FINAL HEALTH CONSULTATION

TEN MILE/LANGE/REVERE DRAINAGE SYSTEM

RESPONSE TO PUBLIC COMMENTS

ST. CLAIR SHORES, MACOMB COUNTY, MICHIGAN

EPA FACILITY ID: MIN000508305

Prepared by

Michigan Department of Community Health
Under a Cooperative Agreement with
Agency for Toxic Substance and Disease Registry

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Abbreviations and Acronyms

1E-3 L/cm^2	one milliliter per square centimeter
µg/day	micrograms per day
µg/dl	micrograms per deciliter
µg/kg	micrograms per kilogram
µg/kg/day	micrograms per kilogram per day
µg/L	micrograms per liter
µg/mg	micrograms per milligram
AE_d	dermal absorption efficiency
AE_i	ingestion absorption efficiency
AF	adherence factor
AT	averaging time
ATSDR	Agency for Toxic Substances and Disease Registry
BW	body weight
CDC	Centers for Disease Control and Prevention
CF	conversion factor
CLP	Contract Laboratory Program
cm	centimeters
cm^2	square centimeters
CREG	Cancer Risk Evaluation Guide
CSF or SF	cancer slope factor
DCC	MDEQ Direct Contact Criteria
DF	age-adjusted soil dermal factor
ED	exposure duration
EF	exposure frequency
EF_d	dermal exposure frequency
EF_i	ingestion exposure frequency
EV	event frequency
GCC	MDEQ Groundwater Contact Criteria
IEUBK model	Integrated Uptake Exposure Biokinetic Model for Lead in Children
IF	age-adjusted soil ingestion factor
kg	kilogram
LHRP	Lead Hazard Remediation Program
LOAEL	Lowest Observed Adverse Effect Level
m^2	square meters
MDCH	Michigan Department of Community Health
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
MDPH	Michigan Department of Public Health
mg/kg	milligrams per kilogram
mg/kg-day	milligram per kilogram per day
ml	milliliter
MRL	Minimal Risk Level
NOAEL	No Observed Adverse Effect Level
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl

ppb	parts per billion (µg/L)
ppm	parts per million (mg/kg)
PWO	Macomb County Public Works Office
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
SA	skin surface area
SP	skin penetration per event
START	Superfund Technical Assessment and Response Team
SVOC	semivolatile organic compound
SWQD	Surface Water Quality Division
TFS	Toxic Free Shores
THQ	target hazard quotient
TR	target cancer risk
U.S. EPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

Summary

Testing of canal sediments prior to a dredging project in St. Clair Shores, Macomb County, Michigan, revealed high levels of polychlorinated biphenyls (PCBs). The resulting investigation found that the storm water sewer of the Ten Mile/Lange/Revere Drainage System, which discharges to the tested canal, had been contaminated by what was likely an illicit release of the chemicals into a storm drain. Water and sediment samples from the storm sewers, catch basins, sanitary sewers, and the Lange/Revere Canal had PCBs and lead at levels of concern. Water sampled from a pond that occasionally receives canal water had a high concentration of PCBs. An air sample taken near where the storm sewer discharges into the canal indicated a PCB air concentration of concern. Soil testing of residential yards irrigated with canal water did not show PCBs at levels of concern, but did reveal concentrations of arsenic above the state generic clean-up criterion.

The levels of PCBs, lead, and other chemical of interest in the sewer systems and the Lange/Revere Canal pose no apparent public health hazard. The PCBs in the air near the sewer outlet to the canal pose no apparent public health hazard. Soil levels of arsenic pose an indeterminate health hazard.

The contamination should be addressed by regulatory authorities so that further environmental degradation, which could lead to adverse public health effects, does not occur. Residents should avoid contact with the canal until the contamination has been addressed. Residential yard soils should be further evaluated, to determine if a health hazard exists, and remediated if necessary.

Purpose and Health Issues

The purpose of this health consultation is to assess the public health implications associated with the PCB contamination of the sanitary and storm water sewer systems of, and the canal connected to, the Ten Mile/Lange/Revere Drainage System (Ten Mile Drainage System) in St. Clair Shores, Macomb County, Michigan. The US Environmental Protection Agency (EPA) and the Macomb County Health Department requested a public health assessment from the federal Agency for Toxic Substances and Disease Registry (ATSDR). The Michigan Department of Community Health (MDCH) conducts assessments for ATSDR under a cooperative agreement.

MDCH and ATSDR consider environmental data and community health concerns when forming a health opinion. Health outcome data (morbidity and mortality) might be considered as well. Based on their conclusion, the agencies then make recommendations to ensure public safety and health. This consultation will address specific health concerns in the Community Health Concerns section and its related appendix. Other non-health related questions or issues regarding the PCB contamination will not be discussed but will be referred to the appropriate agency.

Background

In July 2001, as part of the permitting application process for proposed dredging activities, a private consultant hired by Macomb County collected for chemical analysis sediment samples from the Lange/Revere Canal (the Canal) located in the city of St. Clair Shores, Michigan (Figure 1). Elevated levels of PCBs were found in the samples. The county notified the US Army Corps of Engineers and the Michigan Department of Environmental Quality (MDEQ) of the results. Subsequent testing verified the results.

The Canal receives storm water from the Ten Mile Drainage System and empties into Lake St. Clair, which empties into Lake Erie via the Detroit River. The drainage system is bordered to the north by Bon Brae Avenue, to the east by Jefferson Avenue, to the south by Lange Avenue, and to the west by Harper Avenue (Figure 2).

In December 2001, MDEQ began an investigation of the storm water system upstream of the storm water outfall into the Canal, to determine if there was an upstream source. In addition, the Macomb County Public Works Office (PWO) hired an environmental consultant to collect samples from the Ten Mile Drainage System. Sample results confirmed that elevated levels of PCBs were present in the Canal and storm water sewer. On March 4, 2002, MDEQ notified EPA Region 5 of the presence of elevated levels of PCBs in the Canal. MDEQ requested technical assistance from the EPA in assessing the possible source and the range of contamination of the PCBs. The storm water and sanitary sewer systems and the Canal are located within a primarily residential area with small commercial businesses. According to a preliminary review of city and county records, there are no known current or historic industrial properties in the immediate area (EPA 2002a, b).

On March 5, 2002, EPA requested technical assistance to conduct an emergency site assessment of storm water sewers and the Canal to determine the scope of contamination of the PCBs and the threat to human health and the environment. On March 6, 2002, the Superfund Technical Assessment and Response Team (START) arrived at the site to assist with the investigation. START, with assistance from the City of St. Clair Shores and the US Coast Guard, began collecting samples from the storm water sewer system in order to determine the extent of PCB contamination. Sediment and water samples were collected, or when sediment was inaccessible, a wipe sample was collected. The samples were analyzed for PCBs and total Resource Conservation and Recovery Act (RCRA) metals.[1] Several sediment and water samples were analyzed for volatile and semivolatile organic compounds (VOCs and SVOCs), pesticides, and additional metals. Real-time air monitoring was performed at each sample location. START also collected water and wipe or sediment samples from the sanitary sewer system along Bon Brae Avenue as part of the drainage system investigation. The majority of samples collected in the sanitary system were wipe and water samples due to the inaccessibility of sediment at the sample locations (EPA 2002a, b).

[1] RCRA metals are arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver.

On March 7, 2002, PWO installed a steel weir at the head of the Canal at the discharge point for the storm sewer drainpipe to prevent additional sediment from entering Lake St. Clair (EPA 2002a, b).

On March 12, 2002, START began collecting sediment samples from the Canal in order to determine the vertical and horizontal extent of sediment contamination in the waterway. Core samples were collected every six inches, to 24 inches depth, and analyzed for PCBs and RCRA metals. The investigators also collected Canal water for analysis (EPA 2002a, b).

Preliminary analytical data revealed PCB contamination of both the storm and sanitary sewer systems. The results from the storm sewer samples were much greater than those from the sanitary sewer. The data indicated an area of high levels of PCB contamination near the intersection of Bon Brae and Harper Avenues, suggesting that that area was the point of entry for PCBs into the drainage system. Dye testing was performed in the drainage system at a car wash located at the intersection. The test results indicated that the parking lot drains are connected to the storm sewer system and those in the car wash bays are connected to the sanitary sewer system. The MDEQ and START collected samples from the drains and catch basins on the car wash property and submitted them for analysis (EPA 2002a, b).

Sediment samples collected from the Canal showed elevated PCB concentrations near the storm water drainage outlet. Higher PCB concentrations were detected in the surficial sediment samples (from zero to six inches), and concentrations generally decreased with depth. High concentrations of various RCRA metals were also found in the Canal sediment. Samples collected from the outlet of the Canal, near Lake St. Clair, had much lower PCBs concentrations, indicating that the contamination in the Canal was a result of storm water discharge rather than an influx from Lake St. Clair (EPA 2002a, b).

EPA, acting on a request from the City, sampled the sanitary sewer line of one private residence on March 25 and April 4, 2002. The resident had recently hired a sanitary sewer service company to remove roots from the connection running from the house into the sanitary sewer on Bon Brae Avenue. The resident was concerned, upon hearing about the contamination in the Ten Mile Drainage System, that contaminated debris may have been introduced into the home's sewer line. Wipe samples were taken twice from the inside structure of clean-out ports for a weeping tile (drainage tile placed at the outside of the bottom of the basement foundation) and for the sanitary sewer connection line (Tetra Tech EMI 2002).

Following recommendations from the state and local health departments, EPA collected soil samples from the front and back yards and gardens of selected residences along the Canal on Ten Mile Road and Lange and Revere Avenues on July 25, 2002. Selection was based on information collected from the residents regarding use of Canal water for irrigation. Samples were analyzed for PCBs and RCRA metals to determine if any contamination in the Canal was being transferred to residential soils. Residents whose yards were sampled were notified of their individual results by the Macomb County

Health Department. The county health department also notified the remaining homeowners along the Canal about the testing, indicating that some tested yards had concentrations of arsenic above the state residential clean-up criterion, that more information would be gathered, and that residents would be kept informed of the situation (Macomb County Health Department 2002a, b, c).

On March 13, 2002, a public meeting hosted by EPA was held with local residents to discuss the sampling events and preliminary analytical data. The City of St. Clair Shores, PWO, Macomb County Health Department, and MDEQ participated in the meeting as well. An information repository was established at the St. Clair Shores Public Library, and information was posted and is kept up-to-date on the city's website. Sampling location maps were also posted at City Hall (EPA 2002a, b).

On May 16, 2002, Toxic Free Shores (TFS), a coalition of concerned citizens and environmental organizations, released a statement that included nine demands for immediate action and a list of questions regarding the PCB event (Appendix A). The demands were addressed by federal, state, and local officials involved in the investigation (Appendix B). On June 5, 2002, TFS hosted a public forum in St. Clair Shores to share information with the public and gather questions and concerns for the involved agencies. On June 17, 2002, the coalition hosted a public meeting, inviting the agencies to respond to the nine demands issued in May and to dialogue with residents. Representatives from EPA, ATSDR, MDEQ, MDCH, PWO, the Macomb County Health Department, and the City of St. Clair Shores participated in the meeting.

On August 14, 2002, the City of St. Clair Shores sponsored an informational forum to update residents on the progress of the cleanup. Representatives from the agencies attending the June 17 meeting were present to speak one-on-one with residents.

On February 6, 2003, the City of St. Clair Shores hosted a public meeting to update residents on the cleanup. Representatives from the agencies attending the previous meetings were present to address community concerns and answer questions. At this meeting, the community requested an extension of the public comment period for the draft health consultation released by MDCH so that the community could have its experts review the data. The comment period was extended an additional 60 days.

Updates were and continue to be sent by the City of St. Clair Shores to the residents living near the Canal and the Ten Mile Drainage System. Appendix C is a copy of the first informational newsletter delivered to area residents. Appendices B and D contain the May/June and July/August 2002 issues, respectively, of the Inside St. Clair Shores newsletter articles, published by the city, titled "PCB Information and Investigation: Just the Facts on the 10-Mile Drainage District", copies of which were hand-delivered or mailed to homeowners and businesses in the area and available at the city's website.

Discussion

Data Analysis

Environmental samples taken by the EPA and MDEQ were analyzed by Clayton Group Services (Novi, Michigan) and AAC Trinity (Farmington Hills, Michigan), facilities enrolled in EPA's Contract Laboratory Program (CLP). This program was developed to fill the need for legally defensible results supported by a high level of quality assurance (i.e., data of known quality) and documentation. Prior to becoming CLP certified, analytical laboratories must meet stringent requirements for laboratory space and practices, instrumentation, personnel training, and quality control (EPA 1989).

When MDCH received the data packages from START, a toxicologist reviewed the data validation reports to identify any qualifiers, or codes, associated with the data. Qualifiers are attached to certain data by either the laboratories conducting the analyses or by technicians performing data validation. These qualifiers often pertain to quality assurance/quality control (QA/QC) deviations and generally indicate questions concerning chemical identity, concentration, or both. Qualifiers typically seen in analytical reports are U, J, and UJ. "U" indicates that a compound was analyzed for but not detected in the sample at the detection limit listed. "J" indicates that the value given as a result is an estimate, because of QA/QC deviations. Data with this qualifier attached are still usable in an assessment, but they add uncertainty to the results and should be discussed if they contribute significantly to any risk. "UJ" indicates that the result is an estimated amount but, for QA/QC purposes, it is considered not detected. These three qualifiers were attached to some of the data pertaining to the PCB contamination of the Canal. As well, a fourth qualifier, R, was occasionally used. "R" indicates that, for QA/QC reasons, the result is unusable and therefore rejected (EPA 1989).

Upon review of the data validation reports, MDCH concurred with START's conclusions regarding acceptability of qualified data: results qualified with U or UJ were labeled as not detected, results qualified with J were accepted at their numerical value, and results qualified with R were rejected.

Canal and storm drain sediment and water samples taken by Environmental Consulting and Technology, Inc., the contractor for PWO, were analyzed by RTI Laboratories, Inc., and Midwest Analytical Services, Inc., which are not CLP-certified. Therefore, the validity of the data is questionable. Nonetheless, the data reported by these labs were compared to that for the EPA- and MDEQ-collected samples and found to be within the ranges reported by the federal and state agencies. These data are not discussed further.

Uncertainty Discussion

Risk and health assessments are not exact sciences, for they rely on the most current information available and professional judgment as a basis for recommendations on which stakeholders (e.g., the community, regulatory agencies) can base informed decisions. While scientific research has increased the understanding of effects of chemicals, many unknowns remain. Uncertainty exists at each step of the assessment process and must be acknowledged.

After a no-observed or lowest-observed adverse effect level (NOAEL or LOAEL) is determined from a key research study, numbers called "uncertainty factors" are applied to that value in order to achieve an acceptable level of protection. These factors attempt to account for converting the dose from a LOAEL to a NOAEL (if none of the doses in the key study resulted in no adverse effects), extrapolating animal results to possible human health effects, accounting for a study that was less-than-lifetime (subchronic) to long-term (chronic), and protecting sensitive subgroups within a population, such as children or those whose immune system is impaired.

Analytical data results introduce uncertainty. A result represents a snapshot of a chemical in a medium at a particular time. A second sample, whether taken immediately after the first or weeks later, would not necessarily yield the same value, due to degradation or movement of the compound, or because the compound is not in a homogeneous mixture with the medium. Qualified data indicate uncertainties in analyte identification or concentration or both. Matrix interferences, such as when contaminants exist in the tested media at concentrations above the maximum reporting limit for a specific method or machine, can make the chemical picture to be drawn blurred or obscure. Identifying the specific mixtures of PCBs, called Aroclors, becomes more of an art than a science when the PCBs have aged and are not 100 percent comparable to a standard.

When estimating doses to which certain populations may be exposed, assessors must use assumptions about the behavior and characteristics of that population. Default values are used unless site-specific information is obtainable.

Two terms linked with uncertainty are accuracy and precision. "Accuracy" defines how close an obtained value is to the actual, true value. It is dependent on research dose spacing, QA/QC adherence, and the skill of the technician, among other factors. "Precision" defines how close repeated observations are to each other. Precision also is dependent on QA/QC adherence and technician skill. As well, the variability within the population being studied, whether it is a highly inbred strain of laboratory rats, a diverse human population, or environmental samples separated by time and/or distance, will affect precision. Accuracy can be controlled more easily than precision. The goal of controlling these two aspects of uncertainty is to obtain adequate, representative, quality data.

Upon review of the data collected, MDCH concluded that, while uncertainty did and does exist, there was sufficient information on which to base their conclusions and recommendations. Detailed discussion of the data follows.

Environmental Contamination

Tables 1-4 show the concentrations of PCBs and metals detected in water, sewer sediment, and Canal sediment samples and the amounts of PCBs detected in wipe samples, respectively, taken by EPA or MDEQ from the Ten Mile/Lange/Revere Drainage System. Several sample locations were sampled on more than one date. In

those cases, the highest analytical result is shown for that location and medium. The analytical results from the air and soil sampling are discussed in the text.

Water

It should be noted that the water samples were not filtered. Therefore, the concentrations of PCBs detected may reflect suspended sediments and not PCBs in the water column itself.

The water concentrations in the storm and sanitary sewers and catch basins were compared to the MDEQ Groundwater Contact Criteria (GCC) for the specific chemicals. The GCC identifies a groundwater concentration that is protective against adverse health effects resulting from dermal exposures to hazardous substances in groundwater such as could be experienced by workers in subsurface excavations. The criteria are protective of only chronic, not acute, effects, and address only dermal exposure, not incidental ingestion nor inhalation of any volatiles. Although the water in the sewers and catch basins is not groundwater but rather surface-derived, the GCC is applicable for this scenario.

There were no exceedances of the concentrations of RCRA metals with corresponding GCCs in the water samples from the sewers and catch basins. However, lead does not have a GCC due to an inadequate database in this area for this chemical. The maximum concentration of lead in sewer water (270 parts per billion [ppb]) was found in the storm sewer on Harper Avenue between Ten Mile Road and Hudson Avenue (sample M4205). Qualitative discussion regarding lead in the sewers' water follows in subsequent sections.

There were exceedances of the GCC for PCBs (3.3 ppb) in samples from both sewer systems and the catch basins. The maximum concentration of PCBs in sewer water (510 ppb) was found in the storm sewer on Bon Brae Avenue, near the intersection with F Street (sample M4281). The next highest storm sewer PCB concentration, 98 ppb, occurred at the intersection of Harper and Bon Brae Avenues (sample M7178). Overall, the highest PCB concentrations in sewer water were in the storm sewers on Bon Brae Avenue. The water in the catch basins and sanitary sewers had much lower concentrations of lead and PCBs than did the storm sewers. Qualitative discussion regarding PCBs in the sewers' water follows in subsequent sections.

Full VOC/SVOC and organochlorine pesticide analyses were conducted on two of the storm sewer water samples, M4335 and M7183. None of the compounds tested for were detected in either sample except for bis(2-ethylhexyl)phthalate in sample M7183, which was detected at a concentration well below its GCC and is therefore not of interest for this assessment. Sample M7183 also underwent more extensive metal analysis. There were no exceedances of the concentrations of metals with corresponding GCCs. Calcium, lead, potassium, silicon, and titanium do not have GCCs due to an inadequate database in this area for these chemicals. The values reported for potassium and titanium (2,300 and 20 ppb, respectively) were qualified as estimates; the values for the other three metals (22,000, 11, and 2,600 ppb for calcium, lead, and silicon, respectively) were not qualified. Qualitative discussion regarding the concentrations of these five metals

follows in subsequent sections. More extensive analyses were not conducted on any sanitary sewer or catch basin water samples.

The MDEQ does not generate criteria to protect residents from adverse health effects that could be caused by dermal contact with contaminated surface water. However, the GCC may be adjusted to provide an unofficial screening level to which chemical concentrations in water samples can be compared. Residents normally would not be exposed to waters in the sewer system but would be exposed to the Canal water if they were to swim in it. Appendix E shows the steps taken to calculate adjusted GCCs for PCBs and barium, the only RCRA metal detected in the Canal water with a corresponding GCC. All of the Canal water samples met or exceeded the most protective adjusted GCC for PCBs (0.1 ppb). The concentrations were highest on the west end of the Canal. The concentrations for barium in the Canal water did not exceed the adjusted GCC for that metal. Lead also was detected in the Canal water. As mentioned earlier, this metal does not have a GCC. Qualitative discussion regarding the concentrations of lead in the water of the Canal follows in subsequent sections.

All six of the Canal water samples were analyzed for VOCs and SVOCs. Only one sample, 22501L, reported any detectable analytes, those being toluene and total xylenes at 1.8 and 3.5 ppb, respectively. Appendix E shows the steps taken to calculate adjusted GCCs for toluene and total xylenes. The concentrations of toluene and total xylenes detected in the Canal water were well below the adjusted GCCs for these compounds.

