UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:
SR-6J

VIA ELECTRONIC MAIL

June 14, 2022

Mr. Timothy Barber (via email)
ERM
3333 Richmond Road, Suite 160
Beachwood, OH 44122

Subject: EPA Comments to Remedial Investigation Report, Revised
U.S. Smelter and Lead Refinery, Inc. OU2 Superfund Site, East Chicago, IN
Administrative Settlement Agreement and Order on Consent V-W-17-C-013 (ASAOC)

Dear Mr. Barber,

The U.S. Environmental Protection Agency (EPA) has reviewed U.S. Smelter and Lead Refinery, Inc.'s (USS Lead) *Remedial Investigation Report, Revised, USS Lead Superfund Site, Operable Unit 2, 5300 Kennedy Avenue, East Chicago, IN, dated October 2021* (Revised RI).

EPA has concluded after its review of the Revised RI that USS Lead has neither fully evaluated the nature and extent of contamination nor prepared the Revised RI in accordance with applicable EPA guidance for conducting RIs and risk assessments under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as agreed upon in the ASAOC. According to the ASAOC, Part VIII, Work to be Performed, Item 16:

> *Respondent shall conduct the RI/FS and prepare all plans in accordance with the provisions of this RI/FS ASAOC, the attached RI/FS SOW, CERCLA, the NCP, and EPA guidance, including, but not limited to the "Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA" ("RI/FS Guidance"), OSWER Directive # 9355.3-01 (October 1988), available at https://semspub.epa.gov/src/document/11/128301, "Guidance for Data Useability in Risk Assessment (Part A), Final," OSWER Directive #9285.7-09A, PB 92 963356 (April 1992), available at http://semspub.epa.gov/src/document/11/156756, and guidance referenced therein, and guidance referenced in the RI/FS SOW.*

Furthermore, ASAOC Appendix A, Statement of Work (SOW) states that the scope of the RI for the Former USS Lead Facility and associated Groundwater will be as follows (EPA's emphasis in bold):

> *…the RI shall* ***fully evaluate the nature and extent of hazardous substances, pollutants or contaminants and assess the risk*** *which these hazardous substances, pollutants or contaminants present for human health and the environment.*

EPA has prepared comments, which identify data gaps or omissions with respect to the Revised RI. These comments are presented in the attached table (Attachment 1). The comment table includes specific data requests or questions that seek to clarify noteworthy issues and identifies the corresponding location within the Revised RI where the topic is presented. Where applicable, column 2 of the comment table identifies comments previously provided by EPA on September 15, 2020 and December 2, 2020 following EPA's review of the initial Remedial Investigation Report dated January 2020 and the Field Sampling Plan FSP Addendum dated July 2020. In these instances, EPA reviewed the Revised RI and found that the prior comments were not adequately addressed. A response or additional supporting information as prompted by the comments is required to satisfy requirements of the ASAOC and adhere to EPA guidance.

In addition, as a function of the nomination of the USS Lead Superfund Site Operable Unit 2 to EPA's National Remedy Review Board (NRRB), the comment table now incorporates initial comments provided by risk assessors at EPA Headquarters. These comments are specific to their review of the Revised Human Health Risk Assessment (Revised HHRA) and Revised Baseline Ecological Review Assessment (Revised BERA). EPA also integrated into the comment table relevant information obtained from the United States Fish and Wildlife Service (USFWS) letter dated December 28, 2021 (Attachment 2) regarding aspects of its review of the Revised RI and Revised BERA.

In summary, issues raised and information sought in the comment table emphasize the need to fully evaluate the nature, extent, and risk attributable to all hazardous substances, in contrast to the five contaminants of interest (COIs) that were carried through the Revised RI and risk assessments. This objective and other key concerns reflected in the comment table include:

Revised RI:

1) Clear screening criteria need to be presented for each analyte and each media. USS Lead must explain which screening criteria were used and the rationale and history for why USS Lead selected the screening criteria, especially those screening criteria that differ from EPA-established screening levels. These screening criteria will be used to delineate the nature and extent of contamination in the RI.

2) The COIs were not explicitly identified for each separate media at the end of Section 4.1, which makes the remainder of Section 4 difficult to follow. USS Lead needs to clearly identify the COIs for each media, explain how it determined COIs for each media, and provide supporting information on how it determined COIs.

3) Differentiating between historical and recent data in figures would help EPA and the public better understand the current level and distribution of contamination. The inclusion or exclusion of historical data and rationale for inclusion or exclusion of historical data is not clear in the text and figures of the RI. The report should clarify the media (e.g., groundwater, soil, sediment, surface water) of the historical data.

4) The RI needs to address subsurface groundwater intrusion including an explanation of the pathway and examination of the potential impact of groundwater intrusion into basements with attention paid to groundwater residuals (precipitates and dust) that remain on basement surfaces after groundwater has receded or been removed. This pathway has human health risk implications.

5) Conclusions presented in the Executive Summary and Section 8 will need to be revised to be consistent with the remainder of the comments. Statements such as "no action is required" should be removed. Actions required and media to be addressed should be determined in the Feasibility Study (FS), which should include from the RI a brief summary of the nature and extent of contamination and the risk assessment conclusions.

Revised HHRA:

1) There is no discussion of the Tetra Tech sampling and analysis activities (sump water, precipitates and dust on basement surfaces, and soil) in the residential basements and comparison to EPA's calculated screening levels.

2) The HHRA presents no screening of the complete site dataset justifying why the five metals are the only COIs at the site (the HHRA addressed only five chemicals).

3) Groundwater exposures were underestimated in the HHRA using the Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children; background lead in drinking water from the municipal water supply was not incorporated into the model.

Revised BERA:

1) A screening ecological risk assessment (ERA) was not presented to show why the focus was only on the five metals as COIs.

2) Groundwater was not screened appropriately using ecological screening values to assess the groundwater-to-surface-water pathway. For instance, the revised BERA presented as Appendix N in the Revised Final RI (October 2021) included groundwater screening with ecological screening values, but the screening was limited to only the five metal COIs and did not include the same screening for all site data. Similarly, groundwater screening using tap water values was conducted for analytes other than the five metal COIs identified in the BERA, but this screening was not included in the BERA. This approach results in an incomplete screening evaluation of all site data. As noted within the comments, existing groundwater data for all analytes should be screened using appropriate ecological screening values.

3) Risks to fish and piscivorous wildlife were not evaluated in the BERA. There is some indication in the RI that the open water areas (i.e., surface water ponds and wetlands) may have been remediated, but it is unclear why these receptors were not evaluated. RI Figure 1.3-2 suggests that this area was partially backfilled from 2 to 3 feet. However, the extent of remediation is unclear. The document needs to clarify whether these open water areas were remediated and to what extent. If these areas have not been adequately remediated, then there is a data gap and this data gap needs to be filled to address potential risks to fish and piscivorous wildlife. USS Lead must describe the current condition of the open water areas.

4) Use of the geometric mean of bounded lowest observed adverse effect level (LOAEL) values for reproduction and growth is not a valid method for identifying the LOAEL to be used in an ERA. The approach used for LOAEL selection is not consistent with EPA's ecological soil screening level (Eco-SSL) methodology and we cannot determine whether the results generated with this methodology generate values that are adequately protective of ecological receptors.

On April 12, 2022, EPA had a call with you to communicate several of these key recurring themes. During the call, you expressed a need for clarification of expectations for completing the RI. As previously noted, EPA has provided in the comment table specific issues and corresponding requests that USS Lead will need to address. EPA has also provided an outline of the RI process pursuant to EPA RI guidance (Attachment 3) to further clarify expectations for successful completion of this RI.

EPA requires USS Lead to revise the RI Report in accordance with EPA's review as presented in this letter and the enclosed table (Attachment 1) and submit the updated RI Report within 60 days of receipt of this letter. Given the breadth of comments, EPA recommends setting up a meeting following your review to address any outstanding technical questions. Please let us know your general availability and EPA will coordinate the meeting with the review team.

EPA strongly prefers to work with you to complete successfully an RI consistent with the goals established in the ASAOC. Upon EPA's review of the updated RI, if USS Lead has not adequately addressed all comments, particularly the comments regarding the HHRA and BERA components of the RI, EPA will consider whether to issue written notice to exercise its right to implement RI/FS Work Takeover consistent with ASAOC Paragraph 78 to modify the updated RI and provide the revised updated RI to you for further execution.

If you have any questions, please contact me at (312) 886-0234 or mccartney.kevin@epa.gov. If counsel for the Respondent would like to discuss these issues and comments, she should contact Cathleen Martwick at (312) 886-7166 or martwick.cathleen@epa.gov

Sincerely,

McCartney, Kevin Digitally signed by McCartney, Kevin
Date: 2022.06.14 09:42:22 -05'00'

Kevin McCartney
Remedial Project Manager

cc: (*via e-mail*)
Mary Gade, Esq.
Cathleen Martwick, EPA
Steven Kaiser, EPA
Jamie Getz, EPA
Stephanie Andrews, IDEM
Jennifer Seaman, Jacobs

Attachments: 1 – Revised RI Comment Table
2 – USFWS Letter dated December 28, 2021
3 – RI Process Outline

Attachment 1 – Revised RI Comment Table

Comments on *Remedial Investigation Report, Revised, USS Lead Superfund Site, Operable Unit 2, 5300 Kennedy Ave, East Chicago, IN* (ERM, October 7, 2021)

Comment No.	Previous Comment Referenced [a]	Document	Section, Table, or Figure Reference	¶	PDF Page #	Doc. Page #	Sentence	Comment
1	6	RI	Table 4.1-1 Executive Summary, 1.3.2, 8.2 1.3.2		169 14, 22, 68 22			Correct misspellings in this table and define all acronyms. Indicate the corresponding media for each COI or generate separate tables per each media (soil, sediment, groundwater, etc.). The groundwater ordinance referenced in various sections prohibits the use of groundwater as a potable water supply "except for such uses or methods in existence before the effective date of this ordinance" as noted within the ordinance. Statements regarding the ordinance require modification to capture this notable exception and further evaluation is warranted before the pathway is determined to be incomplete. Remove the last two sentences to bullet "u" starting with the sentence that begins "USEPA has not...".
2	7	RI	Figures 3.2-3, 3.2-4, 4.3-6		110, 111, 124			Add Former USS Lead Facility Building footprints to the figures noted to provide additional insight into sources for elevated metals in soil, sediment, surface water, and groundwater. See Figure 6 from Appendix A of the FSP Revision 2 (July 2018).
3	--	RI	Executive Summary, 5.2, 8.2, 8.3		13, 15, 64-66, 83, 85	ES3, ES5, 49-51, 68, 70		In the Executive Summary, add a bullet to the "Human Health and Ecological Risks" subsection indicating the Tetra Tech sampling and analysis activities (sump water, precipitates/dust on basement surfaces, and soil) at the residential properties and results of the comparison to EPA-generated screening levels. Also, add a bullet to the "Recommended Remedial Action Objectives" subsection based on results of the Tetra Tech sampling. In Sections 5.2 and 8.2, summarize the Tetra Tech sampling and analysis activities (sump water, precipitates/dust on basement surfaces, and soil) at the residential properties and discuss the results of the comparison to EPA-generated screening levels. In Section 8.3, discuss the results of the Tetra Tech sampling based on the comparison to EPA-generated screening levels.
4	--	RI	Executive Summary, 8.1-8.3		11-15, 82-85			Change the title of the header "Recommended Remedial Action Objectives"—these are not remedial action objectives (RAOs) that specify the contaminants and media to be addressed, exposures pathways, and risk levels. RAOs are developed in the feasibility study. Revise the conclusions in these sections to be consistent with edits necessary to address the remainder of the comments provided in this comment document. Remove statements such as "no action is required." Evaluations of whether "no action is required" are typically performed as part of the feasibility study and should be performed as part of the feasibility study in this instance. The media to be addressed must also be determined in the feasibility study. In addition: • Update the figure of previously remediated areas (Figure 1.3-2) to demonstrate the remediation at the Site, excluding the southern wetland, to provide evidence that soil does not need further remediation (except for the areas around MW7 and MW21 noted in Section 8.3). See Comment #44 related to clarifying Figure 1.3-2. Overlay the remediated areas with the locations of samples collected. Provide in the figure or corresponding tables the dates of sampling and the dates of remediation. • Explain the potential source(s) of antimony and how the elevated antimony and lead concentrations in groundwater beneath some parts of OU1 Zone 1 will be assessed. Explain how the distribution of antimony in groundwater, which is not delineated in OU1 Zones 1-3 to its MCL, will be handled in future assessments (such as the feasibility study). • Add arsenic background levels of ambient northern Indiana groundwater to help explain the elevated arsenic concentrations in the three deep wells of OU1 Zones 1, 2, and 3. • When describing areas to be addressed during the feasibility study for groundwater or geochemical impacts, such as MW7 and MW21 (or OU1 Zone 1 groundwater or OU1MW5 in Zone 2), include all COIs exceeding screening criteria and not only the most elevated COIs.
5	13	RI	1.3.4	5	23	8	Dust inside the home was collected and tested for lead and arsenic.	Add a discussion of the EPA dust sample action levels to the HHRA.

Comments on *Remedial Investigation Report, Revised, USS Lead Superfund Site, Operable Unit 2, 5300 Kennedy Ave, East Chicago, IN* (ERM, October 7, 2021)

Comment No.	Previous Comment Referenced [a]	Document	Section, Table, or Figure Reference	¶	PDF Page #	Doc. Page #	Sentence	Comment
6	16	RI	2.3	6	26		At the OU1MW5/5D well pair, the fill material appeared to be composed largely of black, gravel- and sand-sized slag/cinders.	Additional samples have been collected. However, evidence still has not been provided to EPA to conclude that OU1MW5 is an area of localized slag. Revise/delete this sentence to be consistent with the boring log provided in Appendix B or provide additional information documenting the slag observed.
7	18	RI	2.4	1	28		The main elevation of Lake Michigan recorded at Calumet Harbor (NOAA Station No. 9087044) for the 60-year period from 1 September 1969 through 1 September 2019 was 579.04 feet amsl.	Update the text to match Figure 2.4-2. The timeframe should be revised to September 2021 and the elevation revised to 579.12.
8	19	RI	Figures 2.5-1 through 2.5-5		101-105			Figures have not been updated to include the sewer system layer.
9	20	RI	2.5.2 last bullet		30		Otherwise, groundwater flow within OU2 is south southwesterly, to the Grand Calumet River.	Figure 2.5-4 contradicts this statement. Water level elevations for this event seem to indicate that the water level is generally flat (no elevation change) between the CAMU and the Grand Calumet River, and that groundwater flows from the Grand Calumet River to the Site. Revise the text and Groundwater Contour Map figure(s) accordingly.
10	27	RI	Figures 4.2-1 to 4.2-2a		115-117			Figures 4.2-1 to 4.2-2a need to be updated to reflect historical vs. recently collected data.
11	28	RI	3.1.2.5		41		Three subsurface soil samples were collected in 1997 in the former fuel tank area west of the CAMU and analyzed for VOCs, SVOCs, TPH, PCBs, and total lead.	See Comment #2. Add the fuel tank storage area to these figures.
12	--	RI	3.1.3		42		…arsenic, cadmium, chromium, lead, and mercury have been detected in one or more samples above the IDEM SLs identified in Table 4-27 in these wells.	Table reference 4-27 does not exist in this report. Please remove this reference or update with the correct table reference.
13	--	RI	3.1.4	2	42		Arsenic was detected at 170 ug/l versus the ESL of 150 ug/l…	Revise ESL to ESV.
14	--	RI	3.2		43			Format bullets for “At OU1:” to match the previous bulleted list for “At the former USS Lead Facility:”
15	--	RI	3.2.1 and Figure 3.2-2	2	43, 109	28	The Site was divided into Decision Units (DUs).	How were the DUs determined? Provide in the text the rationale and process of determining the DUs.
16	--	RI	Figure 3.2-5, 6, 7		112-114		Note 1 – Maximum Dissolved Metal Concentrations	Clarify the date range of samples for the Maximum Dissolved Metal Concentrations.
17	41	RI	3.2.9		52	37	TPH is not believed to pose a significant risk to human health or the environment.	Based on USS Lead’s response, the updated HHRA was to include a qualitative evaluation of potential risk to humans, but a qualitative evaluation of potential risk to humans is not addressed in the HHRA; add a discussion of TPH results to the HHRA.
18	--	RI	4.3					Create a new table to provide statistical information regarding the number of times each COI exceeded the screening values found in Table 4.1-1 (where applicable for each media) out of the number of times that samples were analyzed (similar to Appendix I tables).
19	48	RI						Provide a discussion in the text regarding the number of samples that exceed appropriate screening criteria and the frequency of the exceedances. See previous comment.
20	--	RI	Figure 4.2-1 through 4.2-3		115-118			Indicate the time period during which the samples were collected. Indicate the difference between historic and recent samples. Indicate if any samples were removed by excavation and clarify in the text/tables if they were excluded from the data set and from the figures. Clarify the meaning of “used in the RI” in the figure notes and in the RI text. For example, were all samples shown on these figures used to define the nature and extent of contamination? Was all data available presented for these samples in tables? Were all data for all samples shown on the figures carried forward into the risk assessments?

