NEW YORK STATE OF OPPORTUNITY. Department of Health | Wadsworth Center

Biomonitoring in the Northeast –Opportunities for Collaboration?

Experience from the Last Ten Years - New York PHL

Kenneth M. Aldous Ph.D.
Director, Division of Environmental Health Sciences

kenneth.aldous@health.ny.gov

May 20, 2015

OUTLINE

- NYS Biomonitoring Recent History
- Projects
  - CHANES
  - Great Lakes
  - Newborn Screening
- Developing Capabilities
- Collaborations
  - Research
  - Method development
- North East Opportunities?

NYS Biomonitoring Timeline

2001 Biomonitoring CDC Planning Grant (2 years)
25 states and state consortia funded

2003 3 Awards (NH, Rocky Mt. Consortium, NY)

2003-2008 Biomonitoring Implementation Funding

–Purchase of GC/HRMS + funded one analytical staff

NYS Tobacco Control Program – State Legislation

NYC CHANES Study (Trace elements, cotinine, pesticides)

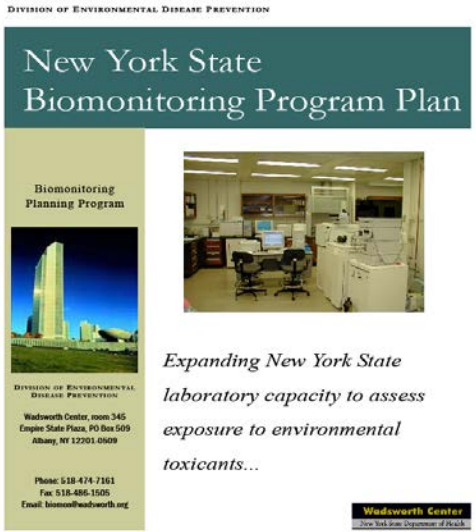
Pilot Projects (PFC, PBDE, OH-PAHs, trace element speciation, etc)

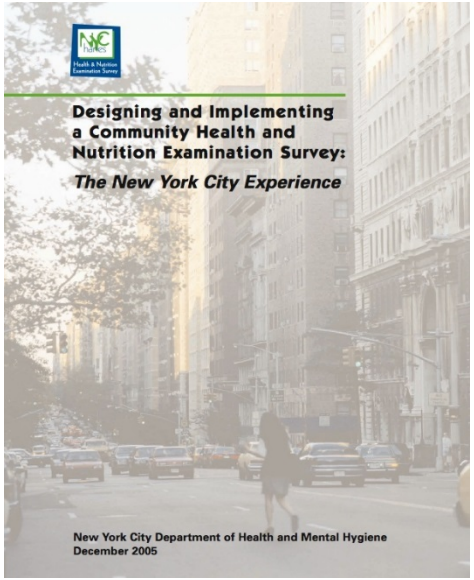
2009-2015 Expanding NY PHL Capability & Capacity

Method development and validation (DU, Speciation, Emerging Organics)

Staff, Automation, Instrumentation

Expanding funding & collaborations





Proposed to develop trained staff and purchase suitable instrumentation for human biomonitoring studies important to NYS public health. (2003)

