DEPARTMENT OF THE ARMY
BUFFALO DISTRICT, CORPS OF ENGINEERS
1776 NIAGARA STREET
BUFFALO, NEW YORK 14207-3199

REPLY TO
ATTENTION OF

February 24, 2016

Environmental Analysis Team

SUBJECT: Cleveland Harbor, Cuyahoga County, Ohio—Revised Dredged Sediment Evaluation for Upper Cuyahoga River Channel Sediments

Mr. Richard D. Blasick, P.E.
Environmental Manager
Division of Surface Water
Ohio Environmental Protection Agency
P.O. Box 1049
Columbus, Ohio 43216-1049

Dear Mr. Blasick:

The U.S. Army Corps of Engineers (USACE), Buffalo District has completed a comprehensive review of analytical and biological test data generated by the Ohio Environmental Protection Agency (Ohio EPA) on Cleveland Harbor's Upper Cuyahoga River sediments across several sampling and analysis (SSA) efforts performed in 2013, 2014 and 2015. The majority of these data were provided to USACE between September 30, 2015 and January 15, 2016.

USACE review of these data revealed considerable substantive quality control and technical issues. A detailed discussion of these issues, as well as all additional appropriate Ohio EPA data, have been integrated into the revised 2016 dredged sediment evaluation (Enclosure 1), the original of which was provided in our November 20, 2015 application for Clean Water Act (CWA) Section 401 water quality certification (WQC). The revised evaluation also includes USACE 2015 data on the bioaccumulation of polychlorinated biphenyls (PCBs). USACE consideration of the additional Ohio EPA data did not change the determination that sediments dredged from the Upper Cuyahoga River Channel meet CWA Section 404(b)(1) Guidelines (40 CFR 230.11[d]) for placement at CLA-1 in Lake Erie.

USACE identified two overarching issues with the data generated by Ohio EPA: (1) many of the sediment samples across the sampling events were collected from outside the Federal navigation channel dredging prism; and (2) the solid phase bioassays (acute toxicity and PCB bioaccumulation tests) did not follow appropriate laboratory methodologies and failed to yield useable data. In addition, Ohio EPA did not perform any testing relative to Section 5.1 of the U.S. Environmental Protection Agency (USEPA)/USACE Evaluation of Dredged Material for Discharge in Waters of the U.S.—Testing Manual (Inland Testing Manual) (ITM). This section of formal CWA guidance is specifically directed at evaluating compliance of any discharge of dredged sediment at a specified open-water site with respect to applicable state water quality standards (WQSs).

The following provides a summary of USACE concerns with the additional data generated by Ohio EPA:

a. Sediment sample locations. As initially noted in our March 2, 2015 letter, many of the core sediment samples obtained from the river by Ohio EPA in April 2014 were collected from outside the Federal navigation channel dredging prism (this is illustrated in the 2016 dredged sediment evaluation). Review of the other sampling events (2013, May 2014, August 2014, October 2014, June 2015 and October 2015) also showed that many sediment samples were collected from outside the dredging prism. In general, these samples were either collected from outside channel boundaries, in areas of the authorized channel officially “not maintained” (i.e., in dredged material management unit [DMMU]-1), below dredging elevation or on channel side slopes. Data on these samples could not be included in the 2016 dredged sediment evaluation as they are not representative of the dredged sediments. USACE further notes that most of the sampling conducted by Ohio EPA across these events was biased in that it targeted sites along the boundaries of the channel (such as outfalls) rather than the shoals that are actually dredged within the Federal navigation channel. Regardless, sediment contaminant concentration data on all sites located within the dredging prism were integrated into the evaluation.

b. Sediment sampling methodologies. Sediment sampling did not follow the appropriate protocols prescribed in formal guidance (USEPA/USACE 1998a and 1998b). For example, DMMUs were not utilized (the data generated by OEPA were placed into the three USACE designated DMMUs to better enable interpretation) and DMMU composite samples were not created from discrete samples collected from each individual DMMUs. Also, open-lake reference area sediments were not collected during each individual sampling event.

c. Sediment testing methodologies. Ohio EPA did not follow the appropriate protocols for the sampling and testing of dredged sediments as prescribed in formal CWA guidance contained in the ITM and Great Lakes Dredged Material Testing and Evaluation Manual (GLTM). In many cases, this resulted in the generation of data that were unusable or of poor quality, and therefore could not be used for any dredged material management decision-making. Also note that many of the discrete samples contributing to the composite samples employed for the bioassays were collected from outside the dredging prism. The rationale as to why the bioassay data are unusable is presented below:

1. Hyalella azteca *bioassay for survival*—This bioassay did not follow appropriate testing protocols prescribed in the ITM and GLTM. Sediment pore water data was not measured or monitored, and the bioassay water was not purged to preclude effects from ammonia in the bioassay. Ammonia is a naturally occurring constituent of pore water that can confound bioassays performed in the laboratory because it can be toxic. Pre-existing information on ammonia toxicity in these sediments available to Ohio EPA (i.e., previous USACE dredged sediment evaluations relating to Cleveland Harbor) reinforces the need to include sediment pore water ammonia monitoring in the bioassay procedures. It is also important to evaluate sediment pore water ammonia toxicity as it can confound the potential toxicity of persistent contaminants. In addition, the presence of a high density of native oligochaete worms in various sediment samples (see 2016 dredged sediment evaluation) may have been a factor in the observed reduced survival of *H. azteca*. Given this information, it is evident that sediment pore water ammonia and/or native oligochaetes were factors contributing to, or in fact driving, the reduced survival (and growth) observed, thus yielding false-positive toxicity data.

2. Lumbriculus variegatus *PCB bioaccumulation experiments*—This test did not follow appropriate testing protocols prescribed in the ITM and GLTM, and the data generated are not representative of the dredged sediments. Because of this it could not be used for any dredged sediment management decision-making.. This is detailed as follows:

(a) Following test exposures, a fundamental requirement is to allow a standard 24-hour period for *L. variegatus* gut clearance; Ohio EPA's test provided for a gut clearance of 6 hours which is 18 hours less than the standard. A 24-hour gut clearance is also recommended by the most recent American Society of Testing and Materials (ASTM) Standard Guide for Determination of the Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates (ASTM E1688-10). Under an assumption that the channel samples contained a significant number of native oligochaete (tubificid) worms in the sediments (as has been USACE observation since at least 2010), it is also possible that the inclusion of tubificidae genera in the tissue samples absent a minimum 24 hour gut clearance biased test PCB concentrations high due to material remaining in the gut. Furthermore, regarding replication, formal USEPA/USACE guidance requires the standard bioaccumulation experiments to be accomplished with five replicates, including quantification of PCB residues in each individual replicate. The five replicates run by Ohio EPA were composited into a single tissue sample, which resulted in no replication of the measured PCB tissue data. These two deviations from formal guidance render these data to be unusable in this case.

(b) In comparison to USACE data and theoretical values, the Ohio EPA data yielded much higher PCB tissue residues relative to PCB concentrations in both channel and lake sediments. This is uncharacteristic for these sediments and unusual for any sediments with such low residual PCB concentrations. Total organic carbon (TOC)-normalized total PCB concentrations measured in both the channel and lake sediment samples infer that total PCB bioaccumulation in *L. variegatus* should be on order of 0.1 mg/kg. However, reported Ohio EPA *L. variegatus* total PCB tissue residues were on average 470 to 760% higher than would be theoretically expected based on PCB and TOC sediment concentrations alone. Such results are improbable because they are inconsistent with recent site-specific bioaccumulation data following appropriate methodologies, and greatly exceed theoretical values.

To examine this sediment-to-tissue concentration aberration further, biota-sediment accumulation factors (BSAFs) were calculated using the reported Ohio EPA *L. variegatus* total PCB bioaccumulation data. This yielded mean BSAFs of 5.0 for both the channel and lake sediment samples, which is over six times the mean BSAF of 0.73 generated from site-specific USACE data using appropriate test methodologies. It is also approximately four times a mean BSAF of 1.30 derived across other researchers using a standard 28-day laboratory exposure period for *L. variegatus*. The disparity among a BSAF of 5, and those based on site-specific data and data from other researchers, is illustrated in Enclosure 2. Even individual Ohio EPA BSAF values do not appear to reflect any apparent adsorptive influence from hard carbon (which reduces PCB bioavailability), which is to be expected in these sediments.

Enclosure 3 is a histogram (frequency distribution) of mean total PCB BSAFs from various researchers using a standard 28-day laboratory exposure period for *L. variegatus*. The data are heavily skewed right. Mean BSAFs of 5 based on the reported Ohio EPA data lie on the extreme right tail of the distribution, beyond the 95th percentile. In other words, 96% of the BSAFs generated by other researchers are less than or equal to 5. The harbor and lake sediment USACE BSAFs of 0.78 and 0.57 fall at the highest point of the distribution (the mode) and occur within the range of values generated by most of the researchers. Furthermore, the combined harbor/lake sediment USACE BSAF mean of 0.73 is comparable to the median of 0.88 across the BSAF distribution.

Collectively, and regardless as to whether the sediment samples were collected from within or outside the channel dredging prism, this information suggests that the Ohio EPA data are not representative of PCB bioaccumulation from channel shoals or sediments at the placement area.

d. <u>Polycyclic aromatic hydrocarbon (PAH) sediment contamination</u>. With respect to the evaluation of sediment-associated PAH contamination, Ohio EPA analyzed the sediments samples across the SSA efforts for bulk concentration. USACE reiterates that the state-of-the-science approach to evaluating accurate PAH-specific toxicity in sediments is through sediment pore water measurements. USACE has now accomplished this type of testing three times on the Upper Cuyahoga River Channel sediments. Since PAHs in these channel sediments are of predominantly pyrogenic origin, PAH compounds tightly adsorb to sediment hard carbon making them less bioavailable to cause any significant toxicity. We are concerned that Ohio EPA continues to disregard this information and revert to bulk sediment concentration data. Such an approach has a high potential to inaccurately portray PAH toxicity.

We appreciate the provision of this additional information and are hopeful that our review will serve to alleviate some of Ohio EPA's concerns. In the interest of carrying forth a weight-of-the-evidence approach toward the characterization of Upper Cuyahoga River Channel sediments as recommended in our November 20, 2015 letter, we request that Ohio EPA provide a direct technical response to this letter.

Questions pertaining to this matter should be directed to Mr. Scott W. Pickard (716-879-4404; scott.w.pickard@usace.army.mil) by writing to the following address: U.S. Army Corps of Engineers, 1776 Niagara Street, Buffalo, New York 14207-3199.

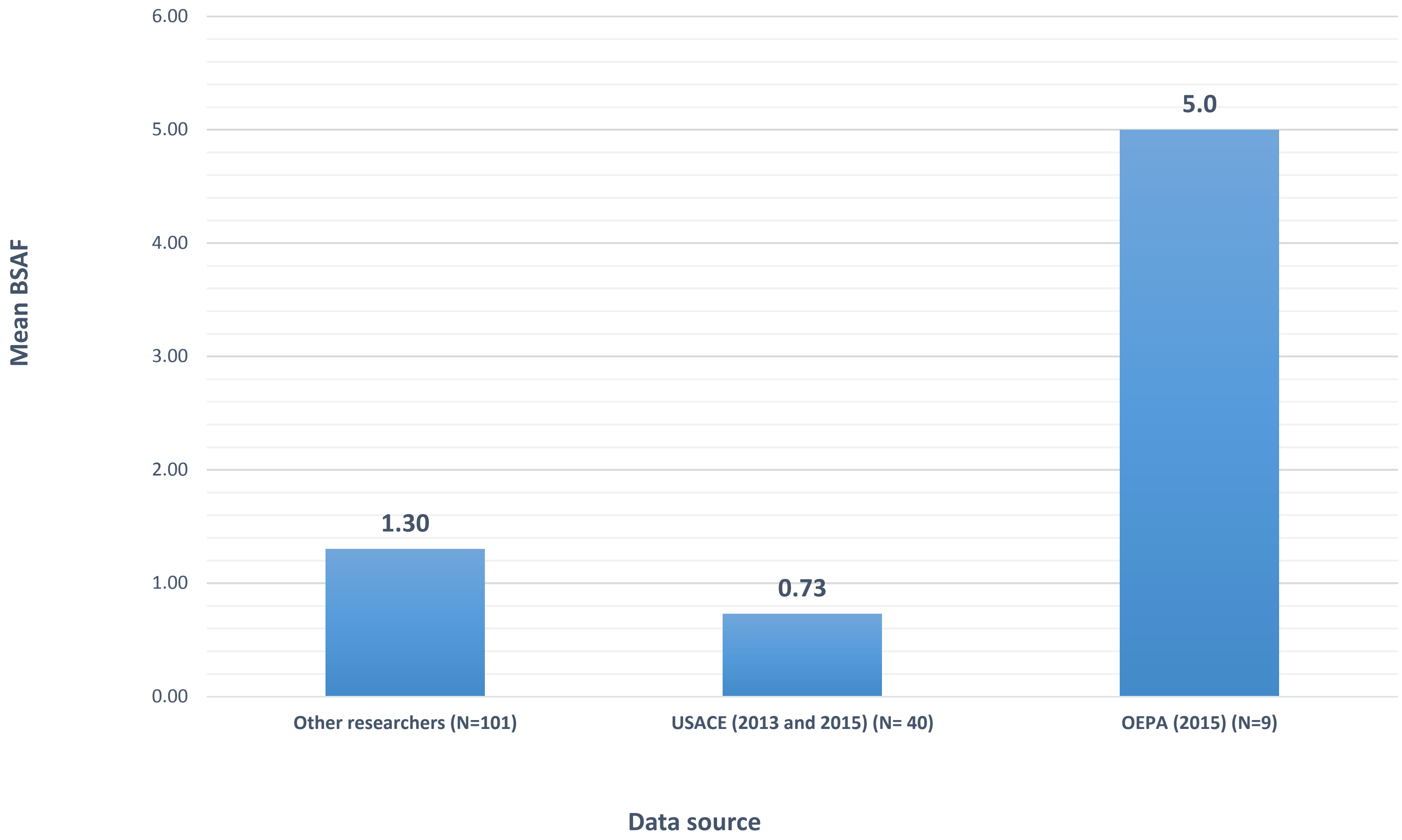
Sincerely,

Martin P. Wargo, PWS
Supervisory Biologist
Environmental Analysis Team

Enclosures

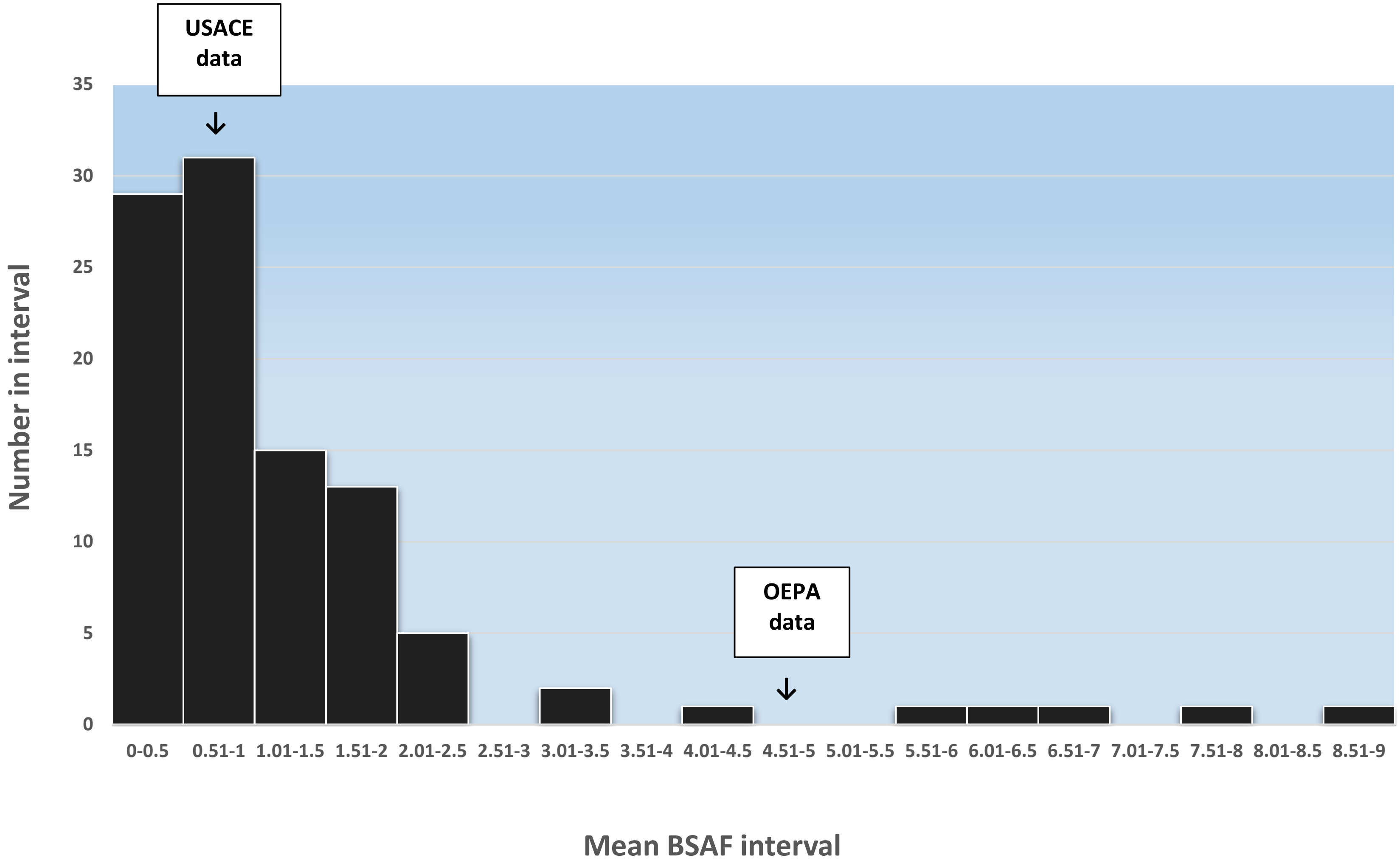
ENCLOSURE 2

Comparison of total PCB BSAFs based on 28-day *L. variegatus* laboratory bioaccumulation experiments



ENCLOSURE 3

Mean total PCB BSAF histogram, *L. variegatus* 28-day laboratory bioaccumulation data from various researchers



EVALUATION OF CLEVELAND HARBOR (UPPER CUYAHOGA RIVER CHANNEL) DREDGED SEDIMENTS WITH RESPECT TO SUITABILITY FOR OPEN-LAKE PLACEMENT

EXECUTIVE SUMMARY

Cleveland Harbor, Ohio sediments within the reach of the Cuyahoga River Channel near the upstream Federal navigation project limit (Upper Cuyahoga River Channel) are typically dredged twice a year to maintain adequate depths for deep-draft commercial navigation. The predominant source of these sediments is erosion within the upstream portions of the Cuyahoga River watershed, including Cuyahoga Valley National Park. Like other sediments or soils within an urbanized and developed watershed or water body influenced by anthropogenic activities, these channel sediments are impacted by low concentrations of metals, nutrients, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides and many other constituents reflective of ambient conditions in the 21st Century environment. These channel sediments were evaluated to determine their suitability for placement at a designated site in Lake Erie. During three sampling events conducted in 2014 and 2015, sediments from this reach of the harbor were sampled as dredged material management units (DMMUs) designated DMMU-1, DMMU-2a and DMMU-2b, and subjected to a suite of physical, chemical and biological tests. In addition, bottom sediments were sampled from a two-square mile deep-water area in Lake Erie proposed for the placement of these dredged sediments (open-lake placement area CLA-1). Other lake locations offshore of Cleveland were also sampled and subjected to similar testing. Depending on the sampling event and sediments sampled, testing included bulk sediment physical and chemical analyses, simultaneously extracted metals/acid volatile sulfide (SEM/AVS) analysis, PAH sediment pore water testing, standard elutriate testing, standard sediment (benthic) and elutriate (water column) bioassays, and sediment benthic bioaccumulation testing for PCBs and pesticides. Data generated from this effort were used to evaluate whether these dredged sediments meet Clean Water Act (CWA) Section 404(b)(1) Guidelines at 40 CFR 230.11(d) for placement in the open-water, including compliance with applicable state water quality standards (WQSs).

To evaluate whether sediments dredged from the Upper Cuyahoga River Channel meet these Guidelines for open-lake placement with respect to contaminant-related impacts, relevant contaminant pathways were examined to evaluate fate, exposure and risks. Primary contaminant exposure pathways in the water column include the uptake of contaminants by plankton and fish as they are released from the dredged sediments during discharge. Water column toxicity tests (bioassays) using a water flea (48-hour survival of *Ceriodaphnia dubia*) and minnow (96-hour survival of *Pimephales promelas*) were used as measurement endpoints to assess these risks. Contaminant exposure pathways from the dredged sediments on the lake bottom include direct toxicity, and net uptake (bioaccumulation) and/or trophic transfer through bioaccumulation. Standard sediment benthic bioassays using an amphipod (10-day survival of *Hyalella azteca*) and midge (10-day survival and growth of *Chironomus dilutus*), and standard benthic bioaccumulation experiments using an oligochaete worm (28-day *Lumbriculus variegatus* bioaccumulation), were used to assess toxicity and bioaccumulation endpoints, respectively.

With respect to benthic contaminant-related impacts after the dredged sediments are placed on the lake bottom, results of the benthic bioassays demonstrated that the channel sediments did not exhibit any toxicity when compared to reference sediments or standard criteria (*H. azteca* mean survival range 86 to 92%; *C. dilutus* mean survival range 88 to 92%; *C. dilutus* mean growth range 0.80 to 2.65 mg dry weight). Total PAHs were initially identified as a preliminary contaminant of concern (PCOC) because bulk concentrations in the channel sediments were at times higher than those in CLA-1 reference sediments. However, the laboratory benthic bioassays and PAH sediment pore water testing indicated that the channel sediments were protective of benthic organisms. PCBs were identified as a PCOC in the channel sediments because bulk concentrations were occasionally measured at higher concentrations than those in CLA-1 and other reference sediments. Laboratory experiments showed that the benthic bioaccumulation of total PCBs from the channel sediments (mean range 5,259 µg/kg-lipid to 8,666 µg/kg-lipid) was not significantly higher than that from CLA-1 reference sediments (mean 7403 µg/kg-lipid [excluding any suspected PCB impacted sediments]), and/or associated magnitudes of difference (MODs) (measured laboratory bioaccumulation from dredged sediments/measured laboratory bioaccumulation from reference area sediments) relative to CLA-1 reference sediments were less than a factor of 2, suggesting that such a difference is not likely to warrant ecological and human health concerns. In addition, benthic bioaccumulation of total PCBs from the channel sediments was comparable to bioaccumulation measured using regional lake background sediments collected offshore of Cleveland (surface area-weighted mean 5,188 µg/kg-lipid). Laboratory experiments showed that the benthic bioaccumulation of dichlorodiphenyldichloroethylene (DDE) from DMMU-1 (8.4 µg/kg) and DMMU-2b sediments (7.3 µg/kg) were statistically higher than those associated with the CLA-1 reference sediments (6.4 µg/kg). However, MODs relative to CLA-1 reference sediments were less than a factor of 2, suggesting that such a difference is not likely to warrant ecological and human health concerns. Laboratory experiments showed that the benthic bioaccumulation of DDE from DMMU-2b sediments (6.7 µg/kg) was not statistically different than those associated with the CLA-1 reference sediments. This information shows that open-lake placement of the channel sediments at CLA-1 would not result in any significant or ecologically meaningful increase in PCBs or DDE bioaccumulation in aquatic life, including in fish, and meets CWA Section 404(b)(1) Guidelines. An important consideration is the benefit resulting from strategic placement of dredged sediments within the southeast quadrant of CLA-1. Placement of this dredged sediment at this location would serve to cap and abate significant PAH-related benthic toxicity associated with existing CLA-1 sediments in that area, and result in a several-fold reduction in potential PCB bioaccumulation from sediments within a portion of that area.

With respect to impacts when contaminants in the dredged sediments are released to the water column during open-lake placement, elutriate testing and water column bioassays identified ammonia-N (maximum measured elutriate concentration 19 mg/L) as a water column PCOC. It was identified as a PCOC because sediment elutriate concentrations were greater than levels protective of water column organisms, prior to consideration of dilution and dispersion during dredged sediment placement. Ammonia is a naturally occurring constituent of sediment pore water and, due to its labile and ephemeral nature, is generally not considered a contaminant of concern in the management of dredged sediments. Water quality modeling indicated that ammonia released during dredged sediment placement would rapidly dilute in the water column to levels protective of aquatic life. Therefore, ammonia-N was eliminated as a PCOC. Elutriate data and modeling indicated that the discharge of the dredged sediments at CLA-1 would be protective of aquatic life and human health, and comply with applicable State WQSs after consideration of dilution and dispersion.

Across several events between 2013 and 2015, the Ohio Environmental Protection Agency (OEPA) generated data on Upper Cuyahoga River and Lake Erie sediments offshore of Cleveland. Data generated from these efforts were reviewed and considered, and some were not integrated into the evaluation due to quality control and technical issues. OEPA data integrated into this evaluation were similar to the data generated by USACE between 2012 and 2015.

This evaluation indicates that the discharge of sediments dredged from DMMU-1, DMMU-2a and DMMU-2b at CLA-1 would not result in contaminant-related, unacceptable adverse effects to the aquatic ecosystem. This conclusion is analogous with the previous 2013 dredged sediment evaluation. Based on this information, it has been concluded that these dredged sediments meet CWA Section 404(b)(1) Guidelines for open-lake placement at CLA-1 as presented in 40 CFR 230.11(d).

1.0 INTRODUCTION AND BACKGROUND

Cleveland Harbor, Ohio is located on south shore of Lake Erie at the mouth and lower reach of the Cuyahoga River at Cleveland, Ohio. Federal navigation channels in the harbor are deep-draft and designed to accommodate commercial navigation, and include a River Channel, Turning Basin, Old River Channel and Outer Harbor channels. These channels have authorized depths ranging from -23 to -29 feet low water datum (LWD)[1]. Cleveland Harbor is situated within the designated Cuyahoga River Great Lakes Area of Concern (AOC) (U.S. Environmental Protection Agency [USEPA] 2015a). The AOC includes the lower 45 miles of the river from the Ohio Edison Dam to the mouth, and approximately 10 miles of Lake Erie shoreline from Edgewater Park to Wildwood Park on the west and east sides of Cleveland, respectively. Maintenance dredging of harbor channels requires the need to manage the resulting dredged sediments. In 2013, sediments dredged from the Upper Cuyahoga River Channel between the upstream limit (Station 799+00) and downstream upper Turning Basin (Station 736+00), which is represented by three dredged material management units (DMMUs) designated DMMU-1, DMMU-2a and DMMU-2b (Figure 1), were found to meet Clean Water Act (CWA) Section 404(b)(1) Guidelines ("contaminant determination" at 40 CFR 230.11[d]) for open-lake placement at the deep-water Lake Erie area referred to as CLA-1 (Figure 2) (USACE 2013a).

In the Cuyahoga River portion of Cleveland Harbor, human alterations to the channel have enlarged channel dimensions compared to the more natural upstream sections of the river. The Cuyahoga River naturally transports a large sediment supply, which is suspended in the water column under certain water velocities and carried downstream. A primary source of sediment loading is natural erosion within the Middle Valley of the Cuyahoga River watershed, including Cuyahoga Valley National Park (USACE 2011). Erosive riverbank soils are subject to increased runoff volumes caused by urbanization of surrounding areas, resulting in streams carrying a heavy sediment load. As water enters the enlarged Upper Cuyahoga River Channel at the upstream end of Cleveland Harbor, velocities decrease significantly, resulting in the rapid deposition of the previously suspended sediment. Consequently, the Upper Cuyahoga River Channel acts as a trap for sediments that would otherwise be discharged and deposited to downstream areas, including Lake Erie. As sediments deposit through sedimentation and accumulate as shoals, they tend to obstruct deep-draft commercial navigation in the channel, thus requiring regular maintenance dredging.

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[1] Low Water Datum for Lake Erie is elevation 569.2 feet above mean water level at Rimouski, Quebec, Canada (International Great Lakes Datum [IGLD] 1985).

FIGURE 1
UPPER CUYAHOGA RIVER CHANNEL
CLEVELAND, OHIO

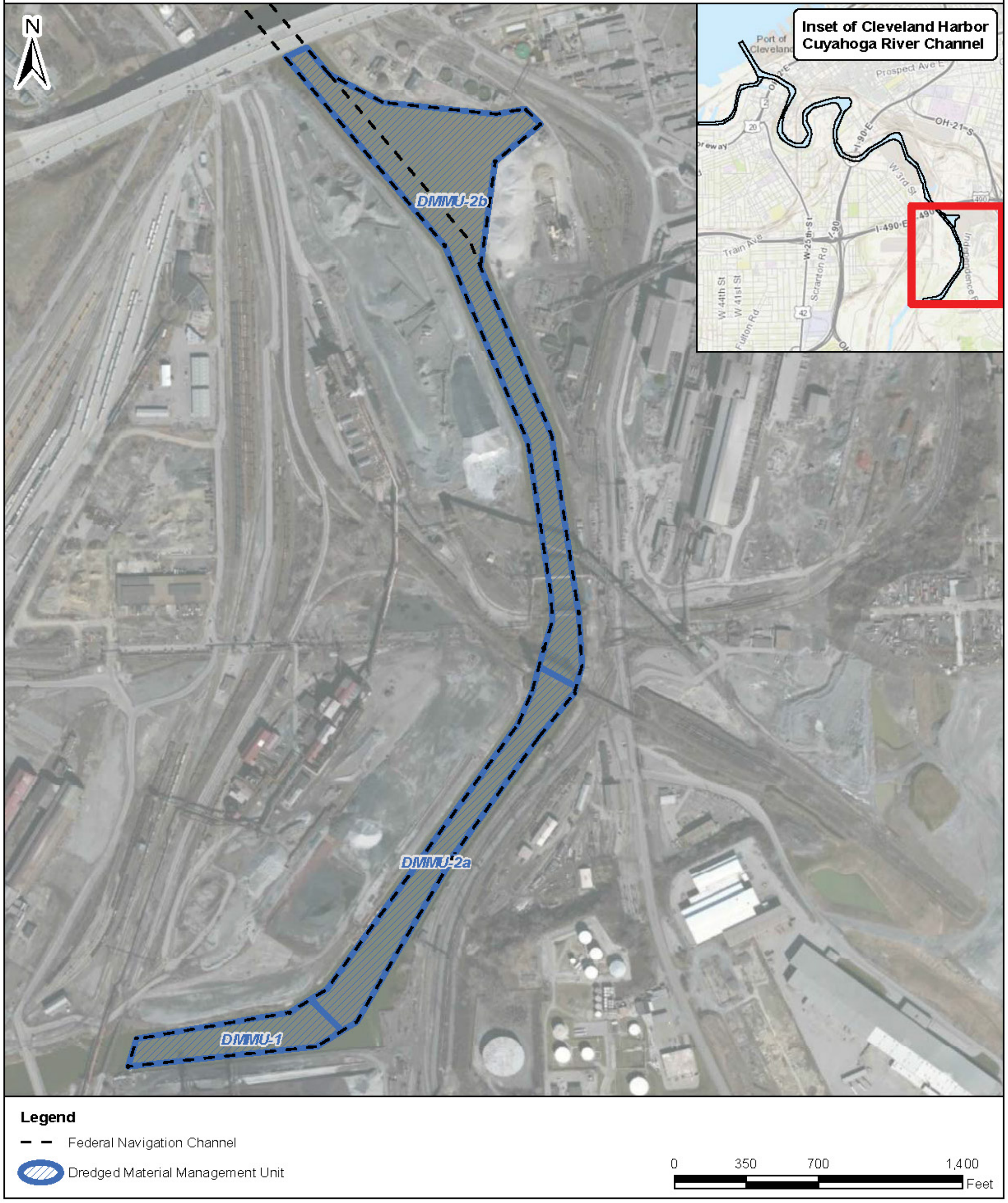
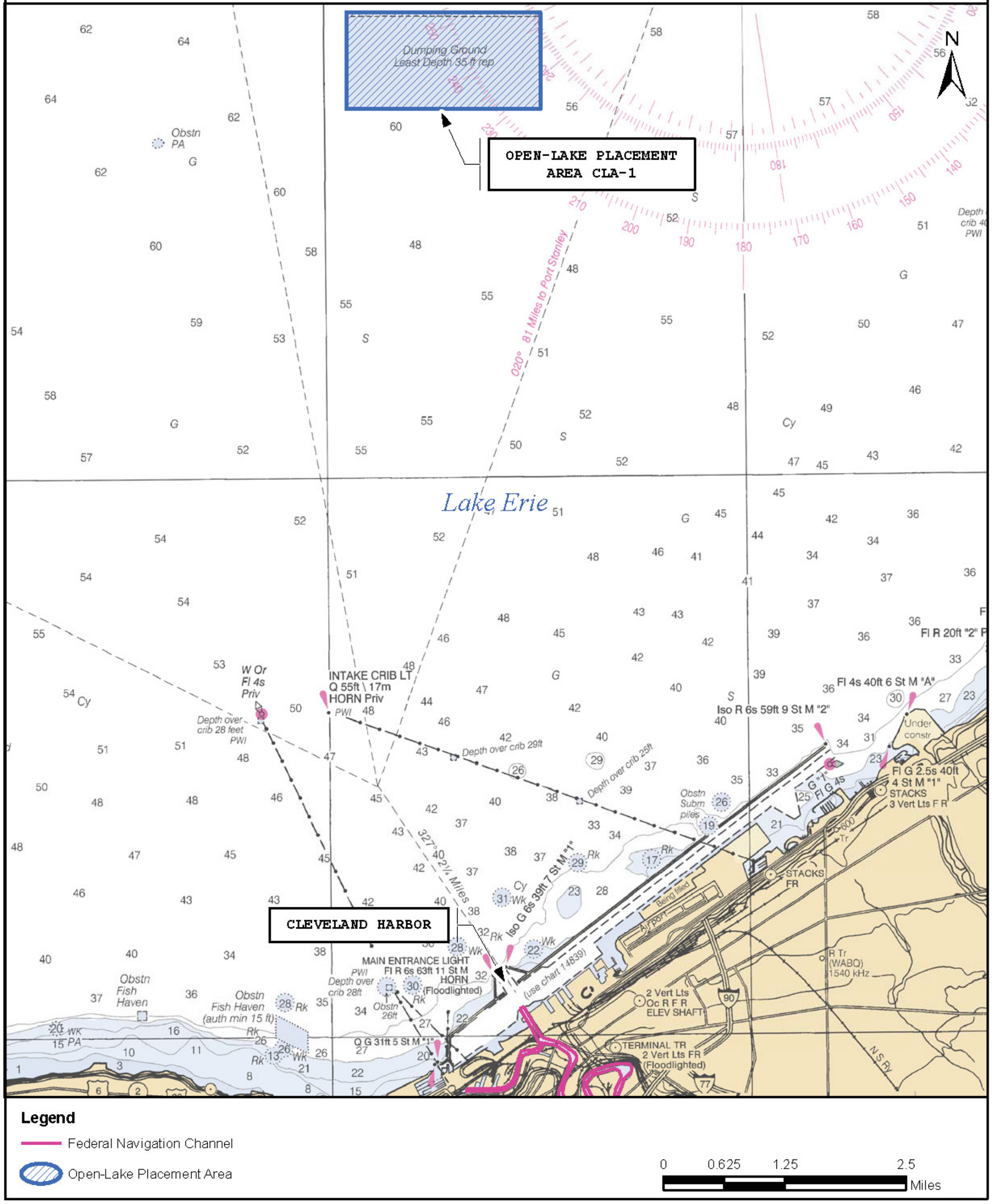


FIGURE 2
PROPOSED OPEN-LAKE PLACEMENT AREA CLA-1
CLEVELAND, OHIO



Sediments within the Upper Cuyahoga River Channel generally consist of organic rich brown clayey silt, with localized areas of sand, gravel and leaf debris mixed in the sediments located immediately downstream of the upstream limit of the Federal navigation project. Lake sediments offshore of Cleveland range widely in composition, and can consist of coarse sand and gravel, shell fragments, hardpan clay, shale and clayey silt. Lake sediments at CLA-1, as well as other deep open-lake areas offshore of the harbor, are more similar to the shoaled sediments in the channel, generally consisting of brown clayey silt.

Because the transition from upstream streambed to the maintained channel functions as a sediment trap, the Upper Cuyahoga River Channel experiences significantly higher shoaling rates than the rest of the harbor, estimated at more than eight feet per year in certain areas. About 200,000 cubic yards of sediment are dredged annually from this portion of the Cuyahoga River Channel, often over multiple dredging events per year, to maintain depths adequate for deep-draft commercial navigation. Cleveland Harbor is typically dredged in two phases; in the spring between May and June, and fall between October and November. The vast majority of sediments are dredged during the spring phase. About 80 percent of the harbor's annual dredging needs are typically in the Upper Cuyahoga River Channel. There are a number of potential sources of sediment contamination within the watershed, both anthropogenic and natural. These sources include: municipal and industrial discharges, urban and agricultural runoff, combined sewer overflows, atmospheric deposition, biological production (detritus) and mineral deposits. Due to the potential for contaminant-related impacts, the vast majority of sediments dredged from harbor have been placed in Federal and non-Federal confined disposal facilities (CDFs) since about 1968. However, evaluations conducted on sediment samples obtained in 2010 to determine suitability of sediment for beneficial use concluded that sediments from the Upper River Channel would be suitable for aquatic placement scenarios (Kreitinger *et al.* 2011). In 2013, sediments dredged from the Upper Cuyahoga River Channel were concluded to meet contaminant-related CWA Section 404(b)(1) Guidelines for open-lake placement at CLA-1 (USACE 2013a).

The objective of this report is to evaluate whether sediments dredged from Cleveland Harbor's Upper Cuyahoga River Channel meet CWA Section 404(b)(1) Guidelines at 40 CFR 230.11(d) for open-lake placement at CLA-1 based on new data. USACE (2013a) concluded that these dredged sediments met these Guidelines. This evaluation is in accordance with the protocols and guidelines prescribed in the Great Lakes Dredged Material Testing and Evaluation Manual (Great Lakes Testing Manual [GLTM]) (USEPA/U.S. Army Corps of Engineers [USACE] 1998a) and Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.—Testing Manual (Inland Testing Manual [ITM]) (USEPA/USACE 1998b), and is specific to 40 CFR 230.11(d) (“contaminant determination”) (USEPA 2015b). Further, it is consistent with 33 CFR 336 toward establishment of the Federal standard relating to the least costly dredged material management alternative, consistent with sound engineering practices and selected through CWA Water Act Section 404(b)(1) Guidelines (USACE 1988).

2.0 SEDIMENT SAMPLING AND TESTING

This evaluation emphasizes 2014 and 2015 analyses performed on sediment samples collected from the Upper Cuyahoga River Channel, and open-lake nearshore and deep water areas in Lake Erie. It addresses the discharge of sediments dredged from the Upper Cuyahoga River Channel at CLA-1. This evaluation also considers relevant sediment data and information from 2012 as contained in USACE (2013a), as well as relevant data and information generated by the Ohio Environmental Protection Agency (OEPA) across several sediment sampling and analysis events performed between 2013 and 2015 (see Section 3.5).

2.1 2014 and 2015 investigations

2.1.1 Objective

The overall objective of the 2014 and 2015 sediment sampling and analyses efforts was to evaluate whether sediments dredged for maintenance of the Upper Cuyahoga River Channel meet CWA Section 404(b)(1) Guidelines at 40 CFR 230.11(d), which includes compliance with applicable state water quality standards (WQSs), for open-lake placement.

The 2014 investigation was implemented to address the most pressing concerns identified by OEPA in reviewing the 2013 water quality certification application for open-lake placement. As such, the 2014 sampling focused on the analyses of polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) in Cleveland Harbor and lake sediments. Another objective of the 2014 investigation was to evaluate the variability of PAHs and PCBs in regional lake sediments offshore of Cleveland, as well as in and around the previously identified open-lake placement/reference areas. The 2015 investigation was a more standard sampling/testing effort to support dredged sediment management decisions. The details of these investigations are provided below.

2.1.2 2014 investigation

a. **Sampling**

Sediment sampling in 2014 was conducted across two events, June 9-11, 2014 and September 23 and 24, 2014. Harbor and lake sediments were sampled in June, and additional lake sampling was conducted in September.

To characterize sediment shoals within the Upper Cuyahoga River Channel, 15 bulk surface sediment grab samples (sites CH-1 through CH-15) were collected from locations staged throughout channel boundaries (Figure A1).

To characterize lake bottom sediments in Lake Erie, sediment grab samples were collected from several deep-water areas adjacent to Cleveland Harbor: CLA-1 (discrete sites CLA1-1 through CLA1-5), and additional reference areas/sites CLA-4 (discrete sites CLA4-1 through CLA4-5), CLA-7 (discrete sites CLA7-1 through CLA7-5), CLA14 (discrete sites CLA14-1 through CLA14-5) and CLAM-1 through CLAM-5 (Figure A2). Discrete sediment samples were also composited as follows (see Figures 1 and 2): DMMUs—composite DMMU-1 (discrete sites CH-1 through CH-5), composite DMMU-2a (discrete sites CH-6 through CH-10), composite DMMU-2b (discrete sites CH-11 through CH-15); proposed open-water placement area—composite CLA-1 (discrete sites CLA1-1 through CLA1-5) and reference composite CLA-4 (discrete sites CLA4-1 through CLA4-5), CLA-7 (discrete sites CLA7-1 through CLA7-5), and CLA-14 (discrete sites CLA14-1 through CLA14-5).

In September, 25 additional lake sediment samples were collected from locations spaced at two-mile increments across a triangular grid extending from just outside Cleveland Harbor breakwaters to CLA-1 (LE-1 through LE-25) (Figure A3). Sediment samples were not collected from six of the proposed sampling locations (LE-5, 8, 9, 15, 17 and 18) due to poor sample recovery.

b. **Analyses**

The sediment samples were analyzed by RTI (2014a) and RTI (2014b) as follows:

(1) **Bulk sediment analyses**

(a) *Discrete samples*—Discrete sediment samples from the harbor and lake were analyzed for bulk grain size (sieve and hydrometer) and percent moisture, total organic carbon (TOC), PCBs (209 congeners) and PAHs (16 USEPA priority pollutants and methylnaphthalenes). The lake samples collected in September were also analyzed for total phosphorus (TP).

(b) *Composite samples*—Composite sediment samples from the harbor (DMMU-1, DMMU-2a and DMMU-2b) and lake (CLA-1, CLA-4, CLA-7 and CLA-14) were also analyzed for bulk grain size (sieve and hydrometer) and percent moisture, TOC, PCBs (209 congeners) and PAHs (16 USEPA priority pollutants and methylnaphthalenes). In addition, sediment and pore water was analyzed for 34 PAHs (18 non-alkylated parent compounds and 16 groups of generic alkylated forms) which have been identified as being generally most abundant in the environment and commonly measured (USEPA 2003).

(2) **Biological testing**

(a) ***28-day Lumbriculus variegatus bioaccumulation (from sediment)***—28-day *L. variegatus* bioaccumulation tests for PCBs (209 congeners) were applied to harbor composite samples DMMU-1, DMMU-2a and DMMU-2b and lake composite samples CLA-1, CLA-4, CLA-7 and CLA-14. Additionally, bioaccumulation testing was applied to each discrete lake sample collected in June. A subset of samples from September were subject to bioaccumulation testing (LE-1, 3, 11, 12, 13, 19, 21, 23, 24). Lipid content in *L. variegatus* tissue was determined for each sample.

2.1.3 2015 investigation

a. **Sampling**

Sediment sampling in 2015 was conducted during the week of April 27, 2015.

To characterize sediment shoals within the Upper Cuyahoga River Channel, 15 bulk surface sediment grab samples (sites CH-1 through CH-15) were collected from locations staged throughout the area, within the navigation channel boundaries (Figure A4). In addition, a subset samples from certain locations collected through core sampling from the sediment surface to project depth or dredging prism (CH-3, 5, 7, 9, 12 and 15).

To characterize sediments in the open-waters of Lake Erie, sediment grab samples were collected from CLA-1 (discrete sites CLA1-1 through CLA1-5), and an additional reference area, CLA-4 (discrete sites CLA4-1 through CLA4-5) (Figure A5).

b. **Analyses**

The sediment samples were analyzed by RTI (2015) and USAERDC (2015a) as follows:

(1) **Bulk sediment analyses**

(a) ***Discrete samples***—Discrete sediment samples from the harbor and lake were analyzed for metals (23 target analytes list (TAL, including mercury), total cyanide, total Kjeldahl nitrogen (TKN), ammonia nitrogen (NH_3), TP, pesticides, bulk grain size (sieve and hydrometer) and percent moisture, TOC, PCBs (Aroclors) and PAHs (16 USEPA priority pollutants and methylnaphthalenes). The lake samples were also analyzed for total oil and grease.

(b) ***Composite samples***—Composite sediment samples from the harbor (DMMU-1, DMMU-2a and DMMU-2b) and lake (CLA-1 and CLA-4) were subjected to the same physical and chemical analyses as the discrete samples with the addition of the analysis of acid volatile sulfides/simultaneously extracted metals (AVS/SEM), PCBs (209 congeners) and analysis of pore water for 34 PAHs.

(2) **Biological testing**

(a) ***28-day* Lumbriculus variegatus *bioaccumulation (from sediment)***—Standard 28-day *L. variegatus* bioaccumulation tests for PCBs (209 congeners) were applied to harbor composite samples DMMU-1, DMMU-2a and DMMU-2b and lake composite samples CLA-1 and CLA-4. Lipid content was determined for each sample.

(b) ***10-day* Hyalella azteca *and* Chironomus dilutus *whole sediment toxicity tests***—Standard 10-day *H. azteca* and *C. dilutus* whole sediment (solid phase) toxicity tests were applied to harbor composite samples DMMU-1, DMMU-2a and DMMU-2b and lake composite samples CLA-1 and CLA-4.

(b) ***48-hour* Ceriodaphnia dubia *and 96-hour* Pimephales promelas *water column toxicity tests***—Standard 48-hour *C. dubia* and four-day *P. promelas* water column toxicity tests were applied to harbor composite samples DMMU-1, DMMU-2a and DMMU-2b. Based on the results of these bioassays, toxicity identification/reduction evaluation (TIE/TRE) was performed on the sediment elutriates.

(3) **Elutriate testing**

The standard elutriate test (SET) was performed on harbor composite sediment samples DMMU-1, DMMU-2a and DMMU-2b. The SET is a laboratory simulation to predict the potential release of contaminants from dredged sediments to the water column during open-water placement of dredged sediments. Elutriate preparations and lake water were analyzed for the same chemical parameters as the discrete sediment samples.

3.0 DREDGED SEDIMENT EVALUATION

3.1 General description

This evaluation focuses on sediments dredged from the upper Cuyahoga River Channel as represented by DMMU-1, DMMU-2a and DMMU-2b (Figure 1), and its placement at open-lake area CLA-1 (Figure 2). It references or integrates information from the previous 2013 dredged sediment evaluation (USACE 2013) as appropriate.

The initial step toward evaluating the toxicological effects of placing any dredged sediments in the open-lake is to compare bulk contaminant concentrations in the DMMU samples to those from open-lake placement area(s). If any DMMU contaminant concentration significantly exceeds open-lake placement area sediment concentrations such that they would present a potential toxicological risk, it was identified as a preliminary contaminant of concern (PCOC) or COC, and then subjected to further testing and/or evaluation. Further testing/evaluation typically includes modeling or biological testing (bioassays). With respect to applicable state WQSs, sediment elutriate data are used to assess compliance after consideration of dilution and dispersion. Water column bioassay data are also utilized to evaluate water quality-related effects and compliance.

3.2 Site conceptual model

The site conceptual model for this activity focuses on potential contaminant-related adverse impacts to the aquatic ecosystem that would occur as a result of the discharge of the dredged sediment at the deep-water open-lake area designated CLA-1. This area is two square miles and in water depths of between 50 and 60 feet. Aquatic habitat at CLA-1 consists primarily of warm water, mud-bottom (mainly silt/clay), benthic substrate with overlying water column. Some of CLA-1 has been impacted by dredged sediment as it was previously used for the placement of sediments dredged from Cleveland Harbor over 40 years ago. Bottom sediments at this area are colonized by a community of benthic invertebrates that are relatively low in species diversity and dominated by oligochaetes and chironomids. The water column at this area is used by most fish, nekton and plankton on a transient basis as required for foraging and migration. Aquatic birds use the water surface and water column on a transient basis for resting and foraging.

Under this dredged sediment management alternative, sediments from Cleveland Harbor would typically be mechanically dredged from the channel using a clamshell bucket, then placed in a scow for transport and discharged at CLA-1. The dredged sediment is composed mainly of silts, clays, sands and water with residual bulk concentrations of contaminants and organic matter. During discharge, dredged sediment is released from the scow and descends through the water column until it hits the bottom substrate, then collapses and spreads out before coming to rest on the lake bottom. Contaminant-related impacts can occur in both the water column and benthic environs, and are assessed mainly through toxicity and bioaccumulation endpoints relative to biological receptors. Typical exposure pathways between the dredged sediment and receptors would include uptake through absorption (bioconcentration) and absorption/ingestion (bioaccumulation), and trophic transfer through bioaccumulation. With respect to contaminant-related impacts in the water column, effects require exposure to biota and include the release of dissolved contaminants from the dredged sediments and turbidity, both of which are short-term events. These effects are evaluated via comparison of elutriate contaminant concentrations, after considering the effects of dilution and dispersion in the water column by modeling of sediment elutriate data, with WQSs and toxicity criteria developed by elutriate bioassays using a minnow and water flea as representative test species. With respect to contaminant-related benthic impacts associated with the placed dredged sediments, effects require exposure to biota and include toxicity and bioaccumulation. These effects are evaluated through bulk sediment chemistry, solid phase bioassays using an amphipod and midge as representative test species, bioaccumulation experiments using an aquatic worm, and modeling. Regarding dredged sediment movement on the lake bottom, the placed sediment would behave in a manner similar to the adjacent and surrounding lake bottom sediments, whereby a thin layer of the actively bioturbated zone could resuspend and migrate from the area under severe storm conditions. Resuspended dredged sediments under these conditions would constitute a very small fraction of the regional suspended sediment load during the storm event. Any resuspended dredged sediments would mix thoroughly with the load and be indistinguishable from the regional load. Deeper depths of the open-lake placement area would serve to allay the potential for sediment erosion, resuspension and movement.

3.3 2014 investigation

3.3.1 Bulk sediment analyses

a. **Physical testing**

Tables B1and B2 present the results of these analyses. The particle size data across the DMMU-1, DMMU-2a and DMMU-2b discrete samples show that the sediments are comprised of between 4.2% (CH-2) and 98.4% (CH-14) clays and silts, with the remainder sands and gravels (on a composite sample basis, 80.8% sands/gravels in DMMU-1 to 84.8% silts and clays in DMMU-2b). Sediments within DMMU-1 and the immediately downstream Site CH-6 were more coarse-grain in nature, ranging from

55.8% (CH-3) to 95.9% (CH-2) sands and gravels. Bottom sediments in discrete samples from CLA-1 were predominantly fine-grain in nature and composed of 87.1% (CLA1-5) to 99% (CLA1-2 and CLA1-4) clays and silts, with the remainder sands and gravels. Bottom sediments in discrete samples from open-lake area CLA-14 were more of a mixture of fine- and coarse-grain sediments, and composed of 44.6% (CLA14-5) to 68.7% (CLA14-4) clays and silts, with the remainder sands and gravels. Bottom sediments at the remaining open-lake areas and sites varied, ranging from 1.8% (LE-6) to 99.6% (CLA7-2) clays and silts, with the remainder sands and gravels. Note that fine sand content in each of the samples is classified with a sieve size of 0.075-0.425 mm as compared to a silt sieve size of 0.005-0.075 mm. It can be very difficult to visually or texturally discern a difference between silt and fine sand under this classification. Consequently, dredged sediments that are predominantly fine sand under this classification are oftentimes not well suited for littoral or beach nourishment.

b. **Chemical testing**

(1) ***Inorganic analyses***

(a) **Inorganics**—Tables B3 and B4 present the results of these analyses

●*TOC*—Table B3 presents the results of these analyses. TOC content in discrete samples across DMMU-1, DMMU-2a and DMMU-2b ranged from 0.72% (CH-2) to 2.8% (CH-6). On a composite sample basis, TOC content in the channel sediments ranged from 1.2% (DMMU-1) to 2.0% (DMMU-2a). The DMMU composite sample mean of 1.6% was higher than the mean of 1.2% in 2012 (USACE 2013). TOC content in discrete samples of bottom sediments at CLA-1 was consistent and ranged from 2.6% (CLA1-4) to 3.6% (CLA-1 composite). TOC content in discrete samples of bottom sediments at open-lake area CLA-14 varied somewhat, ranging from 2.4% (CLA14-1 and CLA14-2) to 6.7% (CLA14-4). TOC content in discrete samples of bottom sediments at the remaining open-lake areas and sites also varied, ranging from 0.19% (LE-11) to 4.4% (CLAM-3).

●*TP*—Table B4 presents the results of these analyses. TP concentrations in discrete samples of bottom sediments at the open-lake sites varied, ranging from 44 (LE-6) to 730 (LE-3) mg/kg.

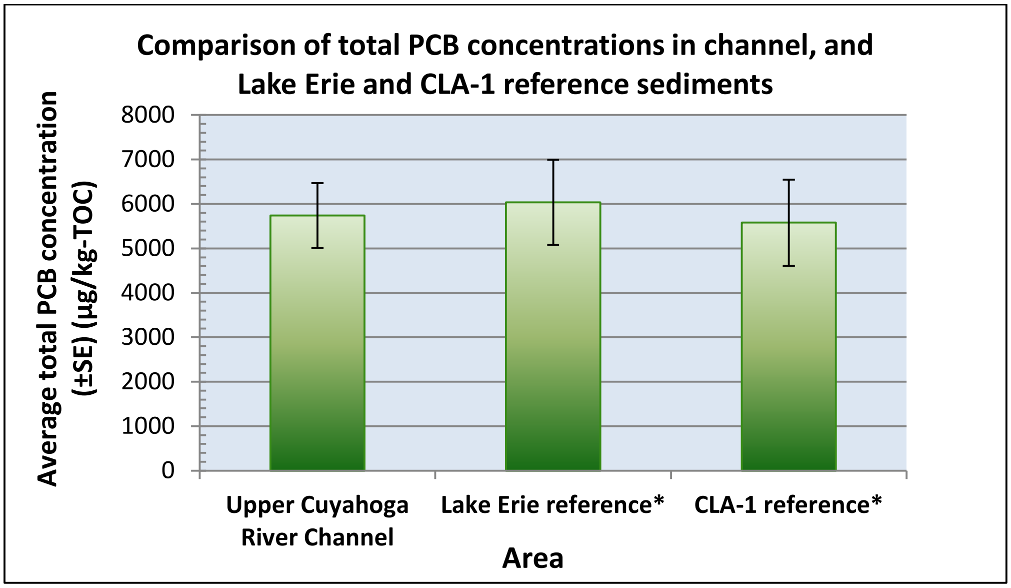
(2) ***Organic analyses***

(a) **PCBs**—Tables B5 and B6 summarize the results of these analyses (congener data are in RTI 2014a and RTI 2014b, respectively). Total PCB concentrations in the sediment samples were determined by summing all congeners, with non-detectable concentrations valued at zero.

●*PCB concentrations in lake bottom sediments*—For the purposes of this evaluation, bulk sediment total PCB concentrations of up to 400 µg/kg were determined to be within the range of ambient lake bottom sediments (not influenced by past dredged sediment discharges) based on the range in measured PCB concentration between sediment samples from LE-11 and LE-10 (Table B6). This also served as the basis for assessing whether total PCB concentrations in sediment samples at assumed former dredged sediment discharge sites were significantly influenced by dredged sediments. These sites were determined to include CLA1-5 (1,450 µg/kg) within the proposed open-lake placement area, LE-3 (5,880 µg/kg) outside and adjacent to Cleveland Outer Harbor and LE-16 (968 µg/kg) just outside of CLA-14. Excluding these three sites, the average and range in total PCB concentrations across all discrete samples in Lake Erie offshore of Cleveland was 112 µg/kg (5,778 µg/kg-TOC) and 9.36 to 400 µg/kg or 248 to 25,000 µg/kg-TOC, respectively. Excluding sites from CLA-1 and CLA-14 made little difference in these values, resulting in an average and range of 102 µg/kg (6,038 µg/kg-TOC) and 9.36 to 400 µg/kg (248 to 25,000 µg/kg-TOC,) respectively. Using this approach, CLA-1 reference sediments were determined based on PCB data from CLA1-1, CLA1-2, CLA1-3 and CLA1-4, yielding a total PCB concentration mean of 156 µg/kg (5,579 µg/kg-TOC).

●*Comparison of PCB concentrations in channel and lake sediments*—The average total PCB concentration across all discrete samples in DMMU-1, DMMU-2a and DMMU-2b was 95 µg/kg (5,737 µg/kg-TOC) (range 32 to 300 µg/kg or 2854 to 15000 µg/kg-TOC) and comparable to the average of 102 µg/kg (6,038 µg/kg-TOC) (range 9.36 to 400 µg/kg or 248 to 25,000 µg/kg-TOC) across all discrete Lake Erie sediment samples not influenced by past dredged sediment placement. It is also comparable to the average of 112 µg/kg (5,778 µg/kg-TOC) (range 9.36 to 400 µg/kg or 248 to 25,000 µg/kg-TOC) across all discrete Lake Erie sediment samples when including samples from CLA-1 and CLA-14, and excluding samples where PCB contamination is assumed to be associated with formerly placed dredged sediments. This shows that PCB contamination in the channel sediments is consistent with (or less than) that which exists in surface Lake Erie sediments offshore of Cleveland. Total PCB concentrations in the vast majority of surface sediments sampled at CLA-1 were consistent with ambient levels (CLA1-1 through CLA1-4 average 156 µg/kg [5579 µg/kg-TOC]), indicating limited impact in these samples from former sediment placement activities. The average total PCB concentration across all discrete DMMU-1, DMMU-2a and DMMU-2b samples was lower or comparable to this average (range 104 to 236 µg/kg or 4,000 to 8,138 µg/kg-TOC). Figure 3 compares total PCB concentrations in the channel, Lake Erie and CLA-1

FIGURE 3



*Excludes sites where PCB contamination was suspected to be influenced from past dredged sediment discharges.

reference sediments.

Table 1 summarizes the total PCB data across all of the channel and lake sediment samples:

TABLE 1

PCB MEASUREMENT	LOCATION/AREA			
	HARBOR	LAKE		
	UPPER RIVER CHANNEL	CLA-1 REFERENCE*	CLA-14*	OTHER AREAS/SITES*
DISCRETE SAMPLES				
Total PCBs (µg/kg)	**32 to 300**	**104 to 236**	**82 to 291**	**9.36 to 400**
TOC-normalized PCBs (µg/kg-TOC)	**2,854 to 15,000**	**4,000 to 8,138**	**2,158 to 9,700**	**248 to 25,000**
COMPOSITE SAMPLES				
Total PCBs (µg/kg)	**67.9 to 144**	**156****	**179**	**110 to 155**
TOC-normalized PCBs (µg/kg-TOC)	**5,100 to 8,471**	**5,579****	**5,967**	**3,929 to 5,536**

*Excludes areas/sites where PCB contamination was suspected to be influenced from past dredged sediment discharges.
**Due to higher PCB contamination encountered at CLA1-5 (1,450 µg/kg) (which biased the composite sample concentration high [1,250 µg/kg]), the average value across CLA1-1 through CLA1-4 was used in lieu of the composite sample concentration.

With respect to comparisons among the channel and lake sediments, there are two main points that can be concluded from the data in this table:

- *PCB contamination in the channel sediments is within the range of PCB contamination in Lake Erie bottom sediments not impacted by past dredged sediment placement activities.*
- *Except for one site within CLA-1 and one site just outside of CLA-14, PCB contamination in reference sediments at open-lake areas CLA-1 and CLA-14 is within the range of PCB contamination in Lake Erie bottom sediments not impacted by past dredged sediment discharge activities.*

The PCB data on the channel sediments are consistent with those presented in USACE (2013a) in which concentrations in discrete sediment samples from DMMU-1, DMMU-2a and DMMU-2b ranged from 33.3 to 333 µg/kg (composite sample range 81.4 to 95.6 µg/kg), and from 2,932 to 26,385 µg/kg-TOC (composite sample range 6,373 to 9,146 µg/kg-TOC) on a TOC-normalized basis. The PCB data on bottom sediments at open-lake areas CLA-1 (except for CLA1-5) and CLA-4 are also consistent with those presented in USACE (2013a).

Based on this information, total PCBs were not identified as a PCOC in the channel sediments. However, benthic bioaccumulation testing for PCBs was nevertheless performed (see paragraph 3.3.2).

(b) **PAHs**

●*PAH concentrations in sediments*—Table 2 summarizes total PAH data across all of the channel and lake sediment samples:

TABLE 2

PAH MEASUREMENT	LOCATION/AREA			
	HARBOR	LAKE		
	UPPER RIVER CHANNEL	CLA-1	CLA-14	OTHER AREAS/SITES
DISCRETE SAMPLES				
Total PAHs (16 USEPA priority pollutants) (µg/kg)	**1,059 to 12,619**	**3,350 to 10,780**	**9,700 to 14,540**	**177 to 13,070**
TOC-normalized PAHs (16 USEPA priority pollutants) (mg/kg-TOC)	**113 to 1,753**	**137 to 385**	**441 to 539**	**7 to 816**
COMPOSITE SAMPLES				
Total PAHs (16 USEPA priority pollutants) (µg/kg)	**3,180 to 6,360**	**6,792***	**12,120***	**2,470 to 2,690***
TOC-normalized PAHs (16 USEPA priority pollutants) (mg/kg-TOC)	**311 to 376**	**243***	**490***	**91 to 96***
Total PAHs (34 PAH structures) (µg/kg)	**8,680 to 14,110**	**529,750****	**587,970****	**9,820 to 10,320**
TOC-normalized PAHs (34 PAH structures) (mg/kg-TOC)	**706 to 801**	**14,715****	**19,599****	**364 to 369**

*Excludes areas/sites where PAH contamination was suspected to be influenced from past dredged sediment discharges.
**Sample likely impacted by past dredged sediment discharges.

- **USEPA 16 priority pollutants**—Tables B7 and B8 summarize the results of these analyses (see Table B9 for total PAH data on the composite sediment samples). Total PAH concentrations in the sediment samples were determined by summing the USEPA 16 priority pollutants. The average total PAH concentration across all discrete samples in DMMU-1, DMMU-2a and DMMU-2b was 5,764 µg/kg (401 mg/kg-TOC) (range 1,059 to 12,619 µg/kg or 113 to 1753 mg/kg-TOC) and higher than the average of 2,562 µg/kg (193 mg/kg-TOC) (range 177 to 13,070 µg/kg or 7 to 816 mg/kg-TOC) across all discrete Lake Erie sediment samples not impacted by past dredged sediment placement. It was also somewhat higher than the average of 4,467 µg/kg (249 mg/kg-TOC) (range 177 to 13,070 µg/kg or 7 to 816 mg/kg-TOC) across all discrete Lake Erie sediment samples (excluding samples assumed to be impacted by formerly placed dredged sediments). This shows that PAH contamination in the channel sediments is somewhat higher than that which exists in surface Lake Erie sediments offshore of Cleveland. Depending on whether the data are TOC-normalized, the average total PAH concentration across all discrete DMMU-1, DMMU-2a and DMMU-2b samples was lower or higher than the average of 6,792 µg/kg (243 mg/kg-TOC) (range 3,350 to 10,780 µg/kg or 137 to 385 mg/kg-TOC) across all discrete non-impacted sediment samples at CLA-1. Regardless of whether the bulk PAH concentrations in the channel sediments are higher or lower than those in these open-lake sediments, gauges of potential PAH toxicity in sediments were evaluated in the form of solid phase bioassays and analysis of sediment pore water concentrations.

The PAH data on the channel sediments are overall consistent with those presented in USACE (2013a) in which concentrations in discrete sediment samples from DMMU-1, DMMU-2a and DMMU-2b ranged from 842 to 16,336 µg/kg (composite sample range 6,250 to 14,972 µg/kg), and from 183 to 778 mg/kg-TOC (composite sample range 417 to 1,682 mg/kg-TOC) on a TOC-normalized basis. The PAH data on bottom sediments at CLA-1 (except for CLA1-3 and CLA1-5) are consistent with or somewhat higher than those presented in USACE (2013a). The PAH data on bottom sediments at CLA-4 are consistent with or somewhat lower than those presented in USACE (2013a).

- **34 PAH structures (18 non-alkylated parent compounds and 16 groups of generic alkylated forms)**—Table B9 summarizes the results of these analyses. Total PAH concentrations in the sediment samples were determined by summing the 34 PAH structures (this table also includes total PAH concentrations based on the 16 USEPA priority pollutants). Total PAH concentrations in the DMMU-1, DMMU-2a and DMMU-2b composite samples ranged from 8,680 to 13,610 µg/kg (706 to 801 mg/kg-TOC). These concentrations are comparable to or somewhat higher than those measured in the CLA-4 and CLA-7 sediments. Note that the very high total PAH concentration in the CLA-1 composite sediment sample appeared to reflect the high concentrations measured in discrete sediment samples CLA1-3 and CLA1-5.

●*PAH concentrations in sediment pore water*—The hydrocarbon narcosis and equilibrium partitioning (EqP) models (USEPA 2003) assume that the risk of PAH mixtures to benthic organisms is attributable to the freely dissolved PAH compound concentrations in sediment pore (interstitial) water. PAHs in the dissolved phase are those which are bioavailable and have potential to cause toxicity. The predicted measure of toxicity is an EqP sediment benchmark toxic unit final chronic value ($\sum \text{ESBTU}_{FCV}$). Sediments determined to have $\sum \text{ESBTU}_{FCV} < 1.0$ for a mixture of PAH compounds are predicted to be acceptable for the protection of benthic organisms. In this case, dissolved water concentrations in sediment pore water were directly measured using ASTM method D7363. Using direct sediment pore water concentration data, sediment interstitial water toxic unit final chronic values ($\sum \text{IWTU}_{FCV}$) are calculated as:

$$\sum IWTU_{FCV} = \sum \frac{C_{IW\,PAHi}}{FCV_i} \qquad (1)$$

Where:
$C_{IW\,PAHi}$ = Dissolved concentration of PAH compound in sediment interstitial water (µg/L)
FCV_i = PAH compound-specific FCV concentration in sediment pore water (µg/L)

Table B10 summarizes sediment pore water concentrations of the 34 PAH structures and associated calculated $\sum IWTU_{FCV}$. Channel sediment $\sum IWTU_{FCV}$ were all <0.1, indicating that PAH bioavailability is low and the measured concentrations in bulk sediment are protective of benthic organisms. Lake area $\sum IWTU_{FCV}$ were <0.1 (CLA-4 and CLA-7), 208 (CLA-1) and 403 (CLA-14), indicating that while PAH contamination in the CLA-4 and CLA-7 sediments was protective of benthic organisms, PAH contamination in certain sediments at CLA-1 and CLA-14 are expected to be chronically toxic to benthic organisms.

The $\sum IWTU_{FCV}$ data on channel sediments are consistent with those sampled in 2012 USACE (2013a). Although the $\sum IWTU_{FCV}$ for CLA-1 sediment samples in 2012 was 2.8, no acutely toxicity to *H. azteca* was observed in the solid phase bioassay (USACE 2013a). This result can be explained by reviewing literature on the critical body burden expected to result in toxicity to *H. azteca*. Sediment pore water concentrations predicted to result in a body burden of less than 13.9 µmol/g-lipid are not expected to be toxic (USEPA 2003). These CLA-1 sediments were predicted to result in a critical body burden of 6.1 µmol/g-lipid which is lower than the 13.9 µmol/g-lipid whole body concentration at which chronic effects would be expected (USACE 2013b). Therefore, the potential risk of toxicity associated with sediments sampled from CLA-1 in 2012 is insignificant, while those collected in the composite sample in 2014 are likely to be toxic with respect to PAHs. It is evident that very high $\sum IWTU_{FCV}$ for CLA-1 sediments sampled in 2014 was influenced by discrete sediment samples CLA1-3 and CLA1-5. For CLA-4, the $\sum IWTU_{FCV}$ were consistent in 2012 and 2014. Figure 7 (Paragraph 3.4.1[b][2][b]) presents a graph of the 2012, 2014 and 2015 $\sum IWTU_{FCV}$ data across the channel, lake reference and toxic lake sediments. These data also indicate that placement of any of the channel sediments at CLA1-5 within the southeast corner of CLA-1 would result in an abatement of acute and chronic toxicity to benthic invertebrates.

Based on this information, PAHs were not identified as a PCOC in the channel sediments.

