HEALTH CONSULTATION

Little Black Creek Sediments – Floodplain Soil Sampling Results
Muskegon County, Michigan

EPA Facility ID: MID006031348

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Prepared by:

Michigan Department of Community Health
Under A Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

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Summary

The Michigan Departments of Community Health (MDCH) and Environmental Quality (MDEQ) sampled surficial soils in easily-accessible floodplain areas along Little Black Creek in Muskegon County, Michigan. The health agency wanted to determine if contaminated sediments from the creek had been deposited to adjacent soils during flood events. The soils were analyzed for pesticides and polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals. The only chemicals that exceeded MDEQ screening levels were benzo(a)pyrene and arsenic. The levels of benzo(a)pyrene found are consistent with what can be expected in an urban environment and are not expected to cause adverse health effects. The exceedance for arsenic is minor and not expected to cause adverse health effects. The soils along Little Black Creek pose no apparent public health hazard. A dilapidated boardwalk at a wetland along the creek poses a physical hazard and should be repaired or removed.

Purpose and Health Issues

This document provides follow-up environmental data gathered in response to recommendations made in the "Little Black Creek Sediments" Health Consultation (ATSDR 2006). In the earlier consultation, MDCH recommended that floodplain soils adjacent to Little Black Creek in Muskegon County, Michigan be characterized to determine if contaminated sediments at concentrations of public health significance had been transferred from the creek during past flood events. Exposure to soils would occur with more frequency than that to sediments and would increase the potential for adverse health effects.

MDCH conducts public health assessments at sites of environmental concern under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR).

Background

On May 23, 2006, staff from MDEQ and MDCH took 10 surficial soil samples from easily-accessible floodplain areas along Little Black Creek, starting near the headwaters and continuing downstream to near the outlet of the creek into Mona Lake (Figures 1 and 2). Photographs and descriptions of the sampling locations, as well as discussion regarding other locations that were not sampled, are provided in Appendix A. MDEQ analyzed the samples for PCBs and pesticides, VOCs, SVOCs, and metals. A complete list of the analytes tested for is in Appendix B. Only those chemicals detected are discussed in the following section.

Discussion

Environmental Contamination

MDCH compared the analytical results to the MDEQ Part 201 Generic Residential and Commercial I Direct Contact Criteria (DCC). The Residential DCC identifies a soil concentration that is protective against adverse health effects (cancer or noncancer) that

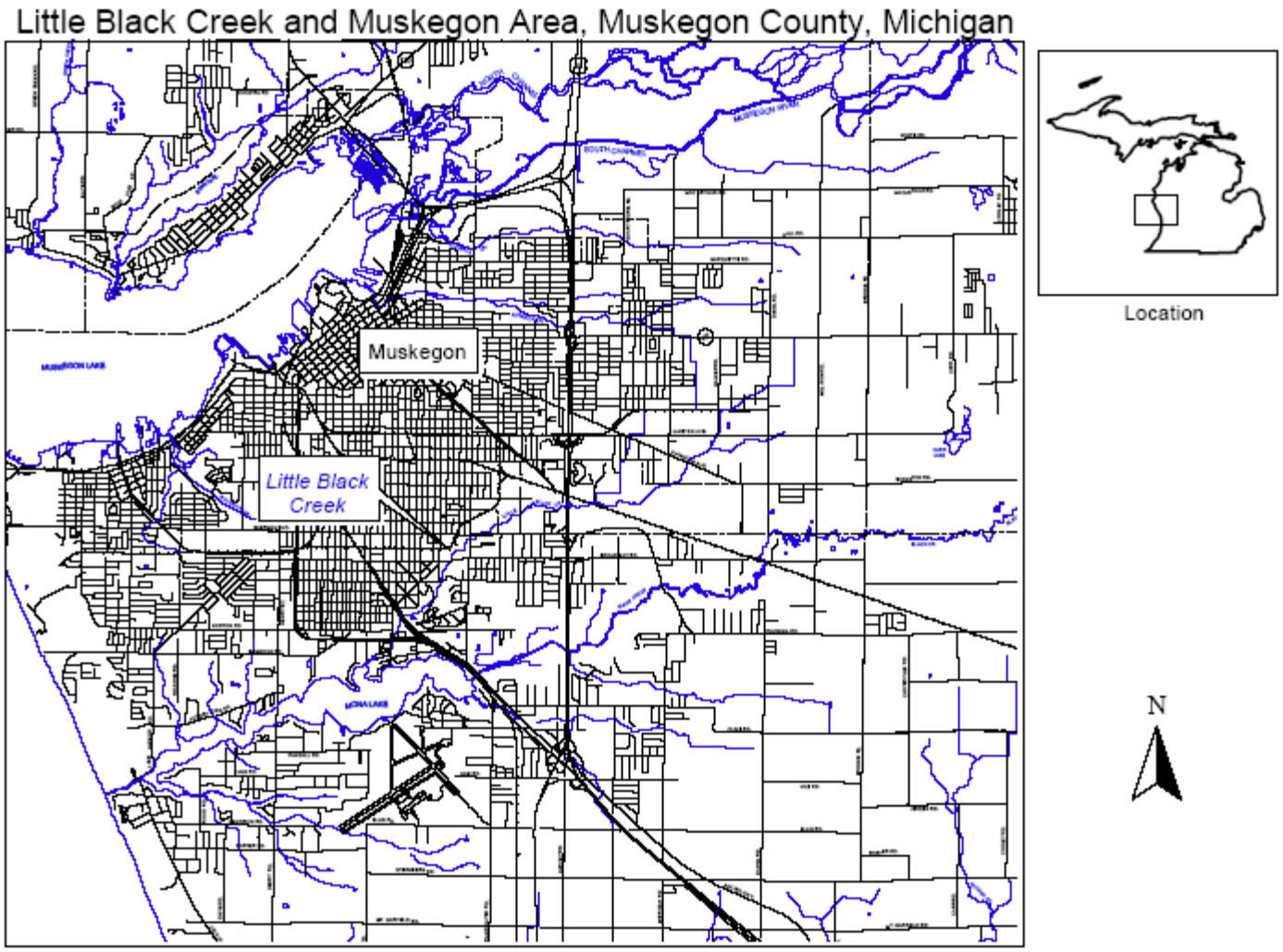
Little Black Creek and Muskegon Area, Muskegon County, Michigan
Muskegon
Little Black Creek
Location
N