Wahby Pond, in Wahby Park at the corner of Revere and Jefferson, is occasionally refilled with water from the Canal. The pond was sampled once during the investigation and analyzed only for PCBs. The sample was taken near the inlet from the Canal (2002, D. Sawicki, EPA START, personal communication). The results indicated that 52 ppb PCBs were in the sample.

Local drinking water intakes are located on Lake St. Clair, several miles away from the Ten Mile Drainage System and the Canal, and are not considered to be at risk from the isolated PCB contamination. In March 2002, water from local drinking water intakes was sampled. According to MDEQ, these water samples did not contain detectable levels of PCBs.

Sediments

The sediment concentrations in the storm and sanitary sewers and catch basins were compared to the MDEQ Industrial Direct Contact Criteria (DCC) for the specific chemicals. The Industrial DCC identifies a soil concentration that is protective against adverse health effects resulting from long-term ingestion of and dermal exposure to contaminated soil in an industrial setting. The criteria are protective of only chronic, not acute, effects, and they do not address inhalation of any volatiles. Although the solids in the sewers and catch basins are sediments and not soils, the Industrial DCC is applied for this scenario in this assessment. An industrial land use scenario was used, rather than a commercial or residential one, because access to the sewer system by the general public is and will continue to be reliably restricted.

The PCB concentrations in the storm sewer were up to 2,000 times greater than those in the sanitary sewer or catch basins. The highest concentration found, 121,000 parts per million (ppm), was reported in the full chemical analysis for sample M4335, which was taken at the intersection of Bon Brae Avenue and E Street. In general, the highest PCB concentrations in the storm sewer sediment were found in samples taken along Bon Brae Avenue, with values exceeding 100 ppm. The only RCRA metal in the sediment samples from the sewers and catch basins that exceeded its corresponding Industrial DCC (900 ppm) was lead. This exceedance occurred in only one sample, the second sample of two taken for M4334, taken March 14, 2002 from the storm sewer near the intersection of Bon Brae Avenue and C Street. The concentrations of lead in the sanitary sewer and catch basins were much less than those from the storm water sewer.

Full VOC/SVOC, organochlorine pesticide, and more extensive metal analyses were conducted on three storm water sewer (samples M4281, M4335, and M7183) and one catch basin (sample CB3467) sediment samples. Other than the PCBs, no organochlorines or pesticides were detected in these samples. However, the detection limits for these compounds were greatly elevated in the storm water sewer samples, likely because of the presence of high concentrations of PCBs. It is possible that this analytical interference could mask otherwise detectable amounts of organochlorines or pesticides. Most of the VOC/SVOCs detected were below the corresponding Industrial DCCs. Sample M4335 contained benzo(a)pyrene at 20 ppm (the criterion is 10 ppm), dibenzofuran at 2 ppm (no corresponding criterion due to an insufficient database in this area for this chemical), and p-isopropyltoluene at 0.2 ppm (not included in MDEQ's criteria). The result for dibenzofuran was an estimate (J-qualified). These chemicals are discussed further under the Toxicological Evaluation section of this document. The only metals detected that are not included in MDEQ's criteria were calcium, potassium, silicon, and titanium. These were detected in all four samples and are discussed further under the Toxicological Evaluation section of this document. The remaining metals did not exceed their corresponding criteria.

The MDEQ does not generate criteria to protect residents from adverse health effects that could be caused by dermal contact with sediments. However, the Residential DCC may be adjusted to provide an unofficial screening level to which chemical concentrations in sediment samples can be compared. Residents normally would not be exposed to sediments in the sewer system, but could be exposed to Canal sediments if they should enter the Canal to perform maintenance on their boats or retaining walls. Appendix F shows the steps taken to calculate adjusted DCCs for PCBs and arsenic, one of the RCRA metals detected in Canal sediments at concentrations exceeding its corresponding Residential DCC. (Exposure to the sediments would occur much less frequently than to soils, for which the Residential DCC is derived. Therefore, the adjusted DCC would be higher than the generic Residential DCC, and those chemicals not exceeding their corresponding generic Residential DCC would not exceed their corresponding adjusted DCC.) None of the sediment samples from the Canal exceeded the adjusted Residential DCC for arsenic. However, there were exceedances of the adjusted Residential DCC for

PCBs at all depths. Qualitative discussion regarding the concentrations of PCBs in the sediments of the Canal follows in subsequent sections.

Lead also was detected in Canal sediments at concentrations exceeding its Residential DCC. The MDEQ derived the Residential DCC for lead using the Integrated Uptake Exposure Biokinetic (IEUBK) Model for Lead in Children (TRW 1994), rather than the standard mathematical algorithm. The IEUBK Model attempts to predict blood lead concentrations for children exposed to multiple sources of lead in their environment. The level of lead in the body, usually expressed as blood levels, rather than an external dose in mg/kg-day, is used to determine the potential for adverse health effects. The MDEQ Residential DCC for lead is intended to be protective of children's blood lead levels. Because of complexities in and the inflexibility of the IEUBK model when adjusting for exposure frequency, the Residential DCC for lead was not adjusted for this assessment. Rather, qualitative discussion regarding the concentrations of lead in the sediments of the Canal follows in subsequent sections.

The highest sediment concentrations of lead in the Canal were located at the western-most end of the Canal. Sample LRC-S-09 was the eastern-most sample in the north canal that exceeded the criterion, with 470 ppm at the 6-to-12-inch depth. This sample location was about 400 feet east of the sewer outlet. Sample LRC-S-05 was the eastern-most sample in the south canal that exceeded the criterion, with 670 ppm at the 6-to-12-inch depth and 890 ppm at the 12-to-18-inch depth. This sample location was about 400 feet south of the sewer outlet, near where the connecting canal bends to the east. The remaining exceedances occurred between these two sample locations.

The results for the wipe samples taken from the sewers and catch basins (Table 4) were used only qualitatively, to determine the presence of PCBs where water or sediment samples could not be obtained, and were not used quantitatively.

The wipe samples taken from the residence where the homeowner had recently hired a sanitary sewer service company to remove roots from the connection running from the house into the sanitary sewer revealed that PCBs were in the line (data not shown). It is likely that PCB-containing sludge entered the sewer line when the plumbing snake was in reverse gear.

Air

The EPA conducted ambient air sampling in areas near the locations of the highest PCB sediment concentrations in late March and mid-April. The locations were as follow: the intersections of Bon Brae Avenue and E Street; Bon Brae Avenue and F Street; Bon Brae and Harper Avenues; and Lange Avenue at the bridge over the Canal. Background samples were taken near the city offices, near Jefferson Avenue and 11 Mile Road. Analysis was done only for PCBs. The MDEQ does not generate inhalation screening levels for PCBs because of an inadequate database for that chemical in that area. However, ATSDR has set the Cancer Risk Evaluation Guide (CREG) for PCBs in air at 0.01 micrograms per cubic meter ($\mu g/m^3$; ATSDR 2002a). CREGs are screening levels for carcinogens (cancer-causing chemicals). If the concentration of a carcinogen of

interest exceeds its CREG, it does not necessarily mean that exposure to that concentration will result in the development of cancer. Rather, further evaluation of the exposure scenario is necessary to determine implications to public health. Only one of the eight air samples exceeded the CREG for PCBs in air, that taken at the bridge over the Canal on Lange Street, at 0.016 µg/m^3. Discussion regarding the concentration of PCBs in the Lange Street air sample follows in subsequent sections.

Soils

EPA surveyed the residents along the Canal to determine the properties most likely to have any PCB contamination in the soil based on canal water usage and the concentrations of PCBs in the Canal sediment and water near those properties. Sixteen yards were sampled along Ten Mile Road and Lange and Revere Avenues, including one property west of Jefferson Avenue used as a background sample. Composite samples were taken from the front yard, the back yard, and/or the garden area and analyzed for PCBs and RCRA metals. Only one sample, taken from a back yard (i.e., adjacent to the Canal), had a detectable amount of PCBs, 0.86 ppm, which is below the MDEQ Residential DCC for PCBs (data not shown). Nine of the properties had arsenic concentrations greater than the MDEQ Residential DCC of 7.6 ppm for that metal (data not shown). The highest concentration of arsenic, 81 ppm, was found in a garden. It was subsequently discovered that the previous homeowner had used chromated-copper-arsenate treated wood to enclose the raised-bed garden, which would account for the elevated concentration of arsenic. The next highest arsenic concentration found was 74 ppm, again in a garden.

Discussion with MDEQ revealed that typical background concentrations of arsenic in soils in the eastern part of Michigan are between 18 and 20 ppm (2002, C. Wilson, MDEQ Environmental Response Division Southeast Office, personal communication). The background sample taken by EPA was not analyzed for RCRA metals. If that sample has been archived and can be analyzed for arsenic, or if MDEQ conducts sampling, and the local background concentration of arsenic is determined to be greater than the generic Residential DCC, then the background concentration becomes the clean-up criterion for this site. It is possible that some of the samples that exceeded the generic Residential DCC would not be above a site-specific Residential DCC.

Additional discussion with MDEQ, EPA, and the Macomb County Health Department revealed that a portion of the homes along the Canal are built on fill and that developments like these can experience elevated concentrations of metals in the soil (2002, C. Wilson, MDEQ Environmental Response division Southeast Office, personal communication). For this reason, it is unlikely that watering from the Canal contributed to the elevated levels of arsenic in the soil samples. Nonetheless, the arsenic concentrations will be discussed further in the Toxicological Evaluation section of this document.

Consistent with the Public Health Action Plan recommended in the draft Health Consultation (ATSDR 2002c), MDEQ conducted follow-up soil sampling of residential yards that exceeded the expected background. One yard contained arsenic concentrations

at levels of concern, the highest concentration being 74 ppm. MDEQ is continuing its evaluation of these property. The remainder of the yards tested showed arsenic levels below background concentrations.

Human Exposure Pathways

To determine whether nearby residents are, have been, or are likely to be exposed to contaminants associated with a property, ATSDR and MDCH evaluate 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) an exposed population. An exposure pathway is considered complete if there is evidence that all five of these elements are, have been, or will be present at the property. Alternatively, an exposure pathway is considered complete if there is a high probability of exposure. 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 at the property, or that there is a lower probability of exposure. The table below shows the exposure pathways expected for the Ten-Mile Drainage System:

Source	Environmental Transport and Media	Chemicals of Interest	Exposure Point	Exposure Route	Exposed Population	Time Frame	Status
Illicit release of PCBs	Sewer water	PCBs, metals, VOCs, SVOCs, pesticides	Storm water sewers and catch basins, sanitary sewers	Dermal absorption, incidental ingestion, inhalation	Utility workers, professional or home-owner drain cleaners	Past	Incomplete
						Present	Incomplete
						Future	Incomplete
Illicit release of PCBs	Canal water	PCBs, metals, VOCs, SVOCs, pesticides	Lange/Revere Canal	Dermal absorption, incidental ingestion, inhalation	Swimmers, residential and visiting boaters	Past	Potential
						Present	Potential
						Future	Potential
			Wahby Pond	Dermal absorption, incidental ingestion, inhalation	Park visitors wading in the pond	Past	Potential
						Present	Potential
						Future	Potential
			Residential surface soils	Dermal absorption, incidental ingestion, inhalation	Gardeners, children playing on bare soil	Past	Potential
						Present	Potential
						Future	Potential
			Garden produce	Ingestion	Consumers of produce grown in yards along the Canal	Past	Potential
						Present	Potential
						Future	Potential
			Fish caught in the Canal	Ingestion	Local anglers	Past	Potential
						Present	Potential
						Future	Potential
Illicit release of PCBs	Sewer sediment	PCBs, metals, VOCs, SVOCs, pesticides	Storm water sewers and catch basins, sanitary sewers	Dermal absorption, incidental ingestion, inhalation	Utility workers, professional or home-owner drain cleaners	Past	Incomplete
						Present	Incomplete
						Future	Incomplete

Source	Environmental Transport and Media	Chemicals of Interest	Exposure Point	Exposure Route	Exposed Population	Time Frame	Status
Illicit release of PCBs	Canal sediment	PCBs, metals, VOCs, SVOCs, pesticides	Lange/Revere Canal	Dermal absorption, incidental ingestion, inhalation	Residents working on boats, docks, or retaining walls	Past	Potential
						Present	Potential
						Future	Potential
			Wahby Pond (sediment)	Dermal absorption, incidental ingestion, inhalation	Park visitors wading in the pond	Past	Potential
						Present	Potential
						Future	Potential
Illicit release of PCBs	Air	PCBs, metals, VOCs, SVOCs, pesticides	Ambient air	Inhalation	Ten-Mile/Lange/-Revere Drainage District	Past	Potential
						Present	Potential
						Future	Potential
NOTE: THE PRESENCE OF AN EXPOSURE PATHWAY IN THIS TABLE DOES NOT IMPLY THAT AN EXPOSURE WOULD BE SUBSTANTIVE OR THAT AN ADVERSE HEALTH EFFECT WOULD OCCUR.							

Water

It is unlikely that utility workers would be exposed to the chemicals in the sewer water if they wear the personal protective equipment required for their work. Hired professional drain cleaners or homeowners who "snake" their own drains also should not be at risk for exposure if they wear rubber gloves during the process. It is likely that such persons would choose to wear protective gloves when working with sanitary sewer lines. It is possible that a person routing a residential drain could inhale vapors from PCBs, VOCs, or SVOCs that might emerge from the drain when the plumbing snake is in reverse gear; however, the duration of that exposure would be minimal compared to that of a utility worker who would regularly be exposed to sewer water. Therefore, exposure to sewer water is considered an incomplete pathway.

Residents have raised concerns about sewer backups and potentially contaminated water and sediment entering their homes through the sanitary sewer lines (2002, C. Shoemaker, Macomb County Health Department, personal communication). Regular routing of drains should prevent backups that might occur due to tree roots penetrating the sewer system. If a basement should become flooded by a sanitary sewer backup, those persons cleaning up the water, whether they are the homeowner or a professional service, would likely be wearing protective equipment such as rubber knee boots and rubber gloves, thus minimizing or eliminating contact with the water. Even if a person were to come into contact with any contaminated water, the exposure would be brief and would not be expected to cause adverse health effects.

Recreational users of the Canal could be exposed to chemicals of interest from swimming in or splashing of the water. Visiting swimmers and boaters would have a lower frequency of exposure than residents in the immediate vicinity who would use the Canal more regularly. The frequency and location of swimming along the Canal are unknown, but MDCH assumed 60 days per year for purposes of adjusting the GCC. Boaters at the western end of the Canal would be traveling at a slow rate of speed because of limited space, and they would not likely be splashed by wake generation. Personal watercraft

(jet-ski) or non-motorized boat (e.g., canoe, kayak, or rowboat) users and people in inner tubes can approach the western end of the Canal more easily and therefore might be exposed to elevated levels of PCBs in the water. The Canal is not a drinking water source. Incidental swallowing of Canal water during recreational use of the Canal is not expected to cause adverse health effects.

Wahby Pond, in Wahby Park at the corner of Revere and Jefferson Avenues, is not intended for use as a swimming area, however, children might play at the water's edge. Because PCBs tend to adhere to sediments rather than disperse in water, it is possible that the sample from that pond contained PCB-contaminated suspended solids (sediments) rather than PCBs in the water itself. Although EPA intends to pump and treat the water in the pond (2002, D. Sawicki, EPA START, personal communication), if the sediments contain PCBs, an exposure pathway still could exist. Nonetheless, it is likely that any dermal exposure to and incidental ingestion of PCBs or other, as yet unknown, chemicals of interest in the pond water would be minimal and would not cause adverse health effects. There are decorative fountains in the pond that are currently shut off. It is possible that any PCBs, VOCs, or SVOCs in the pond water could volatilize in the fountain spray, but air concentrations would not be significant because they would disperse quickly in ambient air.

Fish taken from the Canal might have elevated concentrations of PCBs or certain metals or pesticides; however, this would be attributable to historical contamination of the Great Lakes. The 2002 Michigan Family Fish Consumption Guide (MDCH 2002) lists species of fish for which MDCH recommends limited consumption. Several species of fish from Lake St. Clair are listed in the guide[2]; however, these advisories cover the entire lake and are not specific to certain areas. The most recent available data on Lake St. Clair fish were gathered in 2000 (MDEQ 2001a). The MDEQ sampled carp, smallmouth bass, and walleye from the lake in 2001, and plans to sample carp and walleye in 2002, but the data are not yet available, nor would they necessarily alter the advisories. The Macomb County Health Department has cautioned against eating fish from the Canal (Appendix C). Some anglers might choose to eat the fish, but if they follow the advisories and prepare their catch in accordance with the Family Fish Consumption Guide, then any potential exposure would be reduced or eliminated.

Sediments

As discussed for sewer waters, it is unlikely that utility workers would be exposed to the chemicals in the sewer sediments if they wear the personal protective equipment required for their work. Hired professional drain cleaners or homeowners who "snake" their own drains also should not be at risk for exposure if they wear rubber gloves during the process. It is possible that a person routing a residential drain could inhale any PCBs, VOCs, or SVOCs that might emerge from the drain when the plumbing snake is in

[2] Species of concern in Lake St. Clair are bluegill, brown bullhead, carp, carpsucker, channel catfish, largemouth and smallmouth bass, northern pike, muskellunge, sturgeon, walleye, white bass, and white perch (MDCH 2002). Yellow perch samples have not contained enough of any contaminant to justify issuing an advisory for that species (2002, J. Filpus, MDCH Division of Environmental and Occupation Epidemiology, personal communication).

reverse gear; however, the duration of that exposure would be minimal compared to that of a utility worker who would regularly be exposed to sewer sediments.

As mentioned earlier, residents have raised concerns about sewer backups and potentially contaminated water and sediment entering their homes (2002, C. Shoemaker, Macomb County Health Department, personal communication). Regular routing of drains should prevent backups that might occur as a result of tree roots penetrating the sewer system. If a basement should become flooded by a sanitary sewer backup, those persons cleaning up the water and any sediment, whether they are the homeowner or a professional service, would likely be wearing protective equipment such as rubber knee boots and rubber gloves. Even if a person were to come into contact with any contaminated sediment, the exposure would be brief and would not be expected to cause adverse health effects.

Residents performing maintenance on their boats, docks, or retaining walls might stand in the sediment of the Canal in order to work. A child might assist in this task. If waders are worn, then exposure would be reduced or eliminated. Wearing shoes and long pants would not likely decrease exposure significantly. The possibility of sediment sticking to a person's hands long enough to be unintentionally transferred to the mouth is remote.

Children playing near the edge of Wahby Pond might be exposed to the pond's sediments. The sediments in the pond were not sampled during the investigation. Because PCBs tend to adhere to sediments rather than disperse in water, it is possible that the water sample taken from the pond contained PCB-contaminated suspended solids rather than PCBs in the water itself. Although the EPA intends to pump and treat the water in the pond (2002, D. Sawicki, EPA START, personal communication), if the sediments contain PCBs, then an exposure pathway still would exist. Nonetheless, it is likely that occasional dermal exposure to and incidental ingestion of PCBs or other, as yet unknown, chemicals of interest in the pond sediment would be minimal and would not cause adverse health effects.

Air

The CREG for a chemical in air assumes that a person is exposed continuously. While most residents living near the Canal would likely be away from the area during a portion of the day (e.g., at work or school), some retired citizens or residents who work at home and spend a substantial amount of time in the area could be exposed.

Soils

Elevated levels of arsenic were detected in soil samples taken from residential yards and gardens. While it is not likely for a person to be exposed to chemicals of interest in soil under sod, there may be bare areas of dirt such as gardens or play areas where exposure might occur. As well, garden produce might accumulate certain metals in the edible portion of the plant. The yard where samples indicated elevated levels of arsenic in the soil must be better characterized in order to determine any likely exposure scenarios and associated health implications. As stated previously, MDEQ is continuing its investigation of this property.

Toxicological Evaluation

The potential for adverse health effects that might result from exposure to contaminated media is evaluated by estimating a dose of each chemical of interest. These doses are calculated for scenarios in which individuals might be exposed to (come into contact with) the contaminated media. In order to calculate these doses, assumptions are made about the way people behave; the amount of contaminated media they may ingest, inhale, or make skin contact with; and how long and how frequently they may make contact with the contaminated media. These calculated doses are used along with chemical-specific toxicological information to evaluate the risk of noncancer and cancer health effects.