3.3.2 PCB bioaccumulation testing

a. **Results**. Total PCB concentrations in tissue samples were determined by summing all congeners with non-detectable concentrations valued at zero. Results of the standard 28-day *L. variegatus* bioaccumulation testing for PCBs on channel and lake area sediment samples are provided in Tables B11 and B12 (congener data are in RTI 2014a and RTI 2014b, respectively). Table B11 includes bioaccumulation test data on the channel, and CLA-1 and CLA-14 sediment samples, while Table B12 includes bioaccumulation test data on sediments from CLA-1, CLA-4 and other various lake areas/sites. Table 3 summarizes the benthic bioaccumulation PCB data and corresponding bulk composite sediment sample total PCB data:

TABLE 3

PCB MEASUREMENT	**LOCATION/AREA**						
	UPPER RIVER CHANNEL			LAKE			
	DMMU-1	DMMU-2a	DMMU-2b	CLA-1 REFERENCE*	CLA-4	CLA-7	OTHER DISCRETE SITES**
TISSUE							
Total PCBs (µg/kg)	**156**	**105**	**103**	**195**	**34.8**	**35**	**13.7 to 92.7**
Lipid-normalized PCBs (µg/kg-lipid)	**8,666**	**5,259**	**5,261**	**7,403**	**1,558**	**1,648**	**1,211 to 4,414**
SEDIMENT							
Total PCBs (µg/kg)	**67.9**	**102**	**144**	**156**	**117**	**110**	**9.36 to 400**
TOC-normalized PCBs (µg/kg-TOC)	**5,658**	**5,100**	**8,471**	**5,579**	**4,333**	**3,929**	**248 to 25,000**

*The average value across CLA1-1 through CLA1-4 was used in lieu of the composite sample concentration. CLA1-5 (1,450 µg/kg) was determined to be an outlier that is not representative of reference sediments.
**Excludes sites where PCB contamination was suspected to be influenced from past dredged sediment discharges.

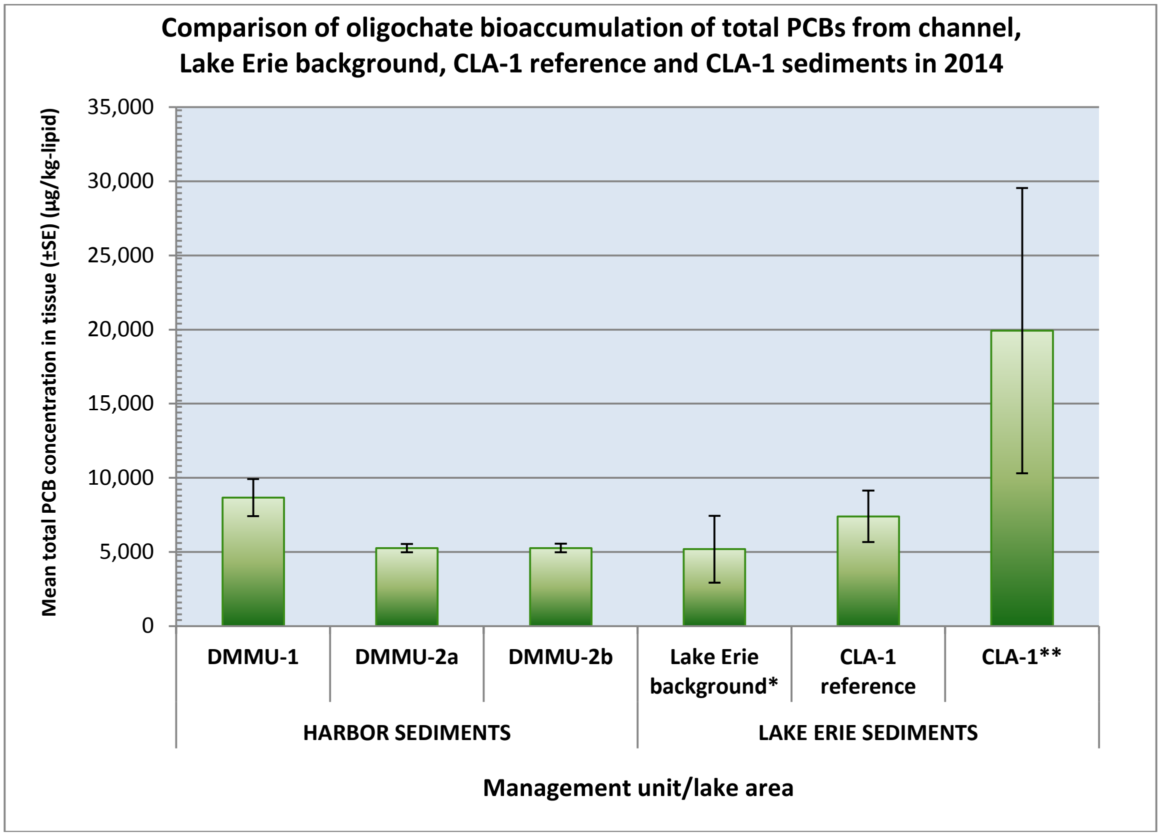
For the purposes of statistical comparisons among the channel and lake area bioaccumulation data and comparison of the 2012 (USACE 2013a) and 2014 bioaccumulation data sets, the 2014 PCB *L. variegatus* tissue data were lipid-normalized. This was because a significant positive linear relationship was established between tissue PCB concentrations and lipid content (Pearson correlation, r=0.748), as well as the fact that the mean lipid content for the 2014 data (1.93±0.05%) was statistically greater than that of the 2012 bioaccumulation data set (1.21±0.02%) (two-sample t-test; $P<0.01$). The average lipid content of 1.93% for the 2014 bioaccumulation data was almost double the overall lipid content of 1% that is characteristic field-collected oligochaetes (Oliver 1984 and 1987; Ankley *et al*. 1992). Similar bulk sediment PCB concentrations and higher TOC content relative to the 2012 dataset indicate that it is likely that the higher lipid content increased PCB bioaccumulation by *L. variegatus* in the laboratory in 2014.

b. <u>**Comparisons to Lake Erie sediments at open-lake placement area and other areas/sites in Lake Erie**</u>

(1) ***CLA-1 and regional background sediments***

(a) **Channel sediments vs. CLA-1 and regional background sediments, 2014 data**—In comparison to CLA-1 reference sediments (7,403 µg/kg-lipid), mean lipid-normalized total PCB residues in *L. variegatus* tissues exposed to the DMMU-2a (5,259 µg/kg-lipid) and DMMU-2b (5,261 µg/kg-lipid) sediments were lower, while those exposed to the DMMU-1 sediments (8,666 µg/kg-lipid) were higher. On a sole total PCB concentration basis, residues in *L. variegatus* tissues exposed to all of the channel sediments (range 67.9 to 144 µg/kg) were lower than those associated with the CLA-1 reference sediments (195 µg/kg). None of the mean lipid-normalized total PCB residues in *L. variegatus* tissues exposed to channel sediments were significantly different in comparison to those exposed to CLA-1 reference sediments (one-tailed Wilcoxon rank sum test; $P\leq0.05$). Therefore, placement of the channel sediments at CLA-1 meets the CWA Section 404(b)(1) Guideline and would not result in any ecologically meaningful increase in bioaccumulation of PCBs at the placement area. The data also indicate that placement of any of the channel sediments at CLA1-5 within the southeast corner of CLA-1 would result in an estimated reduction in the benthic bioaccumulation of PCBs from 55,015 to 6,395 µg/kg-lipid. Figure 4 compares mean oligochaete bioaccumulation of total PCBs from the channel sediments to regional Lake Erie sediments offshore of Cleveland (surface area-weighted), and CLA-1 reference and CLA-1 areas, respectively. It illustrates how the placement of channel sediments at CLA-1 would not result in any significant increase in benthic bioaccumulation of PCBs.

FIGURE 4



*Surface area-weighted mean including some modeled values.
**Includes one modeled value.

(b) **Channel sediments vs. CLA-1 reference sediments**

●*2012 and 2014 data, grouped*—Total PCB benthic bioaccumulation data on the channel and CLA-1 reference sediments from 2012 (USACE 2013) were grouped with those from 2014. In comparison to the grouped CLA-1 reference sediments (5,122 µg/kg-lipid), mean lipid-normalized total PCB residues in *L. variegatus* tissues exposed to the grouped DMMU-2a (4,888 µg/kg-lipid) and DMMU-2b (5,086 µg/kg-lipid) sediments were lower, while those exposed to the grouped DMMU-1 sediments (7,867 µg/kg-lipid) were higher. On a total PCB concentration basis, residues in *L. variegatus* tissues exposed to all (range 78.9 to 121 µg/kg) but the grouped DMMU-1 sediments were lower than those associated with the grouped CLA-1 reference sediments (115 µg/kg). None of the mean lipid-normalized total PCB residues in *L. variegatus* tissues exposed to grouped channel sediments were significantly different in comparison to those exposed to the grouped CLA-1 reference sediments (one-tailed Wilcoxon rank sum test; P≤0.05).

●*2012 vs. 2014 data*—To facilitate comparison of total PCB tissue concentrations between 2012 and 2014, a linear relationship (square of Pearson's, $r > 0.99$) was established between the congener subset analyzed and summed in 2012, and complete list of 209 congeners summed in 2014:

$$\text{Total PCBs} = 3.2 + 1.5(\sum \text{PCB}) \tag{2}$$

When the mean lipid-normalized total PCB concentrations in *L. variegatus* tissues across individual DMMUs in 2012 and 2014 were compared, no statistically significant differences were observed (one-tailed homoscedastic t-Test; P≤0.05). In addition, between 2012 and 2014, there were no statistically significant differences in lipid-normalized total PCB concentrations in *L. variegatus* tissues associated with CLA-1 reference sediments (one-tailed homoscedastic t-Test; P≤0.05).

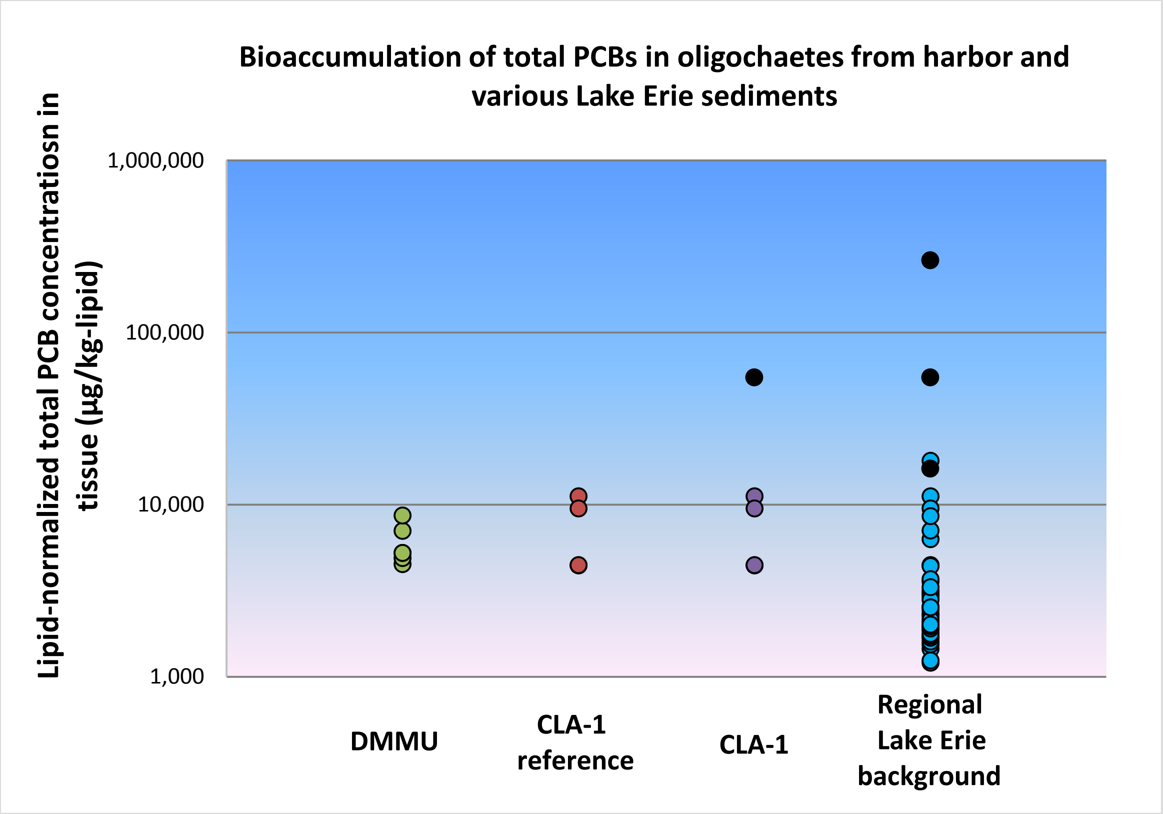
(2) ***Sediments at other lake areas/sites not formally used for dredged sediment discharges***—This includes all 2014 areas/sites excluding those assumed to be formally used for dredged sediment discharges over four decades ago (CLA1-1, CLA1-2, CLA1-3, CLA1-4, CLA1-5, CLA14-1, CLA-14-2, CLA14-3, CLA14-4, CLA14-5, LE-3 and LE-16). Across all discrete lake sediment samples, total PCB residues in *L. variegatus* tissues ranged from 13.7 µg/kg (1,245 µg/kg-lipid) to 92.7 µg/kg (4,414 µg/kg-lipid).

However, this range does not include a value from LE-10 sediments which possessed a higher total PCB concentration of 400 µg/kg for which bioaccumulation was not specifically measured. The theoretical bioaccumulation potential (TBP) model projection (McFarland 1984) using an empirical biota-sediment accumulation factor (BSAF) of 0.72 for Lake Erie sediments offshore of Cleveland (and assuming a 1% lipid content in oligochaetes) estimates that PCBs from the LE-10 sediment sample would bioaccumulate to 180 µg/kg (or 18,000 µg/kg-lipid). This effectively increases the range of PCB bioaccumulation in oligochaetes from these lake sediments to 13.7 to 180 µg/kg (1245 to 18,000 µg/kg-lipid). Total PCB residues in *L. variegatus* tissues exposed to all of the channel sediments were within the higher end of this range. Mean total PCB residues in *L. variegatus* tissues exposed to all of the channel sediments was significantly greater relative to sediments at CLA-4 (1,558 µg/kg-lipid) (one-tailed least significant difference

[LSD] test; α=0.1). Collectively, this information shows that total PCB residues in *L. variegatus* tissues exposed to the channel and CLA-1 reference sediments is within the high end of the range of benthic bioaccumulation of PCBs from regional Lake Erie sediments offshore of Cleveland.

(3) ***Sediments at all lake areas/sites***—This includes all sites regardless of whether they may have been formerly used for dredged sediment discharges. These data represent existing regional background PCB bioaccumulation from Lake Erie sediments offshore of Cleveland. Figure 5 is a plot of combined 2012 and 2014 oligochaete PCB bioaccumulation values for channel sediments, and the 2014 values for CLA-1 reference, CLA-1 and regional lake sediments offshore of Cleveland. It illustrates how the benthic bioaccumulation of PCBs from the channel sediments is comparable to and well within the range of these designated small and large lake areas offshore of Cleveland.

FIGURE 5



NOTE: Black points designate background sites where lake surface sediments are assumed to be influenced from former dredged sediment placement.

Across all discrete lake sediment samples, total PCB residues in *L. variegatus* and oligochaete tissue ranged from 13.7 µg/kg (1245 µg/kg-lipid) to 5,880 µg/kg (262,583 µg/kg-lipid). This range includes several TBP model-predicted values using empirical BSAFs (and assuming a 1% lipid content in oligochaetes) for sites at which bioaccumulation was not specifically measured (CLA1-5, CLA14-4, LE-2, LE-10, LE-14, LE-16, LE-22, LE-23 and LE-25). Mean lipid-normalized total PCB residues in *L. variegatus* tissues exposed to DMMU-2a and DMMU-2b sediments (5,259 and 5,269 µg/kg-lipid, respectively) were comparable to the surface area-weighted background mean of 5,188 µg/kg-lipid across *L. variegatus* and oligochaetes (Figure 4). The mean lipid-normalized total PCB residues in *L. variegatus* tissues exposed to the DMMU-1 sediments (8,666 µg/kg-lipid) is somewhat higher, but within the range and still comparable to this surface area-weighted mean. The magnitude of difference (MOD) (measured laboratory bioaccumulation from dredged sediments/measured laboratory bioaccumulation from reference area sediments) for the benthic bioaccumulation of PCBs from DMMU-1 and regional lake background sediments is 1.67 and less than a factor of 2. This suggests that such a difference between test and reference sediments observed in the laboratory is not likely to warrant ecological and human health concerns based on the ASTM (2010) recommended minimum detectable difference, and the factor of 2 difference measured between PCB bioaccumulation by *L. variegatus* in paired laboratory and field-based experiments by Beckingham and Ghosh (2010). These data demonstrate that PCB bioaccumulation risk from the channel sediments is within the range and comparable to that which currently occurs from regional Lake Erie background sediments offshore of Cleveland. Figure 4 also illustrates how the benthic bioaccumulation of PCBs from channel sediments is not substantially different from that which currently occurs from regional Lake Erie sediments offshore of Cleveland.

3.3.3 COCs

No COCs were identified in the channel sediments based on data generated by USACE in 2014.

3.4 2015 investigation

3.4.1 Bulk sediment analyses

a. **Physical characteristics**

(1) ***Comparison of core and surface sediment grab samples***—Six core samples were co-located with six surface grab samples. The cores sampled intervals consistent with the dredged prism, which was about 2.5 to 3.5 feet at the time of sampling. Consistent with

the physical characteristics of the surface grab sediment samples, core samples consisted mainly of brown organic rich silt (generally 50 to 60%), with the remainder clays (generally 10 to 20%) and sands (generally 20 to 30%) (Table B13). This shoal material typically overlays light gray clay located below project depth. Within DMMU-1 at the upstream end of the channel, core samples consisted mainly of brown organic rich silt intermixed with comparably more fine sands.

(2) ***Testing***—Table B13 presents the results of these analyses. The particle size data across the DMMU-1, DMMU-2a and DMMU-2b discrete samples show that the sediments are comprised of between 64% (CH-3) and 80% (CH-14) clays and silts, with the remainder sands and gravels (on a composite sample basis, 72% to 80% silts and clays in DMMU-1 and DMMU-2b, respectively). Bottom sediments in discrete samples from CLA-1 were predominantly coarse-grain in nature and composed of 54% (CLA1-1) to 79% (CLA1-5) sands/gravels, with the remainder silts and clays (these differ from the 2014 results due to sampling sites differences). Bottom sediments in discrete samples from open-lake area CLA-4 were predominantly coarse-grain in nature and composed of 61% (CLA4-3) to 80% (CLA4-4) sands/gravels, with the remainder silts and clays.

b. **Chemical testing**

(1) ***Inorganic analyses***

(a) **Inorganics**—Table B14 presents the results of these analyses.

●*TOC*—TOC content in discrete samples across DMMU-1, DMMU-2a and DMMU-2b ranged from 0.19% (CH-2) to 2.9% (CH-5). On a composite sample basis, TOC content in the channel sediments ranged from 1.2% (DMMU-1) to 2.0% (DMMU-2a). The DMMU composite sample mean of 1.7% was similar to that in 2014 and higher than the composite sample mean of 1.2% in 2012 (USACE 2013). TOC content in discrete samples of bottom sediments at CLA-1 was generally consistent and ranged from 2.4% (CLA1-5) to 3.9% (CLA1-1). TOC content in discrete samples of bottom sediments at open-lake area CLA-4 was consistent and ranged from 2.8% (CLA4-1, CLA4-2 and CLA4-6) to 3.0% (CLA4-3 and CLA4-4).

●*Nitrogen/ammonia*—Nitrogen/ammonia concentrations in discrete samples across DMMU-1, DMMU-2a and DMMU-2b ranged from 32 (CH-2) to 380 (CH-14) mg/kg. On a composite sample basis, concentrations in the channel sediments ranged from 93 (DMMU-1) to 250 (DMMU-2b) mg/kg. Ammonia/nitrogen concentrations in discrete samples of bottom sediments at CLA-1 ranged from 210 (CLA1-3) to 420 (CLA1-2).

Concentrations in discrete samples of bottom sediments at open-lake area CLA-4 ranged from 180 (CLA4-2) to 3,200 (CLA4-1) mg/kg.

●*TKN*—TKN concentrations in discrete samples across DMMU-1, DMMU-2a and DMMU-2b ranged from 260 (CH-2) to 2,300 (CH-9) mg/kg. On a composite sample basis, concentrations in the channel sediments ranged from 410 (DMMU-1) to 1,800 (DMMU-2a) mg/kg. TKN concentrations in discrete samples of bottom sediments at CLA-1 ranged from 2,500 (CLA1-1) to 5,400 (CLA1-5). Concentrations in discrete samples of bottom sediments at open-lake area CLA-4 ranged from 840 (CLA4-4) to 52,000 (CLA4-3) mg/kg.

●*TP*—TP concentrations in discrete samples across DMMU-1, DMMU-2a and DMMU-2b ranged from 50 (CH-1) to 250 (CH-15) mg/kg. On a composite sample basis, concentrations in the channel sediments ranged from 170 (DMMU-1) to 220 (DMMU-2a) mg/kg. TP concentrations in discrete samples of bottom sediments at CLA-1 ranged from 290 (CLA1-1) to 450 (CLA1 composite). Concentrations in discrete samples of bottom sediments at open-lake area CLA-4 ranged from 190 (CLA4-4) to 360 (CLA4 composite) mg/kg.

●*Cyanide*—Cyanide concentrations in discrete samples across DMMU-1, DMMU-2a and DMMU-2b ranged from 0.54 (CH-4) to 1.2 (CH-6) mg/kg. On a composite sample basis, concentrations in the channel sediments ranged from 0.54 (DMMU-2a) to 0.61 (DMMU-2b) mg/kg. Cyanide concentrations in discrete samples of bottom sediments at CLA-1 were all non-detectable (detection limit range 1.6 to 2 mg/kg). Concentrations in discrete samples of bottom sediments at open-lake area CLA-4 were all non-detectable (detection limit range 1.6 to 1.9 mg/kg).

●*Oil/grease*—Oil/grease concentrations in discrete samples of bottom sediments at CLA-1 ranged from non-detectable (detection limit range 370 to 410 mg/kg) to 1,800 mg/kg (CLA1-5). Concentrations in discrete samples of bottom sediments at open-lake area CLA-4 ranged from non-detectable (detection limit range 350 to 380 mg/kg) to 460 mg/kg (CLA4-4).

(b) **Metals**—Table B15 presents the results of these analyses. The bulk concentration of most metals in discrete sediment samples from DMMU-1, DMMU-2a and DMMU-2b were comparable or lower than those at both CLA-1 and CLA-4. Arsenic was the only notable exception, which ranged in concentration from 6.1 (CH-2) to 21 (CH-9, CH-10 and DMMU-2b composite). Arsenic concentrations in discrete samples of bottom sediments at CLA-1 ranged from 7.5 (CLA1-2) to 13 (CLA1-1, CLA1-3 and CLA1 composite) mg/kg. The somewhat higher concentrations in channel sediments are reflective of background concentrations the Lake Erie/Ontario Lake Plain watersheds (sediment reference value [SRV] = 25 mg/kg) (OEPA 2008) and typically not of significant toxicological concern.

●*SEM/AVS*—Table B16 presents the result of these analyses. AVS is regarded as a key sediment partitioning phase that binds cationic metals (cadmium, copper, lead, nickel, silver and zinc) to form insoluble sulfide complexes, thereby reducing their presence in sediment interstitial water and bioavailability (Di Toro *et al.* 1992). Methodology from USEPA (2005) was applied to determine whether an excess of SEM relative to AVS (on a molar basis) existed in these samples. Based on that methodology, the ΣSEM/AVS model holds that when the molar concentrations of metals exceeds that of AVS (i.e., the ΣSEM-AVS difference is greater than 0.0 µmol), the solid phase concentrations of metals may not be sequestered by the presence of sulfides in the sediments, and therefore bioavailable with the subsequent potential to cause toxicity to benthic organisms.

AVS was not detected in each of the DMMU samples at a detection limit of 0.63 µmol/g. Conservatively assuming that AVS is zero in each of these samples, ΣSEM-AVS values ranged from 0.75 (DMMU-1) to 0.90 µmol/g (DMMU-2a). The composite sediment samples from CLA-1 and CLA-4 yielded ΣSEM-AVS of less than 0 (range CLA1 excess AVS 5.1 µmol/g to CLA4 excess AVS 3.8 µmol/g). For the channel sediments with an excess of SEM, zinc was the major contributor among the six metals. While the ΣSEM/AVS model predicts that no toxicity to benthic organisms in sediments will occur if ΣSEM/AVS ≤0.0, it is not intended to predict whether sediments are toxic if ΣSEM/AVS >0.0. The AVS/SEM ratios across the channel sediments (range 1.19 to 1.43) were all less than 2.0, suggesting that they would not be toxic to benthic organisms if zinc is the main contributor (Burton *et al.* 2005). Irrespective of this, toxicity is unlikely when ΣSEM-AVS <1.7 (USEPA 2005).

◊ΣSEM-AVS model normalized to organic carbon (OC)—Normalizing ΣSEM-AVS to OC content reduces variability associated with the prediction of sediment toxicity. The excess SEM through OC normalization yielded channel sediment ΣSEM-AVS/f_{oc} ranging from 44 to 63 µmol/g_{oc}. These values fall below the OC-normalized excess SEM range of 130 µmol/g_{oc} to 3,000 µmol/g_{oc} in which toxicity to benthic organisms is considered uncertain (toxicity associated with values below 130 µmol/g_{oc} is not likely) (USEPA 2005).

Given that the excess SEM is mostly attributable to zinc, the ΣSEM-AVS were <1.7 and ΣSEM-AVS/f_{oc} <130 µmol/g_{oc}, cationic metal contamination in the channel sediments was determined to be protective of benthic organisms. The results of solid phase bioassays on the channel sediments (Paragraph 3.4.2) reinforce this conclusion.

(2) ***Organic analyses***

(a) **PCBs**—Tables B17 and B18 summarize the results of these analyses. For the Aroclor analyses (Table B17) total PCB concentrations in the sediment samples were determined by summing detected Aroclor mixtures and valuing non-detectable concentrations at zero. For the congener analyses (Table B18), total PCB concentrations in the sediment samples were determined by summing all congeners, with non-detectable concentrations valued at zero.

●*Comparison of PCB concentrations in channel and lake sediments*—The average total PCB concentration (based on Aroclors) across all discrete samples in DMMU-1, DMMU-2a and DMMU-2b was 37.6 µg/kg (3,459 µg/kg-TOC) (range 12 to 73 µg/kg or 571 to 12,105 µg/kg-TOC) and less than the average of 107 µg/kg (3,744 µg/kg-TOC) (range non-detectable [at 28 µg/kg] to 110 µg/kg or 875 to 4,583 µg/kg-TOC) across CLA-1 sediments, and comparable to the average of 47 µg/kg (1,634 µg/kg-TOC) (range 42 to 52 µg/kg or 1,400 to 1,857 µg/kg-TOC) across CLA-4 sediments. The average total PCB concentration (based on congeners) across all composite samples in DMMU-1, DMMU-2a and DMMU-2b was 137 µg/kg (7,978 µg/kg-TOC) (range 100 to 157 µg/kg or 7,750 to 8,333 µg/kg-TOC) and somewhat higher than the composite sediment concentration of 131 µg/kg (3,970 µg/kg-TOC) in CLA-1 sediments, and higher that the composite sediment concentration of 90.6 µg/kg (3,124 µg/kg-TOC) in CLA-4 sediments. Collectively, these data show that PCB contamination in the channel sediments is consistent with or higher than that which exists in sediment at CLA-1 and CLA-4. Based on this information, total PCBs were identified as a PCOC in the channel sediments. Nevertheless, PCB contamination in the channel sediments is also within the 220 to 25,000 µg/kg-TOC concentration range of those measured in regional Lake Erie sediments offshore of Cleveland not influenced by former dredged sediment discharges (see Table 3). Collectively, this information demonstrates that PCB contamination in the channel sediments is consistent with regional lake sediments offshore of Cleveland, even when excluding those which may have been influenced by former dredged sediment discharges.

Table 4 summarizes the total PCB data across all of the channel and lake area sediment samples:

TABLE 4

PCB MEASUREMENT	LOCATION/AREA		
	HARBOR	LAKE	
	UPPER RIVER CHANNEL	CLA-1 REFERENCE	CLA-4
DISCRETE SAMPLES (Aroclors)			
Total PCBs (µg/kg)	**12 to 73**	**28U* to 110**	**42 to 52**
TOC-normalized PCBs (µg/kg-TOC)	**571 to 12,105**	**875 to 4,583**	**1,400 to 1,857**
COMPOSITE SAMPLES (Aroclors)			
Total PCBs (µg/kg)	**36 to 73**	**150**	**41**
TOC-normalized PCBs (µg/kg-TOC)	**1,800 to 6,083**	**4,545**	**1,414**
COMPOSITE SAMPLES (congeners)			
Total PCBs (µg/kg)	**100 to 157**	**131**	**90.6**
TOC-normalized PCBs (µg/kg-TOC)	**7,750 to 8,333**	**3,970**	**3,124**

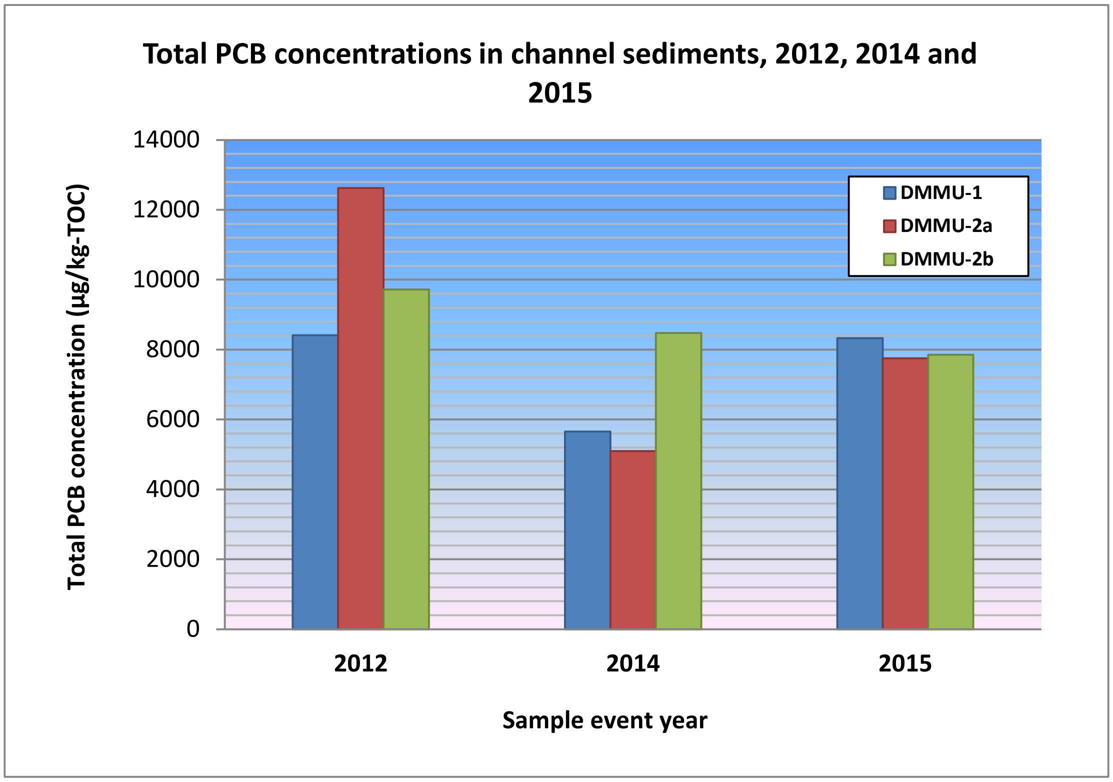
*Non-detectable at the specified detection limit.

●*Comparison of total PCB concentrations in channel sediments across 2015, 2014 and 2012*—Irrespective of the identification of total PCBs as a PCOC, note that the range in TOC-normalized concentrations across the DMMU-1, DMMU-2a and DMMU-2b sediments were within the range of those measured in 2014 (5,100 to 8,471 µg/kg-TOC) and lower than the range of those measured in 2012 (8,407 to 12,625 µg/kg-TOC [USACE 2013]) on a composite sample basis. These data are graphed in Figure 6.

The results of benthic bioaccumulation testing for PCBs on the channel and lake area sediments are discussed in Paragraph 3.4.3.

(b) **Pesticides**—Table B19 summarizes the results of these analyses. Expect for dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyldichloroethane (DDD) and dichlorodiphenyldichloroethylene (DDE), all pesticides were non-detectable in the channel and lake area sediments at detection limits ranging from 2 to 250 µg/kg. In the channel sediments, ∑DDT was detected only in discrete DMMU-1 sediment samples ranging from 6.9 to 16 µg/kg. Such concentrations of ∑DDT are typically not of toxicological significance, and were lower or comparable to those measured in the open-lake area sediments where detectable ∑DDT concentrations ranged from 5.1 to 49 µg/kg. In all channel and open-lake area composite sediment samples, ∑DDT was non-detectable. On a TOC-normalized basis, ∑DDT concentrations in discrete DMMU-1 sediment samples ranged from 1,500 to 2,424 µg/kg-TOC. These were within the range or comparable to the ∑DDT concentration range of 131 to 1,750 µg/kg-TOC in the open-

FIGURE 6



lake area sediments. Even though no pesticides were identified as sediment PCOCs or COCs, benthic bioaccumulation testing for pesticides was nevertheless performed (see paragraph 3.4.4).

(c) **PAHs**—Tables B20 and B21 summarize the results of these analyses.

●*PAH concentrations in sediments*—Table 5 summarizes total PAH data across all of the channel and lake sediment samples:

TABLE 5

PAH MEASUREMENT	LOCATION/AREA		
	HARBOR	LAKE	
	UPPER RIVER CHANNEL	CLA-1 REFERENCE*	CLA-4
DISCRETE SAMPLES			
Total PAHs (µg/kg)	**1,008 to 10,007**	**1,001 to 9,650**	**796 to 1,045**
TOC-normalized PAHs (mg/kg-TOC)	**201 to 1,227**	**31.3 to 402**	**28.4 to 35.6**
COMPOSITE SAMPLES			
Total PAHs (µg/kg)	**4,133 to 5,649**	**6,935**	**1,029**
TOC-normalized PAHs (mg/kg-TOC)	**230 to 344**	**210**	**35.5**

*CLA-1 reference sediments (for PAHs) were determined based on lower bulk sediment concentration and no observation of oil in discrete sample (CLA1-1 was excluded as being suspected as influenced from former dredged sediment discharges).

- **USEPA 16 priority pollutants**—Table B20 summarizes the results of these analyses. Total PAH concentrations in the sediment samples were determined by summing the USEPA 16 priority pollutants. The average total PAH concentration across all discrete samples in DMMU-1, DMMU-2a and DMMU-2b was 5,399 µg/kg (397mg/kg-TOC) to 10,007 µg/kg or 201 to 1,227 mg/kg-TOC), and comparable or higher than the averages of 5,409 µg/kg (201 mg/kg-TOC) (range 1,001 to 9,650 µg/kg or 31.3 to 402 mg/kg-TOC) and 945 µg/kg (33 mg/kg-TOC) (range 796 to 1,045 µg/kg or 1,400 to 1,857 mg/kg-TOC) for CLA-1 reference and CLA-4 sediments, respectively. However, the average total PAH concentration across DMMU composite samples of 4,793 µg/kg (285 mg/kg-TOC) was lower or comparable to the composite sample concentration for CLA-1 reference sediments (6,935 µg/kg or 210 mg/kg-TOC). This shows that PAH contamination in the channel sediments is similar or higher in comparison to the open-lake area sediments. PAH pore water analysis and solid phase bioassay data on the channel and lake area sediment samples are discussed below and in Paragraph 3.4.2, respectively.

  The PAH data on the channel sediments are consistent with those in 2014 in which concentrations in discrete sediment samples from DMMU-1, DMMU-2a and DMMU-2b ranged from 1,059 to 12,619 µg/kg (composite sample range 4,665 to 7,143 µg/kg), and from 113 to 1,753 mg/kg-TOC (composite sample range 311 to 376 mg/kg-TOC) on a TOC-normalized basis (Table 2). The PAH data on bottom sediments at CLA-1 (except for CLA1-5) are consistent with those presented in 2014. The PAH data on CLA-4 sediments are consistent with or somewhat lower than those presented in 2014.

The PAH data on the channel sediments are somewhat lower than those presented in USACE (2013a) in which concentrations in discrete sediment samples from DMMU-1, DMMU-2a and DMMU-2b ranged from 842 to 16,336 µg/kg (composite sample range 6,250 to 14,972 µg/kg), and from 183 to 778 mg/kg-TOC (composite sample range 417 to 1,682 mg/kg-TOC) on a TOC-normalized basis. The PAH data on bottom sediments at CLA-1 (except for CLA1-5) are consistent with or somewhat higher than those presented in USACE (2013a). The PAH data on bottom sediments at CLA-4 are consistent with or somewhat lower than those presented in USACE (2013a).

●*Concentrations of 34 PAH structures (18 non-alkylated parent compounds and 16 groups of generic alkylated forms) in sediment pore water*—Table B21 summarizes sediment pore water concentrations of the 34 PAH structures and associated calculated $\sum IWTU_{FCV}$ using Equation 1. Channel composite sample $\sum IWTU_{FCV}$ were all <0.1, indicating that PAH contamination in the sediments is protective of benthic organisms. Channel discrete sample $\sum IWTU_{FCV}$ ranged from <0.1 (CH-5, CH-7, CH-9 and CH-13) to 1.7 (CH-3).

Although an $\sum IWTU_{34}$ screening value of 1.0 is suggested by USEPA as a screening benchmark for evaluating potential toxicity of PAHs to aquatic organisms, an $\sum IWTU_{34}$ greater than 1.0 may not result in toxicity due to a number of site-specific factors. In this case, PAH-related toxicity to benthic invertebrates from sediments at CH-3 is not expected because the $\sum IWTU_{34}$ value of 1.7 is below the chronic toxicity critical body burden for *H. azteca* which is one of the most sensitive freshwater aquatic organisms to PAHs (USEPA 2003). The $\sum IWTU_{34}$ screening value of 1.0 is based on the sensitivity of both saltwater and freshwater aquatic species to PAHs. The FCV believed to be protective of both saltwater and freshwater aquatic organisms is 2.24 µmol/g-lipid, while *H. azteca* has been determined to have a critical body burden (mean acute value for genus) of 13.9 µmol/g-lipid. In addition, data provided in USEPA (2003) have demonstrated that the acute to chronic ratio for *H. azteca* is near 1. An $\sum IWTU_{34}$ value specific to *H. azteca* and protective of other freshwater invertebrates is estimated to be approximately 6. Hawthorne *et al.* (2007) provides additional empirical evidence that support these benchmark estimates for chronic toxicity to *H. azteca* (i.e., greater than 85% survival is predicted at body burdens <15 µmol/g-lipid).

CLA-1 discrete sample $\sum IWTU_{FCV}$ ranged from <0.1 (CLA1-3 and CLA1-5) to 22.2

(CLA1-1). This information showed that PAH contamination in sediments from CLA1-2 through CLA1-5, and in the composite sample ($\sum IWTU_{FCV} = 0.3$), were protective of benthic organisms. However, it indicated that PAH contamination in sediments from CLA1-5 are predicted to result in an internal benthic body burden of approximately 50 μgmol/g-lipid and therefore expected to result in chronic toxicity to *H. azteca* (Hawthorne *et al.* 2007).

The $\sum IWTU_{FCV}$ data on channel sediments were consistent with those sampled in 2014 and 2012 (USACE 2013a). The $\sum IWTU_{FCV}$ data on lake area/site sediments were consistent or different than those sampled in 2014 and 2012; differences among the sampling events were attributable to sediment sampling site and actual sediments sampled. For CLA-4 sediments, the $\sum IWTU_{FCV}$ were consistent in 2012, 2014 and 2015.

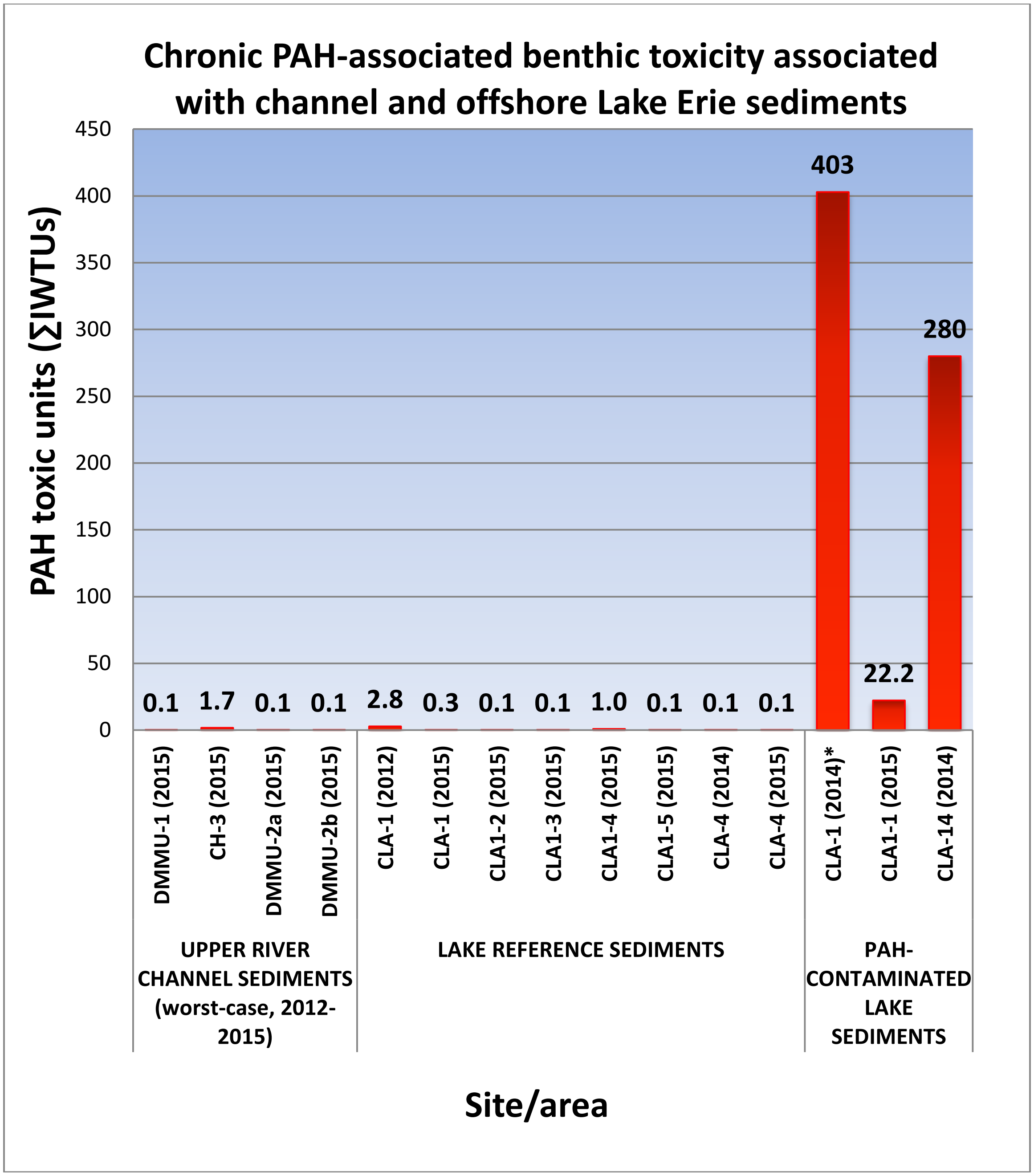
For the lake area sediments, the $\sum IWTU_{FCV}$ for CLA-1 sediment samples in 2012 was low at 2.8 and found to not be acutely or chronically toxic to *H. azteca* (USACE 2013a; USACE 2013b). Therefore, the toxicity of sediments sampled from CLA-1 in 2012 was insignificant, while those collected in the composite sample in 2014 were toxic with respect to PAHs. It is evident that very high $\sum IWTU_{FCV}$ for CLA-1 sediments sampled in 2014 is associated with the high values observed for discrete sediment samples CLA1-3 and CLA1-5. Figure 7 graphs the 2012, 2014 and 2015 $\sum IWTU_{FCV}$ data across the channel, lake reference and toxic lake sediments. Collectively, these data also indicate that placement of any of the channel sediments at CLA1-5 (2014 sample location) and CLA1-1 (2015 sample location) within the southeast quadrant of CLA-1 would result in an abatement of acute and chronic toxicity to benthic invertebrates.

Based on this information, PAHs were not identified as a PCOC in the channel sediments.

3.4.2 Solid phase bioassays

Solid phase bioassays measure the response of sensitive organisms to a mixture of sediment contaminants, through survival and growth endpoints. The amphipod *H. azteca* is a small freshwater crustacean that inhabits the water column and sediment surface, feeding on detritus. This species is an important food item for bottom feeding and water column fish in the Great Lakes. The midge fly *C. dilutus* burrows into sediments and are an important food item in the diets of various species of fish and waterfowl. The two species vary in sensitivity to different contaminants; *H. azteca* is quite sensitive to metals, while *C. dilutus* tends to be more sensitive to pesticides (USEPA and USACE 1998a).

FIGURE 7



*Composite sample assumed to be biased by discrete sample CLA1-5 (2014).

The results of the solid phase bioassays are summarized in Table B22. To minimize the confounding effects of ammonia in the channel sediments in the laboratory (typical for Great Lakes watershed sediments) and ensure a true test for persistent contaminant-related effects, sediment was initially purged of ammonia according to USEPA/USACE (1998b).

a. **H. azteca**—Two rounds of this bioassay were run as the initial bioassay yielded low survivals without any clear persistent contaminant-related cause.

(1) Initial bioassay—In the first bioassay, the mean survival of this test species exposed to the management unit samples ranged from 50±26% (DMMU-2a) to 92±8.4% (DMMU-1). The survival values for DMMU-2a and DMMU-2b (58±13%) sediment samples were statistically lower than that associated with the open-lake area sediments (CLA-1 mean survival 98±4.5% and CLA-4 mean survival 94±13% [Fisher least significant difference [LSD]; α=0.05]). The mean survivals for the DMMU-1 sample was less than 10% different from those for CLA-1 reference and CLA-4 sediments (CLA-1 mean survival 98±4.5% and CLA-4 mean survival 94±13%).

At test termination, a large number of indigenous oligochaetes, likely tubificids, were observed in the DMMU-2a and DMMU-2b sediment test replicates. The number of oligochaetes recovered from several replicates ranged from 104 to 128 worms per replicate. Indigenous organisms are considered a non-contaminant or non-treatment factor that, if present in high enough numbers, can adversely impact the results of a toxicity test (USEPA 2000; ASTM 2005; Reynoldson *et al.* 1994). This is likely due, at least in part, to competition for resources such as food and space. Reynoldson *et al.* (1994) demonstrated that tubificid densities of 75 worms per beaker resulted in mean *H. azteca* survival of 48% in a 28-day exposure, with survival in the absence of worms at 89%. This density is less than the densities of oligochaetes observed in the DMMU-2a and DMMU-2b sediment replicates which yielded a similar level of *H. azteca* survival. The sediment surface area per beaker in Reynoldson *et al.* (1994) was identical, and the sediment volume was similar, to those in the *H. azteca* bioassay.

Reynoldson *et al.* (1994) also showed that high levels of oligochaetes can produce significant reductions in growth for *H. azteca* and the midge *C. riparius*. A significant reduction in growth was similarly observed for *C. dilutus* in the presence of oligochaetes in the DMMU-2a and DMMU-2b sediments. This information, in tandem with the low bulk concentration of contaminants observed in the DMMU-2a and DMMU-2b sediments and supporting evidence that indigenous oligochaetes could be impacting the toxicity test results, incited a re-test.

(2) Follow-up bioassay—Prior to re-running the *H. azteca* bioassay including CLA-1 reference, CLA-4 and performance control sediments, DMMU-2a and DMMU-2b sediments were sieved to reduce the density of native oligochaetes according to USEPA (2001) guidance. Reynoldson *et al.* (1994) also recommended sieving sediments prior to testing when large populations of indigenous invertebrates are present, particularly oligochaetes. The number of native oligochaetes was reduced in the DMMU-2a and DMMU-2b sediments by sieving through a 1 mm sieve as one of the recommended methods for removing indigenous organisms prior to toxicity testing when the presence of indigenous organisms is suspected of negatively impacting test organisms (USEPA 2000; USEPA 2001; ASTM 2005). Note that sieving of sediments is generally believed to increase the likelihood that contaminant-related effects would be observed in a toxicity test since sieving can temporarily disrupt the equilibrium of the sediment resulting in increased bioavailability of organics and metals (USEPA 2000). In addition, contaminants are typically associated with the finer grain fraction of sediments (silts, clays, black carbon; Talley *et al.* 2002) due to the presence of greater surface area for contaminant adsorption; thus sieving and using the smaller fraction for testing increases the percentage of fine-grain sediment that likely contains a higher concentration of contaminants. Therefore, sieving sediments prior to bioassay testing is most likely to increase exposure to contaminants and therefore potentially result in enhanced toxicity. Consequently, the sieved sediment bioassay tests may be considered a more conservative assessment of the toxicological implications of the persistent sediment-associated contaminants.

The follow-up bioassay using the sieved DMMU-2a and DMMU-2b sediment samples yielded high *H. azteca* survivals. Mean survivals of *H. azteca* exposed to the DMMU sediment samples ranged from 86±11.4% (DMMU-2b) to 92±8.4% (DMMU-2a). These survivals were less than 10% different than those for the open-lake area sediments (CLA-1 mean survival 94±5.5% and CLA-4 mean survival 92±8.4%) (USEPA/USACE 1998a). This bioassay using sieved sediments, along with the observations by Reynoldson *et al.* (1994) and low levels of contaminants in the sediment samples, provide strong lines of evidence that a native oligochaete worm-related factor was the cause of the reduced *H. azteca* survival observed in the initial bioassay. It is hypothesized that the results of the initial bioassay reflected competition for resources between *H. azteca* and native oligochaete worms in the laboratory. Because no persistent contaminated-related cause could be identified for the evidenced toxicity in the DMMU-2 sediments in 2010 and associated abundance of native oligochaete worms in the sediments (Kreitinger *et al.* 2011), native oligochaete worms (and sediment pore water ammonia) may also have been a factor contributing to the low survival of *H. azteca* (58±8.4%).

b. <u>C. dilutus</u>—The mean survival of this test species exposed to the channel composite samples ranged from 88±13% (DMMU-2a and DMMU-2b) to 92±4.5% (DMMU-1), and was not reduced by more than 20% than that associated with the open-lake area sediments (CLA-1 mean survival 92±11% and CLA-4 mean survival 96±8.9%) (USEPA/USACE 1998a). With respect to *C. dilutus* growth, mean biomass expressed as mean dry weight (MDW) exposed to the channel composite samples ranged from 0.798±0.040 mg (DMMU-2b) to 2.638±0.580 mg (DMMU-1). All values exceeded a MDW of 0.6 mg (USEPA/USACE 1998a). The lower growth observed with the DMMU-2a and DMMU-2b sediments relative to all of the other channel and open-lake area composite samples was likely attributable to resource competition between *C. dilutus* and native oligochaetes, similar to that encountered in the initial standard 10-day solid phase *H. azteca* bioassay (USAERDC 2015a) (see Paragraph 3.4.2[a][2]).

These solid phase bioassay data did not show any significant, persistent contaminant-related acute or sublethal toxicity associated with the channel sediments, and are similar to those presented in USACE (2013a). Figures 8 and 9 are bar graphs showing the combined 2012 and 2015 results of the standard 10-day *H. azteca* and *C. dilutus* survival bioassays, respectively. These two graphs illustrate the consistently low channel sediment toxicity across the two sampling events, and the comparability of the channel sediment toxicity test data to those of the open-lake area sediments. These results indicate that placement of sediments dredged from DMMU-1, DMMU-2a and DMMU-2b at CLA-1 would not result in any persistent contaminant-related, unacceptable adverse impacts.

FIGURE 8

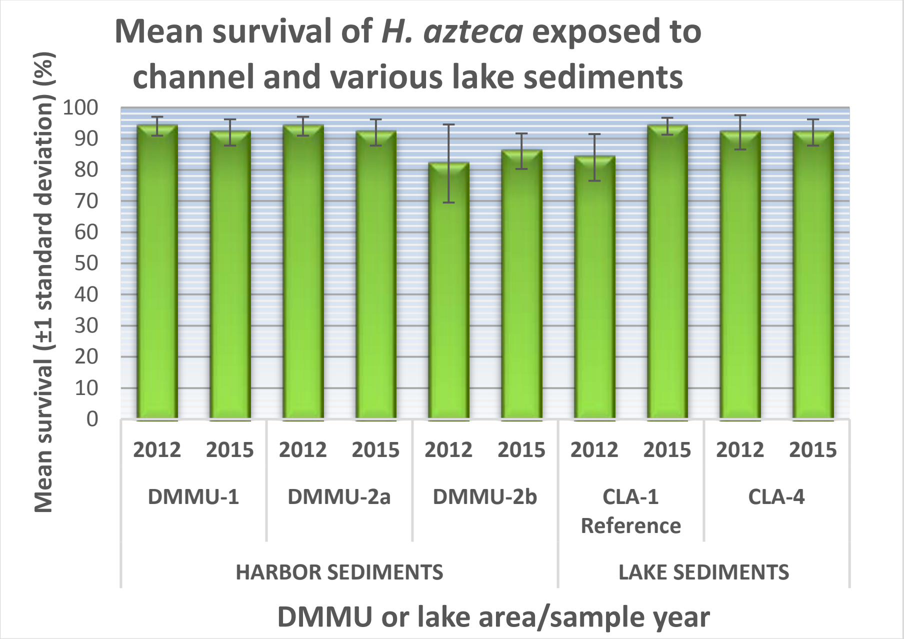
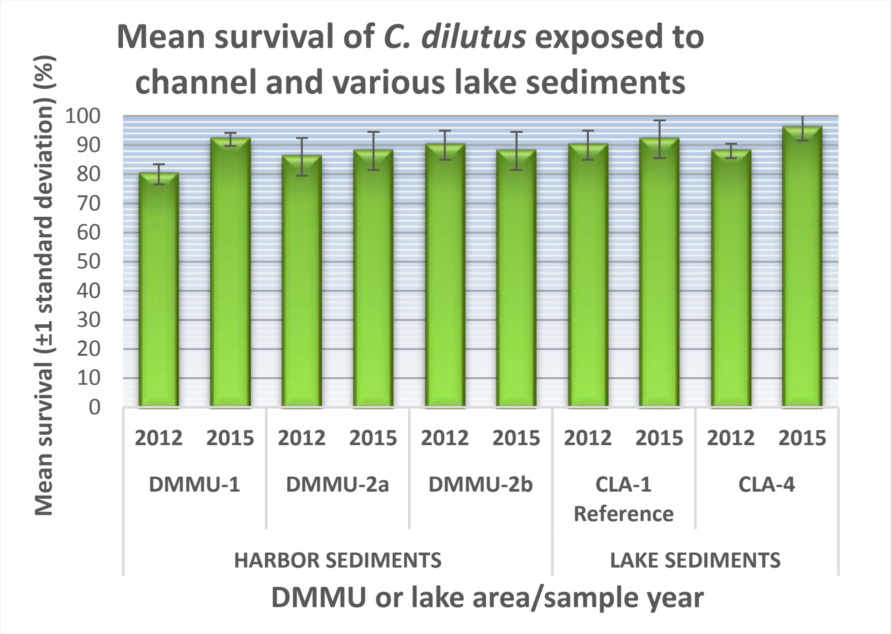


FIGURE 9



3.4.3 PCB bioaccumulation testing

a. **Results**. Total PCB concentrations in tissue samples were determined by summing all congeners with non-detectable concentrations valued at zero. Results of the standard 28-day *L. variegatus* bioaccumulation testing for PCBs on channel and lake area sediment samples are provided in Table B23 (congener data are in RTI 2015). Table 6 summarizes the benthic bioaccumulation PCB data and corresponding bulk composite sediment sample total PCB data:

TABLE 6

PCB MEASUREMENT	LOCATION/AREA					
	UPPER RIVER CHANNEL			LAKE		
	DMMU-1	DMMU-2a	DMMU-2b	CLA-1 REFERENCE	CLA-4	OTHER DISCRETE SITES*
TISSUE						
Total PCBs (µg/kg)	**153**	**164**	**181**	**97**	**34**	**13.7 to 92.7**
SEDIMENT						
Total PCBs (µg/kg)	**100**	**155**	**157**	**131**	**90.6**	**9.36 to 400**
TOC-normalized PCBs (µg/kg-TOC)	**8,333**	**7,750**	**7,850**	**3,970**	**3,124**	**248 to 25,000**

*From Table 4; excludes sites where PCB contamination was suspected to be influenced from past dredged sediment discharges.

Due to data quality issues, lipid content data generated from the laboratory experiments could not be used for the purposes of quantifying bioaccumulation. However, lipid content data were generated on the test control sample were generated by USAERDC and are summarized in Table 7 (USAERDC 2016):

TABLE 7

CONTROL SAMPLE REPLICATE	SUBREPLICATE	PERCENT LIPID
A	A1	**3.1**
	A2	**1.8**
	A3	**2.6**
B	B1	**3.0**
	B2	**3.3**
	B3	**3.1**
MEAN		**2.8**

An average lipid content of 2.8% is a higher lipid content than what is typically observed for *L. variegatus* cultured in the laboratory setting. As with the 2014 data (see paragraph

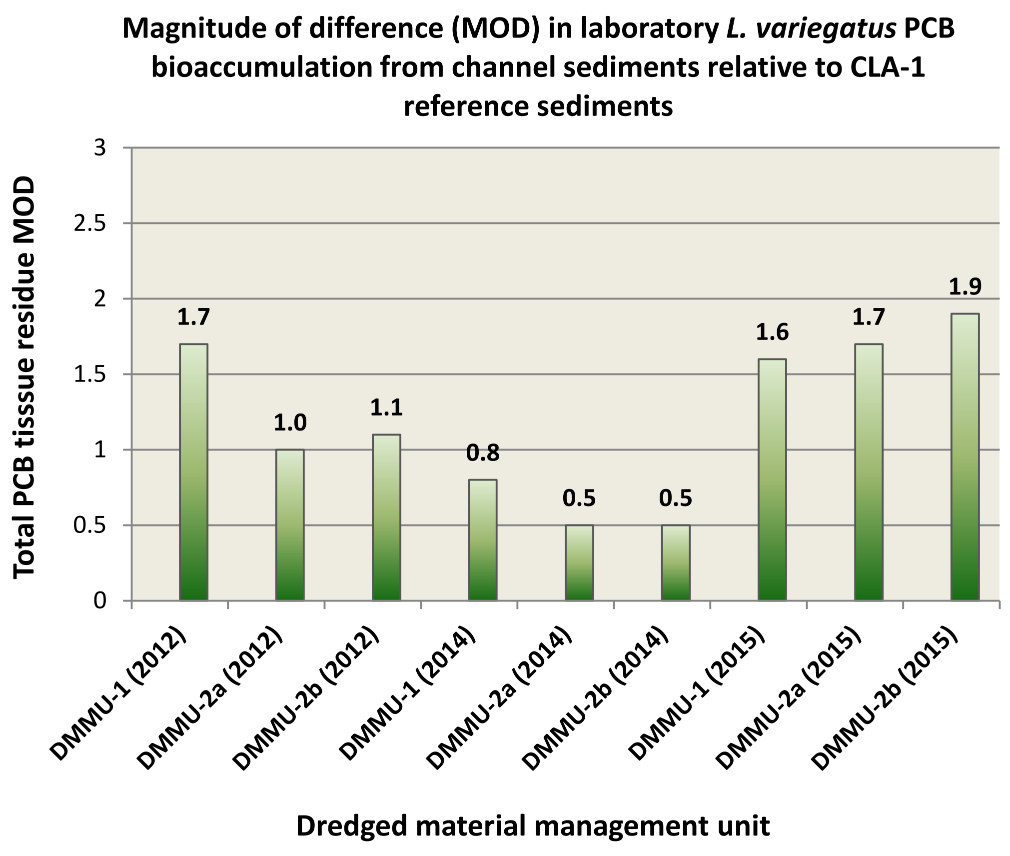
3.3.2[a]), a higher lipid content would explain the higher PCB residues measured in the 2015 *L. variegatus* bioaccumulation experiments. The observed higher PCB tissue residues in 2015 cannot be attributed to any increase in PCB contamination as TOC-normalized concentrations of total PCBs in the channel composite samples were similar to or lower than those measured in 2012 (mean 10,251 µg/kg-TOC; range 8,407 to 12,625 µg/kg-TOC [USACE 2013a]) and 2014 (mean 6,410 µg/kg-TOC; range 5,100 to 8,471 µg/kg-TOC [Table 3]).

b. **<u>Comparisons to Lake Erie sediments at open-lake placement area and other areas/sites in Lake Erie</u>**

(1) ***CLA-1 and regional background sediments***

(a) **Channel sediments vs. CLA-1 and regional background sediments, 2015 data**—On a sole concentration (i.e., not lipid-normalized) basis, total PCB residues in *L. variegatus* tissues exposed to all of the channel sediments (range 153 to 181 µg/kg) were statistically higher than those associated with the CLA-1 reference sediments (97.0 µg/kg) (Fisher's least significant difference [LSD] method one-tailed test; α=0.05). Relative to USACE (2013a), note that the higher bioaccumulation of PCBs from the DMMU sediments was greater than that measured from CLA-1 sediments is a result of a less contaminated composite sample from CLA-1, and not from more contaminated DMMU sediments. Nevertheless, the respective MODs of 1.6, 1.7 and 1.9 for the DMMU-1, DMMU-2a and DMMU-2b sediments relative to CLA-1 reference sediments were all less than a factor of 2. This suggests that such a difference between test and reference sediments observed in the laboratory is not likely to warrant ecological and human health concerns based on the ASTM (2010) recommended minimum detectable difference, and the factor of 2 difference measured between PCB bioaccumulation by *L. variegatus* in paired laboratory and field-based experiments by Beckingham and Ghosh (2010). Therefore, placement of the channel sediments at CLA-1 meets the CWA Section 404(b)(1) Guideline and would not result in any ecologically meaningful increase in bioaccumulation of PCBs at the placement area. Figure 10 is a graph of the MODs for the bioaccumulation of PCBs from channel sediments relative to CLA-1 reference sediments based on the 2012, 2014 and 2015 data sets, illustrating that the MOD is consistently less than a factor of 2 (average MOD=1.2). This information shows that while the benthic laboratory bioaccumulation of PCBs across years may vary from both channel and lake sediments, placement of the channel sediments at CLA-1 would not result in any ecologically meaningful increase in PCB bioaccumulation (note that the 2015 MODs were higher than those from 2012 and 2014 due to less contaminated CLA-1 reference sediments and not more contaminated channel sediments; 2015 MODs relative

FIGURE 10



to grouped CLA-1 reference sediments from 2012, 2014 and 2015 [average total PCB tissue residue 115 μ/kg] ranged from 1.3 to 1.6).

While the lipid data on the bioaccumulation experiments were not used in this case, lipid-normalized PCB bioaccumulation appraisals can nevertheless be made using the 2.8% mean value generated on the laboratory test control sample (Table 7). This yields *estimated* lipid-normalized total PCBs concentrations for the DMMU-1, DMMU-2a, DMMU-2b and CLA-1 sediments on the order of 5,464, 5,843, 6,472 and 3,466 μg/kg-lipid, respectively. This enables a general comparison of the 2012, 2014 and 2015 laboratory PCB bioaccumulation data using lipid-normalized values. The average across the DMMU samples of 5,926 μg/kg-lipid based on estimated values is quite similar to the average of 5,623 µg/kg-lipid across laboratory PCB bioaccumulation measurements from 2012 (USACE 2013a) and 2014 (Table 3). This average is also comparable to mean oligochaete bioaccumulation of total PCBs from regional Lake Erie sediments offshore of Cleveland (surface area-weighted), as well as the 2014 laboratory PCB bioaccumulation from CLA-1 reference sediments (Figure 4). Similar to the conclusions in paragraph 3.3.2(b)(1)(a), this suggests that the placement of channel sediments at CLA-1 would not result in any significant increase in benthic bioaccumulation of PCBs. Further, this information also indicates that placement of any of the channel sediments at CLA1-5 within the southeast corner of CLA-1 would result in an estimated reduction in the benthic bioaccumulation of PCBs from 55,015 to about 6,000 µg/kg-lipid.

(b) **Channel sediments vs. CLA-1 reference sediments, grouped 2012, 2014 and 2015 data**—On a sole concentration basis, total PCB residues in *L. variegatus* tissues exposed to all of the channel sediments were statistically higher than those associated with the grouped CLA-1 reference sediments (109 µg/kg) (Fisher's LSD method one-tailed test; α=0.05). Nevertheless, the respective MODs of 1.4, 1.5 and 1.7 for the DMMU-1, DMMU-2a and DMMU-2b sediments relative to CLA-1 reference sediments were consistently all less than a factor of 2. The estimated lipid-normalized values indicate that differences between laboratory PCB bioaccumulation between the channel sediments relative to the grouped CLA-1 reference sediments (estimated 4,472 µg/kg-lipid) would be less than those portrayed through sole total PCB concentration. This information suggests that no ecologically meaningful increase in PCB bioaccumulation would occur from placement of the channel sediments over CLA-1 reference sediments.

(2) ***Sediments at other lake areas/sites not formally used for dredged sediment discharges***—This includes all 2014 areas/sites excluding those assumed to be formally used for dredged sediment discharges over four decades ago. Across all discrete lake sediment samples, total PCB residues in *L. variegatus* tissues ranged from 13.7 µg/kg to 180 µg/kg (or 18,000 µg/kg-lipid). On a sole total PCB concentration basis, residues in *L. variegatus* tissues exposed to all of the channel sediments were at the high end of this range. Mean total PCB residues in *L. variegatus* tissues exposed to all of the channel sediments was significantly greater relative to sediments at CLA-4 (34.0 µg/kg) (Fisher's LSD method one-tailed test; α=0.05). Collectively, this information shows that total PCB residues in *L. variegatus* tissues exposed to the channel and CLA-1 reference sediments is within the high end of the range of benthic bioaccumulation of PCBs from regional Lake Erie sediments offshore of Cleveland. This comparison does not consider laboratory lipid content data which would serve to lower the actual range of PCB bioaccumulation from the channel sediments (e.g., to on the order of 6,000 µg/kg-lipid).

(3) ***Sediments at all lake areas/sites***—This includes all sites regardless of whether they may have been formerly used for dredged sediment discharges and therefore represent existing regional background PCB bioaccumulation from Lake Erie sediments offshore of Cleveland. It is evident that like the measured 2014 data, *estimated* laboratory bioaccumulation of PCBs from all of the channel sediments (range 5,464 to 6,472 µg/kg-lipid) is comparable to and well within the range of PCB residues *L. variegatus* and oligochaete tissues associated with the designated small and large lake areas offshore of Cleveland illustrated through Figure 5 (range 13.7 µg/kg [1245 µg/kg-lipid] to 5,880 µg/kg [262,583 µg/kg-lipid] (see paragraph 3.3.2[b][3]). This *estimated* mean lipid-normalized total PCB residues in *L. variegatus* tissues exposed to all three DMMU sediments were also comparable to the surface area-weighted background mean of 5,188 µg/kg-lipid across *L. variegatus* and oligochaetes (Figure 4). Like the 2014 data, this information indicates that PCB bioaccumulation risk from the channel sediments is within the range and comparable to that which currently occurs from regional Lake Erie background sediments offshore of Cleveland.

3.4.4 Pesticides bioaccumulation testing

a. **Results**. Results of the standard 28-day *L. variegatus* bioaccumulation testing for pesticides on channel and lake area sediment samples are provided in Table B24. DDE was detected in all the tissue samples associated all DMMU and CLA-1 sediments, but not CLA-4 sediments (at a higher detection limit).

The bioaccumulation data indicated a cluster of pesticide detections (alpha-chlordane, alpha-BHC, methoxylchlor and dieldrin) in the tissue samples associated with DMMU-2a and DMMU-2b sediments, all of which required analytical qualifications. There is a substantial amount of uncertainty associated with these tissue values. First, none of these pesticides were identified as sediment COCs because they were all non-detectable in corresponding sediment samples (paragraph 3.4.1[b][2][b]; USACE 2007; USACE 2013a), also suggesting that they should not appreciably be bioaccumulating in tissue. Second, none of these pesticides were detected in *L. variegatus* tissues generated from previous bioaccumulation testing efforts on these channel sediments (Kreitinger *et al.* 2011; USACE 2013a). Third, most of the values reported that were significantly above CLA-1 sediment detection limits were qualified as “P” indicating that the relative percent difference (RPD) in concentrations yielded between the primary and secondary gas chromatography (GC) column exceeded 40%. The values reported in Table B24 represent the maximum concentrations yielded from the primary column and do not consider the lower value generated from the secondary column (RTI 2014). Table 8 below summarizes this information to illustrate these differences:

TABLE 8

DMMU	PESTICIDE	REPLICATE	REPORTED VALUE (µg/kg)	SECONDARY GC COLUMN VALUE (µg/kg)	RPD (%)
DMMU-2a	Alpha-Chlordane	E	**17**	**6.7**	**157**
	Methoxylchlor	C	**29**	**3.2**	**796**
		D	**7.5**	**3**	**150**
		E	**8.8**	**3.2**	**177**
	Dieldrin	C	**9.9**	**2.7**	**273**
		D	**6.9**	**4.4**	**55**
		E	**15**	**4.4**	**227**
DMMU-2b	Methoxychlor	E	**42**	**3.8**	**985**
	Dieldrin	A	**6.7**	**2.9**	**128**
		B	**8.3**	**3.9**	**111**
		C	**7.7**	**2.6**	**190**
		D	**9.4**	**3.3**	**185**
		E	**13**	**3.8**	**236**

The data in Table 8 make it evident that use of the primary GC column data may have biased the actual tissue residues notably high. Consideration of the substantial RPDs and secondary column values in tandem with the remaining replicate values in this case suggests that actual tissue residues may approach levels of detection. This would be consistent with the corresponding sediment concentration data as well as historic data on these channel sediments. Given these data uncertainties with the fact that none of these pesticides detected in tissue were detected in the sediment samples or identified as sediment COCs, bioaccumulation was not evaluated (USEPA/USACE 1998b).