Figure 1

Little Black Creek, Muskegon County, Michigan: Surficial Floodplain Soil Sampling Locations

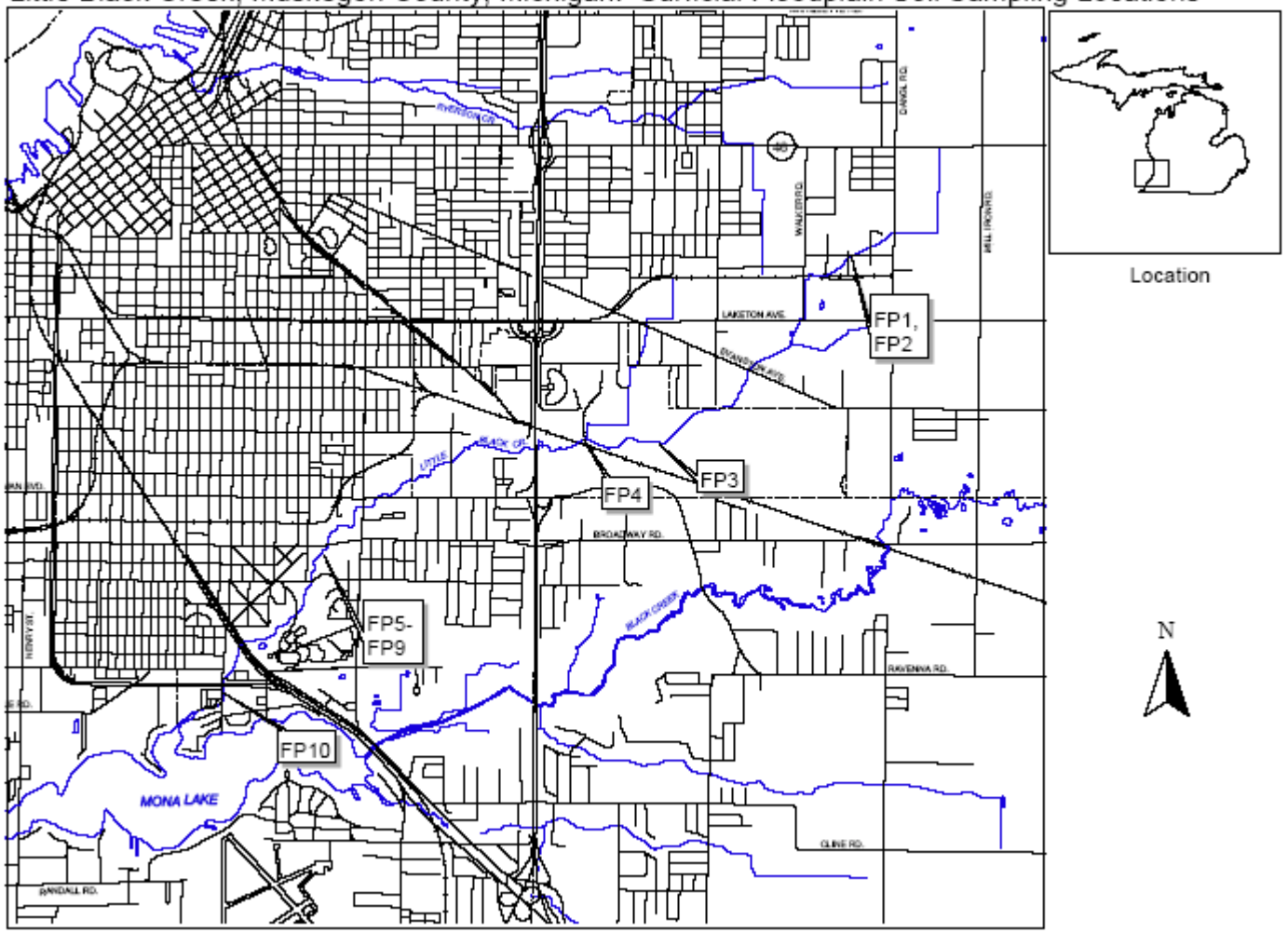

Figure 2

may result from long-term dermal exposure to and incidental ingestion of contaminated soil (MDEQ 2004). No VOCs or pesticides were detected in the samples. Table 1 shows detected chemicals, number of detections (out of 10 samples), the concentration range of the positive samples, and the comparison to the residential DCC. Chemicals listed in bold are discussed in further detail.

Table 1. Chemicals detected in surficial floodplain soil samples taken on May 23, 2006 along Little Black Creek, Muskegon County, Michigan.

Chemical	No. detections	Concentration range[A]	DCC[B]	No. exceedances
PCBs[C]	6	0.23 – 0.36	1	0
Acenaphthene	2	0.22 – 0.46	41,000	0
Anthracene	6	0.15 – 0.96	230,000	0
Benzo(a)anthracene	6	0.23 – 3.8	20	0
Benzo(a)pyrene[D]	6	1 – 5.9	2	**4 - 7 (see text)**
Benzo(a)fluoranthene	6	0.87 – 10	20	0
Benzo(g,h,i)perylene	5	0.56 – 4.9	2,500	0
Benzo(k)fluoranthene	1	0.56	200	0
Bix(2-ethylhexyl)phthalate	4	0.82 – 2.2	2,800	0
Butyl benzyl phthalate	2	0.64 – 0.66	310	0
Carbazole	4	0.53 – 1.2	530	0
Chrysene	6	0.49 – 6.6	2,000	0
Dibenz(a,h)anthracene[D]	0	ND	2	0 - 7 (see text)
Fluoranthene	7	0.7 – 13	46,000	0
Fluorene	4	0.19 – 0.5	27,000	0
Indeno(1,2,3-cd)pyrene	6	0.53 – 4.9	20	0
Naphthalene	1	0.23	16,000	0
Phenanthrene	7	0.29 – 6.7	1,600	0
Pyrene	7	0.77 – 11	29,000	0
Arsenic[D]	10	2.4 – 36	7.6	**1**
Mercury	7	0.08 – 0.18	160	0
Antimony	7	1.1 – 5.4	180	0
Barium	10	19 – 160	37, 000	0
Beryllium	9	0.25 – 0.63	410	0
Cadmium	8	0.35 – 22	550	0
Chromium	10	4.8 – 64	2,500	0
Cobalt	10	0.8 – 6.5	2,600	0
Copper	10	1.8 – 98	20,000	0
Iron	10	4,600 – 37,000	160,000	0