In order to assess the potential for noncancer health effects, estimated doses are compared to an ATSDR Minimal Risk Level (MRL) or the EPA's oral Reference Dose (RfD). MRLs and RfDs are doses below which noncancer adverse health effects are not expected to occur. They are derived from toxic effect levels obtained from human population and/or occupational studies and laboratory animal studies. Toxic effect levels identified from these studies may be either a NOAEL or LOAEL. Because the NOAEL is the highest dose that does not result in any adverse health effects, this effect level is preferred as the basis for an MRL or an RfD. The LOAEL is the lowest dose at which adverse health effects were seen in a study; it is used when a NOAEL cannot be identified.

Because there is uncertainty in both human and animal studies, NOAELs and LOAELs are divided by "uncertainty factors" to derive the more protective RfD or MRL. These uncertainty factors are generally in multiples of ten, but may sometimes be less, depending on the quality of the study or the seriousness of the observed adverse effect. Given the level of uncertainty in the development of RfDs and MRLs, they should not be considered as a strict line between a safe and an unsafe dose. If a calculated dose exceeds either the RfD or the MRL, it is important to consider the magnitude of the exceedance as well as the uncertainty surrounding the calculated dose before determining if noncancer health effects are likely.

Cancer risk is estimated by calculating a dose and multiplying it by a cancer potency factor, known as the cancer slope factor (CSF). Some CSFs are derived from human population or occupational studies. Most of these studies are of individuals, such as those in occupational groups, who are exposed to higher levels than the general population would be. When no human data are available, CSFs are calculated from data obtained from animal studies in laboratories. The dose of chemical to which animals are exposed in the laboratory is generally far higher than would result from environmental exposures. Use of animal data introduces additional uncertainty into the CSF because of differences in metabolism, life span, and body size between test animals and humans.

For most carcinogens, it is generally thought that an increasingly lower dose will result in a proportionally lower cancer risk. The CSF quantitatively defines this relationship between the dose and the risk of developing cancer. In order to calculate the slope factor, it is necessary to extrapolate high doses from either human or animal studies to lower, more realistic levels of exposure. Extrapolation below the observed dose level introduces

uncertainty into the CSF. Cancer risk estimates are, therefore, measures of the chance of developing cancer as a result of exposure to an estimated dose. Cancer risk estimates are generally expressed as the number of individuals in a larger population who may develop cancer (e.g., one in one million). Note that these estimates are for excess cancers that might occur as a result of exposure to chemicals at a site in addition to those cancers that would be expected to occur in an unexposed population. Cancer is a common illness. A population with no known exposure to chemical contaminants could be expected to have a substantial number of cancer cases.

PCBs

PCBs were detected at various concentrations in water and sediment samples from the sewers and the Canal and in the air. As discussed in the Exposure Pathway section, it is not likely that utility workers or those routing drains would be exposed to the PCBs in either the storm or sanitary sewers. Therefore, this discussion will focus on potential health effects resulting from exposure to PCBs in the Canal and the air.

PCBs are complex mixtures of synthetic organic chemicals with no known natural source. They exist as colorless to light yellow, oily liquids or solids. They have no known smell or taste. Some PCBs are volatile and may exist as a vapor in air. Because they don't burn easily and are good insulating materials, PCBs were used widely as coolants and lubricants in transformers, capacitors, and other electrical equipment. The manufacture of PCBs stopped in the United States in 1977 because there was evidence that the chemicals build up in the environment and may cause harmful effects. Products that may contain PCBs include old fluorescent lighting fixtures, electrical devices or appliances containing PCB capacitors made before PCB use was stopped, old microscope oil, and old hydraulic oil (ATSDR 2000b).

In general, PCBs are relatively insoluble in water. Sediments that contain PCBs can release the PCBs into the surrounding water, but the nature of the chemicals causes them to attach more strongly to soil particles rather than enter the water column. PCBs are taken up into the bodies of small aquatic organisms and fish, especially those fish that are bottom-feeders, and can accumulate through the food chain. They accumulate in the body fat and can enter breast milk. The most likely source of human exposure to PCBs is through the eating of contaminated fish, although PCBs also can be absorbed through the skin and via inhalation (ATSDR 2000b).

Long-term consumption of Great Lakes sport fish has been implicated in behavioral and learning deficits detected in children born to mothers who have eaten the fish (ATSDR 2000b). However, effects seen are not consistent across populations or across specific functions, possibly because of different susceptibilities of different populations, uncertainty about the concentration, rate, and mixture of the PCBs, or other confounders. It should be noted that epidemiological (population) studies such as these show associations rather than causation. Therefore, it cannot be concluded, as yet, that PCBs are the causative agents for the effects seen.

The MRL for chronic (one year or greater) oral exposure to PCBs is 0.02 micrograms per kilogram body weight per day (µg/kg/day). For a child weighing 10 kg, the corresponding protective dose would be 0.2 µg/day. While the concentrations of PCBs in the canal sediment are, for the most part, higher than those in the water, it is unlikely that a child would ingest the sediment itself. Rather, it is more probable that some sediments could be suspended in the water column and be ingested if any canal water were swallowed. The MDEQ Surface Water Quality Division (SWQD) Great Lakes Initiative rules indicate that a person might swallow 30 ml (0.03 liters, about ¼ cup of water) per hour of recreation in a surface water body (2002, D. Bush, MDEQ-SWQD, personal communication). If a 10-kg child swimming in the Canal for one hour were to swallow that volume, the maximum amount of PCBs ingested would be 0.17 µg (0.03 liters x 5.8 µg/L [maximum Canal-water PCB concentration]). This product is slightly below the MRL, which has protection calculated into its value. Therefore, any incidental ingestion of canal water during recreational use of the Canal is not expected, by itself, to cause adverse health effects.

If a 10-kg child were to swallow 30 ml of water from Wahby Pond, the ingested dose would be 1.56 µg (0.03 liters x 52 µg/L), which is greater than the protective dose discussed. However, exposure to the pond water is expected to be minimal and would not be expected to cause adverse health effects.

Some absorption through the skin might occur if a person were to swim or stand in the Canal; however, it is difficult to estimate an absorbed amount. At the lower PCB concentrations found at most sites of environmental contamination, the chemicals tend to adhere to organic materials in the soil and migrate through the skin less easily than pure PCBs or technical-grade PCB mixtures. In order to evaluate the potential for uptake of PCBs from the sediment in the Canal, MDCH reviewed several studies of people who have come into contact with contaminated soil. These studies indicated that people who are dermally exposed to very high soil concentrations of PCBs tend to accumulate very little of the chemicals in their bodies.

- In 1982, a Michigan Department of Natural Resources (MDNR)[3] investigation of soil contamination at an industrial site in Lansing, Michigan found up to 10,000 ppm of PCBs in the soil (ATSDR 1988). The Michigan Department of Public Health (MDPH)[4] analyzed blood samples from 10 workers at the company. The workers' blood contained between 7 and 16 ppb PCBs, within the range of values found in numerous epidemiological studies of populations *without* occupational exposure to PCBs (MDCH 1997a).

[3] As of October 1, 1995, the environmental protection and regulation functions of the Michigan Department of Natural Resources (MDNR) were transferred to the newly-formed Michigan Department of Environmental Quality (MDEQ).

[4] On April 1, 1996, the Michigan Department of Public Health (MDPH) Division of Health Risk Assessment was absorbed into the newly-formed Michigan Department of Community Health (MDCH) and the MDPH Division of Water Supply was transferred to the Michigan Department of Environmental Quality (MDEQ) Division of Drinking Water and Radiological Protection.

•In 1986, MDPH learned that some residents of Kalamazoo, Michigan collected worms for fishing bait from a closed paper company landfill where the soil was contaminated with PCBs (up to 64 ppm). The MDPH analyzed samples of nine residents' blood; these samples contained serum PCB levels between non-detect and 14.1 ppb (MDCH 1997b).

•In 1986, MDPH became aware that children were playing in the alleys near a Superfund site in Detroit where the soils were heavily contaminated with PCBs (up to 12,000 ppm in ash on the site, up to 8,800 ppm in sewer sediment from near the site [MDPH 1992]). MDPH tested the blood of 193 residents of the neighborhood. These samples contained up to 81 ppb PCBs, with an average of 10.7 ppb (MDPH 1987).

•The Indiana State Department of Health has carried out two similar studies. A study in Bloomington, Indiana, where soil PCB concentrations ranged up to 9,000 ppm, found mean serum PCB concentrations of 8.1 ppb for males and 7.8 ppb for females, comparable to those in non-exposed populations (ISDH 1992). At a site in Crawfordsville, Indiana, children who had been playing in soil or sediments containing from 0.2 to 384 ppm PCBs had serum PCB levels ranging from 3 to 9.3 ppb, with an average of 3.4 ppb (ISDH 1997).

These studies indicate that dermal exposure to PCBs in the Canal is not expected, by itself, to result in adverse health effects. Prolonged exposure to high levels of PCBs via ingestion and skin contact, collectively, could result in negative health effects. However, oral and dermal exposure to the PCBs in the Canal would be intermittent and not be expected to cause adverse health effects.

There is not an MRL for PCBs in air; however, the CREG for PCBs in air, discussed earlier, was exceeded by the sample taken at the Lange Street bridge. However, only one data point out of eight samples taken is not sufficient to conclude that adverse health effects would occur. Also, because ambient conditions will cause any vapors to dissipate, it is not likely that any air concentrations of PCBs will be consistently high enough to expect adverse health effects to occur.

Arsenic

Arsenic was detected at levels above the MDEQ Residential DCC in soil samples taken from residential yards along the Canal. The highest level detected by EPA, 81 ppm, was likely attributable to the previous resident's using pressure-treated wood to enclose the garden. Therefore, the next highest level detected, 74 ppm, by MDEQ, was evaluated for potential adverse health effects resulting from exposure to arsenic-contaminated soil.

Arsenic is a naturally occurring element. Inorganic arsenic compounds are mainly used to preserve wood ("pressure-treated" lumber). Organic arsenic compounds are used as pesticides. The organic form of arsenic is considered to be essentially harmless to humans, whereas there is concern in the health community regarding exposure to

inorganic arsenic, especially in water. Some nutritional studies indicate that arsenic may be a nutrient essential for good health (ATSDR 2000a).

The MRL for chronic oral exposure to arsenic is 0.0003 mg/kg/day. This equates to a protective dose of 0.003 mg/day for a 10-kg child or 0.021 mg/day for a 70-kg adult. If a child unintentionally eats 200 mg (0.0002 kg) of soil per day, then a soil arsenic concentration of 74 ppm (74 mg/kg) would yield a total of 0.0148 (0.015) mg of arsenic ingested per day for that child, which is five times the protective dose. It should be noted that not all the arsenic in the soil would be absorbed through the walls of the stomach and intestines and enter the child's body. The MDEQ assumes that only half the arsenic in soil will be absorbed, and the actual absorption could be much less. It should also be noted that ATSDR develops MRLs to be very protective; exceeding an MRL does not imply that adverse health effects are expected. If an adult eats 100 mg of soil per day, then a soil arsenic concentration of 74 ppm would yield a total of 0.0074 (0.007) mg of arsenic ingested per day for that adult, which is one-third of the protective dose.

EPA has classified inorganic arsenic as a human carcinogen (EPA 1988). Several studies have shown that ingestion of arsenic in drinking water can increase the risk of lung, bladder, liver, kidney, skin, or prostate cancer. 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 sign of chronic (long-term) exposure to arsenic. Direct dermal contact might cause local irritation and contact dermatitis (a rash). The effects may be mild, but they might progress to papules and vesicles in extreme cases (ATSDR 2000a).

Garden plants might accumulate arsenic by root uptake from the soil, the degree of uptake being affected by the speciation of the arsenic compound. However, even when grown on highly polluted soil or soil naturally high in arsenic, plants have been shown to accumulate comparatively low levels of the metal (ATSDR 2000a). Therefore, any arsenic that might accumulate in produce grown in yards shown to have elevated levels of arsenic is not expected to be at levels that would cause adverse health effects.

Lead

Lead was detected at various concentrations in water and sediment samples from the sewers and the Canal. As discussed in the Exposure Pathway section, it is not likely that utility workers or those routing drains would be exposed to lead in either the storm or sanitary sewers. The metal was also detected in soil samples taken from residential yards, but the concentrations found were below the MDEQ Residential DCC. Therefore, this discussion will focus on potential health effects resulting from exposure to lead in the Canal.

There is no EPA RfD or ATSDR Comparison Value for lead; however, the MDEQ Residential Drinking Water Criterion for lead is 4 ppb. This criterion is applied to a

person's primary drinking water source. The Canal is not a drinking water source. If a person were to swallow some water unintentionally while working or playing in the Canal, that exposure would be minimal and would not likely result in any health effects.

EPA and the Centers for Disease Control and Prevention (CDC) have determined that childhood blood lead concentrations at or above 10 micrograms per deciliter (µg/dl) present risks to children's health. Blood lead concentrations greater than this level have been associated with developmental delays in learning and cognition (ATSDR 1999). Children who frequently play in or on soil containing concentrations of lead greater than 400 ppm may exhibit blood lead concentrations greater than10 µg/dl. The MDCH Lead Hazard Remediation Program (LHRP) has not found children with elevated blood lead levels in areas of the state with high concentrations of lead in sediments (2002, M. Borgialli, MDCH-LHRP, personal communication). Also, any Canal sediment to which a child might be exposed would likely wash off in the Canal water prior to that child's having the opportunity to transfer the sediment to his or her mouth. Lead is poorly absorbed through the skin. Therefore, it is not expected that exposure to lead in the sediment in the Canal would result in adverse health effects.

Other Metals

Calcium, potassium, silicon, and titanium were found at various concentrations in water and sediment samples from the sewer. However, these compounds are not expected to cause adverse health effects in the Ten Mile Drainage System area since sewer workers would be wearing personal protective equipment and residents do not have access to the sewers.

VOCs/SVOCs

Benzo(a)pyrene, dibenzofuran, and p-isopropyltoluene were found at various concentrations in sediment samples from the sewer. However, these compounds are not expected to cause adverse health effects in the Ten Mile Drainage System area since sewer workers would be wearing personal protective equipment and residents do not have access to the sewers.

ATSDR Child 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 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, children are forming the body organs they need to last a lifetime. Injury during key periods of 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 than adults to toxicants that are present in soil, water, or air.

Children living in the Ten Mile Drainage System area would not be expected to have access to the storm or sanitary sewers and should not be at risk to any chemicals present in those structures. Children in the area may swim in the Canal, but exposure to the chemicals in the Canal would be intermittent. Also, children may have access to Wahby Pond, though that access would be minimal. Children playing in their yards might have contact with arsenic in bare soil; however, it is unclear what areas of the yard may be of concern.

As discussed in the Toxicological Evaluation–PCBs section, long-term consumption of PCB-contaminated fish or marine mammals has been implicated in adverse effects seen in children born to exposed mothers. Any PCBs in fish residing in the Canal may have come from the Canal or from Lake St. Clair. The Michigan Family Fish Consumption Guide indicates which fish in Lake St. Clair to avoid. Following the guide would reduce or eliminate direct or indirect exposure of children to contaminants in fish.

Community Health Concerns

Several meetings and forums were held in St. Clair Shores to provide citizens an opportunity to voice their concerns about the PCB investigation. Any health questions received were addressed immediately. Those questions and others received by MDCH or the Macomb County Health Department before and after the release of the Public Comment Draft Health Consultation are listed and more comprehensively answered in Appendices G and H, respectively. Non-health related questions are being addressed by the appropriate agencies.

Conclusions

Water

The main chemicals of interest in the water samples from the Ten Mile Drainage System and the Canal are PCBs and lead. The other chemicals evaluated (calcium, potassium, silicon, and titanium) do not pose a health hazard primarily because these chemicals were present only in the sewers and exposure is not expected to occur.

The levels of PCBs and lead found in the storm and sanitary sewers and catch basins do not pose an apparent health hazard because only utility workers wearing appropriate personal protective equipment should have access to these areas and would not be exposed. In homes where sanitary drains are cleaned by professional drain cleaners or the homeowner, any chemicals returning up the pipe on the plumbing snake should not pose a health threat because the person cleaning the drain would likely be wearing rubber gloves, at the very least, when performing this job and would not be exposed dermally. Any inhalation exposure occurring in this scenario would be brief and insignificant.

The level of PCBs in the Canal water poses no apparent public health hazard to those persons swimming in the Canal. While combined oral and dermal exposures would increase the total dose of PCBs, the exposures would be infrequent and would not be expected to cause adverse health effects.

The concentration of PCBs in the water of Wahby Pond poses no apparent public health hazard because the likelihood of a child's having regular access to the pond water and sediments is remote.

Any PCBs in fish taken from the Canals could have originated from the contaminated sediments in the Canal or elsewhere in the Great Lakes system, as PCBs are ubiquitous in the environment. Because the fish can enter and leave the Canal at any time, it cannot be determined if or to what extent the contamination of the sediments might have contributed to a fish's contaminant load.

The level of lead in the Canal water poses no apparent health hazard.

Sediments

The main chemicals of interest in the sediment samples from the Ten Mile Drainage System and the Canal are PCBs and lead. The other chemicals evaluated (benzo(a)pyrene, calcium, dibenzofuran, p-isopropyltoluene, potassium, silicon, and titanium) do not pose a health hazard because these chemicals were present only in the sewers and exposure is not expected to occur.

As discussed for water above, the levels of PCBs and lead found in the sediments of the storm and sanitary sewers and catch basins do not pose an apparent health hazard because only utility workers should have access to these areas and would not be exposed. Similarly, no apparent health hazard exists for those persons cleaning residential sanitary drains.

The concentration of PCBs in the Canal sediments poses no apparent public health hazard. Exposure would be infrequent and would not be expected to cause adverse health effects.

The lead levels in the Canal sediments pose no apparent health hazard. It is not likely that the sediments would adhere to the skin long enough to be transferred to the mouth. Dermal absorption of lead is not likely.

Air

Only one air sample of eight taken exceeded the ATSDR CREG for PCBs. As discussed earlier, one data point is not sufficient to conclude that negative health effects will occur. Therefore, the air concentrations of PCBs pose no apparent health hazard.

Soils

The levels of arsenic found in soil samples of a residential yard along the Canal pose an indeterminate health hazard. It is possible that high concentrations are in areas where exposure is not expected to occur.

Recommendations

?The contamination of sediments and water in the storm and sanitary sewers, the Canal, and Wahby Pond should be addressed. At the very least, the sediments in the sewers should be removed to prevent further contamination of the Canal, in order that adverse public health effects do not become possible.

?Discrete soil samples should be collected from residential areas to determine the levels and extent of arsenic contamination.

?To reduce the likelihood of potential exposure, residents should avoid boating, fishing, or swimming in the Canal or using the Canal water for irrigation until the contamination has been addressed. If the regulatory agencies choose to remediate the Canal, disturbing of the sediments should be minimized. After any remediation of the Canal is complete, people fishing in the Canal should follow the advice provided in the Michigan Family Fish Consumption Guide.

? Information regarding the progress of the investigation and any remediation should continue to be shared with the community via the public repository and the City's website, with public meetings or informational forums being conducted as necessary.

<u>Public Health Action Plan</u>

? EPA should take measures to address the contamination, such as removing the sediments and treating the water. EPA should coordinate efforts with MDEQ, PWO, and the City of St. Clair Shores. (A removal action was begun August 14, 2002 and completed in April 2003.)

? The MDEQ should continue the Fish Contaminant Monitoring Program and provide the data collected to MDCH so that fish advisories, including that for Lake St. Clair, can be updated as necessary.

? The MDEQ should ascertain whether the soils in yards of homes built along the Canal contain levels of arsenic above the local background. If any levels exceed the local background concentration, MDEQ should address those levels, as mandated by state law. (The MDEQ has completed the first phase of its investigation and is continuing the evaluation of one yard.)

? The Macomb County Health Department and MDCH should continue to provide health-related information to the community regarding the PCBs and other chemicals in the sewers, the Canal, and the soil.

? Several concerned citizens have requested that the health department conduct a health study of people residing next to the affected canals. At the current time, there is no plan for a health study to be performed. While it is likely that persons in the Ten Mile Drainage System area have been exposed to the chemicals of interest, the likely dose, considering exposure frequency and route, is not considered to be sufficient to cause adverse health effects.

If any citizen has additional information or health concerns regarding this health consultation, please contact the Michigan Department of Community Health, Environmental and Occupational Epidemiology Division, at 1-800-648-6942.

