

Attachment 7a. Chemical Analytes

Table 1. Great Lakes Biomonitoring Chemical Analyte Overview and Index

ANALYTES	MICHIGAN			MINNESOTA			NEW YORK		
	Performing Laboratory, Standard Operating Procedure Index, Specimen Matrix								
Required Core	LAB	SOP#	MATRIX	LAB	SOP#	MATRIX	LAB	SOP#	MATRIX
PCBs ¹	A	A1-3	serum	A	A1-3	serum	F	F1	serum
Mercury ²	A	A4	blood	D	D1-2	blood	F	F2	blood
Lead	A	A4	blood	D	D1	blood	F	F2	blood
Mirex	A	A1-3	serum	A	A1-3	serum	F	F3	serum
Hexachlorobenzene	A	A1-3	serum	A	A1-3	serum	F	F1	serum
DDT and DDE	A	A1-3	serum	A	A1-3	serum	F	F1	serum
Optional State	LAB	SOP#	MATRIX	LAB	SOP#	MATRIX	LAB	SOP#	MATRIX
Dioxins	B	B1	serum						
Furans	B	B1	serum						
Co-planar PCBs	B	B1	serum						
PBBs	A	A1-3	serum						
PBDEs							F	F1	serum
1-Hydroxypyrene				F	F4	urine			
Lindane	A	A1-3	serum						
Chlordane	A	A1-3	serum				F	F1	serum
Oxychlordane and trans-nonachlor							F	F1	serum
Toxaphene				A	A6	serum	F	F1	serum
Manganese	A	A4	blood						
Mercury (inorganic)	A	A5	urine				F	F5	urine
Arsenic	A	A5	urine						
Cadmium	A	A5	urine	D	D1	blood	F	F2	blood
Selenium				D	D3	urine			
Omega-3 fatty acids				D	D4	plasma			
PFCs				D	D5	serum	F	F6	serum
BPA and triclosan				D	D6	urine			
Cotinine				E	E1-2	urine			
Glycohemoglobin (A1C)				E	E3	blood			
Cholesterol/ Triglyceride	B	B2-3 ³	serum	E	E4	serum	F	F7	serum
Creatinine	C	C1	urine	E	E5	urine	F	F7	urine

Laboratory Index:

A = Michigan Public Health Laboratory; B = CDC National Center for Environmental Health Laboratories; C = Sparrow Hospital (commercial); D = Minnesota Public Health Laboratory; E = MedTox (commercial); F = New York Public Health Laboratory (Wadsworth Center).

¹Total PCBs including eight required PCB congeners - 28, 52, 101, 105, 118, 138, 153, 180.

²Blood mercury -

MI - total; plus inorganic urinary mercury

MN - total; totals > 5.8 micrograms/L will be further speciated in blood; no urinary mercury

NY - total; plus inorganic urinary mercury

³Lipids will be assayed as part of CDC laboratory assay for SOP B1 (Dioxins, furans, co-planar PCBs).

For Chemical Analytes Justification, see Attachment 7a.

For Program Laboratory QA/QC Procedures, see Attachment 7b.

For Clinical Laboratory Improvement Amendments (CLIA) Certificates, see Attachment 7c.

For Contact Information to Obtain External Proficiency Test Reports and Laboratory Standard Operating Procedures (SOPs), see Attachment 7d.

Table 2. Michigan Department of Community Health Chemical Analytes

Laboratory Analytes		
Analyte	Sample Medium	Laboratory
PCBs*	Serum	Michigan PHL
Mercury (organic)	Whole blood	Michigan PHL
Lead	Whole blood	Michigan PHL
Mirex	Serum	Michigan PHL
Hexachlorobenzene	Serum	Michigan PHL
DDT/DDE	Serum	Michigan PHL
Lindane	Serum	Michigan PHL
Chlordane(s)	Serum	Michigan PHL
PBBs	Serum	Michigan PHL
Manganese	Whole blood	Michigan PHL
Mercury (inorganic)	Urine	Michigan PHL
Arsenic	Urine	Michigan PHL
Cadmium	Urine	Michigan PHL
Dioxins	Serum	NCEH
Furans	Serum	NCEH
Co-planar PCBs	Serum	NCEH
Blood Lipids	Serum	NCEH
Creatinine	Urine	Sparrow Hospital

* 75 congeners including those required: 28, 52, 101, 105, 118, 138, 153, and 180