Lead	10	8 – 220	400	0
Molybdenum	7	1.5 – 3.8	2,600	0
Nickel	10	1.2 – 32	40,000	0
Selenium	10	0.3 – 2.5	2,600	0
Silver	7	0.26 – 0.79	2,500	0
Vanadium	10	9.3 – 57	750	0
Zinc	10	20 –350	170,000	0

Acronyms and Abbreviations**:** Reference: MDEQ 2006

DCC Direct Contact Criteria
PCBs polychlorinated biphenyls

Notes**:**

A. Concentration in parts per million (ppm).
B. MDEQ 2004
C. PCBs as Aroclor 1254.
D. Chemicals listed in bold are discussed in the text.

Benzo(a)pyrene was detected above its Residential DCC in four samples. As well, three samples that the laboratory reported as "not detected" for benzo(a)pyrene had reporting limits higher than the DCC. It is possible that, although the analytical machine did not detect the chemical in those samples, the chemical could have been present above its DCC. However, the highest concentration detected, 5.9 parts per million (ppm), is typical of urban soils and does not exceed the criterion to a degree that warrants public health concern. (The highest reporting limit for benzo(a)pyrene, 4.8 ppm, was less than the maximum concentration detected.) Therefore, benzo(a)pyrene is removed from further consideration in this assessment.

Dibenz(a,h)anthracene was not detected above its Residential DCC in any of the samples. However, seven samples that the laboratory reported as "not detected" for this chemical had reporting limits higher than the DCC. It is possible that the chemical could have been present above its DCC in those samples. The highest reporting limit, 4.8 ppm, does not exceed the criterion to a degree that warrants public health concern. Therefore, dibenz(a,h)anthracene is removed from further consideration in this assessment.