Preparers of Report

Michigan Department of Community Health

Christina Bush, Toxicologist

John Filpus, Environmental Engineer

Robin Freer, Resource Specialist

ATSDR Regional Representative

Mark Johnson
Regional Services, Region V
Office of the Assistant Administrator

ATSDR Technical Project Officer

Alan Yarbrough
Division of Health Assessment and Consultation
Superfund Site Assessment Branch

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Table 1. PCB Concentrations Found in Water Samples Taken from the Ten Mile/Lange/Revere Drainage System[A]

Chemical of Interest	MDEQ Generic GCC	Adjusted GCC[B]	Storm Water Sewer		Catch Basin		Sanitary Sewer		Canal		Wahby Pond	
			n	Range	n	Range	n	Range	n	Range	n	Range
Total PCBs	3.3	0.1	55	ND-510	17	0.61-12.5	10	ND-4.1	6	ND-5.8	1	52
Arsenic	4,300	NA	55	ND-46	17	ND-5.8	10	ND-11	6	ND	0	NT
Barium	14,000,000	18,355	55	20-970	17	10-90	10	40-170	6	18-26	0	NT
Cadmium	190,000	NA	55	ND-6.3	17	ND-0.85	10	ND-3.5	6	ND	0	NT
Chromium	460,000[C]	NA	55	ND-75	17	ND-15	10	ND-26	6	ND	0	NT
Lead	ID	ID	55	ND-270	17	ND-57	10	7.6-27	6	ND-9.3	0	NT
Mercury	56	NA	55	ND-0.54	17	ND-0.7	10	ND-0.34	6	ND	0	NT
Selenium	970,000	NA	55	ND-28	17	ND-7.3	10	ND-7.2	6	ND	0	NT
Silver	1,500,000	NA	55	ND-0.66	17	ND-0.9	10	ND-0.71	6	ND	0	NT

Reference: MDEQ 2002, Tetra Tech EMI 2002

GCC Groundwater Contact Criteria
ID insufficient data
n number of samples
NA not applicable for this scenario
ND not detected
NT sample not tested for chemical

Notes:
A Concentrations in parts per billion (ppb)
B The MDEQ GCC protects workers in subsurface excavations from adverse health effects that can result from coming into dermal (skin) contact with a hazardous substance. It may be adjusted to address the protection of residents who may come into contact with contaminated surface water, such as swimming in a lake. (See Appendix E.)
C More protective criterion for chromium (VI) used

Table 2. PCB Concentrations Found in Sediment Samples Taken from the Ten Mile/Lange/Revere Drainage System[A]

Chemical of Interest	Industrial DCC	Storm Water Sewer		Catch Basin		Sanitary Sewer	
		n	Range	n	Range	n	Range
Total PCBs	1	33	ND-121,000	14	0.02-28.5	2	3.9-48
Arsenic	61	33	ND-15	14	1.4-5.5	2	3.9-10
Barium	250,000	33	17-810	14	20-74	2	100-380
Cadmium	4,100	33	ND-20	14	ND-2.3	2	0.36-8.7
Chromium	17,000[B]	33	9.4-92	14	8.4-140	2	36-74
Lead	900	33	10-990	14	6.3-410	2	51-100
Mercury	1,100	33	ND-0.48	14	ND-1	2	ND-0.3
Selenium	18,000	33	ND-3.1	14	ND-1.1	2	0.45-0.54
Silver	17,000	33	ND-1.1	14	ND-0.4	2	0.1-0.3

Reference: MDEQ 2002, Tetra Tech EMI 2002

DCC Direct Contact Criteria
n number of samples
ND not detected

Notes:
A Concentrations in parts per million (ppm)
B More protective criterion for chromium (VI) used

Table 3. PCB Concentrations Found in Sediment Samples Taken at Varying Depths from the Lange/Revere Canal[A]

Chemical of Interest	Generic Residential DCC	Adjusted DCC[B]	0-6"		6-12"		12-18"		18-24"	
			n	Range	n	Range	n	Range	n	Range
Total PCBs	1	7	33	1.4-150	31	ND-4,900	12	0.36-140	5	1.5-140
Arsenic	7.6	83	33	ND-15	31	3.5-18	12	2.4-14	5	2.5-16
Barium	37,000	NA	33	23-170	31	31-250	12	50-170	5	35-150
Cadmium	550	NA	33	0.38-8.6	31	0.8-8.7	12	0.4-6.2	5	0.39-6.0
Chromium	2,500[C]	NA	33	6.6-110	31	12-100	12	9.9-80	5	12-75
Lead	440	See note D	33	28-560	31	64-930	12	34-1,400	5	44-1,200
Mercury	160	NA	33	ND-3.3	31	ND-1.5	12	ND-1.4	5	ND-0.64
Selenium	2,600	NA	33	ND	31	ND-3.1	12	ND-1.5	5	ND
Silver	2,500	NA	33	ND-2.9	31	0.11-3.3	12	ND-1.8	5	ND-1.3

Reference: Tetra Tech EMI 2002

n number of samples
NA not applicable for this scenario
ND not detected

Notes:
A Concentrations in parts per million (ppm)
B The MDEQ Residential DCC protects against adverse health effects due to long-term ingestion of and dermal exposure to contaminated soil. It may be adjusted to address the protection of residents who may come into contact with contaminated sediments, such as standing in the Lange/Revere Canal. (See Appendix F.)
C More protective criterion for chromium (VI) used
D IEUBK model does not easily allow for adjustment of the DCC for lead

Table 4. PCB Amounts Found in Wipe Samples Taken from the Ten Mile/Lange/Revere Drainage System[A]

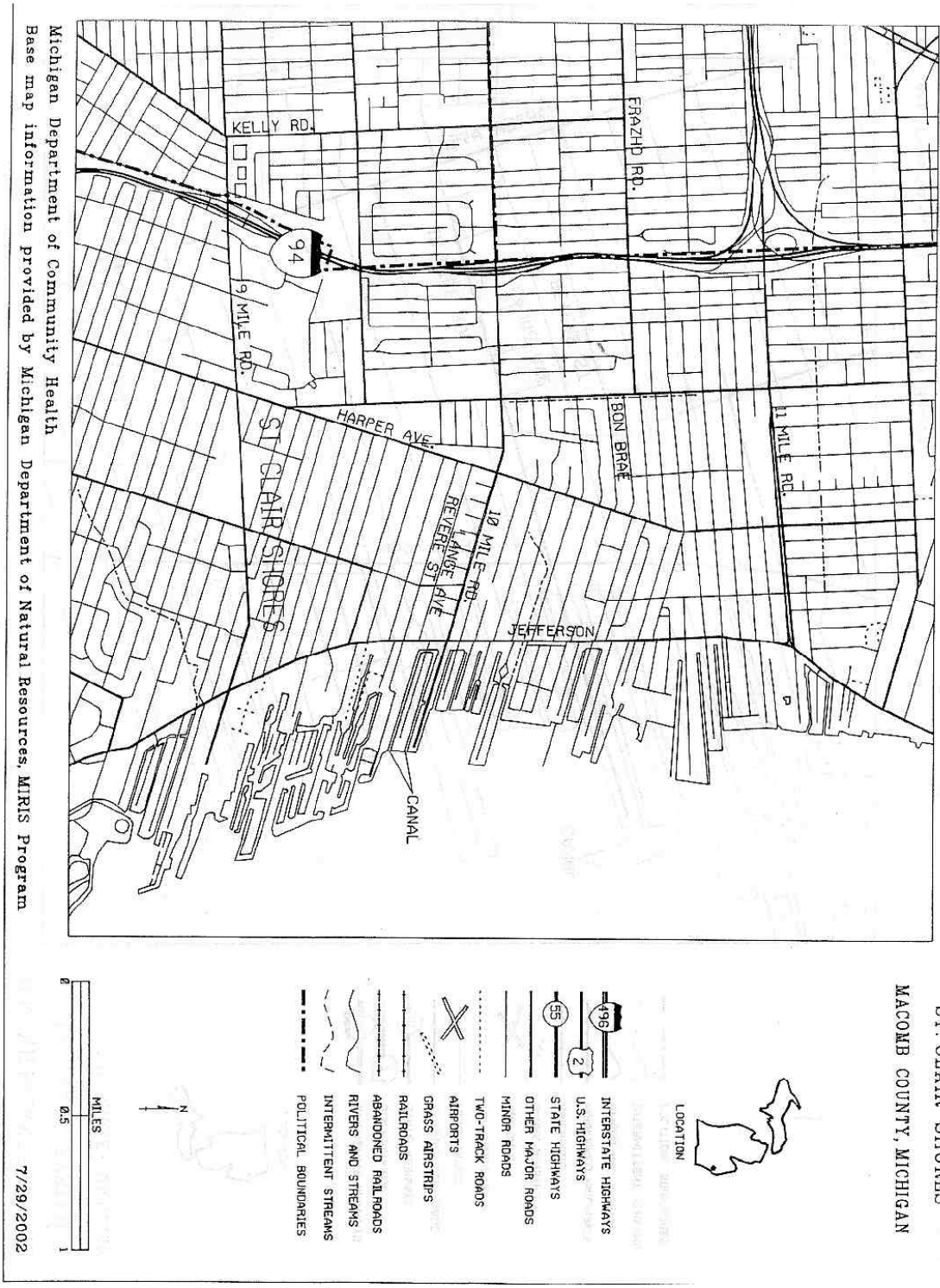
Chemical of Interest	Storm Water Sewer		Catch Basin		Sanitary Sewer	
	n	Range	n	Range	n	Range
Total PCBs	28	ND-480	6	2.28-158	17	ND-189
Arsenic	0	NT	0	NT	0	NT
Barium	0	NT	0	NT	0	NT
Cadmium	0	NT	0	NT	0	NT
Chromium	0	NT	0	NT	0	NT
Lead	0	NT	0	NT	0	NT
Mercury	0	NT	0	NT	0	NT
Selenium	0	NT	0	NT	0	NT
Silver	0	NT	0	NT	0	NT

Reference: Tetra Tech EMI 2002

n number of samples
ND not detected
NT sample not tested for chemical

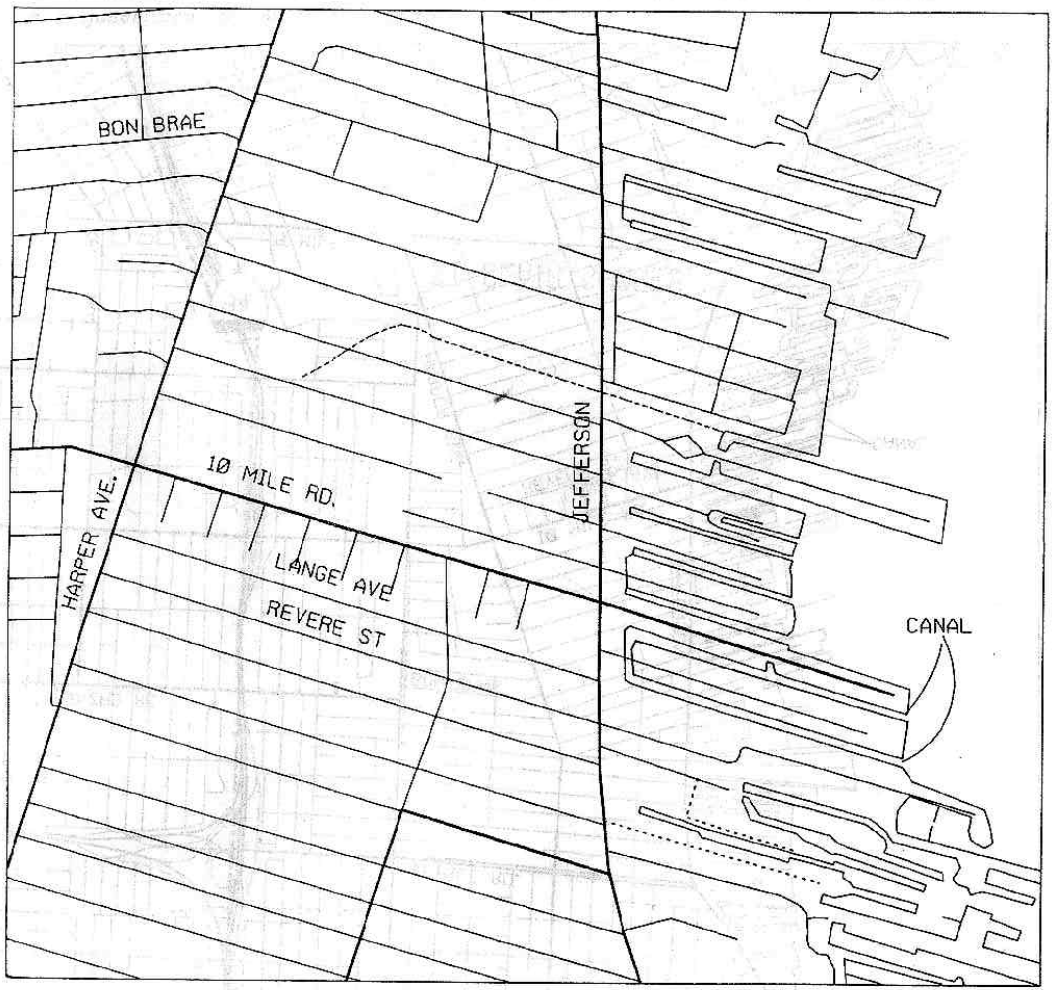
Notes:
A Amounts in micrograms (µg)

Figure 1.



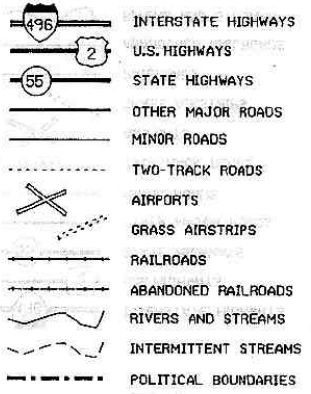
(insert Figure 1)

Figure 2.



TEN MILE/LANGE/REVERE
DRAINAGE SYSTEM
ST. CLAIR SHORES, MICHIGAN

LOCATION



Michigan Department of Community Health
Base map information provided by Michigan Department of Natural Resources, MIRIS Program

7/29/2002

APPENDIX A

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       by gwia01.state.mi.us; Fri, 17 May 2002 10:37:19 -0400
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Microsoft SMTPSVC(5.0.2172.1);
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Microsoft SMTPSVC(5.0.2172.1);
        Fri, 17 May 2002 10:30:06 -0400
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Fri, 17 May 2002 10:30:06 -0400
Received: by superior.great-lakes.net (Postfix)
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       id 0DA2714C76; Fri, 17 May 2002 10:37:12 -0400 (EDT)
Delivered-To: enviro-mich@great-lakes.net
Date: Fri, 17 May 2002 10:37:06 -0400
Message-ID: <OAENLOKFGOLAOELGANICGEKHCKAA.metrodetroit@cleanwater.org>
From: "Brad Wilson" <metrodetroit@cleanwater.org>
To: enviro-mich@great-lakes.net
Subject: E-M:/ PCB and other contamination Press release
MIME-Version: 1.0
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X-Priority: 3 (Normal)
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Precedence: bulk
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Enviro-Mich message from "Brad Wilson" <metrodetroit@cleanwater.org>

ST. CLAIR SHORES AREA RESIDENTS UNITING TO ADDRESS PCB CONTAMINATION

CITIZEN ORGANIZED PUBLIC FORUM ANNOUNCED

FOR IMMEDIATE RELEASE: May 16, 2002

Contacts: Donna Hetzel, St. Clair Shores resident, (586) 775-0636
Brad Wilson, Clean Water Action and Clean Water Fund, (586) 783-8900
Dr. Michael Harbut, Chief of the Center for Environmental and Occupational
Medicine, (248) 547-9100
Dave Hargrave, Lake St. Clair Bass Anglers, (586) 783-8900 or (586) 469-1600

St. Clair Shores, MI B In the wake of the recently discovered PCB disaster
in St. Clair Shores, area residents are saying "enough is enough" as they
unite to demand more answers from public agencies.

"We need immediate answers about the PCBs and other contaminants they=ve
found in our neighborhoods,@ said St. Clair Shores resident Donna Hetzel,
who lives on the Revere Street canal. Hetzel's views are shared by a growing
number of Metro Detroit residents who are seeking to clean up the
contamination in St. Clair Shores and in Lake St. Clair.

"The U.S. Environmental Protection Agency must expand the investigation into
Lake St. Clair so we=ll know where the >emergency= ends," said Brad Wilson
of Clean Water Action and Clean Water Fund. Wilson indicated that the

Agency has only looked at two canals and one storm drain system, and it has not taken any samples in Lake St. Clair or other canals, storm drains or sewer drains. Wilson continued, "How will we know whether or not the emergency clean-up should be extended into Lake St. Clair and other canals if they haven=t tested these areas for contamination?"

St. Clair Shores area is one of the worst contaminated sites in Michigan and it appears to be among the worst in U.S. history. Metro Detroit residents are concerned about the extremely high levels of PCBs and other contaminants that have been discovered. Many live and recreate along Lake St. Clair and its tributaries. The majority of Metro Detroit residents are on the drinking water system, and many also consume fish from these waters.

"Because no testing has been done in or under Lake St. Clair or of its fish and wildlife, we do not know if recreational activities pose public health threats,@ said Dave Hargrave, member of Lake St. Clair Bass Anglers Association and the Michigan United Conservation Clubs. Additional testing must be done to protect the health of the thousands of people who recreate on Lake St. Clair.@

Dr. Michael Harbut, Chief of the Center for Environmental and Occupational Medicine, spoke about the health effects of PCBs and other contaminants that have been found in the storm drain system and 10 Mile/Lange/Revere St. canals.

The speakers announced that a citizen-organized public forum will be held on June 5th at 7:00 p.m. at South Lake
High School*. Metro Detroit area residents are encouraged to attend so they can ask questions to public agency officials and hear from citizens who have worked in other parts of the U.S. to address PCB contamination in their communities.

The speakers also distributed the list of demands developed by concerned area residents. The demands are aimed at protecting public health and ensuring that investigative and clean-up funds are spent wisely.

"We demand a safe, quick, and effective end to this problem. We are not going away until our neighborhoods are safe,@ said Hargrave. AWe are in this for the long haul.@

*South Lake High School Auditorium is located at 21900 East Nine Mile Road in St. Clair Shores, Michigan 48080 (between Harper Avenue and Mack Avenue).

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CITIZEN'S DEMANDS FOR IMMEDIATE ACTION

1. Establish effective methods to monitor Lake St. Clair and all canals, outfalls, storm drains and sanitary sewers and to notify the public in real-time.

2. Have regulatory agency representatives attend the Public Forum to answer the public's questions.

3. Designate the affected area as an Emergency Response Site after a full investigation is completed by the US EPA.

4. Post "NO BOATING, SWIMMING OR FISHING" signs in areas that are determined to contain PCB and other contamination.

5. Conduct a full investigation in Lake St. Clair and other canals, outflows,
storm drains and sanitary sewers, drinking water, fish tissue, and sediment

and air samples.

6. Complete a health study of people in the Emergency Response Site area(s) and make free or low cost tests available for testing people, pets and property.

7. Complete a supplemental US EPA investigation of lawns and gardens in the Emergency Response Site area(s).

8. Enforce the Clean Air and the Clean Water Act.

9. Clean up all affected areas safely, quickly and effectively.

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UNANSWERED QUESTIONS FROM ST. CLAIR SHORES AREA RESIDENTS ABOUT PCBs

The following is a partial list of questions, as of May 15, 2002.
Additional questions will be added as they arise from the public.

* What must be done so this doesn't happen again?
* When was the last time this area was tested for contaminants?
* What were the levels of contaminants found?
* If PCBs aren't in the water, how did they get from the drain to the canals?
* What should you do if someone comes into contact with PCBs?
* Exactly how can one tell if PCBs have been dumped recently or if it is from a long term build up?
* Since no one wants to live with PCBs, what are the economic ramifications for our community?
* How long will these PCBs be around, how long before they break down?
* How would somebody who may have been exposed to PCBs get medical treatment and/or tested for cancer?
* What sediment and water samples have been taken from Lake St. Clair?
* Is there another public meeting set with the regulatory agencies?
* Are other drain systems currently being tested for PCB's and other harmful chemicals?
* How does or how is a company with PCBs supposed to properly dispose of them?
* Hasn't the government always monitored the water and sewer systems for PCBs and other chemicals?
* If my house isn't on a canal why should I care about it, is it my problem?
* How does the sediment flow through and out of the sewer, doesn't it ever mix with the water?
* If officials can't locate the PCBs in the drain system how can they be sure that the PCBs are: 1. not leaking outside of the canals, and 2. not in the water?
* How do you flush out drains and such, will the contaminants go in to the lake?
* How does this get cleaned up?
* Is anyone sick in that area?
* What is the time table for the clean-up?
* How will the clean-up be funded?