NEW YORK STATE OF OPPORTUNITY. Department of Health | Wadsworth Center

New York City CHANES

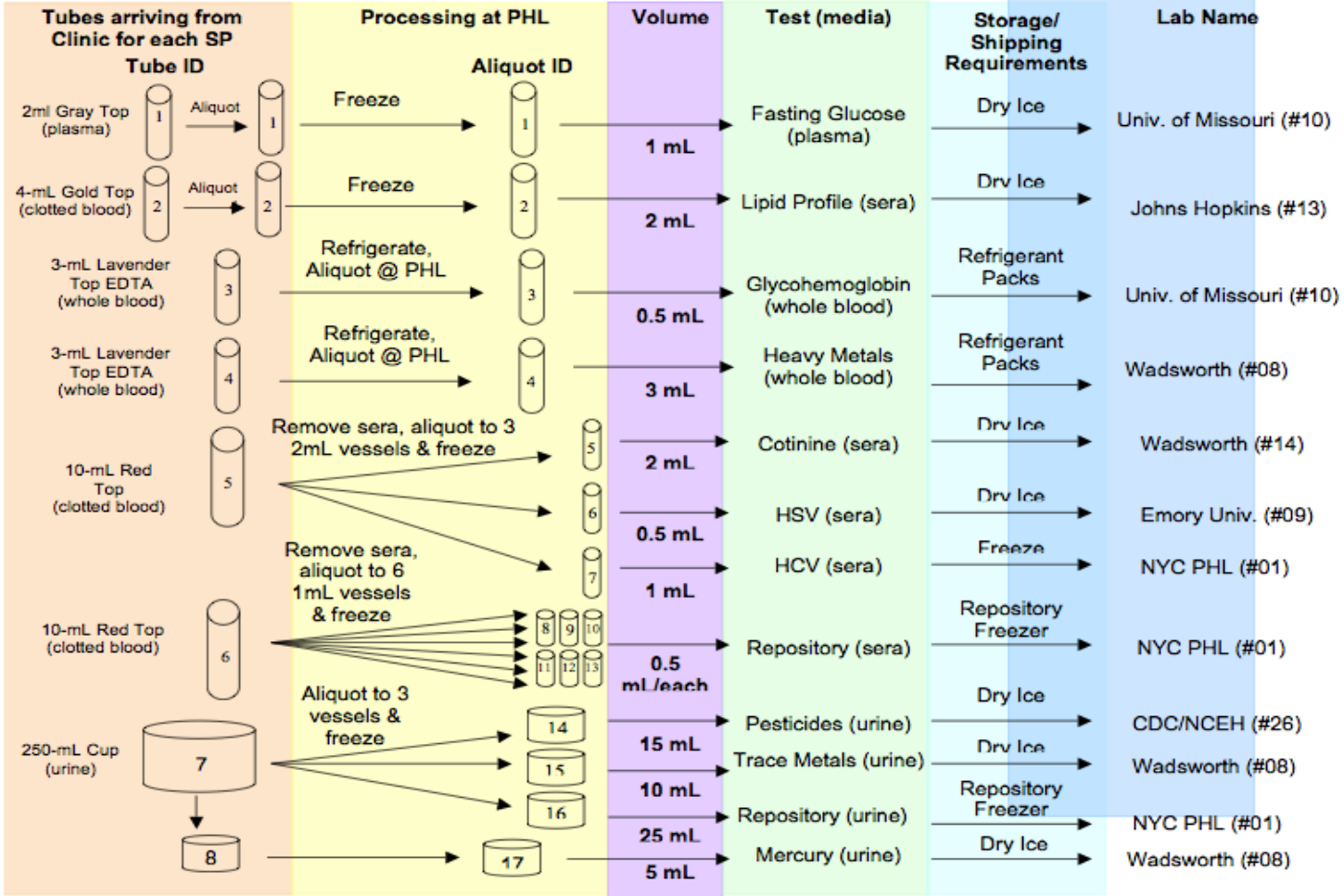
- Population-based, cross-sectional survey of ~2000 civilian, non-institutionalized adults.
- Conducted Jun 2004 – Dec 2004
- Serum Cotinine measured in ~1,800 people
- Analyses by LC/MS/MS
- Blood metals (Pb, Cd and Hg) and Urine Hg were measured in ~1,800 people.
- Analyses performed by ICP-MS

Rogers, HS, Jeffery, N., Kieszak, S., Fritz, P., Spliethoff, H., Palmer, CD., Parsons, PJ, Kass, DE, Caldwell, K., Eadon, G., Rubin, C. 2008. Mercury exposure in young children living in New York City. J Urban Health: Bulletin of the New York Academy of Medicine. 2008 Jan;85 (1):39-51.