Arsenic exceeded its DCC in one sample. This exceedance will receive further evaluation in the *Exposure Pathways Analysis* and *Toxicological Evaluation* sections.

Chemicals Without MDEQ Part 201 Criteria

Of the 183 chemicals analyzed for in the soil samples from Little Black Creek, 21 currently do not have MDEQ Part 201 criteria. However, none of these chemicals were detected in the samples. Given the advanced technology of analytical machines, it is not unusual for chemicals to be identified that do not yet have screening levels established. The analytes without criteria are listed in Appendix C.

Exposure Pathways Analysis

To determine whether persons are, have been, or are likely to be exposed to contaminants, MDCH evaluates the environmental and human components that could lead to human exposure. An exposure pathway contains five elements: (1) a source of contamination, (2) contaminant transport through an environmental medium, (3) a point of exposure, (4) a route of human exposure, and (5) a receptor population. An exposure pathway is considered complete if there is evidence, or a high probability, that all five of these elements are, have been, or will be present at a site. It is considered either a potential or an incomplete pathway if there is no evidence that at least one of the elements above are, have been, or will be present, or that there is a lower probability of exposure. The exposure pathway elements for arsenic in Little Black Creek surficial floodplain soils are shown in Table 2 below:

Table 2. Exposure pathways evaluated for arsenic in Little Black Creek surficial floodplain soils, Muskegon County, Michigan.

Source	Environmental Transport and Media	Chemicals of Interest	Exposure Point	Exposure Route	Exposed Population	Time Frame	Status
Various pollution sources to Little Black Creek	Transfer of sediment to adjacent soil areas during flooding	Arsenic	Soil	Incidental ingestion, dermal, inhalation	Persons living near to the creek, recreational users of creek	Past	Complete
						Present	Complete
						Future	Complete
NOTE: THE PRESENCE OF A COMPLETE EXPOSURE PATHWAY IN THIS TABLE DOES NOT IMPLY THAT AN EXPOSURE WOULD BE SUBSTANTIVE OR THAT AN ADVERSE HEALTH EFFECT WOULD OCCUR.							

Persons playing next to the creek will be exposed to the soil, especially where the soil is bare and not covered by grass or other vegetation. However, based upon the *Environmental Contamination* analysis, the only exposure of potential public health concern is that to arsenic, which is discussed further in the *Toxicological Evaluation* section below.

Toxicological Evaluation - Arsenic

Arsenic is a naturally occurring element that is widely distributed in the earth's crust. Some nutritional studies indicate that arsenic may be a nutrient essential for good health. Inorganic arsenic compounds have been used in the past to preserve wood. Organic arsenic compounds are used as pesticides and herbicides (ATSDR 2000).

Perhaps the single most common and characteristic sign of oral exposure to inorganic arsenic is the appearance of skin ailments: hyperkeratinization (thickening) of the skin, especially on the palms and soles; formation of multiple hyperkeratinized corns or warts; and hyperpigmentation (darkening, usually a speckled pattern) of the skin with some hypopigmentation (loss of pigmentation). These effects are usually the earliest observable signs of chronic (long-term) exposure to arsenic. These dermal effects have been reported at drinking-water doses of 0.01-0.1 milligrams of arsenic per kilogram body weight per day (mg/kg/day; ATSDR 2000). Using default health-assessment assumptions, a 10-kg child unintentionally eating 200 mg soil (less than 1/8 teaspoon) containing 35 ppm arsenic would consume 0.007 mg/kg/day arsenic. It is not likely that a child, or an adult (who would weigh more and consume less soil, resulting in a lower ingestion dose), would experience these dermal effects after long-term exposure to the floodplain soils around Little Black Creek.

Other symptoms of chronic arsenic toxicity include sensory effects, such as particularly painful dysesthesia (an unpleasant, abnormal sensation) or a "pins and needles" sensation. A reversible bone marrow depression may occur. Anemia is common in chronic arsenic toxicity (ATSDR 1990). Because the most common health effect (dermal changes) is not expected to occur following exposure to Little Black Creek floodplain soils, these other health effects also are not expected.

Direct dermal contact with arsenic might cause local irritation and contact dermatitis. The effects may be mild but might progress to papules (inflamed pimples) and vesicles (blisters or cysts) in extreme cases (ATSDR 2000). The concentrations of arsenic in the floodplain soils around Little Black Creek are not expected to cause these effects.

Inorganic arsenic has been classified as a human carcinogen (EPA 1998). Several studies have shown that long-term ingestion of arsenic in drinking water can increase the risk of various forms of cancer. However, this is not an exposure pathway at this site. Long-term ingestion of soil containing arsenic might increase the risk of skin cancer (ATSDR 2000). Arsenic-associated skin cancer often arises from the dermal changes discussed previously. These dermal changes should not occur at this site due to the low frequency of exposure expected. Therefore, no increased cancer risk is expected.

