### 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 |
| PCBs1 | A | A1-3 | | | | serum | A | A1-3 | | serum | F | F1 | serum |
| Mercury2 | 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 | B2-33 | | 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).

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

2 Blood 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

3 Lipids 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 4. New York State Department of Health Chemical Analytes



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.