Comment No.	Previous Comment Referenced [a]	Document	Section, Table, or Figure Reference	¶	PDF Page #	Doc. Page #	Sentence	Comment
21	--	RI	Figures 4.3-2 to 4.3-5		120-122			Indicate the time period during which the samples were collected for the maximum concentrations. The legend is unclear because the brown contour line seems to indicate delineation of the MCL, but this same contour line color is used for all contours – clarify the legend. Change the brown contour lines to a color that is more easily visible to the reader.
22	--	RI	Figure 4.3-6		124			Given the wide range of sample collection dates (2000 – 2021), indicate the sample collection dates with the data on the figure.
23	--	RI	Figure 3.2-5		112			Data shown does not indicate what well the data set is from. Revise to indicate well ID for each data set/callout box similar to other cross section figures.
24	--	RI	4.3.5.3		61			Rewrite this section to match other sections in 4.3.5. "A total of 27 groundwater samples…" is repetitive.
25	--	RI	3.2	3	45			The discussion regarding the exceedance of arsenic in the soil samples collected seems out of place. This discussion is more appropriate within and should be moved to Section 4, Nature and Extent. Revise this paragraph to indicate only what was collected and analyzed.
26	55	RI	4.3.5.4		63			Include phenanthrene in Table 4.1-1.
27	57	RI	5.3		66	51	Site-specific sources of uncertainty associated with the HHRA for the USS Lead Superfund Site include the following: • Limited subsurface sediment sampling data • Limited OU1 groundwater sampling data • The assumption that OU1 residents will be exposed to the maximum concentrations of COIs in groundwater	These sources of uncertainty were not addressed in the HHRA uncertainty section (Appendix M, Section 8). Add a Site-specific discussion of the uncertainties related to these issues in the HHRA uncertainty section.
28	59	RI	7.1		69-70			Insert a statement into Section 7.1 to indicate that volatility is not applicable to metals.
29	--	RI	General Section 7					Because the COIs have not been explicitly stated for each media, it is difficult to interpret why certain metal COIs are included or excluded in the Section 7.4 discussion. For example, iron is discussed in Section 7.3, General Behavior of COIs but is not considered a COI in groundwater (per statement in first paragraph of Section 7.4.4). Is iron a COI for another media? It is compared against SLs in soil but no discussion is provided to indicate it was a COI anywhere.
30	--	RI	7.3.4		72-73			If iron's behavior as a COI is included, make sure it is clear that iron is a COI. Add a discussion about ferric hydroxide complexes formation under oxidizing conditions, which can provide binding sites (which, in turn, can affect the overall mobility) for metals (such as oxidized arsenic [As(V)]). This will support the statement made about iron in Section 7.4.4.
31	61	RI	7.4.2	Last	75			Add a reference to Figure 4.3-6 and add discussion on how surface water concentrations migrate and affect other media, including groundwater, since data indicate high concentrations of arsenic have been observed (610 µg/L) in surface water.
32	63	RI	7.4.4		76		Antimony concentrations in groundwater are generally higher in OU2 and ECHA wells as compared to the rest of the OU1 wells. Concentrations of antimony in ECHA-MW-01 are the highest measured at the Site. Recent concentrations of dissolved antimony (2015 – 2019) are greater than 100 µg/L only in ECHA-MW-01, ECHA-MW-09, MW-21, and MW-23.	There is no explanation given for using 100 µg/L as a comparison value for the wells noted. The SLs should be used for data comparison, which for antimony are 6 µg/L (MCL) and 7.8 µg/L (IDEM).
33	64	RI	7.4.4.2 and Figure 7.4-2		77		Between 2001 and 2019 total arsenic concentrations in samples collected from MW21, located north of the CAMU and midway along its length, have ranged from 85 µg/L to 3,290 µg/L, with the maximum concentration measured in November 2011.	Figure 7.4-2 indicates that the concentration maximum occurred before 2005. Confirm that this is correct. Also, the axis of this figure indicates dissolved concentration. Revise the axis to total arsenic if this is correct. Otherwise, include the concentration curve for total arsenic.

Comment No.	Previous Comment Referenced [a]	Document	Section, Table, or Figure Reference	¶	PDF Page #	Doc. Page #	Sentence	Comment
34	65	RI	7.4.4.2 and Figure 7.4-1		77		In general, total arsenic concentrations in samples collected from MW7 have increased over time, with concentrations between 20,000 µg/L and 23,000 µg/L between December 2018 and June 2019 (Figure 7.4-1).	Figure 7.4-1 indicates that the concentration between December 2018 and June 2019 had a lower concentration value between these two dates, above 15,000. Confirm that this is correct. Also, the axis of this figure indicates dissolved concentration. Revise the axis to total arsenic if this is correct. Otherwise, include the concentration curve for total arsenic.
35	66	RI	7.4.4.2		77-78		However, it is anticipated that arsenic concentrations will continue to decrease in MW21. The CAMU is under hydraulic control; therefore, the CAMU is not the source of elevated arsenic concentrations observed at MW21.	Include data collected in 2021 as part of the discussion in this section. Discussion has not been updated to include the potential source around MW21 (per previous response, it was indicated that local soil around MW21 was a potential source). Revise the text to describe what the potential source is around MW21.
36	67	RI	7					Include subsections for the transport process and contaminant migration trends in accordance with the RI/FS SOW. Adding this subsection could help explain why arsenic concentrations are increasing with depth as shown in Section 7.4.4.3, in addition to the evidence provided in Section 7.4.4.3.
37	68	RI	7.4.4.3		79		This conclusion is corroborated by a strong correlation between dissolved iron and dissolved arsenic concentrations ($p<0.05$; data not shown)	Including a subsection on the transport process and contamination migration trends may help provide additional context and support for this statement.
38	69	RI	7.4.4.4	2	80		As described in Section 2.3, fill material is widespread at the Site…	See Comment #6.
39	72	RI	8					Add context to phrases like "elevated concentrations" or "higher" by adding actual results and by listing specific screening criteria that the media being discussed exceeded. The groundwater summary describes trends but lacks context to better understand why concentrations are exceeding criteria.
40	73	RI	8		82			See Comment #39.
41	74	RI	8		82-83			See Comment #39.
42	75	RI	8.3		84		8. Elevated concentrations of antimony and lead were detected…	See Comment #39. If the context for "elevated concentrations" can be provided, this would explain why other COIs, such as arsenic, cadmium, and selenium, were not discussed here.
43	--	RI	Figure 1.3-2		94			The legend indicates "remediated areas". Define what constitutes remediation (presumably excavation). If excavation was performed, clarify the total dimensions of the excavation (including depth) and backfill depths of each area. For example, Area B states "no backfill." What was the excavation depth? Area A indicates that it was backfilled 4-5 feet; clarify the total excavation depth (presumably 5 feet). What backfill material was used for the remediated areas and was that sufficiently characterized? Clarify what happened with the excavation above the backfill depth (presumably left open). Add dates (e.g., month/year) of when remediation was completed for each area, which will help provide context to historical data and recently collected data. This information can be added to the report text, as a table in the report, or as notes on the figure. Overlay these remediated areas with soil, sediment, and surface water samples collected on a figure or figures to demonstrate what has been remediated and what samples remain in-place. Sample depth intervals and collection dates should be provided in a table that can be cross-referenced with the figure. Use a different color or symbol to indicate samples that were removed by excavation.
44	--	RI	Figure 4.3-2		120			The contour line near MW5 needs to be revised. MW5 is shown between the 10- and 100-µg/L contour lines, but it has a concentration of 150 µg/L.
45	77	RI	Table 2.3-1		129-131			Add context for the free product in MW19 to the RI report. Free product is mentioned in various tables but not discussed in the document.
46	78	RI						Was the pH in OU1MW5 high as well in 2021? If so, include a table of field parameters collected for previous field events including 2021. Include pH values in such a table.
47	81	RI	Figure 2.3-1		97			For the wells located along the CAMU boundary, it is not clear which wells are located inside of the CAMU (presumably within the slurry wall) and which are located outside. Use an inset map with call-out labels or different colored well symbols for those located on the inside of the CAMU. The same color scheme for differentiating between the interior/exterior wells would enhance the groundwater contour maps (Figures 2.5-1 through 2.5-5).

Comment No.	Previous Comment Referenced [a]	Document	Section, Table, or Figure Reference	¶	PDF Page #	Doc. Page #	Sentence	Comment
48	82	RI	Figure 2.3-1		97			Include well ECHA-MW-12 in the figure with a note that this well could not be found.
49	83	RI	Figure 2.5-1 through 2.5-5		101-105			See Comment #47.
50	85	RI	Figure 4.2-1 and 4.2-2		115-116			Differentiate between 2018-2021 samples collected by ERM versus historical soil and sediment samples.
51	86	RI	Figure 4.2-3		118			This figure shows 10 surface water sampling locations; however, the text in Section 4.2 indicates that a total of 38 surface water samples was used in this RI. Indicate the additional locations or add a footnote as to why the other locations are not shown.
52	--	RI	Figure 4.3-1		119			Why are the contours between OU1MW5 and MW14 not connected given the groundwater flow and the placement of the groundwater divide? These two wells are on the same side of the groundwater divide.
53	--	RI	Figure 4.3-6		124			As previously noted for Figure 4.2-3 in Comment 51 above, data for the other 28 locations are not shown for this figure. Add the other 28 locations to this figure and indicate their respective maximum concentrations.
54	--	RI	Table 3.2-1		151			The data in Table 3.2-1 appears to be a limited data set (sample collection dates range from 2018 to 2021) compared to what was presented on the figures showing historical samples that were "used in the RI." Clarify what data is presented in tables vs. the "historic data" presented in the appendices – was all of it used to delineate nature and extent of contamination? This comment applies to the other media as well.
55	--	RI	Table 4.2-1		169		Environmental Studies used for this Remedial Investigation	Clarify how the data was used for the remedial investigation. Was all data in this table presented in tables/appendices and screened against appropriate screening levels (e.g., EPA RSLs)? Was this data plotted on figures to define the nature and extent of contamination? Note that limited analytes are listed in the "analytes" column. However, based on the data presented in the FSP and FSP addendum, more chemicals were analyzed than what this table indicates for each data set.
56	--	RI	Table 7.2-1		175			See Comment #30. Add a footnote as to why iron is not included.
57	--	RI	Appendices G, J, K, L					The historic data presented in these appendices seems to be a much more limited data set compared to what was presented in the FSP and FSP addendum. All data should be included, unless removed by excavation (or excavated samples should be indicated as such in the tables). If data is excluded from use due to the age of the data, then an explanation should be provided along with a discussion of the decision factors for exclusion. Limited analytes are presented in these appendices, despite a broader range of chemical data being available as shown in the FSP and FSP addendum. Describe how the data was "used in the RI." See Comment #55.
58	--	HHRA	1.2 and 3		433	2, 6	Interim measures at the USS Lead Facility included removal of the baghouse dust and bags piles and offsite disposal, removal of the slag piles and disposal/storage at the on-Site Corrective Action Management Unit (CAMU), demolition and storage at the CAMU of the USS Lead Facility's production plant structures, and removal and storage at the CAMU of soil and sediments with lead concentrations greater than 1,200 mg/kg, which was the Indiana regulatory limit for industrial property uses in the 1990s. The Site has undergone a modified RCRA Facility Investigation (MRFI) and remediation of lead-contaminated soils and sediments, consisting of construction of a CAMU to store excavated soils. The depth of excavation of soils and sediments in the remediated areas were up to 15 feet below ground surface (bgs).	Sections 1.2 and 3 note that remediation/excavation of lead contaminated soils has occurred at the Site previously. Page 2 states that "soil and sediment with lead concentrations greater than 1,200 mg/kg" were removed. It is unclear if 1,200 mg/kg was established as the cleanup level for the targeted removal in OU1 as well. Please clarify how and when the cleanup level was established and where it was applied.

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59	--	HHRA	1.4	2	434	3	The areas and depths of the surface water bodies is summarized in Table 2.4-1 of the RI Report.	Please change "deptsh" to depth.
60	1, 96	HHRA	4, 8.1.1	1	437, 458	6, 27	As described in the RI/FS FSP (ERM 2018b), historical data were reviewed to identify the COIs for the RI. Data collected at the former USS Lead Facility over the preceding 20 years were evaluated and compared to regulatory screening levels (SLs). As discussed in Section 4.1 of the RI, antimony, arsenic, cadmium, lead, and selenium have been determined to be the COIs for OU2. At the request of EPA, iron was added to the list of select metals to be analyzed in soil, sediment, and groundwater samples.	It is unclear why the 5 listed metals are the COIs at the Site. The chemicals of potential concern (COPCs) in all Site media for the HHRA should be identified based on the data screening presented in the RAGS Part D Table 2s. Screen all Site data from the RI to demonstrate why other chemicals in Site media are not COPCs for the HHRA. Chemicals exceeding screening levels in RAGS Part D Table 2s should be carried through RAGS Part D Tables 3 through 9 (and 10 if necessary).
61	--	HHRA	4	1	438	7	Generic RSLs available for residential soil, industrial soil (composite workers) and tap water are provided in Table 2.1. In addition, the USEPA's on-line calculator was used to generate soil RSLs for construction workers, soil/sediment RSLs for recreators, and surface water RSLs for recreators.	This paragraph discusses RSL for the various receptors as calculated using the RSL Calculator. However, the RSL Calculator does not produce screening levels for lead. Please discuss in this section this limitation of the RSL Calculator.
62	--	HHRA	4, 5.4.1		437, 440	6, 9	The occurrence, distribution and HHRA screening of COIs is presented in RAGS Part D Table 2.1 (see Attachment 2) for OU2 surface soil (0 – 2 feet), OU2 surface plus subsurface soil (0 – 6 feet), OU2 sediment (0 – 2 feet based on historic discrete sample results), OU2 sediment (0 – 0.5 feet based on current Incremental Sampling Methodology [ISM] results), OU2 surface water, OU2 groundwater, OU1 Zone 1 (Z1) groundwater, and OU1 Zones 2 and 3 (Z2-3) groundwater.	Surface soil should be defined as the top inch of soil which represents the depth to which human receptors are most likely to be exposed (EPA, 1996; https://www.epa.gov/superfund/superfund-soil-screening-guidance). The 0–1-inch depth horizon should be used to assess exposure to lead in surface soil. Add a discussion to the uncertainty analysis section describing the available soil dataset depths, the rationale for the soil sampling depths, the relative soil concentrations expected in the 0-1-inch depth interval based on the conceptual Site model (fate and transport of chemicals from the release point), and how the lack of 0–1-inch depth data may affect the HHRA results.
63	2, 101, 110	HHRA	5.3, 6.3, RAGS Table 1		440, 450, 571	9, 19	**Residential Scenario.** Residents may be exposed to COIs via incidental ingestion and dermal contact with OU1 groundwater due to basement flooding, sump operations, and groundwater seepage into basements. Although groundwater seeping into basements may result in the deposition of residuals onto basement floors after the groundwater seeps recede, this exposure medium is not quantifiable or distinguishable from other potential sources of residuals in residential basement settings. The uncertainty associated with excluding this potential exposure pathway is discussed qualitatively in the Uncertainty Analysis (Section 8).	Discuss the results of the Tetra Tech sampling and analysis activities at the residential properties (sump water, precipitates/dust on basement surfaces, and soil). A comparison of results to EPA-generated screening levels and interpretation of results should be incorporated into the HHRA.
64	--	HHRA	5.5		442	11	For the CTE evaluation, all exposure parameters from the RME scenario were retained; however, instead of using EPCs based on UCL concentrations, mean concentrations based on the underlying data distribution calculated by ProUCL were used as the EPCs.	The CTE scenario should be based on average values for all the exposure factors. CTE exposure factors should be used for estimating lead risks. According to EPA's guidance on the ALM (EPA, 2003; https://semspub.epa.gov/work/HQ/174559.pdf), a soil ingestion rate of 50 mg/day is recommended unless the exposure scenario involves soil-intensive contact. At a minimum, the uncertainty assessment needs to include discussion of the rationale for this deviation.

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65	--	HHRA	5.5.2.3		445-446	14, 15	Section 5.5.2.3 describes the exposure frequencies of O&M workers as 21 days/year accounting for total number of days over the entire year that an O&M worker is on-site conducting monitoring and maintenance activities. The section also notes that for the OU1 residents, the EF value of 16 days/year was selected for the RME to account for groundwater seepage in basements once a month on four occasions requiring two days of cleanup.	To accommodate the minimum exposure frequency and duration required in lead risk models (EPA 2003; http://semspub.epa.gov/src/document/HQ/176288) the exposure period should be adjusted to be at least 1 day/week for a duration of at least 3 consecutive months. CTE exposure should be assumed to be less than that of the RME receptor and may not meet the minimum exposure frequency and duration criteria. Adjustments to the exposure frequency and duration from Site anticipated exposures may be discussed in the Uncertainty Section as health protective estimates of the anticipated exposure.
66	--	HHRA	5.5.2.10		448	17	Relative Bioavailability Factors notes an RBA of 60% for arsenic and states an RBA of 100% was assumed for all other COIs.	Although the HHRA notes that defaults were assumed in the ALM and IEUBK, Section 5.5.2.10 should include text specifically discussing the default RBA of 60% assumed for lead.
67	--	HHRA	6		449	18	Sources used to obtain toxicity criteria are listed below, and follow the hierarchy outlined in USEPA (2003): 1. EPA's Integrated Risk Information System (IRIS). IRIS is an on-line database that contains USEPA-approved reference doeses (RfD, reference concentrations (RfCs), cancer slope factors (CSFs), and inhalation unit risks (IURs). The toxicity criteria provided in IRIS have undergone review and are recognized as agency-wide consensus information. 2. California Environmental Protection Agency's (Cal/EPA) Office of Environmental Health Hazard Assessment (OEHHA) on-line database, which contains approved toxicity criteria. TheCal/EPA toxicity criteria have undergone review and are recognized by the USEPA as toxicity criteria for HHRAs. 3. Agency for Toxic Substances and Disease Registry (ATSDR).	This section does not follow the EPA tiered approach for toxicity values: 1. IRIS 2. PPRTVs 3. HEAST, Cal EPA, ATSDR and other sources.
68	--	HHRA	6.3		450	19	The USEPA and the Centers for Disease Control and Prevention (CDC) have determined that childhood blood lead concentrations at or above 10 micrograms of lead per deciliter of blood (µg/dL) present risks to children's health (USEPA 2019).	Please update this section to include the latest CDC's blood lead reference value as presented in https://www.cdc.gov/nceh/lead/data/blood-lead-reference-value.htm
69	--	HHRA	6.3		451	20	The model output is a probability distribution function describing the percentage of children predicted to have blood-lead levels exceeding 5 ug/dL.	This sentence should read "the probability that the exposure will result in a blood lead level exceeding 5 µg/dL" (note the correct language in the ALM results description).
70	--	HHRA	6.3		451	20	To achieve a specific level of protectiveness, the USEPA has established a limit for exposure to lead levels such that a typical (or hypothetical) child would have an estimated risk of no more than 5% probability of exceeding the 5 ug/dL blood lead level (USEPA 1994).	This target blood lead level was not established by this guidance. A different citation is required.
71	--	HHRA	8.3	1	460	29	Depending on the quality of the available data, the NOAEL or LOAEL is divided by an uncertainty factor ranging from 1 to 10,000.	EPA will not accept a toxicity value if the uncertainty factor is greater than 3,000. Please modify the text to acknowledge and reflect EPA position.
72	--	HHRA	9		461	30		Clarify that the risk estimates presented in the summary table are for all media combined, and no individual medium exceeds EPA's acceptable risk range or target organ threshold HI of 1. Also incorporate into the table results of the lead modeling and Tetra Tech's sampling activities (and results).
73	--	HHRA	RAGS Table 2.1		572			There are numerous instances where the minimum and maximum detection limits are missing in the table, yet analytical data is still presented for the chemical of interest. Please address this discrepancy.