Physical Hazard

During the soil sampling, MDCH and MDEQ noticed that the boardwalk overlooking the wetland between Johnny O. Harris Park and the Mona View Cemetery was in unsafe condition. Many boards were rotted through or missing (Figure A10, in Appendix A). Persons walking out onto the boardwalk could injure themselves if they fell through or fell off the structure. There is no sign warning pedestrians of this safety hazard nor is access restricted to the boardwalk.

Children's Health Considerations

Children may be at greater risk than adults from exposure to hazardous substances at sites of environmental contamination. Children engage in activities such as playing outdoors and hand-to-mouth behaviors that could increase their intake of hazardous substances. They are shorter than most adults, and therefore breathe dust, soil, and vapors found closer to the ground. Their lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. The developing body systems of children can sustain permanent damage if toxic exposures are high enough during critical growth stages. Even before birth, fetuses are forming the body organs they need to last a lifetime. Injury during key periods of prenatal growth and development could lead to malformation of organs (teratogenesis), disruption of function, and premature death. Exposure of the mother could lead to exposure of the fetus, via the placenta, or affect the fetus because of injury or illness sustained by the mother (ATSDR 1998). The obvious implication for environmental health is that children can experience substantially greater exposures to toxicants in soil, water, or air than adults can.

Children might spend more time along the banks of Little Black Creek than would adults, thus increasing frequency and duration of exposure to floodplain soils. Research suggests that children may not detoxify some chemicals as efficiently as adults. Research also suggests that exposure to arsenic may cause neurobehavioral deficits in children, however the exposure was via drinking water and not soil. Arsenic in soil may be less bioavailable than that in water. The World Health Organization (WHO) recommended action level for total excreted (urinary) arsenic is 100 micrograms per liter. In a study of arsenic exposure near smelter sites, where soil arsenic concentrations are high (100-200

ppm), the urinary arsenic levels of children living near these sites, while higher than levels of children without excess exposure, were still well below the WHO action level (ATSDR 2000). The maximum concentration of arsenic found in soils adjacent to Little Black Creek was 35 ppm. It is *not* expected that children in the Little Black Creek area would be exposed to arsenic levels of concern in floodplain soils.

Community Health Concerns

MDCH is not aware of any community health concerns regarding exposure to the soil. Most concerns regarding Little Black Creek pertained to the contaminated sediment. These concerns were addressed in the previous consultation (ATSDR 2006).

Conclusions

Concentrations of pesticides, PCBs, SVOCs, VOCs, and metals in surficial floodplain soils along Little Black Creek in Muskegon County, Michigan pose **no apparent public health hazard**. (For a definition of the ATSDR Public Health Hazard categories, please see Appendix D.)

The old boardwalk at the wetland between Johnny O. Harris Park and the Mona View Cemetery poses a **physical hazard**.

Recommendations

Remove or repair the boardwalk at the wetland between Johnny O. Harris Park and the Mona View Cemetery.

Public Health Action Plan

The City of Muskegon Heights is responsible for repairing the boardwalk. MDCH advised the city Department of Public Works of the agency's concerns on July 5, 2006.

If any citizen has additional information or health concerns regarding this public health consultation, please contact the MDCH Division of Environmental and Occupational Epidemiology at 1-800-648-6942. ATSDR and MDCH remain available for further consultation on this site.

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References

Agency for Toxic Substances and Disease Registry (ATSDR). Case Studies In Environmental Medicine: Arsenic Toxicity. Atlanta: US Department of Health and Human Services; 1990.

Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR, Division of Health Assessment and Consultation. Guidance on Including Child Health Issues in Division of Health Assessment and Consultation Documents. July 2, 1998.

Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Arsenic. Atlanta: US Department of Health and Human Services; 2000 Sept.

Agency for Toxic Substances and Disease Registry (ATSDR). Health consultation concerning Little Black Creek sediments (Responsiveness Summary). Atlanta: US Department of Health and Human Services; 2006 July 12.

Michigan Department of Environmental Quality (MDEQ). Operational Memorandum No. 1 to interested parties from Andrew W. Hogarth, Remediation and Redevelopment Division (RRD) concerning Part 201 Cleanup Criteria and Part 213 Risk-based Screening Levels. Lansing, Michigan. December 10, 2004.

Michigan Department of Environmental Quality (MDEQ). Laboratory data sheets concerning contaminant levels in floodplain soils along Little Black Creek. Lansing, Michigan. 2006.

US Environmental Protection Agency (EPA). Integrated Risk Information System – Arsenic (Inorganic), CASRN 7440-38-2. Accessed 2006. http://www.epa.gov/iris/subst/0278.htm

Appendix A. Locations of surficial floodplain soil sampling conducted along Little Black Creek, Muskegon County, Michigan on May 23, 2006.