Table 3. Minnesota Department of Health Chemical Analytes

Table 5. Laboratory Analyses		
Analyte	Sample Medium	Laboratory
PCBs*	Serum	Michigan PHL
Mirex	Serum	Michigan PHL
Hexachlorobenzene	Serum	Michigan PHL
DDT/DDE	Serum	Michigan PHL
Toxaphene	Serum	Michigan PHL
Mercury	Whole blood	MDH PHL
Mercury speciated**	Whole blood	MDH PHL
Lead	Whole blood	MDH PHL
Cadmium	Whole Blood	MDH PHL
Omega-3 fatty acids	Plasma	MDH PHL
PFCs ***	Serum	MDH PHL
Total cholesterol	Serum	MedTox
Glycohemoglobin (A1C)	Whole blood	MedTox
1-Hydroxypyrene	Urine	NY PHL
Selenium	Urine	MDH PHL
Bisphenol A + triclosan	Urine	MDH PHL
Cotinine	Urine	MedTox
Creatinine	Urine	MedTox

* Required PCB congeners are referred to as 28, 52, 101, 105, 118, 138, 153, 180

** Mercury samples above the U.S. EPA reference level of 5.8 micrograms/Liter will be further analyzed to quantify organic versus inorganic forms of mercury

*** *Perfluorononanoic acid (PFNA), perfluorooctanoic acid (PFOA), perfluorohexanoic acid (PFHxA), perfluoropentanoic acid (PFPeA), perfluorooctane sulfonate (PFOS), perfluorohexane sulfonate (PFHxS), perfluorobutane sulfonate (PFBS), perfluorobutanoic acid (PFBA)

Table 4. New York State Department of Health Chemical Analytes

Appendix 26. List of required and optional analytes to be measured in blood and urine		
Analyte	Required by ATSDR or optional	Specimen type
Organic chemicals		
PCBs (8 required congeners 28, 52, 101, 105, 118, 138, 153, and 180)	Required and Optional	Blood
PBDEs (predominant congeners)	Optional	Blood
Perfluorinated compounds (PFOS, PFOA)	Optional	Blood
DDT/DDE	Required	Blood
Mirex	Required	Blood
Hexachlorobenzene (HCB)	Required	Blood
Toxaphene (Parlar 26, 50)	Optional	Blood
Chlordane	Optional	Blood
Oxychlordane and trans-nonachlor	Optional	Blood
Dieldrin*	Optional	Blood
Dechlorane Plus*	Optional	Blood
Metals		
Mercury (total)	Required	Blood
Lead	Required	Blood
Cadmium	Optional	Blood
Mercury (total inorganic)	Optional	Urine
Nutrient		
Omega-3 fatty acids*	Optional	Blood
Adjustment measurements		
Cholesterol/triglycerides	Optional	Blood
Creatinine	N/A	Urine

* Will be analyzed in the future using archived blood specimens.

All analyses will be performed by the New York State Department of Health Wadsworth Center laboratories (<http://www.wadsworth.org/>).

Chemical Analytes Justification

Great Lakes Biomonitoring Program Chemical Analytes

Over the past century, careless practices have resulted in contamination of the Great Lakes ecosystem with countless chemical products and byproducts of modern life entering into the air, water, land, and biota, and even into people's bodies. Since the 1909 enactment of the Boundary Waters Treaty, the International Joint Commission (IJC) has helped the U.S. and Canadian governments manage the lake and river systems along the border. An important expression of that commitment was the Great Lakes Water Quality Agreement (GLWQA), first signed in 1972. The United States, in Annex 2 of the GLWQA, committed to cooperate with State Governments to ensure that remedial action plans are developed and implemented for all designated Areas of Concern (AOCs) in the Great Lakes Basin.

The U.S. and Canadian governments identified AOCs, defined as ecologically degraded geographic areas within the Great Lakes Basin. Currently, 30 Areas of Concern (AOCs) remain on the U.S. side of the Great Lakes Basin and span across eight states (Illinois, Indiana, New York, Ohio, Pennsylvania, Michigan, Minnesota and Wisconsin). All of these AOCs are impacted by chemical contaminants from either local sources and/or remote sources of pollution.

The program objective is to use biomonitoring to provide a baseline assessment of the exposure of susceptible Great Lakes Basin populations to some of the 11 legacy contaminants identified by the IJC. These legacy pollutants are persistent, bioaccumulative, and harmful to the ecosystem and human health. The biomonitoring program will require assessments for some of the IJC legacy pollutants but will be flexible enough to allow states to also biomonitor for other contaminants of concern. Emerging contaminants of concern such as polybrominated diphenyl ethers, that are widely used in fire retardants, and perfluorinated compounds that are used to make materials stain or stick resistant are examples of contaminants that may also be of interest.

All three state grantee programs will include a core set of analytes (required) to be analyzed in blood and urine specimens. The biomonitoring program is flexible and will allow state grantees to evaluate analytes that are of concern in their state (optional analytes). The required analytes and a list of optional analytes are listed below.

