harbor 0004		
Lab ID:	1211282-002	Matrix:	Solid
Client Sample ID:	087C,<2 sg >425 um		

Analysis	Result	Qual	DL	LOD	LOQ	Units	DF	Date Analyzed
Polychlorinated Biphenyl Congeners			Method: SW8082		SW3550C		Analyst: cr	
2,2',3,3',4,4',5,5',6-NoCB	3.5	J	0.32	0	3.6	µg/Kg	1	1/14/2013 2:53 AM
2,2',3,3',4,4',5,6-OcCB	3.3	J	0.37	0	3.6	µg/Kg	1	1/14/2013 2:53 AM
2,2',3,3',4,4',5-HpCB	48	Jm [DL 1]	15	0	180	µg/Kg	50	1/17/2013 11:47 PM
2,2',3,3',4,4'-HxCB	110	J [DL 1]	14	0	180	µg/Kg	50	1/17/2013 11:47 PM
2,2',3,4,4',5,5'-HpCB	62	J [DL 1]	17	0	180	µg/Kg	50	1/17/2013 11:47 PM
2,2',3,4,4',5',6-HpCB	37		0.52	0	3.6	µg/Kg	1	1/14/2013 2:53 AM
2,2',3,4,4',5'-HxCB	600	m [DL 1]	17	0	180	µg/Kg	50	1/17/2013 11:47 PM
2,2',3,4,4',6,6'-HpCB	0	U	0.45	0	3.6	µg/Kg	1	1/14/2013 2:53 AM
2,2',3,4,5'-PeCB	450	[DL 1]	16	0	180	µg/Kg	50	1/17/2013 11:47 PM
2,2',3,4',5,5',6-HpCB	37		0.52	0	3.6	µg/Kg	1	1/14/2013 2:53 AM
2,2',3,5'-TeCB	750	m [DL 1]	26	0	180	µg/Kg	50	1/17/2013 11:47 PM
2,2',4,4',5,5'-HxCB	400	[DL 1]	26	0	180	µg/Kg	50	1/17/2013 11:47 PM
2,2',4,5,5'-PeCB	1,400	[DL 1]	30	0	180	µg/Kg	50	1/17/2013 11:47 PM
2,2',4,5'-TeCB	770	[DL 1]	29	0	180	µg/Kg	50	1/17/2013 11:47 PM
2,2',5,5'-TeCB	1,200	[DL 1]	35	0	180	µg/Kg	50	1/17/2013 11:47 PM
2,2',5-TrCB	460	[DL 1]	31	0	180	µg/Kg	50	1/17/2013 11:47 PM
2,3,3',4,4'-PeCB	420	[DL 1]	17	0	180	µg/Kg	50	1/17/2013 11:47 PM
2,3,3',4',6-PeCB	1,100	[DL 1]	16	0	180	µg/Kg	50	1/17/2013 11:47 PM
2,3',4,4',5-PeCB	640	[DL 1]	25	0	180	µg/Kg	50	1/17/2013 11:47 PM
2,3',4,4'-TeCB	610	[DL 1]	21	0	180	µg/Kg	50	1/17/2013 11:47 PM
2,4,4'-TrCB	520	[DL 1]	13	0	180	µg/Kg	50	1/17/2013 11:47 PM
2,4'-DiCB	290	[DL 1]	42	0	180	µg/Kg	50	1/17/2013 11:47 PM
3,3',4,4',5,5'-HxCB	0	U	0.59	0	3.6	µg/Kg	1	1/14/2013 2:53 AM
3,3',4,4',5-PeCB	12		0.49	0	3.6	µg/Kg	1	1/14/2013 2:53 AM
3,3',4,4'-TeCB	0	U	0.71	0	3.6	µg/Kg	1	1/14/2013 2:53 AM
DeCB	0	U	0.38	0	3.6	µg/Kg	1	1/14/2013 2:53 AM
Surr: Tetrachloro-m-xylene	83.3			70-130		%REC	1	1/14/2013 2:53 AM

RTI Laboratories - Analytical Report

WO#: 1211282

Date Reported: 1/24/2013

Original

Client: USACE- Detroit District
Project: Manistique Harbor 0004
Lab ID: 1211282-003
Client Sample ID: 087C, <2 sg <425 um

Collection Date: 11/7/2012 1:16:52 PM

Matrix: Solid

Analysis	Result	Qual	DL	LOD	LOQ	Units	DF	Date Analyzed
Polychlorinated Biphenyl Congeners			Method: SW8082		SW3550C		Analyst: cr	
2,2',3,3',4,4',5,5',6-NoCB	0	U	1.2	0	13	µg/Kg	1	1/14/2013 3:48 AM
2,2',3,3',4,4',5,6-OcCB	0	U	1.3	0	13	µg/Kg	1	1/14/2013 3:48 AM
2,2',3,3',4,4',5-HpCB	9.5	Jm [DL 1]	4.3	0	53	µg/Kg	4	1/18/2013 12:42 AM
2,2',3,3',4,4'-HxCB	5.1	Jm [DL 1]	4.0	0	53	µg/Kg	4	1/18/2013 12:42 AM
2,2',3,4,4',5,5'-HpCB	5.4	J [DL 1]	5.1	0	53	µg/Kg	4	1/18/2013 12:42 AM
2,2',3,4,4',5',6-HpCB	0	U	1.9	0	13	µg/Kg	1	1/14/2013 3:48 AM
2,2',3,4,4',5'-HxCB	31	Jm [DL 1]	4.9	0	53	µg/Kg	4	1/18/2013 12:42 AM
2,2',3,4,4',6,6'-HpCB	0	U	1.6	0	13	µg/Kg	1	1/14/2013 3:48 AM
2,2',3,4,5'-PeCB	37	J [DL 1]	4.6	0	53	µg/Kg	4	1/18/2013 12:42 AM
2,2',3,4',5,5',6-HpCB	0	Um [DL 1]	7.7	0	53	µg/Kg	4	1/18/2013 12:42 AM
2,2',3,5'-TeCB	120	m [DL 1]	7.7	0	53	µg/Kg	4	1/18/2013 12:42 AM
2,2',4,4',5,5'-HxCB	28	J [DL 1]	7.7	0	53	µg/Kg	4	1/18/2013 12:42 AM
2,2',4,5,5'-PeCB	84	[DL 1]	8.8	0	53	µg/Kg	4	1/18/2013 12:42 AM
2,2',4,5'-TeCB	190	[DL 1]	8.4	0	53	µg/Kg	4	1/18/2013 12:42 AM
2,2',5,5'-TeCB	280	[DL 1]	10	0	53	µg/Kg	4	1/18/2013 12:42 AM
2,2',5-TrCB	190	[DL 1]	9.1	0	53	µg/Kg	4	1/18/2013 12:42 AM
2,3,3',4,4'-PeCB	22	Jm [DL 1]	4.9	0	53	µg/Kg	4	1/18/2013 12:42 AM
2,3,3',4',6-PeCB	120	[DL 1]	4.7	0	53	µg/Kg	4	1/18/2013 12:42 AM
2,3',4,4',5-PeCB	34	J [DL 1]	7.3	0	53	µg/Kg	4	1/18/2013 12:42 AM
2,3',4,4'-TeCB	0	U	1.6	0	13	µg/Kg	1	1/14/2013 3:48 AM
2,4,4'-TrCB	120	m [DL 1]	3.9	0	53	µg/Kg	4	1/18/2013 12:42 AM
2,4'-DiCB	81	[DL 1]	12	0	53	µg/Kg	4	1/18/2013 12:42 AM
3,3',4,4',5,5'-HxCB	0	U	2.2	0	13	µg/Kg	1	1/14/2013 3:48 AM
3,3',4,4',5-PeCB	0	U	1.8	0	13	µg/Kg	1	1/14/2013 3:48 AM
3,3',4,4'-TeCB	0	U	2.6	0	13	µg/Kg	1	1/14/2013 3:48 AM
DeCB	0	U	1.4	0	13	µg/Kg	1	1/14/2013 3:48 AM

RTI Laboratories - Analytical Report

WO#: 1211282

Date Reported: 1/24/2013

Original

Client:	USACE- Detroit District	Collection Date:	11/7/2012 1:16:52 PM
Project:	Manistique Harbor 0004		
Lab ID:	1211282-003	Matrix:	Solid
Client Sample ID:	087C, <2 sg <425 um		

Analysis	Result	Qual	DL	LOD	LOQ	Units	DF	Date Analyzed
Surr: Tetrachloro-m-xylene	90.6	[DL 1]		70-130		%REC	4	1/18/2013 12:42 AM

RTI Laboratories - Analytical Report

WO#: 1211282

Date Reported: 1/24/2013

Original

Client: USACE- Detroit District
Project: Manistique Harbor 0004
Lab ID: 1211282-004
Client Sample ID: 058C, >2 sg

Collection Date: 11/7/2012 1:16:52 PM

Matrix: Solid

Analysis	Result	Qual	DL	LOD	LOQ	Units	DF	Date Analyzed
Polychlorinated Biphenyl Congeners			Method: SW8082		SW3550C		Analyst: cr	
2,2',3,3',4,4',5,5',6-NoCB	0	U	0.058	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
2,2',3,3',4,4',5,6-OcCB	0	U	0.066	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
2,2',3,3',4,4',5-HpCB	0	U	0.053	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
2,2',3,3',4,4',5-HxCB	0	U	0.050	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
2,2',3,4,4',5,5',6-HpCB	0	U	0.062	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
2,2',3,4,4',5,5',6-HxCB	0	U	0.094	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
2,2',3,4,4',5,5',6-HxCB	0	U	0.060	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
2,2',3,4,4',6,6',6-HpCB	0	U	0.081	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
2,2',3,4,5'-PeCB	0	U	0.056	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
2,2',3,4',5,5',6-HpCB	0	U	0.094	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
2,2',3,5'-TeCB	0	U	0.095	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
2,2',4,4',5,5',5-HxCB	0	U	0.095	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
2,2',4,5,5'-PeCB	0	U	0.11	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
2,2',4,5'-TeCB	0.12	J	0.10	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
2,2',5,5'-TeCB	0.25	J	0.13	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
2,2',5-TrCB	0.18	J	0.11	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
2,3,3',4,4'-PeCB	0	U	0.060	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
2,3,3',4',6-PeCB	0	U	0.057	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
2,3',4,4',5-PeCB	0	U	0.090	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
2,3',4,4'-TeCB	0	U	0.077	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
2,4,4'-TrCB	0.13	J	0.048	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
2,4'-DiCB	0	U	0.15	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
3,3',4,4',5,5',5-HxCB	0	U	0.11	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
3,3',4,4',5-PeCB	0	U	0.088	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
3,3',4,4'-TeCB	0	U	0.13	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
DeCB	0	U	0.069	0	0.65	µg/Kg	1	1/14/2013 4:43 AM
Surr: Tetrachloro-m-xylene	97.5			70-130		%REC	1	1/14/2013 4:43 AM

RTI Laboratories - Analytical Report

WO#: 1211282

Date Reported: 1/24/2013

Original

Client: USACE- Detroit District
Project: Manistique Harbor 0004
Lab ID: 1211282-005
Client Sample ID: 058C, <2 sg >425 um