W. McKelvey, R.C. Gwynn, N. Jeffery, D. Kass, L.E. Thorpe, R.K. Garg, C.D. Palmer, P.J. Parsons, A biomonitoring study of lead, cadmium, and mercury in the blood of New York city adults, Environmental Health Perspectives 115 (2007) 1435-1441.

Ellis, J.A., Gwynn, C., Garg, R. K., Philburn, R., Aldous, K.M., Perl, S. B., Thorpe, L. and Frieden, T. R. Secondhand Smoke exposure among nonsmokers nationally and in New York City, (2009) Nicotine and Tobacco Research (online April 7, 2009)

FIGURE 1. NYC HANES SPECIMEN PROCESSING FLOWCHART (3.4.04)



NYC CHANES 2004

Whole Blood

- Heavy Metals – Lead , Cadmium , Mercury (1,811)
- Mercury Speciation (438)
- Manganese & Selenium (method development)

Serum

- Cotinine (1,800)
- PCBs, DDT, DDE, PBDEs (1,052)

Urine

- 21 Trace Elements (1,876)
- Mercury (1,876)
- Dialkylphosphates (886)
- Hydroxy PAHs (~1,000) (method development/validation)

*2013 CHANES Targets

Trace Element Analysis Biomonitoring Methods

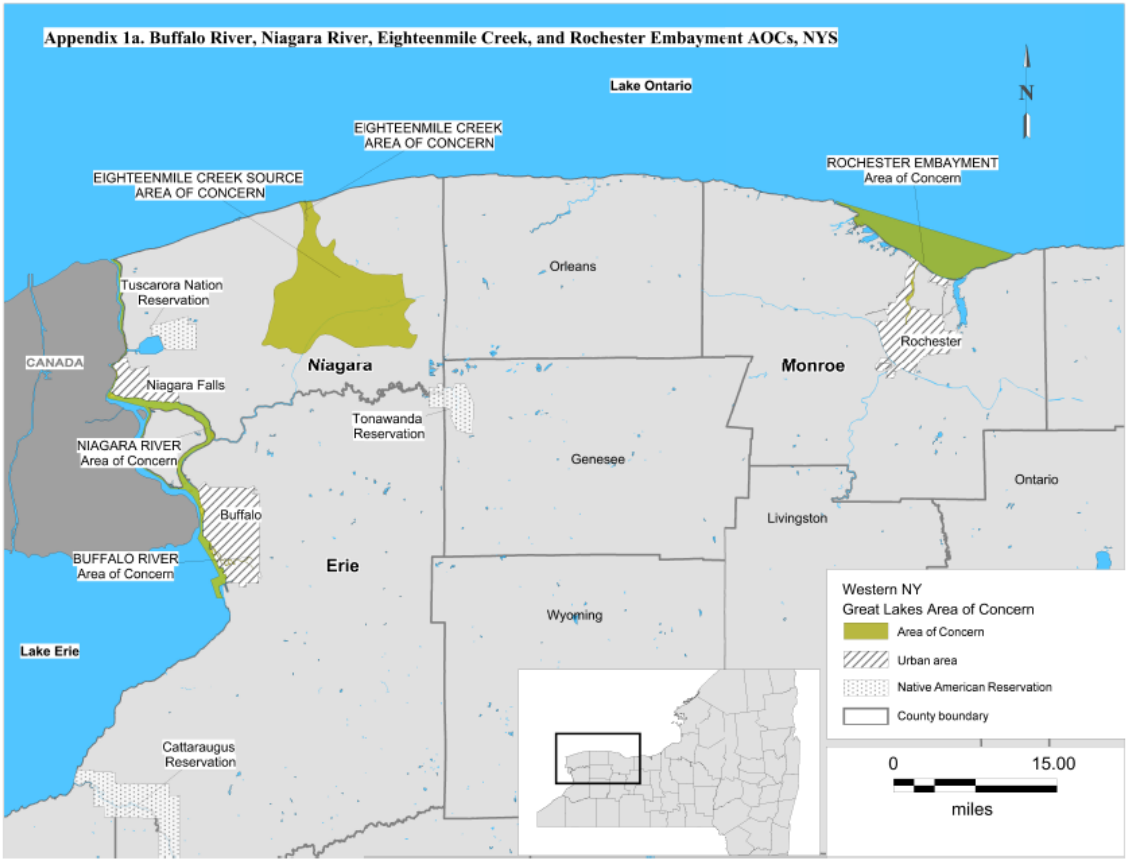
- Blood Metals
  - Lead, Cadmium and total Mercury (ICP-MS); Manganese
- Urine Trace Elements: The “NHANES” suite
  - cobalt; cadmium, lead, uranium; antimony; barium; beryllium; cesium; molybdenum; platinum; thallium; and tungsten.
- Urine Mercury by ICP-MS
- Mercury Speciation in Blood by GC-ID-ICP-MS
  - Blood (MeHg, iHg, EtHg).
- Arsenic Speciation in Urine by LC-ICP-MS)
- Depleted Uranium in Urine by SF-ICP-MS