Table 9 summarizes the benthic bioaccumulation and corresponding bulk composite sediment sample data for DDE:

TABLE 9

DDE MEASUREMENT	LOCATION/AREA				
	UPPER RIVER CHANNEL			LAKE	
	DMMU-1	DMMU-2a	DMMU-2b	CLA-1 REFERENCE	CLA-4
TISSUE					
DDE (µg/kg)	**8.4**	**6.7**	**7.3**	**6.4**	**3.8U***
SEDIMENT					
DDE (µg/kg)	**4.8U**	**5.8U**	**6U**	**5.5**	**12U**
TOC-normalized DDE (µg/kg-TOC)	-	-	-	**167**	-

*Not detectable at the detection limit.

b. **<u>Comparisons to Lake Erie sediments at open-lake area CLA-1 and CLA-4</u>**

On a sole concentration basis, DDE residues in *L. variegatus* tissues exposed to the DMMU-1 (8.4 µg/kg) and DMMU-2b sediments (7.3 µg/kg) were statistically higher than those associated with the CLA-1 reference sediments (6.4 µg/kg) (Fisher's LSD method one-tailed test; α=0.05). However, the respective MODs of 1.3 and 1.1 for the DMMU-1 and DMMU-2b sediments relative to CLA-1 reference sediments were all less than a factor of 2. This suggests that such a difference between test and reference sediments observed in the laboratory is not likely to warrant ecological and human health concerns based on the ASTM (2010) recommended minimum detectable difference. On a sole concentration basis, DDE residues in *L. variegatus* tissues exposed to the DMMU-2b sediments (6.7 µg/kg) were not statistically different than those associated with the CLA-1 reference sediments (Fisher's LSD method one-tailed test; α=0.05). Statistical comparisons to *L. variegatus* tissue residues associated with the CLA-4 sediments were not made because DDE concentrations were all less than a non-detectable concentration of 12 µg/kg. This information shows that placement of the channel sediments at CLA-1 meets the CWA Section 404(b)(1) Guideline and would not result in any ecologically meaningful increase in bioaccumulation of DDE at the placement area.

3.4.5 Elutriate testing

a. **<u>SET</u>**

(1) ***Metals and other inorganics***—Tables B25 and B26 summarize the results of this testing for metals and other inorganics, respectively. The elutriate data show low to moderate releases of metals and other inorganics from the channel sediments. Dissolved ammonia-N concentrations across the DMMU sediment elutriates ranged from 7.1 (DMMU-1) to 19 (DMMU-2b) mg/L and exceeded the acute water quality criterion of 4.5 mg/L. Therefore, ammonia was identified as a water column PCOC and would require dilution and dispersion in the water column during dredged sediment discharge operations. With respect to the copper "R" data qualifier for the channel composite sediment samples, separate SET data showed releases of copper (total basis) from the DMMU-2a and DMMU-2b sediments at 0.009 and 0.012 mg/L, respectively (USAERDC 2015a).

(a) Ammonia-N—The average dissolved ammonia level in sediment elutriate across DMMU sediments samples was 11.1 mg/L (each sample result was greater than the Ohio outside mixing zone maximum [OMZM] water quality criteria (WQC) for the protection of aquatic life of 4.5 µg/L at a pH of 8.1).

The Short-Term (ST) FATE simulation model was employed to predict and evaluate the release of ammonia to the water column during discharge of dredged sediment in the open-water (USAERDC 2015b). Modeling assumptions include (1) clamshell bucket (mechanical) dredging with discharge of the dredged sediment via scow; (2) dredged sediment with a solids content of 45% (about 10% less than *in-situ* material due to water entrained during dredging); (3) use of a 1500 cubic yard (CY) scow with a bin that is 120 x 30 x 12 feet; (4) dredged sediment placement is a single discharge from a slowly moving vessel over a 40-second period; (5) use of a single rectangular two-square mile open-lake placement area in a west-to-east direction with an average water depth of 60 feet; (6) a uniform water column density of 0.999; (7) five depth-averaged current velocities (0.33, 0.66, 0.98, 1.31 and 1.64 feet per second [fps]); (8) dredged sediment was free of clumps in DMMU-1, but was predicted to have 26% clumps by volume in DMMU-2a and 38% clumps by volume in DMMU-2b; and (9) volumetrically, dredged sediment in DMMU-1 was 61% water, 0% clumps, 31% sand, 5% silt and 3% clay, the dredged sediment in DMMU-2a was 55% water, 26% clumps, 4% sand, 10% silt and 5% clay, and the dredged sediment in DMMU-2b was 47% water, 38% clumps, 2% sand, 9% silt and 4% clay; and (10) all fractions except clumps are stripped in the water column with the silt/clay fractions being cohesive. The results of the STFATE model runs are presented by USAERDC (2015b).

Assuming a worst-case ammonia-N release of 19 mg/L and LC_{50} of 68% associated with the dredged sediment discharge and lake water background ammonia concentration of 0.1 mg/L, the STFATE model run indicated that the effluent would achieve the Ohio OMZM WQC of 4.5 µg/L within 100 feet of the point of discharge within one minute. Therefore, the WQS would be met well within the boundary of the open-lake placement area.

The released and rapidly diluted concentrations of ammonia would represent insignificant risk to fish. Fairchild *et al.* (2005) exposed several fish species to ammonia in the laboratory over a chronic 28-day duration. The most sensitive fish species was *P. promelas* exposed as 4-day olds. For this species, they reported a no observed effect concentration (NOEC), lowest observed effect concentration (LOEC) and chronic value (ChV; the geometric mean of the chronic NOEC and LOEC) of 0.31, 0.60 and 0.43 mg/L unionized ammonia (NH_3), respectively. At 25°C and the reported pH of 8.34, this ChV equates to a total ammonia concentration of approximately 6.3 mg/L. The ChV is considered a protective value (Adams and Rowland 2002) and is very conservative in terms of evaluating acute exposures associated with the discharge of dredged sediments from a scow. Fairchild *et al.* (2005) also reported no *P. promelas* mortality after a shorter seven day exposure period to 0.31 mg/L NH_3 which translates to 3.7 mg/L total ammonia at 25°C. Therefore, after immediate mixing in the water column (see next paragraph), ammonia released from these sediments would not be of any significant concern with respect to fish toxicity.

In summary, ample water column for ammonia dilution and dispersion is available at CLA-1. Based on this information, ammonia was eliminated as a water column PCOC.

(3) ***PCBs***—Table B27 summarizes the results of this testing. Dissolved Aroclors were not detected in any of the DMMU sediment elutriates at detection limits ranging from 0.04 to 0.11 µg/L. Such concentrations are well below those which would be expected to cause any acute toxicity.

(4) ***Pesticides***—Table B28 summarizes the results of this testing. With the exceptions of alpha endosulfan and DDE, dissolved pesticides were not detected in any of the DMMU sediment elutriates at detection limits ranging from 0.004 to 0.11 µg/L. Alpha endosulfan and DDE were measured at 0.009 and 0.024 µg/L in the DMMU-2b sediment elutriate. Such concentrations are well below those which would be expected to cause any acute toxicity.

(5) ***PAHs***—Table B29 summarizes the results of this testing. Except for fluoranthene, dissolved PAHs were not detected in any of the DMMU sediment elutriates at a detection limit of 0.16 µg/L. Fluoranthene was measured in all three sediment elutriates at 0.19 µg/L. Such concentration are well below those which would be expected to cause any acute toxicity.

b. Water column bioassays

Water column bioassays assess the potential toxicity of sediment associated contaminants to sensitive organisms in the water column. These tests provide information on the toxicity of contaminants not included in WQSs and indicate possible interactive effects (additive, synergistic or antagonistic) of multiple contaminants. Water column bioassays use elutriate preparations prepared by mixing sediment and water into a slurry. The slurry is allowed to settle and the supernatant decanted. The supernatant is then centrifuged to remove suspended particles. The supernatant is the elutriate, which is used as the test solution for the bioassays. The two organisms used, *C. dubia* and *P. promelas*, are common to the Great Lakes. The water flea *C. dubia* is an important food item for small and young fish and the minnow *P. Promelas* is a forage food item for larger fish.

The results of the water column bioassays are summarized in Table B30.

(1) ***C. dubia***—Mean survival associated with the lake site water (96±9%) was not

statistically different than the laboratory control (100%). The mean survival of this test species exposed to undiluted (100%) elutriate ranged from 64±33% (DMMU-2a) to 100% (DMMU-2b). Relative to the site water, the 100% DMMU-2a sediment elutriate showed a statistically lower mean survival. No other sediment elutriates showed statistically significant differences in mean survival relative to lake site water. The DMMU-2a bioassay data yielded a no observed effect concentration (NOEC) and LC_{50} of 50% and >100%, respectively. These bioassay data indicated acute toxicity associated with the undiluted DMMU-2a sediment elutriate. Bioassay data on the remaining sediment elutriates showed insignificant acute toxicity.

(2) ***P. promelas***—Mean survival associated with the lake site water (100%) was not statistically different than the laboratory control (98±4%). The mean survival of this test species exposed to undiluted elutriate ranged from 22±44% (DMMU-2a) and 22±26% (DMMU-2b), to 80±23% (DMMU-1). Relative to lake site water, the 100% DMMU-2a and DMMU-2b sediment elutriates showed a statistically lower mean survival. The DMMU-1 sediment elutriate did not show statistically significant differences in mean survival relative to lake site water. The DMMU-2a and DMMU-2b bioassay data yielded NOECs and LC_{50} values of 50% and 68%, and 50% and 75%, respectively. These bioassay data indicated acute toxicity associated with the undiluted DMMU-2a and DMMU-2b sediment elutriates. Bioassay data on the DMMU-1 sediment elutriate showed insignificant acute toxicity.

Data generated from the water column bioassays strongly suggest that the significant toxicity observed for the undiluted DMMU-1, DMMU-2a and DMMU-2b sediment elutriates was attributable to ammonia. First, unionized ammonia (usually the form most responsible for causing toxicity) concentrations in the DMMU-2a and DMMU-2b sediment elutriates were above specific toxicity reference values reported in the literature. Unionized ammonia concentrations were 0.89, 0.94 and 1.38 mg/L for the DMMU-1, DMMU-2a and DMMU-2b sediment elutriates, all of which approached or exceeded LC_{50} of 0.56 to 0.94 g/L for *P. promelas* (Nimmo *et al.* 1989). The unionized ammonia concentrations in the three elutriates also approached or exceeded an LC_{50} of 1.18 mg/L for *C. dubia* (Andersen and Buckley 1998). In addition, there were strong correlations between elutriate unionized ammonia concentrations and survivals for both test species (*P. promelas* $r=0.94$, $P<0.001$; *C. dubia* $r=0.92$, $P<0.001$). Finally, *P. promelas* typically exhibits a greater sensitivity to ammonia relative to *C. dubia* (relative to fish, *C. dubia* [and other invertebrates] is typically more sensitive to most contaminants, with ammonia as an exception).

A TIE/TRE was performed to determine whether contaminants other than ammonia may have contributed to the significant toxicity observed in the DMMU-2a and DMMU-2b sediment elutriates. TIE/TRE treatments on the undiluted elutriates included new bioassays using freshly prepared unpurged sediment, and bioassays employing zeolite column manipulation using unpurged sediment elutriate, two pH (6.5 and 7.2) manipulations for unpurged sediment elutriate, ethylenediaminetetraacetic acid (EDTA) metal chelation manipulation using purged sediment elutriate and C18 column treatment using purged sediment elutriate. As with the first round of tests, high *P. promelas* mortality (100%) was yielded from the undiluted DMMU-2a and DMMU-2b elutriates. In contrast to the first round of tests, *C. dubia* survival in the DMMU-2b elutriate was higher (88±18%) but lower for DMMU-2b sediment elutriate (20±14%) (likely due to a comparable increase in unionized ammonia concentration [2.10 mg/L]). For both elutriates, the zeolite stripping treatment removed toxicity (range of survival across both species 93±6 to 100%), suggesting that ammonia was the cause of the toxicity observed in the undiluted sediment elutriates (and that most metals and organic contaminants were not a contributor to the observed toxicity). Since zeolite can also bind some metals, the additional elutriate manipulations were designed to further evaluate potential metal-related toxicity. Those treatments were inconclusive due to either the confounding effects of high biological oxygen (BOD), low dissolved oxygen concentrations and unstable pH caused by the need to aerate elutriate waters due to biological oxygen demand (BOD) (pH treatments), or the ineffectiveness of purging to substantially lower ammonia sediment pore water concentrations, again due to BOD (EDTA and C18 column treatments). Nevertheless, SET data on the DMMU-2a and DMMU-2b sediments indicate that dissolved metal concentrations (Table 23) were protective of aquatic life. Collectively, the initial bioassay, TIE/TRE and SET chemistry data provide strong lines of evidence that ammonia was the cause of toxicity in the undiluted DMMU-2a and DMMU-2b sediment elutriates.

Since ammonia was identified as the cause of the sediment elutriate toxicity, an application factor of 0.1 was applied to the LC_{50} data to compute limited permissible concentrations (LPCs) (as opposed to using an application factor of 0.01 if the toxicity were a result of toxicants other than ammonia). An application factor of 0.1 is appropriate for protection of *P. promelas* (Kennedy *et al.* 2015). Assuming a LPCs of 10, 6.8 and 7.5% for the dredged sediments from DMMU-1, DMMU-2a and DMMU-2b, respectively, application of the STFATE model indicated that the effluent would achieve the LPCs during the first three minutes after discharge and within 300 feet of the discharge (USAERDC 2015b). Use of an application factor of 0.01 for the dredged sediments from DMMU-1, DMMU-2a and DMMU-2b would yield LPCs of 1, 0.68 and 0.75%, respectively. Application of the STFATE model to these reduced LPCs indicated that the effluent would achieve the LPCs during the first 25 minutes after discharge and within 2,500 feet of the discharge (well within the boundaries of the placement area) for the entire range of likely currents at the site (USAERDC 2015b).

This evaluation of channel sediment elutriate data is consistent with that presented in USACE (2013a). The SET and water column bioassay data, and modeling show that the release of contaminants from the dredged sediment to the water column during open-water placement would not result in any contaminant-related unacceptable, adverse impacts to the aquatic ecosystem. They also indicate compliance with applicable State WQSs after consideration of dilution and dispersion.

3.4.6 COCs

PCBs were identified as PCOCs in the channel sediments. Ammonia-N was identified as a water column PCOC. Further evaluation eliminated these PCOCs. No COCs were identified in the channel sediments based on data generated by data generated by USACE in 2015.

3.5 OEPA investigations

3.5.1 General

This section of the dredged sediment evaluation includes a review and evaluation of data generated by the OEPA on Upper Cuyahoga River and Cleveland offshore Lake Erie sediments across nine sampling/testing events accomplished in 2013, 2014 and 2015. All data generated by OEPA across these events have been considered, and appropriate data have been integrated into the evaluation and will be integrated into the CWA Section 404(b)(1) Evaluation. Most of the information on these events was provided to USACE in OEPA letter dated September 30, 2015 (OEPA 2015a). Additional information on these events was requested from OEPA in a USACE e-mail dated December 14, 2015 and provided in an e-mail dated January 4, 2016. Further information on these events was requested from OEPA in a USACE e-mail dated January 14, 2016 and provided in an e-mail dated January 15, 2016.

Review of this collective information provided by OEPA demonstrated considerable substantive data quality control and technical issues. The three overarching issues are summarized as follows:

a. Many of the sediment samples across the sampling events were collected from outside the Upper Cuyahoga River Channel dredging prism. In general, these samples were either collected from outside channel boundaries, in areas of the authorized channel officially “not maintained” (i.e., in DMMU-1), below dredging elevation or on channel side slopes. Data on these samples could not be included in the evaluation as they are not representative of the dredged sediments. It is further noted that the OEPA sites appeared to target the boundaries of the channel (such as near outfalls) rather than the shoals that are actually dredged within the Federal navigation channel. Regardless of sampling site, contaminant concentration data on all sites located within the dredging prism were integrated into the evaluation.

b. Sediment sampling did not follow the appropriate protocols prescribed in formal guidance (USEPA/USACE 1998a, 1998b). For example, DMMUs were not utilized (the data generated by OEPA were placed into the three USACE designated DMMUs to better enable interpretation) and DMMU composite samples were not created from discrete samples collected from each individual DMMU. Also, open-lake reference area sediments were not collected during each individual sampling event.

c. The solid phase bioassays (acute toxicity and PCB bioaccumulation tests) did not follow appropriate laboratory methodologies and failed to yield useable data.

It is also important to note that the sampling/testing efforts accomplished by OEPA did not involve the performance of a SET to the Upper Cuyahoga River sediment samples. As prescribed in Section 5.1 of the ITM (USEPA/USACE 1998b), this is the test directed at evaluating compliance of any discharge of dredged sediment at a specified site with respect to applicable state WQSs.

The remainder of this section addresses each individual OEPA sampling/testing event.

3.5.2 October 2013 event, Upper Cuyahoga River Channel—This effort involved the collection of discrete surface grab sediment samples from the Upper Cuyahoga River, with subsequent bulk physical and chemical analyses. Within the framework of the DMMUs, three discrete sediment samples were from DMMU-1, DMMU-2a and DMMU-2b. A total of nine discrete samples were subjected to testing. In addition, three discrete samples were composited to form three different composited samples. The sediment sampling sites are shown in Figure A6. No sediment samples were collected from any open-lake reference area for direct comparison purposes. Because of this, open-lake reference sediment contaminant concentration ranges were developed for comparison purposes and are summarized in Table B31. Chemical analyses included the nutrients nitrogen-ammonia and TP, TOC, metals, PCBs, pesticides, PAHs, volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs).

More than half of the discrete sediment samples were collected from outside the channel dredging prism, including 200013, F01A21, F01W50, F01S08 and 302580. Because these samples were not representative of the sediments that are maintenance dredged from the Upper Cuyahoga River Channel, the associated data (and data on the related composite samples) were not considered in the evaluation. Data on the remaining four discrete samples (200016, 302581, 302578 and F01A41) were included in the evaluation. Samples generally consisted of gray clays and silts. Evaluation of these sediment data is summarized as follows:

a. **Physical characteristics.** Table B32 summarizes the results of the sediment grain size analyses. Each composite sediment sample subjected to grain size analysis was composed of discrete samples collected from outside the channel dredging prism.

b. **Chemical testing**

(1) ***Inorganic analyses***

(a) **Inorganics**—Table B33 summarizes the results of the nitrogen-ammonia, TP and TOC analyses. The upper range of TP concentrations was 1,350 mg/kg, which is comparable to open-lake reference concentrations.

(b) **Metals**—Table B34 summarizes the results of these analyses. Copper concentrations in samples 200016 and 302578 were both 83.3 mg/kg, which exceeded the maximum open-lake reference sediment concentration. Such levels of copper in sediment are not of significant toxicological concern. Similar concentrations measured in USACE (2013a) did not result in any significant acute toxicity to *H. azteca*. The associated composite sample concentrations (including various discrete samples outside the dredging prism) ranged from 46.9 to 66.4 mg/kg, and were below the maximum open-lake reference sediment concentration.

(2) ***Organic analyses***

(a) **PCBs**—Table B35 summarizes the results of these analyses. Total PCB concentrations in the sediment samples were determined by summing all detected Aroclor mixtures. The total PCB concentration range of 106 to 244 µg/kg (3,029 to 9,365 µg/kg-TOC) was within the open-lake reference sediment concentration range. These channel sediment PCB data are consistent with those presented in USACE (2013a) and USACE (2015a) (as well as in this evaluation). Although most of the 302809 composite sample was collected from outside the dredging prism, the total PCB concentration of 2,419 µg/kg is suspect since the contributing discrete samples show total PCBs concentrations ranging from 120 to 215 µg/kg. In addition, most of the total PCB concentration is attributable to Aroclor 1254, a mixture that was not detected in any of the contributing discrete samples and has not been detected in Upper River Channel sediments.

(b) **Pesticides**—Table B36 summarizes the results of these analyses. All pesticide concentration were within the open-lake reference sediment concentration range.

(c) **PAHs**—Table B37 summarizes the results of these analyses. Total PAH concentrations in the sediment samples were determined by summing the 16 USEPA priority pollutant compounds. All total PAH concentrations were within the open-lake reference sediment concentration range.

(d) **VOCs**—Table B38 summarizes the results of these analyses. Very few VOCs were detected. Acetone, a common laboratory contaminant, was measured in samples 302578 and F01A41 at 0.09 mg/kg (close to detection limits), and toluene was measured in all of the samples at concentrations ranging from 0.06 to 11.9 mg/kg. Such concentrations are not of significant toxicological concern. Similar concentrations of toluene measured in USACE (2013a) did not result in any significant acute toxicity to *H. azteca.*

(e) **SVOCs**—Table B39 summarizes the results of these analyses. Very few SVOCs were detected at low levels. Bis(2-ethylhexyl)phthalate is a common laboratory contaminant.

c. COCs

No COCs were identified in the channel sediments based on data generated by OEPA (2013).

3.5.3 May 2014 event, Upper Cuyahoga River Channel—This effort involved the collection of discrete surface grab sediment samples from the Upper Cuyahoga River, with subsequent bulk chemical analyses. Within the framework of the DMMUs, two to four discrete sediment samples were collected from DMMU-1, DMMU-2a and DMMU-2b. A total of nine samples were subjected to testing. The sediment sampling sites are shown in Figure A7. Since sediment samples were not collected from open-lake reference areas for direct comparison purposes, open-lake reference sediment contaminant concentration ranges from Table B31 were used. Chemical analyses included the nutrients nitrogen-ammonia and TP, TOC, metals, PCBs, pesticides, PAHs, VOCs and SVOCs.

One sample, 302581, was collected from outside the channel dredging prism. Because this sample was not representative of the sediments that are maintenance dredged from the Upper Cuyahoga River Channel, the associated data were not considered in the evaluation. Data on the remaining eight samples (200013, F01A21, F01A42, F01W50, F01S08, 302578, 302579 and 302580) were included in the evaluation. Sampled sediments were generally comprised of gray brown silty clays. Evaluation of these sediment data is summarized as follows:

a. **Inorganic analyses**

(1) ***Inorganics***—Table B40 summarizes the results of the nitrogen-ammonia, TP and TOC analyses. All concentrations of ammonia-nitrogen and TP were within the open-lake reference sediment concentration range.

(2) ***Metals***—Table B41 summarizes the results of these analyses. All metal concentrations were within the open-lake reference sediment concentration range.

b. **Organic analyses**

(1) ***PCBs***—Table B42 summarizes the results of these analyses. Total PCB concentrations in the sediment samples were determined by summing all detected Aroclor mixtures. The total PCB concentration range of 46.8 to 158 µg/kg (2,753 to 12,177 µg/kg-TOC) was within the open-lake reference sediment concentration range. These channel sediment PCB data are consistent with those presented in USACE (2013a) and USACE (2015a) (as well as in this evaluation).

(2) ***Pesticides***—Table B43 summarizes the results of these analyses. Except for DDD, DDE and DDT, all pesticide concentrations were non-detectable. DDE and DDT were measured in all of the samples with ∑DDT concentrations ranging from 26.9 to 53.6 µg/kg (1,029 to 3,007 µg/kg-TOC). The 53.6 µg/kg concentration in sample 301579 is comparable to the maximum open-lake reference sediment concentration. However, on a TOC-normalized concentration basis, most of the samples (range 1,829 to 3,007 µg/kg-TOC) exceeded the maximum open-lake reference sediment concentration. Projections based on the TPB model (McFarland 1984) using empirical ∑DDT BSAFs (and assuming a 1% lipid content in oligochaetes) indicate that bioaccumulation from the three DMMU sediments would consistently be on the order 9 µg/kg. This is within the range of ∑DDT bioaccumulation predicted for open-lake reference area sediments (1.3 to 17 µg/kg). ∑DDT bioaccumulation from the Upper Cuyahoga River Channel sediments based on 2015 bioaccumulation data is evaluated in Section 3.3.4.

(3) ***PAHs***—Table B44 summarizes the results of these analyses. Total PAH concentrations in the sediment samples were determined by summing the 16 USEPA priority pollutant compounds. All total PAH concentrations were within the open-lake reference sediment concentration range.

(4) **VOCs**—Table B45 summarizes the results of these analyses. Very few VOCs were detected. Acetone, a common laboratory contaminant, was measured in samples F01W40 and F01S08 at 0.10 mg/kg (close to detection limits), and toluene was measured in samples 302578 and 302579 at concentrations ranging from 0.35 to 3.11 mg/kg. Such concentrations are not of significant toxicological concern. Similar concentrations of toluene measured in USACE (2013a) did not result in any significant acute toxicity to *H. azteca*.

(5) **SVOCs**—Table B46 summarizes the results of these analyses. Very few SVOCs were detected.

c. COCs

No COCs were identified in the channel sediments based on data generated by OEPA (2014a).

3.5.4 April 2014 event, Upper Cuyahoga River Channel—This effort involved the collection of discrete and vibro-core sediment samples from the Upper Cuyahoga River, with subsequent bulk chemical analyses. Within the framework of the DMMUs, six to eight discrete sediment samples were collected from DMMU-1, DMMU-2a and DMMU-2b. A total of 21 samples were subjected to testing. The sediment sampling sites are shown in Figure A8. Since sediment samples were not collected from open-lake reference areas for direct comparison purposes, open-lake reference sediment contaminant concentration ranges from Table B31 were used. Chemical analyses included the nutrients nitrogen-ammonia and TP, TOC, metals, PCBs, pesticides, PAHs, VOCs and SVOCs.

As noted in a March 2, 2015 USACE letter to OEPA (USACE 2015b), it is evident that portions of many of the core sediment samples obtained from the river in this event were collected from outside the Federal navigation channel's dredging prism. Figure A9 illustrates this. Also, the complete lack of elevation data for the sample’s “50%/50% top and bottom of core split” and bottom of core made it impossible to accurately decipher what portion of the top and bottom samples were collected from within or outside the actual dredging prism. The lack of such fundamental information required making certain assumptions as to what core samples could reasonably be expected to be representative of sediments subject to maintenance dredging. Given this limited available information, it was determined that 14 of the 21 of the samples were collected from outside the dredging prism; these samples included 200013, F01A21, F01A42 (top and bottom), F01W50 (discrete and bottom), F01S08 (bottom), 302581 (bottom), 302578 (top and bottom), 302579 (bottom), 302580 (bottom) and F01A41 (top and bottom). Because these samples were not representative of the sediments that are maintenance dredged from the Upper Cuyahoga River Channel, the associated data were not considered in the evaluation. Data on the remaining seven samples 200016, 302582 (top and bottom), F01S08 (top), 302579 (top) and 302580 (top) were included in the evaluation. Evaluation of these sediment data is summarized as follows:

a. **Inorganic analyses**

(1) ***Inorganics***—Table B47 summarizes the results of the nitrogen-ammonia, TP and TOC analyses. All concentrations of ammonia-nitrogen and TP were within the open-lake reference sediment concentration range.

(2) ***Metals***—Table B48 summarizes the results of the sediment grain size analyses. All metal concentrations were within the open-lake reference sediment concentration range.

b. **Organic analyses**

(1) ***PCBs***—Table B49 summarizes the results of these analyses. Total PCB concentrations in the sediment samples were determined by summing all detected Aroclor mixtures. The total PCB concentration range of 37.4 to 143 µg/kg (3,177 to 8,400 µg/kg-TOC) was within the open-lake reference sediment concentration range. These channel sediment PCB data are consistent with those presented in USACE (2013a) and USACE (2015a) (as well as in this evaluation).

(2) ***Pesticides***—Table B50 summarizes the results of these analyses. Except for DDD, DDE and DDT, all pesticide concentrations were non-detectable. DDD, DDE and DDT were measured in most or all of the samples with ∑DDT concentrations ranging from 5.8 to 54.2 µg/kg (483 to 3,011 µg/kg-TOC). The 54.2 µg/kg concentration in sample F01508 (top) is comparable to the maximum open-lake reference sediment concentration. However, on a TOC-normalized concentration basis, samples 302582 (top), F01S08 (top) and 302580 (top) (range 1,913 to 3,007 µg/kg-TOC) exceeded the maximum open-lake reference sediment concentration. Projections based on the TPB model (McFarland 1984) using empirical ∑DDT BSAFs (and assuming a 1% lipid content in oligochaetes) indicate that bioaccumulation from the DMMU-2b sediments (where average TOC-normalized ∑DDT concentrations exceeded the maximum open-lake reference sediment

value) would be 7.25 µg/kg. This is within the range of ∑DDT bioaccumulation predicted for open-lake reference area sediments (1.3 to 17 µg/kg). ∑DDT bioaccumulation from the Upper Cuyahoga River Channel sediments based on 2015 bioaccumulation data is evaluated in Section 3.3.4.

(3) ***PAHs***—Table B51 summarizes the results of these analyses. Total PAH concentrations in the sediment samples were determined by summing the 16 USEPA priority pollutant compounds. All total PAH concentrations were within the open-lake reference sediment concentration range.

(4) **VOCs**—Table B52 summarizes the results of these analyses. Very few VOCs were detected. Acetone, a common laboratory contaminant, was measured in sample 302580 (top) at 0.10 mg/kg (close to detection limits), and toluene was measured in samples 200016, 302582 (top and bottom), F01508 (top), 302581 (top), 302579 (top) and 302580 (top) at concentrations ranging from 0.08 to 7.69 mg/kg. Such concentrations are not of significant toxicological concern. Similar concentrations of toluene measured in USACE (2013a) did not result in any significant acute toxicity to *H. azteca.*

(5) **SVOCs**—Table B53 summarizes the results of these analyses. Very few SVOCs were detected.

c. COCs

No COCs were identified in the channel sediments based on data generated by OEPA (2014b).

3.5.5 August 2014 event, Upper Cuyahoga River Channel—This effort involved the collection of discrete surface sediment samples from the Upper Cuyahoga River, with subsequent bulk chemical analyses. Within the framework of the DMMUs, one to three discrete sediment samples were collected from DMMU-1, DMMU-2a and DMMU-2b. A total of six to eight samples were subjected to testing. The sediment sampling sites are shown in Figure A10. Since sediment samples were not collected from open-lake reference areas for direct comparison purposes, open-lake reference sediment contaminant concentration ranges from Table B31 were used. Chemical analyses included the nutrients nitrogen-ammonia and TP, TOC, metals, PCBs, pesticides, PAHs, VOCs and SVOCs.

Five of the eight samples (200013, F01A21, F01A42, F01W50 and 302579) were collected from outside the channel dredging prism. Because these samples were not representative of the sediments that are maintenance dredged from the Upper Cuyahoga

River Channel, none of the associated data were considered in the evaluation. Data on the remaining three samples (F01S08, 302578 and 302580) were included in the evaluation. Sampled sediments generally consisted of brown gray silts with some sands. Evaluation of these sediment data is summarized as follows:

a. **Inorganic analyses**

(1) ***Inorganics***—Table B54 summarizes the results of the nitrogen-ammonia, TP and TOC analyses. All concentrations of ammonia-nitrogen and TP were within the open-lake reference sediment concentration range.

(2) ***Metals***—Table B55 summarizes the results of the sediment grain size analyses. All metal concentrations were within the open-lake reference sediment concentration range.

b. **Organic analyses**

(1) ***PCBs***—Table B56 summarizes the results of these analyses. Total PCB concentrations in the sediment samples were determined by summing all detected Aroclor mixtures. The total PCB concentration range of 65.5 to 290 µg/kg (3,447 to 9,145 µg/kg-TOC) was within the open-lake reference sediment concentration range. These channel sediment PCB data are consistent with those presented in USACE (2013a) and USACE (2015a) as well as in this evaluation.

(2) ***Pesticides***—Table B57 summarizes the results of these analyses. Except for DDE and DDT, all pesticide concentrations were non-detectable. ∑DDT concentrations were all below the maximum open-lake reference sediment concentration.

(3) ***PAHs***—Table B58 summarizes the results of these analyses. Total PAH concentrations in the sediment samples were determined by summing the 16 USEPA priority pollutant compounds. All total PAH concentrations were within the open-lake reference sediment concentration range.

(4) **VOCs**—Table B59 summarizes the results of these analyses. Very few VOCs were detected. Acetone, a common laboratory contaminant, was measured in samples F01S08, 302578 and 302580 at concentrations ranging from 0.07 to 0.09 mg/kg (close to detection limits).

(5) **SVOCs**—Table B60 summarizes the results of these analyses. Very few SVOCs were detected.

c. COCs

No COCs were identified in the channel sediments based on data generated by OEPA (2014c).

3.5.6 October 2014 event, Upper Cuyahoga River Channel—This effort involved the collection of discrete surface sediment grab samples from the Upper Cuyahoga River, with subsequent bulk physical and chemical analyses. Within the framework of the DMMUs, three to four discrete sediment samples were collected from DMMU-1, DMMU-2a and DMMU-2b. A total of three to 10 discrete samples were subjected to testing. The sediment sampling sites are shown in Figure A11. Since sediment samples were not collected from open-lake reference areas for direct comparison purposes, open-lake reference sediment contaminant concentration ranges from Table B31 were used. Chemical analyses included the nutrients nitrogen-ammonia and TP, TOC, metals, PCBs, pesticides, PAHs, VOCs and SVOCs.

One of the 10 samples (302579) was collected from outside the channel dredging prism. Because this samples was not representative of the sediments that are maintenance dredged from the Upper Cuyahoga River Channel, the associated data (and data on the related composite sample) were not considered in the evaluation. Data on the remaining nine samples (200016, F01A21-east, F01A21-west, F01A42, F01W50, F01S08, 302581, 302578 and 302580) were included in the evaluation. Samples generally consisted of gray brown silts and clays, with some sands. Evaluation of these sediment data is summarized as follows:

a. **Physical characteristics.** Table B61 summarizes the results of the sediment grain size analyses. Composite samples 302809 and 302808 were composed of silts and clays. Composite sample 302810 was composed of comparably more sands (42 to 72%), with the remainder silts and clays.

b. **Chemical testing**

(1) ***Inorganic analyses***

(a) **Inorganics**—Table B62 summarizes the results of the nitrogen-ammonia, TP and TOC analyses. The TP concentration in sample F01A21-west was 1,330 mg/kg but was very close to the maximum open-lake reference concentration.

(b) **Metals**—Table B63 summarizes the results of these analyses. The chromium concentration in sample 302578 was 84.5 mg/kg, which exceeded the maximum open-lake reference sediment concentration. Such levels of chromium in sediment are not of significant toxicological concern. The composite sample concentration (including discrete sample 302579 outside the dredging prism) was 44.8 mg/kg.

(2) ***Organic analyses***

(a) **PCBs**—Table B64 summarizes the results of these analyses. Total PCB concentrations in the sediment samples were determined by summing all detected Aroclor mixtures. The total PCB concentration range of 106 to 294 µg/kg (5,391 to 12,258 µg/kg-TOC) was within the open-lake reference sediment concentration range. These channel sediment PCB data are consistent with those presented in USACE (2013a) and USACE (2015a) as well as in this evaluation.

(b) **Pesticides**—Table B65 summarizes the results of these analyses. Except for DDE and DDT, all pesticide concentrations were non-detectable. ∑DDT concentrations were all below the maximum open-lake reference sediment concentration.

(c) **PAHs**—Table B66 summarizes the results of these analyses. Total PAH concentrations in the sediment samples were determined by summing the 16 USEPA priority pollutant compounds. All total PAH concentrations were within the open-lake reference sediment concentration range.

(d) **VOCs**—Table B67 summarizes the results of these analyses. Very few VOCs were detected. Acetone, a common laboratory contaminant, was measured in samples 302578 and 302580 at concentrations ranging from 0.12 to 0.18 mg/kg (close to detection limits). Toluene was measured in samples 200013, F01A21-west, F01A42, 302581 and F01508 at concentrations ranging from 0.07 to 1.0 mg/kg. Such concentrations are not of significant toxicological concern. Similar concentrations of toluene measured in USACE (2013a) did not result in any significant acute toxicity to *H. azteca*.

(e) **SVOCs**—Table B68 summarizes the results of these analyses. Very few SVOCs were detected.

c. COCs

No COCs were identified in the channel sediments based on data generated by OEPA (2014d).

3.5.7 April 2015 event, Upper Cuyahoga River Channel—This effort involved the collection of discrete surface and gravity core sediment samples from the Upper Cuyahoga River, with subsequent bulk physical and chemical analyses. Discrete samples were composited into two composite samples from each DMMU. A total of six composite samples were subjected to testing. The sediment sampling sites are shown in Figure A12. Since sediment samples were not collected from open-lake reference areas for direct comparison purposes, open-lake reference sediment contaminant concentration ranges from Table B31 were used. Chemical analyses included the nutrients nitrogen-ammonia and TP, TOC, metals, PCBs, pesticides, PAHs and VOCs.

Four of the six samples (F01A21, 200013, F01W50 and 302580) consisted of discrete samples that were collected from outside the channel dredging prism. Because these samples were not representative of the sediments that are maintenance dredged from the Upper Cuyahoga River Channel, the associated data were not considered in the evaluation. Data on the remaining two samples (302581 and 302578) were included in the evaluation. Evaluation of these sediment data is summarized as follows:

a. **Physical characteristics.** Table B69 summarizes the results of the sediment grain size analyses. The samples were comprised of 99% silts and clays.

b. **Chemical testing**

(1) ***Inorganic analyses***

(a) **Inorganics**—Table B70 summarizes the results of the nitrogen-ammonia, TP and TOC analyses. All concentrations of ammonia-nitrogen and TP were within the open-lake reference sediment concentration range.

(b) **Metals**—Table B71 summarizes the results of these analyses. All metal concentrations were within the open-lake reference sediment concentration range.

(2) ***Organic analyses***

(a) **PCBs**—Table B72 summarizes the results of these analyses. Total PCB concentrations in the sediment samples were determined by summing all detected Aroclor mixtures. The total PCB concentration range of 116 to 139 µg/kg (5,043 to 8,176 µg/kg-TOC) was within the open-lake reference sediment concentration range. These channel sediment PCB data are consistent with those presented in USACE (2013a) and USACE (2015a) as well as in this evaluation.

(b) **Pesticides**—Table B73 summarizes the results of these analyses. Except for

DDD, DDE and DDT, all pesticide concentrations were non-detectable. ∑DDT concentrations were comparable to open-lake reference sediment concentration.

(c) **PAHs**—Table B74 summarizes the results of these analyses. Total PAH concentrations in the sediment samples were determined by summing the 16 USEPA priority pollutant compounds. All total PAH concentrations were within the open-lake reference sediment concentration range.

(d) **VOCs**—Table B75 summarizes the results of these analyses. Very few VOCs were detected. Acetone, a common laboratory contaminant, was measured in sample 302581 at 0.12 mg/kg (close to detection limits). Toluene was measured in samples 302581 and 302578 at concentrations ranging from 2.6 to 3.8 mg/kg. Such concentrations are not of significant toxicological concern. Similar concentrations of toluene measured in USACE (2013a) did not result in any significant acute toxicity to *H. azteca.*

c. COCs

No COCs were identified in the channel sediments based on data generated by OEPA (2015b).

3.5.8 October 2015 event, Upper Cuyahoga River Channel—This effort involved the collection of discrete surface and core sediment samples from the Upper Cuyahoga River, with subsequent bulk physical and chemical analyses. The recovered length of core samples was about 10 to 15 inches. Two to four discrete sediment samples were collected from DMMU-1, DMMU-2a and DMMU-2b. A total of six to 12 samples were subjected to testing. The sediment sampling sites are shown in Figure A13. Since sediment samples were not collected from open-lake reference areas for direct comparison purposes, open-lake reference sediment contaminant concentration ranges from Table B31 were used. Chemical analyses included the nutrients nitrogen-ammonia and TP, TOC, metals, PCBs, pesticides and PAHs.

Eight of the 12 samples (F01A21 core, F01A21 grab, F01W50 core, F01W50 grab, 302581 core, 302581 grab, 302580 core and 302580 grab) were collected from outside the channel dredging prism. Because these samples were not representative of the sediments that are maintenance dredged from the Upper Cuyahoga River Channel, the associated data (and data on the related composite sample) were not considered in the evaluation. Data on the remaining four samples (200013 core, 200013 grab, 302578 core and 302578 grab) were included in the evaluation. Sampled sediments generally consisted of gray brown silts. Evaluation of these sediment data is summarized as follows:

a. **Physical characteristics.** Table B76 summarizes the results of the sediment grain size analyses. The samples were comprised of between 52.4 and 100% silts and clays, with the remainder sands.

b. **Chemical testing**

(1) ***Inorganic analyses***

(a) **Inorganics**—Table B77 summarizes the results of these analyses. All concentrations of ammonia-nitrogen and TP were within the open-lake reference sediment concentration range.

(b) **Metals**—Table B78 summarizes the results of these analyses. All metal concentrations were within the open-lake reference sediment concentration range.

(2) ***Organic analyses***

(a) **PCBs**—Table B79 summarizes the results of these analyses. Total PCB concentrations in the sediment samples were determined by summing all detected Aroclor mixtures. The total PCB concentration range of 51 to 129 µg/kg (699 to 6,450 µg/kg-TOC) was within the open-lake reference sediment concentration range. These channel sediment PCB data are consistent with those presented in USACE (2013a) and USACE (2015a) as well as in this evaluation.

(b) **Pesticides**—Table B80 summarizes the results of these analyses. Except for DDE and DDT, all pesticide concentrations were non-detectable. ∑DDT concentrations were all below the maximum open-lake reference sediment concentration.

(c) **PAHs**—Table B81 summarizes the results of these analyses. Total PAH concentrations in the sediment samples were determined by summing the 16 USEPA priority pollutant compounds. All total PAH concentrations were within the open-lake reference sediment concentration range.

c. COCs

No COCs were identified in the channel sediments based on data generated by OEPA (2015c). No significant differences were noted in sediment contaminant concentrations among core and surface grab samples.

3.5.9 May and June 2015 events, Lake Erie and CLA-1 vicinity—In May 2015, surface grab sediment samples were collected for analysis across open-lake sites adjacent to Cleveland Harbor. Ten out of a possible 12 sediment samples were collected and analyzed (LE-1 through LE-11), along with two composite sediment samples (COMP-1 [LE-1 through LE-6] and COMP-2 [LE-7 through LE-11]. No sample was collected from LE-5 as planned (only mussel shells were recovered) and no sample was collected from LE-12 due to unsafe sampling conditions. The sediment sampling sites are shown in Figure A14. In June 2015, multicore sediment samples were collected for analysis within and adjacent to CLA-1. Multicore sediment samples were collected from eight of nine planned sample locations (CLA1-0, CLA1-0.5E, CLA1-1.5E, CLA1-1S, CLA0.5W, CLA1-1.5W, CLA1-1N and CLA1-2N). These sample locations were staged in north, south, east and west directions from the center of CLA-1, in half a mile and then mile increments. Core samples were subdivided into top and bottom samples for analysis, along with a composite of the top samples and bottom samples. Due to poor sediment recovery, the core from CLA1-1S was not split into top and bottom sections and no sample was collected from CLA1-2S, as planned. However, along with the composited core for location CLA1-1S, a discrete sample located at a depth of three inches was also analyzed for PAHs. Chemical analyses of samples included the nutrients nitrogen-ammonia and TP, TOC, metals, PCBs (as Aroclors), pesticides, PAHs and VOCs. Additionally, the composite samples were subjected to grain size analysis, 10-day *H. azteca* solid phase bioassays and 28-day *L. variegatus* bioaccumulation tests (tissue samples were analyzed for PCBs [as congeners] and lipid content) (Section 3.5.10 addresses this biological testing).

a. **Physical description and analysis. S**urface grab samples consist mainly of brown/gray silty sands. Multicore sample recovery generally ranged from 15 to 20 inches in depth, with the CLA1-1S sample being 10 inches. The core samples in and around CLA-1 generally consisted of gray silty clays with varying sand content. Samples CLA1-0.5W, CLA1-0, CLA1-1S and LE-10 were identified in the field logs as potentially evidencing petroleum contamination. These locations are in the vicinity of sites previously identified by USACE (2015c) as being impacted by petroleum within and to the south of CLA-1. Tables B82 and 83 summarize the results of the sediment grain size analyses. The composite of surface samples LE-7 through LE-11, and the composite of CLA-1 and vicinity core samples were primarily fine-grain, being composed of over 99% silts and clays. The LE-1 through LE-6 composite sample was more coarse-grain, being composed of 45% sands with the remainder silts and clays.

b. **Chemical testing**

(1) ***Inorganic analyses***

(a) **Inorganics**—Tables B84 and 85 summarize the results of these analyses. Nitrogen-ammonia, TOC and TP concentrations were similar among the two sampling events. However, TP concentrations (up to 1,370 mg/kg) were comparatively greater than the concentrations measured by USACE (2015a).

(b) **Metals**—Tables B86 and 87 summarize the results of these analyses. Metal concentrations across the two events were generally consistent with previous evaluations, with the exception of several of the CLA-1 cores which indicated elevated levels of cadmium, copper, lead and zinc. Higher metal concentrations were present in the core samples suspected of petroleum contamination as well as in sample CLA1-1.5E, both in the top and bottom sections of cores.

(2) ***Organic analyses***

(a) **PCBs**—Table B88 and 89 summarizes the results of these analyses. Total PCB concentrations across all samples ranged from non-detectable to 260 µg/kg (8,387 µg/kg-TOC), which is consistent with the data from USACE (2013a) and USACE (2015a) (as well as in this evaluation.

(b) **Pesticides**—Tables B90 and 91 summarize the results of these analyses. Pesticides were generally non-detectable, with the exception of two CLA-1 samples for DDE (18.3 and 32.9 µg/kg). USACE (2015a) (as well as in this evaluation) indicated similar ∑DDT concentrations when detected (ranging up to 49 µg/kg within CLA-4).

(c) **PAHs**—Tables B92 and 93 summarize the results of these analyses. Total PAH concentrations were comparatively elevated in samples LE-10 (37,930 µg/kg), the bottom of core samples CLA1-0.5E (102,770 µg/kg) and CLA1-1.5E (40,170 µg/kg), the top sections of core samples CLA1-1.5E (402,970 µg/kg), and the top and bottom section of CLA1-1S (124,400 µg/kg and 134,720 µg/kg). Of these samples, possible petroleum contamination was noted for samples LE-10 and CLA1-1S.

- <u>Total PAH concentrations consistent with background lake sediments</u>. Total PAH concentrations in the remaining samples, not suspected of being impacted by petroleum contamination, ranged from 780 to 27,680 µg/kg, which is consistent with previous evaluations of lake sediments (USACE 2013a; USACE 2015a [as well as in this evaluation). Total PAH concentrations in Samples LE-8 and LE-11 ranged up to 18,350 and 12,340 µg/kg, which were within the range of concentrations in open-lake reference sediments (Table B31). Similarly, the total

PAH concentration of 16,170 µg/kg in the composite sample of discrete samples LE-1 through LE-6 was well above the contributing discrete sample concentrations (range of 911 to 1,492 µg/kg), but within the range of lake reference sediment background concentrations not being impacted by petroleum contamination.

- <u>Elevated lake sediment total PAH concentrations</u>. The highest total PAH concentration was 402,970 µg/kg in sample CLA1-1.5E located half a mile east of CLA-1. However, unlike previous samples with elevated PAH concentrations in the vicinity of CLA-1, field observations did not indicate the presence of petroleum contamination. Similarly, sample CLA1-0.5E had a total PAH concentration of 102,770 µg/kg in the bottom section of the core with no field indication of petroleum contamination.
- <u>Potential PAH-related sediment toxicity</u>. Each of the lake composite samples submitted for 10-day solid phase toxicity testing yielded 100% survival for *H. azteca* (see Table B96). Total PAH concentrations of 30,130 µg/kg and 96,910 µg/kg were analyzed in the CLA-1 top of core and bottom of core composite samples, respectively and concentrations of 16,170 µg/kg and 1,214 µg/kg were analyzed in the two LE composite samples. The high rate of survival in each of the bioassays indicates low bioavailability of sediment-associated PAHs in the tested samples. The low bioavailability of PAHs, compared to the bulk concentrations in sediment, may be the result of a predominantly pyrogenic assemblage. Pyrogenic PAHs, those derived from combustion of organic matter, including coal tar and creosote, have a relatively low accessibility and bioavailability in sediments compared to petrogenic PAHs (Neff *et al.* 2005). Previous samples with elevated PAH concentrations were linked to suspected petroleum contamination, a petrogenic source, and were associated with higher PAH bioavailability, based on laboratory bioassays and pore water analysis. Based on the field observations and low PAH bioavailability, as evidenced by the solid phase bioassay results, it is suspected that samples CLA1-0.5E, CLA1-1.5E and the CLA-1 top and bottom core composite samples are representative of a pyrogenic source, a different source than the petroleum impacted samples previously identified. These pyrogenic based PAHs are oftentimes not toxic to benthic invertebrates, as contrasted to the petrogenic PAHs previously tested.

(d) **VOCs**—Tables B94 and B95 summarize the results of these analyses. VOCs were generally not detectable in the samples with the exception of acetone, a common laboratory contaminant. Low levels of methyl ethyl ketone, n-butylbenzene and sec-butylbenzene were detected in sample CLA1-1S and low levels of 4-chlorortoluene were detected in the CLA-1 composite samples.

3.5.10 Benthic bioassay 2015 (April, May and June) event, Upper River Channel, Lake Erie and CLA-1 vicinity—An *H. azteca* 10-day acute bioassay (using survival and growth as measurement endpoints) and *L. variegatus* 28-day PCB bioaccumulation test following the methodologies presented in USEPA (2000) were applied to channel and lake sediments offshore of Cleveland. The following composite sediment samples, composed of several discrete surface and/or core sediment samples, were used in this testing: F01A21, 200013, F01W50, 302581, 302580 and 302578 (channel sediments); LE 1 through LE-6 and LE 7 through LE-11 (Lake Erie sediments); and top and bottom of core samples (CLA-1 and vicinity sediments).

a. **H. azteca 10-day acute bioassay.** Table B96 summarizes the results of this bioassay. The mean survival of *H. azteca* ranged between 16 and 40% across all composite channel sediment samples, all of which were statistically lower than those associated with the reference sediments (all 100%). However, there were several major methodological issues with the conduct of this bioassay.

(1) ***Appropriate testing/evaluation guidance***—This bioassay did not follow appropriate formal USEPA/USACE testing and evaluation guidance prescribed in the GLTM and ITM (USEPA/USACE 1998a, 1998b). For example, sediment pore water data in the bioassay was not measured or monitored, and the bioassay water was not purged to preclude effects from ammonia in the bioassay (ammonia is a naturally occurring constituent of pore water that can quite readily confound bioassays performed in the laboratory). These procedures accomplish two main things: (1) most importantly, they ensure that the toxicity of any persistent sediment contaminant(s) is not confounded by toxicity caused by ammonia in the test; and (2) they provide evidence that ammonia may be a contributor to any observed toxicity. Pre-existing information on ammonia toxicity in these sediments available to OEPA (e.g., Kreitinger *et al.* 2011; USACE 2013a) underscores the need to include sediment pore water ammonia monitoring in the bioassay procedures.

(2) ***Effects of sediment pore water ammonia in laboratory testing***—No sediment pore water ammonia reduction procedures were performed. Therefore, it is highly likely that sediment pore water ammonia was a factor contributing to, or potentially driving, the reduced survival and growth observed. Note that while the growth of this *H. azteca* was measured, it is not an accepted measurement endpoint used for evaluating whether dredged sediment meets CWA Section 404(b)(1) Guidelines for open-lake placement due to the absence of interpretive guidance.

(3) ***Effects of native organisms in laboratory testing***—As documented in USACE (2015a) (as well as in this evaluation), it is likely that the presence of native oligochaetes

in many of the sediment samples within at least DMMU-2a and DMMU-2b played some role in the observed reduced survival of *H. azteca*.

(4) ***Consideration of other relevant lines of evidence***—Irrespective of the accuracy of the location of the collected sediment samples, a review of the bulk chemistry, in tandem with existing information, fails to suggest any clear sediment contaminants of concern (COCs). In addition, there were no evident trends among sediment contaminant concentrations and *H. azteca* survival. Regarding PAH contamination, the state-of-the-science approach to evaluating accurate PAH-specific toxicity is through sediment pore water measurements (USEPA 2003). This has been accomplished on the Upper Cuyahoga River Channel sediments three times by USACE (USACE 2013a; USACE 2015a [as well as in this evaluation]), which consistently indicated insignificant PAH-related toxicity. Weight-of-the-evidence (WOE) shows that PAHs in these channel sediments are of predominantly pyrogenic origin; because of this, the PAHs tightly adsorb to hard carbon and are therefore less bioavailable, which prevents them from causing any significant toxicity.

Based on the above information, it is concluded that the *H. azteca* bioassay failed to follow appropriate test procedures, and WOE indicates that the test yielded false-positive results on the Upper Cuyahoga River sediments.

b. **<u>L. variegatus 28-day PCB bioaccumulation test</u>**. Total PCB concentrations in tissue samples were determined by summing all congeners with non-detectable concentrations valued at zero. Table B97 summarizes the results of this test. Total PCB residues in *L. variegatus* tissues exposed to the channel composite sediment samples ranged from 225 to 362 µg/kg. These were statistically greater than those exposed to composited open-lake sediment samples (range 34.9 to 108 µg/kg), and much higher than those yielded from standard 28-day PCB *L. variegatus* bioaccumulation tests on channel sediments in USACE (2013) and USACE (2015) (as well as in this evaluation). However, there were several major methodological issues with the conduct of this bioaccumulation test.

This test did not follow appropriate formal USEPA/USACE testing and evaluation guidance (USEPA/USACE 1998a, 1998b), and the data generated do not appear to be representative of PCB bioaccumulation from the channel or lake sediments. This is detailed as follows:

(1) ***Appropriate testing/evaluation guidance***

(a) **Gut clearance**—Following test exposures, a fundamental requirement is to allow a standard 24-hour period for *L. variegatus* gut clearance; OEPA's test provided for a gut clearance of 6 hours which is 18 hours less than the standard required in formal guidance (USEPA/USACE 1998a, 1998b). A 24-hour gut clearance is also recommended by the most recent American Society of Testing and Materials (ASTM) (ASTM 2010). Under an assumption that the channel samples contained a significant number of native oligochaete (tubificid) (as has been USACE observation since at least 2010), it is also possible that the inclusion of tubificidae genera in the tissue samples absent a minimum 24-hour gut clearance biased test PCB concentrations high due to material remaining in the gut (e.g., Gillis *et al.* 2004).

(b) **Sample replication—**Five test bioaccumulation replicates were composited into a single sample for PCB analysis. USEPA/USACE (1998a, 1998b) requires the standard bioaccumulation experiments to be conducted with five replicates, including quantification of PCB residues in each individual replicate. The five replicates run by OEPA were composited into a single tissue sample, which resulted in no replication of the measured PCB tissue data. Due to lack of replication, no statistical comparisons to any open-lake reference area sediments could be conducted. This also effects lipid-normalization as there is unequal tissue and lipid mass in individual replicates. The average of lipid-normalized replicate tissue concentrations is not equal to the total PCB mass divided by the total lipid mass in the composite tissue sample. It will be biased by larger tissue masses of the individual replicates.

(2) ***PCB bioaccumulation data***

(a) ***L. variegatus* tissue residues relative to sediment—**In comparison to USACE (2013a and 2015a [as well as data in this evaluation]) data and theoretical values, OEPA's data yielded much higher PCB tissue residues relative to PCB concentrations in both channel and lake sediment samples. This is uncharacteristic for these sediments and sediments with such residual concentrations of PCBs.

- One initial issue with the PCB data generated is the use of less precise Aroclor mixtures (i.e., instead of congener data) to quantify total PCBs in the sediment samples. In addition, non-detectable data were yielded from the lake sediment samples due to high detection limits (i.e., 51 to 79.4 µg/kg). Performance of PCB congener analyses would have been a superior method to quantify sediment PCB concentration for the bioaccumulation test with improved precision, and would have added value to the test results.
- A more compelling anomaly is that TOC-normalized total PCB concentrations measured in the channel sediment samples infer that total PCB bioaccumulation from these channel sediments in *L. variegatus* should be on order of 0.1 mg/kg. This is based on application of the TBP model (McFarland 1984) employing the

use of a mean empirical, site-specific BSAF (USACE 2013a; USACE 2015a [as well as in this evaluation]). However, reported *L. variegatus* total PCB tissue residues were on average approximately five times higher than the TBP values. This indicates that the reported tissue values, on average, were 470 to 760% higher than would be theoretically expected based on PCB and TOC sediment concentrations alone. Such results are improbable because they are inconsistent with recent site-specific bioaccumulation data using appropriate methodologies (USACE 2013a; USACE 2015a [as well as in this evaluation]) and greatly exceed theoretical values.

(b) **Estimated bioavailability**—BSAFs for *L. variegatus* using these reported data were calculated to discern total PCB bioavailability and further examine the bioaccumulation data generated. This yielded mean BSAFs of 5.0 (range 2.14 to 8; N=9) for both the channel and lake sediment samples (the lake BSAFs in this case would likely be higher given that they were based on reported but high non-detectable levels of PCBs in sediment). A BSAF of 5 is over six times the mean BSAF of 0.73 (N=40) generated from site-specific data using appropriate test methodologies (USACE 2013a; USACE 2015a [as well as in this evaluation]). It is also approximately four times a mean BSAF of 1.30 (N=101) derived across other researchers using a standard 28-day laboratory exposure period for *L. variegatus* with mixed 24- and 6-hour gut clearance periods (i.e., Ankley *et al.* 1992; Call *et al.* 1993; Pickard *et al.* 2001; Burkhard *et al.* 2015) as contained in the BSAF database (USAERDC 2016). The disparity between such inordinately high mean BSAF values, and those from site-specific data and data from other researchers, is illustrated in Figure 11. In addition, the individual BSAFs alone do not reflect the diminution of PCB bioavailability attributable to the presence of hard carbon in these sediments.

FIGURE 11

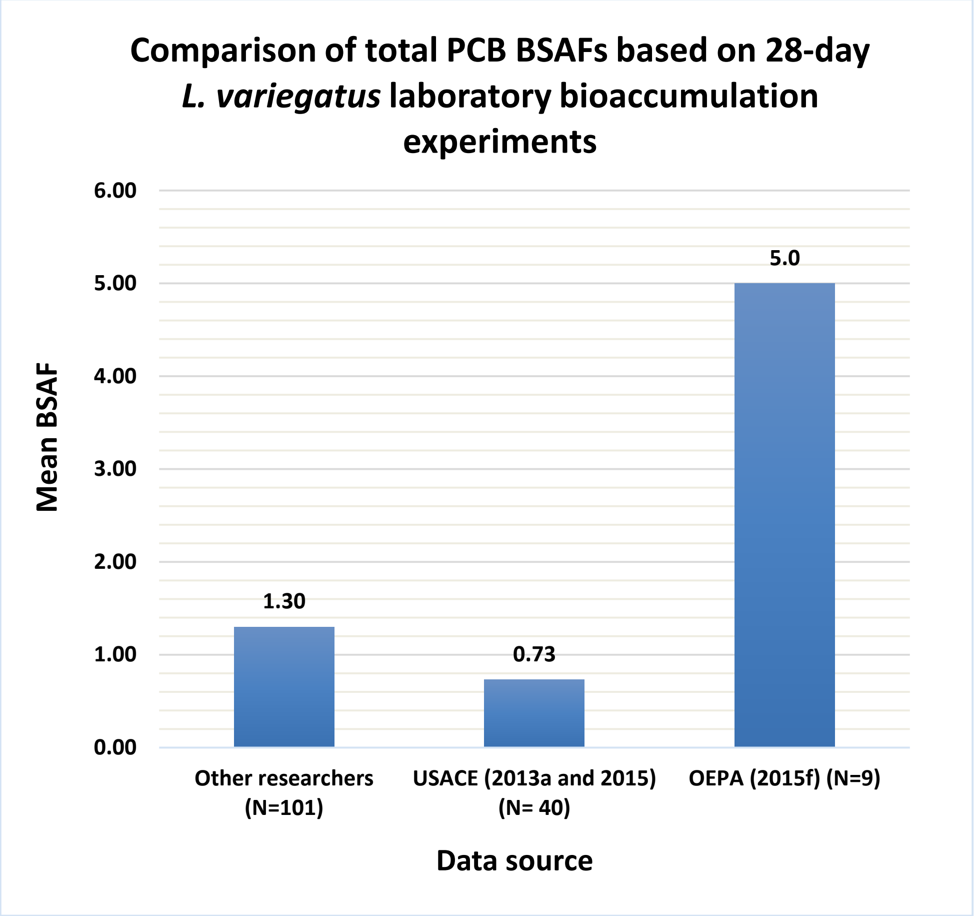
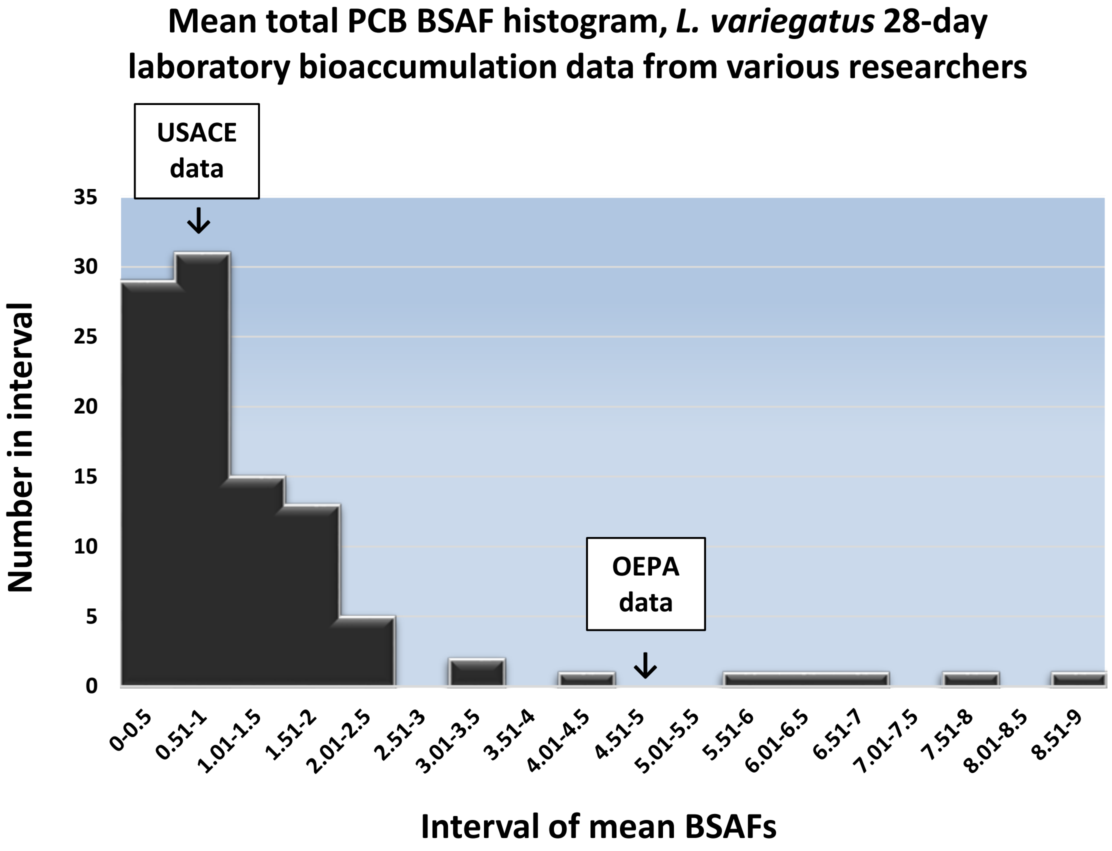


Figure 12 is a histogram (frequency distribution) of mean total PCB BSAFs from researchers using a standard 28-day laboratory exposure period for *L. variegatus* with mixed 24- and 6-hour gut clearance periods. The data are skewed right with about 90% of all mean BSAFs falling within the 0.1 to 2.0 range. The mean total PCB BSAFs for harbor and lake sediments of 0.78 and 0.57 based on data from USACE (2013a) and USACE (2015a) (as well as in this evaluation) are at the mode (high point of the distribution) and fall within the range of values generated by most of the researchers, with the combined harbor/lake sediment mean of 0.73 being comparable to the median of 0.88 across the BSAF distribution. In contrast, the mean total PCB BSAFs of 5 for harbor and lake sediments based on data reported from OEPA (2015f) fall on the right tail extreme of the distribution beyond the 95th percentile (96% of the BSAFs are less than or equal to 5), and are almost 6-fold greater than the distribution median value.

FIGURE 12



Collectively, this data set suggests that the OEPA test results are not representative of PCB bioaccumulation from channel shoals or sediments in Lake Erie. Based on this information, it is concluded that the *L. variegatus* bioassay failed to follow appropriate test procedures, and WOE indicates that the test yielded improbable results on Upper Cuyahoga River and Lake Erie sediments.

4.0 CONCLUSION

Based on data from RTI (2014a, 2014b, 2015) and USAERDC (2015a) in tandem with USACE (2013a) and other relevant information such as from OEPA (2013, 2014a, 2014b, 2014c, 2014d, 2015b, 2015c, 2015d, 2015e and 2015f), contamination and toxicity associated with Cleveland Harbor Upper Cuyahoga River Channel sediments, as represented by DMMU-1, DMMU-2a and DMMU-2b, has been shown to be comparable relative to open-lake reference area sediments and/or would not represent any appreciable increased toxicological risk to the affected aquatic ecosystem when placed at CLA-1. Therefore, it is concluded that all sediments dredged from DMMU-1, DMMU-2a and DMMU-2b meet CWA Section 404(b)(1) guidelines at 40 CFR 230.11(d) for open-lake placement at CLA-1. In an effort to abate existing PAH-related toxicity and/or reduce bioaccumulation of PCBs from impacted lake sediments encountered at CLA1-5 (2014 sample location) and CLA1-1 (sample location), dredged sediment discharge should be conducted within the southeast quadrant of CLA-1 to create a thin layer cap over those sediments. Therefore, placement of Upper Cuyahoga River Channel dredged sediments in portions of CLA-1 would be a beneficial use of the material.

5.0 REFERENCES

Adams WJ, Rowland CD (2002) Aquatic Toxicology Test Methods. In: D.J Hoffman, B.A. Rattner, G.A. Burton and J. Cairns (eds.), Handbook of Ecotoxicology. Boca Raton, Florida: Lewis Publishers.

Andersen HB, Buckley JA (1998) Acute toxicity of ammonia to *Ceriodaphnia dubia* and a procedure to improve control survival. Bull Environ Contam Toxicol 61:116-122.

Ankley GT, Cook PM, Carslon AR, Call DJ, Swenson JA, Corcoran HF, Hoke RA (1992) Bioaccumulation of PCBs by oligochaetes and fishes: comparisons of laboratory and field studies. Canadian J Fish Aquat Sci 49:2080-2085.

ASTM (2005) Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates. ASTM Standard E1706-05.

ASTM (2010) Standard Guide for Determination of the Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates. ASTM Standard E1688-10.

Beckingham B, Ghosh U (2010) Comparison of field and laboratory exposures of *Lumbriculus variegatus* to polychlorinated biphenyl-impacted river sediments. Environ Tox Chem 29:2851-2858.

Burkhard LP, Hubin-Barrows D, Billa N, Highland T, Hockett JR, Mount DR, Norberg-King TJ, Hawthorne S, Miller DJ, Grabanski CB (2015) Sediment bioaccumulation test with *Lumbriculus variegatus*: effects of feeding. Arch Environ Contam Toxicol 68:696–706.

Burton GA, Nguyen LTH, Janssen C, Baudo R, McWilliam R (2005) Field validation of sediment zinc toxicity. Environ Toxicol Chem 24:541-553.

Call DJ, Rau DM, Thompson DR, Kahl MD (1993) A Study of PCB Bioaccumulation from Waukegan Harbor, Lake Michigan Sediments by the Oligochaete *Lumbriculus variegatus*. Report prepared by Lake Superior Research Institute, University of Wisconsin-Superior for USACE, Chicago District.

Di Toro DM, Mahony JD, Hansen DJ, Scott KJ, Carlson AR, Ankley GT (1992) Acid volatile sulfide predicts the acute toxicity of cadmium and nickel in sediments. Environ Sci Technol 26:96-101.

Fairchild JF, Allert AL, Sappington LC, Waddell B (2005) Chronic toxicity of un-ionized ammonia to early life-states of endangered Colorado Pikeminnow (*Ptychocheilus lucius*) and Razorback sucker (*Xyrauchen texanus*) compared to the surrogate Fathead minnow (*Pimephales promelas*). Arch Environ Contam Toxicol 49:378-384.

Gillis PL, Dixon DG, Borgmann U, Reynoldson TB (2004) Uptake and depuration of cadmium, nickel and lead in laboratory-exposed *Tubifex* and corresponding changes in the concentration of a metallothionein-like protein. Environ Toxicol Chem 23:76-85.

Hawthorne SB, Azzolina NA, Neuhauser EF, Kreitinger JP (2007) Predicting bioavailability of sediment polycyclic aromatic hydrocarbons to *Hyalella azteca* using equilibrium partitioning, supercritical fluid extraction and pore water concentrations. Environ. Sci. Technol. 41:6297-6304.

Kennedy AJ, Lotufo GR, Steevens JA (2015) Review of dredged elutriate application factors: relevance to acute-to-chronic protection, contaminant and endpoint specificity. ERDC/EL TR-15-10.
http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA621370

Kreitinger JP, Price RA, Borrowman TD, Kennedy AJ, Brandon DL, Bourne M (2011) Evaluation of Beneficial Use Suitability for Cleveland Harbor Dredged Material: Interim Capacity Management and Long-Term Planning. Vicksburg, Mississippi: USAERDC.