Brad Wilson
Macomb County Community Organizer
Clean Water Fund
38875 Harper
Clinton Township, MI 48036

PLEASE NOTE THAT WE HAVE A NEW AREA CODE FOR ALL OF MACOMB COUNTY

(Voice) (586) 783-8900
(Fax) (586) 783-4033
Email: metrodetroit@cleanwater.org
http://www.cleanwaterfund.org

and Conservation Issues and Michigan-based Citizen Action. Archives at
http://www.great-lakes.net/lists/enviro-mich/

Postings to: enviro-mich@great-lakes.net For info, send email to
majordomo@great-lakes.net with a one-line message body of "info enviro-mich"
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Appendix B

The City of St. Clair Shores JUST THE FACTS

PCB Investigation Update Volume 1, Issue 3—May, 2002

ATTENTION: 10-Mile Drainage District and 10-Mile/Lange/Revere Canal Residents:

As you know, a list of "citizen's demands" was issued to Federal, State, County and City officials entrusted with the investigation and ultimate clean up of the PCB contamination of the 10-Mile Drainage District and 10-Mile/Lange/Revere canals.

We hope that this fact sheet will address these issues and provide you with additional information.

Representatives from the U. S. EPA, the Michigan Department of Environmental Quality, the Michigan Department of Community Health, the Macomb County Health Department, Macomb County Public Works, and the City of St. Clair Shores will also answer resident questions at a public informational meeting hosted by Congressman David Bonior on June 17, 2002 at South Lake High School at 7:30 PM.

More information can be found on the City's web site at www.stclairshores.net. Free Internet access is available at the Library.

Thank you for your patience and cooperation.

U.S. Environmental Protection Agency (U.S. EPA)
Michigan Department of Environmental Quality (MDEQ)
Michigan Department of Community Health (MDCH)
Macomb County Health Dept.,
Macomb County Public Works
City of St. Clair Shores.

#1 Establish effective methods to monitor Lake St. Clair and all canals, outfalls, storm drains and sanitary sewers and to notify the public in real-time.

The U.S. Army Corps of Engineers and the Great Lakes Commission are leading a bi-national project that is developing a comprehensive management plan for Lake St. Clair and the St. Clair River. The goals of the planning effort are to...

1) *Evaluate the causes of environmental stress to the St. Clair River and Lake St. Clair;*
2) *Determine management goals and objectives;*
3) *Review ongoing management activities, and*
4) *Develop recommendations for management priorities.*

More information regarding the comprehensive Management Plan for Lake St. Clair and the St. Clair River can be found at **www.glc.org/stclair/**. This web site provides an opportunity for concerned citizens to directly comment and provide recommendations to the responsible agencies regarding environmental concerns affecting the river and the lake. Project Coordinator Collette Luff can be reached directly at **313-226-7485** for questions.

#2 Have regulatory agency representatives attend the Public Forum to answer the public's questions.

Representatives from the U.S. EPA, the Michigan Department of Environmental Quality (MDEQ), the Michigan Department of Community Health, and the Macomb County Health Department will join forces with Macomb County Public Works and the City of St. Clair Shores to answer resident's questions and concerns on **Monday, June 17, 2002 at 7:30 PM at South Lake High School—21900 E. Nine Mile Rd.** This public informational meeting is sponsored by Congressman David Bonior.

#3 Designate the affected area as a *Emergency Response Site* after a full investigation is completed by the U. S. EPA.

The U.S. EPA is currently in the process of conducting an **Emergency Site Assessment** to determine the magnitude and extent of the PCB contamination. This includes an evaluation of all of the analytical data collected during the investigation. The U.S. EPA, in coordination with local and state agencies, is developing a clean up plan to address the PCB contamination.

The U.S. EPA will designate this clean up as a "Time-Critical Removal Action." An Emergency Response designation is reserved for cases when there is an immediate threat to the public health and welfare posed by an ongoing emergency situation. An example of an Emergency Response is a fire at an industrial facility and the surrounding community is evacuated from their homes because hazardous chemicals in the smoke from the fire pose an immediate threat to the community.

#4 Post "NO BOATING, SWIMMING OR FISHING" signs in areas that are determined to contain PCB and other contamination.

Shortly after the discovery of PCBs in the 10-Mile Drainage District and the 10-Mile/Lange/Revere canals, the Macomb County Health Department established a PCB Hotline (**466-7923**) to provide health-related information to concerned citizens. The Hotline gives several recommendations to minimize exposure to PCBs, including recommendations against swimming and fishing in the canals. These recommendations can also be found on the Macomb

B

JUST THE FACTS

PCB Investigation Update

County Health Department web site **www.macomb.mi.us/publichealth**. As private canals for residential use only, officials from the Macomb County Health Department or the City of St. Clair Shores will be glad to meet with canal residents to determine the location of signs.

Although boat traffic could stir up the PCB-sediments in the canals, abiding by the posted **NO WAKE** regulations within the canals will minimize the disturbance.

#5 Conduct a full investigation in Lake St. Clair and other canals, outflows, storm drains and sanitary sewers, drinking water, fish tissue, and sediment and air samples.

There are a number of projects conducted by Federal, State, County and Local agencies that address contamination including...

A comprehensive Management Plan for Lake St. Clair and the St. Clair River currently in the development stages by the U.S. Army Corps of Engineers and the Great Lakes Commission.

The Macomb County Public Works plans to conduct water and sediment sampling for PCB contamination in all of the county drains that outlet to Lake St. Clair.

The Michigan Department of Environmental Quality manages a **Fish Contaminate Monitoring Program** for Lake St. Clair.

The Michigan Department of Community Health publishes the **2002 Michigan Fish Consumption Advisory Report** that can be found at **www.michigan.gov/mdch**.

The communities along Lake Sty. Clair and the University of Michigan's Department of Naval Architecture and Engineering are in the second year of the development of and **Integrated Environmental Monitoring Network** for Lake St. Clair which, when finished, will provide real-time circulation and pollution predictions.

On a yearly basis the City of St Clair Shores conducts water quality tests per U.S. EPA guidelines for regulated and unregulated contaminants that may pollute the drinking water. Test results are published in the July/August issue of ***Inside St. Clair Shores***, the City newsletter, and distributed to households citywide. ***The Consumer Confidence Report on Drinking Water*** is also available at the City of St. Clair Shores City Hall and Department of Public Works.

#6 Complete a health study of people in the *Emergency Response Site* area (s) and make free or low cost tests available for testing people, pets and property.

At the request of the Macomb County Health Department and the U.S. EPA, the Michigan Department of Community Health (MDCH) is reviewing the data from the 10-Mile Drainage District and the 10-Mile/Lange/Revere canal sampling. They are conducting a public health consultation with the Agency for Toxic Substances and Disease Registry (ATSDR). The MDCH will form a health opinion based on the data and community concerns and will recommend any necessary public health actions. Recommendations could include a health study. Concerns can be directed to Christina Bush at **1-800-648-6942.**

#7 Investigation of lawns and gardens in the area.

The U.S. FPA, in cooperation with state and local health agencies, is in the process of coordinating plans for a supplemental investigation of possible PCB contamination of residential lawns and gardens most likely impacted from the use of water from the 10-Mile/Lange/Revere canals. A sampling plan will be developed and soil samples will be collected from representative properties along the canals to gather sufficient information to determine if the use of water from the canals has had any detrimental effects on these properties.

#8 Enforce the Clean Air and the Clean Water Act.

The U.S. EPA and the Michigan Department of Environmental Quality (MDEQ) are charged with enforcing the Clean Air and Clean Water Acts. Both agencies take this mission very seriously. Enforcement actions are ongoing throughout the state and the nation. Timely notifications from industry, local agencies, and citizen groups are key to assisting U.S. EPA and MDEQ with their enforcement mandates.

In the case of the 10-Mile Drainage District System investigation, law enforcement agencies are also actively investigating the illegal dumping of PCBs into the storm drainage system. If the parties responsible for this action are identified, then they will be prosecuted and held responsible for the total cost of the investigation as well as any costs to clean up the contamination.

#9 Clean up all affected areas safely, quickly and effectively.

The U.S. EPA has already begun its planning process to conduct a Time-Critical Removal Action to address the high-concentration PCB contamination in the 10-Mile Drainage System and the 10-Mile/Lange/Revere canals. The U.S. EPA anticipates initiating a Time-Critical Removal Action to address the high concentration PCB contamination this summer.

The Michigan Department of Environmental Quality (MDEQ) will conduct additional sediment sampling in the 10-Mile/Lange/Revere canals this summer to further define areas of lesser contamination that the U.S. EPA will not address. City and state officials will use the analytical data collected by the MDEQ to move forward with planning efforts to dredge the 10-Mile/Lange/Rever canals as originally planned.

Appendix C

Inside St. Clair Shores

May/June • 2002

PCB Information & Investigation

JUST THE FACTS on the 10-Mile Drainage District

HOW WERE THE PCBS FIRST DETECTED IN THE 10 MILE DRAIN DISTRICT?

Elevated levels of PCB contamination were discovered as part of a routine permit application for the dredging of the 10 Mile/Lange/Revere canals. The Michigan Department of Environmental Quality requested the assistance of the U.S. Environmental Protection Agency Emergency Response Team (USEPA) to locate, define the contamination and identify the source.

What area is affected by the PCB contamination?

Contamination is isolated in the 10 Mile Drainage District. The system, bordered to the north and south by Bon Brae and Lange and to the east and west by Jefferson and Harper avenues, and at the outlet near the "horse-shoe shaped" 10 Mile/Lange/Revere canals. It handles storm water runoff from approximately 258 acres in St. Clair Shores. In addition, PCBs were discovered in the sanitary system along Bon Brae Avenue in low concentrations.

What types of samples have been collected so far?

To date 322 sediment, water, air, and wipe samples were collected from storm and sanitary sewers in the 10 Mile Drainage District and in the 10 Mile/Lange/Revere canals.

What are you looking for in the samples?

All sediment and water samples were analyzed for PCBs and eight metals including arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. In addition, sediment and water samples were also analyzed for volatile and semi-volatile organic compounds, pesticides, herbicides and additional metals.

What have you found?

Preliminary results indicate the highest levels of PCBs were found in the storm sewer near the intersection of Bon Brae Avenue E-Street (121,000 parts per million total PCBs in sediment). PCBs have also been identified in the canal at concentrations as high as 4,900 ppm near the outlet from the storm sewer into the canal.

Is my drinking water safe?

Yes. The 10 Mile Drainage District is not the same system that brings drinking water into the City.

What are PCBs?

PCBs are a group of more than 200 similar manmade chemicals. They are oily liquids or solids, clear to yellow in color with no smell or taste. They are found as mixtures, and are very stable and resistant to extreme temperature and pressure.

What are PCBs used for?

PCBs were widely used in electrical equipment like capacitors and transformers. They were also used in hydraulic fluids, heat transfer fluids, lubricants, plastics, and as components of surface coatings and inks.

Are PCBs still used in industry?

No. Commercial production of PCBs ended in 1977 because of health effects associated with exposure. In 1979 the USEPA banned the use of PCBs.

How do PCBs get into the environment?

PCBs have been released into the environment through spills, leaks from electrical and other equipment, and improper disposal and storage.

How can I be exposed to PCBs?

PCBs can enter the body by eating or drinking contaminated food, through the air we breathe, or by skin contact. PCBs are easily absorbed by the body and are stored in fatty tissue. PCBs are not eliminated well, so they can accumulate in the body.

Most people are exposed to PCBs by eating contaminated fish, meat, and dairy products. Some bottom-feeding, freshwater fish may eat sediments containing PCBs while scavenging. Catfish and carp usually have the highest PCB levels. ***The 2001 Michigan Fish Consumption Advisory*** includes recommendations for limiting the eating of fish caught in Lake St. Clair due to PCB contamination.

How can PCBs affect my health?

Getting sick from being exposed to PCBs depends on the following:

- The amount of PCBs that entered your body
- How long you were exposed to PCBs
- How sensitive your body is to PCBs and
- Whether the PCBs were combined with other chemicals

The health effects associated with exposure to PCBs have been studied in both humans and animals. Several factors have complicated the evaluation of health effects. Some PCB mixtures have a greater ability than others to harm your body. Impurities in PCB mixtures may be more toxic than PCBs at lower concentrations.

In people, PCBs can affect the skin and may cause *chloracne*—small, yellow skin lesions that may last from weeks to years. PCBs can also cause short-term changes in the activity of the liver, but without any noticeable symptoms. These liver changes are similar to those resulting from the consumption of alcoholic beverages or smoking cigarettes. Animal studies also have suggested that PCBs can affect the immune, endocrine, and reproductive systems, but these effects are uncertain in humans.

Large amounts of PCBs given to laboratory animals over a short time can cause cancer. However, studies of human workers exposed to high levels of PCBs for long periods have not consistently shown that PCBs cause cancer in humans. USEPA has classified PCBs as *probable* cancer-causing chemicals, but there is no evidence that PCBs cause cancer at the low levels normally found in the environment.

Is there a medical test for PCBs?

A blood test is the best method for measuring exposure to large amounts of PCBs.

How can I reduce or prevent my exposure to PCBs?

1) Avoiding contact with contaminated sediments can reduce your exposure to PCBs.

2) Following the 2001 Michigan Fish Consumption Advisory.

3) Because PCBs can accumulate in fatty tissues, you can reduce your intake of PCBs by removing the skin and fatty areas from fish fillets. Do not fry fish. Instead, barbecue, broil, or bake fish on an elevated rack that allows the fat to drip away.

Should canal water be used for lawn irrigation or watering fruits and vegetables?

According to the Macomb County Health Department, the precise risk of using canal water for irrigation of lawns or gardens is unknown, but likely very low. Homeowners using canal water for irrigation purposes need to position the water intake in a way that does not disturb and mix the sediments with the irrigation water. And always wash fruits and vegetables before you eat them.

Can I swim or wade in the canal?

No. The Macomb County Health Department does not recommend swimming or wading in canals. These activities should only be pursued at a managed recreational swimming location where regular water quality monitoring and maintenance are conducted and where lifesaving personnel are present.

Does the Macomb County Health Department consider the 10 Mile Drainage District a health risk?

The Macomb County Health Department has reviewed the sediment results and issued the following statement:

"We do not consider the presence of PCBs in the sediment an imminent health risk to area residents. This is based on the fact that human exposure would require ingestion or direct skin contact with the contaminated sediment."

Will boat traffic on the canal stir up the sediments?

Yes. Boat traffic could stir up the PCB-sediments. However, by abiding by existing no-wake regulations within the canal, sediment disturbance can be minimized. Preliminary sampling results suggest that the highest concentrations of PCBs are located at the western end of the canal the outlet of the 10 Mile Drainage District drain. It is unlikely that boat traffic will be heavy at that end of the canal because boats cannot go under the bridge. PCB concentrations drop off significantly as you travel down to the canal out into Lake St. Clair.

Where do we stand in the investigation today?

The USEPA is in the process of analyzing and double-checking (validating) more than 300 samples to determine the scope of the PCB contamination. Working together, City, County, State and Federal agencies will then develop a cleanup plan to address the areas where the highest concentrations of PCBs have been found. At the same time, they are investigating long-term solutions.

What is the timeline for cleanup?

The assessment report containing the validated results for all of the samples collected will be reviewed by the USEPA in draft form at the end of June. It will be available to the City and the public by late July. Once the scope of the problem has been determined, cleanup plans should be finalized by late summer.

How long will the cleanup take, how much will it cost, and who will pay for it?

The cleanup will proceed as a "time critical removal action" which means that once the USEPA completes the assessment report and makes the determination that that there is an immediate threat to the community or to the environment, the cleanup can start. Under emergency response guidelines, the USEPA can fund the cleanup of the highest concentrations of PCB-contaminated areas. Typically, cleanup similar to what may be needed in St. Clair Shores could cost in excess of $1 million dollars. However, until the assessment report is completed, the USEPA cannot develop a budget to address these areas.

Where can I get more information?

The St. Clair Shores Library has been designated as the repository for all data from the USEPA. Completed sample data validation packages titled Volume #1 of the Data Validation Reports is available at the reference desk. USEPA will generate a final set of assessment reports containing all information collected during the investigation. This report will be available in the library by the end of July.

The City's web site at www.stclairshores.net also contains information about the PCB investigation and important links. If you do not have a computer at home, the Library offers free Internet access.

Special thanks to the following agencies for their assistance in providing information for this article-USEPA; MDEQ; Macomb County Health Department, Michigan Department of Community Health, Illinois Department of Public Health, Agency for Toxic Substances and Disease Registry (ATSDR).

Appendix D

Inside St. Clair Shores July/August • 2002

PCB Information & Investigation

JUST THE FACTS on the 10-Mile Drainage District

RECENTLY, A LIST OF "CITIZEN'S DEMANDS" *was issued to Federal, State, County, and City officials entrusted with the investigation and ultimate cleanup of the PCB contamination of the 10-Mile Drainage District and the 10-Mile/Lange/Revere canals. The EPA, the Michigan Department of Environmental Quality, the Michigan Department of Community Health, the Macomb County Health Department, Macomb County Public Works and the City of St. Clair Shores answered the following concerns. The answers were mailed to residents as well as Clean Water Action. Additional information can be found on the City web site at www.stclairshores.net. Free Internet access is also available at the Library.*

#1 Establish effective methods to monitor Lake St. Clair and all canals, outfalls, storm drains and sanitary sewers and to notify the public in real-time.

FACT: The U.S. Army Corps of Engineers and the Great Lakes Commission are leading a binational project that is developing a comprehensive management plan for Lake St. Clair and the St. Clair River. The goals of the planning effort are to:..

1) Evaluate the causes of environmental stress to the St. Clair River and Lake St. Clair;

2) Determine management goals and objectives;

3) Review ongoing management activities, and

4) Develop recommendations for management priorities.

More information regarding the comprehensive Management Plan for Lake St. Clair and the St. Clair River can be found at **www.glc.org/stclair/.**

This web site provides an opportunity for concerned citizens to directly comment and provide recommendations to the responsible agencies regarding environmental concerns affecting the river and the lake. Project Coordinator Collette Luff can be reached directly at **313-226-7485** for questions.

#2 Have regulatory agency representatives attend the Public Forum to answer the public's questions.

FACT: Representatives from the U.S. EPA, the Michigan Department of Environmental Quality (MDEQ), the Michigan Department of Community Health, and the Macomb County Health Department joined forces with Macomb County Public Works and the City of St. Clair Shores to answer resident's questions and concerns on **Monday, June 17, 2002 at 7:30 PM** at **South Lake High School.** This public informational meeting was sponsored by Congressman David Bonior.

#3 Designate the affected area as a *Emergency Response Site* after a full investigation is completed by **the U. S. EPA.**

FACT: The U.S. EPA is currently in the process of conducting an **Emergency Site Assessment** to determine the magnitude and extent of the PCB contamination. This includes an evaluation of all of the analytical data collected during the investigation. The U.S. EPA, in coordination with local and state agencies is developing a clean up plan to address the PCB contamination.

The U.S. EPA will designate this clean up as a "Time-Critical Removal Action." An Emergency Response designation is reserved for cases when there is an immediate threat to the public health and welfare posed by an ongoing emergency situation. An example of an Emergency Response is a fire at an industrial facility and the surrounding community is evacuated from their homes because hazardous chemicals in the smoke from the fire pose an immediate threat to the community.

#4 Post "NO BOATING, SWIMMING OR FISHING" signs in areas that are determined to contain PCB and other contamination.

FACT: Shortly after the discovery of PCBs in the 10-Mile Drainage District and the 10-Mile/Lange/Revere canals, the Macomb County Health Department established a PCB Hotline **(466-7923)** to provide health-related information to concerned citizens. The Hotline gives several recommendations to minimize exposure to PCBs, including recommendations against swimming and fishing in the canals. These recommendations can also be found on the Macomb County Health Department web site **www.macomb.mi.us/publichealth.** As private canals for residential use only, officials from the Macomb County Health Department or the City of St. Clair Shores will be glad to meet with canal residents to determine the location of signs.

Although boat traffic could stir up the PCB-sediments in the canals, abiding by the posted **NO WAKE** regulations within the canals will minimize the disturbance.

#5 Conduct a full investigation in Lake St. Clair and other canals, outflows, storm drains and sanitary sewers, drinking water, fish tissue, and sediment and air samples.

FACT: There are a number of projects conducted by Federal, State, County and Local agencies that address contamination including...