Collection Date: 11/7/2012 1:16:52 PM

Matrix: Solid

Analysis	Result	Qual	DL	LOD	LOQ	Units	DF	Date Analyzed
Polychlorinated Biphenyl Congeners			Method: SW8082		SW3550C		Analyst: cr	
2,2',3,3',4,4',5,5',6-NoCB	0	U	16	0	180	µg/Kg	1	1/14/2013 5:38 AM
2,2',3,3',4,4',5,6-OcCB	0	U	19	0	180	µg/Kg	1	1/14/2013 5:38 AM
2,2',3,3',4,4',5-HpCB	0	U	15	0	180	µg/Kg	1	1/14/2013 5:38 AM
2,2',3,3',4,4',5-HxCB	0	U	14	0	180	µg/Kg	1	1/14/2013 5:38 AM
2,2',3,4,4',5,5'-HpCB	0	U	17	0	180	µg/Kg	1	1/14/2013 5:38 AM
2,2',3,4,4',5',6-HpCB	0	U	26	0	180	µg/Kg	1	1/14/2013 5:38 AM
2,2',3,4,4',5'-HxCB	0	U	17	0	180	µg/Kg	1	1/14/2013 5:38 AM
2,2',3,4,4',6,6'-HpCB	0	U	23	0	180	µg/Kg	1	1/14/2013 5:38 AM
2,2',3,4,5'-PeCB	0	U	16	0	180	µg/Kg	1	1/14/2013 5:38 AM
2,2',3,4',5,5',6-HpCB	0	U	26	0	180	µg/Kg	1	1/14/2013 5:38 AM
2,2',3,5'-TeCB	0	U	27	0	180	µg/Kg	1	1/14/2013 5:38 AM
2,2',4,4',5,5'-HxCB	0	U	27	0	180	µg/Kg	1	1/14/2013 5:38 AM
2,2',4,5,5'-PeCB	0	U	30	0	180	µg/Kg	1	1/14/2013 5:38 AM
2,2',4,5'-TeCB	76	J	29	0	180	µg/Kg	1	1/14/2013 5:38 AM
2,2',5,5'-TeCB	100	J	35	0	180	µg/Kg	1	1/14/2013 5:38 AM
2,2',5-TrCB	100	J	31	0	180	µg/Kg	1	1/14/2013 5:38 AM
2,3,3',4,4'-PeCB	0	U	17	0	180	µg/Kg	1	1/14/2013 5:38 AM
2,3,3',4',6-PeCB	50	Jm	16	0	180	µg/Kg	1	1/14/2013 5:38 AM
2,3',4,4',5-PeCB	0	U	25	0	180	µg/Kg	1	1/14/2013 5:38 AM
2,3',4,4'-TeCB	0	U	22	0	180	µg/Kg	1	1/14/2013 5:38 AM
2,4,4'-TrCB	58	J	13	0	180	µg/Kg	1	1/14/2013 5:38 AM
2,4'-DiCB	94	J	43	0	180	µg/Kg	1	1/14/2013 5:38 AM
3,3',4,4',5,5'-HxCB	0	U	30	0	180	µg/Kg	1	1/14/2013 5:38 AM
3,3',4,4',5-PeCB	0	U	25	0	180	µg/Kg	1	1/14/2013 5:38 AM
3,3',4,4'-TeCB	0	U	36	0	180	µg/Kg	1	1/14/2013 5:38 AM
DeCB	0	U	19	0	180	µg/Kg	1	1/14/2013 5:38 AM
Surr: Tetrachloro-m-xylene	81.2			70-130		%REC	1	1/14/2013 5:38 AM

RTI Laboratories - Analytical Report

WO#: 1211282

Date Reported: 1/24/2013

Original

Client: USACE- Detroit District
Project: Manistique Harbor 0004
Lab ID: 1211282-006
Client Sample ID: 058C, <2 sg <425 um

Collection Date: 11/7/2012 1:16:52 PM

Matrix: Solid

Analysis	Result	Qual	DL	LOD	LOQ	Units	DF	Date Analyzed
Polychlorinated Biphenyl Congeners			Method: SW8082		SW3550C		Analyst: cr	
2,2',3,3',4,4',5,5',6-NoCB	0	U	2.7	0	30	µg/Kg	1	1/14/2013 6:33 AM
2,2',3,3',4,4',5,6-OcCB	0	U	3.0	0	30	µg/Kg	1	1/14/2013 6:33 AM
2,2',3,3',4,4',5-HpCB	0	U	2.5	0	30	µg/Kg	1	1/14/2013 6:33 AM
2,2',3,3',4,4',5-HxCB	0	U	2.3	0	30	µg/Kg	1	1/14/2013 6:33 AM
2,2',3,4,4',5,5'-HpCB	0	U	2.9	0	30	µg/Kg	1	1/14/2013 6:33 AM
2,2',3,4,4',5',6-HpCB	0	U	4.3	0	30	µg/Kg	1	1/14/2013 6:33 AM
2,2',3,4,4',5'-HxCB	0	U	2.8	0	30	µg/Kg	1	1/14/2013 6:33 AM
2,2',3,4,4',6,6'-HpCB	0	U	3.7	0	30	µg/Kg	1	1/14/2013 6:33 AM
2,2',3,4,5'-PeCB	4.9	J	2.6	0	30	µg/Kg	1	1/14/2013 6:33 AM
2,2',3,4',5,5',6-HpCB	0	U	4.3	0	30	µg/Kg	1	1/14/2013 6:33 AM
2,2',3,5'-TeCB	32	m	4.4	0	30	µg/Kg	1	1/14/2013 6:33 AM
2,2',4,4',5,5'-HxCB	0	U	4.4	0	30	µg/Kg	1	1/14/2013 6:33 AM
2,2',4,5,5'-PeCB	21	J	5.0	0	30	µg/Kg	1	1/14/2013 6:33 AM
2,2',4,5'-TeCB	45		4.8	0	30	µg/Kg	1	1/14/2013 6:33 AM
2,2',5,5'-TeCB	68		5.8	0	30	µg/Kg	1	1/14/2013 6:33 AM
2,2',5-TrCB	60		5.1	0	30	µg/Kg	1	1/14/2013 6:33 AM
2,3,3',4,4'-PeCB	0	U	2.8	0	30	µg/Kg	1	1/14/2013 6:33 AM
2,3,3',4',6-PeCB	21	J	2.6	0	30	µg/Kg	1	1/14/2013 6:33 AM
2,3',4,4',5-PeCB	0	U	4.2	0	30	µg/Kg	1	1/14/2013 6:33 AM
2,3',4,4'-TeCB	12	J	3.5	0	30	µg/Kg	1	1/14/2013 6:33 AM
2,4,4'-TrCB	39		2.2	0	30	µg/Kg	1	1/14/2013 6:33 AM
2,4'-DiCB	35		7.0	0	30	µg/Kg	1	1/14/2013 6:33 AM
3,3',4,4',5,5'-HxCB	0	U	4.9	0	30	µg/Kg	1	1/14/2013 6:33 AM
3,3',4,4',5-PeCB	0	U	4.1	0	30	µg/Kg	1	1/14/2013 6:33 AM
3,3',4,4'-TeCB	0	U	5.9	0	30	µg/Kg	1	1/14/2013 6:33 AM
DeCB	0	U	3.2	0	30	µg/Kg	1	1/14/2013 6:33 AM
Surr: Tetrachloro-m-xylene	83.3			70-130		%REC	1	1/14/2013 6:33 AM

RTI Laboratories - Analytical Report

WO#: 1211282

Date Reported: 1/24/2013

Original

Client: USACE- Detroit District
Project: Manistique Harbor 0004
Lab ID: 1211282-007
Client Sample ID: 020C, >2 sg

Collection Date: 11/7/2012 1:16:52 PM

Matrix: Solid

Analysis	Result	Qual	DL	LOD	LOQ	Units	DF	Date Analyzed
Polychlorinated Biphenyl Congeners			Method: SW8082		SW3550C		Analyst: cr	
2,2',3,3',4,4',5,5',6-NoCB	0	U	0.059	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
2,2',3,3',4,4',5,6-OcCB	0	U	0.067	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
2,2',3,3',4,4',5-HpCB	0	U	0.054	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
2,2',3,3',4,4'-HxCB	0	U	0.050	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
2,2',3,4,4',5,5'-HpCB	0	U	0.063	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
2,2',3,4,4',5',6-HpCB	0	U	0.095	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
2,2',3,4,4',5'-HxCB	0	U	0.061	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
2,2',3,4,4',6,6'-HpCB	0	U	0.081	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
2,2',3,4,5'-PeCB	0	U	0.057	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
2,2',3,4',5,5',6-HpCB	0	U	0.095	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
2,2',3,5'-TeCB	0	U	0.096	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
2,2',4,4',5,5'-HxCB	0	U	0.096	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
2,2',4,5,5'-PeCB	0	U	0.11	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
2,2',4,5'-TeCB	0.16	J	0.10	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
2,2',5,5'-TeCB	0.29	J	0.13	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
2,2',5-TrCB	0.15	J	0.11	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
2,3,3',4,4'-PeCB	0	U	0.061	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
2,3,3',4',6-PeCB	0	U	0.058	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
2,3',4,4',5-PeCB	0	U	0.091	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
2,3',4,4'-TeCB	0	U	0.077	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
2,4,4'-TrCB	0.097	J	0.048	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
2,4'-DiCB	0	U	0.15	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
3,3',4,4',5,5'-HxCB	0	U	0.11	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
3,3',4,4',5-PeCB	0	U	0.089	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
3,3',4,4'-TeCB	0	U	0.13	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
DeCB	0	U	0.070	0	0.66	µg/Kg	1	1/14/2013 7:29 AM
Surr: Tetrachloro-m-xylene	89.4			70-130		%REC	1	1/14/2013 7:29 AM

RTI Laboratories - Analytical Report

WO#: 1211282

Date Reported: 1/24/2013

Original

Client: USACE- Detroit District
Project: Manistique Harbor 0004
Lab ID: 1211282-008
Client Sample ID: 020C, <2 sg >425 um

Collection Date: 11/7/2012 1:16:52 PM

Matrix: Solid

Analysis	Result	Qual	DL	LOD	LOQ	Units	DF	Date Analyzed
Polychlorinated Biphenyl Congeners			Method: SW8082		SW3550C		Analyst: cr	
2,2',3,3',4,4',5,5',6-NoCB	0	U	60	0	670	µg/Kg	1	1/14/2013 10:14 AM
2,2',3,3',4,4',5,6-OcCB	0	U	68	0	670	µg/Kg	1	1/14/2013 10:14 AM
2,2',3,3',4,4',5-HpCB	0	U	55	0	670	µg/Kg	1	1/14/2013 10:14 AM
2,2',3,3',4,4',5-HxCB	0	U	51	0	670	µg/Kg	1	1/14/2013 10:14 AM
2,2',3,4,4',5,5'-HpCB	0	U	64	0	670	µg/Kg	1	1/14/2013 10:14 AM
2,2',3,4,4',5',6-HpCB	0	U	97	0	670	µg/Kg	1	1/14/2013 10:14 AM
2,2',3,4,4',5'-HxCB	0	U	62	0	670	µg/Kg	1	1/14/2013 10:14 AM
2,2',3,4,4',6,6'-HpCB	0	U	83	0	670	µg/Kg	1	1/14/2013 10:14 AM
2,2',3,4,5'-PeCB	0	U	58	0	670	µg/Kg	1	1/14/2013 10:14 AM
2,2',3,4',5,5',6-HpCB	0	U	97	0	670	µg/Kg	1	1/14/2013 10:14 AM
2,2',3,5'-TeCB	0	U	98	0	670	µg/Kg	1	1/14/2013 10:14 AM
2,2',4,4',5,5'-HxCB	0	U	98	0	670	µg/Kg	1	1/14/2013 10:14 AM
2,2',4,5,5'-PeCB	230	J	110	0	670	µg/Kg	1	1/14/2013 10:14 AM
2,2',4,5'-TeCB	240	J	110	0	670	µg/Kg	1	1/14/2013 10:14 AM
2,2',5,5'-TeCB	570	J	130	0	670	µg/Kg	1	1/14/2013 10:14 AM
2,2',5-TrCB	0	Um	120	0	670	µg/Kg	1	1/14/2013 10:14 AM
2,3,3',4,4'-PeCB	0	U	62	0	670	µg/Kg	1	1/14/2013 10:14 AM
2,3,3',4',6-PeCB	100	Jm	59	0	670	µg/Kg	1	1/14/2013 10:14 AM
2,3',4,4',5-PeCB	0	U	93	0	670	µg/Kg	1	1/14/2013 10:14 AM
2,3',4,4'-TeCB	0	U	79	0	670	µg/Kg	1	1/14/2013 10:14 AM
2,4,4'-TrCB	84	J	49	0	670	µg/Kg	1	1/14/2013 10:14 AM
2,4'-DiCB	0	U	160	0	670	µg/Kg	1	1/14/2013 10:14 AM
3,3',4,4',5,5'-HxCB	0	U	110	0	670	µg/Kg	1	1/14/2013 10:14 AM
3,3',4,4',5-PeCB	0	U	91	0	670	µg/Kg	1	1/14/2013 10:14 AM
3,3',4,4'-TeCB	0	U	130	0	670	µg/Kg	1	1/14/2013 10:14 AM
DeCB	0	U	71	0	670	µg/Kg	1	1/14/2013 10:14 AM
Surr: Tetrachloro-m-xylene	78.7			70-130		%REC	1	1/14/2013 10:14 AM