Refer to Figure 2 for a map of sampling locations.

Surficial soil samples FP1 and FP2 were taken near the corner of Debaker Road and Violet Avenue, upstream of the defunct Marathon Petroleum Refinery, near the headwaters of Little Black Creek (Figure A1). MDCH and MDEQ staff selected areas along the bank of the drain that were relatively level. FP2 was upstream of FP1. There was evidence of children living and playing in the vicinity.

Figure A1. Little Black Creek floodplain sampling locations FP1 and FP2, Muskegon County, Michigan.

Sampling staff investigated the banks of the creek at the end of Frost Street, off of Violet Avenue, but decided that the banks were too steep to warrant sampling (no transfer of sediments would be expected). Similarly, staff chose not to sample the creek where it crosses Laketon Avenue because the banks appeared too steep for sediment transfer. Between these two locations, Little Black Creek runs as a drain along Walker Road, next to the defunct Marathon refinery. Sampling staff decided that, although access was possible, exposure was not likely here because it does not appear attractive for loitering (too near the roadway and occasional odors from the facility).

At the crossing at Evanston Avenue, the banks of the creek on the south side of the road appeared too steep to warrant testing. On the north side of the road, the creek passes

through residential yards and has easy access. However, results from past sediment testing near this area did not indicate a need for adjacent soils testing.

FP3 was taken along Black Creek Road (Figure A2).

Figure A2. Little Black Creek floodplain sampling location FP3, Muskegon County, Michigan.

Sampling staff drove down an old railroad grade upstream of the wetland that the creek enters by US-31. FP4 was taken from within a marshy area (Figure A3). (FP4 was upstream from FP3.) Although this area did not initially appear attractive for public use, there was evidence of bicycle or motorbike use along the railroad grade and people may enter the marsh for wildlife viewing.

Figure A3. Little Black Creek floodplain sampling location FP4, Muskegon County, Michigan.

Accessibility of Little Black Creek from Roberts Street was questionable. Therefore, MDCH and MDEQ did not sample from this area.

Because there is historic information available regarding soil contamination at the Peerless Plating Superfund site, near Sherman Boulevard and Getty Street, staff did not sample from this area.

Proceeding downstream, the next area of the creek that has easy access and could potentially transfer sediments to adjacent soils was Johnny O. Harris Park. MDCH and MDEQ took five samples at this location, two from areas that had been mown and three from areas closer to the creek bank with tall grass (Figures A4-A7). During this sampling event, agency staff noticed that the downstream area of the park, near Summit Avenue, had been excavated recently. (Further downstream, along Mona View Drive, new sewer lines were being installed.) Therefore, sampling staff did not take samples at the downstream end of Johnny O. Harris Park.

Figure A4. Little Black Creek floodplain sampling location FP5, Muskegon County, Michigan.

Figure A5. Little Black Creek floodplain sampling location FP6, Muskegon County, Michigan.

Figure A6. Little Black Creek floodplain sampling location FP7, Muskegon County, Michigan.

Figure A7. Little Black Creek floodplain sampling locations FP8 and FP9, Muskegon County, Michigan.

There is a small wetland between Johnny O. Harris Park and the Mona View Cemetery. The wetland is bordered on the western side by a small woodlot that has a footpath going through it (Figure A8). There is a dilapidated boardwalk overlooking the marsh along this side (Figures A9 and A10). The eastern bank of the wetland has a tall and steep slope, on top of which are private residences. Wetlands typically serve as protection from flooding, and it did not appear that the creek could overflow in this area. Therefore, MDCH and MDEQ did not sample from this area.

Figure A8. Footpath next to wetland between Johnny O. Harris Park and Mona View Cemetery, Muskegon County, Michigan

Figure A10. Dilapidated boardwalk overlooking wetland between Johnny O. Harris Park and Mona View Cemetery, Muskegon County, Michigan

Figure A9. Sign by boardwalk along footpath next to wetland between Johnny O. Harris Park and Mona View Cemetery, Muskegon County, Michigan

Proceeding downstream from the wetland, Little Black Creek crosses under Mona View Drive (Figure A11). There is a footbridge over the creek next to the road (Figure A12). Sewer line work and road construction were occurring along Mona View Drive beyond the creek crossing. Although this section of the creek may be prone to flooding, its proximity to the road likely makes it less attractive for extended recreation. Therefore, MDCH and MDEQ did not sample at this location.

Figure A11. Mona View Drive approaching Little Black Creek, Muskegon County, Michigan

Figure A12. Footbridge over Little Black Creek at Mona View Drive, Muskegon County, Michigan

After Little Black Creek crosses Mona View Drive, it enters a large wetland. The creek exits the wetland near Airline Road, passing under the road and a railroad bridge (Figure A13). Anecdotal evidence provided to MDCH indicated that people sometimes fish from the railroad bridge. Although there is access to the creek, there is no path and the way appears difficult. MDCH and MDEQ did not sample from this area.