- A comprehensive Management Plan for Lake St. Clair and the St. Clair River currently in the development stages by the U.S. Army Corps of Engineers and the Great Lakes Commission.
- The Macomb County Public Works plans to conduct water and sediment sampling for PCB contamination in all of the county drains that outlet to Lake St. Clair.
- The Michigan Department of Environmental Quality manages a **Fish Contaminate Monitoring Program** for Lake St. Clair.
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- The communities along Lake Sty. Clair and the University of Michigan's Department of Naval Architecture and Engineering are in the second year of the development of and **Integrated Environmental Monitoring Network** for Lake St. Clair which, when finished, will provide real-time circulation and pollution predictions.
- On a yearly basis the City of St Clair Shores communicates the water quality test results per the U.S. EPA guidelines for regulated and unregulated contaminants that may pollute the drinking water. Test results are published in the July/August issue of ***Inside St. Clair Shores,*** the City newsletter, and distributed to households citywide. ***The Consumer Confidence Report on Drinking Water*** is also available at the City of St. Clair Shores City Hall and Department of Public Works.

#6 Complete a health study of people in the Emergency Response Site area (s) and make free or low cost tests available for testing people, pets and property.

FACT: At the request of the Macomb County Health Department and the U.S. EPA, the Michigan Department of Community Health (MDCH) is reviewing the data from the 10-Mile Drainage District and the 10-Mile/Lange/Revere canal sampling. They are conducting a public health consultation with the Agency for Toxic Substances and Disease Registry (ATSDR). The MDCH will form a health opinion based on the data and community concerns and will recommend any necessary public health actions.

Recommendations could include a health study. Concerns can be directed to Christina Bush at **1-800-648-6942.**

#7 Investigation of lawns and gardens in the area.

FACT: The U.S. EPA, in cooperation with state and local health agencies, is in the process of coordinating plans for a supplemental investigation of possible PCB contamination of residential lawns and gardens most likely impacted from the use of water from the 10-Mile/Lange/Revere canals. A sampling plan will be developed and soil samples will be collected from representative properties along the canals to gather sufficient information to determine if the use of water from the canals has had any detrimental effects on these properties.

#8 Enforce the Clean Air and the Clean Water Act.

FACT: The U.S. EPA and the Michigan Department of Environmental Quality (MDEQ) are charged with enforcing the Clean Air and Clean Water Acts. Both agencies take this mission very seriously. Enforcement actions are ongoing throughout the state and the nation. Timely notifications from industry, local agencies, and citizen groups are key to assisting U.S. EPA and MDEQ with their enforcement mandates.

In the case of the 10-Mile Drainage District System investigation, law enforcement agencies are also actively investigating the illegal dumping of PCBs into the storm drainage system. If the parties responsible for this action are identified, then they will be prosecuted and held responsible for the total cost of the investigation as well as any costs to clean up the contamination.

#9 Clean up all affected areas safely, quickly and effectively.

FACT: The U.S. EPA has already begun its planning process to conduct a Time-Critical Removal Action to address the high-concentration PCB contamination in the 10-Mile Drainage System and the 10-Mile/Lange/Revere canals. The U.S. EPA anticipates initiating a Time-Critical Removal Action to address the high-concentration PCB contamination this summer.

The Michigan Department of Environmental Quality (MDEQ) will conduct additional sediment sampling in the 10-Mile/Lange/Revere canals this summer to further define areas of lesser contamination that the U.S. EPA will not address. City and state officials will use the analytical data collected by the MDEQ to move forward with planning efforts to dredge the 10-Mile/Lange/Revere canals as originally planned.

Appendix E. Adjustment of MDEQ Groundwater Contact Criteria to Address Children Swimming in the Lange/Revere Canal

The purpose of the MDEQ Groundwater Contact Criteria (GCC) is to protect workers in subsurface excavations from adverse health effects that can result from coming into dermal (skin) contact with a hazardous substance. The GCC is protective of only chronic, not acute, effects, and it addresses only dermal exposure, not incidental ingestion nor inhalation of any volatiles. The GCC may be adjusted to address the protection of residents who may come into contact with contaminated surface water, such as swimming in a lake. This exercise will demonstrate how the criteria were adjusted to account for children, ages 9 to 12, swimming in the Canal. Adjusted criteria for carcinogenic and noncarcinogenic effects are calculated and compared.

PCBs are probable carcinogens (EPA 1997b). The equation used to determine the GCC of a known or probable carcinogen is below (MDEQ 2001b):

$$GCC_{carcinogen} = \frac{BWxATxTRxCF_1}{SFxSAxSPxEVxEFxEDxCF_2}$$

BW is the body weight. The range of body weights for a child of either sex, aged 9 to 12 years, is 31.5 to 45.3 kilograms (kg; EPA 2000). To be protective, the lower weight is used.

AT is the averaging time factor, which, for carcinogens, is equivalent to the average human lifespan of 70 years, or 25,550 days. When a chemical is found to be carcinogenic in laboratory animals, the research typically involves a high dose of the chemical given to the animal over a short period of time. Based on the assumption that a high dose of a carcinogen received over a short period of time is equivalent to a corresponding low dose spread over a lifetime, human exposures are calculated by prorating the total cumulative dose over an average person's lifetime.

TR is the target cancer risk, or the acceptable risk. An "acceptable" risk may range from one in ten thousand to one in one million, meaning that no more than one additional person in ten thousand (1E-4) or one million (1E-6) persons who are exposed to a carcinogen will die from cancer compared to a similar population not exposed to the carcinogen. The target risk in this exercise is set at one in one hundred thousand (1E-5).

CF_1 is the first conversion factor used so that the appropriate units appear in the product of the equation. This factor is equal to one thousand micrograms per milligram (1E+3 µg/mg).

SF is the oral cancer slope factor, which is an estimate of the increased cancer risk from a lifetime exposure to a chemical. It is a probability estimate that is used only for comparative purposes. It is not a predictive tool. PCBs have been assigned varying slope factors based on level of exposure-specific risk and persistence. The slope factor chosen

for this exercise is 2 per milligram per kilogram-day [2 $(mg/kg\text{-}d)^{-1}$]. It reflects high risk and biological persistence (EPA 1997b) and is the most protective value to use.

SA is the skin surface area. For a child of either sex between the ages of 9 and 12 years, the average total skin surface area is 1.16 square meters (m^2) or 11,600 square centimeters (cm^2; EPA 2000).

SP is the skin penetration per event factor and based on the rate at which a specific chemical penetrates the skin and the exposure time, which is assumed to be 2 hours per event. The SP for PCBs is 1.95 cm/event (2002, J. Crum, MDEQ Environmental Response Division, personal communication).

EV is event frequency, or the frequency of contact with the contaminated water. It is assumed to be 1 two-hour event per day.

EF is exposure frequency. It is assumed in this exercise that a 9- to 12-year-old would swim in the Canal five days per week for 12 weeks (three summer months) for a total of 60 days per year. This scenario allows for bad weather and days spent away from the Canal. It may overestimate the frequency of exposure but it provides a protective estimate.

ED is exposure duration. It is assumed that the scenario will occur over three years, from age 9 to 12 years. Parents would likely have more control over where younger children would swim, and as a child enters adolescence, he or she might be more apt to use a community pool or beach as a social gathering place as well as for swimming.

CF_2 is the second conversion factor used so that the appropriate units appear in the product of the equation. This factor is equal to 1 milliliter per square centimeter (1E-3 L/cm^2).

The adjusted GCC for the carcinogenic effects of PCBs is calculated as follows:

$$AdjustedGCC_{PCBs(\,cancer\,)} = \frac{31.5x25{,}550x1E-5x1E+3}{2x11{,}600x1.95x1x60x3x1E-3}$$

$$AdjustedGCC_{PCBs(\,cancer\,)} = 0.99 = 1mg/L$$

The units µg/L are equivalent to parts per billion (ppb).

If the TR had been set at 1E-4, the resulting Adjusted GCC_{PCBs} would have been 10 ppb. If the TR had been set at 1E-6, the Adjusted GCC_{PCBs} would have been 0.1 ppb.

It is possible that an adjusted GCC for PCBs based on the noncarcinogenic effects of PCBs would be more protective in this scenario. EPA Reference Doses (RfDs) for different Aroclors (commercial mixtures of PCBs containing varying percentages of chlorine) were compared to determine the most protective RfD to use. A Reference Dose

is an estimate of the daily lifetime exposure to a chemical that is not expected to cause adverse (noncancer) effects. The RfD has safety factors calculated into its value to account for uncertainties when extrapolating from laboratory or epidemiological (human data) research results to anticipated human results. The RfD for Aroclor 1016 is 0.07 µg/kg/day (7.0E-5 mg/kg/day); it is based on reduced birth weight in monkeys (EPA 1996a). However, the RfD for Aroclor 1254, based on effects seen on the immune system in monkeys, is 0.02 µg/kg/day (2.0E-5 mg/kg/day; EPA 1996b), and it is a more protective value. Therefore, this value will be used to derive an adjusted GCC for the noncarcinogenic effects of PCBs.

The equation used to determine the GCC of a non-carcinogen is below (MDEQ 2001b):

$$GCC_{noncarcinogen} = \frac{THQxRfDxBWxATxCF1}{SAxSPxEVxEFxEDxCF2}$$

The values for BW, SA, SP, EV, EF, ED, CF_1, and CF_2 remain the same as discussed above for carcinogens.

THQ is the target hazard quotient. An expected dose is compared to the reference dose, resulting in a hazard quotient, that is, the expected value divided by the reference value. If the quotient is less than or equal to 1, the expected dose is generally considered to be acceptable. The THQ in this exercise is the default, 1.

AT, the averaging time for noncarcinogens, is the number of days over which the exposure is averaged, or ED (the exposure duration) times 365 days per year. When a person is exposed to a noncarcinogen, it is believed that, unlike exposures to a carcinogen, a certain threshold must be reached before adverse health effects occur. Therefore, AT for noncarcinogens represents only the exposure period, not the average human lifespan as for carcinogens. Because it was assumed that children age 9 to 12 would swim in the Canal, AT for this exercise is 3 years (ED) times 365 days/yr or 1,095 days. (This appendix and Appendix F of the Public Comment Draft Health Consultation incorrectly determined ATs for noncarcinogens. The correct ATs are shown in this Final Health Consultation.)

The adjusted GCC for the noncarcinogenic effects of PCBs is calculated as follows:

$$AdjustedGCC_{PCBs(noncancer)} = \frac{1x2.0E-5x31.5x1,095x1E+3}{11,600x1.95x1x60x3x1E-3}$$

$$AdjustedGCC_{PCBs(noncancer)} = 0.17 = 0.2 mg/L \ (ppb)$$

The previous equations demonstrate that a noncarcinogen-GCC for PCBs (0.2 ppb), where children, ages 9 to 12, are swimming in the canals 60 days per year is more protective than a carcinogen-GCC (1 ppb).

MDCH calculated carcinogen- and noncarcinogen-GCCs for adults to compare the criteria for adults who live along the canals for 30 years and swim in the canals 60 days per year. In the carcinogen-GCC equation, AT, TR, CF_1, SF, SP, EV, EF, and CF_2 remain the same. BW for adults is 70 kg. The median SA for an adult male is 1.94 m^2 (19,400 cm^2; EPA 1997a). ED is 30 years, the national upper-bound time (90^{th} percentile) at one residence (EPA 1989). The resulting adjusted GCC for the carcinogenic effects of PCBs, for this scenario, is 0.13 (0.1) ppb. In the noncarcinogen-GCC equation, THQ, RfD, CF_1, SP, EV, EF, and CF_2 remain the same. BW, SA, and ED are 70 kg, 19,400 cm^2, and 30 years, respectively. The resulting adjusted GCC for the noncarcinogenic effects of PCBs for this scenario is 0.23 (0.2) ppb. The preceding calculations demonstrate that the exposure scenario determines which type of health effect (cancer or noncancer) drives the risk for PCB exposure.

Barium, toluene, and total xylenes are not classified as carcinogens. The RfDs for barium, toluene, and total xylenes are 0.07, 0.2, and 2.0 mg/kg/day, respectively (EPA 1991, 1994, 1999).

The SPs for barium, toluene, and total xylenes are 0.002, 0.086, and 0.13 cm/event, respectively (2002, J. Crum, MDEQ Environmental Response Division, personal communication).

The adjusted GCC for barium is calculated as follows:

$$AdjustedGCC_{Barium} = \frac{1x0.07x1{,}095x1E+3}{11{,}600x0.002x1x60x3x1E-3}$$

$$AdjustedGCC_{Barium} = 18{,}355 mg/L \ (ppb)$$

The adjusted GCC for toluene is calculated as follows:

$$AdjustedGCC_{Toluene} = \frac{1x0.2x1{,}095x1E+3}{11{,}600x0.086x1x60x3x1E-3}$$

$$AdjustedGCC_{Toluene} = 1{,}220 mg/L \ (ppb)$$

The adjusted GCC for total xylenes is calculated as follows:

$$AdjustedGCC_{TotalXylenes} = \frac{1x2.0x1{,}095x1E+3}{11{,}600x0.13x1x60x3x1E-3}$$

$$AdjustedGCC_{TotalXylenes} = 8{,}068 mg/L \ (ppb)$$

Appendix F. Adjustment of MDEQ Residential Direct Contact Criteria to Address Contact with Contaminated Sediments in the Lange/Revere Canal

The purpose of the MDEQ Residential Direct Contact Criteria (DCC) is to protect against adverse health effects due to long-term ingestion of and dermal exposure to contaminated soil. The DCC is protective only of chronic, not acute, effects, and it does not address inhalation of any volatiles. The Residential DCC may be adjusted to address the protection of residents who may come into contact with contaminated sediments, such as by standing in the Lange/Revere Canal. This exercise will demonstrate how the criteria were adjusted to account for a person standing in the Canal. Adjusted criteria for carcinogenic and noncarcinogenic effects are calculated and compared.

PCBs are probable carcinogens (EPA 1997b). The equation used to determine the Residential DCC of a known or probable carcinogen is below (MDEQ 2001c):

$$Residential DCC_{carcinogen} = \frac{TR x AT x CF}{SF x [(EF_i x IF x AE_i) + (EF_d x DF x AE_d)]}$$

TR is the target cancer risk, or the acceptable risk. An "acceptable" risk may range from one in ten thousand to one in one million, meaning that no more than one additional person in ten thousand (1E-4) or one million (1E-6) persons who are exposed to a specific carcinogen will die from cancer compared to a similar population not exposed to the carcinogen. The target risk in this exercise is set at one in one hundred thousand (1E-5).

AT is the averaging time factor, which, for carcinogens, is equivalent to the average human lifespan of 70 years, or 25,550 days. When a chemical is found to be carcinogenic in laboratory animals, the research typically involves a high dose of the chemical given to the animal over a short period of time. Based on the assumption that a high dose of a carcinogen received over a short period of time is equivalent to a corresponding low dose spread over a lifetime, human exposures are calculated by prorating the total cumulative dose over an average person's lifetime.

CF is the conversion factor used so that the appropriate units appear in the product of the equation. This factor is equal to one billion micrograms per kilogram (1E+9 µg/kg).

SF is the oral cancer slope factor, which is an estimate of the increased cancer risk from a lifetime exposure to a chemical. It is a probability estimate that is used only for comparative purposes. It is not a predictive tool. PCBs have been assigned varying slope factors based on level of exposure-specific risk and persistence. The slope factor chosen for this exercise is 2 per milligram per kilogram-day [2 $(mg/kg\text{-}d)^{-1}$]. It reflects high risk and biological persistence (EPA 1997b) and is the most protective value to use.

EF_i is the ingestion exposure frequency. It is assumed in this exercise that a person would be exposed to the sediment in the Canal (by standing in it) no more than 12 days per year.

IF is the age-adjusted soil ingestion factor. It assumes that a child through the age of six years eats 200 mg of soil per day, and that an adult will eat 100 mg of soil per day for 24 years. Each ingestion total is divided by the respective default body weight and the resulting quotients are summed. In this exercise, the ATSDR default child body weight of 10 kg was used rather than the EPA default of 15 kg, to provide greater protection. Therefore, IF in this exercise is equal to 154 mg-year/kg-day.

AE_i is the ingestion absorption efficiency (a science-based estimate of what percentage of a chemical is absorbed through the gastrointestinal tract) and is chemical-specific. The value for PCBs is 0.5 (50 percent; 2002, J. Crum, MDEQ Environmental Response Division, personal communication).

EF_d is the dermal exposure frequency. Similar to EF_i above, it is assumed that a person would be exposed to the sediment in the Canal no more than 12 days per year.

DF is the age-adjusted soil dermal factor. It considers the skin surface area (SA), a soil adherence factor (AF), number of events per day, and the exposure duration and divides the product of those factors by the body weight. Respective subfactors are determined for a child and an adult and then summed. In this exercise, it was assumed that a child through the age of six years would be exposed from the hip downward, assuming the Canal were not too deep for the child. (Although it is unlikely that children of this age would be standing in the Canal, this population is considered in this exercise in order to calculate a protective value.) The average SA of the legs of a child of either sex, ages 0 to 6 years, is 1,837 cm^2. It was assumed that an adult would be exposed from the knee downward. The average SA of the lower legs of an adult of either sex is 2,005 cm^2. The AF describes the amount of soil that adheres to the surface of the skin. Generally, wet soil adheres more than does dry soil. Therefore, rather than use the default values that MDEQ uses in derivation of the DCC, the child-in-wet-soil AF of 2.7 mg/cm^2 and the adult worker (e.g. irrigation installer) AF of 0.2 mg/cm^2 are used (MDEQ 2001c). The numbers of events per day is 1, and the exposure duration is 6 years for a child and 24 years for an adult. As mentioned above, the child BW is assumed to be 10 kg and the adult BW to be 70 kg. The resulting DF is 3,113 mg-year/kg-day.

AE_d is the dermal absorption efficiency (a science-based estimate of what percentage of a chemical is absorbed through the skin) and is chemical-specific. The value for PCBs is 0.14 (14 percent; 2002, J. Crum, MDEQ Environmental Response Division, personal communication).

The adjusted Residential DCC for the carcinogenic effects of PCBs is calculated as follows:

$$Adjusted\ Residential DCC_{PCBs(cancer)} = \frac{1E-5 x 25{,}550 x 1E+9}{2[(12x154x0.5)+(12x3113x0.14)]}$$

$$Adjusted\ Residential DCC_{PCBs(cancer)} = 20{,}759 mg/kg = 21 mg/kg$$

The units mg/kg are equivalent to parts per million (ppm).

If the TR had been set at 1E-4, the resulting Adjusted Residential DCC_{PCBs} would have been 210 ppm. If the TR had been set at 1E-6, the resulting Adjusted Residential DCC_{PCBs} would have been 2.1 ppm.

It is possible that an adjusted DCC for PCBs based on the noncarcinogenic effects would be more protective in this scenario. EPA Reference Doses (RfDs) for different Aroclors (commercial mixtures of PCBs containing varying percentages of chlorine) were compared to determine the most protective RfD to use. A reference dose is an estimate of the daily lifetime exposure to a chemical that is not expected to cause adverse (noncancer) effects. The RfD has safety factors calculated into its value to account for uncertainties when extrapolating from laboratory or epidemiological (human data) research results to anticipated human results. The RfD for Aroclor 1016 is 0.07 µg/kg/day (7.0E-5 mg/kg/day) and is based on reduced birth weight in monkeys (EPA 1996a). However, the RfD for Aroclor 1254, based on effects seen on the immune system in monkeys, is 0.02 µg/kg/day (2.0E-5 mg/kg/day; EPA 1996b) and is a more protective value. Therefore, this value will be used to derive an adjusted DCC for the noncarcinogenic effects of PCBs.

The equation used to determine the DCC of a non-carcinogen is below (MDEQ 2001c):

$$ResidentialDCC_{noncarcinogen} = \frac{THQxRfDxATxCFxRSC}{[(EF_ixIFxAE_i)+(EF_dxIFxAE_d)]}$$

The values for CF, EF_i, IF, AE_i, EF_d, and AE_d remain the same as discussed above for carcinogens.

THQ is the target hazard quotient. An expected dose is compared to the reference dose, resulting in a hazard quotient, that is, the expected value divided by the reference value. If the quotient is less than or equal to 1, the expected dose is generally considered to be acceptable. The THQ in this exercise is the default, 1.

AT, the averaging time for noncarcinogens, is the number of days over which the exposure is averaged. In this scenario, the national upper-bound (90^{th} percentile) time at one residence of 30 years (EPA 1989) is assumed. Therefore, AT equals 30 years times 365 days per year, or 10,950 days.

RSC is the relative source contribution factor, which accounts for the fact that there are many chemicals to which people are exposed through a variety of media and activities. It is possible that people who live along the Canal also catch and eat fish from the Canal, part of the Lake St. Clair fishery. If these people are not following the advice in the Michigan Family Fish Consumption guide and are being exposed to PCBs via fish consumption, the majority of their total PCB exposure would come from that activity.

For this exercise, it is assumed that only 20% of the total PCB exposure would come from standing in the sediment. Therefore, RSC equals 0.2.