McFarland VA (1984) Activity-based evaluation of potential bioaccumulation from sediments. In: Montgomery RL, Leach JW (eds.), Dredging '84, vol. 1. American Society of Civil Engineers, New York, pp 461-467.

Nimmo DWR, Link D, Parrish LP (1989) Comparison of on-site and laboratory toxicity tests: derivation of site-specific criteria for unionized ammonia in a Colorado transitional stream. Environ Toxicol Chem 8:1177-1189.

Neff JM, Stout SA, Gunstert DG (2005) Ecological risk assessment of polycyclic aromatic hydrocarbons in sediments: identifying sources and ecological hazard. Integr Environ Assess Manag 1: 22-33.

OEPA (2008) Guidance for Conducting Ecological Risk Assessments. Division of Environmental Response and Revitalization. DERR-00-RR- 031. http://www.epa.ohio.gov/portals/30/rules/RR-031.pdf

OEPA (2015a) Letter to USACE dated September 30, 2015 (Subject: Complete 2014 and 2015 Sampling Results from the Cuyahoga River and Lake Erie).

OEPA (2015b) Analytical data on surface grab and core sediment samples collected from the Upper Cuyahoga River, Cleveland Harbor, Ohio in April 2015. Data provided by OEPA to USACE.

OEPA (2015c) Analytical data on surface grab and core sediment samples collected from the Upper Cuyahoga River, Cleveland Harbor, Ohio in October 2015. Data provided by OEPA to USACE.

OEPA (2015d) Analytical data on surface grab sediment samples collected from Lake Erie offshore of Cleveland, Ohio in May 2015. Data provided by OEPA to USACE.

OEPA (2015e) Analytical on core sediment samples collected from the Lake Erie CLA-1 vicinity offshore of Cleveland, Ohio in June 2015. Data provided by OEPA to USACE.

OEPA (2015f) Bioassay data on core and grab sediment samples collected from the Upper Cuyahoga River, Lake Erie and CLA-1 vicinity, Cleveland Harbor, Ohio in April. May and June 2015. Data provided by OEPA to USACE.

OEPA (2014a) Analytical data on surface grab sediment samples collected from the Upper Cuyahoga River, Cleveland Harbor, Ohio. Data provided by OEPA to USACE.

OEPA (2014b) Analytical data on core sediment samples collected from the Upper Cuyahoga River, Cleveland Harbor, Ohio. Data provided by OEPA to USACE.

OEPA (2014c) Analytical data on surface grab sediment samples collected from the Upper Cuyahoga River, Cleveland Harbor, Ohio. Data provided by OEPA to USACE.

OEPA (2014d) Analytical data on surface grab sediment samples collected from the Upper Cuyahoga River, Cleveland Harbor, Ohio. Data provided by OEPA to USACE.

OEPA (2013) Analytical data on surface grab sediment samples collected from the Upper Cuyahoga River, Cleveland Harbor, Ohio. Data provided by OEPA to USACE.

Oliver BG (1984) Uptake of chlorinated organics from anthropogenically contaminated sediments by oligochaete worms. Canadian J Fish Aquat Sci 41:878-883.

Oliver BG (1987) Biouptake of chlorinated hydrocarbons from laboratory spiked and field sediments by oligochaete worms. Environ Sci Technol 21:785-790.

Pickard SW, Irvine KN, Yaksich SM, McFarland VA (2001) Bioaccumulation potential of sediment-associated polychlorinated biphenyls (PCBs) in Ashtabula Harbor, Ohio. J Great Lakes Res 27:44-59.

Reynoldson TB, Day KE, Clarke C, Milani D (1994) Effects of indigenous animals on chronic endpoints in freshwater sediment toxicity tests. Environ Toxicol Chem 13:973-977.

RTI (2014a) Analytical data on sediment collected from Cleveland Harbor Upper River Channel and open-lake areas in Lake Erie.

RTI (2014b) Analytical data on sediments collected from Lake Erie offshore of Cleveland.

RTI (2015) Analytical data on sediments collected from Cleveland Harbor Federal navigation channels and open-lake areas in Lake Erie.

Talley JW, Ghosh U, Tucker SG, Furey FS, Luthy RG (2002) Particle-scale understanding of the bioavailability of PAHs in sediment. Environ Sci Technol 6: 477-483.

USACE (1988) Title 33, Chapter II, Part 336, Factors to be Considered in the Evaluation of Army Corps of Engineers Dredging Projects Involving the Discharge of Dredged

Material into Waters of the United States and Ocean Waters. http://www.law.cornell.edu/cfr/text/33/336.

USACE (2007) Evaluation of Federal Navigation Channel Sediments with Respect to their Suitability for Open-lake Placement—Cleveland Harbor, Cuyahoga County, Ohio. Technical report prepared by USACE-Buffalo District.

USACE (2011) Section 729 Watershed Study, Cuyahoga River, Ohio. Initial Watershed Assessment. Report prepared by USACE-Buffalo District.

USACE (2013a) Evaluation of Cleveland Harbor Federal Navigation Channel (Upper Cuyahoga River Channel) Sediments with Respect to Suitability for Open-lake Placement. Technical report prepared by USACE-Buffalo District.

USACE (2013b) Letter to OEPA dated December 20, 2013 (Subject: Cleveland Harbor, Cuyahoga County, Ohio—Open-lake Placement of Material Dredged from the Upper Cuyahoga River Channel).

USACE (2015a) Evaluation of Cleveland Harbor Federal Navigation Channel (Upper Cuyahoga River Channel) Sediments with Respect to Suitability for Open-lake Placement. Technical report prepared by USACE-Buffalo District.

USACE (2015b) Letter to OEPA dated March 2, 2015 (Subject: Cleveland Harbor, Cuyahoga County, Ohio—Spring 2015 Field Sampling Plan for Cuyahoga River/Old River Channels).

USACE (2013c) Letter to OEPA dated November 20, 2013 (Subject: Cleveland Harbor, Cuyahoga County, Ohio—Request for Section 401 Water Quality Certification for Discharges of Dredged Sediments Associated with the Scheduled 2016 Maintenance Dredging Project).

USAERDC (2016) Tier 3 Biological Testing of Cleveland Harbor Federal Navigation Channel Sediments. Technical report.

USAERDC (2015b) Short-Term Fate (STFATE) Modeling Approach and Results for Evaluation of Contaminant Release During Open-Water Placement of Sediments Dredged from the Cleveland Harbor Upper Cuyahoga River Channel. Technical Memorandum (draft) dated October 30, 2015.

USAERDC (2016) Biota-Sediment Accumulation Factor Database.

http://el.erdc.usace.army.mil/bsaf/index.cfm

USEPA/USACE (1998a) Great Lakes Dredged Material Testing and Evaluation Manual. http://greatlakesdredging.net/files/1998-usace-dredged-material-testing-manual-all.pdf

USEPA/USACE (1998b) Evaluation of Dredged Material for Discharge in Waters of the U.S.—Testing Manual. http://water.epa.gov/type/oceb/oceandumping/dredgedmaterial/testing.cfm

USEPA (2000) Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition. EPA 600/R-99/064.

USEPA (2001) Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual. EPA-823-B-01-002.

USEPA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. USEPA, Office of Research and Development, Washington, DC. EPA/600/R-02/013.

USEPA (2005) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Metal Mixtures (Cadmium, Copper, Lead, Nickel, Silver and Zinc). USEPA, Office of Research and Development, Washington, DC. EPA/600/R-02/011. http://www.epa.gov/nheerl/download_files/publications/metalsESB_022405.pdf.

USEPA (2015a) Great Lakes Area of Concern—Cuyahoga River. http://www.epa.gov/greatlakes/aoc/cuyahoga.html.

USEPA (2015b) Title 40, Chapter 1, Subchapter H, Part 230, Section 230.11, Factual Determinations. http://www.law.cornell.edu/cfr/text/40/230.11

APPENDIX A

FIGURES

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Legend

● Sediment Sample Location

— — Federal Navigation Channel

▨ Dredged Material Management Unit

0 250 500 1,000 Feet

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CHANNEL SEDIMENTS

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CLEVELAND, OHIO

FIGURE A1

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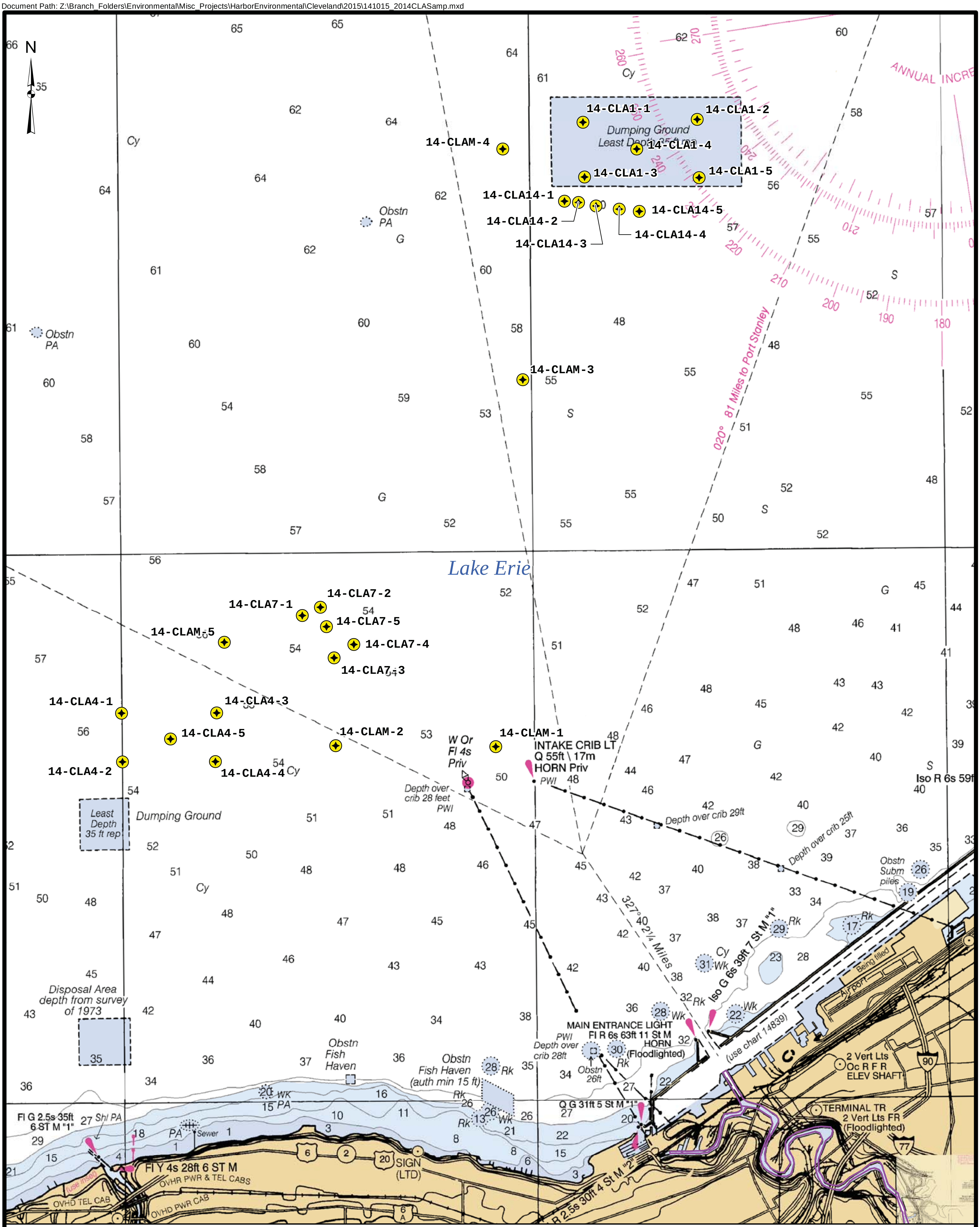

Legend

● Sediment Sample Location

Federal Navigation Channel

Source: NOAA / NOS / Office of Coast Survey

0 0.5 1 2 Miles

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SAMPLING SITES FOR 2014 ANALYSES OF SEDIMENTS AT
PROPOSED-OPEN LAKE PLACEMENT AREA CLA-1, AND OTHER
LAKE AREAS AND SITES OFFSHORE OF CLEVELAND

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FIGURE A2

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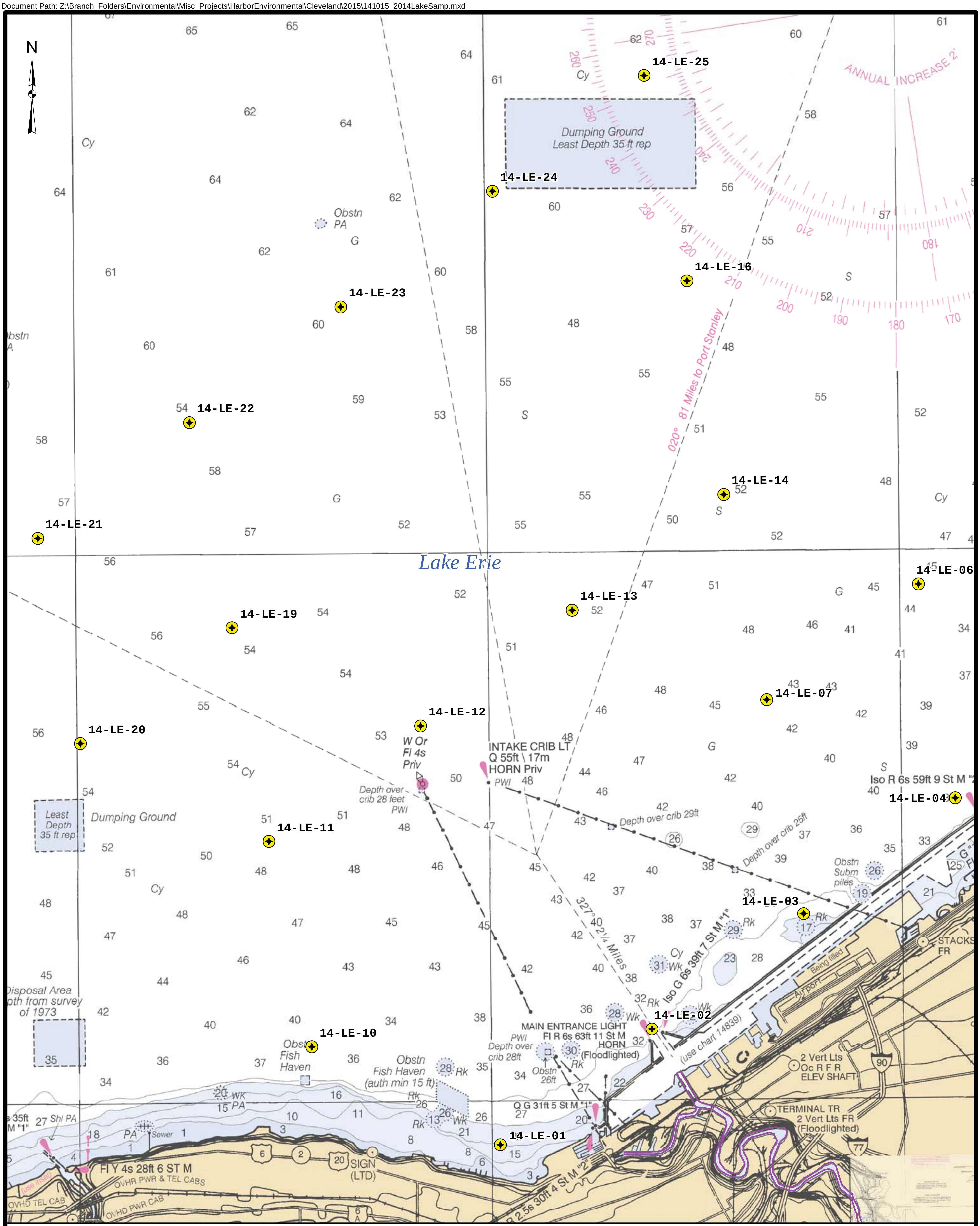

Legend

● Sediment Sample Location

— Federal Navigation Channel

Source: NOAA / NOS / Office of Coast Survey

0 0.5 1 2
Miles

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SAMPLING SITES FOR 2014 ANALYSES OF REGIONAL LAKE ERIE
SEDIMENTS OFFSHORE OF CLEVELAND

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FIGURE A3

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Legend

- ▣ Sediment Core Sample Location
- ✦ Sediment Sample Location
- – – Federal Navigation Channel
- ▨ Dredged Material Management Unit

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DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING
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CHANNEL SEDIMENTS

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FIGURE A4

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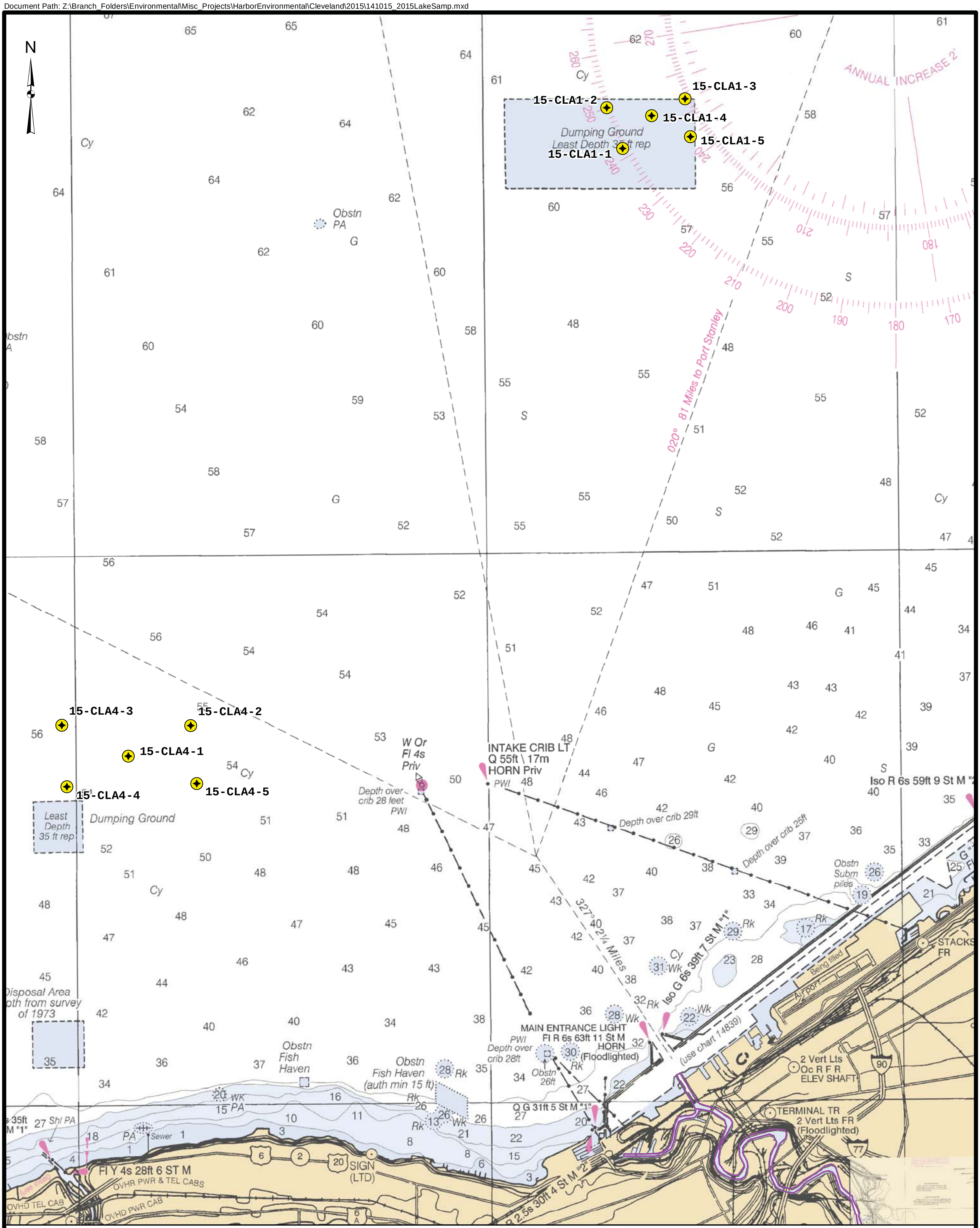

Legend

● Sediment Sample Location

— Federal Navigation Channel

Source: NOAA / NOS / Office of Coast Survey

0 0.5 1 2 Miles

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PROPOSED OPEN LAKE PLACEMENT AREA CLA-1 AND OTHER
LAKE AREAS OFFSHORE OF CLEVELAND

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CLEVELAND, OHIO

FIGURE A5

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Legend

- ▣ Sediment Core Sample Location
- ✦ Sediment Sample Location
- – – Federal Navigation Channel
- ▨ Dredged Material Management Unit
- ▨ Area Not Maintained

0 250 500 1,000
Feet

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DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING
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CHANNEL SEDIMENTS

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CLEVELAND, OHIO

FIGURE A6

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CHANNEL SEDIMENTS

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CLEVELAND, OHIO

FIGURE A7

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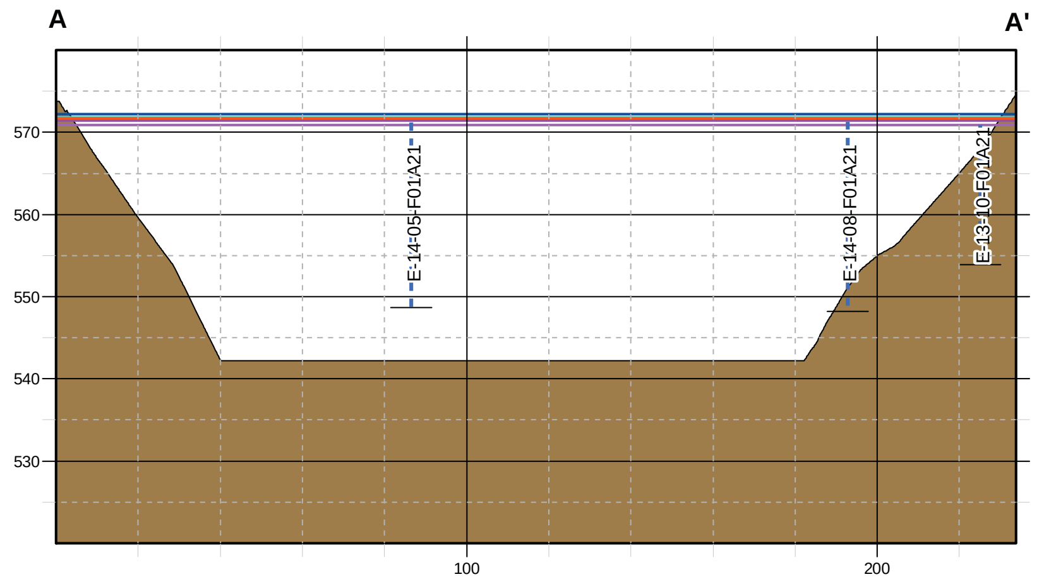
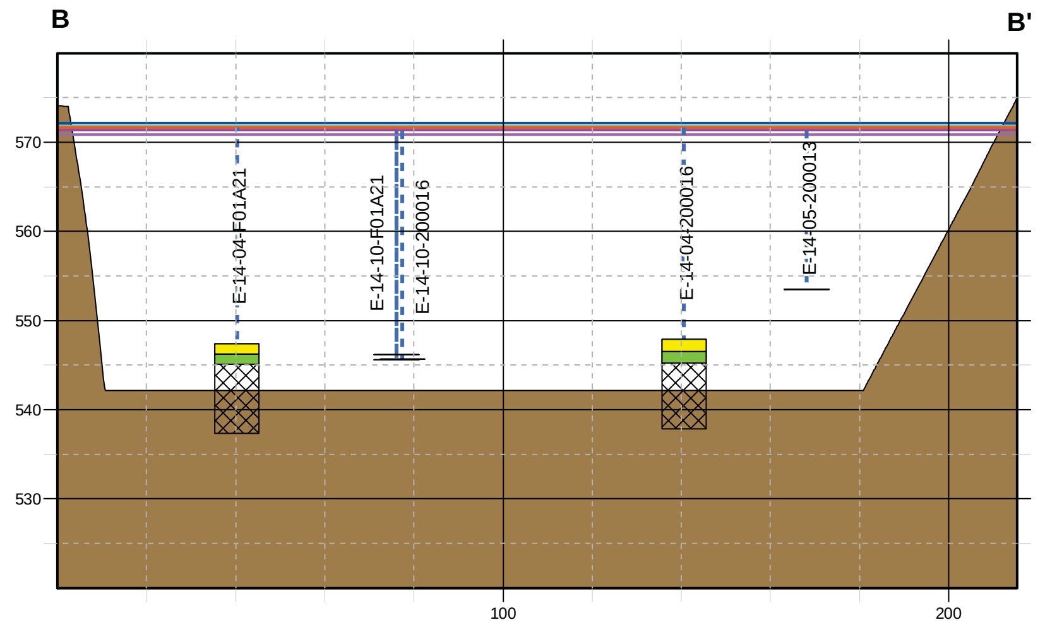
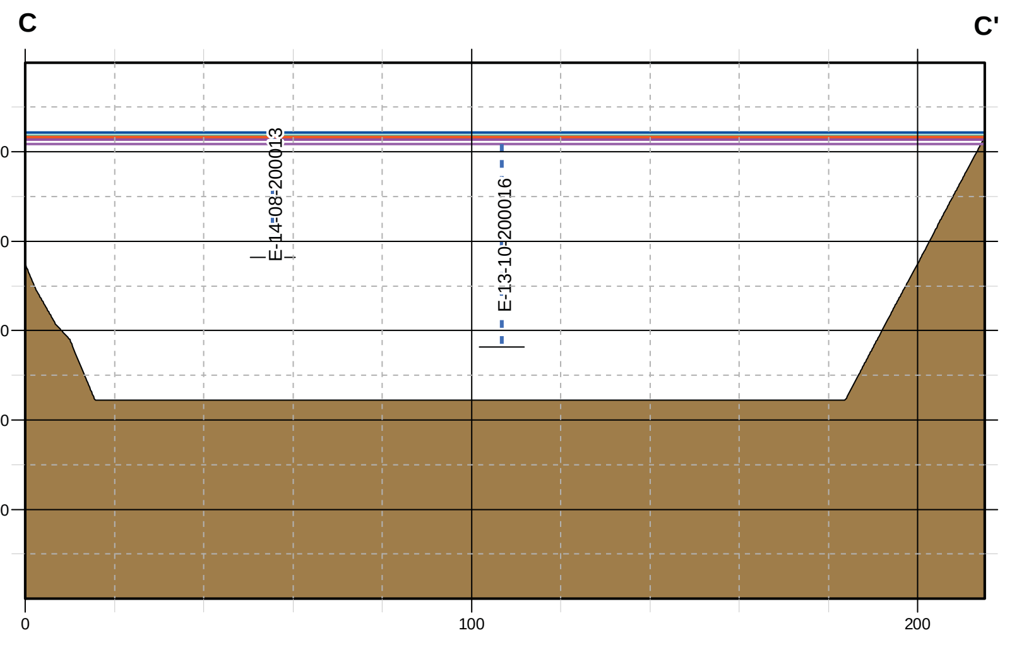
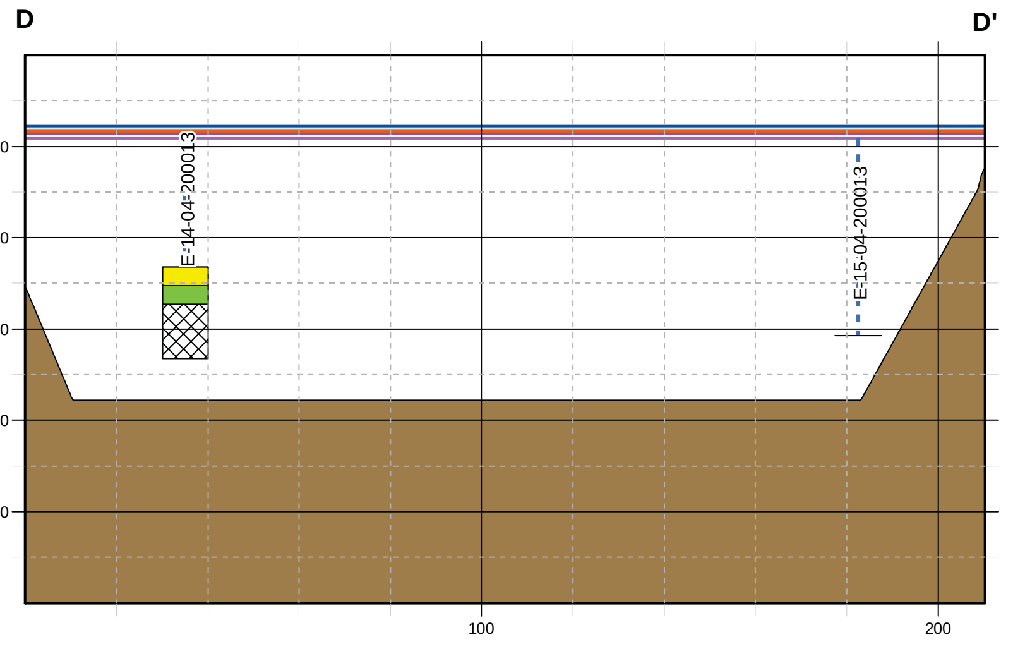
UPPER CUYAHOGA RIVER CHANNEL - CLEVELAND, OHIO
CROSS SECTIONS FOR OEPA SAMPLE LOCATIONS
(OCTOBER 2013 - MAY 2015)

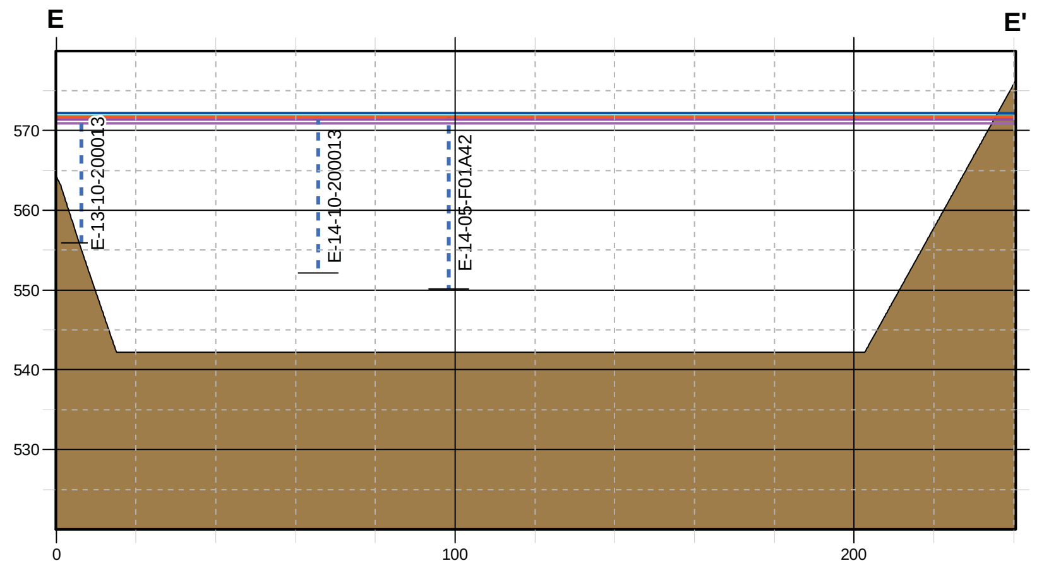
BUILDING STRONG®

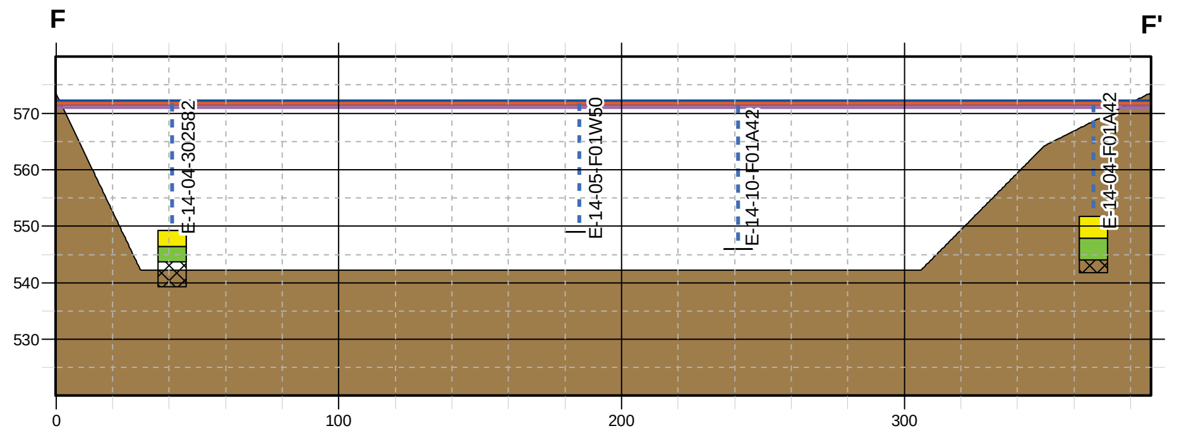


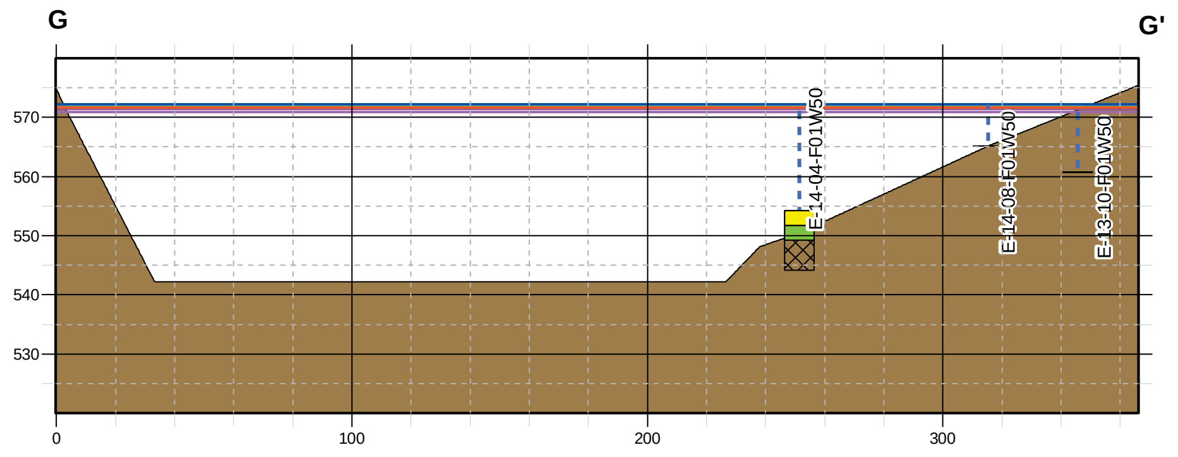


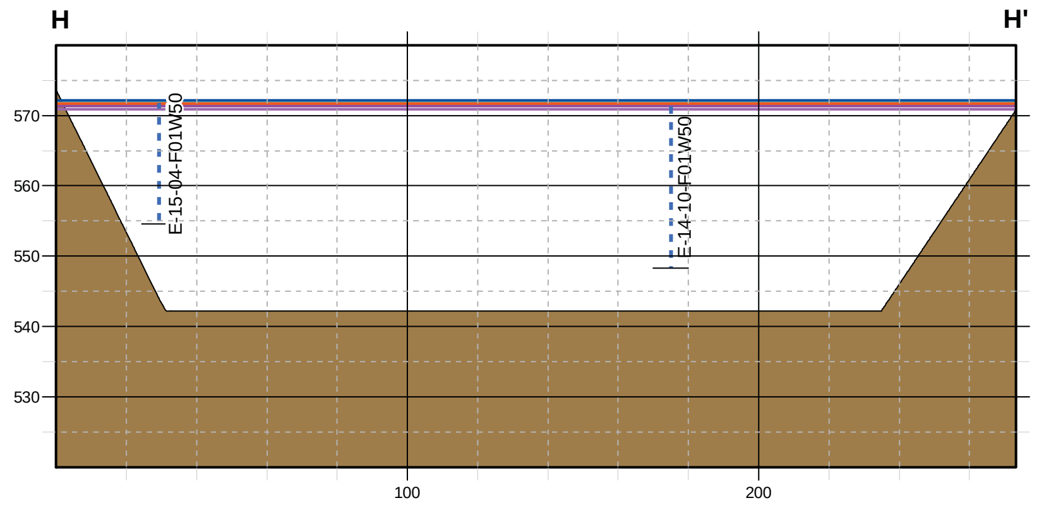


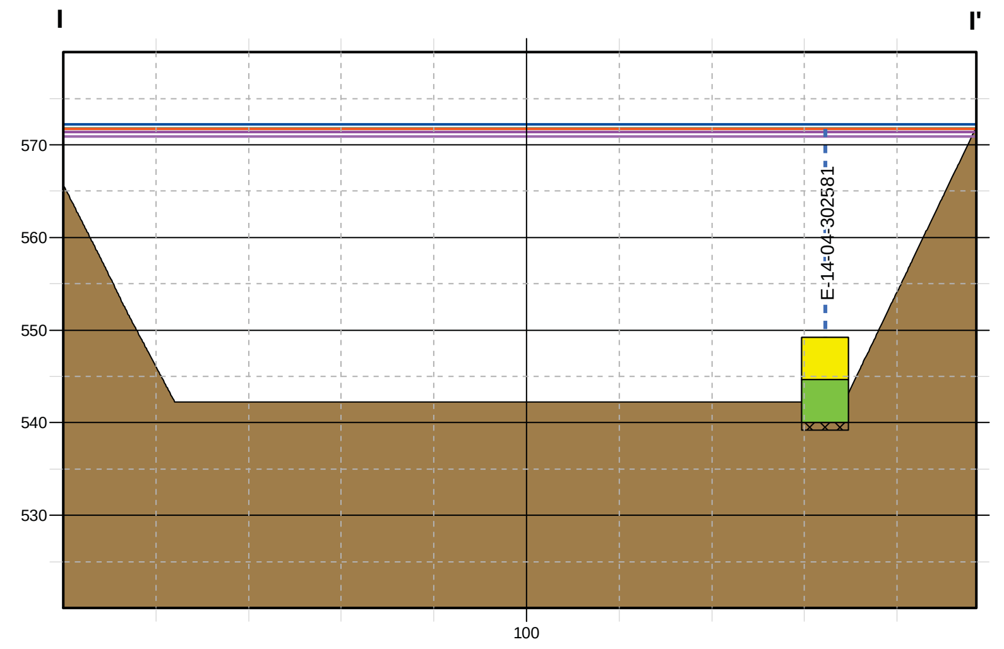


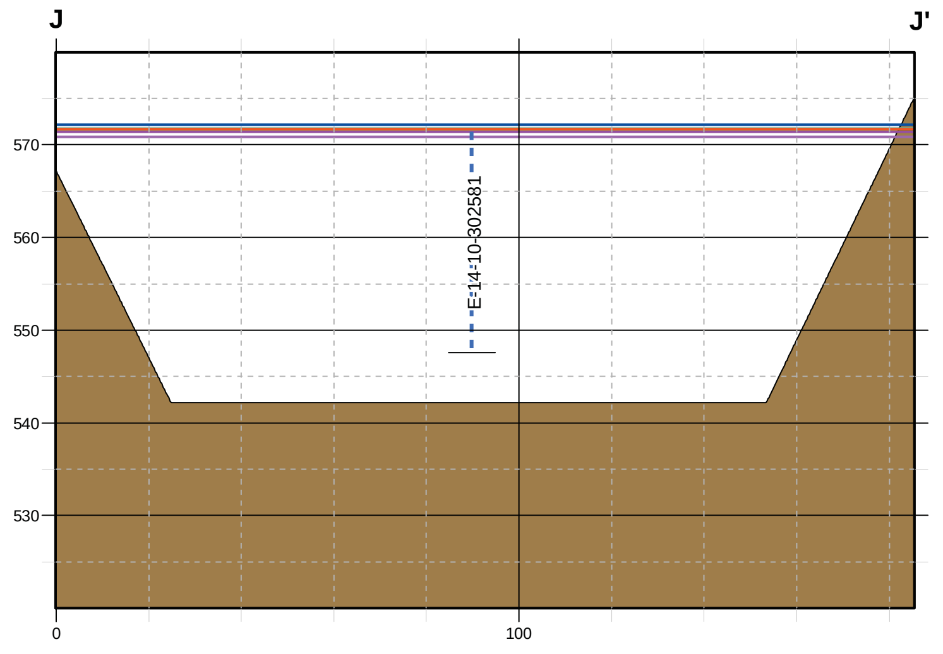


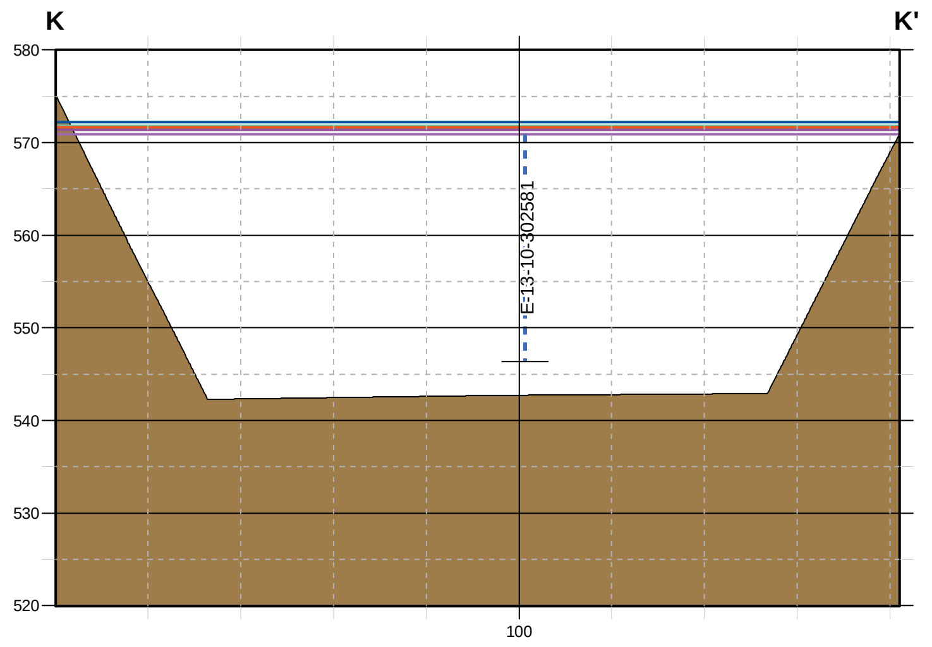


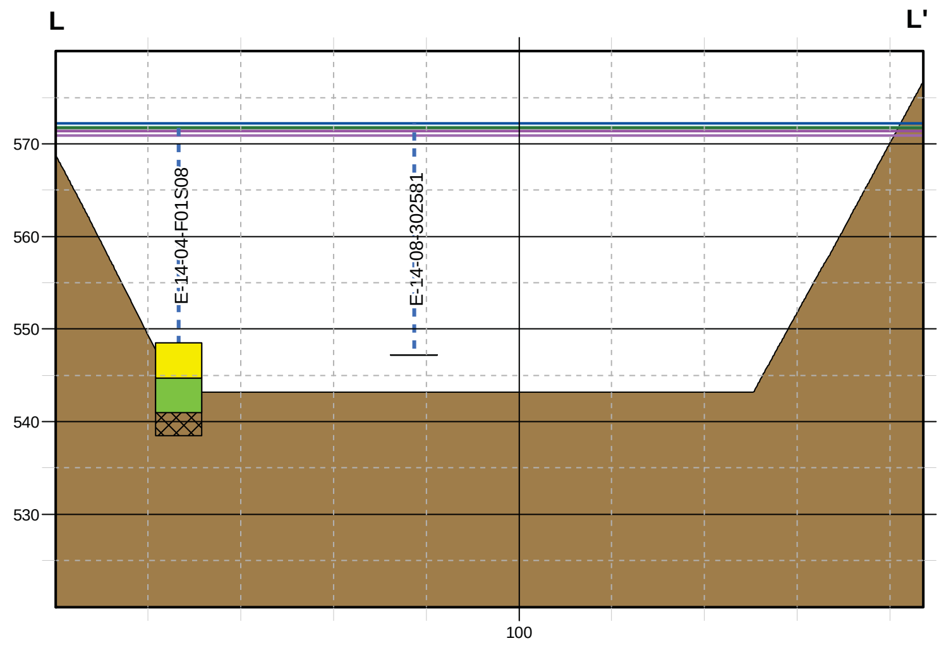


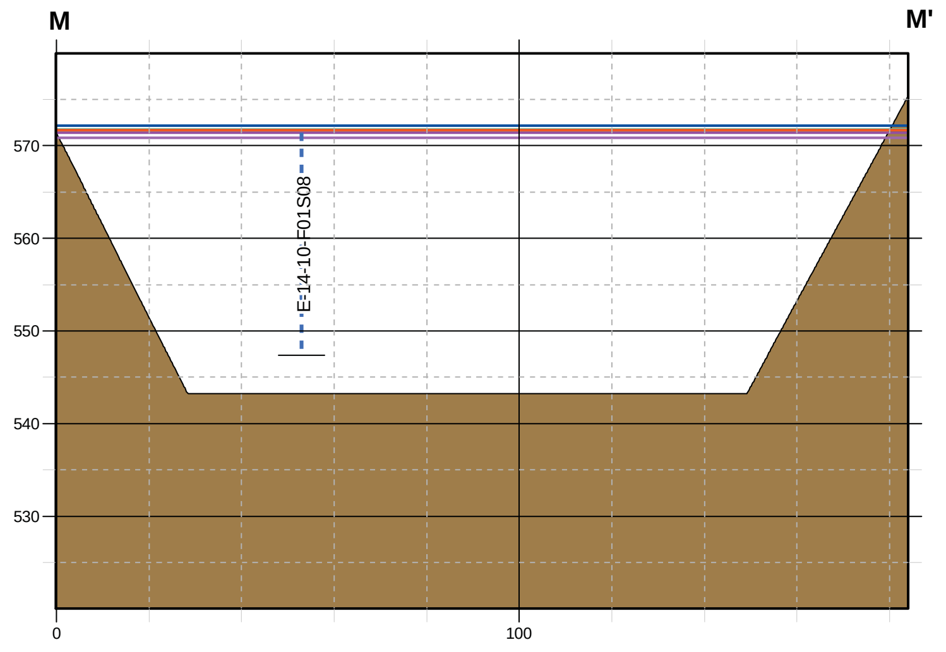


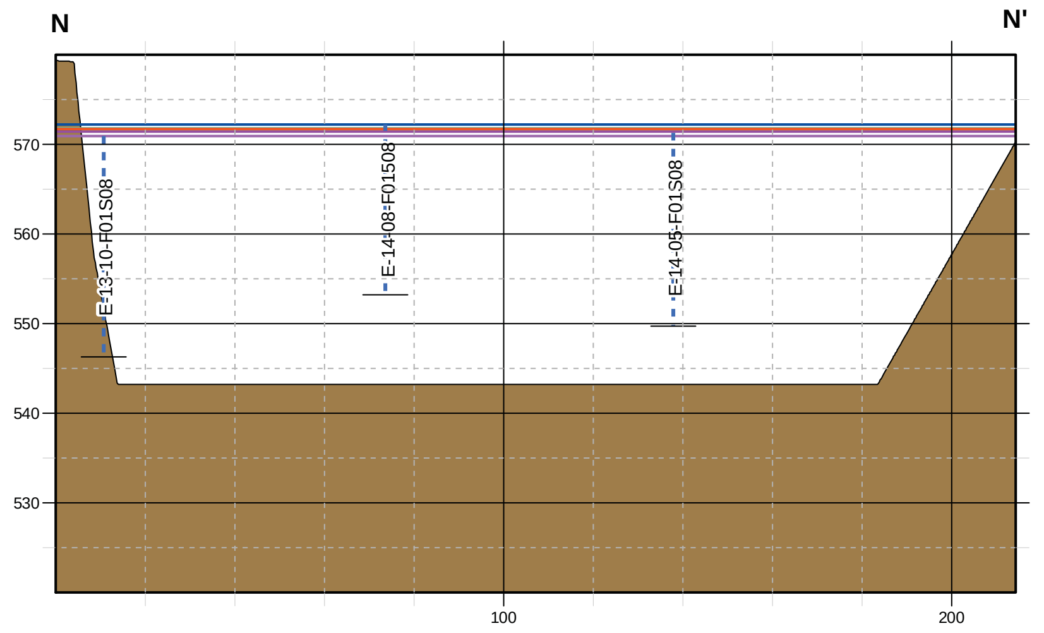


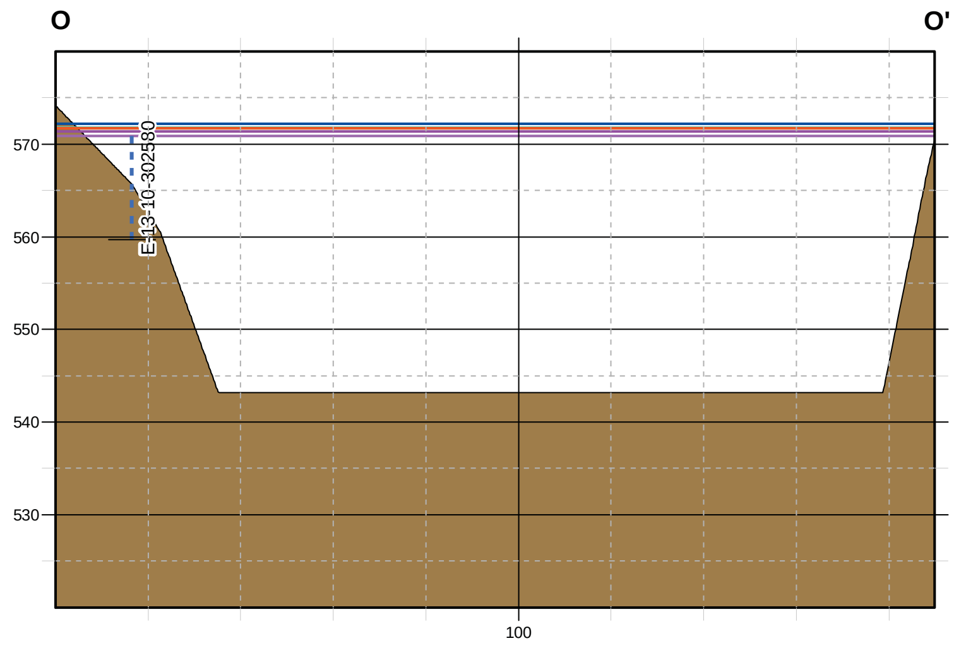


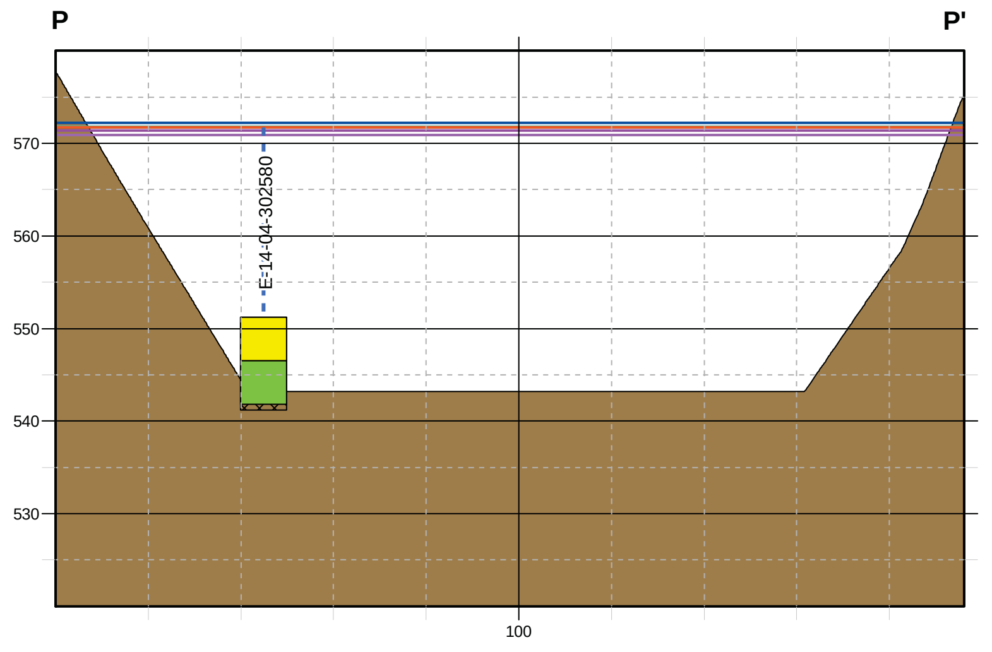


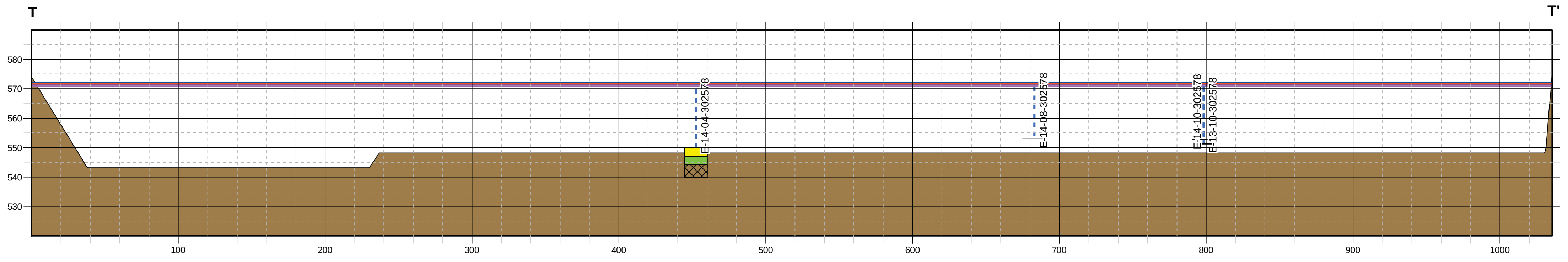


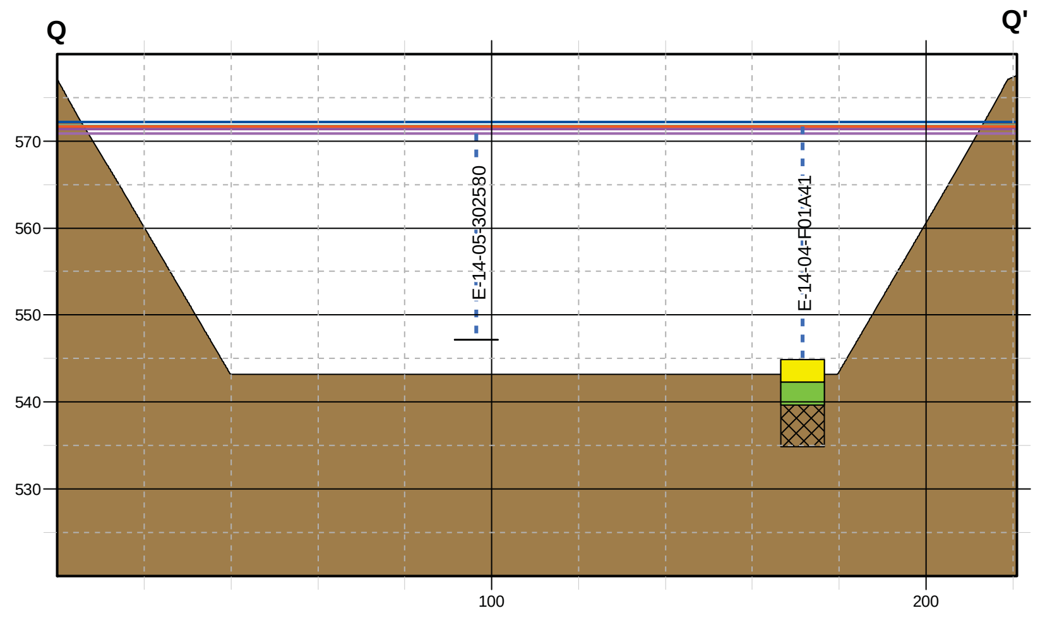


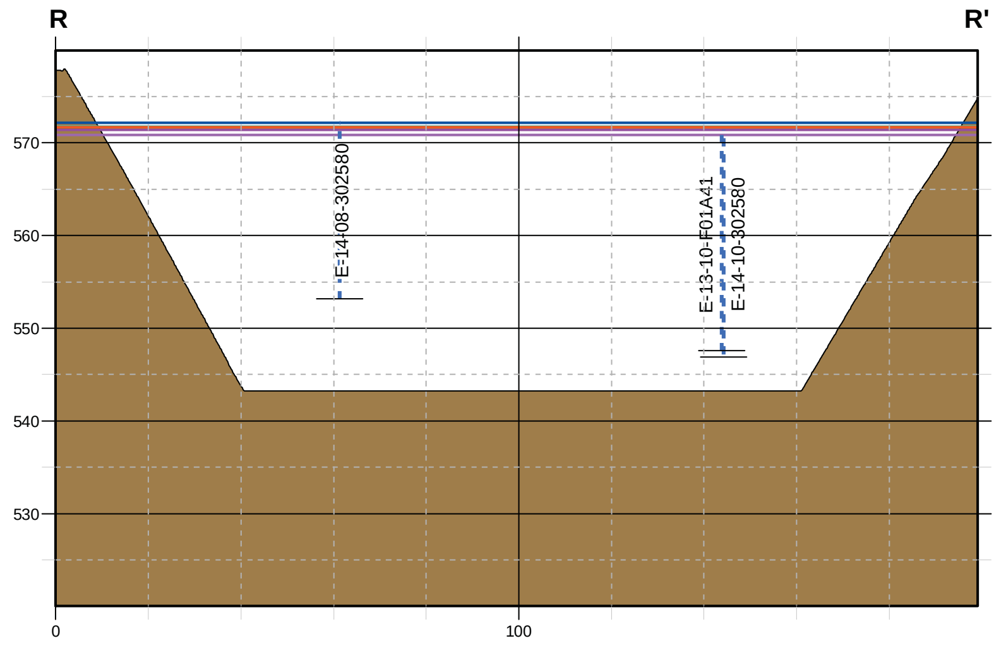


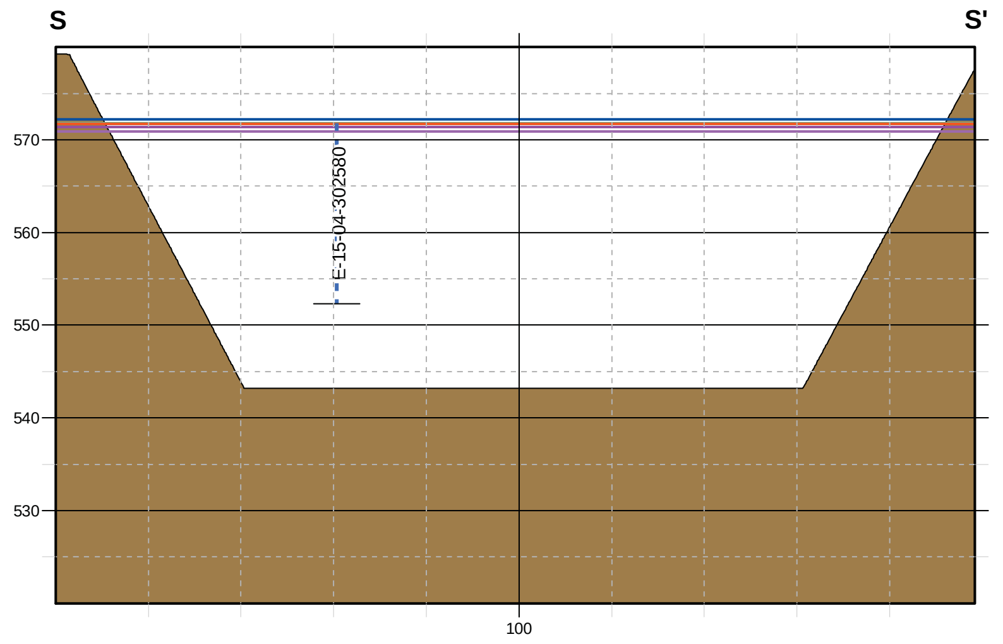


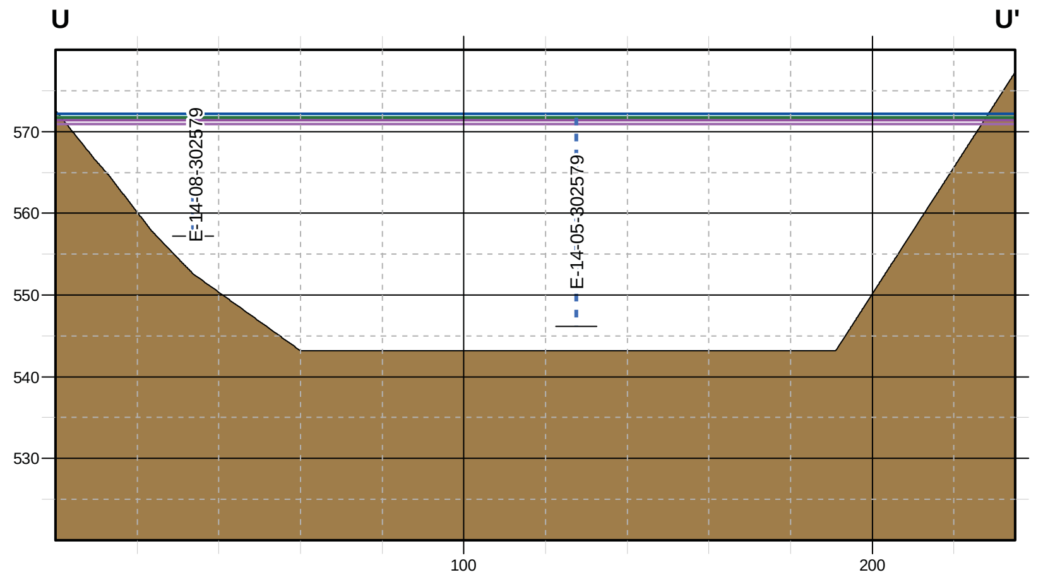


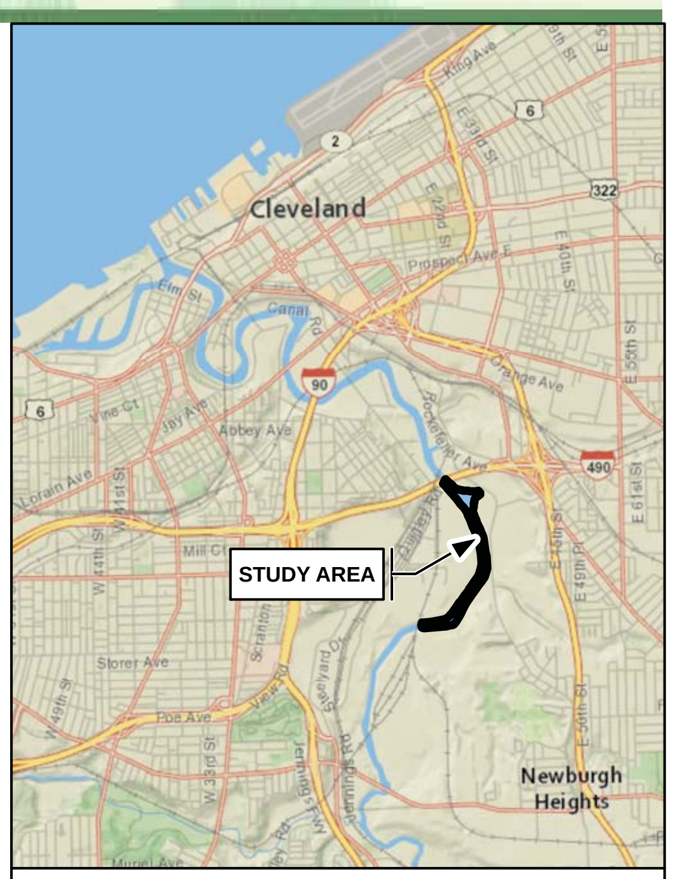












Legend

- ◐ Ponar Grab Composite Sample
- ● Ponar Grab Discrete Sample
- ✦ Vibro-Core Sample Location
- — Cross Section Location
- — Navigation Channel

Cross Section Legend
(The cross sections were drawn at 2X vertical exaggeration.)

- ● Assumed Top of Core
- ● Assumed Bottom of Core
- ▨ 10' Core Length
- - - - Water Depth at Time of Sample
- ● Channel Dredging Limits
- — Mean Lake Elevation on 10/03/13
- — Mean Lake Elevation on 04/24/14
- — Mean Lake Elevation on 05/05/14
- — Mean Lake Elevation on 08/14/14
- — Mean Lake Elevation on 10/29/14
- — Mean Lake Elevation on 04/30/15

NOTE: Dredge limit depths include advance maintenance and 1 foot of overdepth and 1 on 2 sideslopes.