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74	1	HHRA	RAGS Table 3.1		573			Footnotes 5 and 6 are missing from the table and need to be added.
75	2	HHRA	RAGS Table 4.5		583			21 days per year is being used to account for biannual groundwater monitoring, monthly CAMU inspections, quarterly well repairs, biannual maintenance activities, quarterly effluent sampling, and annual CAMU repairs. Confirm that this exposure frequency based on current activities is adequate to account for reasonably foreseeable future Site operations or activities.
76	3	HHRA	RAGS Table 6.2		596			IUR units need to be corrected.
77	4	HHRA	RAGS Table 8.3, 8.8, 8.11		624, 630, 634			Spelling of surface water in "Medium" column needs to be corrected.
78	5	HHRA	RAGS Table 9 series		641			Only the noncarcinogenic hazard quotient results are presented in the tables. Add the carcinogenic risk estimates in the tables, consistent with standard RAGS Part D table format.
79	6	HHRA	RAGS Table 10 series		656			RAGS Part D Table 10s are not needed when receptor risks are within EPA's target risk range and threshold Hazard Index per medium.
80	--	HHRA	Attachment 3				Exposure to incidental groundwater through basement seepage was evaluated by inputting the assumed water ingestion rate of 0.015 L/day into the drinking water menu of the IEUBK model for lead. Lead risks were estimated separately for individual media for each receptor.	The incidental ingestion of 15 mL/day would not replace typical water consumption (which for a young child ranges from 400-630 ml/day). Incidental ingestion of groundwater through basement seepage should be assessed <u>in addition to</u> residential drinking water consumption and, therefore, alternate intake should be used to bound the possible risk for this scenario. Using a multimedia model (like the IEUBK) to assess a single source (ignoring possible contribution of other sources of intake) is an inappropriate use of the model. All sources of exposure to lead should be included in the modeling.
81	--	HHRA	Attachment 3				RAGS D Adult Lead Worksheets; the results state "… results in a probability of X% of fetuses of exposed women…."	This statement should be changed in each of the RAGS D Adult Lead Worksheets to read "… results in a probability of X% that fetuses of exposed women…."
82	132, 133	RI and BERA (Appendix N)	RI Section 6.1 and BERA Section 1.2		67 and 717	52 and 1	<u>RI, Section 6.1</u>: The COI list was developed based on prior work (RI/FS FSP and BERA Work Plan) and confirmed by screening these constituent maximum concentrations with ecological screening values. <u>BERA, Section 1.2:</u> In combination with what was provided in the RI/FS WP and FSP, the RI Report provides a summary of the screening effort undertaken during the preparation of those reports, and is not duplicated here.	The USS Lead response to previous Comment # 132 stated: "Screening evaluation and COI selection process presented in the approved planning documents will be attached to the revised RI Report." New screening tables are now included in Attachment A of the BERA but only for the five metal COIs (antimony, arsenic, cadmium, lead, and selenium). The screening evaluation and COI selection process identifying how these five metals were identified as COIs is not attached – and should be attached - to the Revised Final RI Report. The previous Comment #133 was not addressed and is related to this comment in that presumably the maximum exposure risk estimates for birds and mammals that were not included in the FSP Addendum, would be included in the screening evaluation and COI selection process (as part of the SLERA). Screening calculations should be conducted for all potential COPCs (e.g., the full target analyte list [TAL] metal list). This should be clarified in the BERA text, and the full COPC screen should be included in Attachment A (showing how the five metals were determined to be COIs and other potential Site contaminants were not). It is not possible, given the information presented in Appendix N, to review the SLERA and determine the COIs. The BERA indicates that they were screened by comparing maximum concentrations to EPA Region 4 benchmarks, but it is not possible to fully evaluate this screen regarding other potential contaminants, detection frequency (e.g., for non-detected [ND] chemicals, were they compared to ecological screening values [ESVs] using their detection limit?), etc. This screen should be included in the BERA.

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83	--	BERA	Section 2.1.2		721	5	Several aquatic macroinvertebrate species were noted within this cover type, as well as fish and amphibians. In addition, it is possible that the nesting pair of bald eagles (Haliaeetus leucocephalus) observed at the USS Lead Facility could use this cover type for hunting fish.	Risk to piscivorous receptors was not evaluated in the BERA, even though fish were observed in the open water area. Fish are included as a potential receptor on the conceptual site model (CSM; Figure 7.1-1). The complete pathways identified for fish are direct contact with OU2 soil, direct contact with OU2 sediment, ingestion of and direct contact with OU2 surface water, and ingestion of biota. The only pathway for this receptor that was evaluated in the BERA was contact with surface water. All identified complete exposure pathways in the CSM should have been evaluated. Complete exposure pathways that cannot be quantitatively evaluated (e.g., due to limited toxicity data for herptiles, limited toxicity data available for dietary exposure of fish) should be indicated as such on the CSM.
84	--	BERA	Section 2.1.2		721	5	Several aquatic macroinvertebrate species were noted within this cover type, as well as fish and amphibians. In addition, it is possible that the nesting pair of bald eagles (Haliaeetus leucocephalus) observed at the USS Lead Facility could use this cover type for hunting fish.	If the open water areas in the southern wetlands were previously remediated (which is unclear) and this potential exposure pathway has been addressed, and therefore was not included in the scope of the BERA, then explain this in the BERA and CSM.
85	--	BERA	Section 3		723	7	Wetland vegetation tissue data (Phragmites new shoots and leaves) were collected to characterize risks for mammalian and avian wetland herbivores…" "Wetland invertebrate tissue data (mixed genera) were collected to characterize risks for wetland avian invertivores and riparian avian and mammalian invertivores…"	No information is provided on how plant and invertebrate tissue were collected. This information must be added to the BERA, since it is necessary to evaluate the weight that should be given to Site-specific tissue concentrations in the food chain models.
86	--	BERA	Section 3.4		725	9	This section identifies the following feeding guilds/surrogate receptors: • Semi-aquatic herbivores: Canada goose and Muskrat • Wetland invertivore: Red-winged blackbird • Riparian invertivore: American robin, short-tailed shrew • Terrestrial carnivore: American kestrel	A mammalian wetland invertivore should have been identified and evaluated in the dietary exposure models. EPA (1993) states that short-tailed shrews are insectivores that utilize most habitat types. Although masked shrew may be a more appropriate surrogate receptor for the wetland invertivore (NRCS, 2001), the short-tailed shrew is an acceptable surrogate receptor for a wetland invertivore and needs to be evaluated in the BERA as a wetland invertivore along with the red-winged blackbird.
87	--	BERA	Section 3.4		725	9	Section 2.1.2, page 5 states that fish were observed in the open water areas. Additionally, Section 1.3.1 states, "A nesting pair of bald eagles is located at the former USS Lead Facility. Bald eagles were delisted as endangered or threatened species but retain special protection under federal laws."	A surrogate receptor for an avian piscivore needs to be identified and evaluated in the BERA for exposure via consumption of fish.
88	--	BERA	Section 3.4		725	9	Section 2.1.2, page 5 states that fish were observed in the open water areas. Additionally, Section 1.3.1 states, "A nesting pair of bald eagles is located at the former USS Lead Facility. Bald eagles were delisted as endangered or threatened species but retain special protection under federal laws."	If the open water areas in the southern wetlands were previously remediated (which is unclear) and this potential exposure pathway for avian piscivores has been addressed, and therefore was not included in the scope of the BERA, then explain this in the BERA and CSM.

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89	--	BERA	Section 3.5		726	10	Invertivorous birds and mammals may feed on soil and litter invertebrates or on emerging insects that may biotransfer antimony, arsenic, cadmium, lead, iron, and selenium from water, soil, or wetland sediment, but otherwise would not be expected to contact source media directly. Carnivorous birds may feed on small mammals or birds that may have bioaccumulated antimony, arsenic, cadmium, lead, and selenium from water, soil, wetland sediment, or prey, but otherwise carnivorous birds would not be expected to contact source media directly.	Wildlife receptors would be expected to contact water, soil, and sediment directly; however, exposure via ingestion is expected to be a more important exposure pathway than dermal contact. This should be revised as follows: "Invertivorous birds and mammals may feed on soil and litter invertebrates or on emerging insects that may biotransfer antimony, arsenic, cadmium, lead, iron, and selenium from water, soil, or wetland sediment. While they are expected to contact source media directly, incidental ingestion of soil/sediment and consumption of contaminated food items is expected to be a more important exposure pathway." "Carnivorous birds may feed on small mammals or birds that may have bioaccumulated antimony, arsenic, cadmium, lead, and selenium from water, soil, wetland sediment, or prey. While-carnivorous birds are expected to contact source media directly, incidental ingestion of soil and consumption of contaminated food items is expected to be a more important exposure pathway."
90	--	BERA	Section 3.7.1		728-729	12-13	"Historic surface water data were evaluated on a site-wide basis…" "…comparing the site-wide soil upper confidence limit (UCL) that incorporates both the historic data in addition to the newly collected RI data to USEPA's ecological soil screening levels (Eco-SSLs)…"	Use of historic data, or combining historic and recent data, should be evaluated by looking at sampling dates, locations, conditions. Clarify (provide dates) the term "historic" and "recent" when describing the data. If the term "historic" means "all data," then the text should state it. More information needs to be provided to enable a thorough review of data and to evaluate data that should be included in the BERA dataset. At a minimum, a table summarizing historic data (date[s] of collection, number of samples, summary statistics, detection limits) needs to be added to the BERA.
91	--	BERA	Section 3.7.1		729	13	Ratios between invertebrate tissue concentrations of COIs and sediment concentrations of COIs were used to calculate Site-specific bioaccumulation factors (BAFs). These Site-specific BAFs were multiplied times sediment probable effect concentrations (PECs) to calculate critical body residues (CBRs) to compare to the invertebrate tissue concentrations of COIs from samples collected in the Decision units (DUs).	Typically, measured tissue concentrations are compared with a tissue concentration reported in the literature that has been associated with an adverse effect on an environmentally relevant endpoint (ERE; growth, reproduction, or survival). The Site-overall invertebrate tissue concentration needs to be compared with a literature-based CBR to evaluate whether the assumptions used to calculate CBRs and conduct this evaluation are valid.
92	--	BERA	Section 3.7.1		729	13	The Site-specific ratios of plant tissue to sediment COI concentrations were used to calculate Site-specific BAFs for plant uptake of COIs. These Site-specific BAFs were multiplied times plant Eco-SSLs to calculate CBRs to compare to the plant tissue concentrations of COIs from samples collected from the DUs.	See previous comment.
93	--	BERA	Section 3.7.1		729	13	The magnitude of no observed adverse effect level (NOAEL) and lowest observed adverse effect level (LOAEL) exceedance can be related to the level of organization to be protected in the assessment (population or individual special status species).	This statement is incorrect and should be removed from the BERA. A hazard quotient (HQ) of 1.2 calculated using a LOAEL where 83 percent (%) kit mortality was observed has population-level implications, whereas a HQ of 1.2 calculated using a LOAEL where a significant decrease in kit growth was observed may not.
94	--	BERA	Section 4.2		730	14	"See Attachment 1 of the human health risk assessment (HHRA) for 95% UCL datasets and calculations."	The BERA needs to present summary statistics of the data as well as exposure point concentrations (EPCs) for each medium evaluated, rather than referring to the ProUCL output of the HHRA.

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95	--	BERA	Section 4.3.1.1		731	15	Food ingestion rates for all receptors were taken from the wildlife exposure factors handbook (WEFH; EPA, 1993)	The food ingestion rates presented in the WEFH are in units of grams (g) food wet weight/g body weight wet weight/day. The numbers on the Table in this section match with the numbers in the WEFH. The dose equation on page 17 indicates that the food ingestion rates are in units of kg dry weight per kg body weight per day. The Tables in Attachment B have the food ingestion rates from page 15; again, the formula at the bottom of the table indicates the food ingestion rates are dry weight. Whether food ingestion rates are presented/used in calculations on a dry or wet weight basis needs to be clarified in the BERA; the food ingestion rate units need to match the units that are in the dose equation.
96	--	BERA	Section 4.3.1.2		731	15	Short-Tailed Shrew soil ingestion rate (SIR) 1.1% USEPA (2007); mean value	An SIR of 1.1% seems low for a receptor that is identified as invertivorous, when the SIR for the avian invertivore is 10.4%. USEPA 2007a has a 90th percentile value of 3% soil ingestion rate for the short-tailed shrew. Connor (1993) cites a soil ingestion rate of 5.2% for the short-tailed shrew, and Talmage and Walton cites a soil ingestion rate of 4.1%. An SIR of 3%, at a minimum, should be used in the BERA for the shrew. USFWS comment: Sediment ingestion was minimized when there is significant literature available to suggest that this can be quite a source of toxicity to wildlife at seriously contaminated metal sites such as OU2.
97	--	BERA	Section 4.3.1.6		733	17	"Because herbivorous species (goose and muskrat) may consume roots of Phragmites in addition to new shoots and leaves, a root concentration was estimated from the leaf data using a root/leaf ratio identified in the literature. A conservative root/leaf ratio of 1 was used for antimony, arsenic, and selenium because no specific literature was located on the distribution of these COIs in Phragmites …"	Root tissue metal concentration is typically higher than shoot tissue metal concentration; a ratio of 1 is not a conservative assumption. Please revise by removing the word "conservative" from the statement in Section 4.3.1.6.
98	--	BERA	Section 4.3.1.6		733	17	To model the uptake of COIs into small mammal tissue consumed by kestrel, soil/sediment-to-mammal BAFs for COIs were based on equations provided in USEPA's (2005, 2007b) Guidance for Developing Eco-SSLs.	The EcoSSL bioaccumulation models are for soil to mammal and may not be appropriate for sediment. This discussion should be revised to address this uncertainty and its potential implications.
99	--	BERA	Section 5.1		734	18	For the purposes of modeling chronic exposure to wildlife, TRVs were derived using the USEPA-vetted mammalian and avian NOAEL and LOAEL datasets for reproduction and growth endpoints as tabulated by USEPA for each COI in their Eco-SSL documentation (2005a, 2005b, 2005c, 2005d, 2007c).	The LOAEL values in the EcoSSL documents are included on Tables 5-1 and 6-1 as a check on the NOAEL if needed (see Figure 4-1 of Attachment 4-5). The term "vetted" implies more than the critical review of the studies that was conducted. Please remove the term "USEPA-vetted" from this sentence.

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100	--	BERA	Section 5.1		734	18	Section 5.1, page 18: These NOAEL and LOAEL studies were used by USEPA to calculate Eco-SSLs. Endpoints based on mortality were not used in the calculation of the TRVs in this BERA because lethal effects predominantly occur at concentrations greater than those that elicit chronic, sub-lethal effects, and their inclusion would result in a less conservative TRV. The geometric mean of the bounded values (NOAEL and LOAEL values experimentally derived from within the same study) for reproduction and growth was used to represent the TRV.	Use of the geometric mean of bounded LOAEL values for reproduction and growth is not a valid method for identifying the LOAEL to be used in an ERA. Section 7.3.1 of the ERA Guidance for Superfund (ERAGS; EPA, 1997) states "Key outputs of the risk characterization step are contaminant concentrations in each environmental medium that bound the threshold for estimated adverse ecological effects given the uncertainty inherent in the data and models used. The lower bound of the threshold would be based on consistent conservative assumptions and NOAEL toxicity values. The upper bound would be based on observed impacts or predictions that ecological impacts could occur. This upper bound would be developed using consistent assumptions, Site-specific data, LOAEL toxicity values, or an impact evaluation." A NOAEL is "the highest level of a stressor evaluated in a toxicity test or biological field survey that causes no statistically significant difference in effect compared with controls"; it is a number that is only statistically significant. The LOAEL is defined in ERAGs as "The lowest level of a stressor evaluated in a toxicity test or biological field survey that has a statistically significant adverse effect on the exposed organisms compared with unexposed organisms in a control or reference site"; a LOAEL is a biologically significant number as well as a statistically significant number. Many studies used to derive wildlife TRVs were not conducted using standard methods. Studies that do not have identical exposure durations, exposure and test conditions are not directly comparable. Many of the wildlife toxicity studies utilized a limited number of exposure concentrations or test organisms. Determination of statistical significance for an experiment depends not only on toxicity, but also on study design (the dose levels tested and number of replicates per dose) and the particular statistical procedure chosen to compare the treatment and control responses, all of which affect the statistical power of the comparison. Poorly designed studies with low statistical power result in higher NOAELs and LOAELs compared with more rigorous studies with higher statistical power. Additionally, although several studies may evaluate reproductive effects, different endpoints may be measured. Calculating a geometric mean of LOAELs measured using different test species, experimental methods, and measurement endpoints is not a valid method to derive a protective low adverse effect level. Additionally, no data quality screening step was incorporated into the calculated geometric mean LOAEL TRVs; all of the bounded studies that reported a LOAEL for an effect group were utilized to calculate the proposed TRV. For example, to derive an EcoSSL, the geometric mean of the NOAEL values was examined in relation to the highest bound NOAEL and the lowest bound LOAEL. If the geometric mean NOAEL was higher than the highest bound NOAEL, the geometric mean NOAEL was not selected as the EcoSSL (Attachment 4-5, page 4-9, U.S. EPA 2007). Use of the mid-point of a variety of low adverse effect levels or a geometric mean low effect level results in an under-protective "LOAEL" TRV and is not consistent with developing the range of concentrations that bound the potential for adverse ecological effects described above (ERAGS 1997). Acceptable methods for deriving a LOAEL TRV include using the lowest identified LOAEL cited in a critical study, or a low effect concentration derived using a dose-response or distribution approach (EPA, 2007). Revisions are needed to resolve these issues. A protective LOAEL TRV should be identified for all COPCs. The LOAEL TRV should be identified based on a critical study or a dose-response model. The NOAEL TRV should either be the NOAEL cited in the critical study (or estimated if only a LOAEL is observed in the critical study) or identified based on a dose-response model. The approach used for LOAEL selection is not consistent with the EPA Eco-SSL methodology and is probably not adequately protective of ecological receptors.

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101	--	BERA	Section 5.1		734	18	Section 5.1, page 18: These NOAEL and LOAEL studies were used by USEPA to calculate Eco-SSLs. Endpoints based on mortality were not used in the calculation of the TRVs in this BERA because lethal effects predominantly occur at concentrations greater than those that elicit chronic, sub-lethal effects, and their inclusion would result in a less conservative TRV. The geometric mean of the bounded values (NOAEL and LOAEL values experimentally derived from within the same study) for reproduction and growth was used to represent the TRV.	Concentrations of contaminants in soil and invertebrate tissue from OU2 present a risk of harm to avian species. In the Ecological Risk Assessment for OU2, ERM created Toxicity Reference Values (TRVs) loosely based on data from EPA's Ecological Soil Screening Values (Eco-SSLs). Utilizing TRVs developed by EPA in the Eco-SSL documents and adjusting for body weight and dietary intake of these appropriate species using EPA methodology would provide a more accurate assessment of Site risks and should be undertaken.
102	--	BERA	Section 5.2.2		735	19	Section 5.2.2, page 19: "Predicted sediment toxicity of cadmium, copper, lead, nickel, silver, and zinc to benthic invertebrates is estimated as:"	The value ranges referred to in this section are for predicted acute toxicity. As per EPA (2005) "Chronic effects were observed in six of the seven sediments where predictions of effects are uncertain (130 to 3,000 micromols per gram organic carbon [µmol/gOC]). This suggests that chronic toxicity tests with sensitive benthic species will be a necessary part of the evaluations of sediment predicted to have uncertain effects." This should be revised to state "Predicted acute sediment toxicity of cadmium, copper, lead, nickel, silver, and zinc to benthic invertebrates is estimated as: • Likely bioavailability when (ΣSEM - AVS) / foc is >3,000 micromoles per gram of organic carbon (µmol/goc); • Uncertain bioavailability when (ΣSEM - AVS) / foc is between 130 and 3,000 µmol/goc; • Unlikely bioavailability when (ΣSEM - AVS) / foc is < 130 µmol/goc. Chronic toxicity may occur when (ΣSEM - AVS) / foc is > 130 µmol/goc.
103	--	BERA	Section 5.2.2		735	19	It should be noted that of simultaneously extracted metals (SEM metals), only cadmium and lead are Site-specific COIs. However, as part of the RI, antimony and arsenic in sediment were also subjected to the SEM extraction procedure as a means of making a conservative estimate of the bioavailability for these metals of concern. These estimates were based on the ratio of the extracted metal concentration to the total bulk sediment concentration.	Please provide a reference showing that use of SEM extracted metal concentration as an estimate of bioavailability for non-divalent metals is acceptable practice. If there is no technical support for this assumption, non-divalent metals should be assumed to be 100% bioavailable and this section (5.2.2) should be revised to only evaluate this line of evidence for divalent metals.
104	--	BERA	Section 5.3		735	19	Because plants such as Phragmites and other rooted vascular plants are not true aquatic plants, the Eco-SSLs for plants were also used to compare to sediment COI concentrations as a conservative threshold for potential effects to vascular plants in wetland sediment.	Eco-SSLs were developed for COCs in soil and may not be applicable to COCs in sediment. This should be discussed in the BERA as a potential source of uncertainty.
105	--	BERA	Section 5.4		735	19	"Ambient water quality criteria (AWQC)-Criterion Continuous Concentrations were compared to surface water concentrations with an assumed hardness of 100 milligrams per liter (mg/L) calcium carbonate for hardness dependent metals (cadmium, lead). Historic surface water data included a combination of total and dissolved metals concentration values."	Reviewers should be able to evaluate the historic surface water data (How old are they? Where were they collected?) and whether hardness was measured at that time; these data should be presented in the BERA. If water hardness was measured in the field or analyzed in the surface water samples, Site-specific hardness values should be used to adjust surface water toxicity thresholds for hardness-dependent criteria.

