New Jersey Biomonitoring Program -New Initiative and Challenges

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Program Manager

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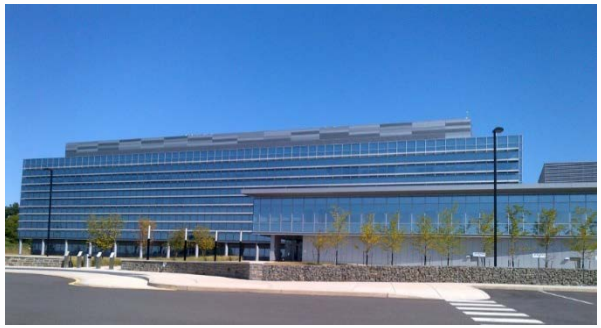
Public Health and Environmental Laboratories (PHEL)
Environmental Chemical Laboratory Service (ECLS)



APHL Annual Conference
Indianapolis, IN
May 18-21, 2015

Background

Population:

- **Most densely populated state**
  - 11th most populated state
  - 4th smallest land area
  - 5% growth rate
- **Socioeconomic, ethnic, & racial diversity**
  - 69% White, 14% Black, 9% Asian, Pacific Islander or American Native, 8% "2+ races" or "other" in 2010 Census
  - 18% Hispanic
  - Foreign born population higher than national average
- **Income & education**
  - Higher than national average
  - Poverty exists (e.g. Newark, Camden, Trenton)

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Background – cont'

Geography

- **Heart of Northeast transportation corridor**
  - I-95, I-295, New Jersey Turnpike, Garden State Parkway, Route 1
  - National and regional rail lines
  - Airports: Newark, Trenton-Mercer, Atlantic City, McGuire AFB
- **Major cities**
  - In-state: Newark, Jersey City, Paterson, Elizabeth, Trenton, Camden
  - Border cities: New York City, Philadelphia, White Plains, Wilmington
- **Shared waterways**
  - Delaware Watershed
  - Hudson Watershed
  - Raritan Watershed
  - Atlantic Ocean

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Environmental Pollution

- **Industrial sources**
  - E.g. pharmaceutical, chemical, refineries, etc.
  - ***Perfluorinated Chemicals (PFCs)***
    - Widespread throughout the state and more prevalent than national average
    - 15% of drinking water supply sites contaminated vs. <5% nationally
    - Highest surface water levels reported worldwide in Delaware River
- **Hazardous sites**
  - Highest number and density of Superfund/National Priorities List sites
  - Over 15,000 contamination sites throughout the state
- **Water Pollution**
  - Known contaminations include PFCs, heavy metals, & organic compounds
  - Affects surface water (sustenance fishers) & public water supply (90% pop.)
- **Air Pollution**
  - Considered to still be in non-attainment for many categories despite progress

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CDC Biomonitoring Program

- 2014 – CA, MA, NH, ***NJ***, VA, Four-Corners Consortium (AZ, CO, NM, and UT)
- 5-year grants (9.1.2014-8.31.2019)
- Grants serve as foundations to permanent programs
- Main Goal: Laboratory Capability and Capacity

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Goals of NJ Biomonitoring Program

- **Goal 1: Laboratory Capability and Capacity Building**
- **Goal 2: Investigational Support – location specific**
- **Goal 3 & 4: Statewide – Vulnerable Subpopulations**
- **Goal 5: Increased Collaboration and Communication**
- **Goal 6: Permanence and Sustainability**

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NJ Biomonitoring Grant Research Team

- **NJDOH**
  - PHEL-ELCS
  - CEOHS
  - Family Health Service (FHS)
- **Rutgers University – EOHSI- Exposure Science Division**
- **NJ Department of Environmental Protection**
  - Office of Science
  - Risk Assessment
- **Delaware River Basin Commission (DRBC)**
- **Delaware Riverkeeper Network (DRN)**