BIOMONITORING AND THE GREAT LAKES

- ATSDR Funded study with NYSDOH EPHT.
- Areas of Concern (AOC) related to lake contamination with “legacy” chemicals (PCBs, PAHs, Mirex, Declorane)
- Vulnerable populations (sport and subsistence fishermen (ethnic communities - Burmese refugees)
- Study planning completed, participants identified and clinics set up, samples collected.
- Laboratory assisted with sample collection
- Possible Collaborative projects with other Great Lake State Departments of Health.

NEW YORK STATE OF OPPORTUNITY. Department of Health | Wadsworth Center

GREAT LAKES STUDY



Biospecimens (blood, urine) collected from subsistence fish eaters living close to areas of concern. Includes ethnic refugee Burmese populations

NEW YORK STATE OF OPPORTUNITY. Department of Health | Wadsworth Center

GREAT LAKES BIOMONITORING PROJECT – INTERIM REPORT - March, 2012

List of required and optional analytes to be measured in blood and urine specimens.

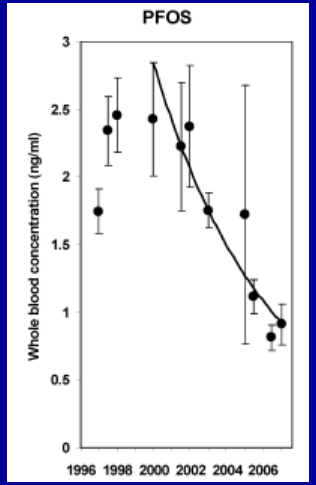
Analyte	Required by ATSDR or optional	Specimen type
Organic chemicals		
PCBs (8 required congeners 28, 52, 101, 105, 118, 138, 153, and 180)	Required and Optional	Blood/Serum
PBDEs (predominant congeners)	Optional	Blood/Serum
Perfluorinated compounds (PFOS, PFOA)	Optional	Blood/Serum
DDT/DDE	Required	Blood/Serum
Mirex	Required	Blood/Serum
Hexachlorobenzene (HCB)	Required	Blood/Serum
Toxaphene (Parlar 26, 50)	Optional	Blood/Serum
Chlordane	Optional	Blood/Serum
Oxychlordane and trans-nonachlor	Optional	Blood/Serum
Dieldrin*	Optional	Blood/Serum
Dechlorane Plus*	Optional	Blood/Serum
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/Serum
Creatinine	N/A	Urine

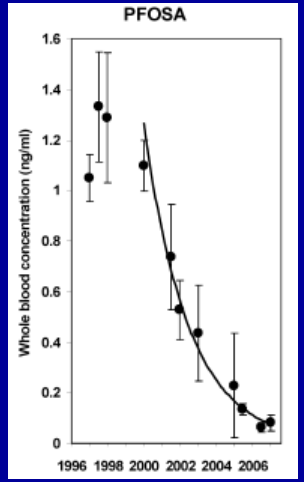
* Will be analyzed in the future using archived blood specimens.