Comment No.	Previous Comment Referenced [a]	Document	Section, Table, or Figure Reference	¶	PDF Page #	Doc. Page #	Sentence	Comment
106	--	BERA	Section 5.5		736	20	Because Site-specific BAFs are available for plants and benthic/litter invertebrates, tissue residue toxicity thresholds (also termed CBRs) were derived as the product of the toxicity thresholds for these receptors in sediment and the BAF (under the assumption that body burdens resulting from exposure at sediment threshold concentrations are tolerated without appreciable effect).	The sediment threshold effect concentrations used in the BERA are PECs, concentrations above which adverse effects would be expected. Because the sediment threshold is a concentration at which effects would be expected, the assumption that body burdens resulting from exposure at sediment threshold concentrations are tolerated without appreciable effect is not defensible. The estimated CBR should be evaluated as a lowest observed effect concentration (LOEC), not as a no observed effect concentration (NOEC).
107	--	BERA	Section 6		736	20	An HQ less than or equal to 1 indicates that exposure to the COI is unlikely to result in adverse ecological effects.	As per EPA guidance (EPA, 1997), a NOAEL-based HQ less than 1 indicates that exposure to the COI is unlikely to result in adverse ecological effects. A LOAEL-based HQ greater than or equal to 1 indicates the potential for unacceptable risk. The sentence should be revised as follows: "A NOAEL-based HQ less than 1 indicates that exposure to the COI is unlikely to result in adverse ecological effects. A LOAEL-based HQ greater than or equal to 1 indicates the potential for unacceptable risk."
108	--	BERA	Section 6.1		736	20	[table with max, mean, and UCL values for incremental sampling methodology (ISM) Site-wide sediment]	For sediment ISM UCLs (n = 3), the UCL is always higher than the maximum concentration; this needs to be discussed in the BERA as a source of uncertainty.
109	--	BERA	Section 6.1		737	21	"Exceedances of the PECs are noted for antimony in DU1, DU2, DU5, DU6, and DU8 sediment; however, these exceedances are relatively marginal in that sediment concentrations in these DUs are less than two times the PEC."	The threshold value is a PEC, a concentration above which adverse effects would be expected. Calculated risk should not be downplayed because the exceedance is less than two times the threshold. As previously noted, the CBR should be evaluated as a LOEC. Also, please see USFWS comment: "We do not believe that ERM's dismissal of tissue residue toxicity thresholds (p. 737) is appropriate given that metals are bioavailable on OU2, and our data indicate that metals are elevated in wildlife in the vicinity of USS Lead."
110	--	BERA	Section 6.3		739	23		The table in this section shows measured plant tissue concentrations in mg/kg wet weight (ww). The plant ESV is the EcoSSL, which is a dry weight (dw) tissue concentration. The plant ESV is multiplied by the Site-specific BAF yielding a CBR in mg/kg dw. For complete transparency, the Site-specific BAFs should be calculated using both tissue and sediment concentrations on a dry weight basis (Boese and Lee 1992). This will result in the ESV and the CBR both clearly in units of mg/kg dw. The measured Site plant tissue concentrations then need to be converted to dry weight before they are compared with the CBR.
111	--	BERA	Section 6.4		740	24		The table in this section shows measured invertebrate tissue concentrations in mg/kg ww. The ESV is the PEC, which is a dw concentration. The ESV is multiplied by the Site-specific BAF yielding a CBR in mg/kg dw. For complete transparency, the Site-specific BAFs should be calculated using both tissue and sediment concentrations on a dry weight basis (Boese and Lee 1992). This will result in the ESV and the CBR both clearly in units of mg/kg dw. The Site invertebrate tissue concentrations then need to be converted to dry weight before they are compared with the CBR.

Comments on *Remedial Investigation Report, Revised, USS Lead Superfund Site, Operable Unit 2, 5300 Kennedy Ave, East Chicago, IN* (ERM, October 7, 2021)

Comment No.	Previous Comment Referenced [a]	Document	Section, Table, or Figure Reference	¶	PDF Page #	Doc. Page #	Sentence	Comment
112	--	BERA	Section 6.5		740	24	"Based on the site-wide mean and UCL surface water concentrations, two COIs exceed the AWQC, arsenic and lead. The arsenic exceedance is minor, with the UCL being slightly greater than the chronic AWQC (0.16 mg/L vs. 0.15 mg/L) and the mean not exceeding the AWQC. Ten of 24 lead results were non-detect. The mean and UCL for lead are skewed by two upper end concentrations, 0.041 mgL collected on 1/22/2020 in the open water wetland canal and 0.020 mg/L collected on 3/26/2007 in the open water wetland area A. Subsequent and more recent surface water sampling results in the open water wetland former canal and open water wetland area A do not confirm these concentrations. Based on these considerations, surface water COI concentrations do not pose a risk to aquatic biota receptors."	The 95UCL concentration of arsenic exceeds the chronic AWQC, and the mean and 95UCL concentration of lead in SW exceeds the chronic AWQC. These exceedances are discounted, and the ERA concludes no risk from exposure to surface water. Exceedances of the threshold benchmark indicate unacceptable risk. Additionally, AWQC are an applicable or relevant and appropriate requirement (ARAR). Text needs to be revised in the BERA to address these issues as follows: "Based on the Site-wide mean and UCL surface water concentrations, two COIs exceed the AWQC, arsenic and lead. Based on these exceedances, surface water COI concentrations may pose a risk to aquatic biota receptors." USFWS comment: The 6 acres of open water wetland on the Site also pose an unsequestered environmental hazard to shorebirds (Scolopacidae), waterfowl (Anatidae), and other wildlife. Lead concentrations in the surface water ranged from 1.7 to 41 ppb and arsenic from 5.8 to 610 ppb, both in exceedance of the Criterion Continuous Concentration.
113	--	BERA	Section 6.6.1		741	25	"It should be noted that the potential risk to avian invertivores is likely overestimated due to conservative input assumptions used in the modeling, including the assumption that these birds will spend 100% of their time annually both feeding and reproducing within the on-Site habitats."	Section 4.3.1.5, page 15, states "The only receptor species with home ranges larger than the area of OU2 (79 acres or 32 hectares) are the Canada goose and American kestrel." The surrogate receptor for avian invertivores is the red-winged blackbird; LOAEL-based HQs for this receptor exceed 1.0. The Site is larger than the home range for this surrogate receptor, therefore it could spend 100% of its time utilizing the Site. Please delete the sentence cited in Section 6.6.1, page 25 ("It should be noted that the potential risk to avian invertivores is likely overestimated due to conservative input assumptions used in the modeling, including the assumption that these birds will spend 100% of their time annually both feeding and reproducing within the on-Site habitats.").
114	--	BERA	Tables in Sections 6.1, 6.2, 6.3, 6.4, and 6.5		736-740	20-24		These summary tables should not just present concentrations and risk benchmarks, but should calculate HQs for plant, invertebrate, and aquatic biota risks and note whether or not they exceed risk benchmarks for each COPC.
115	--	BERA	Tables in Sections 6.3 and 6.4		739-740	23-24		These two tables present the plant Eco-SSL in units of dw and present the exposure concentrations in units of ww. A dw-ww conversion factor is not discussed and should be used; the EPC and the risk benchmark must be expressed on the same basis to make a valid comparison.
116	--	BERA	Tables in Section 6.6		741	25		HQs should be rounded to one significant digit to the right of the decimal point; if the HQ is 0.0034, it should be presented as 0.003.
117	--	BERA	Risk conclusions		745	28		In almost every line of evidence (LOE) evaluation, where EPCs exceed risk benchmarks, calculated risk is downplayed. This is not appropriate and should be revised. Risk conclusions should be presented without any implied judgement or discount (see previous comments #112 and 113).
118	--	BERA/RI	Section 3.6 RI Figure 7.1-1: CSM		727, 125			Groundwater is shown as a pathway not applicable to ecological receptors. Groundwater discharging to surface water is a potentially complete exposure pathway and should be considered in the BERA. This pathway should be revised in the CSM accordingly. In addition, groundwater was not screened appropriately using ecological screening values to assess the groundwater to surface water pathway. The use of tap water values is not appropriate for ecological receptors.

Comments on *Remedial Investigation Report, Revised, USS Lead Superfund Site, Operable Unit 2, 5300 Kennedy Ave, East Chicago, IN* (ERM, October 7, 2021)

Comment No.	Previous Comment Referenced [a]	Document	Section, Table, or Figure Reference	¶	PDF Page #	Doc. Page #	Sentence	Comment
119	--	BERA	Section 4.3.1.6 and Section 4.2		733 and 730	17 and 14	For food web modeling based on sediment-associated exposure, plant and invertebrate BAFs were not necessary as plant leaf tissue concentration and invertebrate tissue concentrations were directly measured. EPCs used in the food web modeling are based on a 95% UCL on the mean calculated using USEPA's ProUCL program (v 5.1.002).	95UCLs calculated for arsenic, cadmium and lead plant and invertebrate tissue concentrations were spot-checked using the tissue data presented in Table 3.2-4. Most of the EPCs shown in the Attachment B tables could not be replicated. All EPCs should be checked and corrected.
120	--	BERA	Attachment A				Attachment A, Comparison of Site Representative Concentrations to Ecological Screening Values: Shows the screening calculations for the maximum measured concentration of antimony, arsenic, cadmium, lead and selenium versus ecological screening values.	Were steps 1 and 2 of the ERA process conducted for all potential COPCs at this Site, or just the five selected inorganics shown in Attachment A? Screening calculations should have been conducted for all potential COPCs (e.g., the full TAL metal list). As noted in comments #1 and 2, the entire COPC screen should be shown in the BERA. A SLERA was not presented in the planning documents or as an attachment to the BERA to show how the five COIs were identified for the focus of the BERA.
121	--	BERA	Attachment B				Hazard Quotient Calculations	Tables in this section have food ingestion rates and plant and invertebrate tissue concentrations in wet weight (as per Table 3.2-4—tissue concentrations, and food ingestion rates on page 15 of the BERA). The equations at the bottom of the tables show food ingestion rate and tissue concentration units as dry weight. These calculations need to be checked to confirm that the correct basis was used in the HQ calculations, and any wet weight-dry weight conversion factors used should be noted in the text and tables.
122	--	BERA	Attachment B				Hazard Quotient Calculations	On pages 1 and 2 of the "Soil Hazard Quotient Calculation" section, soil invertebrate concentrations are estimated using a Site-specific BAF and a measured soil concentration. The soil invertebrate concentration differs for food chain models for the robin and shrew. If the soil concentration and the Site-specific BAF are the same, the soil invertebrate EPC should be the same for both receptors. Please correct this in the BERA and revise the resulting risk calculations and text.
123	--	BERA	Attachment B				Hazard Quotient Calculations	Section 4.3.1.5 states that, "To be conservative the food web modeling assumed that receptors are present year-round (i.e., TF = 1) and COIs are 100% bioavailable" In the absence of data supporting a bioavailability adjustment, the assumption that COIs are 100% bioavailable is appropriate. However, looking at the HQ calculation spreadsheets in Attachment B, it appears that measured soil/sediment, surface water, and tissue concentrations were adjusted for bioavailability (Columns labelled "Absorbed Concentration from Media and Biota"). Please clarify the HQ calculation spreadsheets; if no bioavailability adjustments were made, delete the absorbed concentration columns.
124	--	BERA	Tables in Sections 6.1 and 6.2		736-739	20-		Please explain why the ISM sediment UCL concentrations presented in the table in 6-1 and the Site-wide soil UCL concentrations changed from the 2020 Final BERA to the 2021 Revised Final BERA. For example, the overall UCL sediment concentration for arsenic decreased from 400 mg/kg to 341.1 mg/kg and lead decreased from 1,036 mg/kg to 829.1 mg/kg. Similarly, Site-wide soil UCL concentration for arsenic decreased from 137 mg/kg to 94.4 mg/kg and lead decreased from 668 mg/kg to 440.9 mg/kg.

Comment No.	Previous Comment Referenced [a]	Document	Section, Table, or Figure Reference	¶	PDF Page #	Doc. Page #	Sentence	Comment
125	--	BERA	Attachment B				Hazard Quotient Calculations	The soil concentrations used in the hazard quotient calculations for the 2020 RI/BERA and the 2021 Revised Final RI/BERA are not the same and this is not explained in the BERA. For example, the arsenic concentration used for soil in the 2020 RI/BERA was 137.3 mg/kg and in the Revised Final RI/BERA (2021) it was 94.4 mg/kg. The reason for these changes is unclear and they result in lower risk estimates (HQs) for ecological receptors. Please provide an explanation for this change.

Note "a" – The comment numbers refer to numbered comments within the comment table issued by EPA on September 15, 2020 and later updated and re-issued on December 2, 2020. The comment table presented EPA's review of the initial RI Report issued in January 2020 and the FSP Addendum issued in July 2020, and subsequent communication with USS Lead. Please refer to that comment table for further background information and the basis of the comments requested herein.

Attachment 2 - USFWS Letter dated December 28, 2021

United States Department of the Interior

Fish and Wildlife Service

Bloomington Field Office (ES)
620 South Walker Street
Bloomington, IN 47403-2121
Phone: (812) 334-4261 Fax: (812) 334-4273

December 28, 2021

Stephanie Linebaugh, RPM
U.S. Environmental Protection Agency
77 W. Jackson Blvd
Chicago, Illinois 60604-3590

Dear Ms. Linebaugh:

This regards the October 2021 Remedial Investigation (RI) Report, Revised USS Lead Superfund Site, Operable Unit 2, 5300 Kennedy Ave, East Chicago, Indiana. Also included in this RI was a Baseline Ecological Risk Assessment USS Lead Superfund Site, Operable Unit 2, 5300 Kennedy Ave, East Chicago, Indiana dated September 2021.

These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (l6 U.S.C. 661 et. seq.) and are consistent with the intent of the National Environmental Policy Act of l969, the Endangered Species Act of l973, and the U. S. Fish and Wildlife Service's Mitigation Policy.

USS Lead's Operable Unit (OU) Boundaries should include the Grand Calumet River

According to the Hazard Ranking System Documentation Record for U.S. Smelter and Lead Refining site (IDEM 2008), OU2 has been, and remains significant source of contamination to the Grand Calumet River since operations began at this facility in early 1900s. The Grand Calumet River along the southern and western boundary of OU2 should be designated as part of OU2 or as OU3 for this facility. Historic data confirm the large impact this facility has had on the sediments of this portion of the Grand Calumet River (Appendix 1). For its entire operational history (many decades), USS Lead maintained a waste water canal that flowed to the Grand Calumet River, with discharge permits often exceeded (IDEM 2008). USS Lead contributed PCBs, PAHs and metals from the canal which are reflected in elevated river sediments downstream of the canal. Samples taken by USS Lead's consultants in the canal (Entact 1998, TechLaw, Inc. 1999; Appendix 1, pages 14-16) confirmed the canal was highly contaminated with PAHs (40 – 402 mg/Kg), PCBs (4 – **119.9 mg/Kg; exceeding TSCA thresholds in 4 of 10 samples;** sample CC-1, CC-5, CC-7 and possibly CC-8), As (375-16,300 mg/Kg), Cd (3.8-84.2 mg/Kg), Cr (as high as 2,450 mg/Kg), Cu (as high as 402 mg/Kg), Pb (596-7,110 mg/Kg), Hg (as high as 2.8 mg/Kg), and Zn (617-8,940 mg/Kg). Elevated concentrations of PAHs and PCBs were found in the GCR at the mouth of the USS Lead canal (IDEM 1994; Maxim 1999) and TSCA levels of PCBs (IDEM 1999, Appendix 1, pages 26-27, sample RO5866). This river TSCA exceedance needs to be addressed at some point. The USS Lead canal was not cut off from the river until approximately 2001 (TetraTech FW 2003). We do not know if TSCA PCB levels were fully evaluated the RI, version 2. Based on some of the metals data from the canal area, we are uncertain what happened to the TSCA waste from the canal. Every dataset generated for this reach of the Grand Calumet River substantiates that this area's contamination mirrors the canal as a source of contamination (Appendix 1).

Dupont's contractor (Exponent 1999) took several surficial and core samples from the Grand Calumet River upstream, adjacent to and downstream of USS Lead in 1999 theoretically to assess their contribution to OU3. Exponent (1999) found these same metals at extremely elevated levels (see data for transect K, Appendix 1, pages 17-20). We say theoretical primarily because it was USS Lead that created much of the heavy metal contamination on the Dupont property east of Kennedy Ave (TechLaw 2004). After all, the USS Lead foundry contaminated the properties throughout OU1 some of which are 0.8 miles from the original source. How could it not contaminate the lands adjacent to and in some instances right in line with the neighborhoods that needed remediation?

On Site Contamination Migrating to the Grand Calumet River

Groundwater data from the Revised Remedial Investigation Report, USS Lead Superfund Site, OU2 confirms a pathway to the Grand Calumet River. Dissolved concentrations of multiple chemicals, including arsenic and lead, were detected in groundwater samples. Groundwater is in contact with extremely high concentrations of metals in these sediments and these chemicals being present in the groundwater demonstrate that they are mobile. Dissolved lead concentrations ranged from 0.13 ppb to 7 ppb and dissolved arsenic ranged from 0.42 to 23,000 ppb. The freshwater Criterion Continuous Concentration (CCC) from EPA's National Recommended Aquatic Life Criteria was exceeded for both arsenic (150 ppb) and lead (2.5 ppb).