The adjusted Residential DCC for the noncarcinogenic effects of PCBs is calculated as follows:

$$Adjusted\ Residential DCC_{PCBs(noncancer)} = \frac{1x2.0E-5x10{,}950x1E+9x0.2}{[(12x154x0.5)+(12x3{,}113x0.14)]}$$

$$Adjusted\ Residential DCC_{PCBs(noncancer)} = 7{,}118 mg/kg = 7 mg/kg\ (ppm)$$

The previous equations demonstrate that a noncarcinogen-DCC for PCBs (7 ppm), where a person residing along the Canal stands in the Canal sediment 12 times per year for 30 years, is more protective than a carcinogen-DCC (21 ppm). However, if the person were not exposed to other sources of PCBs, such as through the consumption of contaminated fish, then the RSC would be 1 and the noncarcinogen-DCC would be less protective (35 ppm). As discussed in Appendix E, the exposure scenario determines which type of health effect (cancer or noncancer) drives the risk for PCB exposure.

Arsenic is classified as a human carcinogen (EPA 1988). Therefore, the same equation as above is used to adjust the Residential DCC for arsenic. All parameters remain the same except for SF, which is 1.5 $(mg/kg\text{-}day)^{-1}$ (EPA 1988) and AE_d, which is 0.03 (3 percent; 2002, J. Crum, MDEQ Environmental Response Division, personal communication). The adjusted Residential DCC for the carcinogenic effects of arsenic is calculated as follows:

$$Adjusted\ Residential DCC_{Arsenic(cancer)} = \frac{1E-5x25{,}550x1E+9}{1.5[(12x154x0.5)+(12x3113x0.03)]}$$

$$Adjusted\ Residential DCC_{Arsenic(cancer)} = 83{,}306 mg/kg = 83 mg/kg\ (ppm)$$

If the TR had been set at 1E-4, the resulting Adjusted Residential $DCC_{Arsenic}$ would have been 830 ppm. If the TR had been set at 1E-6, the resulting Adjusted Residential $DCC_{Arsenic}$ would have been 8.3 ppm.

Similar to the PCB exercise, MDCH calculated an Adjusted Residential DCC for the non-carcinogenic effects of arsenic. The RfD for arsenic is 0.3 µg/kg/day (3.0E-4 mg/kg/day), based on hyperpigmentation and keratosis of the skin and possible vascular changes seen in exposed humans (EPA 1988). THQ and AT are the same values as in the noncarcinogen-DCC equation for PCBs. CF, EF_i, IF, AE_i, EF_d, DF, and AE_d are the same values as in the carcinogen-DCC equation for arsenic. The RSC in this case is 1, because any consumption of locally-caught fish would not contribute to exposure to inorganic arsenic. The adjusted Residential DCC for the non-carcinogenic effects of arsenic is calculated as follows:

$$Adjusted\ ResidentialDCC_{Arsenic\ (noncancer)} = \frac{1x3.0E-4x10{,}950x1E+9x1}{[(12x154x0.5)+(12x3{,}113x0.03)]}$$

$$Adjusted\ ResidentialDCC_{Arsenic\ (noncancer)} = 1{,}606{,}608\ mg/kg = 1{,}607\ mg/kg\ \ (ppm)$$

The previous equations demonstrate that a carcinogen-DCC for arsenic (83 ppm), where a person residing along the Canal stands in the Canal sediment 12 times per year for 30 years, is more protective than a noncarcinogen-DCC (1,607 ppm).

Appendix G. Health-related Questions Received Previous to the Public Comment Health Consultation and Answers from MDCH

From Toxic Free Shores' Nine Demands (#6):

Complete a health study of people in the Emergency Response Site area(s) and make free or low cost tests available for testing people, pets, and property.

At the request of the Macomb County Health Department and the EPA, MDCH is reviewing the data from the Ten Mile Drainage System and the Ten Mile/Lange/Revere canal sampling. The agency is conducting a public health consultation with ATSDR. A health "consultation" is the process of a health assessment and the resulting document. During this process, MDCH forms a health opinion based on the data and community concerns and recommends any necessary public health actions to prevent or stop any harmful exposures. Recommendations could include a health "study," which is an investigation of exposed persons designed to assist in identifying effects on public health. A health study might include taking biological samples or performing epidemiological analysis. However, a health study is not planned at this time.

Additional questions from Toxic Free Shores' on-line news release (May 16, 2002):

What should you do if someone comes into contact with PCBs?

It should be noted first that exposure to (contact with) PCBs does not automatically indicate that you are at risk for developing adverse health effects. The duration of contact, the environmental medium that the PCBs are in (water, soil, air), and the concentration of the PCBs all factor into whether or not health effects would occur.

If you are exposed to PCBs dermally (on the skin), washing right away with soap and water will prevent nearly all of the chemical from being absorbed.

If you are in an area where you know there are high concentrations of PCBs in the air, you should leave that area or, if it is your job to be working with the chemicals, you should be wearing the appropriate respirator.

Often, people will not realize they are consuming PCBs in food. It is prudent to educate oneself on what foods might contain PCBs and how to select and prepare those foods to minimize or eliminate any exposure. For instance, the 2002 Michigan Family Fish Consumption Guide provides guidance on preparing and eating various species of freshwater fish.

How long will these PCBs be around? How long before they break down?

PCBs were used by industries because they resist degradation. Therefore, it can be many years before they break down. That is why EPA is going to be cleaning the sewers and Canal.

How would somebody who may have been exposed to PCBs get medical treatment and/or tested for cancer?

There is a blood test that can be used for measuring exposure to large amounts of PCBs. It should be noted that PCBs are ubiquitous in the environment and that people everywhere probably already have a small amount in their bodies. It is not likely that any exposure persons might have had to PCBs in the Ten Mile Drainage System area would

be sufficient to change one's blood level of the chemicals. Concerned persons should consult with their family physician.

Is anyone sick in this area?

There are likely people in this area who are currently sick or not feeling well, just as there would be in any community. There are various tracking systems MDCH operates in the state to monitor for and catch any unusual disease patterns. There have been no reports in this area of illnesses that are likely to be linked to exposure to an environmental contaminant addressed in this document.

From "Just the Facts" May/June 2002 newsletter:

Is my drinking water safe?

Yes. The Canal is not a source of drinking water. Also, as explained in the consultation document, MDEQ has tested the drinking water for the affected area and has not found any contamination.

How can I be exposed to PCBs?

As discussed at the June 5, 2002 public meeting, the most common way people are exposed to PCBs is by eating foods that have PCBs in them. These chemicals tend to reside in the body fat and can be found in meat, dairy products, and fish. Bottom-feeding fish species accumulate some PCBs, then are eaten by larger, predator fish. The PCBs continue to accumulate up the food chain. The 2002 Michigan Family Fish Consumption Guide discusses what species and lengths of fish can be consumed and with what frequency so that people do not accumulate potentially harmful levels of PCBs. The guide also discusses preparation techniques to minimize potential exposure.

While the contamination remains in the Ten Mile Drainage System area, persons might be exposed if they work in the sewers with no protective equipment, if they spend a significant amount of each day near the Lange Street bridge, or if they swim or stand in the Canal. Once the clean-up is complete, these exposure routes will be eliminated

How can PCBs affect my health?

Whether or not a chemical has a harmful effect on a person's health depends upon the dose (the amount that enters the body), the duration of exposure, a person's sensitivity to that chemical, and whether the person is being exposed to other chemicals at the same time. In some cases, a concurrent exposure to a second chemical will counteract the expected effects of the first chemical (antagonism). In other cases, it may increase the magnitude of the effects (synergism).

It cannot be predicted how the health of a person exposed to PCBs will be affected, if at all. The human population is much more diverse and varied than inbred research animals. Research on laboratory animals has shown that PCBs can cause cancer; however, this has not been seen in human subjects. Other animal research suggests that PCBs can affect the immune, endocrine, and reproductive systems. High levels of PCBs, like those seen in industrial or occupational settings, have caused a skin condition called chloracne in workers. Much of the current human research into the effects of PCBs is focused on behavioral and learning differences seen in children of women who ate large amounts of sport fish.

How can I reduce or prevent my exposure to PCBs?

Avoiding the sediments in the Canal, especially at the west end where the storm drain discharges, will prevent exposure to the highest concentrations of PCBs in the Ten Mile Drainage System area. Also, following the Michigan Family Fish Consumption Guide will reduce or prevent exposure to any PCBs in locally-caught fish.

Should canal water be used for lawn irrigation or watering fruits and vegetables?

Ideally, residents should wait until the clean-up is complete before using the Canal water in their yards. Residents who choose to use the Canal to irrigate should position the water intake sufficiently above the sediment becausesince PCBs adhere to soils and sediments more than to water.

Can I swim or wade in the Canal?

It is advised that swimming or wading in the Canal be stopped until the clean-up is complete. Occasional swimming by errant children, especially at the east end of the Canal where concentrations are lower, is not likely to result in any health effects.

Does the Macomb County Health Department consider the Ten Mile Drainage District a health risk?

Based on the information available when the PCB contamination was first discovered, the county health department, along with MDCH and ATSDR, did not consider the contamination to be an imminent (immediate) health risk. An imminent health risk would exist if there were danger of explosion, such as with methane, or a release of a lethal gas, such as cyanide.

From June 5, 2002 Toxic Free Shores Forum:

Has the land been tested for PCB contamination caused by irrigation of the property with water from the Lange Street Canal? If not, when will it be tested?

As of the date of this particular meeting, the residential soils had not been tested. Subsequently, however, 16 residential yards have had their soil analyzed for PCBs and metals. (Discussion in consultation document.)

St. Clair Shores and the EPA said 1 ppm was considered safe, yet on the fact sheet [distributed at this meeting, excerpted from the ATSDR ToxFAQs on PCBs] the FDA said food should contain less than 0.2 to 0.3 ppm.

The 1 ppm level used by EPA is a screening level for PCBs in soil, which is not normally eaten by people but may get consumed if someone's hands are dirty. (That number also addresses possible absorption through the skin following dermal contact.) The default (generic) values of how much soil a person might eat are 200 mg/day for a child and 100 mg/day for an adult. The FDA number is pertaining to actual food, which is intentionally eaten and thus, any PCBs in the food would be delivered directly into the body. A person is going to eat more than 100 or 200 mg/day of food. That is why the FDA's number is less than EPA's.

If you dredge up the sediment containing PCBs, are they then airborne?

If the sediment is treated with a demobilizing, thickening agent so that it does not drip out of the trucks, as is the protocol for removal actions, then there should be no increase in PCB air concentrations and therefore no health threat.

Has there been any recommendation for PCB-exposure treatment that has had any documented benefit?

If a person is exposed dermally to PCBs, multiple washings with soap and water immediately following that exposure have been shown to reduce any absorption.

In the cases of PCBs being ingested, the value of administering activated charcoal to decrease absorption is unknown. In rats, rice bran fiber was shown to decrease absorption, but the value in humans is unknown. Generally, people consuming PCB-containing food do not realize the presence of PCBs in the food until well after consumption, when the PCBs have been absorbed by the body.

Isn't the damage or "potential" damage from PCBs not reversible?

Depending on the effect, any effects PCBs may have on body systems may or may not be reversible. Also, the body may compensate when systems are altered, even before any measurable symptoms might be noticed.

Are you aware of anyone doing a study of the effects of the St. Clair Shores PCB levels? Do you think this will happen?

If this question is referring to a health study, then at the time of this particular meeting, there is no plan for a health study to be conducted. If the health consultation concludes that one is needed, it will be recommended.

The fact sheet states that PCBs exist in transformers, capacitors and other electrical equipment. Does this mean that we are also at risk from the above?

You can only be at risk if you are exposed to the PCBs. If a transformer explodes and you come into contact with the PCBs, then exposure is taking place. As long as the equipment remains intact, then you are not being exposed.

From June 17, 2002 Toxic Free Shores forum (taken from unofficial transcripts):

The Macomb County Health Department says that I'm not in danger, but in the same publication ["Just the Facts" May/June 2002] it says it's an airborne contaminant.

PCBs can be found in the air and have been detected in air samples taken from the area. The language in the publication indicates that the county health department does not find the contamination to be an *imminent* (immediate) health risk. Also, the language earlier in the publication was discussing how a person could be exposed to PCBs in general.

Obviously our concerns are for the children playing in the general area. Will they be safe during clean-up [regarding air concentrations]?

The EPA will set up barriers to prevent people from entering the work areas during the removal. Air concentrations will be monitored and the generation of dusts prevented.

When the sediments are disturbed, will we be at greater risks, and will we be able to stay in our homes?

As stated before, the EPA will be monitoring air concentrations during the removal of the sediment in the Canal. If levels become elevated, the work will stop until provisions can be made to correct the situation. It is not expected that people will be asked to leave their homes.

We live near the mouth of the Canal. I talked to someone at the Health Department and they told me no PCBs were found in the sediment behind our house. Can we water our lawn from the Canal?

Ideally, residents should wait until clean-up is complete to use canal water for irrigating.

How safe is it to swim in the Canal a few houses from the lake? My son swam in there in the past week with some of his friends. Do I need to have him tested, plus talk to the other parents?

Although the PCB concentrations are lower at the east end of the Canal, it would be prudent to avoid swimming in it until the clean-up is finished. If your son just swam there on occasion, he would probably not have been exposed to enough, if any, PCBs to have caused any health effects. We not only look at the level of exposure (the concentration) but at the duration and frequency of exposure as well to determine if health effects are likely.

Last year he went under the bridge, where the contamination is high.

Again, because the exposure was infrequent, even though the concentration was high, it is not likely that he has been exposed to enough PCBs to cause harm

So the kids fishing down at the end, should they be fishing there? Should we put a sign up saying don't fish?

There is already a fish advisory that exists for Lake St. Clair that discusses species and sizes of fish that should be avoided and how to prepare your catch. We can provide you with advisory signs if you want to post them.

I'm just curious about the effects they have on Autoimmune Disorders, people that already have them, or if they can contribute to people acquiring the disease. I've had horrible complications and various health problems in the past years, autoimmune-related.

The body system most sensitive to the effects of PCBs seems to be the immune system. It's difficult, if not impossible, to predict what the impact of PCB exposure would be on a person's immune system without knowing what kind of exposure

occurred, for how long, a history of past exposures to PCBs or other chemicals suspected of causing autoimmune effects. Even with that information, no predictions can be made with any certainty. There are any number of factors, some still unknown, that determine whether or not a person is affected by a chemical.

Could these contaminants have possibly been building up since they were banned in the '70s? Also, we've had constant problems with back-up flooding in our basements when it rains. Could the sediments have been building up over time in our home? It wasn't possible to clean our basement 100% every time that it flooded.

There are not adequate data to determine how long the contaminants have been in the sewers and Canal. Because we do not know how long the PCBs have been there, we cannot predict if any sediments associated with the basement flooding contained PCBs.

I've watered my vegetable garden and lawn for 15 years. Children play on the grass. I want my soil tested and I want clear indicators of safe levels of PCBs. Will you be doing that testing?

As of the date of this particular meeting, EPA was planning on sampling yard soils to determine if any contamination has been transferred from the Canal to residential soils via irrigating. Since that time, sampling has occurred. One of 16 yards had detectable amounts of PCBs in it and that level was below the 1 ppm criterion. There is further discussion about the soil sampling in the consultation document.

Regarding posting, children fishing, fishing off bridge. We tell them. Some listen, some don't. There's no posting. Who is responsible for their safety? Is there any plan for posting?

Because much of the land is private property, the county or state health departments cannot automatically go out and post No Fishing or other signs. The signs are available if people want to post their own property.

When is the community going to be told that the Wahby Park Pond is fed by the lake water coming out of the Lange/Revere Canal? Was the spray from the fountain monitored for safety before they were turned off? Will there be postings to tell people to stay away from the water?

The last time Wahby Pond received water from the Canal, according to the City of St. Clair Shores, was in August of 2001. The EPA tested the water in the pond on April 18, 2002 and the sample results were 52 ppb (for one sample). It is possible that this concentration was not an accurate representation of PCBs in the pond. PCBs tend to adhere to soil and sediments rather than enter the water column. The sample was taken near the inlet from the Canal and may have included suspended sediments containing PCBs.

The fountain spray was not monitored prior to being turned off. Although any PCBs in the water could have been volatized from the spray, any vapors would have dispersed rapidly in the ambient air and likely would not have been at concentrations of concern. Also, because people would not spend a majority of their time at the park, the

duration of exposure to any PCBs in the air would have been short and would not be expected to cause adverse health effects.

The area around the pond was not posted with signs warning people of the PCBs found in the pond water. The pond is used by waterfowl, and it is likely that parents would discourage their children from playing in the water, to avoid exposure to the birds' waste. Also, because people would not spend a majority of their time at the park, any exposure to PCBs in the pond water would have been short and would not be expected to cause adverse health effects.

Has any testing been done on the retention basin at the foot of Bon Brae, between Bon Brae and Bon Heur? We have several air samples there. These PCBs have to be going into that retention basin. Can somebody give me an answer? The reason I'm so concerned is that I've lived on Bon Brae for 51 years, and we've had almost 100 cancer deaths between Bon Brae and Bon Heur. And we would like to see action.

The Macomb County Health Department has received information (from the citizen who asked this question) regarding the types of cancer cases, years of diagnoses, and addresses of patients along these two streets and has shared that information with MDCH. Previous to the Ten Mile Drainage System investigation, a request had been submitted to MDCH to interpret cancer statistics for the St. Clair Shores area, specifically, those areas covered by the 48080, 48081, and 48082 ZIP codes. The cancer types being studied are breast, lung, prostate, leukemia, and non-Hodgkins lymphoma, as well as all cancers combined. The epidemiologist reviewing these data expects to complete his review as early as October 2002. (This is addressed at the end of the next appendix.) His report will be shared with the Macomb County Health Department and made available to interested parties.

The Michigan Cancer Registry has collected information regarding diagnoses and deaths since 1985. Information by county is available on-line at the MDCH website, under "Statistics and Reports."

We know that carcinogens like arsenic are in the canal water that floats into Lake St. Clair, along with barium, PCB, lead, and others. What should I do to protect myself from these contaminants?

As long as you are not exposed to unsafe levels of these chemicals, you are protected. Once the Canal is dredged during clean-up, the possibility for exposure will be eliminated or reduced such that any remaining levels would not be expected to be harmful.

When do you plan to test the other canals, storm drains, and Lake St. Clair for contaminants in the water, air, fish, and sediment?

The PWO will address testing the other canals and storm drains.

MDEQ is in charge of the Fish Contaminant Monitoring Program. This program analyzes fish samples from throughout the state for chemicals of concern (e.g., PCBs, mercury, pesticides). Fish directly from the canals in the St. Clair Shores area are not sampled, but rather from various areas of Lake St. Clair itself. The most recent sampling from the lake was done in 2001 with testing done on smallmouth bass, walleye, and carp.

Sampling in 2002 should occur, though the date is as yet unknown, with carp and walleye being tested. The data gathered by MDEQ are used by MDCH to establish fish advisories for the state's lakes and rivers. The advisory is available on-line at the MDCH (a Quick Link under "Statistics and Reports") and is also available in print by contacting the county or state health department.

Is it safe to boat up and down the canals?

People are asked not to use the Revere/Lange Canal for boating. Even if the operator were to minimize any wake, sediments still could be disturbed. Residents who moor their boats in the Canal should confer with the City and consider moving their boats until the clean-up is complete.

Appendix H. Public Comments Received on "Ten Mile/Lange/Revere Drainage System (aka Ten Mile Drainage System) PCB Spill" Health Consultation and MDCH Responses

MDCH received the comments and questions verbally at community meetings and in written form via e-mail and US mail. Other comments were taken from the Toxic Free Shores website (http://www.toxicfreeshores.org) or forwarded to MDCH from city officials. Similar comments have been grouped together so they can be answered more efficiently. While some comments or questions do not pertain directly to the Draft Health Consultation, they are included here for completeness.

Why was no attempt made to determine length of exposure before the publication of the draft health consultation? It should be determined if the contamination is new, on-going, historical or a re-release of a historical spill.

MDCH and ATSDR concluded that the expected exposure to PCBs in the Canal would be so infrequent that the duration of exposure would have no bearing on public health implications. Exposure was intermittent rather than continuous and by routes that are not as efficient as consumption of contaminated fish is for internalizing PCBs.

The City of St. Clair Shores contracted with two local researchers to determine an approximate length of time of the PCBs in the Canal, for potential litigation purposes if a responsible party were found. Dr. Linda Schweitzer of Oakland University and Dr. Mark Baskaran of Wayne State University performed radiodating and congener-specific analyses of sediment cores they extracted from the Canal. In their report, they conclude that a dumping event may have occurred in the early 1980s and that PCBs have been present in the Canal since the 1960s. They believe the contamination may be due to improper disposal or leakage of PCBs locally. Drs. Schweitzer's and Baskaran's report is available to the public at the City's website, **http://www.stclairshores.net**, under the PCB Investigation link.