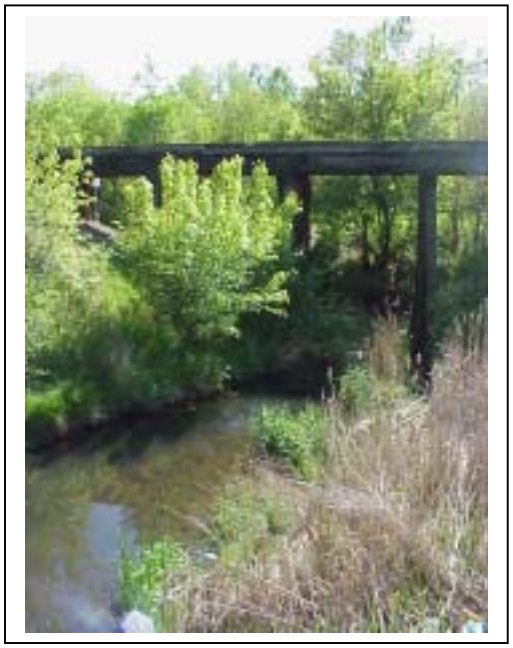

Figure A13. Little Black Creek at Airline Road and railroad, Muskegon County, Michigan

FP10 was taken from Mona Park, slightly upstream from where Little Black Creek empties into Mona Lake (Figure A14).

Figure A14. Little Black Creek floodplain soil sampling location FP10, Muskegon County, Michigan

Appendix B. Analytes tested for in surficial floodplain soil samples taken May 23, 2006 along Little Black Creek, Muskegon County, Michigan.

Pesticides and PCBs

4,4'-Dichlorodiphenyldichloroethane (DDD)
4,4'-Dichlorodiphenyldichloroethylene (DDE)
4,4'-Dichlorodiphenyltrichloroethane (DDT)
alpha-Lindane
alpha-Chlordane
Aldrin
Aroclor 1016
Aroclor 1221
Aroclor 1232
Aroclor 1242
Aroclor 1248
Aroclor 1254
Aroclor 1260
Aroclor 1262
Aroclor 1268
beta-Lindane
delta-Lindane
Dieldrin
Endosulfan I
Endosulfan II
Endosulfan sulfate
Endrin
Endrin aldehyde
Endrin ketone
gamma-Chlordane
Heptachlor
Heptachlor epoxide
Hexabromobenzene
Lindane
Methoxychlor
Mirex
Polybrominated biphenyls (PBBs)
Toxaphene

Semivolatile Organic Compounds

1,2,4-Trichlorobenzene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,4-Dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,6-Dinitrotoluene
2-Chloronaphthalene
2-Chlorophenol
2-Methyl-4,6-dinitrophenol
2-Methylnaphthalene
2-Methylphenol (o-Cresol)
2-Nitroaniline
2-Nitrophenol
3 & 4 Methylphenol
3-Nitroaniline
4-Bromophenyl phenyl ether
4-Chloro-3-methyl-phenol
4-Chlorodiphenylether
4-Nitroaniline
4-Nitrophenol
Acenaphthene
Acenaphthylene
Anthracene
Azobenzene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(g,h,i)perylene
Benzo(k)fluoranthene
Benzyl alcohol
Bis(2-chloroethoxy)methane
Bis(2-chloroethyl)ether
Bis(2-chloroisopropyl)ether
Bis(2-ethylhexyl)phthalate
Butyl benzyl phthalate
Carbazole
Chrysene
Dibenz(a,h)anthracene
Dibenzofuran
Diethylphthalate
Dimethyl phthalate
Di-n-butyl phthalate
Di-n-octyl phthalate
Fluoranthene
Fluorene
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Indeno(1,2,3-cd)pyrene
Isophorone
Naphthalene
Nitrobenzene
N-Nitrosodimethylamine
N-Nitrosodi-n-propylamine
N-Nitrosodiphenylamine
Pentachlorophenol
Phenanthrene
Phenol
Pyrene