RTI Laboratories - Analytical Report

WO#: 1211282

Date Reported: 1/24/2013

Original

Client: USACE- Detroit District
 Project: Manistique Harbor 0004
 Lab ID: 1211282-009
 Client Sample ID: 020C, <2 sg <425 um

Collection Date: 11/7/2012 1:16:52 PM

Matrix: Solid

Analysis	Result	Qual	DL	LOD	LOQ	Units	DF	Date Analyzed
Polychlorinated Biphenyl Congeners			Method: SW8082		SW3550C		Analyst: cr	
2,2',3,3',4,4',5,5',6-NoCB	0	U	8.6	0	96	µg/Kg	1	1/14/2013 11:09 AM
2,2',3,3',4,4',5,6-OcCB	0	U	9.7	0	96	µg/Kg	1	1/14/2013 11:09 AM
2,2',3,3',4,4',5-HpCB	0	U	7.9	0	96	µg/Kg	1	1/14/2013 11:09 AM
2,2',3,3',4,4',6-HxCB	0	U	7.3	0	96	µg/Kg	1	1/14/2013 11:09 AM
2,2',3,4,4',5,5',6-HpCB	0	U	9.1	0	96	µg/Kg	1	1/14/2013 11:09 AM
2,2',3,4,4',5,6-HxCB	0	U	14	0	96	µg/Kg	1	1/14/2013 11:09 AM
2,2',3,4,4',5,6'-HxCB	0	U	8.9	0	96	µg/Kg	1	1/14/2013 11:09 AM
2,2',3,4,4',6,6'-HpCB	0	U	12	0	96	µg/Kg	1	1/14/2013 11:09 AM
2,2',3,4,5'-PeCB	0	U	8.3	0	96	µg/Kg	1	1/14/2013 11:09 AM
2,2',3,4',5,5',6-HpCB	0	U	14	0	96	µg/Kg	1	1/14/2013 11:09 AM
2,2',3,5'-TeCB	0	U	14	0	96	µg/Kg	1	1/14/2013 11:09 AM
2,2',4,4',5,5'-HxCB	0	U	14	0	96	µg/Kg	1	1/14/2013 11:09 AM
2,2',4,5,5'-PeCB	0	U	16	0	96	µg/Kg	1	1/14/2013 11:09 AM
2,2',4,5'-TeCB	31	J	15	0	96	µg/Kg	1	1/14/2013 11:09 AM
2,2',5,5'-TeCB	56	J	18	0	96	µg/Kg	1	1/14/2013 11:09 AM
2,2',5-TrCB	35	J	16	0	96	µg/Kg	1	1/14/2013 11:09 AM
2,3,3',4,4'-PeCB	0	U	8.9	0	96	µg/Kg	1	1/14/2013 11:09 AM
2,3,3',4',6-PeCB	0	Um	8.4	0	96	µg/Kg	1	1/14/2013 11:09 AM
2,3',4,4',5-PeCB	0	U	13	0	96	µg/Kg	1	1/14/2013 11:09 AM
2,3',4,4'-TeCB	0	U	11	0	96	µg/Kg	1	1/14/2013 11:09 AM
2,4,4'-TrCB	21	J	7.0	0	96	µg/Kg	1	1/14/2013 11:09 AM
2,4'-DiCB	0	U	22	0	96	µg/Kg	1	1/14/2013 11:09 AM
3,3',4,4',5,5'-HxCB	0	U	16	0	96	µg/Kg	1	1/14/2013 11:09 AM
3,3',4,4',5-PeCB	0	U	13	0	96	µg/Kg	1	1/14/2013 11:09 AM
3,3',4,4'-TeCB	0	U	19	0	96	µg/Kg	1	1/14/2013 11:09 AM
DeCB	0	U	10	0	96	µg/Kg	1	1/14/2013 11:09 AM
Surr: Tetrachloro-m-xylene	81.1			70-130		%REC	1	1/14/2013 11:09 AM

RTI Laboratories - Analytical Report

WO#: 1211282

Date Reported: 1/24/2013

Original

Client: USACE- Detroit District
Project: Manistique Harbor 0004
Lab ID: 1211282-010
Client Sample ID: 016A, >2 sg

Collection Date: 11/7/2012 1:16:52 PM

Matrix: Solid

Analysis	Result	Qual	DL	LOD	LOQ	Units	DF	Date Analyzed
Polychlorinated Biphenyl Congeners			Method: SW8082		SW3550C		Analyst: cr	
2,2',3,3',4,4',5,5',6-NoCB	0	U	0.059	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
2,2',3,3',4,4',5,6-OcCB	0	U	0.067	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
2,2',3,3',4,4',5-HpCB	0	U	0.054	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
2,2',3,3',4,4'-HxCB	0	U	0.050	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
2,2',3,4,4',5,5'-HpCB	0	U	0.063	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
2,2',3,4,4',5',6-HpCB	0	U	0.096	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
2,2',3,4,4',5'-HxCB	0	U	0.061	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
2,2',3,4,4',6,6'-HpCB	0	U	0.082	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
2,2',3,4,5'-PeCB	0.11	J	0.057	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
2,2',3,4',5,5',6-HpCB	0	U	0.096	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
2,2',3,5'-TeCB	0.36	Jm	0.097	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
2,2',4,4',5,5'-HxCB	0	U	0.097	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
2,2',4,5,5'-PeCB	0	U	0.11	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
2,2',4,5'-TeCB	0.38	J	0.11	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
2,2',5,5'-TeCB	0.64	J	0.13	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
2,2',5-TrCB	0	U	0.11	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
2,3,3',4,4'-PeCB	0	U	0.061	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
2,3,3',4',6-PeCB	0.43	J	0.058	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
2,3',4,4',5-PeCB	0.11	J	0.092	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
2,3',4,4'-TeCB	0	U	0.078	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
2,4,4'-TrCB	0	U	0.048	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
2,4'-DiCB	0.23	J	0.15	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
3,3',4,4',5,5'-HxCB	0	U	0.11	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
3,3',4,4',5-PeCB	0	U	0.090	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
3,3',4,4'-TeCB	0	U	0.13	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
DeCB	0	U	0.070	0	0.66	µg/Kg	1	1/18/2013 3:54 PM
Surr: Tetrachloro-m-xylene	76.9			70-130		%REC	1	1/18/2013 3:54 PM

RTI Laboratories - Analytical Report

WO#: 1211282

Date Reported: 1/24/2013

Original

Client: USACE- Detroit District
Project: Manistique Harbor 0004
Lab ID: 1211282-011
Client Sample ID: 016A, <2 sg >425 um

Collection Date: 11/7/2012 1:16:52 PM

Matrix: Solid

Analysis	Result	Qual	DL	LOD	LOQ	Units	DF	Date Analyzed
Polychlorinated Biphenyl Congeners			Method: SW8082		SW3550C		Analyst: cr	
2,2',3,3',4,4',5,5',6-NoCB	0	U [DL 1]	0.24	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
2,2',3,3',4,4',5,6-OcCB	0	U [DL 1]	0.27	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
2,2',3,3',4,4',5-HpCB	1.0	Jm [DL 1]	0.22	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
2,2',3,3',4,4'-HxCB	2.0	J [DL 1]	0.20	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
2,2',3,4,4',5,5'-HpCB	1.4	J [DL 1]	0.25	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
2,2',3,4,4',5',6-HpCB	0	U [DL 1]	0.38	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
2,2',3,4,4',5'-HxCB	11	m [DL 1]	0.24	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
2,2',3,4,4',6,6'-HpCB	0	U [DL 1]	0.33	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
2,2',3,4,5'-PeCB	6.7	[DL 1]	0.23	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
2,2',3,4',5,5',6-HpCB	0	U [DL 1]	0.38	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
2,2',3,5'-TeCB	14	m [DL 1]	0.39	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
2,2',4,4',5,5'-HxCB	6.7	[DL 1]	0.39	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
2,2',4,5,5'-PeCB	16	[DL 1]	0.44	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
2,2',4,5'-TeCB	13	[DL 1]	0.42	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
2,2',5,5'-TeCB	15	[DL 1]	0.51	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
2,2',5-TrCB	4.0	m [DL 1]	0.45	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
2,3,3',4,4'-PeCB	7.0	[DL 1]	0.24	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
2,3,3',4',6-PeCB	18	[DL 1]	0.23	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
2,3',4,4',5-PeCB	7.4	[DL 1]	0.37	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
2,3',4,4'-TeCB	7.7	[DL 1]	0.31	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
2,4,4'-TrCB	4.0	[DL 1]	0.19	0	2.6	µg/Kg	4	1/18/2013 1:37 AM

RTI Laboratories - Analytical Report

WO#: 1211282

Date Reported: 1/24/2013

Original

Client: USACE- Detroit District
Project: Manistique Harbor 0004
Lab ID: 1211282-011
Client Sample ID: 016A, <2 sg >425 um

Collection Date: 11/7/2012 1:16:52 PM

Matrix: Solid

Analysis	Result	Qual	DL	LOD	LOQ	Units	DF	Date Analyzed
2,4'-DiCB	0.65	Jm [DL 1]	0.62	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
3,3',4,4',5,5'-HxCB	0	U [DL 1]	0.43	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
3,3',4,4',5-PeCB	0	U [DL 1]	0.36	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
3,3',4,4'-TeCB	0	U [DL 1]	0.52	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
DeCB	0	U [DL 1]	0.28	0	2.6	µg/Kg	4	1/18/2013 1:37 AM
Surr: Tetrachloro-m-xylene	81.8	[DL 1]		70-130		%REC	4	1/18/2013 1:37 AM

RTI Laboratories - Analytical Report

WO#: 1211282

Date Reported: 1/24/2013

Original

Client: USACE- Detroit District
Project: Manistique Harbor 0004
Lab ID: 1211282-012
Client Sample ID: 016A, <2 sg <425 um