Groundwater flow in OU2 is "south southwesterly, to the Grand Calumet River." Boring logs for the groundwater sampling wells show water table elevations between 580.24 and 583.22 ft. This indicates that the collected samples are representative of groundwater contribution from OU2 to the Grand Calumet River. The RI reports a geometric mean hydraulic conductivity of 1.72×10^{-3} cm/s for the shallow wells. Groundwater flow for this conductivity is approximately 36.5 gal/day/ft^2. The combination of these site conditions indicates that lead and arsenic, in concentrations in excess of the CCC, are likely leaching into the river.

ERM conducted Synthetic Precipitation Leachate Procedure (SPLP) analyses on soil samples collected from OU2. The results of the analyses show that precipitation is able to mobilize metals deposited in the soil. Mean concentrations of cadmium and lead exceeded EPA's Criteria Maximum Concentration (CMC) and CCC for those metals. Multiple samples also exceeded the CMC and CCC for arsenic.

Table 1. Comparison of SPLP results to National Recommended Water Quality Criteria - Aquatic Life Criteria. All concentrations are reported in ug/L. Only soil samples from 0-2 ft were included.

	Antimony	Arsenic	Cadmium	Lead	Selenium
SPLP mean	207	88.4	52.2	259	1.5
SPLP max	1200	850.0	980.0	1700	2.1
CMC	NA	340	1.8	65	NA
CCC	NA	150	0.72	2.5	NA

The 6 acres of open water wetland on the site also pose an unsequestered environmental hazard to shorebirds (Scolopacidae) waterfowl (Anatidae), and other wildlife. Lead concentrations in the surface water ranged from 1.7 to 41 ppb and arsenic from 5.8 to 610 ppb, both in exceedance of the CCC. There were also a few exceedances of IDEM's proposed surface water cadmium chronic criteria (0.718 ppb) presented in Table K-1 of the USS Lead RI (as well as detection limits higher than this evaluation endpoint). Both groundwater and surface water data from the RI confirm contaminant pathways to the Grand Calumet River which EPA Superfund should not ignore.

Evaluation Methodology for Wetland Sediment Contamination

We have grave concerns about the lack of comprehensive, organized structure to evaluating the contamination remaining on this site. Most of the Pb data (75 % of samples) utilized in this Remedial Investigation (Appendix J) is nearly 2 decades old. It is clear from the older RCRA data that remediation success was spotty; 64% of the 203 "WEX" wetland samples collected in 2002 from the 3.9 acre excavated wetland (see Fig. 4.2-2a) exceeded the PEC for lead. At least in that area sampling was comprehensive (52 samples / acre).

We do not understand the logic behind and utilizing of Decision Units (Fig. 3.2-2, p. 110) that are arbitrarily delineated and appear to strategically miss historic and more recent sediment contamination data (Exponent 1999, Maxim 1999, TechLaw 2004, TetraTech 2015). For example, average lead concentrations in the southern wetlands from TetraTech (2015) was 3,854 ppm. Average lead concentrations in the two Exponent (1999) southern wetland samples, "WETLAND5" and "WETLAND6" (Appendix 1, page 20) contained Pb concentrations averaging 2,600 ppm. These Exponent samples were collected riverward, outside of the arbitrary Decision Unit boxes. Arsenic, Cd, Cr, Cu, Hg and Zn also significantly exceeded PEC for protecting aquatic life. Large areas of contaminated wetlands are not included in these DUs. We estimate that the DUs may cover only 10 acres of the 26.6 acres of southern wetlands and only 24 samples were collected in these DUs. Sampling these wetland areas was neither uniform nor complete, a failure that has been continued from the original RI effort for this site. Clearly sampling in OU1 was not this poorly designed nor should it be for OU2.

A more comprehensive sampling plan should have been implemented for the OU2 wetlands. TechLaw (2004) extensively evaluated seasonal wind directions and velocities in order to understand the local and regional contamination generated by OU2 smelting operations. For decades, this smelting impacted sites in all directions, including east and southeast of Kennedy Ave. Portions of OU1 are up to 0.8 miles from the site. The dune and swale area on the northwestern portion of the site is contaminated (TetraTech 2015) by historical aerial deposition of lead and cadmium from site operations (TechLaw 2004). In addition, on the eastern portions of this dune and swale area, many lead acid battery fragments heavily littered this area. While concerted effort was put forth during the RCRA clean up efforts to scrape these battery fragment areas and incorporate them into the CAMU, for the RI to state that this area was not impacted by USS Lead operations is incorrect.

The analytical data distribution analysis in Appendix O of the RI could have been made to be an extremely useful tool to evaluate the potential for adverse ecological effects and as a tool that could lead to an effective remedy design. Delineating categories that start with an order or two larger than PECs is not a helpful investigation tool. These could be improved and used for an effective remedial investigation of the site. Despite all the problems with the lack of sampling and site evaluation design, it must be understood that groundwater, surface water and wetland sediment contamination in OU2 are continuing to contribute contamination to the Grand Calumet River.

Extent of Wetland Sediment Contamination

Here is an accurate summary of the complete sediment dataset for this RI found in Appendix J. According to Section 4.3.2.1 of the RI (p. 42), surface sediment samples collected from the wetlands had lead concentrations between 1.9 and 20,000 ppm with a mean of 640.6 ppm (n = 358). Appendix J has 403 Pb sediment records. More than 56% of the samples in Appendix J (226/403) exceed the consensus-based Probable Effect Concentration (PEC) for lead (128 ppm) and the high concentrations for Pb exceed the PEC by two orders of magnitude. Arsenic surface sediment concentrations ranged from 1.51 to 5,700 ppm with a mean of 488.6 ppm (n = 47). Appendix J has 73 As sediment records. The mean concentrations exceeded the PEC for arsenic (33 ppm) and the high concentrations exceed the PEC by two orders of magnitude. Cadmium surface sediment concentrations ranged from 0.16 to 160 ppm with a mean of 24 ppm (n =58). The mean concentrations exceeded the PEC for cadmium (4.98 ppm) and the high concentrations exceed the PEC by two orders of magnitude. Every sediment sample taken in the southern wetland in 2018 (n=24) have concentrations in exceedance of the EPA Region IV Ecological Screening Values (ESVs). Every sample exceeded ESVs not only for lead and arsenic, but also for antimony, cadmium, iron, and selenium.

General Ecological Risk Assessment Concerns

ERM's choice of eco-risk target species such as muskrat, robin and Canada geese are rather ill-fitted to OU2. Swans, waterfowl such as mallard or scaup, woodcock as a surrogate for the many shorebirds that visit the Grand Calumet River would have been much more site appropriate here. as red winged blackbird (*Agelaius phoeniceus*), barn swallow (*Hirundo rustica*), marsh wren (*Cistothorus palustris*) and various egrets (Ardeidae) are known to be present in the vicinity of OU2 and would be more appropriate. Plant uptake of metals is really not a significant issue, and is over emphasized in ERM's analysis. The self-regulating metal uptake narrative is quite misleading. Sediment ingestion was minimized when there is significant literature available to suggest that this can be quite a source of toxicity to wildlife at seriously contaminated metal sites such as OU2.

On p. 736 (Ecological Risk Assessment p. 19) the RI states "the use of PECs to evaluate potential effects to biota in sediment, while less conservative than the use of threshold effect concentrations, is appropriate at former industrial Sites located in an urbanized region such as the former USS Lead facility." This is not true for several reasons. The Grand Calumet River corridor is a highly valued ecological resource. Globally rare dune and swale habitats are found on OU2, and surrounding areas with tremendous biodiversity, including many Indiana listed threatened, endangered and rare plants and animals. Located so close to Lake Michigan, these river wetlands seasonally provide high value to hundreds of species of migrating birds in large numbers despite the contamination. Because of its close proximity and connectivity to a healthy Lake Michigan fishery, the aquatic community in this portion of the Grand Calumet River could recover quickly from its currently impacted status if sediment remediation were to occur. It can be useful to use PECs to assess if impacts are occurring because they represent 51% likelihood of toxicity. However, TECs should be used as restoration standards to protect organisms from adverse impacts and to ensure cleanup is effective. Remediation goals are not set to attain LC50 / EC50s (where half of the population is adversely impacted or killed). Remediation efforts are to reduce or eliminate the harmful impacts of toxics. Not to pristine conditions, but to nominally safe levels as reflected in TECs.

Metals Bioavailability

The acid volatile sulfides-simultaneously extracted metals (AVS-SEM) presentation in the ecological risk assessment was very biased and this science is not as reliable as ERM suggests. The RI reports sediment samples contain SEM-AVS values that it states indicate a lack of bioavailability. However, the AVS-SEM model applies to the bioavailability of metals through contact with sediments and sediment pore water. Aquatic macroinvertebrates in the wetland consume organic material present in sediments and conditions in their gut can release sulfide bound metals. The concentrations detected in macroinvertebrate tissues are evidence of this. The RI reports aquatic macroinvertebrates, fish, and amphibians were observed in surface water on the site. Aquatic macroinvertebrate samples collected from the wetland contained 2.7 to 17 ppm of lead and 4.1 to 170 ppm of arsenic. Uptake by the macroinvertebrates on site creates a vector by which contamination contained within surface water and sediment can mobilize into the food web. All macroinvertebrate samples collected in OU2 exceeded EPA's avian TRVs for arsenic, lead, and selenium demonstrating that there is a present hazard to avian species. Higher trophic level taxa can also biomagnify contaminant concentrations from OU2. This RI's invertebrate contaminant data confirms that ERM's narrative of limited bioavailability is in error. Although some reduction in biomagnification may likely be related to overt toxicity from these metals to invertebrates, hydraulic cycling and fluctuating lake levels of Lake Michigan will continue to allow for variations in bioavailability of these contaminants. These water level changes will allow contamination to migrate from this site into the surrounding river and adjacent riverine wetland habitats.

More Appropriate Toxic Reference Doses

Concentrations of contaminants in soil and invertebrate tissue from OU2 present a risk of harm to avian species. In the Ecological Risk Assessment for OU2, ERM created Toxicity Reference Values (TRVs) loosely based on data from EPA's Ecological Soil Screening Values (Eco-SSLs) (Table 2).

Table 2. Comparison of Avian TRVs as calculated by ERM in the Ecological Risk Assessment and TRVs developed by EPA.

	Antimony	Arsenic	Cadmium	Lead	Selenium
ERM avian NOAEL TRV (mg dw/kg bw/d)	NA	2.24	1.46	7.33	0.593
ERM avian LOAEL TRV (mg dw/kg bw/d)	NA	4.51	5.88	42.7	1.39
EPA 2005 avian TRV (mg dw/kg bw/d)	NA	2.24[a]	1.47[b]	1.63[c]	0.29[d]

[a] EPA (2005a)
[b] EPA (2005b)
[c] EPA (2005c)
[d] EPA (2007)

We believe a more accurate assessment would be to start with site appropriate species. Four avian species that are known to utilize USS Lead habitats include red-winged blackbird, barn swallow, marsh wren and American woodcock (*Scolopax minor*). The woodcock is also an excellent surrogate for several species of shorebirds that utilize habitats along the Grand Calumet area. Utilizing TRVs developed by EPA in the Eco-SSL documents (Table 2), and adjusting for body weight and dietary intake of these appropriate species using EPA methodology would provide a more accurate assessment of site risks. These calculations enable direct comparisons between species specific dietary doses at which harm might occur to site specific measured concentrations.

Because red-winged blackbird, barn swallow and marsh wren have diets that can consist entirely of insects, their calculated dietary doses are directly compared to concentrations detected in OU2 invertebrate samples (Table 3). The mean concentrations of arsenic and lead detected in invertebrates from OU2 exceeded the calculated harmful dietary dose (in **bold**) for the red-winged blackbird, barn swallow and marsh wren(Table 3).

Table 3. Site appropriate calculated dietary doses for red-winged blackbird, barn swallow and marsh wren in comparison to USS Lead OU2 invertebrate tissue concentrations from all DUs. TRV calculations assume 100% invertebrate diets for these species.

Ingestion concentration at which EPA TRV is met	Antimony	Arsenic	Cadmium	Lead	Selenium
RWBB (100% invert diet, mg/kg dw)	NA	0.40	0.26	0.29	0.05
BS (100% invertebrates, mg/kg dw)	NA	0.58	0.38	0.43	0.08
MW (100% invert diet, mg/kg dw)	NA	0.66	0.44	0.48	0.09
Mean Invertebrate concentration (mg/kg)	0.97	**51.62**	0.15	**10.59**	**0.80**
Max Invertebrate concentration (mg/kg)	2.11	**224.57**	**0.61**	**22.46**	**0.99**

The American woodcock is a ground feeding insectivore and exposure for the species was compared just to incidental dietary intake of soil. The mean concentration of lead in the top two feet of soil from all OU2 samples exceeded the calculated harmful dietary intake (in **bold**) for the woodcock (Table 4). Additionally, arsenic, cadmium, and selenium soil concentrations exceed calculated harmful dietary intake for woodcock (in **bold**; Table 4). This does not include the 80% of the diet that would consist of metals contaminated invertebrates. There is no way to conclude that this site does not have significant ecological risks to all forms of avian species utilizing this site.

Table 4. Daily soil dose at which EPA TRV met for American woodcock assuming 20% soil ingestion rate(mg/kg dw) compared to USS Lead OU2 discrete soil sample concentrations. Calculations do not account for invertebrate contaminant concentrations.

	Antimony	Arsenic	Cadmium	Lead	Selenium
AWC calculated dietary dose (mg/kg dw)	NA	1.10	0.72	0.80	0.14
Mean 0-2 ft soil concentration (mg/kg)	44.64	**74.6**	**3.5**	**409.6**	**0.57**
Max 0-2 ft soil concentration (mg/kg)	220	**630**	**14**	**2000**	**1.9**

Actual Migratory Bird Lead Uptake and Impacts

We do not believe that ERM's dismissal of tissue residue toxicity thresholds (p. 737) is appropriate given that metals are bioavailable on OU2, and our data indicate that metals are elevated in wildlife in the vicinity of USS Lead. Hundreds of acres of uplands to the east and at least 50 acres of wetlands south and west that have been impacted by this site. These contaminated wetlands are located along the Grand Calumet River less than 3 miles upstream of Lake Michigan. The contaminated uplands include the former DuPont plant site. Data we collected on barn swallow eggs and nestlings from the Kennedy Avenue bridge have extremely elevated lead and cadmium concentrations. Additional investigations into tissue concentrations of invertebrates from the Grand Calumet River indicated that Asiatic clams (*Corbicula fluminea*) near Kennedy Ave have the highest lead and cadmium concentration of any of the other locations from the river (USFWS unpublished).

This data tells us is that there is a significant source of Cd and Pb in the middle reaches of the East Branch Grand Calumet River. Historic data from the USS Lead smelting site has impacted Kennedy Ave bridge nesting barn swallows. USS Lead waste manifests confirm these same wastes were disposed of in the Gary Development Corp landfill Superfund site located on the Grand Calumet River just upstream of the Old Cline Ave bridge swallow nesting site (approximately 2 miles east of Kennedy Ave). Analytical results from RCRA, CERLCA and NRDA investigations reveal significant areas of elevated Pb and Cd concentrations exist in unremediated portions of both of these Superfund sites and in the river adjacent to both of these sites. EPA Superfund needs to take action to remediate these wetlands and the Grand Calumet River sediments at USS Lead Superfund site and at the Gary Development Corp. landfill Superfund site.

We appreciate the opportunity to comment on this remediation effort. If you have any questions, please contact Dan Sparks (daniel_sparks@fws.gov) or Will Tucker (will_tucker@fws.gov) of my staff.

Sincerely yours,

Scott E. Pruitt
Supervisor

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Appendix I.

Grand Calumet River sediment data relevant to USS Lead

Appendix I. Grand Calumet River sediment data relevant to USS Lead

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Figure 4.10. Location of sediment sampling stations for IDEM (1994).

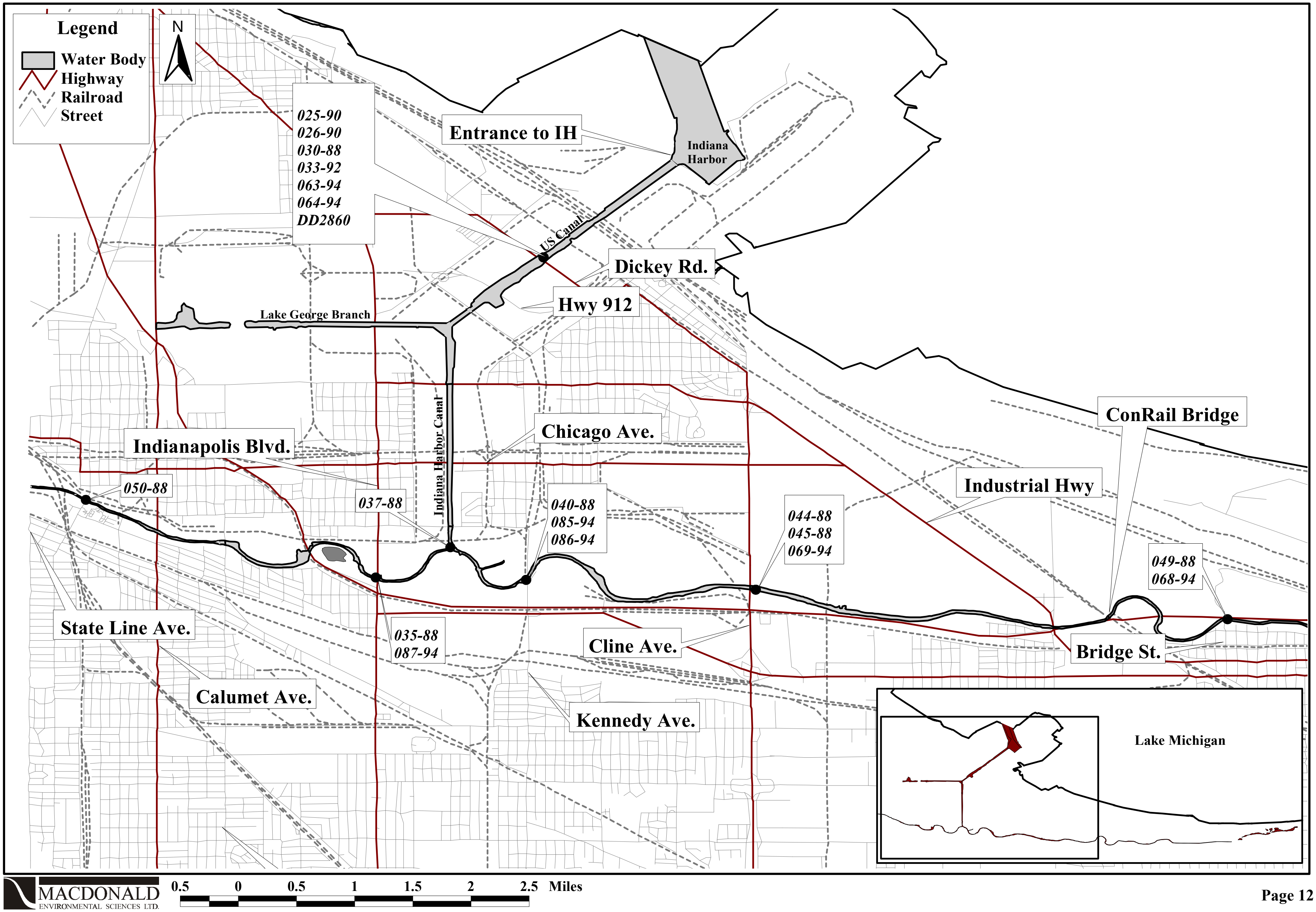

Table 2-8. Sediment data from the USS Lead Reach, Grand Calumet River (IDEM 1994).