Volatile Organic Compounds		Metals
1,1,1,2-Tetrachloroethane	Chloromethane	Arsenic
1,1,1-Trichloroethane	cis-1,2-Dichloroethylene	Antimony
1,1,2,2-Tetrachloroethane	cis-1,3-Dichloropropylene	Barium
1,1,2-Trichloroethane	Dibromochloromethane	Beryllium
1,1-Dichloroethane	Dibromomethane	Cadmium
1,1-Dichloroethylene	Dichlorodifluoromethane	Chromium
1,2,3-Trichlorobenzene	Diethyl ether	Cobalt
1,2,3-Trichloropropane	Diisopropyl ether	Copper
1,2,4-Trichlorobenzene	Ethylbenzene	Iron
1,2,4-Trimethylbenzene	Ethyltertiarybutylether	Lead
1,2-Dibromo-3-chloropropane	Hexachloroethane	Mercury
1,2-Dibromoethane	Isopropylbenzene	Molybdenum
1,2-Dichlorobenzene	m & p Xylene	Nichel
1,2-Dichloroethane	Methyl iodide	Selenium
1,2-Dichloropropane	Methylene chloride	Silver
1,3,5-Trimethylbenzene	Methyltertiarybutylether (MTBE)	Thallium
1,3-Dichlorobenzene	Naphthalene	Vanadium
1,4-Dichlorobenzene	n-Butylbenzene	Zinc
2-Butanone (Methyl ethyl ketone)	n-Propylbenzene	
2-Hexanone	o-Xylene	
2-Methylnaphthalene	p-Isopropyl toluene	
2-Propanone (Acetone)	sec-Butylbenzene	
4-Methyl-2-pentanone (Methyl isobutyl ketone)	Styrene	
Acrylonitrile	tert-Butylbenzene	
Benzene	tertiary Butyl alcohol	
Bromobenzene	tertiary Amylmethylether	
Bromochloromethane	Tetrachloroethylene	
Bromodichloromethane	Tetrahydrofuran	
Bromoform	Toluene	
Bromomethane	trans-1,2-Dichloroethylene	
Carbon disulfide	trans-1,3-Dichloropropylene	
Carbon tetrachloride	trans-1,4-Dichloro-2-butene	
Chlorobenzene	Trichloroethylene	
Chloroethane	Trichlorofluoromethane	
Chloroform	Vinyl chloride	

Appendix C. Chemicals analyzed for in Little Black Creek floodplain soils but without Michigan Department of Environmental Quality Part 201 Criteria

Note: These chemicals were *not* detected in any surficial floodplain soil samples taken near Little Black Creek on May 23, 2006.

Pesticides and PCBs	Semivolatile Organics	Volatile Organics
delta-Lindane	2,4-Dinitrophenol	1,2,3-Trichlorobenzene
Endrin aldehyde	2,6-Dinitrotoluene	Bromochloromethane
Endrin ketone	2-Nitroaniline	cis-1,3-Dichloropropylene
	3-Nitroaniline	Methyl iodide
	4-Bromophenyl phenyl ether	p-Isopropyl toluene
	4-Chlorodiphenylether	trans-1,3-Dichloropropylene
	4-Nitroaniline	trans-1,4-Dichloro-2-butene
	4-Nitrophenol	
	Bis(2-chloroethoxy)methane	
	Bis(2-chloroisopropyl)ether	
	N-Nitrosodimethylamine	

Appendix D. ATSDR Public Health Hazard Categories

Depending on the specific properties of the contaminant(s), the exposure situations, and the health status of individuals, a public health hazard may occur. Sites are classified using one of the following public health hazard categories:

Urgent Public Health Hazard
This category applies to sites that have certain physical hazards or evidence of short-term (less than 1 year), site-related exposure to hazardous substances that could result in adverse health effects. These sites require quick intervention to stop people from being exposed. ATSDR will expedite the release of a health advisory that includes strong recommendations to immediately stop or reduce exposure to correct or lessen the health risks posed by the site.

Public Health Hazard
This category applies to sites that have certain physical hazards or evidence of chronic (long-term, more than 1 year), site-related exposure to hazardous substances that could result in adverse health effects. ATSDR will make recommendations to stop or reduce exposure in a timely manner to correct or lessen the health risks posed by the site.

Indeterminate Public Health Hazard
This category applies to sites where critical information is lacking (missing or has not yet been gathered) to support a judgment regarding the level of public health hazard. ATSDR will make recommendations to identify the data or information needed to adequately assess the public health risks posed by this site.

No Apparent Public Health Hazard
This category applies to sites where exposure to site-related chemicals might have occurred in the past or is still occurring, but the exposures are not at levels likely to cause adverse health effects. ATSDR may recommend any of the following public health actions for sites in this category:

- cease or further reduce exposure (as a preventive measure)
- community health/stress education
- health professional education
- community health investigation.

No Public Health Hazard
This category applies to sites where no exposure to site-related hazardous substances exists. ATSDR may recommend community health education for sites in this category.

For more information, consult Chapter 9 and Appendix H in the 2005 ATSDR Public Health Assessment Guidance Manual (http://www.atsdr.cdc.gov/HAC/PHAManual/index.html).

Certification

This **Little Black Creek Sediments – Floodplain Soil Sampling Results** Health Consultation was prepared by the Michigan Department of Community Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures. Editorial review was completed by the cooperative agreement partner.

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The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

Team Leader, CAPEB, DHAC, ATSDR