A scientific conclusion cannot be based on inference and assumption without any factual reference. There are a lot of assumptions in this consultation. What scientific data did you use, and from what resources, to draw your conclusions? There should be real-life data about fishing and fish consumption, water use, swimming, etc. All residents should be quickly canvassed and length of exposure must be determined.

MDCH used data presented in the EPA Child-Specific Exposure Factors Handbook (2000) and Exposure Factors Handbook (1997a) to assess exposure at this site. These documents summarize key data on human behaviors and characteristics that affect children's or adults' exposure to environmental contaminants and recommend values to use for these factors. MDCH recognizes that each population is unique and will not completely match the populations from which the information in the handbooks was derived. For purposes of a health consultation, the data in these handbooks are sufficient to assess exposure. However, in this case, if MDCH had determined that exposure to the contaminants was such that adverse effects could occur, then more site-specific information may have been collected to assess public health risks.

While sanitary sewer workers would likely wear personal protective equipment on the job, the same might not be true of workers exposed to storm sewer water. Furthermore, the consultation does not address the potential inhalation exposure utility workers may face.

According to the Macomb County Public Works Office, repair and maintenance work in sanitary and storm sewers is considered a confined-space entry, which requires the worker to wear personal protective gear. This gear would include a Tyvek suit, rubber boots, gloves, hard hat, gas detection equipment, and air tanks with appropriate breathing masks.

The consultation does not consider that children in many neighborhoods play in storm sewers and catch basins and could be exposed to chemicals in the water or sediments in these structures.

The storm sewers and catch basins referred to in the consultation are subsurface structures and should not be easily accessible to children.

The consultation does not take into account the exposure to canal sediment when one swims and plays in the water. This would seem to be a potentially significant exposure that was not considered when the Direct Contact Criteria were adjusted.

MDCH considers contact with the sediment while standing in it as a greater risk for exposure and potential absorption than swimming or playing in water that had re-suspended sediments in it. A dose from exposure to re-suspended sediment would be much smaller than if a person is standing for an extended length of time in the sediment itself. If a person briefly stands in the sediment before continuing to play or swim, the sediment would likely wash off quickly. Because of the extended time one would stand in the sediment during dock or boat maintenance, it is likely that some sediment would remain adhered to the skin before being washed off by hand or spray hose, increasing the chances for absorption. Therefore, MDCH does not consider the incremental dose caused by exposure to re-suspended sediments while swimming to be significant.

The adjusted criteria do not take into account vulnerable populations, such as infants and pregnant women.

Infants and pregnant women are considered potentially vulnerable populations and were discussed in the ATSDR Child Health Considerations section.

Non-cancer endpoints are not considered. Please incorporate by reference the ATSDR Toxicological Profile for PCBs as well as the Record of Decision regarding the Lower Fox River PCB contamination, Volumes 1 and 2, including White Paper No. 12—Hudson River Record of Decision PCB—Carcinogenicity White Paper, and White Paper No. 13—Hudson River Record of Decision PCB—Non-Cancer Health Effects White Paper.

Discussion of non-cancer endpoints has been added to Appendices E and F. The Reference Doses used took into account the most sensitive endpoint observed. This was

not a reproductive or developmental effect, but immune system effects in monkeys, in the case of PCBs, and dermal effects in humans, for arsenic.

The ATSDR Toxicological Profile for PCBs was cited in the draft Health Consultation as well as in this final version. The documents for the Lower Fox River in Wisconsin were studied but not cited. The reader should be aware that the Lower Fox River and Hudson River sites are both Superfund sites, whereas the Ten Mile Drainage System was treated as an emergency response site. While all the sites mentioned are or were affected by PCB contamination, their specific designation determines how they are to be remediated. While comparisons can be made, each site is different, with its own remedial course determined by the overseeing regulatory agency.

Could there be a connection between my family's skin problems (pre-cancerous lesions, abscesses, growths) and dermal exposure to the water in the canal?

We are not able to answer this question. The person's own physician is the best resource to provide an answer because he or she knows the patient's full medical history. The patient should inform the doctor about known or suspected exposure to chemical or biological contaminants, not only in the canal but from other sources.

The EPA said that, during the clean-up, water pumped out of the second cell had a level of 24–25 ppm PCBs. This sample was called "a grab sample off the top." If the PCB concentration in the water during the non-boating season was at this level, one would wonder what the concentrations would have been during boating season.

Water samples were not filtered and likely contained suspended sediments. PCBs tend to stay adhered to sediments rather than enter the water column. Therefore, it is possible that the detected concentration of 24–25 ppm represented the concentration of the sediments in the sample in addition to any PCBs in the water itself. The area in which the second cell was placed had received water pumped out of the first cell, likely disturbing the sediments and re-suspending them. Also, setting the sheet piling to enclose the second cell probably disturbed and re-suspended nearby sediments.

Boats using the canal before the PCBs were removed very likely re-suspended sediments. It is not known what the concentration of an unfiltered water sample would have been during boating season.

Is it safe to swim in the canal outside the EPA clean-up zone before the city has it dredged? What is the risk of being in the canal and having open lesions? What is the risk of standing in the boat wells ("cut-outs") in the canal?

Once the physical structure of the canal is returned to its former state (sidewalls shored up, clean-up equipment removed), there will be no public health hazard present. This is not to say there is no danger inherent in swimming in a canal used by boaters.

A person with open lesions who enters the canal is at risk of more easily absorbing through the wound any chemical (such as boat fuel) or infectious microorganism (such as *E. coli* from waterfowl droppings) present in the canal.

Standing in the "cut-outs" should not be of concern. The EPA cleaned from wall to wall, and the dredging of the rest of the canal will be from wall to wall.

Should residents continue to water their yards from the canal or walk on the lawn after watering?

Now that the clean-up has finished, residents may water their yards with canal water and walk on the lawn after watering.

When raking weeds and muck out of the canal, should I worry about touching them before bagging them for trash?

Because the storm sewer discharges into the canal, it is probable that trash that enters the sewer will accumulate in the weeds and muck in the canal and be raked out with them. It is possible that the trash would contain sharp objects, such as glass, a more immediate hazard than exposure to any chemicals present. Therefore, it would be prudent to wear gloves when handling the weeds and muck.

Would you drink water with 10 ppm PCBs?

The EPA Maximum Contaminant Level for PCBs in public drinking water supplies is 0.5 ppb (parts per *billion*). Therefore, public drinking water supplies should be considered safe. It is possible that a person might unwittingly drink canal water while swimming. If a person questions the purity of the water, the person should not drink it.

I really have a problem believing that fish residing in the canals are no more contaminated than those in Lake St. Clair. Fish spawn in the canal, both panfish and perch. The health consultation does not address catching and eating fish from the canal over the years. Was fish consumption a factor in the health consultation? Should residents be consuming fish from the canals? When catching fish, is touching them going to cause health effects?

According to a Michigan Department of Natural Resources (MDNR) fisheries biologist who has worked in the Lake St. Clair area (including connecting canals and marshes) since 1987, fish movement in and out of the canals is routine. Some fish species such as bluegill, pumpkinseed, or largemouth bass may be more "canal" resident than others such as smallmouth bass, yellow perch, or black crappie (which are considered "seasonally" present in the canals), but he would expect all species to move within and between canals in a local area (2003, M. Thomas, MDNR Mount Clemens Fisheries Research Station, personal communication).

Use of the canals for spawning is likely for yellow perch, bluegills, largemouth bass, crappie, and carp, among others. Some species are broadcast spawners and will spawn over any substrate. Others, such as bluegill and bass, prefer a sand or gravel bottom. They will seek out small pockets of sand or gravel along seawalls or bottom debris and spawn in those areas (2003, M. Thomas, MDNR Mount Clemens Fisheries Research Station, personal communication).

The health consultation does address that fish taken from the canal might have elevated concentrations of PCBs or certain metals or pesticides (see Human Exposure Pathways—Water section); however, contamination of the fish can occur outside the canal area due to the historic contamination of the Great Lakes. Discussion has been added to the Toxicological Evaluation—PCBs and the ATSDR Child Health

Considerations sections regarding consumption of PCB-contaminated fish, whether or not the fish came from the canals in question.

If the advice in the MDCH Family Fish Consumption Guide regarding what size and species of fish to consume and how to prepare it is followed, then the risk of exposure to PCBs via fish consumption will be reduced or eliminated.

Touching a fish, say to remove a hook, would not put a person at risk of exposure to PCBs. The chemical is within the flesh of the fish and not in the scales. The small amount of any PCB-contaminated water dripping from the fish when it is pulled from the canal would not be sufficient to warrant concern for dermal exposure. The most efficient way for any PCBs to enter your body is to eat a contaminated fish that is not adequately filleted and cooked.

It should not be assumed that the community is aware of the fish consumption advisories or, even if they are aware, that this advice is followed.

While people cannot be forced to read the advisory or follow its advice, health departments use various means to educate the public about health implications of eating Great Lakes fish: the Michigan Family Fish Consumption Guide is available where fishing licenses are purchased; posters discussing the fish advisory and how to obtain more information were made available at the public meetings MDCH attended for this site; and a sign from the Macomb County Health Department was posted at the canals advising people not to swim or fish in the canals.

A number of studies have shown that people who regularly eat Great Lakes fish are more heavily exposed to PCBs and mercury than the general population. The people who live along the canal likely represent a greater than average number of anglers and likely eat a higher proportion of sport fish than the general population. This significant source of PCBs (fish) should be considered when determining the relative risk of additional PCB exposure (canal water and sediment).

It is true that people who regularly eat Great Lakes fish, especially sport fish, are more heavily exposed to PCBs and methylmercury. Eating contaminated fish is the most likely route of exposure to these chemicals for the general population. People living along the canal are known to ice-fish in the canal during winter and may be exposed to PCBs by eating their catch, especially if they do not follow the recommendations in the MDCH Fish Advisory, since the fish are considered part of the Lake St. Clair fishery, covered by the Advisory. However, the exposure to canal water and sediment that is expected to occur should not be sufficient to cause adverse health effects, nor is this incremental exposure expected to contribute significantly to a person's overall potential exposure to PCBs. Discussion has been added to the Toxicological Evaluation—PCBs section regarding consuming PCB-contaminated fish, whether or not the fish came from the canals in question.

Original yard samples taken for analysis were from five locations in each yard and mixed to be tested as a single sample. MDEQ sampled only 16 yards, whereas 111 other yards could have been affected. It is not clear how the 16 yards were chosen for sampling; the samples may not represent the most highly exposed yards along the canal.

When EPA conducted the original sampling, field staff first interviewed the residents along the Canal regarding their use of canal water. Based on the interviews, EPA sampled from yards most likely to be contaminated. Analytical results showed that PCBs had not been transferred from the Canal to the yards. However, results indicated that there were elevated arsenic levels in some yards. MDEQ re-sampled yards with levels greater than 18–20 ppm arsenic, the typical background concentration in eastern Michigan. One yard requires further evaluation. MDEQ should complete its investigation during the summer of 2003.

Please provide a final ruling on the safety of eating vegetables grown in the soil even without watering from the canal. The health consultation said there were unsafe levels of arsenic in the soil, yet MDCH said it was safe. Which is it?

The health consultation stated that levels of arsenic in some of the yard samples were above state criteria, not that they were unsafe. In regard to residential gardens, there was a paragraph in the Toxicological Evaluation discussion on arsenic: "Garden plants might accumulate arsenic by root uptake from the soil, the degree of uptake being affected by the speciation of the arsenic compound. However, even when grown on highly polluted soil or soil naturally high in arsenic, plants have been shown to accumulate comparatively low levels of the metal (ATSDR 2000a). Therefore, any arsenic that might accumulate in produce grown in yards shown to have elevated levels of arsenic is not expected to be at levels that would cause adverse health effects." Therefore, no health threat is posed by the arsenic in the soil along the Lange and Revere canals when people are eating produce grown in that soil.

The resident living where the 81 ppm of arsenic was detected in the soil claims that they do not have treated-wood mulch on their garden. Please verify.

MDCH called the resident and discussed the area where the soil had 81 ppm arsenic. Apparently, the previous resident had enclosed the raised-bed garden with treated lumber. It is likely that the treated lumber leached arsenic into the soil. This point has been corrected in the consultation.

While only one air sample out of eight taken before the clean-up began exceeded the ATSDR CREG of 10 nanograms per cubic meter (ng/m^3, or 0.01 micrograms per cubic meter [µg/m^3]), this represents 12.5% of the air samples taken. The ATSDR Toxicological Profile for PCBs states that inhalation exposure is considered to be a major route of exposure to PCBs, noting a 1998 ferret study by Apfelbach et al. Air exposure needs to be considered in the overall exposure assessment.

While the percentage of air samples with a CREG exceedance is mathematically correct, it does not have statistical power and therefore cannot be used to suggest that the number of exceedances is substantial.

The language in the ATSDR Toxicological Profile for PCBs, section 3.4.1.1, states, "Inhalation exposure is considered to be a major route of *occupational* exposures to PCBs" (ATSDR 2000b, emphasis added by MDCH). Occupational concentrations of chemicals, such as in capacitor work, are typically much greater than those found at sites of environmental contamination.

In the Apfelbach et al. study, ferrets were exposed to 260 ng/m^3 (0.26 µg/m^3) PCBs in air over five years. The main site of PCB distribution was the olfactory bulbs, but concentrations of the chemicals were also found in the liver, fat tissue, and brain. This was not a nose-only exposure, so dermal exposure may have contributed to the findings. While the levels in the study were considered low, 260 is 26 times greater than the ATSDR CREG (10 ng/m^3) and more than 16 times greater than the reported exceedance (16 ng/m^3). ATSDR states in the Toxicological Profile that the study results are not conclusive and more research is needed in this area.

MDCH did consider in the health consultation whether air exposure contributed significantly to overall exposure and concluded that the incremental contribution was insignificant.

Do PCBs in the air cause health effects, such as headaches, nausea, etc.?

The ATSDR Toxicological Profile for PCBs does not report that any acute effects were seen in humans following inhalation exposure. The results of chronic exposure in humans are inconclusive. Most human data are derived from occupational studies, in which PCB concentrations typically would be much higher than at sites of environmental contamination.

Indoor air samples should be taken to determine if drains inside a home are a significant source of PCBs to the air and if repeated sewer backups result in elevated air levels of PCBs in basements.

MDCH does not recommend testing the indoor air for PCBs. To protect the occupants of a house from dangerous methane levels from a sewer, the drain should have a U-shaped trap that prevents gas from entering the structure. Therefore, chronic exposure to PCBs in indoor air is not expected to occur.

Sewer backups could introduce PCBs into the indoor air if contaminated water or sediment enters the house. However, during the cleaning up, a homeowner would likely increase the ventilation in the house to help remove any odors. Therefore, any exposure

to PCBs in indoor air following a sewer back-up would be of a short duration and would not be expected to cause adverse health effects.

More testing (of Lake St. Clair, other canals, drains, outflows, and sewers) is needed to determine the full extent of contamination. This characterization should have occurred before clean-up efforts began to ensure that the clean-up plan was adequate. The testing is still warranted, to ensure all contaminated areas have been found and addressed and to verify that PCBs have not been re-released or moved as a result of clean-up efforts. Accidental releases may have occurred during the September 7, 2002 incident when an oily black liquid was washed from the storm sewer into the canal and during the December 30, 2002 incident when a barge entered the canal and the excavator on it used its scoop to push on the bottom of the canal to move the barge.

The immediate concern for this site was the contamination in the storm sewer and the canal. As testing of the canal water and sediment proceeded eastward out of each arm of the canal, less and less contamination was found, indicating that the contamination was localized. While it may be possible that other sites, in St. Clair Shores or elsewhere, have as yet unknown levels of hazardous chemicals, EPA determined that contamination at this site was contained to the sewers and the canal. Therefore, EPA addressed that contamination, per its mandate, as a time-critical removal action to prevent further contamination. During all phases of the removal, follow-up testing was done to ensure that EPA had met its clean-up goals.

It is unfortunate that the oil plug washed out of the sewer on September 7 before it could be contained, and that the barge and excavator disturbed the sediment on December 30. Ideally, every contingency can be planned for, but realistically, incidents such as these can happen. It is likely that any contamination caused by these incidents was minimal compared to the contamination that ended up being removed.

Wildlife data must be considered in the health consultation, as these data often can provide important information about extent of the contamination, historical trends, and potential human health effects. Wildlife data can reveal subtle functional losses, immune system problems, etc., that are relevant to the human population and that come from organisms living in the same environment and eating the same fish as humans in the watershed.

Wildlife data can provide useful information regarding potential human health effects from contamination but, in this case, they would have limited, if any, use. The geography and human use of this site does not lend itself to being good habitat for top predators, such as mink, otter, or eagles, which are among the most sensitive indicator species for environmental quality. While portions of the Lake St. Clair shoreline may provide feeding habitat for great blue herons, another predator species, the canals themselves would not be a preferred hunting area for this wading bird due to the depth of the canals. Although photos have shown ducks, geese, and turtles using the canals, these species do not eat much fish and are therefore less favorable for comparing to humans.

If there is no apparent public health hazard, why have warnings about PCB health risks?

Ideally, there will be no exposure to these compounds. However, exposure has occurred, though it likely was not sufficient to cause adverse health effects. People should be aware of chemicals to which they are being exposed and what the health risks for long-term exposure are.

What is the length of time between exposure and disease?

It is impossible to determine the latency, or time, between exposure to a chemical and development of any disease with which it might be associated. A multitude of factors, chemical-specific and person-specific, ultimately determine the action of a chemical. Some of these factors act cooperatively, whereas others counteract each other. The best defense against disease is knowledge and working with your healthcare provider in monitoring your overall health.

There is a vocabulary concern in the health consultation, in the Public Health Action Plan section. The verbage is "exposure not confirmed"; however, exposure *has* occurred. Please clarify the language.

The language has been clarified.

Only "total" PCBs were considered in the consultation. A more precise evaluation would include a congener-specific analysis of the PCBs present and the relative toxicity of those congeners.

It is true that a congener-specific analysis would have been provided a more precise characterization of the contamination. However, the point is moot because expected exposure likely is not sufficient to cause adverse effects.

Also, it is not known how the individual components of complex mixtures of chemicals, such as PCBs in the environment, may interact. The PCB results obtained in this investigation were matched to the most likely Aroclor (a commercial mixture of PCBs) profile, based on analytical results and professional judgment of laboratory scientists. Aroclors have been extensively studied, whereas all 209 individual PCB congeners, alone or in any combination, have not. Therefore, EPA used appropriate scientific methods to characterize the contamination.

Polybrominated biphenyls (PBBs) were not considered in the consultation. Some PBBs are dioxin-like in their activity and must be considered as additive to other PCB exposures. In order to be complete and accurate, all related compounds must be considered when assessing potential health impacts.

It is true that considering all dioxin-like compounds in the assessment would have yielded more information. However, as explained previously, the expected exposure to the chemicals is not likely to cause adverse effects.

Can the boat fuel floating on top of the water cause health effects? How does this risk compare to the risk of the remaining PCBs?

People using the canal would be exposed more readily to boat fuel floating on the surface of the water than to PCBs in the sediment. Because the fuel is more volatile than PCBs and would be exposed directly to air, people could be exposed via inhalation. Swimmers who might swallow some canal water would ingest a minute amount of fuel with the water. It is possible that fuel-contaminated water could irritate the eyes if someone were splashed in the face. Yet, similar to PCBs, because the expected exposure would be minimal, the health risk would also be minimal.

The following discussion is follow-up to a concern raised at the June 17, 2002 Toxic Free Shores forum regarding the perceived cancer rate in St. Clair Shores:

Previous to the Ten Mile Drainage System investigation, a request had been submitted to MDCH to interpret cancer statistics for the St. Clair Shores area, specifically, those areas covered by the 48080, 48081, and 48082 ZIP codes. The cancer types of concern were breast, lung, prostate, leukemia, and non-Hodgkins lymphoma, as well as all cancers combined. The evaluation revealed that only lung cancer showed a higher-than-expected incidence rate. Lung cancer has not been associated with exposure to PCBs. According to the Macomb County Health Department, the county does have a greater than average number of smokers, and smoking is a risk factor for lung cancer.

Certification

This Ten-Mile/Lange/Revere Drainage System – Response to Public Comments 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 existing at the time the health consultation was begun.

Technical Project Officer, SPS, SSAB, DHAC, ATSDR

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

Chief, State Programs Section, SSAB, DHAC, ATSDR