Toxicity Test/Substance	Units	at E / W junction 037-88	W Kennedy 040-88	W Kennedy 085-94	W Kennedy 086-94
Depth	feet	surface	surface	surface	surface
Acid volatile sulfides	µmol/g			10.52	18.6
benzene	µg/kg	93	<70		
Metals					
Arsenic	mg/kg	19	182	77	101
Cadmium	mg/kg	14	76.5	20.3	24.2
Chromium	mg/kg	118	99	399	261
Copper	mg/kg	80	683	243	322
Lead	mg/kg	229	3470	1130	4350
Mercury	mg/kg	0.7	7.73	1.70	12.40
Nickel	mg/kg	24	24	74	68
Selenium	mg/kg	<4.1	<7.1	2.9	9.5
Zinc	mg/kg	1210	12200	4040	3710
Total SEM metals	µmol/g				
SEM-AVS	µmol/g				
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	µg/kg	3200	210	2600	890
Acenaphthylene	µg/kg	860	270	2300	470
Anthracene	µg/kg	3400	340	5200	680
Benz(a)anthracene	µg/kg	11000	4000	22000	10000
Benzo(a)pyrene	µg/kg	12000	2800	18000	3400
Chrysene	µg/kg	20000	5900	47000	4000
Dibenz(a,h)anthracene	µg/kg	<5300	330	2400	2200
Fluoranthene	µg/kg	19000	5900	20000	5700
Fluorene	µg/kg	4300	<920	5100	760
2-Methylnaphthalene	µg/kg	4700	130	810	<23000
Naphthalene	µg/kg	2700	410	1600	660
Phenanthrene	µg/kg	31000	700	16000	1400
Pyrene	µg/kg	29000	14000	3100	5800
Total PAHs[1]	µg/kg	141160	34990	146110	35960
Polychlorinated Biphenyls					
Total PCBs	µg/kg	1028.9	474.1	22198	14133
Pesticides					
Chlordane	µg/kg	<3.2	<5.6	<200	<130.7
Sum DDD	µg/kg	62.7	<11.2	<329.7	<229.3
Sum DDE	µg/kg	<6.4	<11.2	<560.5	<349.4
Sum DDT	µg/kg	<6.4	<11.2	<175.8	<106.6
Total DDTs[2]	µg/kg	69.1	<33.6	NA	NA
Dieldrin	µg/kg	<1.6	<2.8	<44	<26.7
Endrin	µg/kg	<16.1	<28	<439.6	<266.7
Heptachlor	µg/kg	<32	<28	<219.8	<133.3
Heptachlor epoxide	µg/kg	56.3	<14	<169.2	<210.7
Lindane	µg/kg	<1.6	<2.8	<44	<26.7
Toxaphene	µg/kg	NR	NR	<879.1	<533.3
Mean-PEC-Q		**3.04**	**4.63**	**14.50**	**10.20**

Figure 4.31. Location of sediment sampling stations for ENTACT, Inc. (1998) and TechLaw, Inc. (1998).

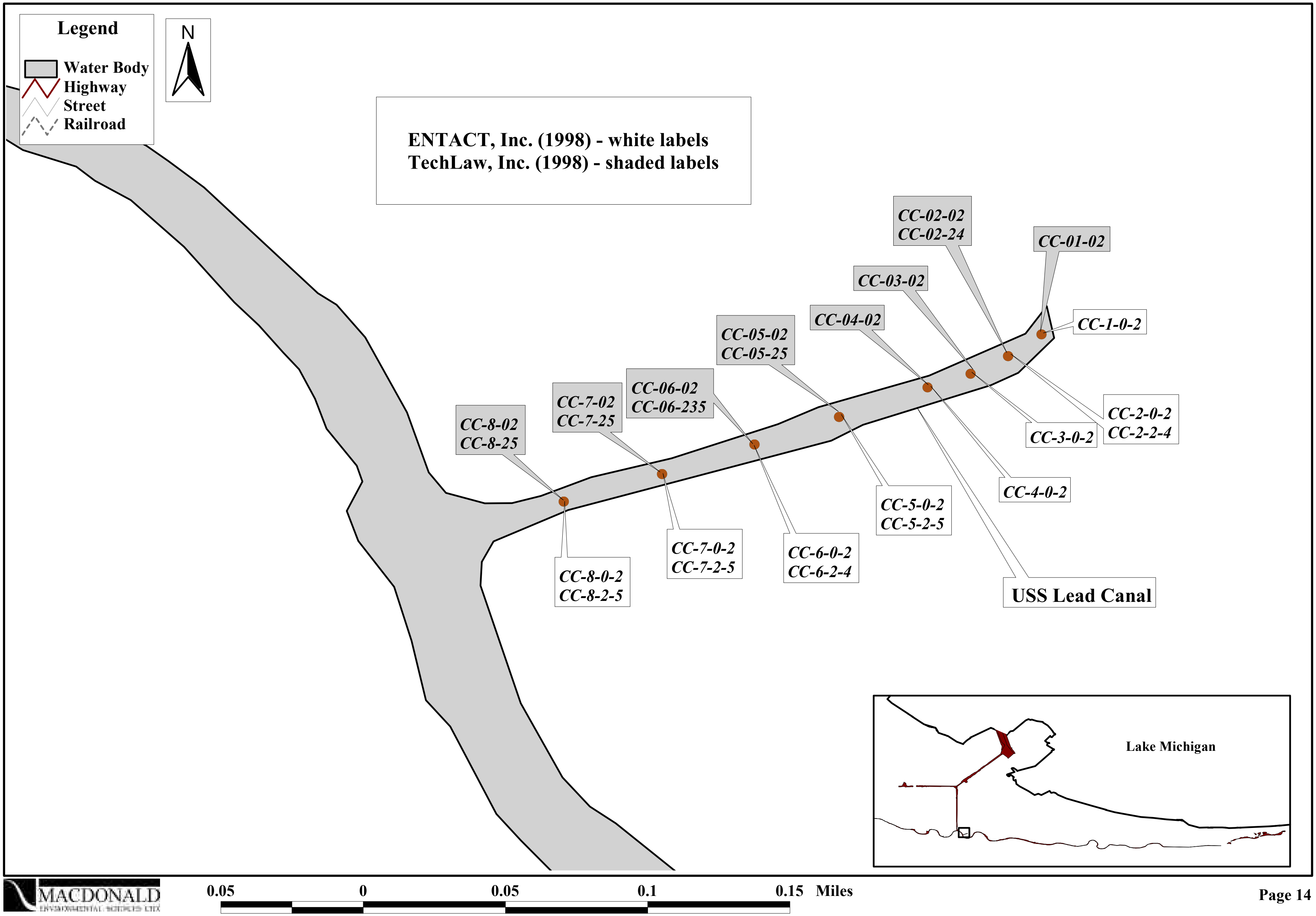

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Table 2-23. USS Lead discharge canal samples (taken prior to damming the canal) are from east to west (Entact 1998).

Substance	**Unit**	**CC-1-0-2**	**CC-2-0-2**	**CC-2-2-4**	**CC-3-0-2**	**CC-4-0-2**	**CC-5-0-2**	**CC-5-2-5**	**CC-6-0-2**
Depth	feet	0-2	0-2	2-4	0-2	0-2	0-2	2-5	0-2
Conventionals									
Benzene	µg/kg	NR	<57	<29	NR	NR	NR	NR	NR
Phenol	µg/kg	NR	<46200	<198000	NR	NR	<9900	NR	NR
Metals									
Lead	mg/kg	4700	5900	1900	760	1400	5100	830	1100
Polycyclic Aromatic Hydrocarbons									
Acenaphthene	µg/kg	<660	<46200	<1140	<660	<1000	<9900	<660	<660
Acenaphthylene	µg/kg	<660	<46200	<1140	<660	<1000	<9900	<660	<660
Anthracene	µg/kg	<660	<46200	9750	12000	4500	<9900	<660	<660
Benz(a)anthracene	µg/kg	<120	<46200	55500	16000	74000	<9900	18000	20000
Benzo(a)pyrene	µg/kg	2300	<46200	10250	6200	1200	<9900	4600	1600
Chrysene	µg/kg	19000	<46200	96500	64000	110000	<9900	36000	31000
Dibenz(a,h)anthracene	µg/kg	<120	<46200	3000	1700	4700	<9900	<120	1100
Fluoranthene	µg/kg	<660	<46200	48500	26000	58000	<9900	14000	28000
Fluorene	µg/kg	<120	<46200	<1140	16000	<1000	<9900	<140	<140
Naphthalene	µg/kg	3300	<46200	<110	<480	<1000	<9900	<120	1300
Phenanthrene	µg/kg	39000	<46200	660	<660	<1000	<9900	<660	<660
Pyrene	µg/kg	19000	58000	126000	70000	150000	<9900	36000	41000
Total PAHs[1]	µg/kg	83440	58000	350215	212470	402900	NA	109450	124730
Polychlorinated Biphenyls									
Total PCBs	µg/kg	119940	14175	4080	32500	6785	62310	<100160	11000
Mean-PEC-Q		**72.6**	**23.2**	**12.1**	**21.1**	**12.9**	**66.0**	**5.64**	**10.1**

Table 2-24. USS Lead discharge canal samples (taken prior to damming the canal) are from east to west (TechLaw 1999).

Substance	**Units**	**CC-01-02**	**CC-02-02**	**CC-02-24**	**CC-03-02**	**CC-04-02**	**CC-05-02**	**CC-05-25**	**CC-06-02**
Depth	feet	0-2	0-2	2-4	0-2	0-2	0-2	2-5	0-2
Benzene	µg/kg	13.1	NR	<50	NR	NR	NR	NR	NR
Phenol	µg/kg	<43000	NR	<107000	NR	NR	NR	NR	NR
Metals									
Arsenic	mg/kg	1200	12100	16300	1370	10330	6660	4175	1600
Cadmium	mg/kg	62.0	115	65.9	3.78	16.8	84.2	52.5	37.1
Chromium	mg/kg	147	187	250	26.1	50.75	294	99.95	243
Copper	mg/kg	216	324	357	64.4	130.5	205	129.5	200
Lead	mg/kg	4490	7110	3980	1280	1355	3880	1070	1190
Mercury	mg/kg	0.580	1.00	1.42	0.710	0.498	0.608	2.124	1.15
Nickel	mg/kg	31.8	47.5	298	14.0	18.35	35.7	32.2	55.9
Selenium	mg/kg	<1.30	<4.48	<3.23	1.0	<2.07	<3.74	<2.32	<2.04
Zinc	mg/kg	1690	3200	7550	617	2375	3000	3815	3650
Mean-PEC-Q		**13.0**	**65.3**	**80.8**	**7.80**	**47.7**	**37.2**	**22.3**	**11.1**

[1] Total PAHs are calculated using all values except those with a detection limit >PEC.

NA = not applicable (i.e., all <DL values were >PEC; therefore total was not calculated); NR = not reported.

Table 2-23. USS Lead discharge canal samples (taken prior to damming the canal) are from east to west (Entact 1998).

Substance	Units	CC-6-2-4	CC-7-0-2	CC-7-2-5	CC-8-0-2	CC-8-2-5
Depth	feet	2-3.5	0-2	2-5	0-2	2-5
Conventionals						
Benzene	µg/kg	NR	NR	NR	110	86
Phenol	µg/kg	<16000	<33000	<82500	<19800	NR
Metals						
Lead	mg/kg	740	2400	2100	1300	1500
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	µg/kg	<16000	<33000	<82500	<19800	<660
Acenaphthylene	µg/kg	<16000	<33000	<82500	<19800	<660
Anthracene	µg/kg	<16000	<33000	<82500	<19800	4600
Benz(a)anthracene	µg/kg	23000	<33000	<82500	<19800	6800
Benzo(a)pyrene	µg/kg	23000	<33000	<82500	<19800	290
Chrysene	µg/kg	59000	<33000	<82500	<19800	11000
Dibenz(a,h)anthracene	µg/kg	<16000	<33000	<82500	<19800	480
Fluoranthene	µg/kg	31000	<33000	<82500	7900	13000
Fluorene	µg/kg	<16000	<33000	<82500	<19800	7100
Naphthalene	µg/kg	<16000	<33000	<82500	<19800	730
Phenanthrene	µg/kg	<16000	<33000	<82500	<19800	21000
Pyrene	µg/kg	81000	<33000	<82500	9100	13000
Total PAHs[1]	µg/kg	217000	NA	NA	17000	78000
Polychlorinated Biphenyls						
Total PCBs	µg/kg	4080	62370	62425	<2800000	<2800000
Mean-PEC-Q		**7.11**	**55.5**	**54.4**	**5.45**	**7.57**

Table 2-24. USS Lead discharge canal samples (taken prior to damming the canal) are from east to west (TechLaw, Inc. 19

Substance	Units	CC-06-235	CC-7-02	CC-7-25	CC-8-02	CC-8-25
Depth	feet	0-3.5	0-2	2-5	0-2	2-5
Conventionals						
Benzene	µg/kg	NR	<5.0	<100	NR	NR
Phenol	µg/kg	NR	<34800	<37900	NR	NR
Metals						
Arsenic	mg/kg	375	915	1950	629	691
Cadmium	mg/kg	14.2	19.3	78.7	13.6	59.8
Chromium	mg/kg	59.1	498	692	2450	1470
Copper	mg/kg	97.9	265	372	267	403
Lead	mg/kg	596	1040	1860	1730	1580
Mercury	mg/kg	1.24	0.913	2.79	1.27	1.82
Nickel	mg/kg	21.4	70.0	95.8	113	122
Selenium	mg/kg	<1.46	<2.11	<2.30	<1.99	<1.39
Zinc	mg/kg	2160	3010	8940	7170	6360
Mean-PEC-Q		**3.60**	**7.71**	**17.1**	**11.0**	**11.1**

[1] Total PAHs are calculated using all values except those with a detection limit >PEC.

NA = not applicable (i.e., all <DL values were >PEC; therefore total was not calculated); NR = not reported.

Figure 4.37. Location of sediment sampling stations for Exponent (1999) and Tetra Tech EM Inc. (1998).

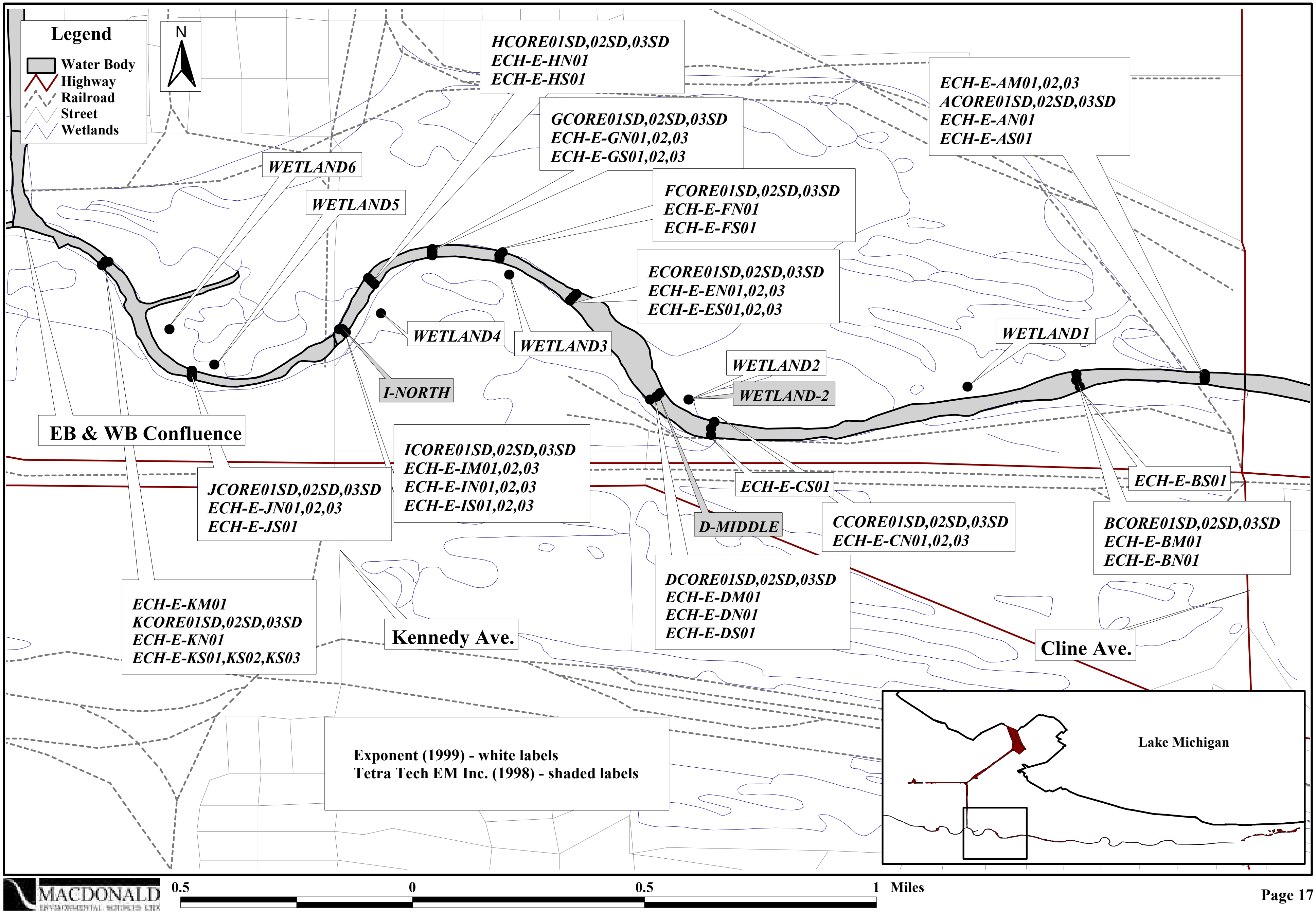

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Table 2-28. Transect sediment samples from the Grand Calumet River, just up stream Buckeye boat ramp in USS Lead reach (Exponent 1999).