FIGURE A8

N

0 400 800
Feet

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Legend

- ▣ Sediment Core Sample Location
- ✦ Sediment Sample Location
- – – Federal Navigation Channel
- ▨ Dredged Material Management Unit
- ▨ Area Not Maintained

0 250 500 1,000 Feet

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DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING SITES FOR MAY 2014 OEPA ANALYSES OF UPPER CUYAHOGA RIVER CHANNEL SEDIMENTS

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CLEVELAND, OHIO

FIGURE A9

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Legend

- ◙ Sediment Core Sample Location
- ✦ Sediment Sample Location
- – – Federal Navigation Channel
- ▨ Dredged Material Management Unit
- ▨ Area Not Maintained

0 250 500 1,000
Feet

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DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING SITES FOR AUGUST 2014 OEPA ANALYSES OF UPPER CUYAHOGA RIVER CHANNEL SEDIMENTS

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CLEVELAND, OHIO

FIGURE A10

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Legend

- ◙ Sediment Core Sample Location
- ● Sediment Sample Location
- - - Federal Navigation Channel
- ▨ Dredged Material Management Unit
- ▨ Area Not Maintained

0 250 500 1,000
Feet

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DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING
SITES FOR OCTOBER 2014 OEPA ANALYSES OF UPPER CUYAHOGA RIVER
CHANNEL SEDIMENTS

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CLEVELAND, OHIO

FIGURE A11

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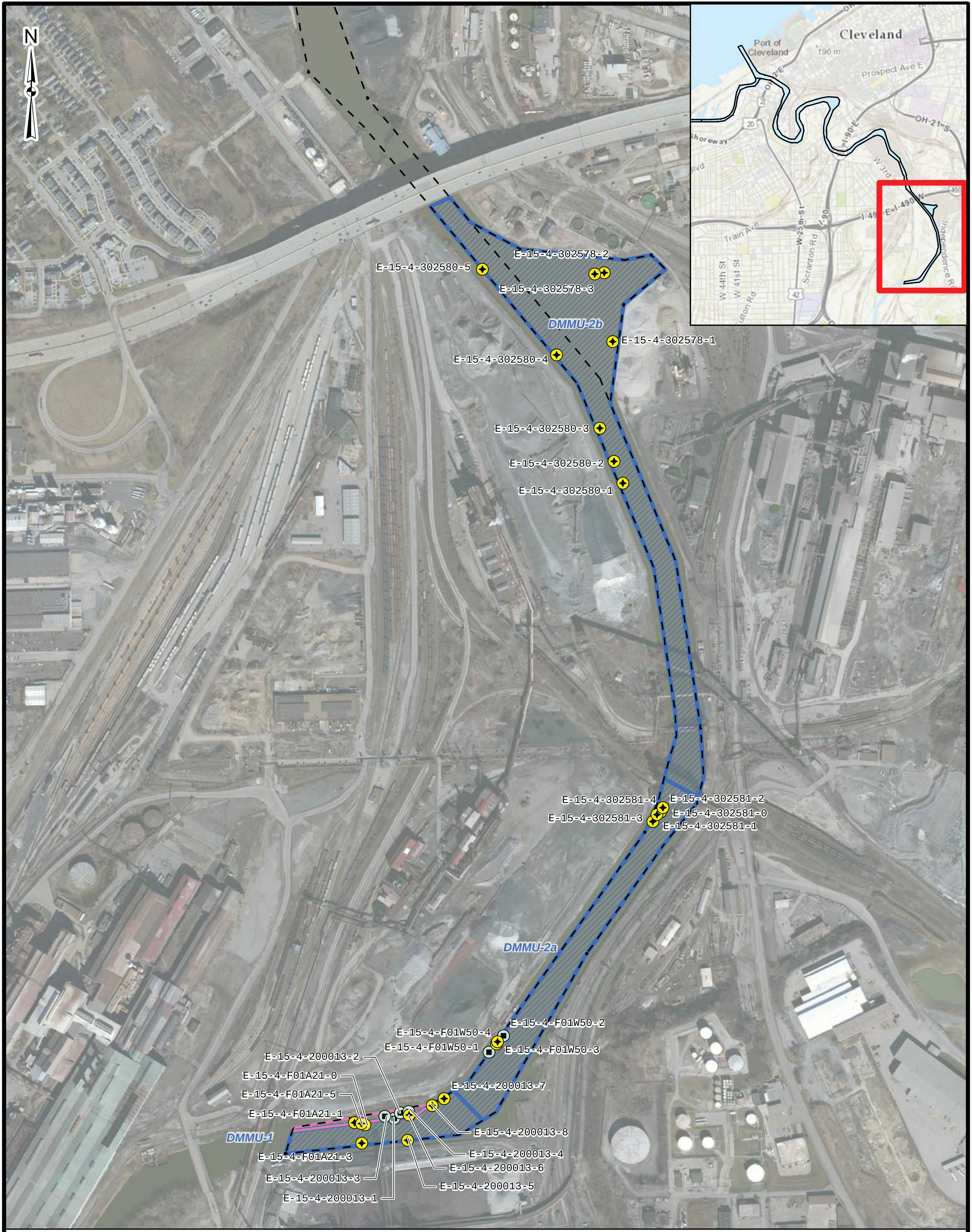

Legend

- ▣ Sediment Core Sample Location
- ✦ Sediment Sample Location
- – – Federal Navigation Channel
- ▨ Dredged Material Management Unit
- ▨ Area Not Maintained

0 250 500 1,000 Feet

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DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING
SITES FOR APRIL 2015 OEPA ANALYSES OF UPPER CUYAHOGA RIVER
CHANNEL SEDIMENTS

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CLEVELAND, OHIO

FIGURE A12

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Legend

- ● Sediment Core/Grab Sample Location
- – – Federal Navigation Channel
- ▨ Dredged Material Management Unit
- ▨ Area Not Maintained

0 250 500 1,000
Feet

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SITES FOR OCTOBER 2015 OEPA ANALYSES OF UPPER CUYAHOGA RIVER
CHANNEL SEDIMENTS

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CLEVELAND, OHIO

FIGURE A13

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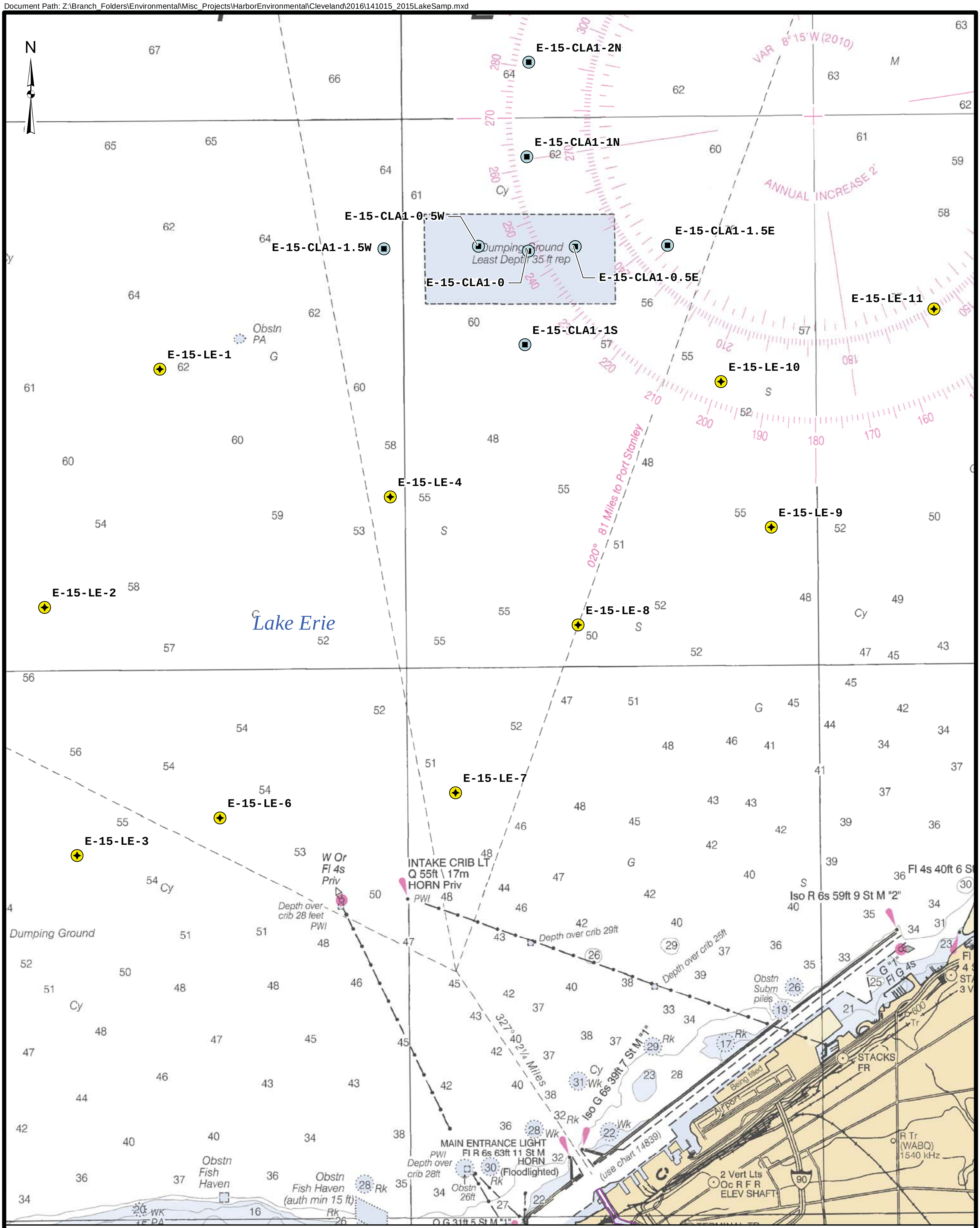

Legend

- ◙ Sediment Core Sample Location
- ✦ Sediment Grab Sample Location
- — Federal Navigation Channel

Source: NOAA / NOS / Office of Coast Survey

0 0.5 1 2 Miles

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SAMPLING SITES FOR 2015 OEPA ANALYSES OF REGIONAL LAKE ERIE SEDIMENTS OFFSHORE OF CLEVELAND

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CLEVELAND, OHIO

FIGURE A14

APPENDIX B

TABLES

TABLE B1: Bulk grain size distribution on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2014a)

PARTICLE SIZE (%)	UPPER RIVER CHANNEL																	
	DMMU-1						DMMU-2a						DMMU-2b					
	CH-1	CH-2	CH-3	CH-4	CH-5	DMMU-1 Comp	CH-6	CH-7	CH-8	CH-9	CH-10	DMMU-2a Comp	CH-11	CH-12	CH-13	CH-14	CH-15	DMMU-2b Comp
CLAY	2	1.2	16.3	12.6	12	7.3	3.4	22.4	27.3	27.3	24.8	25.3	17.8	26.4	27.8	40.2	28.6	24.3
SILT	5.5	3	27.9	24.2	15.7	11.9	42.1	44.4	59.5	60.9	60.2	52.2	35.3	68.1	66	58.2	68.5	60.5
FINE SAND	6	15.4	44	60.2	67.4	25.3	50.5	32	12.4	10.7	13.6	21	45	4.8	5.5	1.4	2.6	14.1
COARSE SAND	36.7	21.2	0.7	0.2	0.3	17.6	1	0.1	0	0.1	0.1	0.3	0.2	0.1	0	0	0	0
MEDIUM SAND	23.1	45.7	10.9	2.8	3.6	21.9	2.4	1.1	0.4	0.7	1	1.1	1.5	0.4	0.4	0.1	0.2	0.7
FINE GRAVEL	24.7	13.6	0.2	0	0	15.2	0	0	0	0	0	0	0	0	0	0	0	0
COARSE GRAVEL	2	0	0	0	0.9	0.8	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL CLAYS/SILTS	**7.5**	**4.2**	**44.2**	**36.8**	**27.7**	**19.2**	**45.5**	**66.8**	**86.8**	**88.2**	**85**	**77.5**	**53.1**	**94.5**	**93.8**	**98.4**	**97.1**	**84.8**
TOTAL SANDS/GRAVELS	**92.5**	**95.9**	**55.8**	**63.2**	**72.2**	**80.8**	**53.9**	**33.2**	**12.8**	**11.5**	**14.7**	**22.4**	**46.7**	**5.3**	**5.9**	**1.5**	**2.8**	**14.8**

PARTICLE SIZE (%)	LAKE AREA																	
	CLA-1						CLA-14						CLA-4					
	CLA1-1	CLA1-2	CLA1-3	CLA1-4	CLA1-5	CLA-1 Comp	CLA14-1	CLA14-2	CLA14-3	CLA14-4	CLA14-5	CLA-14 Comp	CLA4-1	CLA4-2	CLA4-3	CLA4-4	CLA4-5	CLA-4 Comp
CLAY	74.8	70.8	60.5	70.1	41.2	51.2	43.4	43.5	46.3	31.1	24	35.2	72.3	70.3	65	67.5	73.3	69.6
SILT	23.6	28.2	29.9	28.9	45.9	39.4	22.6	17.1	20.3	37.6	20.6	26.5	27.1	29.2	23.2	29.7	25.8	27.2
FINE SAND	1.2	0.8	8.1	0.6	9.2	5.9	26.9	26.3	24.1	15.1	40.6	27.9	0.4	0.3	6.3	1.4	0.5	1.6
COARSE SAND	0	0	0.1	0	0.5	0.3	0.3	0.7	0.9	2	1.7	1.5	0.1	0	0.3	0	0.1	0.3
MEDIUM SAND	0.2	0.1	1.5	0.4	1.8	3.1	6.5	11.9	7.6	7.2	12.4	8.4	0.2	0.1	5.1	1.4	0.3	1.4
FINE GRAVEL	0	0	0	0	1.4	0	0.2	0.5	0.7	4.6	0.7	0.6	0	0	0.1	0	0	0
COARSE GRAVEL	0	0	0	0	0	0	0	0	0	2.4	0	0	0	0	0	0	0	0
TOTAL CLAYS/SILTS	**98.4**	**99**	**90.4**	**99**	**87.1**	**90.6**	**66**	**60.6**	**66.6**	**68.7**	**44.6**	**61.7**	**99.4**	**99.5**	**88.2**	**97.2**	**99.1**	**96.8**
TOTAL SANDS/GRAVELS	**1.4**	**0.9**	**9.7**	**1**	**12.9**	**9.3**	**33.9**	**39.4**	**33.3**	**31.3**	**55.4**	**38.4**	**0.7**	**0.4**	**11.8**	**2.8**	**0.9**	**3.3**

PARTICLE SIZE (%)	LAKE AREA										
	CLA-7						CLAM				
	CLA7-1	CLA7-2	CLA7-3	CLA7-4	CLA7-5	CLA-7 Comp	CLAM-1	CLAM-2	CLAM-3	CLAM-4	CLAM-5
CLAY	62.3	77.5	77.8	69.5	68.4	73.6	66.4	67.2	11.9	75.7	71.7
SILT	36.9	22.1	21.2	27.4	29.1	24.6	32.3	30.9	7.6	23	25.1
FINE SAND	0.3	0.3	0.8	2.5	1.7	1.2	0.9	1.5	56.3	0.5	2.5
COARSE SAND	0	0	0	0	0	0	0	0	9.9	0	0.1
MEDIUM SAND	0.2	0.1	0.1	0.6	0.8	0.5	0.3	0.4	10.7	0.7	0.7
FINE GRAVEL	0	0	0	0	0	0	0	0	3.6	0	0
COARSE GRAVEL	0	0	0	0	0	0	0	0	0	0	0
TOTAL CLAYS/SILTS	**99.2**	**99.6**	**99**	**96.9**	**97.5**	**98.2**	**98.7**	**98.1**	**19.5**	**98.7**	**96.8**
TOTAL SANDS/GRAVELS	**0.5**	**0.4**	**0.9**	**3.1**	**2.5**	**1.7**	**1.2**	**1.9**	**80.5**	**1.2**	**3.3**

TABLE B2: Bulk grain size distribution of lake sediment samples offshore of Cleveland (RTI 2014b)

PARTICLE SIZE (%)	LAKE SITE																		
	LE-1	LE-2	LE-3	LE-4	LE-6	LE-7	LE-10	LE-11	LE-12	LE-13	LE-14	LE-16	LE-19	LE-20	LE-21	LE-22	LE-23	LE-24	LE-25
CLAY	11.8	38.9	8.9	45.8	1.6	6.7	22.7	4.1	45.2	7.3	3.5	17.9	62.5	34.8	36	45.8	51.7	36.4	34.3
SILT	10.1	33.9	7.7	13.1	0.2	3.9	58.7	1.1	17.7	3.6	2.3	24.3	24.5	15.8	14.8	21	22.3	15.7	20.6
FINE SAND	77.2	7.9	39.9	30.3	12.4	16.3	12.3	10.1	11.5	41	15.1	39.9	3.4	13.2	14.7	7.3	6.2	16.1	13.9
MEDIUM SAND	0.7	12.3	20.2	7.2	65.6	57.9	5.7	69.6	24	33.9	40.4	14.9	9.3	33.5	32.2	24.6	18.9	30.1	29.5
COARSE SAND	0.1	1.6	7.7	0.8	13.1	10.1	0	8.6	1.5	9.3	19.1	1.4	0.3	2.6	2.3	1.3	0.9	1.6	1.6
FINE GRAVEL	0	5.3	14.6	2.9	7.2	5.1	0	1.8	0	3.3	15.4	1.6	0	0	0	0	0	0	0
COARSE GRAVEL	0	0	0.9	0	0	0	0	4.6	0	1.6	4.2	0	0	0	0	0	0	0	0
TOTAL CLAYS/SILTS	**21.9**	**72.8**	**16.6**	**58.9**	**1.8**	**10.6**	**81.4**	**5.2**	**62.9**	**10.9**	**5.8**	**42.2**	**87**	**50.6**	**50.8**	**66.8**	**74**	**52.1**	**54.9**
TOTAL SANDS/GRAVELS	**78**	**27.1**	**83.3**	**41.2**	**98.3**	**89.4**	**18**	**94.7**	**37**	**89.1**	**94.2**	**57.8**	**13**	**49.3**	**49.2**	**33.2**	**26**	**47.8**	**45**

TABLE B3: Bulk total organic carbon (TOC) and moisture data on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2014a)

PARAMETER	UPPER RIVER CHANNEL																	
	DMMU-1						DMMU-2a						DMMU-2b					
	CH-1	CH-2	CH-3	CH-4	CH-5	DMMU-1 Comp	CH-6	CH-7	CH-8	CH-9	CH-10	DMMU-2a Comp	CH-11	CH-12	CH-13	CH-14	CH-15	DMMU-2b Comp
TOC (%)	0.94	0.72	1.80	1.10	1.50	1.20	2.80	1.80	1.80	2.10	1.90	2.00	2.00	1.60	1.50	1.70	1.40	1.70
PERCENT MOISTURE	20	17	41	35	41	29	41	40	44	45	43	42	36	41	37	47	37	40

PARAMETER	LAKE AREA																	
	CLA-1						CLA-14						CLA-4					
	CLA1-1	CLA1-2	CLA1-3	CLA1-4	CLA1-5	CLA-1 Comp	CLA14-1	CLA14-2	CLA14-3	CLA14-4	CLA14-5	CLA-14 Comp	CLA4-1	CLA4-2	CLA4-3	CLA4-4	CLA4-5	CLA-4 Comp
TOC (%)	2.90	2.80	2.80	2.60	3.40	3.60	2.40	2.40	2.70	6.70	3.00	3.00	2.60	2.50	2.40	2.50	2.60	2.70
PERCENT MOISTURE	73	70	68	71	49	65	63	66	60	39	48	56	72	73	72	72	73	72

PARAMETER	LAKE AREA										
	CLA-7						CLAM				
	CLA7-1	CLA7-2	CLA7-3	CLA7-4	CLA7-5	CLA-7 Comp	CLAM-1	CLAM-2	CLAM-3	CLAM-4	CLAM-5
TOC (%)	2.60	2.60	2.80	3.10	3.00	2.80	2.70	2.80	4.40	0.46	2.80
PERCENT MOISTURE	75	74	74	75	74	74	72	72	32	75	74

TABLE B4: Bulk total phosphorus, total organic carbon (TOC) and percent moisture data on Lake Erie sediments offshore of Cleveland (RTI 2014b)

PARAMETER	LAKE SITE																		
	LE-1	LE-2	LE-3	LE-4	LE-6	LE-7	LE-10	LE-11	LE-12	LE-13	LE-14	LE-16	LE-19	LE-20	LE-21	LE-22	LE-23	LE-24	LE-25
TOC (%)	0.36	2.4	3.1	0.4	0.41	0.44	1.6	0.19	2.2	0.29	1.4	4.3	2.76	2.7	2.7	3	3.1	2.7	3.3
PHOSPHORUS, TOTAL (mg/kg)	120	230	730	98	44	110	280	59	370	100	180	500	400	380	450	460	430	480	550
PERCENT MOISTURE	77.2	31	52	19	26	20	36	44	28	74	43	46	75	72	76	76	76	76	78

TABLE B5: Bulk total PCB data (sum of congeners) on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2014a)

PARAMETER	UPPER RIVER CHANNEL																	
	DMMU-1						DMMU-2a						DMMU-2b					
	CH-1	CH-2	CH-3	CH-4	CH-5	DMMU-1 Comp	CH-6	CH-7	CH-8	CH-9	CH-10	DMMU-2a Comp	CH-11	CH-12	CH-13	CH-14	CH-15	DMMU-2b Comp
TOTAL PCBs (µg/kg)	38	32	77	85	75	68	80	110	90	119	80	102	300	102	83	70	82	144
TOC (%)	0.94	0.72	1.80	1.10	1.50	1.20	2.80	1.80	1.80	2.10	1.90	2.00	2.00	1.60	1.50	1.70	1.40	1.70
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	3989	4375	4250	7736	4993	5658	2854	6111	5006	5667	4211	5100	15000	6375	5533	4094	5864	8471

PARAMETER	LAKE AREA																	
	CLA-1						CLA-14						CLA-4					
	CLA1-1	CLA1-2	CLA1-3	CLA1-4	CLA1-5	CLA-1 Comp	CLA14-1	CLA14-2	CLA14-3	CLA14-4	CLA14-5	CLA-14 Comp	CLA4-1	CLA4-2	CLA4-3	CLA4-4	CLA4-5	CLA-4 Comp
TOTAL PCBs (µg/kg)	236	116	169	104	1,450	1,240	52	100	82	156	291	179	109	75	102	77	89	117
TOC (%)	2.90	2.80	2.80	2.60	3.40	3.60	2.40	2.40	2.70	6.70	3.00	3.00	2.60	2.50	2.40	2.50	2.60	2.70
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	8138	4143	6036	4000	42647	34444	2158	4167	3030	2328	9700	5967	4192	2984	4250	3080	3431	4333

PARAMETER	LAKE AREA										
	CLA-7						CLAM				
	CLA7-1	CLA7-2	CLA7-3	CLA7-4	CLA7-5	CLA-7 Comp	CLAM-1	CLAM-2	CLAM-3	CLAM-4	CLAM-5
TOTAL PCBs (µg/kg)	103	123	109	131	121	110	136	262	10.9	109	155
TOC (%)	2.60	2.60	2.80	3.10	3.00	2.80	2.70	2.80	4.40	0.46	2.80
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	3962	4731	3893	4226	4033	3929	5037	9357	248	23696	5536

TABLE B6: Bulk total PCB data (sum of congeners) on Lake Erie sediments offshore of Cleveland (RTI 2014b)

PARAMETER	LAKE SITE																		
	LE-1	LE-2	LE-3	LE-4	LE-6	LE-7	LE-10	LE-11	LE-12	LE-13	LE-14	LE-16	LE-19	LE-20	LE-21	LE-22	LE-23	LE-24	LE-25
TOTAL PCBs (µg/kg)	28.6	105	5,880	57.7	38.6	27.7	400	9.36	101	15.8	38.4	968	100	92	111	117	109	60.2	152
TOC (%)	0.36	2.4	3.1	0.4	0.41	0.44	1.6	0.19	2.2	0.29	1.4	4.3	2.76	2.7	2.7	3	3.1	2.7	3.3
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	7944	4375	189677	14425	9415	6295	25000	4926	4591	5448	2743	22512	3623	3407	4111	3900	3516	2230	4606

TABLE B7: Bulk PAH data (sum of 16 USEPA Priority Pollutants) on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2014a)

PAH COMPOUND (µg/kg)	UPPER RIVER CHANNEL														
	DMMU-1					DMMU-2a					DMMU-2b				
	CH-1	CH-2	CH-3	CH-4	CH-5	CH-6	CH-7	CH-8	CH-9	CH-10	CH-11	CH-12	CH-13	CH-14	CH-15
2-METHYLNAPHTHALENE	20	17	16	13	17	17	23	21	30	66	28	25	18	19	26
ACENAPHTHENE	8.6	34	19	23	25	28	28	24	36	110	54	22	21	47 U[1]	21
ACENAPHTHYLENE	5.3	8.4	41 U	18	14	33	26	18	21	23	31	17	18	16	16
ANTHRACENE	20	250	49	76	72	140	110	71	110	120	220	62	73	43	60
BENZO(A)ANTHRACENE	72	1200	240	310	330	520	490	370	570	480	740	300	360	250	330
BENZO(A)PYRENE	82	1200	250	330	350	540	560	410	600	510	750	340	420	290	390
BENZO(B)FLUORANTHENE	170	1700	420	500	640	900	990	780	1300	970	1200	670	750	590	780
BENZO(G,H,I)PERYLENE	30	280	190	210	220	280	260	250	310	240	300	180	180	140	200
BENZO(K)FLUORANTHENE	54	640	170	210	220	290	400	240	330	300	440	220	290	170	260
CHRYSENE	91	960	310	360	420	580	600	470	730	570	780	380	480	310	450
DIBENZ(A,H)ANTHRACENE	6.1 U	41	82	89	94	110	80	100	120	110	120	81	86	65	81
FLUORANTHENE	200	2600	670	790	940	1300	1300	980	1500	1400	1900	820	960	630	960
FLUORENE	12	42	27	38	30	47	44	33	53	130	90	31	34	22	34
INDENO(1,2,3-C,D)PYRENE	35	330	220	250	260	310	270	280	370	280	350	200	240	180	220
NAPHTHALENE	15	14	41 U	38 U	41 U	17	24	21	24	130	28	25	18	19	26
PHENANTHRENE	94	820	290	370	380	600	510	400	590	790	950	330	390	240	370
PYRENE	170	2500	480	590	670	1100	1000	710	1100	980	1400	600	710	470	690
TOTAL PAHs	1,059	12,619	3,417	4,164	4,665	6,795	6,692	5,157	7,764	7,143	9,353	4,278	5,030	3,435	4,888
TOC CONTENT (%)	0.94	0.72	1.80	1.10	1.50	2.80	1.80	1.80	2.10	1.90	2.00	1.60	1.50	1.70	1.40
TOC-NORMALIZED CONCENTRATION (mg/kg-TOC)	113	1,753	190	379	311	243	372	287	370	376	468	267	335	202	349

PAH COMPOUND (µg/kg)	LAKE AREA														
	CLA-1					CLA-14					CLA-4				
	CLA1-1	CLA1-2	CLA1-3	CLA1-4	CLA1-5	CLA14-1	CLA14-2	CLA14-3	CLA14-4	CLA14-5	CLA4-1	CLA4-2	CLA4-3	CLA4-4	CLA4-5
2-METHYLNAPHTHALENE	76	76	160	24	640	140	56	83	6400	310	16	13	16	12	13
ACENAPHTHENE	120	210	370	64	4900	670	240	650	32000	6300	14	12	13	11	9.8
ACENAPHTHYLENE	66	130	240	47	610	290	140	230	400 U	960	14	13	15	9.5	11
ANTHRACENE	210	560	620	140	5000	1200	340	630	14000	6400	32	29	30	22	28
BENZO(A)ANTHRACENE	420	800	2300	250	5400	2000	870	1100	11000	8300	120	130	120	93	100
BENZO(A)PYRENE	440	810	1800	270	5300	1800	980	1200	9200	7200	140	140	130	100	120
BENZO(B)FLUORANTHENE	730	1300	2600	450	5900	2900	1400	1800	10000	11000	220	190	190	150	170
BENZO(G,H,I)PERYLENE	150	210	620	110	4000	460	260	310	6600	2100	130	110	110	83	87
BENZO(K)FLUORANTHENE	290	410	940	140	2000	760	590	610	4400	3100	83	89	73	54	59
CHRYSENE	520	830	2100	280	5800	1900	840	1100	9400	7500	150	130	130	110	100
DIBENZ(A,H)ANTHRACENE	61	100	270	51	1100	200	120	140	1500	850	30	31	31	17	22
FLUORANTHENE	1100	1800	5000	620	13000	4400	1400	2000	27000	15000	240	240	220	190	200
FLUORENE	120	340	190	100	6700	870	200	770	23000	6700	29	18	26	21	18
INDENO(1,2,3-C,D)PYRENE	170	260	690	120	3600	530	310	360	5500	2300	100	93	110	77	80
NAPHTHALENE	150	220	360	78	1900	440	240	240	3000	1100	28	22	31	20	21
PHENANTHRENE	520	1300	1000	370	17000	2900	670	1800	50000	15000	100	89	86	69	76
PYRENE	980	1500	3900	460	11000	3300	1100	1600	24000	15000	200	190	190	140	160
TOTAL PAHs	6,047	10,780	23,000	3,550	93,210	24,620	9,700	14,540	230,600	108,810	1,630	1,526	1,505	1,167	1,262
TOC CONTENT (%)	2.90	2.80	2.80	2.60	3.40	2.40	2.20	2.70	6.70	3.00	2.60	2.50	2.40	2.50	2.60
TOC-NORMALIZED CONCENTRATION (mg/kg-TOC)	209	385	821	137	2,741	1,026	441	539	3,442	3,627	62.7	61.0	62.7	46.7	48.5

PAH COMPOUND (µg/kg)	LAKE AREA									
	CLA-7					CLAM				
	CLA7-1	CLA7-2	CLA7-3	CLA7-4	CLA7-5	CLAM-1	CLAM-2	CLAM-3	CLAM-4	CLAM-5
2-METHYLNAPHTHALENE	13	13	13	15	16	18	16	2	23	19 U
ACENAPHTHENE	9.2	19 U	13	11	13	13	14	4.9	42	19 U
ACENAPHTHYLENE	10	10	18	19	23	27	23	5.4	34	19 U
ANTHRACENE	28	29	28	29	29	43	33	8.8	94	12
BENZO(A)ANTHRACENE	96	97	100	110	120	170	130	29	170	45
BENZO(A)PYRENE	110	110	120	120	140	180	140	25	200	42
BENZO(B)FLUORANTHENE	160	150	220	230	280	320	260	38	350	64
BENZO(G,H,I)PERYLENE	80	78	78	81	83	89	68	11	97	36
BENZO(K)FLUORANTHENE	50	66	74	69	81	140	86	16	120	28
CHRYSENE	97	100	130	130	150	190	140	26	200	45
DIBENZ(A,H)ANTHRACENE	29	19	31	37	36	41	35	9.8	43	19 U
FLUORANTHENE	180	180	220	230	260	350	260	46	410	78
FLUORENE	20	18	23	24	28	36	29	6.4	52	7.7
INDENO(1,2,3-C,D)PYRENE	76	74	91	86	93	110	79	17	110	30
NAPHTHALENE	24	21	23	27	30	27	36	4.9	46	9
PHENANTHRENE	72	64	76	81	89	110	95	22	260	30
PYRENE	140	150	180	190	210	290	230	37	310	77
TOTAL PAHs	1,181	1,166	1,425	1,474	1,665	2,136	1,658	307	2,538	504
TOC CONTENT (%)	2.60	2.60	2.80	3.10	3.00	2.70	2.80	4.40	0.46	2.80
TOC-NORMALIZED CONCENTRATION (mg/kg-TOC)	45.4	44.8	50.9	47.5	55.5	79.1	59.2	7.0	552	18.0

[1] Not detected at the specified detection limit.

TABLE B8: Bulk PAH data (16 USEPA Priority Pollutants) on Lake Erie sediments offshore of Cleveland (RTI 2014b)

PAH COMPOUND (µg/kg)	LAKE SITE																		
	LE-1	LE-2	LE-3	LE-4	LE-6	LE-7	LE-10	LE-11	LE-12	LE-13	LE-14	LE-16	LE-19	LE-20	LE-21	LE-22	LE-23	LE-24	LE-25
2-METHYLNAPHTHALENE	12 U[1]	47	5,100	16	10 U	21	36	16	32 U	11 U	66	3,700	33 U	29 U	34 U	33 U	34 U	59	95
ACENAPHTHENE	11 U	25	1,800	35	9	27	26	10 U	29 U	10 U	170	11,000	30 U	27 U	30 U	30 U	31 U	660	92
ACENAPHTHYLENE	10 U	26	1,100	33	13	57	35	9.7 U	30	37	210	1,600	29 U	25 U	29 U	29 U	29 U	180	81
ANTHRACENE	22	72	1,900	100	34	100	90	11 U	45	31	470	12,000	34	32	33 U	37	43	430	200
BENZO(A)ANTHRACENE	53	310	1,900	260	77	250	280	15	170	150	1,100	13,000	140	130	110	130	160	920	440
BENZO(A)PYRENE	64	470	1,800	300	79	320	350	15	280	210	1,000	11,000	200	210	150	230	250	1,400	660
BENZO(B)FLUORANTHENE	130	800	2,200	410	140	460	570	39	510	340	1,300	15,000	440	470	350	480	500	2,000	1,200
BENZO(G,H,I)PERYLENE	56	290	710 U	120	26	120	140	16 U	140	71	360	4,500	97	87	67	94	110	510	230
BENZO(K)FLUORANTHENE	32	200	1000 U	130	37	100	160	24 U	150	76	350	4,500	110	92	79	140	140	520	290
CHRYSENE	76	400	2,000	240	93	240	290	20	190	150	810	12,000	140	150	110	170	170	830	430
DIBENZ(A,H)ANTHRACENE	38 U	100	1600 U	54	32 U	43	61	36 U	100 U	36 U	180	2400 U	110 U	95 U	110 U	110 U	110 U	110 U	120 U
FLUORANTHENE	190	800	5,200	530	180	510	670	32	360	190	2,100	37,000	270	280	210	300	310	1,900	870
FLUORENE	13 U	41	2,400	45	12	43	57	13 U	36 U	13 U	220	11,000	38 U	34 U	39 U	38 U	39 U	310	42 U
INDENO(1,2,3-C,D)PYRENE	42	290	520 U	130	26	120	160	12 U	150	88	400	4,300	110	100	78	110	130	580	250
NAPHTHALENE	9.3 U	51	29,000	34	22	36	45	12	39	11	250	11,000	46	26	29	48	44	230	230
PHENANTHRENE	81	300	6,800	180	69	190	240	15	110	47	1,000	42,000	90	86	74	100	110	1,300	500
PYRENE	140	580	4,700	450	180	390	530	29	300	160	1,500	33,000	220	220	170	260	260	1,300	740
TOTAL PAHs	**886**	**4,755**	**60,800**	**3,051**	**997**	**3,006**	**3,704**	**177**	**2,474**	**1,561**	**11,420**	**222,900**	**1,897**	**1,883**	**1,427**	**2,099**	**2,227**	**13,070**	**6,213**
TOC CONTENT (%)	**0.36**	**2.4**	**3.1**	**0.4**	**0.41**	**0.44**	**1.6**	**0.19**	**2.2**	**0.29**	**1.4**	**4.3**	**2.76**	**2.7**	**2.7**	**3**	**3.1**	**2.7**	**3.3**
TOC-NORMALIZED CONCENTRATION (mg/kg-TOC)	**246**	**198**	**1961**	**763**	**243**	**683**	**232**	**93.2**	**112**	**538**	**816**	**5184**	**68.7**	**69.7**	**52.9**	**70.0**	**71.8**	**484**	**188**

[1] Not detected at the specified detection limit.

TABLE B9: Bulk PAH data (34: 18 non-alkylated parent compounds and 16 groups of generic alkylated forms, and 16 priority pollutants) on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2014a)

PAH compound (µg/kg)	UPPER RIVER CHANNEL			LAKE AREA			
	DMMU-1	DMMU-2a	DMMU-2b	CLA-14 Comp	CLA-1 Comp	CLA-4 Comp	CLA-7 Comp
1-METHYLNAPHTHALENE	60	40	50	1,870	220	20	20
2-METHYLNAPHTHALENE	130	110	110	1,900	790	60	70
ACENAPHTHENE	20 U	60	50	10,890	3,250	30	40
ACENAPHTHYLENE	40	60	50	1,330	1,100	50	60
ANTHRACENE	130	250	280	15,040	9,050	140	160
BENZO(A)ANTHRACENE	180	390	450	8,390	5,250	160	190
BENZO(A)PYRENE	210	440	480	7,530	4,350	180	230
BENZO(B,K)FLUORANTHENE	450	830	830	8,640	5,300	310	380
BENZO(G,H,I)PERYLENE	190	390	380	3,760	2,470	160	180
CHRYSENE	330	610	590	7,680	5,180	240	280
DIBENZ(A,H)ANTHRACENE	30	60	70	930	530	30	10 U[1]
FLUORANTHENE	480	910	980	16,190	10,690	290	310
FLUORENE	30	70	70	7,560	4,040	50	60
INDENO(1,2,3-C,D)PYRENE	210	460	470	5,920	3,390	190	200
NAPHTHALENE	140	160	120	2,890	2,520	130	40
PHENANTHRENE	310	550	650	21,950	13,000	210	230
PYRENE	450	840	890	15,080	10,040	300	330
PERYLENE	160	290	300	3,900	2,600	580	600
BENZO(E)PYRENE	240	410	390	3,720	2,390	160	220
C1 - CHRYSENE	370	640	640	13,140	9,450	370	390
C1 - FLUORANTHENE/PYRENE	260	490	470	15,730	10,510	270	290
C1 - FLUORENE	120	180	160	9,820	9,210	230	200
C1 - PHENANTHRENE/ANTHRACENE	270	390	380	20,450	17,730	310	360
C2 - CHRYSENE	340	610	490	17,860	15,930	100 U	100 U
C2 - FLUORENE	140	220	220	12,730	13,050	320	280
C2 - NAPHTHALENE	510	550	480	36,270	14,480	630	830
C2 - PHENANTHRENE/ANTHRACENE	1,130	1,740	1,520	102,830	118,410	1,860	1,990
C3 - CHRYSENE	200 U	200 U	200 U	10,320	11,020	200 U	200 U
C3 - FLUORENE	40 U	40 U	40 U	19,900	22,440	40 U	40 U
C3 - NAPHTHALENE	300	310	310	46,440	36,100	370	410
C3 - PHENANTHRENE/ANTHRACENE	680	1,030	840	59,430	74,800	950	940
C4 - CHRYSENE	200 U	200 U	200 U	200 U	200 U	200 U	200 U
C4 - NAPHTHALENE	490	610	540	46,520	46,030	750	810
C4 - PHENANTHRENE/ANTHRACENE	300	410	350	31,360	44,430	470	220
Total (34: 18 non-alkylated parent compounds and 16 groups of generic alkylated forms)	**8,680**	**14,110**	**13,610**	**587,970**	**529,750**	**9,820**	**10,320**
TOC (%)	**1.20**	**2.00**	**1.70**	**3.00**	**3.60**	**2.70**	**2.80**
TOC-NORMALIZED CONCENTRATION (MG/KG-TOC)	**723**	**706**	**801**	**19,599**	**14,715**	**364**	**369**
Total (16 PRIORITY POLLUTANTS)	**3,310**	**6,190**	**6,470**	**135,680**	**80,950**	**2,530**	**2,760**

TABLE B10: PAH (34: 18 non-alkylated parent compounds and 16 groups of generic alkylated forms) pore water concentrations in Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments with calculated USEPA Toxic Units (RTI 2014a)

PAH compound (ug/L)	UPPER RIVER CHANNEL						LAKE AREA								PAH FCV (ug/L)
	DMMU-1	TU	DMMU-2a	TU	DMMU-2b	TU	CLA-14 Comp	TU	CLA-1 Comp	TU	CLA-4 Comp	TU	CLA-7 Comp	TU	
1-METHYLNAPHTHALENE	**0.16**	0.0021	**0.1**	0.0013	**0.21**	0.0028	**24.74**	0.33	**1.53**	0.02	0.05 U[1]		0.05 U		75.37
2-METHYLNAPHTHALENE	**0.15**	0.0021	**0.13**	0.0018	**0.4**	0.0055	**6.64**	0.09	**0.85**	0.01	0.05 U		0.05 U		72.16
ACENAPHTHENE	0.1 U		0.1 U		0.1 U		**45.17**	0.81	**20.19**	0.36	0.1 U		0.1 U		55.85
ACENAPHTHYLENE	0.2 U		0.2 U		0.2 U		**1.92**	0.01	**1.13**	0.00	0.2 U		0.2 U		306.9
ANTHRACENE	0.05 U		0.05 U		0.05 U		**7.79**	0.38	**9.19**	0.44	0.05 U		0.05 U		20.73
BENZO(A)ANTHRACENE	0.001 U		0.001 U		0.001 U		**2.06**	0.93	**0.49**	0.22	0.001 U		0.001 U		2.227
BENZO(A)PYRENE	0.008 U		0.008 U		0.008 U		**0.95**	0.99	**0.25**	0.26	0.008 U		0.008 U		0.9573
BENZO(B,K)FLUORANTHENE	0.005 U		0.005 U		0.005 U		**1.46**	2.28	**0.39**	0.61	0.005 U		0.005 U		0.6415
BENZO(E)PYRENE	0.005 U		0.005 U		0.005 U		**0.45**	0.50	**0.12**	0.13	0.005 U		0.005 U		0.9008
BENZO(G,H,I)PERYLENE	0.001 U		0.001 U		0.001 U		**0.59**	1.34	**0.16**	0.36	0.001 U		0.001 U		0.4391
C1 - CHRYSENE	0.005 U		0.005 U		0.005 U		**1.48**	1.73	**0.36**	0.42	0.005 U		0.005 U		0.8557
C1 - FLUORANTHENE/PYRENE	0.01 U		0.01 U		0.01 U		**5.56**	1.14	**5.62**	1.15	0.01 U		0.01 U		4.887
C1 - FLUORENE	0.02 U		0.02 U		0.02 U		**16.86**	1.21	**21.3**	1.52	0.02 U		0.02 U		13.99
C1 - PHENANTHRENE/ANTHRACENE	0.02 U		0.02 U		0.02 U		**33.9**	4.56	**46.16**	6.21	0.02 U		0.02 U		7.436
C2 - CHRYSENE	0.01 U		0.01 U		0.01 U		**2.58**	5.34	**0.88**	1.82	0.01 U		0.01 U		0.4827
C2 - FLUORENE	0.05 U		0.05 U		0.05 U		**21.58**	4.07	**38.43**	7.24	0.05 U		0.05 U		5.305
C2 - NAPHTHALENE	0.15 U		0.15 U		0.15 U		**146.81**	4.85	**80.97**	2.68	0.15 U		0.15 U		30.24
C2 - PHENANTHRENE/ANTHRACENE	0.05 U		0.05 U		0.05 U		**51.34**	16.05	**93.37**	29.19	0.05 U		0.05 U		3.199
C3 - CHRYSENE	0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.1675
C3 - FLUORENE	0.06 U		0.06 U		0.06 U		**31.38**	16.38	**53.92**	28.14	0.06 U		0.06 U		1.916
C3 - NAPHTHALENE	0.05 U		0.05 U		0.05 U		**285.68**	25.74	**366.39**	33.01	0.05 U		0.05 U		11.1
C3 - PHENANTHRENE/ANTHRACENE	0.04 U		0.04 U		0.04 U		**37.7**	30.02	**75.08**	59.78	0.04 U		0.04 U		1.256
C4 - CHRYSENE	0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.07062
C4 - NAPHTHALENE	0.15 U		0.15 U		0.15 U		**238.12**	54.06	**370.84**	84.19	0.15 U		0.15 U		4.4048
C4 - PHENANTHRENE/ANTHRACENE	0.02 U		0.02 U		0.02 U		**55.79**	99.73	**78.43**	140.20	0.02 U		0.02 U		0.5594
CHRYSENE	0.001 U		0.001 U		0.001 U		**1.69**	0.83	**0.41**	0.20	0.001 U		0.001 U		2.042
DIBENZ(A,H)ANTHRACENE	0.002 U		0.002 U		0.002 U		**0.16**	0.57	**0.03**	0.11	0.002 U		0.002 U		0.2825
FLUORANTHENE	0.01 U		0.01 U		**0.03**	0.0042	**8.51**	1.20	**7.87**	1.11	0.01 U		0.01 U		7.109
FLUORENE	0.04 U		0.04 U		0.04 U		**17.99**	0.46	**11.58**	0.29	0.04 U		0.04 U		39.3
INDENO(1,2,3-C,D)PYRENE	0.001 U		0.001 U		0.001 U		**0.41**	1.49	**0.1**	0.36	0.001 U		0.001 U		0.275
NAPHTHALENE	**0.12**	0.0006	**0.22**	0.0011	**0.49**	0.0025	**3.49**	0.02	**2.4**	0.01	0.1 U		0.1 U		193.5
PERYLENE	0.004 U		0.004 U		0.004 U		**0.17**	0.19	**0.03**	0.03	0.004 U		0.004 U		0.9008
PHENANTHRENE	0.1 U		0.1 U		0.1 U		**36.72**	1.92	**31.27**	1.63	0.1 U		0.1 U		19.13
PYRENE	0.01 U		**0.02**	0.0020	0.01 U		**9.22**	0.91	**8.31**	0.82	0.01 U		0.01 U		10.11
Total USEPA Toxic Units	**<0.1**		**<0.1**		**<0.1**		**280**		**403**		**<0.1**		**<0.1**		

TABLE B11. Results of standard 28-day *Lumbriculus variegatus* bioaccumulation experiments on Lake Cleveland Harbor Upper Cuyahoga River Channel and open-lake area sediments (RTI 2014a).

Management Unit/Area	Replicate	Tissue Measurement			Total PCB Concentration in Sediment (µg/kg-sediment)
		Total PCBs (µg/kg-tissue)	Lipid (%)	Lipid-normalized Total PCBs (µg/kg-lipid)	
DMMU-1	A	216	1.6	13500	**67.9 (composite)**
	B	161	1.9	8474	
	C	125	1.8	6944	
	D	142	1.8	7889	
	E	137	2.1	6524	
MEAN		**156**	**1.84**	**8666**	
DMMU-2a	A	93.5	1.7	5500	**102 (composite)**
	B	96.1	2.1	4576	
	C	117	2.1	5571	
	D	126	2.1	6000	
	E	92.9	2.0	4645	
MEAN		**105**	**2.00**	**5259**	
DMMU-2b	A	96.5	1.9	5079	**144 (composite)**
	B	101	1.8	5611	
	C	109	1.9	5737	
	D	83.9	2.0	4195	
	E	125	2.2	5682	
MEAN		**103**	**1.96**	**5261**	
CLA-1[1]	A	269	2.4	11208	**156 (average)**
	B	120	2.7	4444	
	C	285	3.0	9500	
	D	107	2.4	4458	
	E				
MEAN		**195**	**2.63**	**7403**	
CLA-4	A	35.6	2.5	1424	**117 (composite)**
	B	34.1	2.3	1483	
	C	36.9	2.2	1677	
	D	32.8	2.1	1562	
	E	34.5	2.1	1643	
MEAN		**34.8**	**2.24**	**1558**	

[1] Values across four discrete sites; composite sample result was biased by one discrete sample with higher bulk sediment concentrations (above ambient lake conditions) of total PCBs (CLA-1-5, 1450 µg/kg).

TABLE B12. Results of standard 28-day *Lumbriculus variegatus* bioaccumulation experiments on Lake Erie sediments offshore of Cleveland (RTI 2014b).

Area	Replicate (R) or Discrete Site (D)	Tissue Measurement			Total PCB Concentration in Sediment (µg/kg-sediment)
		Total PCBs (µg/kg-tissue)	Lipid (%)	Lipid-normalized Total PCBs (µg/kg-lipid)	
CLA-1	R-A	650	4.1	15854	
	R-B	690	3.1	22258	
	R-C	668	3.2	20875	
	R-D	681	3.1	21968	
	R-E	721	4.2	17167	
MEAN		**682**	**3.54**	**19624**	**1240 (composite)**
CLA-1	D-1	269	2.4	11208	236
	D-2	120	2.7	4444	116
	D-3	285	3	9500	169
	D-4	107	2.4	4458	104
	D-5				1450*
MEAN		**195**	**2.63**	**7403**	**156**
CLA-14	D-1	91.6	3	3053	51.8
	D-2	145	2.3	6304	100
	D-3	163	2.3	7087	81.8
	D-4				156
	D-5	343	4	8575	291
MEAN		**186**	**2.90**	**6255**	**136**
CLA-4	R-A	35.6	2.5	1424	
	R-B	34.1	2.3	1483	
	R-C	36.9	2.2	1677	
	R-D	32.8	2.1	1562	
	R-E	34.5	2.1	1643	
MEAN		**34.8**	**2.24**	**1558**	**117 (composite)**
CLA-4	D-1	34.9	2.4	1454	109
	D-2	32.6	1.9	1716	74.6
	D-3	58.7	2.6	2258	102
	D-4	41.1	2.2	1868	77
	D-5	33.9	2.2	1541	89.2
MEAN		**40.2**	**2.26**	**1767**	**90.4**
CLA-7	R-A	37.3	2.5	1492	
	R-B	32.3	1.9	1700	
	R-C	33.1	2.3	1439	
	R-D	37.5	2.1	1786	
	R-E	34.6	1.9	1821	
MEAN		**35.0**	**2.14**	**1648**	**110 (composite)**
CLA-7	D-1	32.1	2	1605	103
	D-2	32.1	1.9	1689	123
	D-3	34.7	2	1735	109
	D-4	40.6	2.1	1933	131
	D-5	35.6	2	1780	121
MEAN		**35.0**	**2.00**	**1749**	**117**
CLAM	D-1	53.5	2.3	2326	136
	D-2	92.7	2.1	4414	262
	D-3	23.0	1.9	1211	10.9
	D-4	49.3	2	2465	109
	D-5	56.3	2.2	2559	155
MEAN		**55.0**	**2.10**	**2595**	**135**
CHLE	D-1	13.7	1.1	1245	28.6
	D2				105
	D-3	3151	1.2	262583*	5880*
	D-4				57.7
	D-6				38.6
	D-7				27.7
	D-10				400
	D-11	29.4	1	2940	9.36
	D-12	20.7	1	2070	101
	D-13	21.0	1.1	1909	15.8
	D-14				38.4
	D-16				968*
	D-19	19.3	0.9	2144	100
	D-20	19.7	1	1970	92
	D-21	20.1	1	2010	111
	D-22				117
	D-23				109
	D-24	40.6	1.1	3691	60.2
	D-25				152
MEAN		**371**	**1.04**	**2247**	**68**

*Value not included in mean.

TABLE B13: Bulk grain size distribution on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2015)

PARTICLE SIZE (%)	UPPER RIVER CHANNEL																							
	DMMU-1								DMMU-2a								DMMU-2b							
	CH-1	CH-2	CH-3	CH-3 CORE	CH-4	CH-5	CH-5 CORE	DMMU-1 COMP	CH-6	CH-7	CH-7 CORE	CH-8	CH-9	CH-9 CORE	CH-10	DMMU-2a COMP	CH-11	CH-12	CH-12 CORE	CH-13	CH-14	CH-15	CH-15 CORE	DMMU-2b COMP
CLAY	14	3.6	14	4.4	9.7	14	9.3	6.4	17	13	10	14	24	16	20	13	17	21	18	19	16	13	14	5.1
SILT	57	72	52	60	59	55	56	66	56	65	59	62	52	51	58	67	54	54	56	53	60	68	66	69
FINE SAND	19	16	18	13	22	16	25	12	11	11	18	8.1	5.9	8.3	6.5	9.7	8.2	3.7	5.7	4.6	5	5	4.6	5
MEDIUM SAND	9.1	6.7	6.6	13	5	7.8	4.6	8.1	8	5.3	5.7	6.8	7.8	6.6	7.4	6.1	12	7.4	6.3	9.4	8.4	7	5.1	6.4
COARSE SAND	0.9	1.7	7.6	7.8	3.9	6	4.6	5.1	7.7	5.9	6.2	9.2	9.6	17	6.7	4.2	8.2	13	14	14	9.9	6.8	9.3	14
FINE GRAVEL	0.1	0.1	1	2	0.3	0.9	0.7	1.8	0.3	0.2	0.4	0.4	1	1.3	0.4	0.1	0.7	0.3	0.7	0.8	0.5	0.5	0.3	0.9
COARSE GRAVEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL SILT/CLAY	**71**	**76**	**64**	**64**	**69**	**65**	**72**	**72**	**73**	**69**	**76**	**76**	**67**	**78**	**78**	**80**	**71**	**74**	**72**	**72**	**76**	**80**	**74**	**74**
TOTAL SAND/GRAVEL	**29**	**25**	**36**	**36**	**31**	**35**	**27**	**27**	**27**	**30**	**25**	**25**	**33**	**21**	**21**	**20**	**29**	**27**	**29**	**29**	**24**	**19**	**26**	**26**

PARTICLE SIZE (%)	LAKE AREA											
	CLA-1						CLA-4					
	CLA1-1	CLA1-2	CLA1-3	CLA1-4	CLA1-5	CLA1 COMP	CLA4-1	CLA4-2	CLA4-3	CLA4-4	CLA4-5	CLA4 COMP
CLAY	6.7	15	13	7.1	10	6.5	17	7.1	44	15	16	16
SILT	40	7.8	14	16	11	23	8.7	16	0	5	11	8.5
FINE SAND	16	2.9	5.9	5.1	7.3	6.2	2.6	2.1	4.7	3.1	4.6	3
MEDIUM SAND	12	13	20	24	26	17	2.9	1.1	13	9.5	13	13
COARSE SAND	22	42	30	24	24	31	40	44	32	36	39	37
FINE GRAVEL	3.6	19	17	24	22	16	28	30	11	31	17	23
COARSE GRAVEL	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL SILT/CLAY	**47**	**23**	**27**	**23**	**21**	**30**	**26**	**23**	**44**	**20**	**27**	**25**
TOTAL SAND/GRAVEL	**54**	**77**	**73**	**77**	**79**	**70**	**74**	**77**	**61**	**80**	**74**	**76**

TABLE B14: Bulk inorganics data on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2015)

PARAMETER (mg/kg)	UPPER RIVER CHANNEL																	
	DMMU-1						DMMU-2a						DMMU-2b					
	CH-1	CH-2	CH-3	CH-4	CH-5	DMMU-1 COMP	CH-6	CH-7	CH-8	CH-9	CH-10	DMMU-2a COMP	CH-11	CH-12	CH-13	CH-14	CH-15	DMMU-2b COMP
CYANIDE	0.65 U[1]	0.63 U	0.78	0.54	0.66	0.6	1.2	0.68	0.7	0.79	0.73	0.54	0.87	0.61	0.75	0.91 U	0.76 U	0.61
NITROGEN, AMMONIA	140	32	150	140	200	93	340	260	170	200	200	240	340	210	290	380	220	250
NITROGEN, TOTAL KJELDAHL (TKN)	350	260	1,800	1,500	1,900	410	2,000	1,600	1,400	2,300	1,900	1,800	2,200	860	960	1,100	1,200	1,500
PHOSPHORUS, TOTAL (AS P)	50	54	170	180	210	170	240	220	170	170	190	220	190	190	190	190	250	210
TOTAL ORGANIC CARBON	4,600	1,900	5,900	6,600	29,000	12,000	22,000	20,000	16,000	23,000	21,000	20,000	20,000	20,000	19,000	18,000	18,000	20,000
PERCENT MOISTURE	25	24	48	35	46	32	46	42	39	47	44	43	45	43	44	45	44	44

PARAMETER (mg/kg)	LAKE AREA											
	CLA-1						CLA-4					
	CLA1-1	CLA1-2	CLA1-3	CLA1-4	CLA1-5	CLA1 COMP	CLA4-1	CLA4-2	CLA4-3	CLA4-4	CLA4-5	CLA4 COMP
CYANIDE	1.6 U	1.9 U	1.8 U	1.8 U	1.9 U	2 U	1.9 U	1.6 U	1.8 U	1.6 U	1.8 U	1.6 U
NITROGEN, AMMONIA	250	420	210	290	340	300	3200	180	330	250	280	250
NITROGEN, TOTAL KJELDAHL (TKN)	2,500	3,700	2,900	4,400	5,400	3,200	2,600	3,000	52,000	840	2,400	3,100
PHOSPHORUS, TOTAL (AS P)	290	420	440	430	440	450	200	310	290	190	260	360
TOTAL OIL & GREASE	1,800	450	410 U	370 U	410 U	390 U	360 U	380 U	380 U	460	350 U	430
TOTAL ORGANIC CARBON	39,000	32,000	32,000	29,000	24,000	33,000	28,000	28,000	30,000	30,000	28,000	29,000
PERCENT MOISTURE	68	77	76	73	76	75	73	74	74	72	72	73

TABLE B15: Bulk metals data on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2015)

METAL (mg/kg)	UPPER RIVER CHANNEL																	
	DMMU-1						DMMU-2a						DMMU-2b					
	CH-1	CH-2	CH-3	CH-4	CH-5	DMMU-1 COMP	CH-6	CH-7	CH-8	CH-9	CH-10	DMMU-2a COMP	CH-11	CH-12	CH-13	CH-14	CH-15	DMMU-2b COMP
ALUMINUM	4,900	3,400	12,000	12,000	11,000	8,900	15,000	12,000	12,000	15,000	15,000	14,000	15,000	14,000	15,000	15,000	16,000	16,000
ANTIMONY	0.98	0.96	1.8	1.1	1.3	1.4	1.6	1.5	1.6	1.8	1.5	1.7	2.2	1	1.8	1.8	2	1.5
ARSENIC	10	6.1	18	14	17	13	19	18	18	21	21	18	20	20	19	20	20	21
BARIUM	25	18	76	72	67	49	94	71	66	83	78	76	88	75	83	81	84	81
BERYLLIUM	0.05 U[1]	0.044 U	0.069 U	0.049 U	0.063 U	0.062 U	0.064 U	0.061 U	0.057 U	0.06 U	0.067 U	0.061 U	0.062 U	0.051 U	0.069 U	0.058 U	0.071 U	0.058 U
CADMIUM	0.078	0.044 U	0.42	0.2	0.37	0.17	0.32	0.28	0.43	0.34	0.19	0.22	0.29	0.14	0.18	0.9	0.46	0.26
CALCIUM	7,200	4,200	11,000	11,000	11,000	11,000	17,000	12,000	12,000	14,000	13,000	13,000	16,000	12,000	13,000	12,000	14,000	15,000
CHROMIUM, TOTAL	18	6.3	19	17	18	13	22	18	17	22	20	20	24	19	22	24	22	23
COBALT	5.6	4.1	10	9.3	9.9	7.6	11	10	10	12	12	11	12	12	12	11	12	12
COPPER	14	13	39	30	37	28	43	37	34	43	36	39	41	34	37	39	41	40
IRON	18,000	19,000	30,000	26,000	29,000	23,000	34,000	32,000	32,000	37,000	34,000	33,000	34,000	31,000	31,000	36,000	42,000	38,000
LEAD	12	14	32	22	31	21	35	31	28	33	29	30	33	24	28	33	37	32
MAGNESIUM	3,100	1,800	5,200	5,900	5,200	3,800	8,400	6,800	6,800	8,100	7,800	7,200	8,500	7,100	7,400	7,800	8,700	8,900
MANGANESE	390	210	830	700	650	500	830	710	720	860	810	760	820	670	690	860	1,000	820
MERCURY	0.013	0.007	0.11	0.11	0.1	0.054	0.099	0.091	0.069	0.07	0.078	0.064	0.076	0.07	0.065	0.11	0.12	0.077
NICKEL	24	16	29	28	28	26	37	29	29	35	33	32	38	32	36	33	33	35
POTASSIUM	770	520	1,900	2,200	1,900	1,300	2,500	1,900	1,800	2,500	2,500	2,300	2,900	2,200	2,900	2,400	2,300	2,600
SELENIUM	1.5 U	1.3 U	2.1 U	1.5 U	1.9 U	1.9 U	1.9 U	1.8 U	1.7 U	1.8 U	2 U	1.8 U	1.9 U	1.5 U	2.1 U	1.7 U	2.1 U	1.7 U
SILVER	0.25 U	0.22 U	0.34 U	0.25 U	0.32 U	0.31 U	0.32 U	0.31 U	0.29 U	0.3 U	0.33 U	0.3 U	0.31 U	0.25 U	0.34 U	0.29 U	0.36 U	0.29 U
SODIUM	100	88	240	220	220	160	280	240	240	260	250	240	310	270	280	280	260	280
THALLIUM	0.99 U	0.87 U	1.4 U	0.98 U	1.3 U	1.2 U	1.3 U	1.2 U	1.1 U	1.2 U	1.3 U	1.2 U	1.2 U	1 U	1.4 U	1.2 U	1.4 U	1.2 U
VANADIUM	17	8.7	25	25	25	18	29	25	24	30	29	29	33	29	32	29	28	31
ZINC	84	82	160	120	160	120	180	150	140	170	140	150	170	130	140	190	180	170

METAL (mg/kg)	LAKE AREA											
	CLA-1						CLA-4					
	CLA1-1	CLA1-2	CLA1-3	CLA1-4	CLA1-5	CLA1 COMP	CLA4-1	CLA4-2	CLA4-3	CLA4-4	CLA4-5	CLA4 COMP
ALUMINUM	25,000	34,000	30,000	32,000	33,000	31,000	32,000	33,000	34,000	28,000	27,000	27,000
ANTIMONY	3.7	1.6	2.3	3.8	3.5	2.4	1.8	2.7	1.8	1.5	2.7	1.3
ARSENIC	13	7.5	13	9.2	9.8	13	5.5	7.6	7.8	8.4	7.8	7.1
BARIUM	120	140	150	150	150	150	140	150	150	130	130	140
BERYLLIUM	0.14 U	0.087	0.077	0.16 U	0.17 U	0.13 U	0.69	0.63	0.53	0.45	0.46	0.45
CADMIUM	1.7	1.5	2.1	1.9	1.9	2.2	1.5	1.7	1.7	1.5	1.4	1.6
CALCIUM	890	1,100	1,200	1,300	1,200	13,000	15,000	16,000	14,000	13,000	13,000	14,000
CHROMIUM, TOTAL	53	55	60	59	60	61	56	61	58	53	49	54
COBALT	14	16	17	18	17	17	16	17	17	15	14	16
COPPER	73	50	62	62	61	65	50	55	53	49	46	51
IRON	80,000	43,000	49,000	48,000	47,000	46,000	44,000	46,000	45,000	41,000	40,000	38,000
LEAD	62	53	66	62	63	66	46	52	51	45	41	47
MAGNESIUM	900	1,300	15,000	1,300	1,300	16,000	16,000	17,000	14,000	15,000	14,000	14,000
MANGANESE	660	600	580	650	560	640	560	580	610	530	690	570
MERCURY	0.26	0.33	0.4	0.33	0.29	0.31	0.35	0.28	0.28	0.75	0.25	0.27
NICKEL	56	64	71	69	68	70	61	67	65	60	56	63
POTASSIUM	5,000	7,100	6,900	6,300	7,100	6,400	6,900	6,900	7,300	6,500	5,300	4,900
SELENIUM	4.3 U	4.9 U	4.2 U	4.8 U	5 U	3.9 U	4.2 U	4.5 U	5 U	3.9 U	3.4 U	3.6 U
SILVER	0.72 U	0.81 U	0.69 U	0.8 U	0.83 U	0.65 U	0.71 U	0.75 U	0.84 U	0.65 U	0.57 U	0.6 U
SODIUM	170	240	250	220	250	250	260	280	240	230	220	240
THALLIUM	2.9 U	3.2 U	2.8 U	3.2 U	3.3 U	2.6 U	2.8 U	3 U	3.3 U	2.6 U	2.3 U	2.4 U
VANADIUM	61	77	73	74	79	78	71	78	74	67	63	66
ZINC	250	220	270	270	260	280	200	220	210	190	180	200

[1] Not detected at the specified detection limit

TABLE B16: AVS/SEM data on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2015)

AVS/SEM (µmol/g)	**UPPER RIVER CHANNEL**			**LAKE AREA**						
	DMMU-1 COMP	**DMMU-2a COMP**	**DMMU-2b COMP**	**CLA1-1**	**CLA1-2**	**CLA1-3**	**CLA1-4**	**CLA1-5**	**CLA1-COMP**	**CLA4-COMP**
CADMIUM	0.0013	0.00232	0.00234	0.01	0.003	0.004	0.004	0.004	0.00382	0.00316
COPPER	0.116	0.151	0.148	0.186	0.087	0.075	0.098	0.081	0.0895	0.0874
LEAD	0.0504	0.0591	0.0582	0.139	0.041	0.062	0.059	0.061	0.056	0.0509
MERCURY	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
NICKEL	0.0696	0.107	0.0816	0.122	0.069	0.092	0.211	0.089	0.207	0.0891
ZINC	0.513	0.579	0.595	1.76	0.336	0.516	0.541	0.53	0.479	0.397
∑SEM	0.750	0.898	0.885	2.217	0.536	0.749	0.913	0.765	0.835	0.628
AVS	**0.63U**	**0.63U**	**0.63U**	4.424	1.069	1.494	1.822	1.526	5.1	3.8
∑SEM-AVS[2,3]	**0.75**	**0.898**	**0.885**	-2.207	-0.533	-0.745	-0.909	-0.761	-4.265	-3.172
Foc	0.012	0.02	0.02	0.039	0.032	0.032	0.029	0.024	0.033	0.029
(∑SEM-AVS)/Foc[4]	**63**	**45**	**44**							

[1] Not detected at the specified detection limit

[2] Sediment metal concentrations are protective of benthic organisms if ∑SEM-AVS ≤ 0 µmol/g

[3] Toxicity is unlikely when ∑SEM-AVS < 1.7 µmol/g

[4] Toxicity is unlikely when (∑SEM-AVS)/Foc < 130 µmol/g-oc

TABLE B17: Bulk PCB data on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2015)

AROCLOR (µg/kg)	UPPER RIVER CHANNEL																	
	DMMU-1						DMMU-2a						DMMU-2b					
	CH-1	CH-2	CH-3	CH-4	CH-5	DMMU-1 COMP	CH-6	CH-7	CH-8	CH-9	CH-10	DMMU-2a COMP	CH-11	CH-12	CH-13	CH-14	CH-15	DMMU-2b COMP
AROCLOR-1016	8.8 U[1]	8.7 U	13 U	10 U	12 U	9.5 U	12 U	11 U	11 U	12 U	12 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U
AROCLOR-1221	8.8 U	8.7 U	13 U	10 U	12 U	9.5 U	12 U	11 U	11 U	12 U	12 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U
AROCLOR-1232	8.8 U	8.7 U	13 U	10 U	12 U	9.5 U	12 U	11 U	11 U	12 U	12 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U
AROCLOR-1242	**20**	**18**	**23**	**21**	12 U	**58**	12 U	**15**	**17**	12 U	12 U	12 U	**30**	11 U	12 U	**29**	**13**	**20**
AROCLOR-1248	8.8 U	8.7 U	13 U	10 U	12 U	9.5 U	12 U	11 U	11 U	12 U	12 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U
AROCLOR-1254	8.8 U	8.7 U	13 U	10 U	12 U	9.5 U	12 U	11 U	11 U	12 U	12 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U
AROCLOR-1260	**8.9**	**4.2**	**27**	**15**	**18**	**15**	**31**	**17**	**31**	**27**	**12**	**36**	**32**	**19**	**13**	**29**	**24**	**53**
AROCLOR-1262	8.8 U	8.7 U	13 U	10 U	12 U	9.5 U	12 U	11 U	11 U	12 U	12 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U
TOTAL PCBs	**29**	**23**	**50**	**36**	**18**	**73**	**31**	**32**	**48**	**27**	**12**	**36**	**62**	**19**	**13**	**58**	**37**	**73**
TOC (%)	0.46	0.19	0.59	0.66	2.9	1.2	2.2	2	1.6	2.3	2.1	2	2	2	1.9	1.8	1.8	2
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	**6304**	**12105**	**8475**	**5455**	**621**	**6083**	**1409**	**1600**	**3000**	**1174**	**571**	**1800**	**3100**	**950**	**684**	**3222**	**2056**	**3650**

AROCLOR (µg/kg)	LAKE AREA											
	CLA-1						CLA-4					
	CLA1-1	CLA1-2	CLA1-3	CLA1-4	CLA1-5	CLA1 COMP	CLA4-1	CLA4-2	CLA4-3	CLA4-4	CLA4-5	CLA4 COMP
AROCLOR-1016	20 U	28 U	28 U	24 U	27 U	26 U	25 U	25 U	26 U	24 U	23 U	24 U
AROCLOR-1221	20 U	28 U	28 U	24 U	27 U	26 U	25 U	25 U	26 U	24 U	23 U	24 U
AROCLOR-1232	20 U	28 U	28 U	24 U	27 U	26 U	25 U	25 U	26 U	24 U	23 U	24 U
AROCLOR-1242	20 U	28 U	28 U	24 U	27 U	26 U	25 U	25 U	26 U	24 U	23 U	24 U
AROCLOR-1248	20 U	28 U	28 U	24 U	27 U	26 U	25 U	25 U	26 U	24 U	23 U	24 U
AROCLOR-1254	**89**	28 U	28 U	**61**	**110**	**150**	**52**	**46**	**42**	**50**	**51**	**41**
AROCLOR-1260	20 U	28 U	28 U	24 U	27 U	26 U	25 U	25 U	26 U	24 U	23 U	24 U
AROCLOR-1262	20 U	28 U	28 U	24 U	27 U	26 U	25 U	25 U	26 U	24 U	23 U	24 U
TOTAL PCBs	**89**	28 U	28 U	**61**	**110**	**150**	**52**	**46**	**42**	**50**	**51**	**41**
TOC (%)	3.9	3.2	3.2	2.9	2.4	3.3	2.8	2.8	3	3	2.8	2.9
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	**2282**	**875**	**875**	**2103**	**4583**	**4545**	**1857**	**1643**	**1400**	**1667**	**1821**	**1414**

TABLE B18: PCB congener distributions and total PCB congener sums for Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2015)