Goal 1 – Capability and Capacity Building

Develop and expand current testing capabilities

- Bring online CDC methods for testing PFCs, PCBs, and Metals Speciation
- Working with CDC, develop a method to test shorter chain "replacement" PFCs
- Develop new sample receiving protocol

Increase capacity for current and new capabilities

- Purchase instrumentation for testing
- Hire three analysts to support validation and implementation of new tests
- Current/new staff to receive specialized method training from CDC
- Develop specimen receiving, logging, and reporting procedures

Analytical Methods - PFCs

- **PFC in Serum (CDC Method 6304.04) -** Online Solid Phase Extraction-High Performance Liquid Chromatography-Turbo Ion Spray-Tandem Mass Spectrometry (online SPE-HPLC-TIS-MS/MS)

Analyte*	Analyte*
PFHpA	PFOSA
PFOA	Me-PFOSA-AcOH
PFNA	Et-PFOSA-AcOH
PFDeA	PFBuS
PFUA	PFHxS
PFDoA	PFOS

*PFHxS, PFOA, PFOS, PFNA,

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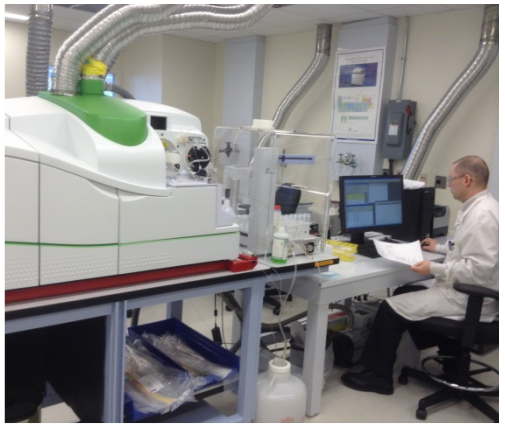
Analytical Methods - Metals

- **Blood Metals Panel 3 - DLS 3016.8-03**
- **Blood Mercury Speciation TSID-GC-ICP-DRC-MS - DLS-3020.5**
- **Urine Multi-Element ICP-DRC-MS - 3018.4-02 for 15 element panel; 3018A.3-02 for total arsenic**
- **Urine Arsenic Speciation HPLC-ICP-DRC-MS - ITU003B**

	Total	Speciated
Urine	Arsenic	Arsenic
	Barium	
	Beryllium	
	Cadmium	
	Lead	
	Thalium	
	Uranium	
Blood	Cadmium	Mercury
	Lead	
	Mercury	