Required Analytes: Hexachlorobenzene, Lead, Mercury, Mirex, pp-DDE, pp-DDT, PCBs 28, 52, 101, 105, 118, 138, 153, and 180

Optional Analytes: 1-hydroxypyrene, Arsenic, Bisphenol A, Cadmium, Chlordane (and predominant metabolites - Oxychlordane and Trans-nonachlor), Dioxins/Furans/Co-planar PCBs, Lindane, Manganese, Perfluorinated chemicals (PFCs), Polybrominated biphenyls (PBBs), Polybrominated diphenyl ethers (PBDEs), Polychlorinated biphenyls PCBs (in addition to required), Selenium, Speciated Mercury, Triclosan, Toxaphene

Below is a list of the optional analytes that will be measured along with justifications for analysis.

Toxaphene: While not included in the required contaminant analysis list, toxaphene is one of the 11 critical pollutants identified by the IJC. Xia et al. (2009) quantified individual toxaphene parlars that including those that persistent in human blood (Parlars 26, 50, 62). These parlars were quantified in Lake Huron lake trout (30 ppb weight weight) and in Lake Erie walleye (2 ppb wet weight). The data demonstrate that toxaphene is present in fish from Lake Erie and Lake Huron. All state grantees will evaluate toxaphene as part of their program.

Dioxins (and dioxin-like compounds): Dioxins are included as one of the 11 legacy pollutants as identified by the IJC. Michigan will evaluate dioxins as part of their list of optional analytes.

Polycyclic aromatic hydrocarbons (PAHs): PAHs are included in the 11 legacy pollutants as identified by the IJC. Minnesota has included 1-hydroxypyrene, a PAH metabolite, on their optional analyte list. Minnesota will also conduct cotinine analysis, which is used to adjust for smoking – a known source of PAH exposure.

Polybrominated diphenyl ethers (PBDEs): PBDEs have been identified as an emerging chemical of concern in the Great Lakes Basin. Lake Ontario, which contains several of New York State's AOCs, has demonstrated some of the highest levels of PBDEs reported in the US Great Lakes. New York State has included analysis of the predominant PBDE congeners on their optional analyte list.

Perfluorinated compounds (PFCs): PFCs have been identified as an emerging chemical of concern in the Great Lakes Basin. PFCs have been measured in and known to accumulate in Great Lakes biota. PFCs were identified in fish from Lake Superior and Lake Ontario. New York State and Minnesota Department of Health have included PFC analysis on their optional analyte list.

Bisphenol A (BPA) and triclosan: BPA and triclosan have been identified by EPA as emerging chemicals of concern. Previous studies have shown that BPA is present in >50% of all Great Lakes Basin water samples. Additionally, triclosan has undergone a review of the Minnesota Department of Health's Drinking Water Contaminants of Emerging Concern. Minnesota Department of Health will evaluate triclosan levels and may include this contaminant in a future revision of the Health Risk Limits Rules that may result in the conversion of health-based values (HBVs) to health risk limits (HRLs).

Chlordane: Chlordane is a known contaminant of specific AOCs in New York State, Niagara River AOC, and Lake Michigan. These states have included chlordane in their optional analyte.

Lindane and polybrominated biphenyls (PBB): Lindane and PBBs are known contaminants in Michigan AOCs, including the Saginaw Bay AOC, and are included as optional analytes for Michigan.

Arsenic: Arsenic is a known contaminant in the Great Lakes Basin. Michigan has included arsenic in their optional list of analytes.

Cadmium: Cadmium has been identified in different media in the Great Lakes basin and AOCs in New York, Michigan, and Minnesota. The three state grantees will evaluate cadmium as part of their optional analyte list.

Manganese: Manganese is a prevalent air and soil contaminant in the southeast Michigan area and the subject of on-going health assessment activities by MDCH and ATSDR.

Selenium: Mercury is the contaminant of greatest concern from fish consumption in Minnesota's study area and study population. It is important to consider the contribution of selenium in fish because it has been shown to play a protective role - it binds to mercury in the body and thus protects against mercury exposure/ negative effects. Minnesota is including selenium as an optional analyte in their analysis.

Fatty acids: Omega-3 fatty acids are found in fish. Since fish represent a large portion of the tribal diet, Minnesota has included this measurement in their analysis.

Glycohemoglobin: As a benefit to the tribal participants, Minnesota will evaluate glycohemoglobin (A1C) levels in the tribal population.

Some of the analytes that will be analyzed requires measurement of cholesterol, triglycerides and creatinine levels. These measurements are needed for lipid and urine dilution adjustments.