Collection Date: 11/7/2012 1:16:52 PM

Matrix: Solid

Analysis	Result	Qual	DL	LOD	LOQ	Units	DF	Date Analyzed
Polychlorinated Biphenyl Congeners			Method: SW8082		SW3550C		Analyst: cr	
2,2',3,3',4,4',5,5',6-NoCB	0	U	3.8	0	42	µg/Kg	1	1/18/2013 4:49 PM
2,2',3,3',4,4',5,6-OcCB	0	U	4.3	0	42	µg/Kg	1	1/18/2013 4:49 PM
2,2',3,3',4,4',5-HpCB	0	U	3.4	0	42	µg/Kg	1	1/18/2013 4:49 PM
2,2',3,3',4,4',5-HxCB	0	U	3.2	0	42	µg/Kg	1	1/18/2013 4:49 PM
2,2',3,4,4',5,5'-HpCB	0	U	4.0	0	42	µg/Kg	1	1/18/2013 4:49 PM
2,2',3,4,4',5',6-HpCB	0	U	6.1	0	42	µg/Kg	1	1/18/2013 4:49 PM
2,2',3,4,4',5'-HxCB	10	J	3.9	0	42	µg/Kg	1	1/18/2013 4:49 PM
2,2',3,4,4',6,6'-HpCB	0	U	5.2	0	42	µg/Kg	1	1/18/2013 4:49 PM
2,2',3,4,5'-PeCB	19	J	3.6	0	42	µg/Kg	1	1/18/2013 4:49 PM
2,2',3,4',5,5',6-HpCB	0	U	6.1	0	42	µg/Kg	1	1/18/2013 4:49 PM
2,2',3,5'-TeCB	46	m	6.1	0	42	µg/Kg	1	1/18/2013 4:49 PM
2,2',4,4',5,5'-HxCB	0	U	6.1	0	42	µg/Kg	1	1/18/2013 4:49 PM
2,2',4,5,5'-PeCB	40	J	6.9	0	42	µg/Kg	1	1/18/2013 4:49 PM
2,2',4,5'-TeCB	50		6.7	0	42	µg/Kg	1	1/18/2013 4:49 PM
2,2',5,5'-TeCB	73		8.1	0	42	µg/Kg	1	1/18/2013 4:49 PM
2,2',5-TrCB	0	U	7.2	0	42	µg/Kg	1	1/18/2013 4:49 PM
2,3,3',4,4'-PeCB	13	J	3.9	0	42	µg/Kg	1	1/18/2013 4:49 PM
2,3,3',4',6-PeCB	59		3.7	0	42	µg/Kg	1	1/18/2013 4:49 PM
2,3',4,4',5-PeCB	15	J	5.8	0	42	µg/Kg	1	1/18/2013 4:49 PM
2,3',4,4'-TeCB	0	U	4.9	0	42	µg/Kg	1	1/18/2013 4:49 PM
2,4,4'-TrCB	0	U	3.1	0	42	µg/Kg	1	1/18/2013 4:49 PM
2,4'-DiCB	0	Um	9.8	0	42	µg/Kg	1	1/18/2013 4:49 PM
3,3',4,4',5,5'-HxCB	0	U	6.9	0	42	µg/Kg	1	1/18/2013 4:49 PM
3,3',4,4',5-PeCB	0	U	5.7	0	42	µg/Kg	1	1/18/2013 4:49 PM
3,3',4,4'-TeCB	0	U	8.3	0	42	µg/Kg	1	1/18/2013 4:49 PM
DeCB	0	U	4.4	0	42	µg/Kg	1	1/18/2013 4:49 PM
Surr: Tetrachloro-m-xylene	68.3	S		70-130		%REC	1	1/18/2013 4:49 PM

RTI Laboratories - Analytical Report

WO#: 1211282

Date Reported: 1/24/2013

Original

Client: USACE- Detroit District
Project: Manistique Harbor 0004
Lab ID: 1211282-013
Client Sample ID: 019C, >2 sg

Collection Date: 11/7/2012 1:16:52 PM

Matrix: Solid

Analysis	Result	Qual	DL	LOD	LOQ	Units	DF	Date Analyzed
Polychlorinated Biphenyl Congeners			Method: SW8082		SW3550C		Analyst: cr	
2,2',3,3',4,4',5,5',6-NoCB	0	U	0.65	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
2,2',3,3',4,4',5,6-OcCB	0	U	0.74	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
2,2',3,3',4,4',5-HpCB	0	U	0.60	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
2,2',3,3',4,4',5-HxCB	0	U	0.55	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
2,2',3,4,4',5,5',6-HpCB	0	U	0.69	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
2,2',3,4,4',5,5',6-HxCB	0	U	1.1	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
2,2',3,4,4',5,5',6-HxCB	0	U	0.67	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
2,2',3,4,4',6,6',6-HpCB	0	U	0.90	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
2,2',3,4,5'-PeCB	0	U	0.63	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
2,2',3,4',5,5',6-HpCB	0	U	1.1	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
2,2',3,5'-TeCB	0	U	1.1	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
2,2',4,4',5,5',5-HxCB	0	U	1.1	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
2,2',4,5,5'-PeCB	0	U	1.2	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
2,2',4,5'-TeCB	0	U	1.2	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
2,2',5,5'-TeCB	0	U	1.4	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
2,2',5-TrCB	0	U	1.2	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
2,3,3',4,4'-PeCB	0	U	0.67	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
2,3,3',4',6-PeCB	0	U	0.64	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
2,3',4,4',5-PeCB	0	U	1.0	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
2,3',4,4'-TeCB	0	U	0.86	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
2,4,4'-TrCB	0	U	0.53	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
2,4'-DiCB	0	U	1.7	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
3,3',4,4',5,5',5-HxCB	0	U	1.2	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
3,3',4,4',5-PeCB	0	U	0.99	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
3,3',4,4'-TeCB	0	U	1.4	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
DeCB	0	U	0.77	0	7.3	µg/Kg	1	1/18/2013 5:44 PM
Surr: Tetrachloro-m-xylene	68.8	S		70-130		%REC	1	1/18/2013 5:44 PM

RTI Laboratories - Analytical Report

WO#: 1211282

Date Reported: 1/24/2013

Original

Client: USACE- Detroit District
Project: Manistique Harbor 0004
Lab ID: 1211282-014
Client Sample ID: 019C, <2 sg >425 um

Collection Date: 11/7/2012 1:16:52 PM

Matrix: Solid

Analysis	Result	Qual	DL	LOD	LOQ	Units	DF	Date Analyzed
Polychlorinated Biphenyl Congeners			Method: SW8082		SW3550C		Analyst: cr	
2,2',3,3',4,4',5,5',6-NoCB	0	U	0.15	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
2,2',3,3',4,4',5,6-OcCB	0	U	0.17	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
2,2',3,3',4,4',5-HpCB	0	U	0.14	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
2,2',3,3',4,4',5-HxCB	0	U	0.13	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
2,2',3,4,4',5,5',6-HpCB	0	U	0.16	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
2,2',3,4,4',5,5',6-HxCB	0	U	0.25	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
2,2',3,4,4',5,5',6-HxCB	0	U	0.16	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
2,2',3,4,4',6,6',6-HpCB	0	U	0.21	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
2,2',3,4,5'-PeCB	0	U	0.15	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
2,2',3,4',5,5',6-HpCB	0	U	0.25	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
2,2',3,5'-TeCB	0	U	0.25	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
2,2',4,4',5,5',5-HxCB	0	U	0.25	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
2,2',4,5,5'-PeCB	0	U	0.28	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
2,2',4,5'-TeCB	0.77	J	0.27	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
2,2',5,5'-TeCB	0.38	J	0.33	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
2,2',5-TrCB	0	U	0.29	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
2,3,3',4,4'-PeCB	0	U	0.16	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
2,3,3',4',6-PeCB	0	Um	0.15	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
2,3',4,4',5-PeCB	0	U	0.24	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
2,3',4,4'-TeCB	0	U	0.20	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
2,4,4'-TrCB	0	U	0.13	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
2,4'-DiCB	0	U	0.40	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
3,3',4,4',5,5',5-HxCB	0	U	0.28	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
3,3',4,4',5-PeCB	0	U	0.23	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
3,3',4,4'-TeCB	0	U	0.34	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
DeCB	0	U	0.18	0	1.7	µg/Kg	1	1/18/2013 6:39 PM
Surr: Tetrachloro-m-xylene	81.0			70-130		%REC	1	1/18/2013 6:39 PM

RTI Laboratories - Analytical Report

WO#: 1211282

Date Reported: 1/24/2013

Original

Client: USACE- Detroit District
Project: Manistique Harbor 0004
Lab ID: 1211282-015
Client Sample ID: 019C, <2 sg <425 um

Collection Date: 11/7/2012 1:16:52 PM

Matrix: Solid

Analysis	Result	Qual	DL	LOD	LOQ	Units	DF	Date Analyzed
Polychlorinated Biphenyl Congeners			Method: SW8082		SW3550C		Analyst: cr	
2,2',3,3',4,4',5,5',6-NoCB	0	U	6.7	0	74	µg/Kg	1	1/18/2013 7:34 PM
2,2',3,3',4,4',5,6-OcCB	0	U	7.6	0	74	µg/Kg	1	1/18/2013 7:34 PM
2,2',3,3',4,4',5-HpCB	0	U	6.1	0	74	µg/Kg	1	1/18/2013 7:34 PM
2,2',3,3',4,4',5-HxCB	0	U	5.7	0	74	µg/Kg	1	1/18/2013 7:34 PM
2,2',3,4,4',5,5',6-HpCB	0	U	7.1	0	74	µg/Kg	1	1/18/2013 7:34 PM
2,2',3,4,4',5,5',6-HxCB	0	U	11	0	74	µg/Kg	1	1/18/2013 7:34 PM
2,2',3,4,4',5,5',6-HxCB	0	U	6.9	0	74	µg/Kg	1	1/18/2013 7:34 PM
2,2',3,4,4',6,6',7-HpCB	0	U	9.2	0	74	µg/Kg	1	1/18/2013 7:34 PM
2,2',3,4,5'-PeCB	0	U	6.4	0	74	µg/Kg	1	1/18/2013 7:34 PM
2,2',3,4',5,5',6-HpCB	0	U	11	0	74	µg/Kg	1	1/18/2013 7:34 PM
2,2',3,5'-TeCB	0	U	11	0	74	µg/Kg	1	1/18/2013 7:34 PM
2,2',4,4',5,5',6-HxCB	0	U	11	0	74	µg/Kg	1	1/18/2013 7:34 PM
2,2',4,5,5'-PeCB	0	U	12	0	74	µg/Kg	1	1/18/2013 7:34 PM
2,2',4,5'-TeCB	34	J	12	0	74	µg/Kg	1	1/18/2013 7:34 PM
2,2',5,5'-TeCB	38	J	14	0	74	µg/Kg	1	1/18/2013 7:34 PM
2,2',5-TrCB	0	U	13	0	74	µg/Kg	1	1/18/2013 7:34 PM
2,3,3',4,4'-PeCB	0	U	6.9	0	74	µg/Kg	1	1/18/2013 7:34 PM
2,3,3',4',6-PeCB	0	Um	6.6	0	74	µg/Kg	1	1/18/2013 7:34 PM
2,3',4,4',5-PeCB	0	U	10	0	74	µg/Kg	1	1/18/2013 7:34 PM
2,3',4,4'-TeCB	0	U	8.8	0	74	µg/Kg	1	1/18/2013 7:34 PM
2,4,4'-TrCB	0	U	5.4	0	74	µg/Kg	1	1/18/2013 7:34 PM
2,4'-DiCB	0	U	17	0	74	µg/Kg	1	1/18/2013 7:34 PM
3,3',4,4',5,5',6-HxCB	0	U	12	0	74	µg/Kg	1	1/18/2013 7:34 PM
3,3',4,4',5-PeCB	0	U	10	0	74	µg/Kg	1	1/18/2013 7:34 PM
3,3',4,4'-TeCB	0	U	15	0	74	µg/Kg	1	1/18/2013 7:34 PM
DeCB	0	U	7.9	0	74	µg/Kg	1	1/18/2013 7:34 PM
Surr: Tetrachloro-m-xylene	72.5			70-130		%REC	1	1/18/2013 7:34 PM