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Analytical Methods - PCBs

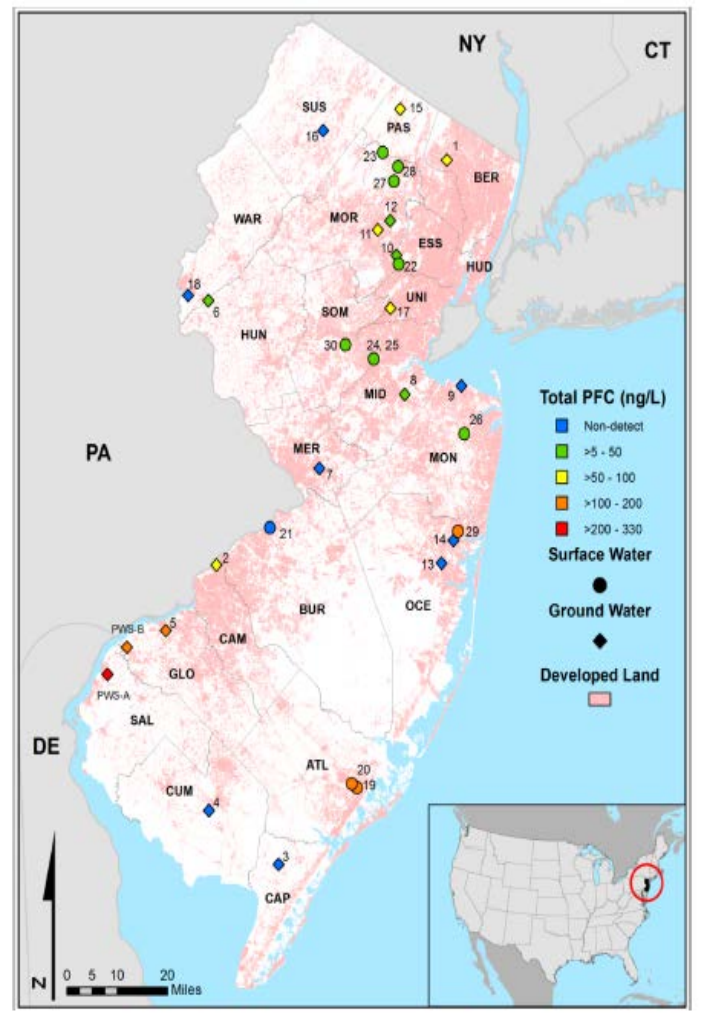
- **PCB method**

  CDC HRGC/ID-HRMS DLS 6502.02 - NHANES LAB 28

- **Analytes:**

  PCB 18, PCB 28, PCB 44, PCB 49, PCB 52, PCB 66, PCB 74, PCB 87, PCB 99, PCB 101, PCB 105, PCB 110, PCB 118, PCB 128, PCB 138, PCB 146, PCB 149, PCB 151, PCB 153, PCB 156, PCB 157, PCB 167, PCB 170, PCB 172, PCB 177, PCB178, PCB 180, PCB 183, PCB 187, PCB 189, PCB 194, PCB 195, PCB 196, PCB 199 PCB 206, PCB 209

Goal 2 – Investigational Support



- **Provide laboratory support to ongoing state investigations**
- **Undertake projects relevant to developed capabilities**

Total PFCs for PWS in NJ (Post et al., ES&T, 2013)

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Project 2. Assessing Effectiveness of Interventions to Reduce Exposure to Perfluorinated Chemicals (PFCs) in Drinking Water

- **OBJECTIVES**
- Evaluate the effectiveness of interventions implemented to reduce exposure to PFCs in drinking water, by monitoring serum concentrations of PFCs over time among individuals living in impacted homes.
- Estimate the half-life of PFCs in the body through longitudinal serum measurements.
- Determine if individuals living in impacted homes had higher PFC serum levels than residents from the general population.
- Model serum: drinking water ratios for PFCs in New Jersey and assess if they differ from those previously estimated.
- Build the laboratory and epidemiologic rapid response capacity to conduct biomonitoring of New Jersey populations exposed to PFCs.

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Project 2 - Study Plan

- **Team: Rutgers University, DRN, and DOH (CEOHS nd ECLS)**
- **Analytical Method (**CDC Method 6304.04 - Online SPE-HPLC-TIS-MS/MS)

  (Spark Holland Symbiosis™ Pico SPE-UHPLC System, AB Sciex QTRAP 6500 system)
- **Sample Collection**
  - Blood samples (serum)
  - Adult only, repeated measurements
  - Questionnaires (sources of PFCs exposure, etc.)
- **Study Period 2-5 years**

Goals 3 & 4 – Statewide Testing

- Generate state-specific, statewide population data to identify exposure trends and to compare to national data (NHANES)
- Establish statewide baselines for future biomonitoring studies
- Identify/target susceptible subpopulations
- Encourage medical interventions through healthcare providers
- Ultimately, improve health outcomes of New Jersey's population

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Project 3 – Clinical Specimens

Using Remnant Clinical Laboratory Specimens to Track General Population Exposure to Chemicals in New Jersey

OBJECTIVES:

- Characterize general population exposure distributions among NJ residents for heavy metals and persistent organic pollutants in blood and urine, and compare the exposure distributions in NJ to national distributions as estimated by NHANES.
- Develop baseline exposure data for select analytes to use as a reference for future studies conducted by the NJ Biomonitoring Program.
- Build and demonstrate the laboratory and epidemiologic rapid response capacity to conduct biomonitoring of NJ populations for environmental pollutants, and to develop the infrastructure to respond to acute exposure incidents.