Substance	Units	J-CORE JCORE01SD	J-CORE JCORE02SD	J-CORE JCORE03SD	J-N ECH-E-JN01	J-N ECH-E-JN02	J-N ECH-E-JN03	J-S ECH-E-JS01
Depth	feet	0 - 0.98	0.98 - 2.82	2.82 - 5.84	0 - 0.33	0.33 - 0.66	0.66 - 0.98	0 - 0.33
Conventionals								
Acid volatile sulfides	µmol/g	13	33	15	29.5	54.4	18	20.3
Ammonia-nitrogen	mg/kg	<180	210	1700	170	330	510	88
Benzene	µg/kg	NR	NR	NR	NR	NR	NR	NR
Nitrogen, total Kjeldahl	mg/kg	340	720	8600	4500	2400	2140	1120
Oil and grease	mg/kg	11700	16000	2500	30500	34600	24000	20000
pH	S.U.	7.60	7.26	7.20	7.06	7.16	7.25	7.2
Phenol	µg/kg	NR	NR	NR	NR	NR	NR	NR
Phenols, total	mg/kg	0.910	0.550	<0.700	1.90	1.1	2.40	0.410
Phosphorus, total	mg/kg	420	650	1800	3600	2900	2000	2100
Total organic carbon	%	0.53	1.14	2.8	2.5	2.36	1.95	1.08
Metals								
Arsenic	mg/kg	14.1	82.9	96.1	58.0	53.0	44	17.5
Cadmium	mg/kg	1.96	16.3	11.6	<0.130	<2.80	<0.49	<0.0830
Chromium	mg/kg	78.6	37.2	24.9	378	378	310	222
Copper	mg/kg	82.7	189	221	258	255	170	105
Lead	mg/kg	249	1100	1150	670	700	870	550
Mercury	mg/kg	0.440	2.66	4.81	1.59	1.38	0.99	0.630
Nickel	mg/kg	17.5	19.2	22.8	117	117	85	47.5
Zinc	mg/kg	797	2640	2380	2590	2490	2100	1220
Total SEM metals	µmol/g	NR	NR	NR	NR	NR	NR	NR
SEM-AVS	µmol/g	NR	NR	NR	NR	NR	NR	NR
Polycyclic Aromatic Hydrocarbons								
Total PAHs[1]	µg/kg	NR	NR	NR	NR	NR	NR	NR
Polychlorinated Biphenyls								
Total PCBs	µg/kg	NR	NR	NR	NR	NR	NR	NR
Pesticides		NR	NR	NR	NR	NR	NR	NR
Mean-PEC-Q		**0.875**	**3.16**	**3.08**	**2.88**	**2.90**	**2.63**	**1.60**

Table 2-28. Transect sediment samples from the Grand Calumet River, downstream of USS Lead canal before it was dammed (Exponent 1999).

Substance	Units	K-M ECH-E-KM01	K-M KCORE01SD	K-M KCORE02SD_1	K-M KCORE02SD_2	K-M KCORE03SD	K-N ECH-E-KN01_1	K-N ECH-E-KN01_2	K-S ECH-E-KS01	K-S ECH-E-KS02	K-S ECH-E-KS03
Depth	feet	0 - 0.33	0 - 1.51	1.51 - 4.99	1.51 - 4.99	4.99 - 6.00	0 - 0.33	0 - 0.33	0 - 0.33	0.33 - 0.66	0.66 - 0.98
Conventionals											
Acid volatile sulfides	µmol/g	34.9	79.1	1.40	0.790	20.8	8.80	13.5	39.1	47.3	14.1
Ammonia-nitrogen	mg/kg	71	140	<150	<150	250	46	66	235	560	520
Benzene	µg/kg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Nitrogen, total	mg/kg	2450	1210	750	850	2110	600	430	2700	2700	2200
Oil and grease	mg/kg	65500	133000	3800	3600	13200	7100	5700	38700	52200	46400
pH	S.U.	7.56	7.61	8.00	8.0	7.47	8.14	7.86	7.23	7.26	7.39
Phenol	µg/kg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Phenols, total	mg/kg	0.550	13.1	3.10	1.85	1.60	0.340	0.930	0.940	1.80	3.50
Phosphorus, total	mg/kg	2300	1200	130	150	340	650	380	4100	6400	4300
Total organic carbon	%	2.66	1.79	0.66	0.637	1.55	0.44	0.46	2.7	1.6	2
Metals											
Arsenic	mg/kg	45.0	63.7	8.70	13.0	23.4	7.00	6.20	44.0	45.0	48.0
Cadmium	mg/kg	<0.0910	7.17	0.600	7.02	2.14	0.0750	<0.0690	<2.80	<2.60	<2.90
Chromium	mg/kg	191	271	21.0	61.1	64.1	42.0	43.7	869	1360	1270
Copper	mg/kg	158	388	12.2	150	45.4	16.2	17.2	242	321	266
Lead	mg/kg	470	846	58.5	313	205	94.0	69.0	1220	1560	1890
Mercury	mg/kg	1.01	1.01	0.107	0.0727	0.420	0.0898	0.140	0.820	1.35	0.920
Nickel	mg/kg	62.7	96.2	8.44	14.7	17.8	9.30	8.19	93.0	129	123
Zinc	mg/kg	2000	3840	203	425	635	292	323	8090	12500	8520
Total SEM metals	µmol/g	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
SEM-AVS	µmol/g	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Polycyclic Aromatic Hydrocarbons											
Total PAHs[1]	µg/kg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Polychlorinated Biphenyls											
Total PCBs	µg/kg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides	µg/kg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Mean-PEC-Q		**1.92**	**3.62**	**0.247**	**1.00**	**0.767**	**0.325**	**0.302**	**5.73**	**8.30**	**7.26**

[1] Total PAHs are calculated using all values except those with a detection limit >PEC.

Table 2-28. Riparian wetland sediment samples from the Grand Calumet River, from DuPont, Resco and USS Lead (Exponent 1999).

Substance	Units	E Dupont woods WETLAND1 ECH-E-W101	W Dupont woods WETLAND2 ECH-E-W102_1	W Dupont woods WETLAND2 ECH-E-W102_2	Black Tern E WETLAND3 ECH-E-W103	Black Tern W WETLAND4 ECH-E-W104	USS Lead S WETLAND5 ECH-E-W105	USS Lead SW WETLAND6 ECH-E-W106
Depth	feet	0 - 0.33	0 - 0.33	0 - 0.33	0 - 0.33	0 - 0.33	0 - 0.33	0 - 0.33
Conventionals								
Acid volatile sulfides	µmol/g	<0.7	<1.20	<1.30	59.7	43.9	<0.800	52.5
Ammonia-nitrogen	mg/kg	1570	1900	1860	830	1110	1240	710
Benzene	µg/kg	<6.00	<9.00	NR	NR	NR	NR	NR
Nitrogen, total Kjeldahl	mg/kg	8200	20000	21000	14000	12500	10600	7300
Oil and grease	mg/kg	6200	NR	14000	47000	25600	28400	101000
pH	S.U.	6.85	6.19	6.21	6.77	6.60	6.28	6.51
Phenol	µg/kg	NR	NR	NR	NR	NR	NR	NR
Phenols, total	mg/kg	1.00	2.80	<1.40	13.1	2.50	1.04	18.1
Phosphorus, total	mg/kg	1800	2900	2600	5100	3200	4400	3200
Total organic carbon	%	7.1	8.2	9.7	7.9	4.9	7.5	8.1
Metals								
Arsenic	mg/kg	20.5	29.1	28.9	35.2	46.4	343	276
Cadmium	mg/kg	0.17	<0.310	<0.320	0.280	1.07	9.82	3.54
Chromium	mg/kg	230	295	277	439	513	493	601
Copper	mg/kg	175	209	207	278	327	377	415
Lead	mg/kg	400	605	553	906	2080	2540	2660
Mercury	mg/kg	<0.28	<0.532	<0.680	0.990	1.38	1.86	1.60
Nickel	mg/kg	53	68.0	61.7	85.5	90.1	92.4	73.4
Zinc	mg/kg	1540	2110	2000	6860	2800	3410	2570
Total SEM metals	µmol/g	202.49	29.09	NR	NR	NR	43.35	NR
SEM-AVS	µmol/g	202.14	28.49	NR	NR	NR	42.95	NR
Polycyclic Aromatic Hydrocarbons								
Total PAHs[1]	µg/kg	NR	NR	NR	NR	NR	NR	NR
Polychlorinated Biphenyls								
Total PCBs	µg/kg	NR	NR	NR	NR	NR	NR	NR
Pesticides		NR	NR	NR	NR	NR	NR	NR
Mean-PEC-Q		**1.64**	**2.24**	**2.11**	**4.39**	**4.66**	**6.93**	**6.45**

[1] Total PAHs are calculated using all values except those with a detection limit >PEC.

[2] Total DDTs are calculated using all values except those with a detection limit >PEC. NR = not reported.

Figure 4.38. Location of sediment sampling stations for Maxim Technologies (1999); USGS (1999).

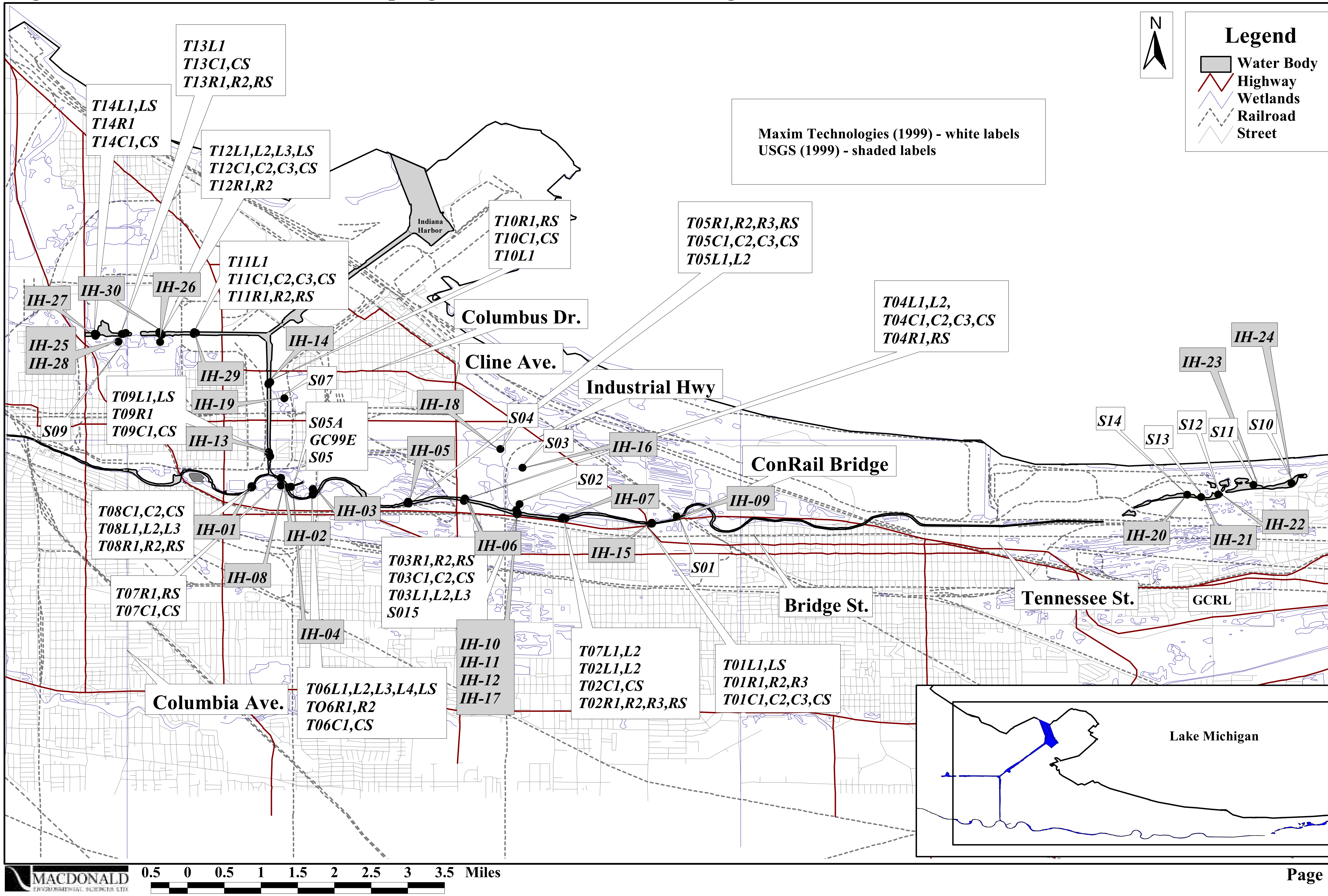

Table 4-9. Transect 6 sediment samples from the Grand Calumet River, west of Kennedy Ave (Maxim 1999).

Substance / end point	Units	GC99T06C1	GC99T06CS	GC99T06R1	GC99T06R2
Depth	feet	0-5	0-0.33	0-5	5.25-9.5
Hyalella azteca (10-d)	length-mm	NA	NA	NA	NA
Hyalella azteca (10-d)	Mortality (%)	NA	NA	NA	NA
Overall Toxicity					
Total organic carbon	%	0.53	0.59	3.7	0.96
Acid volatile sulfides	µmol/g	1.72	13.1	0.8	0.62
Oil and grease	mg/kg	700	5900	500	300
Metals					
Arsenic	mg/kg	6.4	13	5.6	2.8
Cadmium	mg/kg	<0.68	2.4	<0.93	<0.7
Chromium	mg/kg	8.2	65	13	6.2
Copper	mg/kg	6.8	61	13	4.5
Lead	mg/kg	13	190	9.8	<7
Mercury	mg/kg	<0.14	0.35	<0.19	<0.14
Nickel	mg/kg	6.2	18	17	6.8
Selenium	mg/kg	<1.4	<1.4	<1.9	<1.4
Zinc	mg/kg	57	720	50	23
Total SEM metals	µmol/g	0.69	9.54	2.35	0.31
SEM-AVS	µmol/g	-1.03	-3.56	1.55	-0.31
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	µg/kg	<220	<690	<310	<230
Acenaphthylene	µg/kg	<220	<690	<310	<230
Anthracene	µg/kg	<220	630	<310	<230
Benz(a)anthracene	µg/kg	230	1600	<31	<23
Benzo(a)pyrene	µg/kg	280	1800	<31	<23
Chrysene	µg/kg	250	2300	<31	<23
Dibenz(a,h)anthracene	µg/kg	34	240	<31	<23
Fluoranthene	µg/kg	270	3000	<31	5.8
Fluorene	µg/kg	<220	250	<310	<230
2-Methylnaphthalene	µg/kg	NR	NR	NR	NR
Naphthalene	µg/kg	<220	<690	<310	<230
Phenanthrene	µg/kg	81	2000	<310	<230
Pyrene	µg/kg	250	2700	<31	<23
Total PAHs[1]	µg/kg	1725	14520	<1426	523.3
Polychlorinated Biphenyls					
Total PCBs	µg/kg	114	1200	<217	<161
Pesticides					
Chlordane	µg/kg	<4.4	<92	<6.2	<4.6
Sum DDD	µg/kg	<4.5	<92	<6.1	0.48
Sum DDE	µg/kg	<4.5	11	<6.1	<4.6
Sum DDT	µg/kg	<4.5	<92	<6.1	0.54
Total DDTs[2]	µg/kg	<13.5	11	<18.3	3.32
Dieldrin	µg/kg	<4.5	<92	<6.1	<4.6
Endrin	µg/kg	<4.5	<92	<6.1	<4.6
Heptachlor	µg/kg	<2.2	<46	<3.1	<2.3
Heptachlor epoxide	µg/kg	<2.2	<46	<3.1	<2.3
Lindane	µg/kg	<2.2	<46	<3.1	<2.3
Toxaphene	µg/kg	<45	<920	<61	<46
Mean-PEC-Q		**0.116**	**1.06**	**0.112**	**0.0692**

Table 4-9. Transect 6 sediment samples from the Grand Calumet River, west of Kennedy Ave (Maxim 1999).

Substance / end point	Units	GC99T06L1	GC99T06L2	GC99T06L3	GC99T06L4	GC99T06LS IH-03
Depth	feet	0-5	5-10	10-11	11-13.16	0-0.33
Hyalella azteca (10-d)	length-mm	NA	NA	NA	NA	NT (1.81)
Hyalella azteca (10-d)	Mortality (%)	NA	NA	NA	NA	T (60)
Overall Toxicity						T
Total organic carbon	%	7.1	8.5	4.7	5.5	10
Acid volatile sulfides	µmol/g	32.9	40	21.7	4.55	1.78
Oil and grease	mg/kg	25400	43000	12900	1600	18500
Metals						
Arsenic	mg/kg	24	90	34	23	28
Cadmium	mg/kg	0.83	19	2.3	<1.3	<1.1
Chromium	mg/kg	170	170	87	19	160
Copper	mg/kg	110	240	84	21	130
Lead	mg/kg	480	1000	430	33	290
Mercury	mg/kg	0.9	3.7	0.96	<0.26	0.62
Nickel	mg/kg	38	73	28	23	54
Selenium	mg/kg	<1.5	2.8	<1.4	<2.6	<2.1
Zinc	mg/kg	1200	3000	1100	140	1100
Total SEM metals	µmol/g	24.03	58.04	28.08	2.53	28.48
SEM-AVS	µmol/g	-8.87	18.04	6.38	-2.02	26.70
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	µg/kg	<10000	<8100	<2400	<430	<7000
Acenaphthylene	µg/kg	<10000	<8100	<2400	<430	<7000
Anthracene	µg/kg	5800	32000	3500	<430	4700
Benz(a)anthracene	µg/kg	12000	21000	4100	24	6900
Benzo(a)pyrene	µg/kg	13000	6400	3600	<43	8400
Chrysene	µg/kg	12000	NR	5900	48	7700
Dibenz(a,h)anthracene	µg/kg	1300	530	480	<43	420
Fluoranthene	µg/kg	27000	30000	6300	<43	18000
Fluorene	µg/kg	<10000	51000	4200	<430	<7000
2-Methylnaphthalene	µg/kg	NR	NR	NR	NR	NR
Naphthalene	µg/kg	5300	<8100	<2400	<430	<7000
Phenanthrene	µg/kg	17000	410000	19000	260	6100
Pyrene	µg/kg	24000	8400	5100	<43	12000
Total PAHs[1]	µg/kg	117400	559330	52180	1063	64220
Polychlorinated Biphenyls						
Total PCBs	µg/kg	4950	6240	5060	<301	6120
Pesticides						
Chlordane	µg/kg	<26	<28	<48	<8.6	<36
Sum DDD	µg/kg	<25	<27	<48	<8.7	<35
Sum DDE	µg/kg	<25	<27	<48	<8.7	<35
Sum DDT	µg/kg	<25	<27	<48	<8.7	<35
Total DDTs[2]	µg/kg	<75	<81	<48	<26.1	<35
Dieldrin	µg/kg	<25	<27	<48	<8.7	<35
Endrin	µg/kg	<25	<27	<48	<8.7	<35
Heptachlor	µg/kg	<13	<14	<24	<4.3	<18
Heptachlor epoxide	µg/kg	<13	<14	<24	<4.3	<18
Lindane	µg/kg	<13	<14	<24	<4.3	<18
Toxaphene	µg/kg	<250	<270	<480	<87	<350
Mean-PEC-Q		**3.43**	**10.9**	**3.69**	**0.193**	**2.88**

Table 4-9. Transect 7 sediment samples from the Grand Calumet River,downstream of USS Lead Canal (Maxim 1999).