RTI Laboratories - Analytical Report

WO#: 1211282

Date Reported: 1/24/2013

Original

Client: USACE- Detroit District
Project: Manistique Harbor 0004
Lab ID: 1211282-016
Client Sample ID: 043A, >2 sg

Collection Date: 11/7/2012 1:16:52 PM

Matrix: Solid

Analysis	Result	Qual	DL	LOD	LOQ	Units	DF	Date Analyzed
Polychlorinated Biphenyl Congeners			Method: SW8082		SW3550C		Analyst: cr	
2,2',3,3',4,4',5,5',6-NoCB	0	U	0.088	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
2,2',3,3',4,4',5,6-OcCB	0	U	0.10	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
2,2',3,3',4,4',5-HpCB	0	U	0.081	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
2,2',3,3',4,4'-HxCB	0	U	0.075	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
2,2',3,4,4',5,5'-HpCB	0	U	0.094	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
2,2',3,4,4',5',6-HpCB	0	U	0.14	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
2,2',3,4,4',5'-HxCB	0	U	0.091	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
2,2',3,4,4',6,6'-HpCB	0	U	0.12	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
2,2',3,4,5'-PeCB	0	U	0.085	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
2,2',3,4',5,5',6-HpCB	0	U	0.14	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
2,2',3,5'-TeCB	0.35	Jm	0.14	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
2,2',4,4',5,5'-HxCB	0	U	0.14	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
2,2',4,5,5'-PeCB	0	U	0.16	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
2,2',4,5'-TeCB	0.45	J	0.16	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
2,2',5,5'-TeCB	0.77	J	0.19	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
2,2',5-TrCB	0	U	0.17	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
2,3,3',4,4'-PeCB	0	U	0.091	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
2,3,3',4',6-PeCB	0	Um	0.087	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
2,3',4,4',5-PeCB	0	U	0.14	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
2,3',4,4'-TeCB	0	U	0.12	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
2,4,4'-TrCB	0	U	0.072	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
2,4'-DiCB	0.34	J	0.23	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
3,3',4,4',5,5'-HxCB	0	U	0.16	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
3,3',4,4',5-PeCB	0	U	0.13	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
3,3',4,4'-TeCB	0	U	0.19	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
DeCB	0	U	0.10	0	0.98	µg/Kg	1	1/18/2013 8:29 PM
Surr: Tetrachloro-m-xylene	84.5			70-130		%REC	1	1/18/2013 8:29 PM

RTI Laboratories - Analytical Report

WO#: 1211282

Date Reported: 1/24/2013

Original

Client: USACE- Detroit District
 Project: Manistique Harbor 0004
 Lab ID: 1211282-017
 Client Sample ID: 043A, <2 sg >425 um

Collection Date: 11/7/2012 1:16:52 PM

Matrix: Solid

Analysis	Result	Qual	DL	LOD	LOQ	Units	DF	Date Analyzed
Polychlorinated Biphenyl Congeners			Method: SW8082		SW3550C		Analyst: cr	
2,2',3,3',4,4',5,5',6-NoCB	0	U	0.068	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
2,2',3,3',4,4',5,6-OcCB	0	U	0.078	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
2,2',3,3',4,4',5-HpCB	0	U	0.063	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
2,2',3,3',4,4'-HxCB	0	U	0.058	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
2,2',3,4,4',5,5'-HpCB	0	U	0.073	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
2,2',3,4,4',5',6-HpCB	0	U	0.11	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
2,2',3,4,4',5'-HxCB	0	U	0.071	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
2,2',3,4,4',6,6'-HpCB	0	U	0.095	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
2,2',3,4,5'-PeCB	0	U	0.066	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
2,2',3,4',5,5',6-HpCB	0	U	0.11	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
2,2',3,5'-TeCB	0	U	0.11	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
2,2',4,4',5,5'-HxCB	0	U	0.11	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
2,2',4,5,5'-PeCB	0	U	0.13	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
2,2',4,5'-TeCB	0.23	J	0.12	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
2,2',5,5'-TeCB	0	U	0.15	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
2,2',5-TrCB	0	U	0.13	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
2,3,3',4,4'-PeCB	0	U	0.071	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
2,3,3',4',6-PeCB	0	Um	0.067	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
2,3',4,4',5-PeCB	0	U	0.11	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
2,3',4,4'-TeCB	0	U	0.090	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
2,4,4'-TrCB	0	U	0.056	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
2,4'-DiCB	0	U	0.18	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
3,3',4,4',5,5'-HxCB	0	U	0.13	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
3,3',4,4',5-PeCB	0	U	0.10	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
3,3',4,4'-TeCB	0	U	0.15	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
DeCB	0	U	0.081	0	0.76	µg/Kg	1	1/18/2013 9:24 PM
Surr: Tetrachloro-m-xylene	77.8			70-130		%REC	1	1/18/2013 9:24 PM

RTI Laboratories - Analytical Report

WO#: 1211282

Date Reported: 1/24/2013

Original

Client: USACE- Detroit District
Project: Manistique Harbor 0004
Lab ID: 1211282-018
Client Sample ID: 043A, <2 sg <425 um

Collection Date: 11/7/2012 1:16:52 PM

Matrix: Solid

Analysis	Result	Qual	DL	LOD	LOQ	Units	DF	Date Analyzed
Polychlorinated Biphenyl Congeners			Method: SW8082		SW3550C		Analyst: cr	
2,2',3,3',4,4',5,5',6-NoCB	0	U	1.6	0	18	µg/Kg	1	1/18/2013 10:19 PM
2,2',3,3',4,4',5,6-OcCB	0	U	1.8	0	18	µg/Kg	1	1/18/2013 10:19 PM
2,2',3,3',4,4',5-HpCB	0	U	1.5	0	18	µg/Kg	1	1/18/2013 10:19 PM
2,2',3,3',4,4',5-HxCB	0	U	1.4	0	18	µg/Kg	1	1/18/2013 10:19 PM
2,2',3,4,4',5,5'-HpCB	0	U	1.7	0	18	µg/Kg	1	1/18/2013 10:19 PM
2,2',3,4,4',5',6-HpCB	0	U	2.6	0	18	µg/Kg	1	1/18/2013 10:19 PM
2,2',3,4,4',5'-HxCB	0	U	1.7	0	18	µg/Kg	1	1/18/2013 10:19 PM
2,2',3,4,4',6'-HpCB	0	U	2.2	0	18	µg/Kg	1	1/18/2013 10:19 PM
2,2',3,4,5'-PeCB	0	Um	1.6	0	18	µg/Kg	1	1/18/2013 10:19 PM
2,2',3,4',5,5',6-HpCB	0	U	2.6	0	18	µg/Kg	1	1/18/2013 10:19 PM
2,2',3,5'-TeCB	10	Jm	2.6	0	18	µg/Kg	1	1/18/2013 10:19 PM
2,2',4,4',5,5'-HxCB	0	U	2.6	0	18	µg/Kg	1	1/18/2013 10:19 PM
2,2',4,5,5'-PeCB	5.0	Jm	3.0	0	18	µg/Kg	1	1/18/2013 10:19 PM
2,2',4,5'-TeCB	16	J	2.9	0	18	µg/Kg	1	1/18/2013 10:19 PM
2,2',5,5'-TeCB	17	J	3.5	0	18	µg/Kg	1	1/18/2013 10:19 PM
2,2',5-TrCB	0	U	3.1	0	18	µg/Kg	1	1/18/2013 10:19 PM
2,3,3',4,4'-PeCB	0	U	1.7	0	18	µg/Kg	1	1/18/2013 10:19 PM
2,3,3',4',6-PeCB	2.0	Jm	1.6	0	18	µg/Kg	1	1/18/2013 10:19 PM
2,3',4,4',5-PeCB	0	U	2.5	0	18	µg/Kg	1	1/18/2013 10:19 PM
2,3',4,4'-TeCB	0	U	2.1	0	18	µg/Kg	1	1/18/2013 10:19 PM
2,4,4'-TrCB	13	J	1.3	0	18	µg/Kg	1	1/18/2013 10:19 PM
2,4'-DiCB	11	J	4.2	0	18	µg/Kg	1	1/18/2013 10:19 PM
3,3',4,4',5,5'-HxCB	0	U	2.9	0	18	µg/Kg	1	1/18/2013 10:19 PM
3,3',4,4',5-PeCB	0	U	2.4	0	18	µg/Kg	1	1/18/2013 10:19 PM
3,3',4,4'-TeCB	0	U	3.5	0	18	µg/Kg	1	1/18/2013 10:19 PM
DeCB	0	U	1.9	0	18	µg/Kg	1	1/18/2013 10:19 PM
Surr: Tetrachloro-m-xylene	63.8	S		70-130		%REC	1	1/18/2013 10:19 PM

RTI Laboratories - DATES REPORT

WO#: 1211282

Date Reported: 1/24/2013
Original

Client: USACE- Detroit District
Project: Manistique Harbor 0004

Sample ID	Client Sample ID	Collection Date	Matrix	Test Name	Leachate Date	Prep Date	Analysis Date
1211282-001A	087C, >2 sg	11/7/2012 1:16 PM	Solid	SW_8082S-CON-Polychlorinated Biphenyl Congeners		1/4/2013 8:24 AM	1/14/2013 1:58 AM
				SW_8082S-CON-Polychlorinated Biphenyl Congeners		1/4/2013 8:24 AM	1/17/2013 10:52 PM
1211282-002A	087C, <2 sg >425 um	11/7/2012 1:16 PM	Solid	SW_8082S-CON-Polychlorinated Biphenyl Congeners		1/4/2013 8:24 AM	1/14/2013 2:53 AM
				SW_8082S-CON-Polychlorinated Biphenyl Congeners		1/4/2013 8:24 AM	1/17/2013 11:47 PM
1211282-003A	087C, <2 sg <425 um	11/7/2012 1:16 PM	Solid	SW_8082S-CON-Polychlorinated Biphenyl Congeners		1/4/2013 8:24 AM	1/14/2013 3:48 AM
				SW_8082S-CON-Polychlorinated Biphenyl Congeners		1/4/2013 8:24 AM	1/18/2013 12:42 AM
1211282-004A	058C, >2 sg	11/7/2012 1:16 PM	Solid	SW_8082S-CON-Polychlorinated Biphenyl Congeners		1/4/2013 8:24 AM	1/14/2013 4:43 AM
1211282-005A	058C, <2 sg >425 um	11/7/2012 1:16 PM	Solid	SW_8082S-CON-Polychlorinated Biphenyl Congeners		1/4/2013 8:24 AM	1/14/2013 5:38 AM
1211282-006A	058C, <2 sg <425 um	11/7/2012 1:16 PM	Solid	SW_8082S-CON-Polychlorinated Biphenyl Congeners		1/4/2013 8:24 AM	1/14/2013 6:33 AM
1211282-007A	020C, >2 sg	11/7/2012 1:16 PM	Solid	SW_8082S-CON-Polychlorinated Biphenyl Congeners		1/4/2013 8:24 AM	1/14/2013 7:29 AM
1211282-008A	020C, <2 sg >425 um	11/7/2012 1:16 PM	Solid	SW_8082S-CON-Polychlorinated Biphenyl Congeners		1/4/2013 8:24 AM	1/14/2013 10:14 AM
1211282-009A	020C, <2 sg <425 um	11/7/2012 1:16 PM	Solid	SW_8082S-CON-Polychlorinated Biphenyl Congeners		1/4/2013 8:24 AM	1/14/2013 11:09 AM
1211282-010A	016A, >2 sg	11/7/2012 1:16 PM	Solid	SW_8082S-CON-Polychlorinated Biphenyl Congeners		1/4/2013 8:24 AM	1/18/2013 3:54 PM