PCB CONGENER (ng/g)	UPPER RIVER CHANNEL			LAKE AREA	
	DMMU-1 COMP	DMMU-2a COMP	DMMU-2b COMP	CLA1 COMP	CLA4 COMP
2,2',3,3',4,4',5,5',6,6'-DECACHLOROBIPHENYL	0.231	0.469	0.463	0.94	0.341
2,2',3,3',4,4',5,5',6-NONACHLOROBIPHENYL	0.276	0.647	0.581	0.66	0.289
2,2',3,3',4,4',5,5'-OCTACHLOROBIPHENYL	0.853	2.04	1.92	0.904	0.579
2,2',3,3',4,4',5,6,6'-NONACHLOROBIPHENYL	0.04	0.093	0.074 U[1]	0.121	0.063
2,2',3,3',4,4',5',6-OCTACHLOROBIPHENYL	0.502	1.16	1.07	0.471	0.312
2,2',3,3',4,4',5,6-OCTACHLOROBIPHENYL	0.368	0.905	0.8	0.349	0.239
2,2',3,3',4,4',5-HEPTACHLOROBIPHENYL	1.43	3.27	3.27	1.46	1.05
2,2',3,3',4,4',6,6'-OCTACHLOROBIPHENYL	0.054	0.094	0.063	0.034	0.023
2,2',3,3',4,4',6-HpCB & 2,2',3,3',4,5,6-HpCB (PCB171&PCB173)	0.464	1.08	1.06	0.447	0.303
2,2',3,3',4,4'-HxCB1 & 2,3,4,4',5,6-HxCB (PCB128&PCB166)	0.494	0.934	0.845	1.15	0.756
2,2',3,3',4,5,5',6,6'-NONACHLOROBIPHENYL	0.073	0.175	0.15	0.249	0.101
2,2',3,3',4,5,5',6-OcCB & 2,2',3,3',4,5,5',6'-OcCB (PCB198&PCB199)	1.04	2.45	2.27	1.26	0.753
2,2',3,3',4,5,5'-HEPTACHLOROBIPHENYL	0.273	0.598	0.616	0.303	0.221
2,2',3,3',4,5,6,6'-OCTACHLOROBIPHENYL	0.089	0.306	0.294	0.122	0.063
2,2,3,3,4,5,6,6-OCTACHLOROBIPHENYL	0.126	0.304	0.28	0.137	0.079
2,2',3,3',4,5',6'-HEPTACHLOROBIPHENYL	0.952	2.24	2.2	0.973	0.656
2,2',3,3',4,5',6-HEPTACHLOROBIPHENYL	0.102	0.173	0.161	0.065	0.052
2,2',3,3',4,5,6'-HEPTACHLOROBIPHENYL	1.87	4.44	4.37	1.53	1.01
2,2',3,3',4,5'-HEXACHLOROBIPHENYL	0.198	0.384	0.348	0.567	0.394
2,2',3,3',4,5-HxCB & 2,2',3,4,4',5'-HxCB1 & 2,3,3',4',5,6-HxCB (PCB129&PCB138&PCB163)	4.78	9.61	9.47	7.86	5.31
2,2',3,3',4,6,6'-HEPTACHLOROBIPHENYL	0.237	0.548	0.554	0.17	0.109
2,2',3,3',4,6'-HEXACHLOROBIPHENYL	1.57	2.97	2.91	2.31	1.46
2,2',3,3',4,6-HEXACHLOROBIPHENYL	0.049	0.096	0.082	0.087	0.047
2,2',3,3',4-PENTACHLOROBIPHENYL	0.375	0.487	0.466	0.849	0.597
2,2',3,3',5,5',6,6'-OCTACHLOROBIPHENYL	0.151	0.363	0.33	0.225	0.11
2,2',3,3',5,5',6-HEPTACHLOROBIPHENYL	0.338	0.819	0.826	0.348	0.223
2,2',3,3',5,5'-HEXACHLOROBIPHENYL	0.044	0.105	0.1	0.11 U	0.072
2,2',3,3',5,6,6'-HEPTACHLOROBIPHENYL	0.809	1.75	1.77	0.557	0.362
2,2',3,3',5,6-HxCB & 2,2',3,4,5,6'-HxCB (PCB134&PCB143)	0.202	0.401	0.356	0.311	0.17
2,2',3,3',5,6'-HxCB & 2,2',3,5,5',6-HxCB (PCB135&PCB151)	1.96	4.15	4.19	1.87	1.18
2,2',3,3',5-PeCB & 2,2',4,4',5-PeCB (PCB83&PCB99)	1.51	2.12	2.03	3.25	2.15
2,2',3,3',6,6'-HEXACHLOROBIPHENYL	0.7	1.33	1.32	0.559	0.318
2,2',3,3',6-PENTACHLOROBIPHENYL	0.867	0.983	0.969	1.37	0.851
2,2',3,3'-TeCB & 2,2',3,4-TeCB & 2,3',4',6-TeCB (PCB40&PCB41&PCB71)	1.67	1.62	1.8	1.54	1.07
2,2',3,4,4',5,5',6-OCTACHLOROBIPHENYL	0.6	1.47	1.39	0.728	0.397
2,2',3,4,4',5,5'-HpCB1 & 2,3,3',4',5,5',6-HpCB (PCB180&PCB193)	3.83	8.3	8.51	3.37	2.37
2,2',3,4,4',5,6,6'-OCTACHLOROBIPHENYL	0.002 U	0.005 U	0.006 U	0.004 U	0.001 U
2,2',3,4,4',5',6-HEPTACHLOROBIPHENYL	1.14	2.3	2.31	0.847	0.636
2,2',3,4,4',5,6'-HEPTACHLOROBIPHENYL	0.001 U	0.004 U	0.005 U	0.013	0.003 U
2,2',3,4,4',5,6-HEPTACHLOROBIPHENYL	0.011 U	0.007 U	0.009 U	0.017 U	0.004 U
2,2',3,4,4',5-HEXACHLOROBIPHENYL	0.13 U	0.233	0.16	0.257	0.225
2,2',3,4,4',6,6'-HEPTACHLOROBIPHENYL	0.001 U	0.003 U	0.004 U	0.004 U	0.002 U
2,2',3,4,4',6-HxCB & 2,2',3,4,4',6'-HxCB (PCB139&PCB140)	0.045	0.083	0.07	0.11	0.062
2,2',3,4,4'-PeCB & 2,3,4,5,6-PeCB & 2,3,4',5,6-PeCB (PCB85&PCB116&PCB117)	0.665	0.718	0.563	1.01	0.828
2,2',3,4',5,5',6-HEPTACHLOROBIPHENYL	2.02	5.04	5.2	2.03	1.3
2,2',3,4,5,5',6-HEPTACHLOROBIPHENYL	0.002 U	0.008 U	0.01 U	0.008 U	0.004 U
2,2',3,4',5,5'-HEXACHLOROBIPHENYL	0.551	1.11	1.1	1.09	0.773
2,2',3,4,5,5'-HEXACHLOROBIPHENYL	1.05	2.38	2.34	1.04	0.646
2,2',3,4',5,6,6'-HEPTACHLOROBIPHENYL	0.003	0.004 U	0.005 U	0.005 U	0.003
2,2',3,4,5,6,6'-HEPTACHLOROBIPHENYL	0.001 U	0.003 U	0.004 U	0.004 U	0 U
2,2',3,4',5,6'-HEXACHLOROBIPHENYL	0.001 U	0.004 U	0.003 U	0.009	0.006
2,2',3,4,5',6-HEXACHLOROBIPHENYL	0.184	0.549	0.543	0.226	0.088
2,2',3,4,5,6-HEXACHLOROBIPHENYL	0.002 U	0.006 U	0.007 U	0.009 U	0.001 U
2,2',3,4',5,6-HxCB & 2,2',3,4',5',6-HxCB (PCB147&PCB149)	4.25	8.45	8.38	4.67	3.04
2,2',3,4',5-PeCB & 2,2',4,5,5'-PeCB1 & 2,3,3',5',6-PeCB (PCB90&PCB101&PCB113)	3.19	4.9	4.88	5.32	3.51
2,2',3,4',6,6'-HEXACHLOROBIPHENYL	0.003	0.005 U	0.002 U	0.007 U	0.004 U
2,2',3,4,6,6'-HEXACHLOROBIPHENYL	0.001 U	0.002 U	0.002 U	0.003 U	0.001 U
2,2',3,4,6-PeCB & 2,2',3,4',6-PeCB (PCB88&PCB91)	0.524	0.593	0.595	0.758	0.506
2,2',3,4,6'-PENTACHLOROBIPHENYL	0.056	0.059	0.06	0.077	0.048
2,2',3,4'-TETRACHLOROBIPHENYL	1.12	1.08	1.19	0.98	0.758
2,2',3,5,5'-PENTACHLOROBIPHENYL	0.554	0.783	0.785	1.03	0.701
2,2',3,5,6,6'-HEXACHLOROBIPHENYL	0.002 U	0.003 U	0.002 U	0.003 U	0.002 U
2,2',3,5,6-PeCB & 2,2',3',4,6-PeCB & 2,2',4,4',6-PeCB & 2,2',4,5,6'-PeCB (PCB93&PCB98&PCB100&PCB102)	0.164	0.176	0.177	0.211	0.135
2,2',3,5,6'-PENTACHLOROBIPHENYL	0.023 U	0.024	0.026	0.026 U	0.015 U
2,2',3,5'-TeCB1 & 2,2',3,4'-TeCB & 2,3,5,6-TeCB (PCB44&PCB47&PCB65)	3.43	3.26	3.49	2.77	2.13
2,2',3,5-TETRACHLOROBIPHENYL	0.169	0.158	0.164	0.109	0.075
2,2',3,6,6'-PENTACHLOROBIPHENYL	0.035	0.031	0.033	0.028	0.014
2,2',3,6-TeCB & 2,2',4,6'-TeCB (PCB45&PCB51)	0.787	0.645	0.685	0.355	0.234
2,2',3,6'-TETRACHLOROBIPHENYL	0.222	0.171	0.191	0.14	0.09
2,2',3-TRICHLOROBIPHENYL	0.771	0.54	0.569	0.287	0.247
2,2',4,4',5,5'-HxCB1 & 2,3',4,4',5',6-HxCB (PCB153&PCB168)	4.14	8.8	8.8	5.55	3.74
2,2,4,4,5,6-HEXACHLOROBIPHENYL	0.011	0.032 U	0.02 U	0.059 U	0.04
2,2',4,4',6,6'-HEXACHLOROBIPHENYL	0.001 U	0.002 U	0.002 U	0.003 U	0.001 U
2,2',4,5',6-PENTACHLOROBIPHENYL	0.021	0.022	0.026	0.046	0.028
2,2',4,5'-TeCB & 2',3,3',4,5-PeCB (PCB49&PCB69)	2.14	2.17	2.37	1.83	1.38
2,2',4,5-TETRACHLOROBIPHENYL	0.504	0.451	0.514	0.424	0.282
2,2',4,6,6'-PENTACHLOROBIPHENYL	0.001 U	0.002 U	0.002 U	0.002 U	0.001 U
2,2',4,6-TeCB & 2,2',5,6'-TeCB (PCB50&PCB53)	0.591	0.495	0.541	0.326	0.202
2,2',4-TRICHLOROBIPHENYL	0.863	0.699	0.655	0.326	0.288
2,2',5,5'-TETRACHLOROBIPHENYL	3.46	3.36	3.6	3.29	2.27
2,2',5-TrCB1 & 2,4,6-TrCB (PCB18&PCB30)	1.44	1.08	1.16	0.684	0.509
2,2',6,6'-TETRACHLOROBIPHENYL	0.016	0.005 U	0.008 U	0.007 U	0.002
2,2',6-TRICHLOROBIPHENYL	0.353	0.253	0.257	0.061	0.045
2,2'-DICHLOROBIPHENYL	0.567	0.459	0.405	0.137	0.102
2,3,3',4,4',5,5',6-OCTACHLOROBIPHENYL	0.035	0.097	0.107	0.035 U	0.028
2,3,3',4,4',5,5'-HEPTACHLOROBIPHENYL	0.048	0.129	0.128	0.082	0.054
2,3,3',4,4',5',6-HEPTACHLOROBIPHENYL	0.058	0.135	0.141	0.054	0.03
2,3,3',4,4',5,6-HEPTACHLOROBIPHENYL	0.309	0.71	0.7	0.301	0.21
2,3,3',4,4',5-HxCB2 & 2,3,3',4,4',5'-HxCB2 (PCB156&PCB157)	0.365	0.793	0.703	0.839	0.573
2,3,3',4,4',6-HEXACHLOROBIPHENYL	0.377	0.779	0.757	0.578	0.383
2,3,3',4,4'-PENTACHLOROBIPHENYL	0.944	1.59	1.35	2.49	1.91
2,3,3',4,5,5',6-HEPTACHLOROBIPHENYL	0.002 U	0.006 U	0.008 U	0.006 U	0.003 U
2,3,3',4',5,5'-HEXACHLOROBIPHENYL	0.007 U	0.011 U	0.013	0.048	0.03
2,3,3',4,5,5'-HEXACHLOROBIPHENYL	0.065	0.004 U	0.005 U	0.054	0.037
2,3,3',4',5',6-HEXACHLOROBIPHENYL	0.313	0.652	0.668	0.502	0.315
2,3,3',4,5',6-HEXACHLOROBIPHENYL	0.001 U	0.004 U	0.005 U	0.006 U	0.001 U
2,3,3',4,5,6-HEXACHLOROBIPHENYL	0.001 U	0.004 U	0.005 U	0.007 U	0.001 U
2,3,3',4,5'-PeCB & 2',3,4,5,5'-PeCB (PCB108&PCB124)	0.082	0.136	0.122	0.23	0.161
2',3,3',4,5-PENTACHLOROBIPHENYL	0.034	0.059	0.051	0.092	0.065
2,3,3',4',5-PENTACHLOROBIPHENYL	0.135	0.234	0.22	0.465	0.368
2,3,3',4,5-PENTACHLOROBIPHENYL	0.001 U	0.003 U	0.004 U	0.006 U	0.001 U
2,3,3',4',6-PeCB & 2,3,4,4',6-PeCB (PCB110&PCB115)	3.81	6.1	6.11	9.22	5.76
2,3,3',4'-TETRACHLOROBIPHENYL	1.34	1.55	1.76	2.35	1.73
2,3,3',4-TETRACHLOROBIPHENYL	0.016	0.012 U	0.028 U	0.004 U	0.002 U
2,3,3',5,5',6-HEXACHLOROBIPHENYL	0.001 U	0.004 U	0.005 U	0.007 U	0.003 U
2,3,3',5,5'-PENTACHLOROBIPHENYL	0 U	0.003 U	0.004 U	0.005 U	0.004 U
2,3',3,5,6-PENTACHLOROBIPHENYL	2.86	3.91	3.94	3.45	2.09
2,3,3',5,6-PENTACHLOROBIPHENYL	0 U	0.003 U	0.004 U	0.003 U	0 U
2,3,3',5'-TETRACHLOROBIPHENYL	0.001 U	0.004 U	0.005 U	0.16	0.096
2,3,3',5-TETRACHLOROBIPHENYL	0.001 U	0.011	0.015	0.019	0.015
2,3,3',6-TeCB & 2,3,4,6-TeCB & 2,4,4',6-TeCB (PCB59&PCB62&PCB75)	0.328	0.315	0.323	0.313	0.236
2,3,3'-TrCB & 2,4,4'-TrCB1 (PCB20&PCB28)	3.13	3.28	3.62	2.79	2.46
2,3',4,4',5,5'-HEXACHLOROBIPHENYL	0.128	0.289	0.228	0.345	0.239
2,3',4,4',5'-PENTACHLOROBIPHENYL	0.046	0.075	0.039	0.094	0.049
2,3',4,4',5-PENTACHLOROBIPHENYL	2.03	3.29	3.14	5.73	4
2,3,4,4',5-PENTACHLOROBIPHENYL	0.043	0.091	0.07	0.109	0.077
2,3',4,4'-TETRACHLOROBIPHENYL	2.48	2.98	3.27	4.55	3.33
2,3,4,4'-TETRACHLOROBIPHENYL	0.56	0.659	0.787	0.886	0.705
2,3',4,5,5'-PENTACHLOROBIPHENYL	0.003 U	0.008	0.006 U	0.035	0.024
2,3',4,5',6-PENTACHLOROBIPHENYL	0 U	0.003 U	0.004 U	0.004 U	0 U
2,3,4,5-TeCB & 2,3',4',5-TeCB & 2,4,4',5-TeCB & 2',3,4',5-TeCB (PCB61&PCB70&PCB74&PCB76)	3.81	4.4	4.9	7.01	5.06
2,3',4,5'-TETRACHLOROBIPHENYL	0.014	0.014	0.018	0.042	0.029
2,3',4,5-TETRACHLOROBIPHENYL	0.071	0.084	0.096	0.112	0.083
2,3,4',5-TETRACHLOROBIPHENYL	0.089	0.104	0.107	0.138	0.102
2,3,4',6-TETRACHLOROBIPHENYL	1.69	1.68	1.82	1.67	1.28
2,3,4-TrCB & 2',3,4-TrCB (PCB21&PCB33)	0.683	0.595	0.722	0.841	0.581
2,3',4-TRICHLOROBIPHENYL	0.317	0.324	0.333	0.259	0.249
2,3,4'-TRICHLOROBIPHENYL	0.928	0.877	1.07	0.662	0.571
2,3',5,5'-TETRACHLOROBIPHENYL	0.022	0.024	0.028	0.059	0.04
2,3',5',6-TETRACHLOROBIPHENYL	0.001 U	0.002 U	0.003 U	0.003 U	0 U
2,3',5-TrCB & 2,4,5-TrCB (PCB26&PCB29)	0.547	0.583	0.578	0.412	0.374
2',3,5-TRICHLOROBIPHENYL	0.012	0.011 U	0.013 U	0.018	0.001 U
2,3,5-TRICHLOROBIPHENYL	0.002 U	0.006 U	0.008 U	0.003 U	0.001 U
2,3',6-TRICHLOROBIPHENYL	0.218	0.18	0.178	0.084	0.072
2,3,6-TRICHLOROBIPHENYL	0.001 U	0.008 U	0.011 U	0.009 U	0.002 U
2,3'-DICHLOROBIPHENYL	0.263	0.188	0.197	0.16 U	0.099
2,3-DICHLOROBIPHENYL	0.031 U	0.006 U	0.008 U	0.025 U	0.006 U
2,4',5-TRICHLOROBIPHENYL	2.13	2.13	2.33	1.79	1.57
2,4',6-TRICHLOROBIPHENYL	0.829	0.723	0.757	0.238	0.203
2,4'-DICHLOROBIPHENYL	0.493	0.54	0.566	0.43	0.225
2,4-DICHLOROBIPHENYL	0.04	0.033 U	0.032	0.03 U	0.018 U
2,5-DICHLOROBIPHENYL	0.055	0.038	0.037	0.033 U	0.019 U
2,6-DICHLOROBIPHENYL	0.03 U	0.022	0.013 U	0.015 U	0.006 U
2-CHLOROBIPHENYL	0.073	0.057	0.064	0.044	0.029
3,3',4,4',5,5'-HEXACHLOROBIPHENYL	0.002 U	0.005 U	0.006 U	0.005 U	0.001 U
3,3',4,4',5-PENTACHLOROBIPHENYL	0.008 U	0.019	0.011 U	0.051 U	0.045
3,3',4,4'-TETRACHLOROBIPHENYL	0.268	0.369	0.411	0.837	0.645
3,3',4,5,5'-PENTACHLOROBIPHENYL	0.002 U	0.006	0.005	0.005 U	0.005
3,3',4,5'-TETRACHLOROBIPHENYL	0.024	0.028	0.03	0.087	0.054
3,3',4,5-TETRACHLOROBIPHENYL	0.001 U	0.003 U	0.004 U	0.003 U	0.002 U
3,3',4-TRICHLOROBIPHENYL	0.029	0.036	0.039	0.079	0.065
3,3',5,5'-TETRACHLOROBIPHENYL	0.001 U	0.003 U	0.004 U	0.003 U	0.002 U
3,3',5-TRICHLOROBIPHENYL	0 U	0.005 U	0.006 U	0.002 U	0.001 U
3,3'-DICHLOROBIPHENYL	0.113	0.132	0.169	0.362	0.454
3,4,4',5-TETRACHLOROBIPHENYL	0.008 U	0.012 U	0.013 U	0.014	0.013
3,4,4'-TRICHLOROBIPHENYL	0.884	1.1	1.23	1.48	1.2
3,4',5-TRICHLOROBIPHENYL	0.014	0.012 U	0.014	0.013 U	0.014
3,4,5-TRICHLOROBIPHENYL	0.002 U	0.006 U	0.007 U	0.002 U	0.002 U
3,4-DiCB & 3,4-DiCB (PCB12&PCB13)	0.113	0.098	0.119	0.22	0.155
3,5-DICHLOROBIPHENYL	0.004 U	0.005 U	0.007 U	0.022 U	0.006 U
3-CHLOROBIPHENYL	0.005 U	0.002 U	0.008 U	0.099	0.062
4,4'-DICHLOROBIPHENYL	0.672	0.652	0.705	0.959	0.792
4-CHLOROBIPHENYL	0.025	0.019	0.028	0.096	0.039
PentaCB-PCB86 & PCB87 & PCB97 & PCB109 & PCB119 & PCB125	1.94	2.62	2.52	3.62	2.54
TOTAL PCBs	**100**	**155**	**157**	**131**	**90.6**
TOC (%)	**1.2**	**2**	**2**	**3.3**	**2.9**
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	**8333**	**7750**	**7850**	**3970**	**3124**

TABLE B19: Bulk pesticides data on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2015)

PESTICIDE (µg/kg)	UPPER RIVER CHANNEL																	
	DMMU-1						DMMU-2a						DMMU-2b					
	CH-1	CH-2	CH-3	CH-4	CH-5	DMMU-1 COMP	CH-6	CH-7	CH-8	CH-9	CH-10	DMMU-2a COMP	CH-11	CH-12	CH-13	CH-14	CH-15	DMMU-2b COMP
ALDRIN	4.4 U[1]	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
ALPHA ENDOSULFAN	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
ALPHA-CHLORDANE	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
BETA ENDOSULFAN	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
CHLORDANE	88 U	87 U	130 U	100 U	120 U	95 U	120 U	110 U	110 U	120 U	120 U	120 U	120 U	110 U	120 U	120 U	120 U	120 U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
DIELDRIN	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
ENDOSULFAN SULFATE	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
ENDRIN	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
ENDRIN ALDEHYDE	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
ENDRIN KETONE	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
GAMMA BHC (LINDANE)	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
GAMMA-CHLORDANE	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
HEPTACHLOR	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
HEPTACHLOR EPOXIDE	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
METHOXYCHLOR	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
TOXAPHENE	88 U	87 U	130 U	100 U	120 U	95 U	120 U	110 U	110 U	120 U	120 U	120 U	120 U	110 U	120 U	120 U	120 U	120 U
DDD (DICHLORODIPHENYLDICHLORETHANE)	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	**2.9**	4.4 U	6.3 U	**16**	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	**4**	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
∑DDT	**6.9**	**ND**	**ND**	**16**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
TOC (%)	**0.46**			**0.66**														
TOC-NORMALIZED ∑DDT CONCENTRATIONS (µg/kg-TOC)	**1500**			**2424**														

PESTICIDE (µg/kg)	LAKE AREA											
	CLA-1						CLA-4					
	CLA1-1	CLA1-2	CLA1-3	CLA1-4	CLA1-5	CLA1 COMP	CLA4-1	CLA4-2	CLA4-3	CLA4-4	CLA4-5	CLA4 COMP
ALDRIN	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
ALPHA ENDOSULFAN	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
ALPHA-CHLORDANE	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
BETA ENDOSULFAN	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
CHLORDANE	40 U	56 U	55 U	49 U	54 U	51 U	250 U	250 U	260 U	240 U	230 U	240 U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
DIELDRIN	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
ENDOSULFAN SULFATE	3.5	2.8 U	2.8 U	1.8	2.5	3.4	12 U	13 U	13 U	12 U	12 U	12 U
ENDRIN	2 U	2.8 U	2.8 U	2.2	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
ENDRIN ALDEHYDE	2 U	2.8 U	2.8 U	1.8	2.7 U	3.4	20	13 U	13 U	12 U	12 U	12 U
ENDRIN KETONE	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
GAMMA BHC (LINDANE)	2 U	2.8 U	2.8 U	1.7	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
GAMMA-CHLORDANE	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
HEPTACHLOR	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
HEPTACHLOR EPOXIDE	2 U	2.8 U	2.8 U	1.5	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
METHOXYCHLOR	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
TOXAPHENE	40 U	56 U	55 U	49 U	54 U	51 U	**R**	**R**	**R**	**R**	**R**	**R**
DDD (DICHLORODIPHENYLDICHLORETHANE)	**5.1**	**4**	2.8 U	**3**	**4.7**	**4.5**	12 U	13 U	13 U	12 U	**12**	12 U
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	2 U	**4.3**	2.8 U	**4.9**	**7.6**	**5.5**	12 U	13 U	**27**	12 U	**18**	12 U
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	2 U	2.8 U	2.8 U	**7.9**	2.7 U	2.6 U	12 U	13 U	13 U	12 U	**19**	12 U
∑DDT	**5.1**	**8.3**	**ND**	**15.8**	**12.3**	**10**	**ND**	**ND**	**27**	**ND**	**49**	**ND**
TOC (%)	**3.9**	**3.2**		**2.9**	**2.4**	**3.3**			**3**		**2.8**	
TOC-NORMALIZED ∑DDT CONCENTRATIONS (µg/kg-TOC)	**131**	**259**		**545**	**513**	**303**			**900**		**1750**	

[1] Not detected at the specified detection limit

[2] Rejected data (MS/MSD and LCS %REC < LCL, high potential of low bias)

TABLE B20: Bulk PAH data (sum of 16 USEPA Priority Pollutants) on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2015)

PAH COMPOUND (µg/kg)	UPPER RIVER CHANNEL																							
	DMMU-1								DMMU-2a								DMMU-2b							
	CH-1	CH-2	CH-3	CH-3 CORE	CH-4	CH-5	CH-5 CORE	DMMU-1 COMP	CH-6	CH-7	CH-7 CORE	CH-8	CH-9	CH-9 CORE	CH-10	DMMU-2a COMP	CH-11	CH-12	CH-12 CORE	CH-13	CH-14	CH-15	CH-15 CORE	DMMU-2b COMP
2-METHYLNAPHTHALENE	11	27	53	220	68	35	87	29	40	30	59	36	33	52	27	28	35	24	78	35	39	37	56	30
ACENAPHTHENE	5.7	63	52	15	91	34	50	31	56	22	22	20	27	26	20	20	39	17	51	24	20	20	31	23
ACENAPHTHYLENE	4	6	26	6.9	39	20	22	16	25	19	19	20	27	18	14	18	24	15	32	14	16	21	22	19
ANTHRACENE	15	100	150	40	290	110	160	85	170	74	76	75	100	81	58	72	94	51	140	72	68	71	89	75
BENZO(A)ANTHRACENE	74	240	480	74	670	480	430	290	650	320	330	320	390	360	280	300	510	260	480	350	250	250	400	340
BENZO(A)PYRENE	79	310	550	65	650	570	450	350	790	400	400	400	480	450	350	390	750	360	580	510	340	300	500	490
BENZO(B)FLUORANTHENE	120	370	890	110	900	1100	820	580	1600	720	750	760	890	970	650	790	1400	640	1300	950	600	500	1100	960
BENZO(G,H,I)PERYLENE	66	220	270	36	260	290	170	130	410	200	150	210	250	160	200	160	450	200	200	270	160	140	200	230
BENZO(K)FLUORANTHENE	44	110	260	29	330	310	220	250	450	210	250	260	310	250	240	250	420	210	300	250	210	160	310	320
CHRYSENE	88	230	560	76	640	640	480	350	940	410	430	420	530	500	400	410	850	400	650	580	340	310	590	510
DIBENZ(A,H)ANTHRACENE	12	50	69	15	76	70	60	44	120	47	54	60	59	49	43	56	120	61	58	75	51	47	62	70
FLUORANTHENE	180	510	1100	210	1400	1300	1200	760	1900	810	900	870	1100	970	800	830	1700	830	1300	1200	670	630	1100	1000
FLUORENE	6.2	38	63	21	130	49	80	33	72	27	39	34	37	44	25	26	53	25	81	36	27	28	54	30
INDENO(1,2,3-C,D)PYRENE	53	180	250	36	250	37	190	140	390	190	180	200	210	150	170	160	430	180	210	270	150	130	210	220
NAPHTHALENE	8.8	40	50	140	70	35	67	24	44	29	52	33	28	43	24	26	50	28	93	31	38	31	53	32
PHENANTHRENE	82	370	670	150	1100	620	690	410	890	370	390	380	470	440	350	380	730	360	660	490	310	270	530	460
PYRENE	170	460	1000	160	1200	1100	970	640	1500	720	780	710	870	1100	700	710	1300	610	1500	920	570	520	1300	870
TOTAL PAHs	**1,008**	**3,297**	**6,440**	**1,184**	**8,096**	**6,765**	**6,059**	**4,133**	**10,007**	**4,568**	**4,822**	**4,772**	**5,778**	**5,611**	**4,324**	**4,598**	**8,920**	**4,247**	**7,635**	**6,042**	**3,820**	**3,428**	**6,551**	**5,649**
TOC (%)	0.46	0.19	2.4	0.59	0.66	2.3	2.9	1.2	2.2	1.7	2	1.6	2.3	1.8	2.1	2	2	1.8	2	1.9	1.8	1.8	1.8	2
TOC-NORMALIZED CONCENTRATION (mg/kg-TOC)	219	1735	268	201	1227	294	209	344	455	269	241	298	251	312	206	230	446	236	382	318	212	190	364	282

PAH COMPOUND (µg/kg)	LAKE AREA											
	CLA-1						CLA-4					
	CLA1-1	CLA1-2	CLA1-3	CLA1-4	CLA1-5	CLA1 COMP	CLA4-1	CLA4-2	CLA4-3	CLA4-4	CLA4-5	CLA4 COMP
2-METHYLNAPHTHALENE	190	17	33	86	110	78	9.8	14	12	9.4	8.3	13
ACENAPHTHENE	360	21 U	34	140	150	120	18 U	19 U	19 U	18 U	18 U	18 U
ACENAPHTHYLENE	390	11	44	84	150	85	11	7.7	9.1	11	7.1	9.6
ANTHRACENE	930	21	88	480	320	250	16	14	18	19	17	22
BENZO(A)ANTHRACENE	1900	71	220	670	740	500	74	67	66	89	74	79
BENZO(A)PYRENE	2000	90	260	640	1000	640	85	67	79	95	83	91
BENZO(B)FLUORANTHENE	2400	120	320	790	1200	770	130	98	120	130	130	130
BENZO(G,H,I)PERYLENE	1200	84	200	420	720	440	100	67	71	80	79	68
BENZO(K)FLUORANTHENE	760	53	95	230	390	300	48	38	39	56	47	60
CHRYSENE	2000	73	220	620	740	540	73	60	78	90	84	81
DIBENZ(A,H)ANTHRACENE	350	15	57	110	170	110	38	18	25	26	22	19
FLUORANTHENE	3100	150	350	1300	1200	1000	150	120	140	160	150	160
FLUORENE	390	9.8	33	180	120	120	12	7.7	9.1	7	11	9.6
INDENO(1,2,3-C,D)PYRENE	1100	64	170	360	630	420	82	55	58	70	65	63
NAPHTHALENE	580	39	120	250	390	230	21	22	22	18	20	22
PHENANTHRENE	1800	60	180	900	630	550	47	45	49	54	53	65
PYRENE	2900	140	320	1100	1100	860	110	110	120	140	140	150
Total PAHs	**22,160**	**1,001**	**2,711**	**8,274**	**9,650**	**6,935**	**997**	**796**	**903**	**1,045**	**982**	**1,029**
TOC (%)	3.9	3.2	3.2	2.9	2.4	3.3	2.8	2.8	3	3	2.8	2.9
TOC-NORMALIZED CONCENTRATION (mg/kg-TOC)	568	31.3	84.7	285	402	210	35.6	28.4	30.1	34.8	35.1	35.5

[1] Not detected at the specified detection limit

TABLE B21: PAH (34: 18 non-alkylated parent compounds and 16 groups of generic alkylated forms) pore water concentrations in Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments with calculated USEPA Toxic Units (RTI 2015)

PAH COMPOUND (µg/L)	UPPER RIVER CHANNEL						UPPER RIVER CHANNEL (DISCRETE CORE SAMPLES)												LAKE AREA												PAH FCV (µg/L)
	DMMU-1		DMMU-2a		DMMU-2b		CH-3		CH-5		CH-7		CH-9		CH-12		CH-15		CLA1-1		CLA1-2	CLA1-3		CLA1-4		CLA1-5		CLA1-COMP		CLA4-COMP	
1-METHYLNAPHTHALENE	0.05 U[1]		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U	0.05 U		0.05 U		0.05 U		0.05 U		0.05 U	75.37
2-METHYLNAPHTHALENE	0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U	0.05 U		0.05 U		0.05 U		0.05 U		0.05 U	72.16
ACENAPHTHENE	0.1 U		0.1 U		0.1 U		**0.24**	**0.004**	0.1 U		0.1 U		0.1 U		**0.1**	**0.002**	0.1 U		**2.47**	**0.044**	0.1 U	0.1 U		**0.24**	**0.004**	0.1 U		0.1 U		0.1 U	55.85
ACENAPHTHYLENE	0.2 U		0.2 U		0.2 U		0.2 U		0.2 U		0.2 U		0.2 U		0.2 U		0.2 U		**0.52**	**0.002**	0.2 U	0.2 U		0.2 U		0.2 U		0.2 U		0.2 U	306.9
ANTHRACENE	0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		**0.39**	**0.019**	0.05 U	0.05 U		0.05 U		0.05 U		0.05 U		0.05 U	20.73
BENZO(A)ANTHRACENE	0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		**0.05**	**0.022**	0.001 U	0.001 U		0.001 U		0.001 U		0.001 U		0.001 U	2.227
BENZO(A)PYRENE	0.008 U		0.008 U		0.008 U		0.008 U		0.008 U		0.008 U		0.008 U		0.008 U		0.008 U		0.008 U		0.008 U	0.008 U		0.008 U		0.008 U		0.008 U		0.008 U	0.9573
BENZO(B,K)FLUORANTHENE	0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U	0.005 U		0.005 U		0.005 U		0.005 U		0.005 U	0.6415
BENZO(E)PYRENE	0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U	0.005 U		0.005 U		0.005 U		0.005 U		0.005 U	0.9008
BENZO(G,H,I)PERYLENE	0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U	0.001 U		0.001 U		0.001 U		0.001 U		0.001 U	0.4391
C1 - CHRYSENE	0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U	0.005 U		0.005 U		0.005 U		0.005 U		0.005 U	0.8557
C1 - FLUORANTHENE/PYRENE	0.01 U		0.01 U		0.01 U		**0.11**	**0.023**	0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		**0.53**	**0.108**	0.01 U	0.01 U		0.01 U		0.01 U		0.01 U		0.01 U	4.887
C1 - FLUORENE	0.02 U		0.02 U		0.02 U		0.02 U		0.02 U		0.02 U		0.02 U		0.02 U		0.02 U		**2.25**	**0.161**	0.02 U	0.02 U		0.02 U		0.02 U		0.02 U		0.02 U	13.99
C1 - PHENANTHRENE/ANTHRACENE	0.02 U		0.02 U		0.02 U		**0.3**	**0.040**	0.02 U		0.02 U		0.02 U		0.02 U		0.02 U		**2.62**	**0.352**	0.02 U	0.02 U		**0.39**	**0.052**	0.02 U		**0.48**	**0.065**	0.02 U	7.436
C2 - CHRYSENE	0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U	0.01 U		0.01 U		0.01 U		0.01 U		0.01 U	0.4827
C2 - FLUORENE	0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		**3.09**	**0.582**	0.05 U	0.05 U		0.05 U		0.05 U		0.05 U		0.05 U	5.305
C2 - NAPHTHALENE	0.15 U		0.15 U		0.15 U		0.15 U		0.15 U		0.15 U		0.15 U		0.15 U		0.15 U		**7.06**	**0.233**	0.15 U	0.15 U		**1.19**	**0.039**	0.15 U		**1.61**	**0.053**	0.15 U	30.24
C2 - PHENANTHRENE/ANTHRACENE	0.05 U		0.05 U		0.05 U		**1.66**	**0.519**	0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		**5.18**	**1.619**	0.05 U	0.05 U		0.05 U		0.05 U		0.05 U		0.05 U	3.199
C3 - CHRYSENE	0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U	0.01 U		0.01 U		0.01 U		0.01 U		0.01 U	0.1675
C3 - FLUORENE	0.06 U		0.06 U		0.06 U		0.06 U		0.06 U		0.06 U		0.06 U		0.06 U		0.06 U		**3.39**	**1.769**	0.06 U	0.06 U		0.06 U		0.06 U		0.06 U		0.06 U	1.916
C3 - NAPHTHALENE	0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		**27.78**	**2.503**	0.05 U	0.05 U		**2.81**	**0.253**	0.05 U		**1.64**	**0.148**	0.05 U	11.1
C3 - PHENANTHRENE/ANTHRACENE	0.04 U		0.04 U		0.04 U		**1.33**	**1.059**	0.04 U		0.04 U		0.04 U		0.04 U		0.04 U		**4.27**	**3.400**	0.04 U	0.04 U		0.04 U		0.04 U		0.04 U		0.04 U	1.256
C4 - CHRYSENE	0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U	0.01 U		0.01 U		0.01 U		0.01 U		0.01 U	0.07062
C4 - NAPHTHALENE	0.15 U		0.15 U		0.15 U		0.15 U		0.15 U		0.15 U		0.15 U		0.15 U		0.15 U		**24.21**	**5.981**	0.15 U	0.15 U		**2.64**	**0.652**	0.15 U		0.15 U		0.15 U	4.048
C4 - PHENANTHRENE/ANTHRACENE	0.02 U		0.02 U		0.02 U		0.02 U		0.02 U		0.02 U		0.02 U		0.02 U		0.02 U		**2.81**	**5.023**	0.02 U	0.02 U		0.02 U		0.02 U		0.02 U		0.02 U	0.5594
CHRYSENE	0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		**0.08**	**0.039**	0.001 U	0.001 U		0.001 U		0.001 U		0.001 U		0.001 U	2.042
DIBENZ(A,H)ANTHRACENE	0.002 U		0.002 U		0.002 U		0.002 U		0.002 U		0.002 U		0.002 U		0.002 U		0.002 U		0.002 U		0.002 U	0.002 U		0.002 U		0.002 U		0.002 U		0.002 U	0.2825
FLUORANTHENE	**0.09**	**0.013**	**0.09**	**0.013**	**0.09**	**0.013**	**0.05**	**0.007**	**0.07**	**0.010**	**0.05**	**0.007**	**0.06**	**0.008**	**0.06**	**0.008**	**0.05**	**0.007**	**0.95**	**0.134**	0.01 U	**0.02**	**0.003**	**0.09**	**0.013**	**0.04**	**0.006**	**0.05**	**0.007**	0.01 U	7.109
FLUORENE	0.04 U		0.04 U		0.04 U		**0.07**	**0.002**	0.04 U		0.04 U		0.04 U		0.04 U		0.04 U		**1.48**	**0.038**	0.04 U	0.04 U		**0.09**	**0.002**	0.04 U		**0.07**	**0.002**	0.04 U	39.3
INDENO(1,2,3-C,D)PYRENE	0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U	0.001 U		0.001 U		0.001 U		0.001 U		0.001 U	0.275
NAPHTHALENE	**0.31**	**0.002**	0.1 U		0.1 U		**0.23**	**0.001**	**0.15**	**0.001**	0.1 U		0.1 U		**0.24**	**0.001**	**0.13**	**0.001**	**0.42**	**0.002**	0.1 U	0.1 U		0.1 U		0.1 U		**0.11**	**0.001**	0.1 U	193.5
PERYLENE	0.004 U		0.004 U		0.004 U		0.004 U		0.004 U		0.004 U		0.004 U		0.004 U		0.004 U		0.004 U		0.004 U	0.004 U		0.004 U		0.004 U		0.004 U		0.004 U	0.9008
PHENANTHRENE	**0.13**	**0.007**	0.1 U		0.1 U		**0.27**	**0.014**	0.1 U		0.1 U		0.1 U		**0.11**	**0.006**	0.1 U		**2.09**	**0.109**	0.1 U	0.1 U		**0.2**	**0.010**	0.1 U		**0.15**	**0.008**	0.1 U	19.13
PYRENE	**0.07**	**0.007**	**0.07**	**0.007**	**0.07**	**0.007**	**0.09**	**0.009**	**0.1**	**0.010**	**0.11**	**0.011**	**0.13**	**0.013**	**0.12**	**0.012**	**0.12**	**0.012**	**0.76**	**0.075**	0.01 U	**0.03**	**0.003**	**0.08**	**0.008**	**0.04**	**0.004**	**0.05**	**0.005**	0.01 U	10.11
ΣTU	**<0.1**		**<0.1**		**<0.1**		**1.7**		**<0.1**		**<0.1**		**<0.1**		**<0.1**		**<0.1**		**22.2**		**<0.1**	**<0.1**		**1.0**		**<0.1**		**0.3**		**<0.1**	

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[1] Not detected at the specified detection limit

TABLE B22. Results of standard 10-day *Hyalella azteca* and *Chironomus dilutus* solid phase bioassays (±1 standard deviation [SD] from the mean) on Cleveland Harbor Upper Cuyahoga River Channel and open-lake area sediments (USAERDC 2015).

Test Species	Measurement Endpoint	Bioassay	Upper River Channel			Lake Area		Control
			DMMU-1	DMMU-2a	DMMU-2b	CLA-1	CLA-4	
H. azteca	**Mean Survival (%)**	**Initial**	92±8.4	**50±25.5**[1]	**58±13**[1]	98±4.5	94±13.4	98±4.5
		Follow-up[2]		92±8.4	86±11.4	94±5.5	92±8.4	90±10
C. dilutus	**Mean Survival (%)**	**Initial**	92±4.5	88±13	88±13	92±11	96±8.9	100
	Mean Growth (mass, mg DW)	**Initial**	2.638±0.580	1.448±0.283	0.798±0.040	1.864±0.158	1.849±0.376	1.986±0.185

[1] Lower survival was statistically significant.

[2] Bioassay re-run following removal of native worms from sediment samples.

TABLE B23. Results of standard 28-day *Lumbriculus variegatus* PCB bioaccumulation experiments on Cleveland Harbor Upper Cuyahoga River Channel and open-lake area sediments (USAERDC 2016).

AREA	MANAGEMENT UNIT/LAKE AREA	REPLICATE	TOTAL PCB CONCENTRATION IN TISSUE (µg/kg-tissue)	TOTAL PCB CONCENTRATION IN SEDIMENT (COMPOSITE SAMPLE) (µg/kg-sediment)
UPPER RIVER CHANNEL	DMMU-1	A	151	**100**
		B	132	
		C	134	
		D	143	
		E	205	
	MEAN		**153**	
	DMMU-2a	A	125	**156**
		B	189	
		C	136	
		D	168	
		E	200	
	MEAN		**164**	
	DMMU-2b	A	155	**157**
		B	137	
		C	140	
		D	186	
		E	288	
	MEAN		**181**	
LAKE	CLA-1	A	75.0	**131**
		B	97.4	
		C	83.8	
		D	109	
		E	120	
	MEAN		**97.0**	
	CLA-4	A	34.8	**90.6**
		B	34.9	
		C	31.4	
		D	30.7	
		E	38.1	
	MEAN		**34.0**	

TABLE B24. Results of standard 28-day *Lumbriculus variegatus* pesticides bioaccumulation experiments on Cleveland Harbor Upper Cuyahoga River Channel and open-lake area sediments (USAERDC 2016).

AREA	MANAGEMENT UNIT/LAKE AREA	PESTICIDE	CONCENTRATION IN TISSUE (µg/kg)					
			REPLICATE					MEAN
			A	B	C	D	E	
UPPER RIVER CHANNEL	**DMMU-1**	**DDD**	4.6U[1]	4.7U	3.8U	3.9U	4.4U	
		DDE	8.3 P[2]	**8.8**	**8.8**	**7.6**	**8.5**	8.4
		DDT	4.6U	4.7U	3.8U	3.9U	4.4U	
		ALPHA-CHLORDANE	2.6U	2.6U	2.1U	2.2U	2.4U	
		ALPHA-BHC	2.0U	2.0U	1.7U	1.7U	1.9U	
		METHOXYLCHLOR	2.6U	2.7U	2.2U	2.2U	2.5U	
		DIELDRIN	2.5U	2.5U	2.1U	2.1U	2.4U	
	DMMU-2a	**DDD**	3.3U	3.4U	3.5U	2.7U	4.1U	
		DDE	**7.4**	**6**	5.7 Pm[3]	6.0 P	8.3 P	6.7
		DDT	3.3U	3.4U	3.5U	2.7U	4.1U	
		ALPHA-CHLORDANE	1.9U	1.9U	2.0U	1.5U	17 P	4.5
		ALPHA-BHC	1.5U	1.5U	2.7 J[4]P	2.1 JP	2.7 JP	1.8
		METHOXYLCHLOR	1.9U	1.9U	29 P	7.5 P	8.8 P	9.4
		DIELDRIN	1.8U	1.8U	9.9 P	6.9 P	15 P	6.7
	DMMU-2b	**DDD**	3.4U	3.1U	3.2U	4.3U	3.1U	
		DDE	7.6 P	6.3 P	6.1 P	7.4 P	9.0 P	7.3
		DDT	3.4U	3.1U	3.2U	4.3U	3.1U	
		ALPHA-CHLORDANE	9.4 m	3.3 JP	**4.6**	**6.7**	6.1 m	6
		ALPHA-BHC	2.1 JP	2.2 JP	1.4U	2.5 JP	2 JP	1.9
		METHOXYLCHLOR	2.0U	**5**	3.1 J	**5.4**	42 P	11.3
		DIELDRIN	6.7 P	8.3 P	7.7 P	9.4 P	13 P	9
LAKE	**CLA-1**	**DDD**	5.3U	4.3U	4.1U	4.2U	3.5U	
		DDE	5.3U	**7**	**5.9**	**6.1**	**6.5**	6.4
		DDT	5.3U	4.3U	4.1U	4.2U	3.5U	
		ALPHA-CHLORDANE	2.9U	2.4U	2.3U	2.4U	2.0U	
		ALPHA-BHC	2.3U	1.9U	1.8U	1.8U	1.5U	
		METHOXYLCHLOR	3.0U	2.5U	2.3U	2.4U	2.0U	
		DIELDRIN	2.8U	2.3U	2.2U	2.3U	1.9U	
	CLA-4	**DDD**	5.2U	4.9U	3.8U	3.7U	3.8U	
		DDE	5.2U	4.9U	3.8U	3.7U	3.8U	
		DDT	5.2U	4.9U	3.8U	3.7U	3.8U	
		ALPHA-CHLORDANE	2.9U	2.7U	2.1U	2.1U	2.1U	
		ALPHA-BHC	2.3U	2.1U	1.7U	1.6U	1.7U	
		METHOXYLCHLOR	3.0U	2.8U	2.2U	2.1U	2.2U	
		DIELDRIN	2.8U	2.6U	2.1U	2.0U	2.0U	

[1] Not detected at the specified detection limit

[2] Second GC column RPD exceeds 40%

[3] Manual Integration used to determine area response

[4] Estimated value

TABLE B25: Metal SET data on Cleveland Harbor Upper Cuyahoga River Channel sediments (RTI 2015)

METAL (mg/L)	LAKE WATER		UPPER RIVER CHANNEL			OMZM WATER QUALITY CRITERION (mg/L)
	CLA-1	CLA-4	DMMU-1	DMMU-2a	DMMU-2b	
ALUMINUM	0.018	0.043	0.3	0.12	0.44	
ANTIMONY	0.001 U[1]	0.001 U	0.001 U	0.001 U	0.001 U	0.9
ARSENIC	0.001	0.001	0.018	0.035	0.047	0.34
BARIUM	0.021	0.017	0.25	0.25	0.28	2
BERYLLIUM	R[2]	0.001 U	0.001 U	0.001 U	0.001 U	
CADMIUM	0.001 U	0.001	0.001 U	0.001 U	0.001 U	0.0043
CALCIUM	37	32	52	74	80	
CHROMIUM, TOTAL	0.001	0.001	0.001	0.001	0.003	0.57
COBALT	0.001 U	0.001 U	0.001	0.001	0.002	0.22
COPPER	0.002	0.001	R	R	R	0.013
IRON	0.12 U	0.092	3.1	5.3	9.9	
LEAD	0.001 U	0.001 U	0.003	0.002	0.004	0.097
MAGNESIUM	9	8.7	11	15	16	
MANGANESE	0.002	0.001	1.9	2.8	2.5	
MERCURY	0	0	0	0 U	0 U	0.0014
NICKEL	0.002	0.002	0.006	0.006	0.006	0.47
POTASSIUM	1.4	1.3	4.9	6.1	7.5	
SELENIUM	0.003 U	0.003 U	0.003 U	0.002	0.003 U	
SILVER	R	0.001 U	0.001 U	0.001 U	0.001 U	
SODIUM	9.4	9.2	25	32	35	
THALLIUM	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.079
VANADIUM	0.001 U	0.001 U	0.001	0.001	0.002	0.15
ZINC	0.003	0.003	0.021	0.021	0.023	0.12

[1] Not detected at the specified detection limit.

[2] Strong method blank bias.

TABLE B26: Nutrient and cyanide SET data on Cleveland Harbor Upper Cuyahoga River Channel sediments (RTI 2015)

PARAMETER (mg/L)	LAKE WATER		UPPER RIVER CHANNEL			OMZM WATER QUALITY CRITERION (mg/L)
	CLA-1	CLA-4	DMMU-1	DMMU-2a	DMMU-2b	
CYANIDE	0.014	0.009	0.016	0.015	0.014	0.022
NITROGEN, AMMONIA	0.1	0.1	**5.7**	**8.7**	**19**	4.5
NITROGEN, TOTAL KJELDAHL (TKN)	6.9	0.95	5	8	14	
PHOSPHORUS, TOTAL (AS P)	0.011	0.008	0.19	0.28	0.32	1

TABLE B27: PCB SET data on Cleveland Harbor Upper Cuyahoga River Channel sediments (RTI 2015)

PCB (µg/L)	LAKE WATER		UPPER RIVER CHANNEL		
	CLA-1	CLA-4	DMMU-1	DMMU-2a	DMMU-2b
Aroclor 1016	0.041 U[1]	0.042 U	0.043 U	0.043 U	0.043 U
Aroclor 1221	0.041 U	0.042 U	0.043 U	0.043 U	0.043 U
Arcolor 1232	0.041 U	0.042 U	0.043 U	0.043 U	0.043 U
Aroclor 1242	0.041 U	0.042 U	0.043 U	0.043 U	0.043 U
Aroclor 1248	0.041 U	0.042 U	0.043 U	0.043 U	0.043 U
Aroclor 1254	0.041 U	0.042 U	0.043 U	0.043 U	0.043 U
Aroclor 1260	0.041 U	0.042 U	0.043 U	0.043 U	0.043 U
Aroclor 1262	0.051 U	0.053 U	0.053 U	0.054 U	0.054 U
Aroclor 1268	0.1 U	0.11 U	0.11 U	0.11 U	0.11 U
TOTAL PCBs (SUM OF AROCLORS)	0 U	0 U	0 U	0 U	0 U

[1] Not detected at the specified detection limit.

TABLE B28: Pesticide SET data on Cleveland Harbor Upper Cuyahoga River Channel sediments (RTI 2015)

PESTICIDE (µg/L)	LAKE WATER		UPPER RIVER CHANNEL			OMZM WATER QUALITY CRITERION (µg/L)
	CLA-1	CLA-4	DMMU-1	DMMU-2a	DMMU-2b	
ALDRIN	0.004 U[1]	0.004 U	0.004 U	0.004 U	0.004 U	
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
ALPHA ENDOSULFAN	0.004 U	0.004 U	0.004 U	0.004 U	**0.009**	
ALPHA-CHLORDANE	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
BETA ENDOSULFAN	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
CHLORDANE	0.1 U	0.11 U	0.11 U	0.11 U	0.11 U	
DDD (DICHLORODIPHENYLDICHLORETHANE)	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	0.004 U	0.004 U	0.004 U	0.004 U	**0.024**	1.1 [2]
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
DIELDRIN	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
ENDOSULFAN SULFATE	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
ENDRIN	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
ENDRIN ALDEHYDE	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
ENDRIN KETONE	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
GAMMA BHC (LINDANE)	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
GAMMA-CHLORDANE	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
HEPTACHLOR	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
HEPTACHLOR EPOXIDE	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
METHOXYCHLOR	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
TOXAPHENE	0.1 U	0.11 U	0.11 U	0.11 U	0.11 U	

[1] Not detected at the specified detection limit.

[2] Federal criteria maximum concentration (CMC).

TABLE B29: PAH SET data on Cleveland Harbor Upper Cuyahoga River Channel sediments (RTI 2015)

	LAKE WATER		UPPER RIVER CHANNEL			OMZM WATER QUALITY CRITERION (µg/L)
PAH COMPOUND (µg/L)	**CLA-1**	**CLA-4**	**DMMU-1**	**DMMU-2a**	**DMMU-2b**	
2-METHYLNAPHTHALENE	0.15 U[1]	**0.08**	0.16 U	0.16 U	0.16 U	
ACENAPHTHENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
ACENAPHTHYLENE	0.15 U	**0.04**	0.16 U	0.16 U	0.16 U	
ANTHRACENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
BENZO(A)ANTHRACENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
BENZO(A)PYRENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
BENZO(B)FLUORANTHENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
BENZO(G,H,I)PERYLENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
BENZO(K)FLUORANTHENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
CHRYSENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
DIBENZ(A,H)ANTHRACENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
FLUORANTHENE	0.15 U	0.15 U	**0.19**	**0.19**	**0.19**	3.7
FLUORENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
INDENO(1,2,3-C,D)PYRENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
NAPHTHALENE	0.15 U	**0.21**	0.16 U	0.16 U	0.16 U	
PHENANTHRENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	31
PYRENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	42

[1] Not detected at the specified detection limit.

TABLE B30. Results of 48-hour *Ceriodaphnia dubia* and 96-hour *Pimephales promelas* elutriate bioassays (±1 standard deviation [SD] from the mean) on Cleveland Harbor Upper Cuyahoga River Channel sediments and lake water (USAERDC 2015).

		Test Species							
		C. dubia				*P. promelas*			
		Measurement Endpoint				Measurement Endpoint			
Sample	**Elutriate Concentration (%)**	**Survival (%)**	**NOEC (%)**	**LC50 (%)**	**Survival (%), TRE[1]**	**Survival (%)**	**NOEC (%)**	**LC50 (%)**	**Survival (%), TRE[1]**
DMMU-1	13	N/A	100	N/A	N/A	98±4	50	>100	N/A
	25	N/A			N/A	88±4			N/A
	50	92±11			N/A	92±8			N/A
	100	96±9			N/A	**80±23**[2]			N/A
DMMU-2a	13	N/A	50	>100	N/A	98±4	50	68	N/A
	25	84±9			N/A	100			N/A
	50	84±22			N/A	90±7			N/A
	100	**64±33**			100	**22±44**			93±6
DMMU-2b	13	N/A	100	N/A	N/A	96±9	50	75	N/A
	25	92±18			N/A	98±4			N/A
	50	100			N/A	88±13			N/A
	100	100			100	**22±26**			97±6
Control	N/A	100	N/A	N/A	N/A	98±4	N/A	N/A	N/A
Lake Site Water	N/A	96±9	N/A	N/A	N/A	100	N/A	N/A	N/A

[1] Survival following toxicity reduction evaluation (TRE) bioassay using zeolite-treated 100% elutriates to reduce ammonia concentrations; zeolite removed all acute toxicity observed in initial bioassay. Sediment elutriate data re-confirm no other contaminant cause of acute toxicity.

[2] Boldface denotes reduced values that are ≥10% or statistically significant from lake site water.

TABLE B31. Bulk sediment contaminant concentrations at open-lake reference areas offshore of Cleveland, Ohio (based on data from USACE 2013a, USACE 2015a, OEPA 2015d and OEPA 2015e).

CONTAMINANT	UNITS	REFERENCE SEDIMENT[1]			
		CLA-1 (REFERENCE)		LAKE ERIE	
		MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
ALUMINUM	mg/kg	14,400	34,000	5,720	34,000
ANTIMONY	mg/kg	1.6	3.8	1.5	2.7
ARSENIC	mg/kg	7.5	15.7	4.77	76.9
BARIUM	mg/kg	105	150	47.7	188
BERYLLIUM	mg/kg	0.077	0.96	0.321	1.07
CADMIUM	mg/kg	1.5	4.66	0.728	2.88
CALCIUM	mg/kg	1,100	14,100	4,340	16,000
CHROMIUM, TOTAL	mg/kg	43.8	60.6	12.6	61
COBALT	mg/kg	11.9	18	6.08	17
COPPER	mg/kg	50	69.1	12.2	55
IRON	mg/kg	33,900	49,000	18,300	70,900
LEAD	mg/kg	53	108	15.7	73.5
MAGNESIUM	mg/kg	1,300	15,000	3,710	17,000
MANGANESE	mg/kg	528	981	401	1540
MERCURY	mg/kg	0.07	0.4	0.04	0.75
MOLYBDENUM	mg/kg	1.07	1.69	1.1	1.3
NICKEL	mg/kg	44.6	71	16.7	67
POTASSIUM	mg/kg	2,610	7,100	2,900	7,300
SELENIUM	mg/kg	1.36	1.76	1.51	1.57
SILVER	mg/kg	0.5	0.79	0.47	5.38
SODIUM	mg/kg	172	250	161	280
THALLIUM	mg/kg	0.46	0.53	0.45	0.48
TITANIUM	mg/kg	73	73	37	93
VANADIUM	mg/kg	30.6	79	32.9	78
ZINC	mg/kg	220	466	72.9	261
CYANIDE	mg/kg	0.8	1	0.89	0.91
NITROGEN, AMMONIA	mg/kg	104	420	60.4	3200
NITROGEN, TOTAL KJELDAHL (TKN)	mg/kg	1,850	5,400	840	52,000
PHOSPHORUS, TOTAL (AS P)	mg/kg	420	1280	44	1130
TOTAL OIL & GREASE	mg/kg	450	450	460	460
TOTAL ORGANIC CARBON (TOC)	%	2.4	3.2	0.19	4.4
ENDOSULFAN SULFATE	µg/kg	1.8	2.5		
ENDRIN	µg/kg	2.2	2.2		
ENDRIN ALDEHYDE	µg/kg	1.8	1.8	20	20
GAMMA BHC (LINDANE)	µg/kg	1.7	1.7		
HEPTACHLOR EPOXIDE	µg/kg	1.5	1.5		
TOTAL PAHs	µg/kg	1,003	27,230	193	33,399
TOC-NORMALIZED TOTAL PAHs	mg/kg-OC	31	939	7	1,336
TOTAL PCBs	µg/kg	58.1	236	9.36	400
TOC-NORMALIZED TOTAL PCBs	µg/kg-OC	2,003	8,138	248	25,000
∑DDT	µg/kg	7.55	17.6	7.11	49
TOC-NORMALIZED ∑DDT	µg/kg-OC	259	704	284	1,750

[1] Excludes all bottom core samples and samples that are potentially toxic to benthic organisms.

TABLE B32: Bulk grain size distribution on Cleveland Harbor Upper Cuyahoga River sediments (surface samples) (OEPA 2013) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PARTICLE SIZE (%)	UPPER RIVER		
	DMMU-1	DMMU-2a	DMMU-2b
	302808 (COMP)	302809 (COMP)	302810 (COMP)
CLAY	11	12	11
CLAYPAN SOIL	5.7	5.9	5.6
MEDIUM CLAY	3.8	5.9	5.6
VERY FINE SILT	5.7	9.8	11
FINE SILT	27	29	28
MEDIUM SILT	11	12	11
COARSE SILT	35	25	27
TOTAL SILT/CLAY	**99**	**100**	**99**
TOTAL COARSE SAND	0	0	0

TABLE B33: Bulk inorganics data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples) (OEPA 2013) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

INORGANIC (mg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	200013	200016	F01A21	302810 (COMP)	F01W50	302581	F01S08	302809 (COMP)	302578	302580	F01A41	302808 (COMP)
NITROGEN, AMMONIA	270	380	450	240	320	290	280	340	210	190	250	290
PHOSPHORUS, TOTAL (AS P)	1,050	1,350	1,560	952	1,240	1,170	1,170	1,110	989	794	1,210	1,100
TOTAL ORGANIC CARBON (%)	2.7	3.5	3.3	2.2	3.9	2.9	2.7	2.9	2.3	2	2.6	2.8

TABLE B34: Bulk metals data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples) (OEPA 2013) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

METAL (mg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	200013	200016	F01A21	302810 (COMP)	F01W50	302581	F01S08	302809 (COMP)	302578	302580	F01A41	302808 (COMP)
ALUMINUM	10700	11200	10400	10100	9420	9630	9610	12000	11200	6190	14400	9770
ANTIMONY	2.45 U[1]	1.37 U	2.09 U	1.55 U	1.71 U	1.58 U	1.63 U	1.52 U	1.37 U	1.17 U	1.73 U	1.55 U
ARSENIC	19.4	16.2	19.8	15.5	16.6	16.5	16.9	15.9	16.2	11.7	18.3	15.2
BARIUM	89.9	73.2	97.2	72	79.2	75.2	76.9	78	73.2	51.4	95	92.7
BERYLLIUM	0.602	0.572	0.642	0.553	0.568	0.536	0.586	0.61	0.572	0.39	0.693	0.49
CADMIUM	1.44	1.41	1.62	1.26	1.8	1.24	1.16	1.21	1.41	0.857	1.54	1.21
CALCIUM	16000	14700	16700	14900	18500	14500	14900	14500	14700	12000	16100	44200
CHROMIUM, TOTAL	25.8	62.6	26.4	34.8	25.6	22.6	23	24.5	62.6	15.9	29.6	255
COBALT	12.5	10.9	12.9	10.7	10.6	10.9	11.4	10.2	10.9	7.94	11.8	9.14
COPPER	54.1	83.3	67.4	66.4	54.6	54.1	49.8	52.7	83.3	54.4	57.5	46.9
IRON	33400	29900	33600	29300	28600	29000	29900	29000	29900	21000	33500	45900
LEAD	55.2	48.4	62.4	47.9	54	51.3	48.9	46.9	48.4	37.4	54.4	37.9
MAGNESIUM	6940	6490	7180	6290	6210	6180	6320	6180	6490	4580	7120	14500
MANGANESE	910	661	1100	653	747	808	765	739	661	478	740	3660
MERCURY	0.12	0.133	0.163	0.098	0.196	0.116	0.167	0.115	0.133	0.085	0.121	0.124
NICKEL	34.8	35.8	35.9	30.5	30.6	30.7	31.5	30.6	35.8	25.1	33.3	26.1
POTASSIUM	2450 U	1790	2090 U	1550 U	1710 U	1580 U	1630 U	2260	1790	1170 U	2780	1550 U
SELENIUM	2.45 U	1.37 U	2.09 U	1.55 U	1.71 U	1.58 U	1.63 U	1.52 U	1.37 U	1.17 U	1.73 U	1.55 U
SILVER	0.245 U	0.151	0.228	0.161	0.199	0.177	0.194	0.159	0.151	0.124	0.196	0.159
SODIUM	6120 U	3420 U	5230 U	3860 U	4280 U	3940 U	4080 U	3790 U	3420 U	2930 U	4330 U	3870 U
STRONTIUM	37 U	32	38	32	37	31	32	34	32	24	39	53
TITANIUM	61 U	34 U	52 U	39 U	43 U	39 U	41 U	41	34 U	29 U	44	298
VANADIUM	61 U	34 U	52 U	39 U	43 U	39 U	41 U	38 U	34 U	29 U	43 U	193
ZINC	243	395	253	284	218	202	202	196	395	152	238	181

[1] Not detected at the specified detection limit

TABLE B35: Bulk PCB data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples) (OEPA 2013) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

AROCLOR (µg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	200013	200016	F01A21	302810 (COMP)	F01W50	302581	F01S08	302809 (COMP)	302578	302580	F01A41	302808 (COMP)
AROCLOR 1016	36.1 U[1]	43.1 U	43.3 U	34.3 U	42.5 U	33.7 U	38.3 U	38.9 U	37.5 U	29.5 U	56.8 U	41.5 U
AROCLOR 1221	36.1 U	43.1 U	43.3 U	34.3 U	42.5 U	33.7 U	38.3 U	38.9 U	37.5 U	29.5 U	56.8 U	41.5 U
AROCLOR 1232	36.1 U	43.1 U	43.3 U	34.3 U	42.5 U	33.7 U	38.3 U	38.9 U	37.5 U	29.5 U	56.8 U	41.5 U
AROCLOR 1242	**43**	43.1 U	**56.2**	**55.5**	**51.6**	**37.3**	**52.4**	**58**	**43.5**	**72.8**	**80.5**	**50.9**
AROCLOR 1248	36.1 U	43.1 U	43.3 U	34.3 U	42.5 U	33.7 U	38.3 U	38.9 U	37.5 U	29.5 U	56.8 U	41.5 U
AROCLOR 1254	36.1 U	43.1 U	43.3 U	34.3 U	42.5 U	33.7 U	38.3 U	**2,110**	37.5 U	29.5 U	56.8 U	41.5 U
AROCLOR 1260	**88.9**	**106**	**106**	**98.3**	**112**	**82.9**	**163**	**251**	**104**	**71.1**	**163**	**118**
TOTAL PCBs	**132**	**106**	**162**	**154**	**164**	**120**	**215**	**2419**	**148**	**144**	**244**	**169**
TOC (%)	**2.7**	**3.5**	**3.3**	**2.2**	**3.9**	**2.9**	**2.7**	**2.9**	**2.3**	**2**	**2.6**	**2.8**
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	**4,885**	**3,029**	**4,915**	**6,991**	**4,195**	**4,145**	**7,978**	**83,414**	**6,413**	**7,195**	**9,365**	**6,032**

[1] **Not detected at the specified detection limit**

TABLE B36: Bulk pesticides data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples) (OEPA 2013) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PESTICIDE (µg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	200013	200016	F01A21	302810 (COMP)	F01W50	302581	F01S08	302809 (COMP)	302578	302580	F01A41	302808 (COMP)
ALDRIN	7.2 U[1]	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
ALPHA ENDOSULFAN	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
BETA ENDOSULFAN	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
DIELDRIN	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
ENDOSULFAN SULFATE	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
ENDRIN	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
ENDRIN ALDEHYDE	7.2 UJ	8.6 UJ	8.7 UJ	6.9 U	8.5 UJ	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 UJ
GAMMA BHC (LINDANE)	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
HEPTACHLOR	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
HEPTACHLOR EPOXIDE	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
METHOXYCHLOR	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
MIREX	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
DDD (DICHLORODIPHENYLDICHLORETHANE)	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	**9.2**	7.5 U	5.9 U	11.4 U	8.3 U
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	**13.9**	**16.4**	**16.8**	**14.3**	**16**	**12.8**	7.7 U	7.8 U	**15.4**	5.9 U	11.4 U	**13.5**
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
TOTAL DDT	**13.9**	**16.4**	**16.8**	**14.3**	**16**	**12.8**		**9.2**	**15.4**			**13.5**
TOC (%)	**2.7**	**3.5**	**3.3**	**2.2**	**3.9**	**2.9**	**2.7**	**2.9**	**2.3**	**2**	**2.6**	**2.8**
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	**515**	**469**	**509**	**650**	**410**	**441**		**317**	**670**			**482**

[1] Not detected at the specified detection limit

TABLE B37: Bulk PAH data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples) (OEPA 2013) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PAH COMPOUND (mg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	200013	200016	F01A21	302810 (COMP)	F01W50	302581	F01S08	302809 (COMP)	302578	302580	F01A41	302808 (COMP)
ACENAPHTHENE	0.18 U[1]	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
ACENAPHTHYLENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
ANTHRACENE	0.25	0.27	0.25	0.2	0.42	0.21	0.61	0.23	0.19 U	0.28	0.34	0.22
BENZO(A)ANTHRACENE	0.84	0.9	0.87	0.71	1.34	0.69	0.73	0.8	0.63	0.88	1.11	0.75
BENZO(A)PYRENE	0.77	0.95	0.89	0.82	1.2	0.95	0.9	0.83	0.82	1.12	1.42	0.69
BENZO(B)FLUORANTHENE	1.22	1.26	1.3	1.17	1.75	1.02	1.17	1.32	1.17	1.37	1.88	1.04
BENZO(G,H,I)PERYLENE	0.29	0.37	0.33	0.31	0.45	0.35	0.33	0.33	0.38	0.4	0.52	0.26
BENZO(K)FLUORANTHENE	0.57	0.81	0.69	0.61	0.92	0.71	0.83	0.58	0.71	0.8	1.12	0.63
CHRYSENE	1.25	1.32	1.29	1.06	1.86	1.09	1.11	1.22	0.95	1.2	1.66	1.17
DIBENZ(A,H)ANTHRACENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
FLUORANTHENE	2.2	2.25	2.17	1.68	3.37	1.81	1.77	1.99	1.41	2.21	2.74	1.9
FLUORENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.18	0.28 U	0.21 U
INDENO(1,2,3-C,D)PYRENE	0.3	0.37	0.33	0.32	0.45	0.34	0.35	0.33	0.39	0.44	0.55	0.27
NAPHTHALENE	0.18 U	0.22 U	0.22 U	0.31	0.21 U	0.17 U	1.9	0.41 U	0.073 U	0.51	0.42	0.21 U
PHENANTHRENE	1.17	1.28	1.2	1.02	2.3	0.98	1.15	1.16	0.82	1.37	1.61	1.06
PYRENE	1.84	2.01	1.8	1.37	3.32	1.48	1.42	1.65	1.15	1.78	2.22	1.61
TOTAL PAHs	**10.7**	**11.8**	**11.1**	**9.6**	**17.4**	**9.6**	**12.3**	**10.4**	**8.4**	**12.5**	**15.6**	**9.6**
TOTAL ORGANIC CARBON (%)	**2.7**	**3.5**	**3.3**	**2.2**	**3.9**	**2.9**	**2.7**	**2.9**	**2.3**	**2**	**2.6**	**2.8**
TOC-NORMALIZED CONCENTRATION (mg/kg-TOC)	**396**	**337**	**337**	**435**	**446**	**332**	**454**	**360**	**367**	**627**	**600**	**343**

[1] Not detected at the specified detection limit

TABLE B38: Bulk VOC data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples) (OEPA 2013) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

VOC (mg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	200013	200016	F01A21	302810 (COMP)	F01W50	302581	F01S08	302809 (COMP)	302578	302580	F01A41	302808 (COMP)
1,1,1,2-TETRACHLOROETHANE	0.37 U[1]	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,1,2,2-TETRACHLOROETHANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,1,2-TRICHLOROETHANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,1-DICHLOROETHANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,1-DICHLOROETHENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,1-DICHLOROPROPENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,2,3-TRICHLOROBENZENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,2,3-TRICHLOROPROPANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,2,4-TRIMETHYLBENZENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,2-DIBROMO-3-CHLOROPROPANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,2-DICHLOROETHANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,2-DICHLOROPROPANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,3-DICHLOROPROPANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
2,2-DICHLOROPROPANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
2-CHLOROTOLUENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
2-HEXANONE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
4-CHLOROTOLUENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
ACETONE	0.37 U	0.46 U	0.45 U	0.095	0.45 U	0.4 U	0.37 U	0.41 U	**0.092**	**0.14**	**0.089**	0.4 U
BENZENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
BROMOBENZENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
BROMOFORM	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
BROMOMETHANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
CARBON DISULFIDE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
CARBON TETRACHLORIDE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
CHLOROBENZENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
CHLOROETHANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
CHLOROFORM	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
CIS-1,2-DICHLOROETHYLENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
CIS-1,3-DICHLOROPROPENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
CYMENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
DIBROMOCHLOROMETHANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
DIBROMOMETHANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
DICHLORODIFLUOROMETHANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
ETHYLBENZENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
ISOPROPYLBENZENE (CUMENE)	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
M+P-XYLENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
METHYL ETHYL KETONE (2-BUTANONE)	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
METHYLENE CHLORIDE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
N-BUTYLBENZENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
N-PROPYLBENZENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
O-XYLENE (1,2-DIMETHYLBENZENE)	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
SEC-BUTYLBENZENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
STYRENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
T-BUTYLBENZENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
TETRACHLOROETHYLENE(PCE)	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
TOLUENE	**8.61**	**11.9**	**15.3**	0.055 U	**6.68**	**9.09**	**1.11**	**5.57**	0.073 U	**0.066**	**0.056**	**12.1**
TRANS-1,2-DICHLOROETHENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
TRANS-1,3-DICHLOROPROPENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
TRICHLOROETHANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
TRICHLOROETHYLENE (TCE)	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
TRICHLOROFLUOROMETHANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
VINYL CHLORIDE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U

[1] **Not detected at the specified detection limit**

TABLE B39: Bulk SVOC data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples) (OEPA 2013) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