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Project 3 - Study Plan

- **Target Analytes and Sample Matrices**
  - Metals in whole blood and urine
  - PCBs in serum
  - PFCs in serum
- **Specimen Collection**
  - NJ-Based clinical laboratories and blood banks (eg. Bioreference, Quest, Hunterdon Medical Center, NJ/NY Blood Services)
  - Demographic information including:
    - Age
    - Gender
    - Geographic identifier
    - Race/Ethnicity
- **Project Period: 1 – 3 years**

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Project 4 – Expectant Mothers

Conducting Prenatal Screening of Expectant Mothers for Metals and PCBs in New Jersey

OBJECTIVES:

- Identify prenatal exposure to metals and PCBs through testing mothers' blood, serum, and urine collected alongside routine prenatal bloodwork.
- Filling analytical (Pb only) gaps present in the current child exposure screening.
- Establish a cohort to provide long-term monitoring data.
- Compare data to published work identifying exposure levels of concern in order to encourage medical intervention as early as possible.
- Ultimately, improve birth outcomes and long-term health outcomes of New Jersey's babies and reducing healthcare costs associated with *in utero* exposure to heavy metals and PCBs.

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Project 4 -Study Plan

- **Projected Study Team**
  - NJDOH – PHEL, FHS
  - Rutgers University, other academia
  - Insurance providers
  - Professional medical associations
- **Target Analytes and Sample Matrices**
  - Metals in whole blood and urine
  - PCBs in serum
- **Specimen collection**
  - Using hospital, clinical, and private OB/GYN offices and insurance providers in the state to recruit patient/doctor participation.
  - Specimens collected during routine doctor visits
- **Project Period: 2-4 years**
  - Plan to continue working with population beyond time frame of the grant

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Goal 5 - Collaboration/Communication

- **Establish a State Biomonitoring Commission**
  - Provide guidance and oversight to Biomonitoring Program
  - Harmonization of New Jersey State agencies' priorities
- **Size/scope of commission will expand as biomonitoring program grows**
- **Foster internal and external communication**
- **Partnership includes:**
  - NJDOH: Commissioner's Office, CEOHS, FHS, PHEL
  - NJDEP
  - APHL, CDC, DRBC, EPA, academia including Rutgers, professional organizations, and community organizations including Delaware Riverkeeper Network.

Goal 6 – Sustainability

- Developing and sustaining laboratory capability/ capacity and establishing a biorepository
- Permanent program oversight by the Biomonitoring Commission
- Seeking State funding and external funding through grants, partnerships, and revenue
- Providing scientifically relevant biomonitoring data for future state-specific studies
- Generating data to demonstrate improved health outcomes resulting from program

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Progress

- Established collaboration with Exposure Science Division at EOHSI Rutgers University.
- Established New Jersey State Biomonitoring Commission
- Two new hires for analysts for Metals and CT Lab
- Purchased and installed LC-MS/MS
- Completed on-site training about LC-MS/MS
- Begin acquisition of HRGC-HRMS for Organic Lab

- Commenced planning for PFC project in Southern New Jersey
- Outreach through community organizations
- Commenced planning and sample collection for clinical labs/blood bank project
- Commenced IRB process

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Successes and Challenges

- **Successes:**
  - Buy-in from within state and outside collaborators
    - PHEL-ECLS, CEOHS, NJDEP
    - Rutgers Exposure Science Division's NIH Training Grant
  - Potential collaborations outside scope of grant - JHSPH
  - Assistance from CDC and APHL and other states invaluable
- **Challenges:**
  - Funding - federal cuts, 2 state blood banks shut down
  - Staff - hiring restrictions/time frames, partners' limitations
  - Equipment - upgrades necessary, purchasing process
  - Partnership coordination, funding needs

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