RTI Laboratories - DATES REPORT

WO#: 1211282

Date Reported: 1/24/2013
Original

Client: USACE- Detroit District

Project: Manistique Harbor 0004

Sample ID	Client Sample ID	Collection Date	Matrix	Test Name	Leachate Date	Prep Date	Analysis Date
1211282-011A	016A, <2 sg >425 um	11/7/2012 1:16 PM	Solid	SW_8082S-CON-Polychlorinated Biphenyl Congeners		1/4/2013 8:24 AM	1/14/2013 3:46 PM
				SW_8082S-CON-Polychlorinated Biphenyl Congeners		1/4/2013 8:24 AM	1/18/2013 1:37 AM
1211282-012A	016A, <2 sg <425 um	11/7/2012 1:16 PM	Solid	SW_8082S-CON-Polychlorinated Biphenyl Congeners		1/4/2013 8:24 AM	1/18/2013 4:49 PM
1211282-013A	019C, >2 sg	11/7/2012 1:16 PM	Solid	SW_8082S-CON-Polychlorinated Biphenyl Congeners		1/4/2013 8:24 AM	1/18/2013 5:44 PM
1211282-014A	019C, <2 sg >425 um	11/7/2012 1:16 PM	Solid	SW_8082S-CON-Polychlorinated Biphenyl Congeners		1/4/2013 8:24 AM	1/18/2013 6:39 PM
1211282-015A	019C, <2 sg <425 um	11/7/2012 1:16 PM	Solid	SW_8082S-CON-Polychlorinated Biphenyl Congeners		1/4/2013 8:24 AM	1/18/2013 7:34 PM
1211282-016A	043A, >2 sg	11/7/2012 1:16 PM	Solid	SW_8082S-CON-Polychlorinated Biphenyl Congeners		1/4/2013 8:24 AM	1/18/2013 8:29 PM
1211282-017A	043A, <2 sg >425 um	11/7/2012 1:16 PM	Solid	SW_8082S-CON-Polychlorinated Biphenyl Congeners		1/4/2013 8:24 AM	1/18/2013 9:24 PM
1211282-018A	043A, <2 sg <425 um	11/7/2012 1:16 PM	Solid	SW_8082S-CON-Polychlorinated Biphenyl Congeners		1/4/2013 8:24 AM	1/18/2013 10:19 PM

RTI Laboratories - QC SUMMARY REPORT

WO#: 1211282

Date Reported: 1/24/2013
Original

Client: USACE- Detroit District

Project: Manistique Harbor 0004

Batch ID: 28649

Sample ID:	LCS-28649	Samp Type:	LCS	Test Code:	SW_8082S-CON	Units:	µg/Kg	Prep Date:	1/4/2013	RunNo:	55440
Client ID:	LCSS	Batch ID:	28649	TestNo:	SW8082CON	SW3550C		Analysis Date:	1/14/2013	SeqNo:	1092665
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
2,2',3,3',4,4',5,5',6-NoCB	3.2	0.66	3.264	0	99.4	70	130				
2,2',3,3',4,4',5,6-OcCB	3.2	0.66	3.264	0	96.8	70	130				
2,2',3,3',4,4',5-HpCB	3.1	0.66	3.264	0	93.7	70	130				
2,2',3,3',4,4',5-HxCB	3.0	0.66	3.264	0	91.7	70	130				
2,2',3,4,4',5,5'-HpCB	3.2	0.66	3.264	0	97.7	70	130				
2,2',3,4,4',5',6-HpCB	3.0	0.66	3.264	0	92.1	70	130				
2,2',3,4,4',5'-HxCB	3.1	0.66	3.264	0	93.9	70	130				
2,2',3,4,4',6,6'-HpCB	3.3	0.66	3.264	0	100	70	130				
2,2',3,4,5'-PeCB	3.1	0.66	3.264	0	95.3	70	130				
2,2',3,4',5,5',6-HpCB	3.0	0.66	3.264	0	92.1	70	130				
2,2',3,5'-TeCB	2.9	0.66	3.264	0	90.2	70	130				
2,2',4,4',5,5'-HxCB	3.2	0.66	3.264	0	97.7	70	130				
2,2',4,5,5'-PeCB	3.2	0.66	3.264	0	96.9	70	130				
2,2',4,5'-TeCB	3.1	0.66	3.264	0	94.9	70	130				
2,2',5,5'-TeCB	3.0	0.66	3.264	0	91.5	70	130				
2,2',5-TrCB	1.2	0.66	3.264	0	35.7	70	130				S
2,3,3',4,4'-PeCB	3.0	0.66	3.264	0	91.6	70	130				
2,3,3',4',6-PeCB	3.1	0.66	3.264	0	95.9	70	130				
2,3',4,4',5-PeCB	3.1	0.66	3.264	0	94.1	70	130				
2,3',4,4'-TeCB	3.0	0.66	3.264	0	91.4	70	130				
2,4,4'-TrCB	1.6	0.66	3.264	0	48.2	70	130				S
2,4'-DiCB	2.9	0.66	3.264	0	87.7	70	130				
3,3',4,4',5,5'-HxCB	2.4	0.66	3.264	0	72.8	70	130				
3,3',4,4',5-PeCB	3.2	0.66	3.264	0	97.0	70	130				
3,3',4,4'-TeCB	2.9	0.66	3.264	0	87.7	70	130				
DeCB	3.3	0.66	3.264	0	100	70	130				
Surr: Tetrachloro-m-xylene	2.9		3.264		89.9	70	130				

RTI Laboratories - QC SUMMARY REPORT

WO#: 1211282

Date Reported: 1/24/2013
Original

Client: USACE- Detroit District

Project: Manistique Harbor 0004

Batch ID: 28649

Sample ID:	MB-28649	Samp Type:	MBLK	Test Code:	SW_8082S-CON	Units:	µg/Kg	Prep Date:	1/4/2013	RunNo:	55440
Client ID:	PBS	Batch ID:	28649	TestNo:	SW8082CON	SW3550C		Analysis Date:	1/14/2013	SeqNo:	1092666
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
2,2',3,3',4,4',5,5',6-NoCB	ND	0.66									U
2,2',3,3',4,4',5,6-OcCB	ND	0.66									U
2,2',3,3',4,4',5-HpCB	ND	0.66									U
2,2',3,3',4,4'-HxCB	ND	0.66									U
2,2',3,4,4',5,5'-HpCB	ND	0.66									U
2,2',3,4,4',5',6-HpCB	ND	0.66									U
2,2',3,4,4',5'-HxCB	ND	0.66									U
2,2',3,4,4',6,6'-HpCB	ND	0.66									U
2,2',3,4,5'-PeCB	ND	0.66									U
2,2',3,4',5,5',6-HpCB	ND	0.66									U
2,2',3,5'-TeCB	ND	0.66									U
2,2',4,4',5,5'-HxCB	ND	0.66									U
2,2',4,5,5'-PeCB	ND	0.66									U
2,2',4,5'-TeCB	ND	0.66									U
2,2',5,5'-TeCB	ND	0.66									U
2,2',5-TrCB	ND	0.66									U
2,3,3',4,4'-PeCB	ND	0.66									U
2,3,3',4',6-PeCB	ND	0.66									U
2,3',4,4',5-PeCB	ND	0.66									U
2,3',4,4'-TeCB	ND	0.66									U
2,4,4'-TrCB	ND	0.66									U
2,4'-DiCB	ND	0.66									U
3,3',4,4',5,5'-HxCB	ND	0.66									U
3,3',4,4',5-PeCB	ND	0.66									U
3,3',4,4'-TeCB	ND	0.66									U
DeCB	ND	0.66									U
Surr: Tetrachloro-m-xylene	2.9		3.281		87.7	70	130				

RTI Laboratories - QC SUMMARY REPORT

WO#: 1211282

Date Reported: 1/24/2013
Original

Client: USACE- Detroit District

Project: Manistique Harbor 0004

Batch ID: 28649

Sample ID:	1211282-007AMS	Samp Type:	MS	Test Code:	SW_8082S-CON	Units:	µg/Kg	Prep Date:	1/4/2013	RunNo:	55440
Client ID:	020C, >2 sg	Batch ID:	28649	TestNo:	SW8082CON	SW3550C		Analysis Date:	1/14/2013	SeqNo:	1092674
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
2,2',3,3',4,4',5,5',6-NoCB	3.6	0.66	3.300	0	108	70	130				
2,2',3,3',4,4',5,6-OcCB	3.4	0.66	3.300	0	103	70	130				
2,2',3,3',4,4',5-HpCB	3.3	0.66	3.300	0	101	70	130				
2,2',3,3',4,4',5-HxCB	3.2	0.66	3.300	0	96.7	70	130				
2,2',3,4,4',5,5'-HpCB	3.5	0.66	3.300	0	105	70	130				
2,2',3,4,4',5',6-HpCB	3.3	0.66	3.300	0	98.9	70	130				
2,2',3,4,4',5'-HxCB	3.6	0.66	3.300	0	108	70	130				
2,2',3,4,4',6,6'-HpCB	3.6	0.66	3.300	0	110	70	130				
2,2',3,4,5'-PeCB	3.8	0.66	3.300	0	115	70	130				
2,2',3,4',5,5',6-HpCB	3.3	0.66	3.300	0	98.9	70	130				
2,2',3,5'-TeCB	4.1	0.66	3.300	0	124	70	130				m
2,2',4,4',5,5'-HxCB	3.5	0.66	3.300	0	106	70	130				
2,2',4,5,5'-PeCB	6.5	0.66	3.300	0	198	70	130				S
2,2',4,5'-TeCB	4.1	0.66	3.300	0.1561	118	70	130				
2,2',5,5'-TeCB	4.2	0.66	3.300	0.2886	118	70	130				
2,2',5-TrCB	1.4	0.66	3.300	0.1451	38.5	70	130				S
2,3,3',4,4'-PeCB	4.0	0.66	3.300	0	121	70	130				
2,3,3',4',6-PeCB	4.5	0.66	3.300	0	136	70	130				S
2,3',4,4',5-PeCB	4.2	0.66	3.300	0	127	70	130				
2,3',4,4'-TeCB	4.4	0.66	3.300	0	133	70	130				S
2,4,4'-TrCB	1.9	0.66	3.300	0.09696	53.2	70	130				S
2,4'-DiCB	3.1	0.66	3.300	0	94.3	70	130				
3,3',4,4',5,5'-HxCB	2.7	0.66	3.300	0	82.5	70	130				
3,3',4,4',5-PeCB	3.4	0.66	3.300	0	102	70	130				
3,3',4,4'-TeCB	2.9	0.66	3.300	0	88.1	70	130				
DeCB	3.6	0.66	3.300	0	108	70	130				
Surr: Tetrachloro-m-xylene	3.2		3.300		95.6	70	130				