SVOC (mg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	200013	200016	F01A21	302810 (COMP)	F01W50	302581	F01S08	302809 (COMP)	302578	302580	F01A41	302808 (COMP)
1,2,4,5-TETRACHLOROBENZENE	0.18 U[1]	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
1,2,4-TRICHLOROBENZENE	0.18 U	0.22 U	0.22 U	0.055 U	0.21 U	0.17 U	0.19 U	0.41 U	0.073 U	0.061 U	0.05 U	0.21 U
1,2-DICHLOROBENZENE	0.18 U	0.22 U	0.22 U	0.055 U	0.21 U	0.17 U	0.19 U	0.41 U	0.073 U	0.061 U	0.05 U	0.21 U
1,3-DICHLOROBENZENE	0.18 U	0.22 U	0.22 U	0.055 U	0.21 U	0.17 U	0.19 U	0.41 U	0.073 U	0.061 U	0.05 U	0.21 U
1,3-DINITROBENZENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
1,4-DICHLOROBENZENE	0.18 U	0.22 U	0.22 U	0.055 U	0.21 U	0.17 U	0.19 U	0.41 U	0.073 U	0.061 U	0.05 U	0.21 U
1,4-NAPHTHOQUINONE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2,3,4,6-TETRACHLOROPHENOL	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2,4,5-TRICHLOROPHENOL	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2,4,6-TRICHLOROPHENOL	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2,4-DICHLOROPHENOL	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2,4-DIMETHYLPHENOL	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2,4-DINITROPHENOL	0.9 U	1.1 U	1.1 U	0.9 U	1.1 U	0.8 U	1 U	1 U	0.9 U	0.7 U	1.4 U	1 U
2,4-DINITROTOLUENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2,6-DICHLOROPHENOL	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2,6-DINITROTOLUENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2-ACETYLAMINOFLUORENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2-CHLORONAPHTHALENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2-CHLOROPHENOL	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2-METHYLNAPHTHALENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.24	0.19 U	0.19 U	0.16	0.28 U	0.21 U
2-METHYLPHENOL (O-CRESOL)	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2-NITROANILINE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2-NITROPHENOL	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2-PICOLINE (ALPHA-PICOLINE)	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
3,3'-DICHLOROBENZIDINE	0.9 U	1.1 U	1.1 U	0.9 U	1.1 U	0.8 U	1 U	1 U	0.9 U	0.7 U	1.4 U	1 U
3-METHYLCHOLANTHRENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
4,6-DINITRO-2-METHYLPHENOL	0.18 U	0.22 U	0.22 U	0.17 UJ	0.21 U	0.17 U	0.19 UJ	0.19 U	0.19 UJ	0.15 UJ	0.28 UJ	0.21 U
4-BROMOPHENYL PHENYL ETHER	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
4-CHLORO-3-METHYLPHENOL	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
4-CHLOROPHENOL	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
4-METHYLPHENOL (P-CRESOL)	**6.07**	**8.21**	**8.18**	**0.23**	**4.54**	**2.82**	**0.41**	**2.53**	0.19 U	0.15 U	**0.85**	**7.47**
4-NITROANILINE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
4-NITROPHENOL	0.9 U	1.1 U	1.1 U	0.9 U	1.1 U	0.8 U	1 U	1 U	0.9 U	0.7 U	1.4 U	1 U
7,12-DIMETHYLBENZ(A)ANTHRACENE	0.9 U	1.1 U	1.1 U	0.9 U	1.1 U	0.8 U	1 U	1 U	0.9 U	0.7 U	1.4 U	1 U
ACETOPHENONE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
ANILINE (PHENYLAMINE, AMINOBENZENE)	0.9 U	1.1 U	1.1 U	0.9 U	1.1 U	0.8 U	1 U	1 U	0.9 U	0.7 U	1.4 U	1 U
BENZYL ALCOHOL	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
BENZYL BUTYL PHTHALATE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
BIS(2-CHLOROETHOXY) METHANE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
BIS(2-CHLOROISOPROPYL) ETHER	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
BIS(2-ETHYLHEXYL) PHTHALATE	**0.85**	**1.11**	**1.17**	**0.84**	**1.06**	**0.85**	**0.94**	**0.94**	**0.85**	**0.51**	**1.57**	**1.07**
DIBENZOFURAN	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
DIETHYL PHTHALATE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
DIMETHYL PHTHALATE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
DI-N-BUTYL PHTHALATE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
DI-N-OCTYLPHTHALATE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
DINOSEB	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
DIPHENYLAMINE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
ETHYL METHANESULFONATE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
HEXACHLOROBENZENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
HEXACHLOROBUTADIENE	0.18 U	0.22 U	0.22 U	0.055 U	0.21 U	0.17 U	0.19 U	0.41 U	0.073 U	0.061 U	0.05 U	0.21 U
HEXACHLOROCYCLOPENTADIENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
HEXACHLOROETHANE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
HEXACHLOROPROPENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
ISOPHORONE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
METHYL METHANESULFONATE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
NITROBENZENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
N-NITROSO-DI-N-BUTYLAMINE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
N-NITROSODI-N-PROPYLAMINE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
N-NITROSOMORPHOLINE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
N-NITROSOPIPERIDINE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
N-NITROSOPYRROLIDINE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
P-DIMETHYLAMINOAZOBENZENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
PENTACHLOROBENZENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
PENTACHLOROPHENOL	0.18 UJ	0.22 UJ	0.22 UJ	0.17 UJ	0.21 UJ	0.17 UJ	0.19 UJ	0.19 UJ	0.19 UJ	0.15 UJ	0.28 UJ	0.21 UJ
PHENACETIN	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
PHENOL	**0.18**	**0.52**	**0.35**	0.17 U	**0.5**	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	**0.39**
PRONAMIDE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
SAFROLE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U

[1] Not detected at the specified detection limit

TABLE B40: Bulk inorganics data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in May) (OEPA 2014a) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

INORGANIC (mg/kg)	UPPER RIVER								
	DMMU-1			DMMU-2a		DMMU-2b			
	200013	F01A21	F01A42	F01W50	F01S08	302578	302579	302580	302581
NITROGEN, AMMONIA	100	43	170	220	1,100	680	210	320	91
PHOSPHORUS, TOTAL (AS P)	699	441	623	793	670	798	790	674	705
TOTAL ORGANIC CARBON (%)	3.8	1.2	1.4	1.5	1.3	2.0	1.8	1.7	1.6

TABLE B41: Bulk metals data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in May) (OEPA 2014a) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

METAL (mg/kg)	UPPER RIVER								
	DMMU-1			DMMU-2a		DMMU-2b			
	200013	F01A21	F01A42	F01W50	F01S08	302578	302579	302580	302581
ALUMINUM	5,590	3,500	4,970	7,860	7,900	10,100	9,040	10,300	5,860
ANTIMONY	0.8 U[1]	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U
ARSENIC	14.4	9.2	10.5	15	15	17.4	16	17.6	12.8
BARIUM	62.4	31.1	44.5	69.6	67.1	85.7	75.3	83.3	59.7
BERYLLIUM	0.409	0.268	0.327	0.484	0.501	0.596	0.533	0.583	0.434
CADMIUM	0.725	0.387	0.502	0.641	0.657	0.992	0.732	0.669	0.594
CALCIUM	8,110	5,330	7,400	9,400	10,600	13,300	11,300	11,600	9,420
CHROMIUM, TOTAL	14	8.62	10.9	14.5	14.4	44.5	16.7	16.2	12.3
COBALT	7.9	4.95	5.86	8.78	8.8	10.2	9.33	10.6	7.59
COPPER	25.8	14.3	20.5	24.9	24.1	33.5	25.9	26.5	24.1
IRON	22,300	14,500	17,700	25,200	25,600	33,200	30,500	31,100	21,700
LEAD	28.4	16.5	23.2	26.7	25.6	34.8	30.4	28.4	27.1
MAGNESIUM	3,750	2,390	3,170	4,640	5,030	6,450	5,710	5,980	4,130
MANGANESE	666	312	428	679	650	652	640	787	561
MERCURY	0.095	0.037	0.064	0.079	0.066	0.132	0.079	0.109	0.077
NICKEL	19.4	12.9	15.2	21.5	21.9	27.7	24.2	26.3	19
POTASSIUM	800 U	800 U	800 U	800 U	800 U	1380	1270	1500	800 U
SELENIUM	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U
SILVER	0.177	0.08 U	0.149	0.152	0.137	0.179	0.166	0.144	0.147
SODIUM	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U
STRONTIUM	12 U	12 U	17	24	24	29	25	28	22
TITANIUM	20 U	20 U	25	20 U	20 U	20 U	20 U	20 U	20 U
VANADIUM	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
ZINC	138	92.7	112	131	127	246	151	138	127

[1] Not detected at the specified detection limit

TABLE B42: Bulk PCB data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in May) (OEPA 2014a) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

AROCLOR (µg/kg)	UPPER RIVER								
	DMMU-1			DMMU-2a		DMMU-2b			
	200013	F01A21	F01A42	F01W50	F01S08	302578	302579	302580	302581
AROCLOR 1016	20 U[1]	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1221	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1232	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1242	20 U	34	28.6	45.4	36.3	38.5	20 U	20 U	33.6
AROCLOR 1248	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1254	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1260	56.4	32	36.4	54.3	122	83.9	68.4	46.8	116
TOTAL PCBs	56.4	66	65	99.7	158	122	68.4	46.8	150
TOC (%)	3.8	1.2	1.4	1.5	1.3	2	1.8	1.7	1.6
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	1,484	5,500	4,643	6,647	12,177	6,120	3,800	2,753	9,350

[1] Not detected at the specified detection limit

TABLE B43: Bulk pesticide data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in May) (OEPA 2014a) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PESTICIDE (µg/kg)	UPPER RIVER								
	DMMU-1			DMMU-2a		DMMU-2b			
	200013	F01A21	F01A42	F01W50	F01S08	302578	302579	302580	302581
ALDRIN	4 U[1]	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ALPHA ENDOSULFAN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
BETA ENDOSULFAN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DIELDRIN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDOSULFAN SULFATE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDRIN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDRIN ALDEHYDE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
GAMMA BHC (LINDANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEPTACHLOR	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEPTACHLOR EPOXIDE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEXACHLOROBENZENE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
METHOXYCHLOR	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
MIREX	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DDD (DICHLORODIPHENYLDICHLORETHANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	**17.8**	**12.5**	**19.8**	**18**	**18.3**	**21**	**19.3**	**14.3**	**19.4**
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	**21.3**	**14.4**	**22.3**	**22.4**	**16.2**	**22.1**	**34.3**	**16.8**	**24.7**
TOTAL DDT	**39.1**	**26.9**	**42.1**	**40.4**	**34.5**	**43.1**	**53.6**	**31.1**	**44.1**
TOC (%)	**3.8**	**1.2**	**1.4**	**1.5**	**1.3**	**2**	**1.8**	**1.7**	**1.6**
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	**1,029**	**2,242**	**3,007**	**2,693**	**2,654**	**2,155**	**2,978**	**1,829**	**2,756**

[1] Not detected at the specified detection limit

TABLE B44: Bulk PAH data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in May) (OEPA 2014a) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PAH COMPOUND (mg/kg)	UPPER RIVER								
	DMMU-1			DMMU-2a		DMMU-2b			
	200013	F01A21	F01A42	F01W50	F01S08	302578	302579	302580	302581
ACENAPHTHENE	0.72 U[1]	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
ACENAPHTHYLENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
ANTHRACENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
BENZO(A)ANTHRACENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
BENZO(A)PYRENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
BENZO(B)FLUORANTHENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	**0.74**	0.68 U	0.71 U	0.63 U
BENZO(G,H,I)PERYLENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
BENZO(K)FLUORANTHENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
CHRYSENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
DIBENZ(A,H)ANTHRACENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
DIBENZOFURAN	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
FLUORANTHENE	**0.95**	**0.57**	**1.04**	**1.05**	**0.66**	**1.17**	**0.8**	0.71 U	**0.92**
FLUORENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
INDENO(1,2,3-C,D)PYRENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
NAPHTHALENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
PHENANTHRENE	0.72 U	0.54 U	**0.61**	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
PYRENE	**0.79**	0.54 U	**0.86**	**0.86**	0.64 U	**0.91**	0.68 U	0.71 U	**0.77**
TOTAL PAHs	**0.95**	**0.57**	**1.65**	**1.05**	**0.66**	**1.91**	**0.8**		**0.92**
TOTAL ORGANIC CARBON (%)	**3.8**	**1.2**	**1.4**	**1.5**	**1.3**	**2**	**1.8**	**1.7**	**1.6**
TOC-NORMALIZED CONCENTRATION (mg/kg-TOC)	**25**	**48**	**118**	**70**	**51**	**96**	**44**		**58**

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[1] Not detected at the specified detection limit

TABLE B45: Bulk VOC data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in May) (OEPA 2014a) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

VOCs (mg/kg)	UPPER RIVER								
	DMMU-1			DMMU-2a		DMMU-2b			
	200013	F01A21	F01A42	F01W50	F01S08	302578	302579	302580	302581
1,1,1,2-TETRACHLOROETHANE	0.04 U[1]	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,1,2,2-TETRACHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,1,2-TRICHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,1-DICHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,1-DICHLOROETHENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,1-DICHLOROPROPENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,2,3-TRICHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,2,3-TRICHLOROPROPANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,2,4-TRICHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,2,4-TRIMETHYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,2-DIBROMO-3-CHLOROPROPANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,2-DICHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,2-DICHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,2-DICHLOROPROPANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,3-DICHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,3-DICHLOROPROPANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,4-DICHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
2,2-DICHLOROPROPANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
2-CHLOROTOLUENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
2-HEXANONE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
4-CHLOROTOLUENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
ACETONE	0.05 U	0.05 U	0.05 U	**0.099**	**0.097**	0.2 U	0.2 U	0.05 U	**0.097**
BENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
BROMOBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
BROMOCHLOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
BROMODICHLOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
BROMOFORM	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
BROMOMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
CARBON DISULFIDE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
CARBON TETRACHLORIDE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
CHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
CHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
CHLOROFORM	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
CHLOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
CIS-1,2-DICHLOROETHYLENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
CIS-1,3-DICHLOROPROPENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
DIBROMOCHLOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
DIBROMOMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
DICHLORODIFLUOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
ETHYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
HEXACHLOROBUTADIENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
ISOPROPYLBENZENE (CUMENE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
M+P-XYLENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
METHYL ETHYL KETONE (2-BUTANONE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
METHYLENE CHLORIDE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
NAPHTHALENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
N-BUTYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
N-PROPYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
O-XYLENE (1,2-DIMETHYLBENZENE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
P-CYMENE (P-ISOPROPYLTOLUENE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
SEC-BUTYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
STYRENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
T-BUTYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
TETRACHLOROETHYLENE(PCE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
TOLUENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	**3.11**	**0.35**	0.04 U	0.04 U
TRANS-1,2-DICHLOROETHENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
TRANS-1,3-DICHLOROPROPENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
TRICHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
TRICHLOROETHYLENE (TCE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
TRICHLOROFLUOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
VINYL CHLORIDE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U

[1] Not detected at the specified detection limit

TABLE B46: Bulk SVOC data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in May) (OEPA 2014a) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

SVOC (mg/kg)	UPPER RIVER								
	DMMU-1			DMMU-2a		DMMU-2b			
	200013	F01A21	F01A42	F01W50	F01S08	302578	302579	302580	302581
1,2,4,5-TETRACHLOROBENZENE	0.4 U[1]	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,2,4-TRICHLOROBENZENE	0.4 UJ	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
1,2-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,3-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,3-DINITROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,4-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,4-NAPHTHOQUINONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,3,4,6-TETRACHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4,5-TRICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4,6-TRICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DIMETHYLPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DINITROPHENOL	R	R	2 U	2 U	2 U	R	R	R	R
2,4-DINITROTOLUENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,6-DICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,6-DINITROTOLUENE	0.4 UJ	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
2-ACETYLAMINOFLUORENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-CHLORONAPHTHALENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-CHLOROPHENOL	0.4 UJ	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
2-METHYLNAPHTHALENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-METHYLPHENOL (O-CRESOL)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-NITROANILINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-NITROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-PICOLINE (ALPHA-PICOLINE)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
3,3'-DICHLOROBENZIDINE	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
3/4-METHYLPHENOL	**0.83**	0.4 U	**2.2**	**3.37**	**1.82**	**4.97**	**2.71**	**0.73**	**1.46**
3-METHYLCHOLANTHRENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4,6-DINITRO-2-METHYLPHENOL	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
4-BROMOPHENYL PHENYL ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-CHLORO-3-METHYLPHENOL	0.4 UJ	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
4-CHLOROPHENYL PHENYL ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-NITROANILINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-NITROPHENOL	2 UJ	2 UJ	2 U	2 U	2 U	2 UJ	2 UJ	2 UJ	2 UJ
7,12-DIMETHYLBENZ(A)ANTHRACENE	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
ACETOPHENONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ANILINE (PHENYLAMINE, AMINOBENZENE)	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
BENZYL ALCOHOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BENZYL BUTYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROETHOXY) METHANE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROISOPROPYL) ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-ETHYLHEXYL) PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DIETHYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DIMETHYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DI-N-BUTYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DI-N-OCTYLPHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DINOSEB	R	R	0.4 U	0.4 U	0.4 U	R	R	R	R
DIPHENYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ETHYL METHANESULFONATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROBUTADIENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROCYCLOPENTADIENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROETHANE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROPROPENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ISOPHORONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
METHYL METHANESULFONATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
NITROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSO-DI-N-BUTYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSODI-N-PROPYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOMORPHOLINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOPIPERIDINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOPYRROLIDINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
P-DIMETHYLAMINOAZOBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PENTACHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PENTACHLOROPHENOL	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
PHENACETIN	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PRONAMIDE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
SAFROLE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U

[1] Not detected at the specified detection limit

TABLE B47: Bulk inorganics data on Cleveland Harbor Upper Cuyahoga River sediments (core samples collected in April) (OEPA 2014b) (highlighting indicates that sediment sample was not collected from the channel dredging prism; yellow is outside the DMMU boundary while orange is below the dredging depth).

INORGANIC (mg/kg)	UPPER RIVER																				
	DMMU-1							DMMU-2a						DMMU-2b							
	200013	200016	F01A21	F01A42		302582		F01W50		F01S08		302581		302578		302579		302580		F01A41	
				TOP	BOTTOM	TOP	BOTTOM	DISCRETE	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM
NITROGEN, AMMONIA	390	900	26	450	980	320	280	630	420	540	380	440	510	330	680	330	370	470	390	320	740
PHOSPHORUS, TOTAL (AS P)	734	288	374	858	885	941	824	911	672	935	953	1,010	921	1,100	**2,620**	947	832	869	893	1,030	1070
TOTAL ORGANIC CARBON (%)	2.0	1.2	1.0	2.2	2.0	2.4	3.1	1.9	0.2	2.2	1.9	1.8	2.0	2.0	3.8	2.4	2.2	1.7	1.6	2.0	1.9

TABLE B48: Bulk metals data on Cleveland Harbor Upper Cuyahoga River sediments (core samples collected in April) (OEPA 2014b) (highlighting indicates that sediment sample was not collected from the channel dredging prism; yellow is outside the DMMU boundary while orange is below the dredging depth).

METAL (mg/kg)	UPPER RIVER																				
	DMMU-1							DMMU-2a						DMMU-2b							
	200013	200016	F01A21	F01A42		302582		F01W50		F01S08		302581		302578		302579		302580		F01A41	
				TOP	BOTTOM	TOP	BOTTOM	DISCRETE	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM
ALUMINUM	6,680	2,800	3,620	8,410	8,460	7,800	6,550	7,990	8,660	7,970	8,340	9,230	8,470	8,990	10,800	8,850	9,410	7,080	7,180	6,100	9,770
ANTIMONY	0.8 U[1]	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	1.15	0.8 U	0.8 U	0.8 U	**8.48**	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U
ARSENIC	12.4	6.83	8.01	14.8	14.4	14.5	13.6	14.2	14.5	15.2	14.9	16.3	15.5	14.8	20.1	15.6	15.8	13.7	13.7	11.5	14.9
BARIUM	60.8	29.7	31.2	72.1	77.6	76.2	66.5	66.2	65.9	73.5	75	83.2	75.6	73.1	150	82.6	77	69.4	68.5	66.6	80.2
BERYLLIUM	0.404	0.225	0.321	0.53	0.515	0.503	0.423	0.553	0.496	0.483	0.49	0.556	0.543	0.517	0.674	0.56	0.569	0.447	0.465	0.46	0.584
CADMIUM	0.867	0.488	1.13	0.959	1.15	1.05	0.957	1.08	1.68	1.03	0.998	1.13	1.17	1.12	**16.9**	1.14	0.98	0.94	1.08	1.11	1.15
CALCIUM	10,100	4,600	6,940	13,300	13,400	10,200	10,700	14,500	12,600	11,000	14,700	15,100	15,300	14,000	18,900	14,100	13,400	13,600	13,400	14,800	14,500
CHROMIUM, TOTAL	15	7.84	7.83	17.9	19.2	18.5	15.9	20.9	16.2	18	18.5	21.7	19.1	22.8	**141**	20.3	18.9	17	17.7	18.4	20.7
COBALT	7.13	4.19	4.45	9.54	9.04	8.31	7.84	8.8	8.88	8.2	8.99	9.87	9.69	9.39	**13.4**	9.53	10.1	8.29	8.69	8.47	9.13
COPPER	35.4	13.3	22	38.3	38.7	36.1	35.4	37.9	35.6	35.2	44.8	45.3	40.6	39.6	**138**	40.2	36.7	39.7	44.9	42.1	41.9
IRON	22,600	11,900	13,900	27,300	25,400	24,300	23,400	26,400	27,200	26,400	27,300	30,400	28,100	29,300	74,300	29,400	30,100	25,800	25,600	22,800	27,800
LEAD	33.6	16.8	31.4	50.9	40.1	36.6	37.6	36.8	42.7	38.4	40.7	45.3	40.2	39.6	**240**	41.1	36.6	37	40.2	37.9	42.1
MAGNESIUM	4,560	2,030	2,530	5,760	5,360	4,740	4,540	5,460	5,600	5,090	5,780	6,230	5,950	6,200	5,820	6,200	6,230	5,400	5,530	5,250	5,970
MANGANESE	518	222	279	786	681	534	602	681	653	614	712	761	698	630	952	699	784	566	566	620	605
MERCURY	0.07	0.036	0.08 U	0.085	0.226	0.094	0.091	0.115	0.091	0.1	0.088	0.098	0.087	0.072	**0.224**	0.093	0.092	0.93	0.094	0.148	0.097
NICKEL	21.7	15.2	15.1	28	27.9	25.1	23.6	27.1	29.8	24.5	27.5	27.9	31.1	26.6	**80.2**	27.9	28.8	24.3	26.1	23.6	33
POTASSIUM	800 U	800 U	800 U	1,290	1,490	1,440	800 U	1,190	1,320	1,300	1,280	1,510	1,360	1,370	1,820	1,400	1,440	800 U	800 U	800 U	1,760
SELENIUM	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U
SILVER	0.233	0.08 U	0.09	0.252	0.267	0.197	0.201	0.284	0.29	0.289	0.234	0.269	0.255	0.279	2.24	0.278	0.228	0.242	0.3	0.279	0.318
SODIUM	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U
STRONTIUM	24	12 U	12 U	28	31	27	25	30	26	28	33	33	33	29	45	34	30	28	28	30	32
TITANIUM	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	31	20 U	20 U	20 U	20 U	37	20 U	20 U	20 U	20 U	20 U	20 U
VANADIUM	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	28	20 U	20 U	20 U	20 U	20 U	20 U
ZINC	156	78.9	86.1	173	183	180	175	186	173	171	171	206	191	239	**865**	200	183	175	186	179	197

[1] Not detected at the specified detection limit

TABLE B49: Bulk PCB data on Cleveland Harbor Upper Cuyahoga River sediments (core samples collected in April) (OEPA 2014b) (highlighting indicates that sediment sample was not collected from the channel dredging prism; yellow is outside the DMMU boundary while orange is below the dredging depth).

AROCLOR (µg/kg)	UPPER RIVER																				
	DMMU-1							DMMU-2a						DMMU-2b							
	200013	200016	F01A21	F01A42		302582		F01W50		F01S08		302581		302578		302579		302580		F01A41	
				TOP	BOTTOM	TOP	BOTTOM	DISCRETE	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM
AROCLOR 1016	20 U[1]	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1221	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1232	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1242	**63.2**	**37.4**	**26.6**	**45.6**	**62.3**	**58.6**	**50**	**46.9**	**152**	**48.2**	**43.4**	**43**	**41**	**47.9**	**2,620**	**45.3**	**36.3**	**56.3**	**66.3**	**61.5**	**59.9**
AROCLOR 1248	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1254	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1260	**97.5**	**20 U**	**20 U**	**84.9**	**77.1**	**64.5**	**79.6**	**89.8**	**97.7**	**90.3**	**93.1**	**97.7**	**79.2**	**84.8**	**741**	**68.9**	**66.5**	**86.5**	**92.5**	**103**	**82.5**
TOTAL PCBs	**160.7**	**37.4**	**26.6**	**130.5**	**139.4**	**123.1**	**129.6**	**136.7**	**249.7**	**138.5**	**136.5**	**140.7**	**120.2**	**132.7**	**3,361**	**114.2**	**102.8**	**142.8**	**158.8**	**164.5**	**142.4**
TOC (%)	**2**	**1.2**	**1**	**2.2**	**2**	**2.4**	**3.1**	**1.9**	**0.2**	**2.2**	**1.9**	**1.8**	**2**	**2**	**3.8**	**2.4**	**2.2**	**1.7**	**1.6**	**2**	**1.9**
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	**8,035**	**3,117**	**2,660**	**5,932**	**6,970**	**5,129**	**4,181**	**7,195**	**124,850**	**6,295**	**7,184**	**7,817**	**6,010**	**6,635**	**88,447**	**4,758**	**4,673**	**8,400**	**9,925**	**8,225**	**7,495**

[1] **Not detected at the specified detection limit**

TABLE B50: Bulk pesticides data on Cleveland Harbor Upper Cuyahoga River sediments (core samples collected in April) (OEPA 2014b) (highlighting indicates that sediment sample was not collected from the channel dredging prism; yellow is outside the DMMU boundary while orange is below the dredging depth).

PESTICIDE (µg/kg)	UPPER RIVER																				
	DMMU-1							DMMU-2a						DMMU-2b							
	200013	200016	F01A21	F01A42		302582		F01W50		302581		F01S08		302578		302579		302580		F01A41	
				TOP	BOTTOM	TOP	BOTTOM	DISCRETE	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM
ALDRIN	4 U[1]	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	11.7	4 U	4 U	4 U	4 U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ALPHA ENDOSULFAN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
BETA ENDOSULFAN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DIELDRIN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDOSULFAN SULFATE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDRIN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDRIN ALDEHYDE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
GAMMA BHC (LINDANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEPTACHLOR	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEPTACHLOR EPOXIDE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEXACHLOROBENZENE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	8.6	4 U	4 U
METHOXYCHLOR	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
MIREX	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DDD (DICHLORODIPHENYLDICHLORETHANE)	7.4	4 U	4 U	4 U	4 U	4 U	6.4	4 U	8.8	4 U	4 U	8.5	4 U	7.2	8.1	4 U	7.2	7.2	4 U	4 U	7.4
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	15.5	5.8	6.6	13	17.6	21.5	14.5	21.1	13	15.6	15.4	22.8	18.3	17	4 U	18.2	16.3	18	13.7	18.5	17.5
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	8.1	4 U	7.5	4 U	4 U	24.4	8.5	13.8	4 U	10.7	7.2	22.9	8	7.4	4 U	11.4	6.8	8.8	4 U	12.6	4 U
TOTAL DDT	31	5.8	14.1	13	17.6	45.9	29.4	34.9	21.8	26.3	22.6	54.2	26.3	31.6	8.1	29.6	30.3	34	13.7	31.1	24.9
TOC (%)	2.0	1.2	1.0	2.2	2.0	2.4	3.1	1.9	0.2	2.2	1.9	1.8	2.0	2.0	3.8	2.4	2.2	1.7	1.6	2.0	1.9
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	1,550	483	1,410	591	880	1,913	948	1,837	10,900	1,195	1,189	3,011	1,315	1,580	213	1,233	1,377	2,000	856	1,555	1,311

[1] Not detected at the specified detection limit

TABLE B51: Bulk PAH data on Cleveland Harbor Upper Cuyahoga River sediments (core samples collected in April) (OEPA 2014b) (highlighting indicates that sediment sample was not collected from the channel dredging prism; yellow is outside the DMMU boundary while orange is below the dredging depth).

PAH COMPOUND (mg/kg)	UPPER RIVER																				
	DMMU-1							DMMU-2a						DMMU-2b							
	200013	200016	F01A21	F01A42		302582		F01W50		F01S08		302581		302578		302579		302580		F01A41	
				TOP	BOTTOM	TOP	BOTTOM	DISCRETE	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM
ACENAPHTHENE	0.4 U[1]	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	1.75	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ACENAPHTHYLENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ANTHRACENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	2.94	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BENZO(A)ANTHRACENE	0.74	0.4 U	0.4 U	0.4 U	0.69	0.4 U	0.72	1.55	1.43	0.67	0.87	0.79	0.92	0.4 U	4.3	0.4 U	0.4 U	1.76	1.4	0.72	0.77
BENZO(A)PYRENE	1	0.4 U	0.4 U	0.88	1.1	0.83	0.88	1.82	1.69	0.98	1.34	1.09	1.31	1.75	4.03	1.92	1.41	1.92	1.83	1	1.11
BENZO(B)FLUORANTHENE	1.14	0.4 U	0.4 U	1.08	1.36	1.11	0.98	2.11	2.07	1.1	1.76	1.43	1.41	2.25	4.43	2.54	1.92	2.34	2.21	1.22	1.32
BENZO(G,H,I)PERYLENE	0.93	0.4 U	0.4 U	0.84	1.12	0.86	0.82	1.36	1.24	0.96	1.34	1.03	1.3	1.42	1.41	1.46	0.4 U	1.42	1.39	0.98	1.11
BENZO(K)FLUORANTHENE	0.87	0.4 U	0.4 U	0.75	1.03	0.4 U	0.84	1.45	1.37	0.89	1.09	0.79	1.19	1.72	3.4	1.95	0.4 U	1.38	1.78	0.85	1.06
CHRYSENE	1.08	0.4 U	0.4 U	0.92	1.23	1.1	1.09	2.12	1.98	1.06	1.42	1.16	1.46	2.08	5.42	2.46	1.79	2.23	2.27	1.1	1.24
DIBENZ(A,H)ANTHRACENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
FLUORANTHENE	1.98	1.11	0.59	1.55	2.19	2.21	1.99	4.87	4.14	1.9	2.54	2.05	2.51	3.69	11.2	4.65	3.27	4.68	4.21	1.82	2.14
FLUORENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	3.78	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
INDENO(1,2,3-C,D)PYRENE	0.79	0.4 U	0.4 U	0.71	1	0.74	0.71	1.32	1.22	0.82	1.17	0.94	1.08	0.4 U	1.44	1.41	0.4 U	1.3	1.36	0.88	0.95
NAPHTHALENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	2.84	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PHENANTHRENE	1.25	0.4 U	0.4 U	0.7	0.93	1.13	0.94	3.68	3.04	0.96	1.21	1.2	0.98	1.65	10.5	2.34	1.4	3.54	2.09	1.02	1.06
PYRENE	1.65	0.4 U	0.4 U	1.29	1.75	1.7	1.6	3.74	3.46	1.51	2.02	1.61	2.33	2.95	9.79	3.64	2.64	3.66	3.37	1.5	1.73
TOTAL PAHs	11.43	1.11	0.59	8.72	12.4	9.68	10.57	24.02	21.64	10.85	14.76	12.09	14.49	17.51	67.23	22.37	12.43	24.23	21.91	11.09	12.49
TOTAL ORGANIC CARBON (%)	2.0	1.2	1.0	2.2	2.0	2.4	3.1	1.9	0.2	2.2	1.9	1.8	2.0	2.0	3.8	2.4	2.2	1.7	1.6	2.0	1.9
TOC-NORMALIZED CONCENTRATION (mg/kg-TOC)	572	93	59	396	620	403	341	1,264	10,820	493	777	672	725	876	1,769	932	565	1,425	1,369	555	657

[1] Not detected at the specified detection limit

TABLE B52: Bulk VOC data on Cleveland Harbor Upper Cuyahoga River sediments (core samples collected in April) (OEPA 2014b) (highlighting indicates that sediment sample was not collected from the channel dredging prism; yellow is outside the DMMU boundary while orange is below the dredging depth).

VOC (mg/kg)	UPPER RIVER																				
	DMMU-1							DMMU-2a						DMMU-2b							
	200013	200016	F01A21	F01A42		302582		F01W50		F01S08		302581		302578		302579		302580		F01A41	
				TOP	BOTTOM	TOP	BOTTOM	DISCRETE	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM
1,1,1,2-TETRACHLOROETHANE	0.2 U[1]	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,1,2,2-TETRACHLOROETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,1,2-TRICHLOROETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,1-DICHLOROETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,1-DICHLOROETHENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,1-DICHLOROPROPENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,2,3-TRICHLOROBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 UJ	0.2 U	0.2 U	0.04 UJ	0.04 U	0.2 U	0.04 UJ	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,2,3-TRICHLOROPROPANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,2,4-TRICHLOROBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,2,4-TRIMETHYLBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	**0.208**	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,2-DIBROMO-3-CHLOROPROPANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,2-DICHLOROBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,2-DICHLOROETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,2-DICHLOROPROPANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	**0.116**	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,3-DICHLOROBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,3-DICHLOROPROPANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,4-DICHLOROBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
2,2-DICHLOROPROPANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
2-CHLOROTOLUENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
2-HEXANONE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
4-CHLOROTOLUENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
ACETONE	0.2 U	0.2 U	0.2 U	0.2 U	**0.068**	0.2 U	0.2 U	**0.072**	**0.121**	0.2 U	**0.139**	0.2 U	**0.092**	**0.105**	**0.129**	0.2 U	0.05 U	**0.098**	**0.076**	**0.102**	**0.083**
BENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
BROMOBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
BROMOCHLOROMETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
BROMODICHLOROMETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
BROMOFORM	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
BROMOMETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
CARBON DISULFIDE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
CARBON TETRACHLORIDE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
CHLOROBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 UJ	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
CHLOROETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
CHLOROFORM	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
CHLOROMETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
CIS-1,2-DICHLOROETHYLENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
CIS-1,3-DICHLOROPROPENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
DIBROMOCHLOROMETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
DIBROMOMETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
DICHLORODIFLUOROMETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
ETHYLBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
HEXACHLOROBUTADIENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
ISOPROPYLBENZENE (CUMENE)	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
M+P-XYLENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
METHYL ETHYL KETONE (2-BUTANONE)	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
METHYLENE CHLORIDE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
NAPHTHALENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	**0.069**	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
N-BUTYLBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
N-PROPYLBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
O-XYLENE (1,2-DIMETHYLBENZENE)	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
P-CYMENE (P-ISOPROPYLTOLUENE)	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
SEC-BUTYLBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
STYRENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
T-BUTYLBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
TETRACHLOROETHYLENE(PCE)	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
TOLUENE	**0.83**	**0.78**	**1.86**	**10**	0.04 U	**2.86**	**4.41**	0.04 UJ	0.04 U	**7.21**	0.04 U	**0.88**	0.04 U	0.04 U	0.04 U	**7.69**	0.04 U	**0.083**	0.04 U	**0.061**	0.04 U
TRANS-1,2-DICHLOROETHENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
TRANS-1,3-DICHLOROPROPENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
TRICHLOROETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
TRICHLOROETHYLENE (TCE)	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
TRICHLOROFLUOROMETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
VINYL CHLORIDE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U

[1] **Not detected at the specified detection limit**

TABLE B53: Bulk SVOC data on Cleveland Harbor Upper Cuyahoga River sediments (core samples collected in April) (OEPA 2014b) (highlighting indicates that sediment sample was not collected from the channel dredging prism; yellow is outside the DMMU boundary while orange is below the dredging depth).

SVOC (mg/kg)	UPPER RIVER																				
	DMMU-1							DMMU-2a						DMMU-2b							
	200013	200016	F01A21	F01A42		302582		F01W50		F01S08		302581		302578		302579		302580		F01A41	
				TOP	BOTTOM	TOP	BOTTOM	DISCRETE	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM
1,2,4,5-TETRACHLOROBENZENE	0.4 U[1]	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,2,4-TRICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,2-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,3-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,3-DINITROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,4-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,4-NAPHTHOQUINONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,3,4,6-TETRACHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4,5-TRICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4,6-TRICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DIMETHYLPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DINITROPHENOL	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
2,4-DINITROTOLUENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,6-DICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,6-DINITROTOLUENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-ACETYLAMINOFLUORENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-CHLORONAPHTHALENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-CHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-METHYLNAPHTHALENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-METHYLPHENOL (O-CRESOL)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-NITROANILINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-NITROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-PICOLINE (ALPHA-PICOLINE)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
3,3'-DICHLOROBENZIDINE	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
3/4-METHYLPHENOL	**3.57**	0.4 U	**1.72**	**0.83**	0.4 U	**18.6**	**3.73**	0.4 U	0.4 U	**11.9**	0.4 U	**2.93**	0.4 U	**1.5**	0.4 U	**22.2**	0.4 U	**2.15**	0.4 U	**2.09**	0.4 U
3-METHYLCHOLANTHRENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4,6-DINITRO-2-METHYLPHENOL	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
4-BROMOPHENYL PHENYL ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-CHLORO-3-METHYLPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-CHLOROPHENYL PHENYL ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-NITROANILINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-NITROPHENOL	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
7,12-DIMETHYLBENZ(A)ANTHRACENE	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
ACETOPHENONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ANILINE (PHENYLAMINE, AMINOBENZENE)	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
BENZYL ALCOHOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BENZYL BUTYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROETHOXY) METHANE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROISOPROPYL) ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-ETHYLHEXYL) PHTHALATE	**0.67**	0.4 U	0.4 U	0.4 U	**0.89**	**0.94**	**0.79**	**0.84**	**1.68**	**0.84**	**0.88**	**0.95**	**0.97**	**1.96**	**19.7**	**2.09**	**1.61**	**1.01**	**2.07**	**1.12**	**1.05**
DIBENZOFURAN	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	**1.69**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DIETHYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DIMETHYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DI-N-BUTYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DI-N-OCTYLPHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DINOSEB	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 U	0.4 UJ	0.4 U	0.4 U
DIPHENYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ETHYL METHANESULFONATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROBUTADIENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROCYCLOPENTADIENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROETHANE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROPROPENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ISOPHORONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
METHYL METHANESULFONATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
NITROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSO-DI-N-BUTYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSODI-N-PROPYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOMORPHOLINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOPIPERIDINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOPYRROLIDINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
P-DIMETHYLAMINOAZOBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PENTACHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PENTACHLOROPHENOL	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
PHENACETIN	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PRONAMIDE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
SAFROLE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U

[1] Not detected at the specified detection limit

TABLE B54: Bulk inorganics data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in August) (OEPA 2014c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

INORGANIC (mg/kg)	UPPER RIVER					
	DMMU-1	DMMU-2a		DMMU-2b		
	F01A42	F01W50	F01S08	302578	302579	302580
NITROGEN, AMMONIA	230	120	190	190	220	270
PHOSPHORUS, TOTAL (AS P)	744	590	624	750	43.7	49.5
TOTAL ORGANIC CARBON (%)	2.2	1.9	1.9	2	1.5	2

TABLE B55: Bulk metals data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in August) (OEPA 2014c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

METAL (mg/kg)	UPPER RIVER					
	DMMU-1	DMMU-2a		DMMU-2b		
	F01A42	F01W50	F01S08	302578	302579	302580
ALUMINUM	12,100	6,770	9,930	11,400	7,560	9,300
ANTIMONY	0.8 U[1]	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U
ARSENIC	20.9	15.1	15.6	17	12.9	16.1
BARIUM	87	63.3	74.6	74.7	54.9	66
BERYLLIUM	0.687	0.485	0.594	0.622	0.473	0.556
CADMIUM	1.01	1.05	0.965	3.52	0.729	1.08
CALCIUM	14,400	23,100	13,000	14,500	11,700	14,600
CHROMIUM, TOTAL	21.1	22.3	19	52.5	15.4	18.6
COBALT	12.3	8.23	9.3	11	8.08	9.95
COPPER	36.5	35.1	32	40.4	24.4	36.7
IRON	36,100	26,800	29,700	33,000	24,800	30,400
LEAD	35.2	33.3	32.9	39.4	24.8	35.2
MAGNESIUM	7,210	6,120	5,890	6,970	5,450	6,460
MANGANESE	960	740	723	703	502	660
MERCURY	0.064	0.196	0.107	0.06	0.069	0.09
NICKEL	32.4	25.1	25.8	35	21.9	28
POTASSIUM	2,210	800 U	1,760	1,960	800 U	1,550
SELENIUM	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U
SILVER	0.225	0.19	0.193	0.21	0.157	0.245
SODIUM	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U
STRONTIUM	35	36	29	30	23	29
TITANIUM	20 U	20 U	20 U	20 U	20 U	20 U
VANADIUM	20 U	20 U	20 U	20 U	20 U	20 U
ZINC	182	187	188	260	146	179

[1] Not detected at the specified detection limit

TABLE B56: Bulk PCB data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in August) (OEPA 2014c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

AR0CLOR (µg/kg)	UPPER RIVER							
	DMMU-1			DMMU-2a		DMMU-2b		
	200013	F01A21	F01A42	F01W50	F01S08	302578	302579	302580
AROCLOR 1016	20 U[1]	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1221	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1232	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1242	**42**	**49.2**	20 U	**61.2**	20 U	20 U	20 U	**38.9**
AROCLOR 1248	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1254	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1260	**248**	**81.2**	**126**	**115**	**65.5**	**103**	**67.6**	**144**
TOTAL PCBs	**290**	**130.4**	**126**	**176.2**	**65.5**	**103**	**67.6**	**182.9**
TOTAL ORGANIC CARBON (%)			**2.2**	**1.9**	**1.9**	**2.0**	**1.5**	**2.0**
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)			**5,727**	**9,274**	**3,447**	**5,150**	**4,507**	**9,145**

[1] Not detected at the specified detection limit

TABLE B57: Bulk pesticides data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in August) (OEPA 2014c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PESTICIDE (µg/kg)	UPPER RIVER							
	DMMU-1			DMMU-2a		DMMU-2b		
	200013	F01A21	F01A42	F01W50	F01S08	302578	302579	302580
ALDRIN	4 U[1]	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ALPHA ENDOSULFAN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
BETA ENDOSULFAN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DIELDRIN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDOSULFAN SULFATE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDRIN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDRIN ALDEHYDE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
GAMMA BHC (LINDANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEPTACHLOR	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEPTACHLOR EPOXIDE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEXACHLOROBENZENE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
METHOXYCHLOR	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
MIREX	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DDD (DICHLORODIPHENYLDICHLORETHANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	**10.3**	**13.1**	4 U	**10.1**	**14.4**	**11.2**	**15.5**	**11.8**
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	4 U	4 U	4 U	4 U	4 U	4 U	**15.6**	4 U
TOTAL DDT	**10.3**	**13.1**		**10.1**	**14.4**	**11.2**	**31.1**	**11.8**
TOTAL ORGANIC CARBON (%)			**2.2**	**1.9**	**1.9**	**2.0**	**1.5**	**2.0**
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)				**532**	**758**	**560**	**2073**	**590**

[1] Not detected at the specified detection limit

TABLE B58: Bulk PAH data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in August) (OEPA 2014c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PAH COMPOUND (mg/kg)	UPPER RIVER							
	DMMU-1			DMMU-2a		DMMU-2b		
	200013	F01A21	F01A42	F01W50	F01S08	302578	302579	302580
ACENAPHTHENE	0.4 U[1]	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ACENAPHTHYLENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ANTHRACENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BENZO(A)ANTHRACENE	0.4 U	0.4 U	0.4 U	**1.24**	0.4 U	0.4 U	0.4 U	**0.78**
BENZO(A)PYRENE	0.4 U	0.4 U	0.4 U	**1.38**	**0.7**	**0.79**	**0.7**	**1**
BENZO(B)FLUORANTHENE	**0.95**	**1.05**	**0.93**	**1.57**	**0.97**	**1.16**	**1**	**1.32**
BENZO(G,H,I)PERYLENE	0.4 U	0.4 U	0.4 U	**1.12**	**0.7**	**0.79**	**0.72**	**0.98**
BENZO(K)FLUORANTHENE	0.4 U	0.4 U	0.4 U	**1.22**	0.4 U	0.4 U	0.4 U	**0.89**
CHRYSENE	**0.8**	**0.92**	**0.82**	**1.6**	**0.88**	**1**	**0.83**	**1.14**
DIBENZ(A,H)ANTHRACENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
FLUORANTHENE	**1.38**	**1.72**	**1.46**	**3.3**	**1.59**	**1.76**	**1.5**	**1.99**
FLUORENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
INDENO(1,2,3-C,D)PYRENE	0.4 U	0.4 U	0.4 U	**0.95**	0.4 U	0.4 U	0.4 U	**0.8**
NAPHTHALENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PHENANTHRENE	0.4 U	0.4 U	0.4 U	**1.62**	0.4 U	0.4 U	**0.64**	**0.81**
PYRENE	**1.12**	**1.35**	**1.17**	**2.63**	**1.27**	**1.38**	**1.15**	**1.61**
TOTAL PAHs	**4.25**	**5.04**	**4.38**	**16.63**	**6.11**	**6.88**	**6.54**	**11.32**
TOTAL ORGANIC CARBON (%)			**2.2**	**1.9**	**1.9**	**2.0**	**1.5**	**2.0**
TOC-NORMALIZED CONCENTRATION (mg/kg-TOC)			**199**	**875**	**322**	**344**	**436**	**566**

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[1] Not detected at the specified detection limit

TABLE B59: Bulk VOC data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in August) (OEPA 2014c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

VOC (mg/kg)	UPPER RIVER							
	DMMU-1			DMMU-2a		DMMU-2b		
	200013	F01A21	F01A42	F01W50	F01S08	302578	302579	302580
1,1,1,2-TETRACHLOROETHANE	0.2 U[1]	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1,2,2-TETRACHLOROETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1,2-TRICHLOROETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1-DICHLOROETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1-DICHLOROETHENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1-DICHLOROPROPENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,3-TRICHLOROBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,3-TRICHLOROPROPANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,4-TRICHLOROBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,4-TRIMETHYLBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DIBROMO-3-CHLOROPROPANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DICHLOROBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DICHLOROETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DICHLOROPROPANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,3-DICHLOROBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,3-DICHLOROPROPANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,4-DICHLOROBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2,2-DICHLOROPROPANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2-CHLOROTOLUENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2-HEXANONE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
4-CHLOROTOLUENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
ACETONE	0.2 U	0.2 U	**0.096**	0.05 U	**0.079**	**0.094**	0.05 U	**0.071**
BENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOCHLOROMETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMODICHLOROMETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOFORM	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOMETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CARBON DISULFIDE	0.2 UJ	0.2 UJ	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CARBON TETRACHLORIDE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROFORM	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROMETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CIS-1,2-DICHLOROETHYLENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CIS-1,3-DICHLOROPROPENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
DIBROMOCHLOROMETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
DIBROMOMETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
DICHLORODIFLUOROMETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
ETHYLBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
HEXACHLOROBUTADIENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
ISOPROPYLBENZENE (CUMENE)	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
M+P-XYLENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
METHYL ETHYL KETONE (2-BUTANONE)	**0.48**	**0.38**	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
METHYLENE CHLORIDE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
NAPHTHALENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
N-BUTYLBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
N-PROPYLBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
O-XYLENE (1,2-DIMETHYLBENZENE)	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
P-CYMENE (P-ISOPROPYLTOLUENE)	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
SEC-BUTYLBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
STYRENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
T-BUTYLBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TETRACHLOROETHYLENE(PCE)	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TOLUENE	**1.37**	**3.41**	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TRANS-1,2-DICHLOROETHENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TRANS-1,3-DICHLOROPROPENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TRICHLOROETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TRICHLOROETHYLENE (TCE)	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TRICHLOROFLUOROMETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
VINYL CHLORIDE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U

[1] Not detected at the specified detection limit

TABLE B60: Bulk SVOC data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in August) (OEPA 2014c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

SVOC (mg/kg)	UPPER RIVER							
	DMMU-1			DMMU-2a		DMMU-2b		
	200013	F01A21	F01A42	F01S08	F01W50	302578	302579	302580
1,2,4,5-TETRACHLOROBENZENE	0.4 U[1]	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,2,4-TRICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,2-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,3-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,3-DINITROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,4-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,4-NAPHTHOQUINONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,3,4,6-TETRACHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4,5-TRICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4,6-TRICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DIMETHYLPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DINITROPHENOL	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
2,4-DINITROTOLUENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,6-DICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,6-DINITROTOLUENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-ACETYLAMINOFLUORENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-CHLORONAPHTHALENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-CHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-METHYLNAPHTHALENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-METHYLPHENOL (O-CRESOL)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-NITROANILINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-NITROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-PICOLINE (ALPHA-PICOLINE)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
3,3'-DICHLOROBENZIDINE	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
3/4-METHYLPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
3-METHYLCHOLANTHRENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4,6-DINITRO-2-METHYLPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-BROMOPHENYL PHENYL ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-CHLORO-3-METHYLPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-CHLOROPHENYL PHENYL ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-NITROANILINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-NITROPHENOL	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
7,12-DIMETHYLBENZ(A)ANTHRACENE	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
ACETOPHENONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ANILINE (PHENYLAMINE, AMINOBENZENE)	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
BENZYL ALCOHOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BENZYL BUTYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROETHOXY) METHANE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROISOPROPYL) ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-ETHYLHEXYL) PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	**0.89**	0.4 U	**0.82**
DIBENZOFURAN	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DIETHYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DIMETHYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DI-N-BUTYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DI-N-OCTYLPHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DINOSEB	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DIPHENYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ETHYL METHANESULFONATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROBUTADIENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROCYCLOPENTADIENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROETHANE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROPROPENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ISOPHORONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
METHYL METHANESULFONATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
NITROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSO-DI-N-BUTYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSODI-N-PROPYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOMORPHOLINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOPIPERIDINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOPYRROLIDINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
P-DIMETHYLAMINOAZOBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PENTACHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PENTACHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PHENACETIN	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PRONAMIDE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
SAFROLE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U

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[1] **Not detected at the specified detection limit**

TABLE B61: Bulk grain size data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in October) (OEPA 2014d) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PARTICLE SIZE (%)	UPPER RIVER				
	DMMU-1			DMMU-2a	DMMU-2b
	200016	F01A21-EAST	302810 Composite 1	302809 Composite 2	302808 Composite 3
FINE CLAY	9.9	2	9.9	9.9	12
MEDIUM CLAY	4	2	7.9	6	4
COARSE CLAY	6	2	2	6	7.9
VERY FINE SILT	8	2	6	12	12
FINE SILT	9.9	4	7.9	32	34
MEDIUM SILT	16	10	18	12	12
COARSE SILT	4	2	6	23	19
COARSE SAND	42	76	42	0	0

TABLE B62. Bulk inorganics data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in October) (OEPA 2014d) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

INORGANIC (mg/kg)	UPPER RIVER												
	DMMU-1					DMMU-2a				DMMU-2b			
	200016	F01A21-EAST	F01A21-WEST	F01A42	302810 Composite 1	F01W50	F01S08	302581	302809 Composite 2	302578	302579	302580	302808 Composite 3
NITROGEN, AMMONIA	140	87	320	370	230	330	240	210	240	140	140	320	170
PHOSPHORUS, TOTAL (AS P)	637	566	1330	757	751	827	811	757	791	639	672	963	810
TOTAL ORGANIC CARBON	1.8	1.8	2.9	2.4	2.2	2.2	2.4	2.3	2.4	2.1	2	2.4	2.2
pH	7.2	7.8	7.2	7.2	7.3	7.3	7.5	7.5	7.4	7.6	7.8	7.8	7.5

TABLE B63. Bulk metals data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in October) (OEPA 2014d) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

METAL (mg/kg)	UPPER RIVER												
	DMMU-1					DMMU-2a				DMMU-2b			
	200016	F01A21-EAST	F01A21-WEST	F01A42	302810 Composite 1	F01W50	F01S08	302581	302809 Composite 2	302578	302579	302580	302808 Composite 3
ALUMINUM	6,350	4,280	10,300	9,440	7,350	10,700	10,300	11,100	9,050	9,850	8,900	10,200	8,670
ARSENIC	14.5	10.2	18.6	18.5	16.8	19.1	16.9	19	17.2	15.5	13.1	16.6	14.9
BARIUM	49	35.2	94.9	73.4	62	79.4	76.1	76.9	72.3	70.8	61.9	78.5	68
BERYLLIUM	0.392	0.333	0.668	0.552	0.487	0.632	0.652	0.64	0.575	0.595	0.582	0.618	0.565
CADMIUM	0.641	0.679	2.02	0.925	0.825	1.07	1.09	1.01	0.952	1.42	0.93	1.23	1.19
CALCIUM	8,920	11,800	18,800	12,300	11,700	14,800	16,000	14,700	14,600	15,200	13,700	17,000	15,200
CHROMIUM, TOTAL	12.1	11.7	23	18.1	21.2	20.3	20.2	19.4	18.2	84.5	20.9	20.6	44.8
COBALT	8	5.82	11.3	9.7	8.84	10.6	10.5	10.5	10.4	10.1	8.93	10.2	10.1
COPPER	33.1	24.5	45.3	31.6	35.9	40.3	43.4	38.9	39.3	40.2	28.6	44	40.4
IRON	24,200	16,900	33,400	30,500	28,400	33,400	32,000	33,200	31,100	30,700	26,600	32,000	29,500
LEAD	42.7	22.1	39.1	33.3	30.4	41	35.4	35.6	35.1	38.5	28.1	36.7	34.1
MAGNESIUM	4,390	4,680	7,180	5,890	5,360	6,680	6,730	6,850	6,400	6,630	6,050	6,840	6,490
MANGANESE	609	370	947	811	802	813	729	830	753	658	552	676	630
MERCURY	0.066	0.045	0.096	0.066	0.085	0.09	0.089	0.079	0.088	0.089	0.067	0.065	0.079
NICKEL	22.2	27.3	35.3	26.3	26.4	28.8	31.6	29.9	29.2	28.8	25.3	30.6	29
POTASSIUM	800 U[1]	800 U	800 U	1,580	800 U	1,830	1,760	1,970	1,410	1,590	1,560	1,850	800 U
SELENIUM	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U
SODIUM	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U
STRONTIUM	18	19	39	26	23	32	32	30	29	29	27	35	29
TITANIUM	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
VANADIUM	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
ZINC	152	143	232	174	186	195	204	188	194	330	186	213	255

[1] **Not detected at the specified detection limit**

TABLE B64. Bulk PCB data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in October) (OEPA 2014d) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

AR0CLOR (µg/kg)	UPPER RIVER												
	DMMU-1					DMMU-2a				DMMU-2b			
	200016	F01A21-EAST	F01A21-WEST	F01A42	302810 Composite 1	F01W50	302581	F01S08	302809 Composite 2	302578	302579	302580	302808 Composite 3
AROCLOR 1016	20 U[1]	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1221	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1232	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1242	41.2	64	68.3	59.2	66	65.1	71.2	78.7	69.7	65.5	44.8	47.4	74.4
AROCLOR 1248	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1254	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1260	128	42.2	86	235	158	131	165	105	123	95.8	69.6	89.6	94.4
TOTAL PCBs	169	106	154	294	224	196	236	184	193	161	114	137	169
TOTAL ORGANIC CARBON (%)	1.8	1.8	2.9	2.4	2.2	2.2	2.4	2.3	2.4	2.1	2.0	2.4	2.2
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	9,400	5,900	5,321	12,258	10,182	8,914	9,842	7,987	8,029	7,681	5,720	5,708	7,673

[1] Not detected at the specified detection limit

TABLE B65. Bulk pesticides data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in October) (OEPA 2014d) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PESTICIDE (µg/kg)	UPPER RIVER												
	DMMU-1					DMMU-2a				DMMU-2b			
	200016	F01A21-EAST	F01A21-WEST	F01A42	302810 Composite 1	F01W50	302581	F01S08	302809 Composite 2	302578	302579	302580	302808 Composite 3
ALDRIN	4 U[1]	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ALPHA ENDOSULFAN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
BETA ENDOSULFAN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DIELDRIN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDOSULFAN SULFATE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDRIN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDRIN ALDEHYDE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
GAMMA BHC (LINDANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEPTACHLOR	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEPTACHLOR EPOXIDE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEXACHLOROBENZENE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
METHOXYCHLOR	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
MIREX	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DDD (DICHLORODIPHENYLDICHLORETHANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	**8.2**	**10.2**	**14.6**	**11.5**	**10.2**	**14.4**	**10.7**	**14.5**	**12.1**	**10.3**	**11.9**	**13.5**	**12.5**
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	4 U	**10.8**	**9.4**	4 U	4 U	4 U	4 U	4 U	**13.7**	4 U	**6.4**	**7.2**	**12.7**
TOTAL DDT	**8.2**	**21**	**24**	**11.5**	**10.2**	**14.4**	**25.2**	**10.3**	**14.5**	**18.3**	**20.7**	**10.7**	**25.8**
TOTAL ORGANIC CARBON (%)	**1.8**	**1.8**	**2.9**	**2.4**	**2.2**	**2.2**	**2.4**	**2.3**	**2.4**	**2.1**	**2.0**	**2.4**	**2.2**
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	**456**	**1,167**	**828**	**479**	**464**	**655**	**1,050**	**448**	**604**	**871**	**1,035**	**446**	**1,173**

[1] Not detected at the specified detection limit

TABLE B66. Bulk PAH data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in October) (OEPA 2014d) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PAH COMPOUND (mg/kg)	UPPER RIVER												
	DMMU-1					DMMU-2a				DMMU-2b			
	200016	F01A21-EAST	F01A21-WEST	F01A42	302810 Composite 1	F01W50	302581	F01S08	302809 Composite 2	302578	302579	302580	302808 Composite 3
ACENAPHTHENE	0.4 U[1]	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ACENAPHTHYLENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ANTHRACENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BENZO(A)ANTHRACENE	0.4 U	**1.04**	0.4 U	0.4 U	**0.63**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	**0.64**	0.4 U	0.4 U
BENZO(A)PYRENE	0.4 U	**1.12**	**0.83**	**0.75**	**0.84**	0.4 U	0.4 U	0.4 U	**0.86**	0.4 U	**0.81**	**0.72**	**0.74**
BENZO(B)FLUORANTHENE	**0.61**	**1.17**	**1**	**0.88**	**0.91**	0.4 U	**0.84**	**0.76**	**1**	**0.81**	**0.95**	**0.87**	**0.89**
BENZO(G,H,I)PERYLENE	0.4 U	**0.84**	**0.83**	**0.79**	**0.8**	0.4 U	0.4 U	0.4 U	**0.86**	0.4 U	**0.76**	**0.72**	0.4 U
BENZO(K)FLUORANTHENE	0.4 U	**0.93**	0.4 U	**0.68**	**0.69**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	**0.69**	0.4 U	0.4 U
CHRYSENE	**0.64**	**1.19**	**0.92**	**0.88**	**0.86**	0.4 U	**0.83**	**0.86**	**0.84**	**0.82**	**0.93**	**0.9**	**0.87**
DIBENZ(A,H)ANTHRACENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
FLUORANTHENE	**1.21**	**2.88**	**1.68**	**1.68**	**1.68**	**1.13**	**1.39**	**1.47**	**1.52**	**1.39**	**1.72**	**1.78**	**1.53**
FLUORENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
INDENO(1,2,3-C,D)PYRENE	0.4 U	**0.72**	0.4 U	0.4 U	**0.65**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	**0.64**	0.4 U	0.4 U
NAPHTHALENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PHENANTHRENE	**0.67**	**1.88**	0.4 U	**0.9**	**0.83**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	**0.7**	**0.77**	0.4 U
PYRENE	**0.95**	**2.19**	**1.38**	**1.32**	**1.3**	**0.87**	**1.1**	**1.15**	**1.18**	**1.15**	**1.32**	**1.38**	**1.19**
Total PAHs	**4.08**	**13.96**	**6.64**	**7.88**	**9.19**	**2.00**	**4.16**	**4.24**	**6.26**	**4.17**	**9.16**	**7.14**	**5.22**
TOTAL ORGANIC CARBON (%)	**1.8**	**1.8**	**2.9**	**2.4**	**2.2**	**2.2**	**2.4**	**2.3**	**2.4**	**2.1**	**2.0**	**2.4**	**2.2**
TOC-NORMALIZED CONCENTRATION (mg/kg-TOC)	**227**	**776**	**229**	**328**	**418**	**91**	**173**	**184**	**261**	**199**	**458**	**298**	**237**

[1] **Not detected at the specified detection limit**

TABLE B67. Bulk VOC data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in October) (OEPA 2014d) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

VOC (mg/kg)	UPPER RIVER												
	DMMU-1					DMMU-2a				DMMU-2b			
	200016	F01A21-EAST	F01A21-WEST	F01A42	302810 Composite 1	F01W50	302581	F01S08	302809 Composite 2	302578	302579	302580	302808 Composite 3
1,1,1,2-TETRACHLOROETHANE	0.2 U[1]	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1,2,2-TETRACHLOROETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1,2-TRICHLOROETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1-DICHLOROETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1-DICHLOROETHENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 UJ
1,1-DICHLOROPROPENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,3-TRICHLOROBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,3-TRICHLOROPROPANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,4-TRICHLOROBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,4-TRIMETHYLBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DIBROMO-3-CHLOROPROPANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DICHLOROBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DICHLOROETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DICHLOROPROPANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,3-DICHLOROBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,3-DICHLOROPROPANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,4-DICHLOROBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
2,2-DICHLOROPROPANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
2-CHLOROTOLUENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
2-HEXANONE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
4-CHLOROTOLUENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
ACETONE	0.2 U	0.05 U	0.2 U	0.05 U	0.05 U	0.05 U	0.2 U	0.2 U	0.2 U	**0.106**	**0.075**	**0.175**	**0.119**
BENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOCHLOROMETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMODICHLOROMETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOFORM	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOMETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
CARBON DISULFIDE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
CARBON TETRACHLORIDE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROFORM	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROMETHANE	**0.39**	0.04 U	**0.66**	0.04 U	0.04 U	0.04 U	**0.42**	**0.63**	**0.74**	0.04 U	0.04 U	0.04 U	0.04 U
CIS-1,2-DICHLOROETHYLENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
CIS-1,3-DICHLOROPROPENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
DIBROMOCHLOROMETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
DIBROMOMETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
DICHLORODIFLUOROMETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
ETHYLBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
HEXACHLOROBUTADIENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
ISOPROPYLBENZENE (CUMENE)	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
M+P-XYLENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
METHYL ETHYL KETONE (2-BUTANONE)	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
METHYLENE CHLORIDE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
NAPHTHALENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
N-BUTYLBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
N-PROPYLBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
O-XYLENE (1,2-DIMETHYLBENZENE)	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
P-CYMENE (P-ISOPROPYLTOLUENE)	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
SEC-BUTYLBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
STYRENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
T-BUTYLBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
TETRACHLOROETHYLENE(PCE)	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
TOLUENE	**0.55**	0.04 U	**0.92**	**0.069**	**0.133**	0.04 U	**0.93**	**1**	**0.86**	0.04 U	0.04 U	0.04 U	0.04 U
TRANS-1,2-DICHLOROETHENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
TRANS-1,3-DICHLOROPROPENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
TRICHLOROETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
TRICHLOROETHYLENE (TCE)	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
TRICHLOROFLUOROMETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
VINYL CHLORIDE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U

[1] **Not detected at the specified detection limit**

TABLE B68. Bulk SVOC data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in October) (OEPA 2014d) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

SVOC (mg/kg)	UPPER RIVER												
	DMMU-1					DMMU-2a				DMMU-2b			
	200016	F01A21-EAST	F01A21-WEST	F01A42	302810 Composite 1	F01S08	302581	F01W50	302809 Composite 2	302578	302579	302580	302808 Composite 3
1,2,4,5-TETRACHLOROBENZENE	0.4 U[1]	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,2,4-TRICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,2-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,3-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,3-DINITROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,4-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,4-NAPHTHOQUINONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,3,4,6-TETRACHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4,5-TRICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4,6-TRICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DIMETHYLPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DINITROPHENOL	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
2,4-DINITROTOLUENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,6-DICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,6-DINITROTOLUENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-ACETYLAMINOFLUORENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-CHLORONAPHTHALENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-CHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 U
2-METHYLNAPHTHALENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-METHYLPHENOL (O-CRESOL)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-NITROANILINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-NITROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-PICOLINE (ALPHA-PICOLINE)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
3,3'-DICHLOROBENZIDINE	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
3/4-METHYLPHENOL	0.4 U	0.4 U	**5.68**	0.4 U	**0.65**	**0.93**	**0.84**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
3-METHYLCHOLANTHRENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4,6-DINITRO-2-METHYLPHENOL	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
4-BROMOPHENYL PHENYL ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-CHLORO-3-METHYLPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 U
4-CHLOROPHENYL PHENYL ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-NITROANILINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-NITROPHENOL	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
7,12-DIMETHYLBENZ(A)ANTHRACENE	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
ACETOPHENONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ANILINE (PHENYLAMINE, AMINOBENZENE)	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
BENZYL ALCOHOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BENZYL BUTYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROETHOXY) METHANE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROISOPROPYL) ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-ETHYLHEXYL) PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	**0.75**	0.4 U	0.4 U	0.4 U	**0.77**	0.4 U	**0.75**	0.4 U
DIBENZOFURAN	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DIETHYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DIMETHYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DI-N-BUTYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DI-N-OCTYLPHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DINOSEB	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DIPHENYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ETHYL METHANESULFONATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROBUTADIENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROCYCLOPENTADIENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROETHANE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROPROPENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ISOPHORONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
METHYL METHANESULFONATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
NITROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSO-DI-N-BUTYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSODI-N-PROPYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOMORPHOLINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOPIPERIDINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOPYRROLIDINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
P-DIMETHYLAMINOAZOBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PENTACHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PENTACHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PHENACETIN	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 U
PRONAMIDE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
SAFROLE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U

[1] Not detected at the specified detection limit

TABLE B69: Bulk grain size data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core composite samples collected in April) (OEPA 2015b) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PARTICLE SIZE (%)	UPPER RIVER					
	DMMU-1		DMMU-2a		DMMU-2b	
	F01A21	200013	F01W50	302581	302580	302578
FINE CLAY	8	6.1	12	12	12	12
MEDIUM CLAY	2	2	6.1	8.1	4	6
COARSE CLAY	2	4	4	4	6.1	4
VERY FINE SILT	4	2	6.1	8.1	8.1	12
FINE SILT	6	6.1	28	32	34	38
MEDIUM SILT	14	12	10	14	14	14
COARSE SILT	4	4	33	21	21	13
SILT/CLAY	**40**	**36.2**	**99.2**	**99.2**	**99.2**	**99**
COARSE SAND	**60**	**64**	**0**	**0**	**0**	**0**

TABLE B70: Bulk inorganics data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core composite samples collected in April) (OEPA 2015b) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

INORGANIC (mg/kg)	UPPER RIVER					
	DMMU-1		DMMU-2a		DMMU-2b	
	F01A21	200013	F01W50	302581	302580	302578
NITROGEN, AMMONIA	100	130	210	170	190	610
PHOSPHORUS, TOTAL (AS P)	658	616	865	796	844	867
TOTAL ORGANIC CARBON (%)	2.2	2.2	2.5	1.7	1.8	2.3
pH (SU)	7.4	7.3	7.4	7.6	7.6	7.5

TABLE B71: Bulk metals data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core composite samples collected in April) (OEPA 2015b) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

METALS (mg/kg)	UPPER RIVER					
	DMMU-1		DMMU-2a		DMMU-2b	
	F01A21	200013	F01W50	302581	302580	302578
ALUMINUM	4,660	4,830	7,850	7,710	7,420	9,110
ARSENIC	9.48	9.92	13.9	13.9	13.4	15.5
BARIUM	44.8	41.5	65.8	63.5	62.3	76.6
BERYLLIUM	0.281	0.291	0.447	0.419	0.379	0.472
CADMIUM	0.551	0.562	0.718	0.626	0.729	1.33
CALCIUM	6,550	7,140	9,910	9,820	9,800	11,400
CHROMIUM, TOTAL	9.79	10.1	15.1	13.6	13.9	26.3
COBALT	5.55	5.67	7.87	7.97	7.63	9.21
COPPER	19.5	21	26.6	23.3	25.4	33.1
IRON	16,200	16,300	24,000	24,100	23,600	27,800
LEAD	20.5	21.1	27.3	24.4	28.6	53.9
MAGNESIUM	2,930	2,960	4,630	4,750	4,610	5,470
MANGANESE	390	367	563	548	509	589
MERCURY	0.049	0.032	0.094	0.068	0.08	0.087
NICKEL	14.1	15.8	21	20.4	20.4	24.9
POTASSIUM	800 U[1]	800 U	800 U	800 U	800 U	1340
SELENIUM	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U
SODIUM	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U
STRONTIUM	12 U	19	24	23	23	27
TITANIUM	20 U	20 U	20 U	20 U	20 U	20 U
VANADIUM	20 U	20 U	20 U	20 U	20 U	20 U
ZINC	105	111	146	131	141	222

[1] Not detected at the specified detection limit

TABLE B72: Bulk PCB data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core composite samples collected in April) (OEPA 2015b) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