Substance	Units	GC99T07C1	GC99T07CS	GC99T07R1	GC99T07RS IH-02	GC99T07L1	GC99T07L2
Depth	feet	0-5	0.33	0-3	0-0.33	0-5	5-10
Hyalella azteca (10-d)	length-mm	NA'	NA'	NA'	ND'	NA'	NA'
Hyalella azteca (10-d)	Mortality	NA'	NA'	NA'	T (92)	NA'	NA'
Overall Toxicity					**T**		
Total organic carbon	%	2.8	6.1	0.32	7.3	6.6	5.1
Acid volatile sulfides	µmol/g	6.02	8.42	1.62	4.84	93.1	9.565
Oil and grease	mg/kg	1300	11300	2000	11800	29100	4200
Metals							
Arsenic	mg/kg	12	700	3.3	47	170	18
Cadmium	mg/kg	<0.78	<1.3	<0.63	<0.72	30	<1.2
Chromium	mg/kg	18	190	11	120	70	37
Copper	mg/kg	15	140	6.9	70	260	31
Lead	mg/kg	28	360	29	230	1500	96.5
Mercury	mg/kg	<0.31	0.94	<0.13	0.4	6.2	0.325
Nickel	mg/kg	13	63	5.4	35	27	22.5
Selenium	mg/kg	<1.6	<2.5	<1.3	<1.4	<2.4	<2.4
Zinc	mg/kg	140	1500	88	820	5500	370
Total SEM metals	µmol/g	2.65	14.76	1.31	15.64	122.38	11.26
SEM-AVS	µmol/g	-3.37	6.34	-0.31	10.80	29.28	1.7
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	µg/kg	<260	<2100	<2100	<4800	<7900	<790
Acenaphthylene	µg/kg	<260	<2100	<2100	<4800	<7900	<790
Anthracene	µg/kg	79	1600	670	6700	9500	225
Benz(a)anthracene	µg/kg	190	3600	980	19000	5800	430
Benzo(a)pyrene	µg/kg	160	NR	1400	9600	5200	570
Chrysene	µg/kg	430	NR	5800	NR	10000	815
Dibenz(a,h)anthracene	µg/kg	36	770	120	750	740	64
Fluoranthene	µg/kg	190	3600	5000	19000	16000	880
Fluorene	µg/kg	<260	980	<2100	2500	7000	605
2-Methylnaphthalene	µg/kg	NR	NR	NR	NR	NR	NR
Naphthalene	µg/kg	<260	1000	<2100	3100	<7900	<790
Phenanthrene	µg/kg	130	2900	<2100	11000	45000	1800
Pyrene	µg/kg	370	NR	3200	21000	16000	1600
Total PAHs[1]	µg/kg	1845	14450	17170	92650	115240	6989
Polychlorinated Biphenyls							
Total PCBs	µg/kg	318	2623	650	2060	1380	752
Pesticides							
Chlordane	µg/kg	<52	<166	<42	<96	<40	<7.8
Sum DDD	µg/kg	<52	<170	<41	<96	<39	<7.9
Sum DDE	µg/kg	<52	<170	<41	<96	<39	<7.9
Sum DDT	µg/kg	<52	<170	<41	<96	<39	<7.9
Total DDTs[2]	µg/kg	<52	NA	<41	NA	<39	<23.7
Dieldrin	µg/kg	<52	<170	<41	<96	<39	<7.9
Endrin	µg/kg	<52	<170	<41	<96	<39	<7.9
Heptachlor	µg/kg	<26	<83	<21	<48	<20	<3.9
Heptachlor epoxide	µg/kg	<26	<83	<21	<48	<20	<3.9
Lindane	µg/kg	<26	<83	<21	<48	<20	<3.9
Toxaphene	µg/kg	<520	<1700	<410	<960	390	<79
Mean-PEC-Q		**0.255**	**3.00**	**0.611**	**2.72**	**4.17**	**0.627**

Table 4-9. Sediment samples from the Grand Calumet River at the USS Lead Canal and nearby wetlands (Maxim 1999).

		mouth USS Lead Canal			buckeye wetland	USS Lead	USS Lead duplicate
Substance / endpoint	Units	GC99E1	GC99E2	GC99E3	GC99S06 IH-08	GC99S05 IH-04	GC99S05A
Depth	feet	0-5	5-6.29	6.29-10	0-0.33	0-0.33	0-0.33
Hyalella azteca (10-d)	length-mm	NA'	NA'	NA'	NT (2.13)	NT (1.92)	NA'
Hyalella azteca (10-d)	Mortality	NA'	NA'	NA'	T (30)	T (45)	NA'
Overall Toxicity					**T**	**T**	
Total organic carbon	%	12	8.1	0.55	9.9	14	11
Acid volatile sulfides	µmol/g	58.4	29.9	0.53	24.3	25	16.1
Oil and grease	mg/kg	76850	37100	300	19200	24400	37300
Metals							
Arsenic	mg/kg	145	130	4.1	28	120	120
Cadmium	mg/kg	26	26	<0.63	13	8.5	9.1
Chromium	mg/kg	1550	810	11	220	940	670
Copper	mg/kg	355	290	3.9	170	200	210
Lead	mg/kg	1600	1100	12	730	800	850
Mercury	mg/kg	2.25	1.9	<0.13	1.6	3.4	0.96
Nickel	mg/kg	115	66	3.9	53	70	77
Selenium	mg/kg	3.15	2.6	<1.3	<3.3	<2.4	<2.2
Zinc	mg/kg	9150	4300	52	1900	3700	3500
Total SEM metals	µmol/g	130.24	66.94	0.79	32.05	64.21	37.41
SEM-AVS	µmol/g	71.84	37.04	0.26	7.75	39.21	21.31
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	µg/kg	29500	29000	410	<2800	10000	2100
Acenaphthylene	µg/kg	3600	1600	<210	530	<12000	180
Anthracene	µg/kg	21500	18000	310	790	5900	1600
Benz(a)anthracene	µg/kg	12250	NR	190	3400	8100	1800
Benzo(a)pyrene	µg/kg	6700	5700	170	4000	8800	2100
Chrysene	µg/kg	12350	18000	290	7300	8900	2000
Dibenz(a,h)anthracene	µg/kg	1030	740	21	<2800	1200	260
Fluoranthene	µg/kg	45000	19000	340	NR	17000	4200
Fluorene	µg/kg	38500	37000	460	520	5500	1600
2-Methylnaphthalene	µg/kg	NR	NR	NR	NR	NR	NR
Naphthalene	µg/kg	8400	1900	<210	1500	<12000	<3700
Phenanthrene	µg/kg	99500	110000	1600	5700	16000	4500
Pyrene	µg/kg	33500	42000	850	NR	12000	3900
Total PAHs[1]	µg/kg	311830	282940	4746	23740	93400	24240
Polychlorinated Biphenyls							
Total PCBs	µg/kg	45070	14450	233	375	8200	8110
Pesticides							
Chlordane	µg/kg	<154	<62	<4.2	<11	<40	<146
Sum DDD	µg/kg	<150	<61	<4.2	<11	<39	<150
Sum DDE	µg/kg	<150	<61	<4.2	<11	<39	<150
Sum DDT	µg/kg	<150	<61	<4.2	<11	<39	<150
Total DDTs[2]	µg/kg	NA	<61	<12.6	<33	<39	NA
Dieldrin	µg/kg	<150	<61	<4.2	<11	<39	<150
Endrin	µg/kg	<150	<61	<4.2	<11	<39	<150
Heptachlor	µg/kg	<77	<31	<2.1	<5.5	<20	<73
Heptachlor epoxide	µg/kg	<77	<31	<2.1	<5.5	<20	<73
Lindane	µg/kg	<77	<31	<2.1	<5.5	<20	<73
Toxaphene	µg/kg	<1500	<610	<42	<110	<390	<1500
Mean-PEC-Q		**29.7**	**13.1**	**0.213**	**1.37**	**6.88**	**5.72**

Figure 4.39. Location of sediment sampling stations for IDEM (1999).

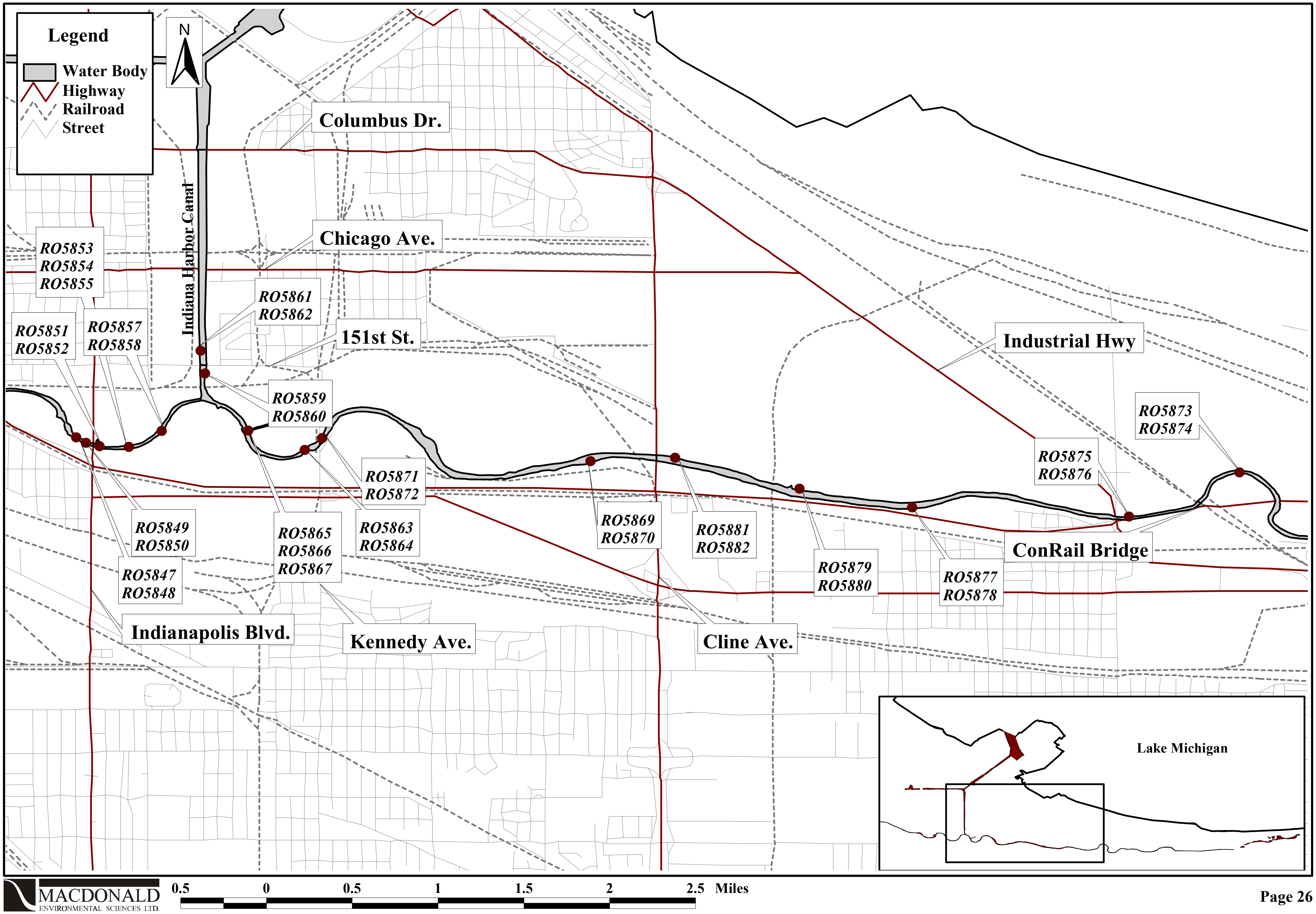

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Table 2-30. Sediment Chemistry from Grand Calumet River in the USS Lead reach (IDEM 1999).

Station Number Substance	Units	W Kennedy RO5863	W Kennedy RO5864	@canal RO5865	@canal RO5866	@canal RO5867
Depth	feet	0-4	0-0.3	0-0.3	0-4	0-0.3
Conventionals						
Phenol	µg/kg	NR	NR	NR	NR	NR
Metals						
Arsenic	mg/kg	NR	NR	NR	NR	NR
Cadmium	mg/kg	NR	NR	NR	NR	NR
Chromium	mg/kg	NR	NR	NR	NR	NR
Lead	mg/kg	NR	NR	NR	NR	NR
Mercury	mg/kg	NR	NR	NR	NR	NR
Selenium	mg/kg	NR	NR	NR	NR	NR
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	µg/kg	NR	NR	NR	NR	NR
Acenaphthylene	µg/kg	NR	NR	NR	NR	NR
Anthracene	µg/kg	NR	NR	NR	NR	NR
Benz(a)anthracene	µg/kg	NR	NR	NR	NR	NR
Benzo(a)pyrene	µg/kg	NR	NR	NR	NR	NR
Chrysene	µg/kg	NR	NR	NR	NR	NR
Dibenz(a,h)anthracene	µg/kg	NR	NR	NR	NR	NR
Fluoranthene	µg/kg	NR	NR	NR	NR	NR
Fluorene	µg/kg	NR	NR	NR	NR	NR
2-Methylnaphthalene	µg/kg	NR	NR	NR	NR	NR
Naphthalene	µg/kg	NR	NR	NR	NR	NR
Phenanthrene	µg/kg	NR	NR	NR	NR	NR
Pyrene	µg/kg	NR	NR	NR	NR	NR
Total PAHs[1]	µg/kg	NR	NR	NR	NR	NR
Polychlorinated Biphenyls						
Total PCBs	µg/kg	3880	5150	20450	52350	17500
Pesticides						
Chlordane	µg/kg	<46	<58	<58	<62	<58
Sum DDD	µg/kg	<46	<58	<58	<62	<59
Sum DDE	µg/kg	<46	<58	<58	<62	<59
Sum DDT	µg/kg	<46	<58	<58	<62	<59
Total DDTs[2]	µg/kg	<46	<58	<58	<62	<59
Dieldrin	µg/kg	<46	<58	78	<62	77
Endrin	µg/kg	<46	<58	<58	<62	<59
Heptachlor	µg/kg	<23	<29	<29	<31	<29
Heptachlor epoxide	µg/kg	<23	<29	<29	<31	<29
Lindane	µg/kg	<23	<29	<29	<31	<29
Toxaphene	µg/kg	<1500	<1800	<1800	<2000	<1900
Mean-PEC-Q		**5.74**	**7.62**	**30.3**	**77.4**	**25.9**

Attachment 3 – RI Process Outline

The detailed process to conduct an RI is referenced in EPA's RI/FS guidance document from October 1988. The major steps to complete the RI and risk assessments for USS Lead are summarized below.

1) Evaluate the comprehensive dataset available for the Site, including the historical data presented in the FSP and FSP Addendum. All analytes should be considered, not just the five COIs presented in the RI.
   a) Determine, based on past remediation, which soil or sediment samples remain in place and which are no longer present (that is, through excavation). Excavation extents (horizontal and vertical) should be considered and compared with sample depth intervals to determine samples remaining at Operable Unit (OU) 2. Samples that have been removed by excavation should be clearly indicated as such on figures and/or tables.

   b) Review groundwater and surface water data (including dates collected) to determine whether they are representative of current site conditions. Certain historical data may no longer be representative but may be useful for screening as an initial step and to determine whether additional data need to be collected. If old data are used in the RI and risk assessments, justification would need to be presented of why the data are representative of current site conditions or more conservative than current site conditions. Sample collection dates should be clearly indicated in tables and on figures.

2) Review the entire dataset available for the Site and screen the data against appropriate screening levels, including EPA's most-recent Regional Screening Levels (RSLs) and ecological screening values.
   a) Exclude samples removed previously by excavation from screening.

   b) Clearly format (for example, by shading) the data in tables that exceed the screening levels.

   c) Compare the laboratory reporting limits with the screening levels and indicate reporting limits that exceed the screening levels.

   d) Identify the COPCs based on analytes that exceed the screening levels (or background levels if lower than risk-based levels). Note: The human health-based screening levels for nature and extent evaluation can be based on a target excess lifetime cancer risk (ELCR) of 1×10^{-6} and target hazard quotient (HQ) of 1.

3) Delineate the nature and extent of contamination at OU2 and within groundwater based on analytes exceeding the screening levels.
   a) Consider vertical and horizontal extents of the screening level exceedances when determining nature and extent.

   b) Present figures clearly showing the nature and extent of contamination, such as by showing sample points in different colors where data exceed the screening levels and/or by presenting data on the figures with highlighted data that exceed the screening levels. Identify current plume extents in groundwater and areas of soil or sediment that exceed the screening levels.

   c) Identify potential sources of the COPCs, such as previous processes at the site and historical activities. For example, consider the former buildings shown on Figure 6 of Appendix F in the FSP, which include the following: tank house building, laboratory, silver refinery, pumphouse, maintenance shop, tellurium plant, battery breaker building, stack, blast furnace, mixed metals building, and bag house. What are likely chemicals that would be used in these buildings and processes? Can they be related to the COPCs?

d) Develop the conceptual site model and discuss fate and transport of the COPCs.

e) Determine whether data gaps are present that may require additional sampling and identify those data needs.

f) Conduct additional data gap sampling, if necessary. Update the previous steps based on data collected.

4) Conduct the risk assessments after data gaps have been addressed.
   a) Risk assessments should be performed using the complete dataset that is representative of current site conditions.

   b) COPCs for the HHRA should be based on a target ELCR of 1×10^{-6} and target HQ of 0.1.

   c) Estimate current and future risk present at OU2 and in groundwater, including receptors and pathways.

   d) Based on risk determined from the risk assessments, develop the list of contaminants of concern (COCs) that will be carried forward into the FS.

Further details are provided on conducting the HHRA in Chapter 5 (Data Evaluation) of the *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part A* (December 1989). According to the guidance, "The following nine steps should be followed to organize the data into a form appropriate for a baseline risk assessment:

1) gather all data available from the site investigation and sort by medium (Section 5.1);
2) evaluate the analytical methods used (Section 5.2);
3) evaluate the quality of data with respect to sample quantitation limits (Section 5.3);
4) evaluate the quality of data with respect to qualifiers and codes (Section 5.4);
5) evaluate the quality of data with respect to blanks (Section 5.5);
6) evaluate tentatively identified compounds (Section 5.6);
7) compare potential site-related contamination with background (Section 5.7);
8) develop a set of data for use in the risk assessment (Section 5.8); and
9) if appropriate, further limit the number of chemicals to be carried through the risk assessment (Section 5.9)."

Step 9 indicates the potential use of a concentration-toxicity screening (that is, comparison to risk-based concentrations, such as RSLs). All COPCs are typically carried through the entire risk assessment to estimate the cumulative risk from the site. At the completion of the risk assessment, some chemicals may be eliminated as COCs on the basis of background or other offsite sources.

Similar steps should be completed as previously listed for the BERA. Reference the *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (June 5, 1997). A screening level risk assessment should be performed prior to the BERA. If a screening level risk assessment was already performed, it should be fully presented.