RTI Laboratories - QC SUMMARY REPORT

WO#: 1211282

Date Reported: 1/24/2013
Original

Client: USACE- Detroit District

Project: Manistique Harbor 0004

Batch ID: 28649

Sample ID: 1211282-007AMSD	Samp Type: MSD	Test Code: SW_8082S-CON	Units: µg/Kg	Prep Date: 1/4/2013	RunNo: 55440						
Client ID: 020C, >2 sg	Batch ID: 28649	TestNo: SW8082CON SW3550C	Analysis Date: 1/14/2013	SeqNo: 1092675							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
2,2',3,3',4,4',5,5',6-NoCB	3.6	0.67	3.317	0	109	70	130	3.561	1.32	25	
2,2',3,3',4,4',5,6-OcCB	3.5	0.67	3.317	0	104	70	130	3.390	2.22	25	
2,2',3,3',4,4',5-HpCB	3.4	0.67	3.317	0	101	70	130	3.344	0.490	25	
2,2',3,3',4,4'-HxCB	3.3	0.67	3.317	0	98.6	70	130	3.192	2.48	25	
2,2',3,4,4',5,5'-HpCB	3.5	0.67	3.317	0	105	70	130	3.468	0.163	25	
2,2',3,4,4',5',6-HpCB	3.3	0.67	3.317	0	100	70	130	3.265	1.64	25	
2,2',3,4,4',5'-HxCB	3.4	0.67	3.317	0	101	70	130	3.557	5.84	25	
2,2',3,4,4',6,6'-HpCB	3.6	0.67	3.317	0	108	70	130	3.616	1.40	25	
2,2',3,4,5'-PeCB	3.3	0.67	3.317	0	100	70	130	3.802	13.5	25	
2,2',3,4',5,5',6-HpCB	3.3	0.67	3.317	0	100	70	130	3.265	1.64	25	
2,2',3,5'-TeCB	3.4	0.67	3.317	0	102	70	130	4.105	19.6	25	
2,2',4,4',5,5'-HxCB	3.5	0.67	3.317	0	104	70	130	3.510	1.58	25	
2,2',4,5,5'-PeCB	3.4	0.67	3.317	0	104	70	130	6.527	61.8	25	R
2,2',4,5'-TeCB	3.9	0.67	3.317	0.1561	113	70	130	4.061	3.74	25	
2,2',5,5'-TeCB	3.5	0.67	3.317	0.2886	96.4	70	130	4.192	18.4	25	
2,2',5-TrCB	1.5	0.67	3.317	0.1451	40.4	70	130	1.415	4.80	25	Sm
2,3,3',4,4'-PeCB	3.3	0.67	3.317	0	98.4	70	130	3.991	20.0	25	
2,3,3',4',6-PeCB	3.4	0.67	3.317	0	104	70	130	4.495	26.4	25	R
2,3',4,4',5-PeCB	3.4	0.67	3.317	0	102	70	130	4.204	21.9	25	
2,3',4,4'-TeCB	3.2	0.67	3.317	0	97.1	70	130	4.390	30.8	25	R
2,4,4'-TrCB	1.8	0.67	3.317	0.09696	52.8	70	130	1.853	0.298	25	S
2,4'-DiCB	3.2	0.67	3.317	0	96.1	70	130	3.112	2.39	25	
3,3',4,4',5,5'-HxCB	2.9	0.67	3.317	0	86.5	70	130	2.723	5.27	25	
3,3',4,4',5-PeCB	3.4	0.67	3.317	0	103	70	130	3.357	2.17	25	
3,3',4,4'-TeCB	3.0	0.67	3.317	0	90.4	70	130	2.906	3.08	25	
DeCB	3.7	0.67	3.317	0	110	70	130	3.574	2.36	25	
Surr: Tetrachloro-m-xylene	3.1		3.317		94.7	70	130		0	25	

DEFINITIONS:

DF: Dilution factor; the dilution factor applied to the prepared sample.

DL: Detection Limit; The lowest concentration of analyte that can be detected by the method in the applicable matrix.

DUP: Duplicate; aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently, used to calculate Precision (%RPD).

LCS: Laboratory Control Sample; prepared by adding a known amount of target analytes to a specified amount of clean matrix and prepared with the batch of samples, used to calculate Accuracy (%REC).

LCSD: A duplicate LCS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

LOD: Limit of Detection; a laboratory verified concentration that can be detected at three times greater than the noise level. This concentration is equal to or greater than the DL.

LOQ: Limit of Quantitation; The lowest verified limit to which data is quantified without qualifications. Analyte concentrations below the LOQ are reported with a "J" qualifier.

MBLK: Method Blank; a sample of similar matrix that does not contain target analytes or interference that may impact the analytical results and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedure, used to assess and verify that the analytical process is free of contamination.

Mg/Kg or mg/L: Units of part per million (PPM) – milligram per Kilogram (W/W) or milligram per Liter (W/V).

MS: Matrix Spike; prepared by adding a known amount of target analytes to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available, used to calculate Accuracy (%REC)

MSD: A duplicate MS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

% REC: Percent Recovery of a known spike (SPK); a measure of accuracy expressed as a percentage of a measured (recovered) concentration compared to the known concentration (SPK) added to the sample. This is compared to the Low Limit and High Limit.

% RPD: Relative Percent Difference; a measure of precision expressed as a percentage of the difference between two duplicates relative to the average concentration. This is compared to the RPD Limit.

Qual: Qualifier that applies to the analyte reported

SPK: Spike; used in the QC section for both SPK Value and SPK Ref Val

Ug/Kg or ug/L: Units of part per billion (PPB) – microgram per Kilogram (W/W) or microgram per Liter (W/V).

QUALIFIERS:

*IX: Reported value exceeds the maximum allowed concentration by regulation or permit.

B: Analyte detected in the associated Method Blank at a concentration greater than 1/2 the LOQ

E: Analyte concentration reported that exceeds the upper calibration standard. Greater uncertainty is associated with this result and data should be considered estimated.

G: CCB result is greater than the MDL

H: Holding time for preparation or analysis has been exceeded

J: Analyte concentrations are equal to or greater than the DL and less than the LOQ. Greater uncertainty is associated with this result and data reported is estimated. These analytes are not routinely reviewed nor narrated as to their potential for being laboratory artifacts.

M: Manual Integration used to determine area response

P: Second column RPD exceeds 40%

Q/S: % REC exceeds control limits

R: % RPD exceeds control limits

T: MBLK result is greater than 1/2 of the LOQ

U: The analyte concentration is less than the DL. The result is reported as less than the LOD

Samp	Desc	Vol		Notes/Modifications
062C	>2 sg	2oz/20g	mineral	Mod 1, will have raised DL/LOD/LOQ if non detect concentrations
062C	<2 sg >425	2oz/5g	coarse floats	Mod 1, will have raised DL/LOD/LOQ if non detect concentrations
062C	<2 sg <425	2oz/1g	fine floats	Mod 1, Note A
007A	>2 sg	4oz/141	mineral	Mod 2
007A	<2 sg >425	4oz/26g	coarse floats	Mod 2
007A	<2 sg <425	2oz/7g	fine floats	Mod 1, will have raised DL/LOD/LOQ if non detect concentrations
031C	>2 sg	2oz/76g	mineral	Mod 2
031C	<2 sg >425	2oz/0.5g	coarse floats	Mod 1, Note A
031C	<2 sg <425	2oz/0.3g	fine floats	Mod 1, Note A
033C	>2 sg	2oz/12g	mineral	Mod 1, will have raised DL/LOD/LOQ if non detect concentrations
033C	<2 sg >425	2oz/9g	coarse floats	Mod 1, will have raised DL/LOD/LOQ if non detect concentrations
033C	<2 sg <425	2oz/2g	fine floats	Mod 1, will have raised DL/LOD/LOQ if non detect concentrations
064C	>2 sg	2ox/29g	mineral	Mod 2
064C	<2 sg >425	2oz/5g	coarse floats	Mod 1, will have raised DL/LOD/LOQ if non detect concentrations
064C	<2 sg <425	2oz/1g	fine floats	Mod 1, Note A
084C	>2 sg	2oz/3g	mineral	Mod 1, will have raised DL/LOD/LOQ if non detect concentrations
084C	<2 sg >425	2oz/3g	coarse floats	Mod 1, will have raised DL/LOD/LOQ if non detect concentrations
084C	<2 sg <425	2oz/0.8g	fine floats	Mod 1, Note A
087C	>2 sg	2oz/19g	mineral	Mod 1, will have raised DL/LOD/LOQ if non detect concentrations
087C	<2 sg >425	2oz/6g	coarse floats	Mod 1, will have raised DL/LOD/LOQ if non detect concentrations
087C	<2 sg <425	2oz/1.5g	fine floats	Mod 1, will have raised DL/LOD/LOQ if non detect concentrations
058C	>2 sg	2oz/111g	mineral	Mod 1, will have raised DL/LOD/LOQ if non detect concentrations
058C	<2 sg >425	2oz/1.6g	coarse floats	Mod 1, will have raised DL/LOD/LOQ if non detect concentrations
058C	<2 sg <425	2oz/0.7g	fine floats	Mod 1, Note A
020C	>2 sg	2oz/108g	mineral	Mod 2
020C	<2 sg >425	2oz/0.04g	coarse floats	Mod 1, Note A
020C	<2 sg <425	2oz/0.4g	fine floats	Mod 1, Note A
016A	>2 sg	2oz/40g	mineral	Mod 2
016A	<2 sg >425	4oz/38g	coarse floats	Mod 2
016A	<2 sg <425	2oz/0.7g	fine floats	Mod 1, Note A
019C	>2 sg	2oz/5g	mineral	Mod 1, will have raised DL/LOD/LOQ if non detect concentrations
019C	<2 sg >425	2oz/11g	coarse floats	Mod 1, will have raised DL/LOD/LOQ if non detect concentrations
019C	<2 sg <425	2oz/0.7g	fine floats	Mod 1, Note A
043A	>2 sg	2oz/24g	mineral	Mod 2
043A	<2 sg >425	4oz/22g	coarse floats	Mod 2
043A	<2 sg <425	2oz/1.3g	fine floats	Mod 1, will have raised DL/LOD/LOQ if non detect concentrations

Mod 1 - Samples will be dried in the sample jar at 60-80 C for several days or to consistent weight. The dried sample will be removed from the container, weighed and processed using an appropriate amount of solvent and concentrated as far as practical.

Mod 2 - 30g of sample will be dried in a weighing dish at 60-80 C for several days or to consistent weight. The dried sample will be removed from the container, weighed and processed according to the RTI SOP with no modifications as to solvent volume.

Note A - There is one gram or less of this sample. RTI will be careful to capture all of the sample possible for analysis. Should there be no detectable concentrations of PCBs in the sample, the DL/LOD/LOQ results will be elevated approximately 30 to 50 times normal.



RTI LABORATORIES, INC.

12H106 AF

CHAIN OF CUSTODY RECORD



AZLA Cert #570 0102



NELAC Cert #000973



MBE Cert #RL-8150-2-424

PAGE: 2 OF: 4

MAIN LAB & HEADQUARTERS

RTI LABORATORIES, INC.

31628 Glendale Street

Livonia, MI 48150-1827

Phone (734) 422-8000

Fax (734) 422-5342

www.rti-lab.com

Please Include Email Address of Report Recipient Whenever Possible !!!