AROCLOR (µg/kg)	UPPER RIVER					
	DMMU-1		DMMU-2a		DMMU-2b	
	F01A21	200013	F01W50	302581	302578	302580
AROCLOR 1016	29.7 U[1]	29 U	33.1 U	32.3 U	33.8 U	32.3 U
AROCLOR 1221	29.7 U	29 U	33.1 U	32.3 U	33.8 U	32.3 U
AROCLOR 1232	29.7 U	29 U	33.1 U	32.3 U	33.8 U	32.3 U
AROCLOR 1242	**54.3**	**36**	33.1 U	32.3 U	33.8 U	32.3 U
AROCLOR 1248	29.7 U	29 U	33.1 U	32.3 U	33.8 U	32.3 U
AROCLOR 1254	29.7 U	**409**	33.1 U	32.3 U	33.8 U	32.3 U
AROCLOR 1260	**63**	**142**	**130**	**139**	**151**	**116**
TOTAL PCBs	**117**	**587**	**130**	**139**	**151**	**116**
TOC (%)	**2.2**	**2.2**	**2.5**	**1.7**	**1.8**	**2.3**
TOC-NORMALIZED PCBs (µg/kg-TOC)	**5,332**	**26,682**	**5,200**	**8,176**	**8,389**	**5,043**

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[1] Not detected at the specified detection limit

TABLE B73: Bulk pesticide data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core composite samples collected in April) (OEPA 2015b) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PESTICIDE (µg/kg)	UPPER RIVER					
	DMMU-1		DMMU-2a		DMMU-2b	
	F01A21	200013	F01W50	302581	302580	302578
ALDRIN	5.9 U[1]	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
ALPHA ENDOSULFAN	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
BETA ENDOSULFAN	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
DIELDRIN	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
ENDOSULFAN SULFATE	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
ENDRIN	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
ENDRIN ALDEHYDE	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
GAMMA BHC (LINDANE)	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
HEPTACHLOR	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
HEPTACHLOR EPOXIDE	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
HEXACHLOROBENZENE	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
METHOXYCHLOR	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
MIREX	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
DDD (DICHLORODIPHENYLDICHLORETHANE)	5.9 U	**6.4**	6.6 U	6.5 U	6.5 U	6.8 U
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	**16.2**	**11.7**	**20.6**	**19.8**	**19.6**	**19.4**
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	**10.3**	4 U	**14.4**	**14.7**	**14.2**	**14.3**
TOTAL DDT	**26.5**	**18.1**	**35**	**34.5**	**33.8**	**33.7**
TOC (%)	**2.2**	**2.2**	**2.5**	**1.7**	**1.8**	**2.3**
TOC-NORMALIZED TOTAL DDT (µg/kg-TOC)	**1,205**	**823**	**1,400**	**2,029**	**1,878**	**1,465**

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[1] Not detected at the specified detection limit

TABLE B74: Bulk PAH data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core composite samples collected in April) (OEPA 2015b) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PAH COMPOUND (µg/kg)	UPPER RIVER					
	DMMU-1		DMMU-2a		DMMU-2b	
	F01A21	200013	F01W50	302581	302580	302578
ACENAPHTHENE	58	55	29	24	27	35
ACENAPHTHYLENE	37	55	46	25	35	46
ANTHRACENE	220	160	120	86	88	110
BENZO(A)ANTHRACENE	600	460	400	350	320	390
BENZO(A)PYRENE	580	480	470	420	380	480
BENZO(B)FLUORANTHENE	780	590	700	690	570	760
BENZO(G,H,I)PERYLENE	650	530	570	610	520	690
BENZO(K)FLUORANTHENE	280	290	180	180	250	200
CHRYSENE	840	630	600	540	510	630
DIBENZ(A,H)ANTHRACENE	140	120	100	120	100	110
FLUORANTHENE	1,500	1,300	1,200	1,100	1,100	1,300
FLUORENE	95	74	45	37	40	59
INDENO(1,2,3-C,D)PYRENE	500	420	480	440	390	490
NAPHTHALENE	32	41	19	19	28	44
PHENANTHRENE	860	660	520	470	440	540
PYRENE	1,100	820	780	720	640	780
TOTAL PAHs	**8,272**	**6,685**	**6,259**	**5,831**	**5,438**	**6,664**
TOC (%)	**2.2**	**2.2**	**2.5**	**1.7**	**1.8**	**2.3**
TOC-NORMALIZED PAHs (mg/kg-TOC)	**376**	**304**	**250**	**343**	**302**	**290**

TABLE B75: Bulk VOC data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core composite samples collected in April) (OEPA 2015b) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

VOC (mg/kg)	UPPER RIVER					
	DMMU-1		DMMU-2a		DMMU-2b	
	F01A21	200013	F01W50	302581	302580	302578
1,1,1,2-TETRACHLOROETHANE	0.04 U[1]	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,1,2,2-TETRACHLOROETHANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,1,2-TRICHLOROETHANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,1-DICHLOROETHANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,1-DICHLOROETHENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,1-DICHLOROPROPENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,2,3-TRICHLOROBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,2,3-TRICHLOROPROPANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,2,4-TRICHLOROBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,2,4-TRIMETHYLBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,2-DIBROMO-3-CHLOROPROPANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,2-DICHLOROBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,2-DICHLOROETHANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,2-DICHLOROPROPANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,3-DICHLOROBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,3-DICHLOROPROPANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,4-DICHLOROBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
2,2-DICHLOROPROPANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
2-CHLOROTOLUENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
2-HEXANONE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
4-CHLOROTOLUENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
ACETONE	0.05 U	0.2 U	0.2 U	**0.118**	**0.59**	0.2 U
BENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
BROMOBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
BROMOCHLOROMETHANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
BROMODICHLOROMETHANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
BROMOFORM	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
BROMOMETHANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
CARBON DISULFIDE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
CARBON TETRACHLORIDE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
CHLOROBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
CHLOROETHANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
CHLOROFORM	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
CHLOROMETHANE	0.04 U	0.2 U	**0.37**	0.04 U	**0.32**	0.2 U
CIS-1,2-DICHLOROETHYLENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
CIS-1,3-DICHLOROPROPENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
DIBROMOCHLOROMETHANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
DIBROMOMETHANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
DICHLORODIFLUOROMETHANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
ETHYLBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
HEXACHLOROBUTADIENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
ISOPROPYLBENZENE (CUMENE)	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
M+P-XYLENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
METHYL ETHYL KETONE (2-BUTANONE)	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.29
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
METHYLENE CHLORIDE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
NAPHTHALENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
N-BUTYLBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
N-PROPYLBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
O-XYLENE (1,2-DIMETHYLBENZENE)	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
P-CYMENE (P-ISOPROPYLTOLUENE)	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
SEC-BUTYLBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
STYRENE	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U
T-BUTYLBENZENE	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U
TETRACHLOROETHYLENE(PCE)	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U
TOLUENE	0.04 U	**9.44**	**11.4**	**3.8**	**0.112**	**2.56**
TRANS-1,2-DICHLOROETHENE	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U
TRANS-1,3-DICHLOROPROPENE	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U
TRICHLOROETHANE	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U
TRICHLOROETHYLENE (TCE)	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U
TRICHLOROFLUOROMETHANE	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U
VINYL CHLORIDE	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U

[1] Not detected at the specified detection limit

TABLE B76: Bulk grain size data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core composite samples collected in October) (OEPA 2015c)

PARTICLE SIZE (%)	UPPER RIVER					
	DMMU-1		DMMU-2a		DMMU-2b	
	F01A21 Grab	200013 Grab	F01W50 Grab	302581 Grab	302580 Grab	302578 Grab
FINE CLAY	6	12	14	8.1	8.1	15
MEDIUM CLAY	4	4.1	4	14	6.1	7.6
COARSE CLAY	2	6.1	6.1	4	4	7.6
VERY FINE SILT	4	2	10	8.1	8.1	15
FINE SILT	4	8.1	24	28	26	31
MEDIUM SILT	10	16	10	12	14	7.6
COARSE SILT	2	4.1	31	25	33	16
SILT/CLAY	**32**	**52.4**	**99.1**	**99.2**	**99.3**	**99.8**
COARSE SAND	**68**	**47**	0	0	0	0

TABLE B77: Bulk inorganics data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core samples collected in October) (OEPA 2015c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

INORGANIC (mg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	F01A21 Core	F01A21 Grab	200013 Core	200013 Grab	F01W50 Core	F01W50 Grab	302581 Core	302581 Grab	302580 Core	302580 Grab	302578 Core	302578 Grab
NITROGEN, AMMONIA	240	79	93	79	160	110	230	170	230	120	230	110
PHOSPHORUS, TOTAL (AS P)	659	539	515	638	812	960	819	799	774	615	931	753
TOTAL ORGANIC CARBON (%)	1.4	2.3	2.0	2.6	2.1	2.0	1.5	1.6	1.6	7.3	1.8	1.8
pH (SU)	7.3	7.7	7.2	7.4	7.4	7.5	7.4	7.4	7.4	1.8	7.4	7.5

TABLE B78: Bulk metals data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core composite samples collected in October) (OEPA 2015c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

METALS (mg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	F01A21 Core	F01A21 Grab	200013 Core	200013 Grab	F01W50 Core	F01W50 Grab	302581 Core	302581 Grab	302580 Core	302580 Grab	302578 Core	302578 Grab
ALUMINUM	3,890	4,580	4,480	5,120	7,680	6,790	5,890	7,300	5,800	6,340	8,670	9,090
ARSENIC	8.7	9.86	10.6	10.6	14.9	12.7	12	13.2	12.3	13.1	15	15.2
BARIUM	36	34	36.1	45.7	61.1	52.6	51.5	54.8	47.8	49.5	63.3	63.3
BERYLLIUM	0.254	0.298	0.344	0.382	0.508	0.42	0.35	0.448	0.373	0.387	0.549	0.529
CADMIUM	0.455	0.55	0.627	0.741	0.749	0.785	0.673	0.752	0.633	0.711	0.93	0.896
CALCIUM	9,170	8,230	8,050	10,200	13,100	12,800	10,300	11,900	9,120	10,700	11,800	12,500
CHROMIUM, TOTAL	37.9	12.8	11.8	14.4	18.1	17.8	13.5	18.4	12.6	14.1	32.4	46.7
COBALT	5.18	7.08	6.26	6.58	10.8	9.5	6.88	9.31	6.91	7.74	9.47	9.92
COPPER	18.7	26.4	24.7	32	36	35.4	25.7	35.8	25.2	32.2	40.6	31.5
IRON	19,000	18,700	18,500	19,600	28,400	24,200	22,500	25,100	21,600	23,500	29,200	30,700
LEAD	17.7	20.9	27	27.5	29.2	33.6	25.3	33.8	26.6	28.9	39.3	30.9
MAGNESIUM	3,190	3,270	3,400	3,860	5,540	4,900	4,430	5,050	4,240	4,800	5,740	6,000
MANGANESE	2210	424	396	416	678	564	467	514	464	493	602	605
MERCURY												
NICKEL	16.2	24.3	18.2	22.9	29.6	27.1	19.7	26.5	19.3	21.6	31.9	26.9
POTASSIUM	975 U[1]	923 U	994 U	1390 U	1200 U	1130 U	555	1130	1150 U	1050 U	1250 U	1420 U
SELENIUM	.98 U	.92 U	.99 U	1.39 U	1.2 U	1.13 U	1110 U	1.03 U	1.15 U	1.05 U	1.25 U	1.42 U
SODIUM	2440 U	2310 U	2490 U	3470 U	2990 U	2830 U	1.11 U	2570 U	2870 U	2620 U	3130 U	3560 U
STRONTIUM	18	16	18	23	28	27	23	26	21	24	27	28
TITANIUM	35	23 U	25 U	35 U	30 U	28 U	28 U	26 U	29 U	26 U	31 U	36 U
VANADIUM	24	23 U	25 U	35 U	30 U	28 U	28 U	26 U	29 U	26 U	31 U	36 U
ZINC	101	140	116	141	141	160	128	154	137	240	290	158

[1] Not detected at the specified detection limit

TABLE B79: Bulk PCB data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core samples collected in October) (OEPA 2015c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

AROCLOR (µg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	F01A21 Core	F01A21 Grab	200013 Core	200013 Grab	F01W50 Core	F01W50 Grab	302581 Core	302581 Grab	302580 Core	302580 Grab	302578 Core	302578 Grab
AROCLOR 1016	27.7 U[1]	29.9 U	31 U	35 U	35 U	35.5 U	31.2 U	32.2 U	30.4 U	32.8 U	33.7 U	36 U
AROCLOR 1221	27.7 U	29.9 U	31 U	35 U	35 U	35.5 U	31.2 U	32.2 U	30.4 U	32.8 U	33.7 U	36 U
AROCLOR 1232	27.7 U	29.9 U	31 U	35 U	35 U	35.5 U	31.2 U	32.2 U	30.4 U	32.8 U	33.7 U	36 U
AROCLOR 1242	32.4	31.3	31 U	35 U	35 U	36.5	31.2 U	32.2 U	30.4 U	32.8 U	33.7 U	36 U
AROCLOR 1248	27.7 U	29.9 U	31 U	35 U	35 U	35.5 U	31.2 U	32.2 U	30.4 U	32.8 U	33.7 U	36 U
AROCLOR 1254	27.7 U	29.9 U	31 U	35 U	35 U	35.5 U	31.2 U	32.2 U	30.4 U	32.8 U	33.7 U	36 U
AROCLOR 1260	194	36.4	129	56.4	56.1	60	81.8	79	76.9	71.4	64.5	51
TOTAL PCBs	226.4	67.7	129	56.4	56.1	96.5	81.8	79	76.9	71.4	64.5	51
TOC (%)	1.4	2.3	2.0	2.6	2.1	2.0	1.5	1.6	1.8	1.8	1.6	7.3
TOC-NORMALIZED PCBs (µg/kg-TOC)	16,171	2,943	6,450	2,169	2,671	4,825	5,453	4,938	4,272	3,967	4,031	699

[1] Not detected at the specified detection limit

TABLE B80: Bulk pesticides data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core samples collected in October) (OEPA 2015c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PESTICIDE (µg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	F01A21 Core	F01A21 Grab	200013 Core	200013 Grab	F01W50 Core	F01W50 Grab	302581 Core	302581 Grab	302580 Core	302580 Grab	302578 Core	302578 Grab
ALDRIN	5.5 U[1]	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
ALPHA ENDOSULFAN	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
BETA ENDOSULFAN	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
DIELDRIN	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
ENDOSULFAN SULFATE	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
ENDRIN	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
ENDRIN ALDEHYDE	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
GAMMA BHC (LINDANE)	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
HEPTACHLOR	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
HEPTACHLOR EPOXIDE	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
HEXACHLOROBENZENE	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
METHOXYCHLOR	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
MIREX	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
DDD (DICHLORODIPHENYLDICHLORETHANE)	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	8	6.3	8	7.6	11.1	10	11.6	11.1	12.2	10.3	11	10.7
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	5.5 U	6.0 U	6.2 U	7.0 U	8.4	8.9	7.3	7	7.5	6.6 U	6.7 U	7.2 U
TOTAL DDT	8	6.3	8	7.6	19.5	18.9	18.9	18.1	19.7	10.3	11	10.7
TOC (%)	1.4	2.3	2.0	2.6	2.1	2.0	1.5	1.6	1.6	7.3	1.8	1.8
TOC-NORMALIZED TOTAL DDT (µg/kg-TOC)	571	274	400	292	929	945	1,260	1,131	1,231	141	611	594

[1] Not detected at the specified detection limit

TABLE B81: Bulk PAH data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core samples collected in October) (OEPA 2015c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PAH COMPOUND (µg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	F01A21 Cores	F01A21 Grabs	200013 Cores	200013 Grabs	F01W50 Cores	F01W50 Grabs	302581 Cores	302581 Grabs	302580 Cores	302580 Grabs	302578 Cores	302578 Grabs
ACENAPHTHENE	550 U[1]	600 U	610 U	700 U	690 U	710 U	620 U	640 U	610 U	660 U	680 U	720 U
ACENAPHTHYLENE	550 U	600 U	610 U	700 U	690 U	710 U	620 U	640 U	610 U	660 U	680 U	720 U
ANTHRACENE	550 U	600 U	610 U	700 U	690 U	710 U	620 U	640 U	610 U	660 U	680 U	720 U
BENZO(A)ANTHRACENE	550 U	600 U	610 U	870	690 U	710 U	620 U	640 U	610 U	660 U	680 U	720 U
BENZO(A)PYRENE	550 U	600 U	610 U	1,060	690 U	720	650	740	710	690	680 U	720 U
BENZO(B)FLUORANTHENE	590	600 U	720	1,270	840	890	920	1,000	910	870	870	720 U
BENZO(G,H,I)PERYLENE	550 U	600 U	610 U	1,060	690 U	730	710	790	700	680	710	720 U
BENZO(K)FLUORANTHENE	550 U	600 U	610 U	1,000	690 U	710 U	620 U	740	650	660 U	680 U	720 U
CHRYSENE	580	600 U	630	1,170	750	800	760	890	820	810	760	720 U
DIBENZ(A,H)ANTHRACENE	550 U	600 U	610 U	700 U	690 U	710 U	620 U	640 U	610 U	660 U	680 U	720 U
FLUORANTHENE	1,090	620	1,210	2,210	1,340	1,520	1,450	1,640	1,630	1,440	1,330	1,070
FLUORENE	550 U	600 U	610 U	700 U	690 U	710U	620 U	640 U	610 U	660 U	680 U	720 U
INDENO(1,2,3-C,D)PYRENE	550 U	600 U	610 U	1,120	691 U	760	720	830	740	720	720	720 U
NAPHTHALENE	550 U	600 U	610 U	700 U	692 U	710 U	620 U	640 U	610 U	660 U	680 U	720 U
PHENANTHRENE	550 U	600 U	610 U	1,070	693 U	710 U	620 U	640 U	760	660 U	680 U	720 U
PYRENE	860	600 U	880	1,640	1,070	1,190	1,140	1,180	1,290	1,170	1,030	760
TOTAL PAHs	**3,120**	**620**	**3,440**	**12,470**	**4,000**	**4,400**	**6,350**	**7,070**	**8,210**	**6,380**	**5,420**	**1,830**
TOC (%)	**1.4**	**2.3**	**2.0**	**2.6**	**2.1**	**2.0**	**1.5**	**1.6**	**1.6**	**7.3**	**1.8**	**1.8**
TOC-NORMALIZED PAHs (mg/kg-TOC)	**223**	**27**	**172**	**480**	**190**	**220**	**423**	**442**	**513**	**87**	**301**	**102**

[1] Not detected at the specified detection limit

TABLE B82: Bulk grain size data on Lake Erie sediments (surface samples collected in May) (OEPA 2015d)

PARTICLE SIZE (%)	LAKE ERIE	
	Composite 1 LE-1-6	Composite 2 LE-7-11
FINE CLAY	22	33
MEDIUM CLAY	6.1	12
COARSE CLAY	6.1	6.2
VERY FINE SILT	6.1	14
FINE SILT	10	6.2
MEDIUM SILT	2	0
COARSE SILT	2	28
SILT/CLAY	**54.3**	**99.4**
COARSE SAND	**45**	**0**

TABLE B83: Bulk grain size data on CLA-1 vicinity sediments (core composite samples collected in June) (OEPA 2015e)

PARTICLE SIZE (%)	CLA-1 AND ADJACENT AREAS	
	TOP CORE COMPOSITE	BOTTOM CORE COMPOSITE
FINE CLAY	30	29
MEDIUM CLAY	13	12
COARSE CLAY	6.4	8.2
VERY FINE SILT	15	16
FINE SILT	6.4	8.2
MEDIUM SILT	0	6.1
COARSE SILT	29	20
SILT/CLAY	**99.8**	**99.5**
COARSE SAND	**0**	**0**

TABLE B84: Bulk inorganics data on Lake Erie sediments (surface samples collected in May) (OEPA 2015d)

INORGANIC (mg/kg)	LAKE ERIE											
	LE-1	LE-2	LE-3	LE-4	LE-6	LE-COMP-1 (LE 1-6)	LE-7	LE-8	LE-9	LE-10	LE-11	LE-COMP-2 (LE 7-11)
NITROGEN, AMMONIA	330	270	870	85	190	160	230	65	130	190	700	210
PHOSPHORUS, TOTAL (AS P)	991	952	913	622	1,130	800	1,020	743	116	881	936	814
TOTAL ORGANIC CARBON (%)	2.9	2.7	2.6	1.6	2.7	2.5	2.1	1.6	2.2	2.6	2.3	3.8
pH (SU)	7.5	7.6	7.4	7.5	7.5	7.7	7.8	7.4	7.7	7.5	7.6	7.5

TABLE B85: Bulk inorganics data on CLA-1 vicinity sediments (core samples collected in June) (OEPA 2015e)

INORGANIC (mg/kg)	CLA-1 & ADJACENT AREAS																
	CLA 1-0		CLA 1-0.5E		CLA 1-1.5E		CLA 1-0.5W		CLA 1-1.5W		CLA 1-1N		CLA1-2N		CLA1-1S	TOP CORE COMPOSITE	BOTTOM CORE COMPOSITE
	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP		
NITROGEN, AMMONIA	300	350	230	270	230	230	310	220	180	210	150	690	260	470	110	180	170
PHOSPHORUS, TOTAL (AS P)	1,190	1,180	1,280	977	1,370	1,170	1,280	841	1,100	709	1,050	991	1,120	703	751	1,150	970
TOTAL ORGANIC CARBON (%)	2.9	3.2	2.9	2.7	3.1	2.7	3.1	2.0	2.8	1.9	3.0	2.2	3.0	1.2	3.2	3.3	5.9
pH (SU)	7.5	7.5	7.6	7.4	7.5	7.2	7.6	7.4	7.5	7.5	7.5	7.6	7.5	7.5	7.8	7.6	7.5

TABLE B86: Bulk metals data on Lake Erie sediments (surface samples collected in May) (OEPA 2015d)

METALS (mg/kg)	LAKE ERIE											
	LE-1	LE-2	LE-3	LE-4	LE-6	LE-COMP-1 (LE 1-6)	LE-7	LE-8	LE-9	LE-10	LE-11	LE-COMP-2 (LE 7-11)
ALUMINUM	18600	19600	20300	5720	18800	10200	13900	6250	9910	15600	10100	14300
ARSENIC	8.48	8.37	7.73	4.77	7.53	21.6	11.6	12	76.9	12.5	17.3	6.21
BARIUM	127	126	131	60.1	125	97	97.5	47.7	188	130	97.4	97.7
BERYLLIUM	1.01	0.973	1.07	0.321	1.01	0.687	0.782	0.441	0.75	0.87	0.647	0.744
CADMIUM	2.59	2.86	2.61	0.728	2.38	1.64	1.7	0.928	1.39	2.38	1.9	1.82
CALCIUM	12,200	14200	13200	4340	12000	8360	12000	4890	7730	11500	8950	9250
CHROMIUM, TOTAL	44.4	44.6	43.7	12.6	39.3	25.4	27.9	21.3	20.8	38	27	31.6
COBALT	12.4	11.6	12	6.08	11.5	9.56	10.1	6.36	12.6	10.9	10	9.18
COPPER	42.3	41.4	39.4	12.2	37.8	28	28	22	21.3	42.9	30.1	29.1
IRON	33400	34200	34600	18300	33000	37100	31500	31700	70900	40600	34900	25800
LEAD	57	56.8	50.8	15.7	46.6	51.9	32.6	39.6	38.9	58.8	44.2	38.2
MAGNESIUM	11600	12600	11800	3810	11000	6800	9100	3710	6330	9320	7260	8380
MANGANESE	557	531	530	401	531	701	664	402	1540	640	696	432
MERCURY	0.1	0.196	0.277	0.042	0.234	0.16	0.183	0.112	0.112	0.229	0.163	0.232
NICKEL	48	47.5	47.1	16.7	43.5	33.2	33.2	20.8	35.3	38.8	34.9	34.2
POTASSIUM	3410	3600	3590	800 U	3380	800 U[1]	800 U	800 U	800 U	2880	800 U	2660
SELENIUM	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U
SODIUM	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U
STRONTIUM	12 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	33	12 U	12 U
TITANIUM	89	93	78	39	81	20 U	20 U	37	20 U	83	20 U	69
VANADIUM	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
ZINC	227	231	218	72.9	204	183	153	126	175	259	191	158

[1] Not detected at the specified detection limit

TABLE B87: Bulk metals data on CLA-1 vicinity sediments (core Samples collected in June) (OEPA 2015e)

METALS (mg/kg)	CLA-1 AND ADJACENT AREAS															
	CLA 1-0		CLA 1-0.5E		CLA 1-1.5E		CLA 1-0.5W		CLA 1-1.5W		CLA 1-1N		CLA1-2N		CLA1-1S	TOP CORE COMPOSITE	BOTTOM CORE COMPOSITE
	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP		
ALUMINUM	14,900	12,600	15,600	10,900	13,800	12,300	19,800	18,100	15,300	14,400	16,000	14,300	16,700	14,200	5840	17200	16700
ARSENIC	7.71	12.3	13.6	9.31	13.7	17.9	17.8	8.88	7.98	6.26	8.84	8.81	9.21	4.39	17.5	12.1	17
BARIUM	122	139	125	119	115	111	143	127	122	109	128	118	132	109	90.9	113	137
BERYLLIUM	0.827	0.826	0.86	0.908	0.842	0.823	1.05	0.888	0.921	0.779	0.917	0.858	0.948	0.706	0.37	0.897	0.843
CADMIUM	2.8	5.77	3.55	2.86	3.81	5.37	5.18	2.56	2.84	1.98	2.84	3.02	2.88	1.28	8.02	3.46	8.89
CALCIUM	13,600	11,800	14,100	12,500	13,100	11,400	12,600	8,630	11,900	8,690	12,100	8,930	11,900	7,710	7760	10500	11600
CHROMIUM, TOTAL	40.4	53.8	43.8	35.6	49.7	49	61.4	31.7	43.3	27.6	43.6	33.2	45.3	22.3	57.6	45.8	67.4
COBALT	11.8	11.7	11.9	9.49	11.3	11.1	13	11.9	12.4	11.8	12.6	11.8	12.6	12.3	7.53	10.6	10.8
COPPER	45.3	78.5	54.7	43.5	78.3	80.5	62.1	37	46	32.4	45.7	43.4	47.1	26	79.3	47.2	88.6
IRON	35,100	38,100	41,600	28,100	44,100	44,800	46,000	34,800	32,300	30,300	34,200	32,100	34,400	29,400	40400	40500	50400
LEAD	62.8	121	92.9	79.4	93.4	135	125	62.5	65.6	41.7	62.8	79.6	66.7	28.1	188	71.3	186
MAGNESIUM	11,400	9,480	10,700	8,940	10,200	8,630	10,800	9,670	11,100	9,500	11,200	9,210	11,300	9,100	2970	9050	8040
MANGANESE	759	722	981	663	763	782	793	601	586	510	708	573	689	488	628	678	722
MERCURY	0.332	0.377	0.379	0.266	0.354	0.311	0.44	0.186	0.314	0.118	0.324	0.186	0.324	0.072	0.327	0.311	0.299
NICKEL	45.5	51	44.6	41.3	48	43.2	54.6	37	50.7	37.1	48.8	39.1	50.2	34.7	56.5	41.4	67
POTASSIUM	1,510	1,255	2,670	800 U	1,350	1,075	3,710	3,130	1,605	1,270	1,470	1,230	1,720	2,320	800 U	3480	3190
SELENIUM	1.51	1.26	0.8 U[1]	0.8 U	1.35	1.08	0.8 U	0.8 U	1.605	1.27	1.47	1.23	1.72	1	0.8 U	0.8 U	0.8 U
SODIUM	3,780	3,140	2000 U	2000 U	3,380	2,690	2000 U	2000 U	4,015	3,170	3,680	3,080	4,295	2,505	2000 U	2000 U	2000 U
STRONTIUM	22.5	19	12 U	12 U	20.5	16	12 U	12 U	24	19	22	18.5	26	15	21	12 U	35
TITANIUM	76 U	63 U	73	20 UJ	68 U	54 U	107	67	80 U	63 U	74 U	62 U	86 U	50 U	46	102	92
VANADIUM	76 U	63 U	20 U	20 U	68 U	54 U	20 U	20 U	80 U	63 U	74 U	62 U	86 U	50 U	20 U	20 U	20 U
ZINC	284	534	406	270	436	555	667	265	247	188	258	320	261	143	879	396	867

[1] Not detected at the specified detection limit

TABLE B88: Bulk PCB data on Lake Erie sediments (surface samples collected in May) (OEPA 2015d)

AROCLOR (µg/kg)	LAKE ERIE											
	LE-1	LE-2	LE-3	LE-4	LE-6	Composite (LE-1-LE6)	LE-7	LE-8	LE-9	LE-10	LE-11	Composite (LE7-LE11)
AROCLOR 1016	82.6 U[1]	76.1 U	73.0 U	31.3 U	74.6 U	51.0 U	59.1 U	35.2 U	45.8 U	54.6 U	48.2 U	65.8 U
AROCLOR 1221	82.6 U	76.1 U	73.0 U	31.3 U	74.6 U	51.0 U	59.1 U	35.2 U	45.8 U	54.6 U	48.2 U	65.8 U
AROCLOR 1232	82.6 U	76.1 U	73.0 U	31.3 U	74.6 U	51.0 U	59.1 U	35.2 U	45.8 U	54.6 U	48.2 U	65.8 U
AROCLOR 1242	82.6 U	76.1 U	73.0 U	31.3 U	74.6 U	51.0 U	59.1 U	35.2 U	45.8 U	54.6 U	48.2 U	65.8 U
AROCLOR 1248	82.6 U	76.1 U	73.0 U	31.3 U	74.6 U	51.0 U	59.1 U	35.2 U	45.8 U	54.6 U	48.2 U	65.8 U
AROCLOR 1254	82.6 U	**87.7**	**76.5**	31.3 U	**77.7**	51.0 U	59.1 U	**35.7**	45.8 U	54.6 U	48.2 U	65.8 U
AROCLOR 1260	82.6 U	76.1 U	76.1U	31.3 U	74.6 U	51.0 U	59.1 U	35.2 U	45.8 U	54.6 U	48.2 U	65.8 U
Total PCBs		**87.7**	**76.5**		**77.7**			**35.7**				
TOC (%)	**2.9**	**2.7**	**2.6**	**1.6**	**2.7**	**2.5**	**2.1**	**1.6**	**2.2**	**2.6**	**2.3**	**3.8**
TOC-NORMALIZED PCBs (µg/kg-TOC)		**3,248**	**2,942**		**2,878**			**2,231**				

[1] Not detected at the specified detection limit

TABLE B89: Bulk PCB data on CLA-1 vicinity sediments (core samples collected in June) (OEPA 2015e)

AROCLOR (µg/kg)	CLA-1 AND ADJACENT AREAS																
	CLA 1-0		CLA 1-0.5E		CLA 1-1.5E		CLA 1-0.5W		CLA 1-1.5W		CLA 1-1N		CLA1-2N		CLA1-1S	TOP CORE COMPOSITE	BOTTOM CORE COMPOSITE
	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP		
AROCLOR 1016	77 U[1]	69 U	49.4 U	57.9 U	68 U	47 U	73.8 U	67.8	85 U	64 U	87 U	68 U	87 U	60 U	25.2 U	84.4 U	79.4 U
AROCLOR 1221	77 U	69 U	49.4 U	57.9 U	68 U	47 U	73.8 U	67.8	85 U	64 U	87 U	68 U	87 U	60 U	25.2 U	84.4 U	79.4 U
AROCLOR 1232	77 U	69 U	49.4 U	57.9 U	68 U	47 U	73.8 U	67.8	85 U	64 U	87 U	68 U	87 U	60 U	25.2 U	84.4 U	79.4 U
AROCLOR 1242	77 U	69 U	49.4 U	57.9 U	68 U	47 U	73.8 U	67.8	85 U	64 U	87 U	68 U	87 U	60 U	25.2 U	84.4 U	79.4 U
AROCLOR 1248	77 U	69 U	49.4 U	57.9 U	68 U	47 U	73.8 U	67.8	85 U	64 U	87 U	68 U	87 U	60 U	25.2 U	84.4 U	79.4 U
AROCLOR 1254	77 U	**248**	**58.1**	**88.8**	**260**	47 U	**181**	67.8	**88.7**	64 U	87 U	68 U	87 U	60 U	25.2 U	**104**	79.4 U
AROCLOR 1260	77 U	69 U	49.4 U	57.9 U	68 U	47 U	73.8 U	67.8	85 U	64 U	87 U	68 U	87 U	60 U	**37.6**	84.4 U	79.4 U
TOTAL PCBs		**248**	**58.1**	**88.8**	**260**		**181**		**88.7**						**37.6**	**104**	
TOC (%)	**2.9**	**3.2**	**2.9**	**2.7**	**3.1**	**2.7**	**3.1**	**2.0**	**2.8**	**1.9**	**3.0**	**2.2**	**3.0**	**1.2**	**3.2**	**3.3**	**5.9**
TOC-NORMALIZED PCBs (µg/kg-TOC)		**7,750**	**2,003**	**3,289**	**8,387**		**5,839**		**3,168**						**1,175**	**3,152**	

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[1] Not detected at the specified detection limit

TABLE B90: Bulk pesticides data on Lake Erie sediments (surface samples collected in May) (OEPA 2015d)

PESTICIDE (µg/kg)	LAKE ERIE											
	LE-1	LE-2	LE-3	LE-4	LE-6	LE-COMP-1 (LE 1-6)	LE-7	LE-8	LE-9	LE-10	LE-11	LE-COMP-2 (LE 7-11)
ALDRIN	16.5 U[1]	15.2 U	14.6 U	6.3 U	14.9 U	10.2 U	11.8 U	7.0 U	9.2 U	10.9 U	9.6 U	13.2 U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2U	11.8 U	7.0 U	9.2 U	10.9 U	9.6U	13.2 U
ALPHA ENDOSULFAN	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2 U	11.8 U	7.0 U	9.2 U	10.9 U	9.6 U	13.2 U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2U	11.8 U	7.0 U	9.2 U	10.9 U	9.6U	13.2 U
BETA ENDOSULFAN	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2 U	11.8 U	7.0 U	9.2 U	10.9 U	9.6 U	13.2 U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2U	11.8 U	7.0 U	9.2 U	10.9 U	9.6U	13.2 U
DIELDRIN	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2 U	11.8 U	7.0 U	9.2 U	10.9 U	9.6 U	13.2 U
ENDOSULFAN SULFATE	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2U	11.8 U	7.0 U	9.2 U	10.9 U	9.6U	13.2 U
ENDRIN	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2 U	11.8 U	7.0 U	9.2 U	10.9 U	9.6 U	13.2 U
ENDRIN ALDEHYDE	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2U	11.8 U	7.0 U	9.2 U	10.9 U	9.6U	13.2 U
GAMMA BHC (LINDANE)	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2 U	11.8 U	7.0 U	9.2 U	10.9 U	9.6 U	13.2 U
HEPTACHLOR	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2U	11.8 U	7.0 U	9.2 U	10.9 U	9.6U	13.2 U
HEPTACHLOR EPOXIDE	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2 U	11.8 U	7.0 U	9.2 U	10.9 U	9.6 U	13.2 U
HEXACHLOROBENZENE	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2U	11.8 U	7.0 U	9.2 U	10.9 U	9.6U	13.2 U
METHOXYCHLOR	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2 U	11.8 U	7.0 U	9.2 U	10.9 U	9.6 U	13.2 U
MIREX	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2U	11.8 U	7.0 U	9.2 U	10.9 U	9.6U	13.2 U
DDD (DICHLORODIPHENYLDICHLORETHANE)	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2 U	11.8 U	7.0 U	9.2 U	10.9 U	9.6 U	13.2 U
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2U	11.8 U	7.0 U	9.2 U	10.9 U	9.6U	13.2 U
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2 U	11.8 U	7.0 U	9.2 U	10.9 U	9.6 U	13.2 U
TOTAL DDT												
TOC (%)	**2.9**	**2.7**	**2.6**	**1.6**	**2.7**	**2.5**	**2.1**	**1.6**	**2.2**	**2.6**	**2.3**	**3.8**
TOC-NORMALIZED TOTAL DDT (µg/kg-TOC)												

[1] Not detected at the specified detection limit

TABLE B91: Bulk pesticides data on CLA-1 vicinity sediments (core samples collected in June) (OEPA 2015e)

PESTICIDE (µg/kg)	CLA-1 AND ADJACENT AREAS																
	CLA 1-0		CLA 1-0.5E		CLA 1-1.5E		CLA 1-0.5W		CLA 1-1.5W		CLA 1-1N		CLA1-2N		CLA1-1S	TOP CORE COMPOSITE	BOTTOM CORE COMPOSITE
	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP		
ALDRIN	15.4 U[1]	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
ALPHA ENDOSULFAN	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
BETA ENDOSULFAN	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
DIELDRIN	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
ENDOSULFAN SULFATE	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
ENDRIN	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
ENDRIN ALDEHYDE	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
GAMMA BHC (LINDANE)	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
HEPTACHLOR	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
HEPTACHLOR EPOXIDE	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
HEXACHLOROBENZENE	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
METHOXYCHLOR	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
MIREX	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
DDD (DICHLORODIPHENYLDICHLORETHANE)	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	15.4 U	**18.3**	9.9 U	11.6 U	13.7 U	9.4 U	**32.9**	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
TOTAL DDT		**18.3**					**32.9**										
TOC (%)	**2.9**	**3.2**	**2.9**	**2.7**	**3.1**	**2.7**	**3.1**	**2.0**	**2.8**	**1.9**	**3.0**	**2.2**	**3.0**	**1.2**	**3.2**	**3.3**	**5.9**
TOC-NORMALIZED TOTAL DDT (µg/kg-TOC)		**572**					**1,061**										

[1] Not detected at the specified detection limit

TABLE B92: Bulk PAH data on Lake Erie sediments (surface samples collected in May) (OEPA 2015d)

PAH COMPOUND (µg/kg)	LAKE ERIE											
	LE-1	LE-2	LE-3	LE-4	LE-6	LE-COMP-1 (LE 1-6)	LE-7	LE-8	LE-9	LE-10	LE-11	LE-COMP-2 (LE 7-11)
ACENAPHTHENE	6.8 U[1]	10	11	9	13	180	13	610	59	380	160	12
ACENAPHTHYLENE	10	15	11	19	18	300	15	220	130	800	290	16
ANTHRACENE	21	25	29	43	27	620	33	1,000	200	1,500	430	27
BENZO(A)ANTHRACENE	59	74	83	120	110	1,400	85	1,600	470	3,600	1,100	81
BENZO(A)PYRENE	79	100	100	150	130	1,800	110	1,700	550	3,900	1,300	100
BENZO(B)FLUORANTHENE	110	150	180	190	210	1,800	160	1,800	610	4,300	1,300	170
BENZO(G,H,I)PERYLENE	82	90	81	94	120	1,300	88	1,200	410	2,900	940	99
BENZO(K)FLUORANTHENE	47	38	34	46	52	780	44	710	230	1,800	540	52
CHRYSENE	92	100	110	130	130	1,500	110	1,500	600	3,700	1,000	110
DIBENZ(A,H)ANTHRACENE	17	25	28	21	32	320	23	290	120	750	230	27
FLUORANTHENE	120	140	160	160	190	1,900	170	2,500	630	4,500	1,600	150
FLUORENE	9.3 U	14	16	12	19	180	20	310	73	380	150	17
INDENO(1,2,3-C,D)PYRENE	64	74	75	86	100	1,100	76	1,100	370	2,600	860	80
NAPHTHALENE	23	27	29	21	33	440	28	310	130	920	310	26
PHENANTHRENE	57	62	72	66	78	950	78	1,500	330	2,200	830	67
PYRENE	130	160	190	190	230	1,600	190	2,000	570	3,700	1,300	180
TOTAL PAHs	**911**	**1,104**	**1,209**	**1,357**	**1,492**	**16,170**	**1,243**	**18,350**	**5,482**	**37,930**	**12,340**	**1,214**
TOC (%)	**2.9**	**2.7**	**2.6**	**1.6**	**2.7**	**2.5**	**2.1**	**1.6**	**2.2**	**2.6**	**2.3**	**3.8**
TOC-NORMALIZED PAHs (mg/kg-TOC)	**31**	**41**	**47**	**85**	**55**	**647**	**59**	**1,147**	**249**	**1,459**	**537**	**32**

[1] Not detected at the specified detection limit

TABLE B93: Bulk PAH data on CLA-1 vicinity sediments (core samples collected in June) (OEPA 2015e)

PAH COMPOUND (µg/kg)	CLA-1 AND ADJACENT AREAS															
	CLA 1-0		CLA 1-0.5E		CLA 1-1.5E		CLA 1-0.5W		CLA 1-1.5W		CLA 1-1N		CLA1-2N		CLA1-1S		TOP COPE SAMPLE	BOTTOM CORE SAMPLE
	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	DISCRETE		
ACENAPHTHENE	110	690	600	2,500	970	570	530	160	17	17	17	42	17	6	6,200	8,100	510	5,600
ACENAPHTHYLENE	54	310	470	790	2,700	730	160	85	17	22	20	57	9.1 U[1]	7	1,200	1,200	290	760
ANTHRACENE	200	740	1,200	5,700	9,800	1,600	710	160	32	43	43	120	22	18	7,400	9,200	1,200	5,900
BENZO(A)ANTHRACENE	280	1,500	2,200	7,800	49,000	3,400	1,100	320	97	110	95	310	74	56	7,900	7,700	2,600	5,800
BENZO(A)PYRENE	300	1,300	2,300	5,400	36,000	3,900	950	320	120	120	130	330	80	62	5,500	4,700	3,100	4,100
BENZO(B)FLUORANTHENE	360	1,500	2,500	6,400	43,000	4,200	1,100	460	190	200	190	410	150	120	6,500	5,300	3,300	5,200
BENZO(G,H,I)PERYLENE	230	1,000	1,800	3,600	19,000	2,800	700	330	120	130	130	260	97	69	3,500	2,700	2,200	2,500
BENZO(K)FLUORANTHENE	160	640	1,000	2,400	16,000	1,300	420	160	57	73	68	160	40	36	2,400	1,700	1,300	1,600
CHRYSENE	330	1,500	2,300	6,700	48,000	3,400	1,300	390	130	110	130	350	64	57	7,900	7,600	2,800	6,100
DIBENZ(A,H)ANTHRACENE	44	260	450	880	3,800	660	190	100	8.4 U	6.2 U	8.3 U	76	8.8 U	5.5 U	1,100	720	430	650
FLUORANTHENE	590	2,600	3,600	18,000	64,000	5,500	2,500	650	190	200	170	420	170	120	18,000	21,000	3,200	14,000
FLUORENE	120	470	680	3,300	1,100	510	230	84	17	26	19	60	19	6.6 U	7,300	9,400	590	5,400
INDENO(1,2,3-C,D)PYRENE	200	870	1,400	3,100	18,000	2,600	580	290	100	110	110	220	83	63	2,900	2,200	2,000	2,100
NAPHTHALENE	180	750	780	2,200	14,000	1,300	410	160	38	50	39	140	86	19	1,600	1,200	610	1,200
PHENANTHRENE	480	2,500	2,900	21,000	5,600	3,700	2,300	480	89	120	97	280	84	49	30,000	36,000	3,000	22,000
PYRENE	600	2,000	3,500	13,000	72,000	4,000	2,200	520	200	190	200	470	140	97	15,000	16,000	3,000	14,000
TOTAL PAHs	**4,238**	**18,630**	**27,680**	**102,770**	**402,970**	**40,170**	**15,380**	**4,669**	**1,414**	**1,521**	**1,458**	**3,705**	**1,126**	**780**	**124,400**	**134,720**	**30,130**	**96,910**
TOC (%)	**2.9**	**3.2**	**2.9**	**2.7**	**3.1**	**2.7**	**3.1**	**2.0**	**2.8**	**1.9**	**3.0**	**2.2**	**3.0**	**1.2**	**3.2**		**3.3**	**5.9**
TOC-NORMALIZED PAHs (mg/kg-TOC)	**146**	**582**	**954**	**3,806**	**12,999**	**1,488**	**496**	**233**	**51**	**80**	**49**	**168**	**38**	**65**	**3,888**		**913**	**1,643**

[1] Not detected at the specified detection limit

TABLE B94: Bulk VOC data on Lake Erie sediments (surface samples collected in May) (OEPA 2015d)

VOC (mg/kg)	LAKE ERIE											
	LE-1	LE-2	LE-3	LE-4	LE-6	LE-COMP-1 (LE 1-6)	LE-7	LE-8	LE-9	LE-10	LE-11	LE-COMP-2 (LE 7-11)
1,1,1,2-TETRACHLOROETHANE	0.04 U[1]	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1,2,2-TETRACHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1,2-TRICHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1-DICHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1-DICHLOROETHENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1-DICHLOROPROPENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,3-TRICHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,3-TRICHLOROPROPANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,4-TRICHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,4-TRIMETHYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DIBROMO-3-CHLOROPROPANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DICHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DICHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DICHLOROPROPANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,3-DICHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,3-DICHLOROPROPANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,4-DICHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2,2-DICHLOROPROPANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2-CHLOROTOLUENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2-HEXANONE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
4-CHLOROTOLUENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
ACETONE	0.172	**0.184**	0.05 U	0.05 U	**0.168**	0.05 U	0.05 U	**0.096**	0.05 U	0.05 U	0.05 U	**0.16**
BENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOCHLOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMODICHLOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOFORM	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CARBON DISULFIDE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CARBON TETRACHLORIDE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROFORM	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CIS-1,2-DICHLOROETHYLENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CIS-1,3-DICHLOROPROPENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
DIBROMOCHLOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
DIBROMOMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
DICHLORODIFLUOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
ETHYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
HEXACHLOROBUTADIENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
ISOPROPYLBENZENE (CUMENE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
M+P-XYLENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
METHYL ETHYL KETONE (2-BUTANONE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
METHYLENE CHLORIDE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
NAPHTHALENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
N-BUTYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
N-PROPYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
O-XYLENE (1,2-DIMETHYLBENZENE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
P-CYMENE (P-ISOPROPYLTOLUENE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
SEC-BUTYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
STYRENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
T-BUTYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TETRACHLOROETHYLENE(PCE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TOLUENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TRANS-1,2-DICHLOROETHENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TRANS-1,3-DICHLOROPROPENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TRICHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TRICHLOROETHYLENE (TCE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TRICHLOROFLUOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
VINYL CHLORIDE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U

[1] Not detected at the specified detection limit

TABLE B95: Bulk VOC data on CLA-1 vicinity sediments (core samples collected in June) (OEPA 2015e)

VOC (mg/kg)	CLA-1 AND ADJACENT AREAS																
	CLA 1-0		CLA 1-0.5E		CLA 1-1.5E		CLA 1-0.5W		CLA 1-1.5W		CLA 1-1N		CLA1-2N		CLA1-1S	TOP CORE COMPOSITE	BOTTOM CORE COMPOSITE
	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP		
4-CHLOROTOLUENE	ND[1]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.139**	**0.144**
ACETONE	ND	ND	ND	**0.156**	ND	**0.163**	**0.18**	**0.223**	ND	ND	ND	ND	**0.13**	ND	**0.156**	ND	ND
CHLOROMETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
METHYL ETHYL KETONE (2-BUTANONE)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.055**	ND	ND
N-BUTYLBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.07**	ND	ND
SEC-BUTYLBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.058**	ND	ND
TOLUENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

[1] Not detected at the specified detection limit

TABLE B96: Results of 10-day *H. azteca* bioassay on Cleveland Harbor Upper Cuyahoga River and lake sediments (OEPA 2015f)

MEASUREMENT ENDPOINT	UPPER RIVER (SURFACE GRAB AND CORE COMPOSITE SAMPLES, APRIL)							LAKE ERIE (SURFACE GRAB AND CORE SAMPLES, MAY AND JUNE)					
	LAB CONTROL	DMMU-1		DMMU-2a		DMMU-2b		LAB CONTROL	LAKE ERIE (SURFACE GRAB COMPOSITE SAMPLES)		LAB CONTROL	CLA-1 AND ADJACENT (CORE COMPOSITE SAMPLES)	
		F01A21	200013	F01W50	302581	302580	302578		LE 1-LE-6	LE 7-LE-11		TOP	BOTTOM
MEAN SURVIVAL (%)	86	40	38	36	16	26	24	100	100	100	100	100	100

TABLE B97: ***L. variegatus tissue*** **PCB data generated from 28-day bioaccumulation testing on Cleveland Harbor Upper Cuyahoga River and Lake sediments (OEPA 2015f)**

PCB CONGENER (µg/kg)	UPPER RIVER (SURFACE GRAB AND CORE COMPOSITE SAMPLES, APRIL)						LAKE ERIE (SURFACE GRAB AND CORE SAMPLES, MAY AND JUNE)			
	DMMU-1		DMMU-2a		DMMU-2b		SURFACE GRAB COMPOSITE SAMPLES		CLA-1 AND ADJACENT CORE COMPOSITE SAMPLES	
	F01A21	200013	F01W50	302581	302580	302578	LE 1-LE-6	LE 7-LE-11	TOP	BOTTOM
PCB209	0.16	0.21	0.067	0 U	0 U	0.15	0.41	0.16	0.23	0.25
PCB206	0.28	0.26	0.21	0.19	0.13	0.23	0.21	0.12	0.16	0.18
PCB194	1.2	0.93	1.1	1	0.65	1	0.21	0.14	0.13	0.094
PCB207	0.033	0.025	0.031	0 U	0.026	0.038	0.03	0.031	0.024	0.024
PCB196	0.58	0.44	0.57	0.55	0.33	0.52	0.11	0.053	0.07	0.059
PCB195	0.64	0.48	0.59	0.52	0.34	0.56	0.12	0.084	0.1	0.057
PCB170	3.3	2.7	3.1	2.8	1.8	2.8	0.39	0.26	0.4	0.31
PCB197	0.048	0.046	0.068	0.029	0.019	0.06	0.016	0.015	0.011	0.011
PCB171	1	0.89	1.1	0.89	0.52	0.98	0.12	0.085	0.14	0.13
PCB128	1.1	1.3	1.2	0.82	0.63	1.1	0.3	0.17	0.43	0.43
PCB208	0.086	0.062	0.069	0.053	0.042	0.076	0.11	0.074	0.091	0.13
PCB199	2.1	1.7	1.9	1.7	1	2	0.51	0.44	0.55	0.42
PCB198	2.1	1.7	1.9	1.7	1	2	0.51	0.44	0.55	0.42
PCB172	0.77	0.51	0.63	0.54	0.36	0.6	0.088	0.058	0.076	0.055
PCB200	0.21	0.17	0.19	0.19	0.099	0.21	0.038	0.037	0.045	0.032
PCB201	0.21	0.15	0.17	0.12	0.1	0.21	0.048	0.044	0.059	0.039
PCB177	2.4	2.3	2.6	2.3	1.4	2.4	0.33	0.29	0.34	0.32
PCB175	0.14	0.13	0.19	0.11	0.083	0.16	0.016	0.015	0.018	0.013
PCB174	4.8	4.2	4.8	3.8	2.6	4.2	0.4	0.25	0.4	0.37
PCB173	1	0.89	1.1	0.89	0.52	0.98	0.12	0.085	0.14	0.13
PCB130	0.36	0.43	0.44	0.26	0.27	0.36	0.15	0.1	0.2	0.18
PCB129	13	15	14	11	7.7	12	2.1	1.3	3.6	3.3
PCB176	0.62	0.57	0.68	0.51	0.29	0.62	0.075	0.056	0.084	0.06
PCB132	2.9	3.2	3.5	3.1	2.3	2.7	0.56	0.36	0.87	0.81
PCB131	0.077	0.11	0.13	0.059	0 U[1]	0.091	0.019	0.013	0.036	0.033
PCB82	0.43	0.55	0.39	0.27	0.23	0.37	0.2	0.12	0.37	0.25
PCB202	0.32	0.25	0.34	0.21	0.17	0.33	0.12	0.086	0.095	0.11
PCB178	0.93	0.89	1.1	0.85	0.48	0.99	0.14	0.12	0.16	0.13
PCB133	0.16	0.18	0.23	0.082	0.12	0.17	0.043	0.038	0.052	0.045
PCB179	2.4	2.2	2.7	2.3	1.4	2.4	0.27	0.22	0.31	0.29
PCB135	8.8	9.5	10	7.4	5.1	10	1	0.65	1.9	1.8
PCB134	0.54	0.72	0.8	0.6	0.41	0.56	0.097	0.07	0.16	0.16
PCB83	1.9	3.1	2	1.2	1.3	1.9	0.9	0.49	1.8	1.4
PCB136	1.8	2	2.4	2.1	1.5	2	0.18	0.17	0.41	0.41
PCB84	0.8	1.2	0.82	0.71	0.91	0.77	0.32	0.16	0.67	0.6
PCB40	1.2	1.7	1.1	1	1.6	0.94	0.2	0.14	0.46	0.27
PCB203	1.1	0.77	0.9	0.8	0.49	0.95	0.29	0.21	0.26	0.22
PCB180	7.1	5.3	5.9	6.2	3.8	5.2	0.57	0.22	0.4	0.35
PCB204	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB183	3.6	2.8	3.3	2.9	1.7	3	0.33	0.2	0.39	0.36
PCB182	0 U	0 U	0 U	0.041	0.051	0 U	0 U	0.005	0 U	0.013
PCB181	0.024	0.032	0.035	0 U	0 U	0.021	0 U	0.007	0.006	0 U
PCB137	0.15	0.22	0.13	0.086	0.1	0.15	0.058	0.012	0.052	0.05
PCB138	13	15	14	11	7.7	12	2.1	1.3	3.6	3.3
PCB184	0 U	0 U	0 U	0 U	0 U	0.007	0.004	0 U	0 U	0 U
PCB140	0.064	0.13	0.11	0 U	0 U	0.079	0.031	0.014	0.055	0.052
PCB139	0.064	0.13	0.11	0 U	0 U	0.079	0.031	0.014	0.055	0.052
PCB85	0.6	0.89	0.59	0.35	0.41	0.61	0.27	0.15	0.58	0.47
PCB187	13	14	15	11	6.9	15	1.7	1.2	2.4	2.2
PCB185	3.6	2.8	3.3	2.9	1.7	3	0.33	0.2	0.39	0.36
PCB146	2.2	1.9	2	1.4	1.2	1.8	0.39	0.29	0.57	0.46
PCB141	4.1	2.8	3.1	2.5	1.8	2.4	0.19	0.084	0.19	0.18
PCB188	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB186	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB149	14	17	19	15	10	16	1.8	1.2	3.5	3.4
PCB148	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB147	14	17	19	15	10	16	1.8	1.2	3.5	3.4
PCB144	0.66	0.65	0.91	0.77	0.43	0.72	0.08	0.045	0.15	0.15
PCB143	0.54	0.72	0.8	0.6	0.41	0.56	0.097	0.07	0.16	0.16
PCB142	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB97	2.2	3.2	2.3	1.5	1.8	2	0.81	0.45	1.8	1.2
PCB90	6.5	7.8	6.8	5.8	5	5.7	1.4	0.78	3.2	2.4
PCB87	2.2	3.2	2.3	1.5	1.8	2	0.81	0.45	1.8	1.2
PCB86	2.2	3.2	2.3	1.5	1.8	2	0.81	0.45	1.8	1.2
PCB150	0 U	0 U	0 U	0 U	0 U	0.007	0 U	0 U	0 U	0 U
PCB145	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB91	0.55	0.84	0.61	0.37	0.52	0.58	0.2	0.14	0.48	0.43
PCB89	0.041	0.078	0.044	0 U	0 U	0.047	0.018	0.01	0.041	0.016
PCB88	0.55	0.84	0.61	0.37	0.52	0.58	0.2	0.14	0.48	0.43
PCB98	0.12	0.22	0.17	0.13	0.085	0.15	0.051	0.029	0.12	0.096
PCB42	0.58	0.9	0.61	0.46	0.63	0.51	0.099	0.074	0.21	0.11
PCB41	1.2	1.7	1.1	1	1.6	0.94	0.2	0.14	0.46	0.27
PCB151	8.8	9.5	10	7.4	5.1	10	1	0.65	1.9	1.8
PCB92	0.81	1.2	1	0.76	0.61	0.95	0.31	0.2	0.62	0.47
PCB152	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB94	0.014	0.023	0 U	0 U	0 U	0.026	0 U	0 U	0.015	0 U
PCB93	0.027	0.034	0.1	0.09	0.078	0.034	0 U	0.008	0.033	0.028
PCB44	2.3	3.3	2.3	2.2	3	1.9	0.35	0.24	0.92	0.49
PCB43	0.098	0.15	0.13	0.08	0.19	0.1	0.017	0.007	0.038	0.023
PCB96	0.02	0.036	0.024	0 U	0 U	0.023	0 U	0.006	0.014	0 U
PCB46	0.14	0.19	0.17	0.13	0.25	0.14	0.023	0.017	0.058	0.037
PCB45	0.46	0.71	0.57	0.41	0.85	0.45	0.056	0.04	0.16	0.11
PCB16	0.27	0.27	0.22	0.15	0.39	0.25	0.04	0.023	0.084	0.056
PCB153	13	13	14	11	7.8	11	1.6	1.1	2.5	2.1
PCB154	0 U	0.083	0.11	0 U	0 U	0.059	0.009	0.03	0.044	0.037
PCB99	1.9	3.1	2	1.2	1.3	1.9	0.9	0.49	1.8	1.4
PCB155	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB100	0.027	0.034	0.1	0.09	0.078	0.034	0 U	0.008	0.033	0.028
PCB47	2.3	3.3	2.3	2.2	3	1.9	0.35	0.24	0.92	0.49
PCB101	6.5	7.8	6.8	5.8	5	5.7	1.4	0.78	3.2	2.4
PCB103	0.021	0.027	0 U	0 U	0 U	0.036	0 U	0 U	0.03	0.025
PCB102	0.12	0.22	0.17	0.13	0.085	0.15	0.051	0.029	0.12	0.096
PCB49	1.5	2.2	1.5	1.4	2.1	1.2	0.21	0.15	0.61	0.35
PCB48	0.39	0.55	0.42	0.33	0.57	0.31	0.053	0.047	0.15	0.067
PCB104	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB51	0.46	0.71	0.57	0.41	0.85	0.45	0.056	0.04	0.16	0.11
PCB50	0.38	0.58	0.39	0.47	0.61	0.34	0.054	0.036	0.15	0.12
PCB17	0.34	0.42	0.3	0.23	0.66	0.33	0.049	0.024	0.12	0.081
PCB52	3.2	4.8	3.4	3.3	4.5	2.7	0.54	0.35	1.7	1.1
PCB53	0.38	0.58	0.39	0.47	0.61	0.34	0.054	0.036	0.15	0.12
PCB18	0.68	0.79	0.59	0.63	1.3	0.63	0.11	0.054	0.24	0.15
PCB54	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB19	0.13	0.13	0.086	0.082	0.19	0.12	0 U	0.008	0.033	0.03
PCB4	0.11	0.12	0.09	0 U	0.19	0.11	0.021	0 U	0.021	0.021
PCB205	0.072	0.09	0.09	0.061	0 U	0.088	0.02	0.018	0.016	0.011
PCB189	0.1	0.09	0.091	0.065	0.041	0.094	0.021	0.015	0.02	0.021
PCB191	0.17	0.15	0.22	0.12	0.072	0.17	0.017	0.007	0.011	0 U
PCB190	0.74	0.64	0.75	0.62	0.46	0.74	0.12	0.071	0.13	0.089
PCB157	0.58	0.75	0.63	0.41	0.34	0.57	0.2	0.091	0.28	0.24
PCB156	0.58	0.75	0.63	0.41	0.34	0.57	0.2	0.091	0.28	0.24
PCB158	0.87	1	1	0.79	0.5	0.78	0.15	0.067	0.21	0.21
PCB105	0.94	1.4	0.79	0.53	0.58	0.77	0.41	0.19	0.8	0.62
PCB193	7.1	5.3	5.9	6.2	3.8	5.2	0.57	0.22	0.4	0.35
PCB192	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB162	0.013	0.029	0.02	0 U	0 U	0.032	0.013	0.011	0.017	0.012
PCB159	0.11	0.12	0.18	0.14	0.067	0.13	0.009	0.008	0.006	0.011
PCB164	0.89	1	1.1	0.67	0.44	0.88	0.15	0.1	0.25	0.22
PCB163	13	15	14	11	7.7	12	2.1	1.3	3.6	3.3
PCB161	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB160	13	15	14	11	7.7	12	2.1	1.3	3.6	3.3
PCB122	0.05	0.077	0.055	0 U	0 U	0.042	0.021	0.014	0.037	0.017
PCB107	0.14	0.29	0.17	0.11	0.13	0.19	0.1	0.054	0.21	0.13
PCB108	0.12	0.19	0.1	0.069	0 U	0.13	0.056	0.034	0.11	0.082
PCB106	0 U	0.005	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB110	4.9	7.1	5	3.5	3.8	4.8	1.9	1	4	3.7
PCB109	2.2	3.2	2.3	1.5	1.8	2	0.81	0.45	1.8	1.2
PCB56	0.79	1	0.64	0.53	0.64	0.54	0.18	0.13	0.39	0.19
PCB55	0.044	0.074	0.09	0 U	0.12	0.051	0.013	0.003	0.024	0.014
PCB165	0.01	0.013	0 U	0 U	0 U	0.006	0 U	0 U	0.003	0 U
PCB111	0 U	0.018	0.006	0 U	0 U	0 U	0.005	0.002	0.007	0 U
PCB95	5.3	7.6	6.4	5.8	4.5	5.8	1.1	0.64	3	2.9
PCB113	6.5	7.8	6.8	5.8	5	5.7	1.4	0.78	3.2	2.4
PCB112	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB58	0.005	0.034	0 U	0 U	0 U	0.004	0 U	0 U	0.054	0 U
PCB57	0.012	0.02	0 U	0 U	0 U	0.01	0 U	0 U	0 U	0 U
PCB59	0.22	0.35	0.22	0.17	0.3	0.19	0.044	0.031	0.092	0.071
PCB20	1.3	1.8	1	0.94	1.8	0.89	0.21	0.15	0.44	0.27
PCB167	0.25	0.29	0.25	0.13	0.15	0.25	0.073	0.04	0.1	0.082
PCB168	13	13	14	11	7.8	11	1.6	1.1	2.5	2.1
PCB166	1.1	1.3	1.2	0.82	0.63	1.1	0.3	0.17	0.43	0.43
PCB123	0.045	0.084	0.043	0 U	0.049	0.06	0.018	0.013	0.046	0.048
PCB118	2.4	4.2	2.5	1.6	1.9	2.1	0.99	0.45	2.2	1.6
PCB114	0.062	0.094	0.074	0 U	0 U	0.063	0.018	0.013	0.048	0.036
PCB119	2.2	3.2	2.3	1.5	1.8	2	0.81	0.45	1.8	1.2
PCB115	4.9	7.1	5	3.5	3.8	4.8	1.9	1	4	3.7
PCB66	1.8	2.5	1.5	1.2	1.5	1.2	0.36	0.27	0.9	0.51
PCB60	0.37	0.54	0.34	0.24	0.29	0.27	0.069	0.059	0.17	0.1
PCB124	0.12	0.19	0.1	0.069	0 U	0.13	0.056	0.034	0.11	0.082
PCB120	0.016	0.025	0.007	0 U	0 U	0.007	0.015	0.01	0.015	0.013
PCB125	2.2	3.2	2.3	1.5	1.8	2	0.81	0.45	1.8	1.2
PCB121	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB117	0.6	0.89	0.59	0.35	0.41	0.61	0.27	0.15	0.58	0.47
PCB116	0.6	0.89	0.59	0.35	0.41	0.61	0.27	0.15	0.58	0.47
PCB76	2.9	4.2	2.4	1.9	2.8	2.1	0.62	0.4	1.8	0.99
PCB70	2.9	4.2	2.4	1.9	2.8	2.1	0.62	0.4	1.8	0.99
PCB68	0.013	0.016	0.014	0 U	0 U	0.013	0 U	0.003	0.009	0.007
PCB67	0.054	0.067	0.06	0 U	0.045	0.05	0.009	0.009	0.032	0.014
PCB63	0.064	0.11	0.076	0.06	0.081	0.063	0.02	0.01	0.04	0.019
PCB61	2.9	4.2	2.4	1.9	2.8	2.1	0.62	0.4	1.8	0.99
PCB71	1.2	1.7	1.1	1	1.6	0.94	0.2	0.14	0.46	0.27
PCB69	1.5	2.2	1.5	1.4	2.1	1.2	0.21	0.15	0.61	0.35
PCB64	0.92	1.5	0.99	0.91	1.3	0.86	0.18	0.14	0.45	0.28
PCB62	0.22	0.35	0.22	0.17	0.3	0.19	0.044	0.031	0.092	0.071
PCB33	0.39	0.45	0.32	0.27	0.64	0.25	0.082	0.049	0.17	0.1
PCB25	0.12	0.18	0.12	0.072	0.15	0.095	0.013	0.015	0.039	0.013
PCB22	0.35	0.53	0.3	0.28	0.39	0.23	0.051	0.044	0.11	0.06
PCB21	0.39	0.45	0.32	0.27	0.64	0.25	0.082	0.049	0.17	0.1
PCB72	0.019	0.05	0.035	0 U	0 U	0.02	0.008	0.008	0.018	0.01
PCB73	0.098	0.15	0.13	0.08	0.19	0.1	0.017	0.007	0.038	0.023
PCB65	2.3	3.3	2.3	2.2	3	1.9	0.35	0.24	0.92	0.49
PCB34	0 U	0.013	0 U	0 U	0 U	0.005	0.002	0 U	0.005	0 U
PCB26	0.24	0.33	0.21	0.15	0.33	0.18	0.04	0.024	0.086	0.044
PCB23	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB27	0.085	0.094	0.091	0.075	0.099	0.083	0.012	0.006	0.027	0 U
PCB24	0.007	0.014	0.012	0 U	0 U	0.018	0 U	0 U	0.004	0 U
PCB6	0.052	0.049	0.03	0.08	0.085	0.052	0.016	0.009	0.029	0.009
PCB5	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB74	2.9	4.2	2.4	1.9	2.8	2.1	0.62	0.4	1.8	0.99
PCB75	0.22	0.35	0.22	0.17	0.3	0.19	0.044	0.031	0.092	0.071
PCB28	1.3	1.8	1	0.94	1.8	0.89	0.21	0.15	0.44	0.27
PCB31	1	1.4	0.82	0.84	1.4	0.71	0.14	0.097	0.35	0.2
PCB29	0.24	0.33	0.21	0.15	0.33	0.18	0.04	0.024	0.086	0.044
PCB32	0.39	0.53	0.34	0.28	0.55	0.39	0.035	0.018	0.11	0.064
PCB30	0.68	0.79	0.59	0.63	1.3	0.63	0.11	0.054	0.24	0.15
PCB8	0.17	0.13	0.11	0.15	0.3	0.13	0.037	0.018	0.061	0.042
PCB7	0.011	0.017	0 U	0 U	0 U	0.011	0 U	0 U	0.009	0.014
PCB9	0.011	0.014	0 U	0.034	0 U	0.019	0.008	0.007	0.012	0.017
PCB10	0.013	0.014	0.011	0 U	0 U	0.011	0 U	0 U	0.004	0 U
PCB1	0.008	0 U	0 U	0 U	0 U	0.008	0 U	0 U	0.006	0.008
PCB169	0.025	0.012	0.051	0 U	0 U	0.044	0.016	0.019	0.026	0 U
PCB126	0.013	0.013	0.011	0 U	0 U	0.009	0.003	0.003	0.009	0.008
PCB77	0.13	0.14	0.11	0.072	0.082	0.097	0.05	0.035	0.084	0.044
PCB127	0 U	0.013	0.007	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB79	0.016	0.033	0.021	0 U	0 U	0.022	0.009	0.004	0.016	0.017
PCB78	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB35	0.015	0.022	0.012	0 U	0 U	0.005	0.01	0.004	0.013	0.009
PCB80	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB36	0 U	0.008	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0.012
PCB11	0.056	0.068	0.08	0.21	0.19	0.062	0.054	0.069	0.059	0.081
PCB81	0.009	0.013	0.007	0 U	0 U	0.007	0.002	0 U	0.004	0 U
PCB37	0.28	0.29	0.21	0.18	0.26	0.2	0.067	0.047	0.13	0.076
PCB39	0.008	0.02	0.015	0 U	0 U	0.01	0 U	0.002	0.009	0 U
PCB38	0 U	0.01	0 U	0 U	0 U	0 U	0 U	0 U	0.003	0 U
PCB13	0.022	0.031	0.024	0 U	0.063	0.024	0.009	0 U	0.018	0.014
PCB12	0.022	0.031	0.024	0 U	0.063	0.024	0.009	0 U	0.018	0.014
PCB14	0 U	0.008	0 U	0 U	0 U	0 U	0.003	0 U	0 U	0.007
PCB2	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0.004	0.008	0 U
PCB15	0.12	0.11	0.088	0.057	0.17	0.082	0.037	0.027	0.055	0.03
PCB3	0.005	0.008	0 U	0 U	0 U	0 U	0 U	0.002	0.009	0 U
TOTAL PCBs	**311**	**362**	**329**	**263**	**225**	**289**	**56.6**	**34.9**	**108**	**86.2**
LIPID (%)	**1**	**0.88**	**1**	**1.5**	**0.77**	**0.89**	**0.9**	**0.64**	**0.6**	**0.8**
LIPID-NORMALIZED PCBs (µg/kg-lipid)	**31052**	**41093**	**32934**	**17534**	**29196**	**32469**	**6285**	**5457**	**18043**	**10780**

[1] Not detected at the specified detection limit