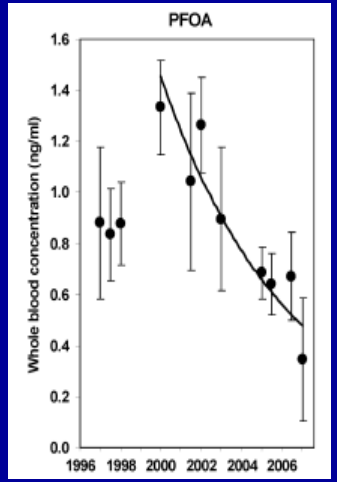
Newborn Blood Spots – Biomonitoring Resource

- Blood Spot Cards – stored at 4°C
- NYS Program Archive for ~10 years
- Use for stable compound trend analysis
- Limited amount of sample from punched disc (0.25” dia)
- Each sample used 24 discs from selected dates
- 10 samples were collected for each year from 1997- 2007
  Total samples 110 (2640 discs)
- Extract and analyze by LC/MS/MS using ^{13}C-labeled I.S.
- Perfluorinated compounds analyzed
  - PFOS perfluorooctane sulfonate
  - PFOA perfluorooctanoic acid
  - PFOSA perfluorooctane sulfonamide
  - PFNA perfluorononanoic acid
  - PFHxS perfluorohexane sulfonate

Use of Blood Spots in detecting declining levels of PFCs in New York State Infants (1997 – 2007)







Production of these PFCs was phased out 2000 - 2002

Samples composite of 24 spots, 10 sample each year

Spliethoff, H.M., Tao, L., Shaver, S., Aldous, K.M., Pass, K., Kannan, K. and Eadon, G. (2008). Use of Newborn Screening Program Blood Spots for Exposure Assessment: Declining Levels of Perfluorinated Compounds in New York State Infants. Environmental Science and Technology, 42, 5361-5367.

Developing Biomonitoring Capabilities

What are your current strengths?
Are there existing methods that can be expanded?
Specific needs not being addressed?
Training on new methods

State/regional initiatives that could benefit from Biomonitoring
External requests?
Funding?

Research and Publications

Developing Collaborations

- Intermural
  - Other state and city program areas
    - Tobacco Control
    - Epidemiology
- Extramural
  - Federal Partners
    - CDC, ATSDR, NIH, NIEHS, NICHD,
  - Academic Partners
    - State Universities, other colleges

Current Biomonitoring Infrastructure

- Trained Staff – (investment)
- Facilities – Biosafety Hoods, Clean Rooms
- Instrumentation (dual-use)
  - detection
  - sample preparation
  - automation – high throughput
- Network(s)
  - for collaboration, support and expertise

SECTION I: LABORATORY INFRASTRUCTURE
Instrumentation

SECTION II: BIOMONITORING STUDY DESIGN
Study Protocol Development – Epi, EPHT

SECTION III: BIOMARKER SELECTION
Biomarker specificity
Analytic specificity and sensitivity
Correction for Urine Dilution
Lipid Adjustment

SECTION IV: ANALYTICAL PROTOCOL AND METHODOLOGY
Quality Management System
Initial Considerations in Analytical Method Selection
Specimen Collection
Method Validation
Analytical Testing

SECTION V: RESULTS REPORTING
Generating Laboratory Result Reports
Results Interpretation
Results Communication
Communication with the Community
External Coordination

NEW YORK STATE OF OPPORTUNITY. Department of Health | Wadsworth Center