SUBMITTING COMPANY: US Army - Engineer Research and Development Center				REPORT TO: Karl Gustavson				BILL TO: Karl Gustavson											
PROJECT NAME: Manistique - Wood Waste		PROJECT #:		QUOTE #:		COMPANY: USACE-ERDC				USACE-ERDC									
SPECIAL INSTRUCTIONS / COMMENTS:						PHONE: 703-603-8753				703-603-8753									
						FAX: 703-603-9112				EMAIL: Gustavson Karl@epamail.epa.gov									
SAMPLER'S PRINTED NAME: Susan Bailey				SAMPLER'S SIGNATURE: <i>Susan Bailey</i>				ANALYTICAL PARAMETERS				COMMENTS Methanol Preserved Weights HOT Sample Notation etc.							
ITEM #	SAMPLE ID.	DATE SAMPLED	TIME SAMPLED	AIR	SOLID	FLUID	VOLUME	SAMPLE DESCRIPTION	NR OF CONTAINERS	PC B Containers									
1	033C, <2 sg >425 um	9/21/12			✓		2 oz/9 g	coarse floats	1	✓									
2	033C, <2 sg <425 um	9/21/12			✓		2 oz/2 g	fine floats	1	✓									
3	064C, > 2 sg				✓		2 oz/29g	mineral	1	✓									
4	064C, <2 sg >425 um				✓		2 oz/5 g	coarse floats	1	✓									
5	064C, <2 sg <425 um				✓		2 oz/1 g	fine floats	1	✓									
6	064C, > 2 sg	9/25/12			✓		2 oz/3 g	mineral	1	✓									
7	064C, <2 sg >425 um	9/25/12			✓		2 oz/3 g	coarse floats	1	✓									
8	064C, <2 sg <425 um				✓		2 oz/8g	fine floats	1	✓									
9	087C, > 2 sg	9/25/12			✓		2 oz/19g	mineral	1	✓									
10	087C, <2 sg >425 um	9/25/12			✓		2 oz/9g	coarse floats	1	✓									
Relinquished By: <i>Susan Bailey</i>		Date: 9/25/12	Time: 11:00	Received By: <i>Edo Flores</i>		Date: 11-2-12	Time: 05:38	FOR LAB USE ONLY											
Relinquished By:		Date:	Time:	Received By:		Date:	Time:	Were samples preserved ☐ in field ☐ in lab ☐ N/A											
Relinquished By:		Date:	Time:	Received By:		Date:	Time:	Were samples filtered ☐ in field ☐ in lab ☐ N/A											
Relinquished By:		Date:	Time:	Received By:		Date:	Time:	Temp of samples <u>11.7.5</u> °C On Wet Ice? ☒											
TAT: Standard ☒ RUSH: Next BD ☐ 2nd BD ☐ 3rd BD ☐														Comments:					
Note: RUSH requests will incur surcharge!																			
Distribution: White and Yellow - Lab; Pink - Field														See reverse side for Laboratory Terms and Conditions of service					

1241282



CHAIN OF CUSTODY RECORD

PAGE 3 OF 4

MAIN LAB & HEADQUARTERS

RTI LABORATORIES, INC.

31628 Glendale Street

Livonia, MI 48150-1827

Phone (734) 422-8000

Fax (734) 422-5342

www.rtlabs.com

RTI LABORATORIES, INC.



AZLA Cert #570 0102



NELAP Cert #000973



MBE Cert #R-8150-2-424

Please Include Email Address of Report Recipient Whenever Possible !!!

SUBMITTING COMPANY: US Army - Engineer Research and Development Center				REPORT TO: Karl Gustavson				BILL TO: Karl Gustavson									
PROJECT NAME: Manistique - Wood Waste		PROJECT #:		QUOTE #:		COMPANY: USACE-ERDC				USACE-ERDC							
SPECIAL INSTRUCTIONS / COMMENTS: 1211282						PHONE: 703-603-8753				703-603-8753							
						FAX: 703-603-9112				EMAIL: Gustavson.Karl@epamail.epa.gov							
SAMPLER'S PRINTED NAME: Susan Bailey				SAMPLER'S SIGNATURE: <i>Susan Bailey</i>				ANALYTICAL PARAMETERS									
ITEM #	SAMPLE ID	DATE SAMPLED	TIME SAMPLED	AIR	SOLID	FLUID	VOLUME	SAMPLE DESCRIPTION	NER OF CONTAINERS	PC R Con gen ers							COMMENTS Methanol Preserved Weights NOT Sample Notation etc.
3	087C, <2 sg <425 um	9/25/12			✓		2oz/1.5g	fine floats	1	✓							
4	058C, > 2 sg	9/28/12			✓		2oz/1.11	mineral	1	✓							
5	058C, <2 sg >425 um	9/28/12			✓		2oz/1.6	coarse floats	1	✓							
6	058C, <2 sg <425 um	9/28/12			✓		2 oz/ 7g	fine floats	1	✓							
7	020C, > 2 sg	10/1/12			✓		2oz/10g	mineral	1	✓							
8	020C, <2 sg >425 um	10/1/12			✓		2oz/ 04	coarse floats	1	✓							
9	020C, <2 sg <425 um	10/1/12			✓		2 oz/ 4g	fine floats	1	✓							
10	016A, > 2 sg	10/4/12			✓		2oz/40g	mineral	1	✓							
11	016A, <2 sg >425 um	10/4/12			✓		4oz/35g	coarse floats	1	✓							
12	016A, <2 sg <425 um	10/4/12			✓		2 oz/ 7g	fine floats	1	✓							
Relinquished By: <i>Susan Bailey</i>		Date: 11/1/12	Time: 11:00	Received By: <i>Lab Flow</i>		Date: 11/2/12	Time: 09:38										
Relinquished By:		Date:	Time:	Received By:		Date:	Time:										
Relinquished By:		Date:	Time:	Received By:		Date:	Time:										
TAT: Standard ☒ RUSH: Next BD ☐ 2nd BD ☐ 3rd BD ☐ Note: RUSH requests will incur surcharges!																	
Distribution: White and Yellow - Lab, Pink - Field See reverse side for Laboratory Terms and Conditions of service																	

FOR LAB USE ONLY

Were samples preserved ☐ in field ☐ in lab ☐ N/AWere samples filtered ☐ in field ☐ in lab ☐ N/ATemp of samples 11.7.5 °C On Wet Ice? ☒

Comments: _____



RTI LABORATORIES, INC.

CHAIN OF CUSTODY RECORD



AZLA Cert #570 01/02



NELAC Cert #000973



MDL Cert #RE-8150-2-424

PAGE: 4 OF: 4

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www.rti-lab.com

1211106 AF

Please Include Email Address of Report Recipient Whenever Possible !!!

SUBMITTING COMPANY: US Army - Engineer Research and Development Center				REPORT TO: Karl Gustavson				BILL TO: Karl Gustavson									
PROJECT NAME: Manistique - Wood Waste		PROJECT #:		QUOTE #:		COMPANY: USACE-ERDC				USACE-ERDC							
SPECIAL INSTRUCTIONS / COMMENTS: 1211282						PHONE: 703-603-8753				703-603-8753							
						FAX: 703-603-9112				EMAIL: Gustavson.Karl@epamail.epa.gov							
SAMPLER'S PRINTED NAME: Susan Bailey				SAMPLER'S SIGNATURE: <i>Susan Bailey</i>				ANALYTICAL PARAMETERS				COMMENTS Methanol Preserved Weights HOT Sample Notation etc.					
ITEM #	SAMPLE I.D.	DATE SAMPLED	TIME SAMPLED	AIR	SOLID	FLUID	VOLUME	SAMPLE DESCRIPTION	NO. OF CONTAINERS	PC B Containers							
13	019C, > 2 sg	10/10/12			✓		2 oz/5g	mineral	1	✓							
14	019C, <2 sg >425 um	10/10/12			✓		2oz/11g	coarse floats	1	✓							
15	019C, <2 sg <425 um	10/10/1			✓		2 oz/7g	fine floats	1	✓							
16	043A, > 2 sg	10/10/1			✓		2oz/24g	mineral	1	✓							
17	043A, <2 sg >425 um	10/10/1			✓		4oz/22g	coarse floats	1	✓							
18	043A, <2 sg <425 um	10/10/12			✓		2oz/1.3	fine floats	1	✓							
7																	
8																	
9																	
10																	
Relinquished By: <i>Susan Bailey</i>		Date: 11/1/12	Time: 11:00	Received By: <i>[Signature]</i>		Date: 11/2/12	Time: 09:38	FOR LAB USE ONLY Were samples preserved ☐ in field ☐ in lab ☐ N/A Were samples filtered ☐ in field ☐ in lab ☐ N/A Temp of samples <u>11.7.8</u> °C On Wet Ice? <u>Y</u> Comments: _____									
Relinquished By:		Date:	Time:	Received By:		Date:	Time:										
Relinquished By:		Date:	Time:	Received By:		Date:	Time:										
TAT: Standard ☒ RUSH: Next BD ☐ 2nd BD ☐ 3rd BD ☐ Note: RUSH requests will incur surcharges!																	
Distribution: White and Yellow - Lab, Pink - Field See reverse side for Laboratory Terms and Conditions of service																	

From: (801) 834-3752
Richard Hudson
U.S. ARMY ERDC CE-WES-LM-MS
5909 Halls Ferry Road
Vicksburg, MS 39180

Origin ID: JANA



Ship Date: 01NOV12
ActWgt: 24.0 LB
CAD: 1039956321W/SX12600

Dim: 14 X 10 X 13 IN

Delivery Address Bar Code



SHIP TO: (734) 422-8800

BILL SENDER

Fred Hoytash
31628 Glendale Street

Livonia, MI 48150

Ref # 02675080W91EWF820
Invoice #
PO #
Dept #

FRI - 02 NOV A1
PRIORITY OVERNIGHT

TRK# 7939 8046 5202

8201

48150
MI-US
DTW



XH DEOA



113019CCBAAM

Cooler: Hoth-1
temp: 1.1° - 7.8°C

CUSTODY SEAL

Person Collecting Sample

(signature)

Sample No.

Date Collected

Time Collected



RTI LABORATORIES, INC.

TEL: (734) 422-8000 FAX: (734) 422-5342
Website: www.rtilab.com

RTI Laboratories
31628 Glendale St.
Livonia, MI 48150

QUOTATION

Quote#: 10316

Date: 10/9/2011

Company: USACE- Detroit District
Contact: Pam Horner
Address: Environmental Analysis Branch
Detroit District, 477 Michigan Ave.
Detroit, Michigan 48150-1827

Phone:

Fax:

Project: Manistique Harbor
TAT: 14 working days
QC Level: LEVEL IV
Project Manager: Deborah Griffiths
Sales Rep:
Quote Expires: 1/7/2012

Item Description	Test	Matrix	Remarks	Qty	Unit Price	Total
Polychlorinated Biphenyls	SW8082	Solid		264	84.60	22,334.40
Total Organic Carbon	SW9060	Solid		240	42.30	10,152.00
Chemical Oxygen Demand, COD	E410.4	Soil		240	33.84	8,121.60
Polychlorinated Biphenyls	SW8082	Aqueous		44	84.60	3,722.40
Carbon	A5310B	Aqueous		40	42.30	1,692.00

Sample Grouping: Physical Kit

Physical Kit		Sediment		240	121.26	29,102.40
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Miscellaneous Charge Summary

Item	Unit	Qty	Total
Misc. Administrative Fees		93,404.47	1 93,404.47

Sub Total: \$75,124.80

Misc: \$93,404.47

Surcharge: 0.00%

TOTAL: \$168,529.27

Comments: RTI Laboratories maintains accreditation through A2LA for Chemical & Mechanical testing, NELAP for environmental testing, MDNRE for potable water, and DoD ELAP for all Department of Defense, EPA and other government agencies related work. Reports will be submitted as electronic copies. The final report is submitted in a PDF format. Electronic data deliverables (EDD) are available and are submitted as either Excel spreadsheets or text files.

Sincerely,

Added 80825 - con

Armando Flores

Project Coordinator

Phone: (734) 422-8000 Ext: (211)

Email: aflores@rtilab.com

Terms and Conditions:

Standard turnaround time is 5-7 working days. Rush turnaround is available at a surcharge on a prearranged basis. Our minimum invoice charge is \$100.00 for a standard turnaround time project and \$200.00 for a rush project. Free sample pickup is available within 30 miles of any of RTI Laboratories facilities. Sample containers and preservatives, if needed, are supplied free of charge. Invoices can be paid via Electronic Funds Transfer, Company Check or Cash.